

TECSYSTEM S.r.l.®

INSTRUCTION MANUAL

NT935-IR + TIR409



RoHS
COMPLIANT
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NT935-IR + TIR409

INTRODUCTION

The temperature monitoring in the presence of very high working voltages (medium voltage and high voltage coils) is difficult since the very high degree of insulation required doesn't allow to use standard thermometric sensors.

The use of an IR sensor, which meets the required insulation levels, allows to measure the temperature staying at a safety range.

Tecsystem has developed an own sensor which allows a simple coupling with the NT935-IR monitoring unit, prepared to receive 4.20mA signals from 3 IR sensors.

The measuring angle of just 10° concentrates the reading on a ~1.75 cm diameter at a distance of 10 cm from the object to measure.

The 4.20mA current output allows an exact remote transmission with a very high immunity to the electromagnetic noises.

TIR409 sensors must be fed only at 24V direct current; with the optional accessory AU24 (a feeder for 3 sensors) the range can be extended to 85-265 V alternating current/direct current.

The reading range from -40 to +200°C makes the system available to monitor the temperatures of the electrical components under voltage.

Tecsysbus output (60-61-62-63 terminals) allows the connection to expansion modules such as:

- a) CONV 4.20-4-A: module with 4-20 mA outputs for each channel
- b) MOD RL-4-A: module with 2 relays (alarm and trip) for each channel
- c) BUSMOD-8-A: module for connection on a ModBus network



RAEE: This SYMBOL, shown on the unit, indicates that the waste must be subject to "separate collection". The end-user must send the unit to the "waste collection centers", or return the unit to the dealer against the purchase of a new equivalent device.

1) TIR409 TECHNICAL SPECIFICATIONS

<p>SUPPLY</p> <ul style="list-style-type: none"> Rated values: 24 Vdc (min. 18 - max. 36 Vdc) 	<p>DIMENSIONS</p> <ul style="list-style-type: none"> 69mm x 55mm x 33mm
<p>TESTS AND PERFORMANCES</p> <ul style="list-style-type: none"> Assembling in accordance with CE rules Protection against electrical noises CEI-EN-61000-4-4 IR sensor reading range: -40°C +200° C IR Sensor accuracy: see Figure 1 page 20 Measuring angle 10° (FOV) Working temperature from -20°C to + 85°C Humidity 90% no condensing Housing by NORYL UL94V0 Highest absorption 40mA Option: protection treatment of the electronic part Vibration test IEC 68-2-6 Amplitude ± 1 mm from 2Hz to 13.2Hz Acceleration ± 0.7G from 13.2Hz to 100Hz. (* Seismic test according to IEEE 344-1.987 <p>*Cross reference T154 for constructive analogy.</p>	<p>OUTPUT</p> <ul style="list-style-type: none"> 4.20 mA output: 4 mA @ -40°C, 20mA @ 200°C Interface accuracy 4.20mA: ± 0.5% full scale value ±1 digit RS485 Tecsybus for future developments.

2) NT935-IR TECHNICAL SPECIFICATIONS

<p>SUPPLY</p> <ul style="list-style-type: none"> Rated values: from 24 to 240VAC/DC 	<p>COMMUNICATION</p> <ul style="list-style-type: none"> Tecsybus output for NT series external modules
<p>INPUTS</p> <ul style="list-style-type: none"> 3 or 4 4.20mA inputs (-40°C @ 4mA, +200°C @ 20mA) Removable rear terminals Input channels protected against electromagnetic noises 	<p>OUTPUTS</p> <ul style="list-style-type: none"> 2 alarm relays (ALARM - TRIP) 1 relay to manage ventilation (FAN) 1 relay for sensor fault or working anomaly (FAULT) Output relays with 5A-250V alternating current contacts
<p>TESTS AND PERFORMANCES</p> <ul style="list-style-type: none"> Assembling in accordance with CE rules Protection against electrical noises CEI -EN-61000-4-4 Dielectric strength: 2500Vac for 1 minute between output relays and 4.20mA inputs, relays and supply, supply and 4.20mA inputs Reading range: -40°C @ 4mA, +200°C @ 20mA Interface accuracy 4.20mA: ± 0.5% full scale value, ± 1 digit Working temperature from -20°C to +60°C Humidity 90% no condensing housing NORYL UL94V0 Front frame by polycarbonate IP65 Highest absorption 4VA Data storage 10 years minimum Option: protection treatment of the electronic part 	<p>DISPLAYING AND DATA MANAGEMENT</p> <ul style="list-style-type: none"> 1 display 13 mm high with 3 digits for displaying temperatures and messages 4 leds to display the selected channel 4 leds to display the state of the alarms of the selected channel Temperature reading from -40°C to 200°C 2 alarm thresholds (alarm/trip) for channels 1-2-3 2 alarm thresholds (alarm/trip) for channel 4 2 thresholds to check ON-OFF ventilation IR sensor connection diagnostic Data storage diagnostic (Ech) Selection between channel automatic scanning, hottest channel or manual scanning Storage of the maximum temperatures reached by the channels, alarm storage and sensor fault. Front key to reset the alarms
<p>DIMENSIONS</p> <ul style="list-style-type: none"> 100 x 100 mm DIN 43700 - depth 130 mm (terminal box included) Panel cut-out 92 x 92 mm 	

3) MOUNTING OF TIR409 SENSOR

TIR409 sensor can be fixed on the transformer upper crossbar through a plate support bracket. For the hole template, please refer to the dimensions shown in figure 3 at page 22. To mount the sensor, you have to take into consideration the following directions:

MINIMUM SATETY RANGE.

The minimum safety range depends on the working voltage of the machine (example Figure 2 Page 21)

Please look at the transformer manufacturer's technical specifications.

WORKING TEMPERATURE

The highest working temperature for the electronics inside the IR sensor is of 85°C. Therefore you have to take into consideration that this value cannot be exceeded.

We suggest to keep it away from the hot air flow which runs inside the secondary coil.

MEASURING POINT

Measuring point diameter is calculated with the following formula:

$$\varnothing(\text{cm})= d(\text{cm}) \times 0.175$$

"d" represents the distance between IR sensor and the surface to control.

For instance at a distance of 10 cm you get:

$$\varnothing= 10 \times 0.175= 1.75 \text{ cm}$$

The laser pointer which can be activated by pressing the side push-button has a 10mm translation as regards to the center of the sensor measuring point.

Please refer to figure 4 at page 23.

4) MOUNTING OF NT935-IR MONITORING UNIT

Make a hole in the panel sheet with dimensions 92 x 92 mm. Firmly tighten the device with the enclosed fixing blocks.

5) SUPPLY OF IR TIR409 SENSORS

TIR409 sensors can be fed with a voltage from 18 to 36 V direct current.

For a correct supply we suggest to use TECSYSTEM AU24 device.

Supply must be connected as shown in Figure 7 at page 26.

The same feeder can be used to supply 24V direct current to NT935-IR monitoring unit.

6) SUPPLY OF MONITORING UNIT NT935-IR

NT935-IR monitoring unit has an UNIVERSAL supply, i.e. it can be indifferently fed from 24 to 240 V alternating current-direct current, regardless of polarities in V direct current. This peculiarity is obtained using a new concept and new designed tested feeder which relieves the technician of each concern for the correct supply V alternating current o V direct current. To the terminal 41 must always be connected the ground.

To protect the monitoring unit from the line overvoltages, we suggest to use the electronic discharger PT-73-220, designed by TECSYSTEM for this specific purpose. As alternative we suggest to use supply voltages from 24 V alternating current or, much better, 24 V direct current.

IMPORTANT NOTE: In case you have to replace an existing card with a new one, in order to guarantee its safe and correct working, you must replace the sensor/relay/ supply connection terminals with the new terminals supplied, provided that they are of a brand different from the previously mounted ones.

7) CONNECTION OF TIR409 SENSOR WITH THE NT935-IR MONITORING UNIT

4.20 mA output of each TIR409 sensor must be connected with 4.20 mA input of the relevant NT935-IR monitoring unit input channel.

To wire the sensors it is sufficient a simple 4-wire cable for signal transport (from AWG24 to AWG30), a pair for supply and the other one for 4.20mA output.

Please refer to figure 8 page 27.

8) DIAGNOSTIC OF IR TIR409 SENSORS

In case of breaking of one of the TIR409 sensors mounted on the machine to protect, output positions on beginning or full scale values

- I<4mA: FLO message on the display
- I>20 mA: FHI message on the display

Verify the IR sensor connections and eventually replace the damaged TIR409.

9) ELECTRICAL CONNECTIONS FOR ALARMS AND FAN

Carry out the electrical connections on the removable rear terminals, after having removed them from the meter. ALARM and TRIP relays just switch when the set temperature limits are reached. FAULT relay (Fault) just switches when the meter is fed, while gets de-energised when a fault occurs to the sensors, data memory fault (Ech) or when supply voltage is lacking. FAN contact can be used to check the cooling fans or it can be inserted in a transformer room conditioning circuit.

10) PROGRAMMED DATA DIAGNOSTIC

In case of breaking of the internal storage or corruption of programmed data, just after switching on Ech indication appears with the relevant reporting of the Fault contact. In this case, for safety reasons, the default parameters: Alarm Ch1-2-3= 90°C, Trip Ch1-2-3= 119° C, Ch4= NO, Ch-Fan= 1-2-3, Fan-on= 70°, Fan-off= 60°, HFN= 000 are automatically loaded. Eliminate Ech indication by pressing RESET and run programming to insert desired values. Finally turn off and turn on again the unit to verify the correct memory working; in case it is damaged and Ech still appears, please return the monitoring unit to TECSYSTEM for repair.

11) TEMPERATURE DIAGNOSTIC

If one of the sensors detects a temperature higher than 1°C compared to set value as alarm limit, after approximately 5 seconds ALARM relay switches together with turning on of channel reference LED ALARM (CHn). When the release temperature limit is passed, TRIP relay switches together with turning on of channel reference LED TRIP (CHn). As soon as taken temperature returns to equal or lower values than set limit for ALARM and TRIP relay switching, they de-energise with consequent turning off of relevant LED's.

12) COOLING FAN CONTROL

NT935-IR Monitoring unit, if opportunely programmed, can control ON-OFF of fans accompanying the transformer, according to set temperatures.

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Fans on machine can be driven in two different ways:

- Using the temperatures taken by the sensors on the three columns
CHF 1.2.3
(example ON at 80°C - OFF at 70°C)

Through an extra sensor (**CH4/YES**) for the room temperature inside the transformer box.

- **CHF 4**
(example ON at 40°C - OFF at 30°C)

13) FAN TEST

It is possible, through programming (**HF_n**), impose that the fans are activated for 5 minutes each "xxx" hours, regardless of column or room temperature values (example: with HF_n=001 fans are activated for 5 minutes each hour).

This function has the aim to periodically verify the working of the fans and their control apparatus during long idle periods.

Loading **000** value this function is inhibited.

14) DISPLAY MODE

Pressing MODE key, the display mode is loaded:

- **SCAN**: monitoring unit displays in scansion (each 2 seconds) all the activated channels
- **AUTO**: monitoring unit automatically displays the hottest channel
- **MAN**: channel temperature manual reading through the cursor keys
- **T.MAX**: monitoring unit displays the highest temperature reached by the sensors and possible alarm or fault situations occurred after the last reset.
Select channels with ▲▼, reset values with RESET.

15) WORKING PROGRAM CONTROL

To check the programmed temperature values, shortly press PRG key.

viS indication appears for 2 seconds, confirming entering in program vision mode.

By repeatedly pressing PRG key, all the previously loaded values are scrolled in sequence.

After 1 minute keyboard no-operation, RELAYS TEST procedure will be automatically left.

To end display, press ENT key.

16) LAMP TEST

We suggest to regularly carry out control device LED test.

For this operation, shortly press TEST key; all displays turn on for 2 seconds.

If one of the LED's should not work, you are kindly requested to return the monitoring unit to TECSYSTEM.

17) ALARM RELAY TEST

This function allows to carry out a test on relay working without having to use further devices.

To start test procedure you have to keep pressed TEST key for about 5 seconds TST indication appears for 2 seconds, confirming entering in Relays Test mode.

Blinking led shows the relay to test, using the cursors you can select the desired one.

Press SET and RESET keys to energise and de-energise the relay to test; the display will show ON-OFF.

After 1 minute keyboard no-operation, RELAYS TEST procedure will be automatically left.

To end RELAYS TEST procedure, press TEST key.

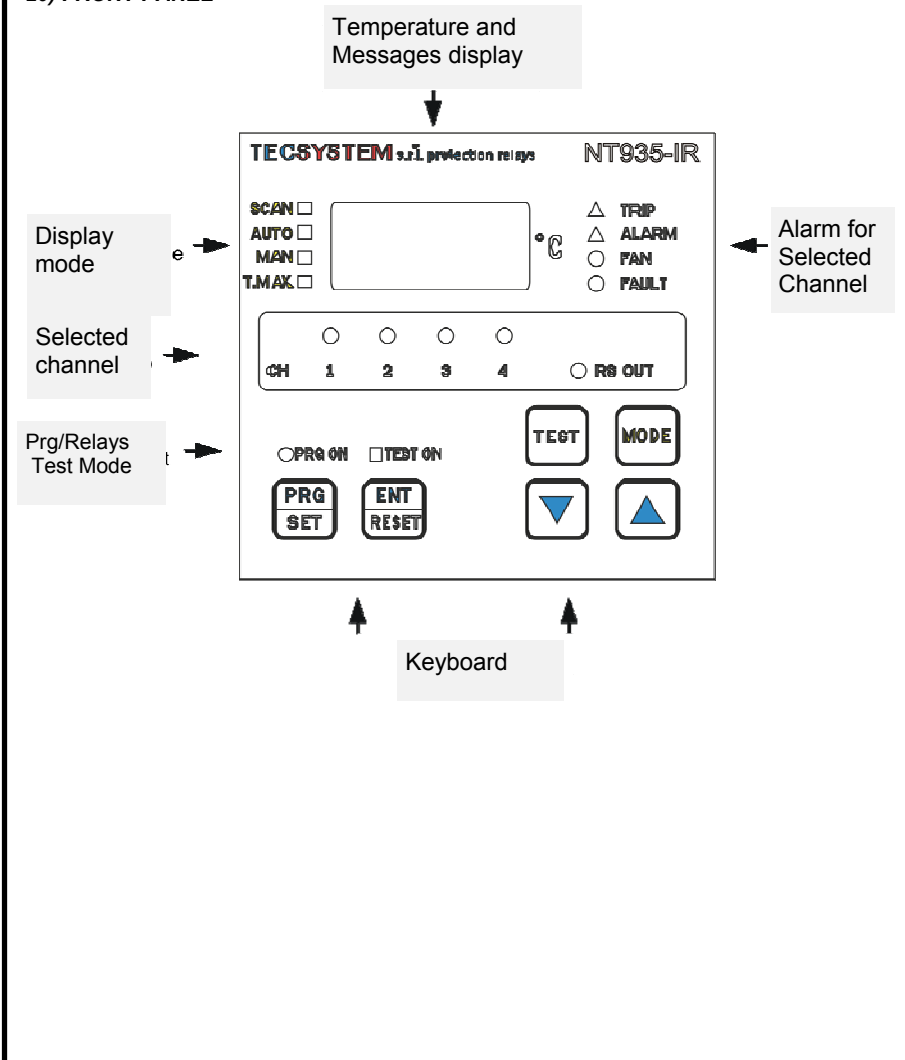
18) ALARM RELAY SILENCING

If you want to silence the ALARM signal press RESET key: relay de-energises and LED ALARM, which was fixed, will start to blink.
Silence system is automatically disconnected when the temperature goes under the ALARM threshold.







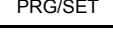

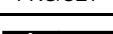
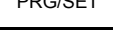
19) IMPORTANT NOTICE

Before carrying out the insulation test on the switchboard where the monitoring unit is mounted, you have to disconnect it from the mains in order to avoid serious damages.

20) FRONT PANEL



21) PROGRAMMING**NOTA: LED PRG-ON OFF: PROGRAM DISPLAY.****LED PRG-ON ON: PROGRAM MODIFICATION**

N°	PRESS	EFFECT	NOTES
1	PRG/SET	Keep pressed PRG key until PRG-ON led turns on. After PRG indication, ALARM threshold for CH 1-2-3 appears	
2		load desired threshold	
3	PRG/SET	TRIP threshold for CH 1-2-3 appears	
4		load desired threshold	
5	PRG/SET	CH 4 led is blinking	Enabling CH 4
6		Load YES or NO	With YES CH 4 is connected With NO CH 4 is disconnected
7	PRG/SET	ALARM threshold for CH 4 appears	If CH 4=NO go to point 11
8		load desired threshold	
9	PRG/SET	TRIP threshold for CH 4 appears	
10		load desired threshold	
11	PRG/SET	Fan led blinks and the channel leds to which the ventilation is referred turn on	
12		Select NO, CH 1-2-3 or CH 4 (if CH 4 YES)	NO: disabled fan, go to point 20
13	PRG/SET	Display shows ON	FAN turning on
14	PRG/SET	ON threshold for FAN appears	
15		load desired threshold	
16	PRG/SET	Display shows OFF	FAN turning off
17	PRG/SET	OFF threshold for FAN appears	
18		load desired threshold	
19	PRG/SET	Display shows HFN	Fan cyclic test for 5 minutes, each "n" hours
20		load desired number of hours	000= disabled function
21	PRG/SET	Display shows FCD <-> "data item"	Fault fast temperature increase (°C/sec)
22		load desired value (please see page 10)	From "no" (function excluded) to 30 °C/sec
23	PRG/SET	Display shows END	Programming end
24	ENT	Loaded data storage and programming exit	Err: wrong programming for values indicated by leds (note 2)
25	PRG/SET	Return to step 1	

- 1) It is possible to return to previous step by pressing **MODE** key.
- 2) If pressing **ENT**, "Err" appears, it means that one of the following mistakes has been made: **ALARM ≥ TRIP** or **FAN-OFF ≥ FAN-ON**. Press **PRG** to return to step 1 and correct the data.
- 3) After 1 minute of keyboard no-operation, programming is left without data storage.

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22) RULES FOR WARRANTY

The Product purchased is covered by manufacturer's warranty or the seller's terms and conditions set forth in the "General Conditions of Sale Tecsystem srl", available at www.tecsystem.it and / or purchase agreement.

The warranty is considered valid only when the product will be damaged by causes attributable to TECSYSTEM srl, such as manufacturing or components defects.

The warranty is invalid if the Product proves tampered / modified, incorrectly connected, because voltages outside the limits, non-compliance with the technical data for use and assembly, as described in this instruction manual.

Any action about warranty is always at our factory in Corsico-MI, Italy as stated by the "General Conditions of Sale Tecsystem srl".

FAULT DIAGNOSTIC	CAUSES AND REMEDIES
Monitoring unit doesn't turn on, even if the terminals are fed.	Connector not well placed inside its seat. Connection cables are not well tightened in the terminal. Burnt out feeder. <i>Take out and give supply again.</i>
CH4 is in FAULT FOC (just the 3 IR are connected)	Monitoring unit wrongly programmed with CH4/no. <i>Repeat the programming.</i>
One of three/four channels is in FAULT	Check IR sensor connections. Possible defective sensor. <i>Replace the damaged sensor.</i>
When turning on the display shows "ECH"	A strong disturbance damaged the stored data. Please refer to paragraph 10. If this problem should persist, please contact <i>TECSYSTEM S.r.l. Technical Department.</i>
All the IR sensors are in FAULT.	Wrong IR sensor connections. Terminal board mounted upside down. <i>Check the connections and the terminal board.</i>
Temperature indicated by one or more channels is wrong.	Contact <i>TECSYSTEM S.r.l. Technical Department</i>
Sudden trip of the main switch. Temperature is on standard levels. Just one channel has caused the trip.	Verify through T.MAX function possible defective sensors. <i>Replace the sensor. Check the measuring signal support terminal boards.</i>

23) NOTES ABOUT FCD FUNCTION

By activating the FCD function it is possible to have on 6-7-8 contacts a Fault signal when the temperature registered by an IR sensor increases with a speed higher than "n" °C/sec (loadable from 1 to 30).

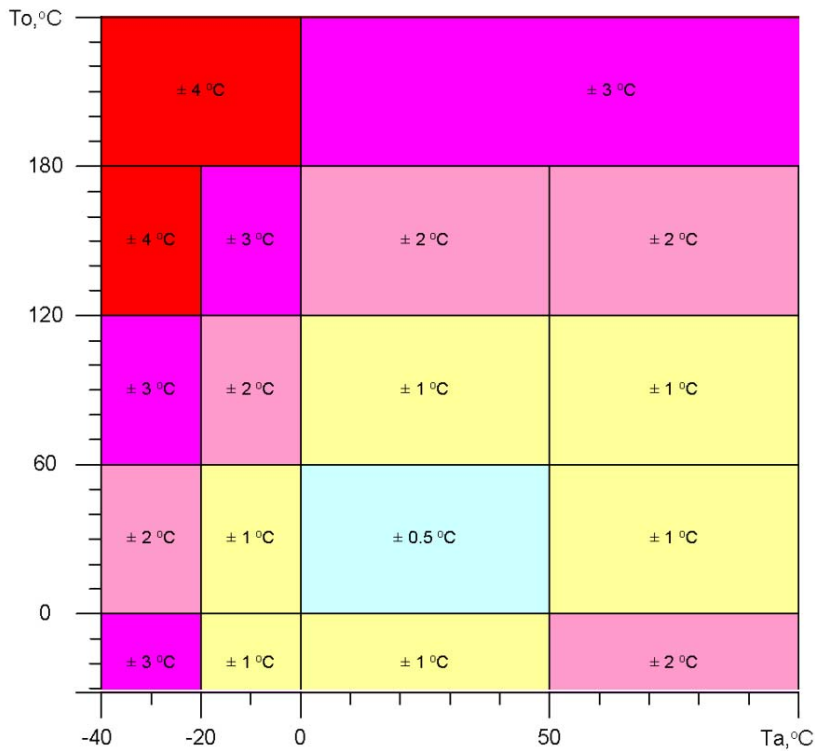
Depending on the loaded value, you can have a different sensitivity, which can be useful for various applications:

- from **1 to 10**: high sensitivity, for instance useful to detect low temperature increases
- from **10 to 20**: medium sensitivity, useful to have indications for possible noises which affect the sensor reading, connection problems or defective sensors.
- from **20 to 30**: low sensitivity, useful for applications where an higher sensitivity could give rise to faults for undesired FCD.
- loading "**no**", FCD function is disabled.

When a channel is in Fault condition for FCD, relevant Alarm and trip signalings are inhibited in order to just report the anomaly for too fast temperature increase.
Press Reset to cancel the FCD signalling of all the channels and restore the fault relay.

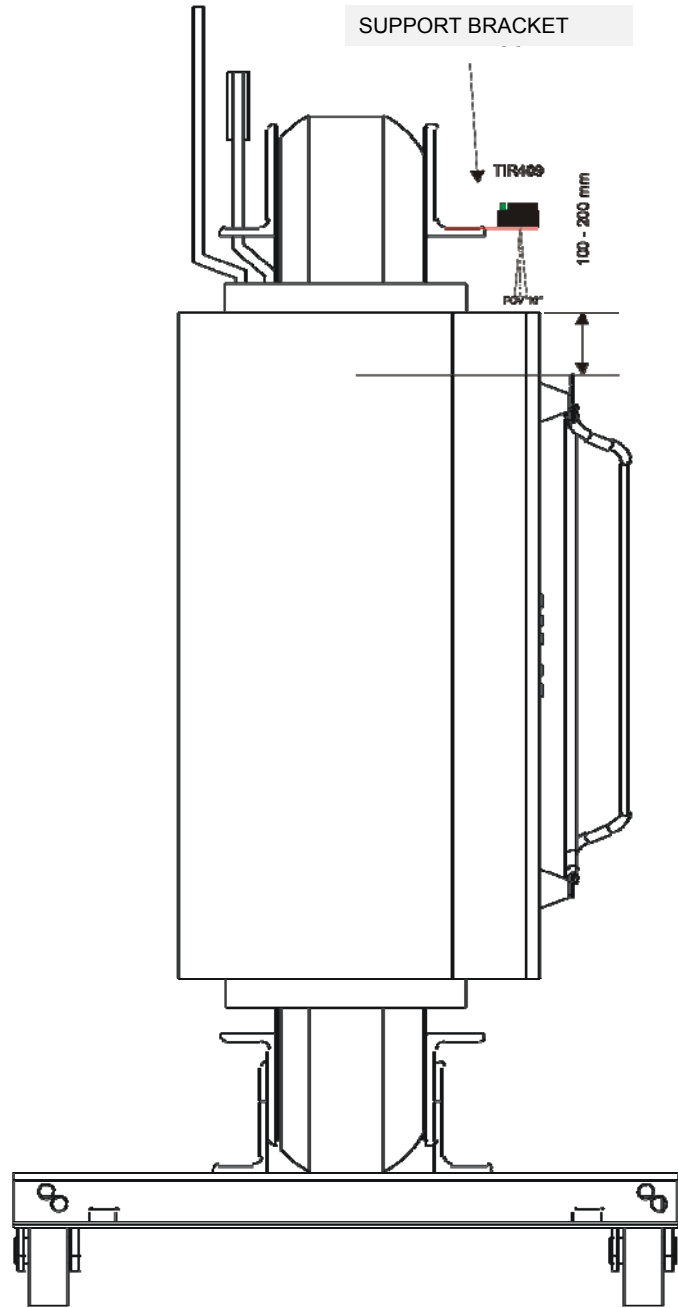
FIGURE 1

ACCURACY OF THE INFRA-RED SENSITIVE ELEMENT



Ta: Room temperature
To: Temperature of the object to measure

FIGURE 2



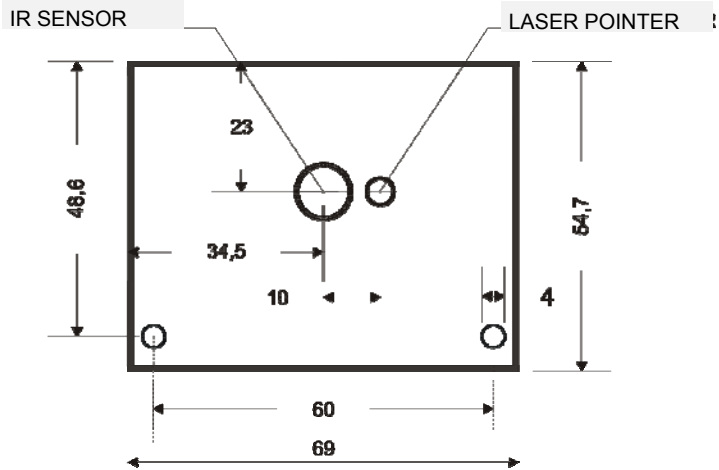


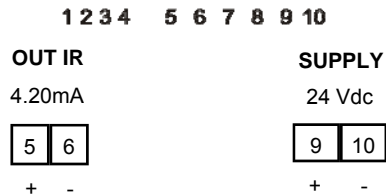
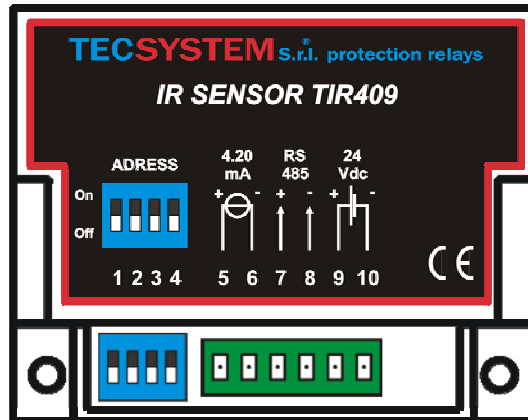
FIGURE 3 Dimensions in mm.

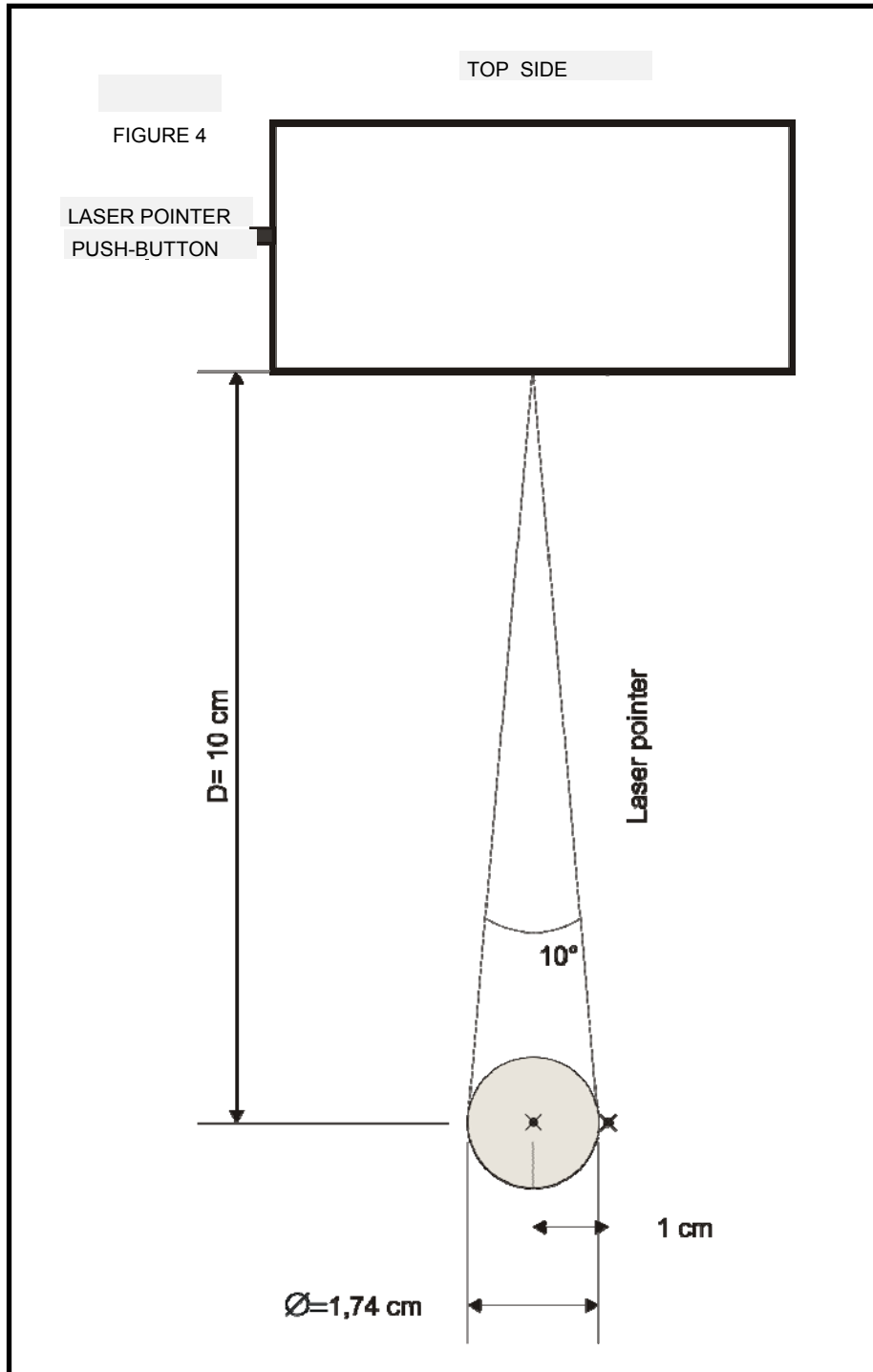
TIR409 ELECTRICAL CONNECTIONS

NOTES:

To use IR TIR409 sensor together with NT935-IR monitoring unit, it is not advisable to use 7-8 output and DIP Switch, which shall be configured all on OFF

FIG. 7





NOTES: