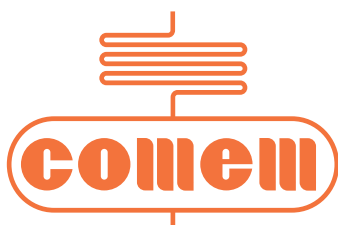


WTI-OTI

Thermometers



WTI-OTI

Crucial parameters to be monitored in large distribution transformers and power transformers are Winding and Oil temperature: those give a fundamental understanding about the overall performances of your valuable equipment by avoiding unacceptable thermal degradation and ensuring a longer lifetime.

WTI-OTI

Accurate and stable measurement through maintenance free thermometers



Thermometers are based on Bourdon working principle, which enables a direct and precise conveyance of the temperature rise from the bulb up to the main dial. The adjustable switching system connected to the pointer shaft provides the desired alarm/trip signals.

On OTI, the bulb of thermometer detects the transformer oil temperature variations generating a contraction or expansion of the capillary connected to the pointer shaft.

On WTI, given that a direct measurement of the winding temperature is not feasible, the device make use of thermal image technology whereas the sensing system comprises a heat sensitive resistive circuit through which passes a current proportional to winding current. A potentiometer placed on the main dial allows to adjust the resistive circuit depending on the transformer parameters.



Advantages:

- Accurate and stable measurement
- Robust design, no need for re-calibration over the time
- Customizable mounting flange
- Easy accessibility to wiring box
- Compact solution, PT 100 embedded into the sensing system
- Up to 4 change over micro-switches suitable to control cooling equipment and protection circuits.

Temperature sensing system

The devices work with an expansion type sensing system compensated for ambient temperature. We adopt particular cares in components testing in order to ensure a very reliable measurement along the time:

- Vacuum test (2×10^{-3} mbar): to verify the quality of the weldings and the porosity of the material.
- Pressure test (up to 280 bar): to verify the welding and the performances of the spring.
- Overheating test (up to 20% higher of the scale range for 8 hours): to train the spring and to verify the precision of the spring.

Indications for assembly

It's possible to provide the instruments with the following connections:

- Rigid locking screw M14 located on the top of thermometer.
- Elastic suspension mounted on the top of the thermometer.
- Rear flange for tank wall mounting.

Tests and inspections

The gauges are subjected to insulation test towards earth as follows between circuit and earth, the minimum dielectric withstand strenght is 2kV in accordance to EN - 50216/1. The instruments calibration is carried-out through thermostatic baths controlled by a computer system.

Calibration procedure:

- a check is carried out to see whether the temperature taken by the instrument under test differs from that taken through the sample sensor by more than the 70% of the maximum allowed instrument reading tolerance value. This test is performed by sequentially plunging thermometer bulb into successive temperature increasing thermostatic baths: 0°C / +20°C / +50°C / +100°C / +125°C.
- the instrument is heated until the instrument pointer exceeds by 20% the angular full scale value.
- step 1 is repeated, but inversely.

Microswitches activation test:

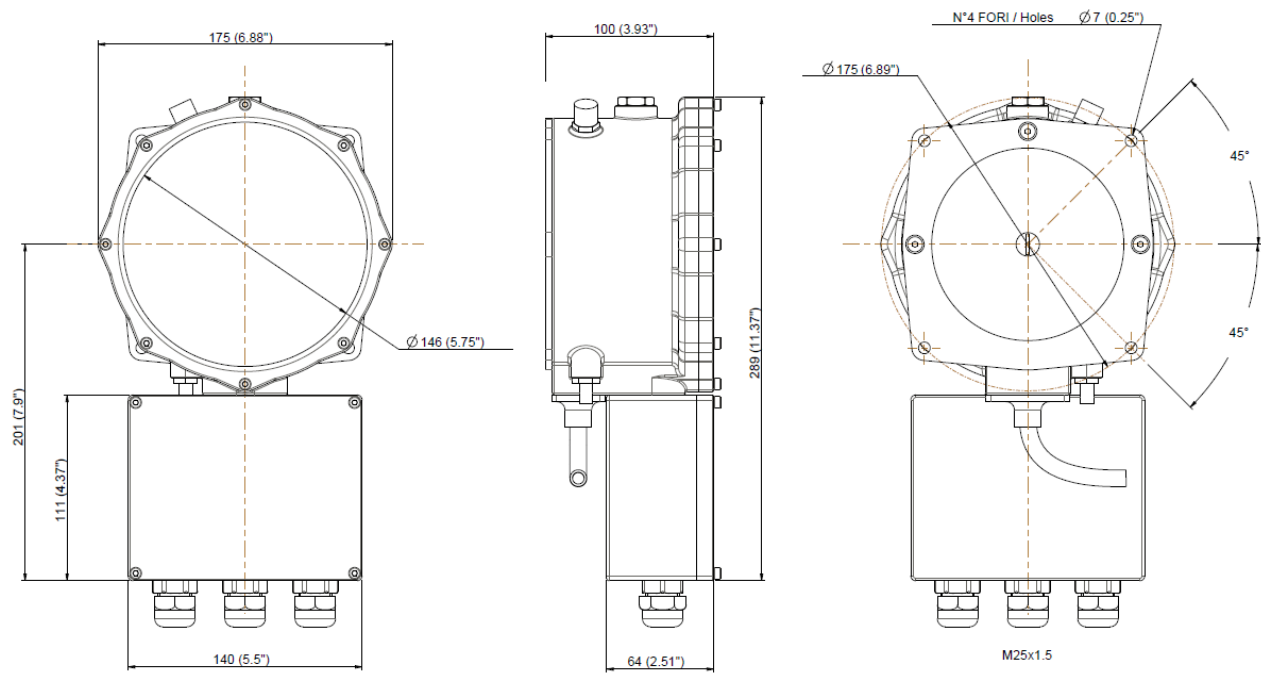
The bulb is immersed in a thermostatic bath. The computer changes the temperature inside the bath and by means of suitable sensors verifies the commutation tolerance, the commutation differential, the electrical circuits of each microswitch. At the end of the test a test report is directly printed by the computer.

No particular maintenance is required. Only periodical inspections (typical interval 6 months) to verify precision, functions and electrical connections. In case of working test effected with thermostatic bath, please note that WTI bulb MUST NOT be immersed in water. The WTI bulb is surrounded by the heating resistance and water may cause serious damages to the heating system. The calibration test must be done with oil or hot air only. When the instrument is equipped with polycarbonate lens, cleaning must be done with care in order to avoid scraps on the surface. Use water and soap only.

Winding and Oil Temperature Indicator	COMEM Technical Data
Standard	Tested and qualified in accordance to EN 50216-11 and JB/T 6302-2005
Material	
Housing	All the external pars are resistant to oils, salt fog and UV rays
Capillary and Bulb	Capillary tube: copper or stainless steel Bulb: bronze or stainless steel
Capillary tube protection	Copper tube Flexible AISI 304 stainless steel armouring or Rilsan
Lens	Mokrolon Polycarbonate, Multistrate glass or Tempered Glass
Specifications	
Painting	RAL 9002
Ambient temperature	-40°C + 70°C
Degree of protection	IP65 according to EN 60529 Optionally IP 66
Ventilation valve	2, to prevent the formation of condensation
Cable gland	Up to 3, M25x1,5
Micro Switches	Up to 4
Output	
Measuring range	WTI: 0/+150°C, 0/+160°C, 0/+180°C, -50/+150°C OTI: -50/+150°C, -20/+130°C, -20/+140°C, 0/+120°C, 0/+150°C, 0/+160°C
Measuring tolerance	1,5% of full scale
Repeat accuracy	1% of full scale value
Remote output	Up to 2x PT 100

Overall dimension

OTI / WTI



OTI Bulbs

O.T.I. Bulbs

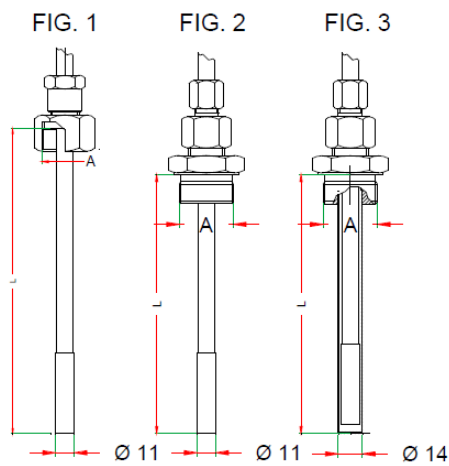


	Fig. 1			Fig. 2/3			
A	3/4 BSP	M27x2	Other	3/4 BSP	1" BSP	M27x2	M22x1.5
L	Min 150mm - Std. 150mm			Min 120mm - Std. 150mm			

O.T.I. equipped with PT 100 sensors bulbs

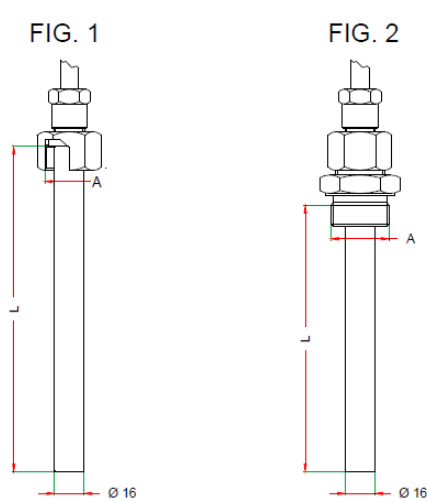


	Fig. 1			Fig. 2			
A	3/4 BSP	M27x2	Other	3/4 BSP	1" BSP	M27x2	M22x1.5
L	Min 150mm - Std. 150mm			Min 120mm - Std. 150mm			

WTI Bulbs

FIG. 1



FIG. 2

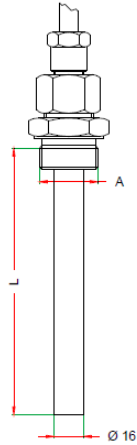


	Fig. 1			Fig. 2				
A	3/4 BSP	M27x2	Other	3/4 BSP	1" BSP	M27x2	M22x1.5	Other
L	Min 150mm - Std. 150mm			Min 120mm - Std. 150mm				

Electrical characteristics

Micro switches making and breaking capacity

Voltage	Standard Micro switches		High-performances micro switches	
	Resistive Load	Inductive Load	Resistive Load	Inductive Load
125 VAC	5 A	5 A	10 A	10 A
250 VAC	5 A	5 A	10 A	10 A
30 VDC	5 A	5 A	10 A	10 A
50 VDC	1 A	1 A	3 A	2.5 A
75 VDC	0.75 A	0.25 A	1 A	0.5 A
125 VDC	0.5 A	0.1 A	0.5 A	0.1 A
250 VDC	0.25 A	0.1 A	0.25 A	0.1 A

Order sheet OTI

Number of pieces					
OTI Standard	EN 50216-11 <input type="checkbox"/>		JB/T 6302-2005 <input type="checkbox"/>		
Fixing	Rigid locking screw <input type="checkbox"/>		Flange <input type="checkbox"/>		Elastic suspension <input type="checkbox"/>
Scale Diam. 150	-50/+150°C <input type="checkbox"/>		-20/+130°C <input type="checkbox"/>		-20/+140°C <input type="checkbox"/>
	0/+120°C <input type="checkbox"/>		0/+150°C <input type="checkbox"/>		0/+160°C <input type="checkbox"/>
Lens type	Makrolon Polycarbonate <input type="checkbox"/>		Makrolon Polycarbonate with resetting pointer <input type="checkbox"/>		
	Multilayers glass with resetting pointer <input type="checkbox"/>		Tempered glass <input type="checkbox"/>		
Contacts features	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	
	Standard <input type="checkbox"/>		High performance <input type="checkbox"/>		
Capillary protection	AISI 304 <input type="checkbox"/>		RILSAN <input type="checkbox"/>		
Provided as standard supply.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	4 <input type="checkbox"/>	6 <input type="checkbox"/>	
	Other pls. specify.....				
PT 100	1 <input type="checkbox"/>		2 <input type="checkbox"/>		
Bulb type	Fig. 1 (female) <input type="checkbox"/>		Fig. 2 (male) <input type="checkbox"/>		Fig. 3 (male with well) <input type="checkbox"/>
Bulb thread	¾ BSP <input type="checkbox"/>	1" BSP <input type="checkbox"/>	M27 x2 <input type="checkbox"/>	M22X1,5 <input type="checkbox"/>	Other
Cable gland	No.		M25x1,5 <input type="checkbox"/>		Other
Environmental protection	Moderate salinity areas acc. to ISO 12944 <input type="checkbox"/>			Off-shore areas acc. to ISO 12944 <input type="checkbox"/>	

Order sheet WTI

Number of pieces					
OTI Standard	EN 50216-11 <input type="checkbox"/>		JB/T 6302-2005 <input type="checkbox"/>		
Fixing	Rigid locking screw <input type="checkbox"/>	Flange <input type="checkbox"/>		Elastic suspension <input type="checkbox"/>	
Scale Diam. 150	0/+150°C <input type="checkbox"/>	0/+160°C <input type="checkbox"/>	0/+180°C <input type="checkbox"/>	-50/+150°C <input type="checkbox"/>	
Lens type	Makrolon Polycarbonate <input type="checkbox"/>		Makrolon Polycarbonate with resetting pointer <input type="checkbox"/>		
	Multilayers glass with resetting pointer <input type="checkbox"/>		Tempered glass <input type="checkbox"/>		
Contacts features	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	
	Standard <input type="checkbox"/>		High performance <input type="checkbox"/>		
Capillary protection	AISI 304 <input type="checkbox"/>		RILSAN <input type="checkbox"/>		
Capillary length (mt)	1 <input type="checkbox"/>	2 <input type="checkbox"/>	4 <input type="checkbox"/>	6 <input type="checkbox"/>	
	Other pls. specify.....				
PT 100	1 <input type="checkbox"/>		2 <input type="checkbox"/>		
Bulb type	Fig. 1 (female) <input type="checkbox"/>		Fig. 2 (male) <input type="checkbox"/>		
Bulb thread	¾ BSP <input type="checkbox"/>	1" BSP <input type="checkbox"/>	M27 x2 <input type="checkbox"/>	M22X1,5 <input type="checkbox"/>	Other
Cable gland	No.		M25x1,5 <input type="checkbox"/>	Other	
Environmental protection	Moderate salinity areas acc. to ISO 12944 <input type="checkbox"/>			Off-shore areas acc. to ISO 12944 <input type="checkbox"/>	
Nominal current from current transformer	1A <input type="checkbox"/>	1.5A <input type="checkbox"/>	2A <input type="checkbox"/>	4A <input type="checkbox"/>	5A <input type="checkbox"/>

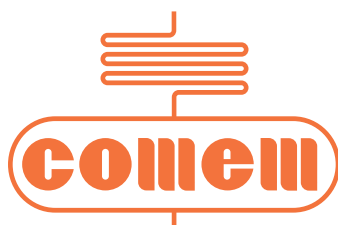
Strada Regionale 11, Signolo 22
36054 Montebello Vicentino (VI) - ITALY
Tel. +39 0444 449311
Fax +39 0444 449352 - 440359
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www.comem.com

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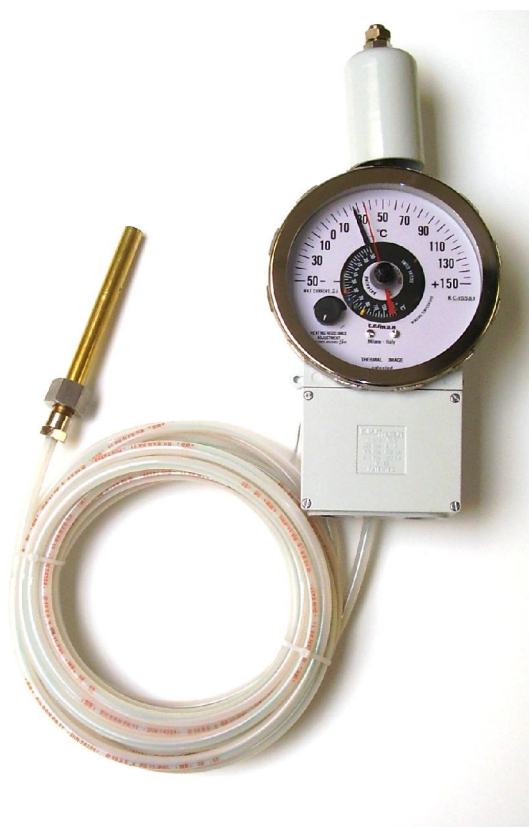
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Ed. 05/2015



Winding Temperature Indicator for Power Transformers type :

MSRT 150-W



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Description and general specifications	page	02
Options	page	04
Operating instructions and maintenance	page	06
Finished product quality control tests	page	08

Introduction.

The winding is the transformer component with the highest temperature and, above all, the one subject to the fastest temperature changes as the load increases. Thus, to have total control of the temperature parameter inside of the transformer, the temperature of the winding must also be measured. An indirect system is used to measure this latter since it is dangerous to place a sensor close to the winding due to the high voltage.

The indirect measuring is done by means of a Thermal Image.

This Winding Temperature Indicator is designed to measure the temperature of the winding by means of a special bulb surrounded by a heating resistance through which passes a current proportional to the current passing through the transformer winding subject to a given load and immersed in insulating oil at temperature T_{oil} . It's possible to adjust the heating system by means of a potentiometer whose knob is located on the winding temperature indicator's dial. In this way the value of the winding temperature indicated by the instrument will be equal to the ones planned by the trafo manufacturer for a given transformer load.

The winding temperature indicators can be fitted with up to five change-over microswitches suitable to control cooling equipments and protection circuits (alarm and trip) of the transformer.

This sector of our production is the result of considerable research and experiment commitment which has led to internationally patented new concept instruments design and construction.

The component designs of our instruments are protected by :

ITALIAN PATENT No. 208603

ITALIAN PATENT No. 89113

E.E.C. PATENT No. 0245212

U.S. PATENT No. 4,727,227

Effectiveness of these instruments must be stressed, both as regards measuring/commutation precision and extreme simplicity of operation. Special attention has been paid to design of each single part resulting in extreme high reliability of our instruments and ensuring long-lasting accurate operating. We have designed the setting system, the mounting devices and the dimensions of the cable boxes to consent the operator to easily install the indicator and to save time in setting and making cable layout.

Besides the exact constructional and severe quality control we adopt, the high performances of our instruments are further assured by the employ of the best products supplied by European technology's more advanced company names. In particular:

- the **INDICATING SHAFT** is mounted on 2 micro ball bearings to reduce the frictions and to grant right working under vibrations;
- the **AWG 22 CABLES** we adopt are silver plated and protected with Teflon according to MIL - W - 16878-4 Standard;
- the **TERMINAL BLOCKS (WEIDMULLER - Germany)** grant very high performances and are certified in accordance with European standards;
- the **POWDER PAINT** grants total protection against corrosion and increases the insulation of the device;
- the **SENSING SPRING TUBE** is manufactured with a special bronze alloy that avoid any plastic deformation and histeresis of the spring.

Description and general specifications.

Temperature sensing system : expansion type compensated for ambient temperature changes by means of a built-in compensating device.

To avoid to many checks after setting into work and periodical re-calibrations we adopt particular cares in testing the components. In particular the sensing system is subject to 3 different tests :

1. vacuum test : the sensing system is connected to a vacuum plant. The plant pressure is decreased to 2×10^{-3} mbar (hpa) to verify the quality of the welding and the porosity of the material;
2. pressure test : the sensing system is put under pressure up to 280 bar to verify the welding and that the spring is not subject to any plastic deformation;

3. overheating test : once the sensing system is completed, its bulb is located in a heating plant controlled by a microprocessor based temperature monitoring system. The temperature is increased up to a value that is 20% higher than the maximum range value of the sensing systems (i.e. for an indicator whose range is 0 / 150°C the overheating test temperature is 180°C). The temperature remains at that value for 8 hours in this way simulating 1 year life under normal working conditions (i.e. for an indicator whose range is 0 / 150°C ---> 110°C). In this way we train the spring and verify that the precision remains the same.

Capillary tube protection : rilsan tubing / stainless steel armouring / steel + PVC armouring.

Bulb : bronze .

Casing : aluminium alloy powder painted (RAL 7035) suitable to withstand to any climate and to heavy polluted atmosphere in as well tropical or arctic climates (-40 / +70°C). All components are made of corrosion resistant or surface treated materials.

The case is provided with a breather device to avoid dew on the lens.

To make cable layout quick and easy, the case is equipped with a large junction box that is completely separate from instrument's sensing system. Cable glands PG 16 - M20 - 3/4"BSP.

Mechanical protection degree : IP 65.

Working temperature : -40 / +70°C.

Lens : glass or polycarbonate.

Locking ring : Nickel plated brass. Transparent coated.

Standard measuring ranges : 0 / +150°C; 0 / +160°C.

Measuring tolerance : 1,5% of full scale value.

Commutation tolerance : 2% of full scale value.

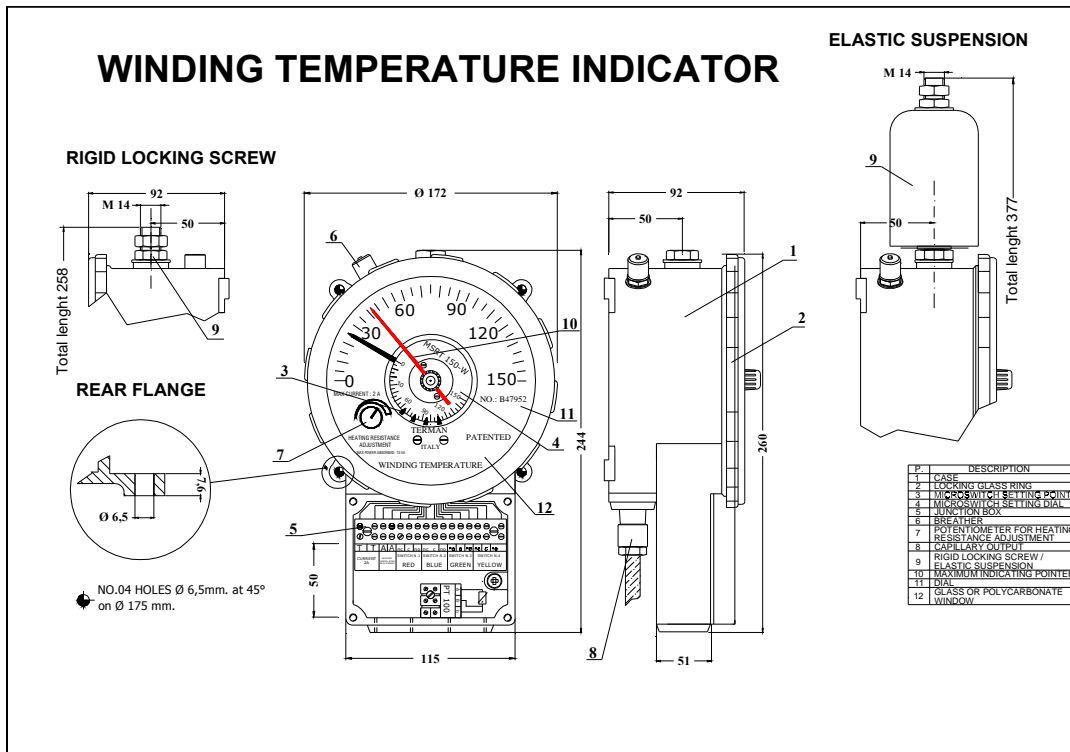
Commutation differential : 4% of full scale value.

On customer's request the differential can be increased.

Insulation : 2000V 50Hz between terminals and earth for a 60 seconds time.

MICROSWITCHES MAKING AND BREAKING CAPACITY :

	STANDARD MICROSWITCHES		HIGH-PERFORMANCE MICROSWITCHES	
VOLTAGE	RESISTIVE LOAD	INDUCTIVE LOAD	RESISTIVE LOAD	INDUCTIVE LOAD
125 VAC	5 A	5 A	10 A	10 A
250 VAC	5 A	5 A	10 A	10 A
30 VDC	5 A	3 A	10 A	10 A
50 VDC	1 A	1 A	3 A	2,5 A
75 VDC	0,75 A	0,25 A	1 A	0,5 A
125 VDC	0,5 A	0,1 A	0,5 A	0,1 A
250 VDC	0,25 A	0,1 A	0,25 A	0,1 A



DRWG. N. 1242/B

Options.

Elastic suspension (Drwg. No.1231) : it's a vibration damping system able to minimize the effects of a machine vibrations on the instrument.

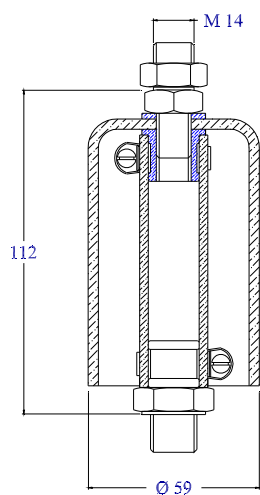
Earthquake proof version : done by equipping the instrument with the elastic suspension and suitable internal components.

PT 100 sensor : the oil temperature indicator can be equipped with one or two PT 100 sensors that convert the temperature values in resistance values and transmit them to a receiver or to a monitoring system. Up to 2 PT 100 sensors can be mounted on the WTI.

Receiver (Drwg. No.1479) : we can supply a digital receiver to display the temperature signal received from the sensor.

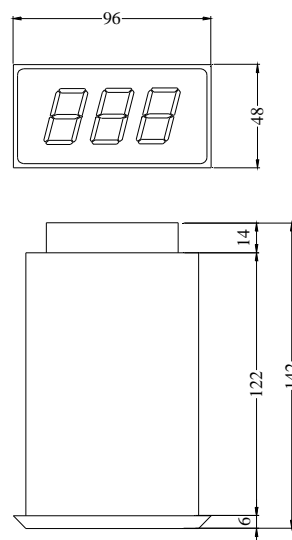
Transducer 4...20mA (Drwg. No.1707) : we can supply a wide range of transducers 4...20mA that convert the resistance values (input Pt100) into current values (output 0..20mA or 4..20mA) or into voltage values (0..5V or 0..10 V). These devices can be mounted on a DIN rail inside of the transformer marshalling box.

ELASTIC SUSPENSION



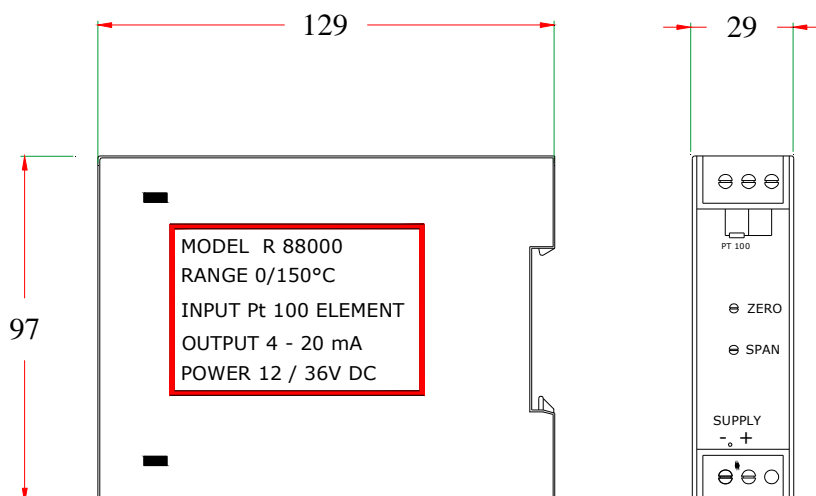
DRWG. N. 1231

PT 100 RECEIVER



DRWG. N. 1479

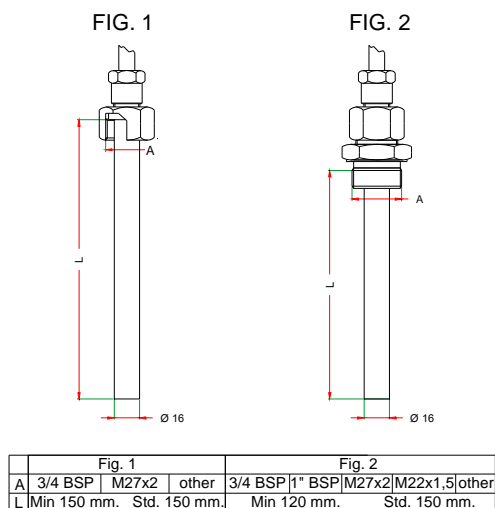
4...20mA TRANSDUCER PT 100 INPUT



DRWG. N. 1707

STANDARD BULBS

W.T.I. BULBS



Operating instructions and maintenance.

Mounting: mount the instrument on its machine or plant :

- rigid locking screw M14 (Drwg. No.1242/B) located on the top of the thermometer;
- elastic suspension (Drwg. 1231) that is mounted on the top of the thermometer with a screw M14 that consents to install the instrument to the plant,
- rear flange (Drwg. No.1242/B-F) for wall mounting to the oil tank.

Removing of the terminal box cover : by unscrewing the 4 stainless steel screws.

Cable layout : the numerations 1-2-3-4-5 indicate the microswitches progression (red, blue, green, yellow, white pointer). Close to the terminals you will find the following abbreviations :

- C = common
- NO = normally open
- NC = normally closed

that allow the operator to choose the desired cable layout. Connect the microswitches terminals and the earth terminal. If the thermal image is equipped with the PT 100 probe you find also the PT 100 terminals with a clear label that indicates how you can connect the probe to the display or to a transducer. After having done all the connecting operations re-position the terminal box cover taking care to put the flat gasket in the right position and screwing the 4 stainless steel screw.

Regulation of the value of ΔT : within the instrument's terminal board there are, as well as earth and microswitches connection terminals, the terminals T-T and the terminals A-A. Procedure for regulating the instruments :

1. insert the ammeter probes in terminals **A-A**;
2. remove jumper **A-A**;
3. connect terminals **T-T** to the current transformer. **AFTER** having checked that the value of the power supply current printed on the dial (above the knob for regulating overheating) is, in fact, the same as that of **CT (current transformer)**;
4. regulate the current on the basis of curve **I - ΔT** attached;

5. replace jumper **A-A**;
6. remove the ammeter probes;
7. wait a few minutes to allow **T_w** to stabilize;
8. check the exactitude of **T_w**;

N.B.: the bulb of the thermometer for the thermal image must be filled with oil to accelerate the heat interchange occurrences. The bulb must be inserted in a well filled with transformer oil : the oil will rise through a suitable hole located in the bottom of the bulb itself until it covers the resistance.

It's very important to stress that the $I - \Delta T$ curves are only valid if the bulb is immersed in oil.

Setting : to set microswitches pls., follow exactly the instructions :

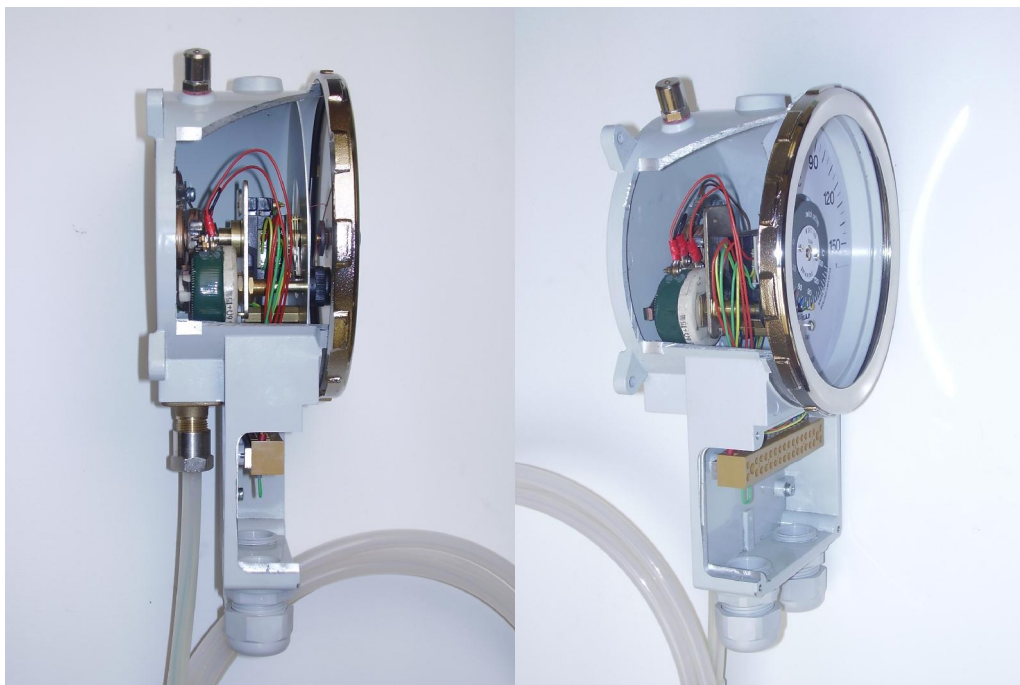
- remove the locking ring;
- remove the glass or polycarbonate lens (take care to the O-ring);
- stop the microswitches setting dial (small black dial) with two fingers and slide the frictioned microswitches setting pointers until they are located at the desired temperature. *Note that to reduce errors you have to slide the pointers towards higher temperature value;*
- Replace the lens taking care that the max. temperature indicating pointer is located on the right side of the temperature indicating pointer and that the lens itself is correctly positioned over the sealing O-ring;
- Lock the lens screwing the locking ring.

Maintenance

No particular maintenance is required. Only periodical inspections (typical interval 6 months) to verify precision, functions and electrical connections.

In case of working test effected with thermostatic bath, please note that WTI bulb **MUST NOT** be immersed in water. The WTI bulb is surrounded by the heating resistance and water may cause serious damages to the heating system. The calibration test must be done with oil or hot air only.

When the instrument is equipped with polycarbonate lens, cleaning must be done with care in order to avoid scraps on the surface. Use water and soap only.



Finished product quality control tests.

Instrument calibration : carried out through thermostatic baths controlled by a computer system. The procedure varies according to instruments scale.

Example of procedure for a thermal image scale 0/150°C: the calibration is made using 5 different baths set at the following temperatures :

bath 1 = 0°C
bath 2 = 20°C
bath 3 = 50°C
bath 4 = 100°C
bath 5 = 125°C

Calibration procedure :

Step 1: a check is carried out to see whether the temperature taken by the instrument under test differs from that taken through the sample sensor by more than the 70% of the maximum allowed instrument reading tolerance value.

This test is performed by sequentially plunging the Winding Temperature bulb into successive temperature increasing thermostatic baths: 0°C / +20°C / +50°C / +100°C / +125°C.

Step 2: the instrument is heated until the instrument pointer exceeds by 20% the angular full scale value.

Step 3: step 1 is repeated, but inversely.

Microswitches actuation test : performed through a computer controlled testing unit.

The bulb is immersed in a thermostatic bath. The computer changes the temperature inside the bath and by means of suitable sensors verifies the commutation tolerance, the commutation differential, the electrical circuits of each microswitch.

At the end of the test a test report is directly printed by the computer.

Check of instrument protection degree : IP 65.

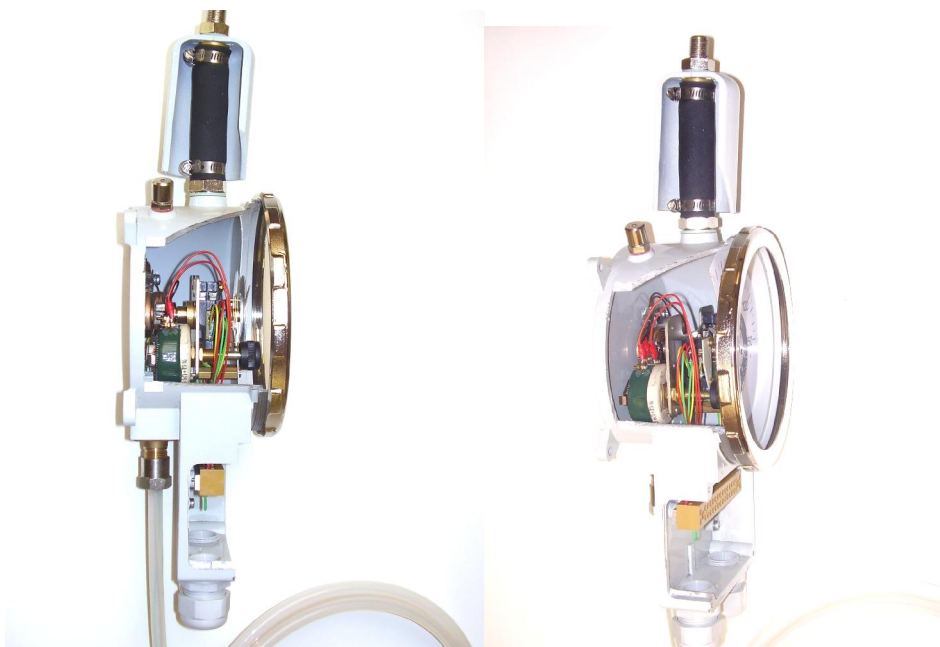
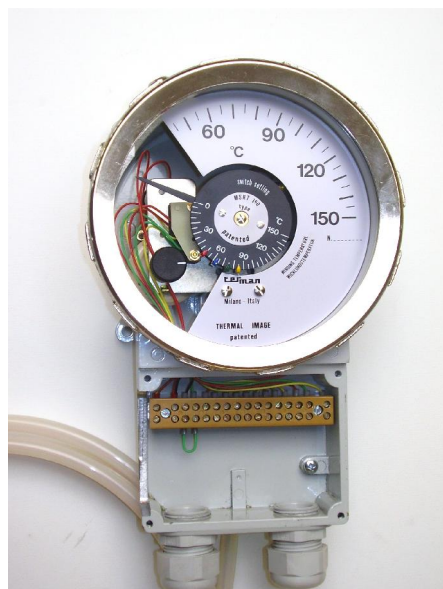
This test is carried out by means a lance-sprinkled water jet on all sides of device

Insulation test : carried out by means of a microprocessor controlled testing unit.

Heating system functionality test : to verify trimming functionality of potentiometer and total resistance values of the circuit.

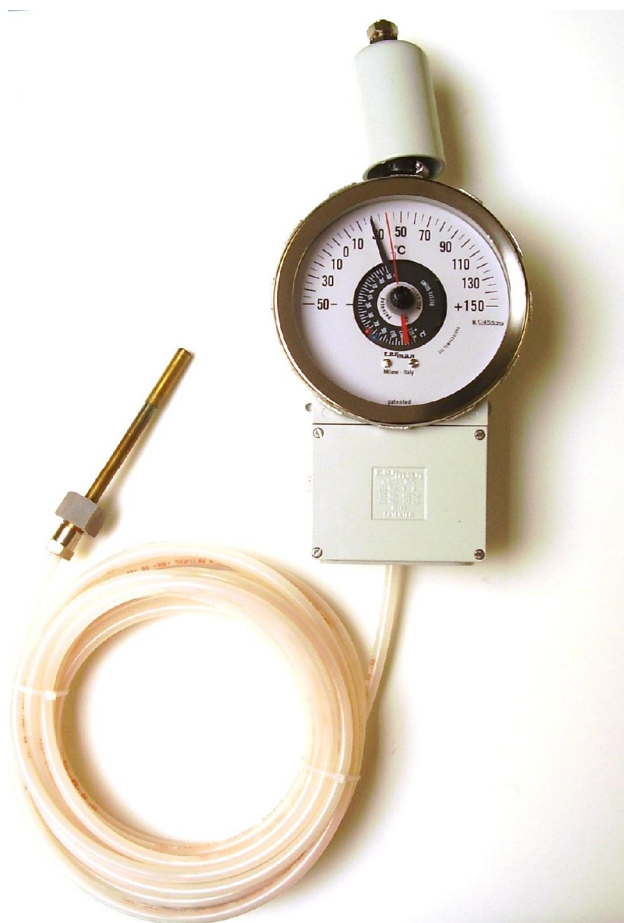
Note : all the collected data are immediately transferred, by means of the computer net, to the quality control and to the design departments to be supervised and evaluated.

In our files, we keep all the above mentioned informations and we can supply to the customer detailed reports regarding the performances of each instrument delivered.



Oil Temperature Indicator for Power Transformer type :

MSRT 150



Introduction	Pag.	02
Description and general specifications	Pag.	02
Options	Pag.	04
Operating instructions and maintenance	Pag.	07
Finished product quality control tests	Pag.	09
Testing sheet for thermometer	Pag.	09

Introduction.

These instruments are designed to measure the temperature of the insulating oil inside of power transformer tanks and they can be fitted with up to five change-over microswitches suitable to control cooling equipments and protection circuits (alarm and trip) of the transformer.

This sector of our production is the result of considerable research and experiment commitment which has led to internationally patented new concept instruments design and construction.

The component designs of our instruments are protected by :

ITALIAN PATENT No. 208603

ITALIAN PATENT No. 89113

E.E.C. PATENT No. 0245212

U.S. PATENT No. 4,727,227

Effectiveness of these instruments must be stressed, both as regards measuring/commutation precision and extreme simplicity of operation.

Special attention has been paid to design of each single part resulting in extreme high reliability of our instruments and ensuring long-lasting accurate operating. We have designed the setting system, the mounting devices and the dimensions of the cable boxes to consent the operator to easily install the indicator and to save time in setting and making cable layout.

Besides the exact constructional and severe quality control we adopt, the high performances of our instruments are further assured by the employ of the best products supplied by European technology's more advanced company names. In particular :

- the **INDICATING SHAFT** is mounted on 2 micro ball bearings to reduce the frictions and to grant right working under vibrations;
- the **AWG 22 CABLES** we adopt are silver plated and protected with Teflon according to MIL - W - 16878-4 Standard;
- the **TERMINAL BLOCKS (WEIDMULLER - Germany)** grant very high performances and are certified in accordance with European standards;
- the **POWDER PAINT** grants protection against corrosion and increases the insulation of the device;
- the **SENSING SPRING TUBE** is manufactured with a special bronze alloy that avoids any plastic deformation and hysteresis of the spring.

Description and general specifications.

Temperature sensing system : expansion type compensated for ambient temperature changes by means of a built-in compensating device.

To avoid too many checks after setting into work and periodical re-calibrations we adopt particular cares in testing the components. In particular the sensing system is subject to 3 different tests:

1. vacuum test: the sensing system is connected to a vacuum plant. The plant pressure is decreased to 2×10^{-3} mbar (hpa) to verify the quality of the welding and the porosity of the material;
2. pressure test: the sensing system is put under pressure up to 280 bar to verify the welding and that the spring is not subject to any plastic deformation.
3. overheating test: once the sensing system is completed, its bulb is located in a heating plant controlled by a microprocessor based temperature monitoring system. The temperature is increased up to a value that is 20% higher than the maximum range value of the sensing systems (i.e. for an indicator whose range is 0/150°C the overheating test temperature is 180°C). The temperature remains at that value for 8

hours in this way simulating 1 year life under normal working conditions (i.e. for an indicator whose range is 0/150°C ---> 110°C). In this way we train the spring and verify that the precision remains the same.

Capillary tube protection : rilsan tubing / stainless steel armouring / steel + PVC armouring.

Bulb : bronze.

Casing : aluminium alloy powder painted (RAL 7035) suitable to withstand to any climate and to heavy polluted atmosphere in as well tropical or arctic climates (-40 / +70°C). All components are made of corrosion resistant or surface treated materials. The case is provided with a breather device to avoid dew on the lens. To make cable layout quick and easy, the case is equipped with a large junction box that is completely separate from instrument's sensing system. Cable glands PG 16, 1/2" BSP, 3/4"BSP or M20x1,5.

Mechanical protection degree : IP 65.

Lens : glass or polycarbonate.

Locking ring : Nickel plated brass; transparent coated.

Standard measuring ranges :

-20 / +130°C; 0 / +150°C; -20 / +140°C; 0 / +160°C; 0 / +200°C.

Measuring tolerance : 1,5% of full scale value.

Commutation tolerance : 2% of full scale value.

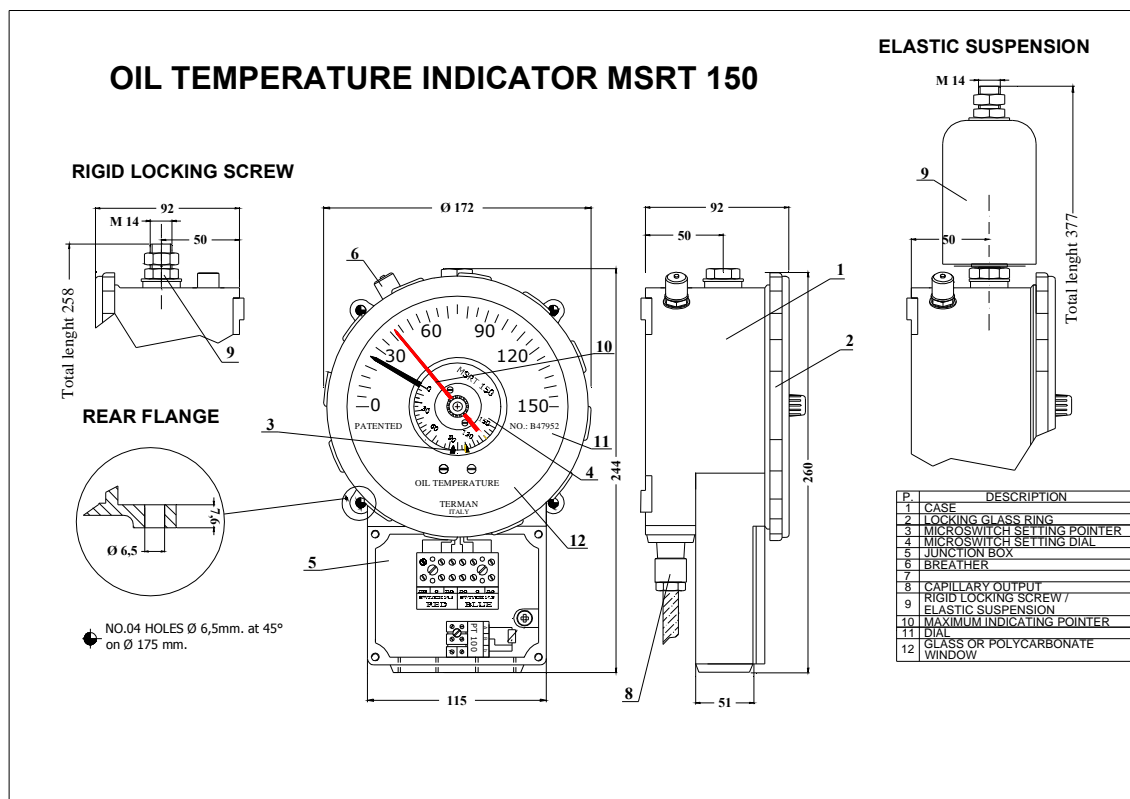
Commutation differential : 4% of full scale value.

On customer's request the differential can be increased.

Insulation : 2000V 50Hz between terminals and earth for a 60 seconds time.

MICROSWITCHES MAKING AND BREAKING CAPACITY :

VOLTAGE	STANDARD MICROSWITCHES		HIGH-PERFORMANCE MICROSWITCHES	
	RESISTIVE LOAD	INDUCTIVE LOAD	RESISTIVE LOAD	INDUCTIVE LOAD
125 VAC	5 A	5 A	10 A	10 A
250 VAC	5 A	5 A	10 A	10 A
30 VDC	5 A	3 A	10 A	10 A
50 VDC	1 A	1 A	3 A	2,5 A
75 VDC	0,75 A	0,25 A	1 A	0,5 A
125 VDC	0,5 A	0,1 A	0,5 A	0,1 A
250 VDC	0,25 A	0,1 A	0,25 A	0,1 A



DRWG. N. 1242

Options.

Elastic suspension (Drwg. No.1231) : it's a vibration damping system able to minimize the effects of a machine vibrations on the instrument.

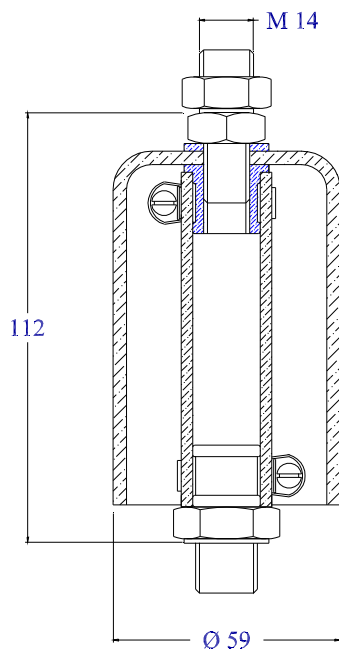
Earthquake proof version : done by equipping the instrument with the elastic suspension and suitable internal components.

PT 100 sensor : the oil temperature indicator can be equipped with one or two a PT 100 sensors that convert the temperature values in resistance values and transmit them to a receiver or to a monitoring system.

Receiver (Drwg. No.1479) : we can supply a digital receiver (220VAC 50/60Hz) to display the temperature signal received from the sensor.

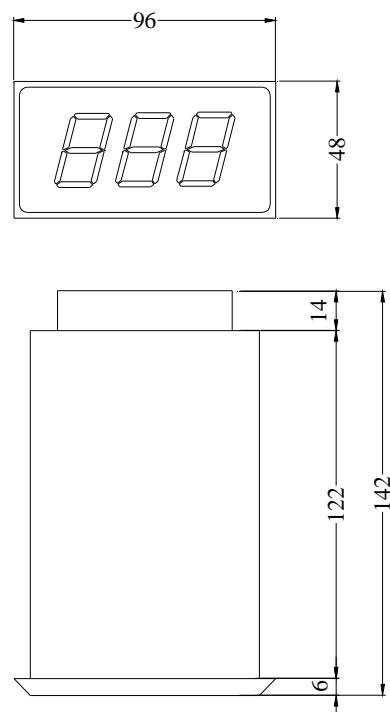
Transducer 4...20mA (Drwg. No.1707) : we can supply a transducer 4...20mA that converts the resistance values in current values. This device must be mounted on a DIN rail inside of the terminal box.

ELASTIC SUSPENSION



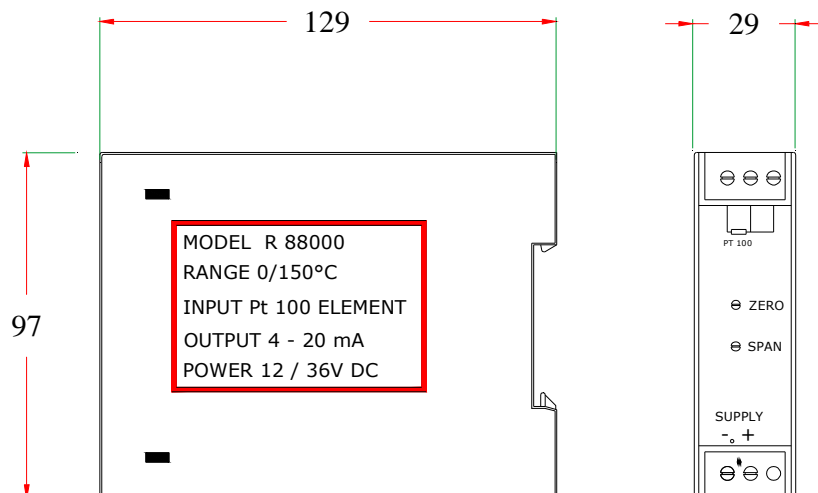
DRWG. N. 1231

PT 100 RECEIVER



DRWG. N. 1479

4...20mA TRANSDUCER for PT 100 PROBE



DRWG. N. 1707

STANDARD BULBS

O.T.I. BULBS

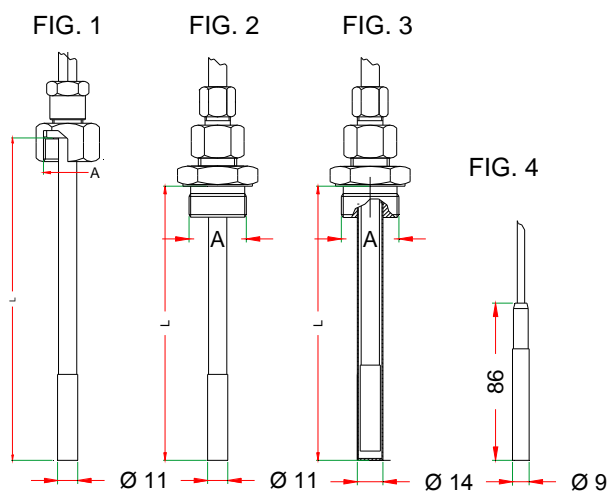


Fig. 1				Fig. 2/3				
A	3/4 BSP	M27x2	other	3/4 BSP	1" BSP	M27x2	M22x1,5	other
L	Min 80 mm.	Std. 150 mm.		Min 80 mm.		Std. 150 mm.		

O.T.I. equipped with PT 100 sensor bulbs

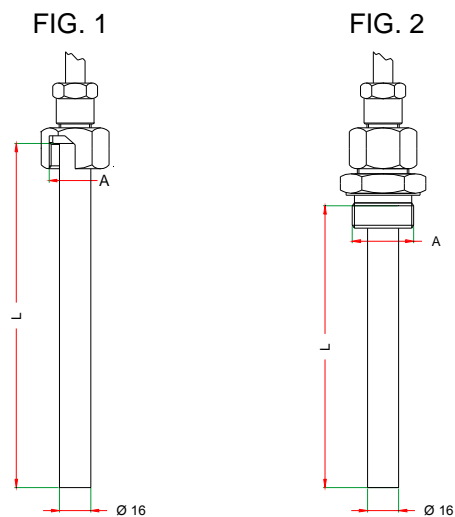


Fig. 1				Fig. 2				
A	3/4 BSP	M27x2	other	3/4 BSP	1" BSP	M27x2	M22x1,5	other
L	Min 150 mm.	Std. 150 mm.		Min 120 mm.		Std. 150 mm.		

Operating instructions and maintenance.

Mounting : mount the instrument on its machine or plant.

Being the instrument provided with capillary tube it is possible to supply the same with one of the following connections :

- rigid locking screw M14 (Drwg. No.1242) located on the top of the thermometer;
- elastic suspension (Drwg. 1231) that is mounted on the top of the thermometer with a screw M14 that consents to install the instrument to the plant;
- rear flange (Drwg. No.1242/F) for wall mounting on the transformers tank.

Removing of the terminal box cover : by unscrewing the 4 stainless steel screws.

Cable layout : the numerations 1-2-3-4-5 indicate the microswitches progression (red, blue, green, yellow, white pointer). Close to the terminals you can find the following abbreviations :

- C = common
- NO = normally open
- NC = normally closed

that allow the operator to choose the desired cable layout.

Connect the microswitches terminals and the earth terminal.

If the thermometer is equipped with the PT 100 probe you find also the PT 100 terminals with a clear label that indicates how you can connect the probe to the display or to a transducer.

After having done all the connecting operations re-position the terminal box cover taking care to put the flat gasket in the right position and screwing the 4 stainless steel screws.

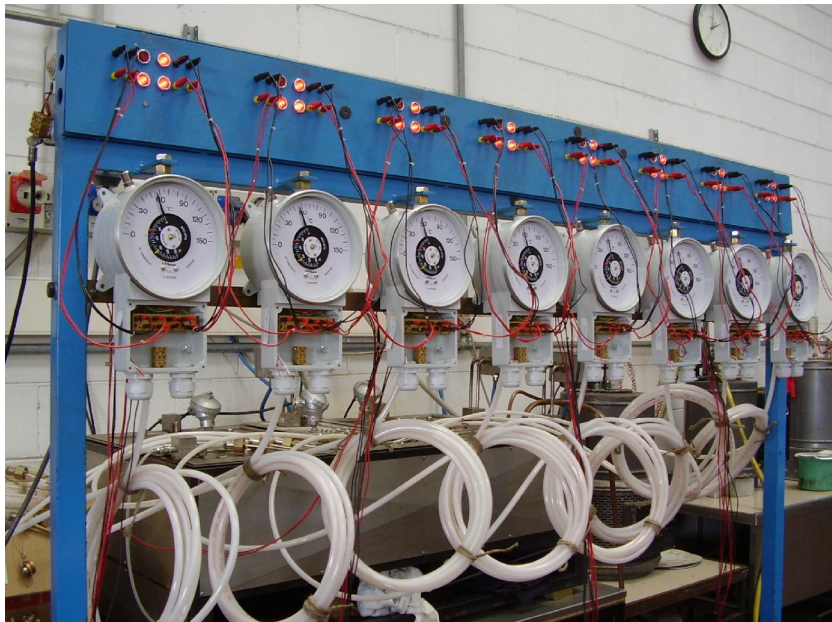
Setting : to set microswitches pls., follow exactly the instructions :

- remove the locking ring;
- remove the glass or polycarbonate lens (take care of the O-ring);
- stop the microswitches setting dial (small black dial) with two fingers and slide the frictioned microswitches setting pointers until they are located at the desired temperature. Note that to reduce errors you have to slide the pointers towards higher temperature value.
- Replace the glass or polycarbonate lens taking care that the max. temperature indicating pointer is located on the right side of the temperature indicating pointer and that the lens itself correctly positioned over the sealing O-ring;
- Lock the lens screwing the locking ring.

Maintenance

No particular maintenance is required. Only periodical inspections (typical interval 6 months) to verify precision, functions and electrical connections.

When the instrument is equipped with polycarbonate lens, cleaning must be done with care in order to avoid scraps on the surface. Use water and soap only.



Finished product quality control tests.

Instrument calibration : carried out through thermostatic baths controlled by a computer system. The procedure varies according to instruments scale.

Example of procedure for a thermometer scale -20 / +130°C: the calibration is made using 5 different baths set at the following temperatures :

bath 1 = -20°C

bath 2 = 20°C

bath 3 = 50°C

bath 4 = 100°C

bath 5 = 125°C

Calibration procedure :

Step 1: a check is carried out to see whether the temperature taken by the instrument under test differs from that taken through the sample sensor by more than the 70% of the maximum allowed instrument reading tolerance value.

This test is performed by sequentially plunging the Oil Temperature bulb into successive temperature increasing thermostatic baths: -20°C / +20°C / +50°C / +100°C / +125°C.

Step 2: the instrument is heated until the instrument pointer exceeds by 20% the angular full scale value.

Step 3: step 1 is repeated, but inversely.

Microswitches actuation test : performed through a computer controlled testing unit.

The bulb is immersed in a thermostatic bath. The computer changes the temperature inside of the bath and by means of suitable sensors verifies the commutation tolerance, the commutation differential, the electrical circuits of each microswitch.

At the end of the test a report is directly printed by the computer.

Check of instrument mechanical protection degree : IP 65.

This test is carried out by means a lance-sprinkled water jet on all sides of device.

Insulation test : carried out by means of a microprocessor controlled testing unit.

Note : all the collected data are immediately transferred, by means of the computer net, to the quality control and to the design departments to be supervised and evaluated.

In our files, we keep all the above mentioned informations and we can supply to the customer detailed reports regarding the performances of each instrument delivered.

Programmable transmitter 6740

- Thermocouples B,C,D,E,G,J,K,L,N,R,S,T
- RTD's Pt100, Pt500, Pt1000 ja Ni100, Ni1000
- Process inputs: 0..20mA, 4..20 mA, -20 .. +20 mA
0..5 V, 0..10 V, -10 .. +10 V
- IR-thermocouples
- mV-inputs -100 .. +100 mV
- Outputs: 0..20, 4..20 mA, 0..5, 0..10 V
- Programming by PC or hand held programmer 6790
- Galvanic isolation, input/output/power supply
- Power supply 24VDC

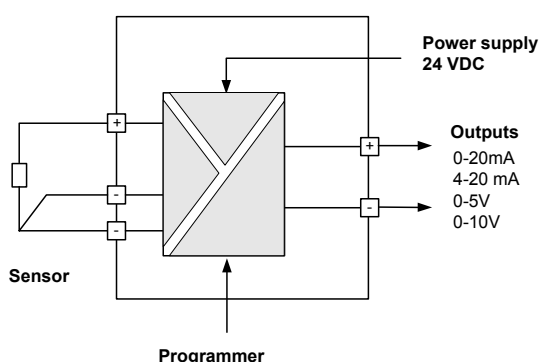


Signal converter 6740 is exceptionally versatile and accepts almost all common sensor inputs. You can configure it by PC. Transmitter front has configuration connector which connects adapter cable POL-RS232 to serial port of the PC. Menu based configuration program is easy to use. By hand held programmer 6790 you can easily control or configure the transmitter in field conditions.

The 16 bit A/D converter enables high accuracy. Linearity of A/D converter is 0.005 % and conversion accuracy of output signal is 0.05 %, without sensor linearization error. Galvanic isolation is specially important with thermocouples but potential differences with other measuring circuits can be avoided also in case of process input signals.

Small size converter is provided with detachable connectors which speed up installation and programming. Large sensor selection and other inputs as well as versatility reduce stocking costs significantly because the 6740 suits for most measuring applications.

Converter 6740 construction



Technical specification:

Thermocouples:

Sensor	Range	Linearity
E	-100.... 900°C	< 0.3°C -50.... 900°C
J	-150.... 900°C	< 0.3°C -50.... 900°C
K	-150.... 1350°C	< 0.4°C -40.... 1300°C
L	-100.... 900°C	< 0.4°C -50.... 900°C
T	-150.... 400°C	< 0.3°C -150.... 400°C
N	0....1300°C	< 0.4°C 0.... 1300°C
R	0....1700°C	< 0.4°C 400.... 1700°C (<1°C < 300 °C)
S	0....1700°C	< 0.4°C 300.... 1700°C (<1°C < 300 °C)
C (W5)	0....2200°C	< 0.4°C 400.... 2200°C (<0.4°C < 400 °C)
D (W3)	0....2200°C	< 0.4°C 500.... 2200°C (<1°C < 500 °C)
B	400.... 1700°C	< 0.5°C 400.... 1700°C
G (W)	1000.. 2200°C	< 0.5°C 1000.. 1700°C (<3 °C >1700 °C)
Range selection	freely selectable	
Calibration accuracy	< 0.1 % of max. span	
Cold junction compensation	< 0.05 °C / °C	
Sensor wire influence	< 10 kohm, negligible	

RTD's:

Range	Pt100, Pt500, Pt1000, Ni100 -200..+700 °C (Pt100, Pt500) -200...+300 °C (Pt1000) -60....+175 °C (Ni100)
Sensor connections	3-, 4-wire connection
Max. sensor wire resistance	<30 ohm /wire
Sensor current	0.3 mA typical
Accuracy	0.1 % of reading (°C) +0.1 °C
Calibration accuracy	±0.1 °C (0 °C)
Linearity	< 0.1 °C (-200..+700 °C)
Sensor error correction	freely offset and span corrections

Other resistance inputs 0-1000 ohm, potentiometer 50-500 ohm

mV-inputs:

Accuracy	-100..+100 mV
Linearity	0.02 % of span
input impedance	0.01 % of span >10 Mohm

Process inputs:

Input impedance	0..20 mA, 4..20 mA, -20..+20 mA, 0..5, 0..10 V, -10..+10V
Accuracy	Current: 5 ohm and voltage: 1 Mohm
Linearity	0.02 % of span 0.01% of span

IR-anturit:

Range	Exergen 140F-K and 440F-K -40...+350°C (linearized range)
Range	-30...+600°C (linearized range)
Emissivity correction	selectable by PC

Output:

Output	0..20, 4..20 mA, 0..5 V, 0..10V
Output scaling	scaling on whole range, straight and reversed
Resolution	< 0.03 % of span (DAC)
Calibration accuracy	<0.05% of span
Sensor break monitoring	3.5 or 24 mA or >10V
Output limiter	24 mA
Output load	<600 Ω for current and >10 k Ω for voltage

Configuration:

Connection	2-pole Nokeval POL-connection (transmitter)
Serial data	RS232, 9600bps, 9-pole D-connector by PC's serial port
Serial protocol	Meku / Nokeval
Hand held programmer	6790, red LED-display

General:

Power supply	24 VDC, ± 15 %
Power consumption	max. 40 mA
Temperature effects	<0.005 %/°C of input range
Galvanic isolation	input/output 1000 VDC/ 1 min.
Measuring rate	4 samples/s.
AD-converter	16 bit
Output DAC	12 bit
Operating temperature	0..60 °C
Ambient storage	-20....+70 °C
Humidity (non-condensing)	0..95 %RH
Weight	80 g
Connection	1.5 mm ² , AWG 16
Protection	IP20

How to order:

Type:

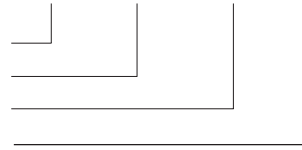
6740 - Pt100 - 0/600 - 0/10

Model

Sensor input

Range

Output



Example. 6740-Pt100-600-0/10, sensor: Pt100,
range: 0..600 °C, output: 0..10V

Transmitter is freely programmable but if you like it factory
configured use above mentioned marking procedure.

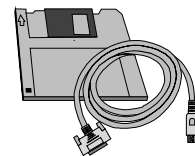
Optional:

Cable for transmitter/PC
Configuration software
Hand held programmer

POL-RS232
MekuWin
6790



Hand held
programmer 6790



Configuration
software MekuWin

Connection and dimensions:

