TEMPERATURE CONTROLLER
Installation & Maintenance Instructions

C102 / C105

The **C102** is an instrument capable of indicating and controlling the temperature of a transformer. It is supplied fully configured and calibrated to customer specifications.

WARNING!
Many of the test procedures specified require the instrument to be exercised over its full scale range. Therefore all switches WILL BE operated. Ensure all Safety Precautions and Procedures are observed.

Principle of Operation:
The temperature indicator is provided with a sensing bulb which is inserted into an oil filled pocket located in the transformer tank cover. This bulb is connected to expansion bellows via a fluid filled capillary tube. The change in volume of the fluid due to temperature variations, causes the bellows to act on a mechanical linkage which rotates a switch plate and an indicating pointer, thus providing a measurement of top oil temperature. The switch plate is capable of accommodating up to four switches that can be independently set.

Maintenance:
The temperature indicator requires no maintenance. Adjustment or replacement of switches may be necessary. Remote temperature information devices
(if fitted) can also be adjusted.

Ambient Temperature Compensation:
This is achieved by a further bellows connected to a capillary which terminates at the head of the bulb. This bellows acts upon the measuring bellows via a linkage and thus compensates for changes in ambient temperature.

Thermal Imaging:
Is achieved by fitting a heater coil around the measuring bellows. The heater coil is fed by the current transformer on the loaded winding. The temperature increase of the heater coil is proportional to the increase in temperature of the winding over the top oil temperature. The temperature of the fluid in the bellows is modified to provide an indication of the temperature in the hottest part of the winding. The thermal time constant of the instrument is the same as that of the winding, thereby giving a true thermal image of the loaded winding in relation to time.

Capillary:
The capillary tubes are contained in a flexible armoured stainless steel sheath. On installation, care must be taken when running the capillary, ensuring a minimum radius of 9 inches (225mm) and cable support at intervals of between 12 to 18 inches (300–450mm). Ensure sufficient length is left at the transformer to allow for the bulb to be freely installed and removed.

Instrument Mounting:
Ensure the instrument is mounted level, as errors in the horizontal plane will affect the zeroing of the mercury switches.
Where transformer vibration is present at the mounting position, it is essential that suitably selected anti-vibration mountings are fitted. These can be supplied for surface mounted instruments. Care must be taken when fitting this type of mounting as over tightening will stress the anti-vibration material and considerably shorten their life.

Test Knob (If fitted)
WARNING! No attempt should be made to force the mechanism back below indicated temperature as this will cause damage to the instrument. The test knob is located on the front of the instrument and causes the switch plate to rotate away from ambient or bulb temperature, allowing for the setting up and testing of the switches. The output from remote monitoring equipment can also be verified when operating the mechanism. The knob should be rotated slowly with control in both directions. The knob can be wire -locked to prevent inadvertent operation.

Electrical Connections:
All connections are made to terminal blocks located in the bottom of the instrument. Access ports are provided to allow for loom routing. A wiring diagram for all connections is provided in the case.

Mercury switch adjustment procedure:
Switch operating points are set by slackening off the two locking screws. Rotate the left hand pointer to the desired temperature value at which the switch is required to operate, and tighten screw. Rotate the right hand pointer to establish the differential value, and tighten screw. Repeat set up operation for remaining switches. For minimum differential value lock pointers together. When slackening and tightening the locking screws, care must be taken to hold the switch plate to avoid any undue strain on the operating mechanism.

Maximum Pointer:
A second pointer is attached to the instrument window and is operated by the indicating pointer. This pointer will indicate the maximum temperature the system has reached since last reset. To reset the pointer to the current operating temperature, rotate using a screwdriver.

Flash Testing:
During final inspection at the factory 3kV is applied between the case and each electrical terminal block connection.
NOTE! Damage will occur to the electronic circuits if this voltage is applied to their connections.
These are labelled **'DO NOT FLASH TEST'.**

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Thermal Gradient Adjustment:

The thermal gradient is set to specification at the factory and should not need adjustment. If the gradient needs altering the following procedure should be applied.

Items required: Temperature controlled bath or Dry Block Calibrator (Model A910 available from Accurate Controls)
Spanners.
Small blade screwdriver.
C.T. Generator.

NOTES: (a) Using the wrong Dry Block Calibrator can result in significant errors

(b) Lid must be fitted to instrument for duration of all thermal image testing because ambient temperature interference will affect the coil heating process.

(c) Establish if instrument is a single or double shunt configuration.

1 Remove bulb from pocket and immerse into a stirred bath or Dry Block Calibrator set to 70-80 degrees C. Wait for 5 minutes. The temperature of the bath is a datum value for future calculations.
2 Apply specified load current to heater coil and selected shunt network. Wait minimum of 40 minutes.
3 Note temperature indication. Subtract temperature obtained from operation '1'.The remaining value can then be checked against the required temperature gradient.
4 If the values are same to within 1.5% of Full Scale Deflection. Temperature gradient test is complete.
5 If the values are such that adjustment is required proceed as follows.
6 Remove retaining nut from selected shunt and withdraw from the instrument case.
7 Slacken the retaining nut and screw of the centre band.
8 Using the value obtained in operation '3' determine the direction of adjustment as follows:
To reduce the temperature gradient required move the centre band towards the other 'WIRED' terminal. Make any adjustments in small incremental steps.
To increase the gradient carry out the reverse. Refit shunt.
9 REFIT LID and carry out operation '2'.
10 If no further adjustment is required the procedure is complete.
11 If the situation arises that no further adjustment is available to meet the revised temperature gradient, then contact Accurate

Remote Temperature Information:

Linear Variable Differential Transformer (L.V.D.T.): (If fitted)

A mechanically isolated non-loading transducer is fitted at the factory to allow for connection to data logging and remote indication equipment. The transducer has been set and tested to the customer requirements for the specification of instrument. If the output is found to differ from the instrument indication, zero and span adjustments can be carried out in accordance with the LV10 Installation and Maintenance Instructions.

Temperature Calibration:

If the instrument at any time is suspected to be outside acceptable limits, contact Accurate Controls Ltd. for service and information.