Supervisory Temperature Controller TCI-88 Series

Safety day and night . . .

* Integral monitor with permanent switch-off capability
* Temperature supervision from +25 to +275°C as standard, other ranges available from -100 to +500°C
* Pt-100 dual probe connection (not Type L)
* Probe element monitored for discrepancy, open-circuit, short-circuit and ground fault
* Audible and optical signalling on fault or over-temperature
* Easy to read digital display of actual and set-point temperatures
* Measurement and logging from - 50 to +500°C (standard)
* Set-point range controller from 0 to +250°C as standard, other ranges available from -100 to +500°C
* Logging output for all actual and set-point temperatures: 1 mV/°C
* External set-point input for controller: 10 mV/°C
* Power cut-off, P-band and correction factors fully selectable
* Breaking capacity 230 V/6.3 A
* 3 additional Pt-100 probe inputs for measurement and 3 outputs for logging with 1 mV/°C (only Type 3R)
* Relay output for external alarm initiation (only Type 3R)

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Application

The Supervisory Temperature Controller Series TCI-88 was designed especially for temperature control to laboratory standard in the chemical industry, food branch, photography, research, hospitals, etc.

The TCI-88 has an electrical outlet to drive the majority of immersion heaters, hotplates, tube ovens, autoclaves, etc. Small inductive loads such as valves can also be connected. An additional feature is that of functional inversion by means of an internal jumper, allowing the controller to regulate a cooling element (instead of heating).

To minimise fire and explosion hazard, the controller has been designed to the latest safety standards. Safe operation day and night is ensured, allowing for a wide variety of risk factors.

The extensive safety of the TCI-88 is due to usage of a dual probe (not Type L). This probe contains two independent elements: one is for control, the other for temperature supervision with a separate setting. Both elements are monitored for discrepancy, ground fault, open-circuit and short-circuit. Should one of these faults occur, the TCI-88 switches the connected heater off. An audible signal and a corresponding LED indicate the fault. An additional safety cut-off is activated when the control probe exceeds the set-point setting by more than 20°C.

A recorder output is provided for logging actual, setpoint and monitored values. An external set-point input is available. The high level of safety, speed and user-friendliness, together with the flexibility of the TCI-88, plays a major role in improving efficiency in the laboratory.

Operating Instructions

Controller Connection

Plug the Pt-100 dual probe into the correspondingly labelled socket on the front panel. Note: For safety reasons, two separate probe elements are contained within the probe tube, otherwise the TCI-88 signals a fault (not Type L). Connect the mains plug belonging to the controlled heater to the socket on the front panel. Plug the TCI-88 power cable into the socket on the front panel, then into the wall outlet and operate the main switch on the front. The digital display lights up.

Adjustment

Set the display selector switch to position 'Set-point Supervisor'. The set-point temperature for monitoring appears on the display.

Set the desired monitoring temperature (not Type L) with the potentiometer 'Supervisor'. This temperature must always be greater than the controller set-point! If the setting of the monitoring temperature is already below that of the measured temperature, the red LED 'Overtemp.' and red lamp 'Error' are illuminated. The audible warning signal is also activated. This signal is silenced by pushing the 'Reset' button. The green LED 'Autostart' will then be lit.

In the above process an internal memory is activated, so that the TCI-88 automatically starts controlling and energises the output, after the measured temperature has cooled below that of the monitor temperature setting. The LED's and the 'Error' lamp are then extinguished.

Set the display selector switch to position 'Set-point Controller'. The display shows the current set-point temperature for the controller.

Set the set-point changeover switch 'SPt.' to position 'Int.'.

Using the potentiometer 'Controller', set the desired control set-point temperature. Note that this must always be lower than the monitor temperature.

The TCI-88 now controls the actual temperature (actual value) at the Pt-100 dual probe (Type L single probe) according to the set-point temperature setting. This can be seen by means of the green lamp 'Load', which is illuminated when the connected heater is energised.

Set the display selector switch to position 'Act. Value Controller'. The display shows the actual temperature, as measured by the controller probe element. This is the Standard setting in operation. If the display selector switch is set to position 'Act. Value Supervisor', the display shows the monitored temperature measured by the monitoring probe element (not Type L). Any discrepancy between the two probes can then be measured.

Monitoring

If the measured monitor temperature exceeds the monitor temperature setting, the red LED 'Overtemp.' and red lamp 'Error' are lit and the audible warning signal may be heard (not Type L). If the 'Reset' button is now pushed, the warning signal is silenced and the green LED 'Autostart' is lit. An internal memory is thereby activated, so that the TCI-88 automatically commences controlling and energises the output after the measured temperature has fallen below that of the monitor temperature setting. The LED's and the 'Error' lamp are then extinguished.

If the measured control temperature exceeds the control reference temperature setting by more than 20K, the same fault indications appear as for exceeding the monitor temperature. The internal memory can also be activated with the 'Reset' button. The TCI-88 then recommences its control function when the actual control temperature exceeds the reference control temperature by less than 20°C.

If the difference between control and monitor probe elements exceeds ±20K, the yellow LED 'Sensor Failure' and red lamp 'Error' are lit and the warning signal is sounded (not Type L). The heater outlet is then permanently switched off. The dual probe must be replaced and the 'Reset' button pushed to cancel this fault. The same fault indications appear for open-circuit, short-circuit or ground fault of a probe element.

If the equipment has an internal fault the yellow LED 'Device Failure' and the red lamp 'Error' are lit and the warning signal is sounded. The heater outlet is then permanently switched off. Contact your TCI-88 supplier should this fault be indicated.

Recording

The 5-pole DIN socket 'Recording' an the front panel is provided for external recording of actual and set-point temperatures. A recorder or similar device can be connected to this output using a suitable DIN plug. The pin arrangement is shown an the front panel, around the socket. The output voltage is 1 mV/°C.

External Set-Point Application

The 5-pole DIN socket 'SPt. Ext.' on the front panel is provided for application of an external control setpoint. A potential-free (not grounded) voltage source can be connected to this input by means of a suitable DIN plug and used as an external set-point for the TCI-88. The pin arrangement is printed an the front panel around the socket. The Input sensitivity is 10 mV/°C (0°C = 0V). The set-point 'SPt.' changeover switch must be set to position 'Ext.'.

Setting 'Correction', 'P-Band' and 'Limitation'

The 3 trimmers should be set to the marked positions for good control characteristics in the shortest time.

- **Correction:** The usual setting is 0%. A controller has, by definition, a small difference from the set-point value, arising through losses such as radiation. If this difference between set-point and actual settings is not desired, it can be set to 0K by reading off the switch 'Set-Point/Act. Value' and setting the correction step by step.
- **P-Band:** The usual setting is 7K. The proportional band is that region in which the relationship between control discrepancy and controlled element setting is proportional. To avoid control oscillation, the controlled region is set by means of the trimmer 'P-Band'. When setting up new control parameters, the trimmer should be set to the mid-point (10K). When the control reference setting is reached, the lamp 'Load' should start to blink rhythmically. If the on/off duration ratio remains approximately steady, the P-band has been set correctly. If full heating is applied and then switched off completely, the P-band needs to be increased. It should be successively decreased otherwise.
- **Limitation:** The usual setting is 100%. The output power can be limited with the trimmer 'Limitation'. the Power setting is 100% for a new set-up. After the control set-point setting has been reached, the power setting is reduced until the actual value begins to decrease slightly. This can easily be seen on the display. The Power limitation is then set to double this value and the controller is then optimised. The heat-up rate can also be slowed using the limitation.

Note that the control loop needs some time to achieve stability. Any changes should be separated by fairly long intervals.

Measurement and Recording of Three Additional Temperatures, External Alarm Output (only Type 3R)

The Type 3R allows 3 single Pt-100 probe temperatures to be measured and recorded, in addition to its control and monitor features. An external alarm circuit can also be activated using a potential-free contact.

Plug the probes into the 5-pole DIN sockets 'Channel A', 'Channel B' and 'Channel C' on the rear panel. Single and dual probes can be used. Set the display selector to position 'Channel A', 'Channel B' or 'Channel C'. The display shows the temperature of the corresponding probe.

The 3-pole DIN sockets 'Channel A', 'Channel B' and 'Channel C' on the rear panel are provided for external recording of these 3 actual temperature values. A recorder or similar device can be connected to these outputs by using suitable DIN plugs. The pin arrangement is printed around the sockets on the rear panel. The output voltage is 1 mV/°C.

External Alarm Initiation (only Type 3R)

The alarm option allows an external alarm to be initiated should a fault occur in the device, the probe or as a result of overtemperature. A potential-free changeover contact is provided for this purpose (max. 48V/1A), accessible via the 3-pole DIN socket 'Alarm Contact' on the rear panel of the device. The pin arrangement is shown printed around the socket. The red LED 'Alarm' is lit when the relay coil is energised.

The jumpers J1 and J3 are inserted as standard (factory setting). The alarm relay functions simultaneously with the LEDs 'Device Failure' and `Sensor Failure'. An 'Overtemp.' fault also initiates an alarm, but this can be reset using the 'Reset' button. The alarm relay cannot be reset, however, if the jumper is moved from J1 to J2. The alarm relay function is inverted when the other jumper is moved from J3 to J4. The relay is energised in normal operation and drops out when a fault appears or the device is switched off.

Specification TCI-88 Series

(unless noted, typical values at 25 °C)

Output

Mains voltage	115 or 230 V, +10/-15%, 50/60 Hz (factory assembled)
Device plug	Europa heat plug IEC 320/C15
Device socket	with ground pin
Max. load current	6.3 A resistive, up to 50 VA inductive load permissible
Output device	Semiconductor switch, zero-crossing type
Safety switch	2 relays for 2-pole switch-off
Fuses	2 x 6.3 AT (slow-blow, 5.0 x 20.0 mm)
Lamp 'Load'	green neon lamp, directly across load socket
Lamp 'Error'	red neon lamp, directly across safety relay

Auxiliary Supply

Demand	115 or 230 V, +10/-15%, 50/60 Hz, 10 VA (factory assembled)
Mains switch	switches only control circuit
Fuse	1 x 200 mA (115V) or 100 mA (230V), type slow-blow, internal (5.0 x 20.0 mm)

Controller

Probe	Pt-100 DIN 43760 in 2-conductor arrangement pin 1 or 2: 1st probe connection pin 3: 2nd probe connection linearised, precalibrated with cable included
Probe current	approx. 2.5 mA
Control set-point	range 0 ...+250°C standard special ranges -100 ... +500°C an request
Accuracy	±0.5% of total range
Controller	
Proportional band	2 ... 20K adjustable, (±20% of end range)
Correction	±50% power specified, (±20% of end range)
Power Limitation	0 ... 100% (±20% of end range)
Recording output	Controller actual value, 1 mV/°C, Ri = 600 0hm Controller set-point value, 1 mV/°C, Ri = 600 0hm
Set-point input	External set-point ±10 mV/°C, Ri = 20 kOhm Range -100...+500°C -> -1000 ... + 5000 mV
Output function	A 3-pole plug is on the mother-board internally for output function selection Heat controller: jumper on left (standard) Cool controller: jumper on right (seen from the front)

Temperature Supervisor (not Type L)

Probe	Pt-100 DIN 43760 in 2-conductor arrangement pin 4: 1st probe connection pin 5: 2nd probe connection linearised, precalibrated with cable included
Probe current	approx. 2.5 mA
Supervisor-set-point range	+25 ... +275°C standard special ranges -100 ... +500°C on request
Accuracy	±0.5% of total range
Overtemperature cut-off	Overtemperature set-point: permanent output shut-down as fault 'Overtemp.'
Logging output	Overtemperature actual value 1 mV/°C, Ri = 600 Ohm Overtemperature set-point value 1 mV/°C, Ri = 600 Ohm

Additional Supervisory Features (with LED indication)

Probe short-circuit	In both sections of the device (controller/supervisor)
Probe open-circuit	this fault initiates permanent shutdown of the output
Probe ground fault	Indication is 'Sensor Failure', shutdown results when
Probe discrepancy	the difference between controller and supervisor probes exceeds ±20K
Supply voltage	If fault, results in permanent shutdown and indication 'Device Failure'
Potentiometer break	Set-point values are automatically set to minimum, other parameters cannot cause dangerously high controller temperatures

Temperature Measurement Circuits A, B and C on Rear Panel (only Type 3R)

Probe	Pt-100 DIN 43760 in 2-conductor arrangement pin 1 or 2: 1st probe connection pin 3: 2nd probe connection
Probe current	approx. 2.5 mA
Measuring range	-100 ... +500°C, optimally linearised between 0...+250°C, precalibrated with cable included
Recording Output	1 mV/°C, Ri = 600 Ohm.
Display front Panel	with switches on front panel, selectable for A, B or C

Alarm Relay Output of Supervisory Controller (only Type 3R)

Switch contact	1 potential-free contact, max. 45 V / 1 A, RC-filter not included
Internal Jumper in J1 or J2	in J1: Relay switches like audible alarm in J2: Relay switches when overtemperature or fault is present
Internal Jumper in J3 or J4	in J3: Relay active in alarm case in J4: Relay drops out in alarm case and for mains failure
Display 'Alarm relay' (on rear Panel)	LED lit when relay is energised

Ambient Temperature Range

Operation	0 ... +40°C ambient, device free-standing
Storage	-20 ... +60°C ambient

Dimensions and Mass

Width	220 mm
Height	90 mm
Depth	180 mm
Mass	approx. 2.0 kg

Ordering Information

Article	Order No.
Supervisory temperature Controller Type TCI-88 for stringent safety requirements, for dual probe	090.523.1250
Supervisory temperature Controller Type TCI-88/3R for dual probe, with three additional temperature measuring stations	on request
Temperature Controller Type TCI-88L for single probe (L)	090.523.3250
Temperature Controller Type TCI-88L/3R for single probe (L) with 3 additional temperature measuring stations	on request
Pt-100 dual probe Type W27, length 250 mm, diameter 7.0 mm, incl. 2 m silicone cable and DIN plug	090.027.0250
Pt-100 Single probe Type W17, length 250 mm, diameter 6.0 mm, incl. 2 m silicone cable and DIN plug	090.017.0250
Other probe types	on request
Recorder cable, length 2 m with 5 insulated banana-plugs, 4 mm	090.523.9205
5-pole DIN plug (180 degrees) for recording	008.810.0501
5-pole DIN plug for Pt-100 for Single and dual grobes	008.810.0500
3-pole DIN plug for external Set-point and alarm Output	008.810.0300

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