Grant
SCIENTIFIC

General purpose immersion thermostats, baths & circulators

Optima T100 & TC120

Operating Manual

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Standards Compliance and Quality

Grants' brand and reputation are based around quality, reliability and accuracy. We ensure our products stringently meet all necessary international safety standards. We pay particular attention to the safety testing of products and remain at the forefront of the product safety standard for laboratory equipment IEC 61010-1. The company is committed to operating its safety test laboratory in accordance with the requirements of ISO 17025.

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Beyond compliance to the standard, Grant is committed to continually improving in everything we do; with particular emphasis on understanding what matters to our customers and suppliers, and designing our systems and work to meet their needs.

If you have any feedback on Grant's products or services we would like to hear from you. Please send all feedback to:

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1.0 Use of products

The following products are covered by this operating manual:

- T100 & T100L
- TC120 & TC120L

The products listed above are general purpose immersion thermostats to be used with baths or circulators designed for indoor laboratory use by a professional user.

2.0 How to use this operating manual

This operating manual will allow you to unpack, set-up and operate this immersion thermostat correctly and safely. Important safety information, symbols and warnings are listed below and should be read carefully. Section 4 gives information about how to unpack and install the product correctly. Section 5 gives operating information for the T100 & TC120 models. Product technical specifications and tips are provided in sections 6 and 7. The warranty for this product is for THREE YEARS and is detailed in section 8 and should be registered by completing the on-line registration form at www.grantinstruments.com.

If there is a technical matter that this operating manual does not address, or any other question concerning this product, please contact Grant Instruments or your local distributor, who will be able to provide any additional information.

A quick start guide is provided with the T100/TC120 immersion thermostats as a reference guide but should not be used until the full user manual has been read.

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3.0 Safety information

3.1 Safety compliance

Grant immersion thermostats meet the requirements of international safety standard IEC 61010: Safety requirements for electrical equipment for measurement, control, and laboratory use. They also comply with the equivalent national standards including:

EN 61010-2-010
UL 61010A-2-010
CAN/CSA-C22.2 NO. 61010-2-010-04.

3.2 Safety symbols

The symbols below are marked on the equipment and throughout this manual to indicate:


Caution: Surfaces and heat transfer liquid can be hot during and after use.


Read this manual before using the bath.


Important safety warning.

3.3 Safety warnings


Read the whole of these instructions. Safety may be impaired if they are not followed.


For the T100, only use water as the working liquid.


For the TC120, only use liquids specified in these operating instructions, within the specified temperature range. If the alarm lamp is illuminated the liquid temperature may be above its recommended maximum. Do not inhale the vapours given off as they may be toxic. Liquids should be safely discarded and replaced.


Do not use the T100/TC120 with flammable heat transfer liquids.


Do not use the T100/TC120 to heat any sample material that could cause a fire or any other kind of hazard.


Do not use the equipment in an area where there are aggressive or explosive chemical mixtures.


If a potentially hazardous liquid is spilt onto or inside the equipment, disconnect it from the power supply and have it checked by a competent person.


It is the user's responsibility to carry out appropriate decontamination if hazardous material is spilt on the equipment.


If the alarm lamp is illuminated do not touch the liquid or the tank base, they may be very hot. Refill carefully, a hot heater can cause a spattering of very hot water droplets and scalding steam.


Do not touch surfaces which become hot during high temperature operation.

4.0 Operating instructions

4.1 Unpacking instructions

Standard equipment includes:

- Immersion thermostat (T100 or TC120)
- Pump outlet plates (TC120 only)
- Mains cord with plug
- Operating manual
- Quick start guide

ST bath accessory includes:

- Stainless steel bath
- Bridge plate
- Circulating tray (ST18, ST26 & ST38 baths only)

P bath accessory includes:

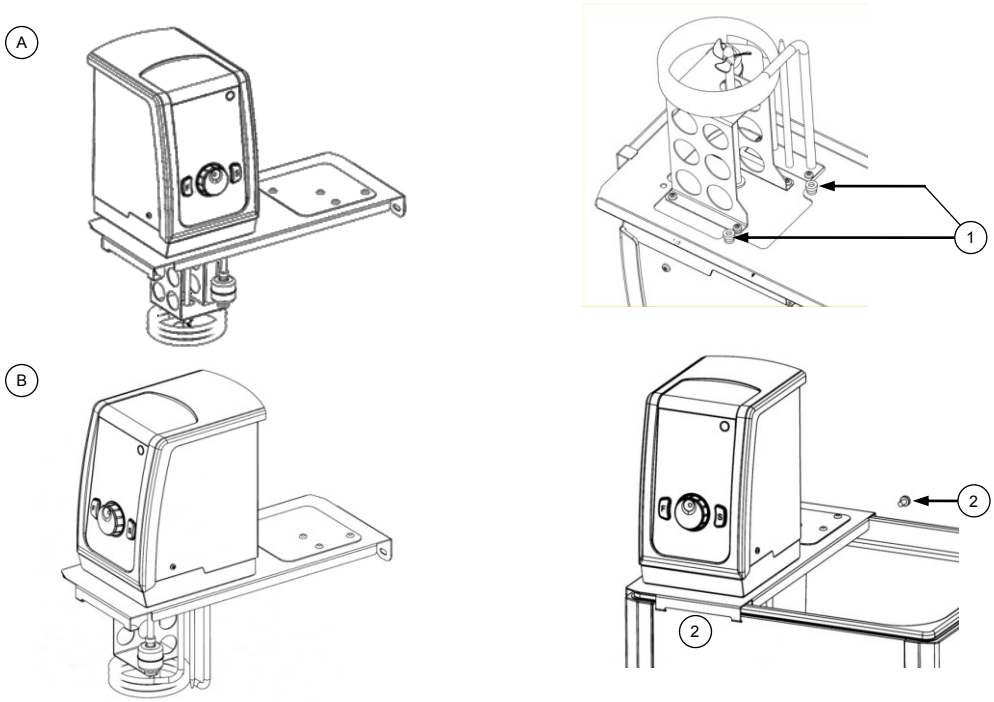
- Plastic bath
- Bridge plate

Remove packing materials carefully and retain them for future shipment or storage of the equipment.

4.2 Fitting controller to ST baths

The T100/TC120 can be fitted to the following stainless steel baths, ST5, ST12, ST18, ST26 and ST38 in two orientations for convenience, facing over ST bath (A) or facing outwards (B):

1. Fit the T100/TC120 through the hole in the bridge plate and align using the locating threads. Secure using the retaining nuts. Hand tighten only.
2. Hook the assembly into the slots on the ST bath and use the supplied fixing to secure to the rear of the bath.



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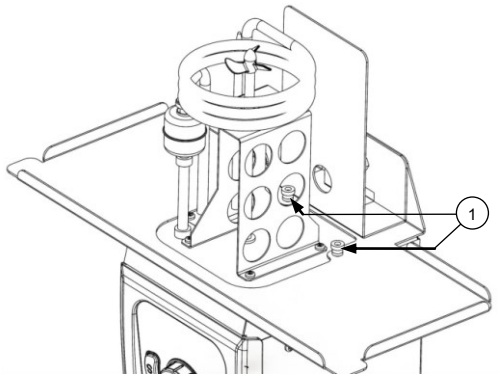
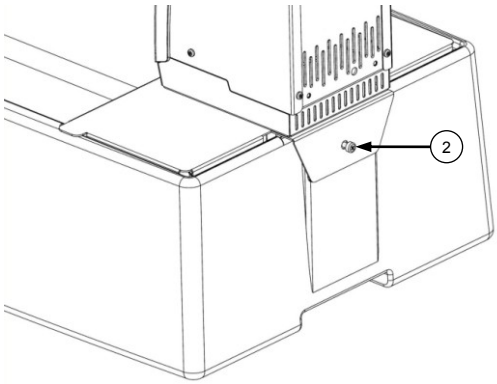
Fit the circulation tray in the base of the tank with the large cut out in the tray underneath the control unit (ST18, ST26 & ST38 only).

4.3 Fitting the controller to P baths

The T100/TC120 can be fitted to the following plastic baths, P5, P12 and P18:

1. Fit the T100/TC120 through the hole in the bridge plate and align using the locating threads. Secure using the retaining nuts. Hand tighten only.
2. Add the assembly to the P bath and use the supplied fixing to secure to the rear of the bath.

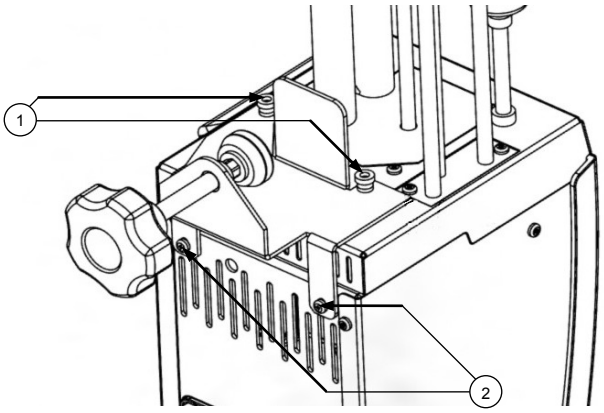




4.4 Fitting the controller to custom baths

A clamp can be fitted to the T100/TC120 to allow attachment to a non-Grant bath or vessel with a wall thickness of up to 30mm. To fit the clamp to the T100/TC120:

1. Place clamp over locating threads on base of T100/TC120. Secure using the retaining nuts. Hand tighten only.
2. Add clamp rear fixings to secure to rear of T100/TC120.



Take care not to over tighten the clamp to avoid damaging the clamp or vessel

The liquid container on which the unit is mounted must be stable and have the necessary robustness, mechanical, chemical and heat resistance.

Do not wash the clamp in a dishwasher or clean it with descaler. Do not submerse the threaded shaft of the clamp. Always dry the threaded shaft and clamp after cleaning. The threads may be lubricated with a small amount of light machine oil.

4.5 Removing the controller from the bridge plate

Allow the working liquid to cool before removing the T100/TC120 from the bridge plate. Carefully remove the T100/TC120 and bridge plate together from the bath or vessel. Take care as the pump will contain a small amount of the working liquid which will leak out as the unit is handled. Undo the retaining nuts and remove the bridge plate. Attach the retaining nuts to the locating threads for safe keeping.

4.6 Recommended liquids

The following table lists the recommended liquids for different temperature ranges. Always ensure the liquid used is safe and suitable for your working temperature. If using non-recommended heat transfer liquids, it is the responsibility of the user to conduct an assessment to ensure the intended fluid is compatible with the T100/TC120 and vessel. If using non-recommended heat transfer liquids it is important to set the over-temperature cut-out to a value no higher than 25°C below the fire point of the liquid. If in doubt please contact the Grant technical support team.

To ensure protection the overtemperature cut out (TC120 only) must be set appropriately for the heat transfer liquid selected. See table below.

If using non-recommended heat transfer liquids it is important to set the over-temperature cut-out to a value no higher than 25°C below the fire point of the liquid. If in doubt please contact the Grant technical support team.

Use fume extraction when using silicone fliuids at elevated temperatures

Temp range	Recommended liquid	Cut-out setting	Comments
-30°C to 30°C	50% water, 50% antifreeze (inhibited ethylene glycol)	40°C	WARNING: Ethylene glycol is toxic – follow the manufacturer's instructions. For safe disposal consult your local regulations. Use a lid to reduce the dilution of the mixture caused by condensing water vapour from the air, and to maintain the cool down rate.
0°C to 30°C	80% water, 20% antifreeze (inhibited ethylene glycol)	40°C	
5°C to 99.9°C	Water*	110°C	Water can be used but care should be taken above 60°C as hot vapour can be dangerous. Use a lid or polypropylene spheres above 60°C to ensure good performance & reduce evaporation. At temperatures approaching 99°C the temperature performance will be affected due to localised boiling. The units should not be used to boil water.

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Temp range	Recommended liquid	Cut-out setting	Comments
70°C to 120°C	Silicone fluid Viscosity ~20cs Flash point ≥230°C Fire Point ≥280°C	130°C	Dow Corning DC200/20 silicone fluid is a suitable liquid – follow the manufacturer's instructions. For safe disposal consult your local regulations.

* See section 7.1 for further details

4.7 Installation

Place the water bath on a level, non-combustible surface. Ensure that the mains plug and the switch at the rear of the unit are easily accessible.

If the equipment has been transported or stored in cold or humid conditions, condensation may form inside it. If that could have happened, allow time (at least 2 hours at room temperature) for the condensation to evaporate before using the equipment.

Do not block or restrict ventilation slots.

4.8 Electrical supply

Check that the supply voltage marked on the serial number label, and the type of mains plug, are correct for your mains supply outlet, which must have a ground connector.

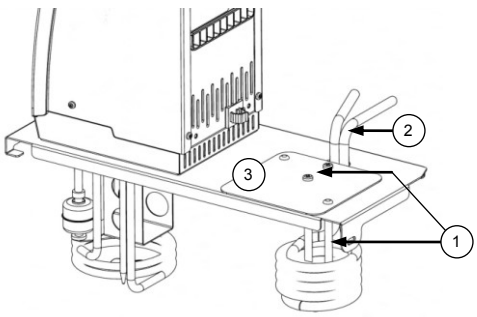
The T100/TC120 must only be connected to the mains using the mains cord supplied or one with an identical rating (see section 9.4)

4.9 Using accessory cooling (C1G, C2G, CW5)

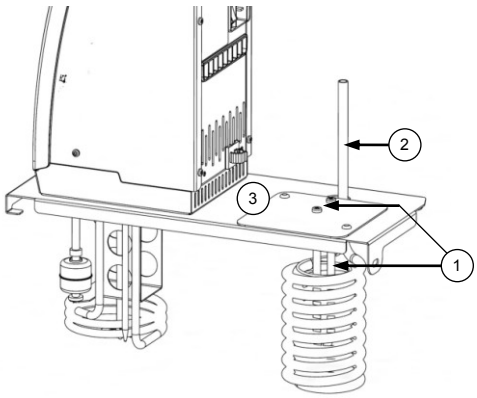
Accessory cooling is required for operation at temperatures below ambient. Refrigerated dip coolers (C1G and C2G) can be used for operation down to -15°C. A water heat exchanger coil (CW5) can be used for operation at or around ambient. The coils can be fitted:

1. Attach u-shaped coil locating rod to cover plate using two fixings supplied.
2. Fit the cooling coil through the hole in the bridge plate and align outlet pipes with cut-out notch.
3. Fit cover plate onto bridge plate and attach with fixings supplied. The coil locating rod should press fit against the inside of the coil and hold it rigidly. Ensure the coil is held safely and securely before operation.

CW5



C1G & C2G



5.0 Operating procedures

5.1 Operation

5.1.1 Liquid level

The minimum and maximum liquid levels are defined in section 6.4 for Grant accessory baths. Liquid level should always be maintained between these levels. These levels apply both when there are no vessels in the bath and with the maximum contents. If using liquids that can evaporate then periodic checking and refilling should be completed. The low level float switch will alarm if the liquid level drops below the minimum required level and the unit will switch off the heater and stop temperature control.

5.1.2 Operation above 60°C

A lid or polypropylene spheres must be used above 60°C to maintain temperature control and to ensure that the bath fluid temperature reaches the set point. They will save energy by preventing excessive evaporation and reduce the frequency that the bath needs to be refilled. As a precaution, the T100/TC120 may display 'Hot' if heating water at or near boiling over extended periods or heating large volumes of liquid with large thermal losses without the use of a lid or polypropylene spheres. See section 11 for additional guidance.
Care should be taken to ensure rear inlet vents are clear and minimise the intake of steam when operating at or near boiling water or with other evaporating liquids.

Take care when lifting and removing the lid as it may be hot. Steam and hot vapours can cause scalding.

5.1.3 Operation at low temperatures

Accessory cooling is required for controlled operation at or below ambient temperature. The minimum working temperature without accessory cooling depends on the size of the bath. The small baths, P5 and ST5, have a minimum working temperature of approximately 10°C above ambient without a lid and 15°C above ambient with a lid. Other bath sizes can be used at a temperature of 5°C above ambient.

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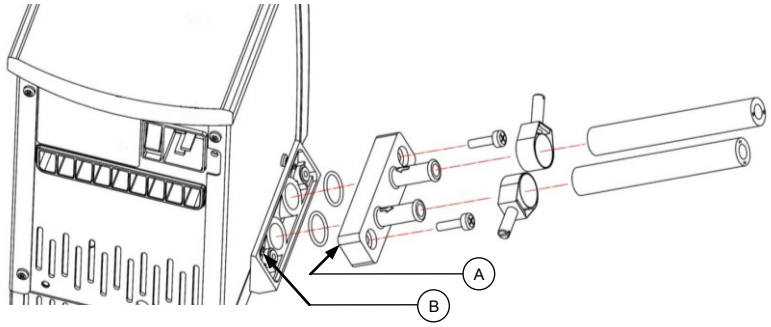
5.1.4 Using the pump (TC120 only)

The TC120 allows liquid to be pumped around a closed external system (not open to the atmosphere). It may be used for circulation through an external open tank only if a gravity feed return is present. An assessment of any reservoir running should be completed to ensure liquid levels are stable during operation and there is no chance of any resevoir running dry or overflowing. The pump is fitted with a blanking plate as standard. Fit a pump connector plate as shown below. Note: the blanking/connector plates have a locating hole (see A below) to assist correct alignment onto the pump moulding. It is important to verify the hole is aligned with the corresponding locating pin (see B below) on the pump moulding. Failure to do so will result in a leaking connection. Retain the blanking plate for refitting when the pump is no longer required.

Always use pump connectors and hoses that are suitable for the operating temperature and liquid used. Check the pipe connections are secure.

Never disconnect any pipes or hoses while they contain very hot or very cold liquids or while the TC120 is pumping.



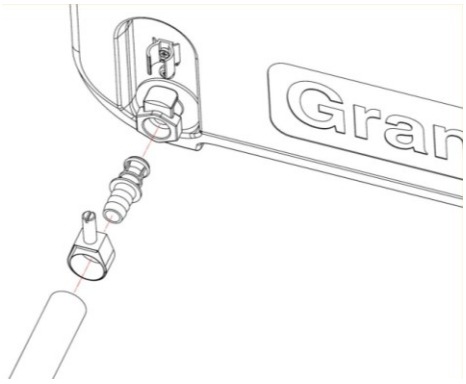
Pumping heat transfer liquid around an external system can lead to hazards that are outside the control of Grant Instruments. It is essential that the user conducts a risk assessment of the entire equipment installation to ensure that correctly rated materials have been used throughout and that the system can be used safely.

5.1.5 Emptying the ST baths

The ST12, ST18, ST26 & ST38 baths should be emptied to a safe level prior to moving. A drain tap is included on these baths to allow convenient emptying.

Allow the liquid temperature to fall to a safe level before emptying. If the bath is drained at temperatures above 50°C then the drain mechanism will be damaged and will need to be replaced. Take reasonable precautions to prevent accidental spillage.

Empty the bath by pushing the supplied drain insert into the drain tap as shown below. Note that the bath liquid will begin to empty as soon as the drain insert is fully engaged. A length of hose can be added to the barbed end of the drain insert if required.



5.1.6 Setting up and switching on

Connect the T100/TC120 to a grounded (earthed) electrical power supply with voltage and frequency within the range specified on the serial number plate.

Attach the T100/TC120 securely to the required bath or vessel. Add the appropriate working liquid to the bath to at least the minimum recommended fill level such that the float level switch is fully raised.

Switch on the T100/TC120 using the power switch on the rear of the unit. The motor will start immediately and the buzzer will sound while the unit starts up. During start up the display will show the model type, followed by the software version and finally the current liquid temperature. The T100/TC120 is ready to use.

To disconnect the equipment from the mains supply, remove the mains plug from the mains supply outlet.

5.2 Using the T100 & TC120

5.2.1 Product description

5.2.2 Product indicators

There are two indicator lights on the T100/TC120:

- Heater on light (orange) marked ≀≀≀
- Alarm light (red) marked **!**

The alarm lamp will light to indicate the following faults:

- Float switch has operated due to low liquid level
- Over-temperature cut out has operated
- Temperature probe fault

The cause of the alarm will also be shown on the display.

The display normally shows the temperature in °C of liquid being controlled.

The **S**(elect) button is used to select and store values whilst the **F**(unction) button is used to access menu options and cancel functions.

The main dial is used to change temperature values and other settable parameters.

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5.2.3 Setting the control temperature

The temperature of the bath liquid can be set using the **S** button.

1. Whilst the display is showing the bath temperature, press the **S** button. This will cause the display to flash indicating that it can be set.
2. Use the main dial to set the desired temperature.
   If no key is pressed for 10 seconds then the display will revert back to showing the bath temperature and the set temperature will remain at its original value.
3. Press the **S** button to store the requested value and the display will revert to showing the bath temperature.
   If the temperature selected is higher than the current liquid temperature, the heater light will come on.

5.2.4 Configuring a preset

Each T100/TC120 contains three presets which can be configured to different set temperatures to allow the bath to be conveniently run at frequently used temperatures. Use the method below to configure preset 1; other presets can be set in a similar manner.

Be aware that once a preset has been saved using the steps below, it will automatically start once all the steps have been completed.

1. Press the **F** button and rotate the dial until the display shows “t-1”.
   The display will alternate between the preset number and its temperature.
2. Press the **S** button to select the preset.
3. Use the dial to set the desired preset temperature.
   If no key is pressed for 10 seconds then the display will revert back to showing the bath temperature and the preset temperature will remain at its original value.
4. Press the **S** button to save the preset temperature.
   The preset will automatically start as soon as the value is saved.

Preset temperatures and set temperatures are limited to the model type and the liquid selection. The T100 settable range is between 0 and 100°C increasing to between -20°C and 120°C for the TC120. The factory preset settings are shown in the table below.

Preset	Set temperature range
t-1	37°C
t-2	56°C
t-3	72°C

5.2.5 Running a bath preset

1. Press the **F** button and rotate the dial until the display shows the correct preset.
2. Press the **S** button to select the preset.
3. Press the **S** button to set the bath to the preset temperature.

5.2.6 Completing a calibration

The T100 & TC120 allow a two point calibration to be completed. The calibration menu can be accessed by simultaneously pressing the **F** and **S** buttons for about 5 seconds.

The calibration temperatures are constrained by the temperature limits of the liquid type setting. Calibration should be carried out using a traceable reference thermometer with an accuracy of at least 0.1°C. This thermometer should be held securely in the centre of the bath or vessel.

The calibration of the T100/TC120 is in two parts, a low temperature offset and a high temperature offset. The high temperature calibration point must be at least 40°C higher than the low temperature point.

Calibration points should be chosen to be at critical experimental temperatures where accuracy is important or at the extremes of the working range of used temperatures.

If only the low temperature calibration point is set then the calibration will be performed between this point and 100°C with the offset decreasingly linearly. If only the high temperature calibration point is set then the calibration will be performed between 0°C and this point with the offset decreasingly linearly.

If the thermometer value is entered before the unit is completely stable then the calibration could be poor and liquid temperature readings will be incorrect. If the T100/TC120 is not in accordance with the thermometer following calibration then it may not have been successful and the unit should be reset.

Setting the low temperature offset

1. Adjust the set temperature to the required low temperature calibration point.
2. Allow the unit to stabilise for at least 5 minutes after a stable temperature condition has been achieved.
3. Measure the liquid temperature by placing a reference thermometer into the centre of the bath.
4. Press the **F** and **S** buttons simultaneously for approximately 5 seconds until “LCAL” is shown.
5. Press the **S** button to select.
6. Use the main dial to update the display to show the temperature on the reference thermometer.
7. Press the **S** button to store the temperature.
   Press the F button to cancel the calibration.
8. Press the **F** button to return to the liquid temperature display.

Setting the high temperature offset

1. Adjust the set temperature to the required high temperature calibration point.
2. Allow the unit to stabilise for at least 5 minutes after a stable temperature condition has been achieved.
3. Measure the liquid temperature by placing a reference thermometer into the centre of the bath.
4. Press the **F** and **S** buttons simultaneously for approximately 5 seconds until “LCAL” is shown.
5. Rotate the dial until the display shows “HCAL” and press the **S** button to select.
6. Use the main dial to update the display to show the temperature on the reference thermometer.
7. Press the **S** button to store the temperature.
   Press the F button to cancel the calibration.

5.2.7 Restoring factory calibration settings

The restore factory calibration allows the unit settings to be reset if there is a problem during calibration or you wish to cancel any of the calibration settings.

1. Press the **F** and **S** buttons simultaneously for approximately 5 seconds until “LCAL” is shown.
2. Rotate the dial until the display shows “rST” and press the **S** button to select.
3. Press the **S** button four times (the display will show “Con.3”, “Con.2”, Con.1” and sound the buzzer to confirm the factory reset has been completed.

5.2.8 Adjusting display brightness

The brightness of the display can be adjusted over a limited range (20% to 100%) if required.

1. Press **F** and **S** buttons simultaneously for approximately 5 seconds until the display shows “LCAL”.
2. Rotate the dial until the display shows “disP” and press the **S** button to select.
3. Rotate the dial between the settings and select required brightness
   The displayed values show the display brightness
4. Press **S** button to save the value.
5. Press **F** button to return to the normal temperature display.

5.3 Additional features of the TC120

5.3.1 Setting the over-temperature thermostat

An over-temperature cut-out dial with a temperature scale is located at the top right of the unit. The over-temperature probe independently monitors the bath temperature and switches the heater off if it goes above the cut-out threshold. The T100 temperature cut-out threshold is fixed at 110 °C. For the TC120, the temperature cut-out threshold can be adjusted for convenience.

Coarse setting of the over-temperature thermostat

Rotate the temperature cut-out dial in line with the marked scale to the desired setting. This should be higher than the set temperature to avoid operating the cut-out before the set temperature has been reached.

If the alarm is triggered, it can be cancelled by pressing either the **F** or **S** button once. The unit must then be switched off to clear the cut-out alarm. To continue to use the TC120, let the bath liquid cool by at least 5°C either naturally or by replacing the liquid, switch the unit off, wait 10 seconds and switch it on again to clear the alarm. To avoid nuisance tripping the trip point needs to be set at least 5°C above the desired control temperature.

Alternative setting of the over-temperature thermostat

Rotate the temperature cut-out dial to maximum (or at least a value above the level required) and configure the set temperature to the cut-out level required. Leave the bath to reach the set temperature and stabilise for at least 5 minutes. Turn the cut-out dial slowly anticlockwise until the alarm lamp comes on and the alarm sounds intermittently. The display will alternate between showing “Cut” and the liquid temperature. This gives an over-temperature trip point at the set temperature. The audible alarm can be cancelled by pressing either the **F** or **S** button once.

The unit must be switched off to clear the cut-out alarm. To continue to use the TC120, let the bath liquid cool by at least 5°C either naturally or by replacing the liquid. To avoid nuisance tripping the trip point needs to be set at least 5°C above the desired control temperature.

5.3.2 Setting a countdown timer

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The TC120 includes a countdown timer in minutes which triggers an audible alarm on completion. The timer can be set between 1 minute and 6000 minutes (100 hours).

1. Press the **F** button twice – the display will show “Cloc”.
2. Press the **S** button to select.
3. Use the main dial to select “On” and press the **S** button to select. The display flashes with time (in minutes) indicated. Rotate navigator control to set time required.
4. Press the **S** button to save and return to liquid temperature display with timer countdown started.

When the countdown clock is set the display alternates between bath temperature and time remaining in minutes.

When the countdown timer reaches zero the audible alarm will sound and the display will alternate between the water temperature and “End”. The alarm can be accepted by pressing the either the **F** or **S** buttons.

Note: the TC120 will continue to control at the set temperature after the timer reaches zero – the heater will not switch off.

5.3.3 Cancelling the timer

The countdown timer can be easily cancelled.

1. Press the **F** button twice – the display will show “Cloc”.
2. Press the **S** button to select.
3. Use the main dial to select “Off” and press the **S** button to select. The display will revert to the bath temperature and the timer will be cancelled.

5.3.4 Setting a high temperature warning alarm

The high temperature alarm sets a warning buzzer to sound if the bath temperature exceeds a defined level.

1. Press the **F** button three times – the display will show ”Alar”.
2. Press the **S** button to select.
3. Use the main dial to select “On” and press the **S** button to select. The display flashes the high temperature alarm value. Rotate the dial to set the high temperature alarm required.
4. Press the **S** button to save and return to liquid temperature.

If the high temperature alarm value is exceeded then TC120 will sound the buzzer intermittently and show “-Al-” on the display. The alarm can be acknowledged by pressing either the **F** or **S** buttons. However, the alarm is persistent and will trigger again if the temperature still exceeds the high temperature value. The alarm can be cancelled by following the steps above but using the dial to select “Off” in step 3 and pressing the **S** button to confirm.

Note: the high temperature alarm will not switch off the heater.

5.3.5 Selecting liquid type

The liquid type determines the limits of the set temperature range.

1. Press the **F** button four times – the display will show the current liquid type.
2. Use the main dial to select the required liquid.
3. Press the **S** button to set the liquid type and return to normal temperature display.

Selection of the liquid types below changes the settable range as follows:

Liquid	**Set temperature range**
H2O	0°C to 100°C
Oil	0°C to 120°C
LTL*	-20° to 50°C

* LTL = low temperature liquid, for example 50% water/50% glycol

6.0 Technical specifications

6.1 Operating conditions

Ambient temperature range	5 to 40°C
Altitude above sea level	Up to 2,000m (6,500ft)
Operating environment	Indoor use only
Maximum relative humidity	80% RH up to 31°C decreasing to 50% RH at 40°C

6.2 Electrical details

Mains supply: 220-240V @ 50/60Hz or 110-120V @ 50/60Hz
Pollution degree: 2
Installation category: II

Mains supply voltage fluctuations are not to exceed ±10% of the nominal supply voltage.

6.3 Product performance

	T100	**T100L**	**TC120**	**TC120L**
Settable temperature range	0°C to 100°C		-20°C to 120°C	
Min operating temperature	5°C to 100°C		-20°C to 120°C	
Stability (DIN 12876)	±0.05°C *			
Uniformity (DIN 12876)	±0.1°C			
Max pump head pressure	-		210mBar (no flow)	
Max pump flow rate	-		16l/min	
Max current consumption	6.5A	12.5A	6.5A	12.5A
Heater power	1.3kW	1.4kW	1.3kW	1.4kW

* Temperature stability may be affected (±0.3C) in the presence of strong RF fields (10V/m) at 380-400MHz. This level of interference is very unlikely and is only likely to be encountered in electrically noisy industrial locations as defined in EN61326)

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6.4 Bath accessories information

	ST5	**ST12**	**ST18**	**ST26**	**ST38**
Tank capacity (litres)	5	12	18	26	38
Liquid depth min/max (mm)	85/140	85/140	75/130	125/180	125/180

	P5	**P12**	**P18**
Tank capacity (litres)	5	12	18
Liquid depth min/max (mm)*	85/140	85/140	85/140

7.0 Technical Tips

7.1 Which water should you use in your bath?

For the long-term reliability of water baths it is important to use oxygenated water that is free from ions and minerals that can cause corrosion of stainless steel. We recommend the use of distilled water and de-ionised water from modern ion exchange systems that do not use salt back flushing to regenerate the ion-exchange cartridges.

Stainless steel is protected from corrosion by a layer of chromium oxide. If the layer is damaged, oxygen present in water can reform the oxide layer. If the water is still or de-oxygenated, and the oxide layer is damaged, ions can corrode the stainless steel tank. If a water bath has been unused for some time, or water boiled, we recommend changing to fresh distilled water or correct de-ionised water.

Water normally contains calcium or magnesium ions. De-ionised water has most ions removed as indicated by its conductivity level; the purer the water the lower the conductivity. It is important to use only de-ionised water from an ion exchange system with replaceable cartridges. Do not use de-ionised water generated from an ion-exchange system that incorporates a salt back-flush system to regenerate the ion-exchange resin as this can leave sodium ions that are very corrosive to stainless steel.

7.2 How to prevent rust in water baths

Most Grant tanks, as well as immersed parts, are made from type 304 stainless steel, an extremely versatile general purpose grade of stainless steel. It is the excellent forming characteristic that has made this grade dominant in the manufacture of laboratory and industrial water baths, as well as domestic sinks and saucepans. Type 304 stainless steel is highly suitable for applications where hygiene is important; it exhibits good heat resistance and excellent resistance to corrosion.

However, despite resistance to general surface corrosion, stainless steel is susceptible to specific types of corrosion, in particular pitting (small pin hole style corrosion) and stress corrosion cracking. It can also undergo general corrosion in specific environments, such as one containing hydrochloric or sulphuric acids.

Stainless steel is protected by its high content of alloying elements, primarily chromium and nickel. Chromium is the most important with respect to corrosion resistance, although the nickel assists in allowing the chromium to do its job. The chromium forms an oxide layer on the surface of the steel, which inhibits further oxidation. This layer adheres extremely well to the metal substrate, but it is essential that it remains intact, and must be protected from various forms of damage.

If the surface chromium oxide layer becomes damaged, oxygen present in water can partially reform the oxide layer, so it is advisable to ensure that water is always fresh and well oxygenated. Baths that will be out of use for an extended period should be emptied, and all moisture should be wiped from the bottom of the tank.

In some cases a brown layer may appear on the surface of a stainless steel tank. In most of these cases this is not rust, but it may be a surface deposit of minerals from the local water supply, or ferrous particles or salts that have fallen into the tank. These surface deposits can usually be removed by using a household cleaner such as Duraglit or Silvo metal polish.

7.3 How to prevent algae and bacteria

Water baths provide the ideal environment for the growth of micro-organisms. If left uncontrolled the growth of these organisms can result in a range of serious problems and health risks from pathogenic bacteria.

The growth of algae on the surface of parts will cause biofouling which can reduce performance.

Micro-organisms that produce acidic metabolic by-products can cause bio-corrosion by depolarisation of metal surfaces.

There are a number of biocides available on the market.

8.0 Warranty information

When used in laboratory conditions according to this manual, this product is guaranteed for THREE YEARS against faulty materials or workmanship.

Extended warranty for years four and five can be purchased by contacting our sales department at labsales@grantinstruments.com.

9.0 Maintenance and service

9.1 Routine maintenance

The over-temperature cut-out on the TC120 should be checked periodically by turning the over-temperature dial with a screwdriver anticlockwise until the alarm lamp comes on. The TC120 will also sound a buzzer and “Cut” will be shown on the display. The over-temperature dial should then be turned to the maximum setting without the alarm cancelling. The TC120 should be powered off and back on to confirm that the cut-out can be reset correctly. If the alarm lamp fails to light when the value indicated on the over-temperature dial is more than 10°C below the current temperature as indicated by the main display, then the unit should be checked by a competent person.

The float liquid level protection should also be checked periodically by lowering the level of liquid in the bath and noting that the unit cuts out with the top turn of the heater still immersed in the liquid. The float should also be checked periodically to ensure no limescale, dirt or debris could impede the operation at low liquid level.

When hoses are fitted to the pump they should be inspected periodically and replaced as necessary to avoid hose failure.

No other routine maintenance is required.

9.2 Cleaning

Clean the outside of the equipment with a damp cloth, using water only. Do not use chemical cleaning agents. Before using any other cleaning or decontamination method, check with Grant Instruments or your local representative to make sure that the proposed method will not damage the equipment. Scale on immersed parts can be removed using chemical de-scaling products designed for use on equipment that has metal parts.

De-scaling products may be toxic and manufacturer's instructions should always be followed

9.3 Fuses

The T100 & TC120 fuses are internal and should not need to be replaced. Please contact the Grant Instruments service department if the unit has a fuse fault.

9.4 Replacing the mains cord

Any replacement mains cord used with the T100 or TC120 must meet the same specification as the one originally supplied with the unit to maintain the safety of the unit.

The cable must have the following markings; <HAR>, HO5VV-F 3Gx1mm^2 90°C and be rated to carry 10A. The mains plug and IEC connector must carry approvals from a European certification body (e.g. BSI, VDE or equivalent).

9.5 Routine safety tests

If routine tests are to be made, we recommend a test of the integrity of the protective earth conductor and an insulation test at 500V DC. Routine flash tests are not recommended for any electrical equipment, because repeated high voltage tests degrade insulation materials.

9.6 Service

If service is required, switch off the unit and contact Grant Instruments or your local representative for repairs.

Please note, all returned units must be accompanied by a Return Materials Authorisation (RMA) number, obtainable by contacting the Grant service department (details below).

Service Department
Grant Instruments (Cambridge) Ltd
Shepreth
Cambridgeshire
SG8 6GB
UK

Tel: +44 (0) 1763 260 811
Fax: +44 (0) 1763 262 410
E-mail: labservice@grantinstruments.com

10.0 Optional accessories

A full listing of product accessories and options is available in the Grant Scientific Reference Catalogue (a copy of which is available upon request) and on the Grant website at www.grantinstruments.com.

11.0 Troubleshooting

Symptom	Possible cause	Action required
Display shows “Cut”	Over-temperature cut-out has operated	Check the set temperature is correct and that the over-temperature cut-out temperature is set at least 5°C above the set temperature. Refer to section 5.3.1 for setting instructions. If the over-temperature cut-out temperature is correctly set but the unit still shows a “Cut” alarm then the unit has an internal fault and must be repaired before it is used again.
Temperature does not rise when expected	Set temp is lower than liquid temp Set temperature is too close to ambient	Check that the bath set temperature is correct (see section 5.2.3). Increase the set temperature (see section 5.2.3) or fit accessory cooling (see section 4.8).
Temp continues to rise when not expected	Set temp is higher than liquid temp	Check that the bath set temperature is correct (see section 5.2.3).
Alarm light on	Over-temperature cut-out has operated Low liquid level float switch has operated	Check the over-temperature cut-out is set appropriately (see section 5.3.1). Check that the liquid level in the bath is adequate (see section 6.4 for minimum fill levels).
Set temperature too restricted	Liquid type set does not allow required set point	Change to different liquid type (see section 5.3.5).
Display shows “Flot”	Liquid level has dropped below minimum level	Check that the liquid level in the bath is adequate (see section 6.4 for minimum fill levels).
Display shows “–Al-”	High temperature warning alarm has tripped	Check that the bath set temperature is correct (see section 5.2.3). Check that high temperature alarm is correct (section 5.3.4). Check that the liquid level in the bath is adequate (see section 6.4 for minimum fill levels).
Display shows “Er H”	Incorrect calibration value	The high temperature calibration point is less than 40°C above the low calibration point – choose a higher temperature (see section 5.2.6).
Display shows “Er L”	Incorrect calibration value	The low temperature calibration point is less than 40°C below the high calibration point – choose a lower temperature (see section 5.2.6).
Display shows “Er d”	Incorrect calibration value	The calibration value is greater than 10°C from the set point – check thermometer reading and set point (see section 5.2.6).

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Display shows “Open”	Faulty temperature probe	Have a competent person check the probe for an open circuit fault or contact Grant.
Display shows “Shrt”	Faulty temperature probe	Have a competent person check the probe for a short circuit fault or contact Grant.
Unit showing erratic temperatures	Calibration values not set correctly	Restore the factory calibration settings (see section 5.2.7) then re-calibrate if required (see section 5.2.6).
Display shows “Hot”	Heating water at or near to boiling without lid Heating very large volumes of liquid with large thermal losses	Add a lid to reduce thermal losses and leave unit running with the “Hot” warning present. If the alarm has not cleared within 1 hour contact Grant. Add measures to reduce thermal losses and leave unit running with the “Hot” warning present. If the alarm has not cleared within 1 hour contact Grant.
Display shows “Fuse”	Faulty fuse(s)	Have a competent person check the internal fuses or contact Grant.
Display shows “Crct”	PCB fault	Have a competent person check the product or contact Grant.
Display shows “Self”	Safety relay fault	Have a competent person check the product or contact Grant.
Stirrer motor not rotating	Stirring propeller or pump impeller is obstructed Faulty motor	Clear obstruction. Have a competent person check the motor or contact Grant.
Display shows “Cold”	Accidentally entered manufacturer reset mode	Warning can be cleared by pressing **S** button, but note that all settings (including any factory calibration) will be reset to the default values. Contact Grant Instruments service department for assistance if required.

For any other errors or service requests, please contact Grant Instruments service department.

12.0 Contact Grant Instruments

At Grant we are continuously trying to improve the performance we offer our customers. If you have any feedback on Grant's products or services we would like to hear from you. Please send all feedback to:

Quality Manager
Grant Instruments (Cambridge) Ltd
Shepreth
Cambridgeshire
SG8 6GB
UK

Tel: +44 (0) 1763 260 811
Fax: +44 (0) 1763 262 410
E-mail: feedback@grantinstruments.com

13.0 Compliance

WEEE directive

Grant Instruments complies fully with the Waste Electrical & Electronic Equipment (WEEE) regulations 2006. We are a member of the B2B compliance scheme (Scheme Approval Number WEE/MP3338PT/SCH), which handle our WEEE obligations on our behalf. Grant Instruments have been issued with a unique registration number by the Environmental Agency, this reference number is WEE/GA0048TZ.

For information regarding WEEE collections in the UK please contact our B2B Compliance Scheme directly on 01691 676 124.
For other countries please contact your equipment supplier.

For General WEEE information please visit: www.b2bcompliance.org.uk

RoHS directive

All the products covered by this manual comply with the requirements of the RoHS Directive (Directive 2002/95/EC).

Electrical safety and electromagnetic compatibility

All the products covered by this manual comply with the requirements of the Low Voltage Directive (2006/95/EC) for electrical safety and the EMC directive (2004/108/EC) for electromagnetic compatibility. See the Declaration of Conformity on the inside back page.

Declaration of Conformity

Manufacturer:-	GRANT INSTRUMENTS (CAMBRIDGE) LTD, Shepreth, Cambridgeshire SG8 6GB
Equipment Name/Type Number:-	Optima range: T100, T100 ELE, T100 IN, T100L, T100L CB, TC120, TC120L,
Description of Equipment:-	Laboratory Immersion Thermostat
Directives:-	EMC Directive 2004/108/EC LVD Directive 2006/95/EC
Including Accessories:-	Detachable cordset on 220-240V models
CE marking first applied:-	2012

Applied Standards:- **Harmonized Standards:-**	BS EN 61326-1:2006 Electrical Equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements BS EN61010 Part 2-010:2003 Safety requirements for electrical equipment for measurement, control and laboratory use; particular requirements for laboratory equipment for the heating of materials

The product complies with the above directives when used with the supplied mains cord-set; it may not comply if an alternative cord-set is used.

I declare that this apparatus conforms to the requirements of the above Directive(s)

L. J. Chapman

Dated 30 AUGUST 2012.

Ludo Chapman
Managing Director
Grant Instruments (Cambridge) Ltd.

USA

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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