



Gerber/Butyrometer bath T100-MST20

Operating Manual

Grant Instruments, based near Cambridge, England is a world leader in the manufacture and design of equipment for sample preparation, scientific analysis, data acquisition and data analysis providing solutions to the global scientific and industrial markets.

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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-MST20

The product listed above is a general purpose immersion thermostat (T100) combined with a custom stainless steel tank (MST20) designed for milk analysis using the Gerber test method. It is intended 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 the T100 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. 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.

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.



Do not use the T100 with flammable heat transfer liquids.



Use fume extraction when using silicone fluids at elevated temperatures



Do not use the T100 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:

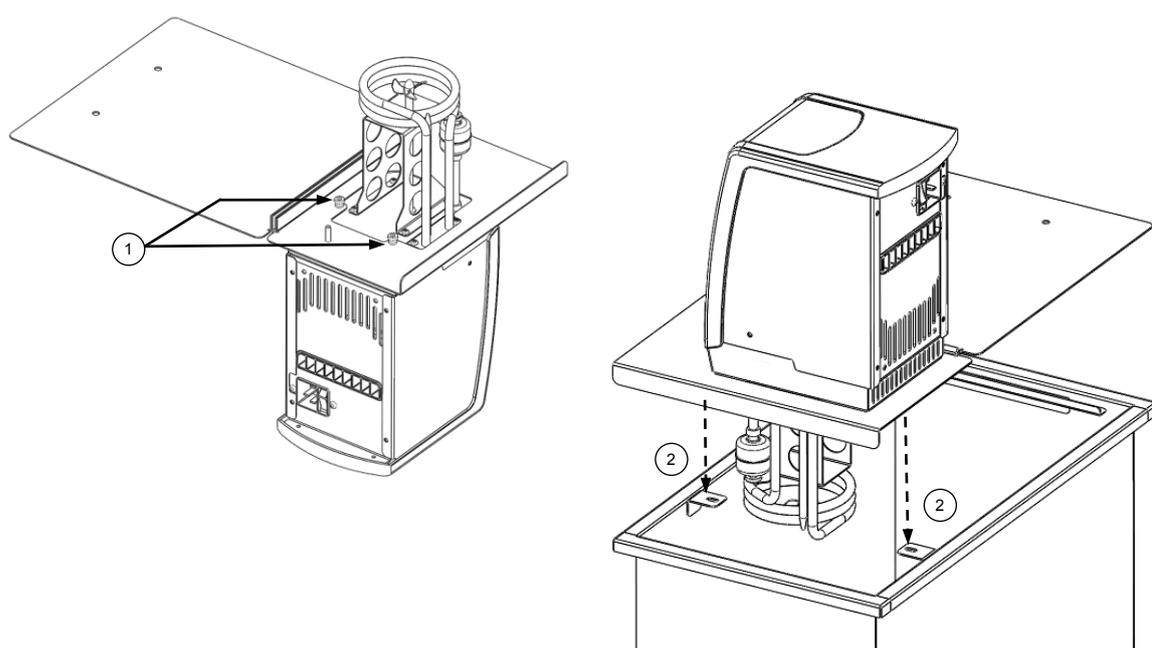
- Immersion thermostat (T100)
- Tank (MST20) includes bridge plate with hinged lid
- Tray
- Mains cord with plug
- Operating manual

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

4.2 Fitting controller to the tank

The T100-MST20 is supplied ready assembled. For cleaning purposes instructions are provided for attachment and removal of the T100 controller.

1. Fit the T100 through the hole in the bridge plate and align using the locating threads. Secure using the retaining nuts (1). Hand tighten only.
2. Lower the assembly onto the slots MST20 bath so that threaded posts fit into the fixing brackets (2). Fasten with the retaining nuts provided.



3. Fit the circulation tray in the base of the MST20 tank.

4.3 Removing the controller from the bridge plate

Allow the working liquid to cool before removing the T100 from the tank. Carefully remove the T100 and bridge plate together from the tank by removing the retaining nuts inside the tank. To remove the bridge plate, turn over the assembly and undo the retaining nuts. Attach the retaining nuts to the locating threads for safe keeping.

4.4 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-MST20 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.

Temp range	Recommended liquid	Comments
-30°C to 30°C	50% water, 50% antifreeze (inhibited ethylene glycol)	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)	
5°C to 99.9°C	Water*	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.
70°C to 120°C	Silicone fluid Viscosity ~20cs Flash point ≥230°C Fire Point ≥280°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

4.5 Installation



Place the T100-MST20 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.

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

5.0 Operating procedures

5.1 Operation

5.1.1 Filling the tank

Fill the tank with approximately 20 litres of water. The T100 has low level float switch which will alarm if the liquid level drops below the minimum required level and the unit will switch off the heater and stop temperature control.

5.1.3 Emptying the tank

The MST20 should be emptied to a safe level prior to moving.

Allow the liquid temperature to fall to a safe level before emptying. Take reasonable precautions to prevent accidental spillage.

5.1.4 Setting up and switching on

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

Attach the T100 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 using the 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 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

5.2.1 Product description



5.2.2 Product indicators

There are two indicator lights on the T100

- Heater on light (orange) marked SSS
- 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 temperature in °C of the liquid being controlled.

The **S**(et) 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.

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

The T100 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. 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 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 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 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.

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
Pollution degree: 2
Installation category: II

Mains supply voltage fluctuations are not to exceed $\pm 10\%$ of the nominal supply voltage.

6.3 Product performance

	T100
Settable temperature range	0°C to 100°C
Min operating temperature	5°C to 100°C
Stability (DIN 12876)	$\pm 0.05^\circ\text{C}$ *
Uniformity (DIN 12876)	$\pm 0.1^\circ\text{C}$
Max current consumption	6.5A
Heater power	1.3kW

* Temperature stability may be affected ($\pm 0.3\text{C}$) 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)

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 float liquid level protection should 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.

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 T100IN 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 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 3Gx1mm² 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
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Cambridgeshire
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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	The heating element has exceeded 110°C. Allow the unit to cool and reset the over-temperature cut-out by switching the unit off and on again. If 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)
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	Low liquid level float switch has operated Over-temperature cut-out has operated	Check that the liquid level in the bath is adequate . The heating element has exceeded 110°C. Allow the unit to cool and reset the over-temperature cut-out by switching the unit off and on again. If unit still shows a "Cut" alarm then the unit has an internal fault and must be repaired before it is used again.
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.
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.
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).

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	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.
	Heating very large volumes of liquid with large thermal losses	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	Clear obstruction.
	Faulty motor	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
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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.

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