



est. 1878

USER- MANUAL TC16-40-58



ISO 9001 : 2015
NL/PRO 238239125

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tc16-40-58-man.docx Rev. 2.5 UK 0923

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1 SAFETY AND WARNINGS

Make sure before installing or operating the equipment to read and understand all instructions and safety precautions listed in this manual. If there are any questions concerning the operation of the equipment or about the information given in this manual please contact your local dealer or our sales department first.

Performance of installation, operation, or maintenance other than those described in this manual may result in a hazardous situation and may void the manufacturer's warranty.

Never operate equipment that is not correctly installed. Unqualified personnel must not operate the equipment. Avoid damage to the equipment, or its accessories, caused by incorrect operation.

Important:

- When performing service, maintenance or moving the apparatus, always disconnect the apparatus at the main's socket,
- Proper skilled and trained personnel are only allowed to operate this equipment,
- Take notice of warning labels and never remove them,
- Refer service and repairs to qualified technician,
- If a problem persists, call your supplier or Tamson Instruments bv.

2 WARRANTY

Tamson Instruments bv. warrants that all their manufactured equipment is free from defects in material and workmanship, preventing the machine from normal operation. Tamson Instruments bv does not warranty that the equipment is fit for any other use than stated in this manual. The manufacturer can only be held responsible for the security, reliability and performance of the equipment, when operated in accordance with the operating instructions, extensions, adjustments, changes and/or if repair is performed by Tamson Instruments bv. or authorized persons only. This warranty is limited to one year from the date of invoicing. All equipment and materials are subject to standard production tolerances and variations.



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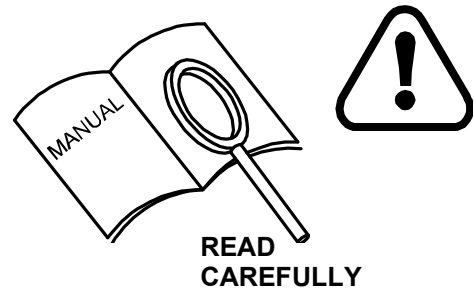
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3 PRECAUTIONS AND HAZARDS

Before attempting to operate the bath read all parts of this manual carefully to insure smooth operation and avoid damage to the equipment or its accessories.

If a malfunction occurs, consult section "TROUBLE SHOOTING", page 17 at the end of this manual. If problem persists, call your supplier or Tamson Instruments bv. Never operate the equipment if not correctly installed. The equipment must be operated only by qualified personnel. Avoid damage to the equipment or its accessories through incorrect operation.



Environment	
Panel sealing	Confirms EN60529: IP65
Environment Temperature	0 tot 35°C. Supply enough ventilation
Humidity	5 tot 95 %, non condensating
Atmosphere	Not suited for altitudes above 2000m or explosive/corrosive environment
Pollution cat. 2	Conducting pollution must be prevented

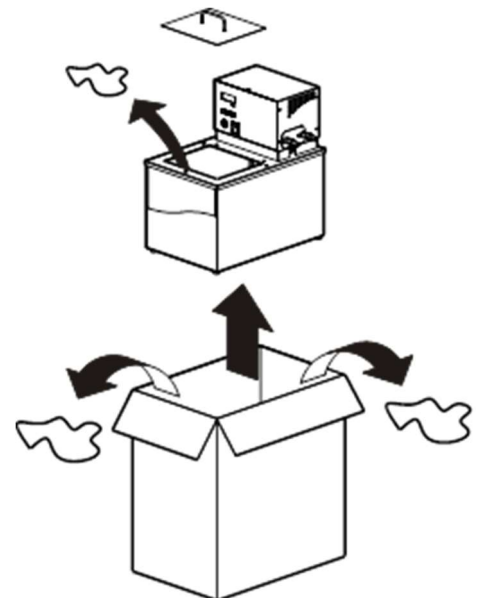
4 INSTALLATION

4.1 Important

Tamson Instruments bv is not responsible for any consequential damage or harm caused by using this bath. Repairs on the electrical system of the bath may only be carried out by well trained and authorized persons.

4.2 Unpacking

Before leaving the factory Tamson baths are adequately packed to prevent damage during normal transportation. Check the packing for external damage and make a note on the shipping documents if any damage is found. Always retain the cartons and packing material until the bath has been tested and found in good condition. (Transport companies generally will not honor a claim for damage if the respective packing material is not available for examination).



REMOVE ALL PACKAGE MATERIAL



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The shipment contains at least the bath as mentioned in the delivery checklist. Further the consignment might contain one or more viscometers, individually packed in small boxes with the calibration certificate included in the box, as well as ASTM thermometers, thermometer holders etc. Please see the packing list for details concerning total contents of consignment.

Before filling the bath remove any remaining packing material from its interior. The interior of the bath can be accessed by taking off the lid on the top of the bath.

4.3 Initial use

Before filling the bath make sure that the bath is clean. Place the bath spirit level, and connect it to the mains after the mains switch is placed in "off" position. Use a mains supply with proper grounding.

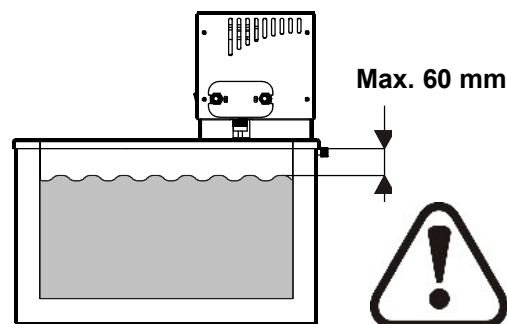
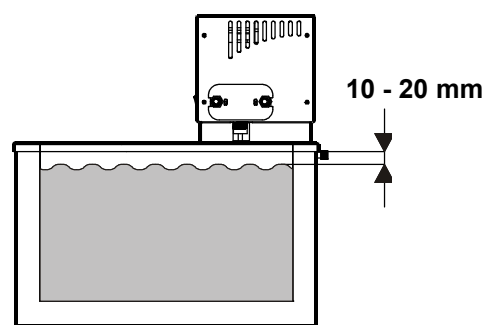
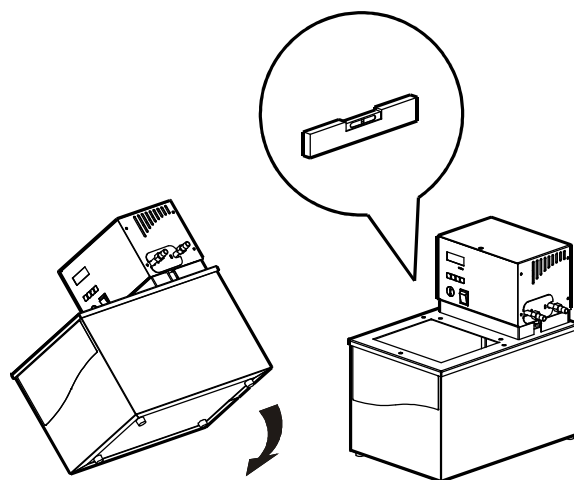
Important: Never use the bath without fluid

4.4 Filling the bath

The bath-fluid level must be 10- to 20 mm below the edge of the top-plate.

In no case the fluid level may be lower than 60 mm under the edge. This can cause severe damage to the heating element.

For working temperatures above +80°C a fluid with a high boiling point must be used. The bath fluid also has to be

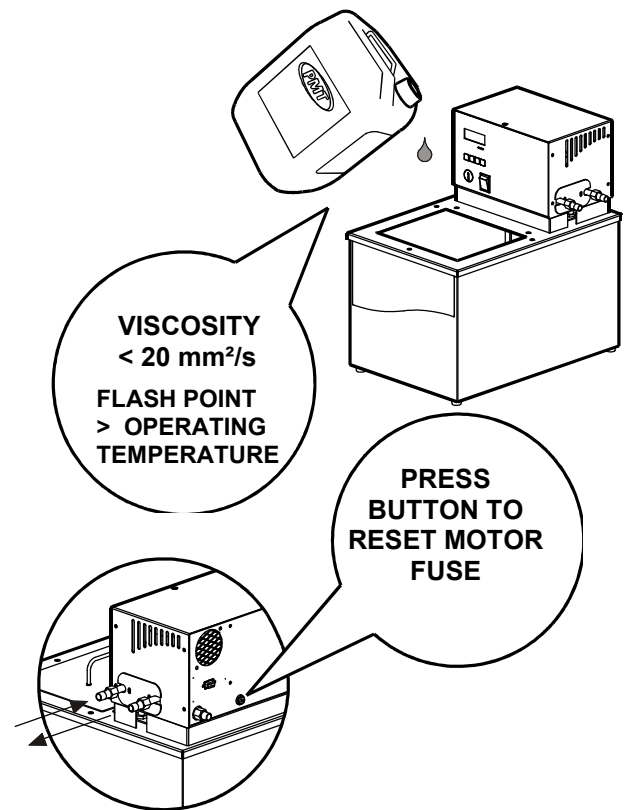


chemically stable and must have low viscosity preventing damage to the pump. Tamson oil type 150 has these characteristics and is recommended to use for temperature ranges which lie between +80°C and +150°C.

Silicon oil can be used for temperatures between +20°C and +150°C.

It is very important to select a liquid with a viscosity of less than 20 mm²/s at the operating temperature and a flash point which is well above the operating temperature.

When viscosity of the bath fluid is too high at room temperature, the motor-fuse will be activated. In such a case the bath fluid can first be heated to set point temperature. When the bath has reached it's set point the motor fuse can be reset by pressing it. This way of operating will reduce the life of the motor and is thus not recommended.



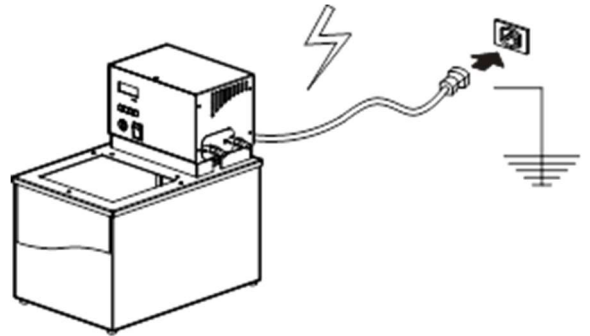
Type	Remarks	Life			Viscosity [mm ² /s] ^x				Temp. Range	Package	Ordering code
		150°C	200°C	250°C	80°C	100°C	150°C	200°C			
Mineral	T150 Yellow Mineral oil	1/2 yr	X	X	20	7	3		80..150° C	20 ltrs	00T0220
Silicon	200 -10 Transparent Dimethyl siloxane polymer	No limit	200hrs	<10hrs	4	3.5	2.5		20..150° C	20 ltrs	08T0001
Silicon	200 -50 Transparent Dimethyl siloxane polymer	No limit	200hrs	<10hrs	20	15	9		80..150° C	20 ltrs	00T0226
Silicon	Silicon 210 Dark Dimethyl poly siloxane	No limit	<2yrs	<1yr	(35)	30	22	12	80..250° C	20 ltrs	00T0231
Silicon	Silicon 550 Colorless Polyphenyl methyl dimethyl siloxane	No limit	<1yr	<1200 hrs	(50)	20	12	5	80..250° C	20 ltrs	00T0238

Do not use demineralized or distilled water. This water can lead to corrosion of the bath and moving parts. The corrosion can wear out the pump bearings

5 CONNECTING

Before plugging the TC 16, TC40 or TC58 into the mains socket, make sure the voltage of the bath corresponds to the local voltage and frequency.

Use a mains supply that is well earthed, clean of interference and suitable for the acquired electrical load of the bath.



6 INTRODUCTION TO THE TC SERIES

The TAMSON TC baths are used for precise temperature control. This series offers a choice in relatively large bath volumes.

6.1 General

The TAMSON baths are constructed throughout from corrosion-resistant – stainless steel and brass – materials. Outer casing is zinc plated powder coated steel. The bath is effectively insulated against heat loss by a layer of Rockwool between the inner tank and outer casing.

6.2 Pump

A circulation pump is built-in to guarantee an uniform temperature distribution within the bath and providing the possibility to circulate through a closed external system.

The standard pump offers a motor protection (small thermal fuse) which is placed on the back panel of the motor compartment. This protects the motor from excessive loads.

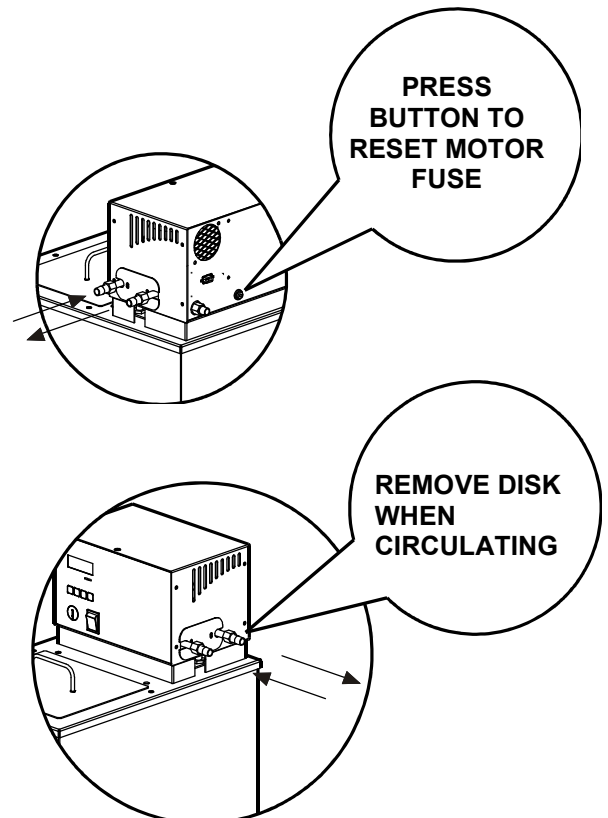
When pumping viscous liquids the thermal fuse can be activated. The motor fuse can be reset by pressing the button.

The inlet and outlet of the pump are fitted with 8 mm hose connections and 1/4" threaded fittings for metal tubing. The outlet is provided with a small disc, stopping the circulation action.

Before the fluid can begin circulating through external systems this disc must be removed by unscrewing the fitting and hose connection.

6.3 Cooling

The TC-bath is equipped with a cooling coil. Circulation of fluid, with a lower temperature than the bath fluid, through this coil will cool down the bath temperature. To get stable control of the bath when using the cooling coil, the temperature of the cooling fluid has to be approximately 5°C lower than the set point temperature of the bath. Cooling is need for set point temperatures of approximately 42°C and lower.



The cause for this relatively high temperature is the self heating of the bath due to friction-heat of the pump. The insulation of the bath prevents this energy to be transferred into the environment. This causes a raise of temperature in the bath up to 25 .. 30°C depending on the environmental temperature and used bath fluid.

For cooling the bath down to lower temperatures, tap-water is mostly used. Also a small circulator can be connected to the cooling coil like the Tamson TLC10-3, or TLC15-5.

6.4 Over-temperature safety

In case of electronic failure the possibility exists that the heater element is continuously switched on. This will cause extreme temperature raise. To prevent high temperatures the bath is fitted with a mechanical temperature switch (thermostat). This thermostat will switch-off the bath at a preset temperature in the range from 50 tot 270°C.

We advise to adjust the mechanical over temperature to approximately + 25°C above the bath set point.

This safety construction prevents for example oil to be heated above flash point which definitely will cause fire or prevent evaporation of bath fluid due to high temperatures.

The thermostat will automatically reset when the bath temperature drops approximately 10°C below the pre-set temperature. To continue normal operation the bath has to be switched-off and on again.

6.5 Adjusting the mechanical over-temperature protection thermostat

- Turn the over-temperature protection (Control Panel page 11) to its maximum (turn clockwise towards 50°C),
- Heat the bath to its set point,
- Gently turn the over-temperature protection anti-clockwise, until the over-temperature protection is activated, and system switches-off,
- Turn the over-temperature protection approximately 25°C higher (turn clockwise), Switch the bath off and on again. The bath is ready to operate safely.

6.6 Fluid Level

Do not operate the bath with low fluid level.

When the fluid level is too low, bath fluid will vaporize leading to toxic and flammable fumes.

Flammable fumes can lead to fire

Flammable fumes can be ignited by the not submerged part of the heating element.

The level indicator(optional) will start to blink (white light) when the fluid level is too low.

When the bath has been installed it must be filled with an appropriate liquid. When working with water the bath should be filled to 1 cm below the overflow outlet. When using oil the bath should be filled to not more than 5 cm below the overflow outlet. Depending on the operating temperature the liquid level in the bath should be observed and excessive fluid will flow out of the overflow outlet.

The liquid level should be maintained between 1 and 3 cm below the overflow outlet during normal operation.

The heating element will be damaged when not fully submerged in the bath fluid. A lower level than 5 cm below the lid may damage the heaters. A high bath level can cause overflow and might also damage the bath insulation.

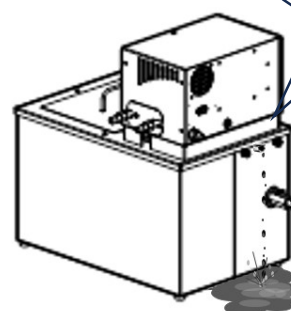
Low fluid level

- Can cause fire when heater gets partially exposed
- Will damage the heater

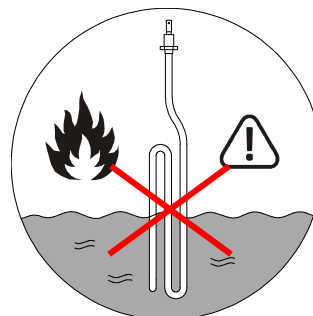
6.7 Fluid Level Detect

Level detection is available as an option. When the fluid level becomes too low an audible alarm is triggered.

**High fluid level
and or
expanding bath fluid**



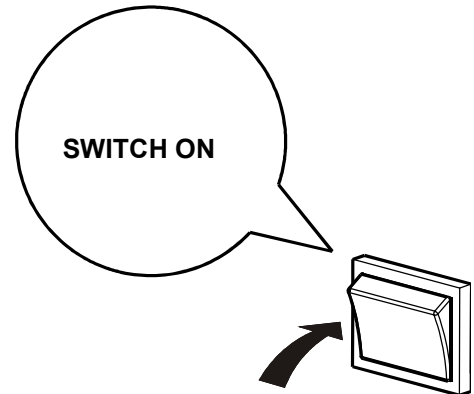
Spillage from
overflow outlet



7 OPERATION

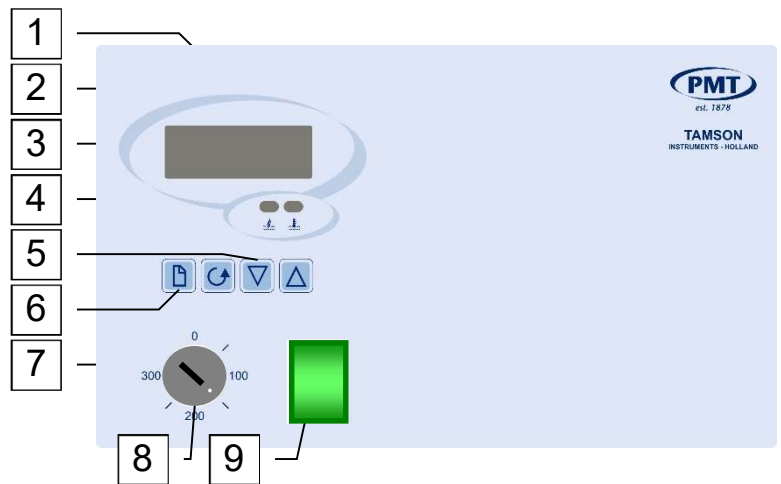
7.1 Switching on

If the bath has been properly filled with fluid it can be switched with the mains switch located on the front panel. Choose a working temperature (set point).

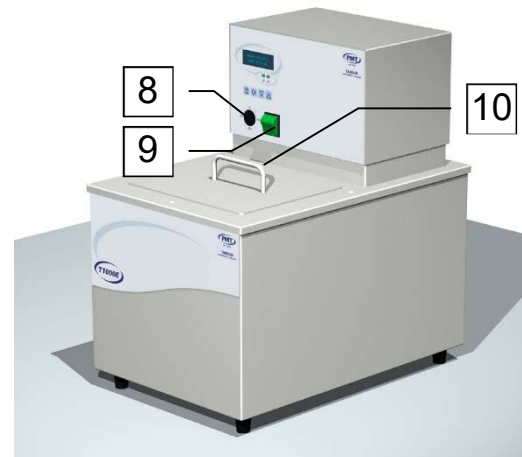


7.2 Control Panel

1. LED Display
2. LED Over-temperature*
3. LED Heater
4. Up - key
5. Down - key
6. Page - key
7. Scroll - key
8. Safety thermostat
9. Mains On/Off
10. Top lid

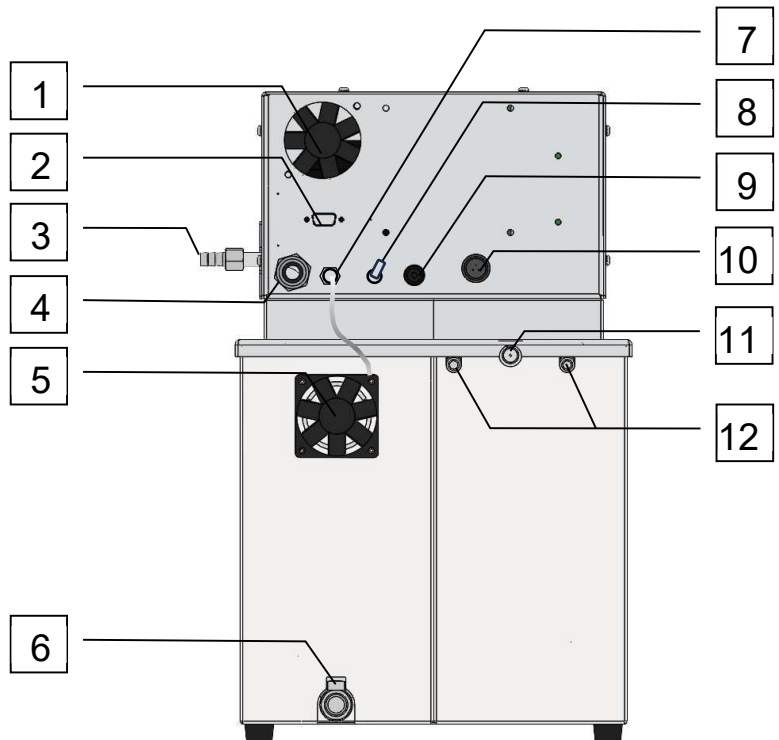


* When the overtemperature safety is activated wait until the bath temperature is lowered several degrees. The safety thermostat will reset itself. Turn the bath off and on again. The bath will continue operation.




7.3 Backside of the thermostatic bath

Pos	Item
1	Cooling fan
2	RS 232 Communication
3	In and outlet pump
4	Mains cable
5	Fan (only in combination with TC16 with p/n 31T0671 & 31T0861)
6	Drain valve 3/8" BSP male
7	Grummit Cable Fan
8	Switch fan [5]
9	Motor fuse
10	Connector (optional)
11	Overflow Outlet
12	Connection Cooling Coil 1/4" thread



7.4 Selecting parameters

The front panel layout shows the following four operating keys:

Press shortly  and following is displayed

SP.1 - Temperature set point in °C, ←
tU.n - Tuning the bath ("Atune"),
Pb - Changing the tuning (PID) parameters "P" value
ti - Changing the tuning (PID) parameters "I" value
td - Changing the tuning (PID) parameters "D" value
OFSt - Change temperature readout offset (± 5°C)

PAGE



LIST




DOWN



UP



Each time  is pressed another option is displayed.

Up and Down keys allow changing the listed value. All changed values, like set point and PID parameters, will be kept in memory when pressing the page key to leave the menu. After switching off the power supply, changed values are kept in memory.

SP.1	Set point adjust. Press page key to confirm setting when altered.
tU.n	Auto tuning PID parameters, set on or off. Off is default value here. On, when selecting parameter 2nd time. On.A is played. This indicates adaptive tune. Bath is adapting PID setting in background operation. When in On.A mode. PID values can not be set manually anymore.
pb	Changing the tuning (PID) parameters. 'Proportional band value. Default value is 1, range 1 .. 100. (Proportional band equals 1/proportional value). Press page key to confirm setting when altered.
ti	Changing the tuning (PID) parameters 'Integrator' value. Default value is 200. Range 1 .. 1200. Press page key to confirm setting when altered.
td	Changing the tuning (PID) parameters 'Differentiator' value. Default value is 0. Range 1 .. 600. Press page key to confirm setting when altered.
OFST	Set offset. The offset value is added to the displayed bath temperature. I.e. when the displayed bath temperature is 20.0°C, an offset of 0.2 displays a value of 20.2°C. An offset of -0.2°C will display 19.8°C. Range is -5°C .. +5°C. Press page key to confirm setting when altered.
Note	When tune is set to on, PID values can not be set. Change tune to off en alter PID values. Press page key to confirm setting when altered.



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8 QUICK START

To quickly start operating the bath:

- Fill the bath with sufficient and appropriate fluid.
see **Fout! Verwijzingsbron niet gevonden..**.
- Place the power plug,
- Switch on the bath using the mains switch,
- Choose a working temperature (set point):

Press  once. Display will indicate "SP.1". Alter set point temperature by using up  and down  key to select the desired bath temperature.

Confirm by pressing .

8.1 Tuning the bath

The temperature control of the bath is based on a digital PID system. When using different fluids in the bath each with their own heat capacity, the use of external cooling and external connected processes (circulation), or working at different set point temperatures requires new settings of the PID parameters. These parameters have to be optimized after changes to the system when optimal and accurate temperature control of the bath liquid is required.



IN-TUNE

Tuning of the bath results in:

- Stable temperature control of the bath,
- No over- or undershoot of the temperature set point,
- Quick response to deviations from the set point caused by external disturbances.

Tuning can be done automatically or manually. The parameters mentioned in table 1 will influence the control of the bath.

Parameter	Description	Display
Proportional band	The bandwidth in display-units over which the output power is proportional between minimum and maximum	Pb
Integration time	Determines the time taken by the controller to remove steady state error signals	Ti
Derivative time	Determines the time taken by the controller to react on error signals.	Td

Table 1 Parameters influencing the temperature control



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8.2 Tune PID values

Choose desired set point,
Wait until the bath has reached the set point temperature,
Highest temperature accuracy can be achieved when
tuning the bath. Select tU.n by pressing  twice.

Press  to choose "ON",

Press  5 times to return to displayed PV
(PID values can no longer be adjusted unless the "tU.n"
value is set to off)

8.3 Deselect tuning

- Pressing  twice,
- Display shows "tU.n",
- Press  to choose "Off",
- Press  5 times to return to displayed PV.

8.4 Manual tuning

The parameters for the PID control can also be changed manually. The method described below provides fast finding of the PID settings and is referred to as the method of "Ziegler Nichols"

This procedure is only to be followed when automatic tuning is not functioning.



This method provides fast manual findings of the PID values. Start the bath at its required running temperature:

1. Set the integral time "Ti" and the derivative Time "Td" to off
2. Check if the Lcb and Hcb are set to auto
3. Ignore the fact that the temperature may not settle precisely at the set point
4. If the temperature is stable, reduce the proportional band Pb so that the temperature just starts to oscillate. If the temperature is already oscillating, increase the proportional band until it begins oscillating. Allow enough time between each adjustment for the loop to stabilize. Make a note of the proportional band value "B" and the period of oscillation "T" Set the Pb, Ti and Td parameter values according to the calculations given in the table below

Type of control	Proportional band	Integral time "ti"	Derivative Time "td"
Proportional only	2xB	Off	Off
P + I control	2,2xB	0,8xT	Off
P + I + D control	1,7xB	0,5xT	0,12xT



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8.5 Draining bath fluid

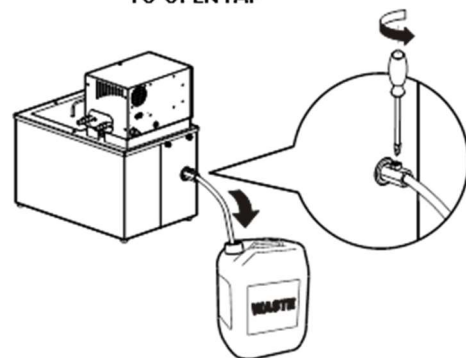
Before removing flammable bath liquids take the appropriate fire hazard precautions against these liquids.

When draining the bath fluid, be sure that the bath fluid has cooled down to ambient temperature. If viscosity is too high at ambient temperature to remove the fluid, make sure that the hose to drain and waste container can withstand the temperature of the bath fluid.

When removing bath fluid do not inhale toxic vapor. Always use appropriate ventilation.



USE SCREWDRIVER
TO OPEN TAP



8.6 Using the drain tap

The TC baths can be drained via the drain tap located at the backside of the apparatus.

The drain has an inner diameter of 3/8" gas fitting. The drain can be connected onto a pipe, tube or drainage system.

For safety reasons the tap can only be opened by using a screwdriver. The thread inside the tap is 3/8".

8.7 Maintenance


Keep the apparatus free from dust. Regularly check the cooling openings and remove dust with vacuum cleaner. If necessary remove cover and clean internally. Use appropriate protection when cleaning, dust can be very unhealthy.



9 TROUBLE SHOOTING

All Tamson products are well designed and carefully tested before shipping. This will not fully prevent small problems in the field. Following will help you to locate commonly known problems and how to fix them. In case of doubt please check your local dealer or Tamson Instruments bv.

9.1 General

Bath malfunction	
The motor is not running and electronics is dead	Check mains fuse
Motor is not running:	<p>Probably the motor fuse is activated. Restart the motor by pressing the motor fuse .</p> <p>Check viscosity of the bath fluid. High viscosity will activate the motor fuse.</p> <p>Electrical defect. Motor capacitor defective. Replace capacitor or contact local dealer or Tamson Instruments bv.</p>
Problems with set point	
Heater LED is not burning, motor is turning and temperature raises above set point:	Setpoint too near to room temperature. <i>Cooling of the bath is needed.</i>
Temperature doesn't reach set point, motor turns fast:	Bath fluid evaporates too quick. Use other fluid.
Heater malfunctions:	Measure electric mains current. Current below 2 amps indicate a problem with the heating element.
Temperature not stable	<p>Tune the bath at the set point temperature.</p> <p>Difference between ambient and bath temperature is too small (Applied power indication is below 8%). Use cooling coil</p>
PID values	
Unable to set PID values:	Check if ATUN has been set to on. PID values can no longer be adjusted unless the ATUN value is set to off. See 8.4 selecting parameters.
Readout / indicator	
The temperature readout on the display does not correspond to the temperature measured.	Check the PT100 sensor
Level indicator on frontpanel blinks. 	<p>Fluid level probably too low, check fluid level</p> <p>Be aware that the fluid level always needs to be higher than the heating element(s).</p> <p>An heating element which partially operates above the fluid (so partially exposed to air above the fluid level) can get hot and may possibly ignite the bath fluid.</p>

9.2 Message on display

Code	What does it mean	What action to take
E61	Defect / calibration PT100	Check wiring and element. Ohmic value at 0°C=100R and at 100°C=138R. Replace PT100
E70	Error on operational parameters	
E50	EEPROM error	Auto - reset after 2 s
E82	Error on input during calibration	
E4	EEPROM error	Auto - reset after 2 s
E5	EEPROM error	Auto - reset after 2 s
E6	Watchdog error	Auto - reset after 2 s

10 SPECIFICATION

10.1 Technical specifications overview

Item	Unit	TC16	TC40	TC58
Ordering code 230V	50 or 60Hz	00T0671	00T0681	00T0691
115V	50 or 60Hz	00T0861	00T0851	00T0881
Power	[230V] [Watt]	1500	2900	2900
	[115V]	1500	1800	1800
Materials	Used inside bath: stainless steel 304, brass			
Range	Ambient .. 250°C/..482°F			
Reading	Standard °C, °F on request			
Setting ±	[°]	0.1		
Stability ±	[°K]	0.02	0.02	0.02
Heating	[230V] [W]	1400**	2800	2800
	[115V]	1400	1750	1750
Bath volume	[L]	16	40	58
Pump	[mBar]	Max pressure 300*		
Pump	[L/min]	Max flow 7.5*		
Opening	[mm]	180 *210	420 *275	420 *275
Depth bath	[mm]	220	200	300
Length	[mm]	455	705	705
Width	[mm]	295	375	375
Height	[mm]	440	440	590
Weight	[Kg]	21	30	35
CE	Conforms to CE regulation			

* Optional pump with pressure max 1bar, flow max 16ltrs/min, reference: 24T0399.

** Additional heater 1400W optional to heat larger loads when circulating

11 SPARE PARTS

Ordering number		Description
230V 50/60Hz	115V 50/60Hz	
25T1242	25T1242	Fan 60x60 12V
04T0044	04T0045	Pump complete (as from year 2022)
24T8080	24T8083	Motor fuse
	24T3312	Motor Capacitor
24T3300		Before 8/8/2023
25T1344		From year 8/8/2023
06T0496	06T0497	PCB TTU Basic
25T0194	25T0195	Heater 1400 Watts
25T0194	25T0194	Boost Heater 1400 Watts
	24T8541	Mains switch
	28T4106	Keypad foil
	28T4107	Front sticker TC16
	28T4108	Front sticker TC40
	28T4109	Front sticker TC58
	24T8581	Safety thermostat
	28T3022	Controller PCB 115V & 230V (Not programmed, when ordering always specify bath (i.e. TC16, TC40, TC58)

12 DISCLAIMER

Information given herein is offered in good faith as accurate, but without guarantee. Conditions of use and suitability of the product for particular uses are beyond our control; all risks of use of the product are therefore assumed by the user.

We expressly disclaim all warranties of every kind and nature, including warranties of merchantability and fitness for a particular purpose in respect to the use or suitability of the product.

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ISO 9001 : 2015
NL/PRO 238239125

Tamson Instruments bv

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13 CE DECLARATION OF CONFORMITY

Following equipment is in compliance with EMC Directive 2014/30/EU:

Product: Thermostatic bath and circulator
 Model: TC16 / TC40 / TC58
 Serial code: Effective from 07Txxx
 Manufacturer: Tamson Instruments bv
 van 't Hoffstraat 12
 2665 JL Bleiswijk
 The Netherlands

The products are in conformity with the following specifications:

Item	Reference	Description	Test result
a	RoHS Directive	2011/65EU	p
b	EN 61010-2-010	Safety requirements for electrical equipment for measurement, control, and laboratory use. Particular requirements for laboratory equipment for the heating of material	
c	Machine Directive 2006/42/EC	Machinery Directive, of the European Parliament and of the Council of 17 May 2006/42/EC 2nd Edition June 2010	p
d	EN 60204	Machinery Directive and Safety requirements	p, p ⁱ
e	EN60950-1	Low Voltage Directive	p
f	EN61000-3-2	Harmonics	p
g	EN61000-3-3	Flicker	p ³
h	EN61000-4-2 +A1+A2	ESD	p
i	EN61000-4-3 +A1+A2	Radiated immunity	p (anechoic room)
j	EN61000-4-4	Electrical Fast Transients	Minimum requirements pass
k	EN61000-4-5+A1	Surges	Minimum requirements pass
l	EN61000-4-6+A1	Conducted immunity	p
m	EN61000-4-11 +A1	Voltage dips and Voltage variations	p
n	EN55016-2-1	Conducted emission	p
o	EN55016-2-3	Radiated emission	p (anechoic room)

p = Pass

pⁱ = Individually tested

p³ = Pass, condition of operating during Pst measurement: Operational with heating element 1400W.

P_{st} and P_{lt} are not evaluated in accordance with A.5 of Annex A of EN 61000-3-3(1995) + A1(2001).

not applicable were:

Conducted discontinuous emissions (Clicks)

Radiated emission (OATS)

Magnetic field immunity

Entity responsible for marking this declaration :

Manufacturer, Tamson Instruments bv, van 't Hoffstraat 12, Bleiswijk The Netherlands,

Name :  R.C. van Hall
 Function : Director
 Date : Sept 18, 2017
 Version : 1.03



ISO 9001 : 2015
 NL/PRO 238239125

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