USER-MANUAL
TV12LT

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.

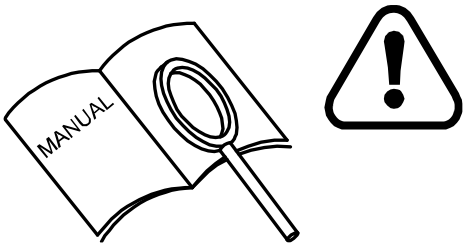
Important:
- When performing service, maintenance or moving the apparatus, always disconnect the apparatus at the main's socket,
- Proper skilled and trained personnel are only allowed to operate this equipment,
- Take notice of warning labels and never remove them,
- Refer service and repairs to qualified 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.

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.



READ CAREFULLY

If a malfunction occurs, consult section TROUBLE SHOOTING, page 24 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

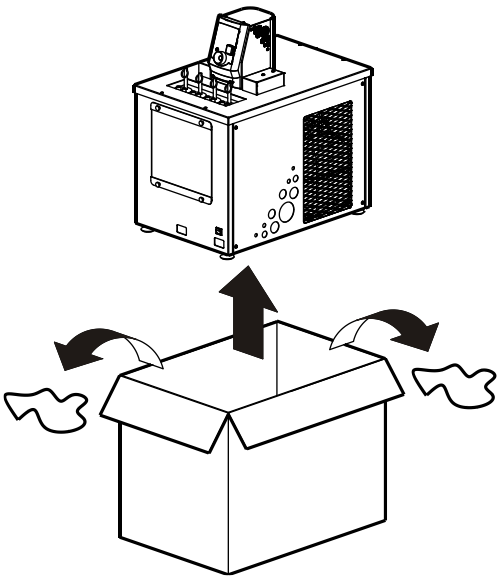
Tamson Instruments bv is not responsible for any consequential damage or harm caused by using this bath. Repairs on the electrical system of the bath may only be carried out by well trained and authorized persons.

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).

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.

REMOVE ALL PACKAGE MATERIAL



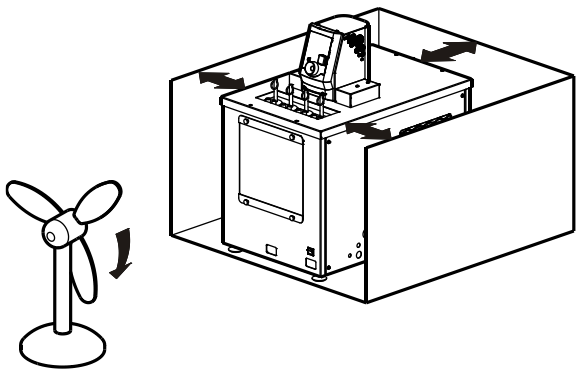
Before filling the bath remove any remaining packing material from its interior. The interior of the bath can be accessed by taking off the lid on the top of the bath.

2.1 Tilting

Before unpacking inspect the tilt watch located on the outside of the packing. When the tilt watch indicates a red color contact Tamson instruments and the forwarder before continuing with unpacking.

2.2 Ventilation

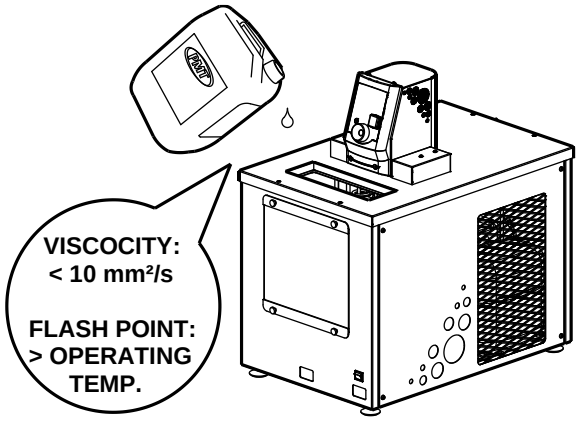
The bath has to be placed in a well ventilated area. Air circulation has to be enabled by 30 cm of free space at all sides.



If the bath has no or insufficient ventilation severe mechanical damage will occur.

3 Bath Liquid

The bath must be filled with a liquid suitable for the minimum operating temperature.



The bath must be filled with a liquid suitable for the minimum operating temperature.

It is important to select a liquid with a viscosity of less than 10 mm²/s.

When using flammable bath liquid choose a flash point well above the operating temperature.

The use of other liquids is allowed as long as the viscosity of the fluid is low enough at the operating temperature. The viscosity must be below 10 mm²/s. High viscosity will result in poor stability as well as poor uniformity of the bath.

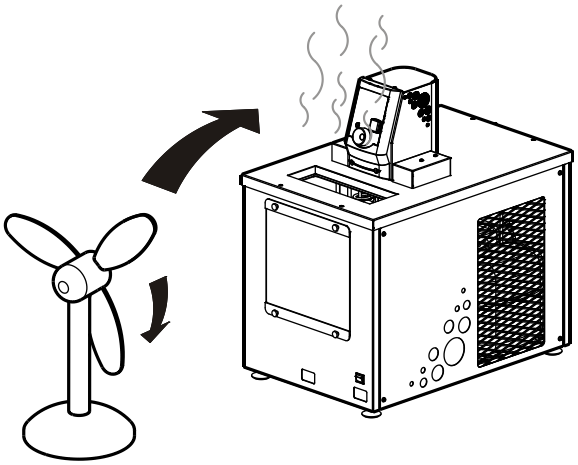
The fluid flash point must be well above the maximum operating temperature. Fluid must not be aggressive when in contact with stainless steel, brass, glass and silicon sealing.

!! Extreme HAZARD !!
Do not use methanol at temperatures above 20°C. The methanol will evaporate and cause toxic and flammable vapors. Explosion hazard can build up in or around the bath.

When working at temperatures above 20°C, water or oil can be used as an alternative.

* Do not use ethanol. Ethanol often contains high level of water. Water will freeze inside the bath and leads to cooling and stability problems.

Do not use the water mixtures at temperatures where the mixture can start to freeze. Frozen bath fluid can severely damage the bath and stirrer mechanism.



Commercial enterprises specialized in refrigeration may supply alternatives for mentioned circulation or bath fluids. These alternatives can be less toxic or flammable. However in most cases they are very corrosive to copper, brass and aluminum, etc.

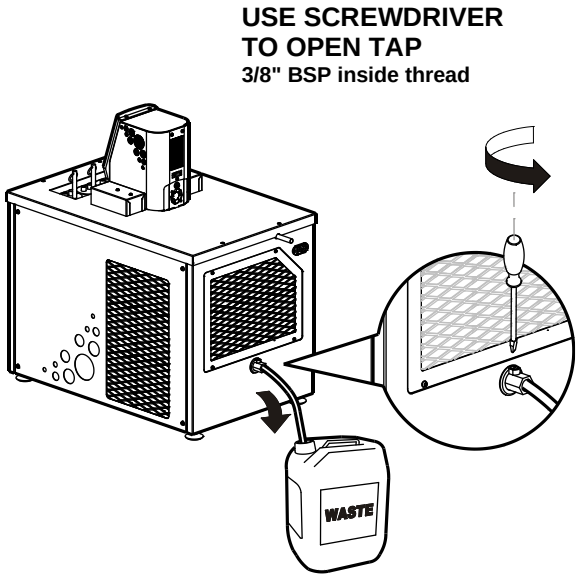
Heated bath fluid can cause toxic fumes. Take precautions and read material safety sheet if applicable. Remove fumes from hot oil or bath medium. Use fume

If the fluid level becomes too low and the heating elements cannot fully dissipate their power, these elements may reach a temperature above the ignition point. It is possible that the bath liquid ignites under these conditions.

The heating element must be fully covered by the bath fluid. The heating element will be damaged when not fully submerged in the bath fluid.

3.1 Drain bath fluid

The TV12LT can be emptied via the drain tap located at the backside of the apparatus. For safety reasons the tap can only be opened when using a screwdriver. The thread inside the tap is 3/8".



Take necessary precautions against fire hazard when removing flammable bath fluid.

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

Handle old bath fluid as toxic waste.

Bath fluid must be at ambient temperature before removing.

3.2 Bath fluid level

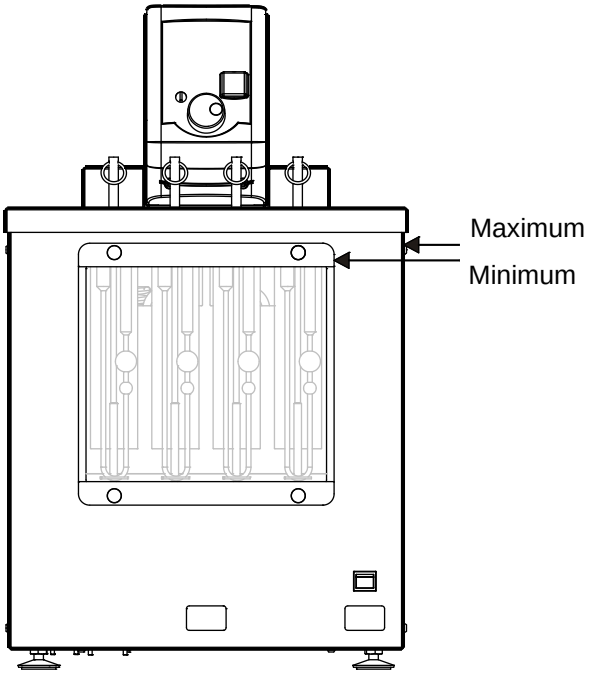
Minimum level

The heating element must be fully covered by the bath fluid. The heating element will be damaged when not fully submerged in the bath fluid.

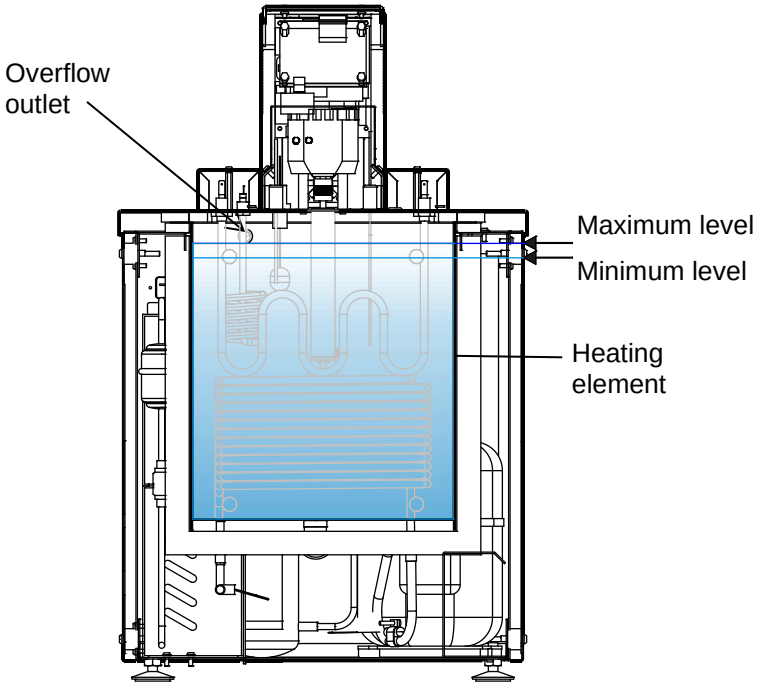
The practical minimum level is indicated below.

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

Front view



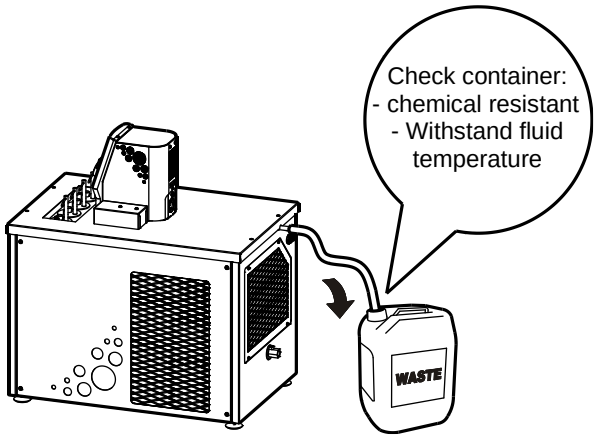
TV12LT inside

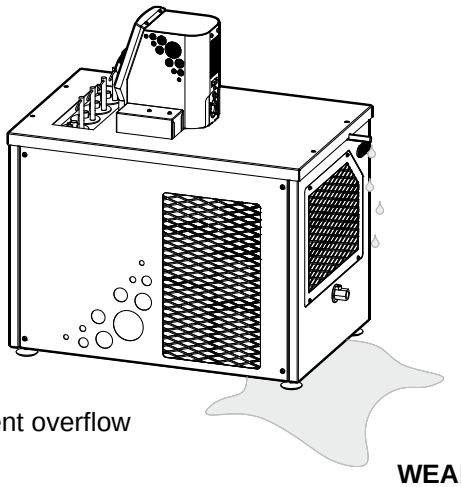


Maximum level

If the fluid level is too high, it will leave the bath via the overflow outlet (14mm outer diameter pipe). Prevent fluid from the overflow outlet entering the backside of the TV12LT. For this reason the overflow outlet must be connected to a waste container.

When the bath is working at high temperatures, tubing and waste container must be chemical resistant and able to withstand high temperatures (>150°C / 302°F).

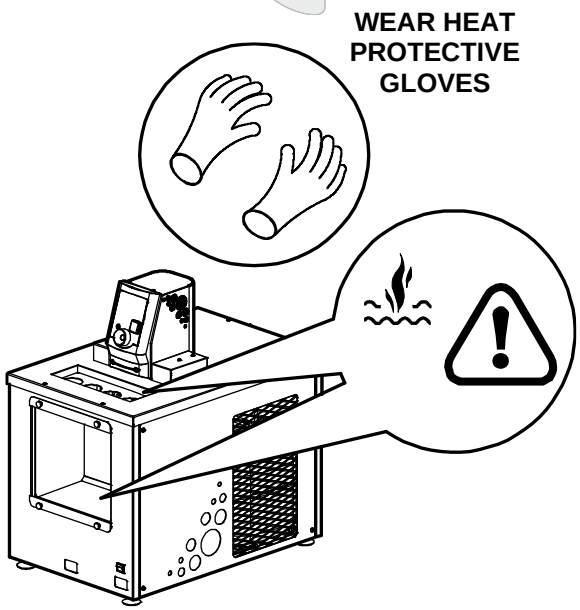




Prevent overflow

3.3 Safety and protection

When operating at high temperatures the lid (of the bath), top plate and the window section of the bath become very hot. Always use heat protective gloves. Care must be taken when placing or re-moving material from the bath.



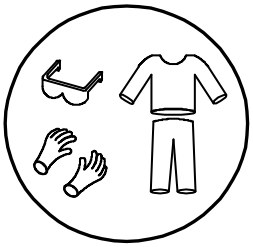
Pay attention when removing hot fluid:

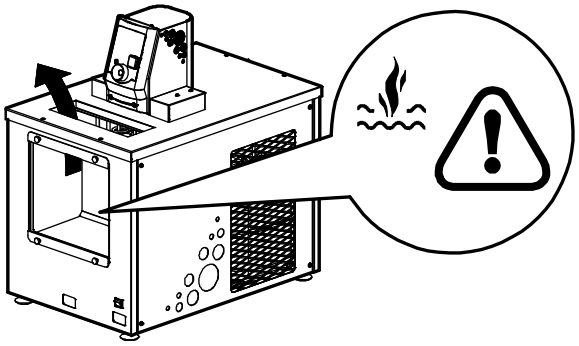
Use heat protective clothing and wear gloves and safety glasses:

remove all the water from the bath. Small drops of water may result in hazardous situations when reheating the bath with oil.

Never mix oil and water in or around the bath.

WEAR PROTECTIVE GLOVES , CLOTHING AND EYE PROTECTION.





3.4 Cooling

The bath is provided with integral cooling system. The cooling is split in two functions.

When cooling down to the set point temperature maximum cooling capacity is used.

Whe the set point temperature is reached the bath will start to tune for stable control. It also switches the cooling in a low power mode.

The surplus of cooling is heated away. This way a very accurate set point temperature is maintained.

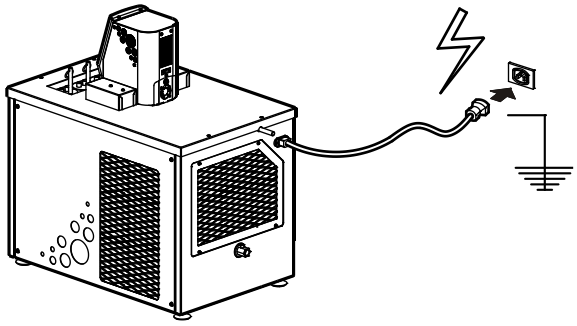
By using this two stage system only limited cooling capacity is heated away. This saves an enormous amount of energy when comparing energy consumption with competition. It also offers much more precise temperature control.

Energy consumption

Temperature	Consumption control	Heat up [boost heater]	Total power SP-control	Peak* power heat to SP
[°C]	[Watt]	[Watt]	[Watt]	[Watt]
80	400	780	400	1180
	⇕			
41	200	780	200	980
40	1300	780	1300	2080
	⇕			
-40	500	780	500	1280

* Only used shortly to reach new set point(SP) temperature

3.5 Connecting



Before plugging TV12LT into the mains socket, make sure the voltage of the bath corresponds to the local voltage.

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

4 INTRODUCTION

The TAMSON model TV12LT baths is designed to perform as ultra stable visibility bath. The intended use is kinematic viscosity measurement and sensor calibration.

4.1 General

The heat input is controlled by a microprocessor system. A special optimized electronic temperature measurement circuit ensures reproducibility of operation conditions.

4.2 Construction

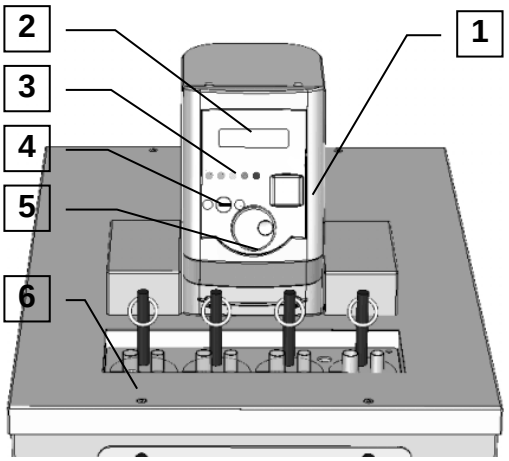
All wetted parts of this TAMSON bath are constructed entirely from corrosion-resistant materials such as stainless steel and brass. The central microprocessor within the control module manages and controls the functions for temperature measuring regulation, program storage, safety control and error coding.

4.3 Stirrer

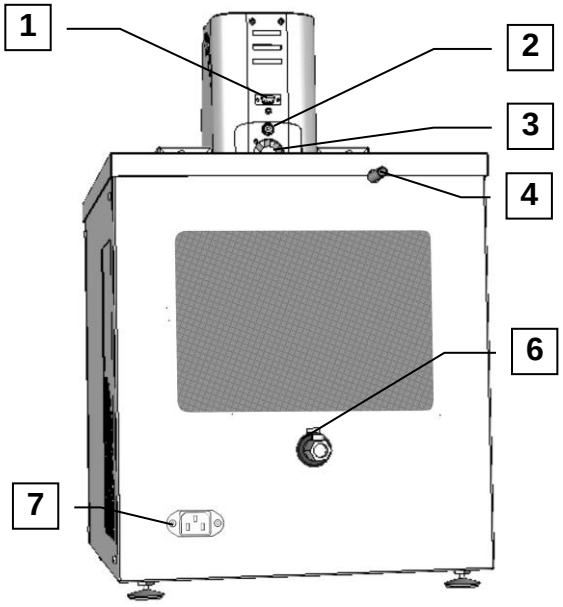
Circulation stirrer is built-in for uniform temperature distribution within the bath.

4.4 Temperature control and setting

The bath temperature is regulated using a Pt-100 temperature probe which is connected to a microprocessor module. The advanced electronic control system continually computes the energy input required for optimal temperature accuracy and stability. The controller will activate the heaters partially or in full, this depends on the difference between actual bath temperature and set point, while taking into account the type of bath fluid used and working conditions. This process does not interfere electrically with other equipment since all heating elements are switched in zero-cross mode. Through the application of an especially developed inlet circuit for the temperature probe, the sensitivity to external interference has been reduced to a minimum. The required temperature is set by means of encoder switch on the front panel. An absolute temperature offset is provided with a resolution of 0.01°C. This fine-tuning can be carried out at any time during operation of the bath



1: On/off switch
2: Display
3: Indicator lights
4: Overtemperature cut-out
5: Encoder switch
6: Viscometer holders

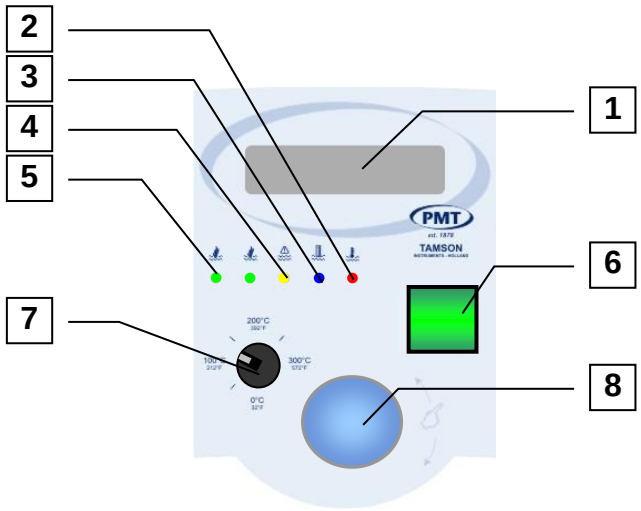


1: RS232 connector (Sub D – female)
2: Motor fuse
3: Fan
4: Overflow outlet (10mm outher diameter)
5: Bath drain 3/8"inner thread
6: Mains connector (IEC60320)

Use protected earth!

4.5 Front Panel

1 LC Display
2 Over temperature indicator (Red)
3 Level indicator, optional (Blue)
4 Error (Yellow)
5 Heater indicators (Green)
6 Mains switch
7 Safety thermostat
8 Turn-push button



Use well grounded mains. Before plugging the TV12LT into the mains socket, make sure the voltage of the bath corresponds to the local voltage.

The front panel layout shows the turn-push button: 

Previous / decrease: Turn left 

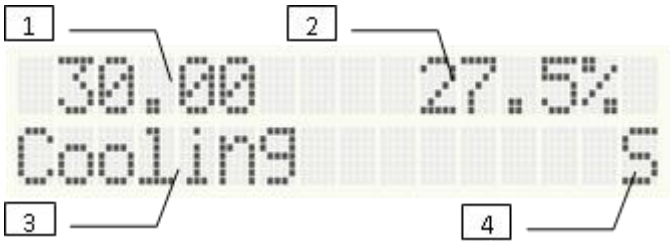
Select: Press 

4.6 Overview menu Items

- Set point
- Offset (press: <-5.00 .. +5.00°C resolution 0.01°C)
- Max Power (press: low 25, med, hi, max)
- Boost heater (press on / off)
- Time const (press: fast, medium slow, precise)
- Stirrer
- Low alarm
- High alarm
- PID parameter :
  PID set 1,
  PID set 2,
  PID set 3,
  PID set 4.
  Each PID set offers settings for
  - Proportional band value
  (Pb=1/P where P is proportional value)
  - Integral value
  - Differential value
- Backlight
- Temp units

- Baudrate
- SP Offset
- Restart

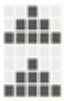
Display



[1] Temperature readout
[2] Applied percentage of power
[3] Operating mode
[4] Indicator, alarm high, alarm low, control stable

Ad 1: When the controller starts or is restarted, the displayed value increases to a stable readout appears after a few seconds.
Ad 2: The controller calculates every second the amount of power which should be applied for stable control. The value is displayed with a resolution of 0.1% and ranges from 0% to 99.9%.

Ad 3:	Boost	Bath is heating to set point using boost heater
	Heating	Bath is heating to set point, B boost heater is off
	Cooling	Bath is cooling down to set point
	Tuning Ratio	Bath is tuning for power needed at set point, first step
	Tuning SA	Bath is tuning, second step
	PID SP=25.00	Bath is controlling, set point is 25.00°C (example)

Ad 4:
- Bath control is stable 
- Alarm high, press button to reset* 
- Alarm low, press button to reset* 

* Optional item

5 Safety Systems

In case of electronic failure the possibility exists that the heater element is continuously switched-on. This will cause fast temperature raise. To prevent high temperatures the bath is fitted with a mechanical over-temperature protection thermostat. This thermostat will switch-off the bath at a preset temperature in the range from 50 to 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 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.

5.1 Mechanical over-temperature protection

Turn the thermostat clockwise (item 7, front panel) to its maximum. Be aware that the safety thermostat is now only functioning at 270 °C. Heat the bath to the appropriate set point. Gently turn the thermostat anti-clockwise, until the over-temperature protection is activated, and system switches off, Turn the thermostat approximately 30°...40° higher (turn clockwise). Switch the bath off and on again. The bath is ready to operate safely

5.2 Level protect

The bath uses a level detection system that switches off the bath when the fluid level is too low. On the frontpanel there is a Blue LED which will blink when the level is too low. If the level detection is activated (blinking of the blue LED) the compressor, stirrer and heating are switched off.

When the bath is switched on and operates with a too low fluid level heating elements can be exposed to to the air. This causes the heating element to overheat which can set fire to the (flamable) bath liquid. When operating the bath always be sure that the heating elements are submersed.

6 OPERATING THE SYSTEM

When the bath is ready for use it can be switched on by pressing the mains switch.

The electronics are suited for both 50 and 60 Hz. Check whether the voltage of the system conforms to the mains voltage.

6.1 Quick Start

To start operating the bath in a quick way do the following:

Fill the bath with fluid as indicated in "Bath fluid level", page 7,
Place the power plug, connect to mains socket,
Switch the bath on using the mains switch,
Select appropriate set point,

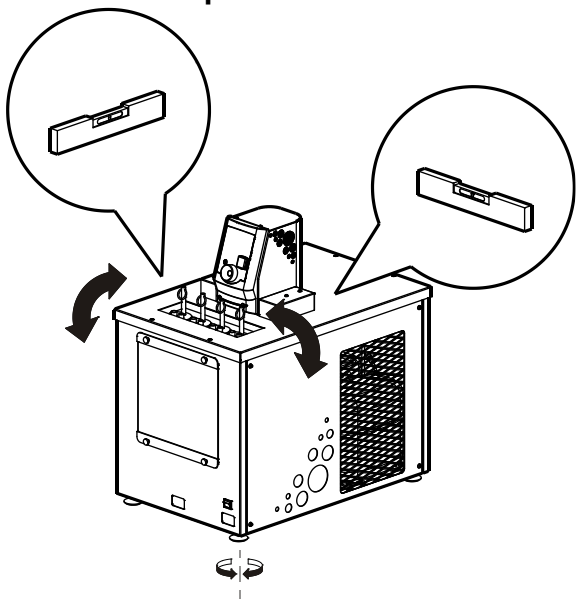
PID settings
All measuring results have been acquired using following PID settings:

Pb	:=	25
I	:=	16
D	:=	0

Under different settings its possible to achieve even better values by trimming the PID settings.

Place the bath spirit level. The four supporting feet can be turned in and outwards for exact adjustment.

Spirit level



6.2 Menu Items

Use the turn-push button to select a menu item and select the item by pressing the button. After pressing a sign appears next to the value indicating the value can now be changed. Pressing the button again activates the value immediately. When the value is altered but the button is not pressed the value will be accepted and stored after 5 seconds automatically. The menu returns back to normal operating mode.

Menu item "Set Point"

Select the set point temperature. Resolution is 0.01°C +/- the system accuracy.

Menu item "Offset"

The temperature displayed can be increased or decreased with an offset ranging from +5.00 down to -5.00 °C in steps of 0.01°C. This way the temperature

reading on the display can be synchronised with an independent separate thermometer.

Menu item "Max Power"

(press: low 25, med, hi, max)
Limits the applied power by a maximum value:

Low	Maximum of 25% applied
Medium	Maximum of 50% applied
High	Maximum of 75% applied
Maximum	100% power is applied

Menu item "Boost heater"

A secondary heater is used to quickly heat up the bath. This menu item enables or disables the heater.
Standard value: On

Menu item "Time const"

Used to select time to tune. The option precise has to be used to reach maximum temperature accuracy. Options are:

- Fast	60 seconds
- Medium	120 seconds
- Slow	180 seconds
- Precise	240 seconds
Standard value:	Precise

Menu item "Stirrer"

Optional: Stirrer 0 .. 100% (step 6%). Inactive

Menu item "Low alarm"

Optional: min SP to max SP. resolution 0.1°C. No hardware connected, display function only.

Menu item "High alarm"

Optional: min SP to max SP. resolution 0.1°C. No hardware connected, display function only.

Menu item "PID parameter"

PID set 1	-	First set of parameters
PID set 2	-	Second set of parameters
PID set 3	-	Third set of parameters
PID set 4	-	Activated when communication via RS232

Each set offers individual PID settings for:
Proportional band value
Integrating value
Differentiating value

Default settings

Pb*	:=	25
I	:=	16
D	:=	0

*Pb= proportional band. Proportional value P is found to be 100/Pb.

Off
Standard value: On

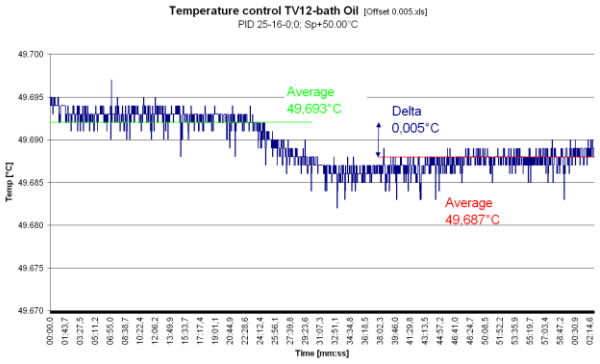
Menu item "Temp units"
°C
°F
Standard value: °C

Menu item "Baudrate"

300
600
1200
2400
4800
9600
19200
38400
Standard value: 9600

Menu item "Offset 0.005"

This menu item offers an additional offset of 0.005°C. The value value. The SP can be selected with 0.01°C accuracy.



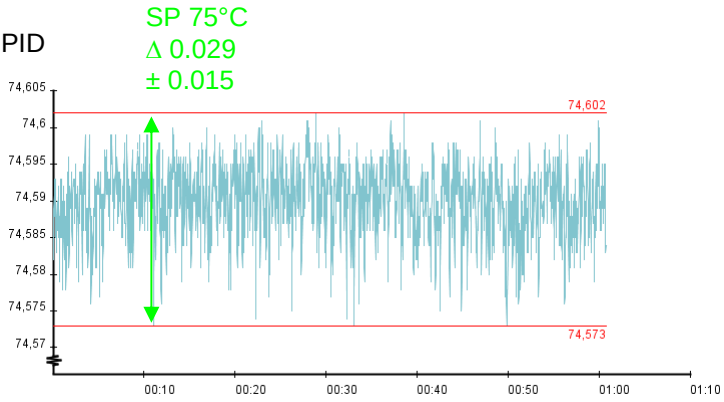
Menu item "Restart"

Restarts system and activates tuning.

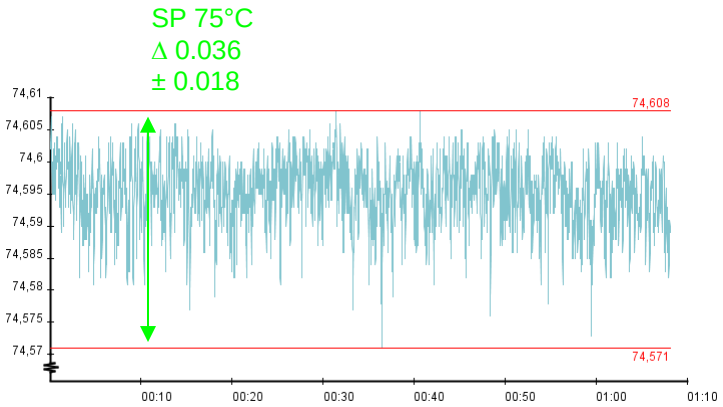
PID settings

Following shows influence on stability with different PID settings

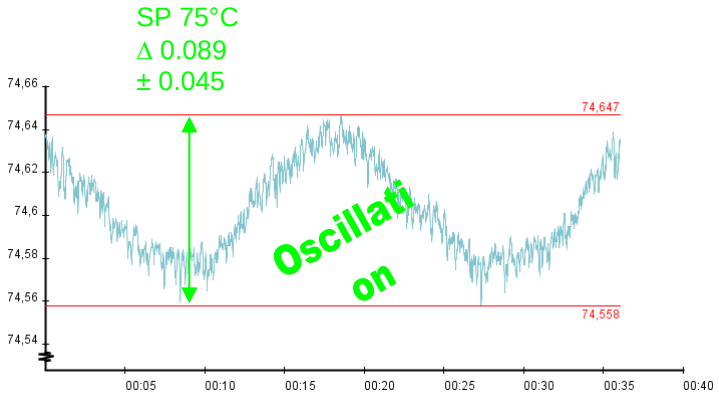
Temperature	:	75°C
Proportional band (Pb)	:	25
Integrator	:	16
Differentiator	:	0
Min/max	:	± 0.015



Temperature	:	75°C
Proportional band (Pb)	:	50
Integrator	:	25
Differentiator	:	0
Min/max	:	± 0.018°C



Temperature	:	75°C
Proportional band (Pb)	:	100
Integrator	:	25
Differentiator	:	0
Min/max	:	± 0.045°C



7 Manual tuning

The parameters for the PID control can be changed manually.

The control of the PID parameters allow setting of the I and D values to zero. The bath will then function as a proportional system. The “P” parameter can than be varied to an optimal value by trial and error. A higher P will stabilize the system when I and D are off.

The PID parameters can also be determined with the use of the Ziegler Nichols method described below. With the process at its normal process value.

Set the integral time “Ti” and the derivative Time “Td” to off. Check if the Lcb and Hcb are set to auto.

Ignore the fact that the temperature may not settle precisely at the set point. 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

8 Maintenance

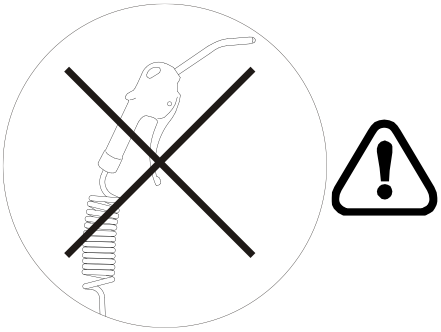
Very important

Keep the condenser free from dus

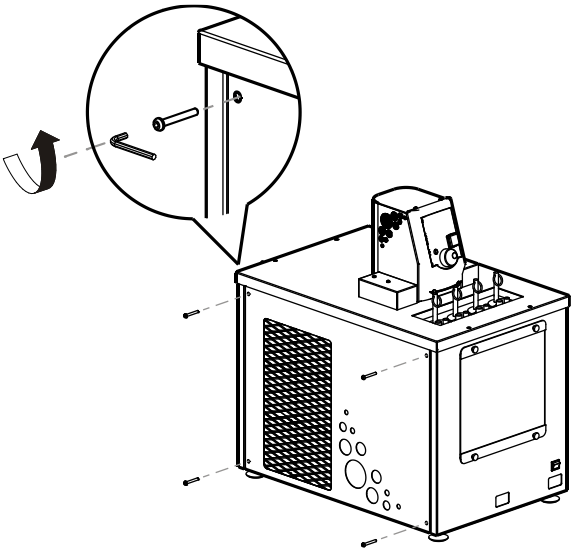
Remove side panel
Use vacuum cleaner to remove dust

Dust builds up depending on environment. Regularly check and clear if dust is spotted.

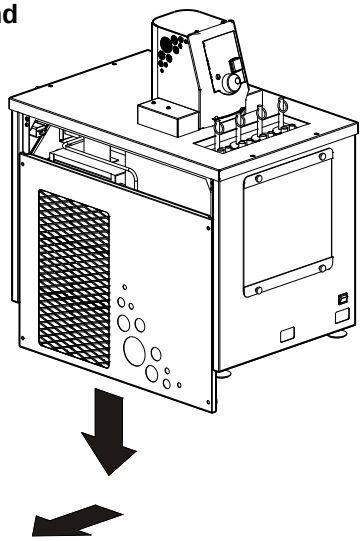
Do not use compressed air to "clean".



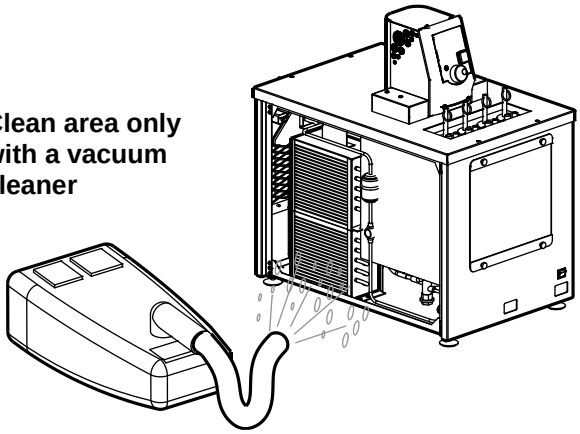
Compressed air is unhealthy, blown away dust can cause allergic reactions and eye infection. It can further have a negative effect on electronics and moving parts.



Lower panel and remove panel



Clean area only with a vacuum cleaner



9 TROUBLE SHOOTING

9.1 Application errors

All Tamson products are well designed and thoroughly 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.

9.2 Bath malfunction

- The pump motor is not running and electronics are dead.

Check mains and main fuse.
Check over-temperature protection see “Temperature control and setting” page 15.

- Motor is not turning

The motor fuse is activated. Restart the motor by pressing the motor fuse. This fuse is located at the backside of the top casing. Also check viscosity of the bath fluid. High viscosity will activate the motor fuse.
Electrical defect.
Motor capacitor defective, replace capacitor or contact local dealer or Tamson instruments bv

9.3 Problems with set point

- Heater LED is not burning, motor is turning and temperature rises above set point.

Set point too near to room temperature. Cooling of the bath is needed.

- Temperature doesn’t reach set point, motor turns fast.

Bath fluid evaporates too quickly. Use other fluid.
Heater malfunctions. Measure mains electrical current output. Low power consumption indicates a problem with the heating element.
Cooling capacity is too high. Reduce cooling.

- Temperature not stable

See explanation “Bath temperature does not become stable” page 25.

9.4 Faulty temperature reading or temperature offset

- The temperature readout on the display does not correspond to the temperature measured.

PT100 is defective,

9.5 Bath temperature does not become stable

If the bath temperature does not stabilize after 30 minutes after set point has been reached the following points might cause this problem:
The operating temperature is around or below 30°C. To stabilize the bath at set points just above the ambient temperature it is necessary to apply cooling water to the cooling coil or to increase or decrease the flow of cooling water through the cooling coil.

If the operating temperature is far above the ambient temperature it is most likely that the viscosity of the bath fluid used is too high. The maximum viscosity of the bath fluid lies below 10 mm^2/s at the operating temperature but is preferably less than 3 mm^2/s. If the viscosity of the bath fluid used is too high the circulating system is incapable to mix it thoroughly resulting in poor stability.

Check PID constant of the bath.
P) 25
I) 16
D) 0

Position of the stirrer fan must be exactly in the center of the hole in the baffle plate (both in horizontal and vertical position).

Check possible heat transfer from additional apparatus close to the bath i.e. oven or central heating.

Check any possible strong magnetic field from other apparatus.

Check overheating of electronics inside apparatus. Cooling fan at backside must run.

Check bath media. If bath media contains high percentage water(i.e. use of ethanol instead of methanol) at low temperatures stability problems may occur.

9.6 Bath doesn't reach SP

Check menu item MAX power, raise value.

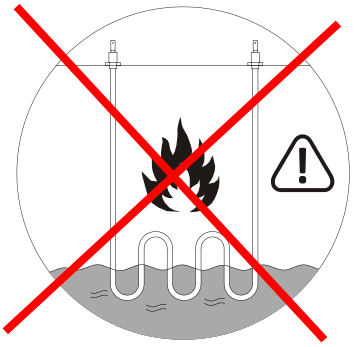
9.7 Blue LED blinks on front panel

Red error LED on frontpanel is on.

Fluid level probably too low, temperature control switches off.

Check fluid level

When the bath is switched on and operates with a too low fluid level heating elements can be exposed to to the air. This causes the heating element to overheat which can set fire to the (flamable) bath liquid. When operating the bath always be sure that the heating elements are submersed.



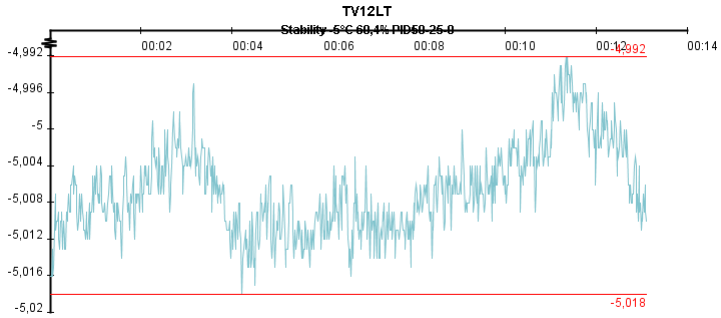
9.1 Over-temperature safety thermostat

When the thermostat is activated the entire bath is switched-off (with the exception of the controller) the red system error LED will light up. When the temperature of the bath has been lowered with approximately 20 degrees, the thermostat re-sets itself automatically, however to continue normal operation the bath has to be switched off and on again.

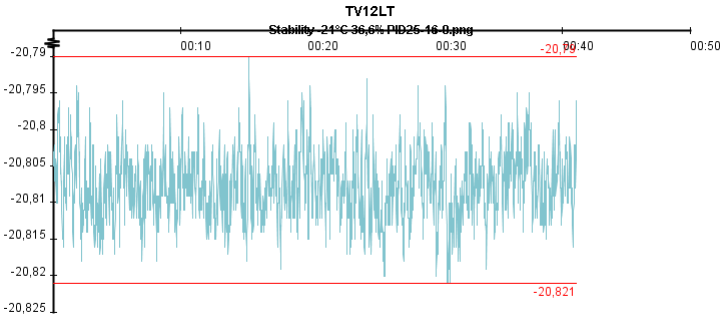
The thermostat can be adjusted as follows:
-Turn the thermostat fully clockwise.
-Heat the bath to its proper temperature. Be aware that the safety thermostat is now only functioning at 270 °C.
-Turn the thermostat gently counter clockwise, until you hear a “click”. Turn the knob approximately 20 to 30° higher (clockwise). Switch the bath Off and On again. The bath is ready to operate safely.

10 SPECIFICATIONS

10.1 Precision of control

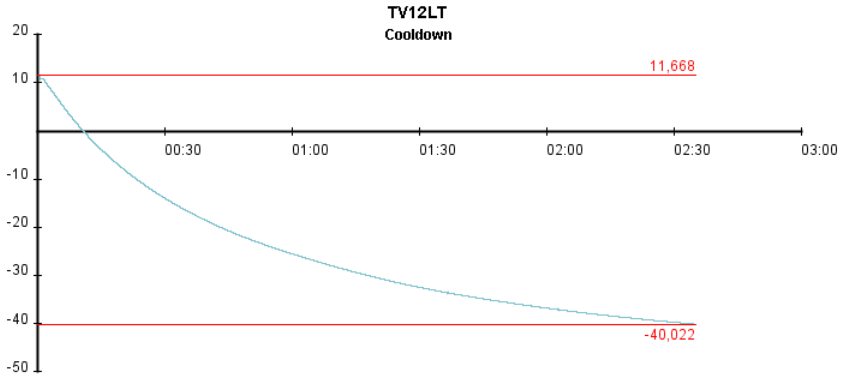


Temperature	:	-5°C
Proportional band (Pb)	:	25
Integrator	:	16
Differentiator	:	0
Min/max	:	± 0.013°C



Temperature	:	-20°C
Proportional band (Pb)	:	25
Integrator	:	16
Differentiator	:	0
Min/max	:	± 0.015°C

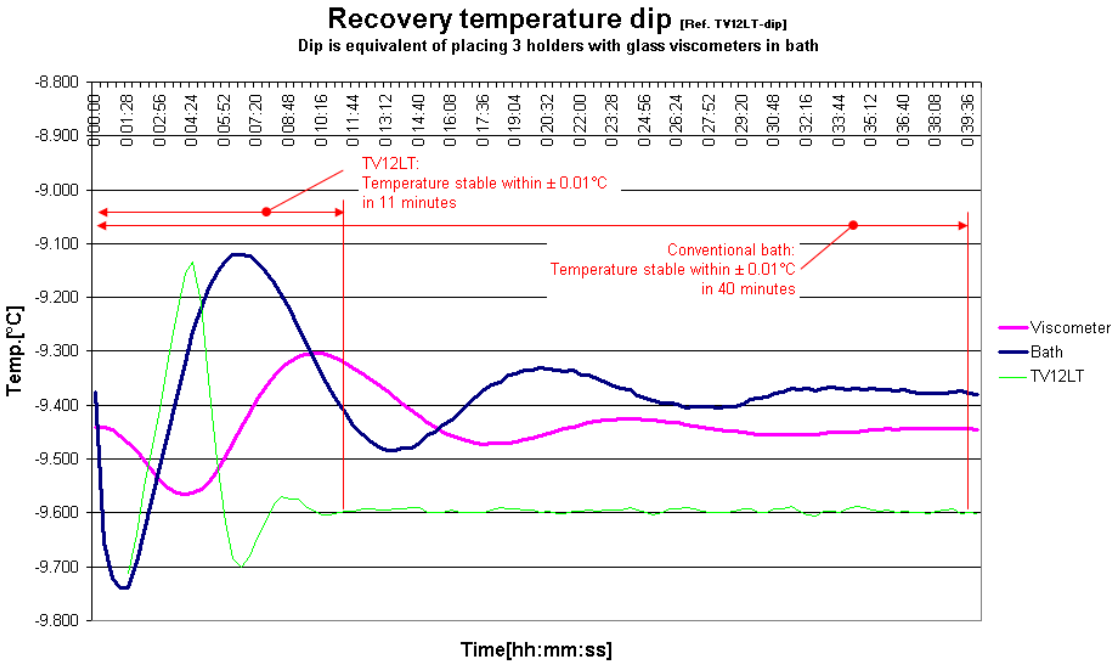
10.2 Cooldown



10.3 Settling time bath fluid

When the bath temperature is disturbed i.e. when viscometer holders are placed, the electronic regulation will establish new control over three times faster than conventional systems.

The graph shows the temperature of a conventional bath (blue) and the temperature measured in the glass capillary of a viscometer (pink). The green curve shows the TV12LT behavior.

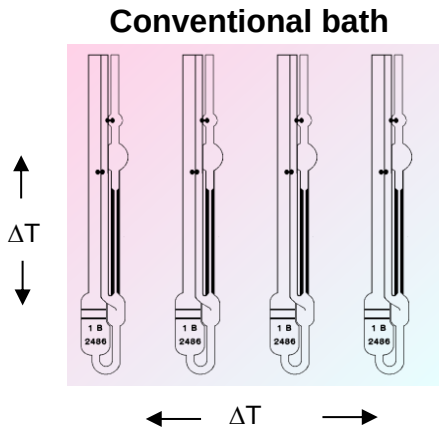


10.4 Homogeneity and ΔT

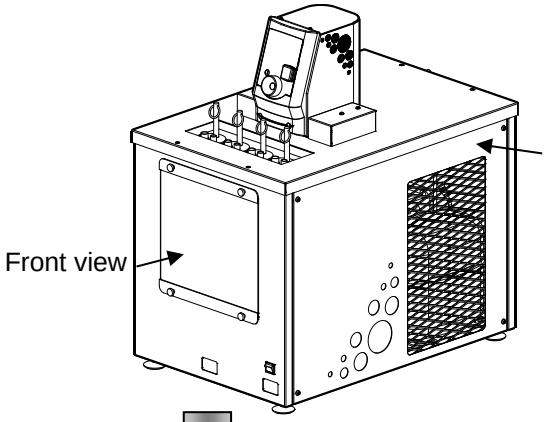
All thermostatic baths contain heating. Simple bath constructions have a single heater and stirrer for circulation. This causes random energy distribution and poor homogeneity. The heating energy is distributed randomly.

More sophisticated systems have controlled flow by using a baffle plate. The heat distribution however is still does diagonal in the bath.

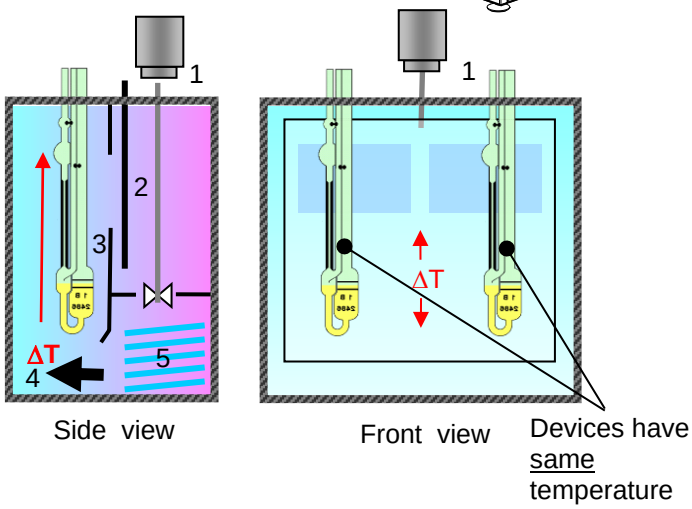
The TV12LT construction is such that it only knows vertical offset. When outlining viscometers or other measuring devices for measuring or calibration, they will all have the same temperature.



When aligning viscometers or sensors in horizontal position they will all have the same temperature.



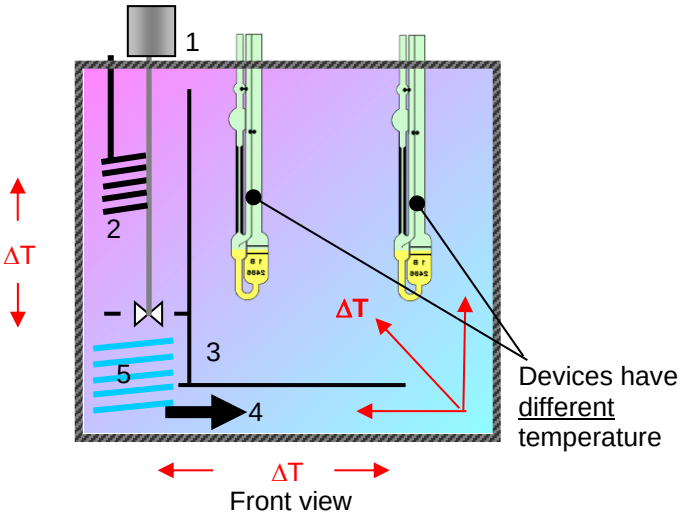
1: Stirrer
2: Heater
3: Baffle plate
4: Circulation
5: Cooling



Temperature gradient TV12LT
versus conventional system

Conventional bath

1: Stirrer
2: Heater
3: Baffle plate
4: Circulation
5: Cooling



11 SPARE PARTS LIST

230 Volt 50~60HZ	115 Volt 60Hz	Description
25T1295	25T1301	Motor for stirrer
26T1455	26T1456	Coil magnetic valve
25T1244	25T1245	Fan 120*38 161^3 /hr
25T1343	n.a.	Capacitor 2uF
n.a.	25T1310	Capacitor 5.5uF
25T0340	n.a.	Heater 780 Watts 230V
n.a.	25T0345	Heater 780 Watts 115V
06T0512	n.a.	PCB Mains board with filter and relay 230V
n.a.	06T0522	PCB Mains board with filter and relay 115V
24T8081	n.a.	Motor fuse 0.3 Amp.
n.a.	24T8080	Motor fuse 0.6 Amp.
25T1123	n.a	Compressor 230V 50Hz
25T1127	n.a.	Compressor 230V 60Hz
	25T1126	Compressor 115V 60Hz
25T0351		DC Heater "W"
25T0404		Window heating (4x 115V placed in series)
24T8581		Over-temperature protection thermostat
24T8545		Mains switch
24T8546		Protective cover mains switch
28T4019		Front keypad
25T2310		PT-100 sensor
06T0500		PCB - uP Controller
06T0503		PCB - IO DC PWM Heating
06T0517		PCB - IO EXT Range
06T0507		PCB - Display

n.a. = Not Applicable

DIMENSIONS

Dimensions		
Length	740 [mm]	
Width	425 [mm]	
Height	720 [mm]	
Weight*	64 [kg]	
Power consumption**		
minimum	200 [W]	
nominal	800 [W]	
maximum	2100 [W]	
Accuracy		
standard deviation	0,004 [°C] standard deviation	Measured with methanol
min/max	± 0,015 [°C] min/max	Measured with methanol
Homogeneity	± 0,014 [°C] min/max	
Temperature drift	0,001 [°C]	per year max
	0,0005 [°C]	per [°C] ambient
General data***		
Ambient temperature	18 .. 23°C	

* Depending on mains voltage/frequency version.
** See energy consumption, page 12.
*** For proper cooling performance ambient temperature needs to be within this range.

12 EC DECLARATION OF CONFORMITY

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

Product: Thermostatic bath and circulator
Model: TV12LT
Serial code: Effective from 08Txxx
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	**EN61010-2-010**	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	**EN61000-3-2:2014**	Harmonics	p
g	**EN61000-3-3**	Flicker	p^3
h	**EN61000-4-2 +A1+A2**	ESD	p
j	**EN61000-4-3 +A1+A2**	Radiated immunity	p (anechoic room)
k	**EN61000-4-4**	Electrical Fast Transients	Minimum requirements pass
l	**EN61000-4-5+A1**	Surges	Minimum requirements pass
m	**EN61000-4-6+A1**	Conducted immunity	p
n	**EN61000-4-11 +A1**	Voltage dips and Voltage variations	p
o	**EN55016-2-1**	Conducted emission	p
p	**EN55016-2-3**	Radiated emission	p (anechoic room)
q	**Pr EN 378**	Refrigerating systems and heat pumps - Safety and environmental requirements	
r	**EN 13445-5**	PED Inspection and Testing	Maximum working pressure level of **30 Bar** is confirmed. On each apparatus following pressure and leak tests have been carried out with positive result - Low pressure side **20 Bar** - High pressure side **25 Bar**

p = Pass
p^i = Individually tested
p^3 = Pass, condition of operating during Pst measurement: Operational with heating element 780W. 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
The equipment conforms with all the specifications and norms in this regard.
The equipment conforms without any further notice.

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	:		January, 2016
Version	:		1.03

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