Validation

Kaye LTR-150

Dry Block and Liquid Bath
All-in-One Temperature Calibrator

Operating Manual

M5101-EN Rev. B
May 2018

Table of Contents

Chapter 1. Product Overview

The Kaye LTR-150 is the next generation, multi-purpose calibrator designed to address the flexibility and capacity needs for validation calibrations and verifications. As a multi-purpose calibrator, the LTR-150 can be easily transformed from a standard dry block to a micro bath or surface temperature calibrator, which are purchasable options. The LTR-150 offers a broad temperature range from -30°C to 150°C with temperature stability of ±0.01°C and uniformity of ±0.1°C. Performance of calibration and calibration verification can either be performed automatically via Remote mode or manual through Standard mode.

The Kaye LTR-150 has been designed to interface directly with all Kaye products (Validator AVS, Validator 2000, IRTD, ValProbe, and RF ValProbe). The firmware is backward compatible with all version of Kaye software without need for software upgrades. This functionality allows the unit to be utilized for fully automatic calibrations/verifications of thermocouples, ValProbes or RF ValProbes utilizing your existing IRTD and applicable Kaye software.

The Kaye LTR-150 also has the flexibility to calibrate other process or validation sensors in Standalone mode through the intuitive 7” touchscreen, and a variety of optional inserts.

To maximum accuracy of the control and measurement during calibration, the LTR-150 includes an external Control Reference Probe. This probe is used for feedback to the calibrator controller.

The calibrator is portable, rugged and can be used in a variety of environments from 0°C to 50°C and humidity ≤80% (non-condensing).

Key Components of the LTR-150

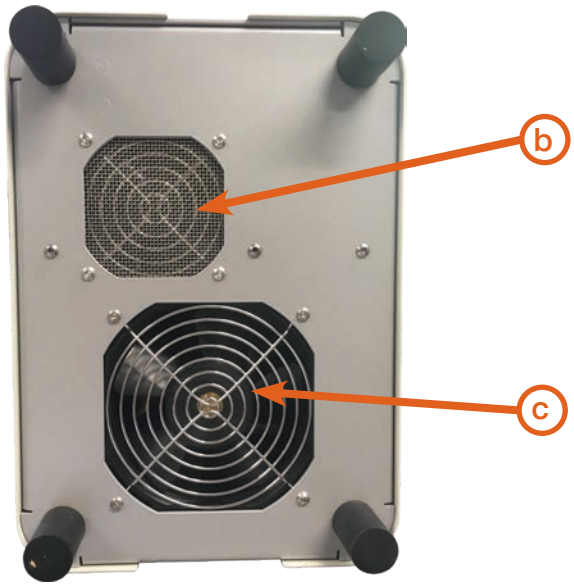
1. Tank (Dry Block, Micro Bath, Surface).
2. Carrying handle.
3. Steel housing.
4. Touch screen for display and operation.
5. Calibrator exhaust ventilation
6. Connection for external reference probe.
7. USB Port for connection to Kaye hardware.
8. Main switch with fuse and mains plug socket.

Calibrator, bottom view:

- Calibrator ventilation

  (b) Inlet air for housing cooling

  (c) Inlet air for tank / metal block cooling



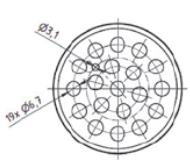
1.1 Dry-Block Function

The LTR-150 comes standard with a dry block insert containing sixteen (16) wells for thermocouples as well as two (2) wells for IRTD, and one (1) well for the Control Reference Probe. Each of the sixteen (16) thermocouple wells is included with a sleeve which can accommodate upwards of three (3) thermocouples. The sleeves are optimized to handle 22AWG thermocouples, which are similar to the ones currently utilized in existing Kaye dry block models.

Kaye also offers additional dry blocks for calibrating specialty process or validation probes. These blocks are easily interchangeable utilizing the supplied insert tool.

Kaye LTR-150 Additional Inserts


Insert Part Number: 410-3031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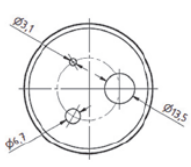
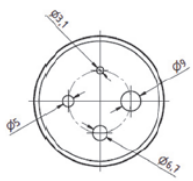
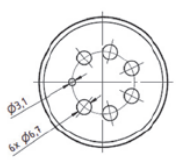
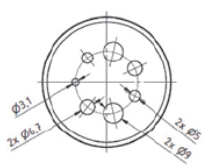

Insert Part Number: 410-3034


Insert Part Number: 410-3035


Insert Part Number: 410-3036


Insert Part Number: 410-3037

1.2 Micro Bath Function

The LTR-150 has the ability to be utilized as a micro bath for calibration/verification of specialty probes or even ValProbe Loggers. Utilization of the micro bath functionality requires the purchase of the optional Micro Bath Kit (PN: 425-3061).

The kit includes a micro bath tub as well as one (1) sensor cage, two (2) magnetic stirrers, one (1) magnetic lifter, one (1) sleeve exchange tool, one (1) work cover, and one (1) transportation cover. Kaye also offers Silicon Oil (type 200 -10cs) which can cover the complete temperature range of the calibrator and can be directly poured into the micro bath tub.

The use of calibration liquids offers certain advantages if temperatures of unusual shape and/or size require calibration. The sensor cage can accommodate up to two (2) ValProbe rigid loggers. The test item is immersed directly into the desired liquid medium without an insulating air gap, resulting in direct temperature contact between the unit and test item(s). The continuous adjustment of the magnetic stirrer together with the removable sensor basket agitates the medium to create a broad and uniform temperature measuring zone. Furthermore, the sensor basket guarantees unhindered stirring, protecting the tank floor.

The sensor cover reduces evaporation of the liquid to a minimum and cooling of the liquid surface. The cover is screwed on to the micro bath and has five (5) openings for sensors under test.

1.3 Surface Temperature Function

The LTR-150 can also be used for surface temperature calibrations by utilizing the optional surface temperature insert (PN: 412-3054). The surface insert is hollow from the bottom and longer than the adapter sleeve enabling fast and easy calibrations.

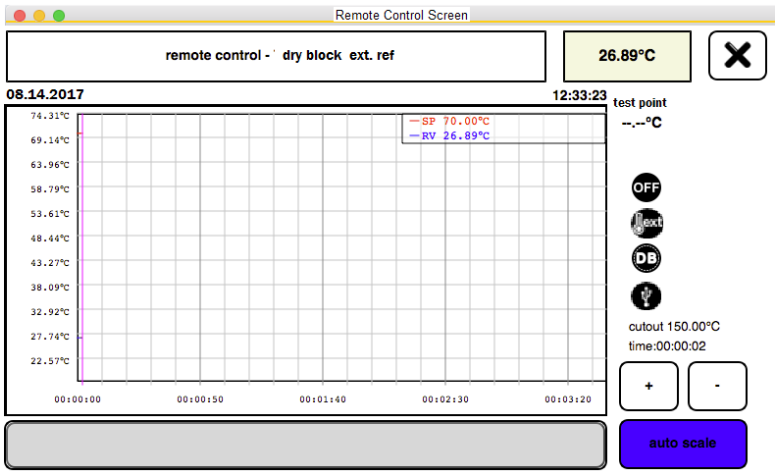
The surface temperature insert has a bored hole where the control reference probe can be inserted which is directly beneath the contact surface of the insert. This enables very accurate measurement of the surface temperature. The insert is designed for optimized homogeneity of the contact surface's center while enabling solid thermal contact.

The surface temperature insert is ideal for calibrating / verifying Flat Surface ValProbes in the temperature range from -25°C to 150°C.

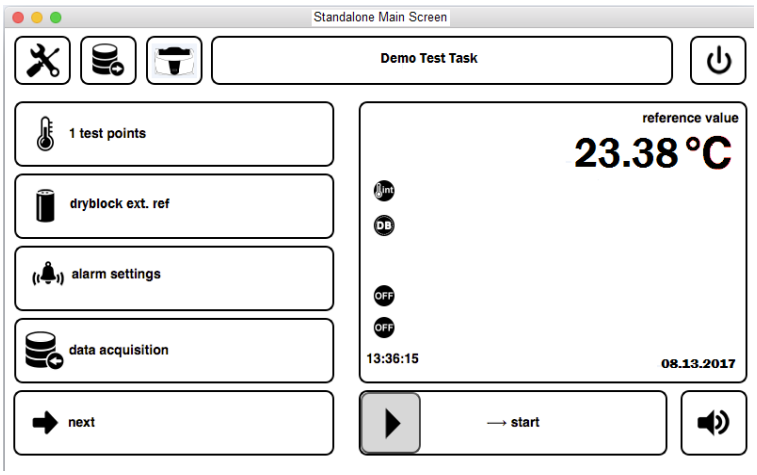
1.4 Calibration Modes

The LTR-150 was designed to offer flexibility and ease of use. To accommodate these needs Kaye implemented two main modes or menu's Remote Control mode and Standalone mode.

Remote Control mode is intended for Automatic Calibration utilizing Kaye Validator equipment (Validator 2000, Validator AVS, ValProbe and RF ValProbe). In this mode, control of the LTR-150 and the touchscreen interface is automatically driven by the appropriate Kaye software. In the Kaye software, the user configures the set points, the stability criteria, and deviation criteria. The user simply starts the calibration from the Kaye software and the control of the calibration is automated. No additional interaction with the touchscreen is required. The LTR-150 when powered on automatically boots into the Remote Control screen.



The Standalone mode is intended again to offer flexibility by allowing fully manual configuration of the LTR-150 to define all different kinds of parameters from different types of sensors, ramp and soaks setups / profiles to address other calibration needs. For Standalone mode, refer to Chapter 7. Manual Calibration and Chapter 8. Controls for details the options and screen flows to manually configure the LTR-150.



1.5 Contact Kaye Customer Service

You may contact our North American customer service team at (814) 834-9140 (FAX: (814) 781-7969). You may also call our European headquarters in Germany at +49 (0) 7231-14335 0.

1.6 Calibration and Repair Information

To schedule and send the LTR-150 to Kaye for calibration or repair:

1. Contact the Kaye Service Center in your area to schedule the calibration or repair.
2. Utilize original packing box and carefully pack and secure the LTR-150.
3. Send the LTR-150 to the Service Center.

Chapter 2. Safety Information

WARNING! A Warning identifies conditions and procedures that are dangerous to the user.

CAUTION! A Caution identifies conditions and procedures that can cause damage to the product or equipment under test.

See Table 1 below for list of symbols used in this manual and on the LTR-150.

Hazard signs and other symbols used:


CAUTION! Electric current!
This sign indicates dangers which could arise from handling of electric current.


WARNING! / CAUTION! Risk of injury!
This sign indicates dangers that cause personal injuries that can lead to health defects or cause considerable damage to property.


CAUTION! High temperature!
This sign indicates dangers resulting from high temperature that can lead to health defects or considerable damage to property.


CAUTION! Material damage!
This sign indicates actions which could lead to possible damage to material or environmental damage.


ADHERE TO OPERATING MANUAL!


NOTICE!
This symbol indicates important notices, tips or information.


NO DOMESTIC WASTE!
The device must not be disposed of together with domestic waste.

⚠ Pay attention to and comply with information that is marked with this symbol.

↳ Follow the specified instructions and steps. Adhere to the given order.

❑ Check the specified points or notices.

→ Reference to another section, document or source.

• Item.

Table 1: Hazard Signs and Symbols

Before you install the LTR-150, read through this operating manual carefully. If the instructions contained within it are not followed, the safety guidelines, this could result in danger for people, the environment, and the device and the system it is connected to.

To guarantee that the device operates safely, the operator must act competently and be conscious of safety issues.

General safety instructions:

⚠ In all work, the existing national regulations for accident prevention and safety in the workplace must be complied with. Any internal regulations of the operator must also be complied with, even if these are not mentioned in this manual.

⚠ Ensure that the complete operating instructions are always available in excellent condition at the calibrator installation site.

⚠ Degree of protection per EN 60529: Ensure that the ambient conditions at the site of use does not exceed the requirements for the stated protection rating.

⚠ Structural safety in accordance with EN 61010-1: The calibrator must be installed in such a way that the requirements for structural safety are met.

⚠ Only use the LTR-150 if it is in perfect condition. Damaged or faulty devices must be checked without delay and, if necessary, replaced. If problems cannot be cleared, immediately shut down the calibrator and ensure that it cannot be started up accidentally.

⚠ Never leave the calibrator unattended when it is in operation or in the cooling phase.

⚠ Do not remove or obliterate type plates or other markings on the device, as otherwise the warranty is rendered null and void.

Special Safety Instructions:

Thermal fuse! The calibrator is equipped with a temperature fuse that works independently. If there is an over-temperature in the inside of the housing, the power supply to the heating system is cut off. The calibrator cannot then be started any more.

After it has cooled, send the calibrator for inspection to Kaye.

⚠ Risk of injury from hazardous gases! When liquids are heated, the evaporation can result in dangerous gases being formed.

⚠ The calibrator may not be used in an explosion-endangered atmosphere (ignitable or explosive atmosphere).

Remove all the easily flammable media from the vicinity of the calibrator.

Ensure that the calibrator cannot encounter easily flammable or explosive media.

⚠ Operate the calibrator only in the temperature range permissible for the test sample.

⚠ Ensure that the test sample is securely fixed in the calibrator.

Use only suitable adapter sleeves or calibration inserts. When doing so, also ensure that the structural safety of the calibrator is retained.

IMPORTANT NOTICE!

Always unscrew the transport cover before putting the micro bath into service to avoid excessive pressure.

Wait until the micro calibration bath has cooled down before screwing on the transport cover.

Further warnings that are specifically relevant to individual operating procedures or activities can be found at the beginning of the relevant sections of this operating manual.

Micro Bath Calibration Safety Instructions:

⚠ Before using calibration liquids, read the entire safety data sheet attentively. Pay attention to the information on the physical and chemical properties.

⚠ Only use calibration liquids that are suitable for the required temperature range and which are not flammable.

⚠ Always wear safety goggles for the eyes when handling calibration liquids.

⚠ Do not exceed the maximum fill level of the tub insert, which is below the fixture for the sleeve exchange tool.

Silicone oil:

⚠ Prevent silicone oil from meeting your eyes by always wearing safety googles.

⚠ Use only the silicone oil recommended here.

⚠ Always read the safety data sheet supplied with the silicone oil before using it.

⚠ Always ensure adequate ventilation when working with silicone oil, since hazardous substances can be released.

⚠ Spilled or leaked silicon oil results in extreme danger of slipping. Clean the affected area immediately by suitable methods.

⚠ Since silicone oil is hygroscopic, always use the transport cover to close the calibration bath after use.

Chapter 3. Specifications

Dry Block		
Temperature Range*	-30°C to 150°C	-22°F to 302°F
Stability	±0.010°C	±0.018°F
Uniformity	0.1°C	0.18°F
Accuracy	±0.1°C	±0.18°F
Heating/Cooling time	20°C to -25°C 20°C to 121°C 121°C to 20°C -30°C to 20°C	45 min 30 min 30 min 20 min
Micro Bath		
Temperature Range*	-30°C to 150°C	-22°F to 302°F
Stability	±0.010°C	±0.018°F
Uniformity	0.15°C	0.27°F
Accuracy	±0.15°C	±0.27°F
Surface		
Temperature Range*	-25°C to 150°C	-13°F to 302°F
Stability	±0.15°C	±0.27°F
Accuracy	±1°C	±1.8°F
Block Dimensions		
Diameter	60 millimeters	2.36 inches
Depth	170 millimeters	6.69 inches
Display Unit		
Display Unit	Brilliant Color (7”) Touchscreen Viewing angle range 120° to 140° Brightness 400 cd/m2 Unit °C/ °F/ °K	
Resolution	0.1/ 0.01/ 0.001 °C/ °F/ °K	
General Data		
Interface	Serial to Validator Ethernet 3 x USB	
Dimensions		
Width	210 millimeters	8.27 inches
Height	380 + 50 millimeters	14.96 + 1.97 inches
Depth	300 millimeters	11.81 inches
Weight (approximate)	15 kilograms	33 pounds
Power Supply	100 – 240 VAC, 50/60 Hz	
Power Consumption	Approximately 375 watts	

* at an ambient temperature of 20°C (68°F)

Chapter 4. Getting Started

4.1 Unpack and Inspect

All units have been carefully checked for their operational reliability before shipment.

Immediately after receipt, please check the outer packaging for damages or any signs of improper handling.

Report any possible damages to the forwarder and your responsible sales representative. In such a case, state a description of the defect, the type and the serial number of the device. IMPORTANT NOTE: Report any in-transit damage immediately. Damage reported later shall not be recognized.

Carefully unpack the unit to prevent any damage.

Check the completeness of the delivery based on the packing slip and/or purchase order.

The X0365 LTR-150 comes with the following components.

Item	Description	Quantity
1	LTR-150	1
2	6 ft. (2 meter) Mains Power Cord (US / EU 100 -240 VAC 50/60Hz)	2
3	Dry Block Insert (for up to 48 thermocouples, 3 IRTD, & 1 Reference Probes	1
4	Thermocouple Fixture	1
5	Insert Transport Cover	1
6	Insert Exchange Tool	1
7	Extruded Sleeves for thermocouples (16)	16
8	External Reference Control Probe	1
9	USB to Serial Communications cable (connection to Kaye hardware)	1
10	Calibration Certificate	1
11	User Manual	1

Save the packaging!

The LTR-150 is delivered in special protective packaging.

- Save the packaging for returning the instrument safely to the manufacturer for recalibration or repair.
- Use the type plate to check if the delivered unit corresponds to your order request.

4.2 Placement

Ensure that the LTR-150 storage and operation conditions described below are met:

- Only suitable for indoor use, do not use outdoors.
- Operate only in the vertical position on an even surface. The surface must be stable, clean, and dry.

IMPORTANT NOTE: If the operation positions do not conform to what is described then the structural safety and the specified properties of the LTR-150 is not guaranteed.

- Sufficient clearance around the machine; greater than 3 feet (1 meter) in the front and 1.5 feet (0.5 meters) on the sides and back. Sufficient head clearance and free space above the machine.
- Sufficient ventilation must be ensured.
- Do not operate near flammable materials.
- The ventilation openings must not be blocked or covered.
- The machine must be installed in a manner so that it can be easily switched off at any time.
- Not suitable for applications with high vibration or possible contamination

4.3 Connect to Main Power

Ensure the following before powering up the LTR-150:

- Ensure supply voltage is from 100- 240 VAC 50/60 Hz.
- Connect the LTR-150 only to a properly installed and grounded, three-pronged outlet.
- Do not use any extension cables or adapter plugs.
- Use only the original power cables supplied by Kaye or approved, like power cable.

IMPORTANT! “KILL” switch!

The plug of the mains connecting cable serves as a “KILL” switch.

- Ensure that the plug is always easily accessible and easy to reach.
- In an emergency, pull the plug, so that the machine is isolated from the mains.

4.4 LTR-150 Startup

Prior to powering up the LTR-150 perform the following tasks;

- Unscrew the Insert Transport Cover exposing the Dry Block Insert.
- Connect the External Reference Probe to the connector marked “ext Ref” on the front panel and insert into the dry block using one of the 2 holes sized specifically for the Reference Control Probe.

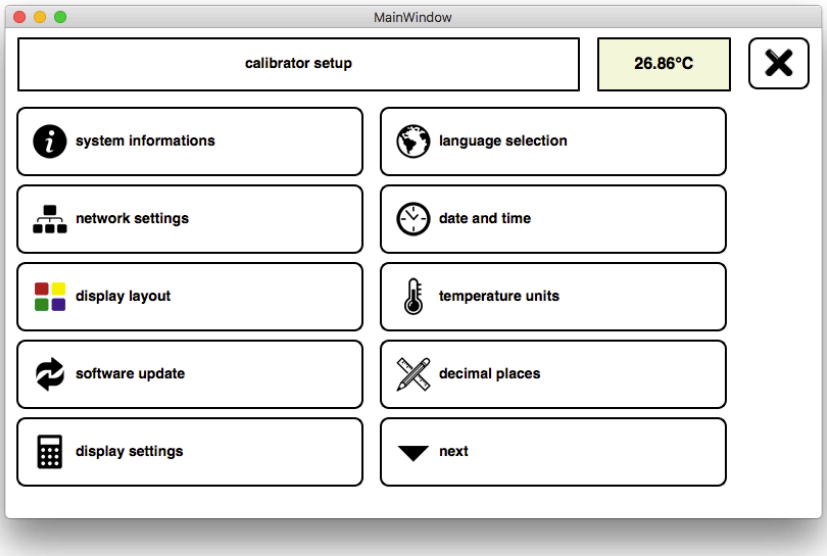
Power On the LTR-150 by utilizing the Power Switch on the front panel

Once powered on, the Kaye LTR-150 splash screen will appear for approximately thirty seconds followed briefly by the model and firmware version before presenting the *Remote Control* home screen.

Since the LTR-150 will predominately be used for automatic calibration with Kaye validation equipment, the unit will automatically boot into the Remote Control screen with the following default settings:

• Mode:		Remote Control mode
• Function:	DB	Dry Block
• Control Temp:	ext	External Reference Probe
• Temp. Controller	OFF	OFF
• Language Selection:		English
• Date and Time		MM.DD.YYYY and 24th
• Temperature Units:		Celsius
• Decimal Places:		0.00
• Cutout Temperatures:		-30.0 to 150.0

Refer to the below sections to change the default settings. To access these parameters, click on the cancel icon in the upper right-hand corner, this will bring up a new screen with the following three options: End Remote Control, Switch Off, and Cancel. Tap on End Remote Control, which will take you to the Standalone home screen. Next, tap on the tools icon in the upper left hard corner to bring up the Calibrator Setup home screen.



4.4.1 Set Screen Brightness

You can modify the screen brightness (100% default) by tapping on the ***Display Settings*** calculator icon then choose ***Brightness*** on the Set Display window.

Enter the desired value (1 through 100) for screen brightness on the numeric keyboard.

Confirm selection by touching the check mark icon to save the change and then the ☒ to return to the ***Calibrator Set Up*** window.

4.4.2 Set Language Selection

Select Language selection from the ***Calibrator Set Up*** window by touching the world icon. The current language is indicated in the information box on the left while all installed languages can be seen in the selection list on the right.

Select the desired language by tapping the desired language.

Confirm selection by tapping on the check mark icon in the lower right of the screen, which will then return you to the ***Calibrator Set Up*** window.

4.4 3 Set Date and Time

Select Date and Time from the ***Calibrator Set Up*** window. Options are available to change the date and time format.

By tapping the respective field, a window is opened for the input/change.

Make the necessary adjustment then touch the check mark icon to save the change and then the ☒ to return to the ***Calibrator Set Up*** window.

4.4.4 Set Temperature Units

By tapping on the thermometer icon, a temperature unit selection list appears providing you with the option to choose between Celsius, Fahrenheit, and Kelvin.

Touch the desired temperature unit, which will then be identified by a check mark.

Confirm selection by touching the check mark icon to save the change and return you to the ***Calibrator Set Up*** window.

4.4.5 Set Decimal Resolution

You can define the format of the temperature values in the windows by tapping on the pencil and ruler icon.

Touch the desired temperature precision, which will then be identified by a check mark.

Confirm selection by touching the check mark icon to save the change and return you to the ***Calibrator Set Up*** window.

4.4 6 Switching Modes (Remote Control / Standalone)

To switch to ***Remote Control*** mode from the ***Standalone Main*** mode simply tap the Validator icon.

To switch to Standalone mode from ***Remote Control*** mode, click on the cancel X icon in the upper right-hand corner. A new window will display with the following three options: ***End Remote Control***, ***Switch Off***, and ***Cancel***. Tap on ***End Remote Control***, which will take you to the ***Standalone home*** screen.

4.4.7 Powering Off

To power off the unit from ***Remote Control*** screen, tap on the cancel X icon in the upper right-hand corner then ***Switch Off***. A ***Switch Off Calibrator*** screen will appear with a temporary message stating, "*system data are saved – please wait*" eventually followed by another message "*you can now turn off the calibrator*" at which point you can flip the switch in the front of the unit.

To power off from ***Standalone*** screen, tap on the power icon in the upper right-hand corner and follow prompts as listed above.

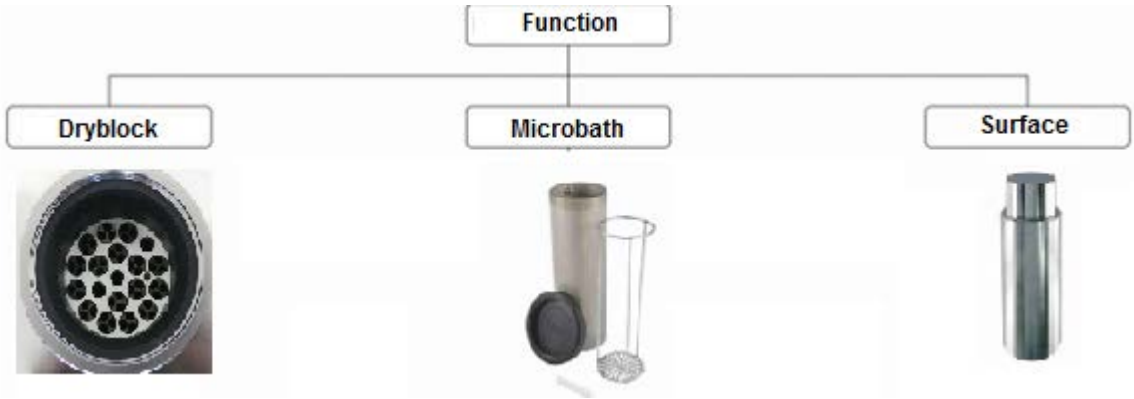
Note: If the temperature value is greater than 40°C then a message will appear stating, "*calibrator is reaching safe temperature – please wait*." Once the value drops below 40°C then a new message will appear informing that "*you can now turn off the calibrator*."

Chapter 5. Preparing for Calibration

5.1 Selecting LTR-150 Function

The LTR-150 is supplied standard with a dry block insert. To utilize the optional micro bath or surface temperature functions, the inserts must first be changed and the appropriate Function defined via the touchscreen.

Insert the appropriate insert based on the calibration function required.



Each measuring insert has its own characteristic values, which are defined at the factory. These characteristic values are influenced by different factors, such as: diameter, type and material of the measuring insert, number and diameter of the bore holes or the physical properties of the calibration liquid.

CAUTION! Risk of burns!

The calibrator can become very hot when in operation. Touching hot parts can result in serious burn injuries.

Never touch the metal block, the tank, the adapter sleeve or the test sensors at temperatures above 35 °C or below 10 °C.

Allow the calibrator to cool to ambient before removal or insertion of any insert.

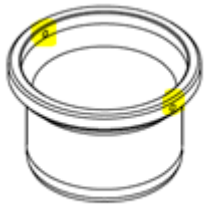
Always power off unit and clean the tank and the desired insert before insertion.

5.1.1 Dry Block

Removal:

Let the calibrator cool before you remove the dry block insert.

Unscrew the black protective cover by first placing the prongs of the insert exchange tool into the holes of the cover. Apply pressure against the prongs then turn counterclockwise to loosen the cover. Once loosened, the insert exchange tool can be removed and you can unscrew the insert by placing a single finger from both hands against opposite sides of the insert and pushing counterclockwise. Continue rotating insert until its top can be securely held by your hand then continue unscrewing with one hand.



Black protective cover

Insert exchange tool

If moisture is present on the inside of the well following insert removal, then gently clean with a dry cloth.

Place the prongs of the insert exchange tool into the holes of the dry well insert. Apply pressure against the prongs by grasping each side of the insert exchange tool, stretch apart, and slowly lift upwards.

If moisture is present on the sides of the dry well insert following its removal, then gently clean with a dry cloth then turn dry well insert upside down to remove any moisture residing within the wells.

Clean the dry block insert walls as well as the walls of the metal block. This prevents the inserts from getting stuck in the metal block.

Installation:

Let the calibrator cool before you install the dry block insert.

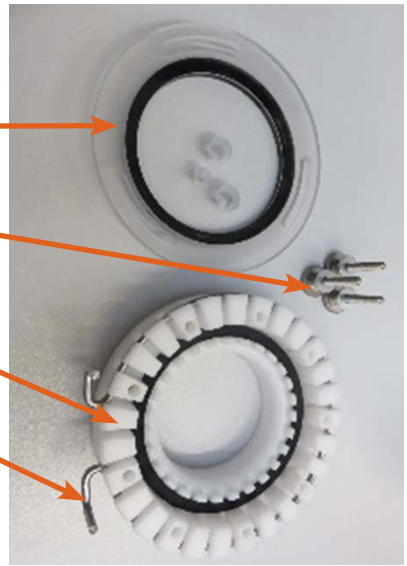
Insert the dry block insert into the metal block with the help of the insert exchange tool.

Utilize the insert exchange tool, to screw in the black protective cover which sits above the dry block insert.

5.1.2 Thermocouple Fixture:

The LTR-150 comes standard with a Thermocouple (TC) Fixture. The Thermocouple Fixture is used with the dry block to ensure that all thermocouples are securely held at the full immersion depth of the dry block inserts to ensure accurate calibrations. The Thermocouple Fixture set contains thermocouple housing with an integrated metal holder, a transparent cover, and three knurled head screws to hold the cover in place.

1. Transparent cover.
2. Three knurled head screws.
3. Thermocouple housing.
4. Integrated metal holder.



Installation:

Let the calibrator cool before installing the TC fixture.

Screw the TC housing onto the dry block thread. Please do not overtighten!

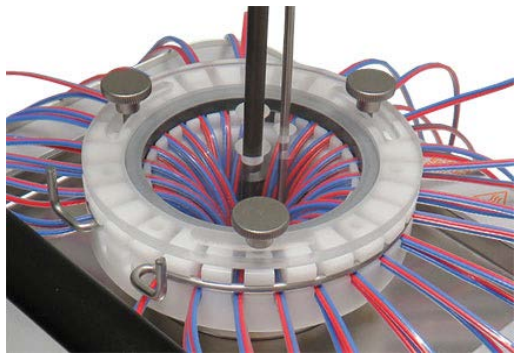
Usage:

Place the thermocouple into the dry block, route it through the accessible notch and move the metal holder to fix the position.

Move to the next accessible notch until all thermocouples are fixed.

Place the transparent cover on the fixture and secure it with the three knurled knob screws.

Place the External Reference sensor and Kaye IRTD in the dry block using the holes in the transparent cover.



Removal of Thermocouples:

Remove the IRDT and sensors and the three knurled knob screws.

Remove the transparent cover.

Remove the metal holder by bending it slightly out of its bed in the fixture.

It is now possible to remove all thermocouples at once.

5.1.3 Micro Bath Tub Kit

The micro bath is used for calibrating sensors with special shapes or dimensions. Direct contact between the sensor and the calibration liquid ensures excellent heat transfer.

The calibration liquid is poured directly into the tub insert.

The micro bath tub kit (optional) includes the transport cover, the work cover, the sensor cage, the magnetic stirrer, the magnetic lifter and, as an accessory, the tub insert. The individual components are described below.

Tub insert:

The tub insert is placed into the tank with the help of the insert exchange tool.
The tub insert can be closed with the associated cover.

Both threaded covers are leakproof, so the calibration liquid can be left in the tank or the tub insert during transport.

Transport cover:

The transport cover serves for secure closing of the micro bath. It prevents spillage of the calibration liquid during transport.

Work cover:

The work cover fulfils various tasks during the operation.

- It reduces the evaporation of the calibration liquid to a minimum.
- It reduces the cooling on the surface of the calibration liquid.
- It ensures stable positioning of the test sensors in the micro bath.

The work cover is screwed on to the micro bath and has five openings for test specimens. The unused openings can be closed with suitable silicon plugs.

Sensor cage and magnetic stirrer:

The sensor cage protects the magnetic stirrer. It prevents the sensors from blocking the magnetic stirrer. The function of stirring is ensured by the sensor cage.

The magnetic stirrer ensures a uniform temperature distribution in the calibration liquid. The default speed of the magnetic stirrer is set to 100%.

IMPORTANT! Wearing part! The magnetic stirrer is a wearing part.

Replace worn-out magnetic stirrers.

Silicone Oil:

To achieve the best accuracy over the entire range -30° to 150°C it is recommend using the Kaye 200 Silicone Fluid 10 CS or equivalent. (1 litre)

The calibration liquid (sold separately) is poured directly into the micro bath tub insert.

IMPORTANT NOTICE!

Only use clean calibration liquid. Over time repeated use of the oil can lead to a contamination of the calibration liquid. This contamination can lead to smeary gel effect on the bottom of the tank due to the rotation of the magnetic stirrers.

Clean the tub before calibrating sensors.

Exchange the worn magnet stirrer.

Exchange dirty, smeary calibration fluid.

Filling the Micro Bath

CAUTION! Risk of incorrect measurement or material damage!

Do not exceed the maximum fill level during operation!

- Above the maximum fill level, the heat dissipation is too great, preventing compliance with the specified tolerances.
- Overflow of the calibration liquid causes contamination and can damage the calibrator.

Ensure that the maximum fill level is not exceeded during operation.

The fill level in the tub insert rises because of the following factors:

- **Thermal expansion:** Calibration liquids expand to varying degrees because of heating. The increase in fill level depends the reference temperature setting.
- **Displacement by sensors:** The volume displaced by the sensors being calibrated must be considered in the filling amount.
- **Rise due to stirring:** The rotation of the magnetic stirrer forms a whirlpool in the liquid. This raises the fill level at the wall.

The maximum fill level with the tub insert is below the fixture for the insert exchange tool.

The maximum fill level is ~0.32 litres.

IMPORTANT NOTICE!

- **Use only recommended silicone oil.**
- **Always read the safety data sheet supplied with the silicone oil before using it.**
- **Always ensure adequate ventilation when working with silicone oil, since hazardous substances can be released.**
- **Spilled or leaked silicone oil results in an extreme danger of slipping. Clean the affected ranges by suitable means.**
- **Since silicone oil is hygroscopic, always use the associated transport cover to close the tank or the tub insert after use.**

Installation:

Insert the tub insert in the tank using the insert exchange tool.

Place the magnetic stirrer in the tank / tub insert.

Insert the sensor cage.

Insert the test sensors in the sensor cage.
This accounts for the volume of the sensors to be tested.

Fill the calibration liquid in the tub insert to the fill level.

Leave sufficient reserve space for additional level rise.

If necessary, remove the test sensors again.

Screw the work cover onto the tank and if necessary insert the sensors through the work cover into the tub insert.

Removal:

Let the calibrator cool before you remove the tub insert.

If necessary, remove the working cover or transport cover.

Pull the tub insert out of the metal block with the help of the insert exchange tool.

Empty fluid.

Remove and clean the sensor cage, magnetic stirrer, and tub insert.

Clean the metal block.

5.1.4 Surface Temperature Insert

A special optional surface insert is used for calibrating surfacetemperature sensors. This makes calibration fast and easy.

The surface insert is hollow from the bottom and longer than the adapter sleeve. For reference sensors, three boreholes are located directly under the surface

The two threaded boreholes in the border are for the accompanying exchange tool, while the third hole is used for the External Reference Probe to measure the insert.

Inserting:

The surface insert is inserted into the metal block with the aid of the insert exchange tool.

Removing and cleaning:

Let the calibrator cool before you remove the surface insert.

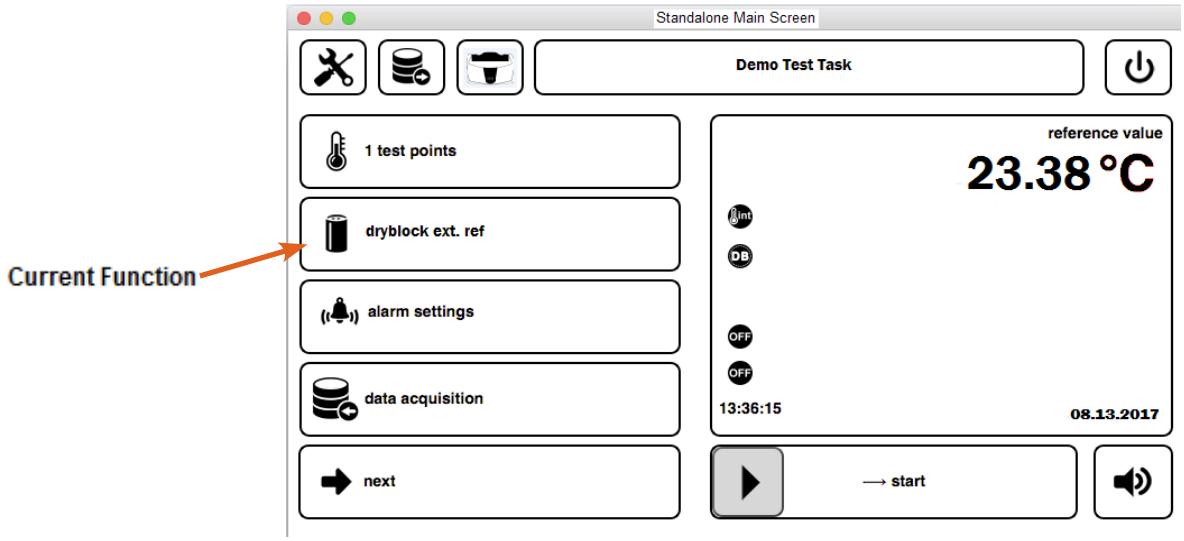
Pull the surface insert out of the metal block with the help of the exchange tool.

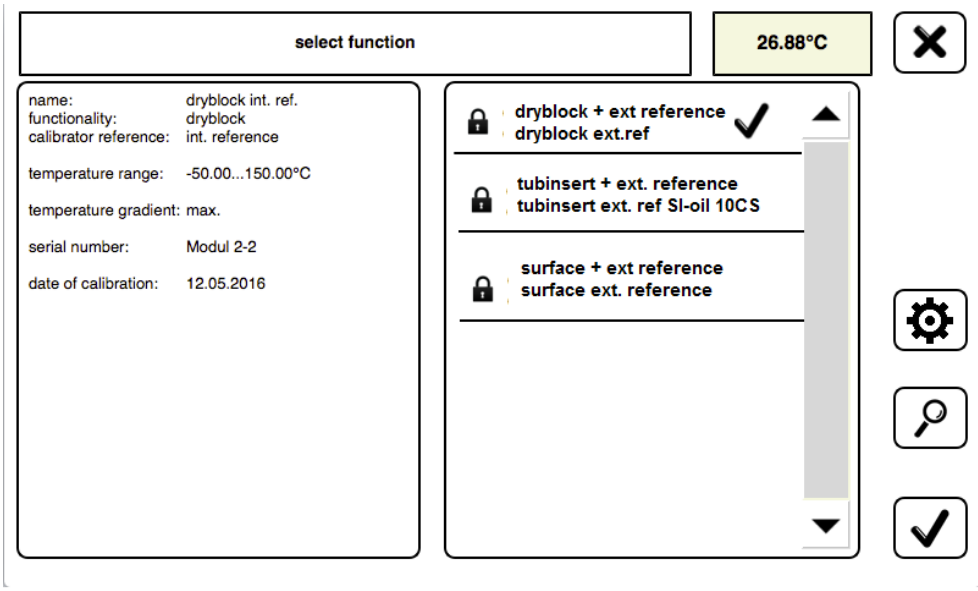
Clean the surface insert and the metal block.

5.2 Setting Calibration Function

Once the desired calibration insert has been installed, the Calibration Function must be set via the touchscreen.

From the Standalone Main screen, tap on Current Function icon on the left which will bring up the Select Function screen.





From the ***Select Function*** screen, tap on the desired function on the right (ex., ***dryblock ext reference, tub insert ext reference, or surface ext reference***), which will then be identified by a check mark.

Confirm selection by tapping the check mark icon in the bottom right hand corner to save the change and return you to the ***Standalone Main*** screen.

Information on the selected function will be displayed on the information box on the left.

With the desired insert installed and the associated function defined the LTR-150 is now ready for calibration.

Chapter 6. Automatic Calibration Mode

The LTR-150 was designed to interface with all Kaye Validation products (IRTD, Validator AVS, Validator 2000, ValProbe, and RF ValProbe) to support automatic calibration of validation sensors and loggers. The unit is backward compatible with all versions of Kaye validation software which means that no software upgrades are required to use the LTR-150.

During the automatic calibration process the appropriate Kaye software will automatically step the LTR-150 thru the programmed set points defined in the Kaye software. The Kaye software will automatically determine stability, deviation of the sensors, and load the calculated offsets to the Kaye hardware. Calibration/ Verification reports will be generated by the applicable Kaye software.

See the appropriate Kaye Software manual for detail instruction on how to setup the automatic calibration software

An IRTD Temperature standard is required for automatic calibration of all Kaye software.

Prior to performing calibration and/or calibration verification, Kaye recommends the following best practices to maximize accuracy and system performance:

- Place the thermal validation system along with the LTR-150 in a location with stable ambient conditions and away from any local heat or cold sources, such as close proximity to a sterilizer, supply air duct, or door opening to a cold storage unit.

- Power on the Kaye validation system and allow it to acclimate in its testing environment for approximately 20 minutes prior to initiating calibration or calibration verification process.

6.1 Starting Automatic Calibration

Ensure the appropriate inserts (dry block, micro bath tub, or surface) are inserted in the well and that the ***Calibration Function*** (see Section 5.2 Setting Calibration Function) has been set via the touchscreen.

Connect the IRTD to the appropriate Kaye validation hardware and place into the insert utilizing the IRTD slots. Verify with Kaye validation software that on the calibration Hardware screen that the IRTD is displayed as being connected

Connect the supplied External Reference Probe to the front panel of the LTR-150 and place in the insert using the appropriate slot.

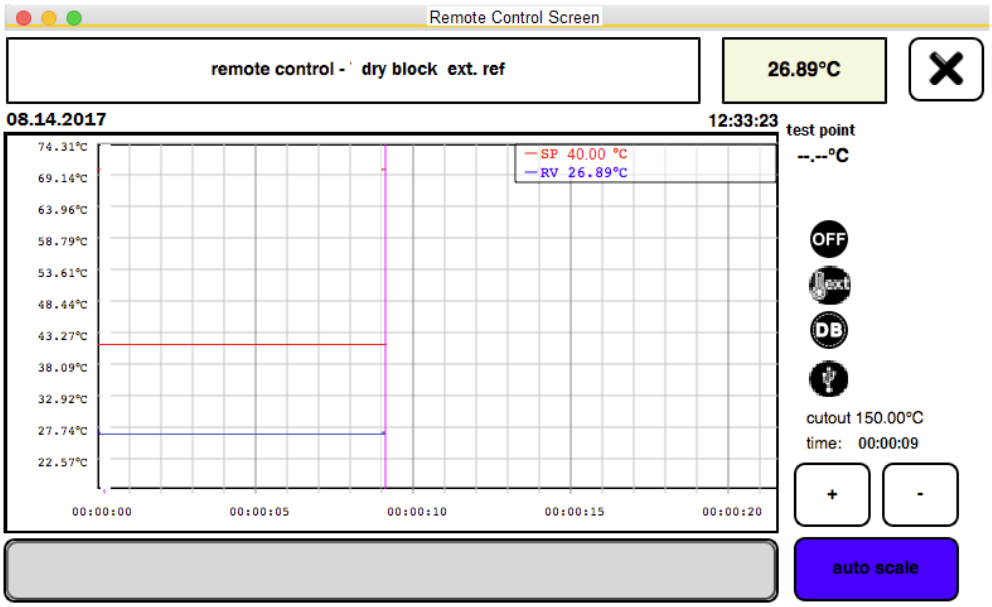
For (DB) dry block insert, place the thermocouples into the wells utilizing the well sleeves. Ensure that each thermocouple tip is touching the bottom of the well by gently pushing down until the sensor can go no further without bending.

For the (TI) micro bath tub insert, place desired number of sensors either in the tub or thru the work cover and into the silicon oil. Ensure the measuring element is fully immersed in the silicone oil and work cover is installed.

For the (SU) surface temperature insert place sensor on top surface of insert.

Connect the USB end of the supplied USB to Serial cable to one of the three (3) USB slots in the front panel of the LTR-150. Connect the serial end of the supplied cable to the existing bath cable supplied with your Kaye Validation system, and then to the Kaye Validation system.

Power up the LTR-150. The LTR-150 will boot up into ***Remote Control*** mode.



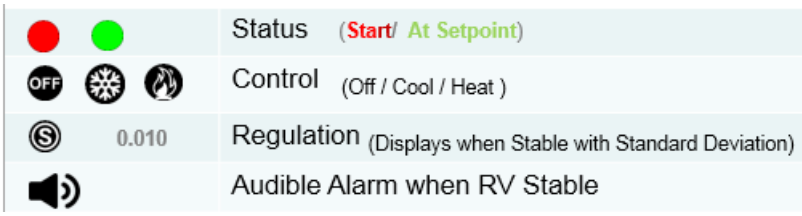
Verify the following are displayed;

OFF	Controller is OFF (Heat, Cool). Test Point is left blank
ext	External Reference (error message will display if not connected)
DB	Appropriate Function is configured (dry block, tub insert, surface)
	USB to Serial cable connected to LTR-150
26.89°C	External Reference Control Probe Temperature is displayed.

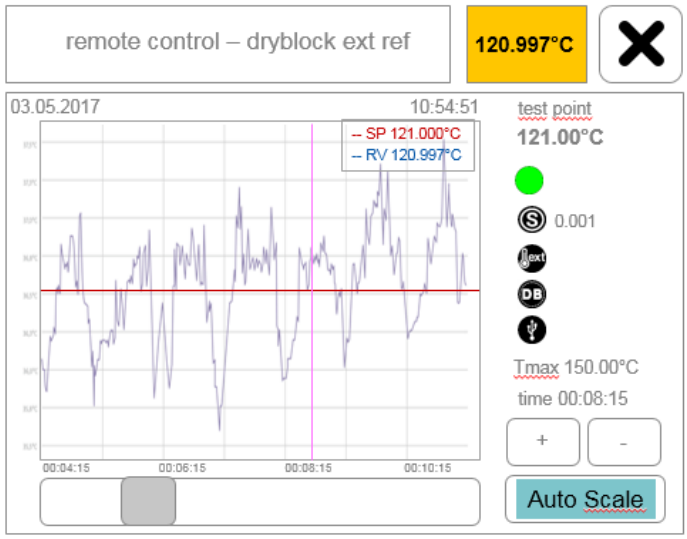
Verify with Kaye validation software that on the calibration hardware screen that the LTR-150 is displayed as being connected

Start the Kaye calibration or calibration verification process from the Kaye validation software. The LTR-150 will now be controlled by the Kaye validation software. The LTR-150 will be automatically programmed via the Kaye validation software with all appropriate set points.

- During the automatic calibration process the LTR-150 Remote Control screen will provide the following status information:



- During the automatic calibration process the LTR-150 Remote Control screen will also display and graph the set point (red), and the External Reference Probe value (blue), in digital and graphical format.



- The graph displays the reference value (RV in blue) and target test point (SP in red).

- User can zoom in or out the graph by tapping on the plus or minus icons.

- User can also scroll back to the start of test to view the historical trend by tapping down and sliding the grey box immediately to the left of the Auto Scale box. To return to current time and temperature, simply release hold of the grey box.

- Following completion of testing, allow the LTR-150 to return to ambient conditions before carefully removing the thermocouples and IRTD before powering off the unit. Never attempt to remove sensors immediately following testing at elevated temperatures (≥45°C) or below freezing as the former can cause personal injury while the latter could potentially damage the sensors should ice form around the sensors. Note: the LTR-150 will be left programmed at the low set point as defined in the Kaye validation software.

Chapter 7. Standalone Manual Mode

While the Kaye LTR-150 was primarily intended for automatic calibration with the Kaye Validation products it can also be utilized as a Standalone multi-calibrator for a wide range of sensors and applications. This makes it ideal for general use in the metrology lab.

In Remote mode, the LTR-150 relies solely on the associated Kaye software to define and control the set points, dwell times, ramp and soak profiles, perform datalogging, and report generation.

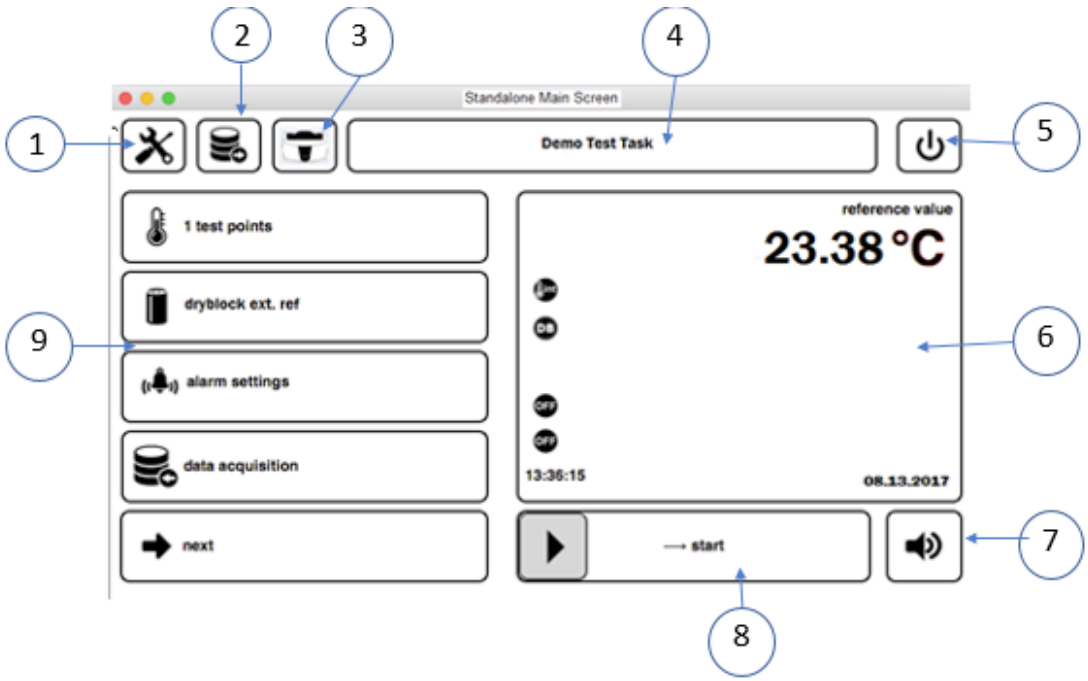
In Standalone mode, utilizing the easy to use touchscreen, the user has the flexibility of configuring these parameters under Test Tasks. Test tasks are containers for defined test conditions. They are helpful for recurring testing processes and standardising test sequences.

All the required settings and configurations for the calibration of test sensors are compiled in a test task. The parameters of the testing task can be saved, and easily selected later for specific testing.

The operational concept of the LTR-150 in Standalone mode is based on self-defined test tasks, which are described below.

7.1 Standalone Main Screen

The individual icons and key features of the main screen are presented in brief in the following:



① **Calibrator Set Up:** By using the tools icon, you can reach the “Calibrator Set Up” screen. There, you can change the settings of the calibrator.

② **Measurement Reports:** By using the reports icon, you can reach the “Select measurement report” screen. There, you can select saved measurement logs and view them.

③ **Remote Control:** By using the validator icon, you can switch back to remote control screen for automatic calibration with Kaye products.

④ **Test Task Selection:** Using this parameter field, you can reach the “Select Test Task” screen. There, you can select the saved test tasks and create or configure your own test tasks.

⑤ **Power Off:** By using the power icon, you can switch the calibrator off.

⑥ **Selected Test Task Details:** The reference temperature, the set temperature as well as additional information related to the selected test task.

⑦ **Alarm Signal:** By tapping the alarm annunciator icon, you can switch the alarm signal on or off. 

Note: To define when alarm signal is to be activated, tap on the alarm setting icon. 

⑧ **Start / Stop Slider:** The start / stop slider is used to start  or end  the testing process.

⑨ **Configuration Range:** You can use the parameter fields of the configuration range to get to the parameter screens of the calibrator.

7.2 Toolbars and Icons

The individual icons and key features of the main screen are presented in brief in the following:

Cancel / Back: Return to the previous window. Changes are discarded without saving.

Input confirmation / Save: The selected value or setting is confirmed and saved.

Manage / Configure: The selected entry is processed and the relevant screen is displayed.

Copy: The selected entry is copied and the relevant screen is displayed.

Create New: A new entry is generated for the selection list and the relevant screen is displayed.

Delete: The selected entry in the selection list is deleted.

Search: The selection list is searched and the result is displayed in the selection list.

Sorting A-Z: The selection list is sorted alphabetically in ascending order.

Sorting Z-A: The selection list is sorted alphabetically in descending order.

Export: The selected entry is copied and the relevant screen is displayed.

7.3 Selecting Functions

By utilizing different inserts, the LTR-150 can be easily configured for different calibrator functions (dry block, micro bath, or surface).

IMPORTANT! When changing functions, please consider!

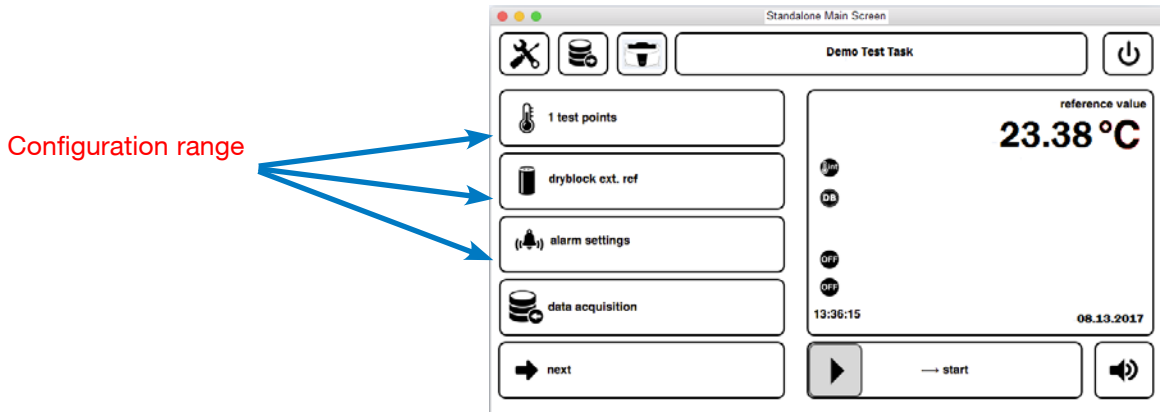
The individual functions of the calibrator are independent. Changes to existing functions always affect all the test tasks that are linked to the function.

You can get to the “Select Function” screen via the Configuration range in the Standalone main screen or from the window “Test Task configuration”.

Selection and installation of the desired insert and setting of the associated function is detailed in Section 5.2 Setting Calibration Function.

7.4 Configuration Range Settings

The calibrator settings can be easily and quickly changed directly from the configuration range. Selecting any of the options will open appropriate screens for changing the set points, function, or alarm settings.



The operation of the calibrator via the configuration range is particularly well suited for one-off testing processes. You can directly set the required test conditions and then start the testing process by swiping right the start icon.

You can save the new test conditions under the current test task or a new test task. Without saving, the test conditions are discarded.

7.5 Test Tasks

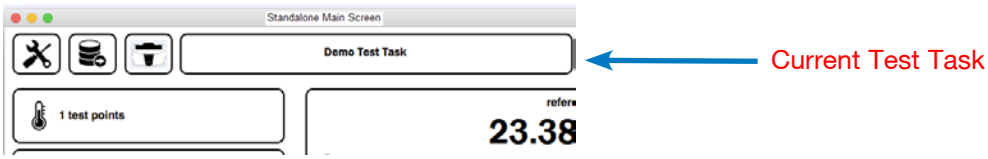
Test tasks are containers for defined test conditions. They are helpful for recurring testing processes, standardising test sequences, and generating measurement logs.

All the required settings and configurations for the calibration of a test specimen are compiled in a test task. The parameters of the testing task are saved and linked to the selected functions

The operational concept of the calibrator is based on pre-installed and self-defined test tasks. They are a central component of the function and operation of the LTR-150 in Standalone mode.

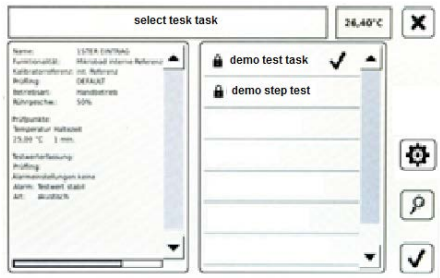
The calibrator is shipped with functions and basic testing tasks defined in the factory internally stored. These protected test tasks cannot be deleted nor edited. They serve as templates for your own self-defined test tasks. You can define your own test tasks for different test sequences. These test tasks are directly saved in the calibrator for ready access and activation.

From the Standalone main screen, you will see displayed the current test.



Tap on the Current Test Task window to go to “Select Test Task” screen.

Select Test Task:



Information on the selected test task is displayed in the information box.

All the test tasks of the calibrator are displayed in the selection list.

From the toolbar, you can accept the selected test task, search for test tasks, or switch to *Manage Test Task* *for managing and configuring the test tasks*.

Manage Test Task:

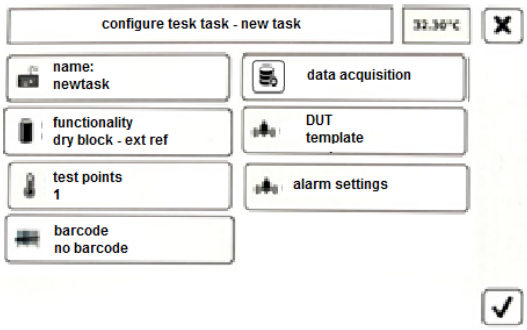
This window differs slightly from the Select Test Task screen only by the functional elements appearing in the toolbar.

The test tasks can be sorted, copied, deleted, configured, or new ones created.

Configure Test Task:

From the Manage Test Task screen, you can use the icon to go to Configure Test Task.

Here, you can change the parameters of the selected test task.



Tap on the desired parameter field you wish to change. The window of that parameter is opened, which you can then edit. Below is a listing of the available fields and brief function description.

Name: Here, you can change the name of the test task through the virtual keyboard with the input line is displayed.

Input the new name of the test task and confirm the input.

☛ The new name is adopted and you will be returned to the previous window.

Functionality: Here, you can link the desired function of the calibrator with the test task.

IMPORTANT!

The selected function must be suitable for the calibrator type and the measuring insert used.

Select the desired function by tapping on ✓ in the selection list.

Confirm the selection by using the ☑ icon.

☛ The new function is adopted and you will be returned to the previous window.

Data Acquisition: Here, you can enable data acquisition and give the file a name or it can be disabled.

Alarm Settings: Here you can select from a variety of choices should you want an audible alarm to sound when conditions are met.

Select the desired alarm setting by tapping on ✓ in the selection list.

Confirm the selection by using the ☑ icon.

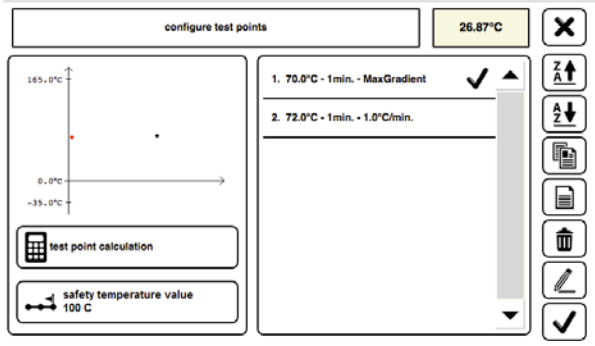
Confirm the selection by using the ☑ icon.

Test Points: The parameters of the test points are set here. You can set the parameters of one or more test point(s).

The information box has several parameter fields for setting the test points.

All the test points are displayed in the selection list.

The test points can be moved, copied, created, deleted or changed from the toolbar.



Move test point:

Select the desired test point by tapping on ✓ in the selection list.

Move the test point down or up by tapping the / icons.

Copy test point:

Tap on the icon to copy the selected test point.

☛ The test point is copied and appended at the end of the selection list.

Create new test point:

Tap on the create icon for a new test point.

☛ The window for the test point setting is opened.

Input the temperature, the dwell time, and gradient then confirm the relevant input.

☛ The input values are adopted and you will be returned to the previous window.

Delete test point:

On tapping the delete icon, the selected test task is immediately deleted.

Change test point:

Tap on the modify icon to edit the selected test point.

☛ The window for the test point setting is opened.

Change the temperature dwell time and gradient and confirm the new values.

☛ The new values are adopted and you will be returned to the previous window.

Calculate test points

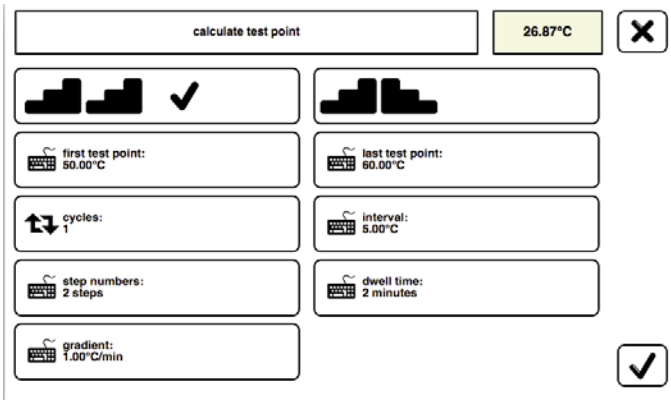
Here, you can easily have the steps between two temperatures calculated. If a change is made to a parameter, the other parameters dependent on it are calculated afresh automatically.

Tap the parameter field to open the window Calculate test points.

Define Test Points:

To do so, tap on the parameter fields (i.e., first test point or last test point), input the new values and confirm the input.

☛ The new values are adopted, the interval is calculated afresh and you will be returned to the previous window.



Set Interval:

For fixed intervals, tap on the parameter field Interval, input the desired step width and confirm the input.

☛ The new interval is adopted and the number of steps is calculated. If necessary, the last test point is also adjusted to match, and you will be returned to the previous window.

Set Cycles: You can set the number of cycles here. For every cycle, the test points in the selection list are approached successively.

Tap on the parameter field to change the number of cycles.

Input the desired number in the input window and confirm the input.

☛ The new values are adopted and you will be returned to the previous window.

Set Steps:

Tap on the parameter field Number of Steps to change the number of steps.
Input the desired number and confirm the input.

☛ The number of steps is adopted and the interval is calculated afresh.

Set Dwell Time:

Tap on the parameter field Dwell Time, input the new values and confirm the input.

☛ The new value is adopted and you will be returned to the previous window.

One-Sided Step Selection:

Activate the parameter field by tapping ✓ if the test points are to be approached in succession from the first to the last test point.

Two-Sided Step Selection:

Activate this parameter field by tapping ✓ if the test points are to be approached in succession from the first to the last back to the first test point.

Select Gradient:

Tap on the parameter field Gradient, input the new values and confirm the input.

☛ The new value is adopted and you will be returned to the previous window.

✓ At the completion of configuration of the test task, continue to tap the check mark icon thru all screens until you return to the select test task screen.

✓ To load, select desired test task and tap the check mark icon. The test task will load and screen will return to Standalone main screen with name of selected test task.

Chapter 8. Starting Standalone Manual Calibration

CAUTION! Risk of burns!

The calibrator can become very hot when in operation. Touching hot parts can result in serious injuries.

- Never touch the metal block, the tank, the adapter sleeve or the test specimen at temperatures above 35 °C or below 10 °C.
- Allow the calibrator to cool before you remove the test specimen, clean the tank, change the adapter sleeve or the calibration insert or switch off the machine.

Before the testing process:

Before the start of the testing process, check whether

the instructions regarding the installation site and the operational position have been complied with

the electrical connections have been made correctly.

the correct measuring insert has been selected for the test task.

the test sensors are securely fixed in the calibrator.

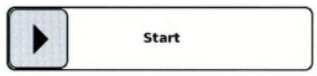
the calibrator has sufficient structural stability.

Starting the testing process:

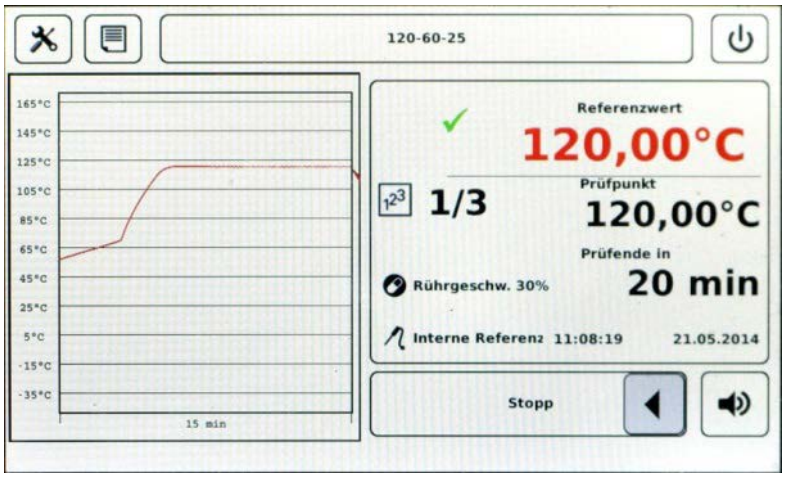
IMPORTANT! Parameter fields disabled!

During the testing process, all the parameter fields, except for the Start / Stop slider and the alarm signal, are disabled.

Push the button of the start / stop slider completely to the right.



☛ The testing process is started. Information on the testing process and the temperature progression is displayed in the window.



☛ To see live display of current reference value against target test point, touch and slide the right arrow icon from its left side location to far right-side location of the *Display Live Graph* field.

☛ The *Live Graph* screen appears, displaying current reference value (RV in blue) and target test point (SP in red) along with current elapsed time of test.

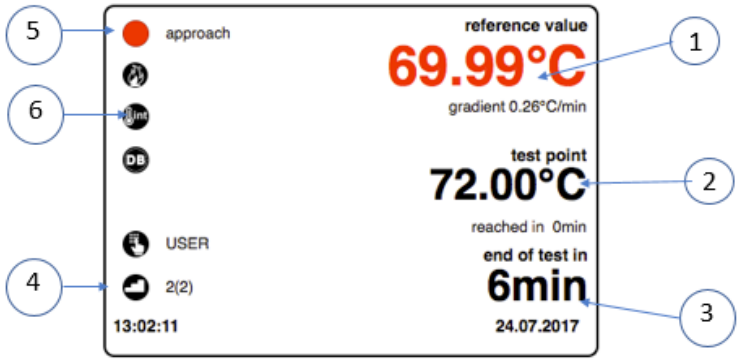
☛ User can zoom in or out the graph by tapping on the plus or minus icons.

☛ User can also scroll back to the start of test to view the historical trend by tapping down and sliding the grey box immediately to the left of the ***Auto Scale*** box. To return to current time and temperature, simply release hold of the grey box.

☛ Tap on the **X** icon in the upper right-hand corner to exit live trend.

Display range:

The following information is shown in the display range:



① Current External Control Reference Probe value.

② Current test point / set point.

③ Probable remaining test duration for the current test point.

④ Step counter for stepped operation.

⑤ Reference Status.

⑥ Reference used (ext).

☛ The test will continue running until its desired parameters have been achieved then automatically stop and ramp back to its default startup temperature. Note: If data logging has been enabled then a screen will appear prompting user to enter the test temperature target value. A ***Test Task Completed Successfully*** window appears.

To stop test manually, touch and slide the left arrow next to ***Stop*** all the way to the left.

To obtain logged data, tap on the data icon to bring up the ***Select Log Data*** screen. Tap on the desired file then the check mark in the lower right-hand corner.

☛ The ***View Log Data*** window appears providing user with the following four options:

- o Diagram
- o Table
- o Export Log Data
- o Export All Log Data

Choose the desired option(s).

☛ Following completion of test, power the unit down.

Note: If the temperature value is greater than 40°C then a message will appear stating, “calibrator is reaching safe temperature – please wait.” Once the value drops below 40°C then a new message will appear informing that “you can now turn off the calibrator.”

After the testing process:

Allow the calibrator to cool to room temperature.

Note: The instructions in the section ***Error! Reference source not found***.

Clean the calibrator.

Chapter 9. Maintenance and Troubleshooting

9.1 Introduction

This section provides instruction on how to care for and troubleshoot the LTR-150 to prolong longevity, maintain precision and accuracy, and functionality.

9.2 Maintenance

Before maintenance and cleaning, ensure that the LTR-150 has sufficiently cooled and that the unit has been powered off and unplugged from the electrical outlet.

9.2.1 Dry Block

If recently used, allow the LTR-150 to stabilize at room temperature before attempting to remove the adapter sleeve.

Once properly acclimated, use the insert exchange tool to unscrew the black moisture protection insert out of the metal block.

Once properly acclimated, use the insert exchange tool to pull the adapter sleeve out of the metal block.

Clean the adapter sleeve and the metal block with a dry or slightly damp lint-free cloth. This prevents the adapter sleeve from getting stuck in the metal block.

9.2.2 Micro Bath

If recently used, allow the LTR-150 to stabilize at room temperature before attempting to remove the micro bath components.

Remove the sensor cage from the tank.

Remove the magnetic stirrer with the help of the magnetic lifter.

Carefully pour the silicon oil in its original container.

Clean the cage, the magnetic stirrer, magnetic lifter, and the tank then allow to dry thoroughly before storing.

Replace fouled or aged silicon oil as needed.

Replace the magnetic stirrer when the fillet in its middle has worn. The fillet reduces friction during rotary movement. A worn fillet increases friction upsetting the reliability of the stirring function.

9.2.3 Surface Temperature

If recently used, allow the LTR-150 to stabilize at room temperature before attempting to remove the adapter sleeve.

Once properly acclimated, use the insert exchange tool to pull the surface insert out of the metal block.

Clean the surface insert and the metal block with a dry or slightly damp lint-free cloth. This prevents the surface insert from getting stuck in the metal block.

9.2.4 Main Unit

Clean the unit with a dry or slightly damp lint-free cloth. Do not use sharp objects or aggressive agents for cleaning.

Ensure that your cleaning agent cannot be a source of danger from a reaction with parts of the machine or the materials inside it. If you have any questions regarding compatibility, please contact our customer service.

The grill openings in the base and sides of the calibrator must be cleaned at regular intervals. The cleaning intervals depend very closely on the air pollution at the installation site and the daily operation duration. Clean the grill openings by vacuuming or brushing off. Air flow that is too low can result in the temperature fuse getting triggered. The calibrator is then rendered operationally disabled until reset.

During operation, small quantities of metal dust get created in the adapter sleeves and calibration inserts, which can result in the measuring insert getting stuck in the calibration block. To prevent this, pull the measuring insert out of the calibration block with the help of the insert exchange tool and clean the measuring insert and the calibration block at regular intervals.

9.3 Troubleshooting

The following table details potential problems that you may encounter, which allows you to determine the root cause and corrective action.

Problem	Possible Cause	Corrective Action
LTR-150 and touch screen unresponsive	Fuse has blown	Replace both fuses even if only one is defective
	Unknown	Power off unit, wait a few minutes, and then power on
	Fingers too cold or slick to allow recognition on touch screen	Dry and/or warm up fingers
Touch screen is dim or dark	Brightness setting too low	Increase brightness setting.
Sensor damage	External reference sensor improperly or not fully connected	Verify connection and unplug then reconnect, if necessary
	Sensor cable broken or has a short circuit.	Contact Kaye for service
Fan not running	The fan is defective or blocked	The temperature switch may have been triggered, switching off power supply to the heart cartridge. Contact Kaye for service
	Fuse has blown	Replace both fuses even if only one is defective
End of temperature is not achieved	Solid state relay is defective or heating/ cooling element has short-circuited or aged	Contact Kaye for service
	External reference sensor improperly or not fully connected	Verify connection and unplug then reconnect, if necessary
No display	Controller defective	Contact Kaye for service
Cannot communicate with Kaye AVS or Kaye Validator 2000	Remote control not enabled.	Enable remote control on the LTR-150
	Physical interface cable connection between units absent, improper, or damaged	Ensure cable is present and properly secured. If verified and problem persists then replace cable

Appendix A.1 - Warranty

The Kaye LTR-150, sold by Amphenol Advanced Sensors is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the unit to normal operation or replacing the unit, at the sole discretion of Amphenol Advanced Sensors. The warranty is effective from the date of delivery to the original purchaser. If Amphenol Advanced Sensors determines that the Kaye LTR-150 was defective, the warranty period is;

- One year for general electronics or mechanical failures
- If Amphenol Advanced Sensors determines that the LTR-150 was damaged by misuse, improper installation or operation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by Amphenol Advanced Sensors, the repairs are not covered under this warranty.
- The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties or merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).Appendix A. Warranty and Return Policy

If the Kaye LTR-150 malfunctions within the warranty period, the following procedures must be completed.

1. Contact the local Customer Support Center, listed below, and provide the full details of the problem and the serial number of the unit. If the nature of the problem indicates the need for factory service, Amphenol Advanced Sensors will provide you with a “RETURN AUTHORIZATION” number and shipping instructions for the return of the unit to the nearest service center.
2. If Amphenol Advanced Sensors instructs you to send the unit to a service center, it must be shipped prepaid to the authorized repair center indicated in the shipping instructions.
3. Upon receipt, Amphenol Advanced Sensors will evaluate the unit to determine the cause of the malfunction.

Then one of the following courses of action will be taken:

- If the malfunction is covered under the terms of the warranty, the unit will be repaired at no cost to the owner and returned.
- If Amphenol Advanced Sensors determines that the malfunction is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner’s approval to proceed, the unit will be repaired and returned.

Notes:

Customer Support Centers

U.S.A.

Sales and Services
(Repair/Calibration):
Amphenol Thermometrics, Inc.
St. Marys Center
St. Mays, Pennsylvania 15857 U.S.A.
T: 814-834-9140
F: 814-781-7959
E:kaye-us@amphenol-sensors.com

Brazil

Sales and Service
Amphenol TFC DO Brazil LTDA
Rodovia Governador Adhemar
Pereira de Barros, KM 121.5 S/N
13098-396 Campinas
Sao Paulo, Brazil

Europe, Asia & Middle East

Sales and Service
Amphenol Advanced Sensors GmBH
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D-75179 Pforzheim, Germany
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