HART SCIENTIFIC
A Fluke Company

2016
Fluid Level Adapter User's Guide

Rev. 4A0401

Hart Scientific, LLC • 799 E. Utah Valley Drive • American Fork, UT 84003-9775 • USA
Phone: +1.801.763.1600 • Telefax: +1.801.763.1010 • E-mail: support@hartscientific.com

www.hartscientific.com

Rev. 4A0401

1 Before You Start

1.1 Symbols Used

Table 1 lists the International Electrical Symbols. Some or all of these symbols may be used on the instrument or in this manual.

Table 1 *International Electrical Symbols*

Symbol	Description
	AC (Alternating Current)
	AC–DC
	Battery
	CE Complies with European Union Directives
	DC
	Double Insulated
	Electric Shock
	Fuse
	PE Ground
	Hot Surface (Burn Hazard)
	Read the User's Manual (Important Information)
	Off
	On

Symbol	Description
	Canadian Standards Association
CAT II	OVERVOLTAGE (Installation) CATEGORY II, Pollution Degree 2 per IEC1010-1 refers to the level of Impulse Withstand Voltage protection provided. Equipment of OVERVOLTAGE CATEGORY II is energy-consuming equipment to be supplied from the fixed installation. Examples include household, office, and laboratory appliances.
	C-TIC Australian EMC Mark

1.2 Safety Information

Use this instrument only as specified in this manual. Otherwise, the protection provided by the instrument may be impaired.

The following definitions apply to the terms "Warning" and "Caution".

- "Warning" identifies conditions and actions that may pose hazards to the user.
- "Caution" identifies conditions and actions that may damage the instrument being used.

1.2.1 Warnings

To avoid personal injury, follow these guidelines.

GENERAL

- **DO NOT** turn on the instrument if the flow valve is closed (see Figure 1 on page 15). Fluid can overflow the bath which can cause severe bodily injury or extreme danger of fire.
- Appropriate personal safety protection should be worn by the operator at all times while using the bath.
- **DO NOT** use the instrument for any application other than calibration work. The instrument was designed for use with a Hart Scientific bath for temperature calibration. Any other use of the unit may cause unknown hazards to the user.
- When inserting or removing the instrument from a salt bath, **EXTREME CAUTION** is required.
- **DO NOT** use the instrument in equipment other than Hart Scientific calibration baths.
- **DO NOT** use the instrument in environments other than those listed in the user's guide.

- **DO NOT** overfill the bath. When activated, this instrument can cause overflowing of extremely cold or hot fluid which may be harmful to the operator. See calibration bath manual for specific instructions.
- Follow all Warnings and Cautions listed in this User's Guide and in the User's Guide for the applicable bath in which this instrument will be used.
- Calibration Equipment should only be used by Trained Personnel.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Before initial use, or after transport, or after storage in humid or semi-humid environments, or anytime the instrument has not been energized for more than 10 days, the instrument needs to be energized for a "dry-out" period of 2 hours before it can be assumed to meet all of the safety requirements of the IEC 1010-1. If the product is wet or has been in a wet environment, take necessary measures to remove moisture prior to applying power such as storage in a low humidity temperature chamber operating at 50°C for 4 hours or more.
- **DO NOT** operate high temperature baths (500°C) near flammable materials. Extreme temperatures could ignite the flammable material.
- Overhead clearance is required. Do not place the instrument under a cabinet or other structure. Always leave enough clearance to allow for safe and easy insertion and removal of probes.
- The instrument is intended for indoor use only.

BURN HAZARD

- High temperatures may be present in this equipment. Fires and severe burns may result if personnel fail to observe safety precautions.
- Extremely cold temperatures may be present in this equipment. Freezer burns and frostbite may result if personnel fail to observe safety precautions.
- Before installing this unit in a bath, ensure the bath **DOES NOT** contain any water and has been completely dried prior to filling with fluid. Any trapped water can cause a steam explosion resulting in personal injury. If the bath has recently been filled with water, ensure the inside of the drain tube is dry prior to filling the bath with fluid.
- When installing this instrument in the bath, ensure that you do not introduce anything into the bath that will react with the bath fluid. **Ensure that the Fluid Level Adapter is DRY and free of contaminants.** Ensure there is no water or contaminants trapped in the Lower Flow Tube (see Figure 1, page 15). Read the MSDS (Material Safety Data Sheet) for the bath fluid used.
- Extreme caution should be used when installing the Fluid Level Adapter in a bath. For baths using any liquid medium, install the Fluid Level Adapter in the bath with the bath de-energized and the fluid at

room temperature. The Fluid Level Adapter will displace fluid. It may be necessary to remove fluid from the bath in order to prevent overflow. **For MAXIMUM safety, place the Fluid Level Adapter in the bath prior to adding the bath fluid** and carefully add the bath fluid to the appropriate level for the proper operation of the Fluid Level Adapter at the desired temperature.

- The bath in which this instrument is used may generate extreme temperatures. Precautions must be taken to prevent personal injury or damage to objects. Probes may be extremely hot when removed from the bath. Cautiously handle probes to prevent personal injury. Carefully place probes on a heat resistant surface or rack until they are at room temperature.
- **When inserting the Fluid Level Adapter into a salt bath, EXTREME CAUTION must be used.** Always wear appropriate personal protective equipment when inserting the instrument into a salt bath. For easiest insertion in a salt bath, set the bath set point to the lowest temperature at which the salt will remain liquid (approximately 150–200°C) during installation. Allow the bath temperature to settle at the lower temperature. Remove enough of the liquid salt to allow for fluid displacement by the Fluid Level Adapter. **The salt level should be 1–2 inches (25.4–50.8 mm) below the top of the tank, NOT THE BATH LID.** Salt may be added to adjust the fluid level to the appropriate level after the Fluid Level Adapter is in place and the bath is set to the desired temperature. De-energize the bath while installing the Fluid Level Adapter. Follow all other Warnings and Cautions pertaining to installation and use of the Fluid Level Adapter contained in this User's Guide (see Section 3.1, Installation and Operating Procedures).
- When removing the Fluid Level Adapter from the bath, use extreme caution. For a bath with a transfer medium that is liquid at room temperature, de-energize the bath and remove the Fluid Level Adapter with the fluid at room temperature (25°C). The Fluid Level Adapter will drip and fluid will be caught in the Lower Flow Tube (see Figure 1). Ensure that an appropriate catch basin is available for the type of bath fluid. Use appropriate protection for the floor (see Section 3.2, Removing the Fluid Level Adapter).
- When removing the Fluid Level Adapter from a salt bath, use extreme caution. Always wear appropriate personal protective equipment. Set the bath set point to the lowest temperature at which the salt will remain liquid (approximately 150–200°C) during removal. Allow the bath temperature to settle at the lower temperature. De-energize the bath and carefully remove the Fluid Level Adapter. The Fluid Level Adapter will drip and liquid sale will be caught in the Lower Flow Rube (see Figure 1). Ensure that an appropriate catch basic is available that can handle the hot salt and Fluid Level Adapter. Use appropriate protection for the floor (see Section 3.2, Removing the Fluid Level Adapter).

ELECTRICAL HAZARD

- These guidelines must be followed to ensure that the safety mechanisms in this instrument will operate properly. This instrument must be plugged into the stirrer outlet of the bath in which it is used. Ensure that the mains voltage of the bath matches the voltage of this instrument. The power cord of the instrument is equipped with a three-pronged grounding plug for your protection against electrical shock hazards. It must be plugged directly into the stirrer outlet of the bath only. **DO NOT** use an extension cord or adapter plug. **DO NOT plug this into a mains outlet.**
- Always replace the power cord with an approved cord of the correct rating and type. If you have questions, contact a Hart Scientific Authorized Service Center (see Section 1.3).
- High voltage is used in the operation of this equipment. Severe injury or death may result if personnel fail to observe the safety precautions. Before working inside the equipment, turn off the power and disconnect the power cord.

BATH FLUIDS

- Fluids used with instrument may produce noxious or toxic fumes under certain circumstances. Consult the fluid manufacturer's MSDS (Material Safety Data Sheet). Proper ventilation and safety precautions must be observed.

1.2.2  Cautions

To avoid possible damage to the instrument, follow these guidelines.

- Always operate this instrument at room temperature between 41°F and 104°F (5°C to 40°C).
- **DO NOT** allow fluid to enter the electrical components of the instrument.
- **DO NOT** overfill the bath in which this instrument is used. Overflowing liquid may damage the electrical system. Be sure to allow for thermal expansion of the fluid as the bath temperature increases. See the calibration bath user's guide for specific instructions.
- **DO NOT** operate this instrument in an excessively wet, oily, dusty, or dirty environment.
- This instrument is a precision instrument. Although it has been designed for optimum durability and trouble free operation, it must be handled with care. Position the bath before the tank is filled with fluid. When possible, insert the Fluid Level Adapter prior to filling the bath tank with fluid (see Section 3.1, Installation and Operating Procedures).
- Most probes have handle temperature limits. Be sure that the probe handle temperature limit is not exceeded in the air above the instrument.

- The instrument and any thermometer probes used with it are sensitive instruments that can be easily damaged. Always handle these devices with care. Do not allow them to be dropped, struck, stressed, or overheated.
- **DO** ensure the fluid is cleaned from the probes prior to immersing the probe in the next bath. Clean your probe between each bath to avoid contamination between bath fluids.
- Under filling the bath in which this instrument is used may reduce the bath performance and may possibly damage the bath.
- When calibrating PRTs always follow correct calibration procedure and calibrate from high temperatures to low temperatures with the appropriate triple point of water checks. Never immerse a wet or cold PRT into a bath filled with hot fluid. Severe damage to the PRT may result as well as personal injury to the calibration technician.

1.3 Hart Scientific Authorized Service Centers

Please contact one of the following authorized Service Centers to coordinate service on your Hart product:

Hart Scientific, Inc.

799 E. Utah Valley Drive
American Fork, UT 84003-9775
USA

Phone: +1.801.763.1600
Telefax: +1.801.763.1010
E-mail: support@hartscientific.com

Fluke Nederland B.V.

Customer Support Services
Science Park Eindhoven 5108
5692 EC Son
NETHERLANDS

Phone: +31-402-675300
Telefax: +31-402-675321
E-mail: ServiceDesk@fluke.nl

Fluke Int'l Corporation

Service Center - Instrimpex

Room 2301 Sciteck Tower
22 Jianguomenwai Dajie
Chao Yang District
Beijing 100004, PRC
CHINA

Phone: +86-10-6-512-3436
Telefax: +86-10-6-512-3437
E-mail: xingye.han@fluke.com.cn

Fluke South East Asia Pte Ltd.
Fluke ASEAN Regional Office
Service Center
60 Alexandra Terrace #03-16
The Comtech (Lobby D)
118502
SINGAPORE

Phone: +65 6799-5588
Telefax: +65 6799-5588
E-mail: antng@singa.fluke.com

When contacting these Service Centers for support, please have the following information available:

- Model Number
- Serial Number
- Voltage
- Complete description of the problem

2 Introduction

The Hart Scientific Fluid Level Adapters adapt Hart baths for use in calibrating liquid-in-glass (LIG) thermometers. It may be installed into any standard bath lid. Different models apply to different bath sizes and temperature ranges. The fluid level adapter consists primarily of a pump and test well. The pump maintains the fluid level at the top of the test well which enables the user to view the meniscus of total-immersion and partial-immersion liquid-in-glass thermometers.

The temperature gradients in the test well are maintained to very low levels in both radial and vertical directions. Actual gradients are dependent on the temperature and stability of the bath. A bath with stabilities of ±0.001°C at 25°C will have virtually no gradients in excess of 0.001 degree, while a bath at 300°C and a stability of ±0.010°C can be expected to have higher gradients.

Temperature stability with the 2016 is slightly reduced over that of a completely covered bath. Actual results will depend on the bath temperature, the fluid type and ambient temperature conditions. Slightly chilled (or heated) fluid at the exposed surface of the 2016 is mixed into the bath, which explains the reduction in stability of the bath while using a 2016.

3 Description and Operation

The fluid level adapter assembly is shown in Figure 1 on page 15.

- **Safety Switch:** Used to turn the pump motor on and off. It has the additional feature of preventing the automatic start up of the pump after a power failure. This prevents the fluid from gushing out onto the top of the bath during start up. Opening the flow valve before resetting prevents this problem.
- **Flow Valve:** Controls the pump rate and the meniscus level of the bath fluid in the test well.
- **Valve Lock:** Sets the flow valve at the desired position.
- **Valve Handles:** Used to open and close the flow valve.
- **Test Well:** Working area for inserting the test thermometers and the reference thermometer.
- **Pump Motor:** Provides the pumping power to maintain a constant flow of bath fluid into the test well. It also provides stirring for the bath during operation of the fluid level adapter. (See Figure 1 on page 15.)

3.1 Installation and Operating Procedures

***CAUTION**: Each time the adapter motor shuts off, steps 5 and 6 need to be repeated. If the Flow Valve is not held open during start up, the fluid may be forced out of the adapter.*

3.1.1 General

1. Read all Warnings and Cautions before operating this instrument.
2. Always wear appropriate personal protective equipment when installing the Fluid Level Adapter.
3. Install the Fluid Level Adapter in the access hole of the bath.
4. Unplug the circulating motor (IEC plug) normally used on the bath and plug the adapter motor into that receptacle.
5. The adapter motor is normally off and will need to be turned on each time the power is removed from the Fluid Level Adapter.
6. Ensure the Flow Valve is OPEN. Open the Flow Valve (see Figure 1 on page 15) by raising the valve handles to the highest position.

3.1.2 Fluid Level Adapter Installation (Liquid Medium at Room Temperature)

NOTE: *For maximum safety, install the Fluid Level Adapter prior to filling the bath with fluid.*

1. De-energize the bath.
2. Let the bath equilibrate to room temperature.
3. The Fluid Level Adapter will displace fluid. Remove fluid so that the fluid level is 1–2 inches (25.4–50.8 mm) below the top of the bath tank, NOT THE BATH LID. Ensure that the catch basin for the fluid is clean and free of contaminants. Fluid may be added after the Fluid Level Adapter is installed and the bath has reached the desired temperature.
4. Ensure that the Fluid Level Adapter is dry and free of any contaminants. Ensure that no fluid is trapped in the Lower Flow Tube (see Figure 1) and that the inside of the Lower Flow Tube is dry.
5. Carefully lower the Fluid Level Adapter into the bath through the Access Opening in the bath lid.
6. Once the Fluid Level Adapter is solidly in place, insure that the Flow Valve is open. While holding the Flow Valve open, start the motor by pressing the "Start" button
7. Slowly lower the valve handles until the desired flow rate is obtained. Note that flow in the adapter is affected by the fluid level in the bath and fluid viscosity.
8. Tighten the valve lock to set and maintain this flow rate. Changes due to temperature setting and evaporation may require periodic adjustment to the flow valve.

3.1.3 Fluid Level Adapter Installation (Solid Medium at Room Temperature)

1. Always wear appropriate personal protective equipment while operating a salt bath or installing the Fluid Level Adapter in a salt bath.
2. Adjust the bath set point to a temperature (approximately 150–200°C) just high enough to keep the salt in a molten state during installation of the Fluid Level Adapter. Allow the bath temperature to settle at the lower temperature.
3. De-energize the bath.
4. The Fluid Level Adapter will displace molten salt. If necessary, carefully remove the molten salt from the bath so that the fluid level is 1–2 inches (25.4–50.8 mm) below the top of the bath tank, NOT

THE BATH LID, before installing the Fluid Level Adapter. Ensure the instrument used for removing salt and the catch basin meet the following:

A. Able to withstand 200°C

B. Dry, clean, and free of contaminants

C. Non-reactive with the salt used (Refer to the manufacturer MSDS if unsure of a hazard that may exist)

5. Ensure the Fluid Level Adapter is dry, clean and free of contaminants. Ensure that nothing is trapped in the Lower Flow Tube (see Figure 1).
6. Slowly and carefully lower the Fluid Level Adapter into the bath through the Access Opening in the bath lid.
7. Once the Fluid Level Adapter is solidly in place, check that the Flow Valve is open. Secure the Flow Valve with the Valve Lock. Energize the Fluid Level Adapter by pressing the "Start" button.
8. While holding the Flow Valve open, carefully loosen the Valve Lock. Slowly lower the valve handles until the desired flow rate is obtained.

NOTE: *The flow in the adapter is affected by the fluid level in the bath.*

9. Tighten the valve lock to set and maintain this flow rate. Changes due to temperature setting and evaporation may require periodic adjustment to the flow valve.

3.2 Removing the Fluid Level Adapter

3.2.1 General

1. Read all Warnings and Cautions before removing this instrument.
2. Always wear appropriate personal protective equipment when removing the Fluid Level Adapter.
3. Unplug the Fluid Level Adapter (IEC plug) from the receptacle on the bath.

3.2.2 Fluid Level Adapter Removal (Liquid Medium at Room Temperature)

NOTE: *The Fluid Level adapter will be coated will fluid and require proper handling to minimize exposure to the fluid. Provide a proper place and situation for the Fluid Level Adapter once removed from the bath. Ensure that the fluid on the Fluid Level Adapter will not react with or create a hazard for operators or other instruments.*

1. Set the bath to room temperature (25°C) and allow the bath to equilibrate at room temperature prior to removing the Fluid Level Adapter.
2. De-energize the bath.
3. Carefully remove the Fluid Level Adapter from the access hole of the bath.
4. The Lower Flow Tube will trap fluid. Once the adapter has been mostly removed, the Fluid Level Adapter may have to be tipped to one side to allow the fluid to drain from the Lower Flow Tube back into the bath through the Access Opening.

3.2.3 Fluid Level Adapter Removal (Solid Medium at Room Temperature)

WARNING: *The Fluid Level adapter will be EXTREMELY HOT and coated with molten salt and require proper handling to minimize exposure to the molten salt. Provide a proper place and situation for the Fluid Level Adapter once removed from the bath. Ensure that the location and situation can withstand the conditions set forth in Section 3.1.3, step 4, conditions A-C. Ensure that the fluid on the Fluid Level Adapter will not react with or create a hazard for other operators or instruments. See the salt MSDS if unsure of hazards that may exist once the Fluid Level Adapter is removed.*

1. Adjust the bath set point to a temperature (approximately 150-200°C) just high enough to keep the salt in a molten state during removal of the Fluid Level Adapter. Allow the bath to settle at the lower temperature.
2. De-energize the bath.
3. Carefully remove the Fluid Level Adapter from the access hole of the bath.
4. The Lower Flow Tube will trap liquid salt. Once the adapter has been mostly removed, the Fluid Level Adapter may have to be tipped

to one side to allow the liquid salt to drain from the Lower Flow Tube back into the bath through the Access Opening.

3.3 Suggestions for Measurements

Maintain the fluid level in the test well within about 12 mm below the measurement point of total immersion thermometers.

A magnifier or telescope is recommended for reading the thermometer to insure the highest precision. A magnification should be from 5 to 10 diameters and the field should be about 1.5 cm. Refer to ASTM Standards Section 14 Volume 14.3, Temperature measurement, designation E 77–84.

Comparison measurements may be made with either a standard liquid and glass thermometer or an SPRT.

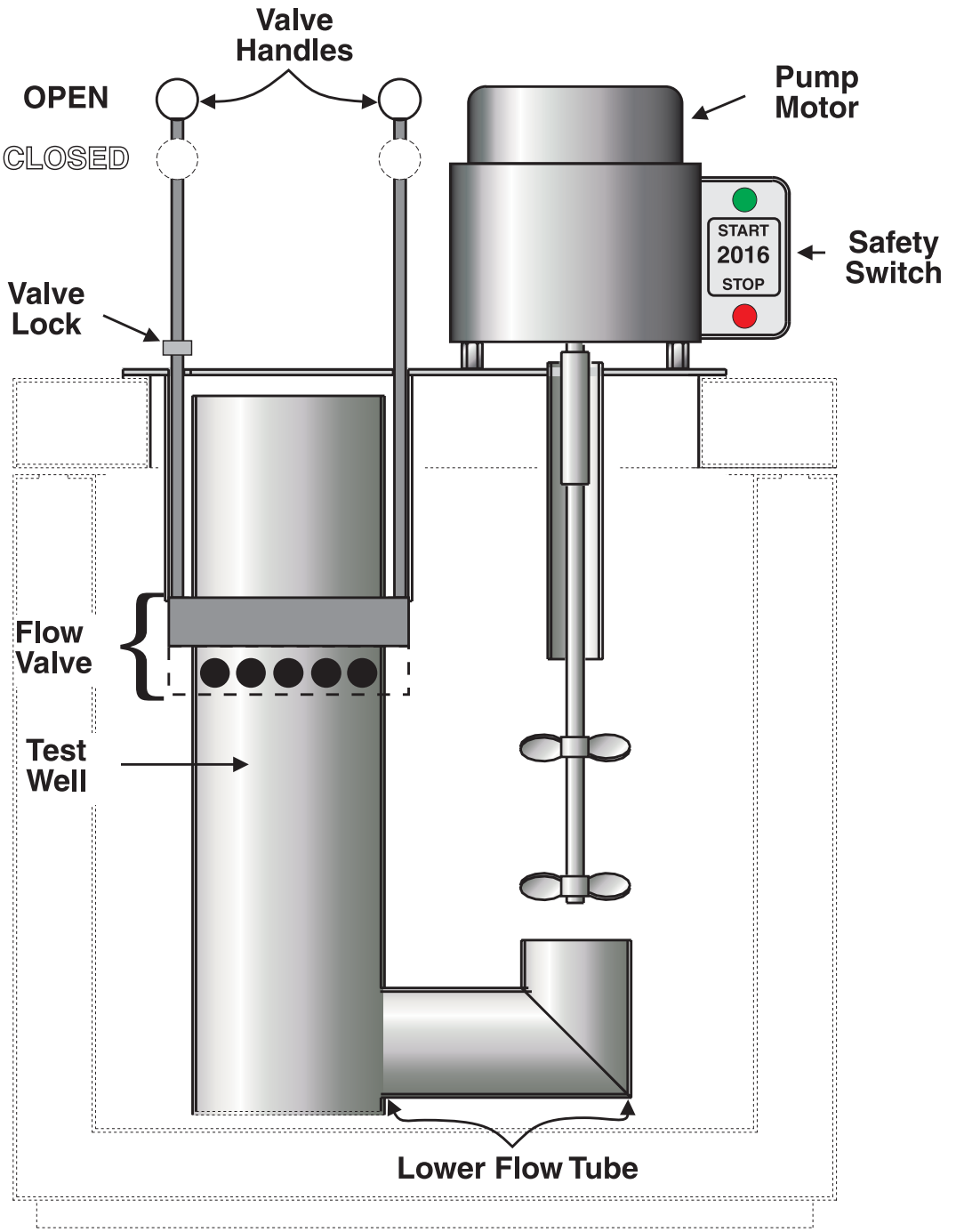

Figure 1 *Typical 2016 installation in a bath*