FLUKE®

Hart Scientific®

2031A

Quick Stick User's Guide

Rev. 841501

Fluke Corporation, Hart Scientific Division
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. 841501

Table of Contents

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
	The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) 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.

- **EXTREMELY COLD TEMPERATURES PRESENT** in this equipment.
- **FREEZER BURNS AND FROSTBITE** may result if personnel fail to observe safety precautions.
- The dry ice is extremely cold. Wear gloves to protect against freezer burn or frostbite when handling the dry ice.
- The dry ice does produce carbon dioxide gas. Only use the dry ice in a well ventilated area.
- **DO NOT** use this unit for any application other than freezing the mantle of a triple point of water cell.
- Always wear protective eyewear when crushing the dry ice.
- Use caution when adding the dry ice to the cup containing alcohol to prevent splashing of the alcohol.
- Always build the mantle in a prechilled cell.
- Follow the directions concerning building the ice ball on the end of the tube before inserting it in the cell. If this process is not followed, the wa-

ter can become super cooled without forming a mantle. Any movement of the super cooled water will cause a chain reaction within the cell forming an icy slush rather than building a mantle. If this occurs, the cell must be melted and re-chilled before building a new mantle.

- Follow all safety guidelines listed in the user's manual.
- Only trained personnel should use calibration equipment.

1.2.2 ⚠ Cautions

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

- The 2031A Quick Stick is a precision instrument. Although it has been designed for optimum durability and trouble free operation, it must be handled with care. After use, the plastic outer covering is very brittle. Keep the Quick Stick in an upright supported position until it warms up to prevent fracture from impact.
- DO NOT drop the Quick Stick. The stem could bend and may result in refrigerant loss.
- The Quick Stick is a relatively heavy instrument. Use the Hart model 2031-STND or other support system to prevent accidental tipping and damage of the Quick Stick and the TPW cell. The cell and Quick Stick must be supported separately.

1.3 Authorized Service Centers

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

Fluke Corporation, Hart Scientific Division

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
- Complete description of the problem

2 Introduction

The 2031A Quick Stick heat pipe operates on a continuous, closed loop two-phase cycle. The heat from TPW cell boils the refrigerant, causing a cooling effect within the evaporator portion of the tubing. The refrigerant travels upward to the condenser as a vapor. The dry ice/alcohol mixture cools the vapor and condenses it back to a liquid. The refrigerant travels back down the walls of the tube to the bottom where cycle begins again. In this way, the Quick Stick draws the heat out of the water in the TPW cell until an ice mantle is frozen around the reentrant tube.

3 Parts and Features

The Quick Stick includes all necessary items needed for forming a mantle in a TPW cell.

- The double wall insulated stainless steel cup holds enough dry ice for freezing a good mantle. A plastic cap and plastic insulating outer cover enclose the cup.
- The Quick Stick is of adequate length for generally available cells.
- The large diameter evaporator allows for faster freezing.
- The centering bushing centers the evaporator inside the reentrant well.
- A copper end plug provides heat transfer to the bottom of the Quick Stick.
- The removable heat pipe, from the cup, provides for ease of cleaning.
- The heat sink helps to prevent ice bridging.
- The stand, Hart model 2031-STND is used to support the Quick Stick and TPW cell during the mantle creation process.

If all items are not present, contact a Hart Scientific Authorized Service Center (see Section 1.3).

The Quick Stick (Figure 1 on page 8) consists of an insulated cup at the top for containing the coolant and the heat pipe itself. The heat pipe has a condenser at the top (the larger diameter portion) and an evaporator that is the bottom portion that inserts into the cell. A thin wall stainless steel (5/16 inch) diameter tube forms the evaporator, which is capped at the bottom with a copper plug to facilitate heat transfer to the bottom of the cell. A wick located inside the tubing facilitates the flow of refrigerant. The refrigerant inside the heat pipe is a non-CFC. A centering bushing can be used to center the evaporator portion within the reentrant well of the TPW cell. A stem insulator below the cup insulates the portion of the evaporator that is not inside the cell. The stem insulator may be adjusted to fit a particular cell by cutting it to a new length. For some cells, you may need to remove it entirely.

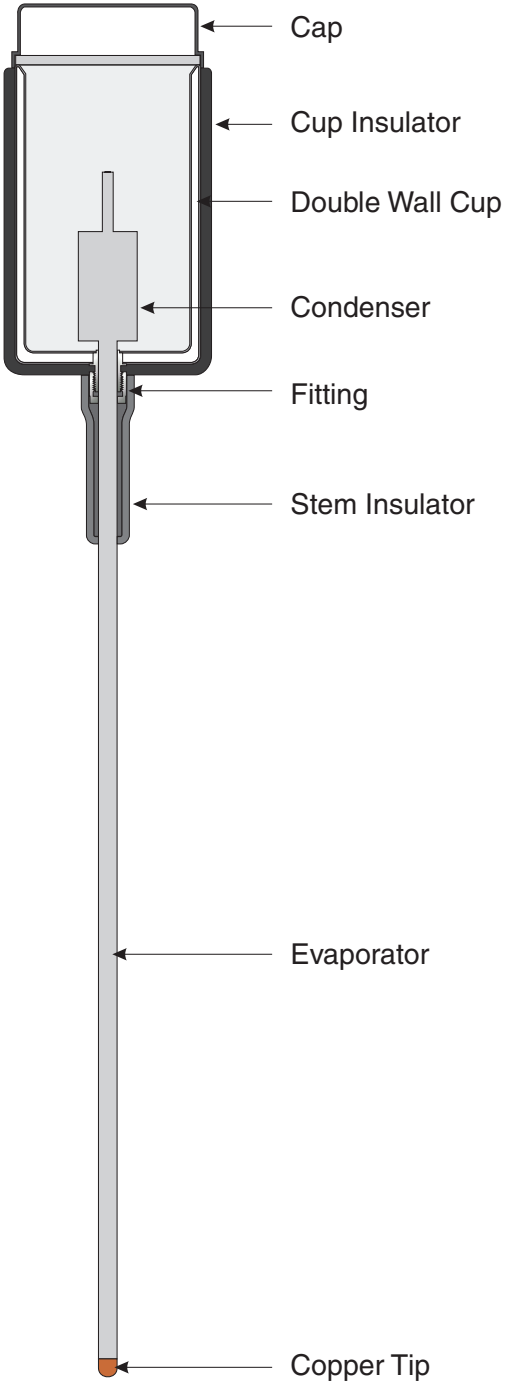

Figure 1 *Quick Stick Features*

4 Freezing Process

The freezing process is described in the steps below. The TPW cell and Quick Stick need to be supported separately during this process. Care must be taken not to break the entrant tube during this process or the cell is ruined. Use the Hart model 2031-STND to support the cell and Quick Stick during this operation.

Figure 2 *2031-STND with 2031A and triple point of water cell*

1. Cool the TPW cell in the bath to near the triple point temperature before freezing. Keep the cell in the bath until you are ready to start the mantle forming process.
2. Break dry ice into small chunks (less than ¼ inch) appropriate for fitting into the cup.
3. Dry the reentrant well of the TPW cell with alcohol (ethanol). Place approximately ¼ inch into the bottom of the reentrant well. Add approximately 5 ml of finely crushed dry ice to the reentrant well. This will help start the freezing process and prevent super cooling of the water. A

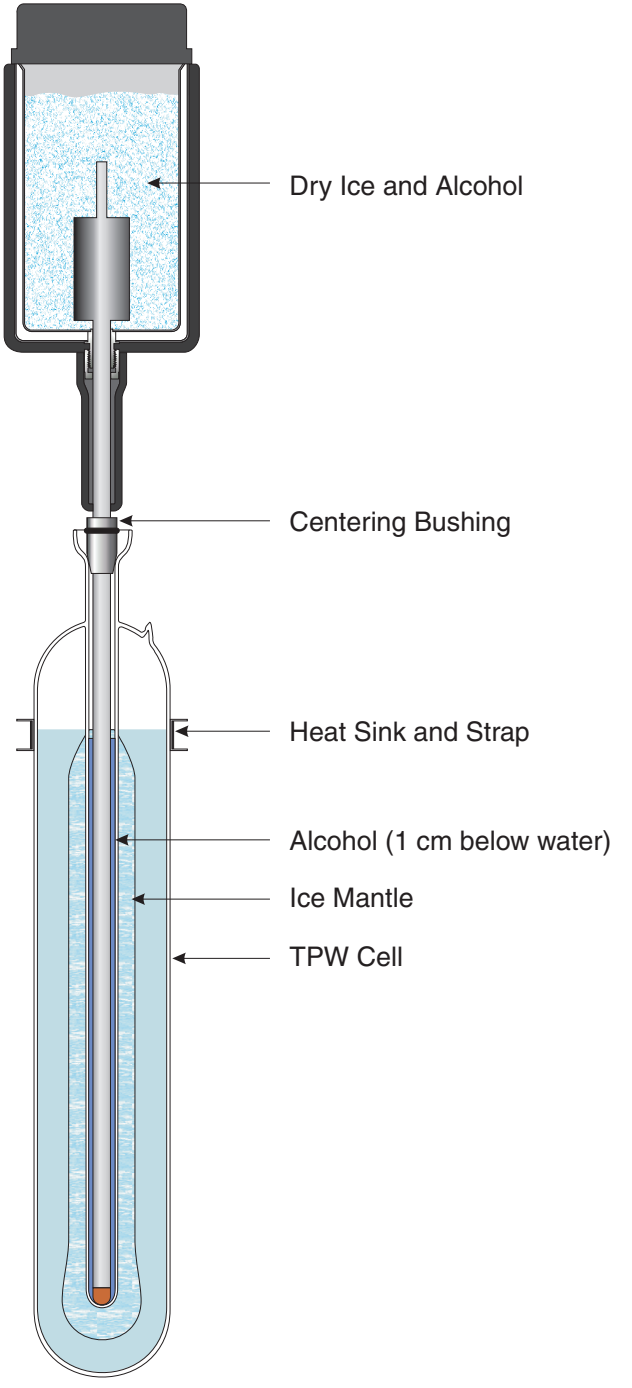

Figure 3 *Freezing Process*

small ball of ice will form on the end of the well tube. This helps thicken the ice mantle at the bottom of the reentrant well.

4. The dry ice is loaded into the cup and the spaces are filled with ethanol (approximately 100ml). The Quick Stick must be cooling before inserting it into the TPW. Insert it to the bottom of the reentrant well. The radius at the bottom helps center it in the well.

5. Once the Quick Stick is inserted into the TPW cell, fill the space around the tube with alcohol (ethanol) up to within approximately 1 cm below the water level in the cell. This helps to prevent ice from bridging across the top of the cell during mantle formation. A special heat sink is provided that fits around the TPW cell that also helps prevent bridging. Slide the heat sink onto the cell up to the level of the water. Adjust the centering bushing until the heat pipe is centered in the reentrant tube.

6. It will take approximately 40 to 60 minutes to form mantle. Be sure that there is no ice bridging at the top of the TPW cell. One fill of the Quick Stick cup is usually sufficient to form a good mantle.

   Remember that the magnification of the water makes the mantle appear larger than it actually is. Remove the cell from the fixture and tilt so that you can view the ice through the vapor only to see the actual size of the ice mantle.

7. Once the mantle is formed, remove the Quick Stick from the TPW cell. Keep the Quick Stick upright and supported until the dry ice and alcohol is evaporated. This will end the cooling cycle and the Quick Stick will return to room temperature.

***Caution**: The plastic outer covering can become very brittle and cold during use.*

8. Place the cell into the maintenance bath. The mantle must be freed prior to use. For highest accuracy, the cell must anneal by keeping it in the bath for about 24 hours prior to use.

5 Troubleshooting

In the event that the instrument appears to function abnormally, this section may help to find and solve the problem. If a problem arises, please read this section carefully and attempt to understand and solve the problem. If the problem cannot otherwise be solved, contact a Hart Scientific Authorized Service Center for assistance (see Section 1.3). Be sure to have the model number and serial number of your instrument available.

Problem	Possible Causes and Solutions
Instrument won't cool	**Dry ice and alcohol remain in the instrument**. Empty the cup of the remaining contents of dry ice and alcohol. Let the unit return to room temperature. Redo the process. If the unit still does not cool, call a Hart Scientific Authorized Service Center.
Mantel does not build in the cell	**Quick Stick may not be cooling.** Check to see that the Quick Stick is cooling. Check to see if the small ball of ice was formed on the end of the reentrant tube initially before inserting the heat pipe into the well. Check to see if the cell is super cooled as described in the safety section. If so, melt the cell and start over.
Difficulty building small ball of ice on the end of the reentrant tube	**Cell may not be pre-chilled correctly.** Pre-chill the cell in an appropriate bath at 0°C.
Small mantle formed when all the alcohol and dry ice evaporated from the cup	**Cell may not be pre-chilled correctly.** Pre-chill the cell in an appropriate bath at 0°C.