Model 9125

Surface Dry-well

User's Guide

Hart Scientific

CE

Rev. 022501

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Rev. 022501

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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
	AC-DC
	Battery
	CE
	DC
	Double Insulated
	Electric Shock
	Fuse
	PE Ground
	Hot Surface
	Read the User's Manual
	Off
	On

2 Introduction

Hart Scientific's Model 9125 Surface Dry-well Calibrator is a small, portable instrument designed for quick on-site checks and calibration of surface temperature probes. The instrument is controlled by a microprocessor based digital PID temperature controller and uses a precision platinum RTD as a sensor with a heater to control the well temperature. The controller display shows the well temperature and also the set-point temperature. The temperature may be set to any temperature within the range of the instrument in 0.1 degree increments by using the three buttons on the control panel. The calibrator's multiple fault protection devices insure user and instrument safety and protection.

The 9125 surface calibrator was designed for portability, low cost, and ease of operation. It's use provides a means of quick, accurate calibration and comparisons of temperature sensors and other devices.

3 Specifications and Environmental Conditions

3.1 Specifications

Operating Range	33°C to 200°C (92°F to 400°F)
Accuracy	±0.5°C
Stability	±0.1°C
Resolution	0.1°C, 1°F
Stabilization	Approximately 10 minutes
Heater	150 Watt etched-foil, solid state relay controlled
Cooling	Internal fan
Plate	3.5 x 3.5 inches
Fault Protection	Sensor burnout protection, over temperature cut-out, electrical fuse
Power	115 VAC (±10%), 50/60 Hz, 2.5 amps [230 VAC (±10%), 50/60 Hz, 1.25 amps]
Size	4 x 7.5 x 10 inches (102 x 191 x 254 mm)
Weight	7 lb. (3.2 kg)

3.2 Environmental Conditions

Although the instrument has been designed for optimum durability and trouble-free operation, it must be handled with care. The instrument should not be operated in an excessively dusty or dirty environment. Maintenance and cleaning recommendations can be found in the Maintenance Section of this manual.

The instrument operates safely under the following conditions:

- temperature range: 5–40°C (41–104°F)
- ambient relative humidity: 15–50%
- pressure: 75kPa–106kPa
- mains voltage within ±10% of nominal
- vibrations in the calibration environment should be minimized
- altitudes less than 2,000 meters

3.3 Warranty

Hart Scientific, Inc. (Hart) warrants this product to be free from defects in material and workmanship under normal use and service for a period as stated in our current product catalog from the date of shipment. This warranty extends only to the original purchaser and shall not apply to any product which, in Hart's sole opinion, has been subject to misuse, alteration, abuse or abnormal conditions of operation or handling.

Software is warranted to operate in accordance with its programmed instructions on appropriate Hart products. It is not warranted to be error free.

Hart's obligation under this warranty is limited to repair or replacement of a product which is returned to Hart within the warranty period and is determined, upon examination by Hart, to be defective. If Hart determines that the defect or malfunction has been caused by misuse, alteration, abuse or abnormal conditions or operation or handling, Hart will repair the product and bill the purchaser for the reasonable cost of repair.

To exercise this warranty, the purchaser must forward the product after calling or writing Hart for authorization. Hart assumes NO risk for in-transit damage.

For service or assistance, please contact the manufacturer.

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THE FOREGOING WARRANTY IS PURCHASER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OR MERCHANTABILITY, OR FITNESS FOR ANY PARTICULAR PURPOSE OR USE. HART SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR LOSS WHETHER IN CONTRACT, TORT, OR OTHERWISE.

4 Safety Guidelines

- Operate the instrument in room temperatures between 5–40°C (41–104°F). Allow sufficient air circulation by leaving at least 6 inches of space between the instrument and nearby objects. Overhead clearance needs to allow for safe and easy insertion and removal of probes for calibration.
- The dry-well is a precision instrument. Although it has been designed for optimum durability and trouble free operation, it must be handled with care. Store the instrument with the feet folded up. The instrument should not be operated in excessively wet, oily, dusty, or dirty environments. It is important to keep the plate of the instrument clean and clear of any foreign matter. **DO NOT** operate near flammable materials.
- **DO NOT** use fluids to clean the plate.
- The instrument can generate extreme temperatures. Precautions must be taken to prevent personal injury or damage to objects. Probes may be extremely hot when removed from the instrument. Cautiously handle probes to prevent personal injury. Carefully place probes on a heat resistant surface or rack until they are at room temperature. Never place any objects other than the probe to be calibrated into the well.
- Use only a grounded AC mains supply of the appropriate voltage to power the instrument. The dry-well requires 2.5 amps at 115 VAC (±10%), 50/60 Hz and 1.25 amps at 230 VAC (±10%) 50/60 Hz.
- Before initial use, after transport, and anytime the dry-well has not been energized for more than 10 days, the instrument needs to be energized for a “dry-out” period of 1-2 hours before it can be assumed to meet all of the safety requirements of the IEC 1010-1.
- If a mains supply power fluctuation occurs, immediately turn off the instrument. Power bumps from brown-outs and black-outs could damage the instrument. Wait until the power has stabilized before re-energizing the instrument.
- The calibrator is equipped with an internal electrical fuse. If a fuse blows, it is likely caused by failure of another part. If this occurs, the calibrator should be returned to the factory for inspection.

5 Quick Start

5.1 Unpacking

Unpack the instrument carefully and inspect it for any damage that may have occurred during shipment. If there is shipping damage, notify the carrier immediately.

Verify that the following components are present:

- 9125 Calibrator
- Power Cord
- Manual

5.2 Set-up

Place the calibrator on a flat surface with at least 6 inches of free space around the instrument. The feet may be swung down to raise the front of the instrument from a horizontal position. Plug the power cord into a grounded mains outlet. Observe that the nominal voltage corresponds to that indicated on the back of the calibrator.

Turn on the power to the calibrator by toggling the power switch on. The fan should begin quietly blowing air through the instrument and the controller display should illuminate after 3 seconds. After a brief self-test the controller should begin normal operation. If the unit fails to operate please check the power connection.

The display will begin to show the well temperature and the well heater will start operating to bring the temperature of the well to the set-point temperature.

5.3 Power

Plug the dry-well power cord into a mains outlet of the proper voltage, frequency, and current capability. Typically this will be 115 VAC (±10%), 50/60 Hz or 230 VAC (±10%), 50/60 Hz. Turn the dry-well on using the switch on the rear panel. The dry-well will turn on and begin to heat to the previously programmed temperature set-point. The front panel LED display will indicate the actual dry-well temperature.

6 Parts and Controls

The user should become familiar with the dry-well calibrator and its parts: (See Figures 1, and 2).

6.1 Rear Panel

Power Cord - The removable power cord, (Figure 1) attaches to the back side of the 9125. It plugs into a standard 115 VAC (optional 230 VAC) grounded socket.

Power Switch - The power switch is located on the back panel of the calibrator. The switch has three positions On, Off, or Fan. The on position is for normal operation. The off position disconnects power to the entire unit. The fan position disconnects power to the controller while allowing the fan to remain on for continued cooling.

Fan - A fan inside the calibrator runs continuously when the unit is being operated. Slots at the front of the instrument are provided for airflow. This

Figure 1 *Rear Panel*

provides cooling to the instrument. Allow 6 inches of open space in front and behind the calibrator to allow adequate ventilation.

6.2 Top View

Plate – On top of the unit is the plate to which temperature probes are applied. At the front of the plate is a hole through which probes may be inserted into the plate. The plate cover around the surface plate is not meant for use with probes.

6.3 Front Panel

Controller Display - The numeric LED display shows the process temperature or the actual temperature of the well from 0 to 200°C. (0.0 to 392°F.) The display shows the set-point temperature when the ✱ button is pressed. Located in the upper left of the temperature display is the main set-point (SP1) LED. This is the cycle indicator and shows the on/off state of the block heater.

Controller Buttons - The three buttons on the controller allow for adjustment of the set-point temperature. When pressed, the button marked ✱ toggles the display from the actual block temperature to the set-point temperature with the units of measure being used (°C or °F). While holding the ✱ button, the set-point temperature can be changed by pressing and holding in either the button marked ▲ or ▼ until the desired set-point is reached. The longer the keys are held down, the faster the set-point will change. When the desired set-point temperature is reached, releas-

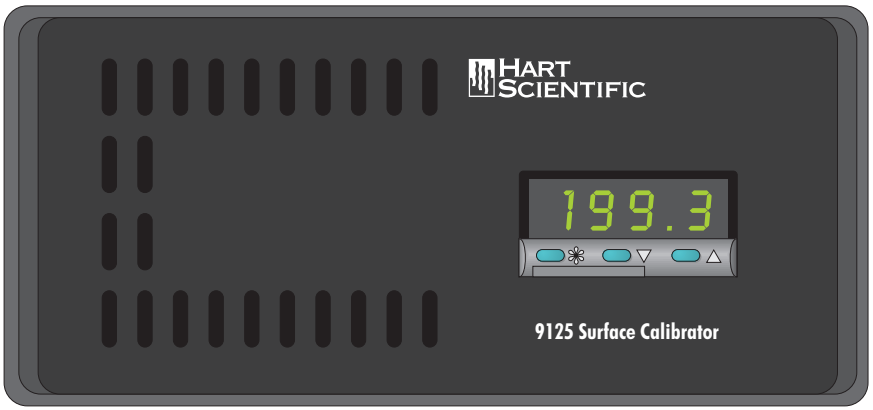

Figure 2 *Front Panel*

ing ✱ button immediately changes the display back to the actual block temperature and the controller begins to heat or cool to the new set-point temperature.

7 General Operation

7.1 Set-up

Place the calibrator on a flat surface with at least 6 inches of free space in front of and behind the instrument. The prop may be swung down to raise the front of the instrument from a horizontal position. Plug the power cord into an AC grounded outlet of the appropriate voltage.

The well must be clear of any foreign objects before probes are inserted. Turn on the power to the calibrator by toggling the switch at the rear of the instrument to the on position. The controller display should illuminate and after a few seconds the fan should begin blowing air through the instrument. If the unit fails to operate check the power connection. When the calibrator is first powered on all of the LED segments will temporarily illuminate as the controller performs a brief self-test and set-up. The display will then begin to show the actual block temperature and the well heater will begin operating to bring the temperature of the well to the set-point temperature.

7.2 Setting the Temperature

The dry-well calibrator may be set to any temperature between 0.0 and 200°C in 0.1°C increments. To set the temperature, simply press and hold the ✱ key and the appropriate ▲ or ▼ button until the desired temperature is attained. Pressing the ✱ button changes the numeric display to show the set-point temperature and activates the ▲ and ▼ keys. Note that the longer the ▲ or ▼ keys are held down, the faster the set-point will change. When the desired set-point temperature is reached, release the ▲ or ▼ and the ✱ buttons. The panel will resume display of the actual block temperature.

If the set-point temperature is changed the controller will cause the unit to heat or cool to the desired set-point temperature. The cycle indicator LED will pulse on and off indicating the duty cycle of the heater. The display will indicate the actual block temperature which continuously changes until it reaches the set-point temperature. A small overshoot in the block temperature is typical as it stabilizes to the set-point temperature. Three to five minutes is normally required for the block to reach the set-point temperature if the set-point is adjusted to a higher value. It may take a little longer if the set-point is adjusted to the outer temperature limits.

8 Controller Operation

The controller is fully programmable. Each of the parameters such as proportional band, integration time, display units, and calibration offset can be viewed and altered. The controller has been configured at the factory for optimum accuracy, stability, and response time. These parameters should not be changed although the user is free to do so if desired. The following section explains how the controller is programmed and particularly how to switch the parameter units from the factory settings.

8.1 Programming

The controller is shipped from the factory with a software lock on all programmable parameters. This prevents accidental accessing and changing of the pre-set parameters. The 9125 parameters can be browsed and read without unlocking the software lock mentioned above. (See Figure 3.)

Programming the controller and accessing the parameter settings is done using the three controller keys just below the display. The program menu is entered and exited by pressing the ▲ and ▼ buttons at the same time for three seconds. After three seconds the controller will enter level 1 of its menu. The display will toggle between tunE and oFF.

From this point in the control menu, the ▲ and ▼ buttons can be used to step up or down through the parameters of level 1. To access another level of the controller, press the ▼ button to step through the controller parameters to the bottom of level 1 until the display toggles between LEUL and 1. From this point the other 2 levels are accessed by pressing and holding in the ✱ button and pressing the ▲ button to step to levels 2 or 3. Each of the 3 levels can be stepped through in the same way using the ▲ or ▼ button.

8.2 Locking/Unlocking the Controller

In order to change any parameter, the controller will have to be unlocked. The lock/unlock parameter is accessed by going into level 3 as explained above. Once inside level 3 (see Figure 3), step up until the UEr and 2 is toggling on the display. Now press and hold the ▲ and ▼ buttons simultaneously for 10 seconds. The LoCK and ALL should now be alternating on the display (see Figure 4). Press the ✱ button and step down using the ▼ button until nonE appears in the display. Holding down the ▲ and ▼ buttons for 3 seconds from this point will unlock all controller parameters and settings and return the controller display to show the block temperature.

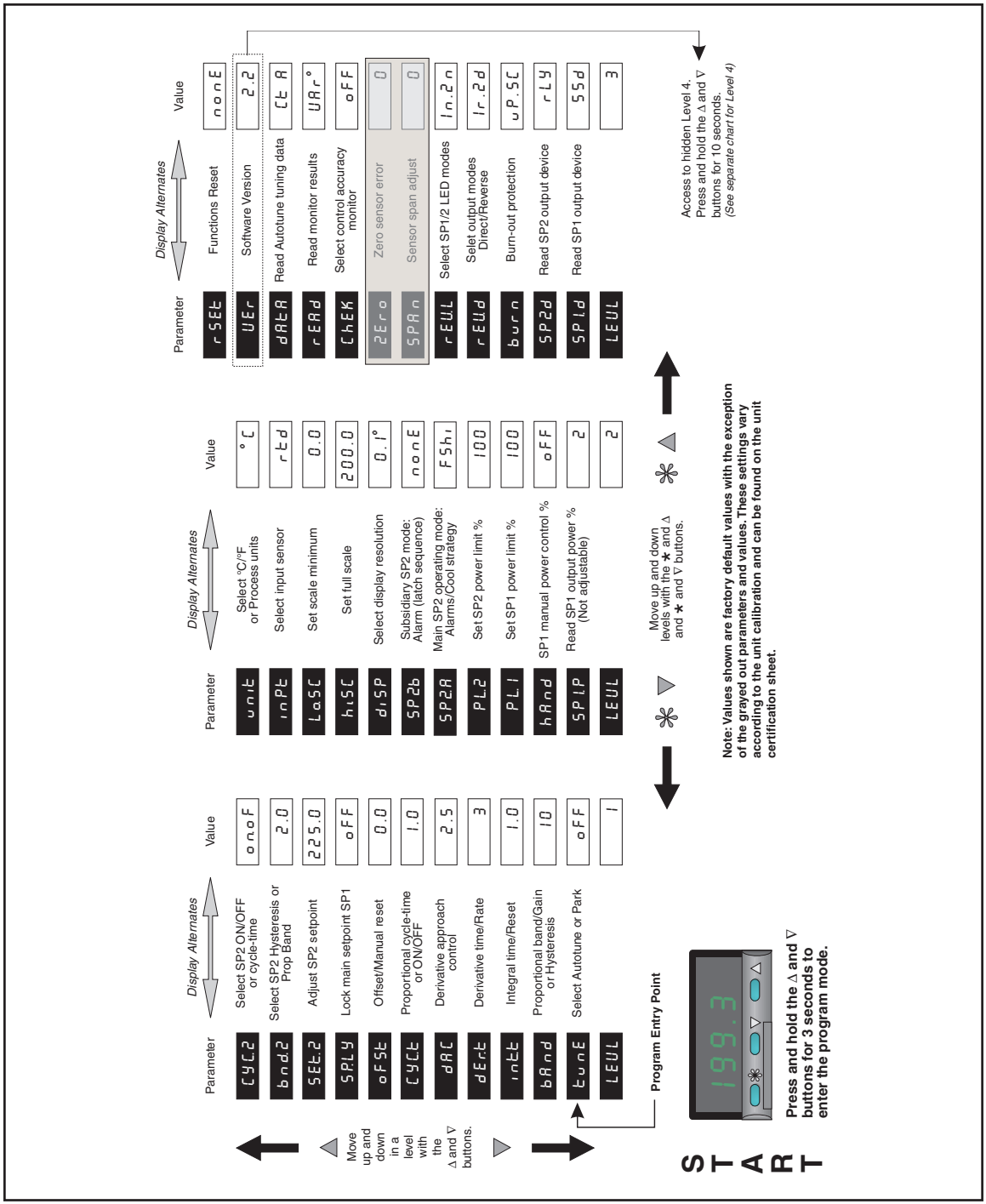

Figure 3 *Controller Programming Chart*

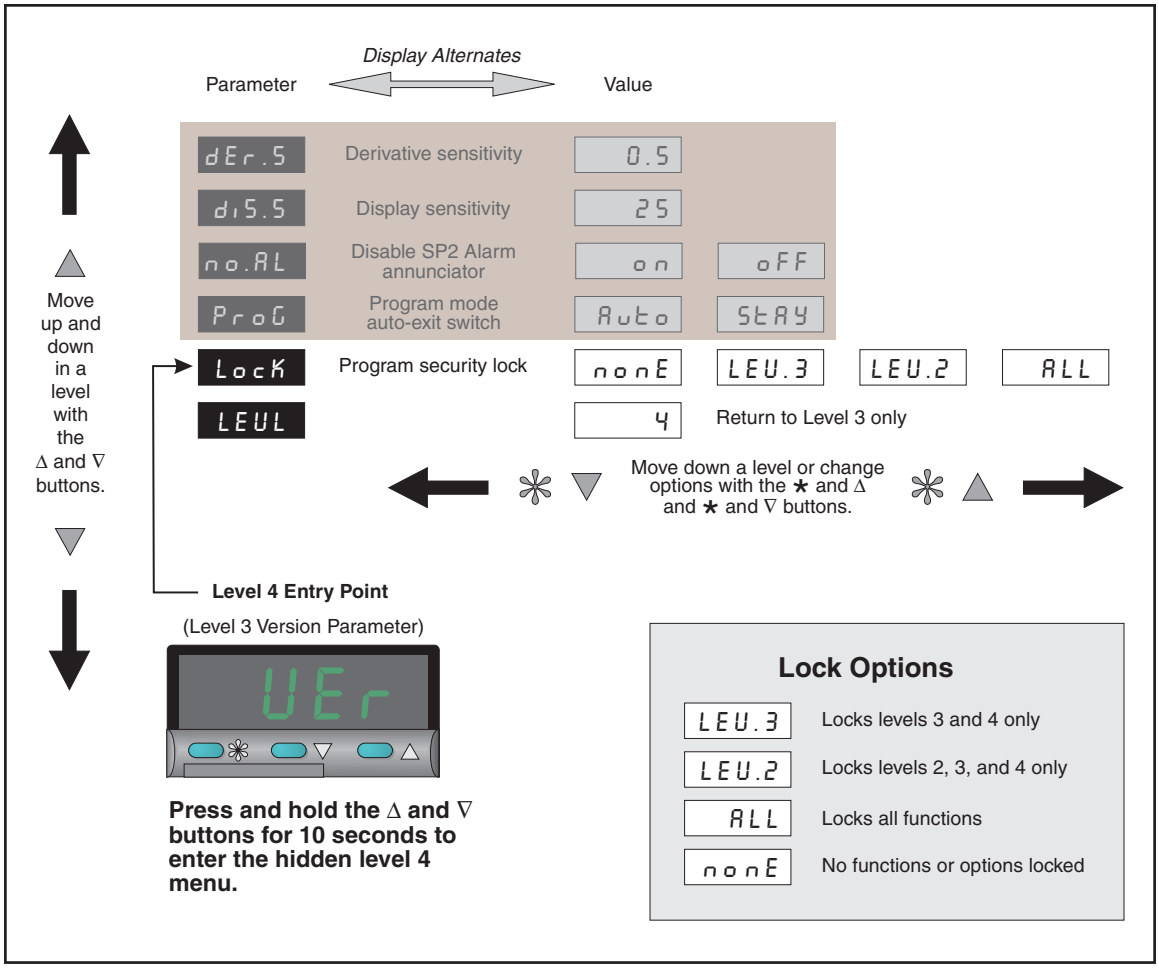

Figure 4 *Controller Level 4 (Parameter Lock Options) Programming Chart*

8.3 Switching display units

The calibrator is set at the factory to display in °C or °F. At some point the user may want to change units from °C to °F or from °F to °C. The unit change is a simple one that can be used as an example of changing any of the variables or parameters within the program menu. After unlocking the controller as described above, press the ▲ and ▼ buttons for 3 seconds. This accesses level 1 of the menu.

Once inside level 1, the other levels of the menu may be accessed. After looking at the menu chart (Figure 3), the user can see that the unit parameter is changed within level 2. Press the ▼ button to get to the bottom

of level 1 where the LEUL and 1 are shown alternating in the display. Press and hold the ✱ button and press the ▲ button until the 2 shows on the display. Now inside level 2, use the ▲ and ▼ buttons to find the unit parameter. Notice how the display flashes between unit and °C. Press and hold the ✱ button and press the ▼ button until °F shows on the display. After the buttons are released, the display should be flashing unit and °F instead of unit and °C. The change has been made.

To return to the temperature display either press and hold the ▲ and ▼ buttons for 3 seconds or wait approximately 1 minute and the controller will automatically return. This is how all of the adjustable parameters for the controller work on the 9125 HDRC Calibrator. The controller may be locked again after changing parameters to avoid accidentally changing one of them. Follow the instructions above and replace the nOnE at the LoCK menu with ALL and then exit out of the program menu as explained.

9 Test Probe Calibration

For optimum accuracy and stability, allow the calibrator to warm up for 30 minutes after power-up and then allow adequate stabilization time after reaching the set-point temperature. The displayed plate temperature should be within 0.1 degree of the set-point.

Place the probe to be calibrated onto the plate of the dry-well calibrator. The probe must make good contact with the plate. Best results are obtained within 1 inch of the center of the plate. Probes may also be inserted into the hole at the front of the plate. Allow adequate stabilization time to allow the test probe temperature to settle. Once the probe has settled to the temperature of the plate, it may be compared to the calibrator display temperature.

After operating the calibrator allow the plate to cool by setting the temperature below 50°C or by setting the power switch to “Fan” position for 30 minutes before switching the power off.

10 Calibration Procedure

10.1 Pre-Calibration

Make sure all parameters in the controller are set according to the parameter table provided in the operation manual.

a) Turn the unit on.

b) Set all parameters to the values shown in the chart.

10.2 Calibration

Accuracy Specification: ±0.5°C for 30 to 100°C ±1.0°C for 100 to 200°C

10.2.1 Span Adjust

1. Record the current span value ($span_{cur}$)

2. Set the controller to 50°C (S_{low}). Allow the dry-well to stabilize (about 15 minutes) after reaching the set temperature.

3. Record the actual temperature of the dry-well at 50°C. (T_{low})

4. Set the controller to 200°C (S_{high}). Allow the dry-well to stabilize (about 15 minutes) after reaching the set temperature.

5. Record the actual temperature of the dry-well at 200°C. (T_{high})

6. The new span value is calculated by the following formula:

$$span = 200 \left(\frac{error_{high} - error_{low}}{T_{high} - T_{low}} \right) + span_{cur}$$

where $error_{high}$ is T_{high}–S_{high} and
$error_{low}$ is T_{low}–S_{low} .

7. Record and set the new span parameter.

10.2.2 Zero Adjust

Note: New temperature measurements must be taken. You cannot use the values from span adjust.

1. Record the current zero value ($zero_{cur}$).

2. Set the controller to 50°C (S_{low}). Allow the dry-well to stabilize (about 15 minutes) after reaching the set temperature.

3. Record the actual temperature of the dry-well at 50°C. (T_{low})

4. Set the controller to 200°C (S_{high}). Allow the dry-well to stabilize (about 15 minutes) after reaching the set temperature.

5. Record the actual temperature of the dry-well at 200°C. (T_{high})

6. Calculate the "zero" parameter by averaging the error values:

$$zero = \left(\frac{error_{low} + error_{high}}{2} \right) + zero_{cur}$$

where $error_{high}$ is $T_{high} - S_{high}$ and
$error_{low}$ is $T_{low} - S_{low}$.

7. Record and set the zero parameter.

10.2.3 Accuracy Check

Set the controller to 50°C. Allow about 15 minutes for stabilization after reaching the set-point temperature. Record the actual temperature of the dry-well. Repeat for set-points of 50°C, 100°C, 150°C, and 200°C.

If any of the measured temperatures are not within specification, repeat the Span Adjust and the Zero Adjust section of the procedure as needed.

11 Maintenance

- The calibration instrument has been designed with the utmost care. Ease of operation and simplicity of maintenance have been a central theme in the product development. Therefore, with proper care the instrument should require very little maintenance. Avoid operating the instrument in an oily, wet, dirty, or dusty environment.
- If the outside of the instrument becomes soiled, it may be wiped clean with a damp cloth and mild detergent. **DO NOT** use harsh chemicals on the surface which may damage the paint.
- It is important to keep the well of the calibrator clean and clear of any foreign matter. **DO NOT** use fluid to clean out the well.
- The dry-well calibrator should be handled with care. Avoid knocking, bumping, or dropping the calibrator. Due to the size and portability of the 9125, it is vulnerable to being shocked and dropped as it is carried around. It may be easily dragged off from a counter top while in use. This action will not only cause damage to the instrument, but may damage probes that are inserted at the time. Never string probe cables or the power cord across an isle where people could trip over them and pull the calibrator from its place. **DO NOT** place objects on top of the calibrator or apply excessive pressure to the chassis. With a little care, this calibrator will provide long-lasting, trouble-free operation.
- **DO NOT** slam the probe stems into the well. This type of action can cause a shock to the sensor.
- If a hazardous material is spilt on or inside the equipment, the user is responsible for taking the appropriate decontamination steps as outlined by the national safety council with respect to the material.
- If the mains supply cord becomes damaged, replace it with a cord with the appropriate gauge wire for the current of the instrument. If there are any questions, call Hart Scientific Customer Service for more information.
- Before using any cleaning or decontamination method except those recommended by Hart, users should check with Hart Scientific Customer Service to be sure that the proposed method will not damage the equipment.
- If the instrument is used in a manner not in accordance with the equipment design, the operation of the dry-well may be impaired or safety hazards may arise.

- The 9125 calibrator is programmed and calibrated at the factory for optimum performance. Field adjustment to the program should not be necessary. If the unit is suspected to be out of calibration or in need of repair, please contact the factory for assistance. The unit should be recalibrated at the factory yearly. Never attempt to modify the unit or alter the programmed constants.
- **Warning: Never introduce any fluids or other foreign material on the plate. This will damage the calibrator and may cause sticking and damage to your probes. In the event that the calibrator should require service or repair, please contact the manufacturer for assistance. The user should not attempt to make any repairs or adjustments.**

12 Troubleshooting

This section contains information on troubleshooting, CE Comments, and a wiring diagram. In the event that the instrument appears to function abnormally, this section may help to find and solve the problem.

12.1 Troubleshooting

Several possible problem conditions are described below along with likely causes and solutions. If a problem arises please read this section carefully and attempt to understand and solve the problem. If the instrument seems faulty or the problem cannot otherwise be resolved, contact Hart Scientific Customer service for assistance (1-801-763-1600). Be sure to have the instrument model number, serial number, and voltage available.

Problem	Causes and Solutions
Incorrect temperature reading	Check the sensor span adjust “SPAn” in Level 2 to see that it is set correctly. Check the zero sensor error “ZEro” in Level 2 to see that it is set correctly. Check the input sensor “inPt” in Level 2 to see that it is set to “rtd”. If not, perform a **master reset** of the controller. (See Section 8.2, Locking/Unlocking the Controller, for the master reset instructions.)
The display is off after waiting 30 seconds	Check that the power cord is plugged in. If the unit has power and the display is off, the fuse may be blown and the unit needs to be returned to Hart Scientific for repair. Contact Hart Scientific Customer Service for a return authorization number.
The display flashes “Input Fail”	There is a sensor error. Contact Hart Scientific Customer Service for a return authorization number.
The display flashes “Input None”	Contact Hart Scientific Customer Service for a return authorization number.
The unit will not heat to 200°C	The ambient temperature is too low.
The user cannot set the temperature to the maximum of minimum values of the unit	Check to see that “hi.SC” in Level 2 is set to 200. Check to see that “Lo.SC” in Level 2 is set to 0.0.

Problem	Causes and Solutions
The controller is locked	Perform a **master reset** of the controller by setting “rSEt” to “ALL”. The controller transfers to Level 5 where, “InPt” must be set to “rtd” “Unit” must be set to “°C” “SPI.D” must be set to “rLY” Re-enter the Level 1,2, and 3 parameters. Refer to figures 4 and 5 and the Report of Calibration for the Level 1, 2, and 3 values.
Temperature read-out is not the actual temperature of the well	With the unit stable, slowly rotate the unit. If no change occurs, the unit may need to be calibrated. Contact Hart Scientific Customer Service. If the display changes more than twice the normal display deviation, another unit in the area could be emitting energy. Move the unit to a different location and rotate the unit again. IF the temperature is correct in this new area or deviates differently than the first area, energy is present in the room. If you have to perform the test in the effected area, use the comparison test to eliminate any possible errors.

12.2 Wiring Diagram

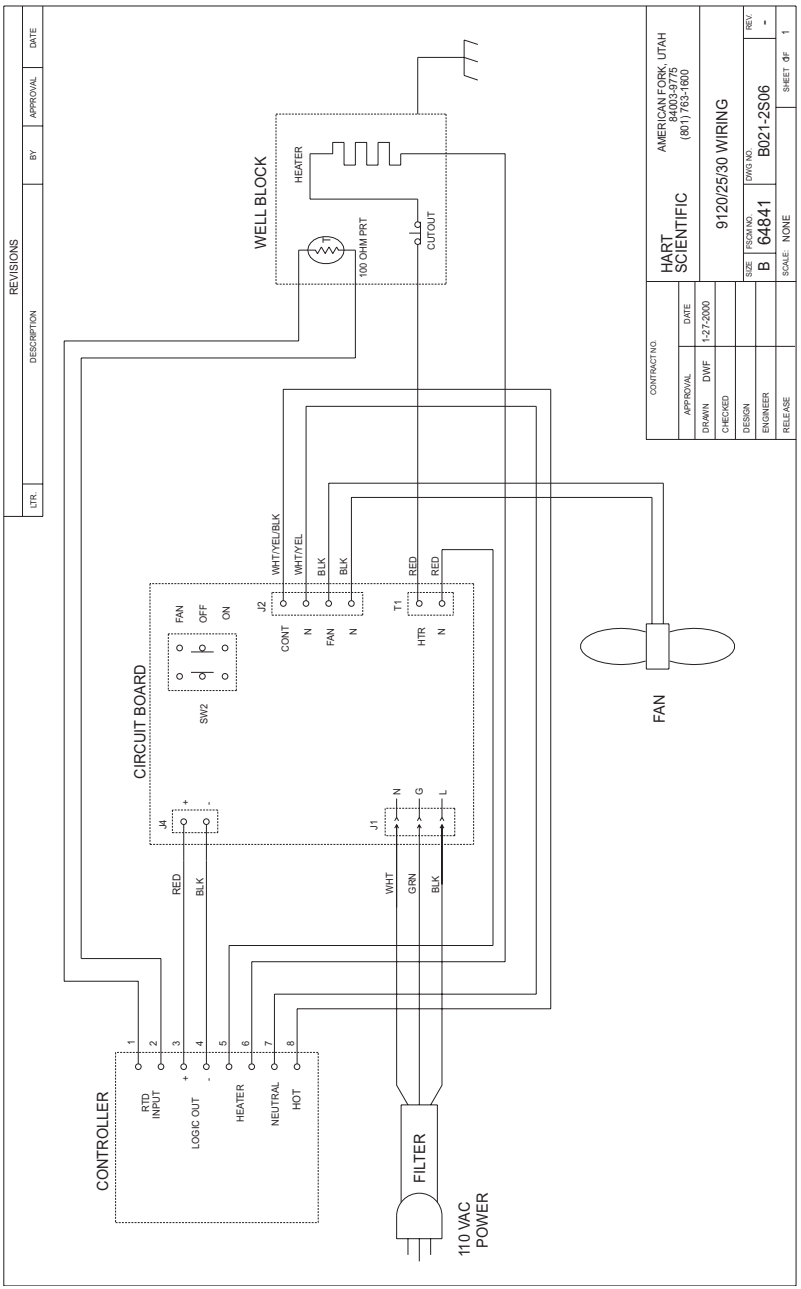

Figure 5 *Wiring Diagram*