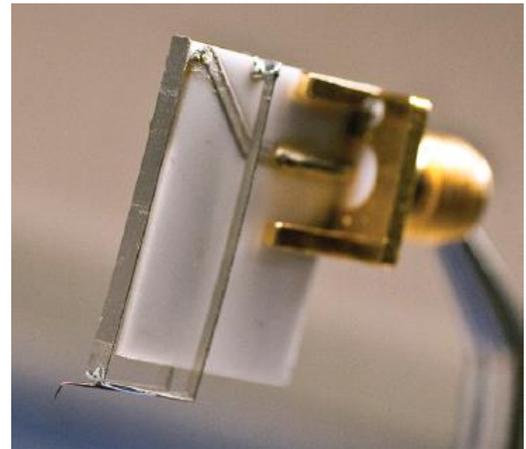


## ZN50R-CVT Probe Operating Instructions

### Introduction

Lake Shore's patented Model ZN50R-CVT (continuously variable temperature) probes enable uninterrupted or unattended variable temperature measurements in the Lake Shore probe stations. The probe's integrated flexible member compensates for thermal expansion in the probe arm that occurs during normal operation when the sample stage temperature is changed. The probe keeps its tip at a fixed landing location.

The ZN50R-CVT probes are interchangeable with standard ZN50R probes, and are compatible with standard ZN50 probe mounts and cable options.



### Removing the probe from the case

Carefully remove the ZN50R-CVT probe from its protective case by grasping the gold SMA connector and gently pulling the probe out of the foam. It may be necessary to rotate the probe back and forth to free the probe from the foam. Be careful not to grasp the silver colored spring member of the probe body as this member is flexible and is easily damaged. Damage to the flexible spring member will affect probe performance. Anytime the probe is removed from the probe station it should be returned to the storage case for protection.

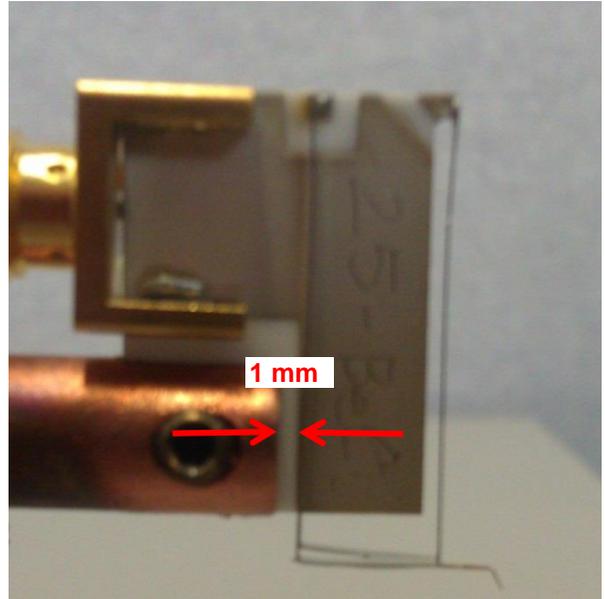
**CAUTION:** Grasping the flexible spring member may cause permanent damage to the ZN50R-CVT probe



## Installation

The procedure for installing a ZN50R-CVT probe is the same as for the standard ZN50R probe. Follow the steps in the section titled *Installing a ZN50R Probe* in Chapter 3 of the probe station manual. The ZN50R-CVT probe should be placed in the holder with the ceramic blade fully inserted into the probe holder and with the bottom of the ceramic blade flush with the bottom of the probe holder as shown in the photo.

When properly installed, the probe will be straight in the holder, and there will be approximately a 1 mm gap between the front of the probe holder and the ZN50R-CVT flexible spring member. This gap is necessary to ensure that the member does not contact the probe holder. If the spring member contacts the probe holder during variable temperature operation, the signal tip for that probe will be electrically shorted to ground.



*ZN50R-CVT probe shown properly mounted in probe holder.  
Ensure there is approximately 1 mm gap between the spring and probe holder.*

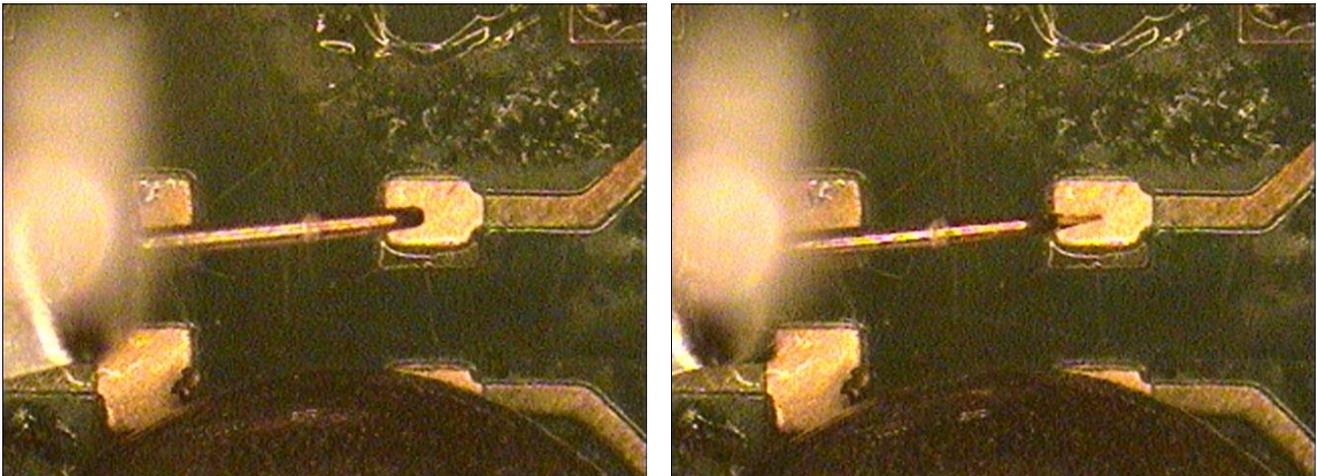
## Operation

Landing the ZN50R-CVT probe tip on the sample surface is different than standard ZN50R probes. Standard probe tips have a tendency to “skate” across the surface of the sample when making contact. The ZN50R-CVT probe does not skate. The spring member will instead flex. Users should watch for this flexing movement when beginning to make contact. Too much downward Z-travel after making contact can result in too much force on the probe tip and cause damage. However, too little downward Z-travel can result in too little force exerted reducing the variable temperature performance. Too little force can also cause poor or inconsistent electrical contact. The proper landing procedure must be followed to ensure the rated performance and consistent measurement results.

## Landing Procedure

The following probe station procedure should be followed for landing the ZN50R-CVT probes. This procedure assumes the probes are installed in the station with the probes a few millimeters above the sample.

1. Use the camera to zoom and focus on the landing pad or area.
2. Use the z-axis micrometer to lower the probe. When the tip makes contact with the landing pad, the spring member and tip assembly will move in the negative X direction while lowering in the z-axis direction. The tip may also begin to bend or flex (see picture below).
3. Note the z-axis micrometer reading at the point of first contact of the tip to the sample. Stable contact between the tip and sample can be made with additional, downward z-axis over-travel past the point of contact.
4. Refer to Table 1 for the recommended amount of probe tip over-travel for each probe station model. The over-travel required is dependent on probe station model. One full turn of the z-axis micrometer is represented by 50 tick marks and is equal to 500  $\mu\text{m}$ .
5. Depending on the sample type and landing pad material, you may need to adjust the landing procedure for best ZN50R-CVT performance.



**Left:** ZN50R-CVT probe tip makes contact with gold pad; **Right:** BeCu probe is over-traveled. Notice the entire probe moves left (negative x-direction) and the tip bends. This exposes more of the top of the probe tip to the camera.

**CAUTION:** Too much over-travel in the z-axis direction can result in damage to the tip or the sample.

|                                 | CPX, CPX-VF, CPX-HF<br>CRX-VF  | TTPX, EMPX-HF, FWPX<br>CRX-6.5K, CRX-4K, CRX-EM-HF                     |
|---------------------------------|--|--|
| Downward over travel on landing | 75 to 100 $\mu\text{m}$<br>(7.5 to 10 tick marks on z-axis micrometer) | 150 to 200 $\mu\text{m}$<br>(15 to 20 tick marks on z-axis micrometer) |

**Table 1.** ZN50R-CVT over-travel for each probe station model

## Temperature Operation

The operational temperature range for the ZN50R-CVT probe is defined as starting at the lowest desired temperature and warming the sample stage through the range. The starting temperature may be anywhere in the probe station's sample stage operating limits. The ZN50R-CVT probe's ability to keep the tip stable while landed on a sample is dependent on both the probe tip (material and radius) and on the probe station model. Composition of the landing pad is also critical to the probe performance. Table 2 gives the temperature range specifications for the ZN50R-CVT probes for each probe station model when landed on gold plated copper pads. Harder or softer pads may affect temperature range.

|                   | CPX, CPX-VF, CPX-HF<br>CRX-VF | TTPX, EMPX-HF, FWPX<br>CRX-6.5K, CRX-4K, CRX-EM-HF |
|-------------------|-------------------------------|--|
| ZN50R-CVT-25-W    | Δ400 K                        | Δ150 K   |
| ZN50R-CVT-10-W    | Δ200 K                        | Δ100 K   |
| ZN50R-CVT-25-BECU | Δ200 K                        | Δ100 K   |

**Table 2.** ZN50R-CVT temperature range for each probe station model

The following probe station procedure should be followed for making variable temperature measurements using the ZN50R-CVT probes. This procedure assumes the probes are installed and the station has been prepared for standard temperature operation using the procedures in the probe station manual.

1. Use the z-axis micrometers to raise all probes 3 mm to 4 mm above the sample. Failure to do so will potentially cause damage to the probe tip or scratch the sample surface.
2. Cool the entire probe station to base temperature allowing the probe arms and radiation shields to stabilize in temperature prior to beginning a measurement.
3. Once the station is stabilized at base temperature, control the sample stage to the desired starting temperature for the measurement.
4. Land the probe tips using the specified amount of probe tip over-travel from Table 1 above.
5. Control the sample stage over the allowable temperature range given in Table 2. The Setpoint ramping feature of the Model 336 is recommended.
6. Once the temperature range is completed, the sample stage may be cooled back to the starting temperature with the probe tip landed, or the probe tip can be raised and re-landed to control the sample stage through another temperature range up in temperature.

**CAUTION:** When the ZN50R-CVT probe is raised at the warm end of a variable temperature run the tip may have a tendency to spring forward as the probe is raised. This spring action may cause damage to delicate sample landing pads. To avoid this, while raising the probes also retract the probe in the negative x-axis direction by approximately 100 to 200 μm to unload the spring tension in the flexible member.