

## **USER GUIDE FOR PPMS STRAIN PROBE**

This datasheet is for the P450 PPMS probe, modified to work with the CS100 and FC100 series stress and strain cells. It applies to both complete probes ordered from Razorbill, and probes converted by customers using a Razorbill conversion kit. See also the standard P450 documentation from Quantum Design, the PPMS manual, the stress or strain cell datasheet and the documentation for your RP100 power supply.



**Mixed metric and US Customary standards.** All Razorbill Instruments cells use metric fixings and fittings. The PPMS and the P450 probe built by Quantum Design use US Customary fixings. Attempting to fit a metric screw into a US hole or vice versa may damage one or the other. Take care to select screws according the screw identification section on page 8. If in doubt, contact Razorbill Instruments for clarification.



Refer to ***Physical property measurement system hardware manual from Quantum Designs*** for instructions on fitting your probe and puck to your PPMS. The puck supplied with this probe is a genuine Quantum Designs PPMS puck that has been modified by Razorbill Instruments. **The puck will need to be adjusted to the correct fit according to the procedure in your PPMS hardware manual.**



**For probe conversion kits, refer to *PPMS1: kit installation*.** If you have purchased a probe conversion kit, you need to fit the kit to your own probe according to the installation instructions. If you have purchased a complete probe from Razorbill Instruments, the conversion has already been carried out at our factory.

## USAGE PRECAUTIONS

In addition to the usual precautions when using the PPMS and probes, the following should be observed when using this probe and the stress or strain cell:

- Never leave the high voltage connections open when the probe is in the PPMS, as temperature changes can cause large voltages to appear on the piezoelectric stacks. If the probe is not connected to a power supply, connect the shorting caps instead.
- To avoid shorts and arcing, make sure that the high voltage connectors within the cryostat are fully mated, and repair any damage to the high voltage lines immediately.
- For best results, the outer braids of the coax cables used for the capacitance measurement should be connected to ground at the

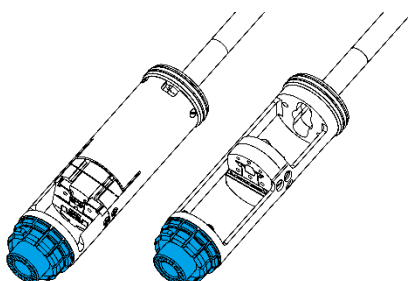
capacitance bridge and nowhere else, and they should also not make contact with each other. Appropriate insulation is provided on the probe, but if normal BNC cables are used outside the probe, then it may be advantageous to cover them in insulating tape or wrap them in paper.

## COMPONENTS & ASSEMBLY

Refer to the PPMS1 technical drawing (at the rear of the document folder, or available from the website at the foot of the page). A table of screw types and locations is also included at the back of this manual.

### Mounting The Puck

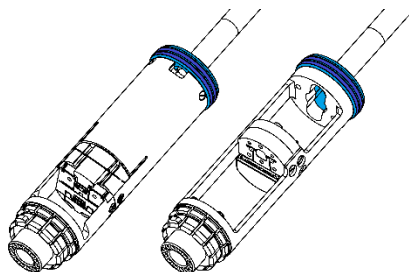
The puck is mounted to the bump guard (FC100) or cell holder (CS100) using 4 tapped holes near its edge. It's easier to fit these before mounting the cell.



It is recommended that the PPMS puck be attached, even if the wiring is not needed. The puck is required for heat transfer, and will protect the fragile sample chamber pins at the bottom of the PPMS from damage.

### Thermal Link Plate & Springs

The thermal link plate fits between the cell and the probe. It is held in place by the screws that hold the cell or cell holder to the probe. The chamfered edge should face down and the holes should line up with the holes in the end of the probe.

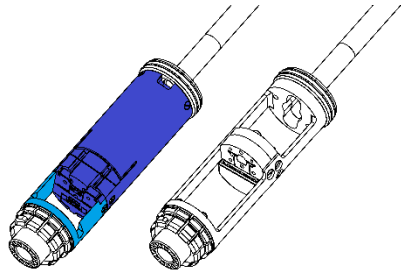


The Thermal link plate has grooves for two thermal link springs. The springs will engage with the PPMS sample chamber about 2-3 cm before the puck engages. If the springs are reluctant to engage, rotating the probe may help – check the spring visually to confirm the direction of twist.

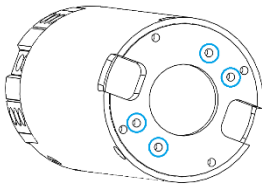
The springs are delicate, and care must be taken to avoid damage. Lightly deformed springs can still be used with no reduction in performance. Two spare springs are provided with each probe.

**Mounting Your Cell: FC100**

The cell holder is not required when mounting an FC100. The thermal link plate fits between the cell and the probe. The puck is screwed to the bump guard



The FC100 is usually mounted sample-down. Mounting it Sample-up is possible, please contact Razorbill Instruments for more information.

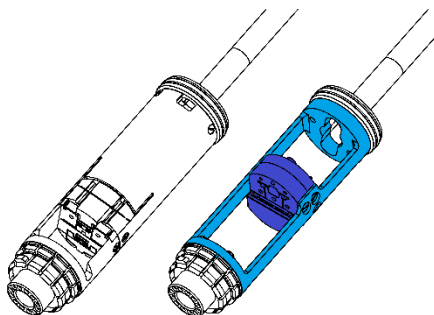


The cell is attached to the probe with four screws using the holes highlighted in the drawing on the left.

The wiring needs to be fed through the holes in the thermal link plate and the probe end plate.

## Mounting Your Cell: CS100

The CS100 mounts into cell holder. The thermal link plate fits between the cell holder and the probe. There are three countersunk holes for M2 screws, which allow mounting in vertical or horizontal arrangements. The cell is supported on one side only so that the difference in thermal expansion between the copper cell holder and the titanium cell does not distort the cell. The wiring needs to be fed through the holes in the top of the cell holder, the thermal link plate and the probe end plate.



## CONNECTORS & WIRING

A complete wiring diagram is included in the Technical Drawings section at the back of this folder, or can be obtained from Razorbill Instruments. The calculated heat load of all the cabling running down the probe is 2.5 mW at 4 K, which has no discernible impact on the cooling capability of the PPMS.

### Coaxial Cables

The coaxial connectors are standard, and should mate with any connector of the same standard. The small ones inside the vacuum chamber are MMCX and the ones on the top plate are SMA. The cables are Lakeshore SS.

### Drive Wiring

The drive wires inside the cryostat also use Lakeshore SS cable, but only the cores are connected. The sheath is used for mechanical protection only. The small “stepped” connectors are LEMO FGG.0S.302.ZLAT, which mate with the same. The feedthrough at the top of the probe are LEMO HGG.0B.302.CLLPV. They will mate with any LEMO 0B.302 series plug.

## Puck Wiring

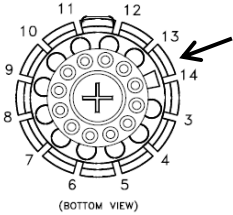
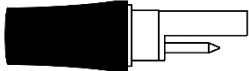
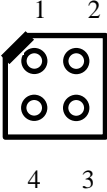

The puck is a Quantum Design P101, which has been modified with the addition of wiring and connectors. The black pin-header type connectors are Preci-Dip 853-87-004-10-001101 which have been chamfered to mark pin 1. They mate with Preci-Dip 852-80-004-10-001101 or any similar round-pin header.

For standard PPMS wiring, each of the three pin-header connectors on the top of the puck corresponds to a channel on the Quantum Design Model 6000. A summary of the connections is shown in the table below.

Puck connector pad number	Preci-Dip pin number	Preci-Dip connector	Model 6000 channel	Model 6000 function
3	1	Left (1)	1	I +
4	2			I -
5	3			V +
6	4			V -
7	1	Middle (2)	2	I +
8	2			I -
9	3			V +
10	4			V -
11	1	Right (3)	3	I +
12	2			I -
13	3			V +
14	4			V -

Unmodified pucks can be supplied by Quantum Design. If you require an additional modified puck, contact Razorbill Instruments. LEMO connectors can be supplied by Razorbill instruments (no minimum order) or direct from LEMO. MMCX, SMA, Preci-Dip headers and the LEMO connectors used outside the cryostat are also available from most electronics distributors.

Drawings of the connectors, including pin number assignments, are below:

<p>View onto mating face (fiberglass cover removed)</p>  <p>Square pad marks pin 14</p> <p>(BOTTOM VIEW)</p> <p>PPMS puck sample connector. Mates with PPMS chamber.</p>	 <p>1: Male pin (exposed) 2: Female pin (hidden)</p> <p>PEEK stepped connector. LEMO FGG.0S.302.ZLAT. Mates with the same.</p>
<p>View onto mating face</p>  <p>Chamfer marks pin 1</p> <p>Three connectors numbered 1-3 from left to right*</p> <p>Preci-Dip 853-87-004-10-001101 Mates with most standard headers with round pins on a 1.27mm pitch.</p>	<p>View onto mating face</p>  <p>Red dot and keyway</p> <p>Pin 1 Pin 2</p> <p>LEMO HGG.0B.302.CLLPV. Mates with any LEMO 0B.302 series plug.</p>

\* probes or kits shipped prior to May 2019 may use coloured heat shrink to identify connectors (blue = 1, brown = 2, black = 3)

## SCREW IDENTIFICATION

The P450 probes are manufactured by quantum designs using US Customary screw standards UNF and UNC. To avoid confusion, Razorbill Instruments has used the same standards for screws used in modifying the P450 probe. All Razorbill instruments stress or strain cells use metric fasters throughout, so the fully assembled probes must contain a mixture of screw standards. It is important not to use the wrong screws, as in some cases the different standards are close enough for the wrong screw to insert several turns before being damaged, or to insert fully but exhibit reduced strength. The below table identifies all the screws used in the probes, including those supplied by Quantum Design.

Description	Material	Standard	Dimension	Quantity
PEEK top plate to Probe head (upper body seal)	Stainless steel	UNC	4-40 x 9/16"	8
Probe head upper and lower seals	Stainless steel	UNC	4-40 x 5/16"	16 (8 removed)
Probe head to probe rod	Stainless steel	UNC	10-24 Grub screw	1
FC100 to probe	Brass	Metric	M1.6 x 8	4
Cell holder to probe	Brass	UNC	4-40 x 3/8"	2
CS100 to cell holder	Brass	Metric	M2 x 3	2
Puck to cell holder or FC100 bump guard	Brass	UNF	0-80 x 3/16"	4

All screws fitting into Razorbill Instruments cells are metric. For dimensions refer to the technical drawing for the specific cell.