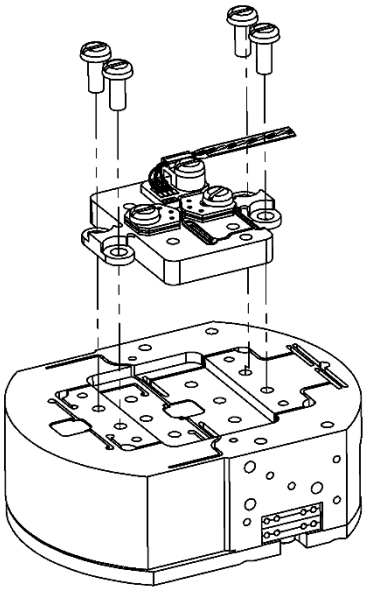
SR200 Sample Carrier

Datasheet for sample carriers which fit UC200 cells



The SR200 Sample Carrier is an alternative to the standard sample plates to use with the UC200 Universal cell. It supports the sample separately from the cell and is designed to allow samples to be rapidly exchanged, without breaking the sample. By using several Sample Carriers with one UC200, new samples can be prepared while the device is in use for an experiment, or samples can be tested then put aside to return to later.

The sample carrier is not suitable for all use cases however, as delicate samples may not survive handling, and the flexures used in the sample carrier cause some disturbance of the force sensor in the UC200. The SR200 is most suitable for larger, stronger samples.

Specifications

Stiffness and force measurement

The flexures in the sample carrier are placed in parallel with the sample. This means that as they move, the force needed to deflect them will be recorded by the force sensor and added to the force needed to strain the sample. The stiffness of these flexures is around 0.06 N/µm but does vary between individual carriers. The measured displacement from the UC200 displacement sensor can be used to correct for this effect. To maximise the accuracy of this correction, it is recommended that you perform a calibration using the particular carrier and UC200 you intend to use in your experiment.

This calibration can be done by attaching the carrier to the cell without any sample, and exercising the cell through the full voltage range. The force-displacement curve of the carrier can then be calculated and subtracted from the final experimental results.

The SR200 raises the sample location by around 4 mm, which slightly increases the sensitivity of the force sensor, but this effect is small – typically < 0.2%

Series stiffness

The hinges necessary to take up any misalignment when the carrier is mounted back on the cell also have some compliance when the cell is applying force to the sample. The spring constant of the sample carrier is approximately 4 N/µm and lies in series with the 4 N/µm spring constant of the cell itself. This has the effect of reducing the apparent stiffness of the cell to 2 N/µm. This means that although the full displacement range of the cell remains available, the zero-displacement force reduces to approximately 20 N at 4 K. The UC200 datasheet has further discussion of cell and sample stiffness.

Using the sample carrier

There are two possible approaches to using the sample carrier. Firstly, the sample may be mounted on the carrier when the carrier is on the cell. Alternatively, the sample may be mounted on a carrier that has been removed from the cell.

Mounting the sample when the carrier is on the cell is likely to give the best results. Once the sample mounting epoxy has cured it should be possible to remove and reattach the carrier.

Mounting the sample with the carrier off the cell is particularly useful when using epoxies that need to be cured at higher temperature than the cell can withstand.

To minimise the difference in position between each mounting, keep the mating faces clean and free of debris and place the carrier in the same orientation each time.

Sample mounting arrangement

There are two methods of mounting a sample on the SR200 sample carrier. Samples can be mounted using the standard sample plates and spacers used on the UC200. Alternatively, samples can be directly glued to the sample carrier. It is preferable to use the standard sample plates and gluing the samples directly to the sample carrier should only be done if there is no space for the mounting screws (for example, if good sample access is required for SPM).

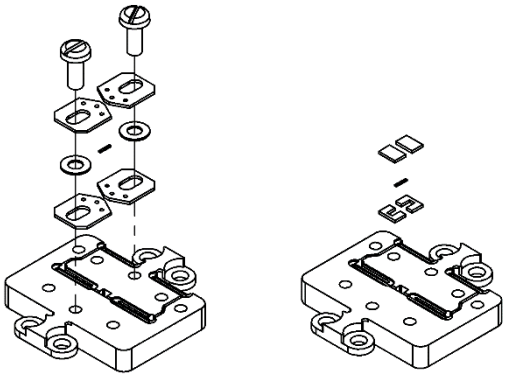
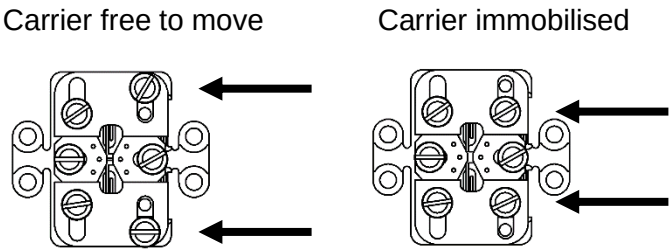


Figure 1: A SR200 sample carrier with standard SP200 sample plates (left) or C-shaped spacer and top cover plate, SP150, (right).

If gluing samples directly to the sample carrier we recommend that a C-shaped spacer and top cover plate (SP150 sample plates) are used instead of the standard sample plates and these are available on request. Please let us know before purchase for these to be included instead of the standard sample plates. When gluing the specimen directly to the carrier, the sample length cannot be set by sliding the sample plates forward and back because the lower surface will be the carrier itself. The gap in the centre of the carrier is 1.2 mm, but this can be extended by removing material from the carrier using e.g. wire EDM or an abrasive slurry saw. To prevent damage to the flexures, the carrier must be immobilised before any machining step. This can be done by screwing the sample plate guides to the carrier as shown below.

The sample plate guides supplied with the UC200 will fit the SR200. If the outermost screws are used, the SR200 can move, if the innermost screws are used it will be immobilised.



Using a WP101 wiring platform with a sample carrier

The WP101 wiring platform offers 4 or 8 electrical contacts close to the sample. Contacts are supplied through twisted pair wiring and fitted with a copper heat sink. For more information see the WP101 datasheet.

The sample carrier has tapped holes in it. These are positioned so that WP100 wiring platforms can be mounted on the carrier. Some of these holes line up over the holes in the cell where the platforms can be attached if the sample carrier isn't used. Use M2 x 6 screws, which will secure the wiring platform without protruding from the bottom of the sample carrier.

Do not put a longer screw right through the threaded hole in the sample carrier and into the cell below, as this may damage the carrier.

Accessories and replacement parts

	Part Number	Description
Normal spacers and sample mounting plates	SP200	Replacement sample mounting plates of the type supplied with the UC200
Direct mount spacers and sample mounting plates	SP150	Rectangular upper sample plates and C shaped spacers allowing a sample to be glued direct to the carrier
Wiring Platform	WP101	Provides 4 or 8 electrical contacts close to the sample, with incoming wiring passing through a copper heat sink. See WP101 datasheet for options
Wiring platform screw	N/A	M2 x 6 Brass
Carrier-to-cell screws	N/A	M2 x 4 Brass