MeasureMax+™
Measurement Software
For Sheffield® Coordinate Measurement Machines

MeasureMax+ Utilities for Probe / Stylus Changers

1 March 2003

At Giddings & Lewis, our business is quality and precision. To help us maintain a high level of quality, we invite you to send us your comments.

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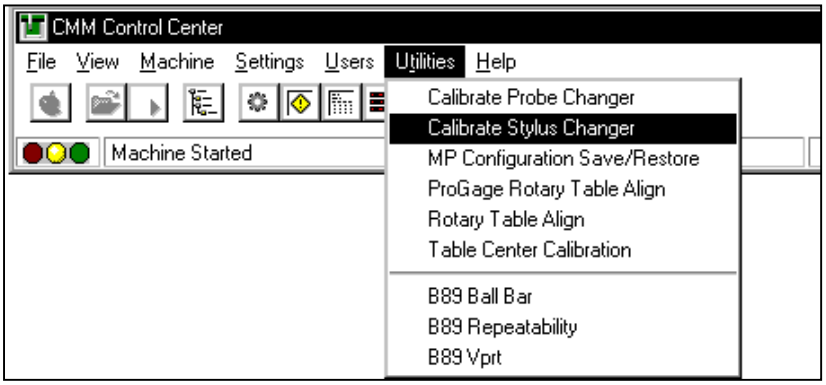
Probe / Stylus Changers

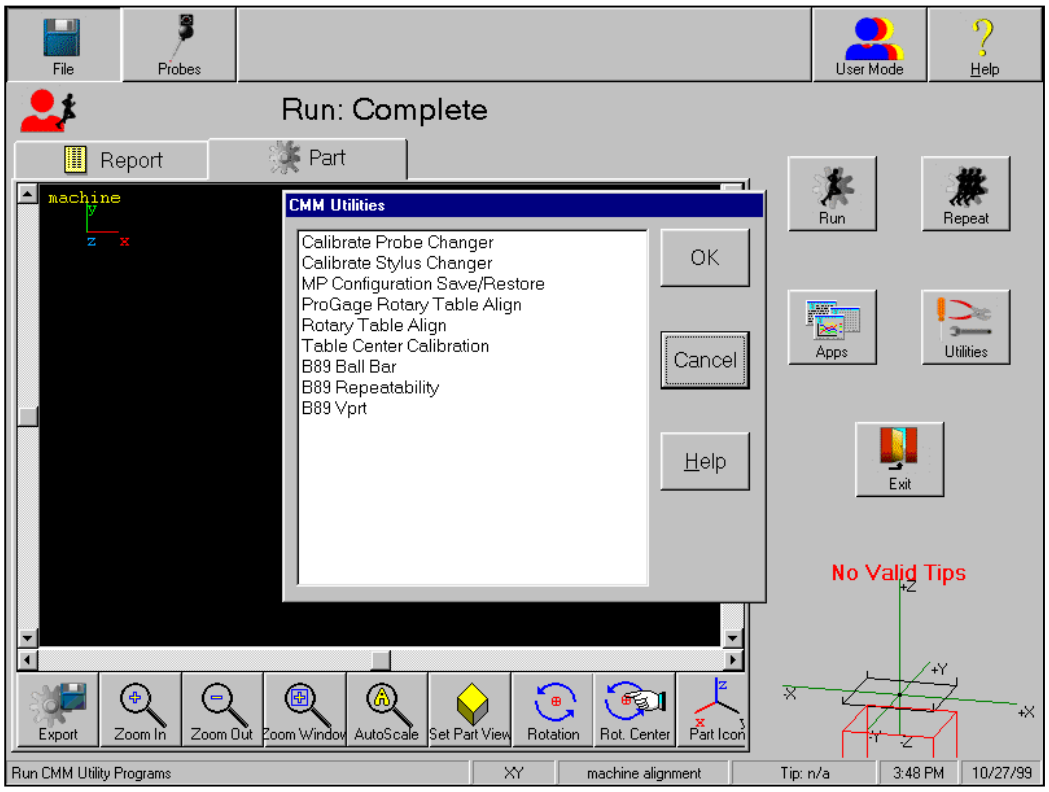
Your Cordax Measurement Suite™ includes several utilities that are used for calibration purposes. At the time your probe changer or stylus changer is installed, one of the Calibration Utilities should be run to store the location and orientation of the probe rack permanently into the memory of the SMP/MP.

This document will assist you in running the correct utility to calibrate your rack. Be aware that due to different versions of software and system configurations, the appearance and wording of your windows and prompts may vary somewhat from this document; however, the operation and instructions will be very similar.

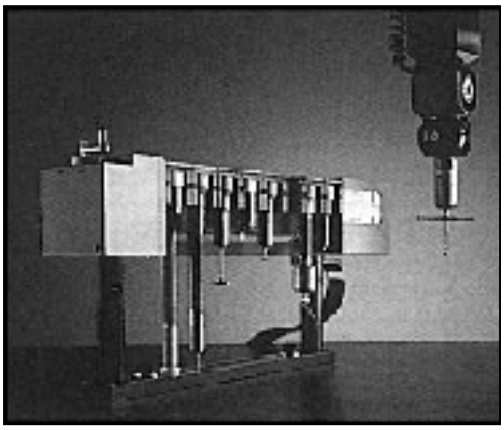
The utilities can be accessed from the Utilities pulldown menu in the MeasureMax Control Center window.



Or, from the CMM Utilities window in the MaxLite User Mode Run window.



ACR1 Autochange Rack



The Renishaw® ACR1 facilitates fast, automatic probe exchange for eight probes and probe extensions.

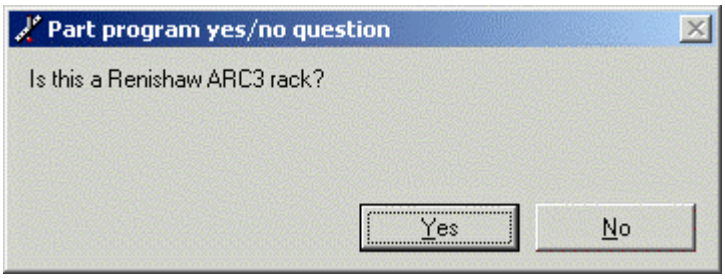
If the picture at the left does not resemble your rack, then you do not have an ACR1 and should not follow these instructions.

Step 1 – Start Utility.
Start the *Calibrate Probe Changer* (also referred to as CALSTA) utility to calibrate the ACR1. Before you start the utility, make sure that an appropriate probe with a diameter less than 3mm is mounted and calibrated as tip 0 oriented in the downward position.

As you run through the utility, the Prompt monitor displays a brief set of instructions for your assistance. All prompts assume that you are facing the rack with its lids on top and station #1 to your left.

Step 2 – Rack Type
Prompt: "Is this a Renishaw ACR3 rack?"

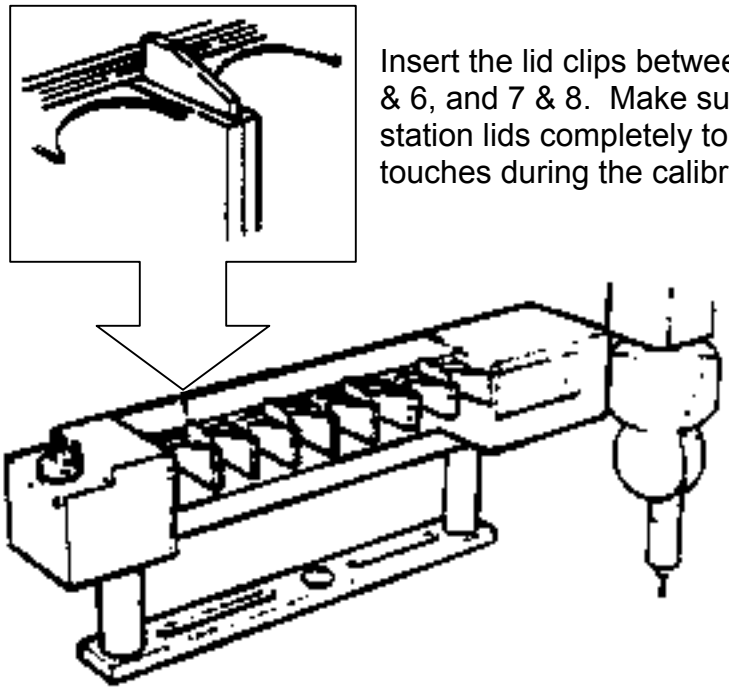
The default answer is "YES". Click on the "**NO**" box to calibrate the ACR1.



Step 3 – Equipment Location.
Prompt: "Enter rear to front rack axis (X, -X, Y, -Y, Z) [-Y]"

The first question asks which axis end describes the location of the ACR. Usually, on a Vertical Arm CMM, the rack is mounted at the back of the table (+Y table end). In this case, the stations open toward the -Y direction (enter -Y). The stations should always open toward the center of the table.

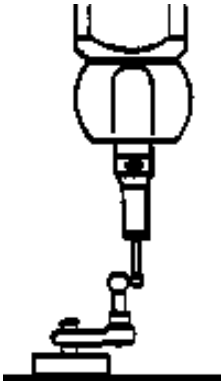
Step 4 – Insert Lid Clips.
Prompt: "Place lid clips in the rack and press reset on the Autochange control unit. Press Record."

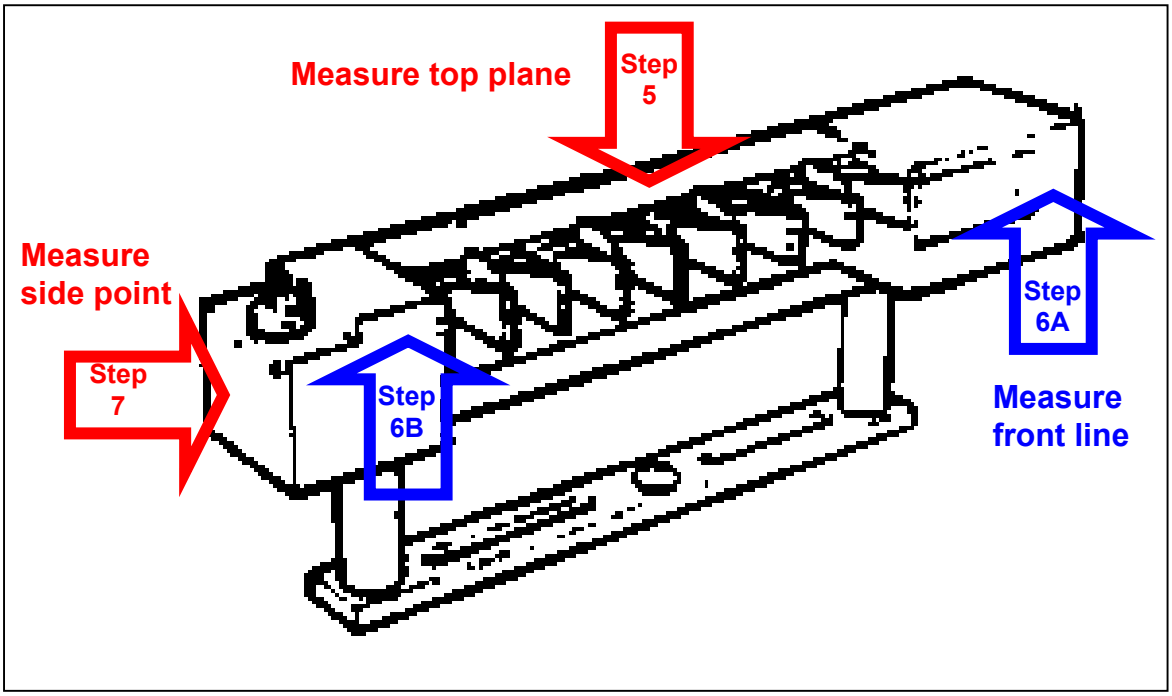


Insert the lid clips between stations 1 & 2, 3 & 4, 5 & 6, and 7 & 8. Make sure the clips open the station lids completely to avoid unexpected touches during the calibration.

Press Reset on the Autochange control unit. Then press Record on the RCU.

Step 5 – Measure Sphere.
Measure four points on the ACR sphere. The Manual Measure window is displayed to assist you. Remember to press the Record button to validate each touch, if appropriate.





Step 6 – Measure Plane.
Measure three points on the top surface of the ACR.

Step 7 – Measure Line.
Measure a point on the front surface to the right of station #8, near the ACR lights. Then measure a point on the front surface to the left of station #1, near the ACR sphere.

Step 8 – Measure Point.
Measure a point on the left side of the ACR, near the ACR sphere.

Step 9 – Rack Calibration.
Press the Auto button on the RCU when so prompted. The utility then measures the ACR sphere and each station.

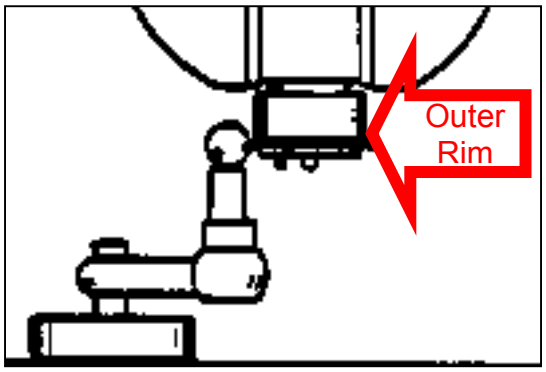
Step 10 – Remove Lid Clips.
Prompt: "Remove clips from the rack. Machine will initialize, park and then prompt for head probe calibration. Press Record on RCU to proceed."

Remove the lid clips. Turn servos on and position for a clear move to the zero switches. Press Record and Auto.

Step 11 – Calibrate Probe Head.
Prompt: "Remove probe from the probe head then measure rack sphere using probe head. Take 4 points using the edge of the probe head. Take 1 point using a flat on the bottom of the probe head."

Put the servos in manual mode. On an RCU2, pressing the Auto or Joy button does this.

Remove the probe from the probe head using the key provided with your probes.



Record four points around the equator of the rack sphere using the outer rim of the probe head bottom. Then record one point on the top of the sphere with a flat area on the bottom of the probe head. Be careful that a pin on the probe head is not used.

Step 12 – Safe Position.
Prompt: "Record safe position."

The SMP/MP needs to know a safe position that it can use when changing a probe. The machine will move directly to the safe position before going to the Autochange Rack. It will reorient the PH9/10 if necessary, and then move directly from this position to the rack. After unloading and/or loading a probe, the machine will return to this position and then if necessary reorient the PH9/10.

Move the machine to an appropriate safe position and press Record on the RCU to proceed.

Step 13 – Calibrate Extensions.
Prompt: "Do you wish to calibrate any extensions?"

If you answer "yes" to this prompt, proceed with the following steps.

- Enter the station number that contains the extension. If you manually insert an extension or probe into a station, ensure that the key slot aligns with the screwdriver that is located at the rear of each station.

- Ensure a clear path to the safe position and press Record. Press the Auto button on the RCU when so prompted.

- The system will automatically pick up the extension.

- Put the servos in manual mode.

- Record four points around the equator of the rack sphere using the outer rim near the bottom of the extension. Then record one point on the top of the sphere with a flat area on the bottom of the extension. Be careful that a pin on the extension is not used.

- Ensure a clear path to the safe position and press Record.

- When the system is in auto mode, it will automatically return the extension.

Step 14 – Verification.
Performing this verification step is not required; however, it is recommended that you confirm that you correctly followed the calibration steps. During verification you should place the servos in slow mode and be prepared to quickly put the servos in manual mode should the machine drive to an unexpected position.

You will need to use the Function Command String window in MeasureMax QuickTeach or MaxLite to send FCS commands.

Use the following steps to verify that the probes and extensions can be exchanged.

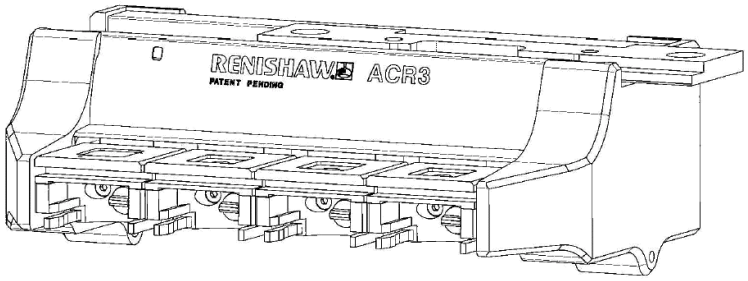
- Put the servos in manual mode. On an RCU2, pressing the Auto or Joy button does this. Make sure that station #1 contains a probe and station #8 contains an extension that has been calibrated for the ACR.

- Send the FCS command **GS 1**. The system will go through the motions of loading a probe from station #1 of the rack.

- Send the FCS command **GS 8,1**. The system will return the probe to station #1, then pickup the extension in station #8 and the probe in station #1.

- Send the FCS command **GS 0** to unload the probe and extension in their respective stations.

ACR3 Autochange Rack



The ACR3 autochange rack is the latest in Renishaw® probe change technology. The ACR3 utilizes the CMM movement to lock or unlock the joint between the probe and probe head. No electrical power or control connections are required. The ACR3 provides docking stations for four probe combinations. A second ACR3 may be fitted to provide a total of eight stations. The ACR3 is mounted in the CMM volume using the Renishaw® Modular Rack System (MRS).

Extension bars are not supported as separate tools. The ACR1 and ACR3 are supported separately. A Sheffield MP will not support both rack types at the same time. Refer to Renishaw® documentation for installing and aligning the MRS to the CMM before performing calibration of the SCP600 or ACR3.

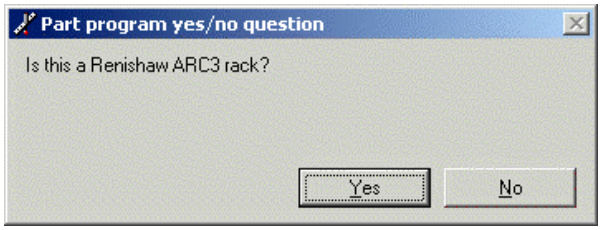
Beginning the calibration of the ACR3 is similar to the procedure for the ACR1.

Step 1 – Start Utility.
Start the *Calibrate Probe Changer* (also referred to as CALSTA) utility to calibrate the ACR3. Before you start the utility, make sure that an appropriate probe with a diameter less than 3mm is mounted and oriented perpendicular to the station openings.

As you run through the utility, the Prompt monitor displays a brief set of instructions for your assistance. All prompts assume that you are facing the rack with its lids on top and station #1 to your left.

Step 2 – Rack Type
Prompt: "Is this a Renishaw ACR3 rack?"

The default answer is "YES". Select the "**YES**" answer or press the ENTER key to calibrate the ACR3.



Step 3 – Rack Ports
Prompt: Is this a 4 or 8 station rack? (4,8) [4]:

The default answer is 4. Enter 4 or 8 and press the ENTER key.

Step 4 – Equipment Location.
Prompt: "Enter rear to front rack axis (X, -X, Y, -Y, Z) [-Y]"

The first question asks which axis end describes the orientation of the ACR3. Usually, on a Vertical Arm CMM, the rack is mounted at the back of the table (+Y table end). In this case, the stations open toward the -Y direction (enter -Y). The stations should always open toward the center of the table.

Step 5 – System Reset
Prompt: "The machine will now initialize then begin calibration.
PRESS RECORD ON RCU TO PROCEED"

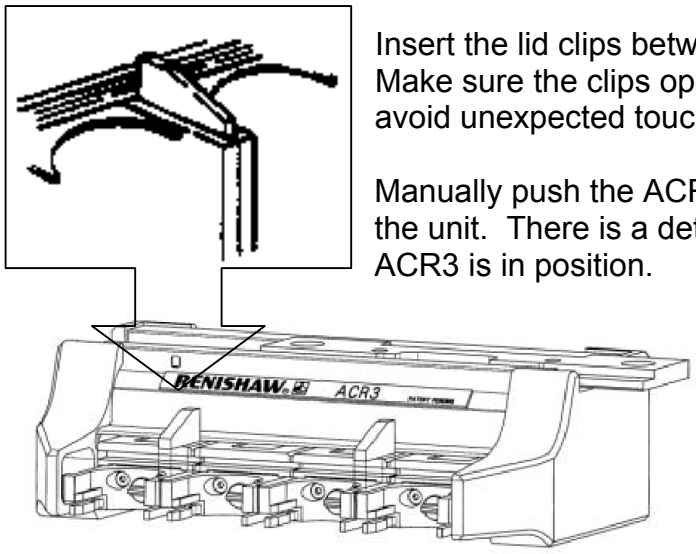
The CMM will now enter a reset phase and search for the scale zero reference.

Prompt: "Enable the servos and put in AUTO mode to continue."

Step 6 – Probe Qualification
Prompts: "Position the probe over the calibration sphere. Press RECORD."
"Position the probe 150 mm above the sphere."
"Position the probe 6 mm above the sphere."

Enable the joysticks and manually move the CMM probe as directed by the prompts. Press the RECORD button on the Remote Control Unit after completing each movement. The probe will then auto-calibrate on the reference sphere.

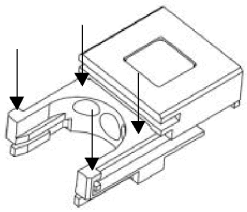
Step 7 – Insert Lid Clips.
Prompt: "Position the rack to the UNLOCKED position and place the lid clips to hold the stations open. Press RECORD when ready."



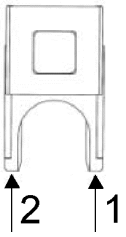
Insert the lid clips between stations 1 & 2 and 3 & 4. Make sure the clips open the station lids completely to avoid unexpected touches during the calibration.

Manually push the ACR3 towards the left, when facing the unit. There is a detent in the rack slide when the ACR3 is in position.

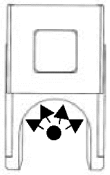
Step 8 – Measure Plane.
Manually measure four points on the top rails of the open station #1 of the ACR3 as shown.



Step 9 – Measure Line.
Manually measure a point (1) on the front surface of station #1. Then measure a point (2) on the the left rail of station #1.



of the right rail front surface of



Step 10 – Measure Station Circle.
Manually measure four points round the curved part at the rear of station #1 as shown here.

Step 11 – Rack Unlocked Position Calibration.
Press the Auto button on the RCU when so prompted. The utility then measures each of the ACR3 stations.

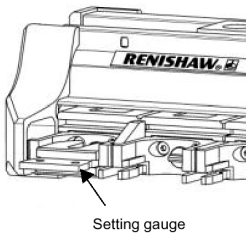
Step 12 – Rack Locked Position Calibration.
Prompt: "Position the rack to the LOCKED position, then press RECORD."

Manually slide the ACR3 towards the right until the locked position detent is felt. Press the Auto button on the RCU when so prompted. The utility then measures the ACR3 station #1 again.

Step 13 – Remove the Probe Head, Install the Setting Gauge.
Prompt: "Remove the probe from the head at the auto-joint."

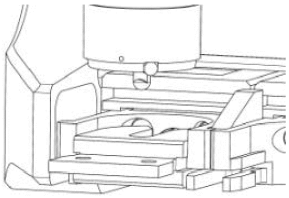
Manually remove the probe from the probe head

Step 14 – Install the Setting Gauge.
Prompt: "Install the setting gauge in *** STATION 1 ***."



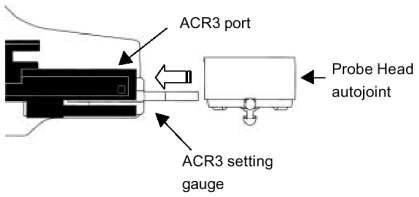
Manually place the Renishaw® supplied setting gauge into the ACR3 station #1. Do not move the ACR3.

Step 15 – Set the Joint Face.
Prompt: "Drive the head to the top center of the setting gauge so that the joint face just touches the gauge top. Then press RECORD."



Enable the joystick and position the joint face so that it is just above the top surface of the setting gauge. Enable AUTO mode. The RCU is now set to fine position the probe head. Use the DRIVE button to move the probe head to the setting gauge. Each press of the DRIVE button will move the head .050mm. The RETURN key will move the head away from the gauge. Do not overdrive the probe head. Use the gauge as a feeler to sense the proximity of the joint face. If the head should dislodge, move the CMM away from the ACR3, clear the error and set the face again. Press the RECORD button when the probe head is in position.

Step 16 – Set the Joint Edge.
Prompt: "Now drive the head so the joint body is touching the setting gauge at the port front. Then press RECORD."



Enable the joystick and, in **slow** mode, position the joint cylinder so that it is near the front edge of the setting gauge. Enable AUTO mode. The RCU is now set to fine position the probe head. Use the DRIVE button to move the probe head to the setting gauge. Each press of the DRIVE button will move the head .050mm. The RETURN key will move the head away from the gauge. Do not overdrive the probe head. Use the gauge as a feeler to sense the proximity of the joint cylinder. If the head should dislodge, move the CMM away from the ACR3, clear the error and set the cylinder again. Press the RECORD button when the probe head is in position.

Step 17 – Auto-Move for ACR3 Positioning.
Prompt: "The head will now drive in front of station 4 before the last alignment step. PRESS RECORD ON RCU TO PROCEED"

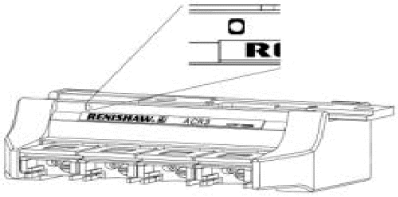
Enable Auto so that the probe head may auto-move for the next step.

Step 18 – Position the ACR3 for Slide Offset.
Prompt: "Position rack so that station 4 is directly behind the probe. Drive the probe head so that the joint is in station 4. "

Position the ACR3 so that its station #4 is directly in front of the probe head. Enable the joystick and drive the head into the station.

Step 19 – Manually Jog the CMM.
Prompt: "Jog the probe head so that the rack alignment circle is in the center of the alignment window. Press RECORD."

Use the joystick to slowly jog the CMM side-to-side in station #4 of the ACR3 until the white circle is fully visible in the ACR3 setting window. See the diagram below. Press the RECORD button on the RCU when the ACR3 is in position.

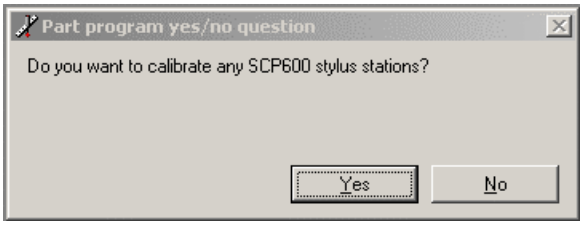


Step 20 – Manually Reset the ACR3.
Prompt: "The calibration is complete. Remove the lid clips and setting gauge. PRESS RECORD ON RCU TO PROCEED"

Use the joystick to slowly drive out of the ACR3 station #4. Position the probe head away from the ACR3 and remove the lid clips. Slide the ACR3 to the LOCKED position.

Step 21 – Query for Calibrating SCP600 Stylus Stations

Prompt: "Do you want to calibrate any SCP600 stylus stations?"



The user is prompted to calibrate any SCP600 stylus stations that are available on the CMM. Selecting "YES" will step through the SCP600 calibration procedure.

Step 21 – System Reset
Prompt: "Enable the servos and put in AUTO mode to continue."

The CMM will now enter a second reset phase to update and install the new rack calibration settings.

Step 22 – Safe Position.
Prompt: "POSITION PROBE HEAD TO ALLOW FOR STATION ACCESS. RECORD SAFE POSITION."

The SMP/MP needs to know a safe position that it can use when changing a probe. The machine will move directly to the safe position before going to the Autochange Rack. It will reorient the PH9/10 if necessary, and then move directly from this position to the rack. After unloading and/or loading a probe, the machine will return to this position and then if necessary reorient the PH9/10.

Move the machine to an appropriate safe position and press RECORD on the RCU to proceed.

Step 23 – Verification.
Performing this verification step is not required; however, it is recommended that you confirm that you correctly followed the calibration steps. During verification you should place the servos in slow mode and be prepared to quickly put the servos in manual mode should the machine drive to an unexpected position.

You will need to use the Function Command String window in MeasureMax QuickTeach or MaxLite to send FCS commands.

Use the following steps to verify that the probes can be exchanged.

- Put the servos in manual mode. On an RCU2, pressing the Auto or Joy button does this. Make sure that stations #1 and #4 contain a probe.

- Send the FCS command **GS 1**. The system will go through the motions of loading a probe from station #1 of the rack.

- Send the FCS command **GS 4**. The system will return the probe to station #1, then pickup the probe in station #4.

- Send the FCS command **GS 0** to unload the probe in its respective station.

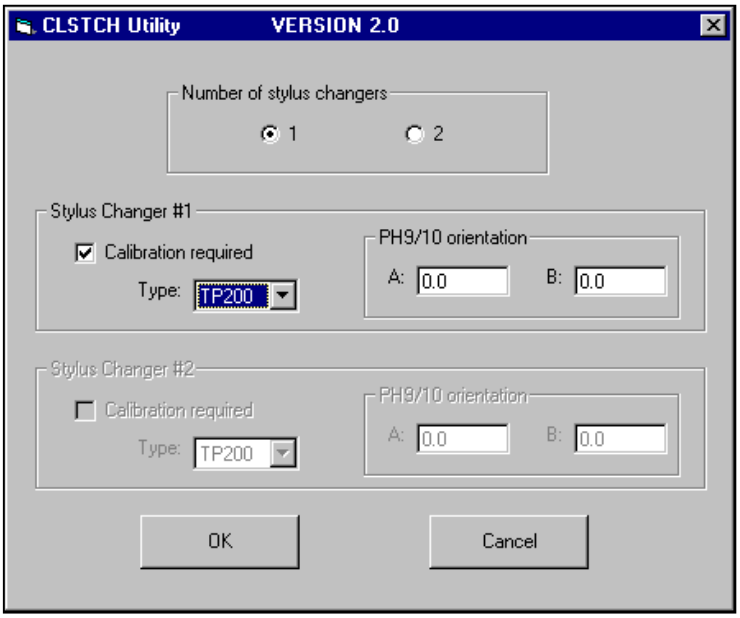
SCR200 Stylus Changer Rack

The Renishaw® SCR200 provides automatic, high speed changing of up to six stylus assemblies for the TP200 Probe System.

If the picture at the left does not resemble your rack, then you do not have an SCR200 and should not follow these instructions.

It is recommended that you use a PS35R rack calibration stylus to calibrate the rack.

Step 1 – Start Utility.
Start the *Calibrate Stylus Changer* (also referred to as CLSTCH) utility to calibrate the SCR200. Before you start the utility, make sure that an appropriate probe is mounted and calibrated as tip 0 oriented in the downward position.



Step 2 – Equipment Selection.
The CLSTCH Utility window allows you to specify your configuration. It is important that you select "**TP200**" as the stylus changer type.

If you have two stylus changers, the *Calibration required* checkbox enables you to control which ones are to be calibrated.

You can also specify the orientation of the PH9/10 for the move from the safe position towards the rack.

Select the OK button to continue.

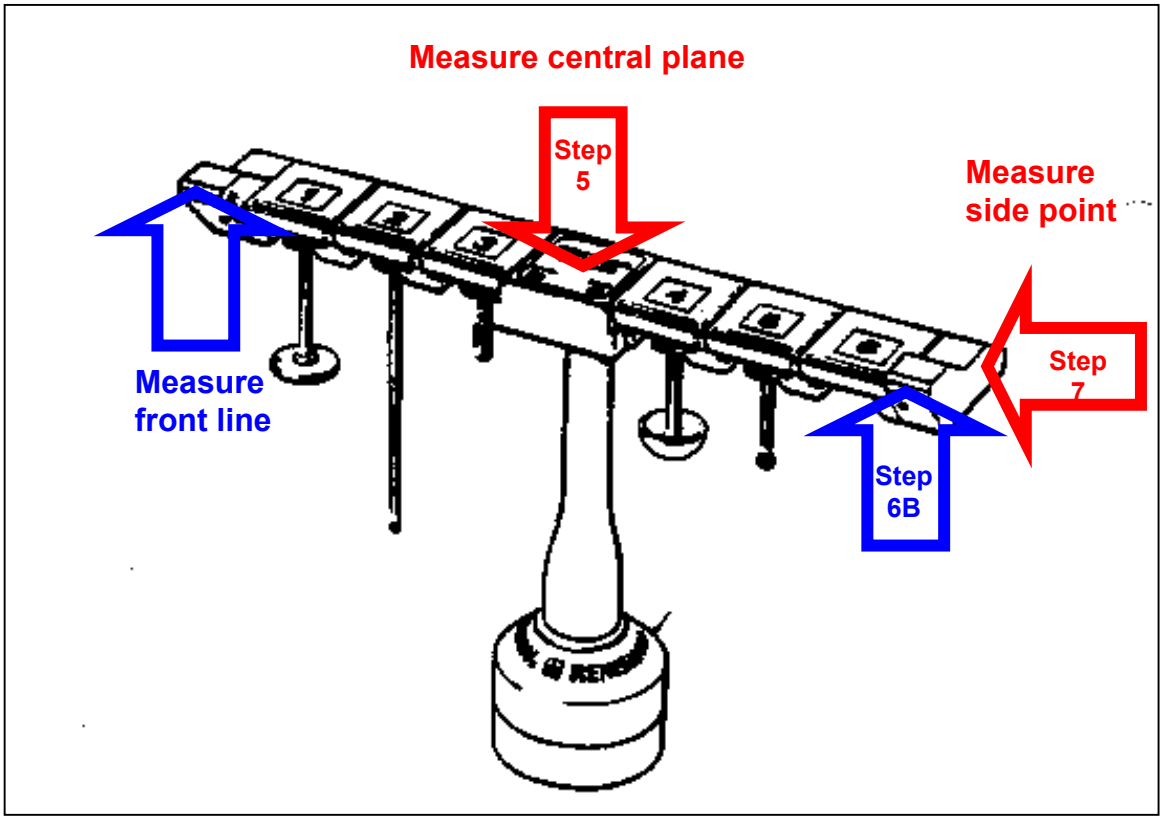
As you run through the utility, the Prompt monitor displays a brief set of instructions for your assistance. Use this document as a supplement to the instructions in the Prompt monitor. All prompts assume that you are facing the rack with its lids on top and station #1 to your left.

Step 3 – Safe Position.
The SMP/MP needs to know a safe position that it can use when changing a stylus. The machine will move directly to the safe position before going to the Stylus Changing Rack. It will reorient the PH9/10 if necessary, and then move directly from this position to the rack. After unloading and/or loading a stylus, the machine will return to this position and then if necessary reorient the PH9/10.

Ensure that the TP200 is mounted with a PS35R stylus (20 mm length and 2 mm diameter). Move the machine to an appropriate safe position and press Record on the RCU to proceed.

Step 4 – SCR200 Preparation.
Disconnect the SCR200 cable by pulling the connector from the back of the SCR200 support post. Open the lids for stations #1 and #6 by rotating them back towards the rear of the rack and sliding them towards the center of the rack. Remove stylus modules from all stations. Press Record to proceed.

Step 5 – Measure Plane.
Measure three points on the corners of the central top flat surface surrounding the SCR200 label. The Manual Measure window is displayed to assist you. Remember to press the Record button to validate each touch, if appropriate.



Step 6 – Measure Line.
Measure a point on the small flat surface on the front of the “ear” located at the far left end of the SCR200. Then measure a point on the small flat surface on the front of the “ear” located at the far right end of the SCR 200.

Step 7 – Measure Point.
Measure a point on the flat surface on the right side of the “ear” located at the far right end of the SCR200.

Step 8 – Rack Calibration.
Press the Auto button on the RCU when so prompted. The utility then measures points on the front of the right and left ends, a point on the front central face, four points around the SCR200 label, two points in station #1 and two points in station #6.

Step 9 – Second Rack.
Repeat the previous steps for a second rack, if so prompted.

Step 10 – Data Download.
Press Record on the RCU to send the calibration data to the SMP/MP. After initialization, close the lids to stations #1 and #6, remove the stylus module from the TP200 and reconnect the SCR200 cable. Press Reset on the PI200 Controller and Record on the RCU to reinitialize the system. Turn servos on and position for a clear path to the zero switches. Press Record and Auto when so prompted.

Step 11 – Verification.
Performing this verification step is not required; however, it is recommended that you confirm that you correctly followed the calibration steps. During verification you should place the servos in slow mode and be prepared to quickly put the servos in manual mode should the machine drive to an unexpected position.

The TP200 styluses must be loaded into the stylus changer under DCC control to ensure that they are properly aligned with the TP200 probe head. You will need to use the Function Command String window in MeasureMax QuickTeach or MaxLite to send FCS commands.

Use the following steps to verify that the styluses can be exchanged.

- Put the servos in manual mode. On an RCU2, pressing the Auto or Joy button does this. Make sure that stations #1 and #6 in the SCR200 rack are empty and there is no stylus in the probe.

- Send the FCS command **GS 21**.

- Press the Auto button on the RCU when so prompted. The system will go through the motions of loading a stylus from station #1 of the rack.

- Put the servos in manual mode. Mount a stylus module onto the TP200.

- Send the FCS command **GS 0** to drop off the stylus module. Press the Auto button on the RCU when so prompted.

- Send the FCS command **GS 26**. The system will go through the motions of loading a stylus from station #6 of the rack.

- Put the servos in manual mode. Mount a stylus module onto the TP200.

- Send the FCS command **GS 0** to drop off the stylus module. Press the Auto button on the RCU when so prompted.

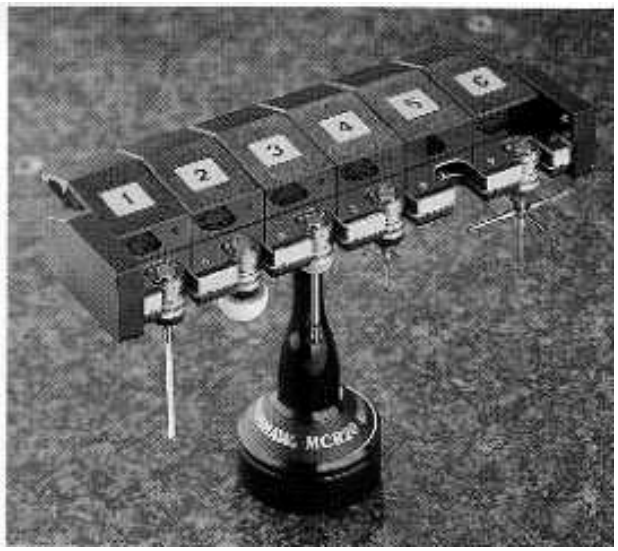
- Send the FCS command **GS 21** to load a stylus from station #1.

- Send the FCS command **GS 26** to unload the stylus currently mounted to the TP200 into station #1 and load the stylus from station #6.

- Send the FCS command **GS 0** to unload the stylus currently mounted to the TP200 into station #6.

- Install a TP20 probe (body and stylus module) and verify that the Probe LED on the CMM probe adapter body (not the TP20 itself) is energized and that it is de-energized when the probe stylus is deflected.

MCR20 Module Changer Rack

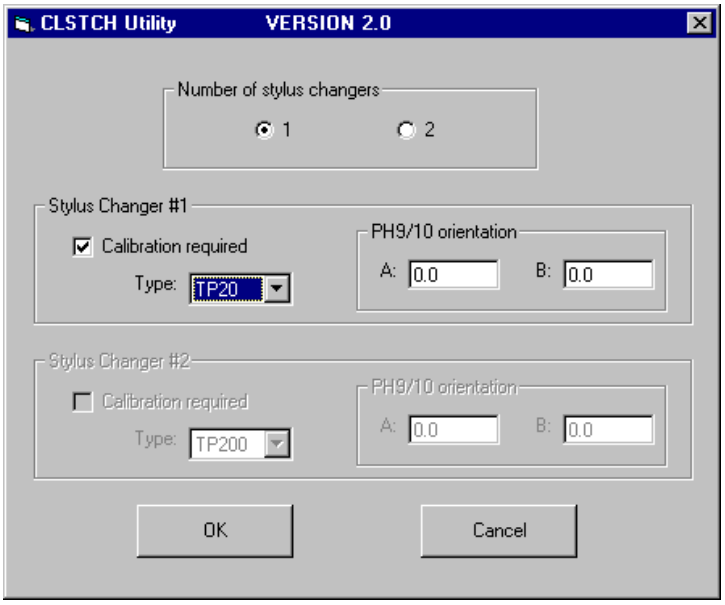


The Renishaw® MCR20 provides automatic, high speed changing of up to six stylus assemblies for the TP200 Probe System.

If the picture at the left does not resemble your rack, then you do not have an MCR20 and should not follow these instructions.

It is recommended that you use a PS35R rack calibration stylus to calibrate the rack.

Step 1 – Start Utility.
Start the *Calibrate Stylus Changer* (also referred to as CLSTCH) utility to calibrate the MCR20. Before you start the utility, make sure that an appropriate probe is mounted and calibrated as tip zero oriented in the downward position.



Step 2 – Equipment Selection.
The CLSTCH Utility window allows you to specify your configuration. It is important that you select "**TP20**" as the stylus changer type.

If you have two stylus changers, the *Calibration required* checkbox enables you to control which ones are to be calibrated.

You can also specify the orientation of the PH9/10 for the move from the safe position towards the rack.

Select the OK button to continue.

As you run through the utility, the Prompt monitor displays a brief set of instructions for your assistance. Use this document as a supplement to the instructions in the Prompt monitor. All prompts assume that you are facing the rack with its lids on top and station #1 to your left.

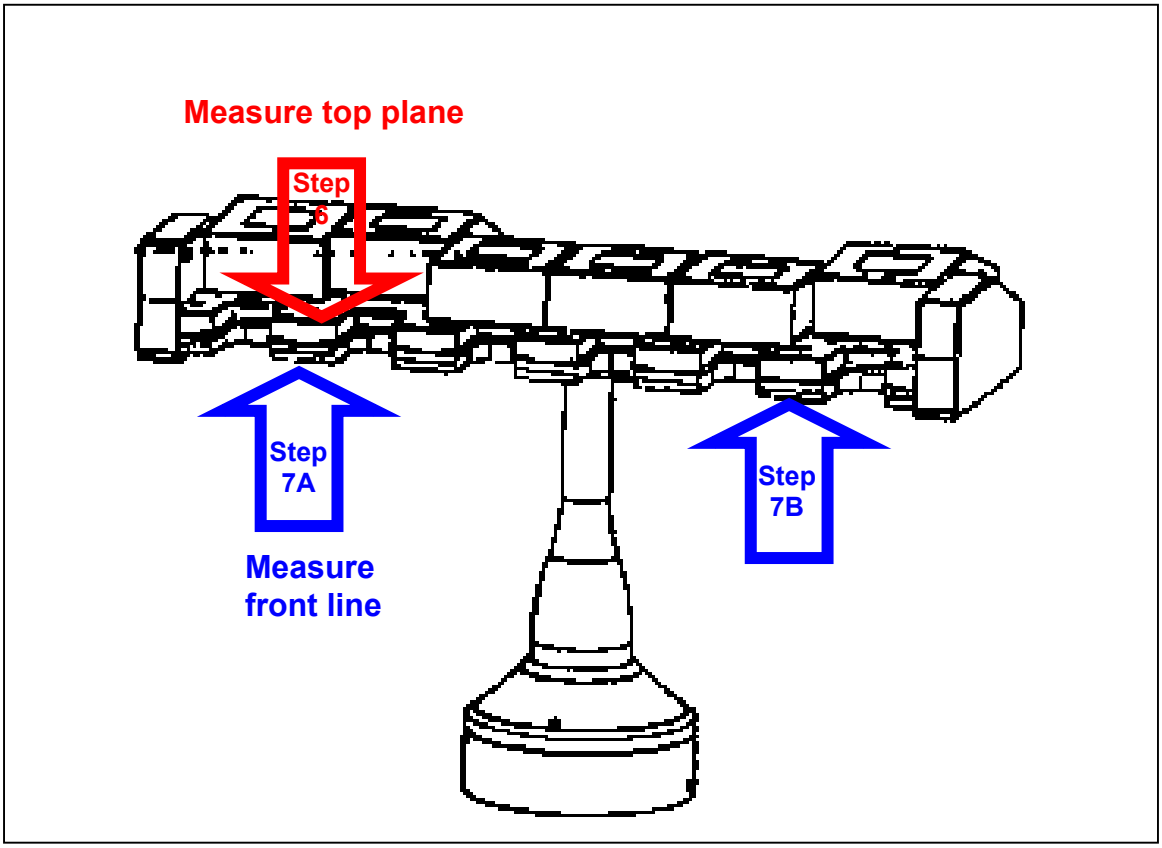
Step 3 – Set Zero Switches.
Position the probe for a clear move to the zero switches. Press Record and Auto on the RCU.

Step 4 – Safe Position.
The SMP/MP needs to know a safe position that it can use when changing a stylus. The machine will move directly to the safe position before going to the Stylus Changing Rack. It will reorient the PH9/10 if necessary, and then move directly from this position to the rack. After unloading and/or loading a stylus, the machine will return to this position and then if necessary reorient the PH9/10.

Ensure that the TP20 is mounted with a PS35R stylus (20 mm length and 2 mm diameter). Move the machine to an appropriate safe position and press Record on the RCU to proceed.

Step 5 – MCR20 Preparation.
Open the lids for all stations by pushing them back towards the rear of the rack until they lock. Remove stylus modules from all stations.

Step 6 – Measure Plane.
Measure three points on the flat metal surface immediately above the stations. The Manual Measure window is displayed to assist you. Remember to press the Record button to validate each touch, if appropriate.



Step 7 – Measure Line.
Measure a point on the metal front face at far left of rack by station #1. Then measure a point on the metal front face at far right of rack by station #6.

Step 8 – Measure Points.
Measure two points on the left and right sides inside station #1. The first point is on the metal edge along the left straight side of the station. The second point is on the right side, directly across from the first point.

Step 9 – Rack Calibration.
Press the Auto button on the RCU when so prompted. The utility then measures two points on the front face, points on the metal surface above the stations, and two points in station #1

Step 10 – Second Rack.
Repeat the previous steps for a second rack, if so prompted.

Step 11 – Data Download.
The calibration data is sent to the SMP/MP. Close the lids to the stations and remove the stylus module from the TP20. Press Record to reinitialize. In the event that the Prompt monitor displays a message to reconnect the SCR200 cable and press Reset on the PI200, ignore the instruction as it does not apply to the MCR20.

When the Servo Ready light comes on, turn servos on and position for a clear path to the zero switches. Press Record and Auto when so prompted.

Step 12 – Verification.
Performing this verification step is not required; however, it is recommended that you confirm that you correctly followed the calibration steps. During verification you should place the servos in slow mode and be prepared to quickly put the servos in manual mode should the machine drive to an unexpected position.

The TP20 styluses must be loaded into the stylus changer under DCC control to ensure that they are properly aligned with the TP20 probe head. You will need to use the Function Command String window in MeasureMax QuickTeach or MaxLite to send FCS commands.

Use the following steps to verify that the styluses can be exchanged.

- Put the servos in manual mode. On an RCU2, pressing the Auto or Joy button does this. Make sure that stations #1 and #6 in the MCR20 rack are empty and there is no stylus in the probe.

- Send the FCS command **GS 21**.

- Press the Auto button on the RCU when so prompted. The system will go through the motions of loading a stylus from station #1 of the rack.

- Put the servos in manual mode. Mount a stylus module onto the TP20.

- Send the FCS command **GS 0** to drop off the stylus module. Press the Auto button on the RCU when so prompted.

- Send the FCS command **GS 26**. The system will go through the motions of loading a stylus from station #6 of the rack.

- Put the servos in manual mode. Mount a stylus module onto the TP20.

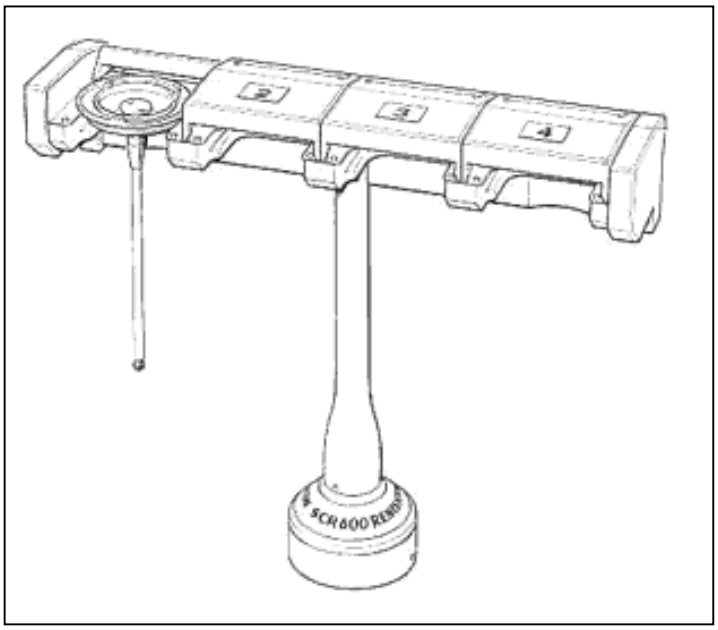
- Send the FCS command **GS 0** to drop off the stylus module. Press the Auto button on the RCU when so prompted.

- Send the FCS command **GS 21** to load a stylus from station #1.

- Send the FCS command **GS 26** to unload the stylus currently mounted to the TP20 into station #1 and load the stylus from station #6.

- Send the FCS command **GS 0** to unload the stylus currently mounted to the TP20 into station #6.

SCR600 Stylus Changer Rack

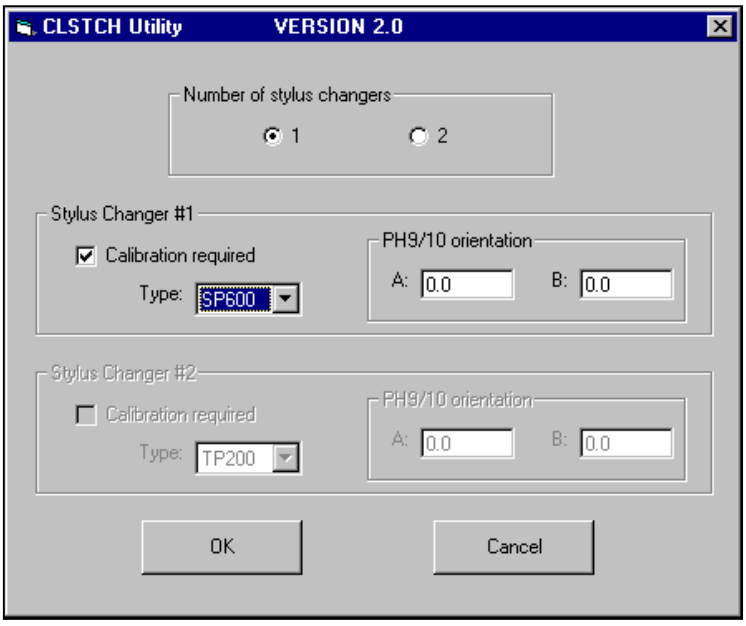


The Renishaw® SCR600 provides automatic, high speed changing of up to four stylus assemblies.

If the picture at the left does not resemble your rack, then you do not have an SCR600 and should not follow these instructions.

It is required that you use an SP600 with 50 mm length and 8 mm diameter stylus to calibrate the rack.

Step 1 – Start Utility.
Start the *Calibrate Stylus Changer* (also referred to as CLSTCH) utility to calibrate the SCR600. Before you start the utility, make sure that an appropriate probe is mounted and calibrated as tip 0 oriented in the downward position.



Step 2 – Equipment Selection.
The CLSTCH Utility window allows you to specify your configuration. It is important that you select "**SP600**" as the stylus changer type.

If you have two stylus changers, the *Calibration required* checkbox enables you to control which ones are to be calibrated.

You can also specify the orientation of the PH9/10 for the move from the safe position towards the rack.

Select the OK button to continue.

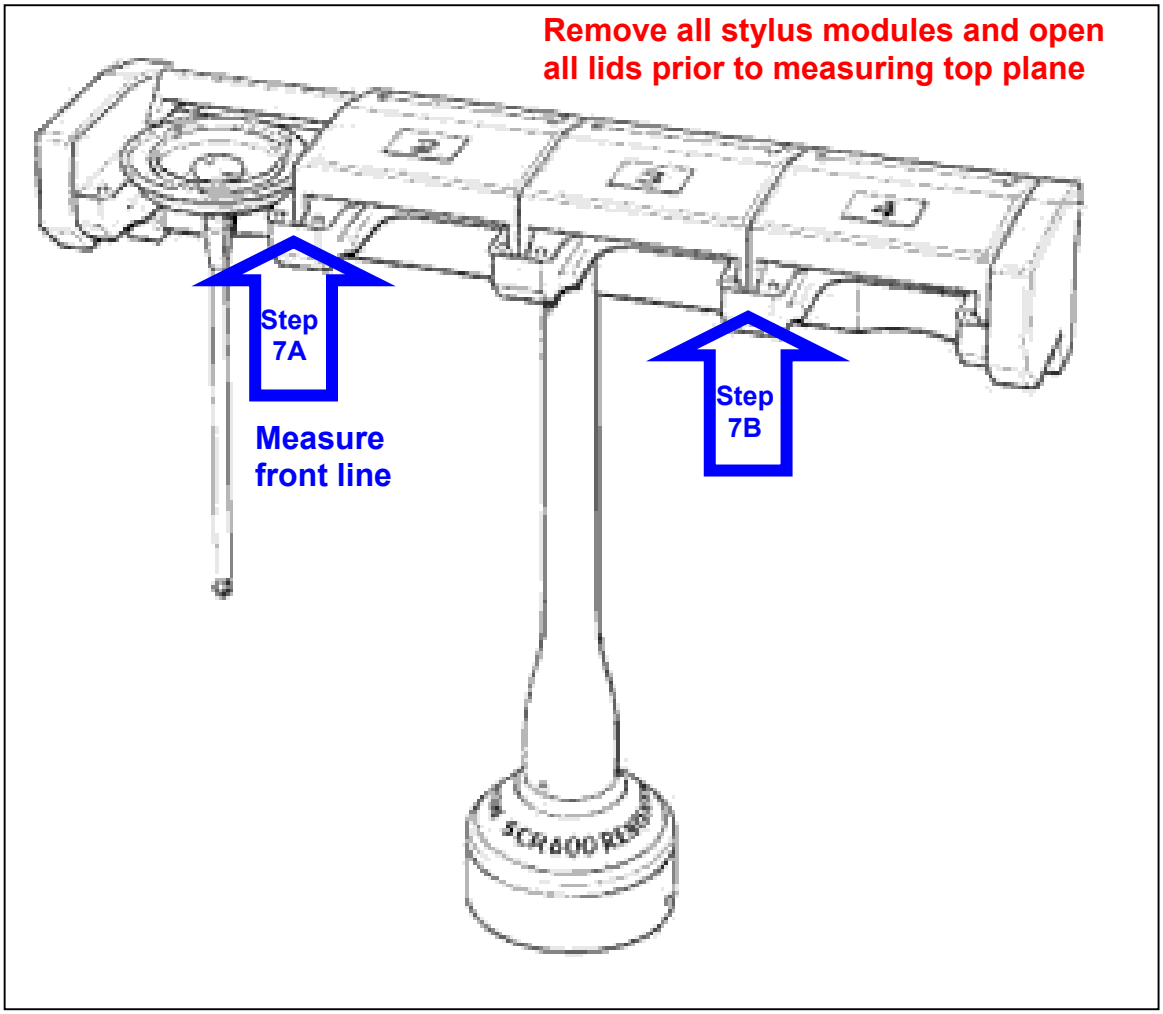
As you run through the utility, the Prompt monitor displays a brief set of instructions for your assistance. All prompts assume that you are facing the rack with its lids on top and station #1 to your left.

Step 3 – Set Zero Switches.
Position the probe for a clear move to the zero switches. Press Record and Auto on the RCU.

Step 4 – Safe Position.
The SMP/MP needs to know a safe position that it can use when changing a stylus. The machine will move directly to the safe position before going to the Stylus Changing Rack. It will reorient the PH9/10 if necessary, and then move directly from this position to the rack. After unloading and/or loading a stylus, the machine will return to this position and then if necessary reorient the PH9/10.

Ensure that the SP600 is mounted with a stylus that has a 50mm length and 8mm diameter. Move the machine to an appropriate safe position and press Record on the RCU to proceed.

Step 5 – SCR600 Preparation.
Open the lids for all stations by pushing them back towards the rear of the rack until they lock. Remove stylus modules from all stations.



Step 6 – Measure Plane.
Measure three points on the flat metal surface immediately above the stations. The Manual Measure window is displayed to assist you. Remember to press the Record button to validate each touch, if appropriate.

Step 7 – Measure Line.
Measure a point on the front surface between stations #1 and #2. Then measure a point on the front surface between stations #3 and #4.

Step 8 – Measure Points.
Measure two points on the left and right sides inside station #1. The first point is on the metal edge along the left straight side of the station. The second point is on the right side, directly across from the first point.

Step 9 – Rack Calibration.
Press the Auto button on the RCU when so prompted. The utility then measures points on the front face, points on the metal surface above the stations, and points in station #1.

Step 10 – Second Rack.
Repeat the previous steps for a second rack, if so prompted.

Step 11 – Data Download.
The calibration data is sent to the SMP/MP. Close the lids to the stations and remove the stylus module from the SP600. Press Record to reinitialize.

When the Servo Ready light comes on, turn servos on and position for a clear path to the zero switches. Press Record and Auto when so prompted.

Step 11 – Verification.
Performing this verification step is not required; however, it is recommended that you confirm that you correctly followed the calibration steps. During verification you should place the servos in slow mode and be prepared to quickly put the servos in manual mode should the machine drive to an unexpected position.

The SP600 styluses must be loaded into the stylus changer under DCC control to ensure that they are properly aligned with the SP600 probe head. You will need to use the Function Command String window in MeasureMax QuickTeach or MaxLite to send FCS commands.

Use the following steps to verify that the styluses can be exchanged.

- Put the servos in manual mode. On an RCU2, pressing the Auto or Joy button does this. Make sure that stations #1 and #4 in the SCR600 rack are empty and there is no stylus in the probe.

- Send the FCS command **GS 21**.

- Press the Auto button on the RCU when so prompted. The system will go through the motions of loading a stylus from station #1 of the rack.

- Put the servos in manual mode. Mount a stylus module onto the SP600.

- Send the FCS command **GS 0** to drop off the stylus module. Press the Auto button on the RCU when so prompted.

- Send the FCS command **GS 24**. The system will go through the motions of loading a stylus from station #4 of the rack.

- Put the servos in manual mode. Mount a stylus module onto the SP600.

- Send the FCS command **GS 0** to drop off the stylus module. Press the Auto button on the RCU when so prompted.

- Send the FCS command **GS 21** to load a stylus from station #1.

- Send the FCS command **GS 24** to unload the stylus currently mounted to the SP600 into station #1 and load the stylus from station #4.

- Send the FCS command **GS 0** to unload the stylus currently mounted to the SP600 into station #4.

SCP600 Stylus Changer Stations

This picture illustrates the Renishaw® SCP600 stylus station installed on the Modular Rack System (MRS). The MRS is available in a number of lengths and supports both the SCP600 and the ACR3 probe rack. Refer to Renishaw® documentation for installing and aligning the MRS to the CMM before performing calibration of the SCP600 or ACR3.

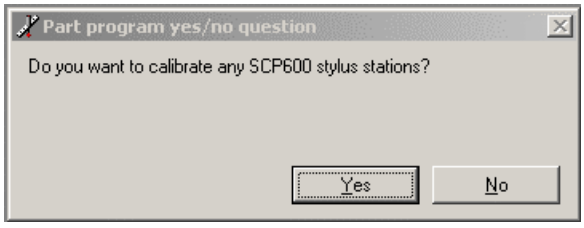
Calibration of the SCP600 must be accomplished with the SP600 scanning probe with a 50 mm stylus and 8 mm diameter ball.

Calibration of SCP600 stations is a straight-forward procedure.

Step 1 – Start Utility.
Start the *Calibrate Stylus Changer* (also referred to as CLSTCH) utility to calibrate the SCP600. Before you start the utility, make sure that a SP600 probe is mounted with a 50 mm long stylus with an 8 mm diameter ball oriented in the downward position. This procedure will calibrate the probe before making any measurements.

Step 2 – Query for Calibrating SCP600 Stylus Stations
Prompt: "Do you want to calibrate any SCP600 stylus stations."

The user is prompted to calibrate any SCP600 stylus stations that are available on the CMM. Selecting "YES" will step through the SCP600 calibration procedure.



Step 3 – Rack Ports
Prompt: "How many SCP600 stations do you have?"

Enter an integer of 1 through 8 and press the ENTER key.

Step 4 – Equipment Location.
Prompt: "Enter rear to front rack axis (X, -X, Y, -Y, Z) [-Y]"

The first question asks which axis end describes the orientation of the SCP600. Usually, on a Vertical Arm CMM, the rack is mounted at the back of the table (+Y table end). In this case, the stations open toward the -Y direction (enter -Y). The stations should always open toward the center of the table.

Step 5 – System Reset
Prompt: "The machine will now initialize then begin calibration.
PRESS RECORD ON RCU TO PROCEED"

The CMM will now enter a reset phase and search for the scale zero reference.

Prompt: "Enable the servos and put in AUTO mode to continue."

Step 6 – Probe Qualification
Prompts: "Position the probe over the calibration sphere. Press RECORD."
"Position the probe 150 mm above the sphere."
"Position the probe 6 mm above the sphere."

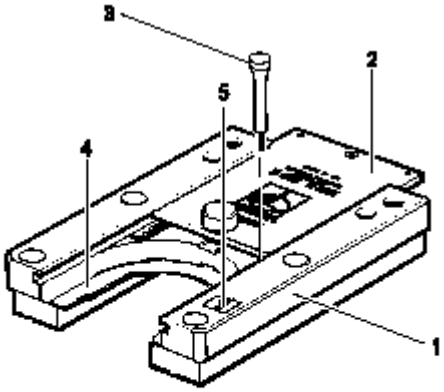
Enable the joysticks and manually move the CMM probe as directed by the prompts. Press the RECORD button on the Remote Control Unit after completing each movement. The probe will then auto-calibrate on the reference sphere.

Step 7 – Open the Station Lids.
Prompt: "Open each of the SCP600 lids and install the stylus tools to hold them open. Press RECORD when ready."

Push the lid (2) of the SCP600 station (1) to the extreme of its travel. Place the stylus tool (3) into the retaining hole at the rear of the SCP600 station. Release the SCP600 lid so that the stylus tool holds the lid open.

Step 8 – Measure Plane
Prompt: "Take 4 points on the top face of the docking plate"

Manually measure four points on top of the metal docking plate of the SCP600. (4)



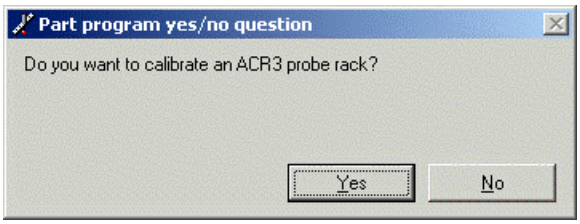
1. SCP600
2. Lid
3. Stylus tool
4. Docking plate
5. Port identification label

Step 9 – Measure Station Circle.
Manually measure four points round the curved part at the rear of the station.

Steps 8 and 9 will be repeated for each station.

Step 10 – Query for Calibrating ACR3 Probe Rack

Prompt: "Do you want to calibrate an ACR3 probe rack?"



The user is prompted to calibrate any ACR3 probe stations that are available on the CMM. Selecting "YES" will step through the ACR3 calibration procedure.

Step 11 – System Reset
Prompt: "Enable the servos and put in AUTO mode to continue."

The CMM will now enter a second reset phase to update and install the new station calibration settings.

Step 12 – Safe Position.
Prompt: "POSITION PROBE HEAD TO ALLOW FOR STATION ACCESS. RECORD SAFE POSITION."

The SMP/MP needs to know a safe position that it can use when changing a probe. The machine will move directly to the safe position before going to the MRS rack. It will reorient the PH9/10 if necessary, and then move directly from this position to the rack. After unloading and/or loading a probe, the machine will return to this position and then if necessary reorient the PH9/10.

Move the machine to an appropriate safe position and press RECORD on the RCU to proceed.

Step 13 – Verification.
Performing this verification step is not required; however, it is recommended that you confirm that you correctly followed the calibration steps. During verification you should place the servos in slow mode and be prepared to quickly put the servos in manual mode should the machine drive to an unexpected position.

The SP600 styluses must be loaded into the stylus changer under DCC control to ensure that they are properly aligned with the SP600 probe head. You will need to use the Function Command String window in MeasureMax QuickTeach or MaxLite to send FCS commands.

Use the following steps to verify that the styluses can be exchanged.

1) Put the servos in manual mode. On an RCU2, pressing the Auto or Joy button does this. Make sure that the SCP600 stations are empty and there is no stylus in the probe.

2) Send the FCS command **GS 41**.

3) Press the Auto button on the RCU when so prompted. The system will go through the motions of loading a stylus from station #1 of the rack.

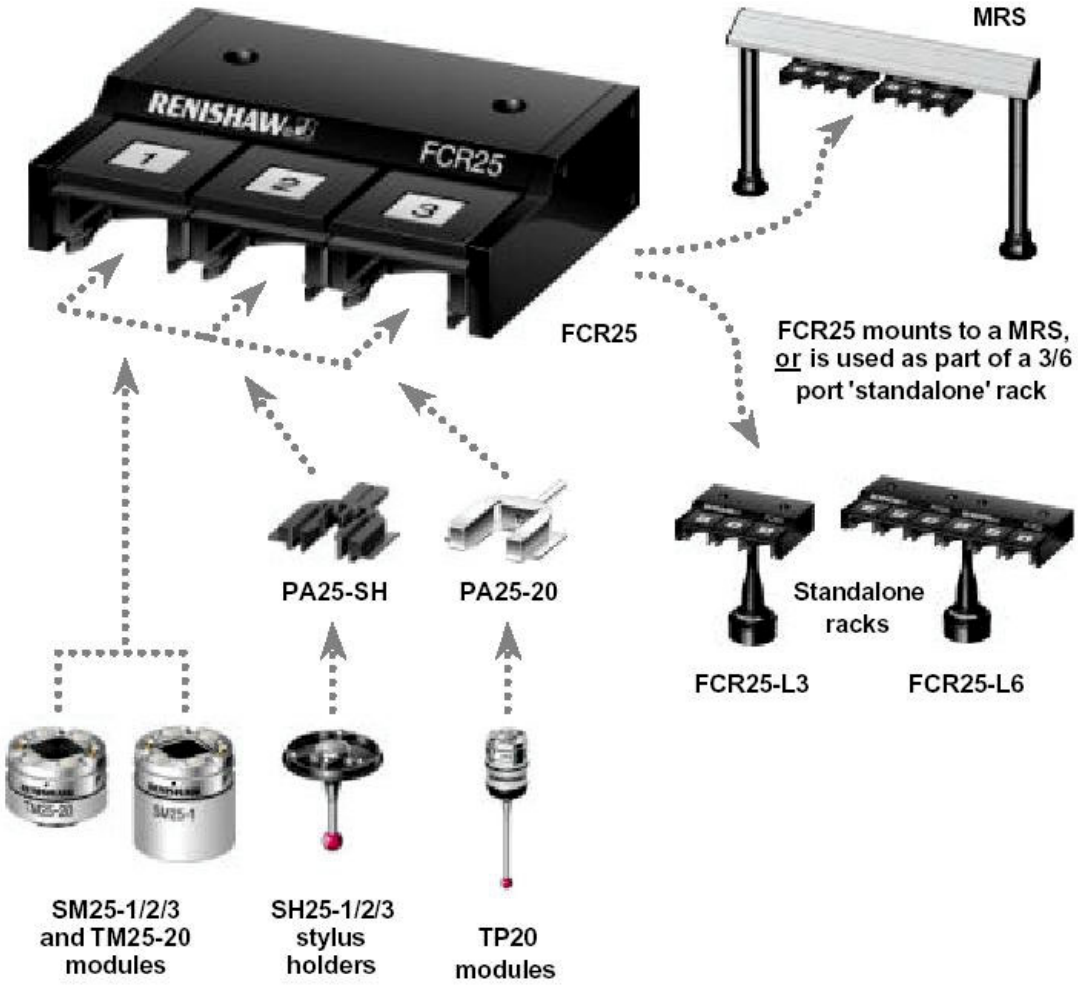
4) Put the servos in manual mode. Mount a stylus module onto the SP600.

5) Send the FCS command **GS 0** to drop off the stylus module. Press the Auto button on the RCU when so prompted.

6) Repeat steps 2 through 5 for each SCP600 station on the MRS. The SMP identifies the SCP600 stations as numbered 41 through 48.

FCR25 Flexible Change Rack

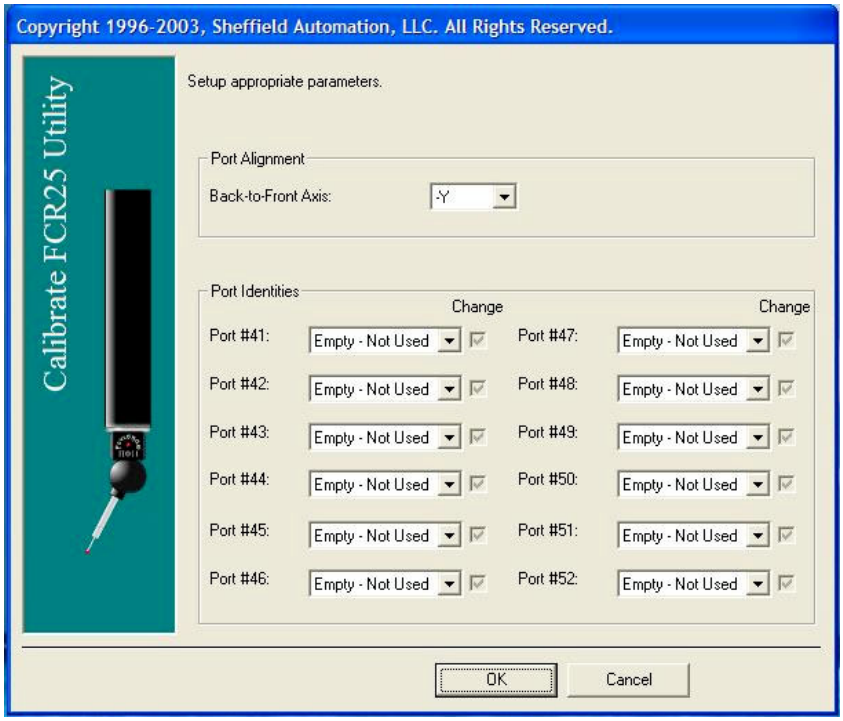
This picture illustrates various forms of the Renishaw® FCR25 Flexible Change Racks. Refer to Renishaw® documentation for installing and aligning the rack mounts to the CMM before performing calibration of the FCR25 ports.



The base port configuration supports the SM25-1/2/3 scanning modules and the TM25-20 TTP adapter module. The SH25-1/2/3 stylus holder requires the use of a PA25-SH port adapter insert. The TP20 modules require the use of a PA25-20 port adapter insert. The calibration procedure allows designating each port with the module type that will be placed in it. A different calibration method is required for each port designation.

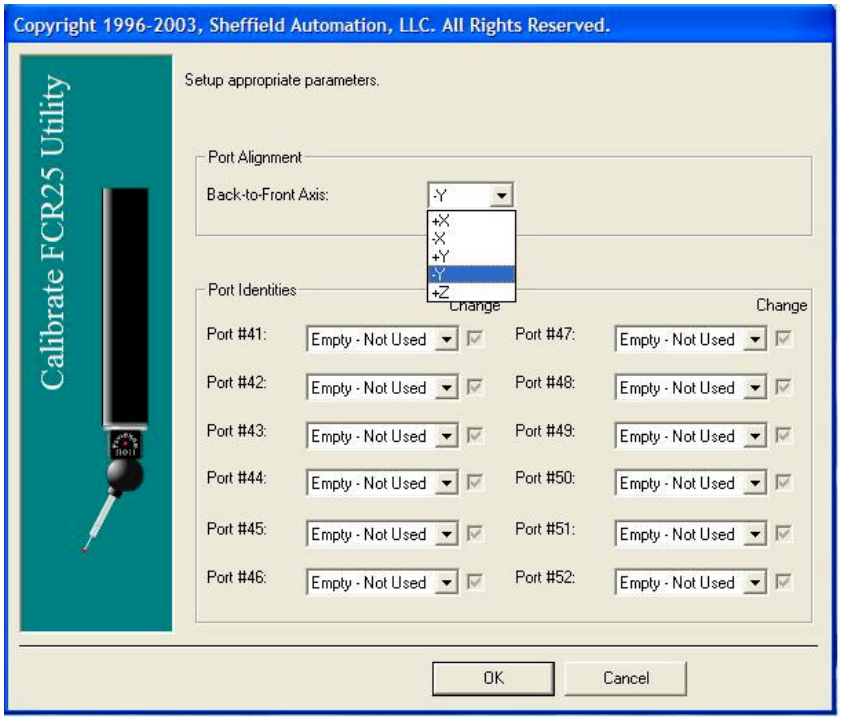
Step 1 – Start Utility.

Start the *Calibrate FCR25 Changer* from the *Utilities* menu of MeasureMax. You will be presented a selection window as shown here to define the FCR25 orientation and port configurations of your installation.



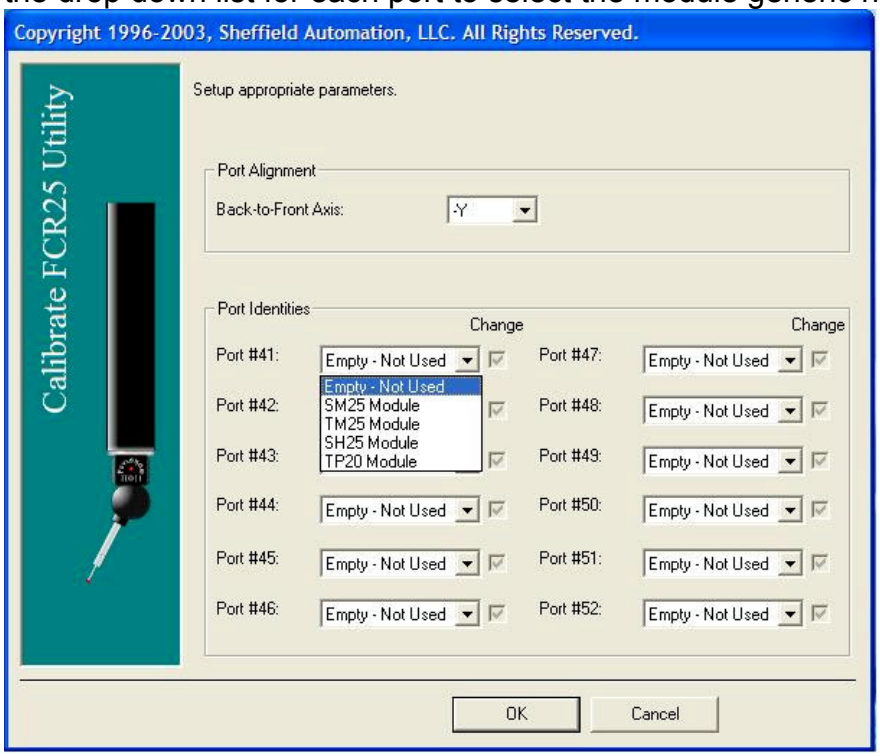
Step 2 – Set Port Alignment

The Port Alignment box designates the CMM direction the open ports face. Usually, on a Vertical Arm CMM, the rack is mounted at the back of the table (+Y table end). In this case, the stations open toward the -Y direction. The stations should always open toward the center of the table. Use the drop list button to display and select the correct direction for your installation.

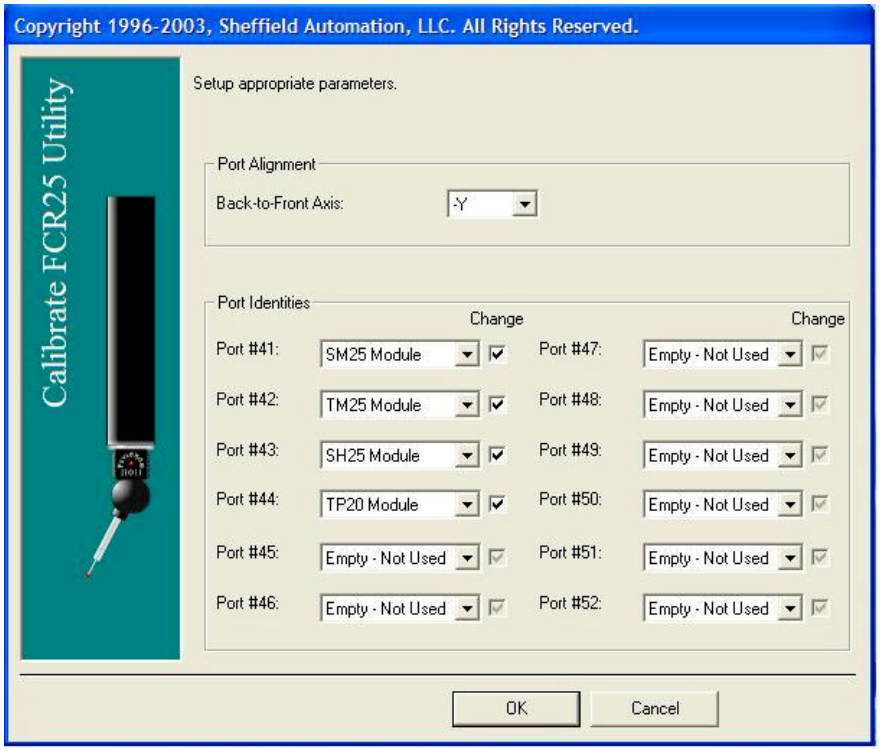


Step 3 – Set Port Identities.

The Sheffield Measurement Processor will support up to twelve FCR25 ports. Each port must be identified with the type of tool that will be placed there. Use the drop down list for each port to select the module generic name.



The system will remember the setting for each port, once it has been calibrated. Use the *Change* check box to force the calibration of a port. Because of the differing requirements for calibrating ports with TP20 versus SH25 components, you may wish to do these in separate sessions.



Step 4 – Install Probe
Click "OK" on the form and the calibration process will begin. You will now be prompted to install a 21 x 3 mm touch probe. The probe head will position to A=0 and B=0.

Step 5 – System Reset
Prompt: "The machine will now initialize then begin calibration.
PRESS RECORD ON RCU TO PROCEED"

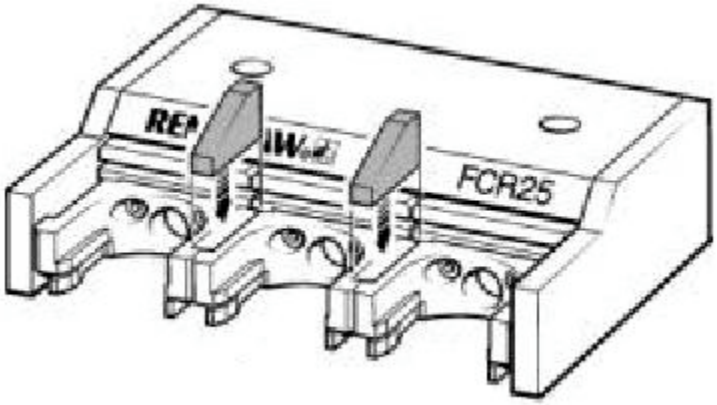
The CMM will now enter a reset phase and search for the scale zero reference.

Prompt: "Enable the servos and put in AUTO mode to continue."

Step 6 – Probe Qualification
Prompts: "Position the probe over the calibration sphere. Press RECORD."
"Position the probe 150 mm above the sphere."
"Position the probe 6 mm above the sphere."

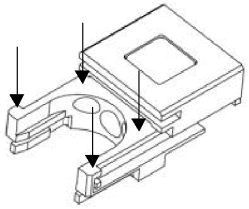
Enable the joysticks and manually move the CMM probe as directed by the prompts. Press the RECORD button on the Remote Control Unit after completing each movement. The probe will then auto-calibrate on the reference sphere.

Step 7 – Insert Lid Clips.
Prompt: "Position the rack to the UNLOCKED position and place the lid clips to hold the stations open. Press RECORD when ready."



Insert the lid clips between ports 1, 2 & 3 as shown. Make sure the clips open the port lids completely to avoid unexpected touches during the calibration.

Step 8 – Calibrate Location of Ports for the SM25 & TM25 Modules.
Each port with either the SM25 or TM25 module uses the same calibration techniques. Do these steps for each port of these identities.

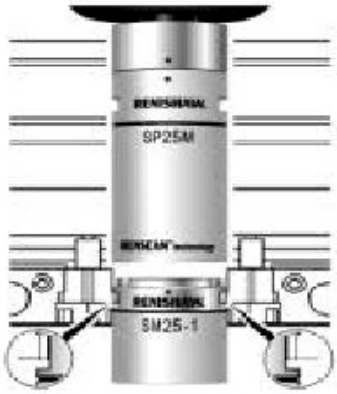


Step 8a. Manually measure four points on the top rails of the port as shown.

Step 8b. Take 2 points on the front side faces of the port rails – left then right.

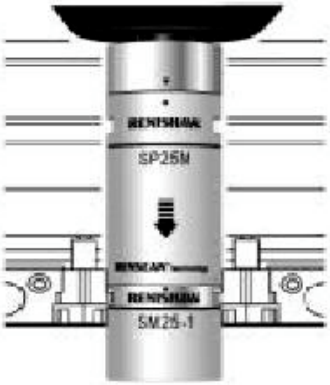
Step 8c. Take 2 points inside the port rails.

Step 9 – Calibrate Height of Ports for the SM25 & TM25 Modules.
When the last port location has been measured, carefully remove the SM25 or TM25 module from the probe body. Insert the SM25 and/or TM25 module(s) into each of the FCR25 ports to be calibrated. Use the joystick to manually position the now empty probe body to just above the first port. You will be prompted to enable AUTO and jog the probe body vertically, until the probe light comes on. The RCU is now set to fine position the probe body. Use the DRIVE button to move the probe body to the SM25 or TM25 module. Each press of the DRIVE button will move the head .050mm. The RETURN key will move the head away from the module the same amount. Do not overdrive the probe head.



Step 9a. Use the joystick to manually position above the SM25 module. Note that the module is resting down on the port rails.

Step 9b. Enable AUTO. Press DRIVE to jog the probe body down until the module jumps straight upwards due to the magnetic attraction.

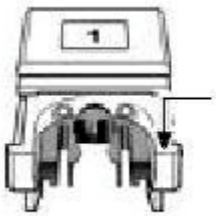


Step 9c. Continue jogging downward. STOP immediately when the probe head LED is lit. Press the RECORD button to complete the calibration.

Step 9d. The probe head will now retract away from the module in order to position to the next port to be calibrated. Repeat step nine for each SM25 or TM25 module port.

Step 10 – Calibrate Location of Ports for SH25 Modules.
In order to calibrate the SH25 ports, you must use the SM25 module that will be grabbing the component in the port. It is recommended to re-run this utility for each set of ports used by a given SM25 module.

Re-install the SM25 module calibrated earlier. Install the Renishaw Stylus Holder Setting Piece (SHSP) in place of the stylus.

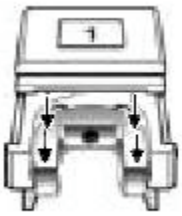


Step 10a. Take one point on top surface.

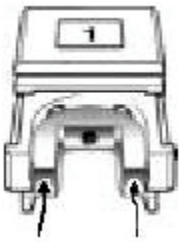
Step 10b. Take two points on front face.

Step 10c. Take two points on inside rails.

Step 11 – Calibrate Location of Ports for TP20 Modules.
The calibration of the PA25-20 port adapter for the TP20 modules will likely be performed separately from calibration of the SH25 ports. It is recommended to re-run this utility to calibrate the TP20 ports after calibrating SH25 ports. A TM25-20 module and a TP20 module must be installed for this calibration.



Step 11a. Take 4 points on top of the PA25-20 adapter.



Step 11b. Take 2 points on the front side faces of the adapter – left then right.

Step 11c. Take 2 points inside the PA25-20 adapter rails.

Step 11d. Repeat this step for each port identified as having a TP20 probe.

Step 12 – Calibrate Height of Ports for TP20 Modules.

When the last port location has been measured, carefully remove the TP20 module from the probe body. Insert the TP20 module(s) into each of the FCR25 ports to be calibrated. Ensure the alignment marks are aligned properly. Use the joystick to manually position the now empty probe body to just above the first port. You will be prompted to enable AUTO and jog the probe body vertically, until the probe light comes on. The RCU is now set to fine position the probe body. Use the DRIVE button to move the probe body to the TP20 module. Each press of the DRIVE button will move the head .050mm. The RETURN key will move the head away the same amount. Do not overdrive the probe head. Press RECORD when the head LED lights.

Review Step 9 as the procedure is similar.

Repeat Step 12 for each port identified as having a TP20 probe.

Step 13 – System Reset

Prompt: "Enable the servos and put in AUTO mode to continue."

The CMM will now enter a second reset phase to update and install the new station calibration settings.

Step 14 – Safe Position.

Prompt: "POSITION PROBE HEAD TO ALLOW FOR STATION ACCESS. RECORD SAFE POSITION."

The SMP/MP needs to know a safe position that it can use when changing a probe. The machine will move directly to the safe position before going to the MRS rack. It will reorient the PH9/10 if necessary, and then move directly from this position to the rack. After unloading and/or loading a probe, the machine will return to this position and then if necessary reorient the PH9/10.

Move the machine to an appropriate safe position and press RECORD on the RCU to proceed.

Step 15 – Verification.

Performing this verification step is not required; however, it is recommended that you confirm that you correctly followed the calibration steps. During verification you should place the servos in slow mode and be prepared to quickly put the servos in manual mode should the machine drive to an unexpected position.

The SP25 modules must be loaded into the FCR25 changer under DCC control to ensure that they are properly aligned with the probe head. You will need to use the Function Command String window in MeasureMax QuickTeach or MaxLite to send FCS commands.

Use the following steps to verify that the styluses can be exchanged.

a) Put the servos in manual mode. On an RCU2, pressing the Auto or Joy button does this. Make sure that the FCR25 ports are empty and there is no stylus in the probe.

b) Send the FCS command **GS 41**.

c) Press the Auto button on the RCU when so prompted. The system will go through the motions of loading a module from port #1 of the rack.

d) Put the servos in manual mode. Mount an appropriate module onto the SP25.

e) Send the FCS command **GS 0** to drop off the module. Press the Auto button on the RCU when so prompted.

f) Repeat steps b through e for each FCR25 port. The SMP identifies the FCR25 ports as numbered 41 through 52.