

# CARTO Explore





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## Legal information

### Terms and conditions and warranty

Unless you and Renishaw have agreed and signed a separate written agreement, the equipment and/or software are sold subject to the Renishaw Standard Terms and Conditions supplied with such equipment and/or software, or available on request from your local Renishaw office.

Renishaw warrants its equipment and software for a limited period (as set out in the Standard Terms and Conditions), provided that they are installed and used exactly as defined in associated Renishaw documentation. You should consult these Standard Terms and Conditions to find out the full details of your warranty.

Equipment and/or software purchased by you from a third-party supplier is subject to separate terms and conditions supplied with such equipment and/or software. You should contact your third-party supplier for details.

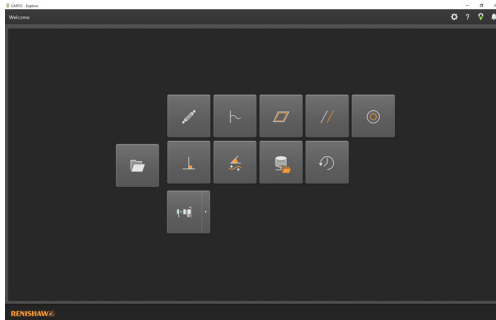
### Safety

Before using the laser system, consult the *XL laser safety* information booklet (Renishaw part no. M-9908-0363) or the *XM laser safety* information booklet (Renishaw part no. M-9921-0202).



## Home screen

The home screen allows the user to view individual measurement files, import legacy data or open the test browser displaying all the tests in the test database. To return to the home screen at any point, select the 'Home' icon on the top left of the screen.



## Open test

Select 'Open test' to view the test browser, and display all the tests in the database and options for filtering the available tests. Tests can be managed through this view, allowing exporting, importing, tagging, editing and deletion of previously run tests. Individual tests can be selected and expanded for in-depth analysis or comparison.

## View legacy data

Using the icons on the home screen, data can be viewed, but not imported from Ballbar 20 and LaserXL data capture software. The following can be viewed:

- Ballbar analysis (.b5r files)
- Dynamic (.rtx and .rtd files)
- Flatness moody and grid: (.rtn files)
- Linear parallelism analysis
- Rotational parallelism analysis
- Squareness analysis

## ANGST

The ANGST icon allows the user to convert an angular data file into a straightness file to give an indication of the form of axis straightness error.



## Importer

The 'Importer' icon on the home screen to import legacy file-based tests into the CARTO database. This functionality enables the user to transfer files from LaserXL or RotaryXL software to the CARTO suite. Selecting the 'Search' button on the left-hand side will prompt the user to define the location folder of the test to be imported. For any test missing, 'Axis under test' is highlighted in red until edited by the user. Select 'Edit test' at the bottom right of the screen and select the relevant letter in the drop-down list under 'Axis under test'. Tags can be added during the importing process, as described in the **'tagging' section**. Use the 'Show imported tests' toggle to show or hide tests that have already been imported.

## Migrate from Laser XL to CARTO



The importer function allows easy migration from LaserXL and RotaryXL software applications to the CARTO software suite. It allows Laser10, LaserXL and RotaryXL test data and test methods to be imported providing data in a single database location. Importing test data automatically creates test methods and allows existing machine part programs to be used. The 'How to' video features instructions to carry out the migration process.

It can be found on the CARTO support page: <http://www.renishaw.com/carto-support>.

**NOTE:** The importer function is found on the landing page of the Explore application.

## Restore

Highlight a test record that has been deleted from the database and either restore or clear the test.

## XK10 alignment laser analysis

Selecting the drop-down menu from the XK10 icon to view and analyse straightness, parallelism and squareness data from the XK10 capture software. This data is not imported into the database.



## Test browser screen

The image below highlights the main areas of the Explore interface.

Test title	Machine name	Serial number	Axis	Operator	Date
squareness example	Squareness X axis	XY1234	X		Thursday 2023/03/16 10:40 AM
Squareness example	Squareness Y axis	XY1234	Y		Wednesday 2023/03/15 03:40 PM
Example	-	1234	X1		Tuesday 2023/01/24 12:56 PM
- 2023-01-24 12_54_40	M/C 54	XY1234	X1	ss	Tuesday 2023/01/24 12:54 PM
- 2022-12-13 15_06_11	Machine	-	X	ss	Tuesday 2022/12/13 03:06 PM
- 2022-12-13 15_04_13	Machine	-	X	ss	Tuesday 2022/12/13 03:04 PM
- 2022-12-13 15_01_01	Machine	-	X	ss	Tuesday 2022/12/13 03:01 PM
test	Machine	-	X	ss	Tuesday 2022/12/13 02:56 PM
- 2022-12-13 14_53_32	Machine	-	X1	ss	Tuesday 2022/12/13 02:53 PM
- 2022-12-13 14_47_38	Machine	-	X1	ss	Tuesday 2022/12/13 02:47 PM
Axis stitch	Machine	-	X	ss	Wednesday 2022/12/07 09:35 AM
datastitch -600 to -1000	Machine	-	X	jim	Monday 2022/09/26 10:10 AM
datastitch -300 to -700	Machine	-	X	jim	Monday 2022/09/26 10:04 AM
datastitch 0 to -400	Machine	-	X	jim	Monday 2022/09/26 09:57 AM
Z-axis test (0 to200)	Linear axis	123ABC	X	M.C	Tuesday 2013/07/23 10:48 AM
Y-axis test (-400 to 0)	Linear axis	123ABC	X	M.C	Tuesday 2013/07/23 10:47 AM
Z-axis test (-400 to 0)	Linear axis	123ABC	X	M.C	Tuesday 2013/07/23 10:47 AM
X-axis test (-500 to 0)	Linear axis	123ABC	X	M.C	Tuesday 2013/07/23 10:46 AM
X-axis test (-1000 to 0)	Linear axis	123ABC	X	M.C	Tuesday 2013/07/23 10:45 AM
example	X	X	X	X	Friday 2012/10/19 10:08 AM

1	Home
2	Data stitch
3	Compare
4	Combined report
5	Settings
6	Help
7	About
8	Notification tab
9	Test browser
10	Data analysis view
11	Delete/import/export
12	Add tags
13	Filter tags

System	<b>Data Management</b>	Configuration
Data Analysis	Reporting	Compensation



## Test browser

The 'Test browser' is an area used for handling and selecting results. Browse through the tests saved in the database and open them for analysis or export them.

## Search

**Quick** – for a quick way to filter test results, use the search box available when the search area is not expanded.

**Advanced** – expand the search area to use the advanced search. Results can be filtered based on multiple criteria at the same time.

## Order

Select a category (test title, machine name, axis etc.) to organise the tests based on the chosen category. The user can then toggle between ascending and descending order by selecting again. For fast loading time, long lists of test records are split up into pages. The number of test records per page can be adjusted in settings.

## Export to CSV

Select one or multiple tests from the database and export the tests to a comma separated values (.csv) file. This function exports all test information, including the raw laser readings.

## Export tests

Export test records to RTL, RTA and ST\* files by highlighting a test or a group of tests and then selecting the 'Export tests' icon. Exported files are compatible with Renishaw XCal-View software. To export files that are compatible with older file formats, go to 'Settings' > 'Application' and tick 'Use the legacy LaserXL precision settings while exporting to files'.

## Export to transfer file / import transfer file

To transfer test records to a CARTO database on a different computer, highlight the required test records and select the 'Export to transfer file' icon at the bottom right of the screen.

## Export all tests

To export all database records to a single .CARTO file, select the 'Export all tests' icon at the bottom right of the screen.

The .CARTO file can then be transferred to a different computer and then imported to the new CARTO database by selecting the 'Import transfer file' icon. When importing data from a .CARTO file, the test records will be automatically tagged with a name that states when they were imported (dd/mm/yy).



System	<b>Data Management</b>	Configuration
Data Analysis	Reporting	Compensation



## Delete

Highlight a test record and select the 'Delete' icon at the bottom right of the screen. Deleted test records can be restored from the home screen.

## Refresh results

When tests are saved in Capture whilst the 'Test browser' is open, the new tests will not be shown until the next time Explore is opened, or the 'Refresh' icon is selected.

## View selected test

Open a test record by double-clicking or by selecting the 'View selected test' icon when the test record is highlighted.

## Tagging

Tags can be added by selecting a test record or group of test records and typing in the 'Add tags' field, then pressing enter.

The user can remove the association between the test record and a tag name by holding the cursor over the tag name and selecting the 'Remove tag' icon.



## Settings

The 'Settings' window will automatically open the first time Explore is used and can be accessed at any time by selecting the 'Settings' icon. Any changes can be saved using the 'Apply' button.

There are five tabs that can be used to specify preferences.

### Units

This tab is used to change the units and decimal places for error and environmental data that will be displayed in the analysis graphs.

**Linear and straightness units** – assign units for linear and straightness error and for target

**Angular units** – assign units for angular error and for target

**Squareness units** – assign units for squareness error

**Environment units** – assign units for temperature, expansion coefficient, pressure and humidity.

### Application

This tab is used for interface and report generation preferences.

**Theme** – choose whether Explore has a 'light' or 'dark' appearance.

**Records per page** – the number of records displayed per page in the test browser, from 25 to 100.

**Display time in 24 hrs format** – switches between 12 and 24 hour time formats.

**Display channel names according to ISO 230-1 standard** – error channels are named according to the VDI 2617 standard by default.

**Use the legacy LaserXL precision settings while exporting to files**

**Use full legacy format while exporting to files**

**Use legacy error compensation format** – uses the LaserXL error compensation format.

**Suppress warning to overwrite output file** – prevents a warning when an output file has the same name as a previous file.

**Default LEC output path** – set the default folder location when generating LEC files.

**File name attributes** – select the file name attributes while exporting to files. Include or remove machine name, serial number, and test title from the exported file.

### Angular

**Display as average across all angular channels** – average angular results at each position across all runs.



## Straightness

**Display as average across XL-80 runs** – averages straightness results at each position across all runs for XL-80.

**Display as average across XM-60 runs** – averages straightness results at each position across all runs for XM-60.

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**NOTE:** These options will only perform averaging on data in the 'Raw', 'Renishaw straightness 2012', and 'Compare' graphs.

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**Show data slope value on graph** – displays the slope value when slope removal has been applied to the captured data.

### Enable slope removal for raw and compare views

**Method** – select the averaging method: End point fit or Least squares fit.

**Averaging type** – run by run, average runs per direction, average all runs.

**Run by run** – Slope is calculated for each individual run to perform detrending on each individual runs with the slope.

**Averaging runs per direction** – Slopes are calculated for all averaged forward and reverse runs separately to perform detrending on each individual runs with the corresponding slope values.

**Averaging All** – Slope is calculated for all averaged data to perform detrending on each individual runs with the slope.

## Report

**Language** – change the language used when generating a report.

**Font** – allows the report font to be selected.

**Logo** – browse and add a personalised logo to a report. Personalised logos will appear in the top right of PDF and printed test reports.

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**NOTE:** The size of the logo in reports will be 200 × 50 pixels. If the logo is not this size, the software will automatically scale the chosen logo to fit on the report.

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**Use local date format for reports** – the ISO date format (YYYY-MM-DD) will be used by default in PDF reports.

**Hide environmental conditions table in report** – environmental data captured from the XC-80 will not be included when generating a combined report. The laser data remains environmentally compensated.

## Advanced configuration

This tab is used to configure squareness and file encoding options.

### Squareness configuration:

**Prism error (arcsecs)** – define the specified prism error

**File encoding** – select from a range of encoding types.

System	Data Management	Configuration
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## Help improve CARTO

Choose whether to share technical information to help improve CARTO.

## Notifications

Software notifications, such as check for updates, are displayed here.

## Data review and analysis

### Test explorer

The 'Test explorer' panel, found on the left-hand side of the software when a test is open, contains details regarding the open test.

**Measurements** – displays the 'Graph plot' and 'Raw data' table for the selected test. When viewing the 'raw' graph of an error channel, there is a toggle beneath the graph to change whether the channel is plotted against position or time.

**Test information** – contains details of the selected test. The title, operator, notes and machine name of a test record can be edited (this is indicated by the pen symbol next to these fields). To edit the text, select the field, type the new text and select the 'Save' icon in the top right.

**Environmental conditions** – the 'Environmental conditions' tab summarises the data captured by the environmental compensation unit during the test (when connected). Clicking on a graph will give more information and will allow printing or creation of a PDF file.

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## Analysis

**Opening a standard** – once a test has been opened, it is possible to view the data using one of the international analysis standards supported within Explore. The analysis standards can be found in the column on the left-hand side.

**Supported analysis standards** – ASME 5.54 1992, ASME 5.54 2005, GB/T 17421.2 2000, GB/T 17421.2 2016, ISO 230-2 1988, ISO 230-2 1997, ISO 230-2 2006, ISO 230-2, 2014, JIS B 6192 1999, ISO 10791-1 2015, ISO 10791-4 1998, JIS B; 6190-2 2008, Renishaw 2012, VDI 3441 1977, VDI 2617 Template 1989.

**Switching the data view** – data can be viewed in different formats using the tabs at the top of the data plot. The format options vary depending on the analysis standard that has been selected.

**Enable and sort analysis standards** – the ‘Enable and sort analysis standards’ window allows users to choose which analysis standards should be displayed and to change the order. To toggle between showing and hiding the standard, select the eye symbol next to each standard. To change the position of an analysis standard, select the standard to highlight it, then select the ‘Move up’ or ‘Move down’ icon.

## Graph plot options

**Change the plot style** – select ‘Graph configuration’ icon to display the following options:

- a. **Scale tab** – select the desired scaling type for the X and Y axis independently. The available options are automatic, manual or manual centred scaling.
- b. **Display tab:**
  - Show legend – displays the run identifications on the right-hand side of the plot.
  - Show grid – displays a ‘Background grid’ on the plot relative to the scale.
  - Black and white – switches all plot runs to black and white.
  - Line thickness – adjusts the thickness of the plot lines.
  - Marker style – select the style of marker used in RAW, Renishaw graphs.

## Analysis feature highlights

Select from different analysis standards next to the graph plot to display them on the graph.



## Graph interaction

When analysing a test within Explore, the following options are available to customise the graph:

### ‘Zoom’ in and out about the cursor:

- Position the cursor over the graph and use the scroll wheel to zoom.
- Press and hold the control key (ctrl), and press the + or – key to zoom in or out.

**‘Zoom’ the axis scale** – Position the cursor over the required axis, select it and then use the scroll wheel to zoom.

### ‘Zoom’ to a manually selected area:

- Hold the scroll wheel and drag to select an area to zoom.
- Press and hold the control key (ctrl), select and hold the right mouse button and drag to select the area to zoom.

### ‘Pan’ the axis scale up and down:

- Position the cursor over the required axis, select and hold the right mouse button, and drag the axis.

### ‘Pan’ the graph plot:

- Position the cursor over the graph, select and hold the right mouse button and drag.
- Position the cursor over the graph and select it. Press and hold the control key (ctrl) and use the arrow keys.

### ‘View’ point co-ordinates and series details:

- Position the cursor over a capture point on the graph and hold the left mouse button to view information.

### ‘Revert’ to default settings:

- Position the cursor over the graph and double-click the scroll wheel.
- Position the cursor over the graph, press the control key (ctrl) and double-click the right mouse button.
- Position the cursor over the graph and press the control (ctrl) and A keys.
- Position the cursor over the graph and select the ‘Home’ icon.



## Data stitch

Stitching data together allows the user to capture a measurement axis in multiple sections before using the data stitch function to create a single measurement record. This allows measurement of axes that are greater in length than the specification of the laser system being used, or breakdown measurements of axes captured in noisy measurement environments into smaller sections.

### To stitch tests:

1. Select 'Data stitch' in the bar towards the top right of the screen.
2. Select the measurement type, machine name and axis from the dropdown menus. This will filter the database when selecting the tests to be stitched.
3. Select add tests and select the tests to be stitched.
4. Each test section will be displayed as an individual test in the view window.
5. Select 'Stitch test' to stitch the tests together. This creates a preview and will highlight the overlapping section.
6. Enter a 'Test name' and 'Operator' details before selecting 'Save' to add the new test to the database.

## Compare

Comparing test records can be useful for applications such as comparing data before and after error compensation or viewing the effects of angular error for linear positioning. Whilst in compare view, zero point offset, slope removal and graph inversion can also be applied to the data.

### To compare files:

1. Go to the test browser.
2. Select one or more test records.
3. Select 'Compare' in the bar towards the top right of the screen.
4. In the table at the bottom of the page, tick the boxes of the error channels of interest.
  - Select 'Add' to add extra test records to the table.
  - Select the 'Reset' button on the left of the table to remove tests.
  - To edit how an error channel is displayed, select the error channel in the table and make adjustments using the panel on the left.



## Zero point offset

'Zero point offset' enables the data to be offset so the displayed and effective '0' position is different from that set at the time of data capture. This can be useful for error compensation of rotary axes.

### Applying 'Zero point offset'

1. From the bottom of the 'test explorer' panel, select the 'Zero point offset' to display the 'Zero point offset' dialog box.
2. Configure the 'Zero point offset' as required.

### Revert to original settings

Uncheck 'Apply zero point offset' to revert to the original settings.

## Data clipping options

Selecting 'Data clipping options' to display and edit the maximum and minimum values for the X axis.

These can be removed at any time to return the full range of the X axis by selecting 'Undo'.

## Error visualisation (XM tests only)

Selecting error visualisation allows the user to view a training animation of the captured measurement. This highlights the relationship between each individual degree of freedom and the effect they have on the axis being measured.

## Offset readings (XM tests only)

Select offset reading to offset all six error channels from the XM measurement to a different point of interest. This allows the user to see the effect of different offset values on the measurement values.



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## Creating reports

Reports can be created using the following methods:

- Copying and pasting the relevant data into another application for editing.
- Creating a formatted PDF from within Explore.

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**NOTE:** Adobe® Reader or a similar program must be installed on the device to view PDF reports.

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## Copy and paste

Data within the software can be copied from any page where the 'Copy' icon appears.

## Create a PDF

A PDF report can be generated from any analysis screen by selecting the 'Adobe®' icon. This allows selection of further Adobe® options, such as 'Save' and 'Print.' Alternatively, select the 'Print' icon to go directly to printing.

## Combined report

A single PDF report can be created for a single or multiple tests, displaying all six error channels in one report.

1. Select the 'Combined report' icon in the bar towards the top right of the screen.
2. Use the report builder window to create and generate a combined report for information (for example, RAW plot, RAW stats, GB/T 17421.2 2016) of the required error channels.



## Error compensation

1. Expand the 'Test explorer' panel on the left-hand side of the software screen using the 'Expand' icon.
2. Select 'Error compensation'.

### Configuration

#### Compensation type:

- Unidirectional – One table of compensation values with a backlash value.
- Bidirectional – Separate values for forward and reverse directions.

#### Calculation type:

- Incremental – This gives values calculated with respect to the previous compensation point.
- Absolute – This gives values calculated at user defined points with respect to the reference position.

**Compensation units** – Assign the units for compensation values.

**Decimal places** – Enter the number of decimal places to be used for the compensation values.

**Resolution** – The resolution of compensation values produced.

**Sign convention** – Configures the output values to either 'as errors' or 'as compensation'. Inverts the sign of compensation values produced.

#### Type:

There are two error compensation formats available: LEC.REN and LEC2.REN.

Choose a format which best suits the requirements for the relevant machine controller.

**Reference position** – The axis position where the zero point of compensation is applied.

**Start** – The start position on the axis where compensation is applied.

**End** – The end position on the axis where compensation is applied.

**Spacing** – The spacing between each compensation point.

**No. of points** – Instead of specifying the compensation spacing, the number of compensation points can be specified.

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## Saving configuration settings

If the configuration settings are required for future use, they can be saved by selecting the 'Save' icon.

## Loading configuration settings

Select the 'Load configuration' icon to load a previously saved compensation configuration.

## Viewing error compensation files within Explore

Once the configuration settings are complete select the 'Generate' icon.

The error compensation data can then be viewed in 'compensation table' format or 'graphical compensation' format.



In graphical compensation view, the plot displayed will show the initial captured data results as well as the 'predicted machine performance after compensation'.

## Saving the error compensation file

When the error compensation has been generated, select 'Export' to save the compensation file. Select a location to save the compensation table.

[www.renishaw.com/carto](http://www.renishaw.com/carto)

 #renishaw

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