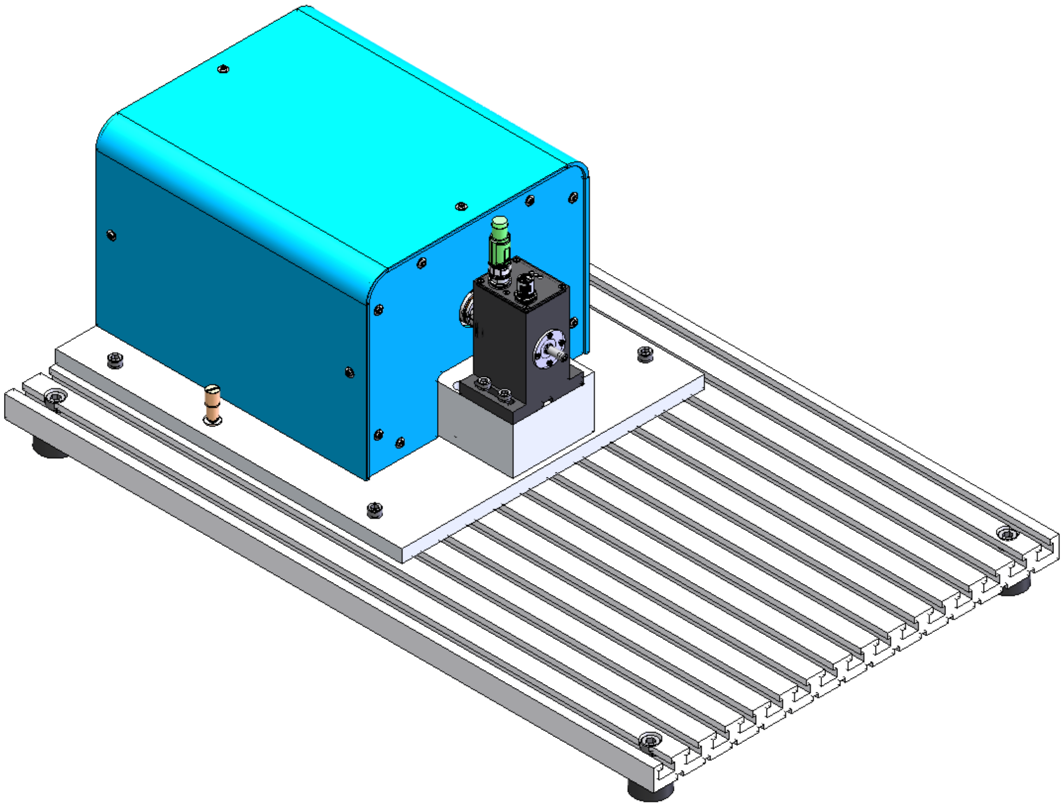
CTS-200

Cogging Testing Software



User's Manual

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Purchase Record

Please record all model numbers and serial numbers of your Magtrol equipment, along with the general purchase information. The model number and serial number can be found on either a silver identification plate or white label affixed to each unit. Refer to these numbers whenever you communicate with a Magtrol representative about this equipment.

Model Number: ______________________________

Serial Number: ______________________________

Purchase Date: ______________________________

Purchased From: ______________________________

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Safety Precautions

1. Make sure that all Magtrol dynamometers and electronic products are earth-grounded, to ensure personal safety and proper operation.
2. Check line voltage before operating electronic equipment.
3. Make sure that dynamometers and motors under test are equipped with appropriate safety guards.

REVISION RECORD

Revision	DATE	DESCRIPTION PM N°
1	24.04.2017	Original Issue
2	05.07.2018	012 modifications
3	12.07.2019	021 modifications
4	09.12.2019	021f2 modifications Add Part Number, Serial Number and Direction of test
5	21.01.2020	021f3 modifications Add Drag Torque
6	01.04.2020	021f4 modifications Add Cogging Torque value by Sector based on FFT analysis Solve small bugs of X-Y scaling Export FFT value in Graph tab when FFT is displayed
7	14.5.2020	021f5 modifications Correct size of font for vector Correct Export to Excel (removed column with 0 inside)
8	30.6.2020	021f6 modifications Increasing sampling rate by 2 ==> 200Hz Low pass filter on TS fixed to 20Hz
10	21.10.2020	021f7 modifications Correct Drag Torque in negative side Add Vector table in Report and Graph
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1. INTRODUCTION

1.1 ABOUT CTS 2.0

Magtrol’s CTS 2.0 is a program designed for use with Windows® 7 SP1/10 operating systems for PC-based data acquisition. Used in conjunction with Magtrol’s Cogging Test System, CTS 2.0 is equipped to interface and measure mechanical parameter of device under test (cogging torque).
The data generated can be stored, displayed and printed in tabular or graphic formats, and is easily imported into a spreadsheet.
Magtrol can also make custom modifications to the software to meet your specific requirment.

This software is protected by a software security code. One installation per licence.

1.2 SYSTEM REQUIRMENTS

Minimum Recommanded:

- Personal computer with Intel i3 Processor (or equivalent, i5 recommended)
- Microsoft® 7SP1 / 10 (32 or 64 Bits)
- 4 GB of RAM
- 4 GB of available hard drive space
- VGA color monitor with minimum screen resolution 1280 x 900
- One USB-A interface available

1.3 DESCRIPTION / FUNCTIONALITY

CTS serie bench is based on Torquemaster sensor (TS 1xx) to measure the torque at low speed. MUT is not supplied, a second motor drive the shaft at low speed with Torque and Angle measurement.

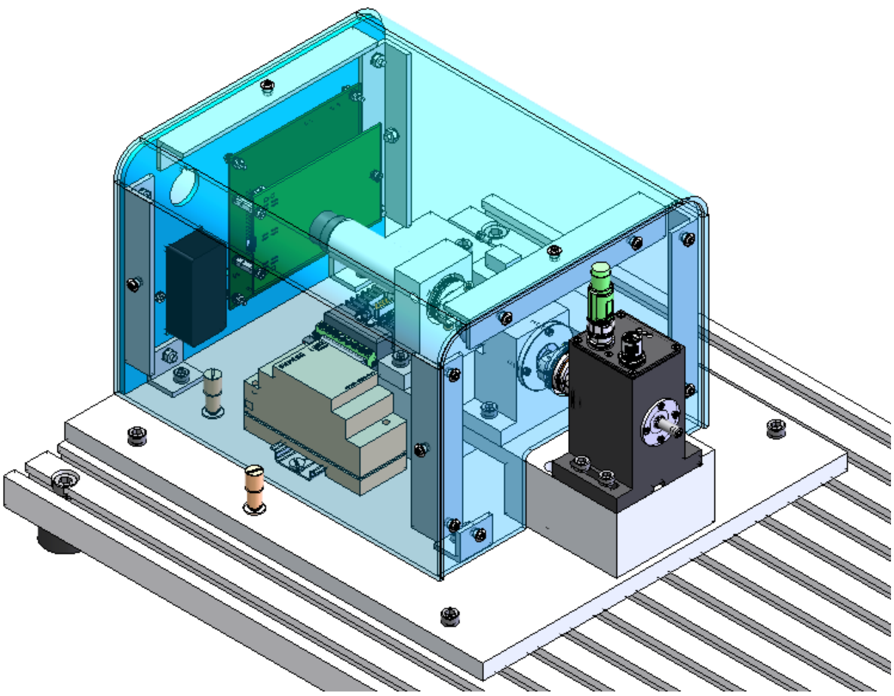


Figure 1 (Mechanical design)

This figure show the mechanical parts.

1.4 CHARACTERISTIC

CTS is composed by two groups:

Model	Rated Torque	Torque Precision for RT	Max. Speed	Angle encoder	Clutch security
CTS-100	50 mNm	2 ‰	10 rpm	5000 CPR	Yes
CTS-101	100 mNm	1 ‰	10 rpm	5000 CPR	Yes
CTS-102	200 mNm	1‰	10 rpm	5000 CPR	Yes

Model	Rated Torque	Torque Precision for RT	Max. Speed	Angle encoder	Clutch security
CTS-103	500 mNm	1 ‰	8 rpm	5000 CPR	No
CTS-104	1 Nm	1 ‰	8 rpm	5000 CPR	No

The interchangeability of TS size can be done inside of the group
The Clutch security is used to prevent an over torque of TS for small size.

1.5 MOTOR COUPPLING

The coupling between the cogging bench and the motor under test is very important and must be precise and perfect alignement.

2. SOFTWARE INSTALLATION

2.1 INSTALLATION PROCEDURE

Insert the CTS 2.0 disk into your target computer's DVD drive or plug the USB flash memory.
When the following window appears (Figure 2 Run Setup Windows), click Run setup.exe.

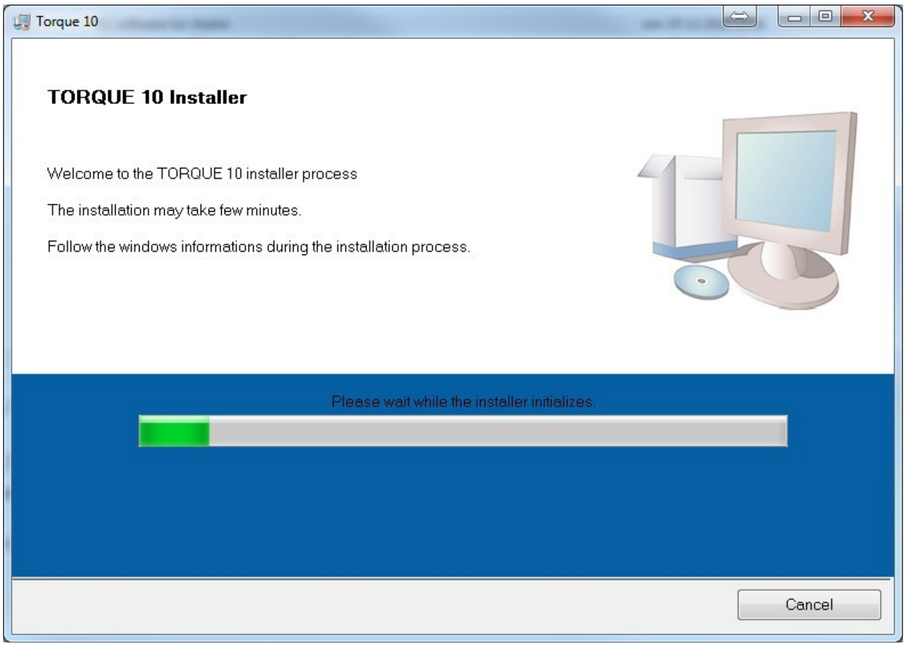


Figure 2 Run Setup Windows

If you do not see this window, use Explorer to find the setup.exe file on the disk. Double-click this file to begin the installation process.
If security is enabled, allow Windows to install this program.
The default installation folders for CTS 2.0 and the required drivers appear in the next window

(Figure 3 Destination Directory Window). You may change these if necessary but do not install CTS 2.0 in the Windows Program Files (x86) folder.

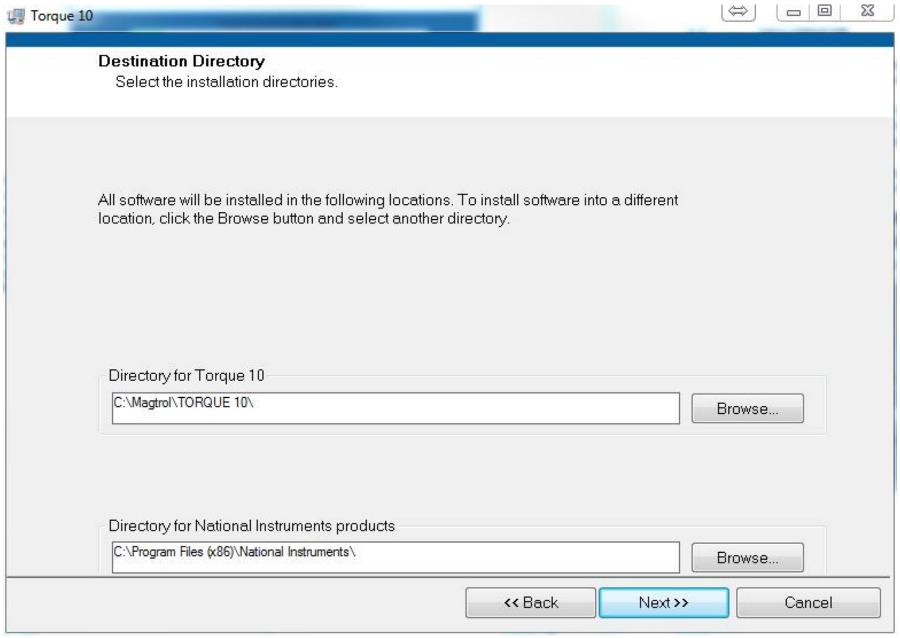


Figure 3 Destination Directory Window

This process can take several minutes to an hour depending upon the computer being used. Please plan accordingly.

When all programs are installed, the following window will appear. Click Finish to complete the installation.

3. "CTS 2" INTERFACE

From the taskbar, click Start, point to Programs >> MAGTROL >> CTS 2.0, then click CTS 2.0. From your desktop, double-click the desktop icon and the program will automatically start. The Start window will appear.

3.1 START TAB

This is the default tab when starting the CTS 2.0 program.

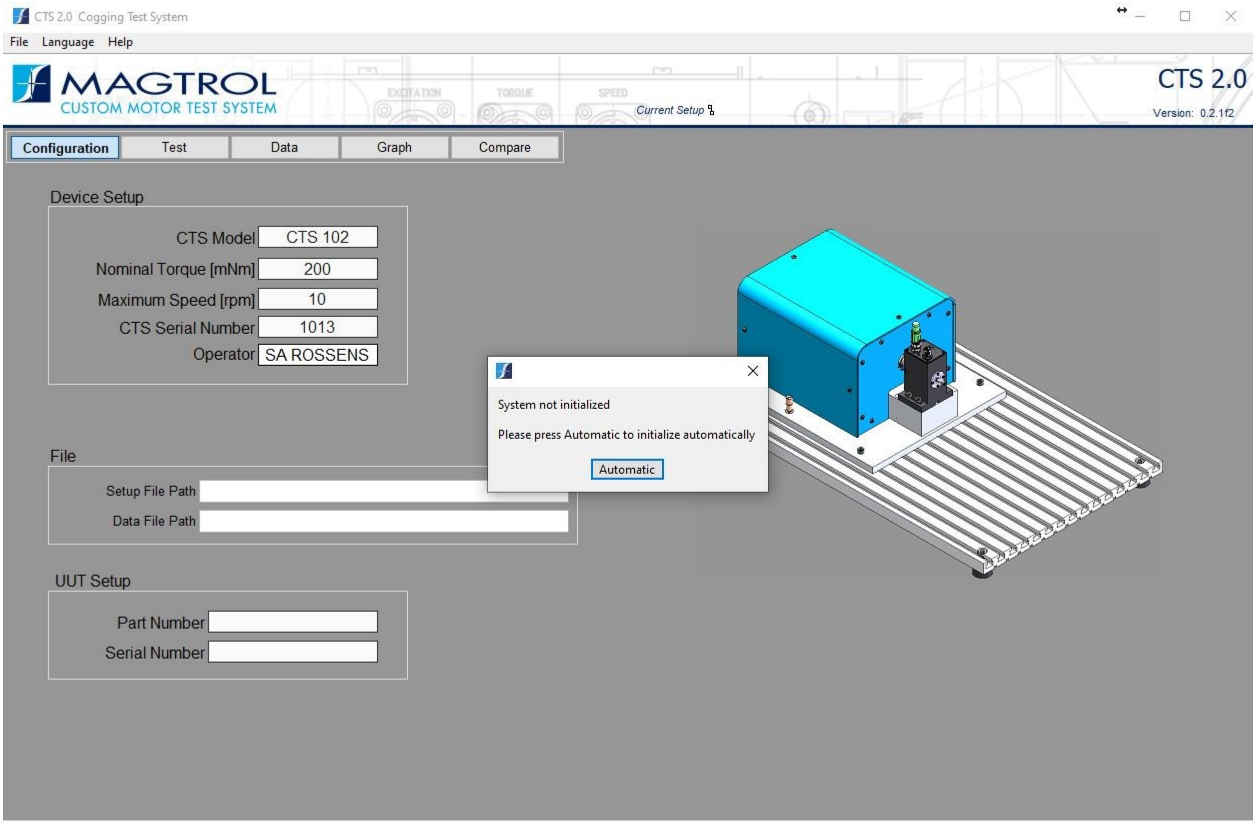


Figure 4 Start Tab

3.2 INITIALIZED

At each start the program, the initialization must be done to detect the index positioning.

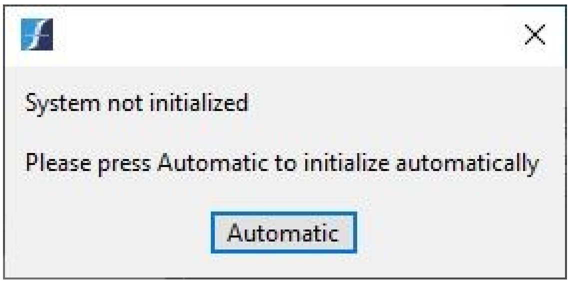


Figure 5 Initialization

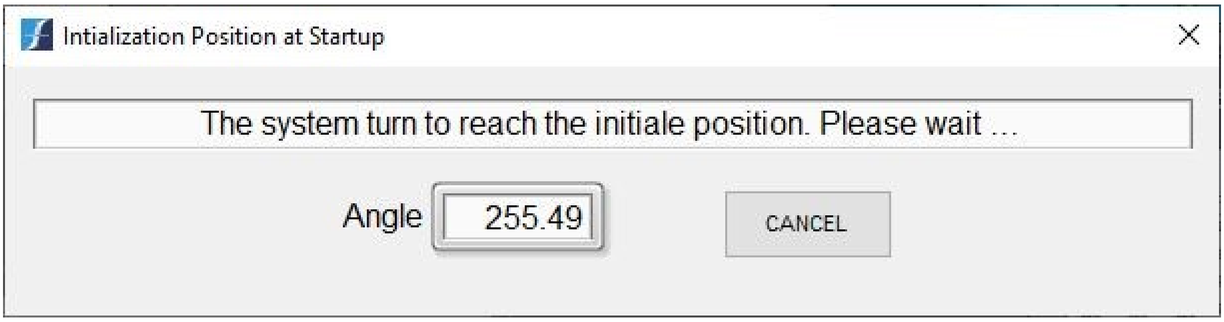


Figure 6 Initialization in progress

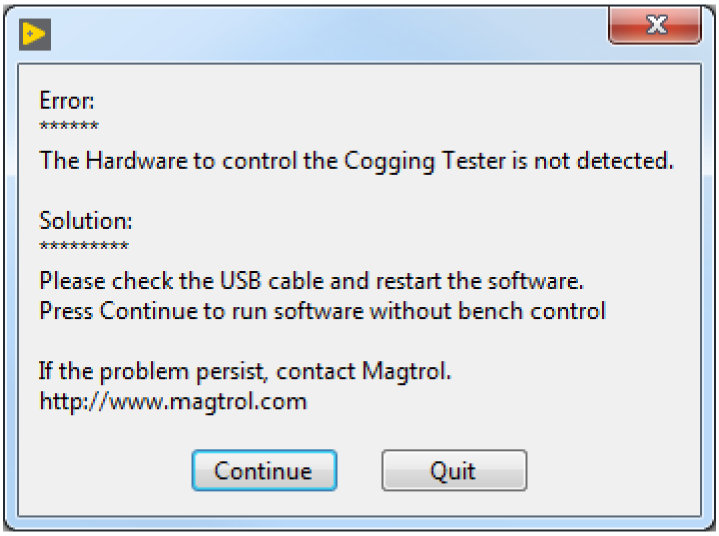


Figure 7 Warning message

If this message appears when start the program, please check the USB connection and the power supply of bench. Press Exit and restart software.
Please check if the correct services are enable:

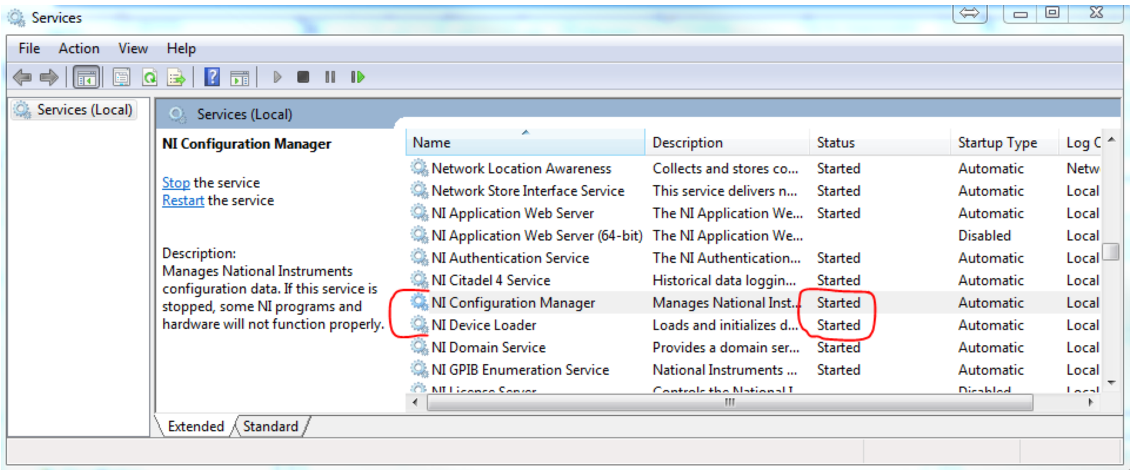


Figure 8 NI services Started

If service not started, please select the service then press Start.
Wait few second to see if hardware is detected and try to restart software.

If the error persist, please contact Magtrol SA. Press Continue to run the software without bench control.

3.3 MENU

On top of the window, 3 menus are available

3.3.1 FILE MENU

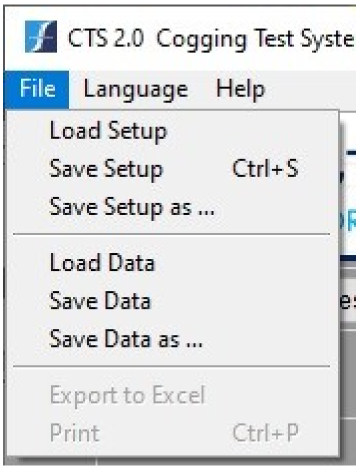


Figure 9 File Menu

Control	Function
Load Setup	Press to load a specific Setup file.
Save Setup Ctrl+S	Press to save the current configuration in current filename. If the current filename is empty, a dialog windows opens to select the filename to save. The shortcut Ctrl+S is the same function
Save Setup as …	Press to save the current configuration in specific filename. The filename and path will be use when press “Save Setup”
Load Data	Press to load a specific data file.
Save Data	Press to save the current data in current data filename. If the current filename is empty, a dialog windows opens to select the filename to save.
Save Data as …	Press to save the current data in specific filename. The filename and path will be use when press “Save Data”
Export to Excel	Press to export directly current data in Excel application. In X-Y and Polar view, the full test data are exported. In FFT view, the FFT value are exported. This function require to have Excel 2010 or higher.
Print Ctrl+P	Press to print the Data or Graph The shortcut Ctrl+P is the same function

3.3.2 LANGUAGE MENU

Figure 10 Language Menu

Language menu allow the user to select the language used throughout the program. The current language is a flag.

3.3.3 HELP MENU

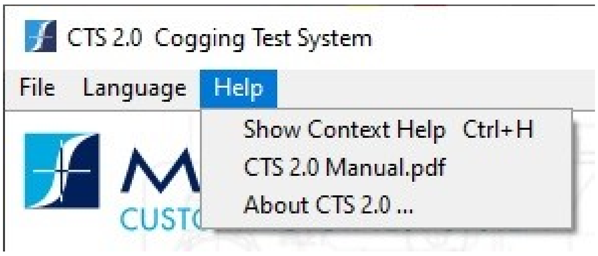


Figure 11 Help Menu

Control	Function
Show Context Help Ctrl+H	Enable or disable the context help
CTS 2.0 Manual.pdf	Load the manual to Acrobat Reader.
About CTS 2.0…	Show informations about this software

4. CONFIGURATION BUTTON

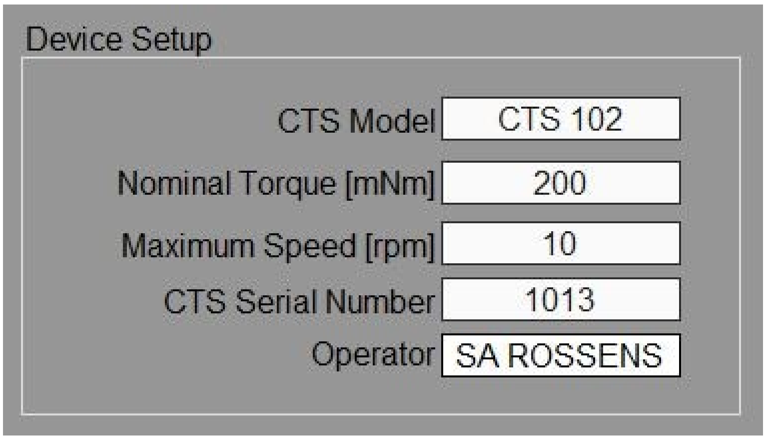


Figure 12 Device Setup

This part indicate the model and configuration of the CTS.
The Operator name can be entered.

4.1 FILE

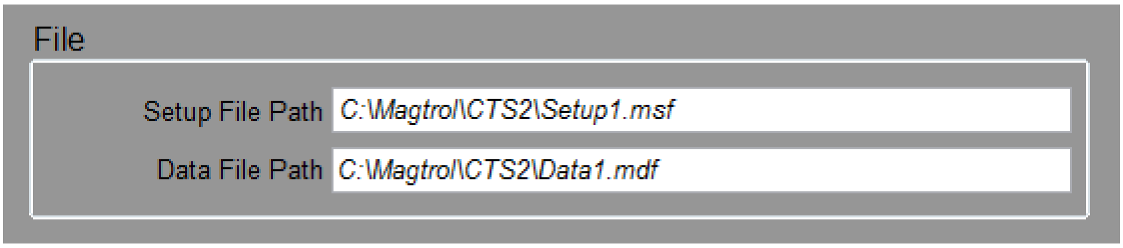


Figure 13 File indicator

Indicator	Function
Setup File Path	Show the current Setup file path and name.
Data File Path	Show the current Data file path and name.

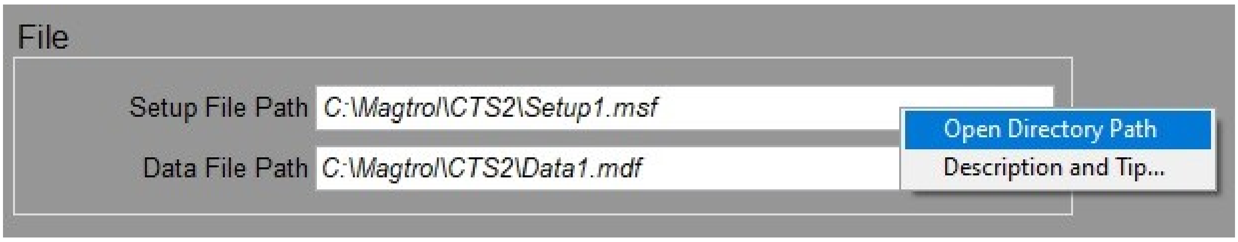


Figure 14 Right Click

Right click on field can be used to Open the file location. This is a helpful to locate and manage the Setup and Data files.

4.2 UUT SETUP

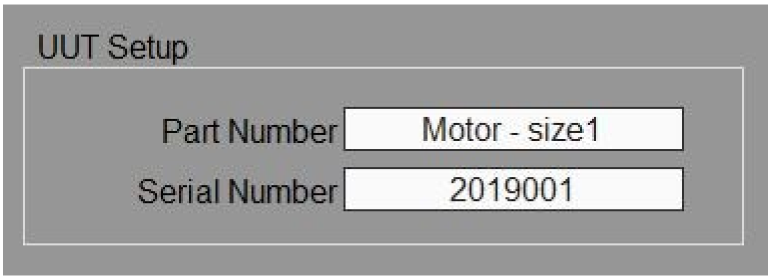


Figure 15 UUT Setup

Unit **U**nder **T**est **Setup** fields are used to specified the Part Number and the Serial Number

5. TEST BUTTON

The Setup of the Test is selected in this page.

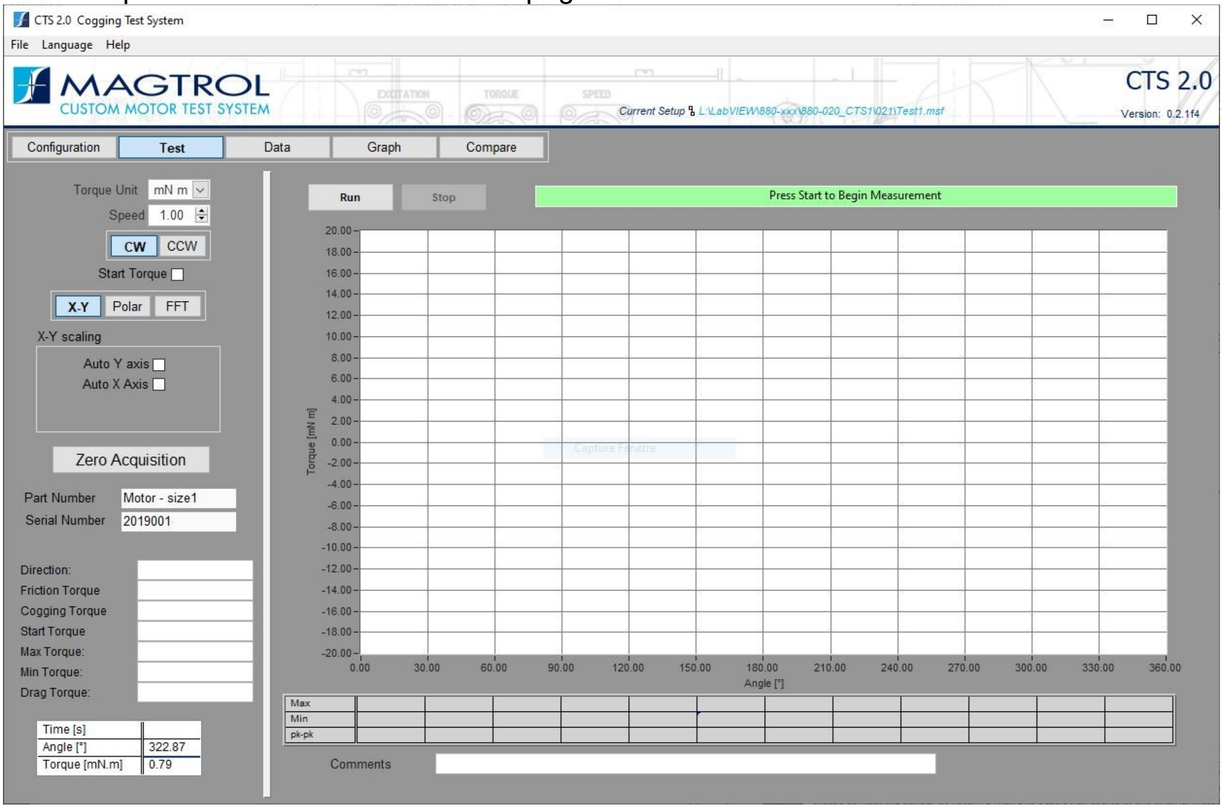


Figure 16 (Test page)

5.1 TEST PAGE CONTROL

Control	Function
Torque Unit	Select the display unit of torque
Speed	Set the speed value for test in CW and CCW and Zero Acquisition
CW / CCW Sens Rotation	Select the direction of the rotation of the test. CW ➔ 0 to 360° CCW ➔ 360 to 0°
Start Torque	Enable the Start torque calculation. CW ➔ -45° to 360° CCW ➔ 45° to 0° Except FFT, other displayed format show full data, including the first part -45° to 0 for CW and 45° to 0 for CCW. If disable, the field Start Torque is empty.
Plot Type X-Y / Polar / FFT	Select the display view during the test. FFT is only to view the Fondamental at the end of Test.
Auto Y/X Axis	Autoscaling Y and X axis
Zero Acquisition	This function is used to increase the precision of the measurement system. See chapter 5.2
Part Number	Enter the Part Number of the unit under test. This information is shown on the report
Serial Number	Enter the Serial Number of the unit under test This information is shown on the report
Table Min/Max/pk-pk	This table is fulled at the end of measure based on FFT analysis The fundamental value is used to divide the 360° by sector. For each sector, a Min, Max and Pk-Pk are calculated and the Cogging Torque value is the high value of all pk-pk

5.2 ZERO ACQUISITION

This process must be done frequently to measure the Torque versus Angle value of the system alone. To preform this job, the UUT must be uncoupled.

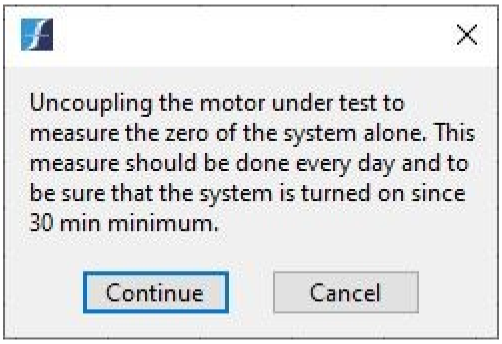


Figure 17 Zero Acquisition Start

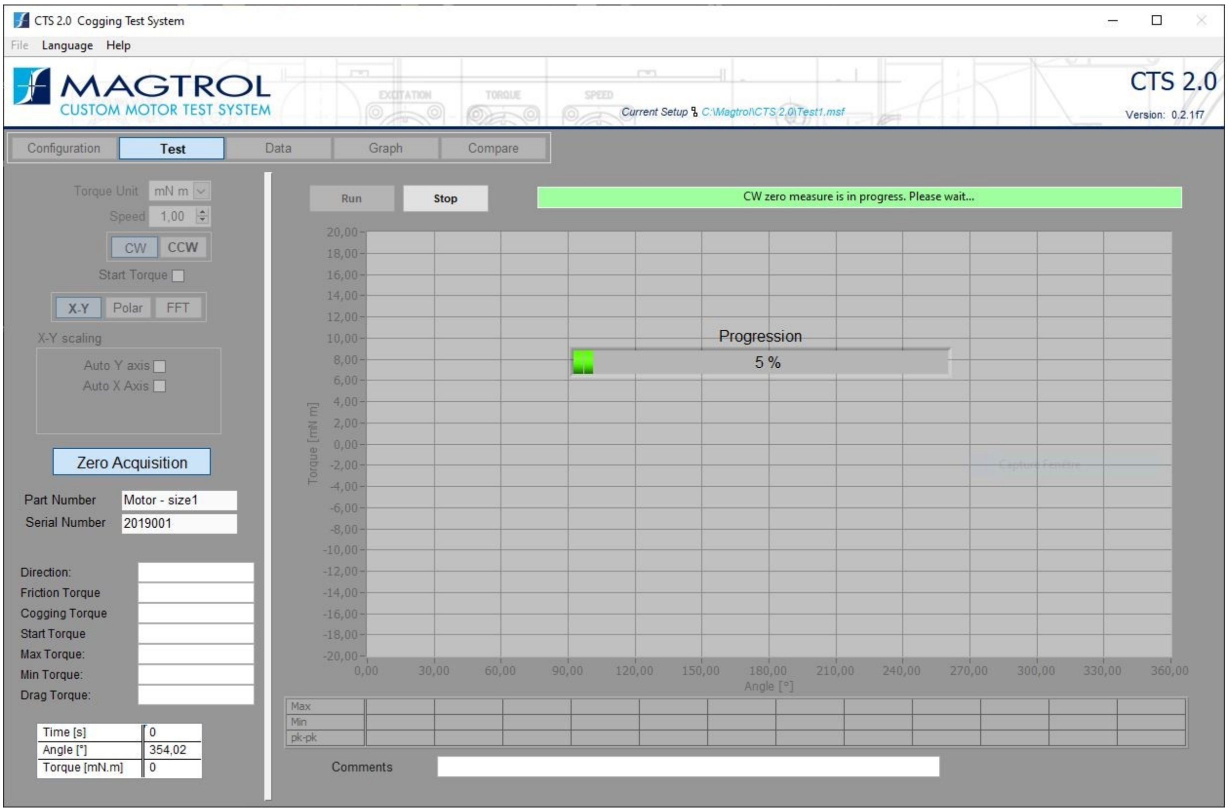


Figure 18 Zero Acquisition in progress

The zero process is done at the speed specified in the field Speed.
A zero measure is done in two directions.
The new acquisition overwrite the previous if the test is not stopped before end.

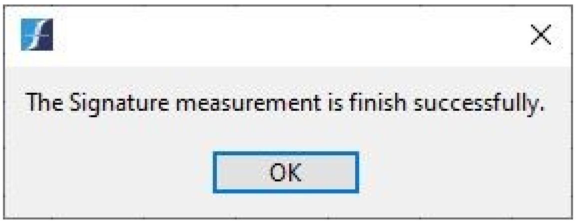


Figure 19 Zero Acquisition end

2 files are created and located on the USB dongle inside of the CTS.

5.3 START TEST

Before start the measure, coupled the UUT to the bench.
To screw the coupling, check the Torque value in real time to not over load the TS.

Select the Type of Plot displayed during the test, the display Torque unit, the speed and the rotation direction CW/CCW
Enable or disable the Starting Torque
X-Y ➔ select auto scaling or enter a specific scaling.
Polar ➔ enter the scaling
FFT ➔ enter the scaling

Then press Start

5.3.1 X-Y VIEW

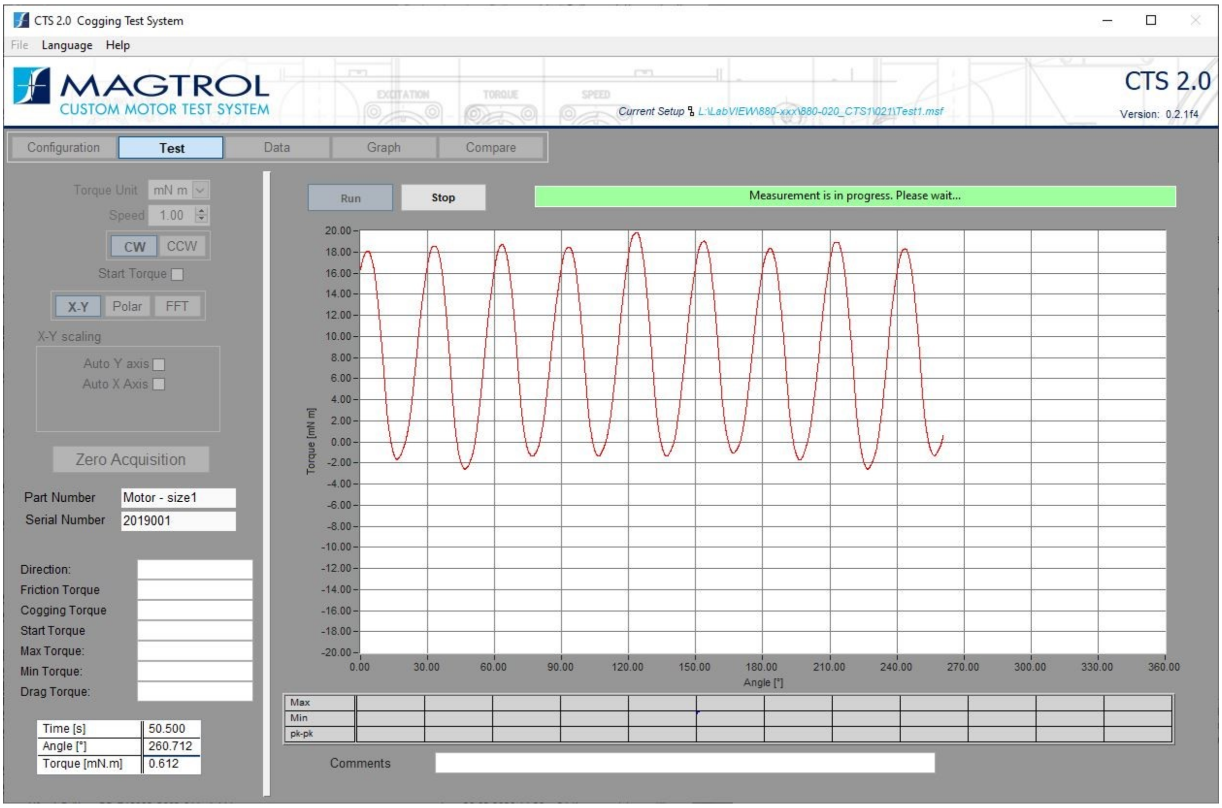


Figure 20 (X-Y plot Test view in progress)

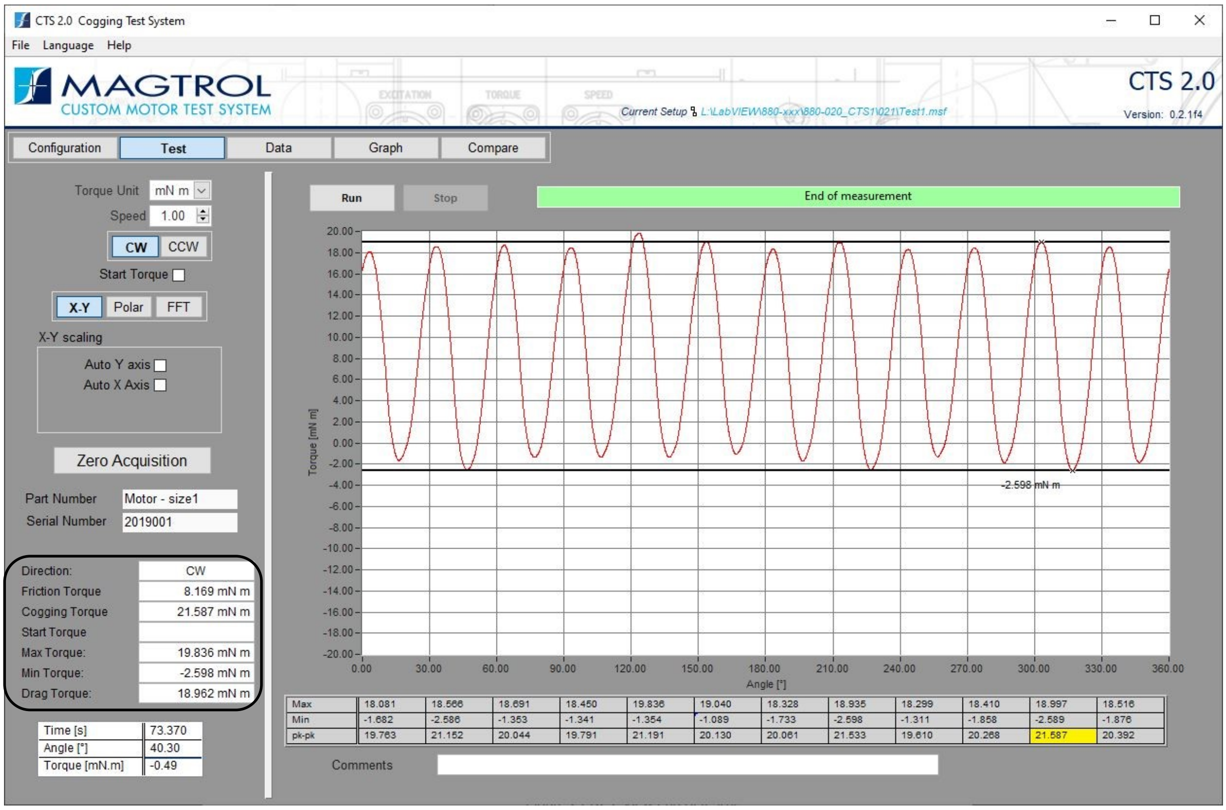


Figure 21 (X-Y View end of test)

At the end of the test, the parameters:
Friction Torque, **Cogging Torque**, **Start Torque**, **Max Torque**, **Min Torque** end **Drag Torque** are calculated automatically.
The table below the graph show the calculation for each sector. The **Cogging Torque** is the higher value, in yellow. The number of sector is based on the FFT analysis. If the Fondamental is not correct, please adjust it directly in the field **FFT Fondamental**.

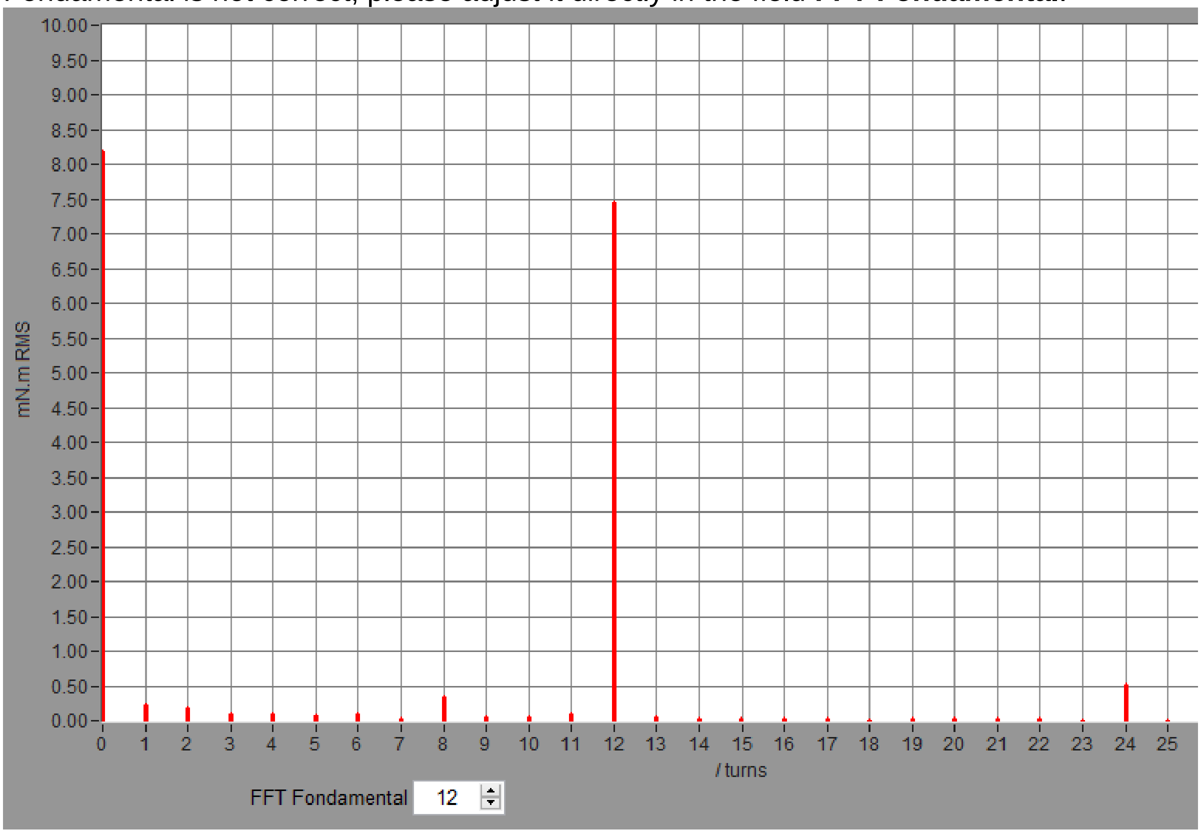


Figure 22 (FFT View end of test)

Start Torque is measured before 0°.
Friction Torque is the means of all between 0 and 360°.
Max Torque is the max of all between 0 and 360°.
Min Torque is the min of all between 0 and 360°.
Drag Torque = Friction Torque + (Cogging Torque / 2)

Two horizontal cursor (black) are available to adjust the **Cogging Torque** value.
If the auto Cogging Torque calculation not correspond to the desired value, it is possible to play with cursor to select the new Cogging Torque.

One vertical cursor (Red) is available to adjust the **Start Torque** value.

Move cursor if nessary to adjut value.

When the values are good, **Save Data as** function must use to save file.

At the end of the test, it is possible to switch between X-Y View, Polar View and FFT View

5.3.2 POLAR VIEW

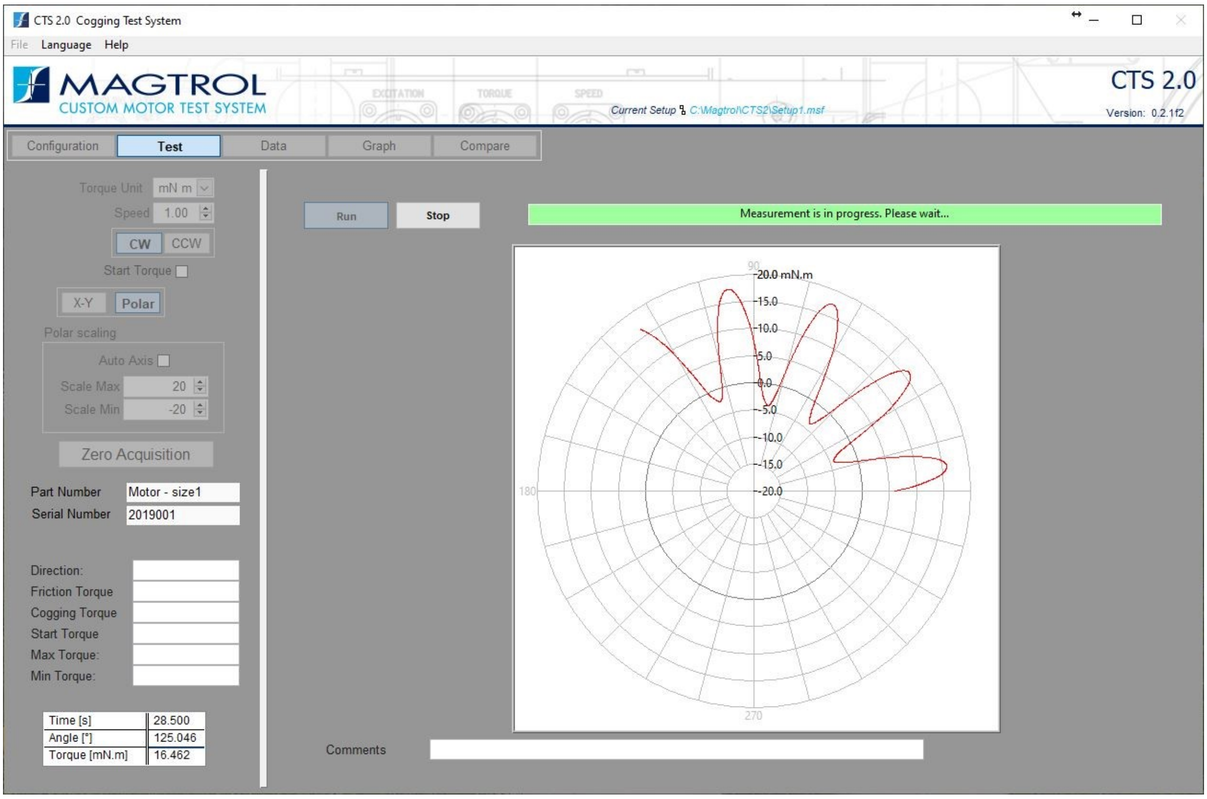


Figure 23 (Polar plot Test view in progress)

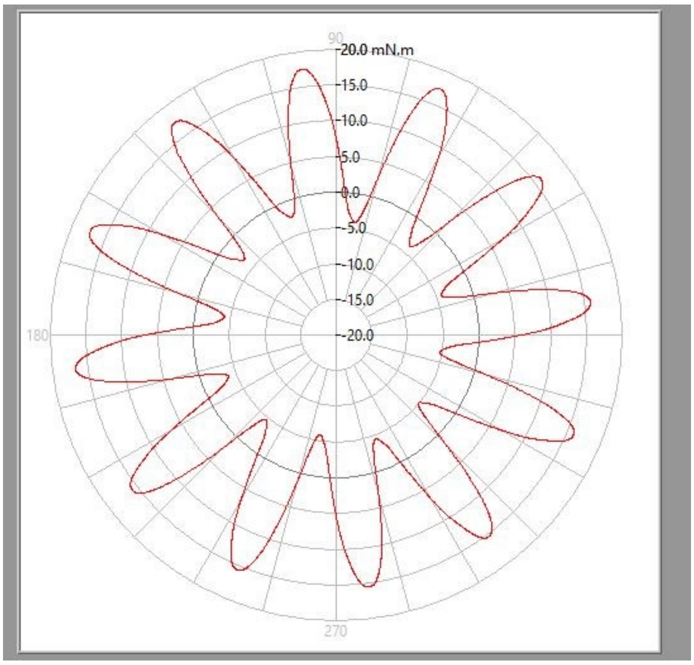


Figure 24 (Polar view at end test)

In polar view, the autoscaling during acquisition not exist. If the scaling need to be adjusted, wait the end of the measure and the scaling can be adjusted at your convenience.

The measure is not automatically saved at the end of the test. Save manually at the end of test.
Polar View not show cursors to adjust parameters, switch in X-Y View to do that.

6. VIEW DATA

After the test, click **View Data** to see test results in a tabular format.

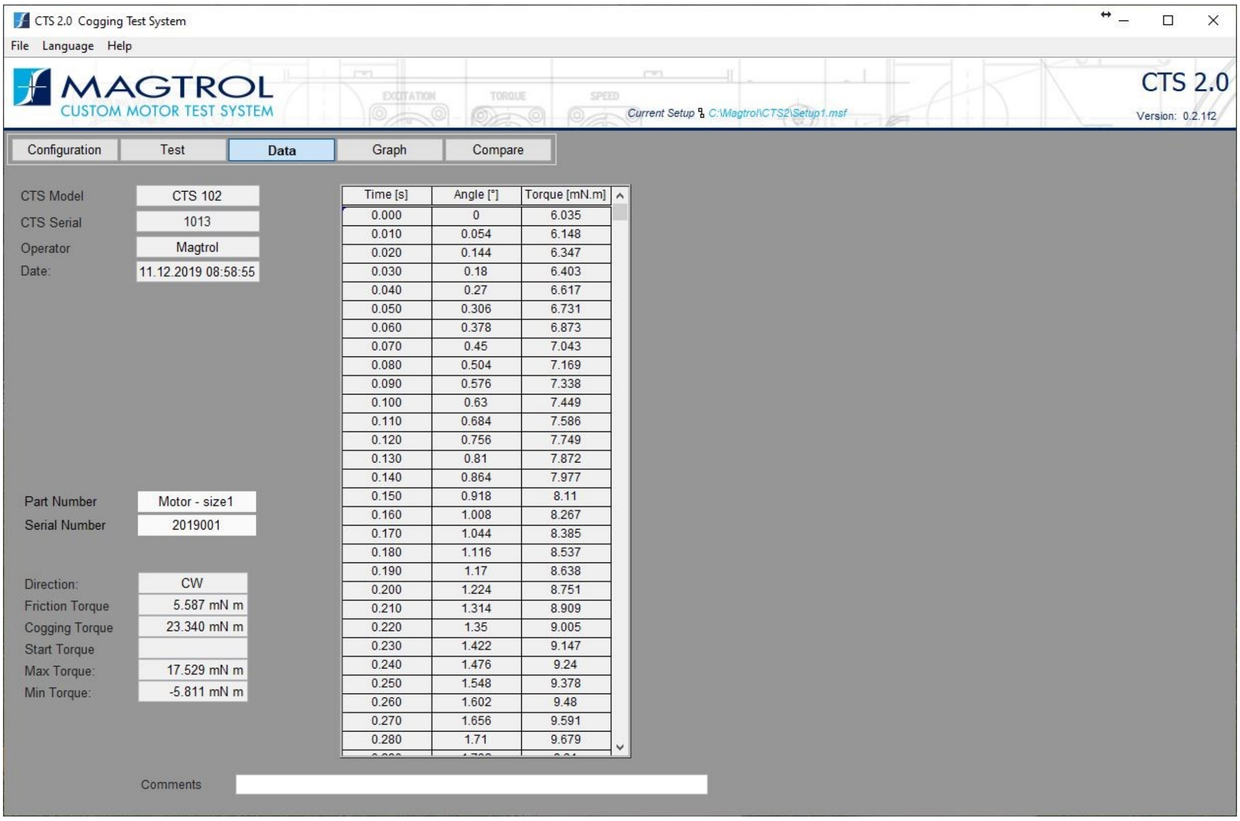


Figure 25 (View Data)

Use the scroll bars at the right and at the bottom of the table to view all the data.

Export to Excel (File menu) can be use to open excel and write data automatically in first sheet. The function require Microsoft Excel on the computer.

7. GRAPH

After the test, click on Graph page to view test results in a plot graph.
Three different view can be selected.

7.1 X-Y PLOT

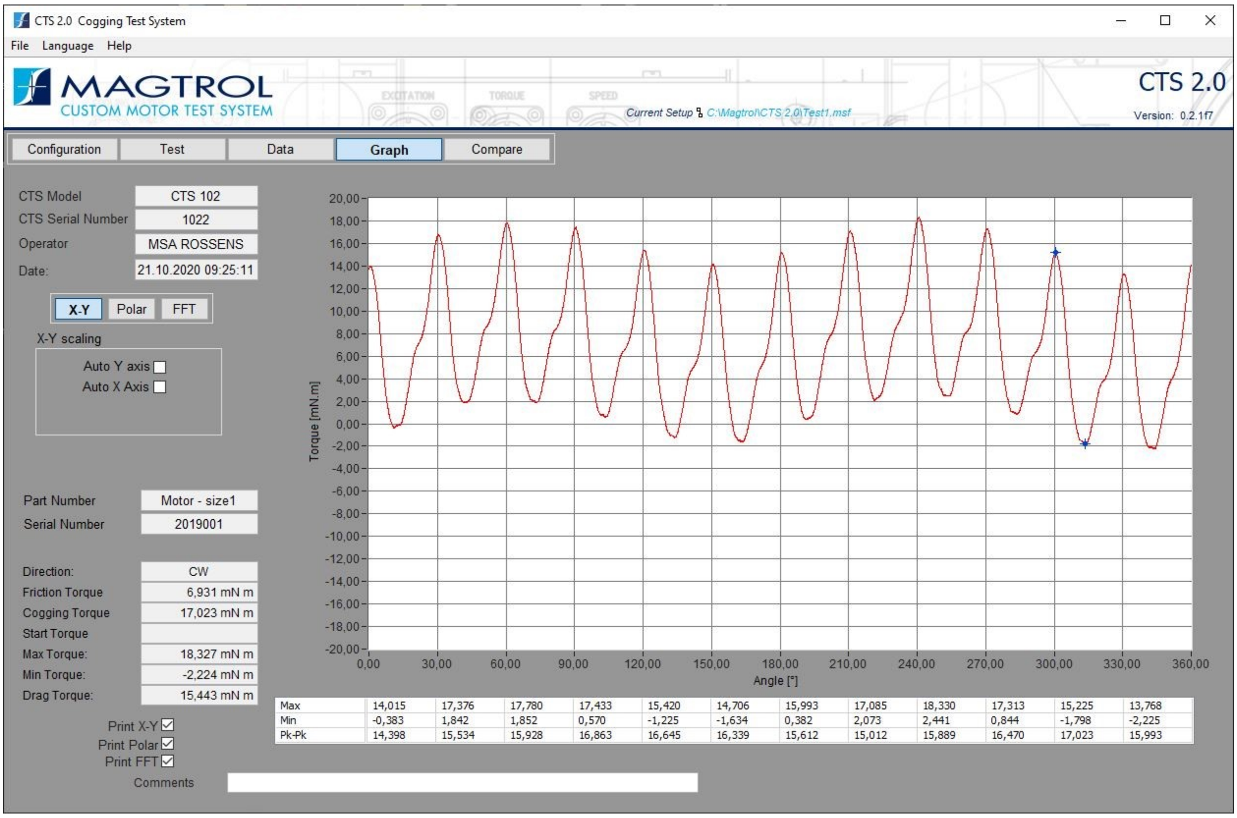


Figure 26 (5 axis Graph)

On the graph X-Y, two blue points show the position where the Cogging Torque is calculated.

The Table below the graph show the cogging values by sector.

Select Auto Y axis / X axis or set the scaling directly on the graph.

7.2 POLAR PLOT

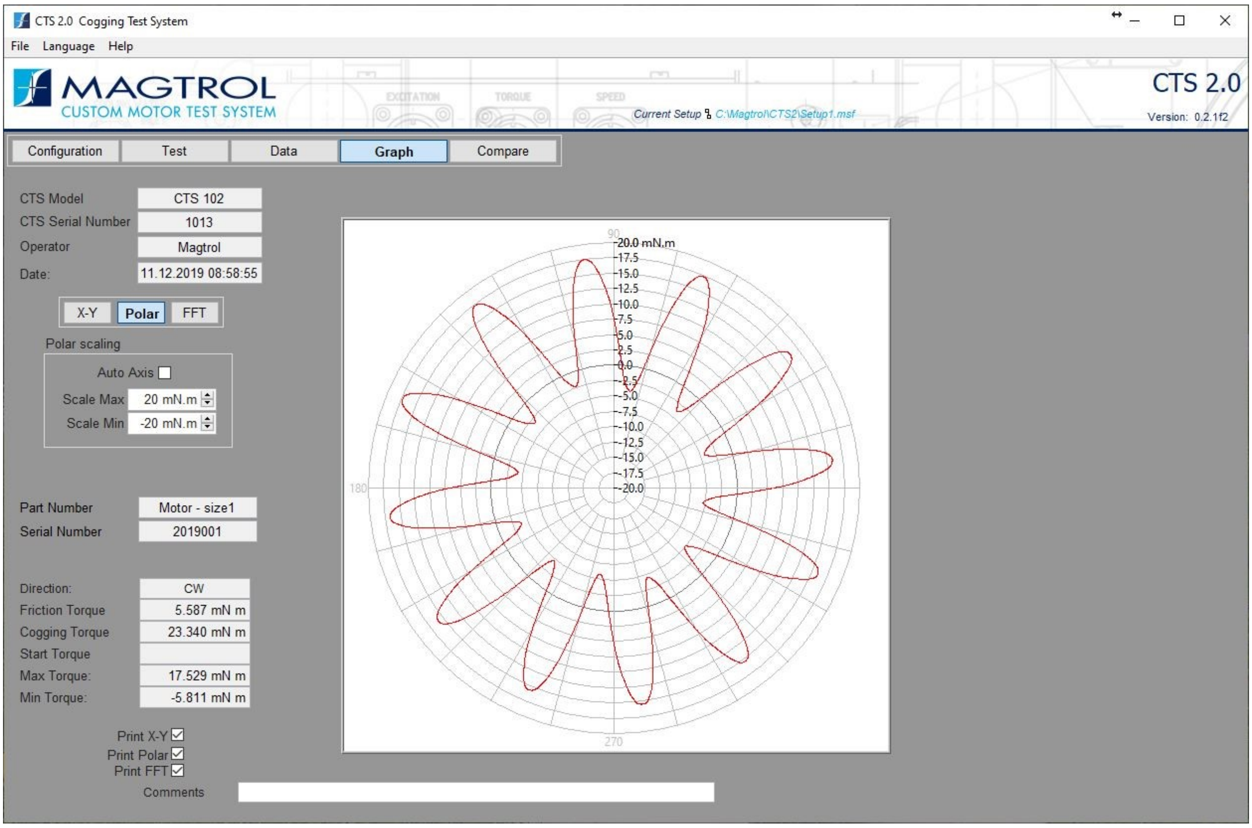


Figure 27 (polar plot)

7.3 FFT PLOT

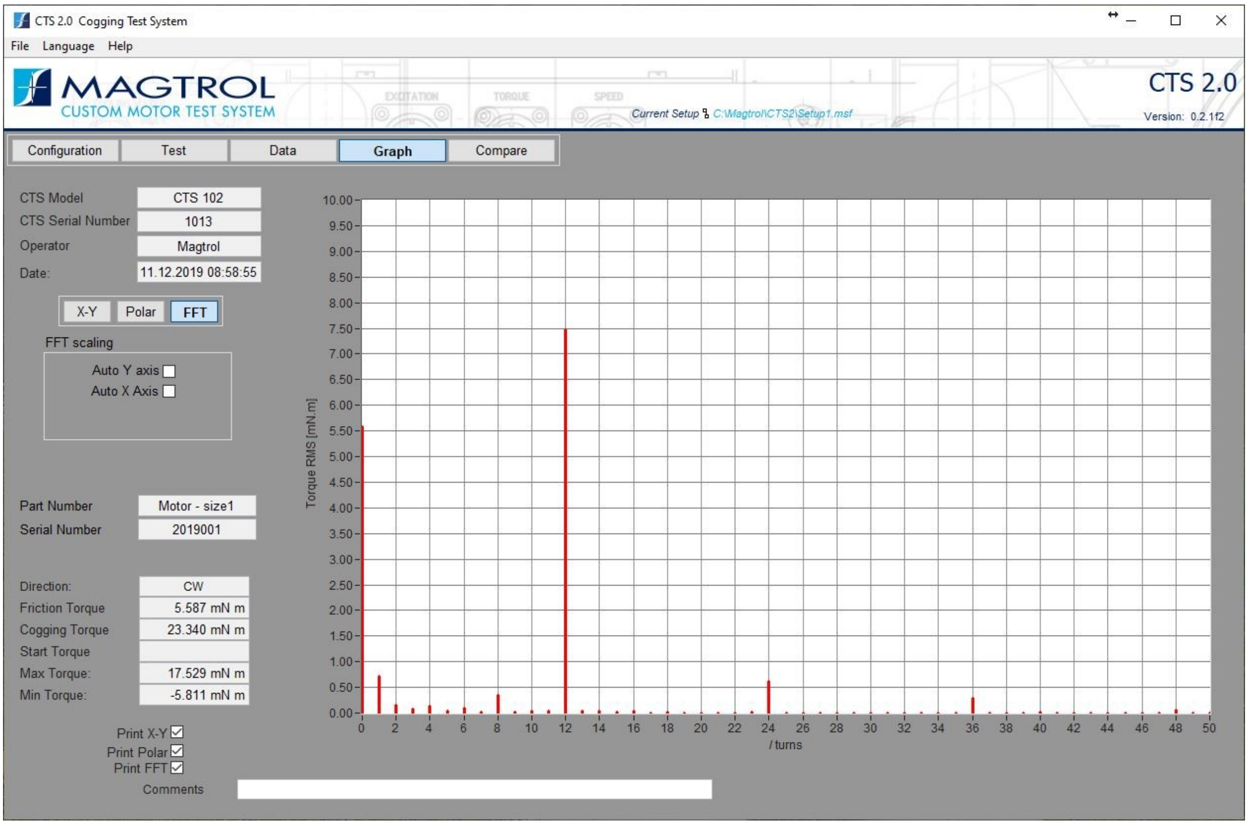


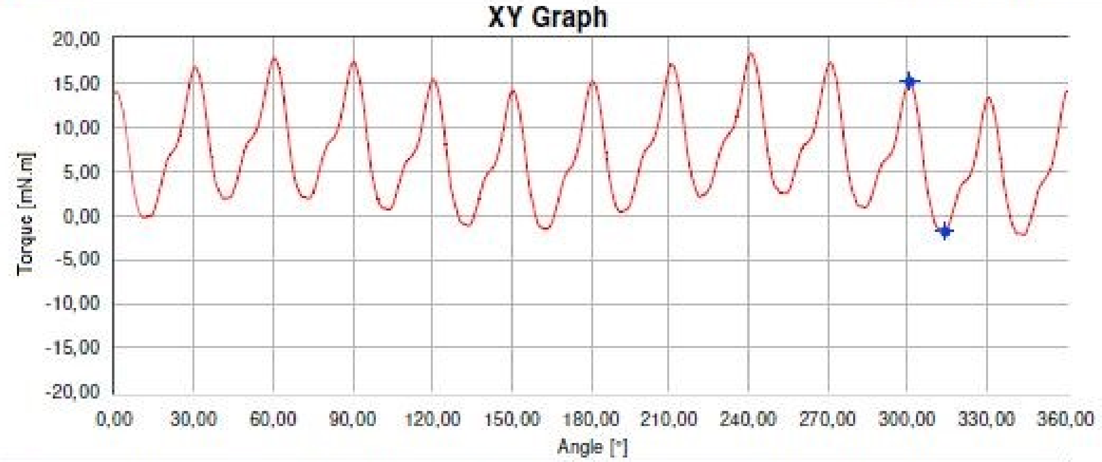
Figure 28 (FFT Plot)

7.4 PRINT FUNCTION FROM FILE MENU

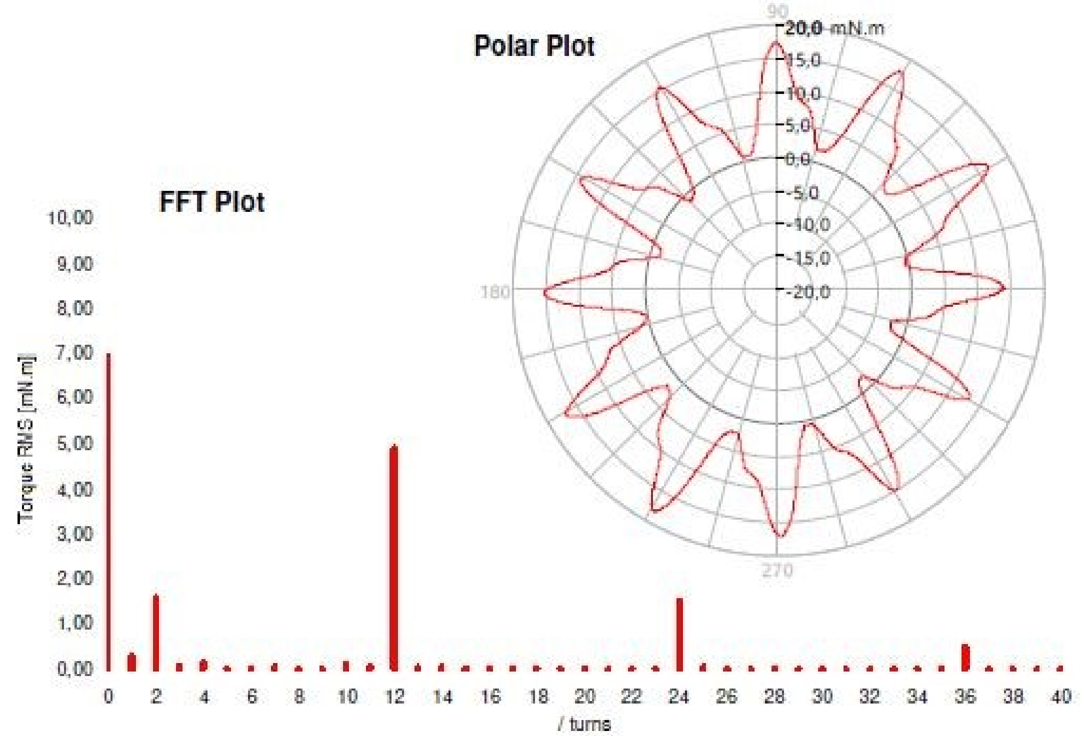
Select which plot you want to print.
The scaling of plots will be take from representation on this tab.
Depending on the Print flag selected, the view of report is not the same.
On the graph X-Y, two blue points show the position where the Cogging Torque is calculated.

MAGTROL

COGGING TEST SYSTEM
CTS 102 1022



Max	14,015	17,376	17,780	17,433	15,420	14,706	15,993	17,085	18,330	17,313	15,225	13,768
Min	-0,383	1,842	1,852	0,570	-1,225	-1,634	0,382	2,073	2,441	0,844	-1,798	-2,225
Pk-Pk	14,398	15,534	15,928	16,863	16,645	16,339	15,612	15,012	15,889	16,470	17,023	15,993



Part Number	Motor - size1	Direction:	CW	Start Torque	
Serial Number	2019001	Cogging Torque	17,023 mN m	Max Torque:	18,327 mN m
Date:	21.10.2020 09:25:11	Friction Torque	6,931 mN m	Min Torque:	-2,224 mN m
Operator	MSA ROSSENS	Drag Torque:	15,443 mN m		
Comments					

Figure 29 (Report print)

8. COMPARE

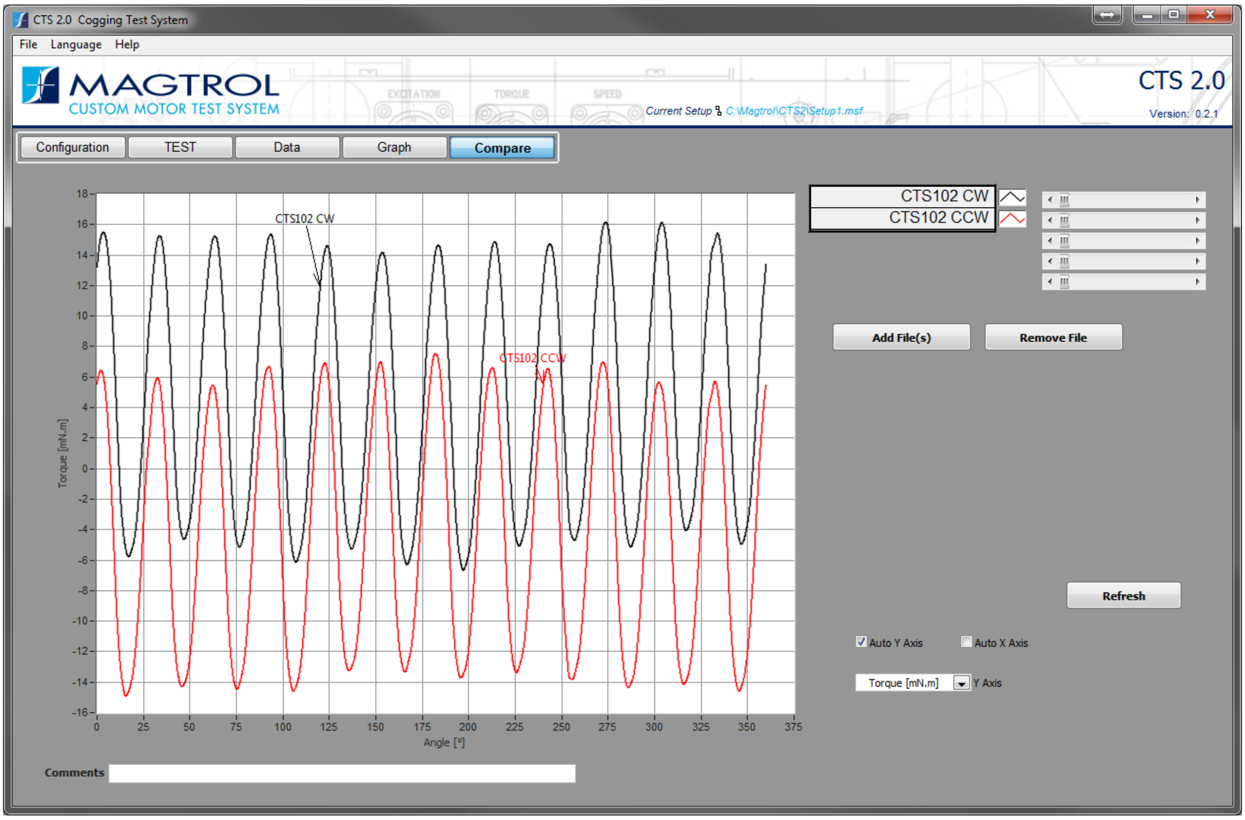


Figure 30 (Compare tab)

This tab can be use to compare different results.
The slide at the top right corner is a nice feature to adjust the angle curve to superpose properly different curve independent of the shaft positioning during the coupling process between CTS and MUT.

End of manual

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