

NYCe 4000

Linear motion system
LMS Tools Manual

Commissioning
R911419541

Edition 01



Title NYCe 4000
 Linear motion system
 LMS Tools Manual

Type of Documentation Commissioning

Document Typecode DOK-NY4000-LMS*CON*V52-CO01-EN-E

Internal File Reference RS-4578921be291f3870a347e867c5b4280-1-en-US-3

Record of Revision	Edition	Release Date	Notes
	DOK-NY4000-LMS*CON*V52-CO01-EN-E	12/2022	First edition 52V02

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Published by Bosch Rexroth AG
 P.O. Box 7170 ■ 5605 JD Eindhoven ■ The Netherlands
<http://www.boschrexroth.com>

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1 NYCe 4000 LMS Tools

1.1 Introduction

This manual provides information how to configure an LMS.

- [chapter 2 "System configuration" on page 3](#)

This chapter describes the steps you must do whether your LMS application is executed on a PC or on an LMS node.

- [chapter 3 "Carrier Position Adjustment \(CPA\) tool" on page 9](#)

The Carrier Position Adjustment tool is a tool to generate the so-called CPA tables. The actual position of carriers can be improved if the CPA functionality is enabled in an LMS configuration and CPA tables are available. These CPA tables are generated using an external measurement system.

- [chapter 4 "NYCeCmMonitor" on page 25](#)

The NYCeCmMonitor tool gives you a quick overview of the status of the LMS, such as the system state, tracks and carriers in the LMS.

General information of the LMS can be found in the LMS User Manual.

LMS sensor

This manual uses the term "LMS sensor" for the sensor that is used in an LMS to detect the position of a carrier. The LMS sensor can be based on two different technologies. One technology uses two Hall sensor elements, the other technology uses two magneto-resistive sensor elements. The term "LMS sensor" is used when a general reference can be made, "Hall sensor" and "MR sensor" is used when a specific reference must be used.

The dialog screens shown in this manual may slightly differ from the actual displayed windows on the screen.

1.2 General remark on XML formatted files

The NYCe 4000 tools and software API functions read and write XML formatted files on the host. You can also modify these XML (configuration) files with a suitable (XML) editor. If you do not use the NYCe 4000 tools, but use an external editor to modify an XML formatted file, make sure that the file is saved ANSI encoded. If the file is saved with a byte order mask (for example a UTF-8 byte order mask), the NYCe 4000 tools and API functions report the error `SAC_ERR_OPEN_FILE_ERROR` when such a file is opened. The folder "xmlnotepad" on the NYCe 4000 DVD contains a supported XML editor. Further, make sure that the information that you add manually in an XML file is correct. Invalid information in an XML file may generate error messages or cause unexpected behavior.

1.3 Used abbreviations in this manual

The following table gives a summary of abbreviations used in this manual.

Abbreviation	Description
CPA	Carrier Position Adjustment
Hall sensor	A sensor based on two Hall elements
IEEE	Institute of Electrical and Electronics Engineers
LMS	Linear Motion System

Abbreviation	Description
MCU	Motion Control Unit
MR sensor	A sensor based on two magneto-resistive (MR) elements
NHI	Node Hardware Interface (subsystem)
NY4114	MCU module with 3 IEEE 802.3 interfaces
NY4120	PWM Drive Module
NY4120/10	PWM Drive Module for LMS
NY4150	SERCOS III Master Module
pu	Position unit (user-defined dimension of position)
PVL	Position Velocity Loop

Tab. 1-1: Summary of used abbreviations

2 System configuration

2.1 Introduction

An LMS consists of two major parts, the LMS application which is developed by the user and the LMS Carrier Management (CM) software which is part of the NYCe 4000 LMS product. The LMS application can be executed

- as a program on a Windows-based PC.

A Windows-based PC is required in the NYCe 4000 network and the NYCe 4000 software must be installed on that PC. CM can be active on the PC or on any LMS node.

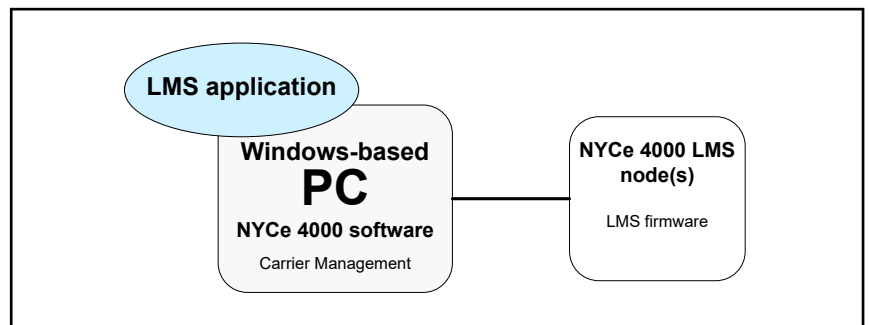


Fig. 2-1: LMS application on a PC

- as a program executed on a PLC.

A Windows-based PC in the NYCe 4000 network and NYCe 4000 software installed on that PC is optional. If the PC is not used Carrier Management must be active on one LMS node.

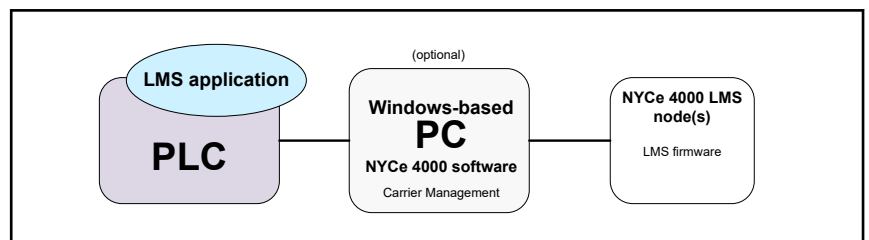


Fig. 2-2: LMS application on a PLC

- as an Embedded Application on an LMS node.

A Windows-based PC is no longer needed, Carrier Management is executed on one LMS node.

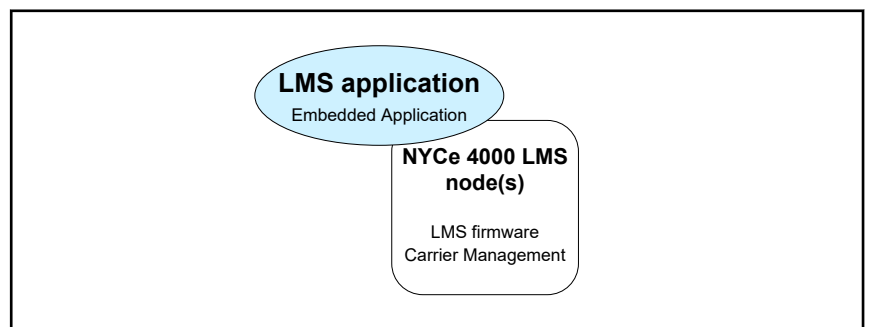


Fig. 2-3: LMS application on an LMS node

The LMS CM provides the CM functionality API for the LMS application, CM service for LMS control, and CM socket server for CM application execution on a separate PLC or PC.



Start-up of the LMS application, regardless where the application executes, is significantly improved when the LMS configuration file (`lms.xml`) and axis (coil) configuration file(s) are stored in flash memory on the node, and have "UseFlash" specified in the LMS configuration file. You only have to do the following actions once.

- Start NYCeConfigurator.
- Initialize the system from file.
- Save the configuration to flash memory on the node.

2.2 CM on the PC

Traditionally, a NYCe 4000 LMS consists of one or more NYCe 4000 LMS nodes and a PC. On the PC runs the CM service and the CM socket server. The LMS application can run on the same PC or on a PLC. If the LMS application runs on a PLC, the CM socket server is needed.

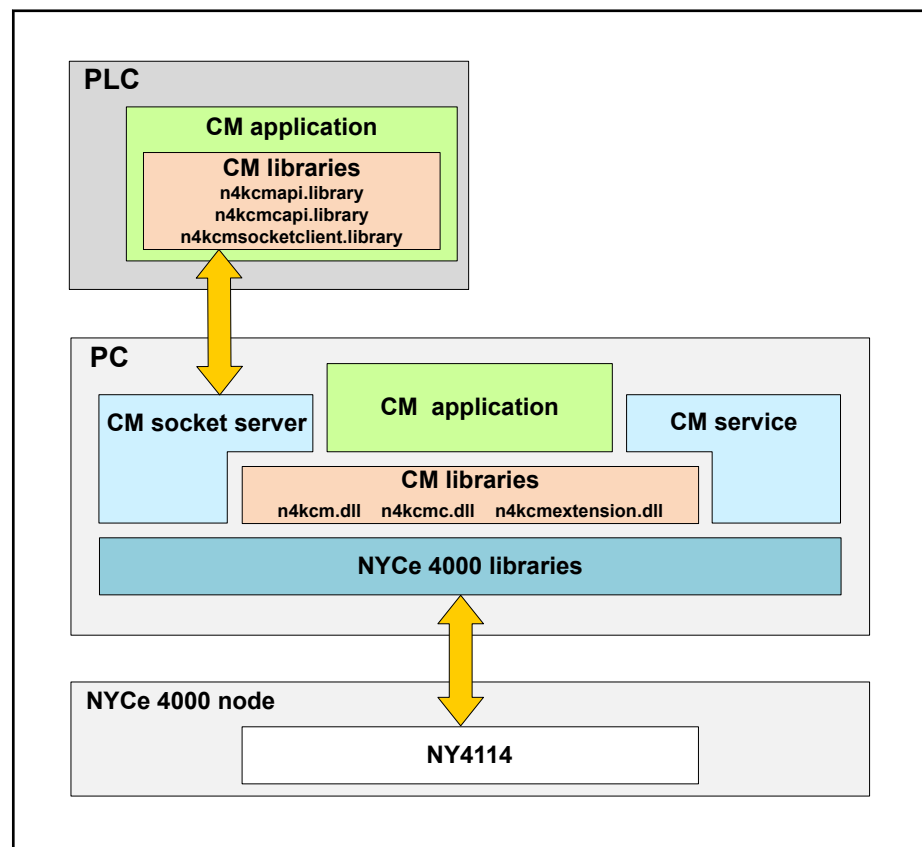


Fig. 2-4: CM (service and socket server) on the PC

2.3 CM on a node

The LMS node has the NY4114 MCU which executes the Linux operating system. As such, the MCU offers the possibility to run the LMS application on a node as an Embedded Application. In this configuration the PC is no longer

required by the LMS application. The CM service and CM socket server are moved from the PC to any LMS node and are executed as daemon processes. For brevity, when "CM service" is mentioned, CM socket server is included, unless explicitly mentioned otherwise.

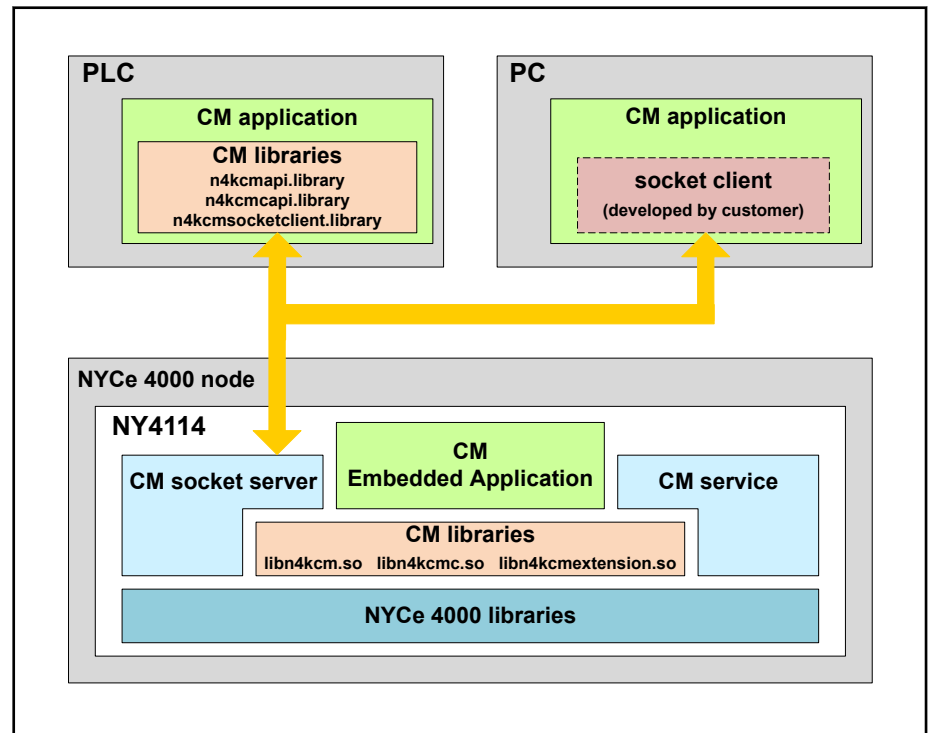


Fig. 2-5: CM (service and socket server daemon) on the node

Restrictions The following restrictions apply when CM service is active on a node.

- LMS Commissioning Tool is not supported.
- Event enrolment and redirection of logging is only supported on the node where CM service is active. If an LMS application requires event enrolment or redirection of logging, the LMS application must be executed on the same device where CM service is active.
- Multiple instances of NYCeLogger are not supported. NYCe 4000 log information can be retrieved from only one device.
- It is not possible to distinguish which LMS application calls a log function. The change of logging settings applies for all LMS applications.
- CM service and CM socket server are two separate daemon processes that run on one node.



A Windows-based PC in the NYCe 4000 network with NYCe 4000 software LMS installed on that PC is still needed for any LMS configuration definitions, because the NYCe 4000 (LMS) tools only run on a Windows-based PC. LMS Commissioning Tool requires that CM service is active on the PC.

2.4 Configuration

2.4.1 Introduction

When the CM application is executed as an Embedded Application on a node or the CM application is executed as a program on a PC, CM service can be

active either on any LMS node or on the PC. When the NYCe 4000 (LMS) tools are needed, a PC is required to run the tools, but CM service can be active either on the PC or on any LMS node. However, the LMS Commissioning Tool requires that CM service is active on the PC.

2.4.2 Starting and stopping CM service

When NYCe 4000 LMS is installed, CM service is activated on the PC by default. CM socket server must be manually started. You can change the location where CM service is activated. When CM service and CM socket server are activated on a node, both start automatically. No restart of the PC or node(s) is needed when CM service is moved from PC to a node or vice versa to effectuate the new configuration.

The following options are available to change the location of CM service.

- NYCe 4000 web page
- NYCeCommand
- NYCeConfigurator
- User-developed program

NYCe 4000 web page

The screenshot shows the 'Home' page of the NYCe 4000 web interface. At the top, the 'rexroth' logo is displayed as 'A Bosch Company'. Below the logo is a navigation menu with tabs: 'Home', 'Network', 'Boot', 'Temperature', 'Admin', and 'Reset'. The 'Home' tab is selected. The main content area is titled 'Home' and contains several configuration fields: 'Node name' (lmsF0), 'Mac address' (00:60:34:C2:8E:30), and 'Firmware type' (LMS Firmware). Below these fields are two checkboxes: 'Activate CM service' (unchecked) and 'EtherCAT enabled' (unchecked). A note below the checkboxes states: 'Make sure to upgrade the node after enabling/disabling the EtherCAT functionality.' At the bottom right of the form are 'Cancel' and 'Save changes' buttons. The footer of the page indicates 'Version: 50T13Drel4'.

Fig. 2-6: activate/deactivate CM service on a node via MCU browser page

Start the web browser on the PC and enter in the address field the address of the MCU. Default address is `http://192.168.41.14`. On the "Home" tab you can put a checkmark in the checkbox "Activate CM service" to activate CM service on this node, or remove the checkbox to deactivate CM service on this node.

If the node is not configured as an LMS node, the checkbox is not available.

NYCeCommand With the functions `CmActivateCmService` and `CmDeactivateCmService` you can activate and deactivate CM service on

the specified node or PC. If the specified node is not a node configured for LMS, the error `SYS_ERR_NOT_SUPPORTED` is returned.

NYCeConfigurator

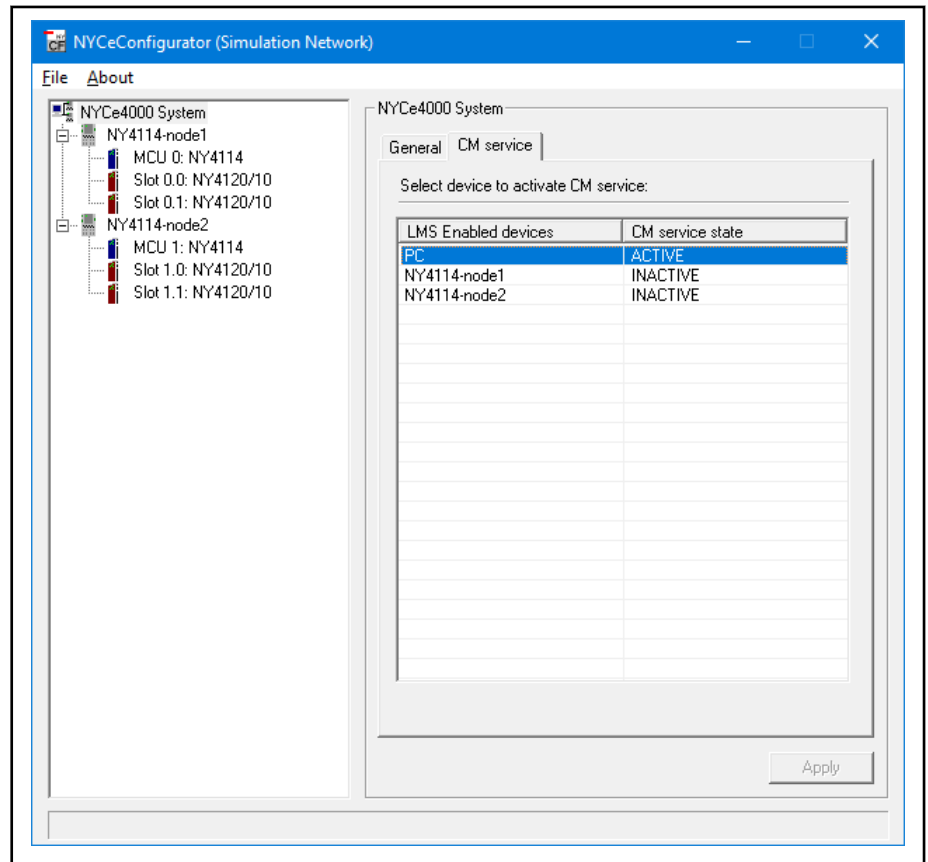


Fig. 2-7: activate/deactivate CM service via NYCeConfigurator

Select the top item "NYCe4000 System" of the tree in NYCeConfigurator. Select the tab "CM service". To move CM service to an other MCU or to the PC, select the device and click the "Apply" button..

The NYCe 4000 system generates a "network changed" event and synchronizes again in the new configuration, where CM service is active on the device as displayed in the list on the "CM service" tab.

User program With the function `CmGetCmServiceActiveDevices` you can retrieve all devices that have CM service running. This includes all nodes and the PC. With the function `CmGetCmServiceActivation` you can retrieve whether the specified node or the PC has CM service activated or deactivated. With the functions `CmActivateCmService` and `CmDeactivateCmService` you can activate and deactivate CM service on the specified node or the PC.

As CM service can be active on the PC and on a node, it is possible that (by mistake) CM service is active on more than one device in the network. However, only one CM service is allowed to be active in the system at any time. You can use NYCeConfigurator to see where CM service is active and subsequently solve the conflict if two (or more) CM service are active. Note that CM service is always running on the PC, but only in the active state when configured to be in the active state.

LMS client behavior is as follows when more than one CM service is active in the network.

- LMS clients that are already connected are not influenced.
- LMS clients that try to initialize the system (CmInitialize) receive the error `CM_ERR_DUPLICATE_CM_SERVICE`.

If no CM service is active in the network, any LMS client that tries to connect to CM service via `CmConnect` receives the error `CM_ERR_CM_SERVICE_NOT_AVAILABLE`.

2.4.3 Application considerations

Environment dependencies An LMS application can only use system functionality of the environment where the application is executed. Thus, Windows functionality cannot be used when the application executes as an Embedded Application on a node. Vice versa, Linux functionality cannot be used when the application executes on a PC.

If you use an extension library and CM service is executed on the PC, the extension library must be built as a DLL. If CM service is executed on a node, the extension library must be built as a shared object (.so). See "NYCe 4000 LMS Generic PLC Interface Manual" for more information.

Logging All logging of events and data is written to shared memory. The shared memory is created by CM service. When CM is running on the PC, NYCeLogger can access the shared memory directly and present the logged information. When CM service is active on a node, NYCeLogger can access the information using the CM socket server. To access the logged information via the CM socket server, you must start NYCeLogger from the command line with the option `/CM` or `/N`.

- With the `/CM` option, NYCeLogger finds the device where CM service is active and then retrieves the log information from that device.
- With the `/N` option, you can specify the IP address of the node which NYCeLogger must connect to retrieve the logged information. Note that CM service must be active on the specified node. For example, when you used the default path of the NYCe 4000 software installation, you enter `C:\Program Files\Rexroth\NYCe4000\amd64\bin\NYCeLogger /N 192.168.41.14` to start NYCeLogger on the PC and retrieve log information via the CM socket server running on the node with the specified IP address.

3 Carrier Position Adjustment (CPA) tool

3.1 Introduction

When a carrier with a magnet plate moves over a Hall sensor, the position of the carrier can be determined. However, due to inaccuracies in the production of a magnet plate, different carriers at the same position above the same Hall sensor result in slightly different carrier positions. The correct carrier position can be determined if the difference for that specific carrier is known.

The Carrier Position Adjustment (CPA) functionality in LMS adjusts the carrier positions measured by the Hall sensors in the track with the differences for each carrier position that are stored in a so-called CPA table. The CPA tool can create the CPA table for each carrier on a track. All CPA tables are stored in one or more XML files. The XML file(s) can be downloaded to the Motion Control Unit (MCU). If more than one XML file is used and a CPA table identifier is used more than once, the last downloaded CPA table with same identifier is used without a warning. When the CPA functionality is enabled for a track and CPA tables are assigned to carriers, the "raw" carrier positions measured by the left, middle and right Hall sensors are updated, with the adjustment values in the CPA table for this carrier, to the actual positions.

In this chapter you can find the following information.

- [chapter 3.2 "CPA measurement systems" on page 9](#) describes the two supported measurement systems.
- [chapter 3.3 "NYCeCPATool" on page 12](#) describes the CPA tool and the measurement procedures.



The CPA tool does not support the MR sensor; only the Hall sensor is supported.

3.2 CPA measurement systems

3.2.1 Introduction

The CPA tool uses the NYCe 4000 system to create the CPA tables. The NYCe 4000 system must consist of a Hall sensor, a magnet plate and an additional measurement system. The magnet plate and the Hall sensor are moved in such a way that a profile is measured of the entire magnet plate. With the external measurement system the position of the Hall sensor relative to the magnet plate is measured. A NYCe 4000 system is used for the data acquisition of the Hall sensor and external measurement system. The CPA tables can be created in off-line and on-line mode. In off-line mode the CPA tool creates the CPA tables from a NYCe 4000 trace file. The NYCe 4000 trace file is generated with NYCeScope or in a measurement session with NYCeCPATool. In on-line mode the CPA tool collects the trace data before the CPA tables are created.

The CPA tool supports two measurement systems.

1. Measurement system 1
consists of at least one NYCe 4000 LMS node and at least one NYCe 4000 standard node.
2. Measurement system 2
consists of at least one NYCe 4000 standard node. If an LMS node is present in the system, the LMS node is not used.

3.2.2 Measurement system 1: two-node (LMS/STD) setup

Measurement system 1 consists of a two-node setup. This setup has (at least) one NYCe 4000 LMS node and (at least) one NYCe 4000 standard node. The Hall sensor pair (cosine and sine signal) of one coil are directly connected to the LMS node.

The reference axis is connected to the encoder input of a NYCe 4000 standard node. This standard node has one or more drive slots. The reference axis (for example a ruler with an encoder) can be connected to any axis of drive module.

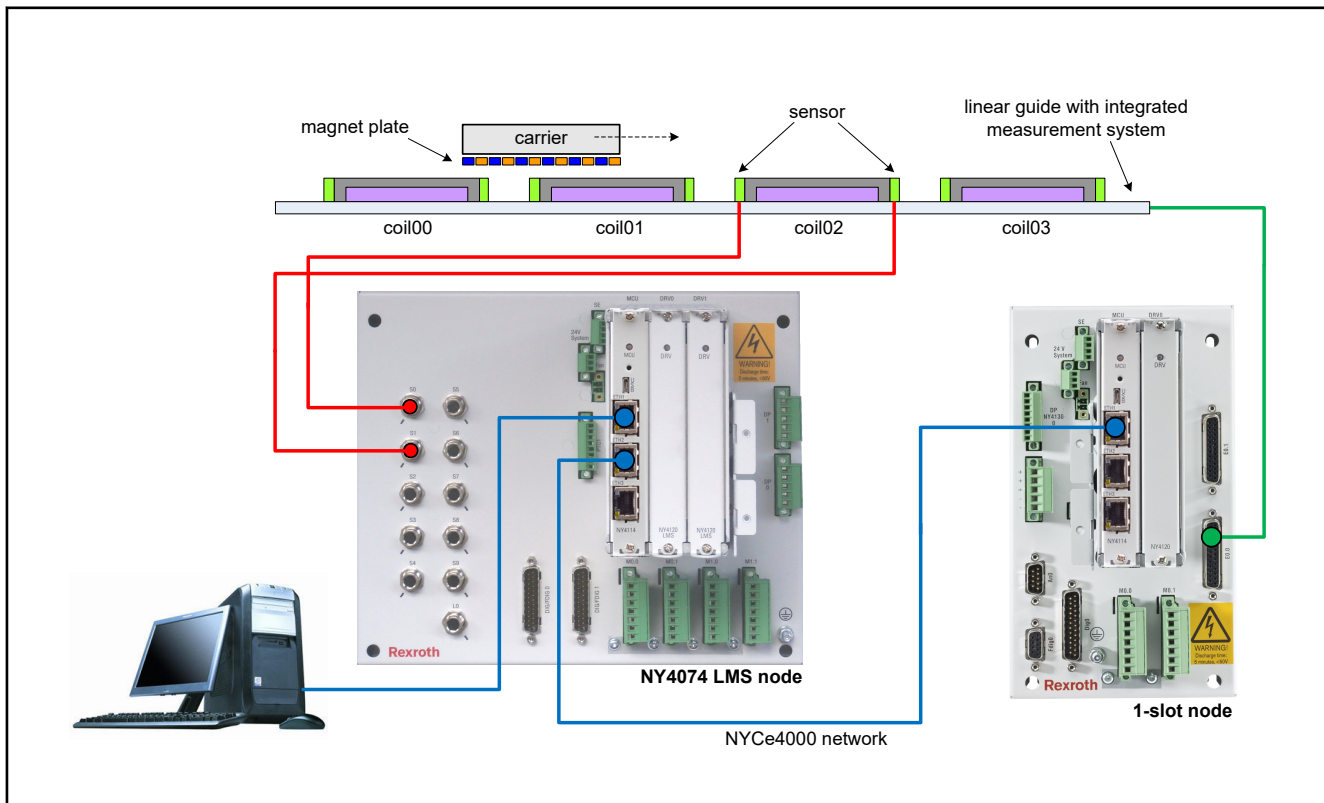


Fig. 3-1: Measurement system 1: two-node setup

In the CPA tool you select the coil axis (and Hall sensor) of the LMS node and the reference axis of the NYCe 4000 standard node. The reference axis type must be defined as `SAC_SENSOR_AXIS` in NYCeConfigurator, and the axis resolution and measurement system direction must be correctly configured.

3.2.3 Measurement system 2: one-node (STD) setup

Measurement system 2 consists of a one-node setup. This setup has (at least) one NYCe 4000 standard node. If LMS node(s) are present in the system, those LMS nodes are not used. The Hall sensor pair (cosine and sine signal) of one coil are connected to analog inputs of the NYCe 4000 standard node. You need an adapter cable from the Hall sensor M8 connector to the analog input sub-D 9-pin connector, see [tab. 3-1 "Adapter cable M8 female / 9-pin sub-D female" on page 11](#). The reference axis is connected to the encoder input of the standard node. This standard node has one or more drive slots.

The reference axis (for example a ruler with an encoder) can be connected to any axis of any drive module.



Note that when you connect the Hall sensor to the analog inputs of a drive module in a standard node, the power supply connection for the Hall sensor must be wired separately.

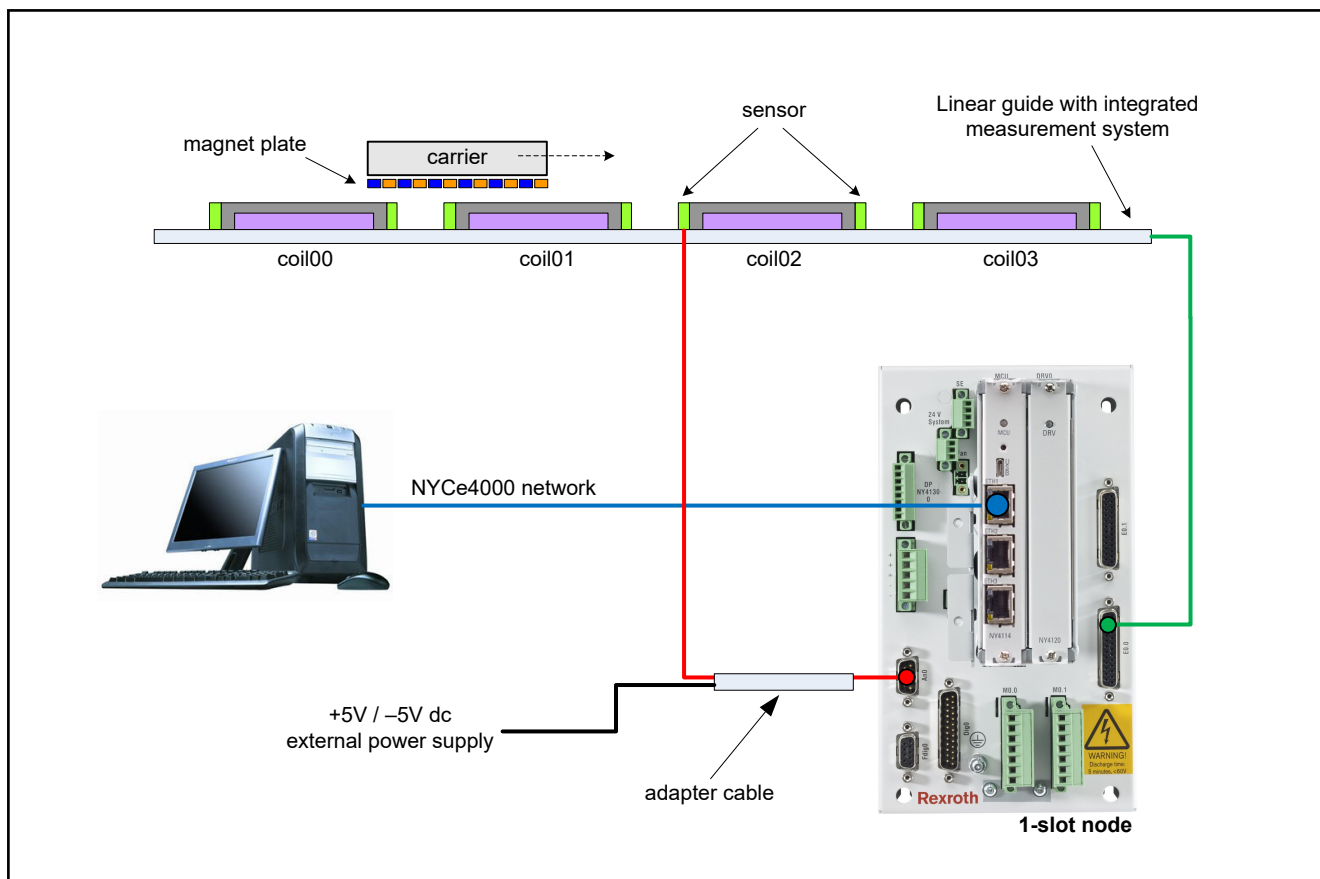


Fig. 3-2: Measurement system 2: one-node setup

M8 (female) connector pin number	9-pin sub-D female connector pin number	Remark
1	1	
2	3	
3	6	
4	9	
5	-	External +5V power supply
6	8	GND
7	-	External -5V power supply
8	8	
housing shielding	cable shielding	

Tab. 3-1: Adapter cable M8 female / 9-pin sub-D female

Carrier Position Adjustment (CPA) tool

In the CPA tool you only select the reference axis (defined as axis type `SAC_SENSOR_AXIS` in NYCeConfigurator) of the NYCe 4000 standard node.

3.2.4 Requirements

- The Hall sensor which is used to measure the magnetic field of the magnet plate must be part of a correctly commissioned LMS track (in measurement system 1).
- Two complete movements are required, one in positive direction and one in negative direction, to calculate the adjustment values that are stored in the CPA table.
- The data acquisition must start before the Hall sensor enters the magnetic field of the magnet plate, and the data acquisition stops after the Hall sensor leaves the magnetic field of the magnet plate while moving in the opposite direction.
- The first detected signal when the Hall sensor enters the magnetic field of the magnet plate when the movement is in the positive direction must be the cosine signal of the Hall sensor, because the NYCeCPATool expects this.
- The measurement system must be as similar as possible to the real system, because the quality of the calculated CPA tables define the position accuracy of the real system when CPA is used. Therefore, the distance and material between the Hall sensor and the magnet plate must be the same.
- The PVL frequency of the reference axis must be set to 8 kHz. Signals from the multiplexer on the I/O backplane of the NY4074 and NY4079 have a small delay caused by the sample frequency used in the multiplexer. This PVL frequency setting makes sure that the delays of the measured signals is identical for all signals.
- The unit of position of the coil axis and the reference axis must be the same.
- For measurement system 1, the measurement setup must have at least one NYCe 4000 standard node and at least one NYCe 4000 LMS node in the network, and the LMS must be initialized. The coil must be defined on the LMS node, the reference axis must be defined on the standard node.
- For measurement system 2, the measurement setup must have at least one NYCe 4000 standard node. The reference axis is defined on this node. The cosine signal of the Hall sensor must be connected to analog input 0 of the used slot, and the sine signal of the Hall sensor must be connected to analog input 1 of the used slot. The voltage level of the cosine and sine signals must be at least $10 V_{tt}$ (+/-5 V symmetrical). With this requirement the calibration process in both measurement systems is consistent. Note that the maximum analog input range of a drive module is +/-10 V.

3.3 NYCeCPATool

3.3.1 Introduction

The NYCeCPATool window appears when you start NYCeCPATool.

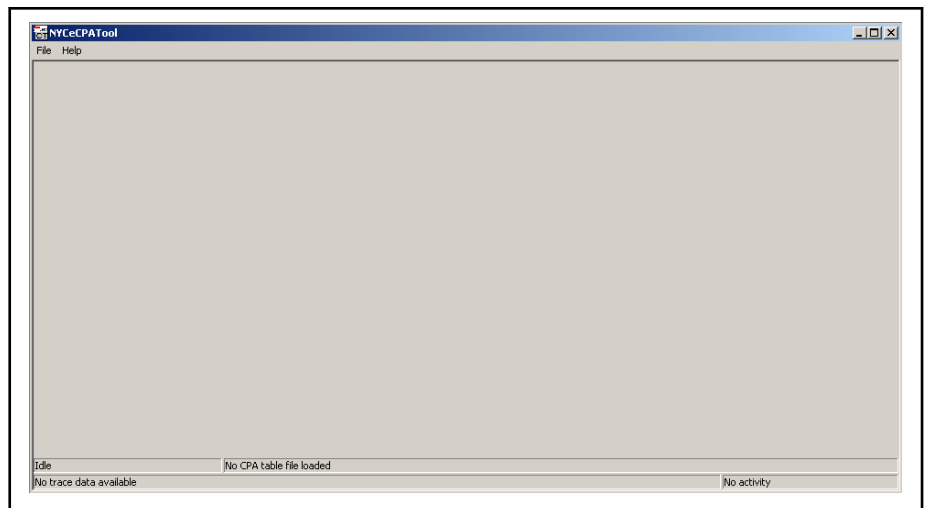


Fig. 3-3: Main dialog window of NYCeCPATool

The menu bar of the NYCeCPATool window has two entries, "File" and "Help". At the bottom of the NYCeCPATool window is status information displayed.

The drop down list of the "File" entry has the following entries.

- New CPA Table...
This selection creates a new CPA table using data from a calibration system. Appropriate data must be entered in the "Calibration system" section.
- Open Trace File...
This selection creates a CPA table from a trace file. The selected trace file name is displayed in the status bar.
- Save CPA File
This selection saves all CPA tables to the opened CPA file. All previous contents of the opened CPA file is erased.
- Save CPA File As...
This selection saves all CPA tables to the CPA file specified in the "Save As..." dialog window. If the specified file exists, all previous contents of the file is erased.
- Open CPA File...
This selection shows the contents of a CPA table. The selected CPA file name is displayed in the status bar.
- Exit
This selection terminates the NYCeCPATool. An active calibration process and data collection process is aborted. If applicable, a warning is displayed that there is not-saved CPA parameter data and/or not-saved trace data.

The drop down list of the "Help" entry only has the "About NYCeCPATool" entry. When this selection is chosen, the "About NYCeCPATool" dialog window appears. This window shows the NYCe 4000 version information.

The status fields at the bottom of the "NYCeCPATool" main window show the information:

- Operation information

Carrier Position Adjustment (CPA) tool

- "Idle", when the tool is started
- "View", when displaying a CPA table from an opened CPA file
- "Create", when creating a CPA table using a calibration system or trace file.
- CPA file name if a CPA file is opened
- A field that indicates how trace data is collected
 - Axis name, axis state and trace state if data is collected from a calibration system
 - Trace file name if data is collected from a trace file.
- Activity field

Some operations of the NYCeCPATool require time to complete. Feedback about the activity is given with a busy indicator. Time-consuming operations are reading and writing a trace file or CPA table file, and the data collection and calibration process.

3.3.2 Create CPA table using data from a calibration system

In the on-line mode you can create the CPA table(s) from data collected from both measurement systems.

After you select "File → New CPA Table...", the "Calibration system" dialog window appears.

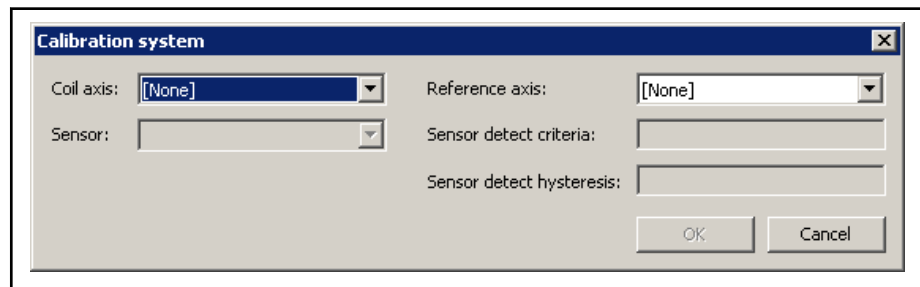


Fig. 3-4: Calibration system dialog window

Depending on the filled entry fields in the "Calibration system" dialog window the measurement system to be used is selected.

- Coil axis and Reference axis specified

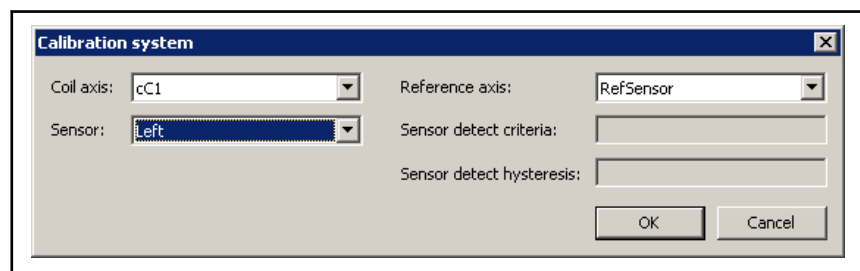


Fig. 3-5: Measurement system 1 - coil axis and reference axis selected

If you select a coil axis and a reference axis, measurement system 1 is used. The only other entry field that must contain information is which sensor of the coil is used for the measurement. The coil axis is used to capture the coil sensor data during the data collection process. Note

that the coil axis is only available after the LMS is initialized. No additional information for the reference axis is needed.

- Reference axis only specified

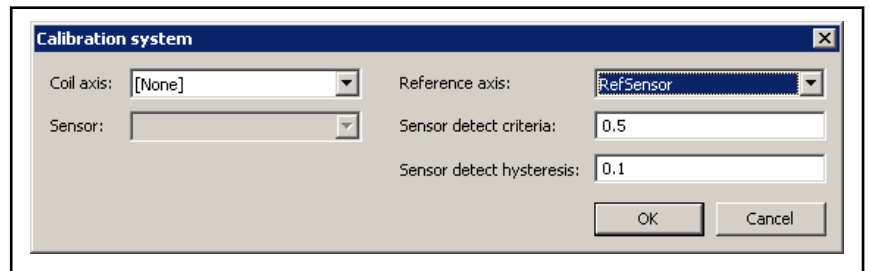


Fig. 3-6: Measurement system 2 - only reference axis selected

If you only select a reference axis, measurement system 2 is used. In this case you must specify values for the sensor detect criteria and sensor detect hysteresis. These values are part of the configuration of the LMS sensors. You can see appropriate values with the NYCeLmsCommissioning tool. For each sensor of every coil, see the "Sensor detect criterion" and "Sensor detect hysteresis" entry.

If the appropriate fields contain data, the "OK" button in the "Calibration system" dialog window is enabled, else the "OK" button is disabled. If the "Calibration system" dialog window is closed with the "OK" button the selected axis names are shown in the status fields of the NYCeCPATool window. The NYCeCPATool window displays the following sections.

- "CPA Table"
- "Data collection"
- "System"

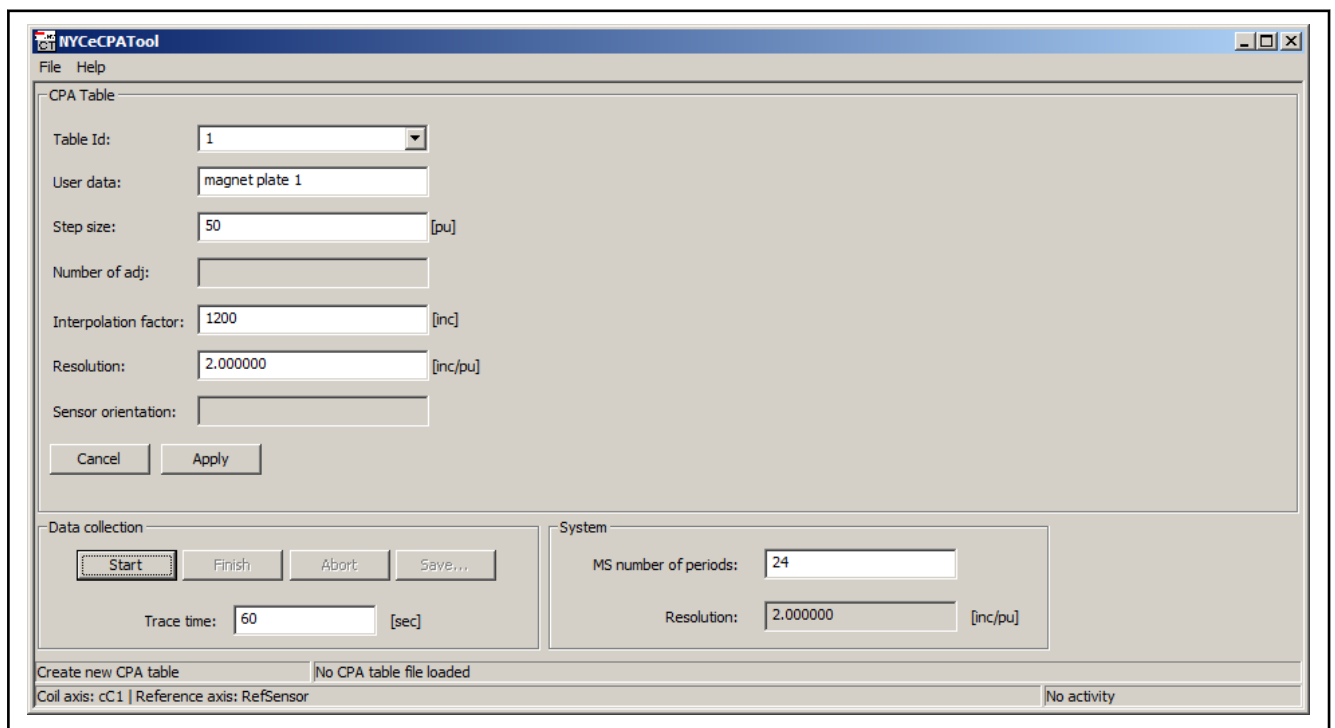


Fig. 3-7: NYCeCPATool ready to capture data from the measurement system

Carrier Position Adjustment (CPA) tool

CPA table field	Explanation
Table Id	CPA table identifier. This is an integer number between 0 and CM_MAX_NR_OF_CPA_TABLES.
User data	Free format text string to identify unambiguously the magnet plate to which this CPA table belongs. You must enter some text in this field.
Step size	Parameter step size specified in pu, and defines the number of measurement points in the CPA table. Note that the value for this parameter depends on LMS components such as the magnet plate. Step size = (length magnet plate - ½ pole pitch) / (number of points - 1)
Number of adj	Number of position adjustments in the CPA table. This is an odd number, the maximum value is CM_MAX_NR_OF_CPA_VALUES. This edit box is always read-only, because the parameter value is determined by the calibration process. See "Step size".
Interpolation factor	Parameter interpolation factor, specifies the number of increments per quarter of the pole pitch. The initial value for this parameter is read from the LMS configuration file.
Resolution	Parameter resolution specified in inc/pu. The initial value for this parameter is read from the LMS configuration file.
Sensor orientation	Sensor orientation, the value can be "negative" or "positive". This edit box is always read-only, because this parameter is determined by the calibration process. Note that it is possible that the initial value is wrong, but the value is correct after the measurement is completed.

Tab. 3-2: The fields of the "CPA table" dialog window

You must enter a number for the CPA table identifier and a text to unambiguously describe for which magnet plate this CPA table is generated. The step size, interpolation factor and resolution are set to default values and can be changed to match the system parameters. The values in the read-only fields "Number of adj" and "Sensor orientation" are determined by the data collection and calibration process.

If you click the "Cancel" button, changed values of the CPA parameters are discarded and the previous values are displayed.

If you click the "Apply" button, a new CPA table for the specified table identifier is created. The created CPA table does not contain any measurement data, because the data collection and calibration process has not yet been executed.

The "Trace time" field specifies how long trace data is collected. If the trace is still active when the specified time has elapsed, the trace is stopped and an error message is displayed.

When you click the "Start" button the data collection from a calibration system is started. The "Finish" and "Abort" buttons are enabled, and the "Start" and

"Save..." buttons are disabled. Click the "Finish" button when the movements are completed and the data collection can be stopped.

The required movements, one movement in the positive direction and then one movement in the negative direction can be done manually, if possible. Note that for each movement the magnet plate must be outside the detection range of the Hall sensor, and be moved over the Hall sensor until the magnet plate is again outside the range of the Hall sensor at the other side.

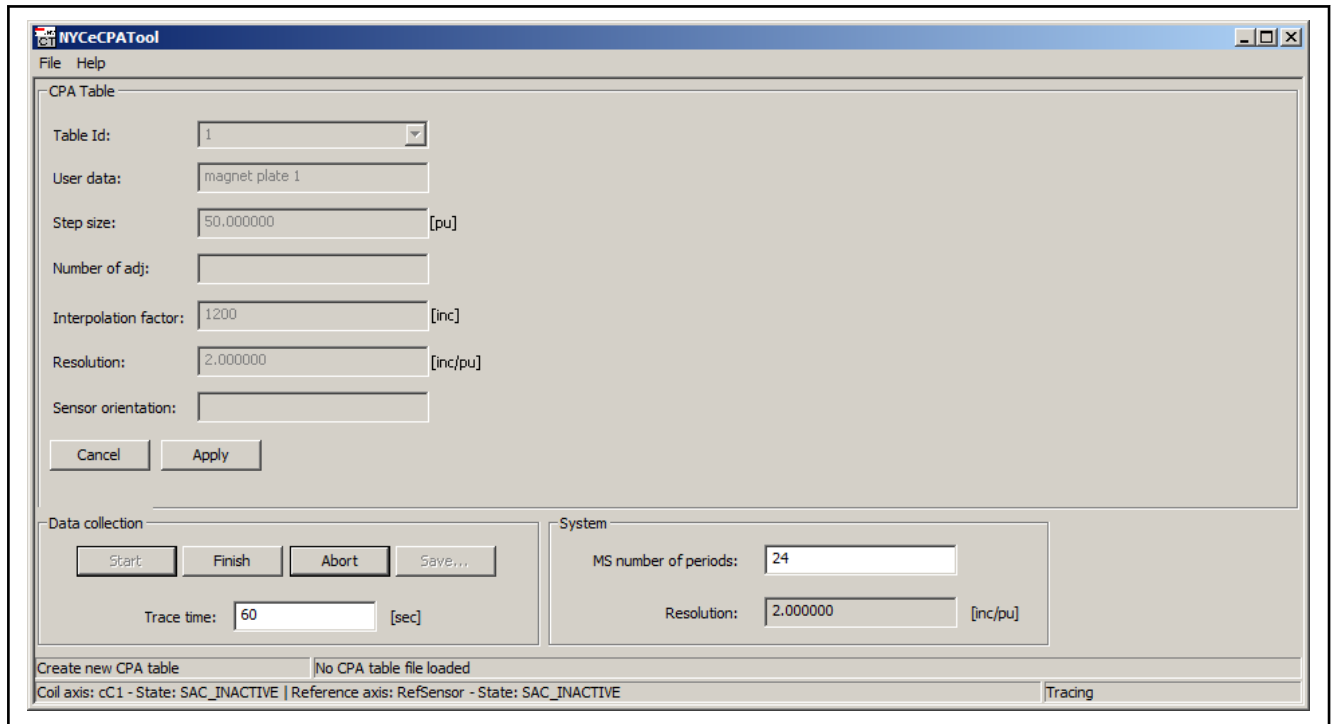


Fig. 3-8: NYCeCPATool capturing measurement data

After you clicked the "Finish" button the calibration process is started. When the calibration process has completed the "Start" and "Save..." buttons are enabled and the "Abort" and "Finish" buttons are disabled.

Click the "Save..." button to save the collected trace data in a file. The "Open" dialog window appears and you can specify a file name for the trace data. Note that NYCeCPATool appends a time stamp to the file name that you specify. As you will most likely do more than one measurement, because the track consists of more than one carrier, you can click the "Save..." button after each data collection and calibration process without changing the file name. The file name is unique because of the appended time stamp.

You can click the "Abort" button to stop the data collection. The calibration process is not started.

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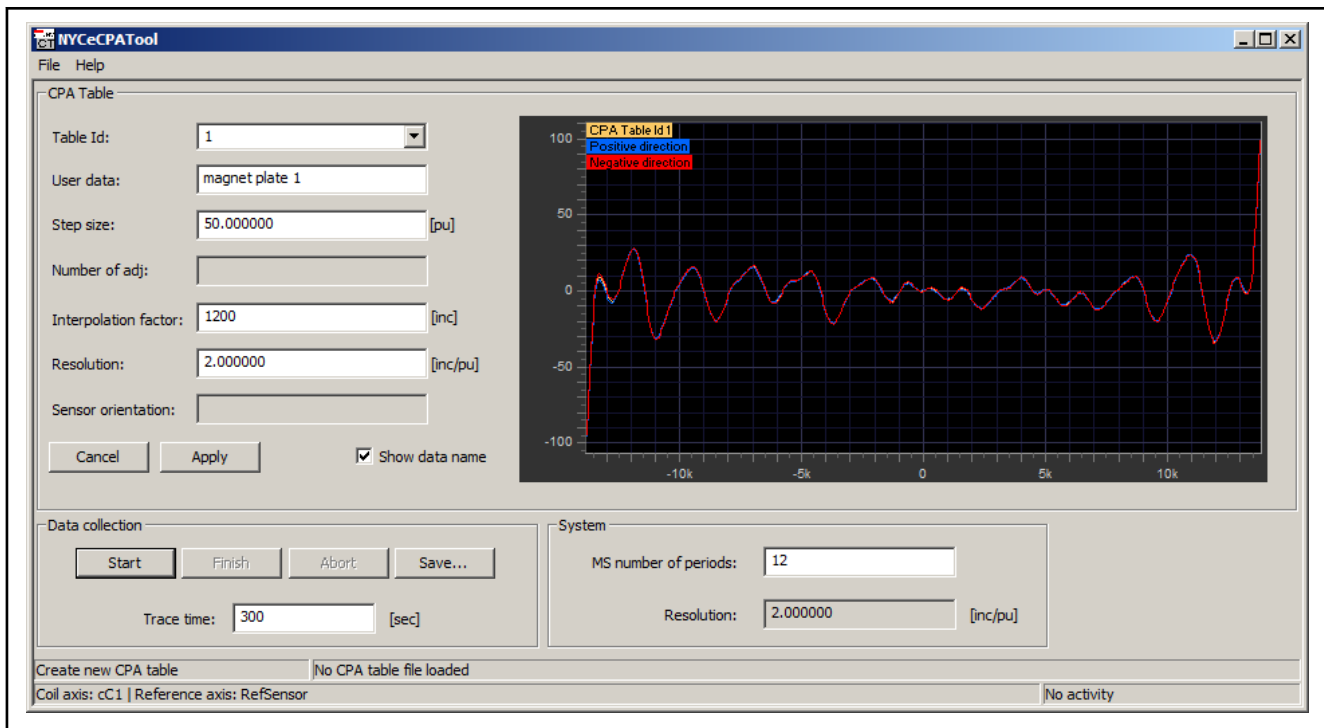


Fig. 3-9: NYCeCPATool measurement data processing finished

Three graphs for the CPA parameters adjustment are displayed. The three graphs show data from the movement in the positive direction, the movement in the negative direction, and one graph shows the averaged values. You can remove and add the names of the three graphs with the checkbox "Show data name" in the "CPA Table" section. The scale of the X-axis and Y-axis is pu. The position of consecutive adjustments is calculated with the parameter step size. The carrier position when the middle of the magnet plate is right above the Hall sensor is marked with "0" on the X-axis. Using the mouse, you can draw a "rectangle" to magnify a specific area of the graph (zoom-in functionality). Double-clicking the left mouse button while the mouse pointer is in the graph shows the original graph again. If the mouse is hovered over a graph, the actual adjustment value and position are displayed.

The "System" dialog window displays the values of system parameters, and allows a change of them.

The field "MS number of periods" displays the initial value taken from the CPA tool settings. MS stands for "Measurement System". You can change this value. The value is used in the calibration process, and must be specified before the data collection and calibration process is started.

The field "Resolution" displays the value of the parameter resolution of the coil axis, if present, else the field displays the parameter resolution of the reference axis.



You can still make changes to the enabled fields in the "CPA Table" section. Click the "Apply" button to save the changes, or click the "Cancel" button to discard any changes you made.

Select the menu bar entry "File → Save CPA File" or "File → Save CPA File As..." after you have executed the described procedure for all magnet plates (carriers) in the track. The CPA file, containing a CPA table for every magnet plate, is saved. The file name is "untitled.xml" if you select "Save CPA File". If

you select "Save CPA File As..." the "Save" dialog window appears and you can specify a file name.

After the calculated differences are stored, the NYCeCPATool can only show these calculated differences, the graph only shows these values.

3.3.3 Create CPA table using data from a trace file

In the off-line mode you can create the CPA table from trace files that are saved during previous measurements, or from data collected and stored with NYCeScope.

Select the following variables in NYCeScope for measurement system 1.

- Channel 1 - SAC_VAR_AXIS_POS of the reference axis
- Channel 2 - SAC_VAR_LMS_LEFT_SENSOR_ANGLE of selected coil
- Channel 3 - SAC_VAR_LMS_LEFT_SENSOR_COS of selected coil
- Channel 4 - SAC_VAR_LMS_LEFT_SENSOR_POSITION of selected coil
- Channel 5 - SAC_VAR_LMS_LEFT_SENSOR_SIN of selected coil
- Channel 6 - SAC_VAR_LMS_LEFT_SENSOR_STATUS of selected coil

Note: the selected "LEFT_SENSOR" variables can also be "MIDDLE_SENSOR" or "RIGHT_SENSOR", depending on the sensor that is used.

Select the following variables in NYCeScope for measurement system 2.

- Channel 1 - SAC_VAR_AXIS_POS of the reference axis
- Channel 2 - NHI_VAR_AN_IN0_VALUE_SLOT0 for the cosine signal of the Hall sensor
- Channel 3 - NHI_VAR_AN_IN1_VALUE_SLOT0 for the sine signal of the Hall sensor

Note: the selected slot number "0" can also be 1, 2, 3, 4, or 5, depending on the slot where the reference axis is configured.

After you select "File → Open Trace File..." and selected a valid trace file in the "Open" dialog window, the NYCeCPATool window displays the following sections.

- "CPA Table"
- "Data collection"
- "System"

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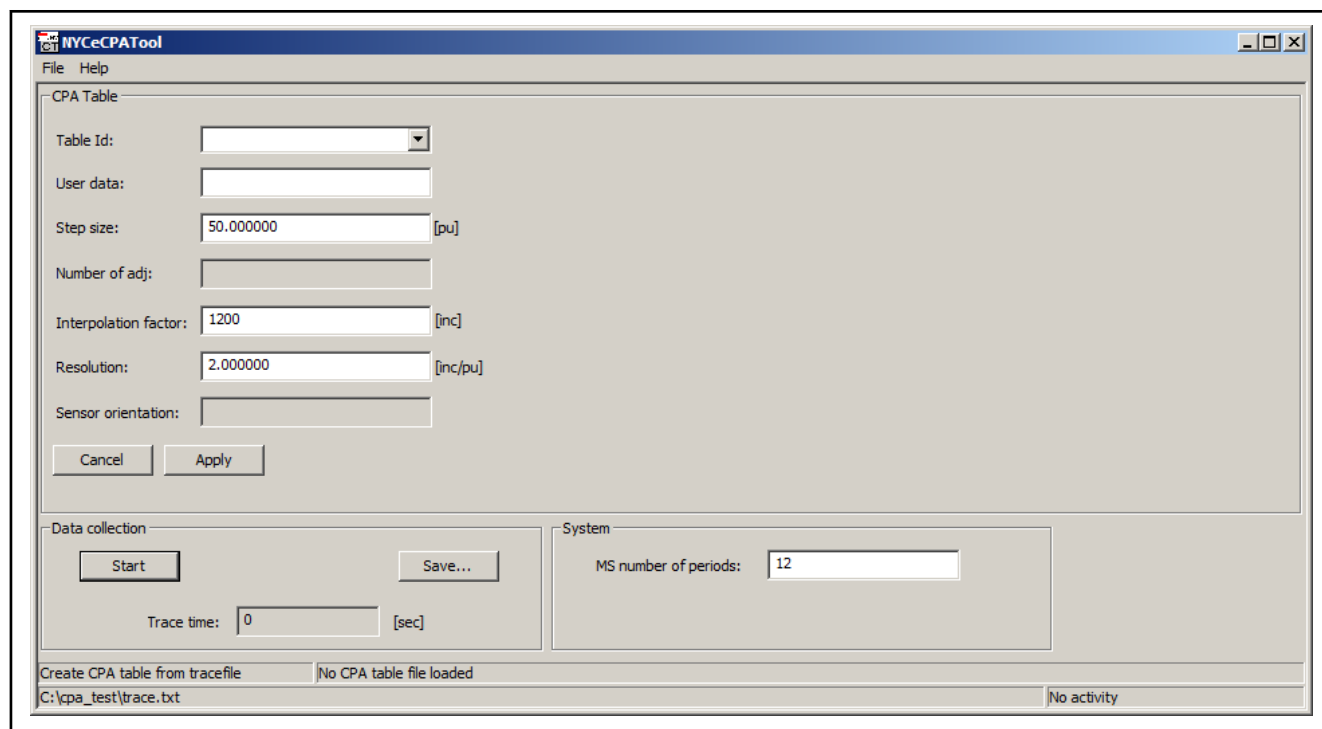


Fig. 3-10: NYCeCPATool window after opening a trace file

The "CPA Table" section shows the value of the CPA parameters, see [tab. 3-2 "The fields of the "CPA table" dialog window"](#) on page 16.

You must enter a number for the CPA table identifier and a text to unambiguously describe for which magnet plate this CPA table is generated. The step size, interpolation factor and resolution are set to default values and can be changed. The values in the read-only fields "Number of adj" and "Sensor orientation" are determined by the data collection and calibration process.

If you click the "Cancel" button the changed values of the CPA parameters are discarded and the previous values are displayed.

If you click the "Apply" button, a new CPA table for the specified table identifier is created. The value for the field "Number of adj" is set to zero, because the trace file has not yet been processed. The "Sensor orientation" is initialized to "Negative". Repeat this for all magnet plates for which you want to create CPA tables.

If you click the "Start" button in the "Data collection" section, the data collection and calibration process starts if the trace data is collected with measurement system 1. If the trace data is collected with measurement system 2, you must first enter appropriate values in the "Calibration system" dialog box that appears.

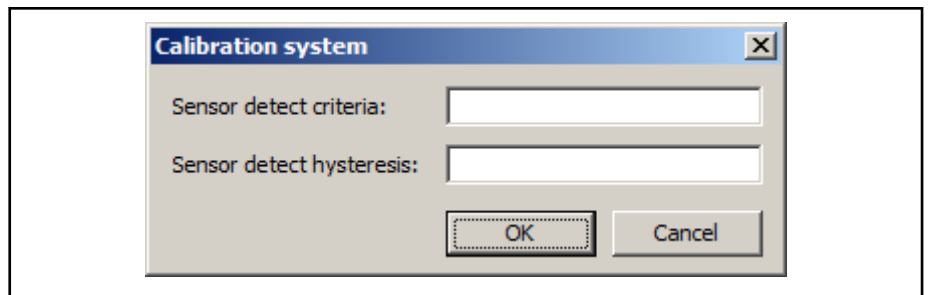


Fig. 3-11: Measurement system 2: specify sensor detect criteria and hysteresis

Click the "OK" button.

The "Trace time" field shows the amount of time for which data is stored in the trace file. A new CPA table for the specified table identifier is created, just like the action after you click the "Apply" button, but in this case the CPA table contents is generated and the value for the field "Number of adj" is set to the actual number of measurements after the data collection and calibration process is finished.

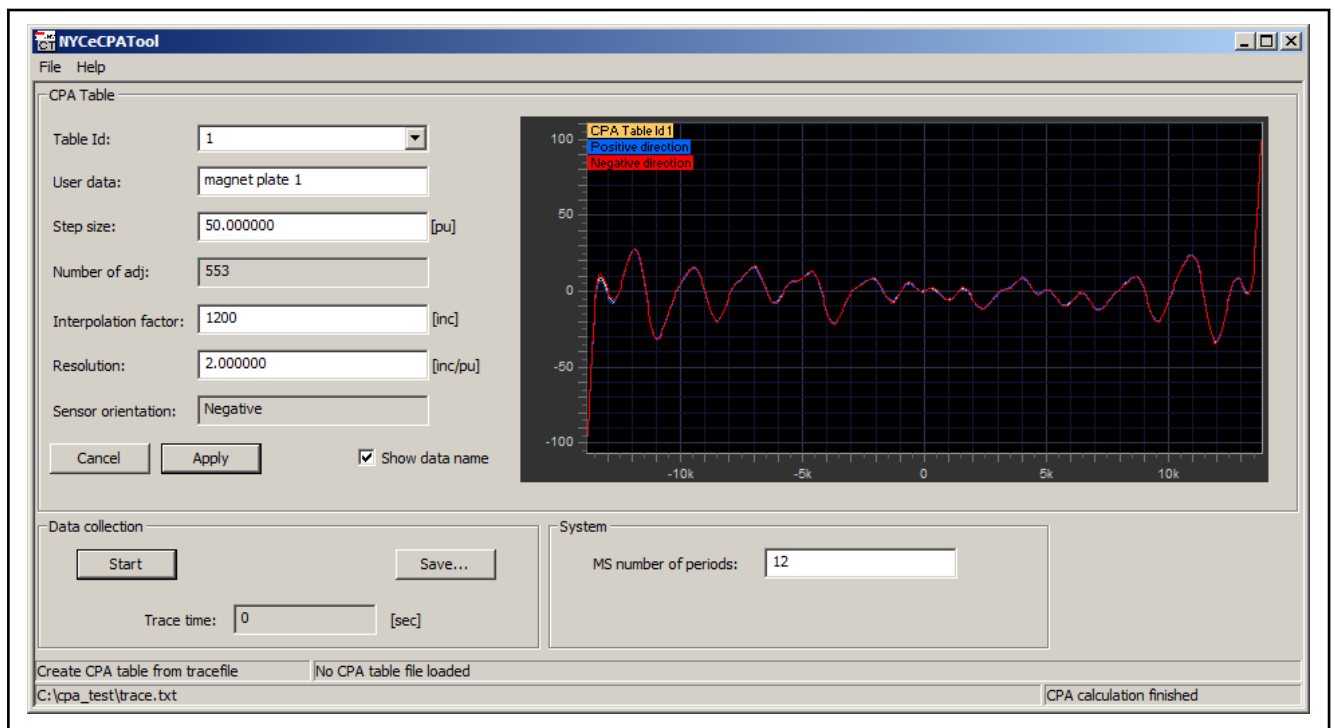


Fig. 3-12: The result of processing a trace file

Three graphs for the CPA parameters adjustment are displayed. The three graphs show data from the movement in the positive direction, the movement in the negative direction, and one graph shows the averaged values. You can remove and add the names of the three graphs with the checkbox "Show data name" in the "CPA Table" section. The scale of the X-axis and Y-axis is pu. The position of consecutive adjustments is calculated with the parameter step size. The carrier position when the middle of the magnet plate is right above the Hall sensor is marked with "0" on the X-axis. Using the mouse, you can draw a "rectangle" to magnify a specific area of the graph (zoom-in functionality). Double-clicking the left mouse button while the mouse pointer

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is in the graph shows the original graph again. If the mouse is hovered over a graph, the actual adjustment value and position are displayed.

At this point you can still make changes to the parameters in the "CPA Table" section. If you click the "Cancel" button in the "CPA Table" section, the changes are discarded and the previous values before the data collection and calibration process are used. If you click the "Apply" button in the "CPA Table" section, the changed values are accepted. A message is displayed if the opened CPA file already contains a CPA table with the same table identifier.

The field "MS number of periods" in the "System" section displays the initial value taken from the CPA tool settings. You can change this value. The value is used in the calibration process, and must be specified before the data collection and calibration process is started. If the value in the field "MS number of periods" in the "System" section is not equal to the value derived from the trace data, the mismatch is reported.

Repeat the described procedure to create a CPA table from a trace file of every magnet plate in the track.

When you click the "Save..." button in the "Data collection" section, you can store the trace data in a file.

With the menu bar selections "File → Save CPA File" and "File → Save CPA File as..." you can store the calculated differences for each position for every CPA table in a CPA XML file. The file name is "untitled.xml" if you select "Save CPA File". If you select "Save CPA File As..." the "Save" dialog window appears and you can specify a file name.

After the calculated differences are stored, the NYCeCPATool can only show these calculated differences, the graph only shows these values.

3.3.4 View CPA table XML file data

Click the menu bar selection "File → Open CPA File..." to view the CPA XML file data. The "Open" dialog box appears. After you specify a valid XML CPA file, the NYCeCPATool displays the data.

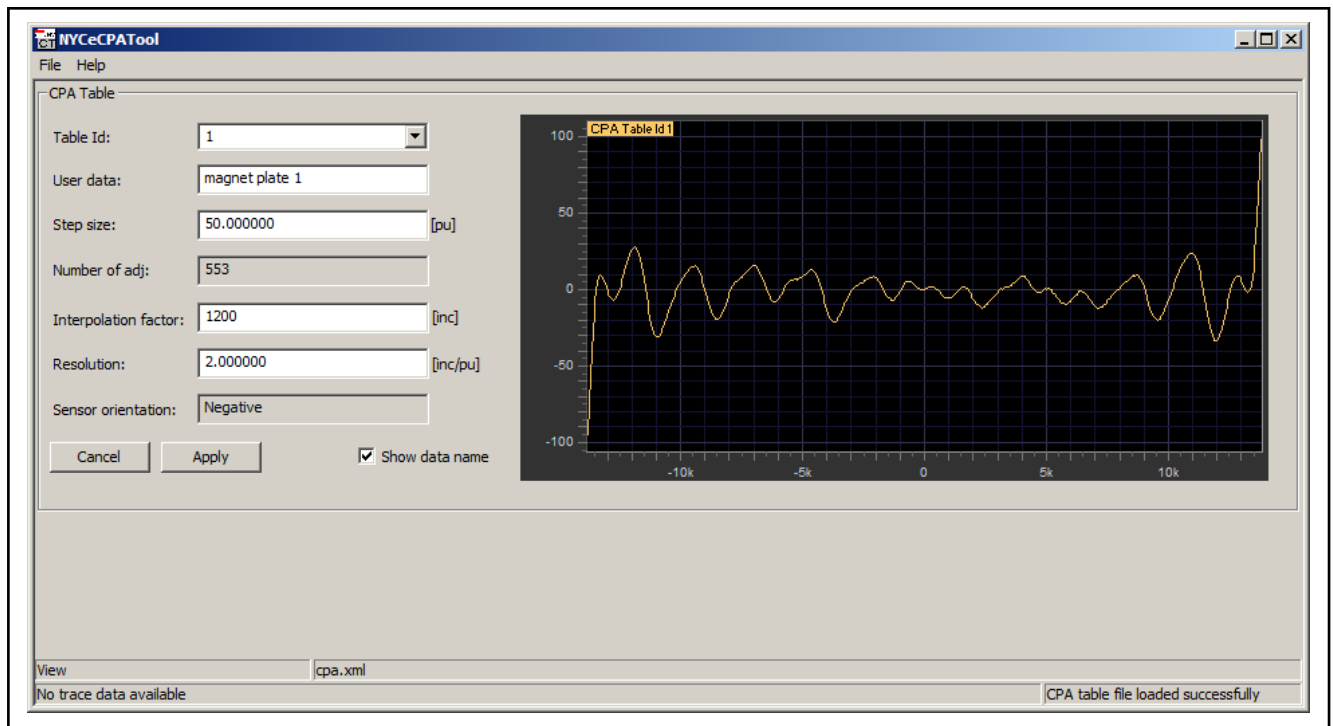


Fig. 3-13: Viewing XML CPA table data

You can select the CPA table identifier with the drop down box in the "Table Id" field. The graph shows the calculated values from the selected CPA table.

You can change the values in the fields "User data", "Step size", "Interpolation factor", and "Resolution". Click the "Cancel" button in the "CPA Table" section to discard the changes. Click the "Apply" button in the "CPA Table" section to accept the changes.

Notes

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