rexroth
A Bosch Company

Application Manual

PLC App

PLC Runtime Environment for ctrlX CORE

R911403787, Edition 04

Liability

The specified data is intended for product description purposes only and shall not be deemed to be a guaranteed characteristic unless expressly stipulated in the contract. All rights are reserved with respect to the content of this documentation and the availability of the product.

DOK-XCORE*-PLC********-AP04-EN-P

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1 About this documentation

Editions of this documentation

Edition	Date	Note
01	2020-06	First edition Release date for PLC app version PLC-V-0102 and PLC-V-0104
02	2020-12	Release date for PLC app version PLC-V-0106 Revision: ● ➦Chapter 5.2.1 “Window – “PLC”” on page 11 ● ➦Chapter 8 “Related documentation” on page 17
03	2021-06	Release date for PLC app version PLC-V-0108 New: ● ➦Chapter 7 “Flexible memory configuration for remanent PLC data” on page 15 Revision: ● ➦Chapter 5.2.1 “Window – “PLC”” on page 11
04	2021-09	Release date for PLC app version PLC-V-0110 New: ● Chapter 6 "Multicore functionality", page 13

2 Important directions on use

2.1 Intended use

2.1.1 Introduction

Rexroth products are developed and manufactured to the state-of-the-art.

The products are tested prior to delivery to ensure operational safety and reliability.

⚠ WARNING	**Personal injury and damage to property due to incorrect use of products!**
	The products may only be used as intended.
	Failure to use the products as intended may cause situations resulting in property damage and personal injury.

NOTICE	**Damages resulting from unintended use**
	Rexroth As the manufacturer does not assume any warranty, liability or compensatory claims for damages resulting from unintended use of the products. The user alone shall bear the risks of an unintended use of the products.
	Before using Rexroth products, make sure that all the prerequisites for an intended use of the products are met: – Personnel that in any way, shape or form uses Rexroth products must first read and understand the relevant safety instructions and be familiar with their intended use – Leave hardware products in their original state, i.e., do not make any structural modifications. It its not permitted to decompile software products or alter source codes – Do not install damaged or defective products or commission them – It has to be ensured that the products have been installed as described in the relevant documentation

2.1.2 Areas of use and application

Products of the ctrlX series are suitable for Motion/Logic applications.

NOTICE	Products of the ctrlX series may only be used with the accessories, mounting parts, and other components specified in this documentation. Components that are not expressly mentioned must neither be attached nor connected. The same applies to cables and lines.
	Only to be operated with the hardware component configurations and combinations expressly specified and with the software and firmware specified in the corresponding documentations and functional descriptions.

Products of the ctrlX series are suitable for single-axis as well as for multi-axis drive and control tasks. Device types with different equipment and interfaces are available for using the system in specific applications.

Typical areas of application:

- Building automation
- IoT and Security Gateway or Device
- Handling & Robotic

Controls of the ctrlX CORE series may only be operated under the mounting and installation conditions, in the position of normal use and under the ambient conditions (temperature, degree of protection, humidity, EMC, etc.) specified in the related documentations.

2.2 Unintended use

"Unintended use" refers to using the ctrlX products outside of the above-mentioned areas of application or under operating conditions and technical data other than described and specified in the documentation.

ctrlX products must not be used if they are exposed to following conditions:

- Operating conditions that do not meet the specified ambient conditions. Operation under water, under extreme temperature fluctuations or under extreme maximum temperatures is prohibited
- Applications that have not been expressly authorized by Rexroth

3 Safety instructions

The Safety instructions contained in the available application documentation feature specific signal words (DANGER, WARNING, CAUTION or NOTICE) and, where required, a safety alert symbol (in accordance with ANSI Z535.6-2006).

The signal word is meant to draw the reader's attention to the safety instruction and identifies the hazard severity.

The safety alert symbol (a triangle with an exclamation point), which precedes the signal words DANGER, WARNING and CAUTION, is used to alert the reader to personal injury hazards.

The Safety instructions in this documentation are designed as follows:

⚠ **DANGER**	In case of non-compliance with this safety instruction, death or serious injury **will** occur.
⚠ **WARNING**	In case of non-compliance with this safety instruction, death or serious injury **could** occur.
⚠ **CAUTION**	In case of non-compliance with this safety instruction, minor or moderate injury could occur.
NOTICE	In case of non-compliance with this safety instruction, property damage could occur.

4 Introduction and overview

4.1 PLC App – Basics

Introduction

Install the app “PLC App” to provide a PLC runtime environment to the ctrlX CORE control.

The control receives its "PLC functionality".

PLC App license

The following license is required to operate the PLC App:

Type code	Part number
SWL-XC*-PLC-PLC**********-BANN	R911397817

Function

The “PLC Runtime” is based on the PLC runtime system CoDeSys Control V3. If it is perfectly integrated into the ctrlX CORE system environment, it processes the programmed IEC 61131-3 codes and debugs the ctrlX PLC Engineering.

Further information

- Chapter 5.2.1 “Window – “PLC”” on page 11

5 ctrlX UI – Elements

5.1 Navigation

5.1.1 Side navigation – PLC App

Install the “PLC” app on the control and the following entries are added to the ctrlX CORE side navigation.

Side navigation – “PLC”

In the side navigation, the entry “PLC” is added. Select this entry to go to the window“ Status”. Information on projected PLC applications is provided, see ➥Chapter 5.2.1 “Window – “PLC”” on page 11.

Side navigation – “Automation”

The window “Automation” shows the tile “PLC”. Information about the operating state of the configured PLC applications can be found via the tile. Via links, navigation to the window “Status” or ctrlX PLC Engineering is possible to edit the respective program.

5.2 Windows

5.2.1 Window – “PLC”

Manage the PLC applications in the “PLC” window and the respective memory to manage the remanent data on the control (`VAR RETAIN` / `VAR PERSISTENT`).

The currently configured memory size is displayed in the upper window area. Set the memory size here, see ➥Changing the memory size for remanent data.

Below the memory display, the available PLC applications are listed in a table:

Displays:

- Name of the application
- Operating state of the application (RUN / STOP)
- Interfaces to change the operating state or PLC application reset

The following PLC application variants are not supported:

- Device application
- Child application

Call:

ctrlX CORE side navigation *“PLC”*

Elements of the “PLC” **window**

GUI element	Description
Display of the retain memory	Display of the current memory size of the retain memory in byte. Buttons: ●  Opens the “Change retain memory” dialog to change the memory size, see ➥Changing the memory size for remanent data ● Indicates the current memory utilization and the remaining memory size

GUI element	Description
Command bar “PLC”	The command bar includes buttons to control the operating state of the PLC application. **Prerequisite**: At least one of the listed applications has to be selected in the selection box ☑.
Table “PLC”	Selection box ☑ = The PLC application is selected. Control the operating state of the selected application in the command bar via buttons ▷, ☐ and ⏲.
	Table column “Name” (name of the PLC application)
	Table column “State” (status of the PLC application) ● “STOP” = PLC application is stopped ● “RUN” = PLC application is started
	Table column “Action”: Buttons to control the operating state: ● ▷ = Starting the PLC application ● ☐ = Stopping the PLC application ● ⏲ = Reset of the PLC application: – Reset warm – Reset cold – Reset origin
Button “ctrlX PLC Engineering”	Start the tool to program the integrated PLC via ctrlX PLC Engineering. If no PLC project has been stored on the control via the project synchronization (), it is opened. Otherwise, a new project with enabled project synchronization is created.

Further information

- ➦Chapter 5.1.1 “Side navigation – PLC App ” on page 11

6 Multicore functionality

6.1 Introduction

The multicore function facilitates the use of all CPU cores of ctrlX CORE to simultaneously process PLC IEC tasks.

Advantages:

- Increased execution velocity by parallel processing in case of simultaneous use of the available processor performance
- Complex PLC logics can be divided into different, independent task groups and CPU cores
- Separating the logic application, the communication and additional functions such as Motion or visualization

The multicore functionality is available from version PLC-V-0110 for ctrlX CORE and requires an in-app license per runtime.

related topics:

- ➦Apps and licenses in the ctrlX Store
- ➦License center "Quick Start Guide"
- ➦Multicore and task configuration - Basics and configuration

6.2 Licensing the multicore functionality

related topics:

- ➦License center "Quick Start Guide"
- ➦Apps and licenses in the ctrlX Store

The following license is required to use the multicore functionality on the ctrlX CORE control:

Name	Description	License of the type code	Part number
PLC Advance license	In-app license to enable the PLC multicore functionality on the ctrlX control.	SWL-XC*-PLC-PLC**********-ADNN	R911401461

The PLC Advance license is installed via the web interface of the ctrlX CORE control, see ➦Further documentation

Multicore project - Behavior without PLC Advance license

If no PLC Advance license is installed on the ctrlX CORE control, PLC projects configured for multicore systems are operated in demo mode for 120 minutes. In this case, processing takes place on a processor core.

After the 120 minutes have been expired, the PLC goes to state STOP and reports an exception. The following message is output in the PLC logger: „Multi-core demo mode expired! Reboot of the controller is necessary now!“

Convert existing projects to multicore

If an existing project is to be converted to multicore functionality, please note that the device description file has version V1.10.0.1 or higher.

In case of projects created with a PLC Engineering version < WRK-V-0110, it is required to update the device description file of the control, see command ➦Update Device.

6.3 Multicore in the IEC program

The multicore functionality can result in an increased performance when processing the PLC program by partitioning the IEC tasks and their load to different CPU cores.

In case of projects without multicore functionality, the tasks are processed on CPU kernel # 2.

- User IEC tasks
- Communication tasks
- System tasks

Assign tasks into different CPU cores

Prerequisites:

- The ctrlX CORE control supports the multicore functionality (from device description V1.10.0.1)
- At least two tasks are defined in your application, such as "MainTask" (IEC task) and "LowTask" (IEC task)

The tasks are assigned to the CPU cores via ctrlX PLC Engineering in the Task Groups tab, see ➦Further documentation.

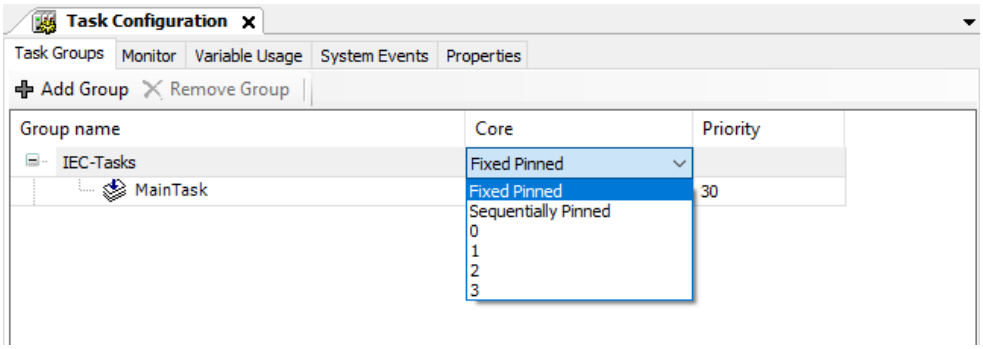

Fig. 1: Task group tab

In the state upon delivery, the "IEC tasks" task group is preconfigured in the "Fixed Pinned" setting in which all tasks are processing in the CPU core #2.

Create another task group to assign the tasks to different cores. Subsequently, select the CPU number used to process the second task group in the "Core" field. Use Drag&drop to drag the tasks to the new task group.

In the "Sequentially pinned" setting, the CPU cores are allocated continuously

Please note, that the ctrlX CORE operating system is running on the CPU cores 0 and 1.

If task groups are running on these cores, the IEC task watchdog should always be enabled.

IEC tasks have a higher priority than the operating system. Thus, they can be slowed down considerably or rendered inoperable in case of high load.

Further information about the multicore application can be found in the PLC Engineering documentation, see ➦Multicore and task configuration

7 Flexible memory configuration for remanent PLC data

The memory for remanent PLC data is available as pool to all PLC applications that are operated on the control during runtime.

A property of the remanent variables is to retain their values beyond a switch-off process of the control.

Physically, up to 128 kB non-volatile memory is available on the ctrlX CORE control. The memory space can be requested by the apps and can be used for remanent variables. The default value 64 kB is available for variables of type `VAR RETAIN` and `VAR PERSISTENT` for the PLC app and the PLC applications.

From PLC App version PLC-V-0108, the reserved memory size can be set dynamically to up to 120 kB.

Reboot the control in case of a memory size change.

Existing retain and retain persistent data are lost.

Configuring the memory size

1. Opem the ctrlX CORE web interface and navigate to the “PLC” window, see ➦Documentation
   ➡ The current memory size of the retain memory is displayed in the top window area.
2. Click on
   ➡ The “Change retain memory” dialog opens
3. Enter the desired memory size in bytes (max. 120 kB).
   If the input value is outside the minimum or maximum memory size, the minimum or maximum value is entered.
   Use “Cancel” to cancel the operation. The last valid value is retained.
4. Confirm the dialog with OK.
   ➡ The control executes a reboot
   The memory size change is completed

8 Related documentation

8.1 Overview

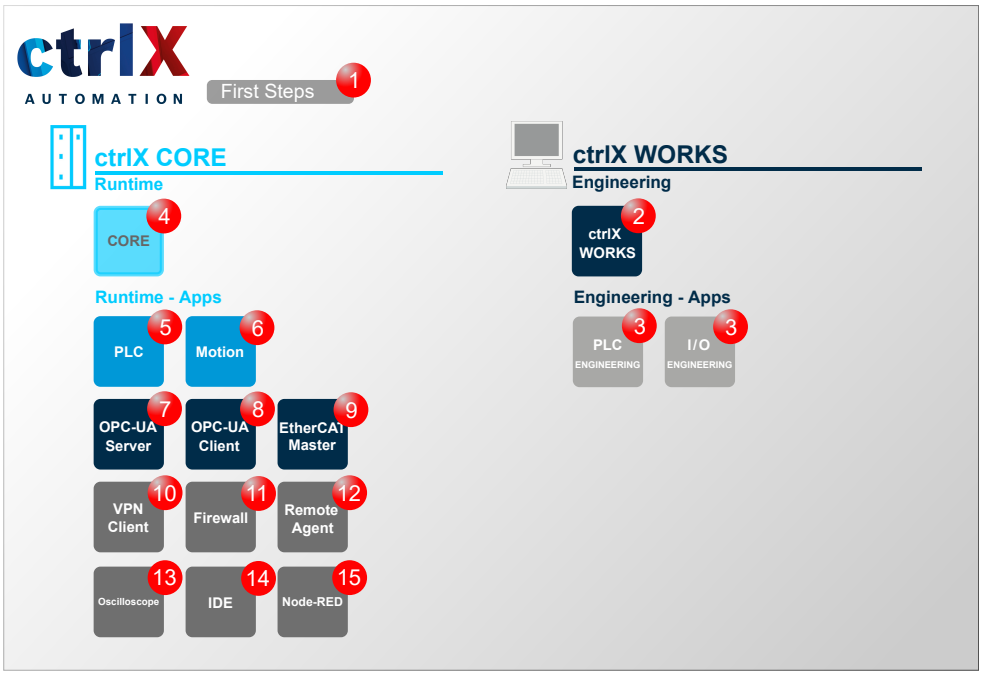

Fig. 2: Overview on further documentations

8.2 ctrlX AUTOMATION

No.	Documentation
1	**ctrlX WORKS First Steps** Quick Start Guide ➥Web documentation link Ordering information: • DOK-XWORKS-F*STEP*****-QURS-EN-P • R911403760

8.3 ctrlX WORKS

No.	Documentation
2	**ctrlX WORKS Basic System** Application Manual ➦Web documentation link Ordering information: • DOK-XWORKS-**********-APRS-EN-P • R911403761
3	**ctrlX PLC Engineering - PLC Programming System** Application Manual ➦Web documentation link Ordering information: • DOK-XPLC**-ENGINEERING-APRS-EN-P • R911403764
3	**ctrlX PLC Engineering - PLC Libraries** Reference ➦Web documentation link Ordering information: • DOK-XPLC**-LIBRARY****-RERS-EN-P • R911403766

8.4 ctrlX CORE

No.	Documentation
4	**ctrlX CORE - Runtime** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-BASE*******-APRS-EN-P • R911403768
	ctrlX CORE - Diagnostics Reference ➦Web documentation link Ordering information: • DOK-XCORE*-DIAG*******-RERS-EN-P • R911403770

8.5 ctrlX CORE Apps

No.	Documentation
5	**PLC App - PLC Runtime Environment for ctrlX CORE** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-PLC********-APRS-EN-P • R911403787

No.	Documentation
6	**Motion App - Motion Runtime Environment for ctrlX CORE** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-MOTION*****-APRS-EN-P • R911403791
7	**OPC UA Server App - OPC UA Server for ctrlX CORE** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-OPCUA*SERV*-APRS-EN-P • R911403778
8	**OPC UA Client App - OPC UA Client for ctrlX CORE** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-OPCUA*CLIEN-APRS-EN-P • R911403781
9	**EtherCAT Master App - EtherCAT master for ctrlX CORE** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-ETHERCAT***-APRS-EN-P • R911403773
10	**VPN Client App - Remote Support Software for ctrlX CORE** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-VPN********-APRS-EN-P • R911403775
11	**Firewall App - Security Functions for ctrlX CORE** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-FIREWALL***-APRS-EN-P • R911403783
12	**Remote Agent App - Device Portal Connection for ctrlX Devices** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-REMOTE*AG**-APRS-EN-P • R911403785

No.	Documentation
13	**Oscilloscope App - Oszilloskop function for ctrlX CORE** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-OSCI*******-APRS-EN-P • R911409806
14	**IDE App - Integrated Development Environment** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-IDE********-APRS-EN-P • R911410625
15	**Node-RED App - Graphical Programming for ctrlX CORE** Application Manual ➦Web documentation link Ordering information: • DOK-XCORE*-NODE*RED***-APRS-EN-P • R911403789

9 Service and support

Our worldwide service network provides an optimized and efficient support. Our experts provide you with advice and assistance. You can contact us **24/7**.

Service Germany

Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

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Fax:	**+49 9352 18 4941**
Email:	➦ service.svc@boschrexroth.de
Internet:	➦ http://www.boschrexroth.com

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

Service worldwide

Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information

To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

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