rexroth
A Bosch Company

Application Manual

Modbus TCP App

Modbus TCP Communication over ctrlX CORE

R911417926, Edition 01

Liability

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Editions of this documentation

Edition	Release date	Note
01	2022-11	First edition Version MBT-V-0116

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

Modbus is a data communication protocol that enables data exchange between a master and several slaves Modbus is a common communication protocol for automation and supports the connection of industrial electronic devices Modbus can coexist with Ethernet TCP/IP on the same physical interface. The data is sent via TCP/IP packets.

The ctrlX Modbus TCP App function allows a ctrlX device to be connected via Modbus TCP to additional third-party devices. No PLC is required to run the app. The data of the connected Modbus devices are available on the ctrlX device for all apps via the realtime data system "ctrlX Data Layer". The data can be read and written. The Modbus TCP bus configuration is realized in the web interface of the ctrlX device, see ➦Window – Modbus TCP.

The Modbus TCP App supports the following functions:

- Communication with the Modbus network
- Configuration of Modbus devices
- Administration of Modbus devices

4.1 Modbus TCP App – Installation

The Modbus TCP App can be installed on real and virtual ctrlX CORE devices. The operation of the Modbus TCP App requires the following license per target device.

Type code	Part number
SWL-XC*-MBT-MODBUSTCP****-NNNN	R911413192

For further information on the installation, please refer to the following links (link to the "ctrlX CORE Runtime" Application Manual):

➦Licenses – Overview

➦ctrlX CORE – App basics

➦ctrlX CORE – Licensing notes

App source

➦ ctrlX App Store

Interesting facts

➦ctrlX CORE community

➦ctrlX CORE - How to

➦ctrlX CORE - Forum

5 Configuring the Modbus TCP

The data exchange between the ctrlX device and the connected Modbus device is realized via subscriptions, which can be configured in the web interface of the ctrlX device. A function code within the subscription specifies which action is to be executed, for example reading a byte or reading one or more registers.

Additional topics

- Creating a new device
- Creating a new subscription (access to coils or registers)

NOTICE	Adding, deleting or changing of Modbus devices or subscriptions temporarily interrupts all Modbus TCP connections. The connections are restored automatically.

5.1 Supported function codes

The function code informs the addressed Modbus device which function is to be executed, for example whether only one bit is to be read or a register.

The function code is selected when creating a subscription, see: Creating a new subscription (access to coils or registers)

In the current version the following function codes are supported by the ctrlX device:

FC function code	Description
1	Reading a number of bits (Read Coils)
4	Reading a number of registers (Read Input Registers)
16	Writing a number of registers (Write Multiple Holding Registers)

5.2 Supported data types

The transmitted data corresponds to a data type specified by the Modbus device, e.g. INT or WORD.

The required data type has to be selected when creating a subscription, see: Creating a new subscription (access to coils or registers)

The ctrlX system supports the following Modbus data types in the current version:

Data type	Register
int16	1
uint16	1 - WORD
uint32	2 - DWORD
float	2
string	n

5.3 Poll interval (ms)

The setting “ Poll interval (ms)” defines the intervals at which data is requested from the Modbus device. The setting is defined when creating a subscription, see: Creating a new subscription (access to coils or registers)

The minimum polling interval is 10ms (default value 2s).

If the connection to the Modbus device is interrupted, the ctrlX device tries to re-establish the connection automatically every 5s.

The Modbus data can be processed on the ctrlX device in real time, for example in the PLC.

The exchange of data to Modbus TCP devices is subject to the conditions specified by the Modbus TCP protocol. It should be noted that the data can no longer be written by other applications, for example if the PLC is the owner.

The Modbus realtime data is located in the Data Layer under the following directory: `fieldbuses/modbustcp/client/realtime_data`

5.4 Creating a new device

1. In the ctrlX CORE web interface, open the “Modbus TCP” window
   Refer to ➦ Window – Modbus TCP
2. In the command line click on +
   ➡ The dialog for creating a new device opens
3. Fill in the information in the dialog:
   - Device name
   - IP address
   - Port (default 502)
   - Unit Id (standard 255)
4. Confirm the dialog with Save
   ➡ The device is created and is displayed in the overview table

5.5 Editing the device

1. In the ctrlX CORE web interface, open the “Modbus TCP” window
   Refer to ➦ Window – Modbus TCP
2. Click on ✎ in the device entry
   ➡ The dialog for editing the device is displayed.
   The following settings can be changed:
   - IP address
   - Port (default 502)
   - Unit Id (standard 255)
3. Implement the desired change and confirm the dialog with Save

5.6 Creating a new subscription (access to coils or registers)

Prerequisite: At least one Modbus device has to be configured, see ➦ Creating a new device

1. In the ctrlX CORE web interface, open the “Modbus TCP” window
   Refer to ➦ Window – Modbus TCP
2. Click on ⊕ in the device entry
   ➡ The dialog for creating a new subscription opens, see ➦ Dialog – Add Subscription
3. Several specifications and settings have to be selected in the dialog. The input fields may vary depending on the selected function code.
4. Confirm the dialog with Save
   ➡ The subscription is created and appears in the overview table below the device entry

5.7 Edit subscription

Prerequisite: At least one subscription has to be created, see ➦ Creating a new subscription (access to coils or registers)

1. In the ctrlX CORE web interface, open the “Modbus TCP” window
   Refer to ➦ Window – Modbus TCP

2. Click on ⌄ in the device entry
   ➡ The subscriptions of the Modbus device are displayed
3. Click in the subscription entry on ✎
   ➡ The editor will be opened, see ↪ Editor – Edit Subscription
4. Perform the change of settings
5. Confirm the change with Save

6 Application examples

6.1 Read multiple registers with one subscription

Task

In this application example, several register values of a device are to be read out with a subscription Modbus device are to be read out with a subscription.

The example device is a Modbus power measuring terminal UMG96-PA of the manufacturer Janitza.

The power terminal was already added to the Modbus configuration of the ctrlX device in the run-up of the application example, see: ➦ Creating a new device

Basics

Registers are read out via subscriptions which can be created in the web interface of the ctrlX device below the Modbus device entry, see here ➦ Creating a new subscription (access to coils or registers).

Each subscription contains several settings that determine which function is to be executed and which registers are to be read at which interval. The settings are selected when creating the subscription, in this application example:

- **Function code**
  The function code specifies which action is to be performed, e.g. reading bits or reading registers.
  In this example registers are to be read which is triggered by the function code "FC4", see here:
  ➦ Supported function codes
- **Data Type**
  The registers to be read contain values of a certain data type.
  The appropriate data type has to be taken from the documentation of the device Modbus device, see documentation example below.
- **Register address**
  The register address specifies from which register reading is to start (start address)
  The register addresses can be found in the documentation of the Modbus device, see documentation example below.
- **Quantity**
  The number specifies how many registers are to be read out, starting at the register address (start address).
- **Poll interval (ms)**
  The registers are read out of the device according to the set polling interval Modbus device (min. 10ms)

Creating a "Read register" subscription

1. In the ctrlX CORE web interface, open the “Modbus TCP” window
   Refer to ➦ Window – Modbus TCP
2. Click on ⊕ in the device entry
   ➡ The dialog for creating a new subscription opens, see ➦ Dialog – Add Subscription

3. Select the following settings:
   - **Name**: [Read register]
   - **Function code**: [FC4]
     FC4 = read a number of registers
   - **Data Type**: [float]
     In this example, it is a register of type [float]
   - **Register address**: [19000]
     In this example, [19000] is the start address from which the register values are transmitted
   - **Quantity**: [122]
     Number of registers to be transferred, in this example 122 register values.
   - **Poll interval (ms)**: [2000]
     In this example a slow interval of 2 seconds is sufficient
4. Confirm the dialog with Save
   ➡ The subscription is created and is displayed in the overview table below the device entry and the connection is established automatically

   NOTICE Adding, deleting or changing of Modbus devices or subscriptions temporarily interrupts all Modbus TCP connections. The connections are restored automatically.

Device documentation Janitza UMG 96-PA

The exemplary extract from the device documentation shows the register addresses and data types:

Address list UMG 96-PA

Frequently required readings

Address	Format	RD/WR	Variable	Unit	Note
19000	float	RD	_ULN[0]	V	Voltage L1-N
19002	float	RD	_ULN[1]	V	Voltage L2-N
19004	float	RD	_ULN[2]	V	Voltage L3-N
19006	float	RD	_ULL[0]	V	Voltage L1-L2
19008	float	RD	_ULL[1]	V	Voltage L2-L3
19010	float	RD	_ULL[2]	V	Voltage L3-L1
19012	float	RD	_ILN[0]	A	Current, L1
19014	float	RD	_ILN[1]	A	Current, L2
19016	float	RD	_ILN[2]	A	Current, L3
19018	float	RD	_I_SUM3	A	Vector sum; IN=I1+I2+I3
19020	float	RD	_PLN[0]	W	Real power L1
19022	float	RD	_PLN[1]	W	Real power L2

7 ctrlX UI – Elements

By installing the Modbus TCP app on the control, the side navigation of the ctrlX CORE web interface is extended by the “Modbus TCP” node, see: ➦Window – Modbus TCP

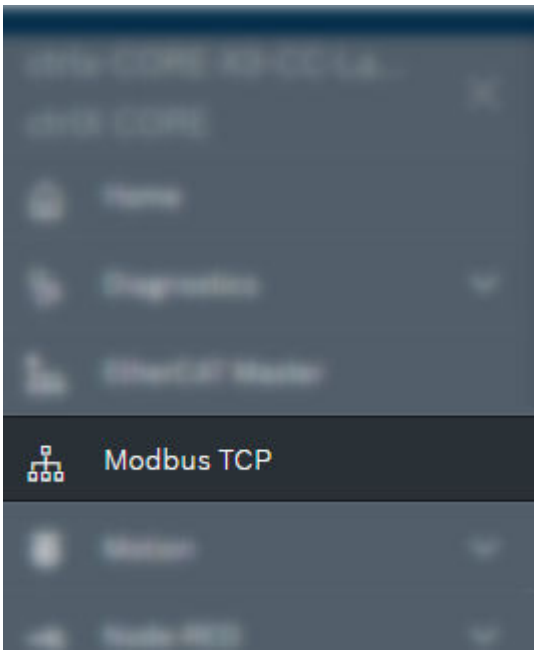

Fig. 1: Modbus TCP node of the web interface

7.1 Window – Modbus TCP

The window is used for configuration and management of Modbus TCP devices and subscriptions. New Modbus devices can be added in the window. Already existing Modbus devices are displayed in tabular form in the window. Buttons can be used to edit device configurations, e.g. add or edit subscription. Each device entry can be expanded and collapsed to show or hide the subscriptions.

Related topics

➦Creating a new device
➦Creating a new subscription (access to coils or registers)

Window call

In the ctrlX CORE web interface:
“side navigation → Modbus TCP”

Window description

GUI element	Description
Command bar	“[x] items” Number of configured Modbus devices
	+ Add new Modbus device to the configuration
Displays	Name of the Modbus device (alias)
	IP address of the Modbus device
	Status of the Modbus device

GUI element	Description
Buttons	⊕ Adding a new subscription, see ➦ Creating a new subscription (access to coils or registers)
	Editing existing subscription, see ➦ Edit subscription
	Remove Modbus device from configuration
	Show subscription
	Hide subscription
Shown subscriptions	Subscription name
	“FC” = function code Supported function codes, see: ➦ Supported function codes
	“Register Address” Address of the Modbus register to be transferred
	“Value” Data values contained in the transferred registers
	“Status” Diagnostic messages
Buttons	Editing a subscription, see ➦ Editor – Edit Subscription
	Deleting a subscription

7.2 Dialog – Add Subscription

When creating a new subscription, various settings have to be specified so that the data exchange between a configured Modbus device and the ctrlX device can take place. The required settings vary according to the selected function code.

Input field	Description
“Name”	Subscription name
“Function code”	Selection of the function code, see ➦ Supported function codes
“Register address”	Address of the register to be transferred or start address if several registers are to be transferred. The required register address can be found in the documentation of the device Modbus device documentation.
“Quantity”	Number of registers to be transferred
“ Poll interval (ms)”	Time interval in which the registers are transferred (minimum 10ms)
“Data Type” Only for function codes: 4 / 16	Data type selection of the register values to be transferred. The required data type can be found in the documentation of the device Modbus device documentation. Supported data types, see ➦ Supported data types

Related topics

➦ Creating a new device
➦ Window – Modbus TCP

7.3 Editor – Edit Subscription

Existing subscriptions can be edited via the editor, see: ➦ Edit subscription
The following settings can be edited:

Input field	Description
“Function code”	Selection of the function code, see ➦ Supported function codes
“Register address”	Address of the register to be transferred or start address if several registers are to be transferred. The required register address can be found in the documentation of the device Modbus device documentation.
“Quantity”	Number of registers to be transferred
“ Poll interval (ms)”	Time interval in which the registers are transferred (minimum 10ms)
“Data Type” Only for function codes: 4 / 16	Data type selection of the register values to be transferred. The required data type can be found in the documentation of the device Modbus device documentation. Supported data types, see ➦ Supported data types

Related topics

➦ Window – Modbus TCP

8 Related documentation

8.1 Overview

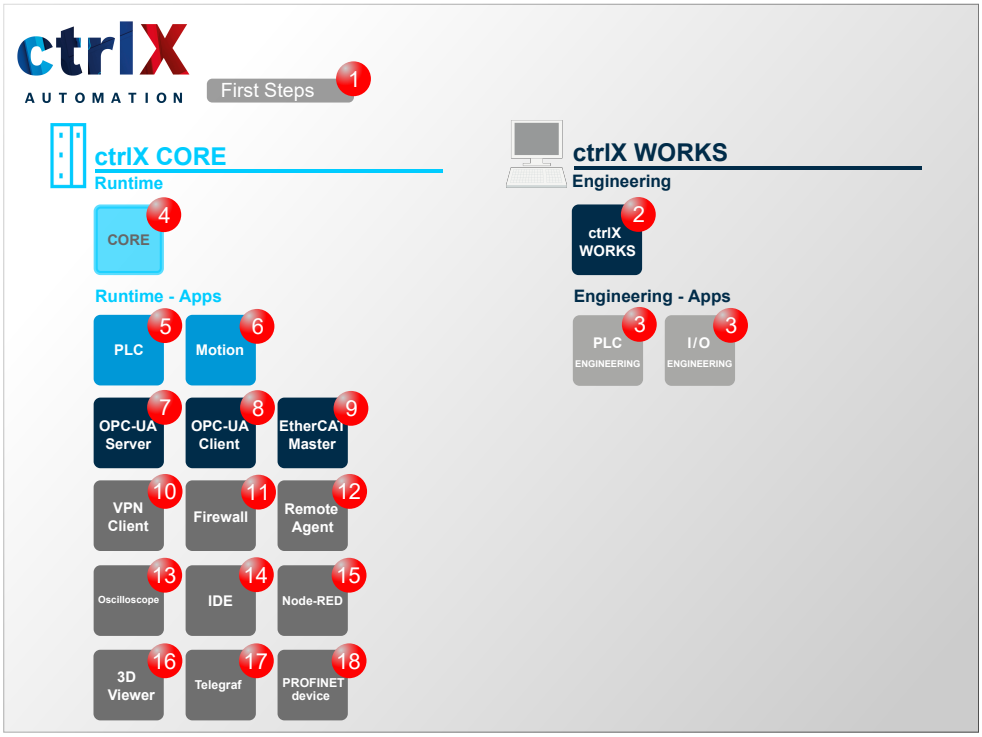

Fig. 2: Overview on further documentations

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 - ctrlX 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 - Oscilloscope Function for ctrlX Devices** 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 - Graphic Programming for ctrlX CORE** Application Manual ➦ Web documentation link Ordering information: • DOK-XCORE*-NODE*RED***-APRS-EN-P • R911403789
16	**3D Viewer App - Browser-based 3D Kinematic Simulation for ctrlX CORE** Application Manual ➦ Web documentation link Ordering information: • DOK-XCORE*-3D*VIEWER**-APRS-EN-P • R911416124
17	**Telegraf App - Server Agent for Collecting Data in the Data Layer** Application Manual ➦ Web documentation link Ordering information: • DOK-XCORE*-TELEGRAF***-AP01-EN-P • R911416836
18	**PROFINET device App - PROFINET device for ctrlX CORE** Application Manual ➦ Web documentation link Bestellinformationen: • DOK-XCORE*-PROFINET***-AP01-EN-P • R911417857

9 Service and support

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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)

10 Index

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