

Title: **How to use G-Code UI on ctrlX CORE**
App Version: GCO-V-3.2.0
Last modification: 2024/08/16

Introduction

This documentation describes how to install and use ctrlX G-Code UI. G-Code UI was developed with Node-RED and PLC Engineering. It consists of a PLC project package and Node-RED template which can be customized.

G-Code UI functionality

G-Code UI supports the following features:

- Editor to create / write / delete a NC program.
- NC program selection.
- Start, stop, reset, and pause the NC program kinematics, respectively.
- Control path velocity by feed rate override.
- Different coordinate systems like ACS and PCS.
- Observe position and state of kinematics.
- System diagnostics.

Installation and activation of G-Code UI

A licensed installation of following apps (3.2.0) is expected before activating G-Code UI.

Mandatory:

- ctrlX CORE - MOTION App (3.2.0)
 - ctrlX CORE - Motion Standard License 4 Axes
 - ctrlX CORE - Motion Cartesian License (add-on)
- ctrlX AUTOMATION - G-Code Runtime App (3.2.0)
 - ctrlX OS License - G-Code Runtime
- ctrlX AUTOMATION - Node-RED App (3.2.0)
 - ctrlX OS License - Node-RED
- ctrlX AUTOMATION - PLC App (3.2.0)
 - ctrlX CORE License - PLC Standard (add-on)
- ctrlX AUTOMATION - G-Code UI (3.2.0)

Note: Please install G-Code Runtime App after MOTION App!

Optional:

- ctrlX AUTOMATION - 3D Viewer App
 - ctrlX OS License - 3D Viewer
- ctrlX AUTOMATION - Oscilloscope App

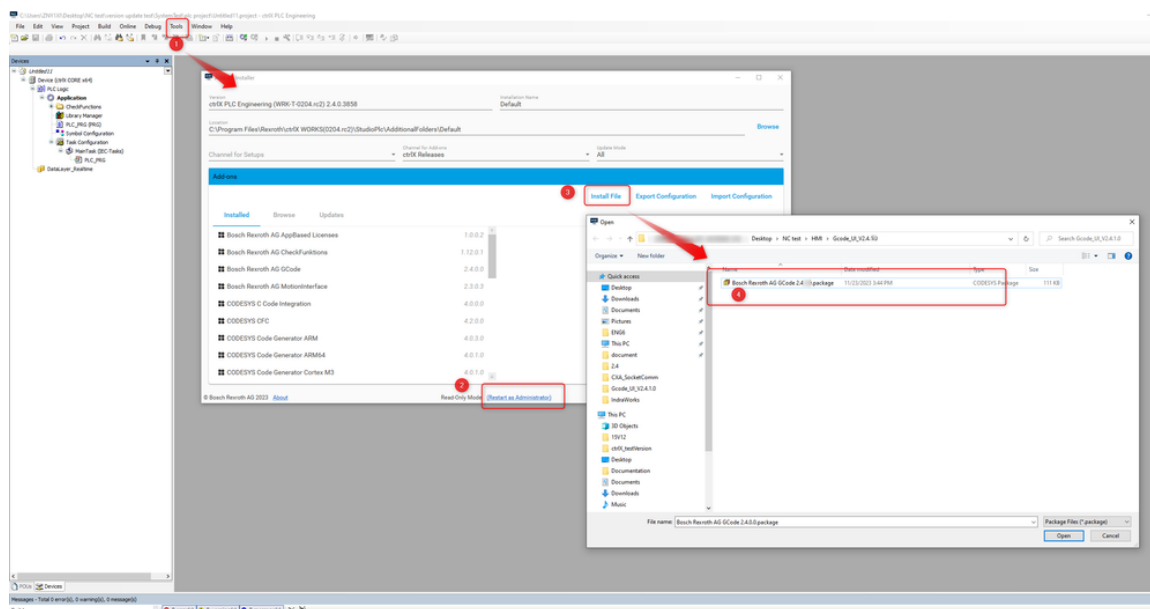
The G-Code UI template includes two parts:

- PLC package: Bosch Rexroth AG GCode ****.package
- Node-RED template flows: GCode_UI_****.json
(or GCode_UI_*.zip)

Both should be installed to activate and operate the UI.

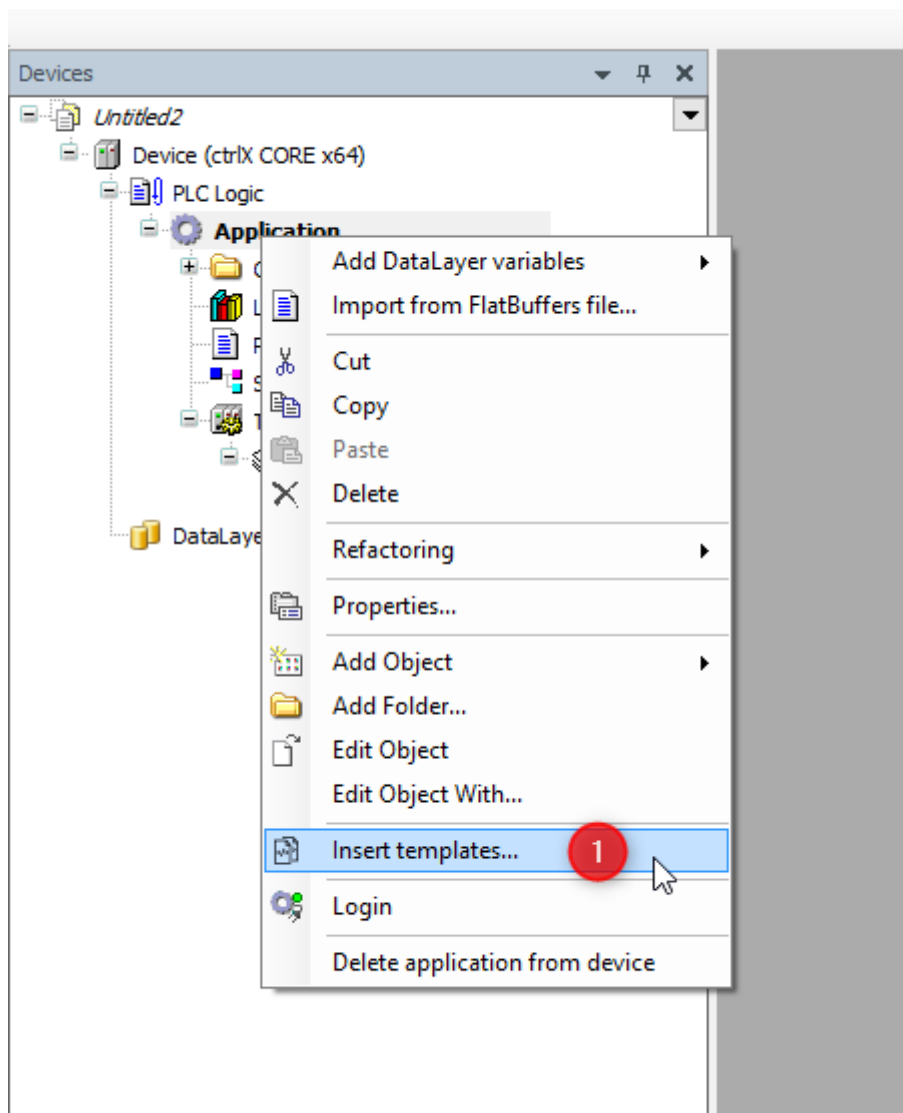
PLC Part

Install the G-Code template package to the ctrlX PLC Engineering, only need to install for the first time:

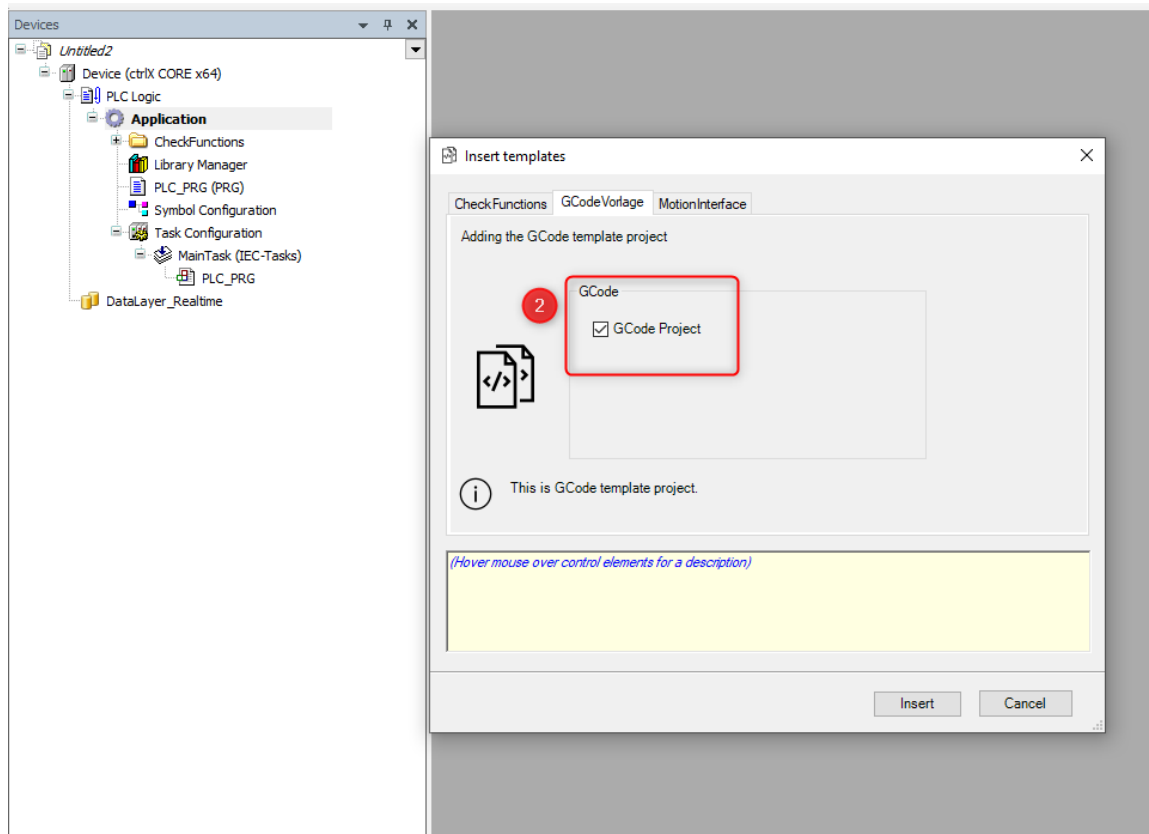


How to install PLC template package of G-Code UI

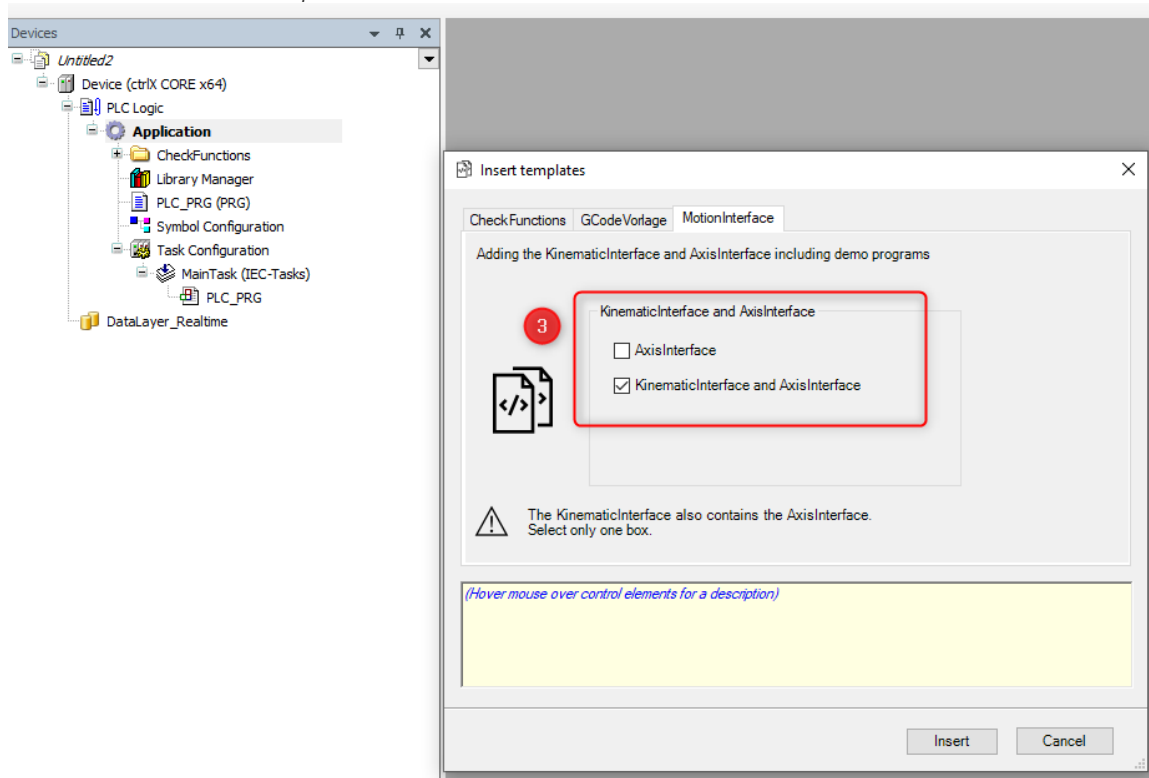
Create a new PLC project and insert PLC templates. Both the G-Code template and Motion Interface template need to be inserted:



Insert the PLC templates in PLC project

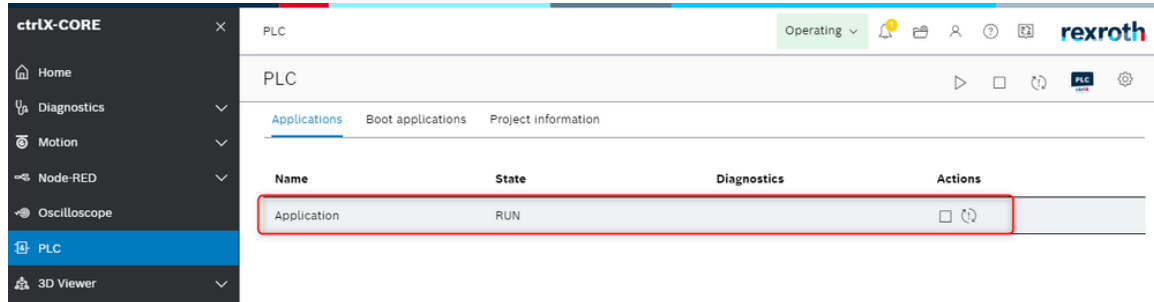


Select and insert G-Code template



Select and insert Motion Interface template

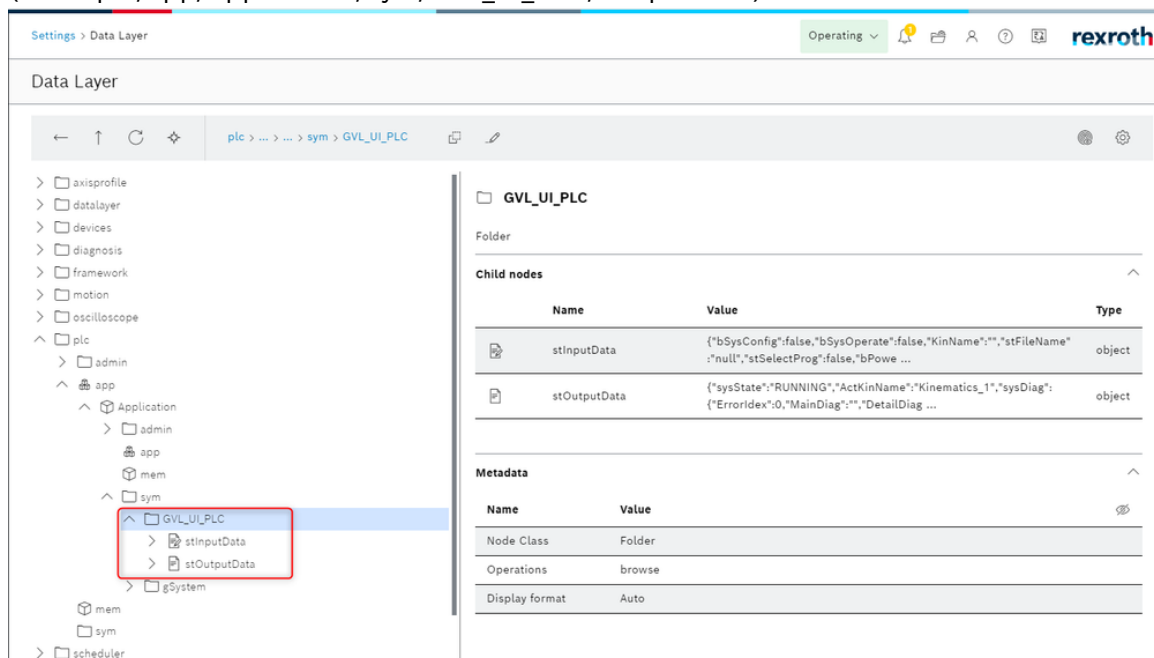
Make sure the right PLC project is loaded, and "Application" of PLC runtime in ctrlX WORKS is in state of "RUN".



Application of PLC runtime in ctrlX WORKS is in state of RUN

All of PLC interface variables can be traced in the DataLayer node, as shown in the figure below.

(Path: plc/app/Application/sym/GVL_UI_PLC/stInputData)



PLC interface variables in the DataLayer node

Node-RED part

There are two methods to load and active Node-RED configuration:

- Load GCode_UI_****.zip from the "Manage app data".
- Or import GCode_UI_****. json in Node-RED flow editor.

Note:

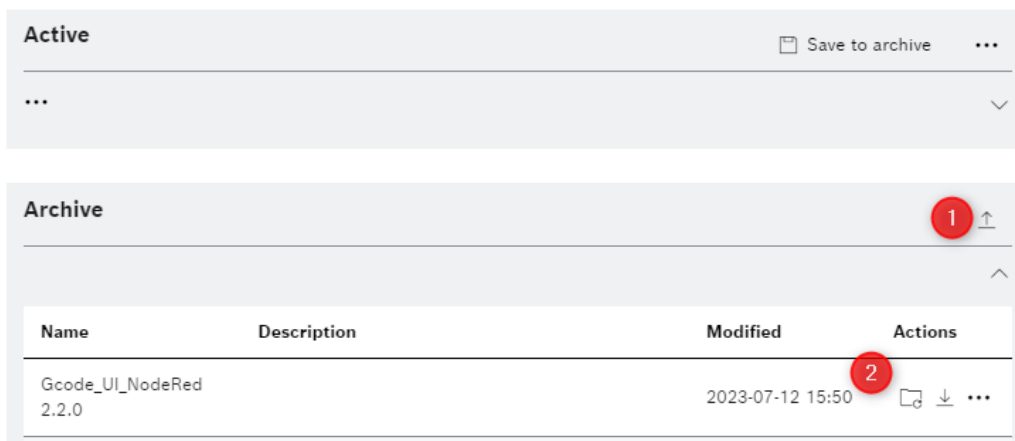
GCode_UI_****.zip: It doesn't only contain the configuration of Node-RED, but also the configuration of Motion, the existing motion configuration will be overwritten. Therefore, it is recommended to load and activate the Node-

RED configuration through the second way.

GCode_UI_****.json: It only contains the configuration of Node-RED, the user needs to add axes and create at least one kinematics before implementation.

Method 1: Activate the configuration of Node-RED by loading the GCode_UI_****.zip file.

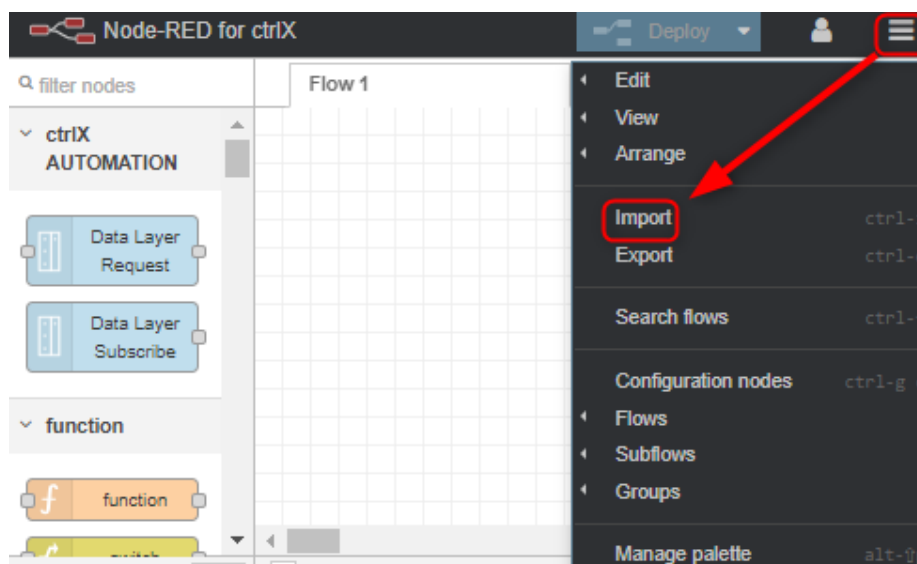
- Switch ctrlX CORE state to "Setup" mode, uploads GCode_UI_****.zip file via "Home → Manage app data → Archive/Uploads Configuration".
- Active the configuration and switch the ctrlX CORE state to "Operating" mode.



Activate the configuration of Node-RED by loading the GCode_UI_****.zip file

Method 2: Activate the configuration of Node-RED by import the GCode_UI_****.json file.

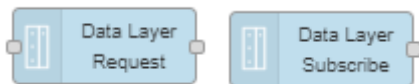
Open Flow Editor of Node-RED App, then import the Node-RED configuration flows.



Activate the configuration of Node-RED by import the GCode_UI_****.json file

Note:

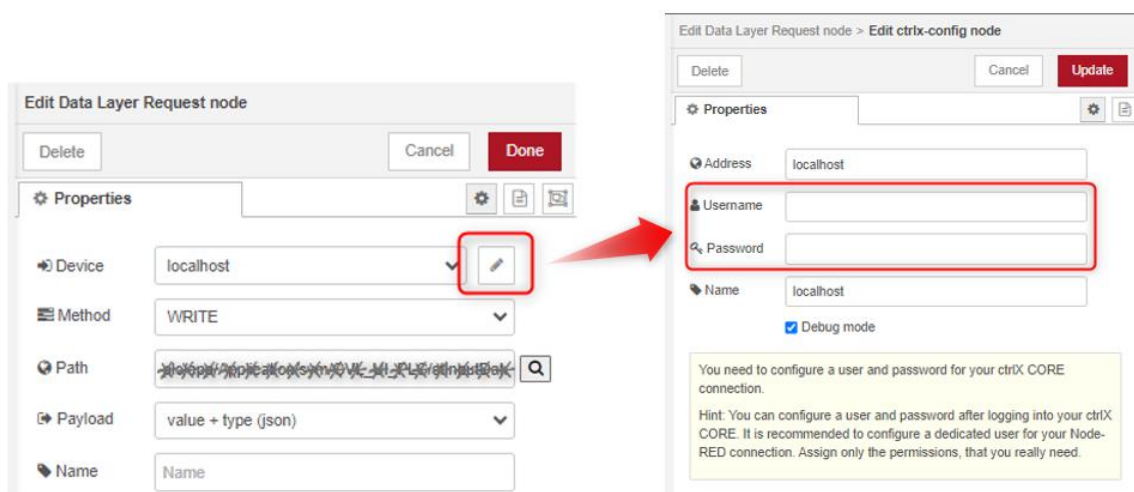
The Node-RED configuration has been uploaded, but there are two ctrlX Automation nodes that need to be logged in before flows are deployed. One is the “Data Layer Request” node and another one is “Data Layer Subscribe” node.



How to log in “Data Layer Request” node:

- Double-click any “Data Layer Request” node to open the configuration window.
- Enter the username and password to log in, as shown in the figure below.
- Deploy the flows.

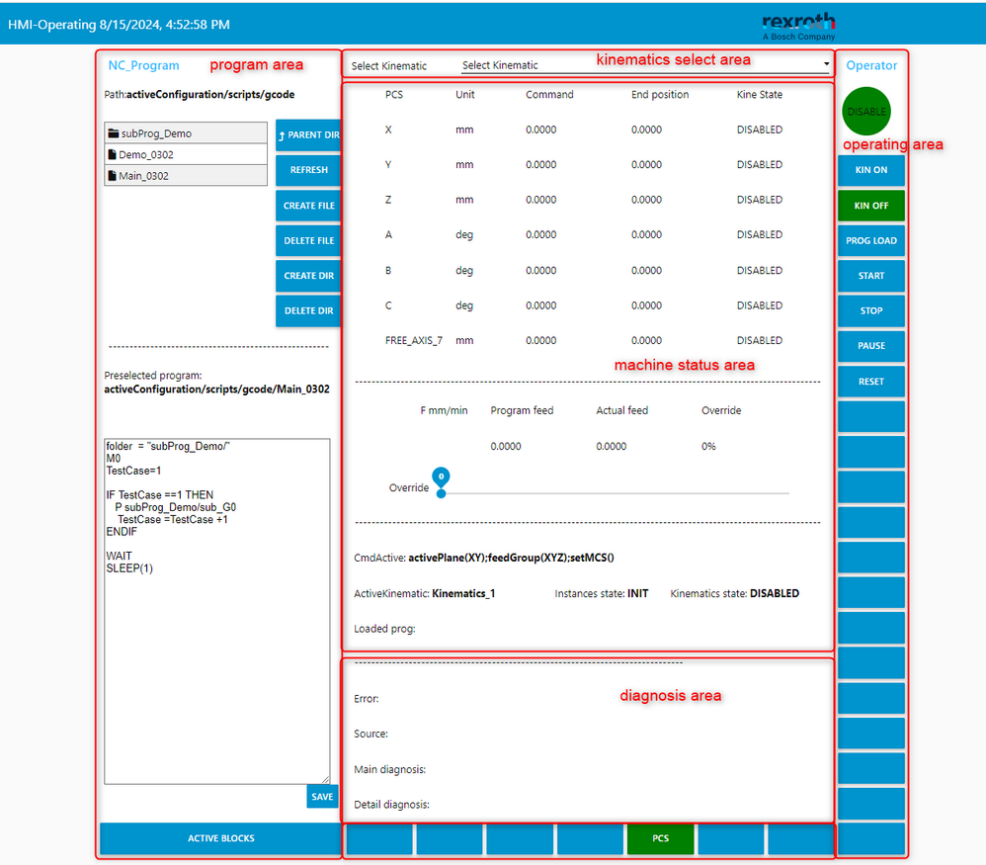
Same for the "Data Layer Subscription" node.



How to log in Data Layer request node

Description of G-Code UI

The page HMI-Operating includes five areas: kinematics select, program, machine status, operation and diagnosis.



HMI-Operating of G-Code UI

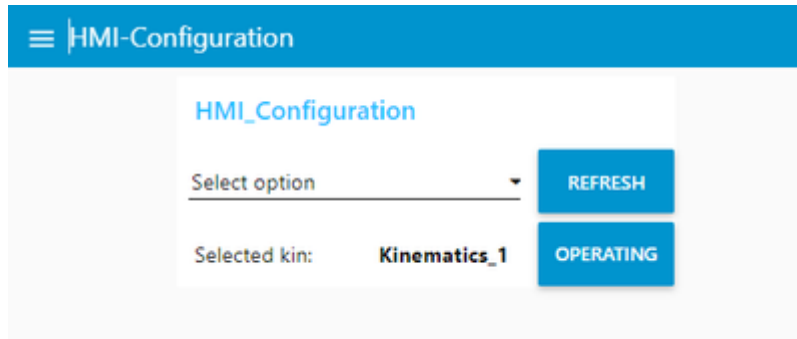
kinematics select area:

Before using this UI, at least one kinematics should be created, then the created kinematics can be read and selected.



kinematics select

For 2.6.0 and below, before active operating mode, need refresh and select the kinematics in the configuration mode page, show as below picture.



HMI-Configuration of G-Code UI (2.6.0 and below)

Programming area:

There are two pages in the program area. The default page "NC_Program" displays the operable fields for of the program, which are described in the below table. The "Active_NC_Blocks" page displays the activated NC block. The page is switched from "NC_Program" to "Active_NC_Blocks" automatically when the NC program is running.

Optional operations of program area of HMI-Operating

	Name	Description
1	Path	Show the file path of program.
2	PARENT DIR	Return to the parent directory.
3	REFRESH	Refresh the program list.
4	CREATE FILE	Create program. For 2.6.0 and below, need input the file name of new program via "Filename to be created", and then click "CREATE" to complete the creation of the program.
5	DELETE FILE	Delete program.
6	CREATE DIR	Create customer directors in path "Manage app data/Active/scripts".
7	ACTIVE BLOCKS	Switch page to "Active_NC_Blocks" manually via "ACTIVE BLOCKS". Only when NC program is running, the "ACTIVE_NC_BLOCKS" page can display the executing NC blocks. Switch from "Active_NC_Blocks" page to "NC_Program" page via "PROGRAM" button.
8	SAVE	Save the NC program.

Machine status area:

- Display axis status, position, and velocity information. Maximal seven axes status can be displayed.
- Slider of override to modify the percentage of command value F.
- Observe the active command options.

- Show kinematics activated name and state.
- Displays pre-selected and loaded programs.

Operating area:

This area provides operation buttons to control the system.

Optional operations of operating area of HMI-Operating

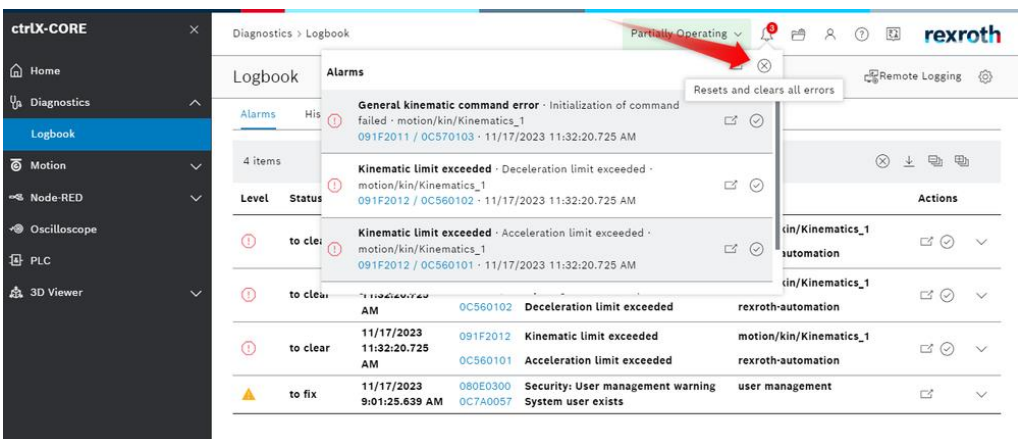
	Name	Description
1	KIN ON	Axes power on and group enable.
2	KIN OFF	Axes power off and group disable.
3	PROG LOAD	Load the pre-selected program, switch UI state from "DISABLED" to "READY".
4	START	<ul style="list-style-type: none"> ▪ Start NC program, switch UI state from "READY" to "RUNNING". ▪ Continue running NC program which has been interrupted by pause. UI state switch from "PAUSE" to "RUNNING". ▪ Reset M0 and continue running NC program.
5	STOP	Stop NC program, switch UI state from "RUNNING" / "PAUSE" to "READY".
6	PAUSE	Pause NC program, switch UI state from "RUNNING" to "PAUSE".
7	RESET	Reset errors, switch UI state from "ERROR" to "DISABLED".
8	PCS	Show kinematics position in product coordinate system.

Diagnosis display:

When an error occurs, the user can get the following information from the UI:

- Main diagnosis: Main number of the diagnostic information.
- Detail diagnosis: Detailed number of the diagnostic information.
- Error Information: Description of error.
- Error source: Traced source of the error

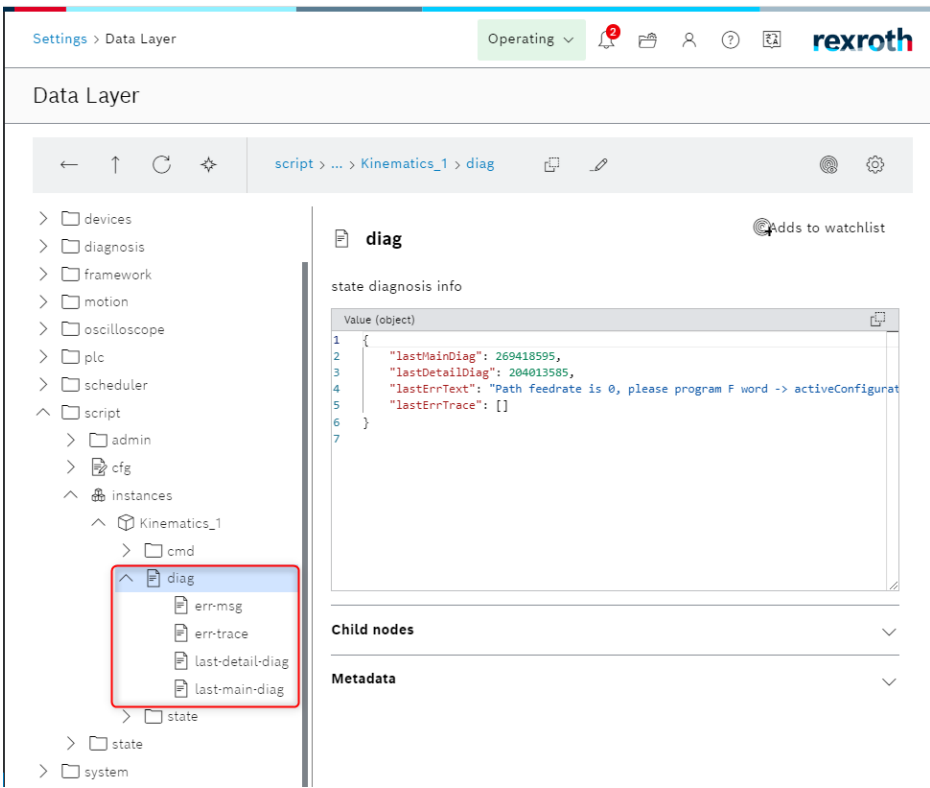
The diagnosis includes motion error, G-Code error, PLC error and error from others. If the error cannot reset from UI, users can clear pending alarm as below picture.



Clear pending alarms

All errors also can be traced in Diagnostics/Logbook, and in addition, the errors from G-Code and motion can also be traced in data layer node.

G-Code error: `script/instances/<"kinematics name">/diag`



DataLayer node for G-Code error

The

Motion error: motion/kin/Kinematics_1/state/diag-info

Settings > Data Layer

Data Layer

← ↑ ↺ ✦ motion > ... > state > diag-info

- > collision-avoidance
- ^ kin
 - > Kinematics
 - ^ Kinematics_1
 - > cfg
 - > cmd
 - ^ state
 - cmd-state
 - coord-systems
 - diag
 - ^ **diag-info**
 - cmd-src
 - diag-descr
 - diag-detail
 - diag-main
 - first-cmd-src
 - first-diag-descr
 - first-diag-detail
 - first-diag-main
 - obj-name
 - obj-uri
 - err-level
 - interrupt
 - kin-axs
 - kin-axs-list
 - opstate
 - realtime
 - values
 - realtime-data
 - state
 - oscilloscope
 - plc

diag-info

overview of diagnosis info

Value (object)

```

1 {
2   "mainDiagCode": 151986193,
3   "detailedDiagCode": 207028483,
4   "objName": "Kinematics_1",
5   "objURI": "motion/kin/Kinematics_1",
6   "source": "key.datalayer|motion/kin/Kinematics_1/cmd/move-abs|0",
7   "addInfo": "add command init failed, error: 4027645956",
8   "firstMainDiagCode": 151986194,
9   "firstDetailedDiagCode": 206962945,
10  "firstSource": "key.datalayer|motion/kin/Kinematics_1/cmd/move-abs|0",
11  "firstAddInfo": "less than lower limit; limit: 2.642 m/s^2, commanded: 2.000 m/s^2"
12 }
13

```

Child nodes

Metadata

The DataLayer node for Motion errors

Note:

Big NC file can be loaded in "Manage app data -> Active -> Scripts will be executed by script runner", it should be edited before loading.

Operate G-Code UI

Before you operate G-Code UI, at least one kinematics should be created and PLC project should be in "RUN" state.

- Open G-Code UI at the Node-RED/ Dashboard.
- Select one kinematics.
- Axes power on and group axes of kinematics via "KINON" button.
- Create a new program via "CREATE FILE". The NC programs are saved in "Manage app data-> Active->Scripts will be executed by script runner->gcode".

- Select and open the new program, then NC program can be edited.
- Save the NC program via "SAVE" button.
- Click the "PROG LOAD" button to load the pre-selected program.
- Click the "START" button to implement the program which loaded.
- Pause NC program via "PAUSE", and then continue running program via "START".
- Stop NC program via "STOP" and reset error via "RESET".

Related Links

- [ctrlX AUTOMATION - G-Code Runtime App](#)
- [Documentation G-Code Runtime App](#)
- [Documentation ctrlX MOTION App \(including CXA_MOTION, Data Layer/REST, Python, C++\)](#)
- [Documentation ctrlX Node-RED App](#)
- [Documentation ctrlX PLC App](#)