Getting Started CODESYS Control SL for Weidmüller u-OS

Table of Contents

Requirements

To develop and deploy CODESYS projects on u-OS you require the following components:

- Weidmüller u-OS compatible device running u-OS 2.1.5 or later
- USB or ethernet connection between u-OS device and engineering PC
- The CODESYS Development System 3.5.21.40 or later: Download it for free from the CODESYS Store. After installation on your Windows workstation PC, you can use it immediately.
- CODESYS Control SL for Weidmüller u-OS Package
- CODESYS Control SL for Weidmüller u-OS Runtime
- For 24/7 operation, you need a license that fits your application. An overview of the CODESYS license packages can be found here. Without a valid license, the CODESYS Control SL for Weidmüller u-OS Runtime runs in demo mode and automatically stops after a runtime of 2 hours.
- u-OS 2.2.0 requires Package Version 4.12.1.0 or later. See Migrating from older versions if you are upgrading from an older u-OS version.

Installation

The CODESYS Control SL for Weidmüller u-OS Package adds Weidmüller u-OS devices and UR20 I/O modules supported on the local System Bus to the device repository of your CODESYS Development System installation. The package can be installed using the CODESYS Installer, administrative privileges are required for installation.

Starting with Package Version 4.12.2.0, the CODESYS Control SL App is included in the Package and can be installed on u-OS via the CODESYS SL Deploy Tool, no separate download is required. Installation via SWU file is still possible via the u-OS Control Center. The SWU file can be downloaded via the link above.

Uninstallation of the CODESYS Control SL App is only possible by doing a factory reset in u-OS. Make sure to backup all user data!

Runtime installation via CODESYS SL Deploy Tool

- Enable SSH access in u-OS Control Center under “Identity & access” – “Access”
- Open the CODESYS Development System
- Verify that both the CODESYS SL Deploy Tool and the CODESYS Control SL for Weidmüller u-OS Package are installed via “Tools” – “CODESYS Installer”
- Open the Deploy Tool via “Tools” – “Deploy Control SL”
- Provide the correct IP address and login data for the u-OS device in the Communication tab and click “Connect”
- Once connected, navigate to the “Deployment” tab. Under “Install and Deploy Product” select the Product “CODESYS Control SL for Weidmüller u-OS”. Under Version select the desired Runtime version. Click “Install”.
- Watch the install progress in the messages view of the CODESYS Development System.
- After successful installation the device will automatically restart. This might be indicated by an error message in the messages view and a loss of connection in the CODESYS Development System.
- After the device has booted up, reestablish a connection on the “Communication” tab. Change to the “Deployment” tab and verify that “CODESYS Control SL for Weidmüller u-OS” is listed under “Installed Packages”.

Runtime installation via u-OS Control Center

- Login to the Control Center of u-OS as a user with the Firmware Update privilege, i.e. an admin user
- Navigate to “Software & updates” – “Update & installation”
- Click on “Update & installation”
- Follow the on-screen instructions and upload the appropriate *u-os-app-codesys-*.swu*, matching your device type
- After the upload has finished, installation will proceed automatically, and the device will reboot.
- Navigate back to the welcome page of the u-OS Control Center. CODESYS should be listed in the Apps overview.

Post Installation

The CODESYS Runtime will be installed without a default user and login password. These are set on first login from the CODESYS Development System.

- Create a standard CODESYS project in the CODESYS Development System.
- Insert the correct Weidmüller device in the project tree (context menu “<project name>” / “Add Device”).
- Double-click the device in the project tree.
- Establish communication with the device (click the “Scan network” button, select device).
- You will be prompted to create a new user and password.
- After creation of the initial user, you might need to login again via “Online” – “Login”.

Licensing

One CODESYS Runtime License is required per device. Additional feature licenses might be required depending on your application. You can evaluate all features of CODESYS without a license. The runtime will run for two hours, other components like fieldbus might run for a shorter time.

- Open the CODESYS Development System
- Open the License Manager via “Tools” – “License Manager”
- Select “Device”, click “Next”.
- The License Manager will scan for Devices on the Network. Select the correct device by verifying the serial number matching the displayed host name or using the “Wink” function. Click “OK”.

- You will be prompted to login to the device. If you have not yet created a user and password, refer to Post Installation above.
- The License Manager will poll existing Softcontainers and Licenses from the device. If you have other Apps installed on u-OS that utilize Wibu Codemeter licensing, you might see more than one Softcontainer. At creation of this document, the License Manager does not display any further information about empty Softcontainers. Choose the first Softcontainer and proceed.
- Select "Install Licenses". Follow the on-screen instructions.
- Should you receive an error message stating that the License cannot be installed in the selected Softcontainer, select the next Softcontainer and repeat.
- After License activation the valid license will be listed under the Softcontainer in the License Manager.
- Restart the device to use the new license.

License activation locks the license to the device. Reinstallation is possible only on the same device. If you need to use the license on multiple devices, i.e. for development, consider using a CM Stick Dongle (only devices with a USB Type-A host port).

Licenses are not affected by a factory reset and do not need to backed up manually.

Additional device descriptions and libraries

If you plan to use UR20 I/O modules on a separate UR20 fieldbus coupler, please download the respective device descriptions from u-remote Device Descriptions (Weidmüller Support Center). Weidmüller also provides function blocks for a selected list of function modules to ease development. These are available as a separate download from u-remote UR20 Library for CoDeSys (Weidmüller Support Center).

Migrating from older versions

PLC programs on u-create web (firmware < 2.0.0) are not compatible with CODESYS and cannot be migrated.

Breaking Change: CODESYS Control SL for Weidmüller u-OS Package version 4.12.1.0 is required to be installed in the CODESYS Development System to support devices running u-OS 2.2.0 or later.
If you are using the u-remote UR20 Library for CODESYS, an update to version 3.0.0 or later is required.

u-OS 2.2.0 introduces changes to the communication with UR20 modules on the System Bus that require an updated CODESYS for Weidmüller u-OS Package, version 4.12.1.0 or later. These changes also affect the currently deployed CODESYS project. They will result in the System Bus becoming inoperative when updating to u-OS 2.2.0. To restore the System Bus to operation, follow the steps below. We recommend to also update the CODESYS Control SL Runtime app to the latest version.

When migrating projects from an older version of the CODESYS Control SL for Weidmüller u-OS follow these steps:

1. Install the desired version of CODESYS for Weidmüller u-OS Package in your CODESYS Development System.
2. Update the libraries of your project to the most recent versions from the package.
3. If you are using the u-remote UR20 Library for CoDeSys, update to a version that suits the Package version.
4. Verify in the device tree that the version of the controller matches the version of the installed runtime.
5. Verify in the device tree that the system-bus is set to the latest version, i.e. 2.0.0.0 for u-OS 2.2.0.
6. Make a clean build and redeploy the project to the controller, overwriting the old boot application.
7. Restart the controller for all changes to take effect.

If you encounter issues with the System Bus, please verify that you are using the appropriate package version and have updated the libraries in your project. Create a new CODESYS project from scratch and configure just

the UR20 I/O on the System Bus. Deploy this project to the controller and verify the System Bus is operational.

Setting up CODESYS WebVisu

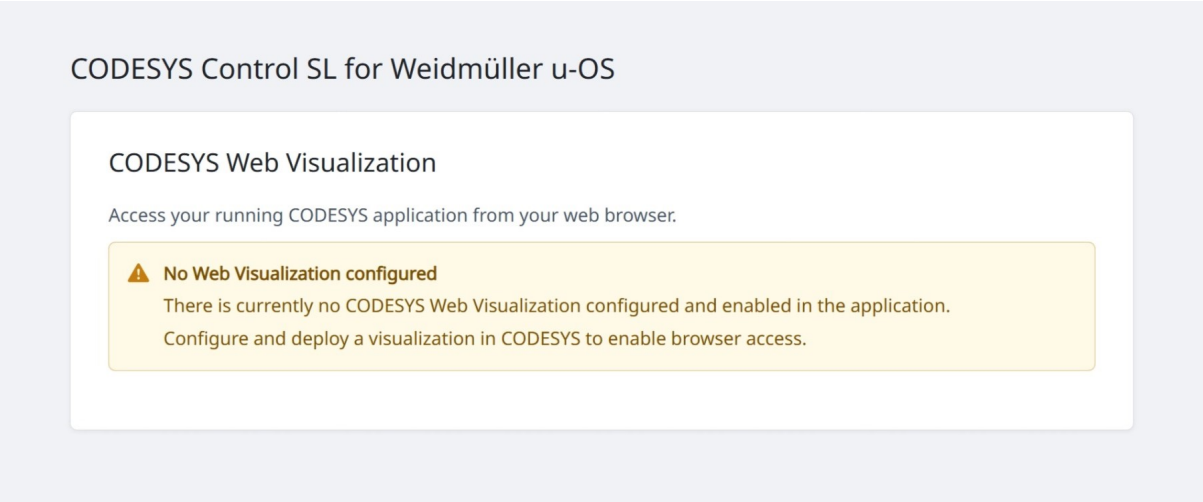
CODESYS WebVisu can be used on u-OS like on any other CODESYS Control SL for Linux System. The URL and port for accessing the CODESYS WebVisu on u-OS are described below.

Security Relevant Change: Since CODESYS Control SL for Weidmüller u-OS Version 4.21.1.0 the CODESYS WebVisu is directly exposed via the u-OS devices network interfaces by default, it is not protected by the u-OS Identity and Access Management anymore. This change takes effect when updating CODESYS Control SL without further notice. After updating to this version, the HMI user will be presented with a selection page instead of the CODESYS WebVisu, offering a redirect to the exposed WebVisu port. This page will redirect to the default page of the CODESYS WebVisu, regardless of the URL configured in the HMI. Only update an existing installation after reading WebVisu since CODESYS Control SL for Weidmüller u-OS 4.21.1.0 and later carefully.

WebVisu until CODESYS Control SL for Weidmüller u-OS 4.20.1.0 and prior

The CODESYS WebVisu is not directly exposed via the u-OS devices network interfaces. By default, it is only reachable through the u-OS Reverse Proxy and protected by the u-OS Identity and Access Management. It can be accessed via the CODESYS Control SL App Tile in the u-OS Control Center or via the URL https://IpOfYourDevice/u-os-app-codesys/. Use HTTP if you enabled HTTP mode of the u-OS Web Server.

If no WebVisu is available, the following page is displayed instead:



Note that this page does not provide any information about why the WebVisu is unavailable. Possible reasons include: No PlcApplication deployed, PlcApplication does not include a WebVisu, CODESYS Runtime stopped or ran into an Exception, Demo License expired.

Access to the WebVisu can be granted to any Role created in the u-OS IAM. Unauthenticated Access can be enabled as well. By default, only authenticated access is enabled. When allowing unauthenticated access, usage of the Codesys User Management to protect access to the visualization should be considered. See CODESYS Online Help - Use user management to protect visualizations.

If you encounter issues with your specific visualization behaving different to a system where it is not served via a reverse proxy, you may want to modify the CODESYSControl.cfg to expose the WebVisu directly. Note that access to the WebVisu is not protected by the u-OS IAM in this configuration.

On u-OS, the CODESYSControl.cfg is located in the /etc/ directory and can be edited via SSH and vi, for example. Change the CmpWebServer section from

```
[CmpWebServer]
ConnectionType=HTTP
```

```
NetworkAdapter.0=127.0.0.1
WebServerPortNr=65530
WebServerSecurePortNr=65531
```

to

```
[CmpWebServer]
ConnectionType=HTTP
NetworkAdapter.0=0.0.0.0
WebServerPortNr=65530
WebServerSecurePortNr=65531
```

Restart the codesyscontrol service or reboot u-OS for the changes to take effect. Now the WebVisu will be accessible via http://IpOfYourDevice:65530 or https://IpOfYourDevice:65531. Please refer to CODESYS Online Help - WebVisu for further documentation, i.e. how to create a CODESYS WebServer certificate to enable https.

WebVisu since CODESYS Control SL for Weidmüller u-OS 4.21.1.0 and later

Since CODESYS Control SL for Weidmüller u-OS Version 4.21.1.0 the CODESYS WebVisu is directly exposed via the u-OS devices network interfaces by default. This has the following implications for the WebVisu:

- it is not protected by the u-OS Identity and Access Management
- it is not routed through the u-OS reverse proxy
- it is served as HTTP by default, whereas in previous versions the connection was upgraded to HTTPS by the u-OS reverse proxy. HTTPS can enabled by the user, see below.
- when accessing the WebVisu via the CODESYS Control SL App Tile in the u-OS Control Center or via the URL https://IpOfYourDevice/u-os-app-codesys/, you are presented with a status page instead of the WebVisu. By tapping on a button you are redirected to the WebVisu, see examples below.

Accessing the WebVisu

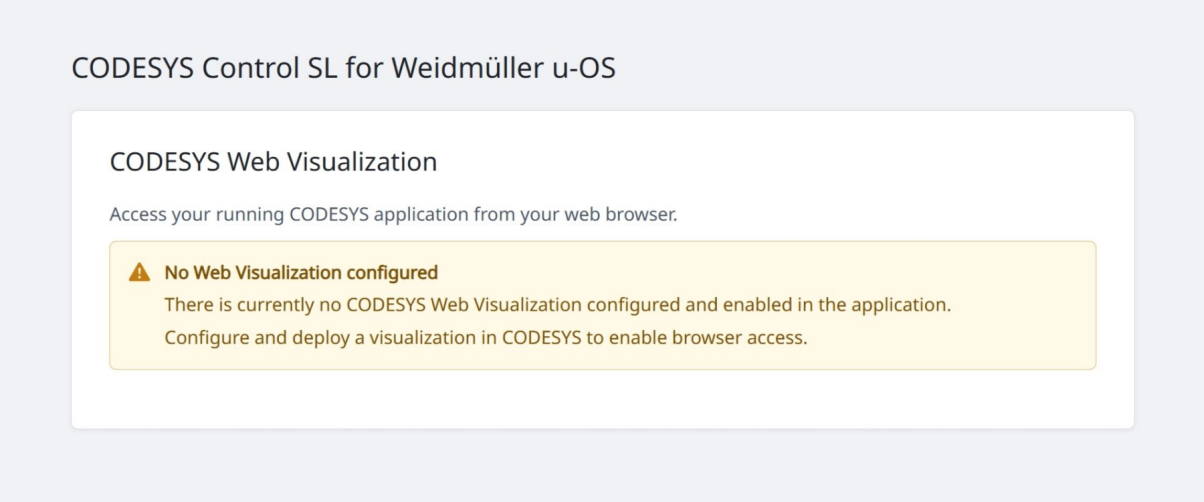
There are three ways to access the WebVisu:

1. via http://IpOfYourDevice:65530
2. via https://IpOfYourDevice:65531
3. via the CODESYS App Tile and https://IpOfYourDevice/u-os-app-codesys/

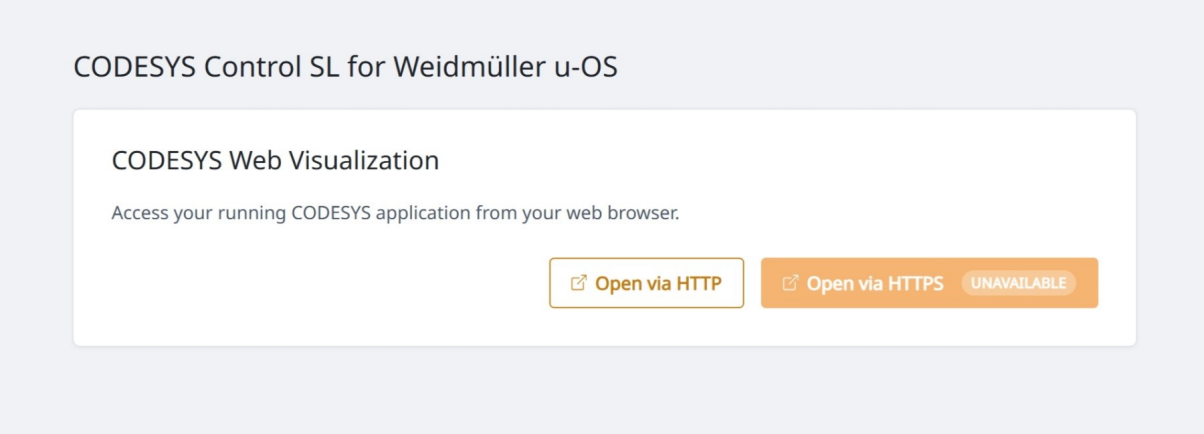
Note that option 3 is considered as a compatibility path for existing installations where the URL configured in a HMI panel might not be easily changed. It also serves as a convenient entrypoint to the WebVisu via the u-OS Control Center. It is **not** recommended to use this URL when setting up a HMI panel, since the user has to click an additional button to be redirected to the actual visualization.

On a u-OS device where the CODESYS Control SL Runtime App has been installed but no CODESYS WebVisu has been deployed yet, option 1 and option 2 will present as a browser error "refused to connect", since the CODESYS WebServer is not serving anything. The same applies when no CODESYS Control SL Runtime App has been installed or the runtime has terminated, i.e. due to an expired demo license.

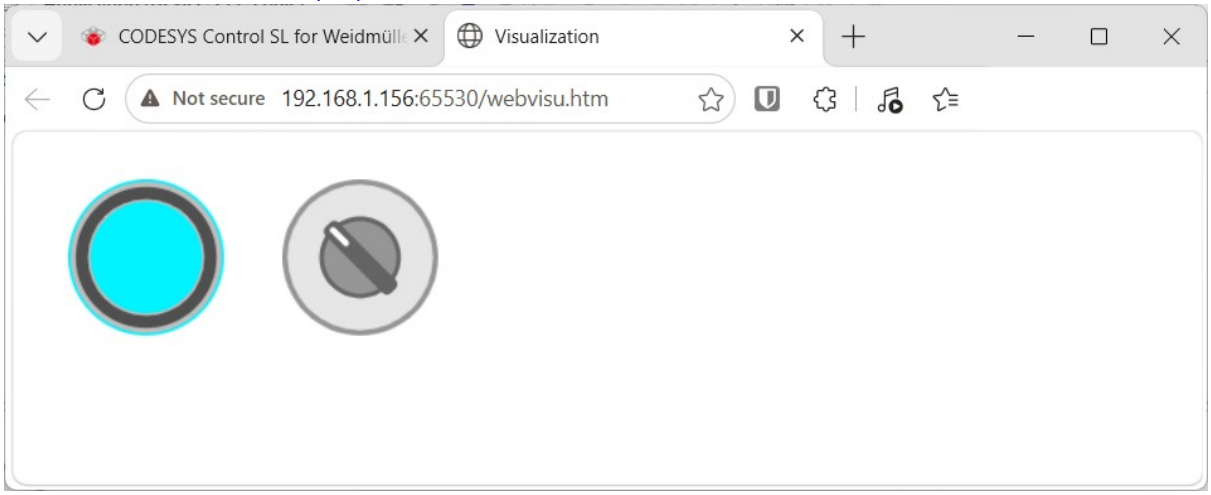
Option 3 will present like this when no WebVisu is available:



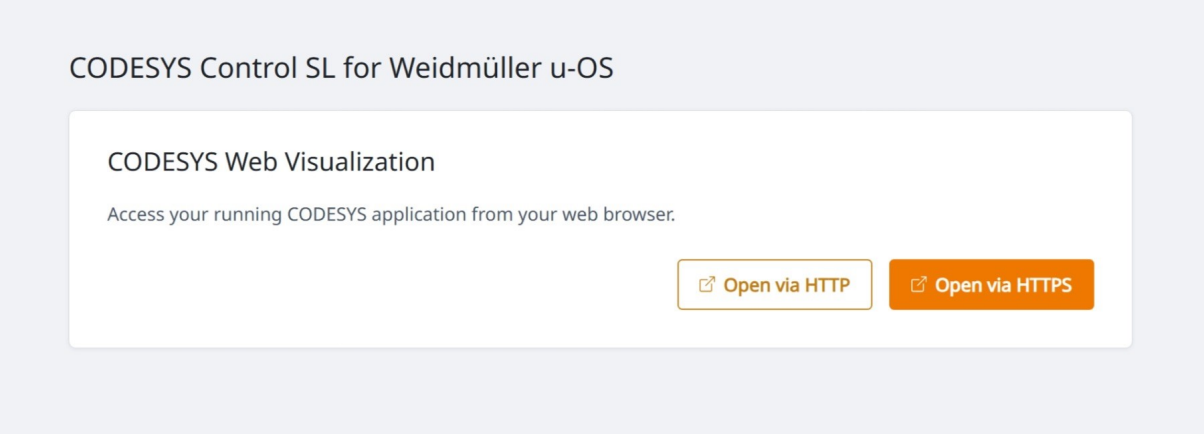
When a WebVisu has been deployed and the CODESYS runtime is in state running, option 1 is available by default. Option 3 now displays a button that redirects the browser to option 1 on interaction by the user:



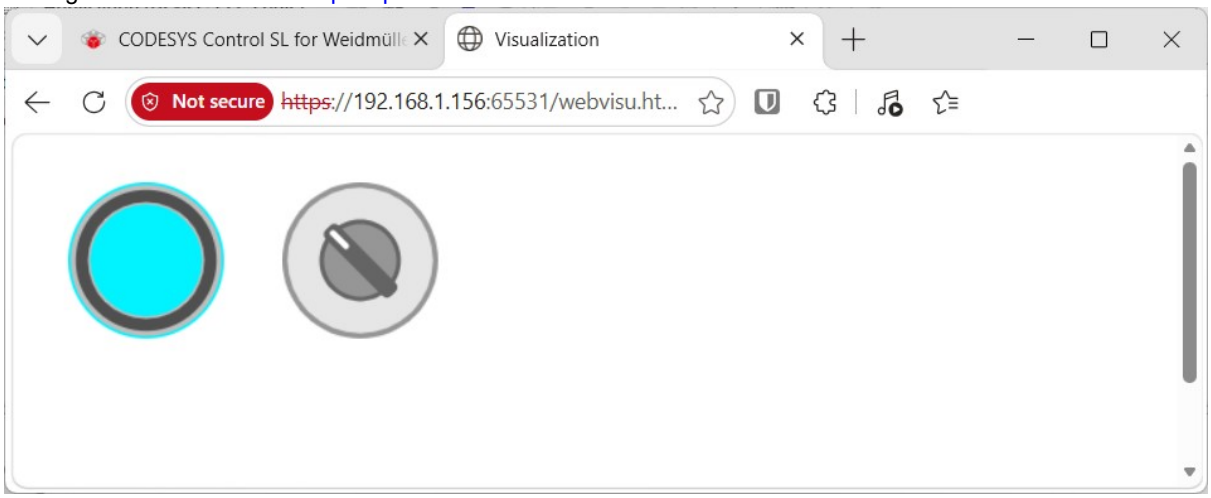
The left button redirects to http://IpOfYourDevice:65530 in a new browser tab:



Option 2 is only available if the prerequisites described in Enabling HTTPS are met. In this case, option 3 also has the right button for HTTPS enabled:



The right button redirects to https://IpOfYourDevice:65531 in a new browser tab:

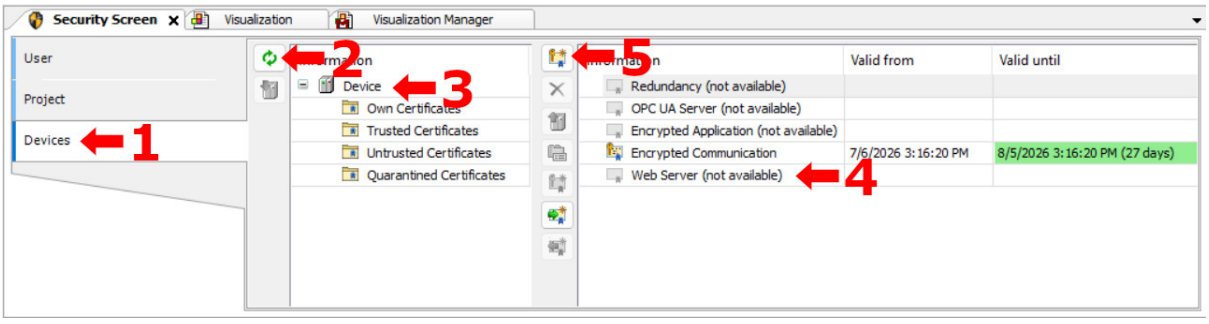


Enabling HTTPS

The CODESYS WebVisu is only served via HTTPS if the following prerequisites are met:

- The ConnectionType in the CODESYSControl.cfg is set to 1 or 2
- A WebServer certificate has been created using the CODESYS Security Agent

Please refer to Run as WebVisu for a complete walkthrough. Below is an example of how to create a WebServer certificate using the Security Agent. Open the Security Agent either via the Menu, "View" → "Security Screen", or by clicking the "Shield" Symbol in the very bottom right-hand corner of the CODESYS Development System.

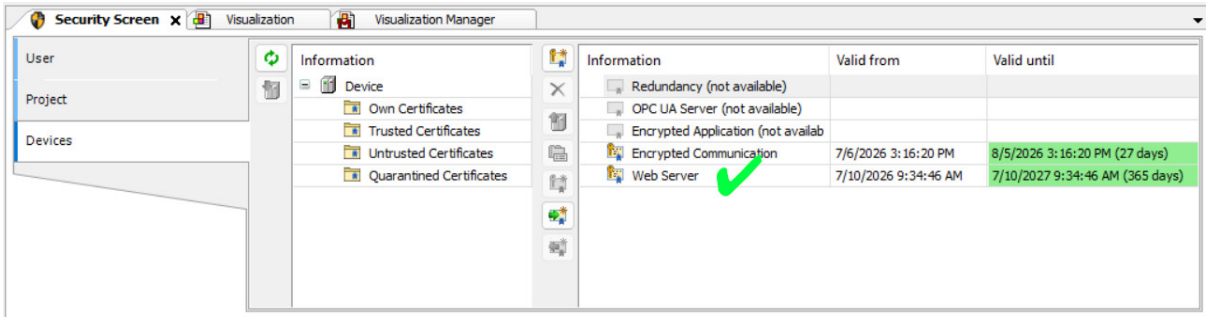


Follow the steps below to create a WebServer certificate:

1. Select the "Devices" tab.
2. Refresh the view to fetch certificates already present on the device.

3. Select "Device". Make sure **not** to select any of the folders below.
4. Select "Web Server".
5. Click on the "Create new certificate" button.
6. A dialog will open prompting you to select a certificate complexity and validity period. After confirming the dialog, the certificate will be created on the device. This might take a moment.

A valid WebServer certificate will be displayed like below:



Hardware specific information

UC20-M4000

- Ethernet X4 / eth-x4 and X5 / eth-x5 are intended for general use, X6 / eth-x6 and X7 / eth-x7 for fieldbus.

UC20-M3000

- Ethernet X4 / eth-x4 is intended for general use and port X5 / eth-x5 for fieldbus.

UC20-WL2000 variants

- Ethernet X1 / eth0 is intended for general use, X2 / eth1 for fieldbus.
- CAN variant: The CAN interface X4 / can0 is available for CANopen Manager & Device.
- NVRAM is only available on HW version 1.23 or later. (HW version 1.00 on CAN variant)
  If the controller is powered by USB only, the NVRAM and other periphery like the system-bus are disabled. If a PLC project with Retain Variables is deployed while the controller is powered by USB or on a controller without NVRAM, the project will not persist, i.e. it will be lost on reboot. Supply the controller with 24V before deploying a project with Retain Variables.

IOT-GW30 variants

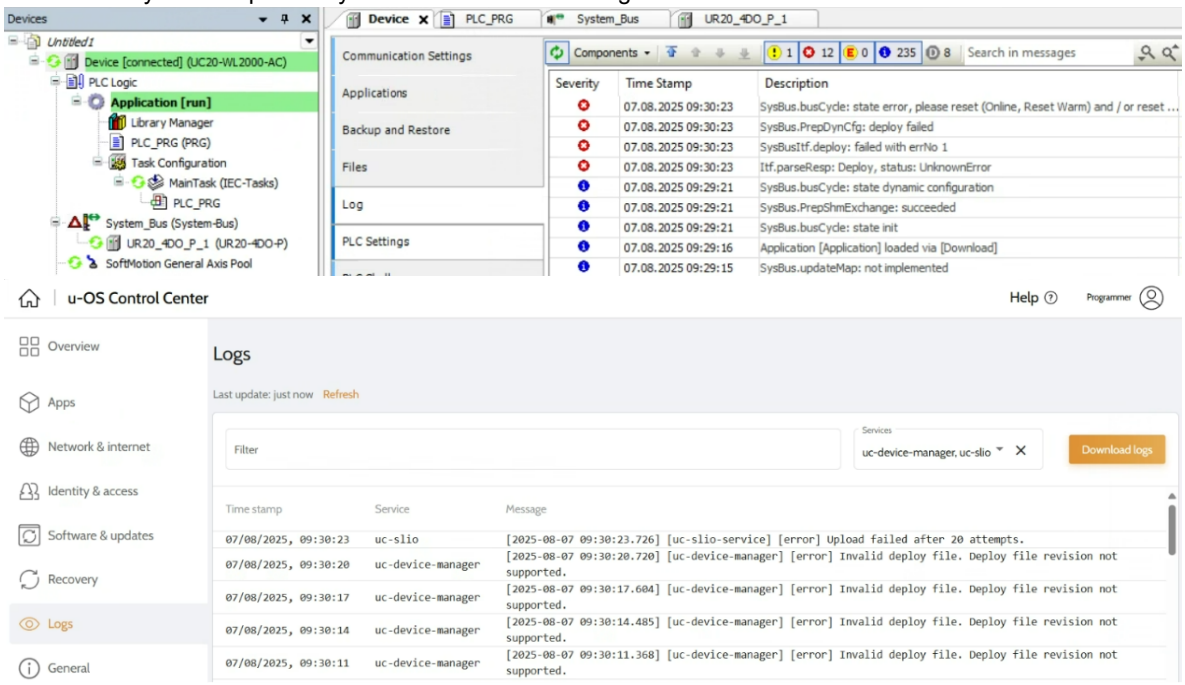
- Ethernet 1 / eth0 is intended or general use, port 2 / eth1 for fieldbus.
- RS232 Interface /dev/ttyAMA0 is COM1, RS485 Interface /dev/ttyAMA2 is COM2
- The CAN interface can0 is available for CANopen Manager & Device
- The device does not have NVRAM, persistent or retain variables do not persist a power loss or reboot.
- **Breaking Change:** The GPIO (DO 1, DI 1, DI 2) cannot be used by CODESYS in u-OS 2.2.0 or later.
- GPIO can be used by CODESYS or other apps exclusively in u-OS 2.1.x or earlier. CODESYS will write the DO cyclically, writing to them from other programs at the same time will result in erratic behavior.
  If you used the GPIO in CODESYS and would like to use them in a different program now, follow these steps:

Delete the GPIO from the Device Tree of your CODESYS project.Build and deploy the project to the device.Restart the device before accessing the GPIO from any other program.

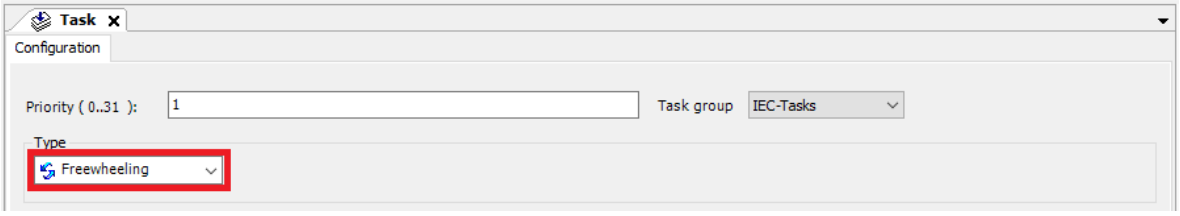
Limitations and known issues

The following applies to all versions of the CODESYS Control SL for Weidmüller u-OS Package and Runtime to date. For version specific issues please refer to the Version History.

- PLC Handler (i.e. ARTI3) connections from a visualization, HMI or similar can cause high CPU load and Codesys Runtime instability if the refresh rate is set to high / the communication delay to low. System load can increase with increasing number of client connections. Choose a refresh rate / communication delay suitable for your application while observing CPU load of the controller.
- u-OS 2.2.0 or later: If the System Bus does not start and the Codesys Log reports a System Bus Deployment issue, verify that the Codesys for Weidmüller u-OS Package Version 4.12.1.0 or later is installed in the Codesys Installer. Also verify that both the PLC and the System Bus have been updated to version 4.12.1.0 or later and 2.0.0.0 or later, respectively. This issue often arises if a Codesys Project has been created with a Codesys Development System with the correct package version installed, but then is opened and deployed with a Codesys Development System with an older Package version.



- The task configuration type “freewheeling” is not supported. It results in increased system load and can cause the system to become unresponsive.



- UR20 module hot-plug is not supported on the System Bus. Unplugging a module can lead to the system-bus to go into an error state and communication to other modules breaking down. On re-insertion of the module the bus will resume operation, but CODESYS Development System might still report an error for the unplugged module. The error cannot be acknowledged. A restart of the CODESYS PLC project or a system reboot might be required for the error message to disappear.
- Substitute values for modules on the system-bus are not correctly applied on system startup. When the UC20 system reboots or is powered up, the configured module substitute values will be applied initially. As soon as the uc-slio-service has started and initialized the system-bus, the outputs will be set to 0, regardless of the status of the CODESYS runtime which might require additional time to start up.
- Invalid module parameter combinations can cause the system-bus to go into a non-recoverable error on project deployment in u-OS 2.1.3 or earlier.

Severity	Time Stamp	Description
⊗	21.06.2024 17:01:37	SysBus.busCycle: state error, please reset (Online, Reset Warm) and / or reset controler
⊗	21.06.2024 17:01:37	SysBus.PrepDynCfg: deploy failed
⊗	21.06.2024 17:01:37	SysBusItf.deploy: failed with errNo 1

To recover the error, do a “Reset Origin” in CODESYS, reboot the UC20 system and deploy a project with valid module parameters. Allowed parameter combinations are documented in the Remote-I/O-System u-remote

manual.

- Deploy fails when PLC setting "update I/O while in stop" is enabled. Do a warm reset before to deploying.
- IO Configurator: Serial number, firmware version and hardware version of UR20 Modules on the System Bus is not displayed correctly.