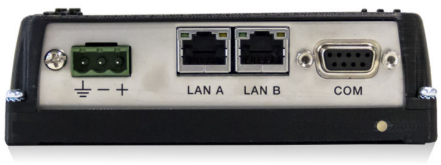
Configuration and Image Manual
BoX2 base v2, pro (SC), extreme (SC), (pro motion)

MAEN363
2024-05-02



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Foreword

This manual contains information about the image/firmware/system program (from now on referred to as *image*) and how to get started with the device in the most common applications.

The information in this manual is valid for the latest versions of hardware at the time the manual was released. All documentation is available in our Download center.

Visit Beijer Electronics SmartStore for image updates and software downloads.

Table of Contents

1. Introduction

BoX2 is a series of protocol converters, IIoT gateways and edge controllers that combine clever connectivity with smart functions such as local data base storage, alarm servers, data exchange, reporting, C# scripting, etc. BoX2 series is configured (except BoX2 pro motion) with iX Developer. For BoX2 pro SC/BoX2 extreme SC, BCS Tools 3.50 or later is used to write the PLC program.

Please refer to the BoX2 Hardware and Installation manuals (with technical data as well as cutout and outline dimensions) and iX Developer manuals for further information. All documentation is available in our Download center.

1.1. Note, Tip and Important Icons

This publication may include Important and Note icons where appropriate to point out safety-related, or other important, information. It may also include Tips to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:

NOTE
The Note icon alerts the reader to pertinent facts and conditions.

TIP
The Tip icon indicates advice on, for example, how to design your project or how to use a certain function.

IMPORTANT
The Important icon highlights important information.

1.2. Trademarks

Microsoft, Windows, Windows Embedded CE 6.0 R3, Windows Embedded Compact 2013, Windows 7, Windows Embedded Standard 7 are registered trademarks or trademarks of Microsoft Corporation in the USA and/or other countries. Any additional trade names given in this documentation are trademarks of their corresponding owners.

1.3. References

Name	Description
MAEN361	Best Practice Image Update
MAEN362	Hardware and Installation Manual BoX2 base v2
MAEN275	Hardware and Installation Manual BoX2 pro
MAEN276	Hardware and Installation Manual BoX2 extreme
MAEN355	Reference Manual iX Developer Version: 2.40 SP7 b 2.47.473 and later
MAEN831	Reference Manual iX Developer Version: 2.40 SP7 b 2.47.417 and earlier
MAEN832	User's Guide iX Developer
MU299609	BCS Tools - User Manual
KI00390	BoX2 pro motion and BSD Start up manual

The installation, technical data as well as cutout and outline dimensions of the devices are described in the Hardware and Installation manual for each device. Please refer to the Hardware and Installation manuals and the iX Developer manuals for further information.

NOTE

For image and software updates/downloads, visit Beijer Electronics SmartStore.

Additional information, such as Start Up guides, manuals and “Best practice" documents are available in our Download center.

NOTE

For specifications on supported USB memories and SD cards, please refer to the Hardware and Installation manual for your specific BoX2 device.

1.4. Operating Systems

Image family	Operating system license	Runtime licenses
BoX2 base v2	Windows Embedded Compact 2013 (General Embedded)	iX Runtime
BoX2 pro		iX Runtime
BoX2 pro SC		iX Runtime and CODESYS Runtime
BoX2 pro motion		CODESYS motion runtime iX Runtime excluded.
BoX2 extreme		iX Runtime
BoX2 extreme SC		iX Runtime and CODESYS Runtime

2. General Information

NOTE
BoX2 pro motion is only partly covered in this manual. For more information on configuring the BoX2 pro motion, see the BoX2 pro motion and BSD Start up manual (KI00390).

IMPORTANT
When updating the system image through “Make recovery SD card” an SD card formatted with FAT16/FAT32 and maximum 32 GB must be used.

2.1. Default IP Addresses

These are the default IP addresses for the BoX2 devices:

	BoX2 base v2, extreme (incl. SC), pro (incl. SC)	BoX2 pro motion
LAN A	192.168.1.1	None (EtherCAT)
LAN B	DHCP	192.168.1.1

NOTE
Devices with 2 Ethernet ports MUST NOT have IP addresses in the same subnet.

2.2. Open Ports

In the firmware there are some ports that are open by default due to the operating system or that the internal application requires it.

Type	Description	Open by default
UDP and TCP	Project transfer (9999)	Yes
UDP	Netbios (137)	Yes
UDP	Netbios (138)	No[1]

[1]Filtered.

2.3. LED Indication

BoX2 uses three colors for LED indication; Red, Purple and Blue.

2.3.1. Red

State	Description
Constant on	Unit is busy booting, or updating image through recovery SD card.
Every 2 seconds on/off	Unit is in standby/update mode. If image recovery has been run, then this indicates it has finished, eject SD card and reboot unit.

State	Description
Fast flashing	Eject USB/SD card. **NOTE** Fast flashing continues for a couple of seconds after ejecting the USB/SD card.

2.3.2. Purple

State	Description
Constant on	Operating system is booting up.
Every 0.5 seconds on/off	The unit is on standby and no iX Runtime or CODESYS project is running.
Fast flashing for 5 seconds	USB/SD card project (iX or CODESYS) update successful.

2.3.3. Blue

State	Description
Every 0.5 seconds on/off	The iX project is running.
Every 0.5 seconds, short flash	CODESYS project is running.
Every 0.5 seconds, alternately short and long flash	Both iX and CODESYS running.

NOTE
If the LED alternatively flashes Red to Blue to Purple, the wrong image type is installed. Please reinstall correct image.

3. Configuration

To be able to configure the BoX2 device, the following software might be required:

- **iX Developer**

> **NOTE**
> Not applicable for BoX2 pro motion.

- **BCS Tools** for BoX2 with CODESYS Runtime.

3.1. How to Set the IP Address in BoX2

Changing the IP address on a BoX2 device can be done through our BoX2 Configuration Tool or by editing a JSON-file manually. For instructions on manually editing the JSON-file, see the following chapter.

3.1.1. Manually Editing the JSON-file

> **NOTE**
> On BoX2 pro SC, BoX2 pro motion and BoX2 extreme SC, if the EtherCAT driver is enabled, LAN A is used for EtherCAT only.
>
> LAN B is for programming and communication.

Follow these steps to edit the network settings on a BoX2 base v2, BoX2 pro (incl. motion) and BoX2 extreme:

1. Download and extract this zip-file on your computer.
   The zip-file and instructions can also be found here.
2. Edit the JSON-file to change the network settings.
   In the following example, IP-address on LAN B is changed:
   Original content in JSON-file:

```
{
   "Number": "6",
   "Enabled": true,
   "Command": "LAN B IP",
   "Entry": [
   "192.168.1.1"
   ],
   "Comment": ""
},
```

Edited content in JSON-file:

```
{
   "Number": "6",
   "Enabled": true,
   "Command": "LAN B IP",
   "Entry": [
   "192.168.1.2"
   ],
   "Comment": ""
},
```

NOTE
"Enabled" must be set to 'true' for the change to take effect.

Several settings can be changed at the same time, but they must all be set to 'true'.

NOTE
Do not change the file name.

3. Put "BoX2ConfigSet.json" on a USB flash drive or SD card and connect it to your BoX2 device. This will immediately update the network settings. When the change is done the LED on the BoX2 will change temporarily to a red flash.
4. A log file will be created on the USB flash drive, this can be used to verify that the setting was changed. Example:

   "New result file input
   Time: 2000-5-28 21:32:37
   LAN B set IP: 192.168.1.2
   Adapter rebind LAN B successful"

The network settings have been updated.

4. Image and CODESYS Runtime Update

The device comes pre-loaded with a system image (including firmware and system program).

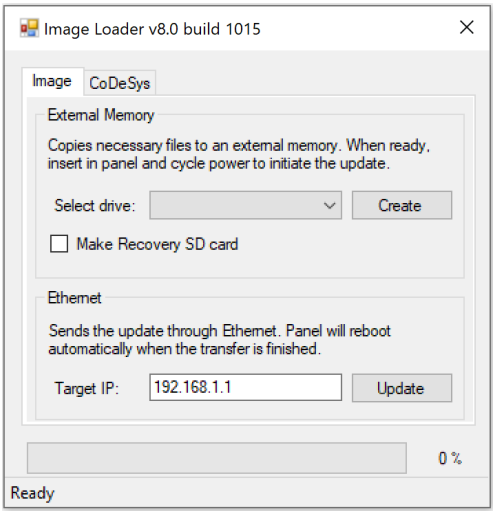
Images and the Image Loader utility, can be downloaded from the Firmware section in our SmartStore.

CODESYS runtime is available from the Firmware section in our SmartStore.

IMPORTANT
CODESYS runtime update is only applicable for devices with a CODESYS runtime license, such as BoX2 pro SC and extreme SC.

The image/Image Loader utility is used for:

- Updating the image by,
  - creating an Image Loader **SD** card or **USB** flash drive
  - transferring an image to a device through **Ethernet**
- Updating the CODESYS Runtime by,
  - creating an auto-install package for **SD** card or **USB** flash drive
  - transferring the CODESYS Runtime over **Ethernet**



In some occasions it is necessary to make a complete system update via **Make Recovery SD card**.

IMPORTANT
On a BoX2 pro device with image version 2.0 b775 or older, we recommend to update the image using **Make Recovery SD Card**. This means that the iX Developer project and IP settings must be backed up from the device before the image is updated. See manual MAEN361 chapter 1.2 on how to do the backup.

IMPORTANT
On a BoX2 extreme device with image version older than 2.0 b365, we recommend to update the image using **Make Recovery SD Card**. This means that the iX Developer project and IP settings must be backed up from the device before the image is updated. See manual MAEN361 chapter 1.2 on how to do the backup.

To summarize, the image/CODESYS runtime can be updated in the following ways:

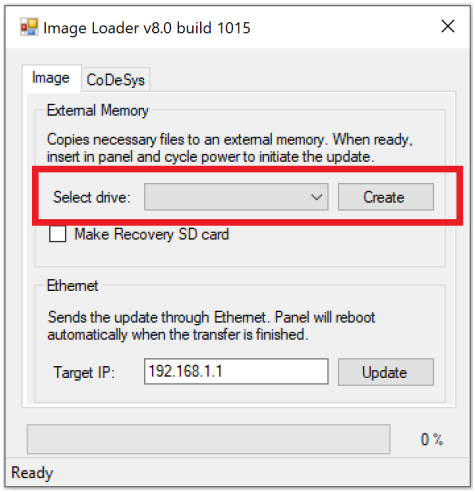
Update method	iX Developer project deleted by updating	IP address reset by updating
USB	No	No
SD	No	No
Ethernet	No	No
Recovery SD card[1]	**Yes**	**Yes**

[1]Only available for image update.

4.1. Update the Image Using USB or SD Card

Do the following:

1. Download your image from Beijer Electronics SmartStore.
2. Unzip the downloaded file and start the Image Loader application.
3. Connect a USB flash drive or SD card to the computer.
4. In **Select drive:**, choose the connected USB flash drive or SD card.



5. Click **Create**.
6. When finished, eject the USB flash drive or SD card.
7. Connect the USB flash drive or SD card to the BoX2 device and power up the device.
8. Wait until red LED indication starts flashing fast and eject the USB flash drive or SD card.

NOTE
Make sure to eject the USB/SD card. Otherwise, the device will try to update again during next boot up.

9. The device automatically reboots.
10. Wait until the LED shows a blue status light, or purple on/off every 0.5 seconds (if no iX or CODESYS project is installed).

The update is now completed.

4.2. Update the Image Over Ethernet

The Image Loader utility can be used to update the image over Ethernet.

IMPORTANT
Before doing any transfer over Ethernet, ensure that the network is considered secure in order to limit the risk of any malicious intrusion.

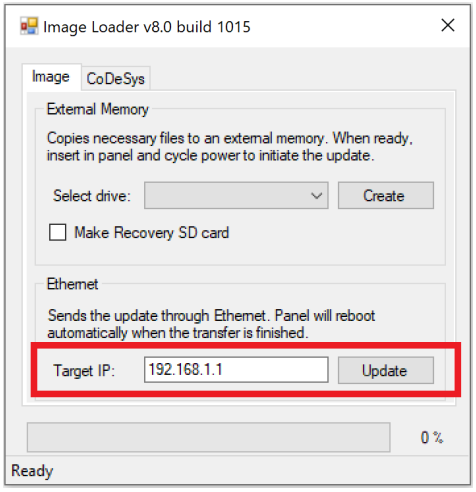
Some best practices that are encouraged:

- Use strong passwords to ensure that network devices (routers/switches/servers) are protected with strong, passwords.
- Utilize encryption protocols to encrypt data packets.
- Divide the network into separate segments to limit the impact of a security breach.
- Configure Access Control Lists on network devices to restrict traffic based on IP addresses/protocols/ports.
- Restrict access to your network by only allowing trusted devices based on MAC addresses.
- Regularly update firmware and software on the network devices.
- If running remote, make sure to connect via VPN to create a secure tunnel for data transmission.
- Ensure that all firmware is validated and verified before transfer, ensuring that there is no risk of tampering.

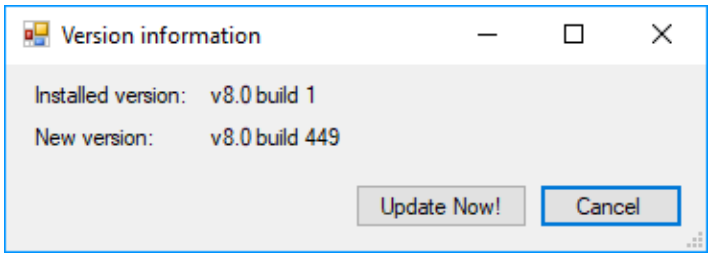
NOTE
Before trying to update the image over Ethernet, make sure that your PC is on the same IP-subnet as the BoX2 device. If your device has an IP address of 192.168.1.1, and a subnet mask of 255.255.255.0, then your PC must have an IP address in the range of 192.168.1.2 – 192.168.1.254 and a subnet mask of 255.255.255.0, in order to communicate with the device.

Do the following:

1. Enter the device **Target IP** address in the dialog and click on **Update** to start the update.



2. The dialog shows the current installed image and the new image that the device will be updated to. Click on **Update Now!** to confirm the start of the update.



3. A progress bar shows the update transfer status. When the transfer is done, the device will reboot.
4. Wait until the LED shows a blue status light, or purple on/off every 0.5 seconds (if no iX or CODESYS project is installed).

The update is now completed.

NOTE
If the device contains a CODESYS Runtime, then the CODESYS Runtime must be transferred to the device after the image has been updated. See section Update the CODESYS Runtime Version Using USB or SD Card or Update the CODESYS Runtime Version Over Ethernet.

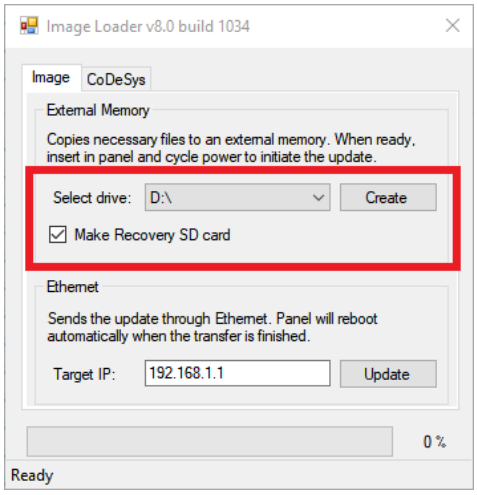
4.3. Update the Image Version Using Recovery SD Card

In a complete system update the IP settings will be reset to default values and the iX Developer project will be deleted. To keep the IP setting and the iX Developer project it is recommended to make a backup of the iX Developer project and make a note of the IP settings prior to an image update.

NOTE
When updating the system image through “Make recovery SD card” an SD card formatted with FAT16/FAT32 and maximum 32 GB must be used.

Do the following:

1. In **Select drive:**, choose the connected SD card.
2. Create an image recovery SD card by selecting **Make Recovery SD card** when using the Image Loader utility.



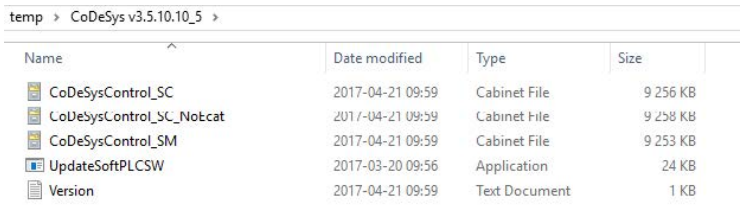
3. Click **Create**.
4. When finished, eject the SD card.
5. Connect the SD card to the BoX2 device and boot the device.
6. A red LED indication, with constant light, will indicate that the device is booting and updating the image.
7. When the red LED indication starts to slowly blink, 2 seconds on, 2 seconds off, the update is complete.
8. Eject the SD card and reboot the device.
9. After the reboot, wait until the LED indications shows purple, on/off every 0.5 seconds.

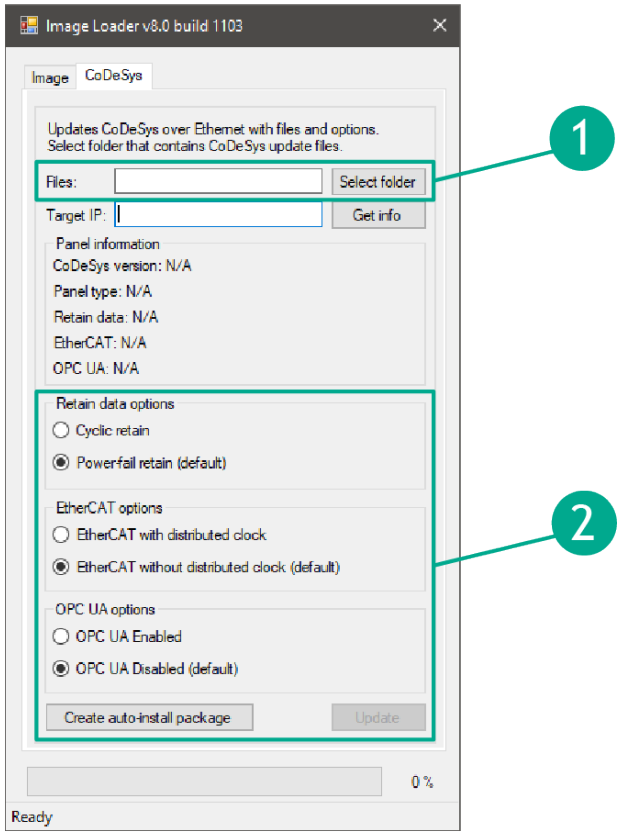
The update is now completed.

4.4. Update the CODESYS Runtime Version Using USB or SD Card

NOTE
Refer to document SUEN00392, available at Help Online, for more details and recommendations on using the X2/BoX2 series range of products with embedded CODESYS runtime.

To update the CODESYS Runtime, the folder containing the CODESYS .cab-files listed below must be specified in the Image Loader utility. The existing Power Management and EtherCAT Distributed Clock settings are shown in the Image Loader utility and can be set before updating the CODESYS Runtime.





Do the following:

1. Select the folder that contains the CODESYS files.
2. Select the desired options for **Retain data**, **EtherCAT** and **OPC UA** and click **Create auto-install package**.

> **NOTE**
> The only valid options for BoX2 motion are Power fail retain and EtherCAT with distributed clock.

NOTE

The PLC functionality has support for storing non-volatile variables. Those variables can be stored dynamically in two different modes:

- **Power-fail mode (Default setting)**
  If the voltage drops below a hardware given threshold (that is, during a power loss or power dip), the system instantly copies all persistent data defined in the PLC application from RAM into the battery backed SRAM. They are verified and restored when the device is restarted.
- **Cyclic mode**
  The PLC is instructed to store all retain and persistent data directly into SRAM synchronously with every PLC cycle. This means all device types can use the whole available memory, which is 128 kB. However, writing to the SRAM might increase the configured PLC cycle depending on the size of used retain and persistent data, because a SRAM is naturally slower than a RAM. This possible increase is dependent of the application and to find out about the possible increase one would need to monitor the configured task(s) of the project. For projects with large amounts of persistent data, cyclic mode is recommended.

3. Save the **auto-install package** to your connected USB or SD card.
4. Eject the USB or SD card.
5. Connect the USB flash drive or SD card to the device and boot the device.
6. Wait until red LED indication starts flashing fast and eject the USB flash drive or SD card.

NOTE

Make sure to eject the USB/SD card. Otherwise, the device will try to update again during next boot up.

7. The device automatically reboots.
8. Wait until the LED shows a blue status light, or purple on/off every 0.5 seconds (if no iX or CODESYS project is installed).

The update is now completed.

4.5. Update the CODESYS Runtime Version Over Ethernet

IMPORTANT

Before doing any transfer over Ethernet, ensure that the network is considered secure in order to limit the risk of any malicious intrusion.

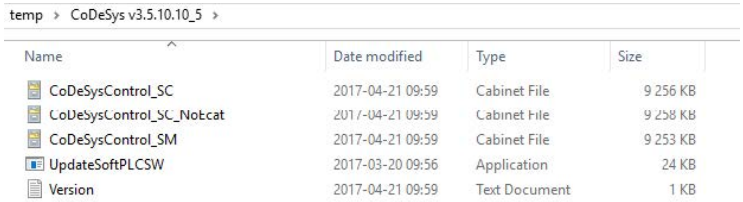
Some best practices that are encouraged:

- Use strong passwords to ensure that network devices (routers/switches/servers) are protected with strong, passwords.
- Utilize encryption protocols to encrypt data packets.
- Divide the network into separate segments to limit the impact of a security breach.
- Configure Access Control Lists on network devices to restrict traffic based on IP addresses/protocols/ports.
- Restrict access to your network by only allowing trusted devices based on MAC addresses.
- Regularly update firmware and software on the network devices.
- If running remote, make sure to connect via VPN to create a secure tunnel for data transmission.
- Ensure that all firmware is validated and verified before transfer, ensuring that there is no risk of tampering.

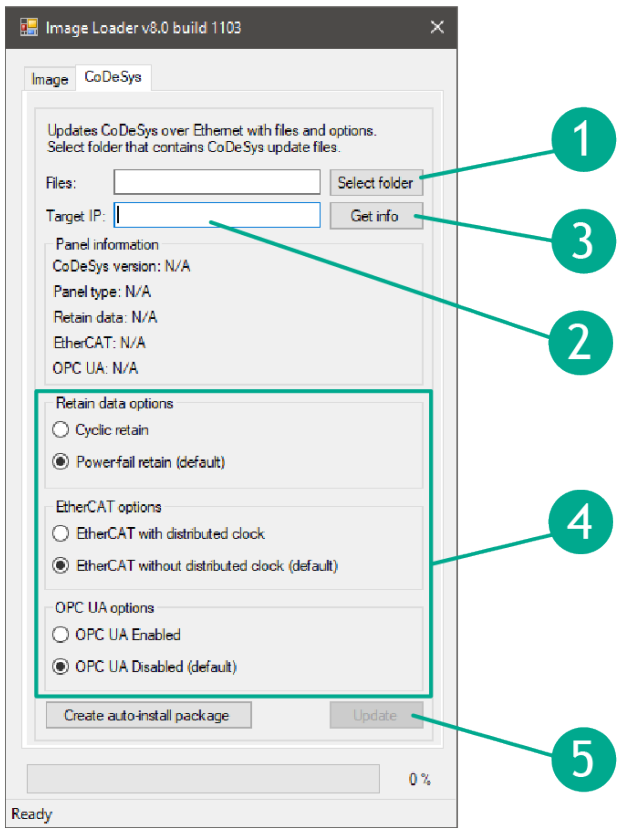
NOTE

Refer to document SUEN00392, available at Help Online, for more details and recommendations on using the X2/BoX2 series range of products with embedded CODESYS runtime.

To update the CODESYS Runtime, the folder containing the CODESYS .cab-files listed below must be specified in the Image Loader utility. The existing Power Management and EtherCAT Distributed Clock settings are shown in the Image Loader utility and can be set before updating the CODESYS Runtime.



Do the following:



1. Select the folder that contains the CODESYS files.
2. Input the **Target IP** address for the device.
3. Press the **Get info** button to make sure that communication with the device is working.
4. Select the desired options for **Retain data**, **EtherCAT** and **OPC UA**.

> **NOTE**
> The only valid options for BoX2 motion are Power fail retain and EtherCAT with distributed clock.

NOTE

The PLC functionality has support for storing non-volatile variables. Those variables can be stored dynamically in two different modes:

- **Power-fail mode (Default setting)**
  If the voltage drops below a hardware given threshold (that is, during a power loss or power dip), the system instantly copies all persistent data defined in the PLC application from RAM into the battery backed SRAM. They are verified and restored when the device is restarted.
- **Cyclic mode**
  The PLC is instructed to store all retain and persistent data directly into SRAM synchronously with every PLC cycle. This means all device types can use the whole available memory, which is 128 kB. However, writing to the SRAM might increase the configured PLC cycle depending on the size of used retain and persistent data, because a SRAM is naturally slower than a RAM. This possible increase is dependent of the application and to find out about the possible increase one would need to monitor the configured task(s) of the project. For projects with large amounts of persistent data, cyclic mode is recommended.

5. Press **Update** to perform the update.

NOTE

This button is disabled until communication has been established with the device, by previously pressing the **Get info** button.

6. The BoX2 device will show a purple LED indication, with constant light, to indicate that the CODESYS Runtime is updating.
7. Once finished, the device will automatically reboot.
8. Wait until the LED shows a blue status light, or purple on/off every 0.5 seconds (if no iX or CODESYS project is installed).

The update is now completed.

NOTE

Before downloading a new CODESYS Runtime, the image should always first be downloaded to the device again, even if there are no changes to the image. If only the CODESYS Runtime is installed, then this may result in problems connecting to, and communicating with, other devices.

5. Getting Started and Commonly Used Functions

IMPORTANT

Before doing any transfer over Ethernet, ensure that the network is considered secure in order to limit the risk of any malicious intrusion.

Some best practices that are encouraged:

- Use strong passwords to ensure that network devices (routers/switches/servers) are protected with strong, passwords.
- Utilize encryption protocols to encrypt data packets.
- Divide the network into separate segments to limit the impact of a security breach.
- Configure Access Control Lists on network devices to restrict traffic based on IP addresses/protocols/ports.
- Restrict access to your network by only allowing trusted devices based on MAC addresses.
- Regularly update firmware and software on the network devices.
- If running remote, make sure to connect via VPN to create a secure tunnel for data transmission.
- Ensure that all firmware is validated and verified before transfer, ensuring that there is no risk of tampering.

5.1. Create and Download Project Using iX Developer

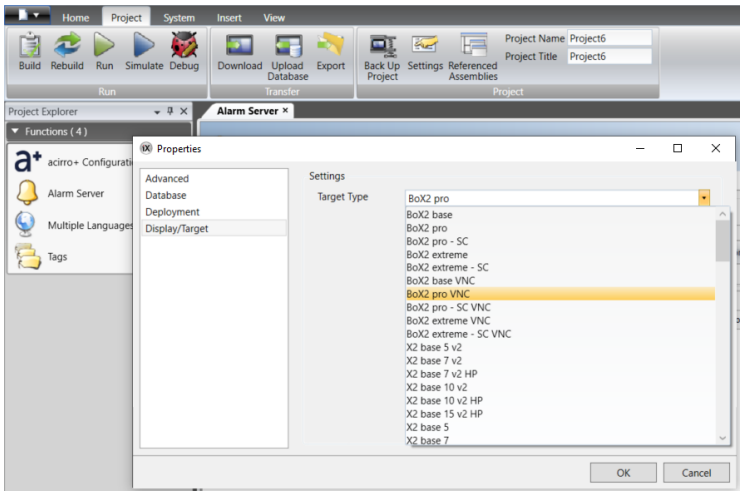
5.1.1. Create a Project in iX Developer

For information on creating a new project in iX Developer, see the iX Developer Reference Manual.

When creating a new project for BoX2 devices, we recommend setting the target to BoX2 base/pro (SC)/extreme (SC) **with VNC**.

Creating a BoX2 target **with VNC** allows the user to create graphical screens that can be viewed remotely via VNC. This can is some cases lead to easier configuration and troubleshooting of the device.

Creating a target **without VNC** means that the possibility to create screens and to access them through VNC is disabled, the hardware and image are identical. A project created without VNC can afterwards be changed to VNC enabled by changing **Target Type** in **"Project** - **Settings** - **Display/ Target"**.



NOTE
It is possible to switch from a target **without VNC** to a target **with VNC** at any time, but not the other way around.

For more information on how to enable VNC in iX Developer, see Remote Access (FTP and VNC) in iX Developer 2.xx, SUEN00314.

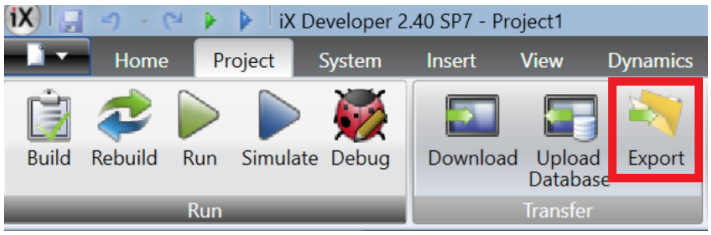
5.1.2. Download the iX Developer Project

To download an iX Developer project to a device, you can choose to either export the project to a USB/SD card or to download the project over Ethernet.

NOTE
Not applicable for BoX2 pro motion.

Export Project to USB or SD Card

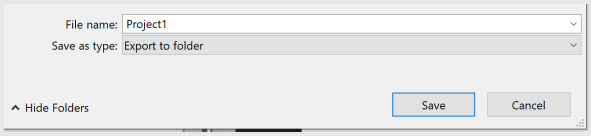
1. Open your project in iX Developer.
2. Select the **Project** tab and click **Export**.



3. In the pop-up window, find and select the root folder of your USB/SD card, and save the project there by clicking **Save**.

NOTE

Make sure **Save as type** is set to **Export to folder**.



4. Eject the USB/SD card.
5. Connect the USB/SD card to your BoX2 device and boot it.
6. Wait until you get a blue LED-indication.

The installation is now completed.

Download Over Ethernet

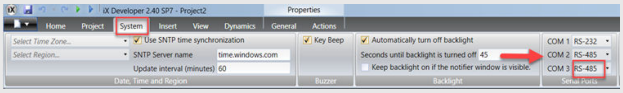
1. Connect the BoX2 device to the PC via an Ethernet connection.
2. Open your project in iX Developer.
3. Select the **Project** tab and click **Download**.
4. The **Download Project** dialog opens, and all devices connected in the network are listed with information about IP address and device type.
   Select your BoX2 device from the list.
5. Check that the IP address is correct and click **Download**.
   a. Optional: Click the **Include compressed project** check box, to compress the project and save it as a ZIP file.
   b. Optional: Click the **Password protected** check box and enter a password, to protect the ZIP file.
   c. Optional: Click the **Copy downloaded project to Memory card** check box, to enable SD card backup of project and settings.
6. The BoX2 device responds to a download request by stopping any current project. The LED will show purple on/off every 0.5 seconds.
7. Wait until you get a blue LED-indication.

The installation is now completed.

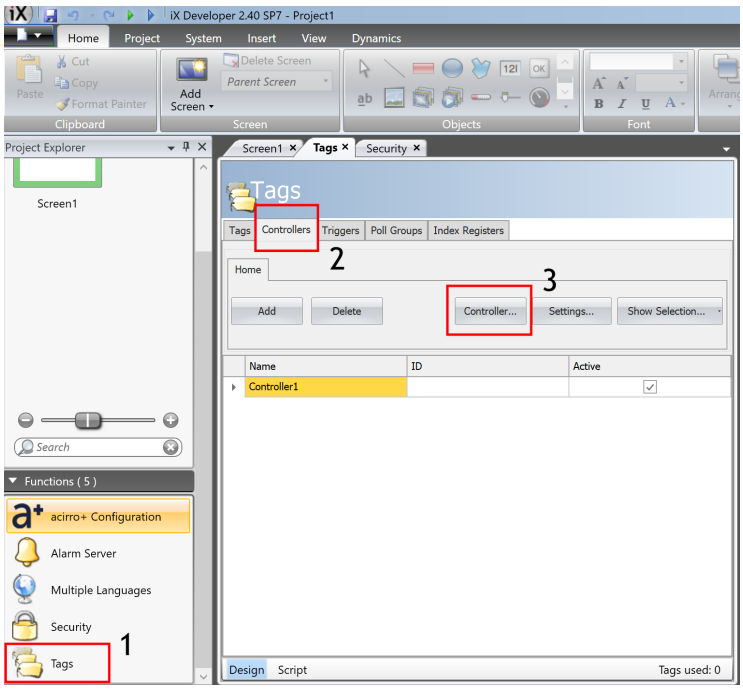
5.2. Data Exchange Between Two Controllers

5.2.1. Configure Controllers

NOTE
In iX Developer, COM port settings can be adjusted on the **System** ribbon tab.



In iX Developer, do the following:

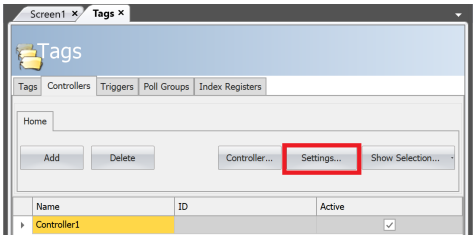


1. Click the **Tags** icon, (**1**) in the **Project Explorer.**
2. Click on the **Controllers** tab (**2**).

NOTE
In this example we will add two controllers and exchange data between them through your BoX2 device.

3. Click on the **Controller...** button (**3**).
4. Identify your controller and select it in the **Select brand** and **Select protocol** lists. Click **OK**.

5. Click the **Settings...** button to configure your controller.



> **NOTE**
> If you are unsure about Settings and Addressing, see our *Drivers* documentation, accessed by clicking **Help** in the bottom right corner of the **Settings...** dialog.

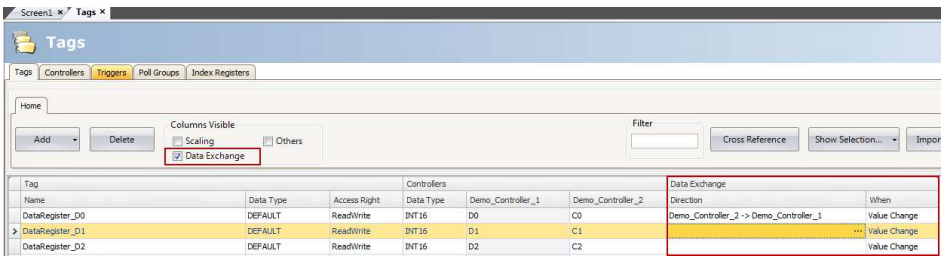
6. Rename your controller by changing the name in the controllers list.
7. Click on **Add** and repeat steps 4 - 6 for your second controller.

5.2.2. Configure Data Exchange

To be able to configure data exchange, at least two controllers must be configured in the project (see how this is done in the previous chapter).

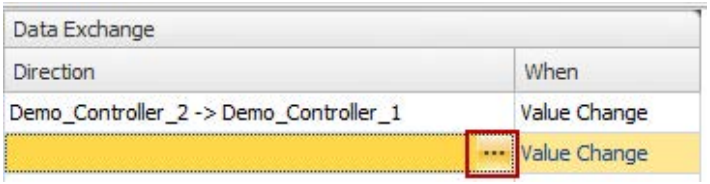
In iX Developer, do the following:

1. Click on the **Tags** tab.
2. Check the **Data Exchange** checkbox under **Columns Visible**.

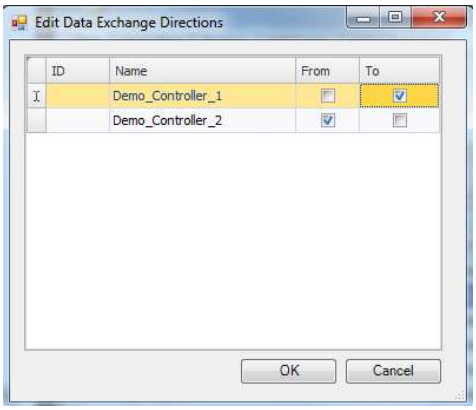


NOTE
Un-checking the checkbox will not remove your settings, it is just a visibility filter.

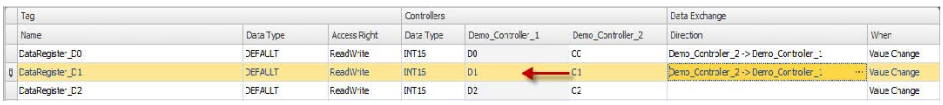
3. Use the default **Tag1** or add new ones. Select **Data Type** and add addresses for your controllers.
4. Under **Data exchange** > **Direction**, click the **...** button and select how the data should be exchanged.



In the following screenshot, data exchange is configured to move the data for the selected tag from the device configured under the Demo_Controller_2 to the device configured under Demo_Controller_1.

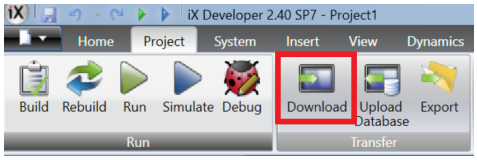


In this case, it would mean that the value from C1 in Demo_Controller_2 would be copied to D1 in Demo_Controller_1:

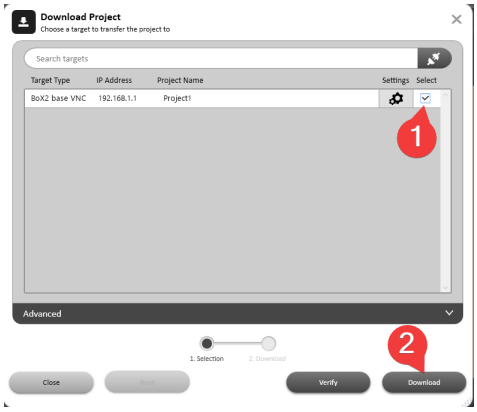


NOTE
The direction setting must be configured separately for each tag.

5. When the data exchange is configured, click the **Download** button under the **Project** tab in the Ribbon at the top of the screen.



6. Select (**1**) your BoX2 device as the target and click **Download** (**2**).



A green checkmark will illustrate that the project has been downloaded.

NOTE

Before further configuring data exchange, make sure that communication to all devices works.

This is done by:

1. Opening the downloaded iX Runtime project on your BoX2 device remotely from your PC.
   For information on enabling VNC in iX Developer, see previous section Create a Project in iX Developer and separate document Remote Access (FTP and VNC) in iX Developer 2.xx, SUEN00314.
2. In the iX Runtime project, check that the tags that are configured to the different controllers receive values as expected.

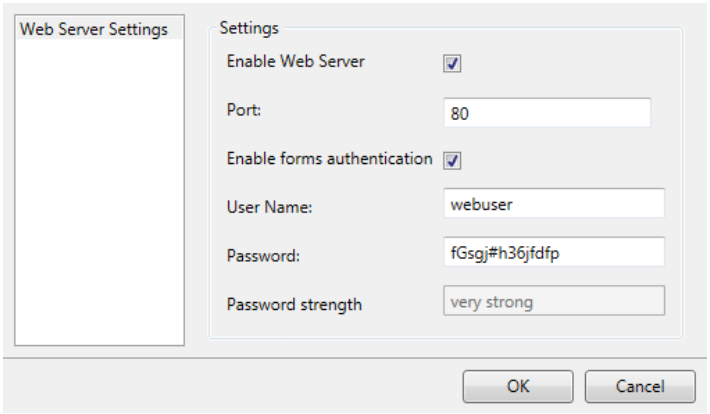
5.3. Enable Diagnostics Page

The diagnostics page shows diagnostic values from the BoX2 device. The diagnostic values include internal temperature, available RAM, used storage, connection and database errors and other system related information. The diagnostic page can be viewed after the project is downloaded to the device.

In iX Developer:

1. Open **Web server** configuration from **System** ribbon tab. Set values needed to access web server and enable web server for the project.

NOTE
The URL for the diagnostics page should include the assigned port number.

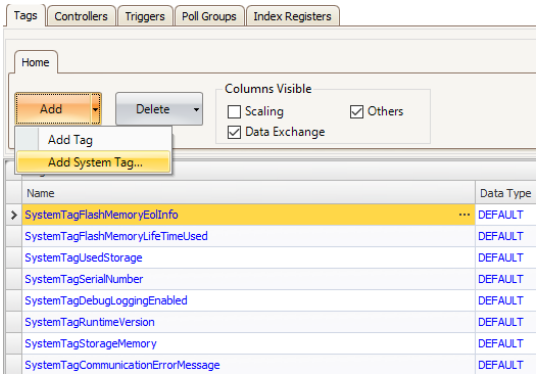


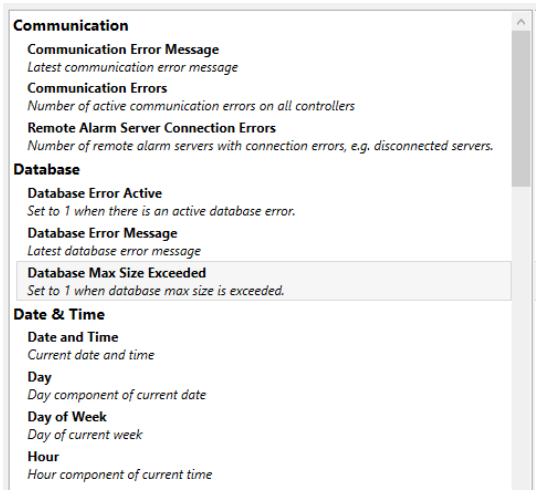
2. Add system tags, used on the page, manually to the project. If the system tag is missing, '-' will be displayed on the page.

NOTE
The following system tags are available:

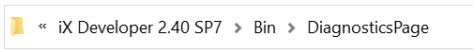
- Communication Errors (count) (*SystemTagCommunicationErrorMessage*)
- Communication Error Message (*SystemTagCommunicationErrorMessage*)
- Database Error Active (*SystemTagStorageErrorActive*)
- Database Error Message (*SystemTagStorageErrorMessage*)
- Database Max Size Exceeded (*SystemTagStorageMaxSizeExceeded*)
- Current Date and Time (*SystemTagDateTime*)
- Debug Logging Enabled (*SystemTagDebugLoggingEnabled*)

3. Select **Functions** - **Tags** - **Add - Add System Tag...**. Select and add needed tags in System tags dialog.



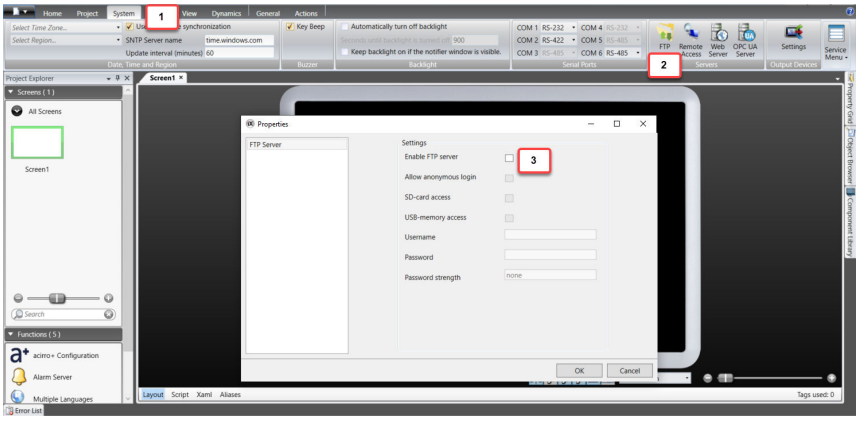


4. Deploy by either upload files via FTP or copy into the ProjectFiles folder. Diagnostics page files are installed with iX Developer installation and reside in *iX Developer <version>\Bin\DiagnosticsPage*.



   a. Enable FTP server for the project.

      i. On the **System** ribbon tab (**1**), within the **Servers** group, click **FTP** (**2**).

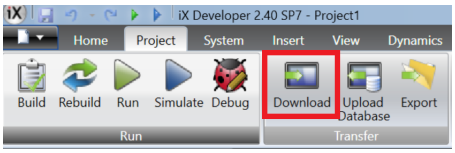


      ii. In the dialog, check the **Enable FTP server** checkbox (**3**).

      iii. (Optional) Set a username and password.

      iv. Click **OK**.

   b. Download the project to the BoX2 device through **Project - Download**.



c. Connect to the BoX2 device. Use FTP settings specified in the project with the help of any FTP client.

d. Create a new folder named ‘diagnostics’ in the ‘Website’ folder and copy the diagnostics page files into it.

Use this URL to access the diagnostic page: *http://<image_ip_address><:port>diagnostics/index.html* to access the page. Use the port defined in the web server configuration. If Forms authentication is enabled for the web server, user is first taken through authentication process. The page is updated asynchronously every 2 seconds with the latest data.

NOTE
For more information about how to use FTP, see Remote Access (FTP and VNC) in iX Developer 2.xx, SUEN00314.

5.4. Create a Project in BCS Tools and Download the PLC Program

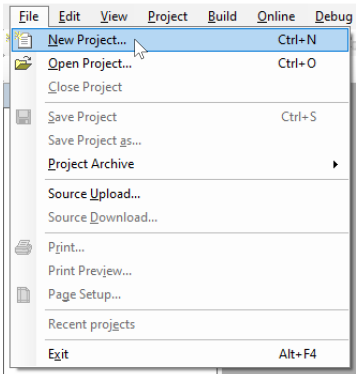
5.4.1. Create a Project in BCS Tools

If you are using a CODESYS Runtime in BoX2 pro SC or BoX2 extreme SC, the software BCS Tools is required

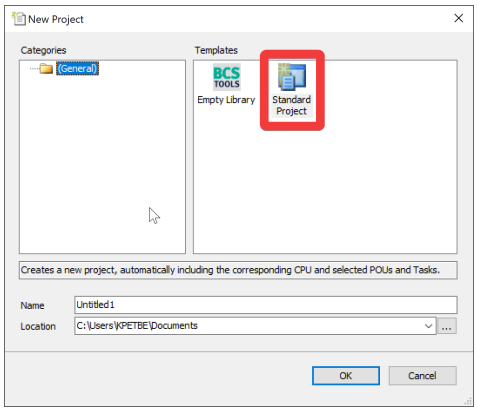
BCS Tools can be downloaded from Beijer Electronics SmartStore.

Once you have downloaded and launched BCS Tools, do the following to create your project:

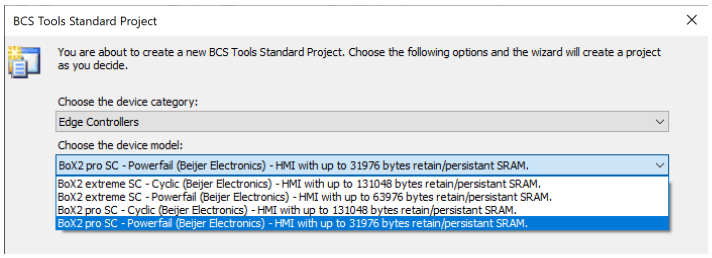
1. Click **File** > **New project...**.



2. Choose **Standard Project**.



3. In the **BCS Tools Standard Project** window, click the **Choose the device category:** drop-down and select the **Edge Controllers** group.
4. Click the **Choose the device model:** drop-down and select your BoX2 device from the list.



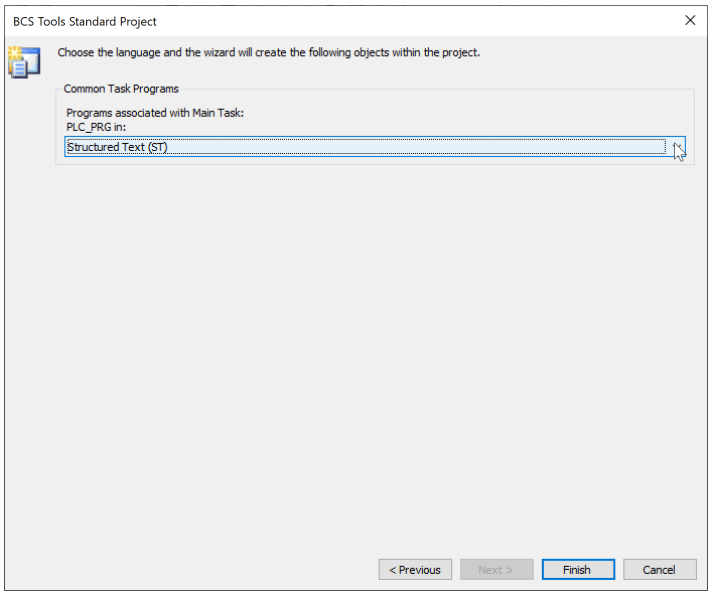
NOTE

The PLC functionality has support for storing non-volatile variables. Those variables can be stored dynamically in two different modes:

- **Power-fail mode (Default setting)**
  If the voltage drops below a hardware given threshold (that is, during a power loss or power dip), the system instantly copies all persistent data defined in the PLC application from RAM into the battery backed SRAM. They are verified and restored when the device is restarted.
- **Cyclic mode**
  The PLC is instructed to store all retain and persistent data directly into SRAM synchronously with every PLC cycle. This means all device types can use the whole available memory, which is 128 kB. However, writing to the SRAM might increase the configured PLC cycle depending on the size of used retain and persistent data, because a SRAM is naturally slower than a RAM. This possible increase is dependent of the application and to find out about the possible increase one would need to monitor the configured task(s) of the project. For projects with large amounts of persistent data, cyclic mode is recommended.

These settings must match the settings made in “Retain data options”, see Update the CODESYS Runtime Version Using USB or SD Card or Update the CODESYS Runtime Version Over Ethernet.

5. Make sure that **Create directory for project** is checked and click **Next**.
6. In the following window, choose the programming language for the POU created by the wizard, and click **Finish**.



5.4.2. Compile the Project

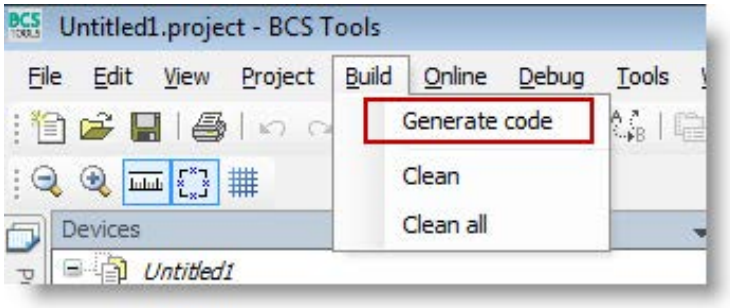
When the program is ready, a compile is needed to generate the executable code for the BoX2 device.

There are two ways to compile the project, the **Generate code** function which is an **offline compile** and the **online compile**, which is triggered when logging into the device if there is a code change from the last online session.

Compile Offline

NOTE
When a program change has been made to the project, the project must be compiled.

The offline compile is triggered by using the option **Generate code** from the **Build** menu.



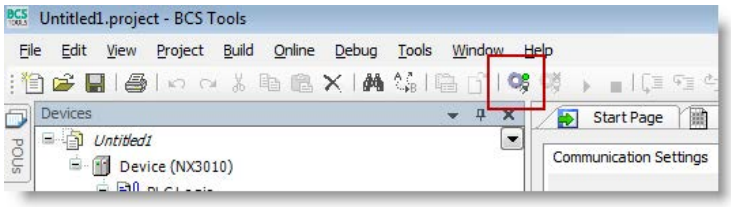
The other two options, **Clean/Clean all**, will remove the generated application binaries and forces BCS Tools to regenerate the application. After a **Clean** or **Clean all**, the controller must be stopped to be able to update the application.

NOTE
A project can still be changed online if the offline compile is being used, if it is only program code changes.

Compile Online

NOTE
When a program change has been made to the project, the project must be compiled.

This compile is triggered when logging into the CPU if there is uncompiled program code. If there are any compile errors, the login procedure will be interrupted. The compilation must be successful to be able to login to the CPU.



If the compilation is successful, a question of online change will be shown.

5.4.3. Download the PLC Program

There are two ways to transfer the program code to your BoX2 device, the **Download** and the **Online Change** function.

The **Download** function is a mode for downloading new projects and also current projects where the PLC parameters have been changed; hardware configuration, task changes etc.

The **Online Change** function is a mode for downloading changes while the CPU is in RUN mode. There is no restriction regarding how large the code change can be, as long as the only change is the program code, the online change function is always available.

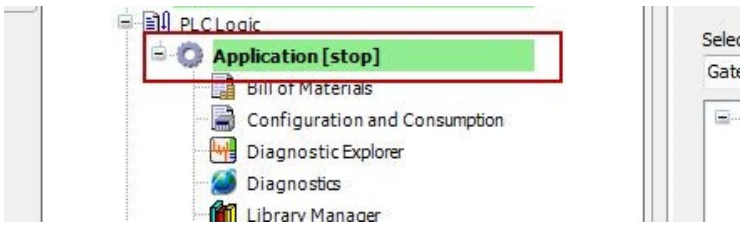
Download in STOP Mode

To download a new application or an application with hardware changes, task changes etc, the CPU must be in STOP mode.

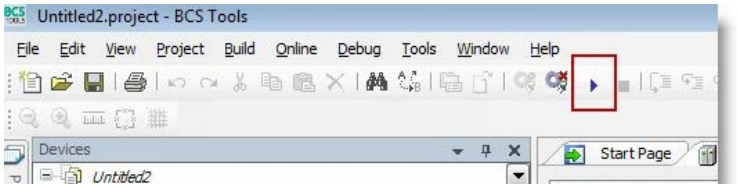
When logging into the CPU, BCS Tools will prompt that a download needs to be made.

When the **Yes** button is pressed, the CPU will enter STOP mode and the application is downloaded.

When the download is complete, BCS Tools will enter the online state with the CPU in STOP mode.



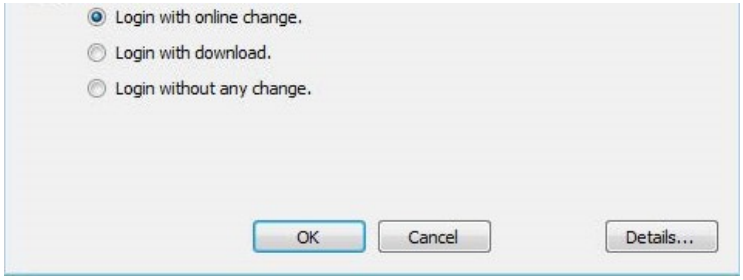
To set the CPU into RUN state, press the **RUN** button in BCS Tools.



Online Change

The online change function is a mode for downloading changes while the CPU is in RUN state. There is no restriction regarding how large the code change can be, if the only change is the program code.

When a change is made in the program code, BCS Tools will prompt with the following message to let the user decide whether to make an online change or a download with the PLC in STOP mode.



When a login attempt is made and the program code differs between BCS Tools and the PLC, online change is available.

When a change in parameters, tasks or other parameter related options are changed, no online change can be performed. BCS Tools will prompt with a message asking if you want to perform a download instead. Click **Yes** or **No**. Clicking **Details...** shows the code generation timestamp of the PC vs the PLC.

Boot Application

The Boot Application is the program code that the CPU will load and execute, after powering on or resetting the system.

When a download is made with the CPU in STOP mode, the downloaded project will be registered as a Boot Application.

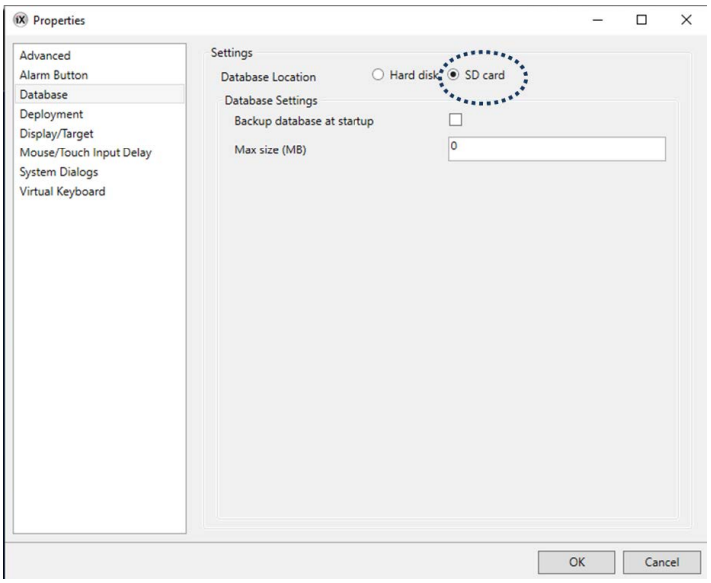
An online change updates the Boot Application per default.

5.5. Reduce Flash Wear by Storing Data on SD Cards

Beijer Electronics recommend using industrial SD card instead of the built-in flash memory when data logging is performed. The capability to use external SD card for data logging on BoX2 devices was introduced in iX Developer 2.40 SP5. Since extensive writing to the flash memory can cause wear problems and possibly premature failures, the alternative to write to an exchangeable SD card will potentially lengthen the lifetime of the device. An SD card is easy to replace compared to a built-in memory. In addition, the memory size of the SD card is normally much larger than the built-in flash memory.

To set up the SD card database in iX Developer:

1. Go to **Project/Settings**. Select **Database** and select **SD Card** in the dialog.



2. Click on the **OK** Button to confirm the new settings.

When the location of the database is changed from flash to SD card (or vice versa) in an existing application, the database will be automatically copied to the new location once the project is transferred to the device. This will be started immediately after the project transfer has taken place and hence a somewhat slower project start-up time can be noticed.

It is advisable to do a backup of the database in case something happens during the database copy operation.

If during runtime of the device, the SD card is removed and the chosen location for the database is the SD card, the panel will close the application and attempt to reboot until either an SD card is reinserted into the device, or a project is downloaded to the device with the location set to “Hard disk”.

Please note that if any scripting has been done towards the database, then these scripts need to be manually adapted to work with the new location (flash or SD card).

If Audit Trail is enabled for the project and if the database is stored on SD card, the transfer client will not provide the option to keep/remove audit trail in an existing project. It will always keep the audit trail database. If the user wants to clear the audit trail database for the same project, the SD card needs to be inserted into a PC and manually delete the audit trail database file.

It is also recommended to track the flash wear status in your iX Developer project.

The following **System Tags** can be used for that purpose:

System Tag	Description
Flash Memory Life Time Used	The usage of the device lifetime (in percent).
Flash Memory EOL Info	Information about the flash memory end of life. The three possible values are: • Normal • Warning - Consumed 80% of reserved block • Urgent

Please see document Best Practice Database on SD card or flash memory for more detailed information.

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