

## Ethernet over EtherCat with CODESYS and u-OS

### **Abstract:**

This guide describes how to setup Ethernet over EtherCAT (EoE) in CODESYS and u-OS. EoE can be used, e.g., to access the web user interface of an EtherCAT field bus coupler that is only connected to a u-control PLC via EtherCAT.

## Ethernet over EtherCat with CODESYS and u-OS

### Software reference

No.	Software name	Article No.	Software version
1	u-OS	-	2.1.0
2	Codesys	-	3.5

### File reference

No.	Name	Description	Version
1	prepare-device-for-eoe.sh	Script to setup the device for EoE	0.1

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## 1 Warning and Disclaimer

### Warning

Controls may fail in unsafe operating conditions, causing uncontrolled operation of the controlled devices. Such hazardous events can result in death and / or serious injury and / or property damage. Therefore, there must be safety equipment provided / electrical safety design or other redundant safety features that are independent from the automation system.

### Disclaimer

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### Security notes

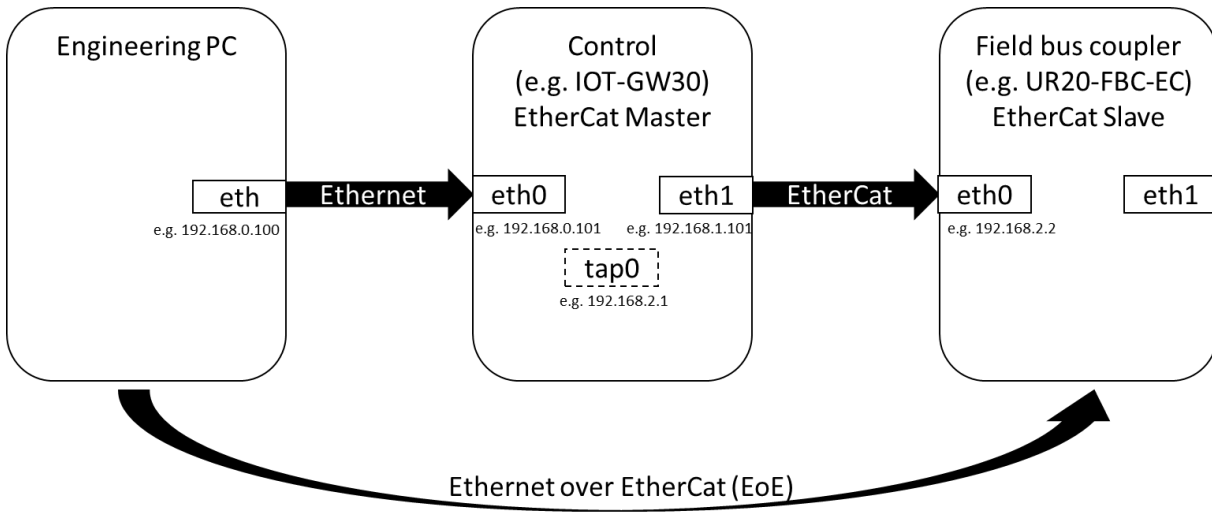
In order to protect equipment, systems, machines and networks against cyber threats, it is necessary to implement (and maintain) a complete state-of-the-art industrial security concept. The customer is responsible for preventing unauthorized access to his equipment, systems, machines and networks. Systems, machines and components should only be connected to the corporate network or the Internet if necessary and appropriate safeguards (such as firewalls and network segmentation) have been taken.

## 2 Prerequisites

SSH access must be activated on the device and the u-OS CODESYS app installed.

Familiarity with CODESYS and the UNIX shell is assumed.

## 3 Basic setup



The image shows a basic Ethernet over EtherCat (EoE) setup that should help the user navigate this application note. The devices and IP addresses which will be used as an example throughout this guide.

### 4 Adapt script

Before copying the `prepare-device-for-eoe.sh` script to the device, it must be edited.

#### 4.1 TAP IP Address

The script creates a TAP network interface which acts as a Gateway to communicate with the EtherCat Slaves via EoE. Therefore, an IP address and netmask need to be assigned for the TAP device. This IP address needs to be in a different subnet to the network interface of the EtherCat Master. Other EtherCat Slaves need to be in the same subnet as the TAP device.

Note: The selected IP network may not be used for any other purposes, since all requests to this network will be routed via the controller in the future. Devices in the local network with this IP address range will no longer be accessible.

The IP address of the TAP device can be set by editing the value of the `TAP_IP_ADDRESS` variable.

As an example:

```
TAP_IP_ADDRESS=192.168.2.1/24
```

#### 4.2 Engineering Network Interface

The engineering network interface is used to access the device running the CODESYS runtime from the engineering PC. For all devices, except IOT-GW30 and IOT-GW30-4G-EU, the engineering network interface needs to be assigned in the script to allow routing from engineering PC to the EtherCAT slave via EoE.

The engineering network interface can be set by editing the value of the `ENGINEERING_NETWORK_INTERFACE` variable. The network interface name can be found in the *Network & internet* section in u-OS Control Center.

In keeping with our example:

```
ENGINEERING_NETWORK_INTERFACE=eth0
```

# 5 Setup device

## 5.1 Copy script to device

Transfer the adapted script to the following path, on the device:

```
/home/admin/prepare-device-for-eoe.sh
```

Hint: The file can also be copied to the device by using WinSCP or via micro sd card or usb drive.

Note: From this step onwards root privileges are required.

```
> sudo -i
```

Move the script to the following path:

```
/opt/codesys/scripts/prepare-device-for-eoe.sh
```

After moving the script, check if the executable flag is set:

```
> ls -l /opt/codesys/scripts/prepare-device-for-eoe.sh
```

The executable flag can be added by running the following command:

```
> chmod a+x /opt/codesys/scripts/prepare-device-for-eoe.sh
```

## 5.2 Setup

To setup EoE on each bootup, the script needs to be executed each time the CODESYS runtime service starts. Therefore, it is required to edit the existing codesyscontrol-prepare service.

Edit the service with the *vi* text editor:

```
> systemctl edit --full codesyscontrol-prepare
```

Add the following line below the ExecStart entry.

```
ExecStartPost=/opt/codesys/scripts/prepare-device-for-eoe.sh
```

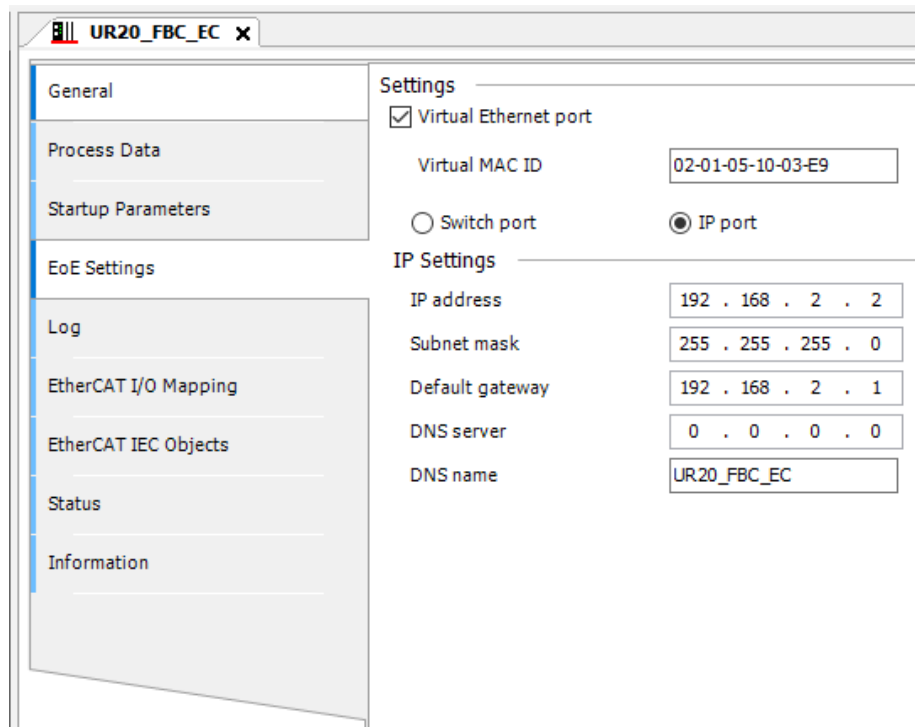
After editing the service, save the changes and reboot the system.



### 6 Setup CODESYS

In the CODESYS IDE, set up the EtherCat Master and add the EtherCat Slaves. Select the EoE Settings section of the EtherCat Slave and activate the Virtual Ethernet port. As IP address, enter a free IP address in the same subnet as the TAP device from section 4.1. As *Subnet mask* enter the same netmask as the TAP device. As *Default gateway* enter the IP address of the TAP device.

The image below shows an example configuration where the IP address of the TAP device is set to 192.168.2.1/24. For the EtherCat Slave the IP address 192.168.2.2 is assigned.



## 7 Route from Windows engineering PC to EtherCat slave

To add a permanent route in Windows, the route add command is used.

```
> route add -p <ETHERCAT IP> MASK <NETMASK> <DEVICE IP>
```

ETHERCAT IP and NETMASK must be in the same subnet as the EtherCat Master. The DEVICE IP is the IP address of the device the engineering PC is connected to:

Example:

```
> route add -p 192.168.2.0 MASK 255.255.255.0 192.168.0.101
```