

Anybus[®] CompactCom[™] 40 - Using Ethernet over EtherCAT[®]

APPLICATION NOTE

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1. Overview

The module supports transparent tunneling of non-EtherCAT Ethernet frames to and from an EtherCAT slave, using Ethernet over EtherCAT (EoE).

With Ethernet over EtherCAT enabled, the following features are supported:

- Web server with customizable content
- FTP server
- E-mail client
- Server Side Include (SSI) functionality
- JSON functionality

In order to be used, EoE must be enabled in the CompactCom 40, and the ESI-file must be configured for EoE. The following sections will describe how to enable and use EoE.

2. Configuration

2.1. Enable/Disable EoE

EoE is enabled/disabled with attribute #17 (Enable EoE) in the EtherCAT host object (F5h). If this attribute is not enabled in the host application, EoE is enabled in the CompactCom 40 by default.

If EoE is enabled, the tag `<EoE IP="0" MAC="0" TimeStamp="0" />` must be added to the Mailbox section of the ESI-file, and if it is disabled, the tag must be removed. The HMS ESI generator will automatically add the EoE tag based on the setting in the EtherCAT host object. However the IP, MAC, and Timestamp keywords must be added manually.

```
<Mailbox DataLinkLayer="1">
  <EoE IP="0" MAC="0" TimeStamp="0" />
  <CoE SdoInfo="1" CompleteAccess="1" PdoAssign="0" PdoConfig="0"
PdoUpload="1" />
  <FoE/>
</Mailbox>
```

`IP="0" MAC="0"` means that IP address and MAC ID shall not be set from the EtherCAT master (not supported by the CompactCom 40). `TimeStamp="0"` means that the EoE frames shall not be time stamped (not supported by the CompactCom 40).

2.2. EtherCAT Conformance Test – CTT

The test case TF-1100 Data Link Layer – Error Reply Service Data (CoE) in the EtherCAT CTT is unable to handle EoE frames initiated by the Device Under Test, i.e. this test will fail. There are two options to pass the test:

- Set the IP settings of the Device Under Test to:
 - IP: 0.0.0.0
 - Subnet Mask: 0.0.0.0
 - Gateway: 0.0.0.0
 - Disable DHCP
- Disable EoE in the EtherCAT host object.

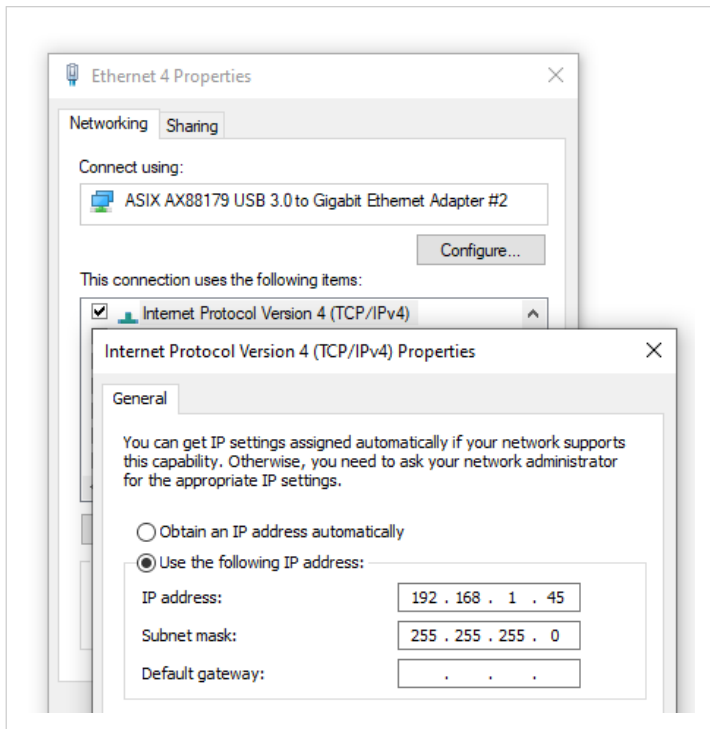


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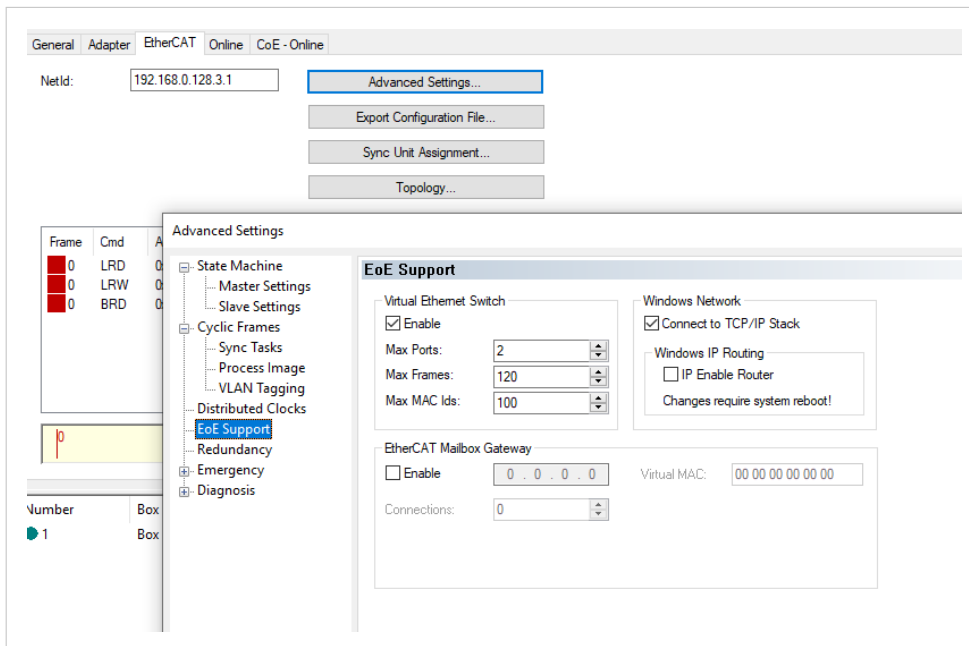
Some EtherCAT masters does not support EoE, which can manifest itself as startup issues or unstable connections. One of the options above should solve the problem in those cases as well.

2.3. Enable EoE in Beckhoff TwinCAT 3

1. Activate Windows standard IPv4-protocol for the Ethernet interface to be used for the EtherCAT network. To do this select **IPv4** in the **Networking** tab and set a static IP address.

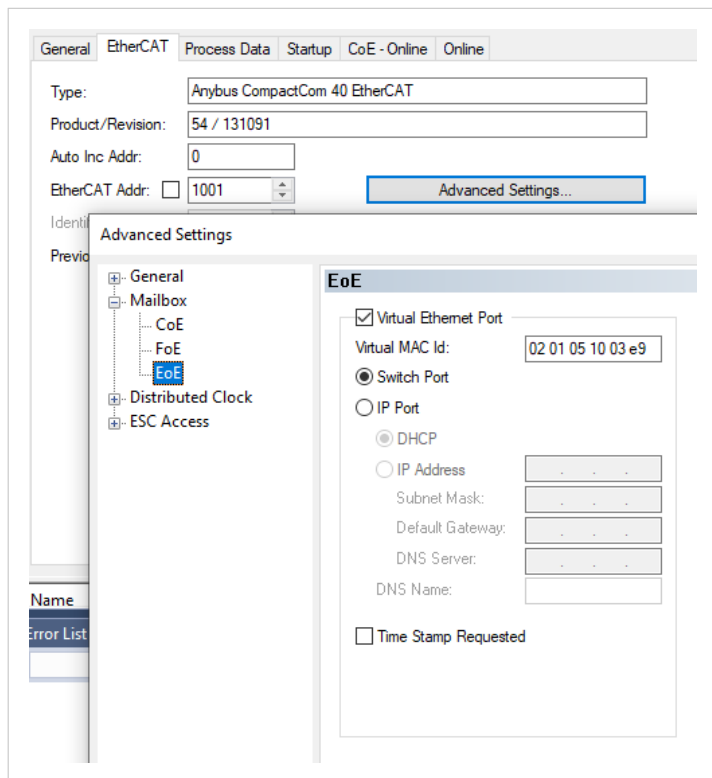


2. Start TwinCAT 3, add a new EtherCAT master, make sure it is bound to the correct network interface and ensure that the IP settings for the interface is also listed here.
3. Activate EoE for the master by opening **Advanced Settings** in the **EtherCAT** tab, and navigating to **EoE Support**. Select **Enable** under **Virtual Ethernet Switch** and select **Connect to TCP/IP Stack** under **Windows Network**. **IP Enable Router** under **Windows IP Routing** does not need to be selected.



4. Generate an ESI-file for the slave and copy it to the 'C:\TwinCAT\3.1\Config\Io\EtherCAT' folder.

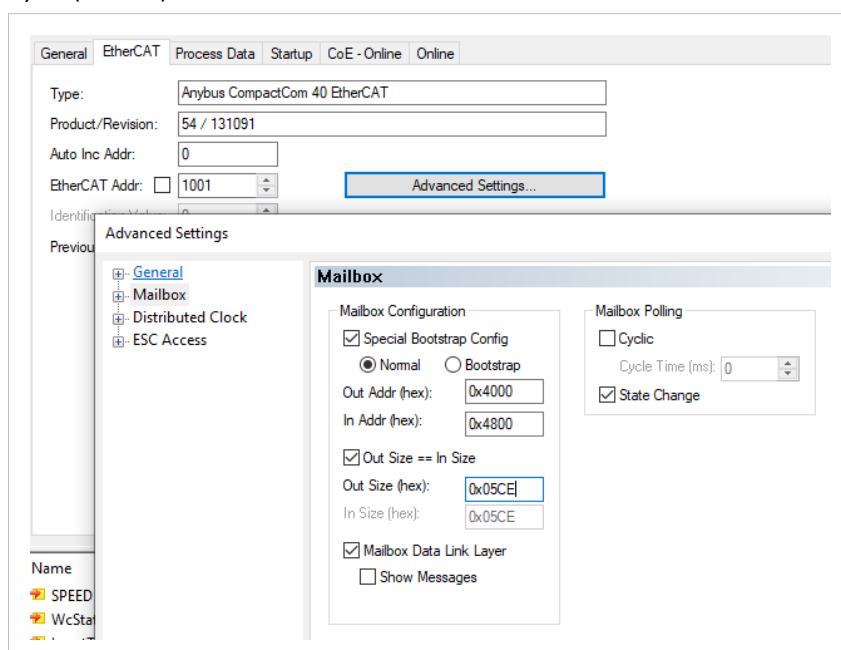
5. Add the slave or scan the network and activate EoE for the slave. To activate EoE for the slave open **Advanced Settings** under the **EtherCAT** tab, and navigate to **EoE** located under the **Mailbox** submenu. Select **Virtual Ethernet Port** and **Switch Port**.



6. Save and activate the configuration.
7. Check with HMS IPconfig (the HMS IP configuration tool) that it shows up. Here you can also set the IP address and then try with standard ping or FTP.

2.3.1. Improvements for better EoE performance

- Increase the Mailbox sizes on the slave by opening **Advanced Settings** under the **EtherCAT** tab, and navigating to **Mailbox**. Edit the value in the **Out Size (hex)** field and/or the **In Size (hex)** field. The maximum size is 1486 bytes (0x05CE).



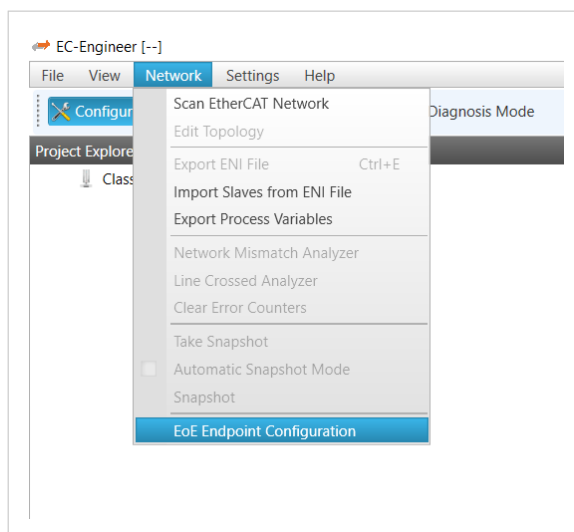
- Reduce the Cycle Time. When in Freerun, the cycle time is configured on the master's **Adapter** tab.

The screenshot shows the 'Adapter' configuration window in Acontis EC-Engineer. The 'General' tab is selected, and the 'Network Adapter' radio button is chosen. The configuration fields are as follows:

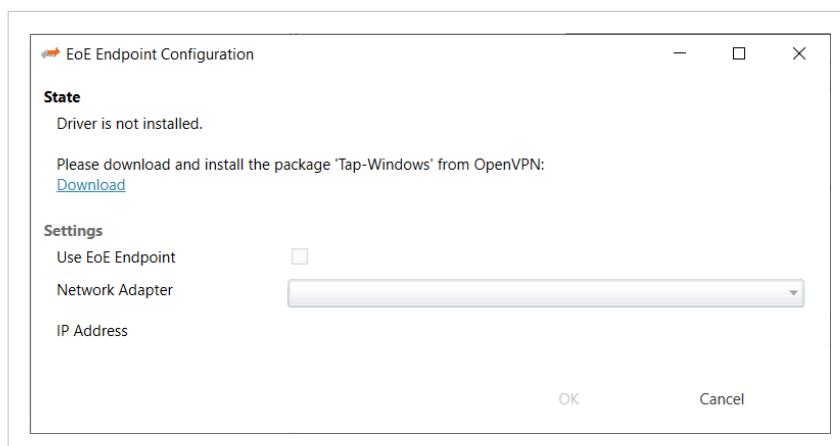
- Description:** Kontorsnät (TwinCAT-Intel PCI Ethernet Adapter (Gigabit))
- Device Name:** \DEVICE\{95FBDE80-97E2-427C-9AF7-C7B469173B2A}
- PCI Bus/Slot:** (Empty field with a 'Search...' button)
- MAC Address:** c8 f7 50 0f 1a f5 (with a 'Compatible Devices...' button)
- IP Address:** 192.168.0.1 (255.255.255.0)
- Promiscuous Mode (use with Wireshark only):** ☐
- Virtual Device Names:** ☐
- Adapter Reference:** (Empty dropdown menu)
- Freerun Cycle (ms):** 4

2.4. Enable EoE in Acontis EC-Engineer

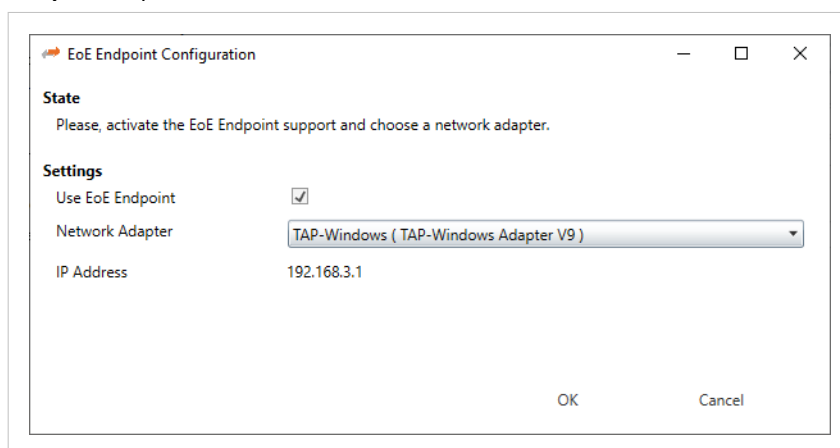
1. Start EC-Engineer and select Network Adapter. Open the **Network** menu and select **EoE Endpoint Configuration**.



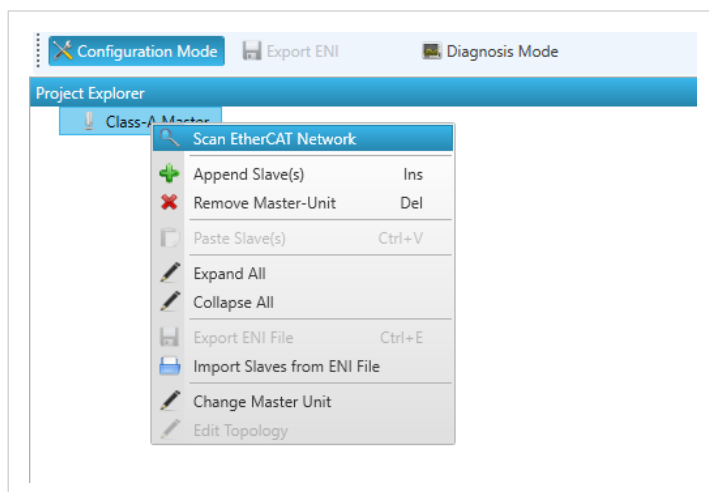
2. If Tap-Windows driver is not installed, follow the Download link and install it according to the instructions.



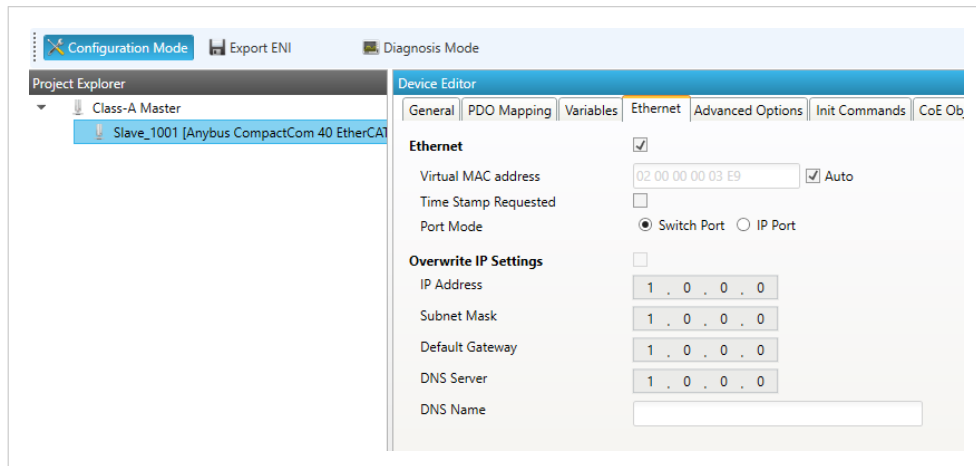
3. Select the **Use EoE Endpoint** checkbox and then select the **TAP-Windows Adapter** option from the **Network Adapter** drop-down menu.



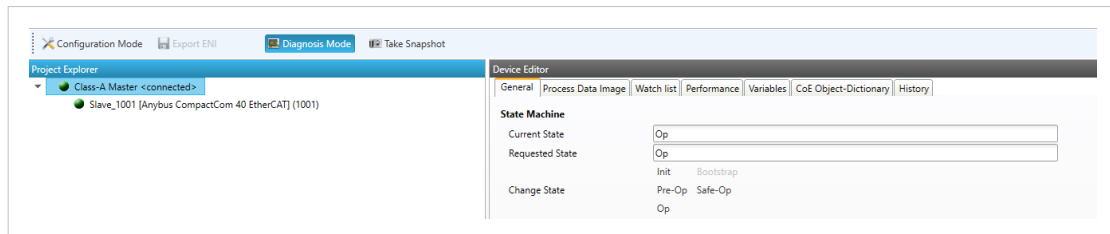
4. Generate an ESI-file for the slave and install it in EC-Engineer by using the **ESI Manager** located in the **File** menu.
5. Right-click the master and select **Scan EtherCAT Network**.



6. Slave configuration – On the slave's **Ethernet** tab, select the **Ethernet** checkbox, and set **Port Mode** to **Switch Port**.



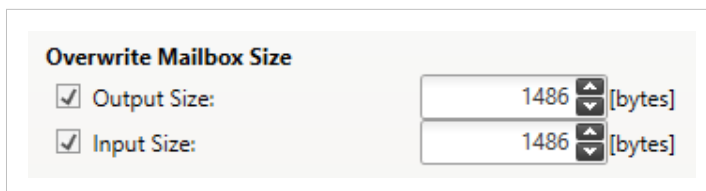
7. Switch to **Diagnosis Mode**, and make sure the master and slave are in state **Op-mode**.



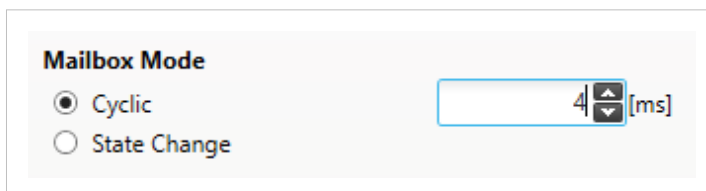
8. Check with HMS IPconfig (the HMS IP configuration tool) that it shows up. Here you can also set the IP address and then try with standard ping or FTP.

2.4.1. Improvements for better EoE performance

- Increase the Mailbox sizes on the slave. To do this, navigate to **Overwrite Mailbox Size** under the **Advanced Options** tab. Edit the value in the **Output Size** field and/or the **Input Size** field. The maximum size is 1486 bytes (0x05CE).



- Reduce the Cycle Time. To do this navigate to **Mailbox Mode** under the **Advanced Options**, edit the value for the **Cyclic** field.



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