XMC4800 EtherCAT® generic slave example

Getting started V1.0
July 2016

Agenda

1. Overview and requirements
2. Setup
3. Description
4. How to test

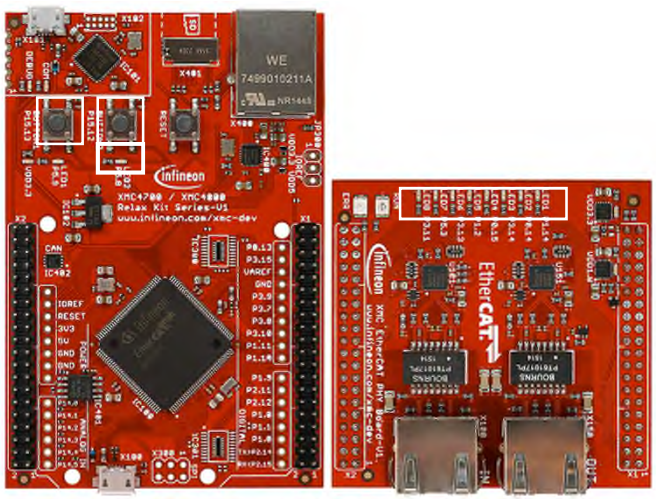
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Overview



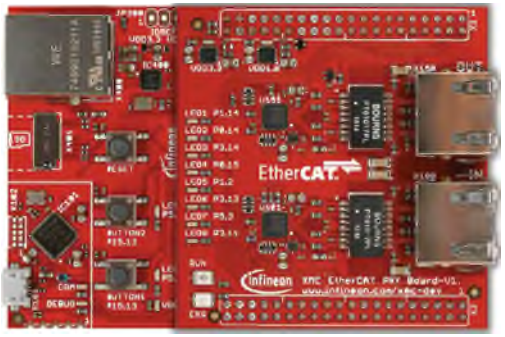
This example demonstrates the usage of an generic EtherCAT® slave node on „XMC4800 Relax EtherCAT® Kit".

The term „generic" refers to the fact, that the data structures shared between master and slave do not have a dedicated application specific purpose.

While reviewing this example you will see in output direction the EtherCAT® master controlling the 8 LEDs on the „XMC™ EtherCAT® PHY Board" and dimming LED2 of the Relax Kit. In input direction you will monitor inside the master device the status of the buttons available on the Relax Kit.
You will observe inside code how you can modify the mapping of the generic data structures to the I/Os for your own evaluations and testing.

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Requirements



XMC4800 Relax EtherCAT® Kit



RJ45 Ethernet Cable



Windows Laptop installed

- DAVE™ v4 (Version4.1.4 or higher)
- TwinCAT2 or TwinCAT3 Master PLC



Micro USB Cable (Debugger connector)

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Requirements
Free downloads



TwinCAT2 (30 day trial)
(used inside this document as reference)
Link: Download TwinCAT2

or



TwinCAT3 (no trial period; usability limited)
Link: Download TwinCAT3

DAVE™ (v4.1.4 or higher)
Link: Download DAVE (Version 4)

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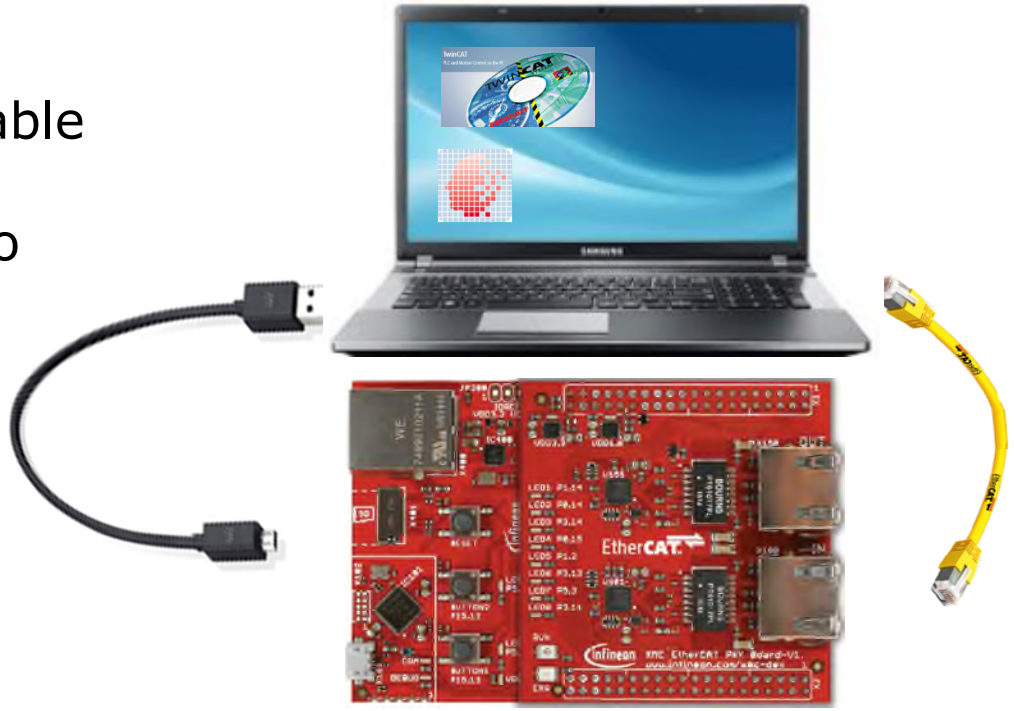
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Setup
Hardware

Micro usb cable debugger connected to X101 debug connector

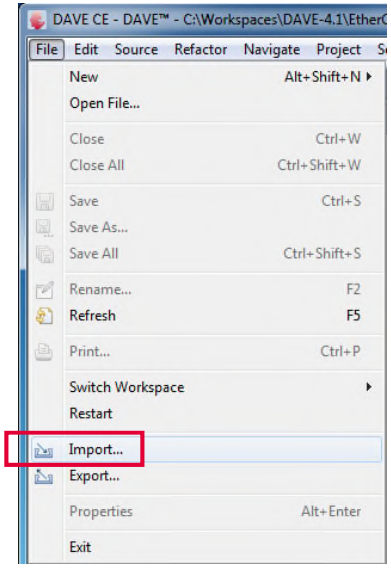


Ethernet cable connected to in-port

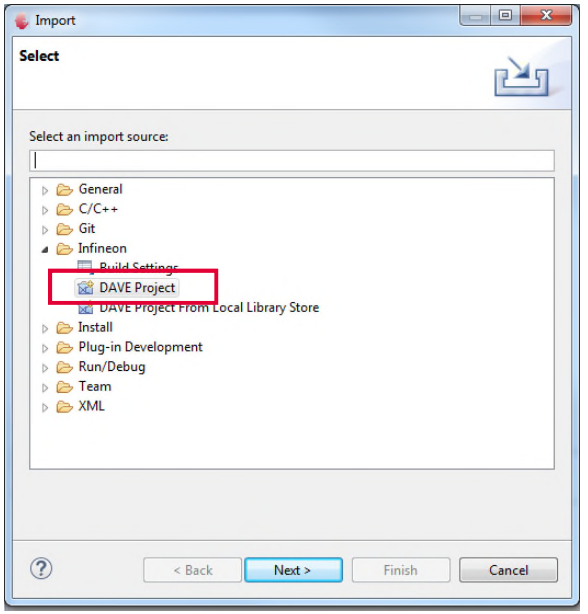
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Setup
Import example project into DAVE™ & build

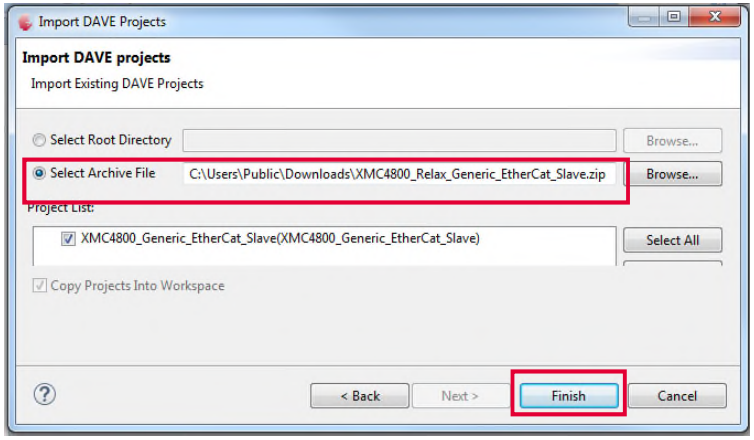
1



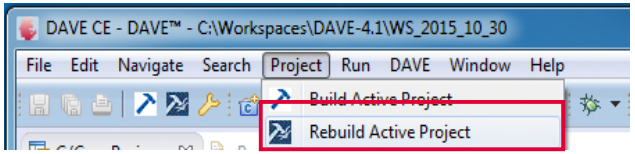
2



3



4



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Setup
Add device configuration to TwinCAT

1. Inside the workspace of the DAVE™ example project you find the device description XML-file:
   XMC4800_Relax_Generic_EtherCat_Slave.xml

2. Copy the device description file to your TwinCAT installation:
   C:\TwinCAT\Io\EtherCAT

3. If TwinCAT System Manager is currently running already, exit TwinCAT.

4. Start TwinCAT. You should see device description cache being re-worked automatically because the new device is added.

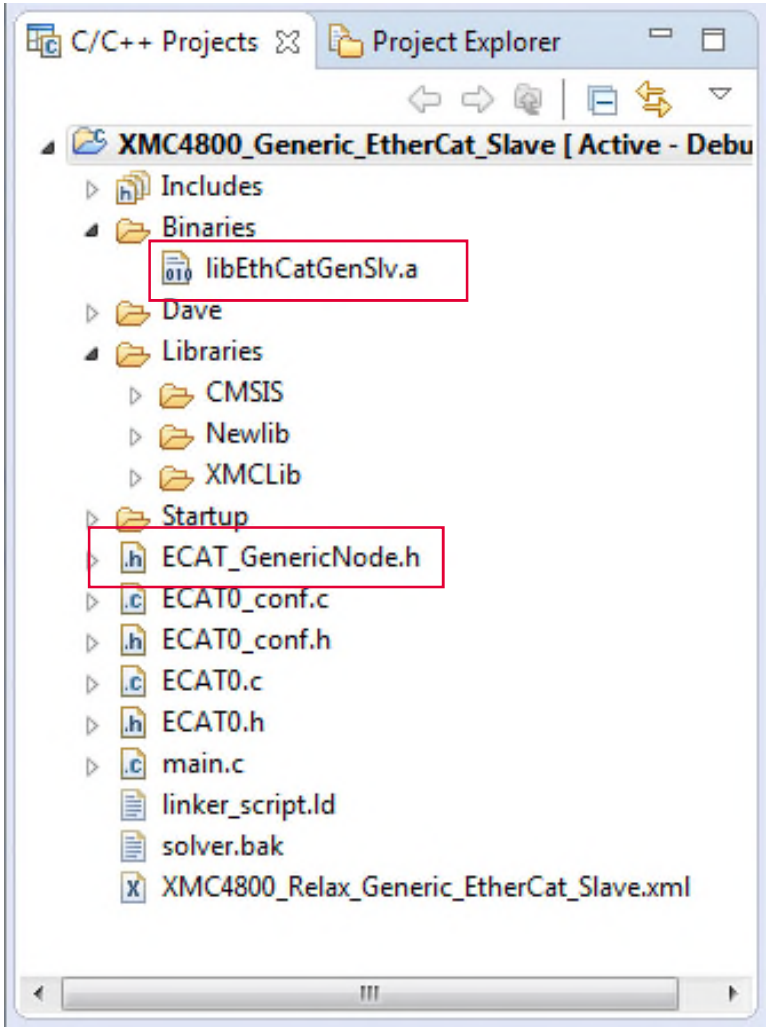
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Description
Generic EtherCAT® slave library



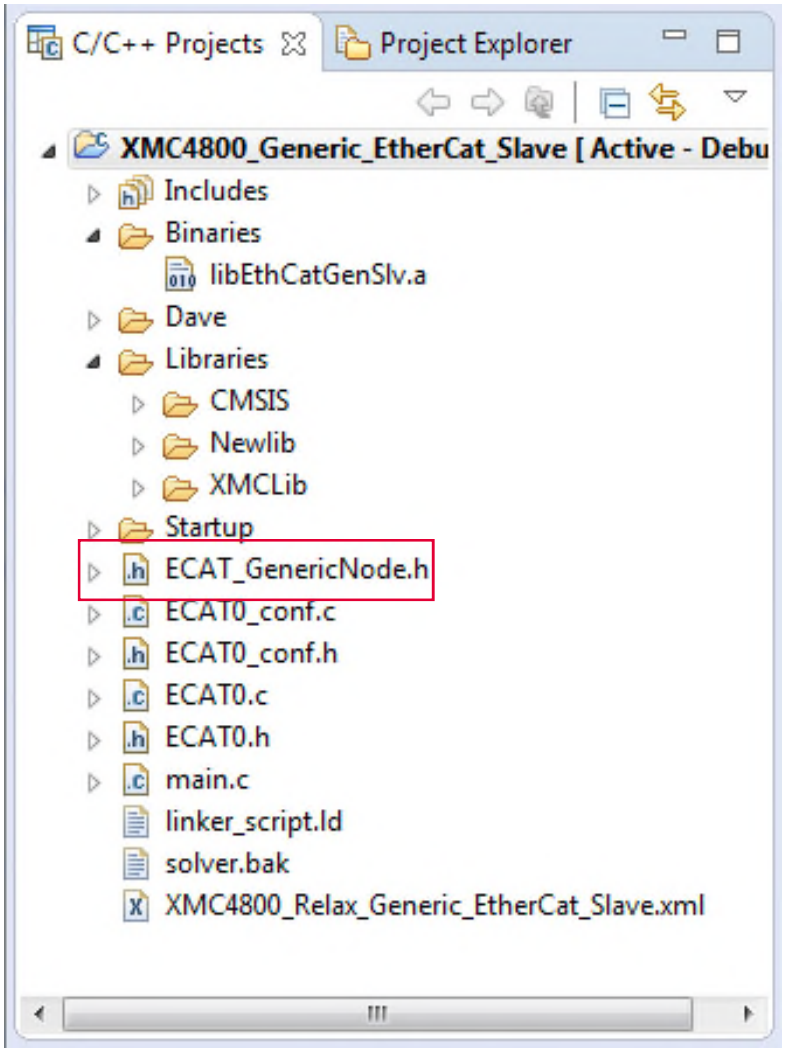
The state machine of the generic slave is implemented inside the library libEthCatGenSlv.a.

ATTENTION: This library is for demonstration purpose within this example only and is not certified, not conform and not planned to be used in any other context than this example here.

Established tool providers may help you in your product development and certification. A list of vendors can be found here: https://www.ethercat.org/en/products.html

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Description
Generic EtherCAT® slave library



The API of the generic slave is simple:

1. ECAT_init
To initialize the slave device

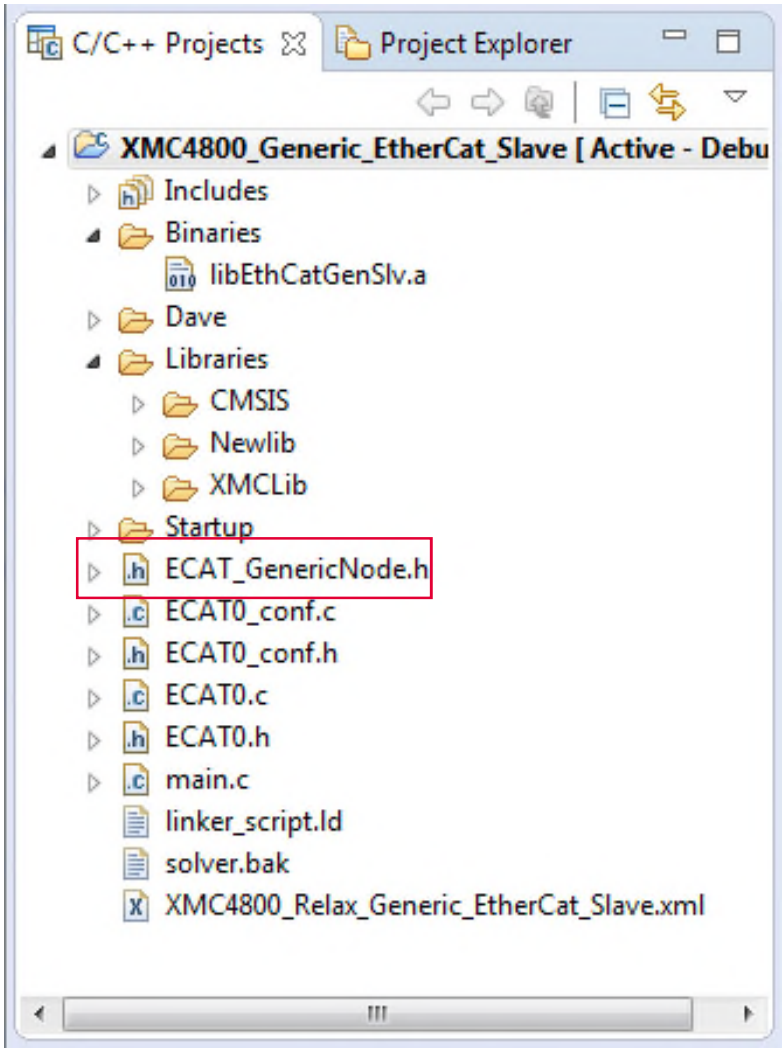
2. ECAT_registerCb
To register a callback.

Inside the callback the I/O data from/to master is processed and e.g. connected to hardware (ports, timers, PWM,…)

3. ECAT_main_loop
Main loop called inside while(1) to process the state machine

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Description
Generic EtherCAT® slave library

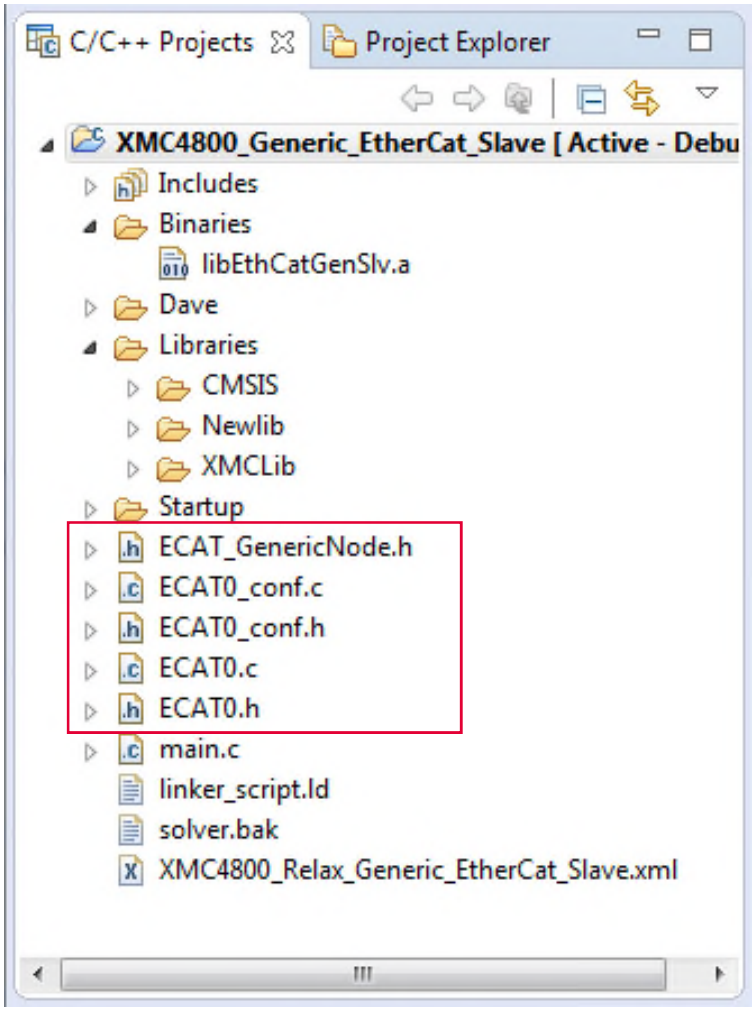


The size of generic data in both directions is 4x16-bit and 8x1-bit.

Check the types IN_object / OUT_object inside the headerfile ECAT_GenericNode.h for details.

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Description
EtherCat® ports and physical connection



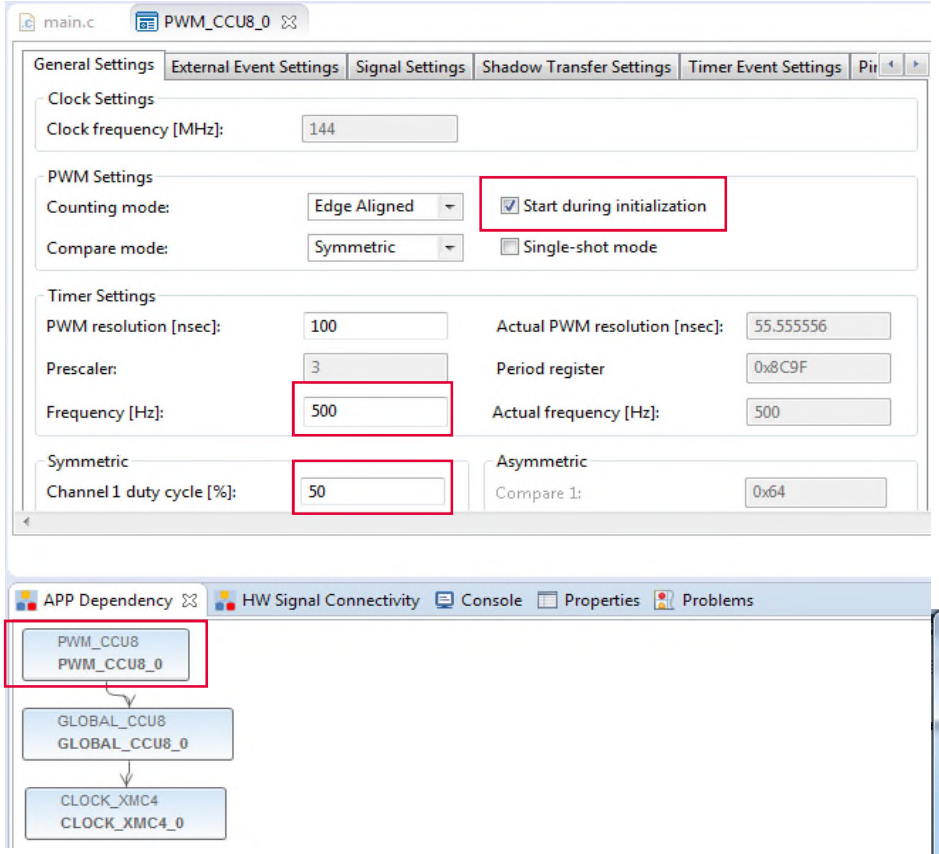
Inside the ECAT0_* files the physical setup of the EtherCAT® ports is provided.

For the example provided, the configuration is fixed to the LQFP144 which fits to the XMC4800 Relax EtherCAT® Kit.

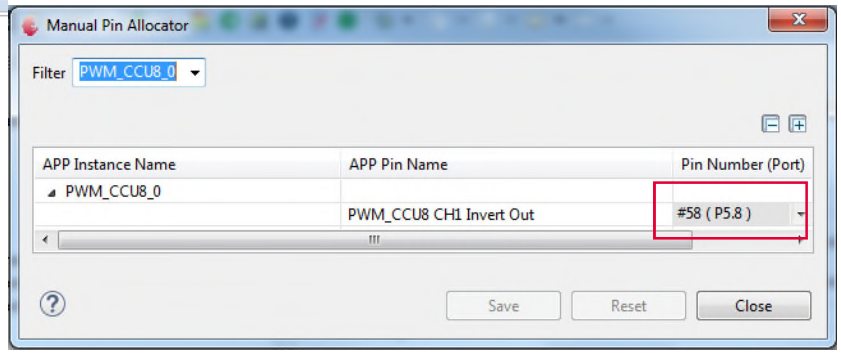
Inside main() during initialization the port configuration is set in place by calling ECAT0_Init.

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Description
Setup PWM for dimmable LED2 on P5.8

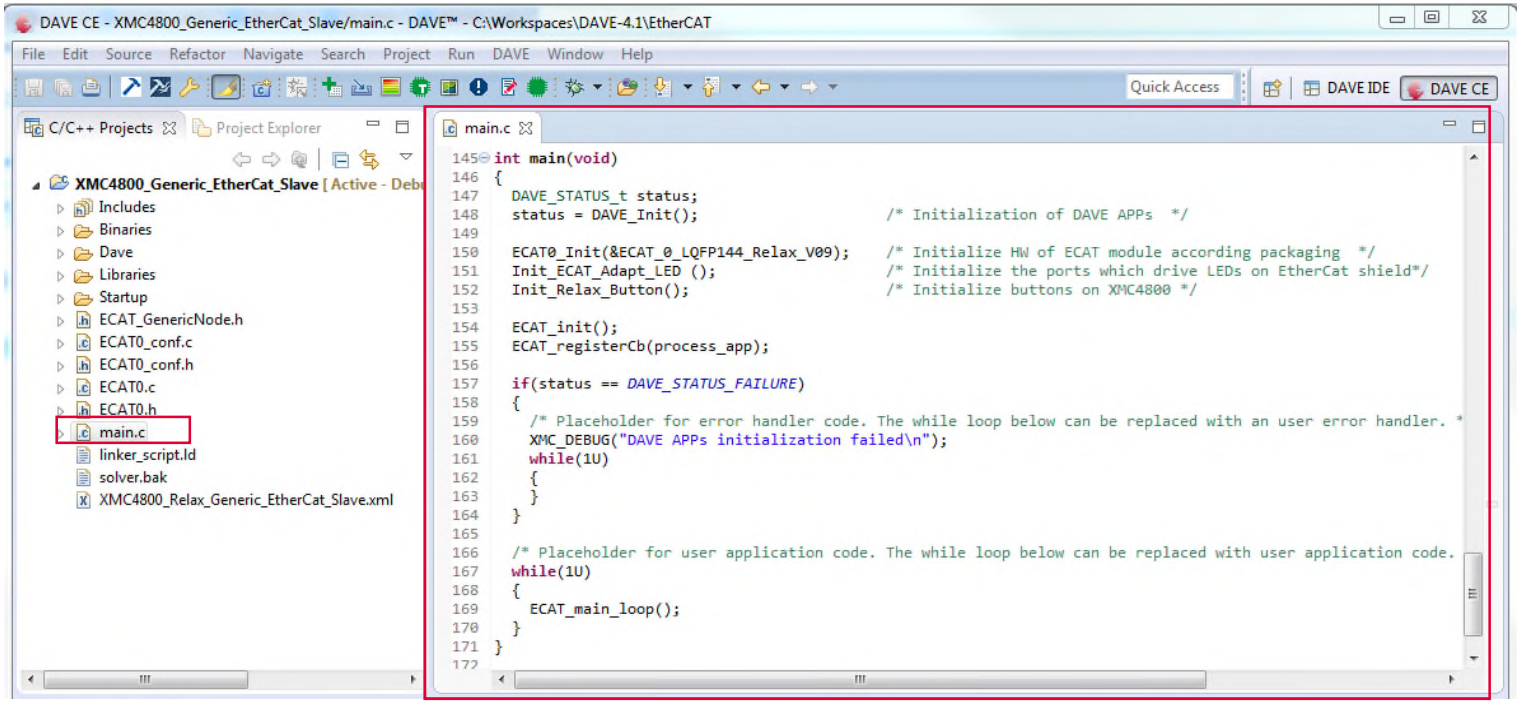


For driving the dimmable LED2 on the XMC4800 Relax EtherCAT® Kit PWM_CCU8 is used. The PWM is set to start during initialization, frequency is 500 Hz and the initial duty cycle is set to 50%. The pin P5.8 is allocated to channel1 of CCU8 inside manual pin allocator (right-click PWM_CCU8 APP).



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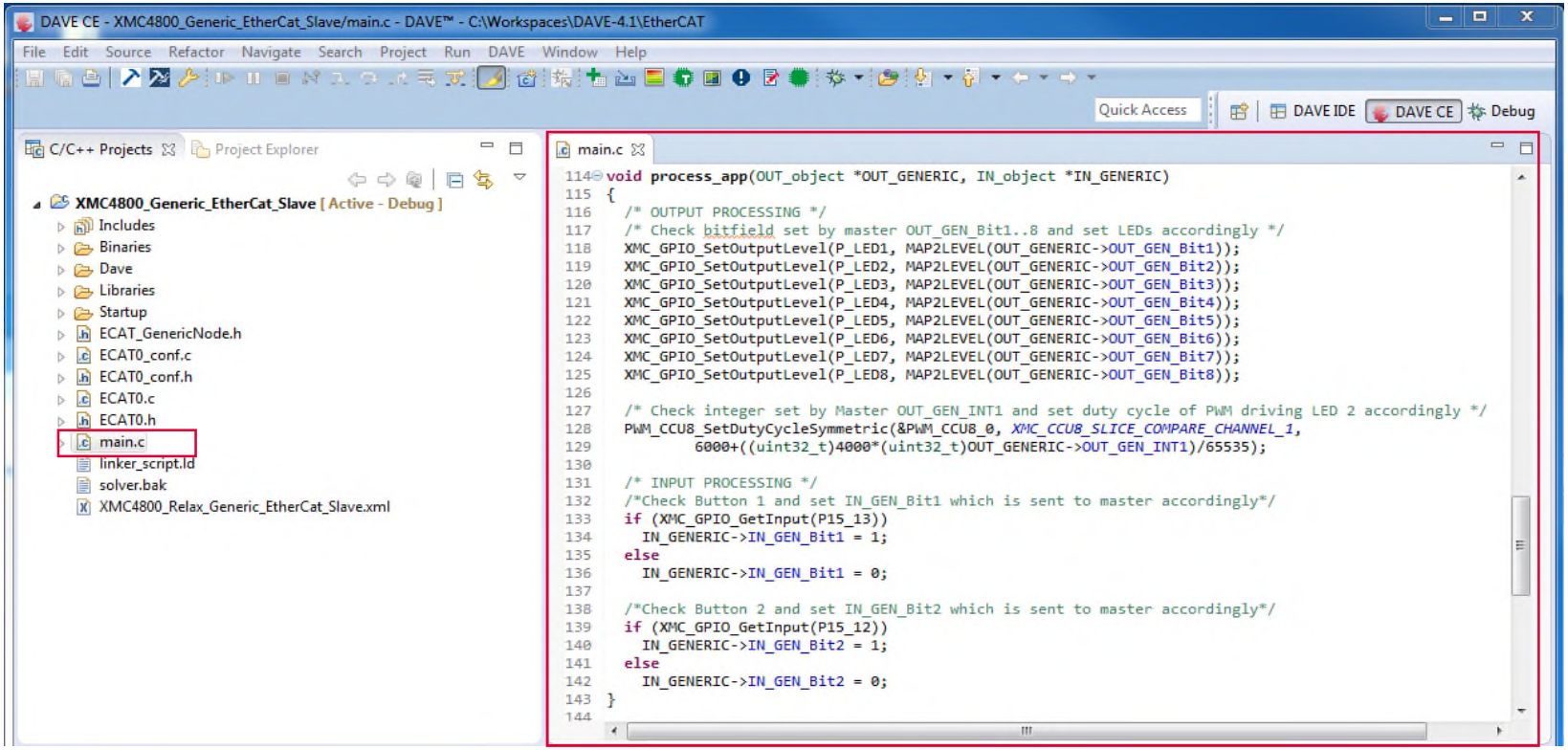
Description
Initialization inside main.c



Inside main() the DAVE™ system (PWM CCU8) and the ports of the EtherCAT® module are initialized. InitECAT_Adapt_LED() and Init_Relax-Button() are used to initialize the buttons and LED1 to 8 of the „XMC™ EtherCAT® PHY Board“. Finally the generic EtherCAT® slave node is initialized, the callback is registered and the ECAT_main_loop is called cyclic to process the state machine.

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Description
Callback to process input and output



Inside the callback function the binary output data (master->slave) is used to set the level of LED1 to 8 of „XMC™ EtherCAT® PHY Board". The integer output data is used to set the duty cycle of the dimmable LED2. Finally the states of the buttons are checked and propagated to the input data (slave->master).

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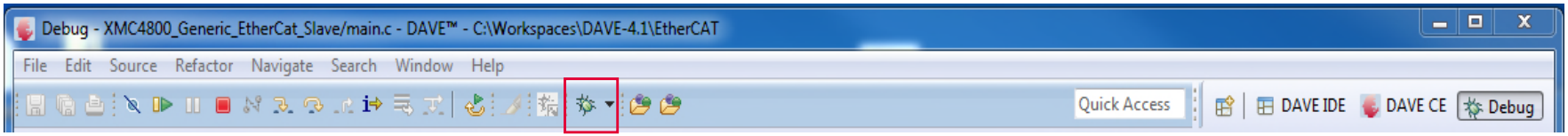
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How to test
Start the slave to run

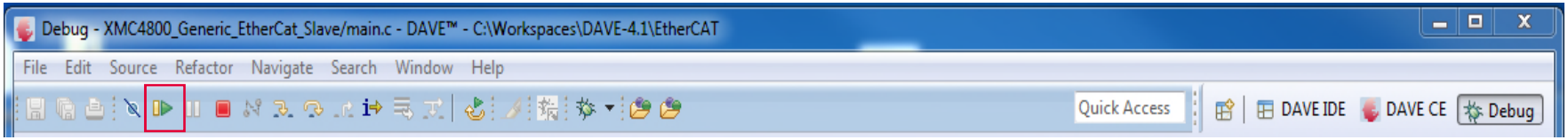


ACTIONS

1. Download software to XMC4800 and start debugger



2. Start the software to run





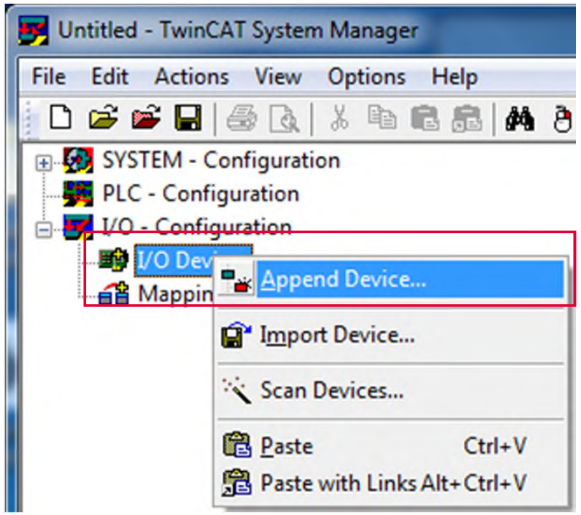
OBSERVATIONS

1. The ERR-LED on the "XMC™ EtherCAT® PHY Board" will turn on and immediately turn off again.
2. The LED2 on the "XMC4800 Relax EtherCAT® Kit" will remain turned on.

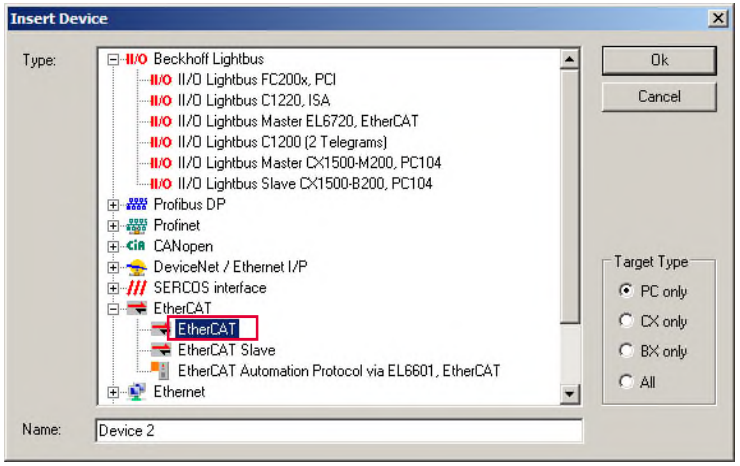
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How to test
Start the TwinCAT 2 master to run (1/4)

1



2





ACTIONS

After starting the TwinCAT System Manager from windows start menu:

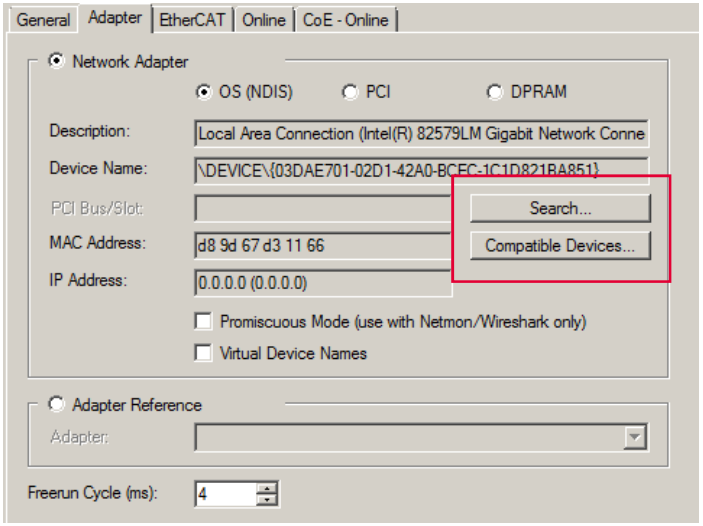
1 Right Click I/O-Devices and select „Append Device…"

2 Create an EtherCAT® master device by double click

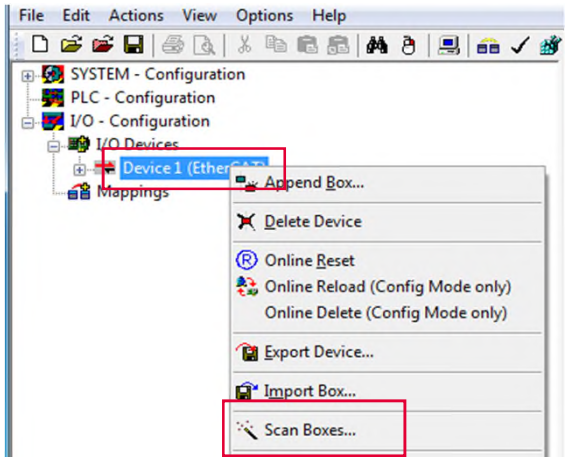
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How to test
Start the TwinCAT 2 master to run (2/4)

3



4



ACTIONS

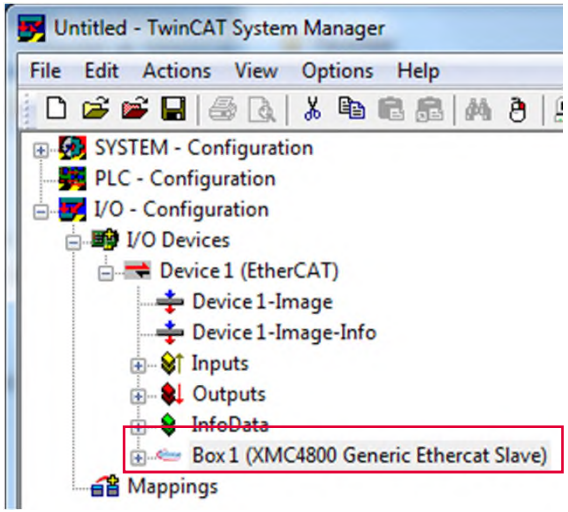
3 Select the network adapter you want to use (search and select).
Application hint:
In case the device is not found please install the respective device driver by following the instructions given by TwinCAT through the „Compatible Devices…“ button.

4 Right Click EtherCAT® master and select „Scan Boxes…“.

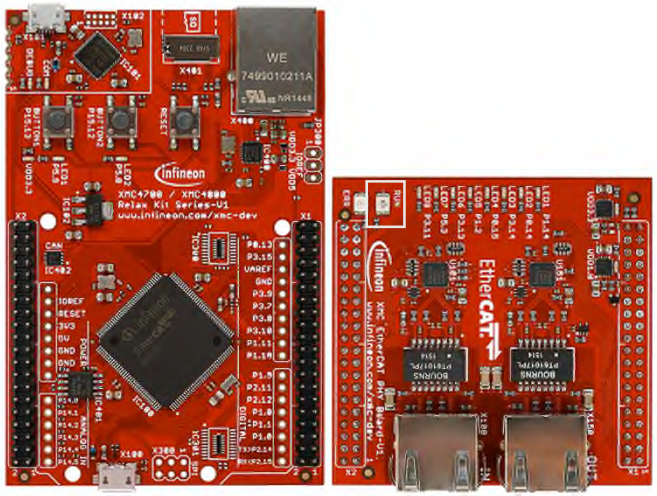
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How to test
Start the TwinCAT 2 master to run (3/4)

1



2



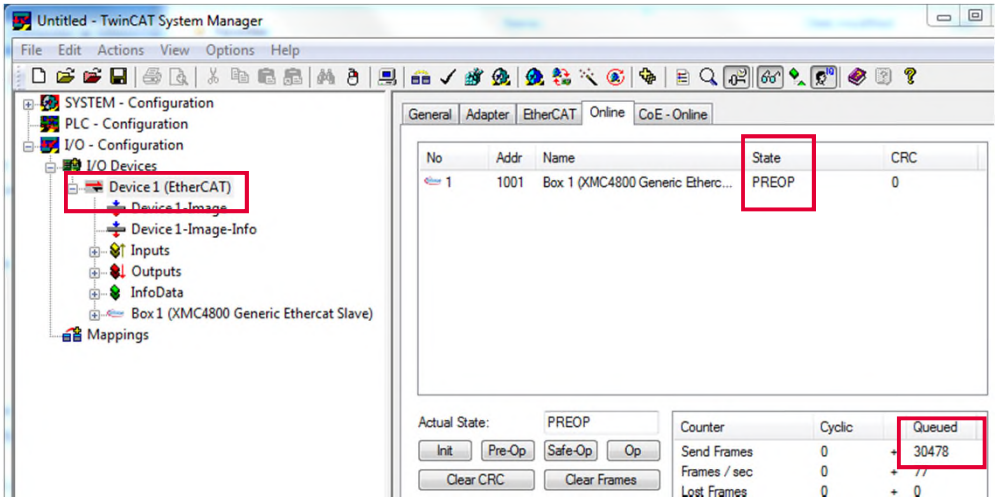
OBSERVATIONS

1. The slave appears as a node on the bus of the EtherCAT® master.
2. The RUN-LED is flashing indicating PREOP-state.

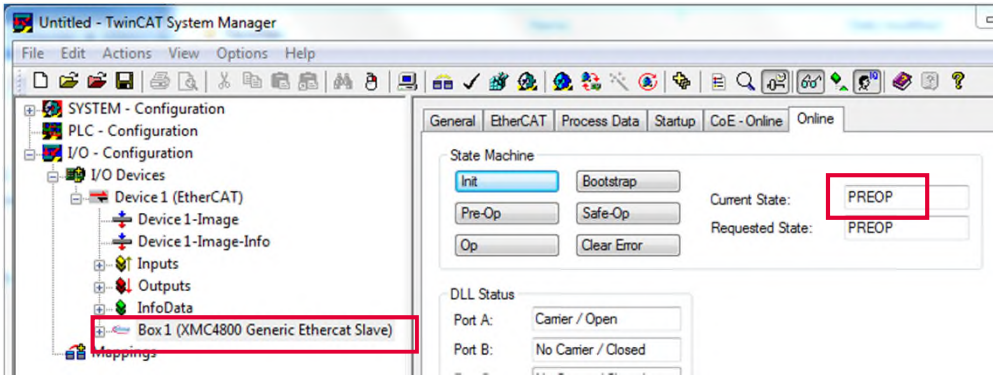
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How to test
Start the TwinCAT 2 master to run (4/4)

3



4



OBSERVATIONS

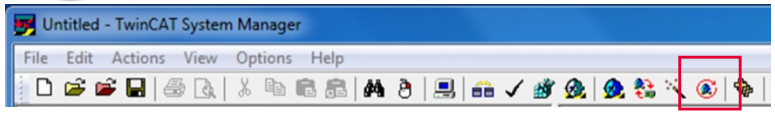
3 EtherCAT® master view: Inside the EtherCAT® master online state you see the queued frames counting up, the connected slave and its PREOP state.

4 EtherCAT® slave view: The PREOP-state of the slave is indicated within the TwinCAT system manager.

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How to test
Setting slave to operational mode

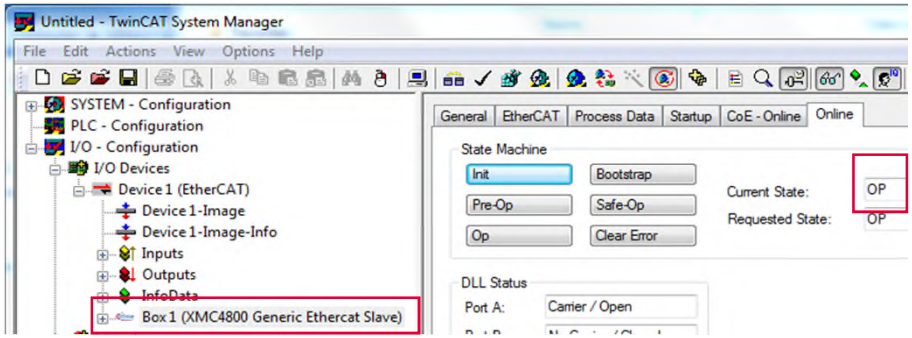
ACTION



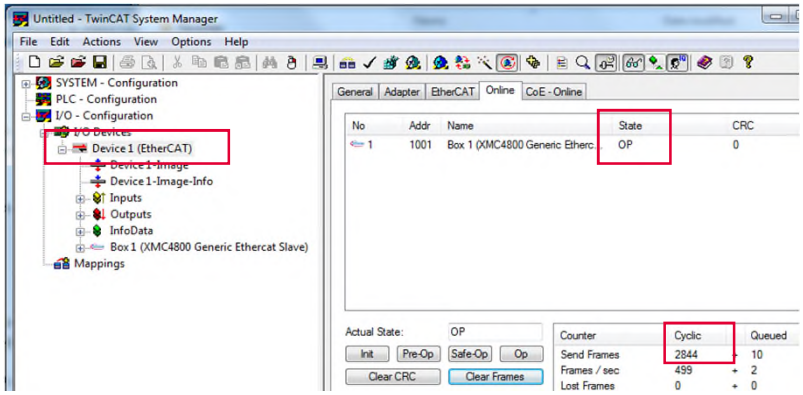
Set master device to free run mode

OBSERVATIONS

1



2



1 EtherCAT® slave view: Online status of slave shows the slave in OP state.

2 EtherCAT® master view: Online status of master shows the slave in OP state. Frames are no more queued. Cyclic counter is incrementing.

3 „XMC™ EtherCAT® PHY Board“: RUN-LED is static turned on indicating OP-state.

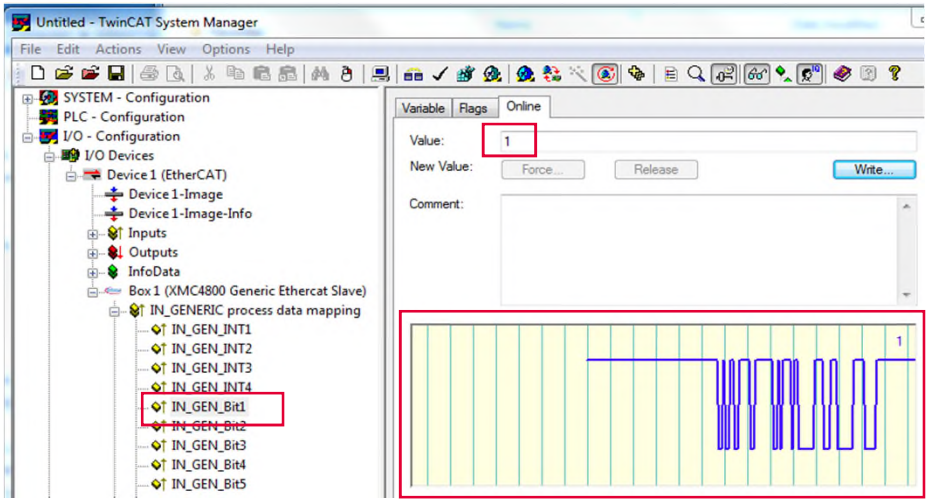
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How to test
Monitoring slave inputs on master

ACTIONS

While pushing Button1 on „XMC4800 Relax EtherCAT® Kit" button state is updated on host.





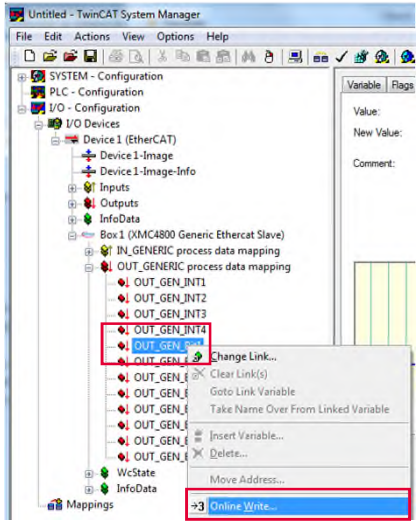
State of IN_GEN_Bit1 changes according state of BUTTON1. Same is true for IN_GEN_Bit2 and BUTTON2.

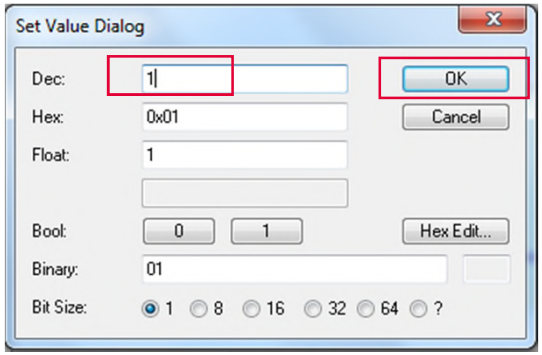
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How to test
Setting slave outputs on master (1/2)

ACTIONS

Right click on OUT_GEN_Bit1 of the slave node and select „Online Write…“ inside the context menu. Change the value from 0 to 1 to switch on LED1/ from 1 to 0 to switch off LED1.





OBSERVATION

LED1 „XMC™ EtherCAT® PHY Board“ is turned on/off according to OUT_GEN_Bit1 setting.

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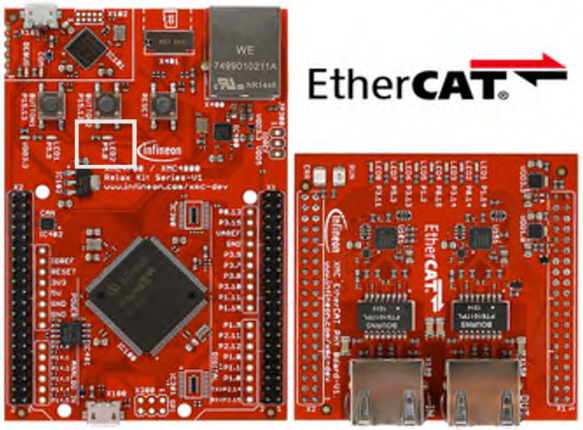
How to test
Setting slave outputs on master (2/2)

ACTION

1. Right click on OUT_GEN_INT1 of the slave node and select „Online Write…" inside the context menu. Change the value from 0 to 50000.

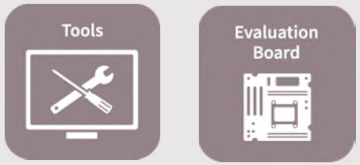
OBSERVATION

1. Brightness of LED2 on „XMC4800 Relax EtherCAT® Kit" is dimmed. Setting OUT_GEN_INT1 to 65535 the LED2 is turned off. The lower the value, the brighter the LED2.



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