

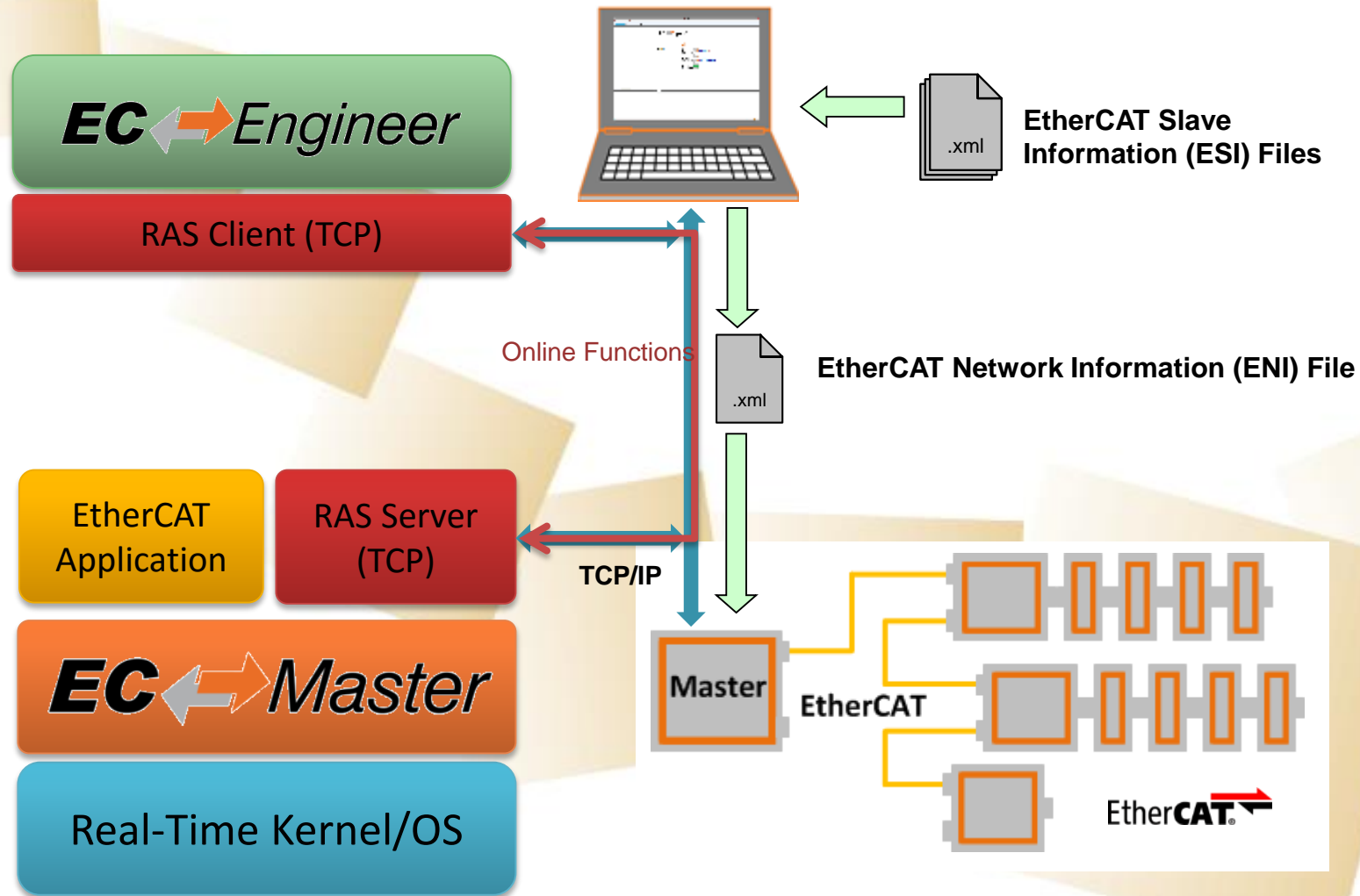
EC-Master EtherCAT Master

Quick Start Guide

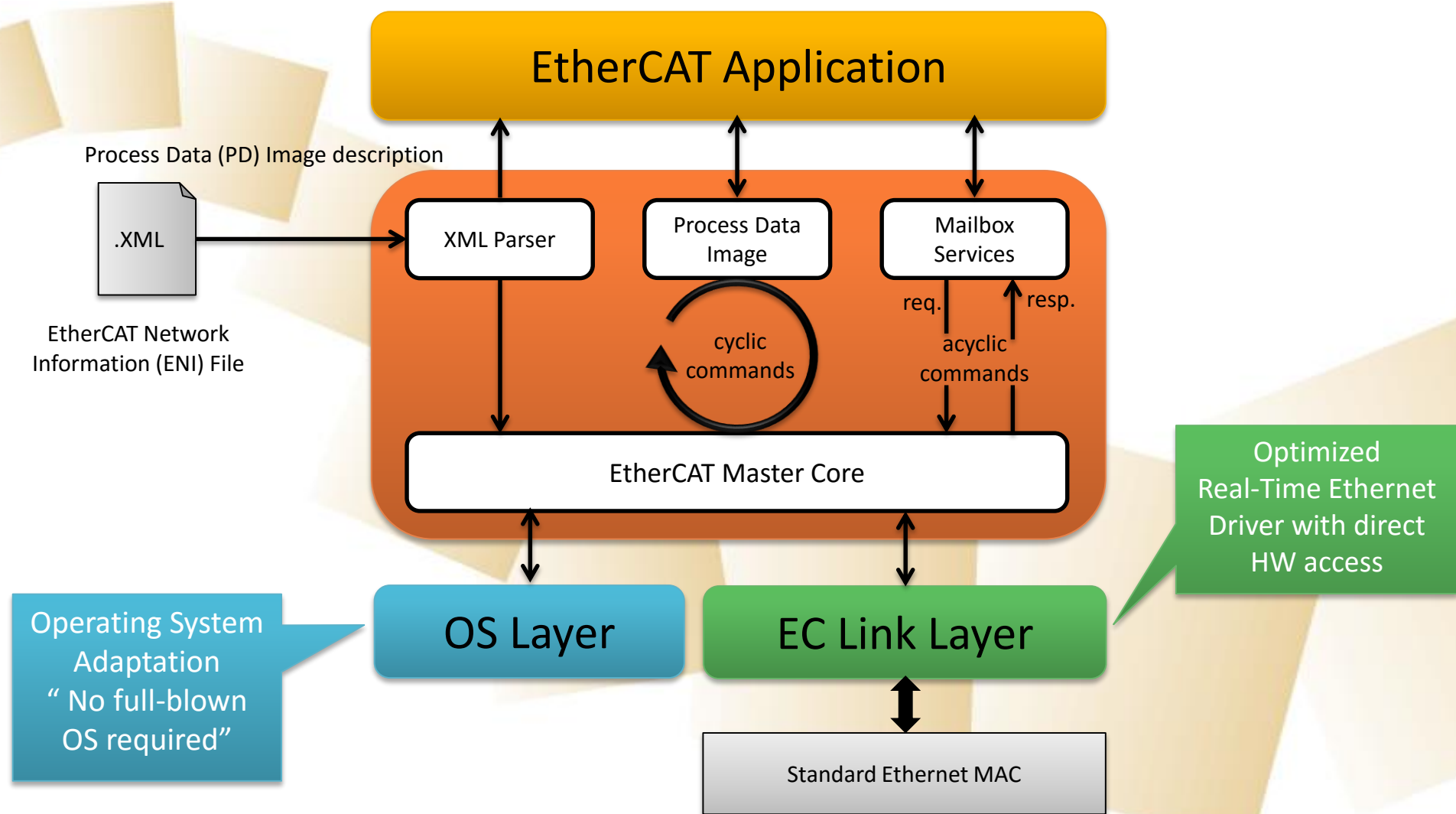
- EtherCAT System Architecture
- EtherCAT Master Architecture
- EtherCAT Master Building Blocks
- Generate bus configuration with EC-Engineer
- Operate slaves with EC-STA EtherCAT Slave Test Application
- Connect EC-Engineer with EC-STA Application
- Next steps

EtherCAT System Architecture

EC  **Master**



EC-Master Architecture



EC-Master according to ETG.1500 Master Classes Directive

Class A Core

- Compare network configuration
- Cyclic process data exchange
- All mailbox protocols: CoE, SoE, EoE, FoE, AoE, VoE
- Slave to slave communication
- **Distributed Clocks with master synchronization**

Class B Core

- Compare network configuration
- Cyclic process data exchange
- Mailbox protocol CoE
- Mailbox protocol SoE
- Mailbox protocol EoE
- Slave to slave communication

Feature Pack
Cable Redundancy

Feature Pack
Hot Connect

Feature Pack
Remote Access

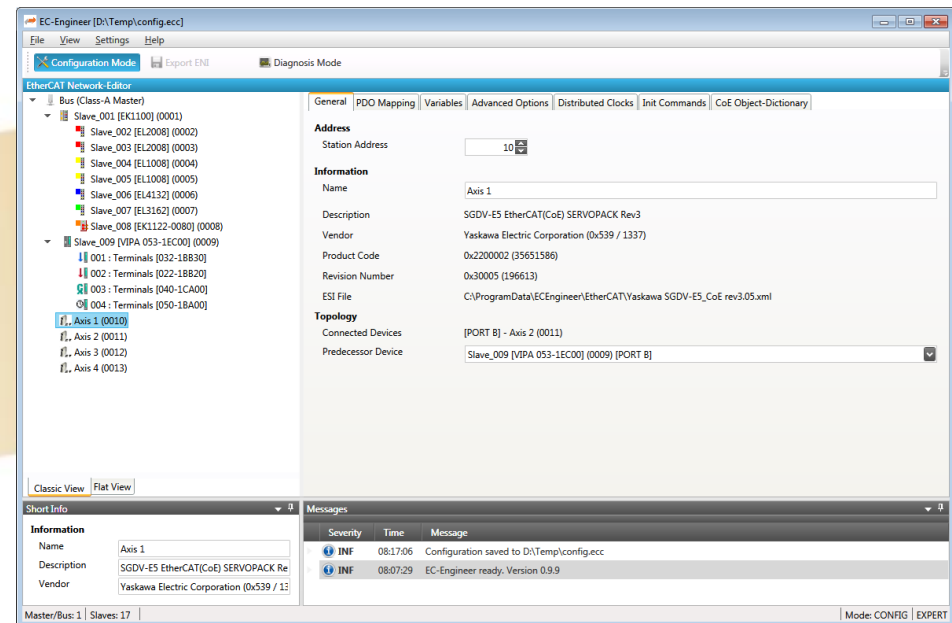
Feature Pack
Superset ENI

Feature Pack
EoE Endpoint

Feature Pack
Master Obj. Dict.

EC-Engineer: Overview

- One single tool for EtherCAT configuration and diagnosis
- Perfect supplement to EC-Master
- Import of EtherCAT Slave Information (ESI) files
- Export of EtherCAT Network Information (ENI) file
- Register here to get a free evaluation version:
<http://www.acontis.com/eng/products/downloads/index.php>

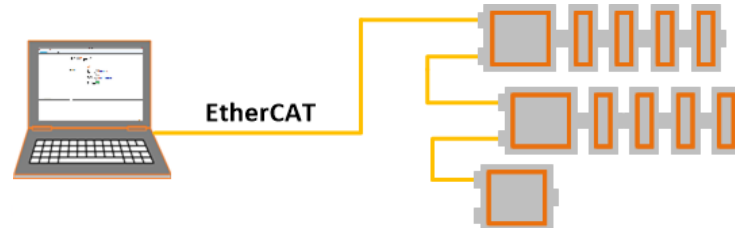


EC-Engineer Operating Modes

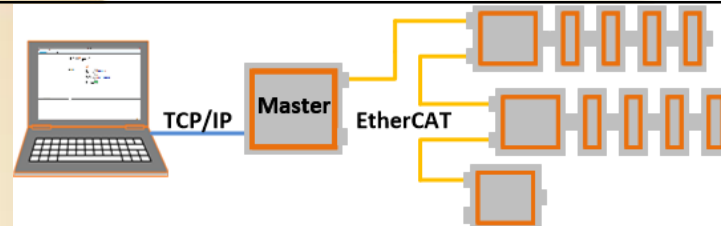
Offline **Configuration:**
(In the Office)



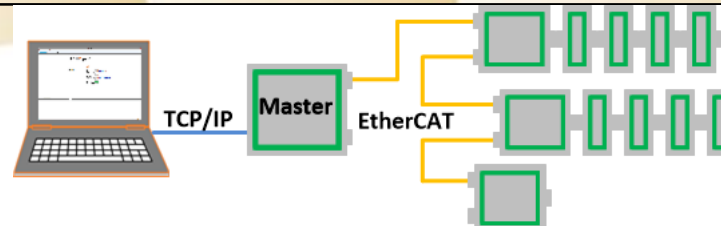
Online **Configuration:**
Slaves connected to
Engineering System



Remote **Configuration:**
Slaves connected to
Target System



Remote **Diagnosis:**
Slaves connected to
Target System



Generate bus configuration with EC-Engineer

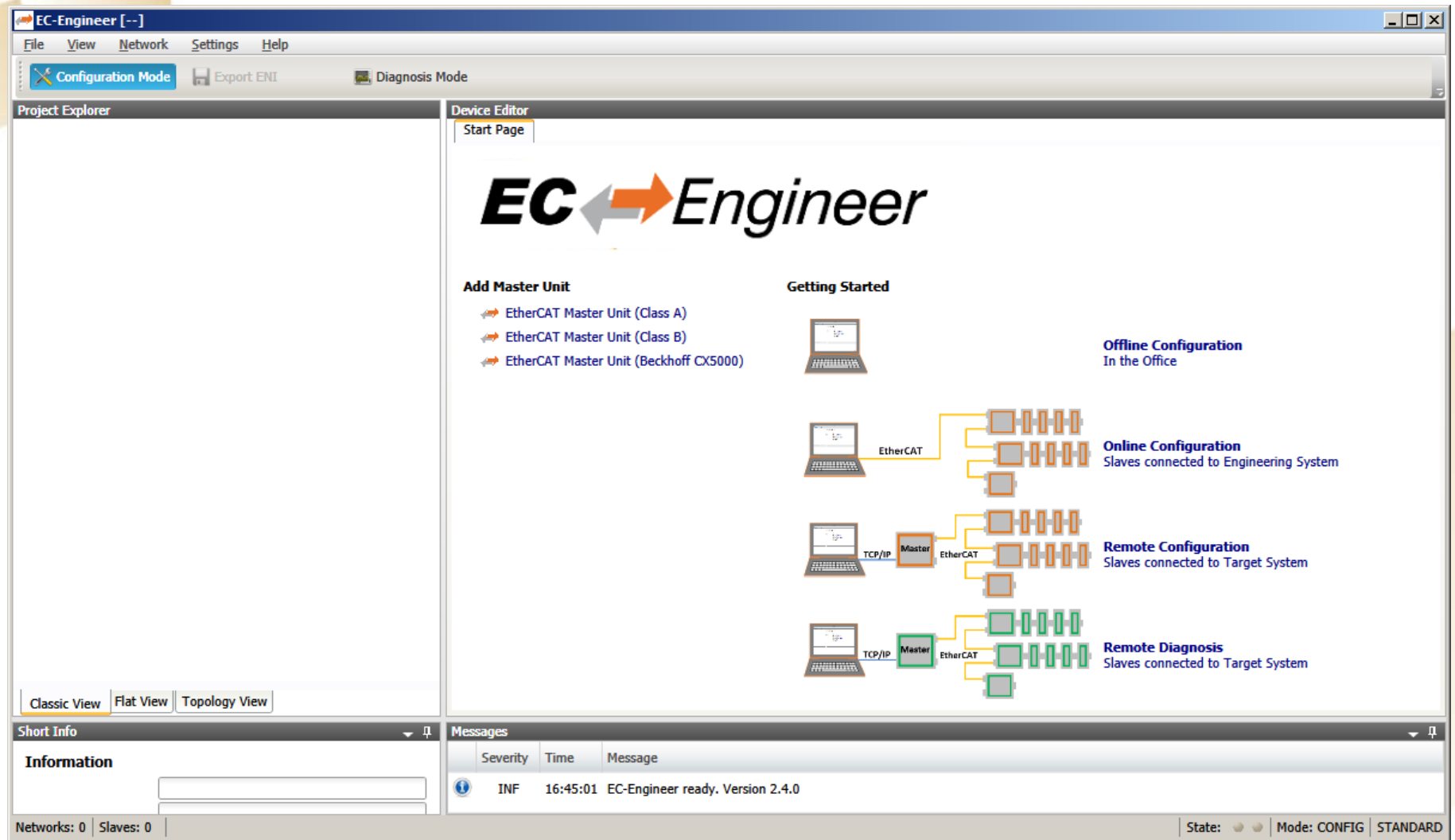
Step 1: Connect EtherCAT Slaves

- EC-Engineer comes with an integrated EtherCAT master for scanning the connected EtherCAT slaves
- Every Ethernet Network Interface with an valid Windows driver can be used
- A second, dedicated Network Interface for EtherCAT is recommend
- Warning: Do not connect any EtherCAT slaves to your Office LAN



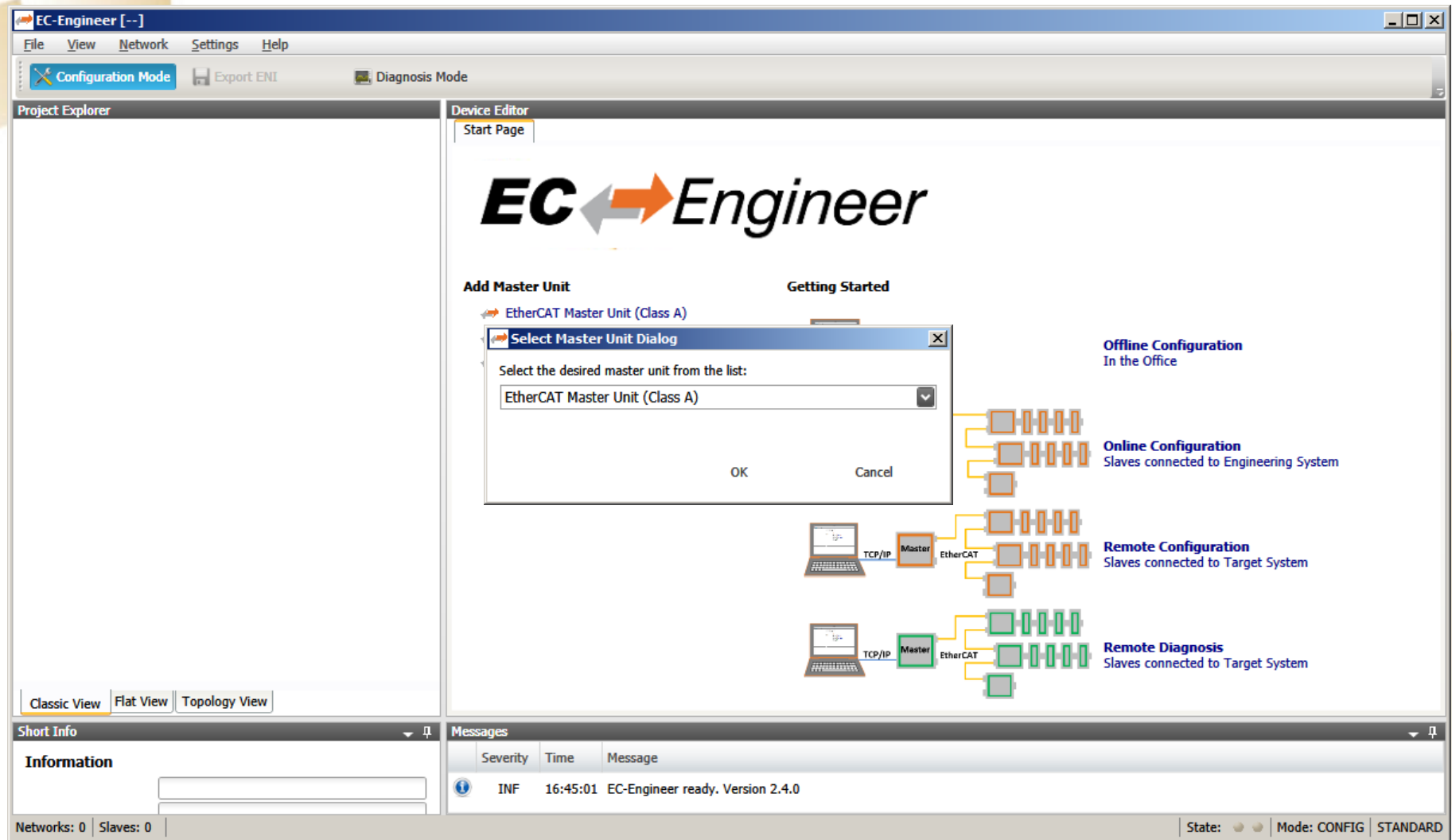
Generate bus configuration with EC-Engineer

Step 2: Install and start EC-Engineer



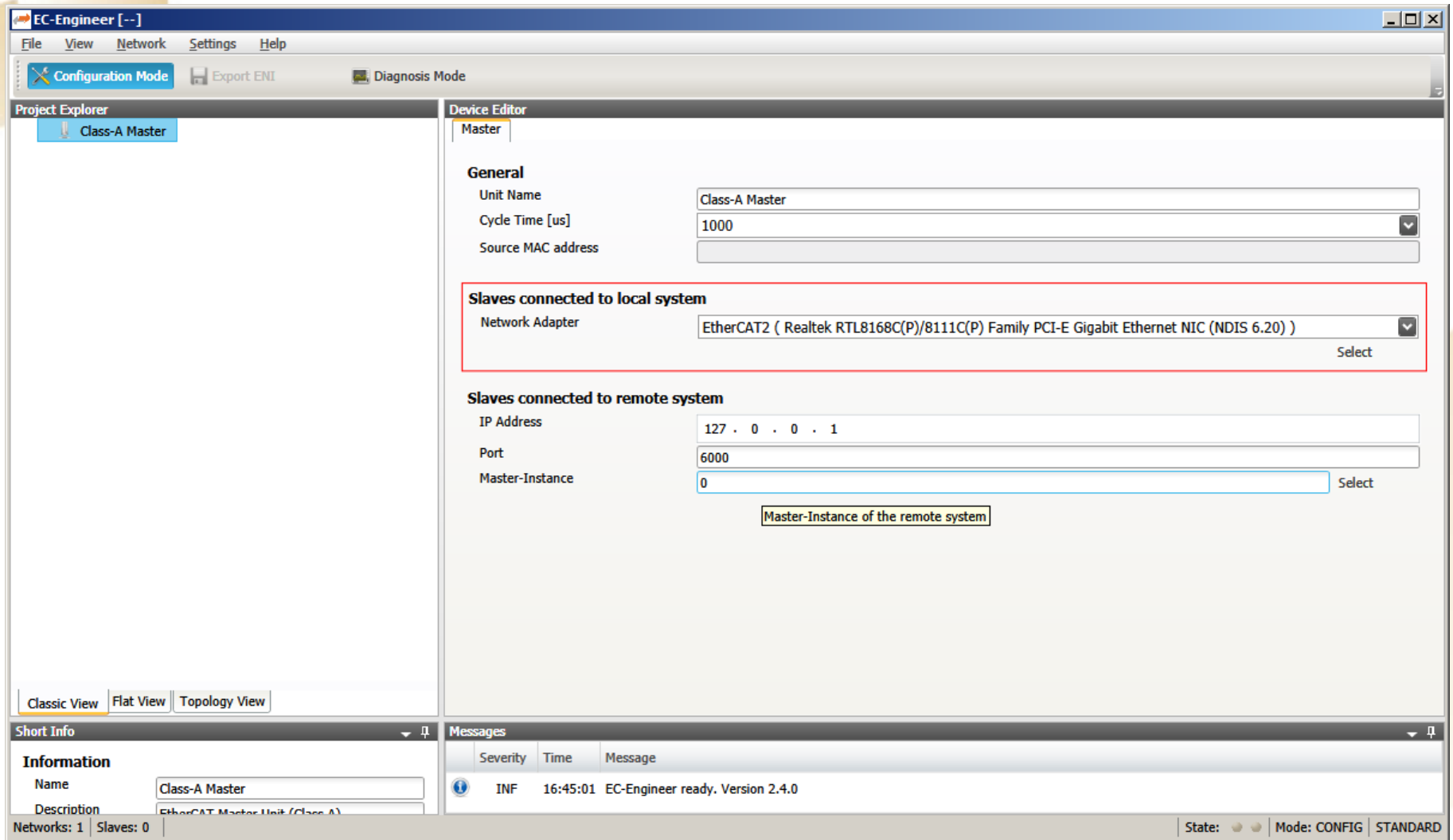
Generate bus configuration with EC-Engineer

Step 3: Select "Online Configuration" and "EtherCAT Master Unit (Class A)"



Generate bus configuration with EC-Engineer

Step 4: Choose network adapter from list and press "Select"



The screenshot shows the EC-Engineer software interface. The main window is titled "EC-Engineer [--]" and has a menu bar with "File", "View", "Network", "Settings", and "Help". Below the menu bar is a toolbar with "Configuration Mode" (selected), "Export ENI", and "Diagnosis Mode".

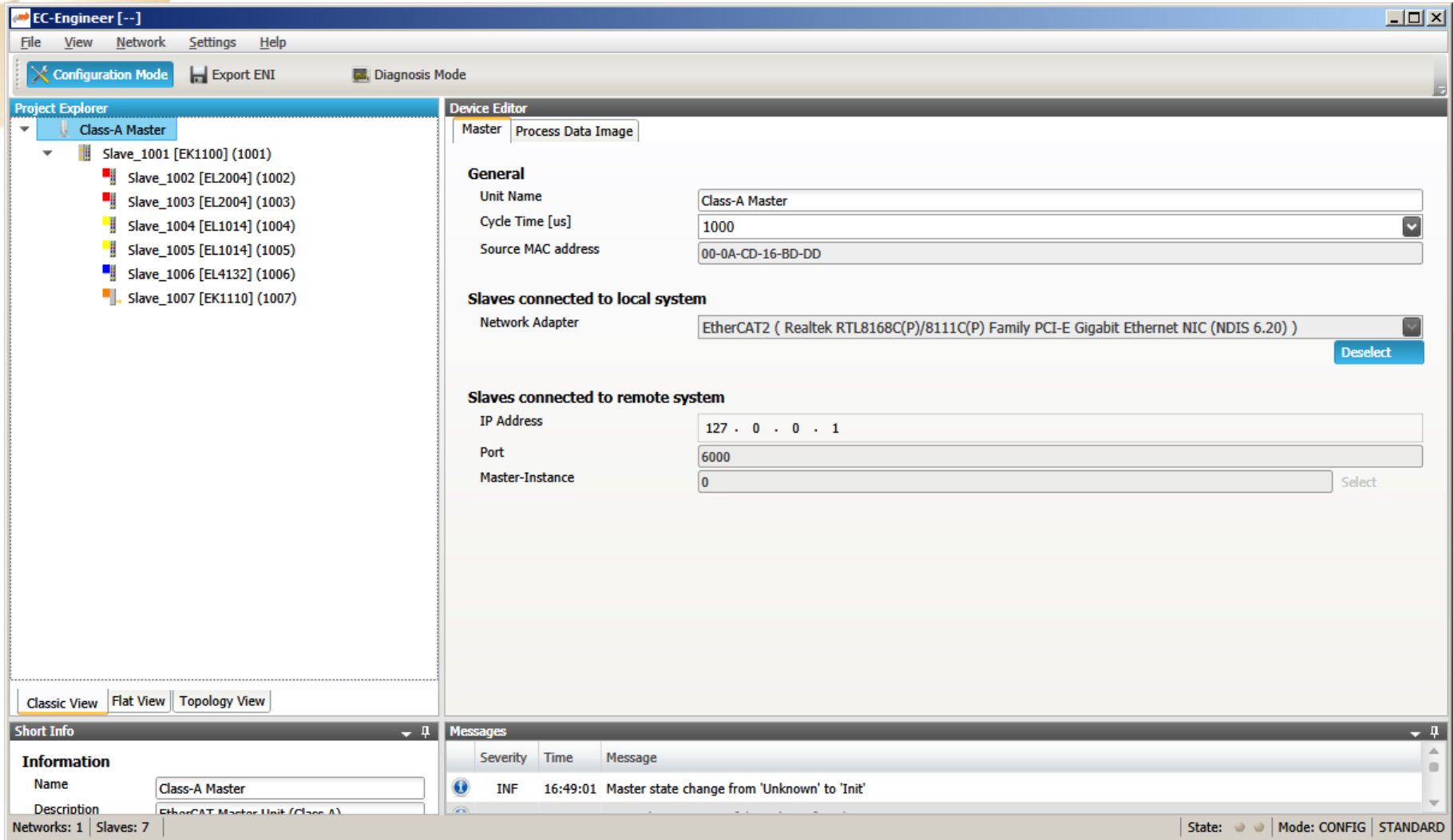
The interface is divided into several panes:

- Project Explorer:** Shows a tree view with "Class-A Master" selected.
- Device Editor:** Contains configuration fields for the selected device.
 - General:**
 - Unit Name: "Class-A Master"
 - Cycle Time [us]: "1000" (with a dropdown arrow)
 - Source MAC address: (empty field)
 - Slaves connected to local system:** (Highlighted with a red box)
 - Network Adapter: "EtherCAT2 (Realtek RTL8168C(P)/8111C(P) Family PCI-E Gigabit Ethernet NIC (NDIS 6.20))" (with a dropdown arrow and a "Select" button)
 - Slaves connected to remote system:**
 - IP Address: "127 . 0 . 0 . 1"
 - Port: "6000"
 - Master-Instance: "0" (with a "Select" button)
 - Below the Master-Instance field is a label: "Master-Instance of the remote system"
- Short Info:** Contains information about the selected device.
 - Information:
 - Name: "Class-A Master"
 - Description: "EtherCAT Master Unit (Class-A)"
 - Networks: 1 | Slaves: 0
- Messages:** A log of messages.
 - Severity: "INF" (Information)
 - Time: "16:45:01"
 - Message: "EC-Engineer ready. Version 2.4.0"

At the bottom right, there is a status bar with "State: (two small circular icons)", "Mode: CONFIG", and "STANDARD".


Generate bus configuration with EC-Engineer

Step 5: The found slave devices are listed in the tree



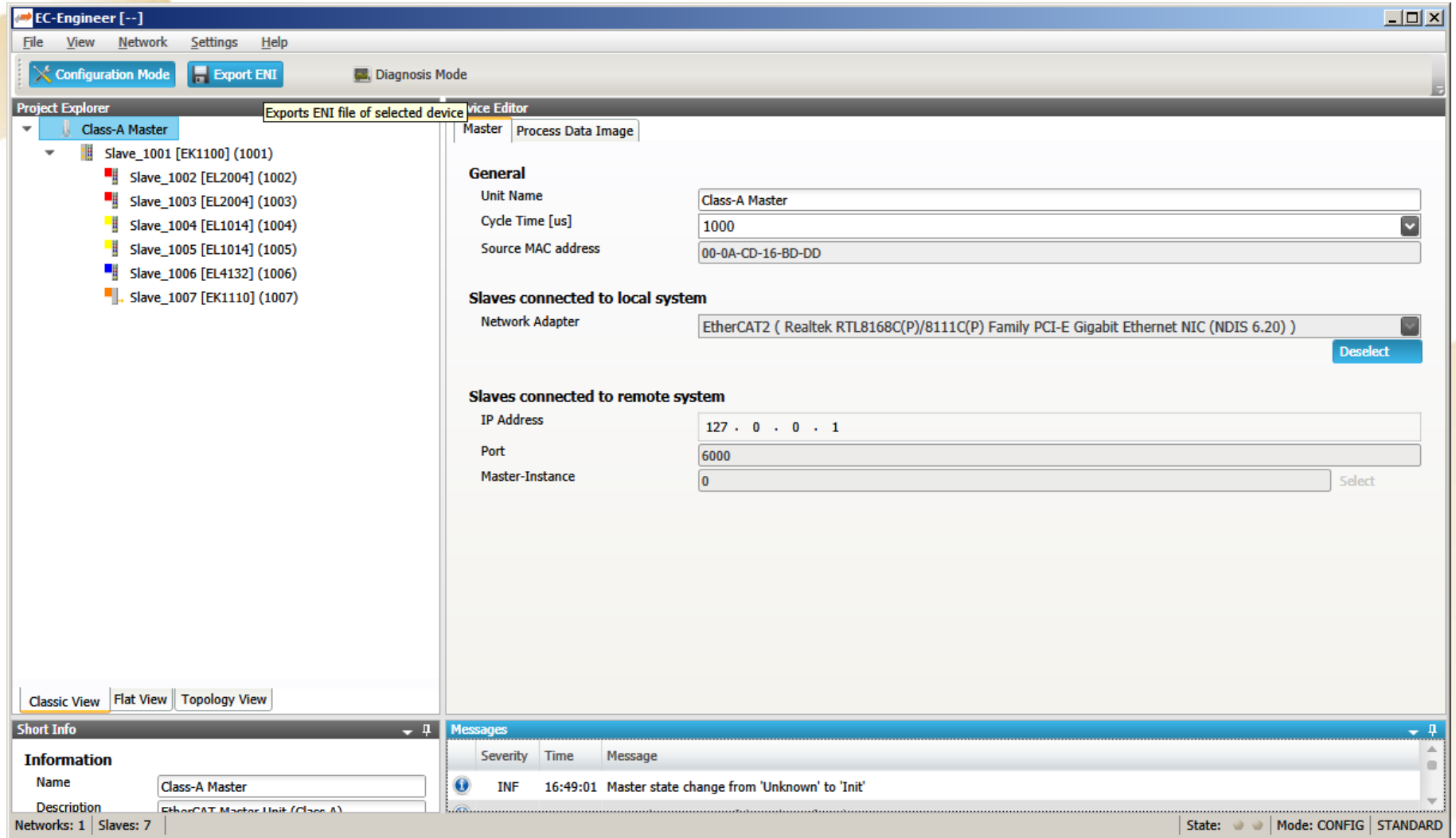
The screenshot displays the EC-Engineer software interface, which is used for configuring bus systems. The interface is divided into several sections:

- Project Explorer:** Located on the left, it shows a tree structure of the project. Under the 'Class-A Master' node, seven slave devices are listed: Slave_1001 [EK1100] (1001), Slave_1002 [EL2004] (1002), Slave_1003 [EL2004] (1003), Slave_1004 [EL1014] (1004), Slave_1005 [EL1014] (1005), Slave_1006 [EL4132] (1006), and Slave_1007 [EK1110] (1007).
- Device Editor:** Located on the right, it provides configuration options for the selected device. The 'Master' tab is active, showing the following settings:
 - General:** Unit Name (Class-A Master), Cycle Time [us] (1000), and Source MAC address (00-0A-CD-16-BD-DD).
 - Slaves connected to local system:** Network Adapter (EtherCAT2 (Realtek RTL8168C(P)/8111C(P) Family PCI-E Gigabit Ethernet NIC (NDIS 6.20))).
 - Slaves connected to remote system:** IP Address (127 . 0 . 0 . 1), Port (6000), and Master-Instance (0).
- Short Info:** Located at the bottom left, it provides a summary of the configuration, including the Name (Class-A Master) and Description (EtherCAT Master Unit (Class-A)).
- Messages:** Located at the bottom right, it displays a log of events. The current message is: 'Master state change from 'Unknown' to 'Init''.

The status bar at the bottom indicates the current state: State:  Mode: CONFIG STANDARD.

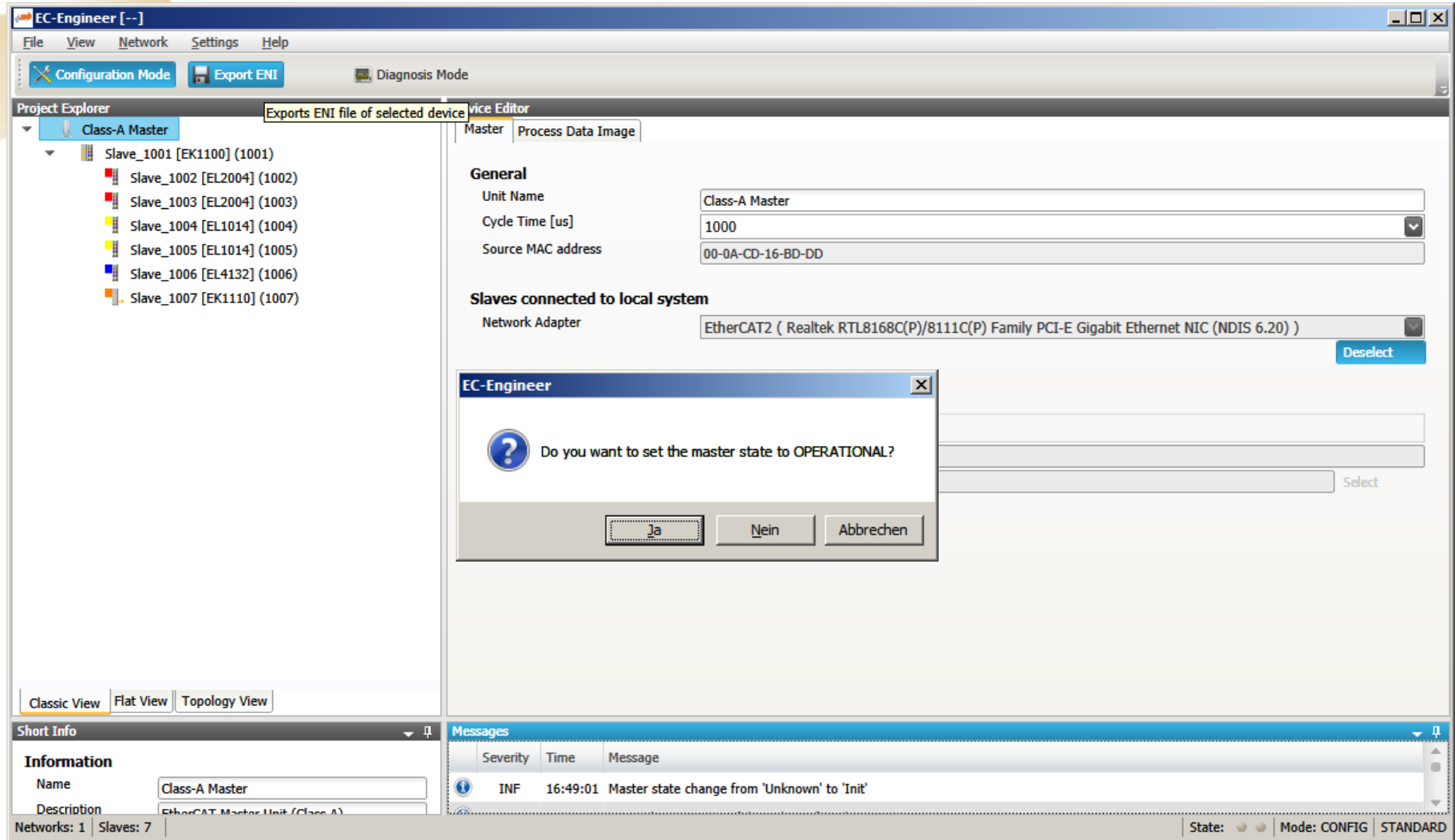
Generate bus configuration with EC-Engineer

Step 6: Export ENI file



Generate bus configuration with EC-Engineer

Step 7: Switch to "Diagnosis Mode" and set state to OPERATIONAL



Generate bus configuration with EC-Engineer

Step 8: Bus is OPERATIONAL

The screenshot displays the EC-Engineer software interface, which is used for configuring and monitoring a bus system. The interface is divided into several panels:

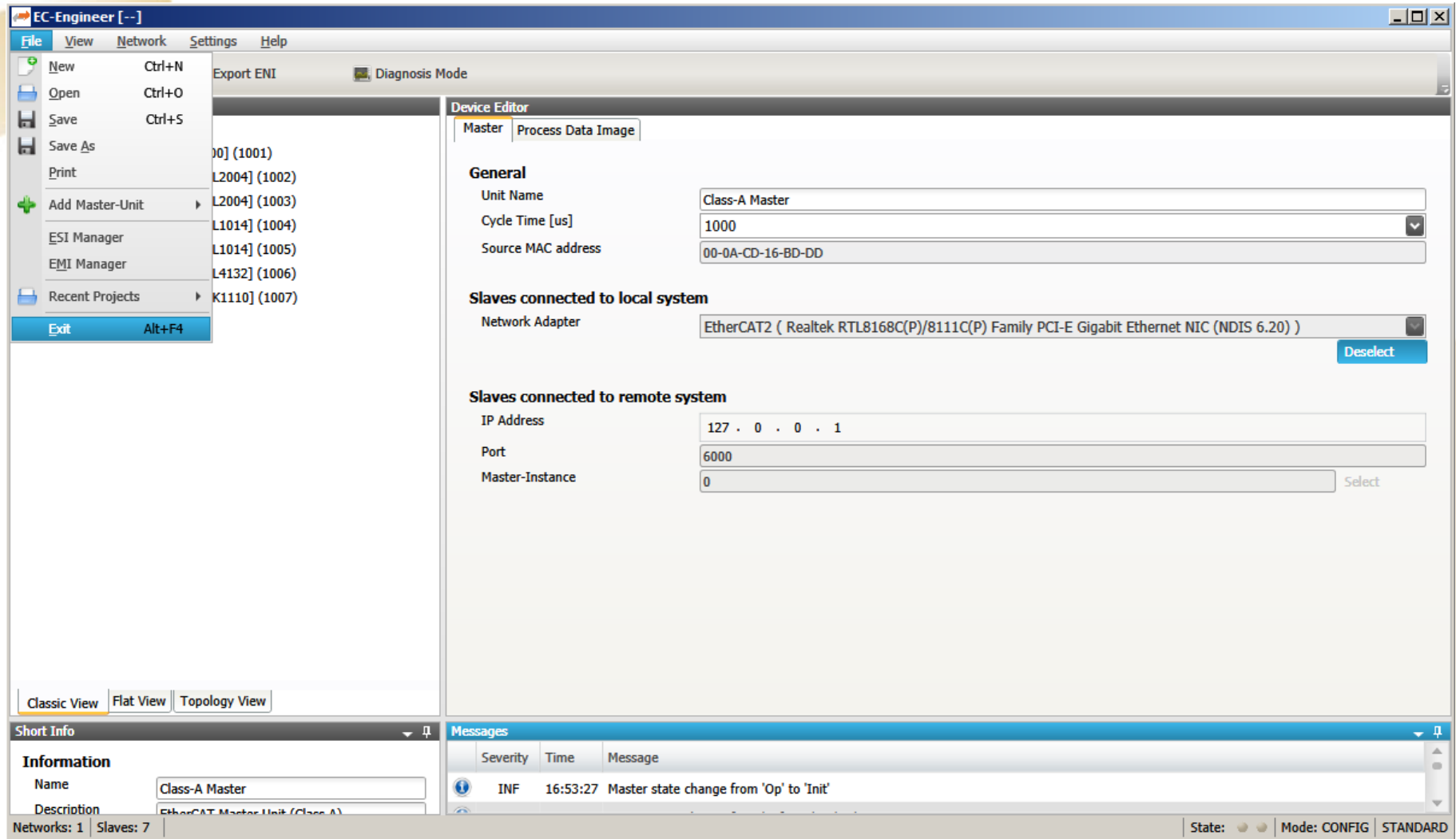
- Project Explorer:** Shows a tree view of the bus configuration. The root node is "Class-A Master <connected>". Under it, there are seven slave nodes, each represented by a green circle and labeled "Slave_1001 [EK1100] (1001)" through "Slave_1007 [EK1110] (1007)".
- Device Editor:** Contains tabs for "General", "Process Data Image", and "Watch list". The "General" tab is active, showing the "State Machine" and "Information" sections.
 - State Machine:** Displays the current state as "Op" and the requested state as "Op". It also shows the change state options: "Init", "Bootstrap", "Pre-Op", "Safe-Op", and "Op".
 - Information:** A table of system parameters:

Parameter	Value
Number of found slaves	7
Number of slaves in configuration	7
Number of DC slaves	0
DC in-sync	-
Topology Ok	Yes
Link Connected	Yes
Slaves in Master State	Yes
 - Frame Counter:** A table of frame statistics:

Parameter	Value
Sent frames	52532
Lost frames	0
Cyclic frames	52416
Acyclic frames	116
- Short Info:** A panel at the bottom left showing the "Information" section with fields for "Name" (Class-A Master) and "Description" (EtherCAT Master Unit (Class-A)). It also displays "Networks: 1" and "Slaves: 7".
- Messages:** A panel at the bottom right showing a log of messages. The latest message is "INF 16:52:50 Master state change from 'Safe-Op' to 'Op'".
- Bottom Status Bar:** Displays the current state as "State: [Green Circle]" and the mode as "Mode: DIAGNOSIS | STANDARD".

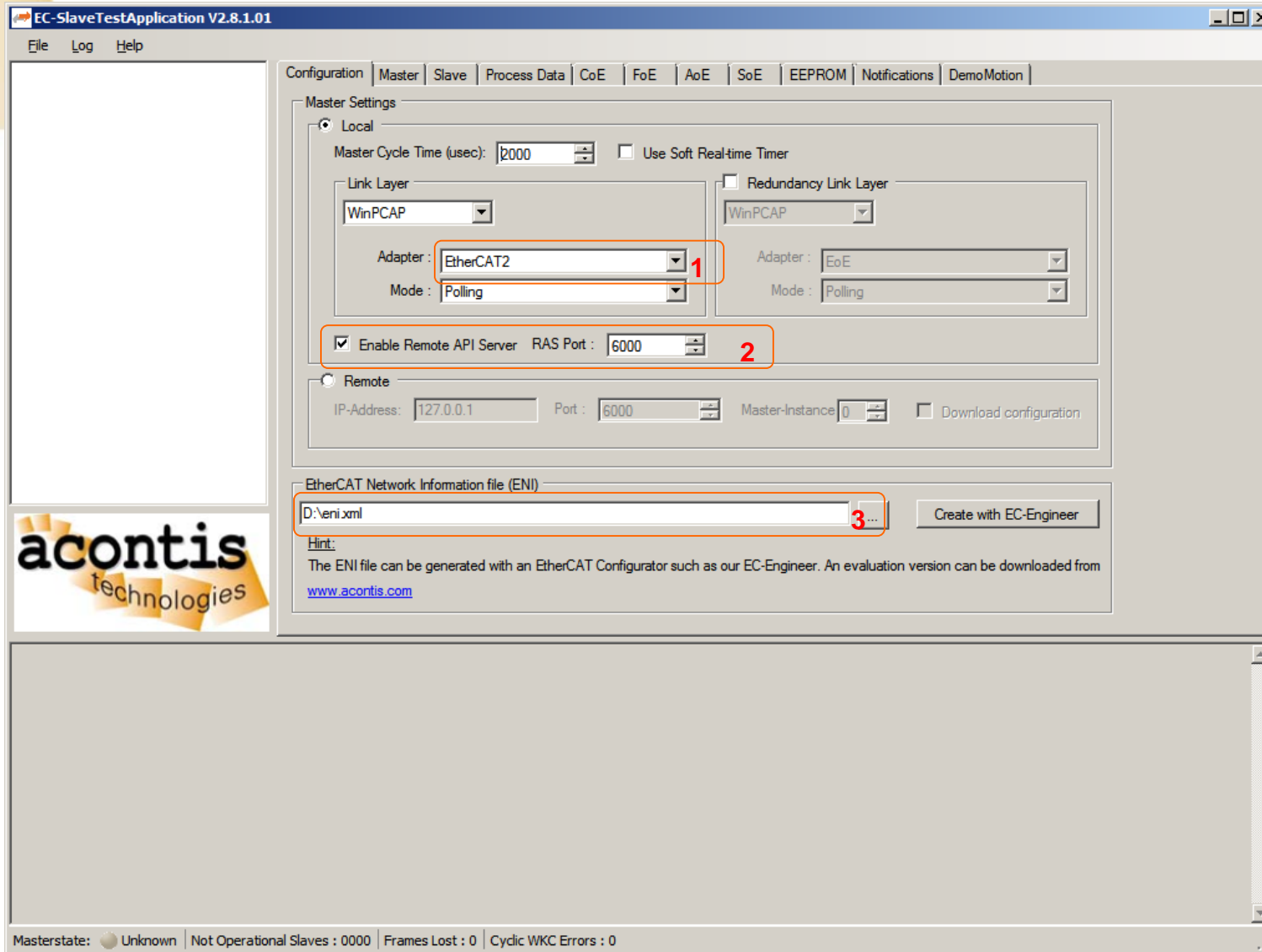
Generate bus configuration with EC-Engineer

Step 9: Switch back to "Configuration Mode" and Exit



Operate slaves with EC-STA Slave Test Application

Step 1: Start EC-STA and setup configuration



EC-SlaveTestApplication V2.8.1.01

File Log Help

Configuration Master Slave Process Data CoE FoE AoE SoE EEPROM Notifications DemoMotion

Master Settings

Local

Master Cycle Time (usec): 2000 Use Soft Real-time Timer

Link Layer: WinPCAP Adapter: EtherCAT2 Mode: Polling

Redundancy Link Layer: WinPCAP Adapter: EoE Mode: Polling

☒ Enable Remote API Server RAS Port: 6000

Remote

IP-Address: 127.0.0.1 Port: 6000 Master-Instance: 0 Download configuration

EtherCAT Network Information file (ENI)

D:\eni.xml

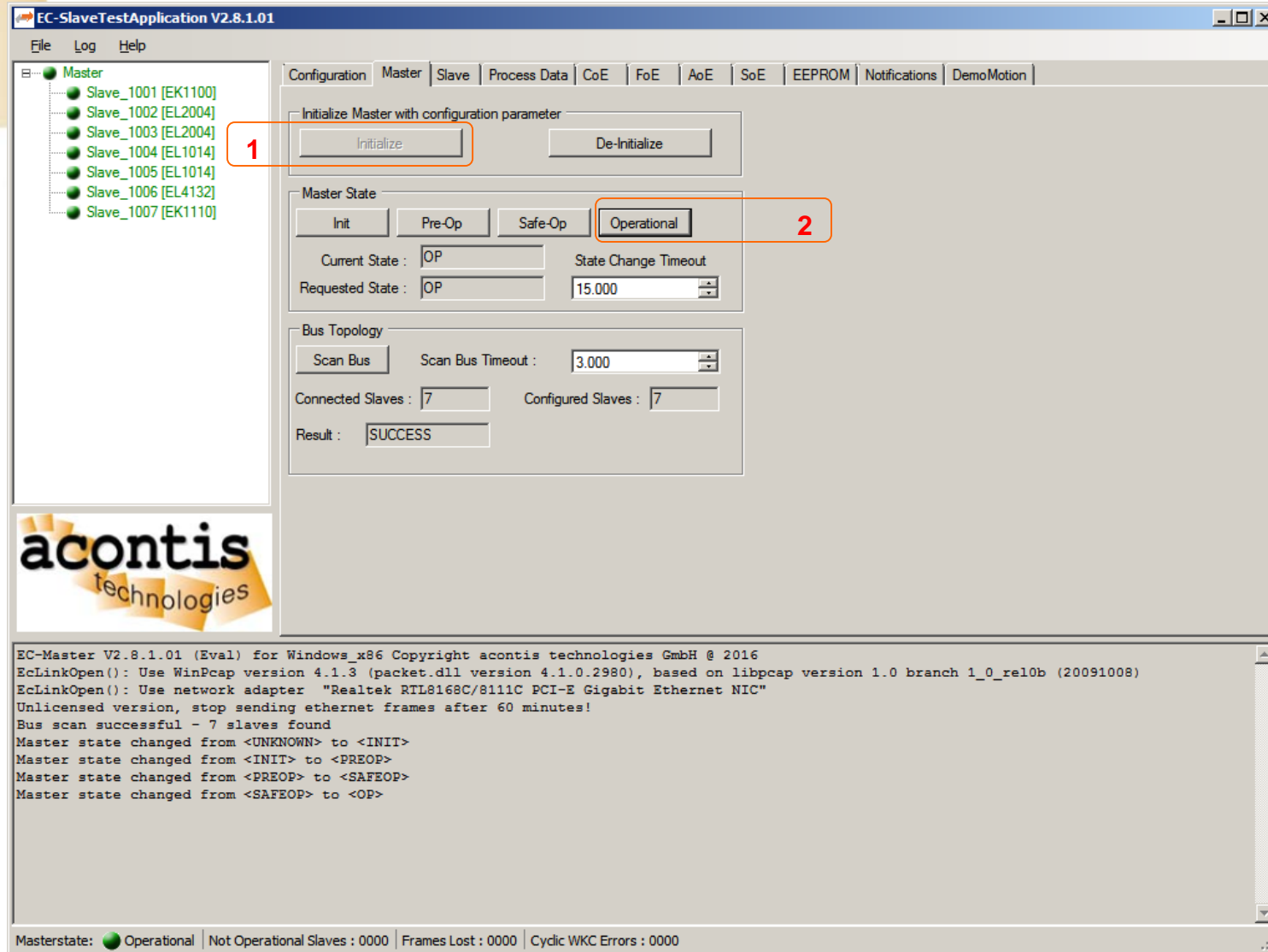
Create with EC-Engineer

Hint:
The ENI file can be generated with an EtherCAT Configurator such as our EC-Engineer. An evaluation version can be downloaded from www.acontis.com

Masterstate: Unknown Not Operational Slaves: 0000 Frames Lost: 0 Cyclic WKC Errors: 0

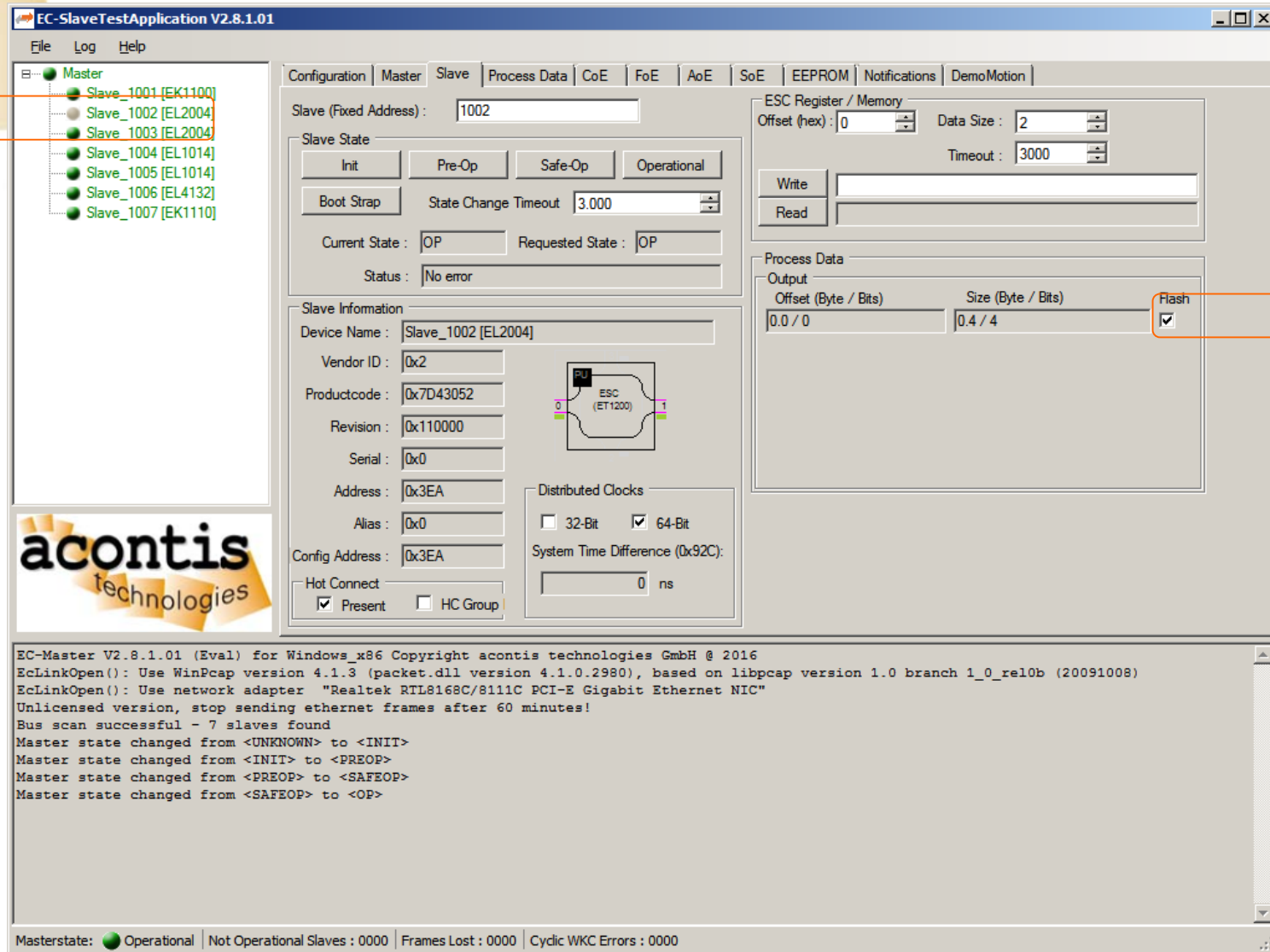
Operate slaves with EC-STA Slave Test Application

Step 2: Initialize and set master state to operational



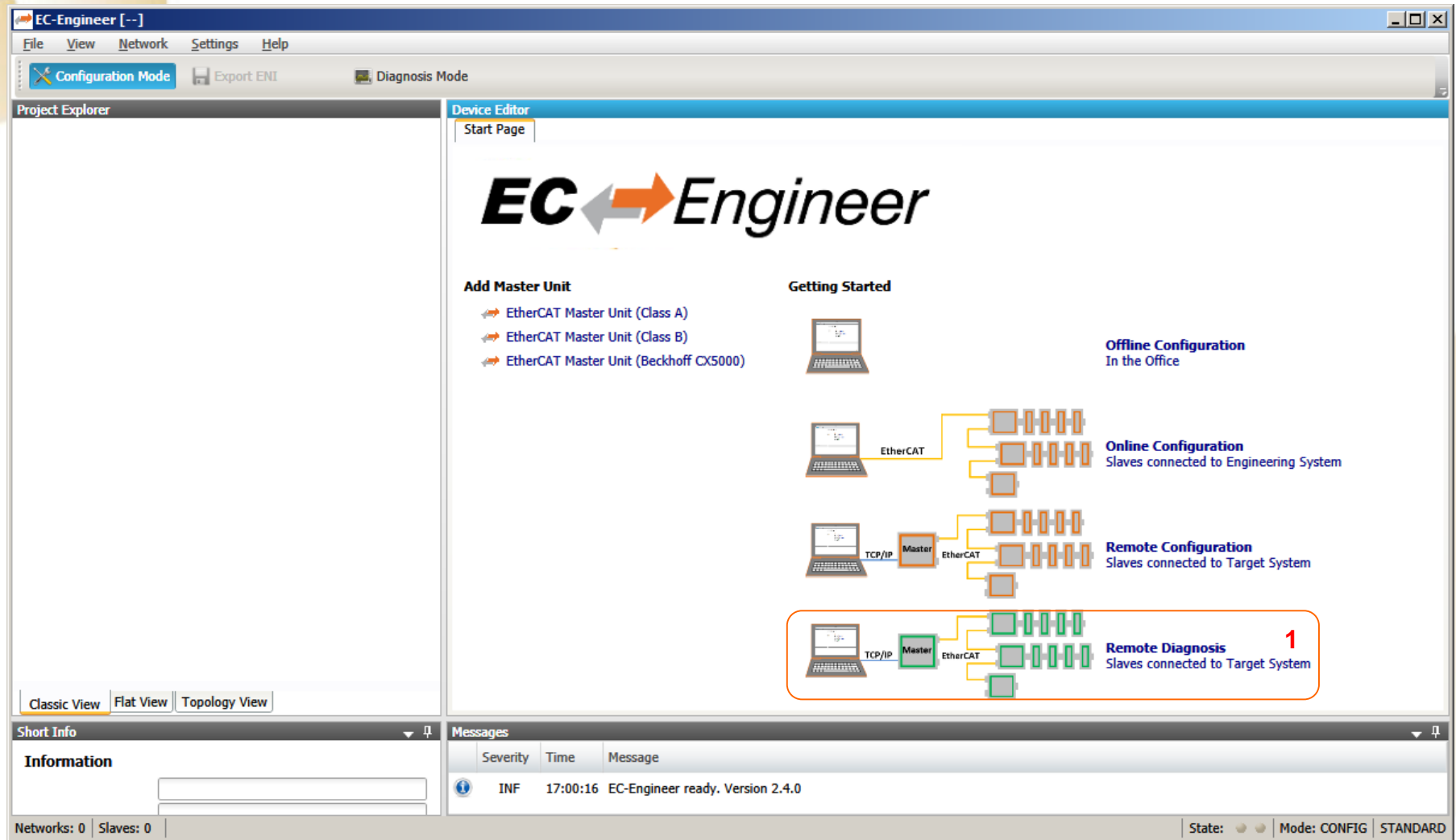
Operate slaves with EC-STA Slave Test Application

Step 3: Do further tests, e. g., flashing outputs



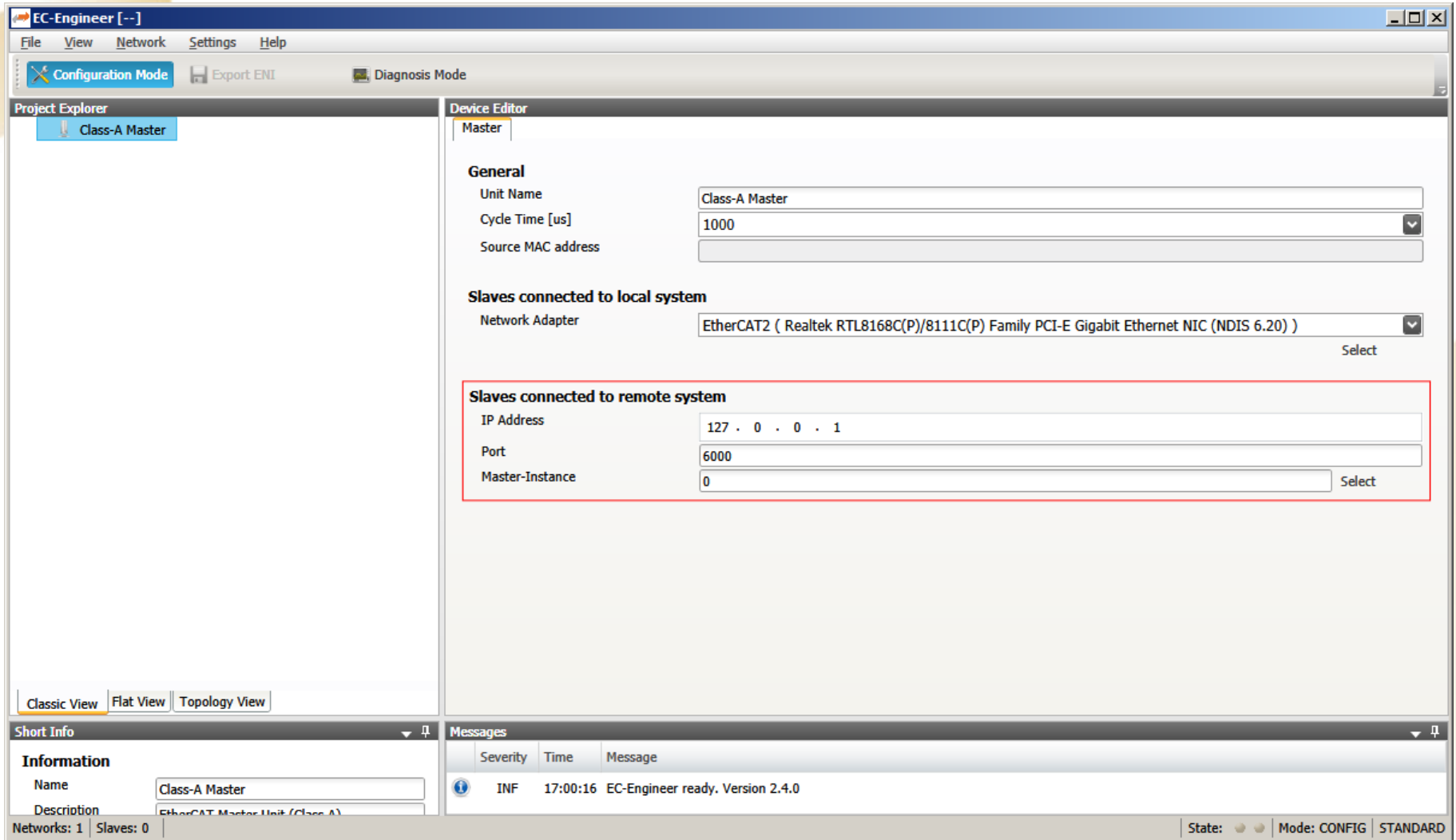
Connect EC-Engineer with EC-STA Application

Step 1: Start EC-Engineer and select "Remote Diagnosis"



Connect EC-Engineer with EC-StA Application

Step 2: Choose "Slaves connected to remote system"



The screenshot shows the EC-Engineer software interface. The main window is titled "EC-Engineer [--]" and has a menu bar with "File", "View", "Network", "Settings", and "Help". Below the menu bar are three tabs: "Configuration Mode" (selected), "Export ENI", and "Diagnosis Mode".

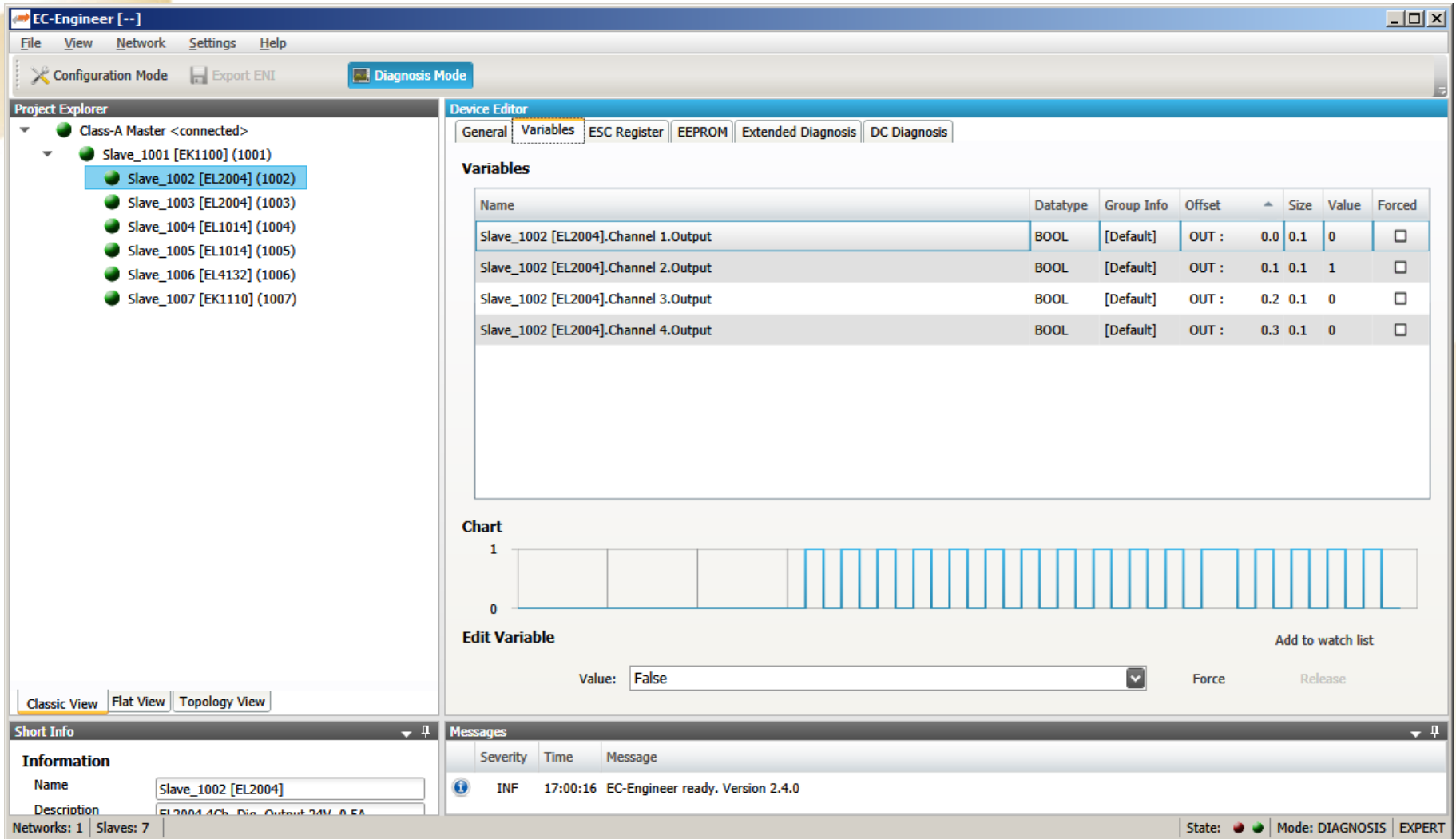
The interface is divided into several sections:

- Project Explorer:** Located on the left, it shows a tree view with "Class-A Master" selected.
- Device Editor:** Located on the right, it shows the configuration for the selected device. It has a tab labeled "Master".
 - General:** Contains fields for "Unit Name" (Class-A Master), "Cycle Time [us]" (1000), and "Source MAC address".
 - Slaves connected to local system:** Contains a dropdown for "Network Adapter" (EtherCAT2 (Realtek RTL8168C(P)/8111C(P) Family PCI-E Gigabit Ethernet NIC (NDIS 6.20))).
 - Slaves connected to remote system:** This section is highlighted with a red border. It contains fields for "IP Address" (127 . 0 . 0 . 1), "Port" (6000), and "Master-Instance" (0).
- Short Info:** Located at the bottom left, it shows "Information" for the selected device, including "Name" (Class-A Master) and "Description" (EtherCAT Master Unit (Class A)).
- Messages:** Located at the bottom right, it shows a log of messages. The current message is "INF 17:00:16 EC-Engineer ready. Version 2.4.0".

At the bottom of the window, there is a status bar with "Networks: 1", "Slaves: 0", "State: ", "Mode: CONFIG", and "STANDARD".

Connect EC-Engineer with EC-STA Application

Step 3: Check input or output variables



Project Explorer

- Class-A Master <connected>
 - Slave_1001 [EK1100] (1001)
 - Slave_1002 [EL2004] (1002)**
 - Slave_1003 [EL2004] (1003)
 - Slave_1004 [EL1014] (1004)
 - Slave_1005 [EL1014] (1005)
 - Slave_1006 [EL4132] (1006)
 - Slave_1007 [EK1110] (1007)

Device Editor

General Variables ESC Register EEPROM Extended Diagnosis DC Diagnosis

Variables

Name	Datatype	Group Info	Offset	Size	Value	Forced
Slave_1002 [EL2004].Channel 1.Output	BOOL	[Default]	OUT :	0.0 0.1	0	<input type="checkbox"/>
Slave_1002 [EL2004].Channel 2.Output	BOOL	[Default]	OUT :	0.1 0.1	1	<input type="checkbox"/>
Slave_1002 [EL2004].Channel 3.Output	BOOL	[Default]	OUT :	0.2 0.1	0	<input type="checkbox"/>
Slave_1002 [EL2004].Channel 4.Output	BOOL	[Default]	OUT :	0.3 0.1	0	<input type="checkbox"/>

Chart

1

0

Edit Variable

Value:

Short Info

Information

Name: Slave_1002 [EL2004]

Description: EL2004 4Ch. Dig. Output 24V, 0.5A

Networks: 1 Slaves: 7

Messages

Severity	Time	Message
INF	17:00:16	EC-Engineer ready. Version 2.4.0

State: ● ● Mode: DIAGNOSIS EXPERT

Next Steps

- Run EcMasterDemo on your target system
→ EC-Master User Manual Chapter 3 “Software Integration”
- Learn more about EcMasterDemo and the application framework
→ EC-Master User Manual Chapter 3.3 “Application Framework”