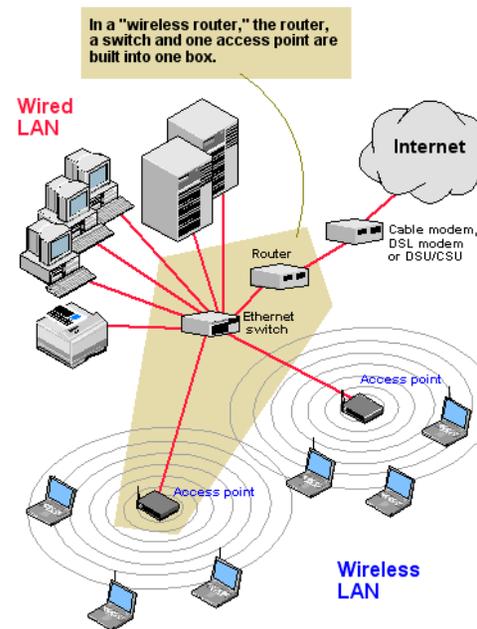


CoNeT Mobile Lab

Wireless Communication



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(Version 2)



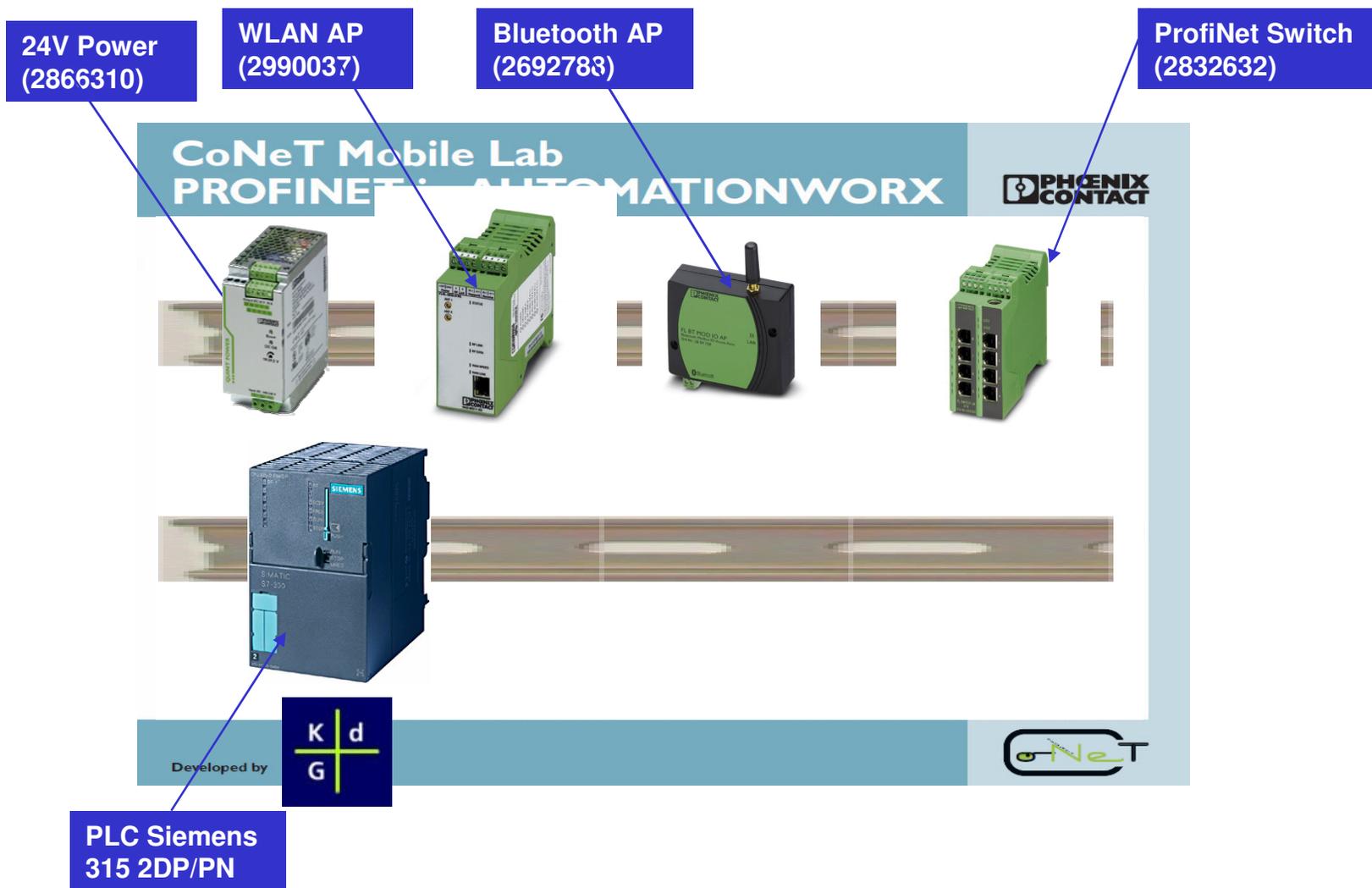
CoNeT Mobile Lab Wireless Communication

PART 2: Practical Aspects of Wireless Communication

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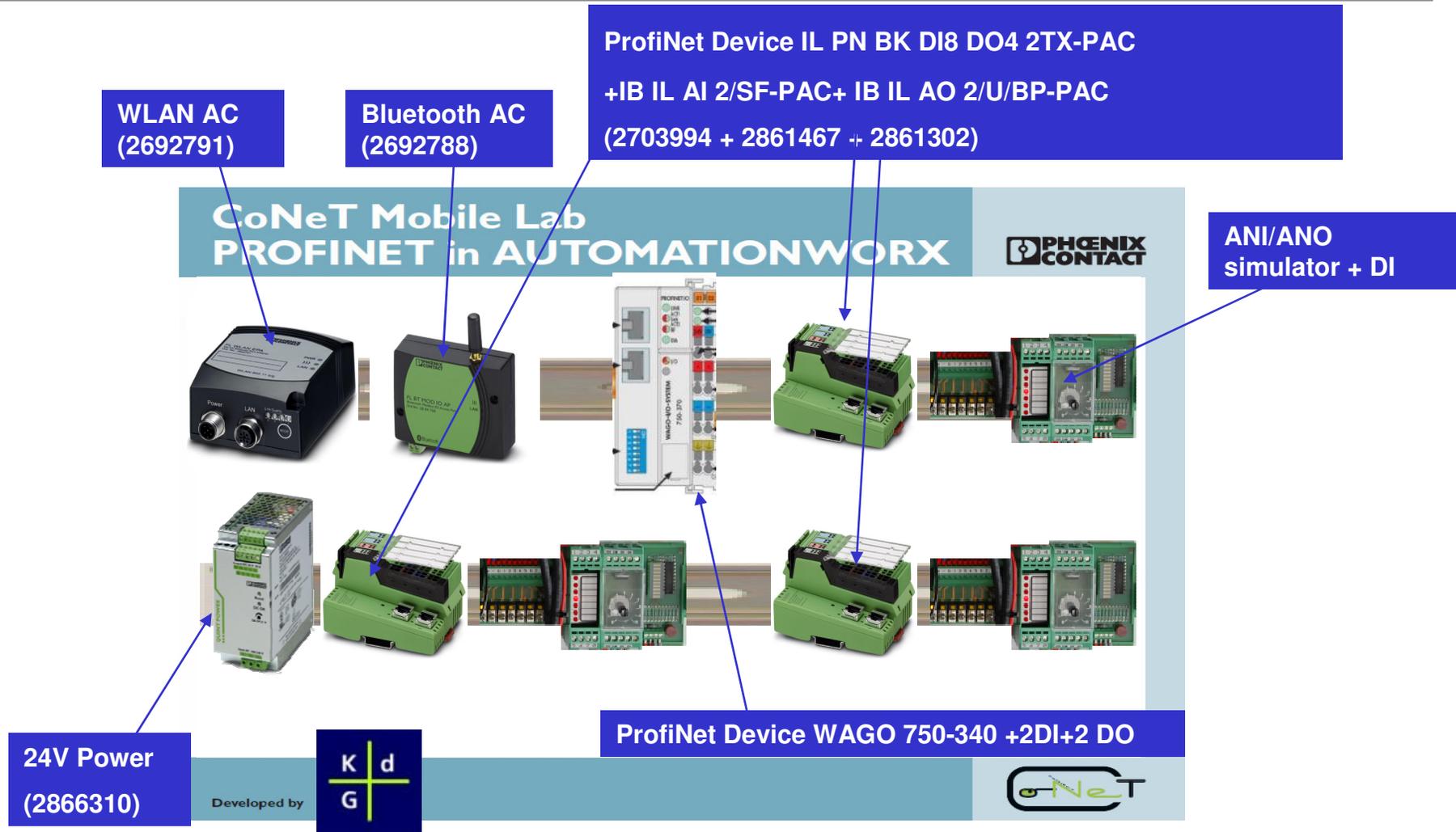


1. Overview of the Components in the Wireless CML(1)



Chapter 1: Overview of the Basic Components in de Wireless CML

1. Overview of the Components in the Wireless CML(2)



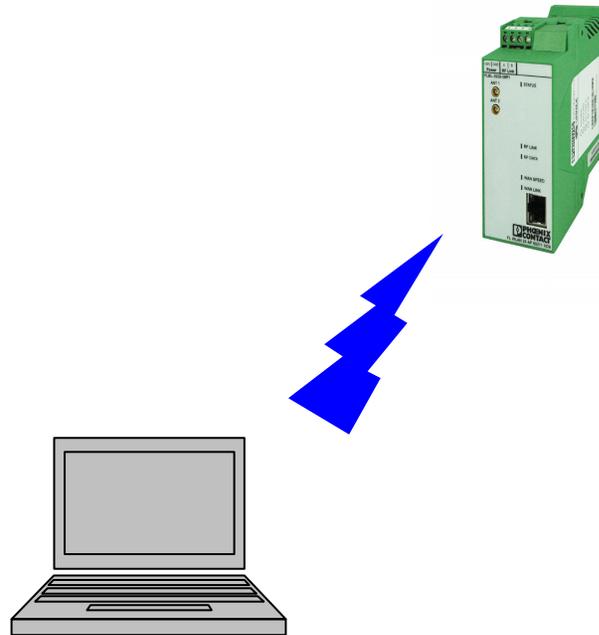
2. Description functionalities of the Wireless components

2.1 FL WLAN 24 AP 802-11 XDB

- wireless transceiver that can function as:
 - ✓ Access Point (AP)
 - ✓ Bridge
 - ✓ Access Client (AC)
- The transceivers can send Ethernet data with the option of adding serial data over the wireless link.
- Is conform to IEEE 802.11 a/b/g standards
- Security Mechanism
 - ✓ WEP Encryption (shared or open authentication)
 - ✓ WPA with TKIP/AES-CCMP Encryption
 - ✓ WPA-EAP-TLS, and WPA2-EAP-TLS
 - ✓ MAC Address Filtering
 - ✓ Bridge encryption (AES)

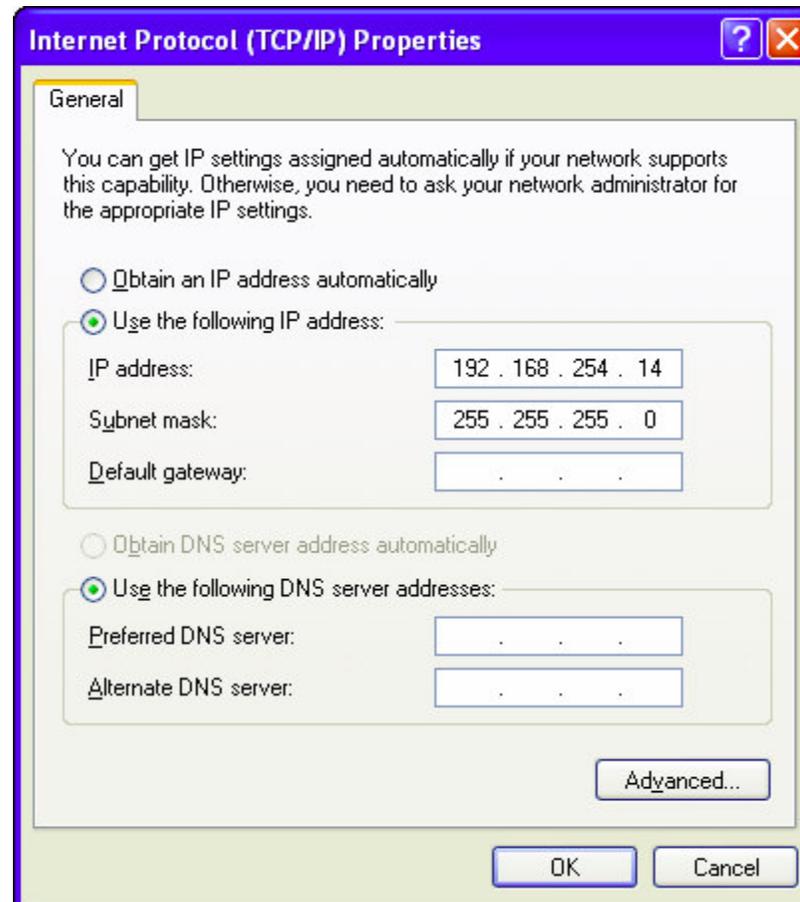


Ex 1: Wireless communication between PC with WLAN interface and the FL WLAN 24 AP 802-11 XDB



2.2 Configuration WLAN transceiver (FL WLAN 24 AP)

2.2.1 Configuration PC to communicate with the WLAN AP



2.2.2 Configuration WLAN Transceiver as Access Point (AP)

To configure the WLAN transceiver to function as an Access Point:

1. Apply power to the WLAN transceiver and open a web browser on the computer, such as Internet Explorer.
2. Enter the following IP address into the “Address” field of the browser:
https://192.168.254.254
3. Enter the default case-sensitive credentials:
Username: Admin
Password: admin
4. Agree to the terms and conditions and click the “Sign In” button.

FL WLAN 24 AP 80211-XDB
FL WLAN 24 AP 80211-XDB - Version 2.4.6 Build 19125

Username: Admin
Password: admin
 I agree to the terms and conditions below.
Sign In

Terms and Conditions: This device is for authorized use only. Any unauthorized use of this product is prohibited.

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https://192.168.254.254

Username: Admin
Password: admin

- The “Configuration... General” menu

5. Click the “Expand All” button at the bottom of the menu to open all of the folders.
6. Click the “Configuration... General” menu
7. Click the “Submit” button to make the settings active.

The screenshot displays the web interface for a PHOENIX CONTACT device. On the left is a navigation menu with categories: Home, Device Information, Configuration (expanded), Operational Mode, LAN, Access Point Radio, Passwords, Store Retrieve Settings, Performance, Maintenance, Monitoring/Reports, and Glossary. At the bottom of the menu are 'Expand All' and 'Collapse All' buttons. The main content area shows the device name 'FL WLAN 24 AP 80211-XDB' and the last update date '03/31/2008'. A 'Logout' link is visible in the top right. The 'General Configuration' section includes input fields for Device Name / Location, Host Name, Domain Name, and Contact, all containing default values. Below this is the 'System Time and Date' section, showing the current date and time (03/18/2008, 17:30:07) and radio buttons for 'Manual', 'Use PC Clock', and 'Use NTP Server'. The 'Use NTP Server' option is selected, with a dropdown menu for 'Time Zone' set to '(GMT-05:00) Eastern Time (US & Canada)' and two empty input fields for 'Time Server 1' and 'Time Server 2'. A 'Submit' button is located at the bottom of the configuration area. At the very bottom of the page, a copyright notice reads: © 2008 PHOENIX CONTACT & OMNEX Control Systems ULC. All rights reserved.

•The “Configuration... Operation Mode” menu

8. Click the “Configuration... Operational Mode” menu.

9. Click the “Wireless Access Point” button. Then, click the Submit” button. The radio will reboot.

The screenshot displays the Phoenix Contact web interface for device FL WLAN 24 AP 80211-XDB. The page title is "FL WLAN 24 AP 80211-XDB" with a "Last Update 03/31/2008" timestamp and a "Logout" link. The main heading is "Operational Mode Configuration". The configuration area contains four options: "Wireless Access Point" (selected with a radio button), "Wireless Bridging" (radio button), "Wireless Client" (radio button), and "Wireless Link Monitoring" (checkbox). A "Submit" button is located at the bottom of the configuration area. The left sidebar menu includes: Home, Device Information, Configuration (General, Operational Mode, LAN, Access Point Radio, Passwords, Store Retrieve Settings), Performance, Maintenance, Monitoring/Reports, and Glossary. At the bottom of the sidebar are "Expand All" and "Collapse All" links. The footer of the page reads "© 2008 PHOENIX CONTACT & OMNEX Control Systems ULC All rights reserved."

A reboot may take up to one minute and requires the user to log in again.

- The “Configuration..Access Point Radio..General” menu

11. Enter a new value (ex. CoNeT) in the “SSID” field. All Client transceivers in the same network must have the same SSID.

CoNeT

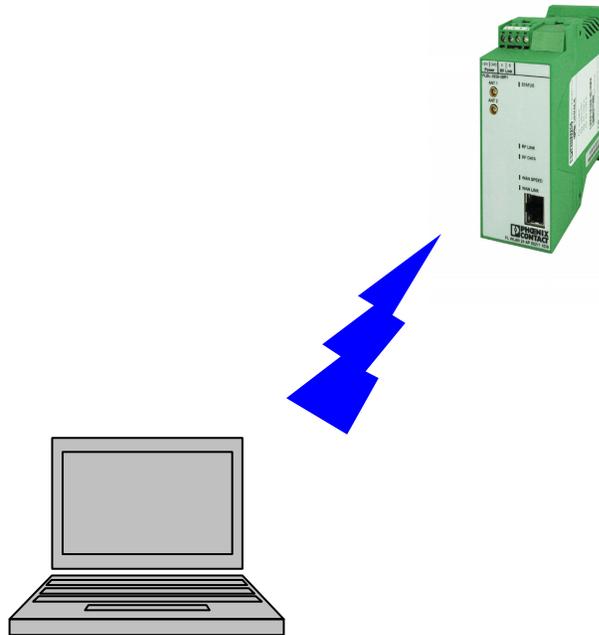
12. Click the “Submit” button to save the settings.

To maintain security, the SSID should be changed to something other than the default. Ex. CoNeT

The screenshot shows the web interface for a Phoenix Contact device, specifically the configuration page for 'FL WLAN 24 AP 80211-XDB'. The page title is 'Access Point Radio - General'. The SSID field is highlighted with a red box and labeled 'CoNeT'. Other visible settings include Wireless Mode (802.11b), Channel No. (1 (2.412 GHz)), Tx Pwr Mode (Auto), and various advanced settings like Beacon Interval (100), RTS Threshold (2346), DTIM (1), Basic Rates (1, 2 Mbps), Preamble (Short Preamble), and Broadcast SSID (Enable). A 'Submit' button is located at the bottom of the configuration area. The page also includes a navigation menu on the left and a 'Logout' link in the top right corner.

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TEST of the Wireless communication between PC and the FL WLAN 24 AP 802- 11 XDB



- The “Configuration..Access Point Radio..Security” menu

13. Click the “Access Point Radio... Security” menu.
14. Enter the desired method of security and appropriate settings.
15. Enter the desired security settings.

PHOENIX CONTACT

FL WLAN 24 AP 80211-XDB

Home

Device Information

Configuration

General

Operational Mode

LAN

Access Point Radio

General

Security

MAC Addr. Filtering

Rogue AP Detection

Advanced

Passwords

Store Retrieve Settings

Performance

Maintenance

Monitoring/Reports

Glossary

Expand All Collapse All

FL WLAN 24 AP 80211-XDB Last Update 03/31/2008

Logout

Access Point Radio - Security

Security Method: IEEE 802.11i and WPA

WPA options

Pre-Shared Key

Passphrase (minimum 20 characters)

802.1x

Pairwise Key AES-CCMP TKIP

802.11i (WPA2) options

Pre-Shared Key

Passphrase (minimum 20 characters)

802.1x

Pairwise Key AES-CCMP TKIP

RADIUS Server

Primary Radius Server Settings

Radius Server IP Address

Shared Secret (minimum 6 characters)

Encryption Suite and Re-keying

Group Key

Group Encryption Key Lifetime

• WEP security Settings for AP

1. Click the “Access Point Radio... Security” menu.

- The “Authentication Type” drop-down menu allows selection of “open”, “shared” or “open/shared” (clients may employ either)
- WEP Encryption Method selects one of three sizes of keys that can be used by WEP
- WEP Keys 1-4 (64-bit encryption) selects one of four possible keys that can be used with 64-bit encryption

PHOENIX CONTACT
FL WLAN 24 AP 80211-XDB

FL WLAN 24 AP 80211-XDB Last Update 03/31/2008 [Logout](#)

Access Point Radio - Security

Security Method:

Authentication Type:

WEP Encryption Method

64-bit Encryption

Default WEP Key:

(Enter 64-bit WEP keys as 10 hexadecimal digits (0-9, a-f, or A-F))

WEP Key 1:

WEP Key 2:

WEP Key 3:

WEP Key 4:

128-bit Encryption

(Enter 128-bit WEP keys as 26 hexadecimal digits (0-9, a-f, or A-F))

WEP Key:

152-bit Encryption

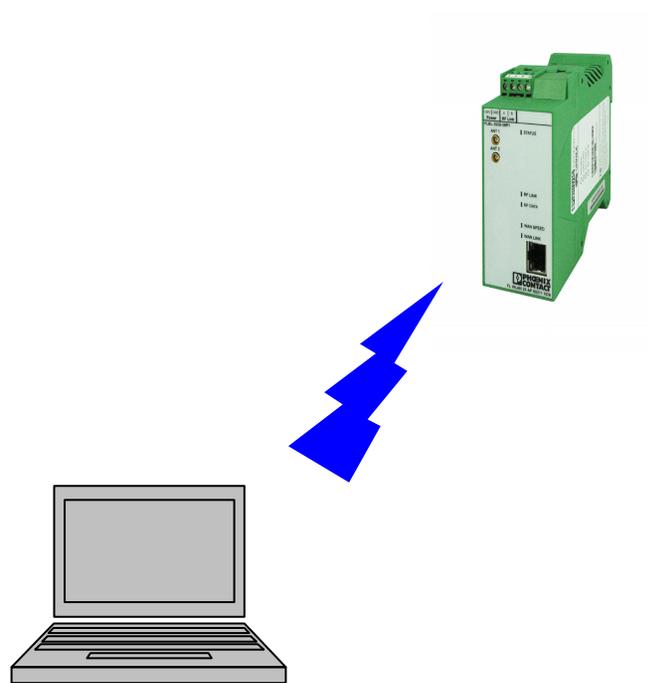
(Enter 152-bit WEP keys as 32 hexadecimal digits (0-9, a-f, or A-F))

WEP Key:

Click 'Key Generator' button and encryption key will be generated automatically.

Done

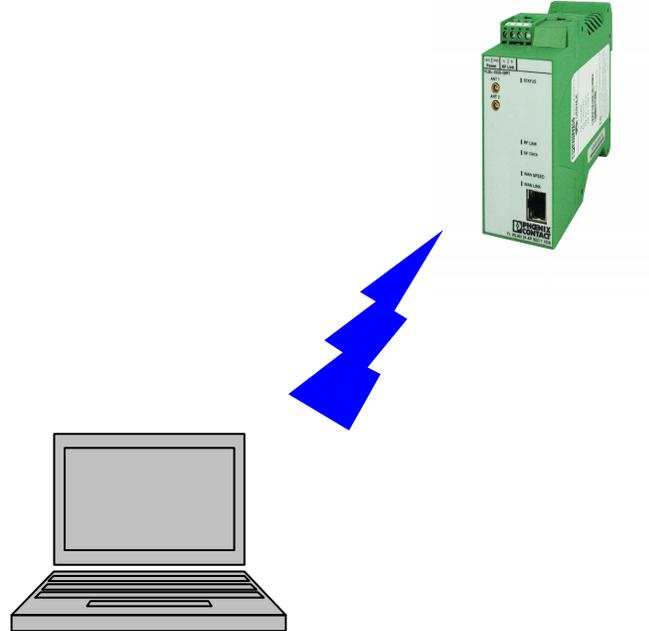
TEST of the WEP security



• WPA and 802.11i (WPA2) security Settings for AP

1. Click the “Configuration... Access Point Radio... Security” menu
2. From the “Security Method” drop-down menu, select either WPA, WPA2 (802.11 i) or IEEE 802.11i and WPA. Selecting IEEE 802.11i and WPA allows clients to use either method to connect to the Access Point
3. Select the desired options:
 - To use 802.1x authentication, a Radius server must exist in the network. If a Radius server does not exist in the network, select “Pre-Shared Key” and enter up to 63 characters in the “Passphrase” field.
 - Pairwise Key. If wireless clients use AES-CCMP or TKIP, select accordingly. If there will be a mix of clients using AES-CCMP or TKIP, select both.
 - If 802.1x authentication is selected, enter the appropriate data in the “Radius Server IP Address” and “Shared Secret” fields.
 - Select the appropriate choices from the “Group Key” and “Group Encryption Key Lifetime” drop-down menus.
 - Click the “Submit” button to write the changes to the radio.

TEST of the WPA security



• The “Configuration...LAN...IP Configuration” menu

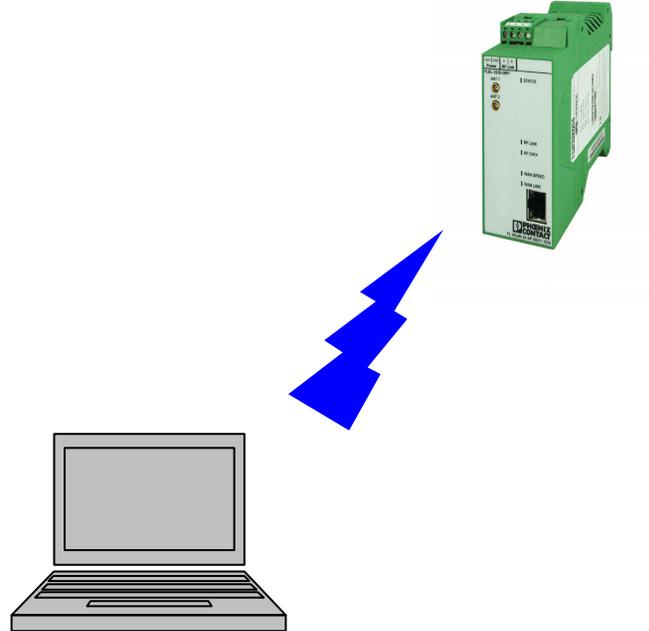
1. Click the “Configuration...LAN... IP Configuration” menu
 - Select the speed of the LAN or select Auto from the “LAN Link” dropdown menu. If Auto is selected, the radio automatically determines network speed.
 - If the network does not support DHCP (Dynamic Host Configuration Protocol), click the “Specify a static IP Address” radio button and enter the data in the “Subnet Mask” and “Default Gateway” fields.
2. Click the “Submit” button to activate the new LAN settings.

The screenshot shows the web interface for a Phoenix Contact device, specifically the 'LAN - IP Configuration' page for 'FL WLAN 24 AP 80211-XDB'. The page title is 'FL WLAN 24 AP 80211-XDB' and it shows 'Last Update 03/31/2008' and a 'Logout' link. The main content area is titled 'LAN - IP Configuration' and contains the following settings:

- Link Speed and Duplex:** A dropdown menu for 'LAN Link' is set to 'Auto'.
- LAN IP Address:** Two radio buttons are present: 'Using DHCP to get an IP address' (unselected) and 'Specify a static IP address' (selected).
- IP Address:** Four input fields containing '192', '168', '254', and '254'.
- Subnet Mask:** Four input fields containing '255', '255', '255', and '0'.
- Default Gateway:** Four input fields containing '192', '168', '254', and '1'.
- DNS1:** Four input fields containing '0', '0', '0', and '0', with the text '(0.0.0.0 for none)' below.
- DNS2:** Four input fields containing '0', '0', '0', and '0', with the text '(0.0.0.0 for none)' below.
- Submit:** A button at the bottom right of the configuration area.

The left sidebar contains a navigation menu with the following items: Home, Device Information, Configuration (General, Operational Mode), LAN (IP Configuration, SHMP Configuration, DHCP Server), Access Point Radio, Passwords, Store Retrieve Settings, Performance, Maintenance, Monitoring/Reports, Glossary, and Expand All/Collapse All.

Test out your configuration !!!!



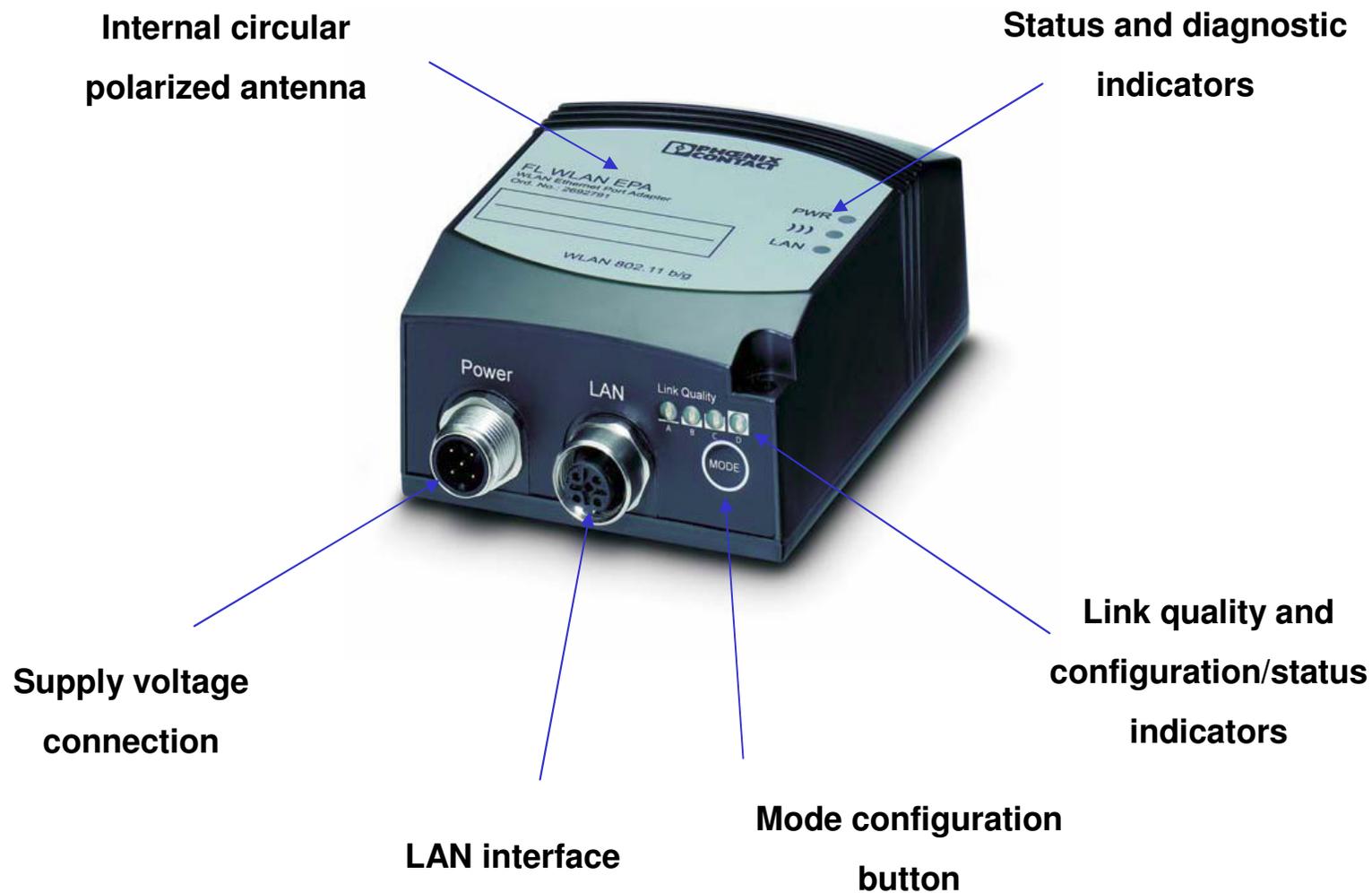
2.3 The Phoenix Contact FL WLAN EPA

2.3.1 Properties

- The Ethernet port adapter (FL WLAN EPA) is a high-performance, industrial WLAN interface for Ethernet or Profinet-compatible automation equipment (Higher priority for Profinet data)
- A transparent protocol is used for data transmission on Layer 2 level, which ensures easy integration in Industrial Ethernet networks such as Profinet, Modbus/TCP or Ethernet/IP.
- The FL WLAN EPA meets the Profinet requirements of conformance class A and the Profisafe profile for failsafe communication.
- compatibility with WLAN standard IEEE 802.11 b/g
- High level of security with WEP, WPA, and IEEE 802.11i encryption mechanisms
- Easy configuration with standard web browsers via Ethernet, SNMP or AT commands. The "Phoenix SPA EPA Toolbox" software package can be downloaded free of charge at www.phoenixcontact.com



2.3.2 FL WLAN EPA interface



2.3.3 WLAN and WLAN EPA operating modes

1 WLAN Operating modes

- Infrastructure mode: Communication between all devices is via a shared access point
- Ad hoc mode: is used to connect two WLAN devices together without an access point

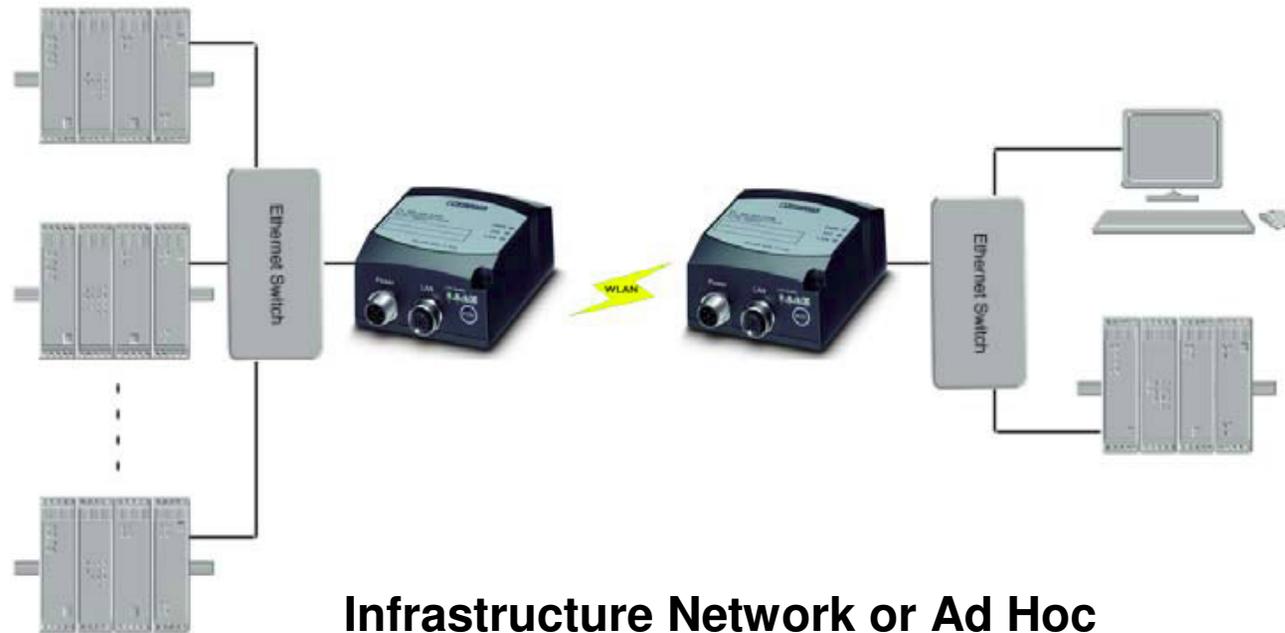
2 WLAN EPA operating modes

- Ethernet bridge mode:
 - This mode is only supported between two WLAN EPAs.
 - Ethernet data packets are encapsulated in UDP packets and transmitted transparently between the EPAs.
 - Due to UDP encapsulation and the additional overhead, the data throughput is considerably lower than in external wireless mode
- External wireless mode:
 - the EPA acts as a wireless extension of the wired Ethernet device. The WLAN EPA uses the MAC address of the connected termination device, which means that only one Ethernet device can be connected to the WLAN EPA.
 - The connection of several devices via a hub or switch is not possible.

2.3. 4 Examples of FL WLAN EPA Configurations

Example 1: Two WLAN EPAs form an Ethernet bridge (option1)

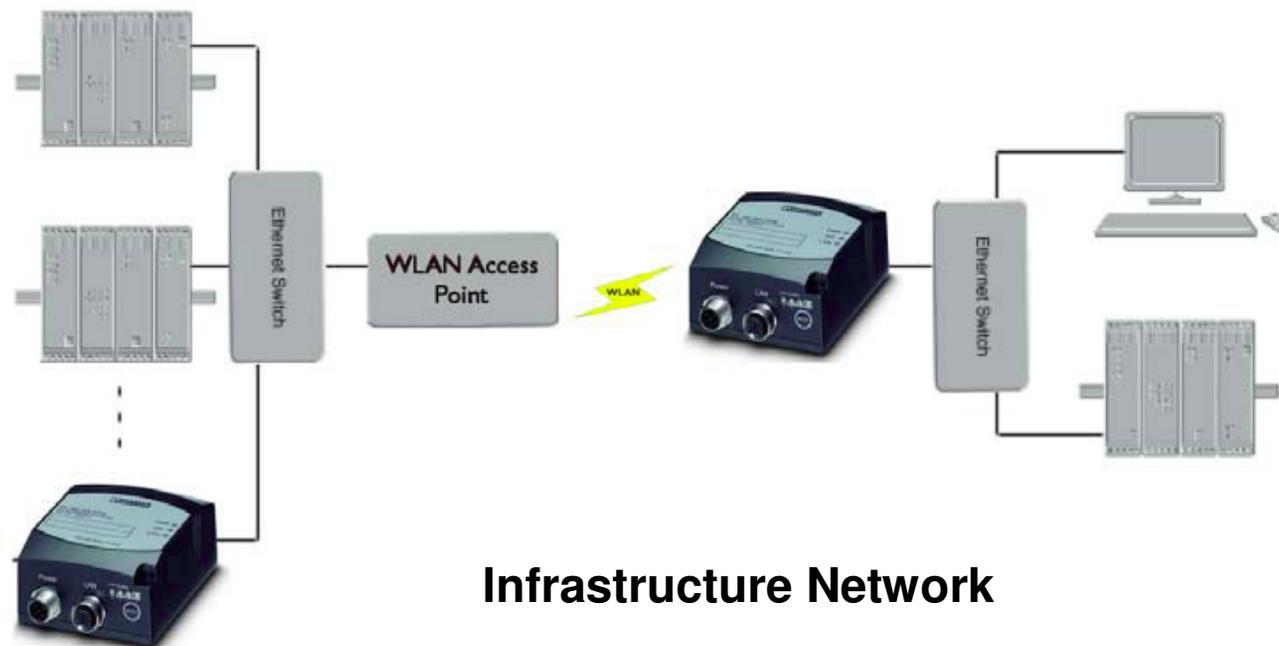
- several devices are connected to both EPAs
- The data from the connected devices is transmitted via the UDP tunnel.
- This mode can be used both in ad hoc mode and in infrastructure mode.



2.3.4 Examples of FL WLAN EPA Configurations

Example 2: Two WLAN EPAs form an Ethernet bridge (option2)

- Two EPAs in "Ethernet bridge" mode. One of the EPAs is connected to a wired network and not via the wireless interface.
- In this case, only infrastructure mode can be used.



2.3.4 Examples of FL WLAN EPA Configurations

Example 3: Two WLAN EPAs in external wireless mode (option1)

- This example shows two EPAs in "External wireless" mode. One Ethernet device is connected to each EPA.
- This operating mode has a considerably higher data throughput than "Ethernet bridge" because there is no UDP data encapsulation.

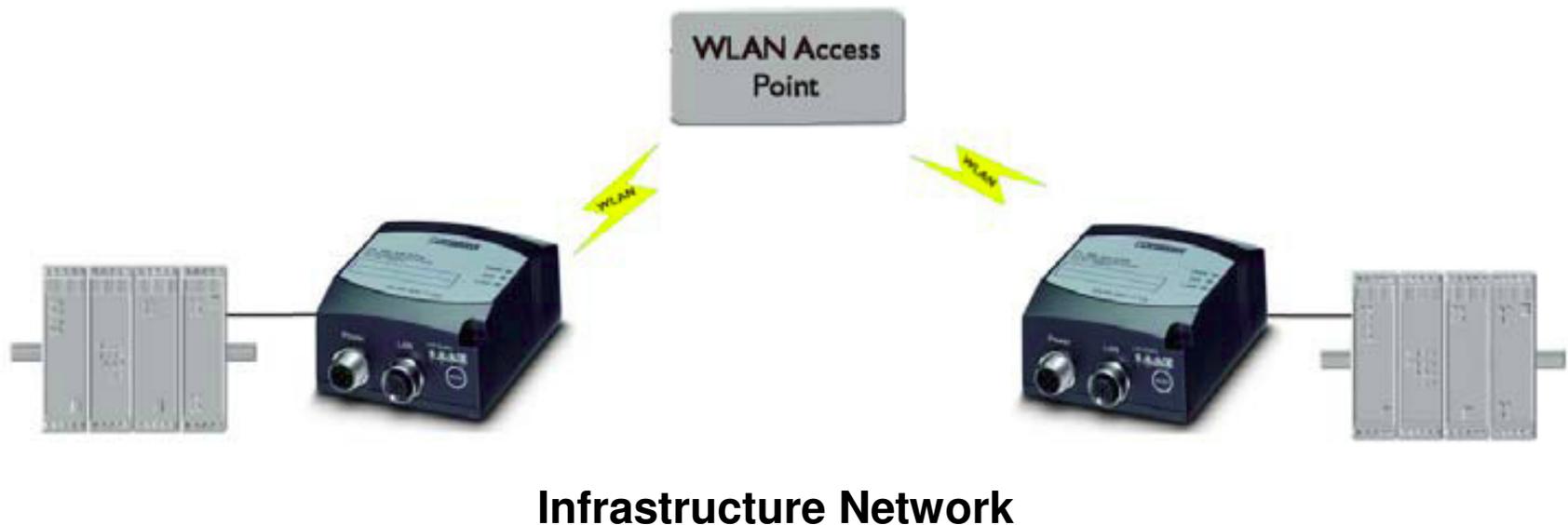


Ad Hoc Network

2.3.4 Examples of FL WLAN EPA Configurations

Example 4: Two WLAN EPAs in external wireless mode (option2)

- One Ethernet device is connected to each EPA. The EPAs are connected together via a WLAN access point.
- This operating mode has a considerably higher data throughput than "Ethernet bridge" because there is no UDP data encapsulation



2.3.4 Examples of FL WLAN EPA Configurations

Example 5: WLAN connection between PC and EPA(option1)

- In this example, the EPA must be in "External wireless" mode.



Ad Hoc Network

2.3.4 Examples of FL WLAN EPA Configurations

Example 6: WLAN connection between PC and EPA (option2)

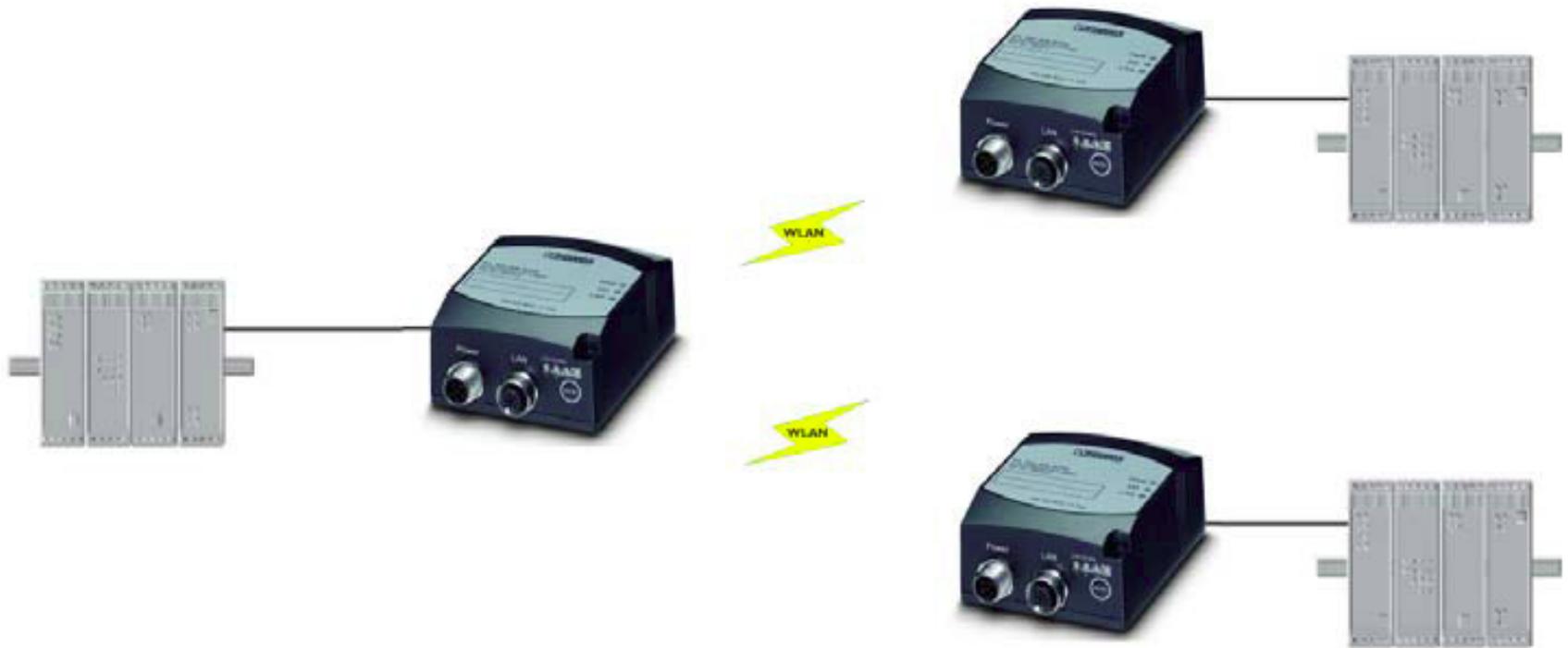
- an Ethernet device is connected to the EPA. The PC uses Ethernet protocols to access the Ethernet device (e.g., http for WBM or Modbus/TCP).
- Since both the PC and the EPA are connected to one access point, it is possible to use managed (infrastructure) mode.



Infrastructure Network

2.3.4 Examples of FL WLAN EPA Configurations

Example 7: Several Ethernet devices connected in external wireless mode (option 1))

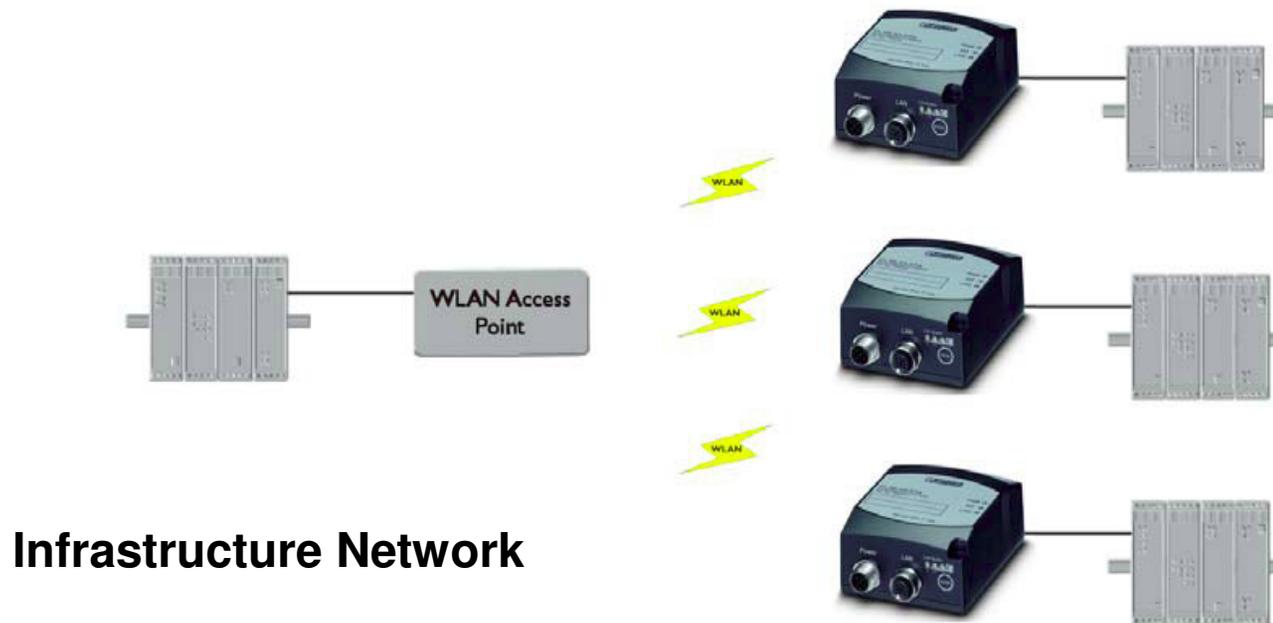


Ad Hoc Network

2.3.4 Examples of FL WLAN EPA Configurations

Example 8: Several Ethernet devices connected in external wireless mode (option 2)

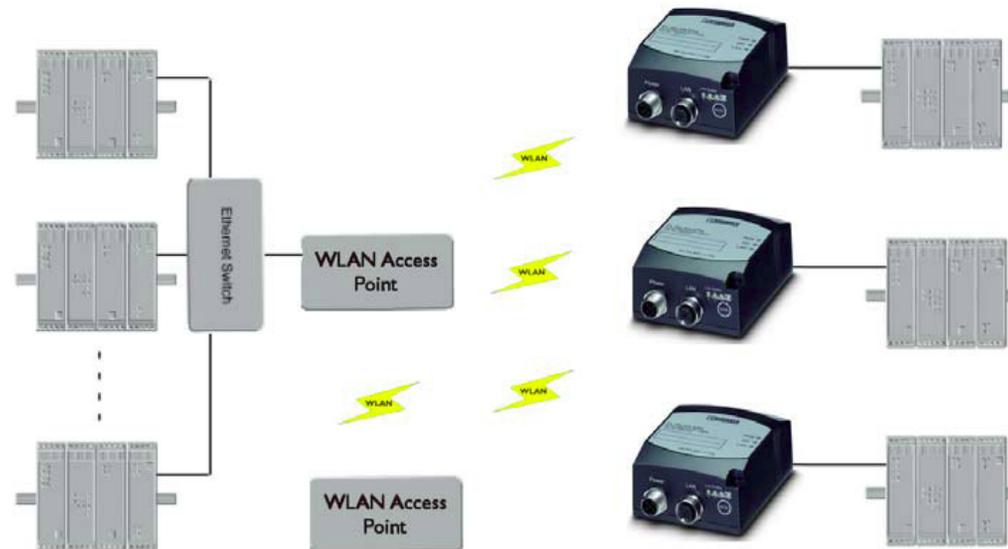
- three or even more Ethernet devices are connected via EPAs in managed mode via WLAN access point



2.3.4 Examples of FL WLAN EPA Configurations

Example 9: Several EPAs connected via WLAN to a wired infrastructure

- three or even more EPAs are connected via WLAN access points to the Ethernet infrastructure.
- Other WLAN clients can be operated at the WLAN access point at the same time.



Infrastructure Network

2.3.4 Examples of FL WLAN EPA Configurations

Example 10: External WLAN client connected to EPA

- a WLAN client is connected to an EPA.



Ad Hoc Network

2.4 Startup and Configuration of the FL WLAN EPA

- Configuration using the “Mode” Button
- Web-Based management (WBM)
- Configuration using the Phoenix SPA/EPA Configuration Tool "Toolbox" software



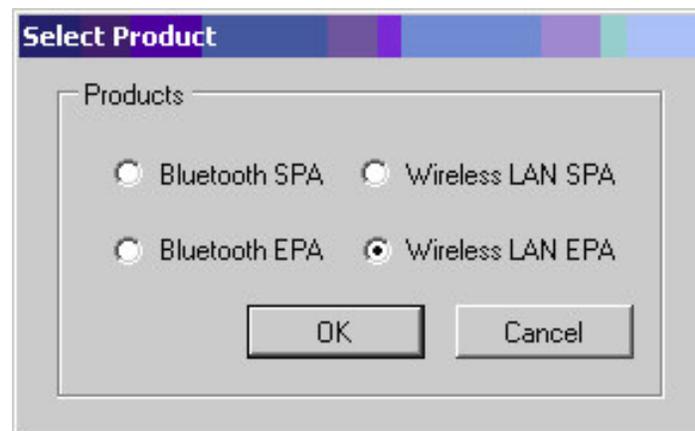
Phoenix SPA EPA
Toolbox.exe

2.4.1 Configuration of the FL WLAN EPA FL by SPA/EPA Toolbox

- Start the "Toolbox" software by double-clicking on the program icon

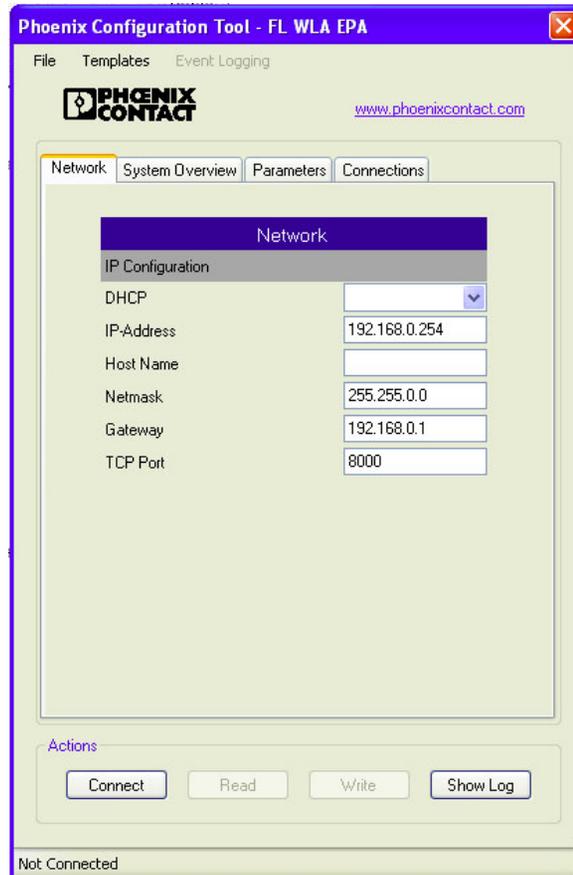


- Select the device: FL WLAN EPA = Wireless LAN EPA



2.4.1 Configuration of the FL WLAN EPA FL by SPA/EPA Toolbox

- Confirm the device selection with "OK". The following window opens:



IP# 192.168.0.254 (default)

SM# 255.255.0.0

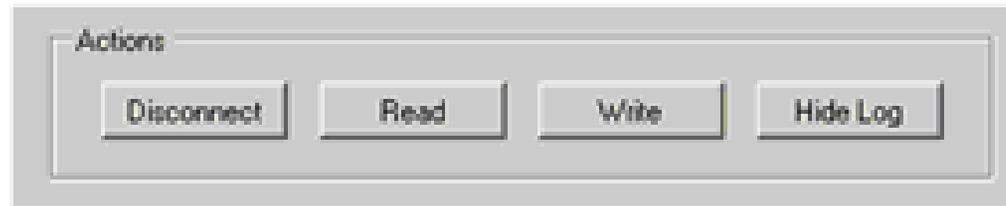
TCPport: 8000

- Click "Connect" to establish a connection to the module



2.4.1 Configuration of the FL WLAN EPA FL by SPA/EPA Toolbox

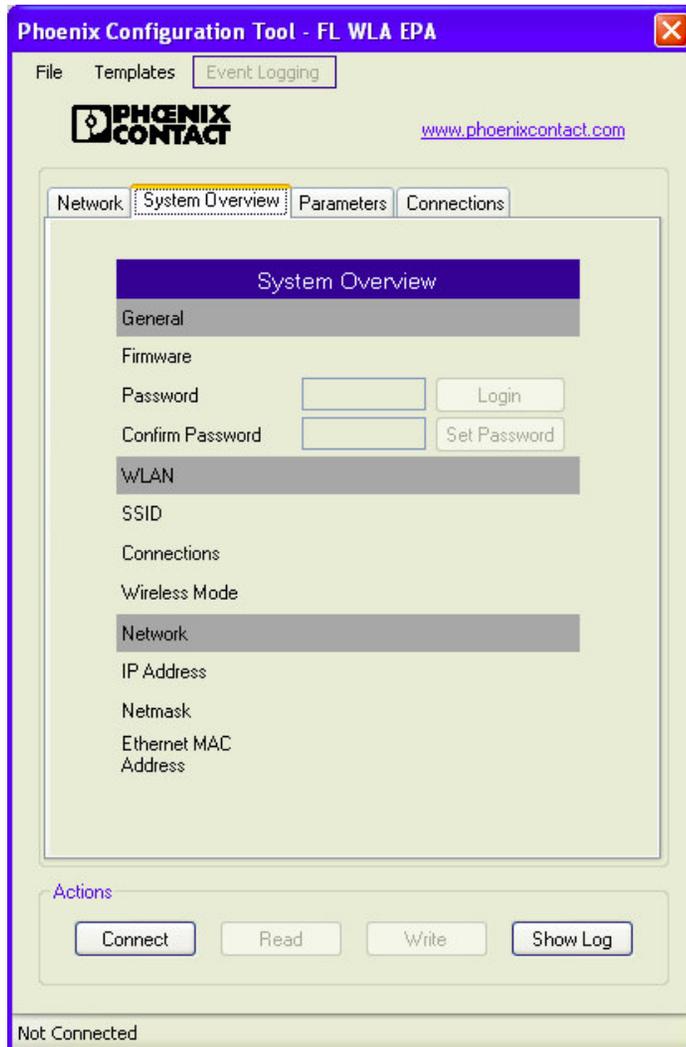
- Following successful connection establishment, the "Connect" button changes to "Disconnect" and "Read" and "Write" are activated.



- Read = Read the device configuration
 - The password for this must be entered in the "System Overview" tab. In order to read the configuration, the password for device access must first be entered.
 - Switch to the "System Overview" tab. Enter the password under "Password" and confirm with "Login".

Password (default): admin

„System Overview“ tab



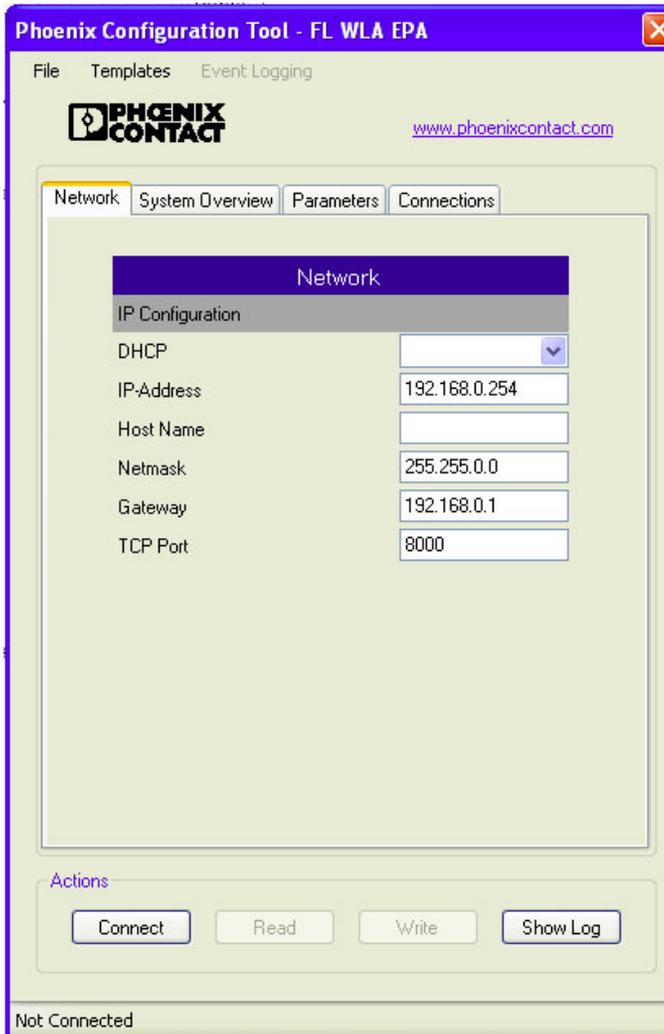
- Write = "Write" to transmit all modifications to the device.



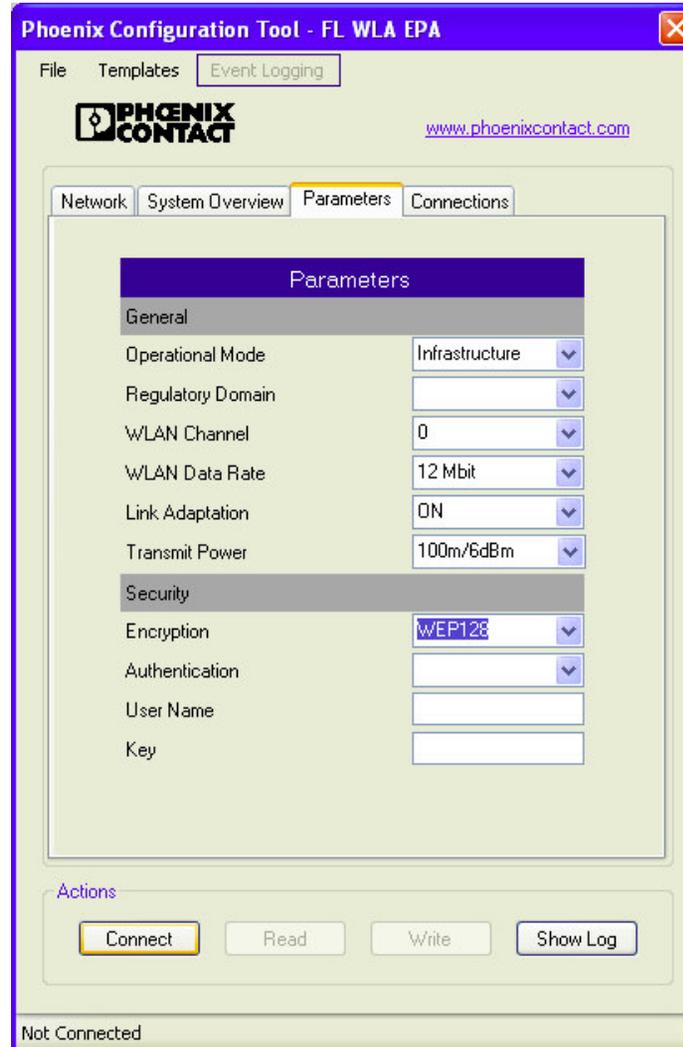
- Show/Hide Log: to show or hide the command log window



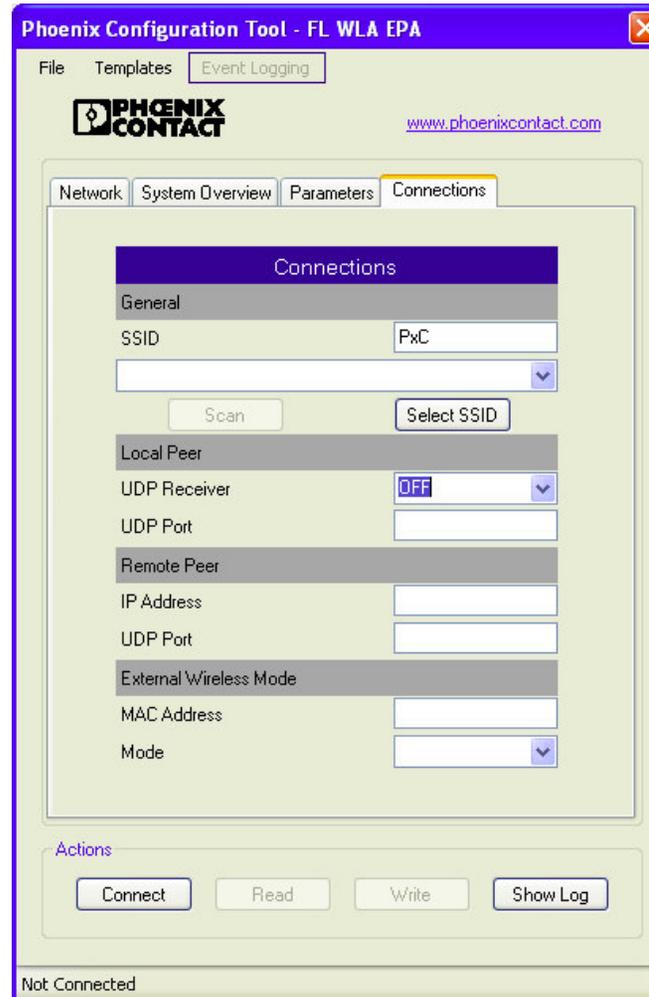
„Network“ tab



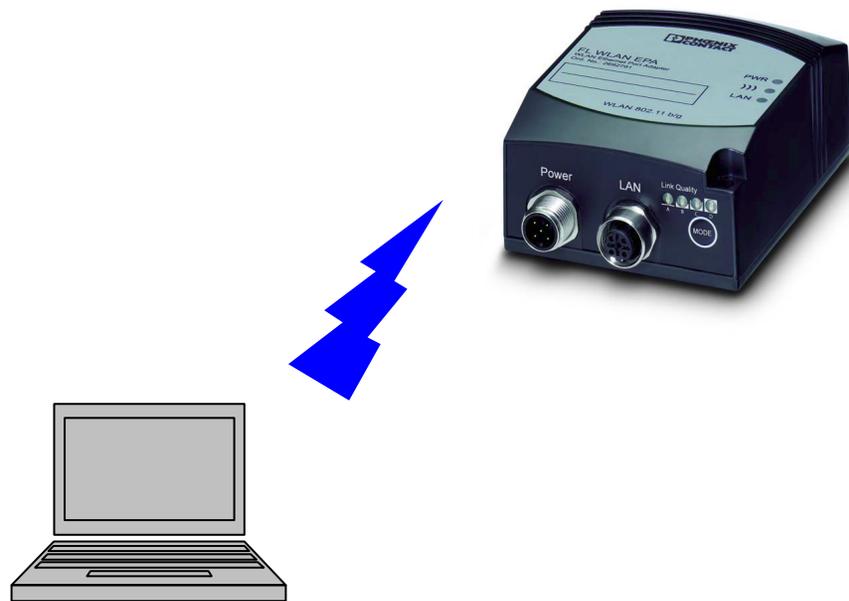
„Parameters“ tab



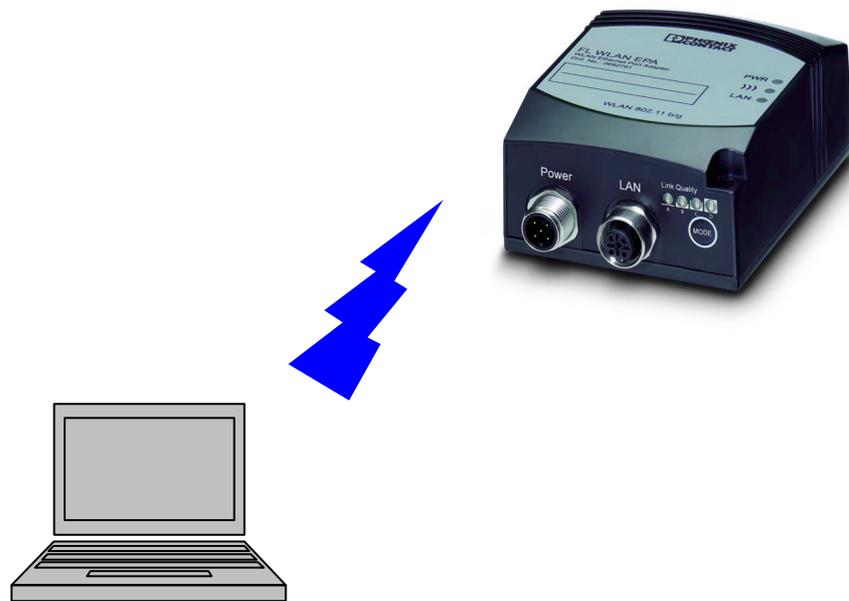
„Connections“ tab



Ex 2: Wireless communication between PC with WLAN interface and the FL WLAN EPA (cfr. configuration example 5)

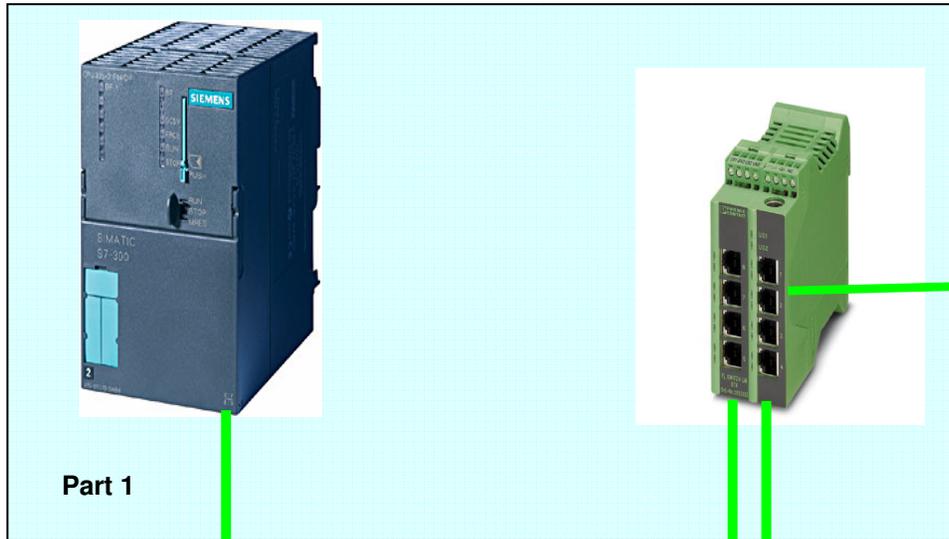


Ex 3: WLAN between PC, Access Point XDB and FL WLAN EPA (cfr. configuration example 6)

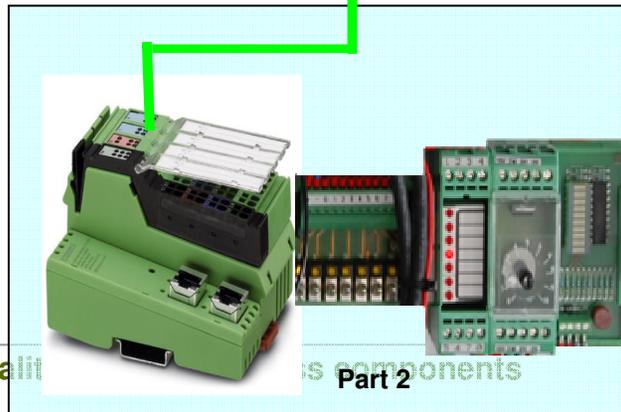


Ex 4: Configuration PROFINET Siemens S7 315-2DP/PN and IL PN BK 2TX_PAC (See also CML2)

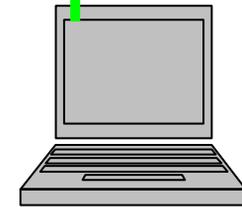
First try out: wired with Ethernet UTP cables



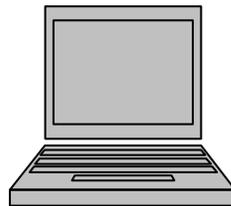
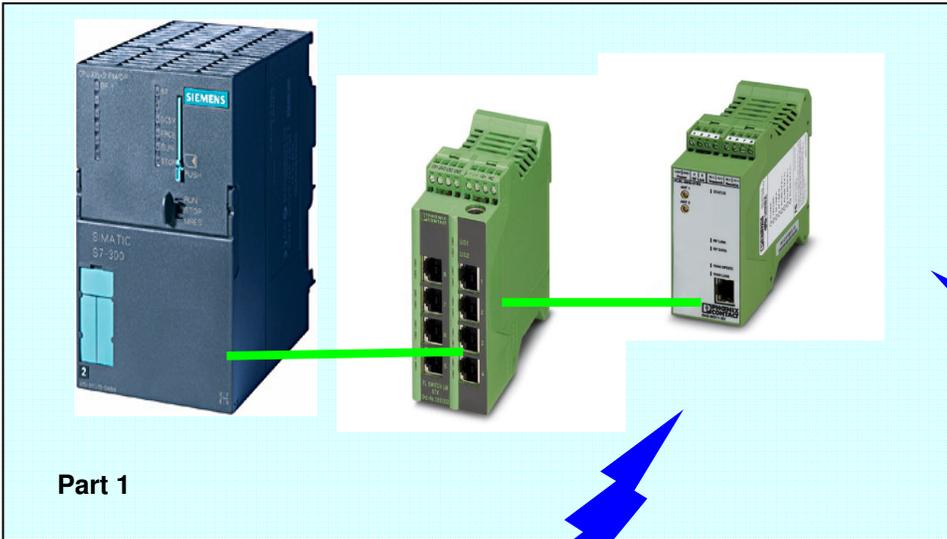
Part 1



Part 2

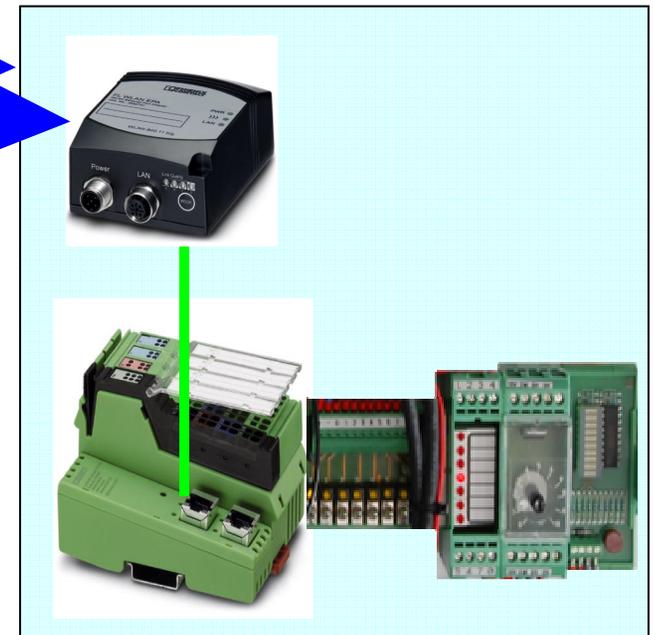


Ex 5: Configuration PROFINET Siemens S7 315-2DP/PN and IL PN BK 2TX_PAC (See also CML2)



Part 2

Second try out: wireless conform example 6





3. Real-time aspect WLAN

Ex 6: Research of the maximum update rate PROFINET device

Ex 7: Influence of 'other' TCP/IP traffic

4. Bluetooth (IEEE802.15.1)

- Bluetooth is a wireless technology which, in the consumer sector has a very large spread.
- Currently, more effectively than Bluetooth wireless chipsets sold, mainly attributable to the application of this technology in mobile phones, headsets, etc.
- The basic technology is standardized in IEEE 802.15.1.
- Above the standard in places the Bluetooth SIG (Special Interest Group), an association of producers (Bluetooth chipsets and products), various application profiles, eg for voice transmission, serial communications or wireless Ethernet connection in the so-called Personal Area Networks (PAN).



References for part 2

Phoenix Contact.: Quick Start Guide UM QS EN FL WLAN AP XDB Radios, order No: 2751762

Phoenix Contact.: User Manual UM EN...XDB, order No: 2751760

Phoenix Contact.: User Manual UM EN FL WLAN EPA, order No: 7901_en_01 06/2010