

MC

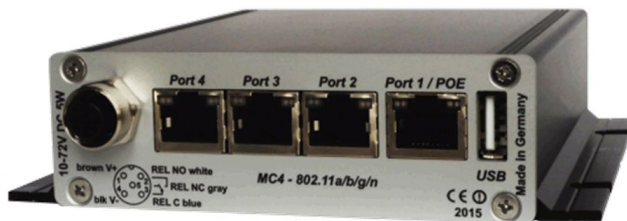
802.11 a/b/g/n

Wireless LAN-Bridge
&
Serial Client Adapter

Manual



MC1



MC4



MC2

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1 Technical Description

The MC is a Wireless LAN-Adapter that connects devices via Ethernet, USB or serial Port to wireless networks conforming to the 802.11a/b/g/n standard.

The MC can connect via these interfaces:

1. 1, 2 or 4 Port LAN
2. serial RS232 , 422, 485 interface
3. USB2 port

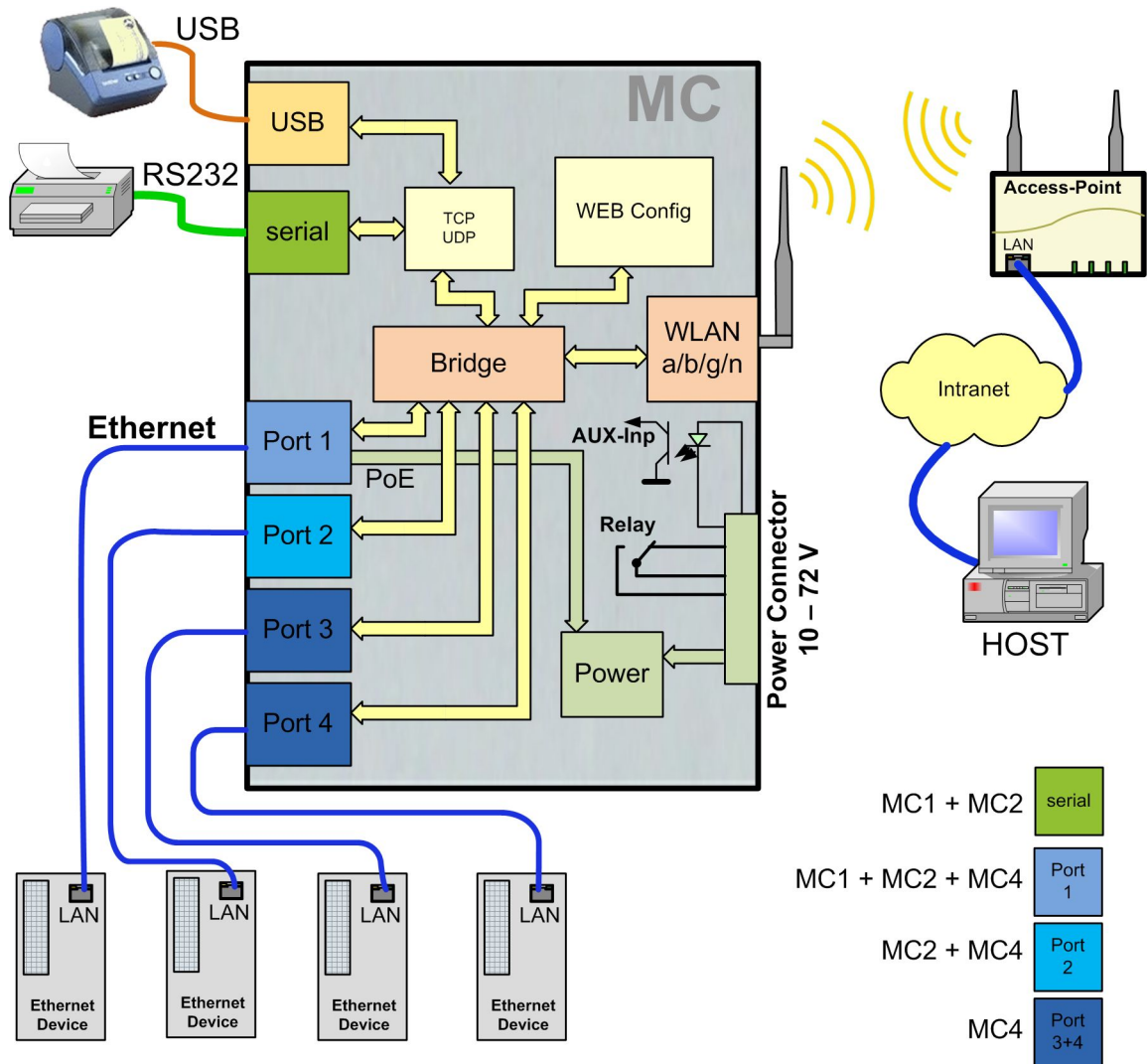


Figure 1: Overall System (example)

The central component of the MC is a ARM® Cortex®-A9 Processor which controls all functionality. The different ports are:

- 1) Mini-PCI-Express Socket
- 2) Ethernet-Interface with 1-4 Ports 10/100/1000 Mbit/s + Auto-MDIX (auto crossover function)
- 3) 1 x serial Port with six control lines (RTS, CTS, DTR, DSR, DCD, RI)
- 4) 1 x USB2 – Port e.g. for printers or port extension
- 5) optional: relay switching contact + input with opto coupler

The Ethernet-Ports are implemented as an RJ45-connectors. The LAN-Port1 has a PoE functionality (IEEE 802.3af), so that the MC can be powered via this LAN-Port.

The serial port is connected by a 9pin D-SUB plug. The assignment is selected in a way that a 1:1 serial cable can be used for the connection to a serial COM-Port of a PC. The exact assignment can be seen in Figure 2.

The power supply for the MC device needs a voltage source of 10-72V. The usual power consumption is around 3-4 Watt (WLAN + LAN-Port active).

1.1 Ports of the MC1

The following figures show how the LEDs and ports of the MC are arranged.

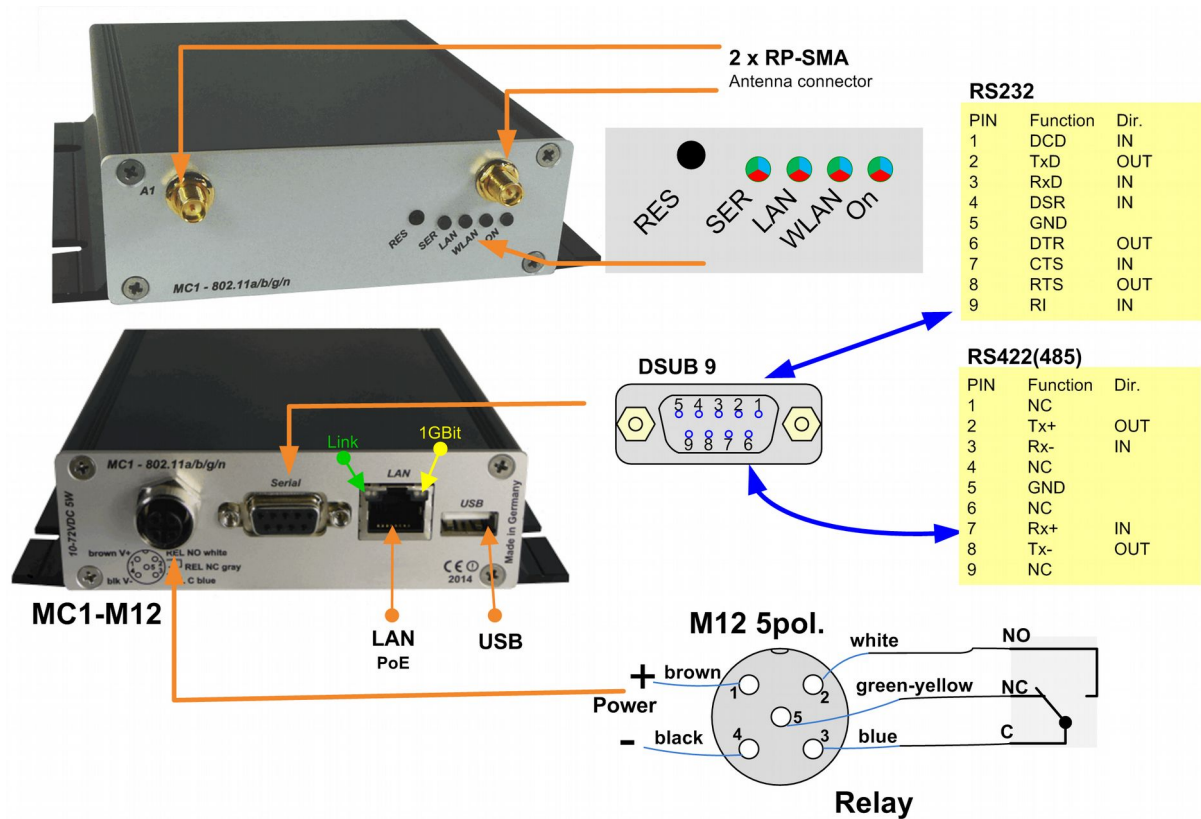
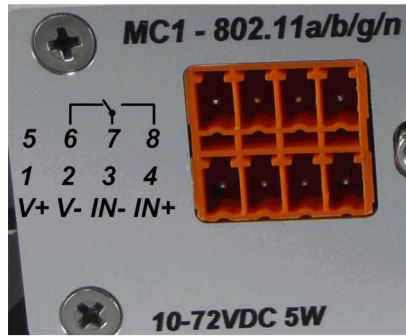


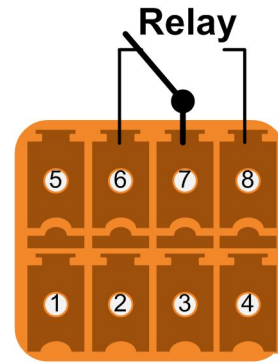
Figure 2: Ports and LED's of the MC1-SL-M12

Figure 2 shows the MC1 in its standard design with one serial Port, a 5pin M12 connector for power supply and a relay switching contact.

There are different options for the power connector of the MC devices:

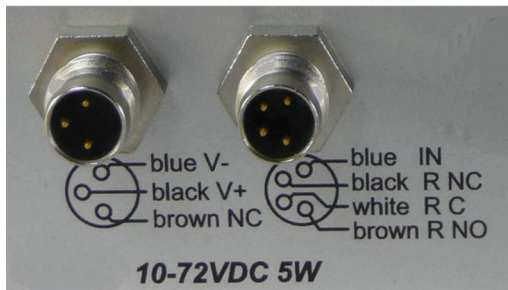


MC1-WK8



V+ V- IN- IN+
U_b Aux-IN

Figure 3: WK8 power connector (with relay + digital input)



MC1-M8 (with optional Relay Connector)

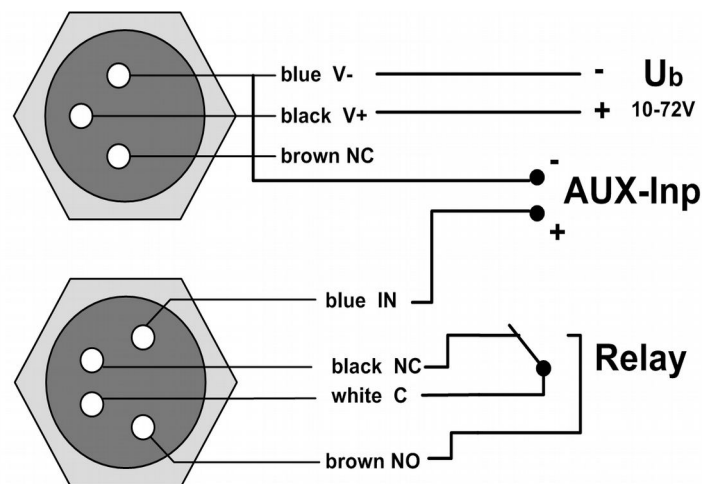


Figure 4: M8 power connector + extra M8 connector with relay + digital input

1.2 Ports of the MC2

The front panel of the MC2 is identical to the MC1. The MC2 back panel has the following plug assembly:



Figure 5: MC2 plug assembly on the back panel

The MC2 is also available with the options MC2-Sx-WK8 and MC2-Sx-M8.

1.3 Ports of the MC4

The front panel of the MC2 is identical to the MC1.
The MC4 back panel has the following plug assembly:

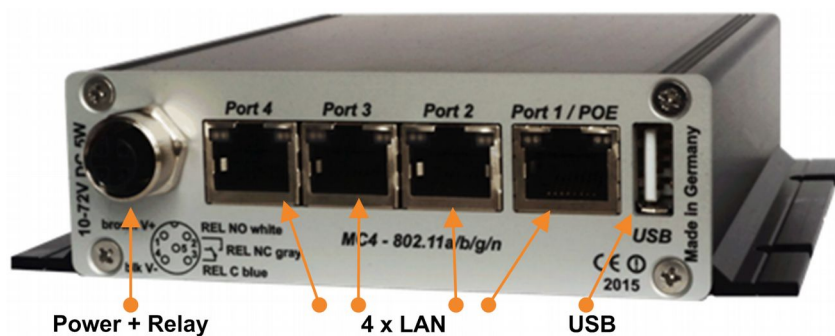


Figure 6: MC4 plug assembly on the back panel

MC4 plug assembly on the back panel

The MC4 is also available with the options MC2-Sx-**WK8** and MC2-Sx-**M8**.

1.3.1 Meaning of the LEDs

The 4 LEDs on the front represent the operating state of the MC. All LEDs can shine in three different colors: red, yellow, blue. If all three colors are on, the LEDs color is white.

LED	State	Mode
On	Off	No or not enough power
	Green	Sufficient voltage connected
	Green + blinking orange (red & green)	Standard mode MC ready
WLAN	Off	WLAN option off
	Blinking red	MC is looking for suitable APs or is currently authenticating
	Green	Wireless LAN connection works. Short orange blinking shows activity (sending or receiving of data) at the interface.
LAN	Off	No device connected to the LAN-Port
	Green	Device connected to LAN-Port. Short orange blinking shows activity (sending or receiving of data) at the interface.
Serial	Off	The interface is inactive.
	Green	A partner-device is connected to the interface. Short orange blinking shows activity (sending or receiving of data) at the interface.
	Blinking green	The interface is ready and awaits a connection.

Table 1: LED-Modes

1.4 Technical Properties

Specifications:	
<i>Ethernet</i>	<i>1, 2 or 4 x 10/100/1000 MBit Auto MDI/MDIX</i>
<i>Serial</i>	<i>1 x RS232, 300-460,8 KBit/s, RTS, CTS, DSR, DTR, RI, DCD or (optional) RS485</i>
<i>USB</i>	<i>1 x USB 2.0</i>
<i>Relay</i>	<i>1 x Switch over, max 1A@24V, max 125VAC</i>
<i>Signal Input</i>	<i>1 x galv. separated 10 – 72V</i>
<i>Antenna Connectors</i>	<i>2 x RPSMA (optional TNC or RPTNC)</i>
<i>Power Supply</i>	<i>10 – 72VDC or 802.3af PoE via LAN Port1</i>
<i>Energy</i>	<i><= 5W (typically 3W)</i>
<i>Temperature</i>	<i>0-60°</i>
<i>Dimensions</i>	<i>105x125x35mm</i>
<i>Weight</i>	<i>ca. 400g</i>

1.5 Wireless LAN - Interface

Wireless LAN-Interface:		
Technology	802.11 a/b/g/n WLAN (2.4 + 5 GHz Band)	
Antennas	2 Antennas (2T2R MIMO)	
Encryption	WEP (64,128bit) + TKIP/AES	
Security	802.11i WPA(2) – PSK 802.1x EAP-PEAP, -TLS, -TTLS, -LEAP	
Channels	802.11b/g/n ETSI 1-13, USA/Canada 1-11 802.11a/n ETSI 19, USA/Canada 12	
Data Rates	Mode	Data Rate
	802.11b:	1, 2, 5.5, 11Mbps
	802.11g / a	6, 9, 12, 18, 24, 36, 48, 54Mbps
	802.11n (20MHz)	1Nss: max. 72.2Mbps 2Nss: max. 144.4Mbps
	802.11n (40MHz)	1Nss: max. 150Mbps 2Nss: max. 300Mbps
Transmission Power	802.11b/g 17 dBm	802.11a 15 dBm
	802.11gn 16 dBm	802.11an 15 dBm

Table 2: Properties of the Wireless LAN-Interface

2 Initial startup

Please connect the MC via the Ethernet-Port with a PC using a patch cable for the initial startup.

When turning on power supply voltage, all LEDs briefly blink white. After that only the ON-LED lights up green, which soon starts blinking orange (red & green) and green. This indicates the boot process. After about 15 seconds the application is ready and the LEDs indicate the modes described above.

2.1 The MC-Config-Application

For its initial startup the MC is only able to communicate via its LAN-Port because typically there is no wireless network with a suitable SSID.

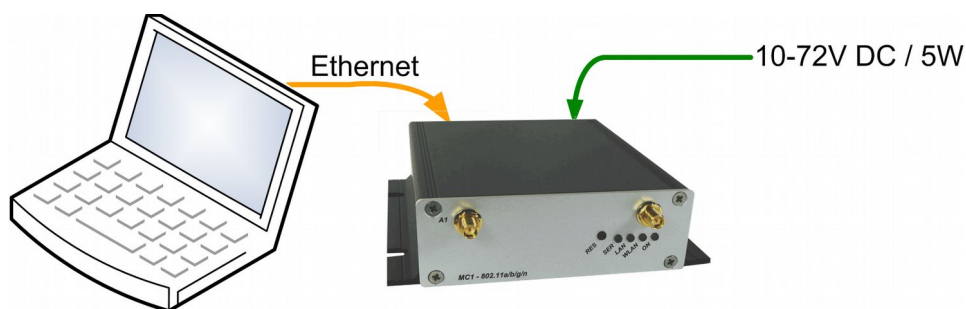


Figure 7: Setting for the initial configure of the MC

To do the „first time setup“ the MC has to be connected via the LAN-Interface to the computer (PC) that runs the MC-Config-Program.

What to take into account:

- The connected PC (Notebook) should have a fixed IP-Address on its LAN-Port (no DHCP).
- The LAN-Port needs to be recognized as active by the operating system of the PC. You can check the LAN-Port by entering "ipconfig" in the terminal.
- If the LAN-Port is recognized as active by the PC then press "Refresh" in the MC-Config-Application.
- An active Firewall on the PC might prevent communication with the MC.

After launch, the MC-Config-Application first detects all network interfaces, that are currently active on the PC. A Broadcast-UDP-Request is then sent out to all these interfaces and the MC devices will respond. The responding devices will be registered and listed in the application.

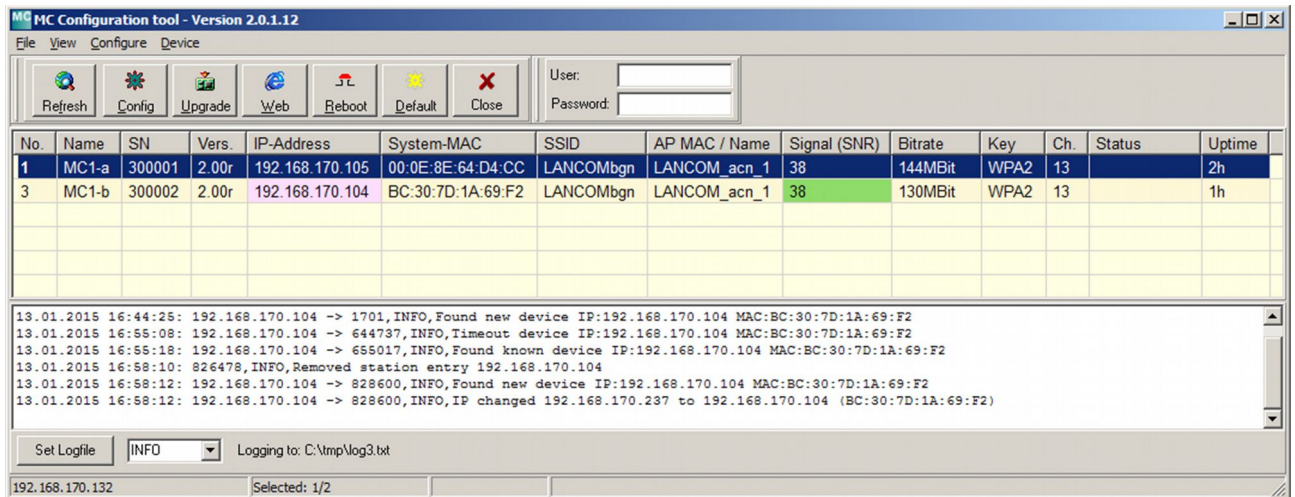


Figure 8: Screenshot of the MC-Config-Application

Besides the device properties like name, serial number, software-version, IP-Address and MAC-Address, the Wireless LAN connection details are displayed as well. Initially the set SSID is visible. As soon as a connection to an Access-Point has been established the MAC-Address and the name of the AP are displayed as well as the signal strength represented by a number and an equivalent background color. The numbers can be interpreted as follows:

- Signal ≥ 40 → Very good connection
- Signal ≥ 30 → Good connection
- Signal ≥ 20 → Connection still sufficient
- Signal < 20 → Connection impaired, Bit rates are reduced in order to transfer data

How to use the MC-Config-Application is described in detail in a separate manual.

2.2 *Reset to factory settings*

By pressing the reset-button for a long time, the MC can be set back to its factory settings. When keeping the reset button pressed, the MC goes through different sequences that are visualized by all four LEDs lighting up in the same color.

The LED-sequences start with lighting up in white, then blue, then red and then green; restarting with white again. Holding the reset button pressed after the third time the all LEDs light up blue, the device is set back to its factory settings. All LEDs are off during the reset to factory settings. After that, the reset button can be released. When the reset button is released before the factory reset was initiated, then the MC needs to be restarted by briefly pressing the reset button again.

The MC possesses the following (important) factory settings:

Device Name: „MC“
SSID = „MC_WLAN“
Encryption mode = no encryption
MODE= 802.11 a/b/g/n (2.4 + 5 GHz)

IP = 192.168.170.100
Netmask = „255.255.255.0“
Gateway = 192.168.170.249

user = „“ (empty)
password = „“ (empty)

Serial 1: inactive
Relay: inactive
Input: inactive

3 Setup of the parameters via Web-Interface

After having established a connection with the MC's http-Server via Web-Browser, a site with general information about the MC as well as information about the current state of the device will be displayed. This site can be accessed without the need of knowing the possibly set "User" + "Password"-combination. Before being able to access any of the other sites, the "User" + "Password"-combination will be requested.

3.1 General Information

The first site that is visible contains general information regarding the current state of the device and about its firmware.

3.1.1 System Information

This section contains general information about the device:

Information	Remark
Device Name	This information can be edited under → Admin and is being displayed in the MC-Config-Application as the device's name
Uptime	This reflects the time since the MC was switched on or resetted the last time.
Realtime clock (UTC)	This shows the internal device time. The MC sets the internal time by default according to the time of the compilation of the firmware. If a time server is set up though, (Configuration → Real Time Server) then the MC will try to reach it and get the UTC information. If this is successful, the MC changes the internal time accordingly. The information about the internal time is useful for debug outputs.
Serial number	The serial number assigned by the manufacturer.
Firmware Version	The currently installed firmware on the device.
Kernel Version	The MC firmware is based upon Linux. This version-number refers to the Linux-version that has been used for the firmware.
System Information	
Device Name	MC1
Uptime	0 Week(s) 0 Day(s) 00:14:37
Realtime clock (UTC)	16.04.2015 10:05:31
Serial number	370987
Firmware Version	2.04c
Kernel Version	Linux version 4.0.0+

3.1.2 Wireless Status Information

This section contains information about the Wireless LAN state:

Operation Mode	The MC can be used as a client in a Wireless LAN Infrastructure or as a device in Adhoc Mode.																								
AP Mac Address (BSSID)	This is the MAC-Address of the access point (AP) the MC is connected to. If the AP transmits a device name, then the name will also be displayed here.																								
SSID (Network Name)	This is the name of the Wireless LAN network the MC is supposed to or has connected to.																								
Connection state	<p>State of the connection to the AP. The shown status information depends on the configured authentication method:</p> <table border="1"> <tr> <td>Idle</td> <td>no connection active</td> </tr> <tr> <td>Disconnected</td> <td>previously existing connection was interrupted</td> </tr> <tr> <td>EAP Success</td> <td>completed EAP authentication</td> </tr> <tr> <td>KeyCompleted</td> <td>key exchange completed</td> </tr> <tr> <td>Connected</td> <td>WLAN connection established</td> </tr> <tr> <td>Authenticate</td> <td>Authentication in process</td> </tr> <tr> <td>Associate</td> <td>Association in process</td> </tr> <tr> <td>Associated</td> <td>Association ready</td> </tr> <tr> <td>EAP Started</td> <td>EAP Authentication in process</td> </tr> <tr> <td>Timeout</td> <td>Timeout in EAP Authentication process</td> </tr> <tr> <td>EAP Failed</td> <td>EAP Authentication failed</td> </tr> <tr> <td>EAP Select Method</td> <td>EAP Authentication in process</td> </tr> </table>	Idle	no connection active	Disconnected	previously existing connection was interrupted	EAP Success	completed EAP authentication	KeyCompleted	key exchange completed	Connected	WLAN connection established	Authenticate	Authentication in process	Associate	Association in process	Associated	Association ready	EAP Started	EAP Authentication in process	Timeout	Timeout in EAP Authentication process	EAP Failed	EAP Authentication failed	EAP Select Method	EAP Authentication in process
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EAP Started	EAP Authentication in process																								
Timeout	Timeout in EAP Authentication process																								
EAP Failed	EAP Authentication failed																								
EAP Select Method	EAP Authentication in process																								
Security	Active encryption and authentication method																								
Connection time	Duration of the connection between MC and the current AP																								
Bitrate	The bitrate that is used to send data to the AP.																								
Channel/Frequency	This is the channel number and frequency that is used for the connection to the AP																								

SNR (Signal-to-Noise Ratio)	<p>The SNR can be valued as follows :</p> <table border="1"> <thead> <tr> <th>SNR</th> <th>State</th> </tr> </thead> <tbody> <tr> <td>>= 40</td> <td>very good condition</td> </tr> <tr> <td>>= 30</td> <td>good condition</td> </tr> <tr> <td>>= 20</td> <td>with this SNR the MC will start to scan for APs with a stronger signal</td> </tr> <tr> <td>>= 10</td> <td>weak signal! The MC will frequently scan for APs with a stronger signal. The data throughput will be interfered</td> </tr> <tr> <td>< 10</td> <td>very weak signal. The connection can get lost.</td> </tr> <tr> <td></td> <td></td> </tr> </tbody> </table>	SNR	State	>= 40	very good condition	>= 30	good condition	>= 20	with this SNR the MC will start to scan for APs with a stronger signal	>= 10	weak signal! The MC will frequently scan for APs with a stronger signal. The data throughput will be interfered	< 10	very weak signal. The connection can get lost.		
SNR	State														
>= 40	very good condition														
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< 10	very weak signal. The connection can get lost.														

Wireless Status Information

Operation Mode Infrastructure
 AP Mac Address (BSSID) 00:0B:6B:33:E7:8D (L-54A/G)
 SSID ESCG_WLAN_WPA
 Connection state Connected
 Security WPA2-PSK
 Connection time 4min 52sec
 Bitrate 54MBit
 Channel/Frequency 6: 2.437GHz
 SNR 38dB (Min 13dB Max 39dB, 24h: Min 13dB Max 39dB)



3.1.3 Wired LAN Status Information

This section shows the current status of the LAN ports

Wired LAN Status Information

LAN link state

Link: **Up**
 Speed: **100MBit/s**
 Duplex: **Full**
 MDI-X: **Cross**

LAN link state	state of the LAN-Port	Link	down → no LAN cable with an active Ethernet client connected up → LAN cable with an active Ethernet client connected
		Speed	10, 100, 1000 MBit → transfer rate
		Duplex	Half, Full → Simultaneous sending and receiving possible (Full) or not (Half)
		MDI-X	Straight, Cross → MDI-X State

3.1.4 Serial1

This section shows the current status of the serial Ports

Serial 1

State Serial Port is active
 Device /dev/ttymx0
 Network Connection Mode: 'TCP-Server' IP: 192.168.170.132:59879 (**Established**)
 Baudrate - Parity - Databits 115200 - None - 8
 Serial Tx Frames/Bytes 3122/48642
 Serial Rx Frames/Bytes 30412/49441
 Network Tx Frames/Bytes 421/49441
 Network Rx Frames/Bytes 98/48804
 Net->Uart: Bytes in Buffer 162
 Uart->Net: Bytes in Buffer 126

Info	Meaning	Comment
State		The port has to be activated.
Device	Device definition	This specification refers to the hardware interface of the serial port. The normally used processor internal device is: /dev/ttymx0
Network Connection	Mode and state	The configured port mode is shown here followed by the current state of the connection with IP and port of the connected device.
Baudrate Parity Databits	transmission parameter	These are the configured parameters of the serial interface. Meaning: <code>aaaa - b - c</code> <code>aaaa</code> = baudrate <code>b</code> = parity (n = none, o = odd, e = even) <code>c</code> = databits (7 or 8)
Serial Tx Frames/Bytes Serial Rx Frames/Bytes Network Tx Frames/Bytes Network Rx Frames/Bytes Net->Uart: Bytes in Buffer Uart->Net: Bytes in Buffer	Statistical information	These values shown here, inform us how many bytes or data packets via the serial port has been sent or received.

3.1.5 IO - Info (Optional)

In this section the current state of the relay is displayed. If the relay function is disabled, this section will not be shown.

Relay	Mode and state of the relay switch	Mode	Function
		TCP (UDP)	The relay function is active and listening on the configured port
		Internal	The relay is controlled by the digital input.

3.1.6 Network Information

This section displays information on the active network interfaces. The shown information depends on the configured bridge mode.

Bridge - Mode	Shown Information (for a sample setting)
LAN Client Cloning	<p>Network Information</p> <p>Interface wlan0 (IPv4) IP 192.168.170.255 Broadcast 192.168.170.255 Netmask 255.255.255.0 MAC 00:E0:00:17:C7:B1</p> <p>Bridge</p> <p>Bridge Type LAN Client Cloning Client IP 192.168.170.127 (Autodetected) Client Netmask 255.255.255.0 (Configured value) Client Gateway 192.168.170.1 (Autodetected) Client MAC 00:E0:00:17:C7:B1 (Autodetected) Original WLAN Card MAC 00:0E:8E:64:E6:D7 LAN MAC 90:5F:8D:05:A5:CB</p>
NAT or Single Client NAT	<p>Network Information</p> <p>Interface wlan0 (IPv4) IP 192.168.170.104 Broadcast 192.168.170.255 Netmask 255.255.255.0 MAC 00:0E:8E:64:E6:D7 Interface eth0 (IPv4) IP 192.168.1.1 Broadcast 192.168.1.255 Netmask 255.255.255.0 MAC 90:5F:8D:05:A9:2B</p> <p>Bridge</p> <p>Bridge Type Single Client Nat</p> <p>DHCP Server Status</p> <p>DHCP Client 1 00:E0:00:17:C7:B1 192.168.1.80 (siemens-nb)</p>
Level 2 Pseudo-Bridge	<p>Network Information</p> <p>Interface wlan0 (IPv4) IP 192.168.170.104 Broadcast 192.168.170.255 Netmask 255.255.255.0 MAC 00:0E:8E:64:E6:D7 Interface eth0 (IPv4) IP 192.168.170.104 Broadcast 192.168.170.255 Netmask 255.255.255.255 MAC 90:5F:8D:05:A5:CB</p> <p>Bridge</p> <p>Bridge Type Level 2 Bridge</p> <p>Level 2 Bridge Status</p> <p>Bridge Entry 1 eth0: 00:0B:6B:37:4F:0A 192.168.170.164 (1sec) Bridge Entry 2 eth0: 00:E0:00:17:C7:B1 192.168.170.127 (9sec)</p>

3.1.7 Access point information

In this section a list of all access points that are registered by the MC is displayed. The currently connected AP is grayed out and is always shown first in the list. The next entries are AP's with matching SSID's followed by AP's with other or hidden SSID's. The information at „Security“ shows us what authentication methods are expected by these AP's. If this methods don't match the configured MC authentication method these info is shown with red letters. The same is for the column „Channel/Frequency“ if the AP is working on a channel that the MC is currently not supported by configuration (Configuration->Wireless->Roaming).

Accesspoint List

BSSID	SSID	Security	SNR	AP Name	Channel/Frequency	Max Bitrate	Last Seen	Extra Information
00:A0:57:22:41:4A	LANCOMacn	[WPA2-PSK-TKIP+CCMP] [WPA-PSK-TKIP+CCMP] Infrastructure	55dB	LANCOM_acn_2	36: 5180MHz	54.0 + MCS Rates	0	Country DE
00:A0:57:22:41:2A	LANCOMacn	[WPA2-EAP-TKIP+CCMP-preauth] [WPA-EAP-TKIP+CCMP] Infrastructure	12dB	LANCOM_acn_1	44: 5220MHz	54.0 + MCS Rates	316	Country DE
02:A0:57:22:41:4A	LANCOMacn_EAP	[WPA2-EAP-TKIP+CCMP] [WPA-EAP-TKIP] Infrastructure	57dB	LANCOM_acn_2	36: 5180MHz	54.0 + MCS Rates	13	Country DE
68:BD:AB:67:C9:9C	WLC_INT	[WPA2-PSK-TKIP+CCMP] [WPA-PSK-TKIP+CCMP] Infrastructure	27dB	LAP1262	136: 5680MHz	54.0 + MCS Rates	316	Country DE
BC:30:7D:1A:69:5C	AP_HG76361_NRT_E_1	[WPA2-PSK-TKIP+CCMP-preauth] [WPA-PSK-TKIP+CCMP] Infrastructure	27dB		36: 5180MHz	54.0	13	Country DE
68:BD:AB:67:C9:97	LANCOMbgn_EAP	[WPA2-EAP-TKIP+CCMP] [WPA-EAP-TKIP+CCMP] Infrastructure	26dB	LAP1262	136: 5680MHz	54.0 + MCS Rates	316	Country DE
68:BD:AB:67:C9:98	LANCOMbgn_EAP	[WPA-EAP-TKIP] Infrastructure	26dB	LAP1262	136: 5680MHz	54.0 + MCS Rates	316	Country DE

3.2 Device Menu

In this menu item you can select functions to transfer firmware files to the MC or to handle with config files.

3.2.1 Firmware

with this dialog a firmware file can be uploaded to the MC

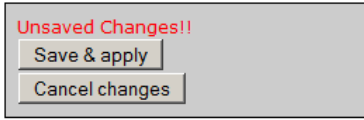
Upgrade firmware file Keine Datei ausgewählt



It is very important that the power supply of MC is not interrupted at this stage and also the reset key is not actuated.

3.2.2 Configuration Management

with this menu item following functions are supported:

Reset configuration to defaults	<p>With this button all parameters can be set to the factory default values. The user has to confirm this setting with the button "Save & apply". With the button "Cancel changes" the changes will be declined.</p> 
Download running configuration	<p>With this button the running configuration can be stored to a file. "Running configuration" means the configuration that is currently active on the MC without the changes made with the actual session.</p>
Download new configuration	<p>With this button the new configuration can be stored to a file. "New configuration" means the configuration that is currently active on the MC with the changes made with the actual session.</p>
Reboot device	<p>With this button the MC will make a reboot. Changes made in the actual session will get lost.</p>
Upload configuration file	<p>With this dialog a config file can be selected and uploaded to the MC. If parameters of the current configuration are changed with this upload, a dialog box will appear to "Save & apply" the new setting or to cancel the changes.</p>

Reset configuration to default values. All current configuration settings will be lost!

Download of the running configuration.

Download of the new configuration which is not yet activated.

Reboot device

Upload configuration file: Keine Datei ausgewählt

Figure 9: Configuration Management

3.2.3 Configuration

The “Configuration” menu has a collection of items to get to the configuration dialogs for all of the MC functions. Depending on the build-in options of the MC some of this submenu items will not appear.

Menu Item	important parameter	requirement
Admin	Device name, User, Password	
Network	IP-Address, Bridge-Mode	
Wireless	SSID, Security	
Serial Ports	Baudrate, Mode ...	Serial Port
Printer Server	USB-Printer Mode	USB-Port
Relay	Relay-Mode	Relay Option
Realtime clock	NTP-Server-IP	
Input	Input-Mode	digital input
LAN-Port	LAN-Port Parameter	
Logging	Debug-Messages	

The individual web pages for configuration are presented and explained in detail on the following sites.

3.2.4 Statistics

The “Statistics” menu gives you access to information regarding the activity on the LAN + WLAN interfaces and watch and download system stored messages.

3.2.4.1 Statistics - System Log

The MC devices generates system messages that are stores in the internal file system. On this website the messages are shown.

Download System Log
 Download System Log
 Reset System Log

```
System log:
317633 1086 1 10:16:09.918404 Main Debug.c [ 163] INFO: Cleared System Log
317632 1082 3 10:16:09.917982 Main Debug.c [ 804] INFO: Started logging to /mnt/nvm/DebugLog.dat - 2.04e
317632 1081 3 10:16:09.917772 Main Debug.c [ 803] INFO: *****
317632 1080 3 10:16:09.917461 Main Debug.c [ 802] INFO:
```

Figure 10: Example of a system log message

Two buttons are placed here to download the system messages and to clear the message memory. The downloaded system log file includes information's from the home website of the MC device and the configuration data.

3.2.4.2 Statistics - Network

This sub menu shows some statistical data on the network interfaces of the device.

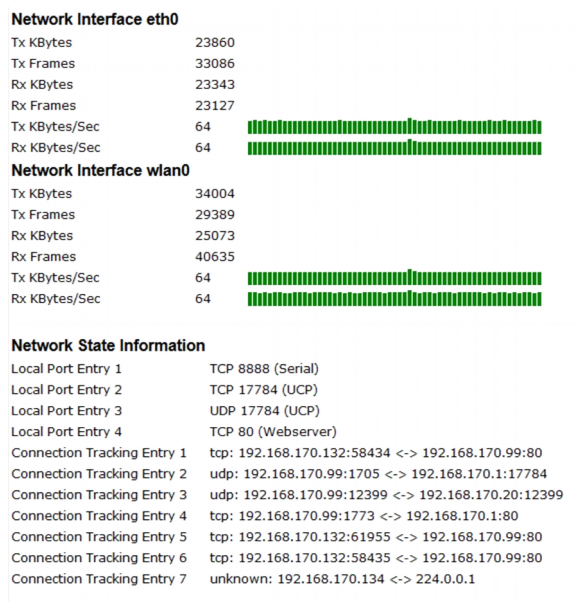


Figure 11: Example output of Statistics Network

4 Bridge Modes

The MC WLAN-Client-Adapter is used to connect one or more devices with an Ethernet interface via a WLAN infrastructure to a stationary network.

The MC offers various bridge modes to meet application-specific requirements.

Bridge mode	LAN-Clients	IP's im WLAN	Transparency	Note
LAN Client Cloning	1	1 (LAN Client IP)	all ports	IP- and MAC-address of the LAN-Client is registered in the WLAN.
Single Client NAT	1	1 (MC IP)	all ports	IP- and WLAN-MAC-address of the MC is registered in the WLAN.
NAT	as many	1 (MC IP)	Ports def. by config	IP- and WLAN-MAC-address of the MC is registered in the WLAN.
Level 2 Bridge	as many	n LAN-Clients + 1	all ports	All LAN-Client-IP's and the MC-IP are registered with the WLAN-MAC-address of the MC.
MWLC-Mode	as many	1 (MC IP)	all ports	Only the IP- and the WLAN-MAC-address of the MC is registered in the WLAN.

4.1 LAN Client Cloning

In this mode the device connected to the LAN port of the MC determines the IP- and the MAC-address of the WLAN connection that the MC establish to the WLAN infrastructure. The configuration and monitoring of the MC is done via the IP address of the LAN-Client. If only one LAN client is connected to the MC, this mode should be preferred.

4.1.1 Parameter for the "LAN Client Cloning mode"

In "LAN Client Cloning mode" the wireless connection is activated only when the LAN client is connected and data packets are received via the LAN port.

Parameter	Optionen	Default	Funktion
LAN client Type	Autodetect static DHCP	Autodetect	The MC can detect the IP address of the LAN-Client automatically. Nevertheless the user can configure the mode how the LAN-Client gets its IP address.
LAN-Client IP		0.0.0.0	If the LAN-Client IP is fixed and known the user can configure that address here.
LAN Client Netmask		255.255.255.0	If the LAN - Client does not use DHCP the network mask the LAN-Client uses has to be typed here.
LAN Client Gateway		0.0.0.0	If the LAN - Client does not use DHCP the gateway IP the LAN-Client uses has to be typed here.
Bridge IP		0.0.0.0	With this parameter the user can define the IP that the MC device will use for communication on the LAN side.
Timeout		30	The MC device tests permanently the connection to the LAN-Client. If the connection is interrupted because for example the LAN-Client is switch of, the MC device will switch of the WLAN interface. This is the timeout in seconds the MC device will switch of the WLAN interface if the connection to the LAN Client gets lost.
Stay connected		off	If the MC device should hold the WLAN connected even if the LAN-Client is down, this option can be activated.

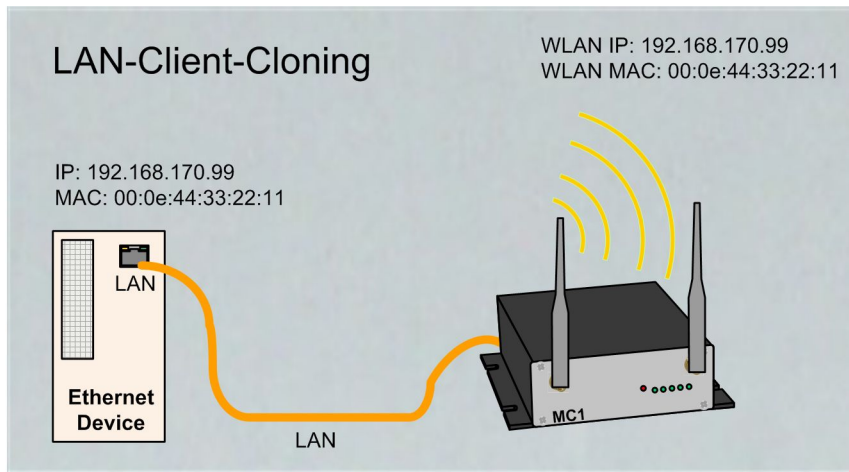


Figure 12: LAN Client Cloning Mode

To use the MC device internal interfaces (website, serial, relay or USB) the IP address of the LAN-Client must be used. To avoid collisions with the internal used port numbers the user has to adjust this. Specially the website port number of the MC device can be configured at „Configuration“-> „Admin“

Advantage of the LAN Client Cloning-Mode:

1. In the WLAN network, the MC will appear along with the LAN client only with one IP address.

Disadvantage of the LAN Client Cloning-Mode:

1. Only one LAN-Client can be connected to the MC.

4.1.2 NAT- und Single Client NAT Mode

The NAT mode is characterized in that the LAN clients connected to the MC work in a separate network from the wireless network. The traffic of the LAN clients via WLAN to the stationary network is transformed by the MC, so that all data is sent and received via the IP address of the MC.

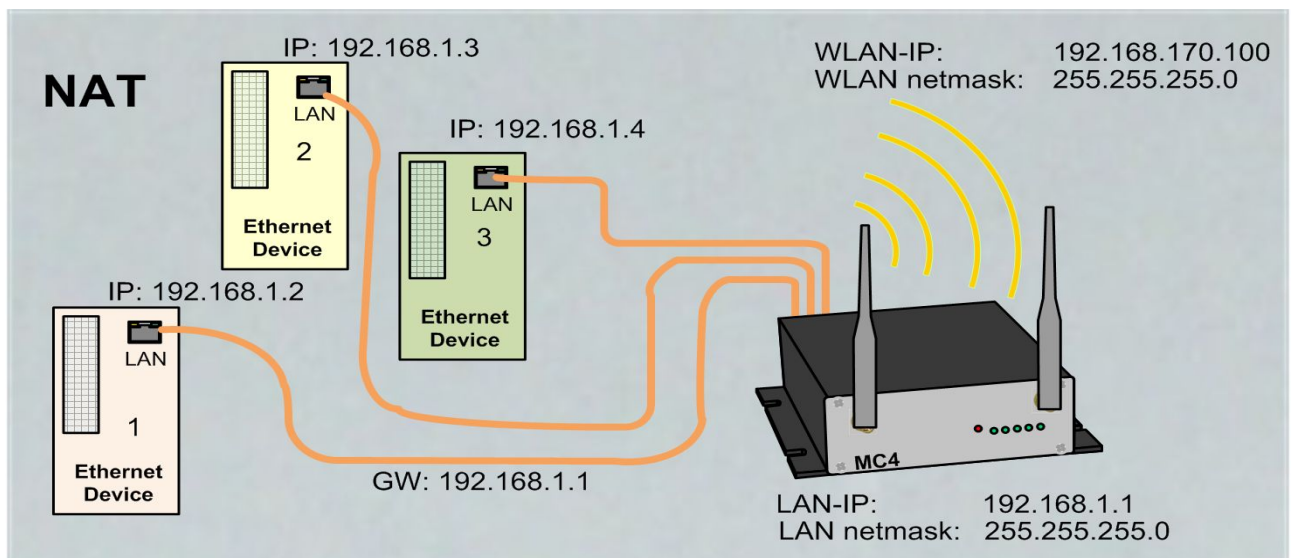


Figure 13: NAT-Modus (Beispielkonfiguration)

This example shows 3 LAN Clients connected to the MC. This LAN Clients have IP addresses that are configured fix or they get them from the DHCP-Server of the MC device. It is important, that the Gateway IP is set to the LAN site IP of the MC device.

What to consider:

If only one LAN client is connected to the MC, the "Single Client NAT" mode should be used. In this mode the LAN client can be reached better without further configurations.

If multiple LAN clients are connected to the MC the NAT mode **must** be defined.
When the LAN clients offer server services that are addressed via WLAN, the used ports has to be defined in a port forwarding table (NAT rules).

Forwarding rules for NAT

Format: <Protocol: TCP/UDP>:<Port/Range[>Forward Port][,...]>:<IP>

Examples:

TCP:8001>80:192.168.1.2 to redirekt TCP connection to port 8001 to 192.168.1.2:80

TCP:987:192.168.1.3 to redirect TCP connection to port 987 to 192.168.1.3

TCP:800-810:192.168.1.4 to redirect TCP connections to the ports between 800 and 810 to 192.168.1.4

TCP:21-23,80,85:192.168.1.4 to redirect TCP connections to the ports 21-23 AND 80 AND 85 to 192.168.1.4

NAT Rule 1	<input type="text" value="TCP:8001>80:192.168.1.2"/>
NAT Rule 2	<input type="text" value="TCP:8001>80:192.168.1.3"/>
NAT Rule 3	<input type="text" value="TCP:8001>80:192.168.1.4"/>

Figure 14: Screenshot NAT-Rules

4.1.2.1 Advantages:

1. Any number of LAN clients can be connected to a MC
2. The MC with all LAN-Clients appear only with one IP address in the WLAN.
3. If many units are working in a project, consisting of multiple LAN clients with an MC, the configuration for all units is the same. Only the IP address of the MC for the wireless side may need to be individually configured.
4. The LAN clients are better protected against unwanted access, because the MC switches through only data for the configured ports.
5. Local broadcast packets (on the LAN side of the MC) are not sent over the WLAN.

Disadvantages:

1. Access to the LAN clients via WLAN is possible only on the ports defined in the NAT rules.
2. If LAN clients offer server services on the same port numbers (eg FTP), the user must define port forwarding rules in a way that these services are addressed on different ports for each LAN clients.

4.2 Level 2 Bridge Mode

In this mode, each LAN client communicates with its own IP address over the wireless network. However, all data is sent with the MAC address of the MC-WLAN card. This procedure can make problems in some WLAN infrastructure systems. Problems can appear when the WLAN controller is working with ARP caching.



All IP 's of the LAN-Clients and the IP of the MC must be in the same network range.

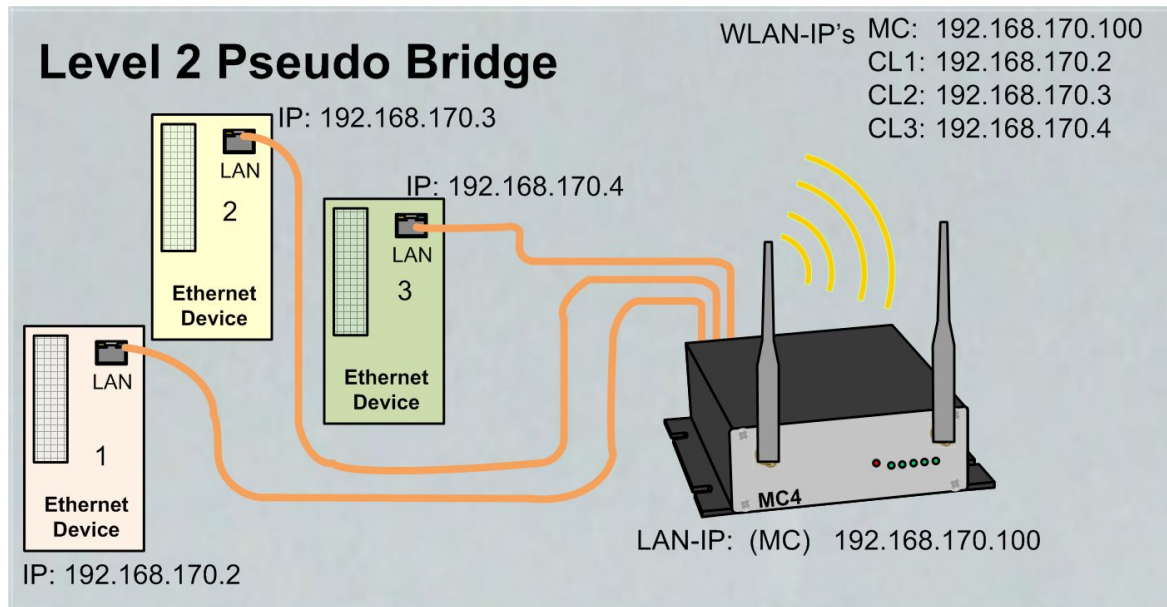


Figure 15: Level 2 Bridge Beispielkonfiguration

Advantages:

1. Any number of LAN clients can be connected to a MC.
2. Good transparency of the LAN clients to the WLAN without configuration.

Disadvantages:

1. The MC and all wireless clients work with their own IP addresses. These IP addresses must be in the same network.
2. Problems in some WLAN infrastructures with centralized controllers (no accessibility to the LAN clients from the WLAN side).

4.3 MWLC-Mode

With the MWLC mode, all restrictions on the availability, IP address assignment and transparency especially in applications with multiple LAN clients are solved. In this Mode all data packets received from the LAN-Clients are tunneled by the MC (Slave) to another MC (master) that is installed on stationary network side. The master MC extract the LAN-Client data packets and send it into the stationary network.

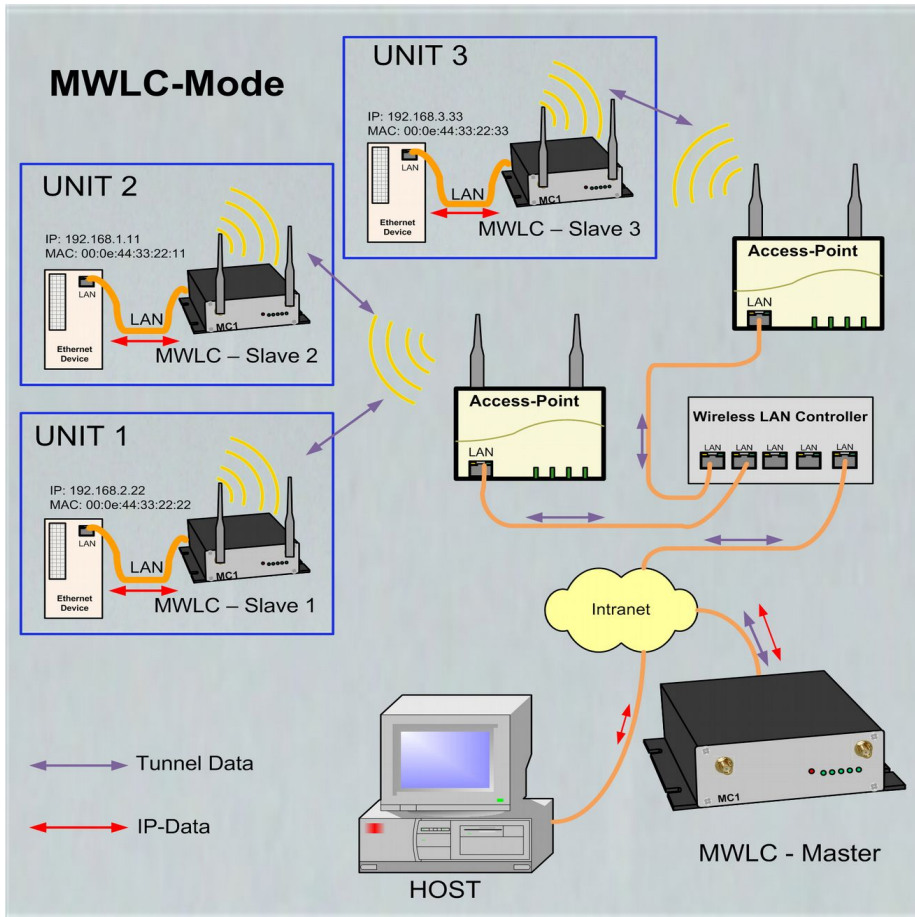


Figure 16: MWLC-Mode example setting

In this mode the IP addresses of the LAN clients has no influence to the MC. The LAN-Clients are connected to the stationary network with there own IP- and MAC addresses. Because the MWLC master in this constellation plays a central role, and a failure of this device would disconnect all clients, there is the possibility to install a 2nd MWLC master as a backup.

Bridge mode configuration

Bridge active
Check this box to enable bridge between WLAN and LAN.

Bridge mode: MWLC Slave
Select the type of bridging. Single Client NAT and LAN Client Cloning is used when only one client is attached on the LAN port. NAT is used when more than one Client is attached to the LAN Port. Level 2 Pseudo-Bridge is for transparent bridging between LAN and WLAN. Select MWLC-Slave or -Master to tunnel the client data between WLAN and the stationary network.

Master IP: 192.168.170.105
Enter master ip for MWLC-Mode.

Backup Master IP: 192.168.170.107
Enter backup master ip for MWLC-Mode.

Figure 17: Parameter for the MWLC-Mode

The WLAN interface of the Master-Modul has to beswitched off.

Advantages:

1. Maximum connection transparency for the LAN clients via WLAN into the stationary network.
2. The configuration work to the MC doesn't depend on the amount of LAN clients.

Disadvantages:

1. On the stationary network side one or two additional MC adapter are needed .