
LIP-ME201TM

BACnet Router

User's Manual

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Abbreviations

100BaseT.....	100 Mbps Ethernet network with RJ-45 plug
BACnet.....	Building Automation and Control Network
BBMD	BACnet Broadcast Management Device
BDT.....	Broadcast Distribution Table
B/IP.....	BACnet over IP (this is a BACnet data link layer)
DHCP	Dynamic Host Configuration Protocol
DNS.....	Domain Name System
DST	Daylight Saving Time
FD.....	Foreign Device
FTP	File Transfer Protocol
GMT	Greenwich Mean Time
IP	Internet Protocol
MAC.....	Media Access Control
MS/TP	Master/Slave Token Passing (this is a BACnet data link layer)
NAT.....	Network Address Translation, see Internet RFC 1631
NTP	Network Time Protocol

1 Introduction

1.1 Overview

The LIP-ME201 is a BACnet router between MS/TP and B/IP (BACnet over IP) as well as a BBMD (BACnet Broadcast Management Device) for transportation of BACnet broadcasts over an IP network with several subnets. Additionally, it can serve as a BACnet time and a BACnet MS/TP slave proxy.

1.2 Scope

This document covers LIP-ME201 devices.

2 Quick-Start Guide

This chapter provides the minimum list of steps necessary to setup the LIP-ME201.

2.1 Hardware Installation and IP Connection

- Connect power, Ethernet, and MS/TP (Sections 3.7 and 3.8).
- Connect the Console (Section 4.1) and configure the IP address, netmask, and gateway (Section 4.5) or connect to the LIP-ME201 over the Web interface right away (Section 5.1) and setup the IP configuration there (Section 5.2.4).
- In both cases, reboot the LIP-ME201 to commit the new IP settings (use corresponding menu item either in console menu or Web interface).

2.2 Configuration of the LIP-ME201

- Connect to the LIP-ME201 using the new IP address in a Web browser.
- Click on “Config” and enter the default administrator password “admin”.
- Click on “BACnet Config” and setup the BACnet Device Configuration (Section 5.2.5)
- Click on “Port Config” and setup the BACnet/IP and BACnet MS/TP Data Link Configuration (Sections 5.2.6, 5.2.7, 5.2.8).
- If the LIP-ME201 should also act as a BBMD, click on “BACnet BDT” and setup the Broadcast Distribution Table (Section 5.2.9).
- Reboot the LIP-ME201 to commit the changes (Section 5.4).

3 Hardware Installation

3.1 Enclosure

The LIP-ME201 enclosure is 6 TE (1 TE = 17.5 mm) wide for DIN rail mounting, following DIN 43 880 (see Figure 1).

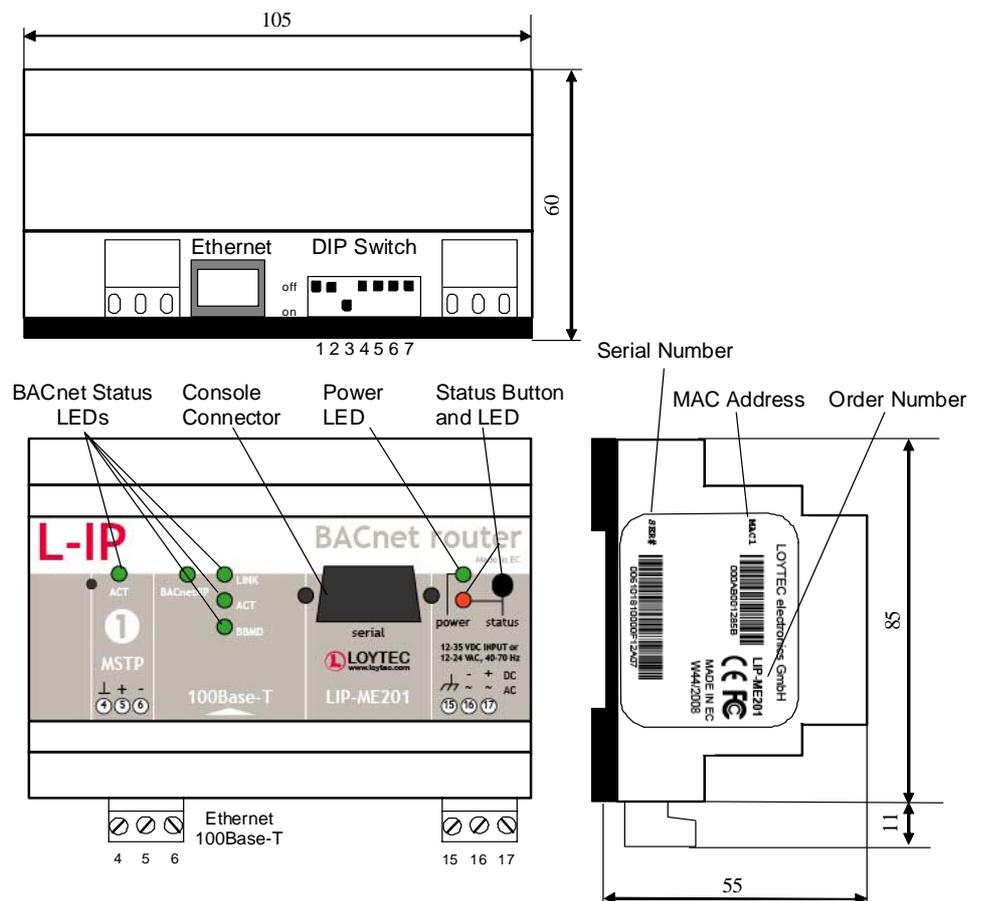


Figure 1: LIP-ME201 Enclosure (dimensions in mm)

3.2 Product Label

The product label on the side of the LIP-ME201 contains the following information (see Figure 1):

- LIP-ME201 Order Number,
- Serial Number with bar-code (SER#),
- Ethernet MAC Address with bar-code (MAC1).

Unless stated otherwise, all bar codes are encoded using "Code 128". An additional label is also supplied with the LIP-ME201 for documentation purposes.

3.3 Mounting

The device comes prepared for mounting on DIN rails following DIN EN 50 022. The device can be mounted in any position. However, an installation place with proper airflow must be selected to ensure that the LIP-ME201's temperature does not exceed the specified range (see Chapter 9).

3.4 LED signals

3.4.1 Power LED

The LIP-ME201 power LED lights up green when power is supplied to terminals 16 and 17.

3.4.2 Status LED

The LIP-ME201 is equipped with a red status LED (see Figure 1). This LED is normally off.

If the fall-back image is executed, the status LED flashes red once every second.

3.4.3 MSTP Activity LED

The MS/TP port has a three-color MSTP Activity LED (see Figure 1). Table 1 shows the different LED patterns of the port and their meaning. A permanent color reflects a state. Flicker is for 25 ms when there is activity on the MS/TP data link layer.

Behavior	Description	Comment
GREEN permanently, flicker off	Multi-Master, token ok, flicker when traffic	Normal condition on a multi-master MS/TP network.
ORANGE flicker	Sole master, flicker when traffic	Normal condition on a single-master MS/TP network.
RED permanent, flicker GREEN	Token lost state, flicker when transmit attempt	Cable might be broken.
RED flash fast	Transmission or receive errors	This indicates bad cabling.

Table 1: MS/TP Activity LED Patterns

3.4.4 Ethernet Link LED

The Ethernet Link LED lights up green whenever an Ethernet cable is plugged-in and a physical connection with a switch, hub, or PC can be established.

3.4.5 Ethernet Activity LED

The Ethernet Activity LED lights up green for 6 ms whenever a packet is transmitted or received or when a collision is detected on the network cable.

3.4.6 BACnet/IP LED

The BACnet/IP LED flashes green for 25 ms when BACnet packets are transmitted or received over the BACnet/IP interface.

3.4.7 BBMD LED

The BBMD LED is permanent green if BBMD is enabled. Otherwise, it is off.

3.5 Status Button

The LIP-ME201 is equipped with a status button (see Figure 1). When pressing the status button shortly during normal operation of the LIP-ME201, it sends a BACnet "I-Am" message on all active BACnet data link layers.

The status button can also be used to switch the device back to factory default state. Press the service button and power-cycle the device. Keep the button pressed until the port LEDs illuminate orange permanently. Release the button within five seconds from that time on to reset the device to factory defaults. Alternatively, the device can be switched back to factory defaults over the console user interface (see Section 4.3.6).

3.6 DIP Switch Settings

The DIP switch assignment for the LIP-ME201 is shown in Table 2. Please leave all switches at default state.

DIP Switch #	Function	Factory Default
1	Must be OFF	OFF
2	Must be OFF	OFF
3	Must be ON	ON
4	Must be OFF	OFF
5	Must be OFF	OFF
6	Must be OFF	OFF
7	Must be OFF	OFF

Table 2: DIP Switch Settings for LIP-ME201

3.7 Terminal Layout and Power Supply

The LIP-ME201 provides screw terminals to connect to the network as well as to the power supply. The screw terminals can be used for wires of a maximum thickness of 1.5 mm²/AWG12. The device can either be DC or AC powered.

Terminal	Function
4	BACnet MS/TP Ground
5	BACnet MS/TP Non-Inverting Input
6	BACnet MS/TP Inverting Input
8	Ethernet 100BaseT
15	Earth Ground
16, 17	Power Supply 12-35 VDC or 12-24 VAC \pm 10% Do not connect terminal 17 to earth ground!

Table 3: LIP-ME201 Terminals

3.8 Wiring

If BACnet over MS/TP is enabled, the MS/TP network segment must be properly terminated with an LT-04 network terminator connected at each of the two ends of the segment media.

Important: *When using 2-wire MS/TP, earth ground must be connected to both terminal 15 and 16 (see Figure 2a). Never connect terminal 17 to earth ground!*

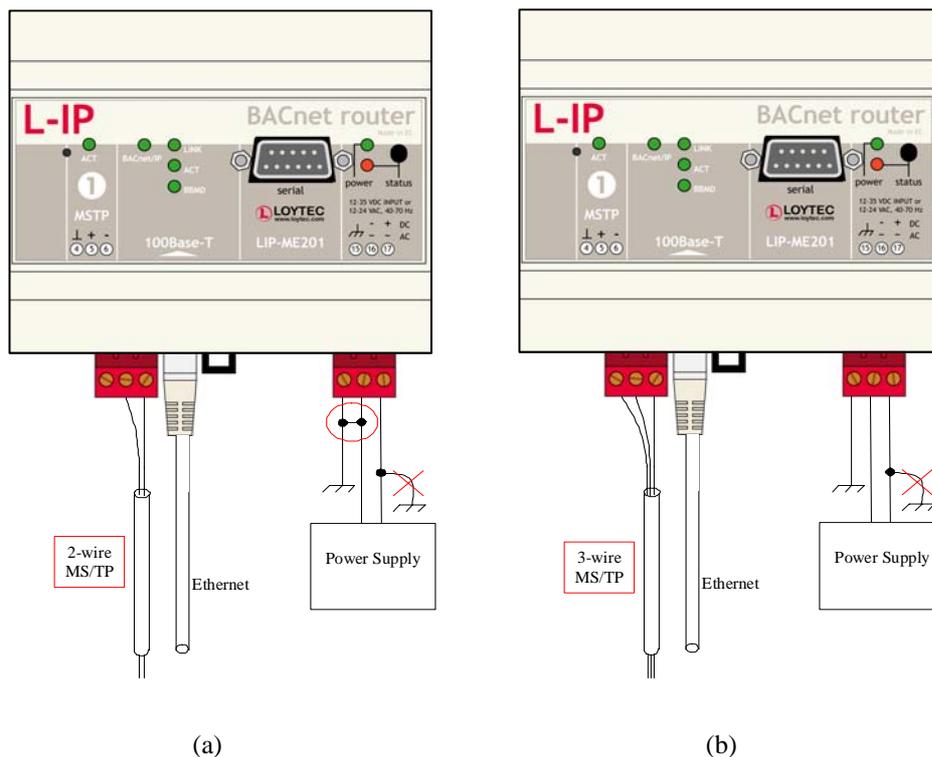


Figure 2: Connecting the LIP-ME201: (a) 2-wire MS/TP, (b) 3-wire MS/TP

4 Console Interface

Observe that for fully configuring the LIP-ME201, the Web interface (see Chapter 5) is needed. Therefore it is recommended to perform the complete setup using the Web interface. In some cases, it may be easier to first setup the IP configuration using the console (Section 4.5) and then proceed in the Web interface.

4.1 Console Connection and General Guidelines

The LIP-ME201 is equipped with a serial interface to

- display the results of the self test,
- allow configuration via a console menu,
- upgrade the LIP-ME201 firmware.

To use the serial interface, the console connector (see Figure 1) of the LIP-ME201 can be connected to the RS-232 port of a PC. The PC can communicate with the LIP-ME201 using a standard terminal program with communication settings of 38400 bps / 8 data bits / no parity / 1 stop bit. Use a standard null-modem cable with full handshaking to connect the LIP-ME201 serial console interface to your PC.

Here are some general guidelines for setting IP addresses, port numbers, and time values in the console interface:

- Enter **0.0.0.0** to clear an IP address.
- Enter **0** to select the default port number.
- Enter **0** to disable a time setting.
- Press **Return** to keep the current setting.

4.2 Self Test

Whenever the LIP-ME201 comes out of reset it performs a self-test. The console output of a successful boot sequence on an LIP-ME201 reads as follows:

```

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Testing Board ID (3)           Passed
Testing RAM                   Passed
Testing boot loader           Passed
Testing fallback image        Passed
Testing primary image         Passed
Testing Flash                  Passed

Loading primary image         Passed

Bootloader version 2
L-IP BACnet Primary Image loading...
Firmware version 1.0.0

Type bootshell to enter the boot shell...

Mounting file system          Passed
Starting TCP/IP networking    Passed
Starting BACnet networking    Passed
Starting FTP server           Passed
Starting Web server           Passed

L-IP BACnet Router(c)
LOYTEC electronics GmbH
Thu Sep  4 12:30:55 2008 - V1.0.0

```

Figure 3: Console messages during the boot phase.

The duration of a successful boot sequence of an LIP-ME201 is typically 20 seconds.

4.3 Device Main Menu

After booting has completed, the LIP-ME201 displays the console menu as shown in Figure 4.

```

Device Main Menu
=====

[1] Show device information
[2] Serial firmware upgrade
[3] System configuration
[5] IP configuration
[7] BACnet configuration
[8] Reset configuration (factory defaults)
[9] Device statistics

[0] Reset device

Please choose:

```

Figure 4: LIP-ME201 Device Main Menu.

The menu items are described in the following sections.

4.3.1 Option 1 - Show device information

This menu item shows information about the LIP-ME201 and the current firmware version. The output should look like what is shown in Figure 5.

```
Device Information
=====

Product:      L-IP BACnet Router
Product code: LIP-ME201
Firmware:     L-IP BACnet Primary Image
Version:      1.0.0
Build date:   Thu Sep  4 12:30:55 2008
Serial number: 011101-000AB001C4CB
Free memory:  12198K,615K
CPU load:     4.8%
System temp:  38.7C
Supply volt:  23.6V

Press <RETURN> to continue
```

Figure 5: Device Information

4.3.2 Option 2 – Serial firmware upgrade

This menu item allows updating the LIP-ME201 firmware via the serial interface (console). See Section 7.2 for detailed instructions.

Note: If you select this option accidentally, you can return to the main menu by sending a break signal. In case your terminal program does not offer an option to send a break signal, the device must be reset to return to the main menu.

4.3.3 Option 3 – System configuration

Select this menu item to change system configuration settings. See Section 4.4 for details.

4.3.4 Option 5 – IP configuration

Select this menu item to change the IP configuration settings like IP address, default gateway, DHCP, and MAC address. See Section 4.5 for details.

4.3.5 Option 7 – BACnet configuration

Select this menu item to change the BACnet configuration settings like device ID, device name, and data link layer related configuration setting. See Section 4.6 for details.

4.3.6 Option 8 - Reset configuration (factory defaults)

This menu item resets the LIP-ME201 to factory defaults. See Section 4.7 for details.

4.3.7 Option 9 – Device statistics

Select this menu item to display advanced IP and BACnet MS/TP statistics information. See Section 4.8 for details.

4.3.8 Option 0 – Reset Device

Select this menu item to reboot the LIP-ME201. Some configuration changes require rebooting the device. Note, that this option does not reset the configuration.

4.4 System Configuration Menu

The system configuration menu holds various system configuration settings. Typically the system configuration menu looks like shown in Figure 6.

```

System Configuration Menu
=====

[1] Configure date/time : Fri Sep 26 13:19:01 2008 (GMT+00:00)
[2] Configure earth pos : 48:13:14 N 16:20:05 E 200 m
[7] FTP server          : enabled
[8] FTP server port    : 21 (default)
[9] Web server         : enabled
[0] Web server port    : 80 (default)

[q] Quit without saving
[x] Exit and save

```

Figure 6: System Configuration Menu

4.4.1 Option 1 - Configure Date/Time

This menu item allows configuring the LIP-ME201's system time. It provides several sub-items as shown in Figure 7. With menu option '1' the time source is defined. The following options are available: 'auto', 'manual', 'NTP', 'BACnet'. In the 'auto' mode the device switches to the first external time source that is discovered (e.g., synchronizes to BACnet, if a BACnet time sync is received). The option 'manual' allows setting the time manually using menu items '2' and '3'. In 'manual' mode, the device does not switch to an external time source. Note that if NTP is selected, the NTP servers have to be configured in the IP setting menu (see Section 4.5).

```

Date/Time Configuration Menu
=====

[1] Set time sync source: manual
[2] Set date           : 2008-01-29
[3] Set time           : 10:58:56
[4] Set timezone offset : +01:00
[5] Set DST            : none

[q] Quit without saving
[x] Exit and save

Please choose:

```

Figure 7: Configure Date/Time Menu

The timezone offset must be defined independently of the time source. It is specified in menu option '4' and defines the offset to GMT in hours and minutes (e.g., Vienna/Austria is +01:00, New York/U.S.A. is -06:00). Start and end of daylight savings time (DST) is defined in menu option '5'. Pre-defined choices are offered for Europe and U.S.A./Canada. DST can be switched off completely, or set manually for other regions.

4.4.2 Option 2 - Configure Earth Position

This menu item is reserved for future use.

4.4.3 Option 7 – FTP server, 8 – FTP server port

This menu option allows enabling and disabling the FTP server and configuring the FTP server port. Press <7> to toggle between enabled and disabled. Press <8> to change the FTP server port. To use the default port, enter 0 when asked for the port number. The FTP server can be used to update the firmware (see Section 7.1).

4.4.4 Option 9 – Web server, 0 – Web server port

These menu items allow enabling and disabling the Web server and configuring the Web server port on the LIP-ME201. You can disable the Web server if you do not want to provide access to the LIP-ME201 configuration via the Web interface. Press <9> to toggle between enabled and disabled. Press <0> to change the Web server port. To use the default port, enter 0 when asked for the port number.

4.5 IP Configuration Menu

The IP configuration menu holds relevant IP settings. The IP configuration menu, when DHCP is disabled, is shown in Figure 8.

```
IP Configuration Menu
=====

[1] DHCP                : disabled
[2] IP Address          : 192.168.1.200
[3] IP Netmask          : 255.255.255.0
[4] IP Gateway          : 192.168.1.1
[5] Hostname            : new
[6] Domainname         : <unset>
[7] DNS Servers         : <unset>
[9] MAC Address         : 00:0A:B0:01:45:1F (factory default)
[0] NTP Servers         : <unset> (out-of-sync)
[b] Link Speed & Duplex : Auto Detect

[q] Quit without saving
[x] Exit and save

Please choose:
```

Figure 8: IP Configuration Menu when DHCP is disabled

The IP configuration menu, when DHCP is enabled, is shown in Figure 9.

```
IP Configuration Menu
=====

[1] DHCP                : enabled
    IP Address          : 192.168.1.200
    IP Netmask          : 255.255.255.0
    IP Gateway          : 192.168.1.1
[5] Hostname            : new
    Domainname         : <unset>
    DNS Servers         : <unset>
[9] MAC Address         : 00:0A:B0:01:45:1F (factory default)
[0] NTP Servers         : <unset> (out-of-sync)
[b] Link Speed & Duplex : Auto Detect

[q] Quit without saving
[x] Exit and save

Please choose:
```

Figure 9: IP Configuration Menu when DHCP is enabled

4.5.1 Option 1 – DHCP

This option allows switching between manual entry of the IP address, netmask, and gateway address or automatic configuration from a DHCP server. If DHCP is disabled, one must enter the configuration data described in the following sections. If DHCP is enabled, please skip menu items 2 through 7.

Press <1> to toggle between “DHCP enabled” and “DHCP disabled”.

4.5.2 Option 2 – IP Address, 3 - IP Netmask, 4 – IP Gateway

Please enter the IP address for the LIP-ME201, the netmask (e.g., 255.255.255.0), and the default gateway address.

Important! *The default IP address and gateway 192.168.1.254 is only set for configuration access. It must be changed in order to make the device functional.*

4.5.3 Option 5 – Hostname, 6 – Domainname

“Hostname” and “Domainname” are optional entries and can be left empty. For some DHCP configurations it may be necessary to enter a hostname. Please contact your system administrator to get information on how to configure DHCP to acquire an IP address.

4.5.4 Option 7 – DNS Servers

You can configure up to 3 Domain Name Servers. Currently, these entries are not used.

4.5.5 Option 9 – MAC Address

The LIP-ME201 comes configured with a unique MAC address. This address can be changed in order to clone the MAC address of another device. It can be dangerous to change the MAC address. Please contact your system administrator to avoid MAC address conflicts. After selecting menu item 9 the following message appears.

```
Override factory MAC address (y/n):
```

Enter “y” to input a new MAC address or enter “n” to clear the current MAC address and return to the factory default MAC address.

4.5.6 Option 0 – NTP Servers

You can configure up to 2 NTP servers. Select <0> and when prompted

```
Enter new address of NTP server 1:
```

enter the first NTP server's IP address. Press <Enter>. When prompted enter the IP address of the second NTP server and press <Enter>. To clear an NTP server's address leave the respective IP address blank and press <Enter>.

The NTP server information will be used to synchronize the system time, if the NTP time source has been selected in the system configuration menu (see Section 4.3.3). The text appended to this menu item displays the current NTP synchronization status (out-of-sync, or in-sync).

4.5.7 Option b – Link Speed & Duplex

If the LIP-ME201 is operated with an old 10Mbit/s-only hub, the link speed should be switched from “Auto Detect” to “10Mbps/Half-Duplex”. With modern 100/10Mbit/s switches this setting can be left at its default (Auto Detect).

```
Change Link Speed & Duplex
=====
```

```
[1] Auto Detect (default)
[2] 100Mbps/Full-Duplex
[3] 100Mbps/Half-Duplex
[4] 10Mbps/Full-Duplex
[5] 10Mbps/Half-Duplex
```

4.6 BACnet Configuration Menu

This menu allows configuring the BACnet interface of the LIP-ME201. The BACnet configuration menu is shown in Figure 10.

```
BACnet Configuration Menu
=====
```

```
[1] Device ID           : 17800
[2] Device name        : L-IP BACnet Router
[3] Device description : L-IP BACnet Router
[4] Device location    : unknown
```

```
[0] Configure Data Link Layers
```

```
[q] Quit without saving
[x] Exit and save
```

```
Please choose:
```

Figure 10: BACnet Configuration Menu

4.6.1 Option 1 – Device ID

This configuration option allows setting the instance part of the “Object_Identifier” property of the BACnet Device object. Note that this instance number must be unique within the BACnet internetwork.

4.6.2 Option 2 – Device name, 3 – Device description, 4 – Device location

These menu items allow to set the value of the properties “Object_Name”, “Description”, and “Location” of the BACnet Device object. Note that the “Object_Name” property must be unique within the BACnet internetwork.

4.6.3 Option 0 – Configure Data Link Layer

Please first select the BACnet data link layer you want to configure:

```
Select Data Link Layer
=====
```

```
[1] BACnet/IP
[2] MS/TP
```

Please choose:

The two corresponding configuration menus are described in the following sections.

4.6.3.1 BACnet/IP Configuration Menu

The BACnet/IP configuration menu is shown in Figure 11. Select <1> to enable or disable the BACnet/IP data link layer. This might be useful for debugging, for normal operation of the LIP-ME201, it must always be enabled.

```
BACnet/IP Configuration Menu
=====
```

```
[1] Interface status      : enabled
[2] Network number       : 1
[3] BACnet/IP port       : 47808 (0xBAC0, default)
[4] BACnet/IP mode       : Device (Default)
```

```
[q] Quit without saving
[x] Exit and save
```

Please choose:

Figure 11: BACnet/IP Configuration Menu

Set the BACnet network number of the BACnet/IP data link layer and the UDP port used for the BACnet/IP protocol with <2> and <3>. Enter a port number of 0 to use the default port (47808/0xBAC0). Option <4> allows setting the BACnet/IP mode:

```
Select BACnet/IP mode
=====
```

```
[1] Device (Default)
[2] Foreign Device (FD)
[3] Broadcast Management Device (BBMD)
```

Please choose:

Observe that when choosing “Foreign Device”, additional settings will be available. Please refer to the corresponding Web interface Section 5.2.7 for more information on the different modes.

4.6.3.2 MS/TP Configuration Menu

The MS/TP configuration menu is shown in Figure 12. Select <1> to enable or disable the MS/TP data link layer. If MS/TP is disabled, the LIP-ME201 will only be able to work as a BBMD but not as a router. Set the BACnet network number of the MS/TP data link layer with <2>.

```

MS/TP Configuration Menu
=====

[1] Interface status   : enabled
[2] Network number    : 2
[3] MS/TP node number : 127
[4] Baud rate         : 38400
[5] Max info frames   : 1
[6] Max master        : 127

[q] Quit without saving
[x] Exit and save

Please choose:

```

Figure 12: MS/TP configuration menu.

Additionally, the menu offers the following options:

4.6.3.2.1 Option 3 – MS/TP node number

This menu item is used to set the MS/TP node number of the LIP-ME201. It must be in the range 0 to the number configured with the “Max master” configuration option.

4.6.3.2.2 Option 4 – Baud rate

This menu item allows configuring the baud rate on the MS/TP channel. Possible options are 9600, 19200, 38400, and 76800 baud.

4.6.3.2.3 Option 5 – Max info frames

This menu item allows setting the maximum number of info frames on the MS/TP channel. The default value is 1. It is recommended to leave this configuration option at the default setting.

4.6.3.2.4 Option 6 – Max master

This menu item allows setting the maximum number of masters on the MS/TP channel. The default value is 127. It is recommended to leave this configuration option at the default setting.

4.7 Reset configuration (factory defaults)

This menu item allows resetting the device into its factory default state. The menu appears as shown in Figure 13.

```

Reset Configuration Menu
=====

[1] Reset everything to factory defaults
[3] Reset all passwords

[q] Quit

Please choose:

```

Figure 13: Reset to Factory Defaults Menu

4.7.1 Option 1 – Reset everything to factory defaults

Select this menu item to reset the complete device to factory defaults (including error log, passwords, etc.).

4.7.2 Option 3 – Reset all passwords

Select this menu item to reset all passwords (Web interface, FTP server, etc.) to factory defaults.

4.8 Device Statistics Menu

This menu holds relevant information regarding the device statistics of the LIP-ME201. The device statistics menu is shown in Figure 14. Use this menu only for debugging purposes. There is no need to access this menu if the network is running smoothly.

```

Statistics Menu
=====

[4] Show IP statistics
[7] Show BACnet MS/TP statistics

[q] Quit

Please choose:

```

Figure 14: Device Statistics Menu

4.8.1 Option 4 – IP statistics

A sample console output is shown in Figure 15.

```

***** INTERFACE STATISTICS *****
**** lo0 ****
Address:127.0.0.1      Net mask:255.0.0.0
Flags: Up Loopback Running Multicast
Send queue limit:50  length:0  Dropped:0
**** eth0 ****
Ethernet Address: 00:0A:B0:01:C4:CB
Address:192.168.1.254  Broadcast Address:192.168.1.254  Net mask:255.255.255.2
55
Flags: Up Broadcast Running Simplex Multicast
Send queue limit:50  length:0  Dropped:0
MACB driver statistics (unit 0)
  Interrupts: 80100  Single collisions: 0  Multiple collisions: 0
    RX OK: 43901  FCS errors: 0  Alignment errors: 0
  TX deferred: 0  Late collisions: 0  Excessive collisions: 0
  TX underruns: 0  No carrier: 0  RX resource errors: 0
  RX overruns: 0  RX symbol errors: 0  Excess length errors: 0
  Receive jabbers: 0  Undersize frames: 0  SQE test errors: 0
  RX length mismatch: 0  TXd pause frames: 0  RX No mbufs: 0
  RX No clusters: 0  RX latency reached: 159  TX latency reached: 0

Extended statistics:
  INT Mdio done: 41052  INT RX ok: 38593  INT RX buf used: 0
  INT TX buf used: 456  INT TX buf underrun: 0  INT TX retry limit: 0
  INT TX buf exhaust: 0  INT TX ok: 0  INT link change: 0
  INT RX overrun: 0  INT HRESP not ok: 0  INT Pause frame: 0
  INT Pause time zero: 0  Packets delivered: 43901  TX no buffers: 0
  TX enqueue err: 0  RX IO err: 0  RX dropped: 0
  RX overload: 0

PHY      0      1      2      3      4      5      6      7
0 00001100 0000782d 00000007 0000c0c4 000001e1 000045e1 00000003 00007fff
8 0000ffff 0000ffff 0000ffff 0000ffff 0000ffff 0000ffff 0000ffff 00000000
16 00000040 00000002 000000ff 0000ffff 00000000 00000000 00000000 00000000
24 0000ffff 0000ffff 00000000 0000001a 00000000 000000c8 00000000 00001058
***** MBUF STATISTICS *****
mbufs:1024  clusters:128  free: 110
drops: 0  waits: 0  drains: 0
  free:1005  data:19  header:0  socket:0
  pcb:0  rtable:0  htable:0  atable:0
  soname:0  soopts:0  ftable:0  rights:0
  ifaddr:0  control:0  oobdata:0

***** IP Statistics *****
  total packets received 27709
  packets rcvd for unreachable dest 16364
  datagrams delivered to upper level 11345
  total ip packets generated here 391

Destination  Gateway/Mask/Hw  Flags  Refs  Use  Expire  Interface
252.132.42.16  0.0.0.0  U  2  0  7  eth0
127.0.0.1  127.0.0.1  UH  0  0  0  lo0
192.168.1.1  00:14:6C:E2:41:46  UHL  0  0  17854  eth0
192.168.1.254  255.255.255.255  U  0  0  7  eth0
192.168.17.209  00:0A:B0:01:35:DF  UHL  0  2  17180  eth0
255.255.255.255  255.255.255.255  UH  2  199  0  eth0
255.255.255.255  255.255.255.255  U  1  0  0  eth0
***** TCP Statistics *****

***** UDP Statistics *****
  total input packets 11345
  no socket on port 116
  of above, arrived as broadcast 3854
  total output packets 275

```

```
***** ICMP Statistics *****
      Calls to icmp_error()      116
      Type 3 sent                 116
```

Figure 15: IP Statistics

The IP statistics menu has the additional feature of displaying any IP address conflicts. If the LIP-ME201's IP address conflicts with another host on the network, the banner shown in Figure 16 is displayed.

```
WARNING: Conflicting IP address detected!
          IP address 10.125.123.95 also used by device with MAC address
          00 04 5A CC 10 41!

Clear IP conflict history (y/n):
```

Figure 16: IP Address Conflict

As useful information, the MAC address of the conflicting host is shown. If the information about this conflict shall be cleared, hit <y>. If <n> is selected, the conflict will show up again the next time this menu is entered.

4.8.2 Option 7 – Show BACnet MS/TP Statistics

This menu option is available for the MS/TP data link layer. A sample output is shown in Figure 17. When prompted to clear the MS/TP statistics, hit <y> to reset the counters or <n> to keep them. The following describes the most important statistics data.

The MS/TP token status reports the current token passing state. In state 'OK', the token is circulating between the masters. This is the normal state, when multiple masters are on the MS/TP network. The state 'SOLE MASTER' is the normal state when the LIP-ME201 is the only master on the network. If there are multiple masters on the network, this state is a hint to a broken cable. In state 'TOKEN LOST', the token is currently not circulating.

The counters 'Rcv ok' and 'Send ok' reflect the number of successfully received or transmitted MS/TP frames. Check these counters to verify that communication is flowing on the MS/TP segment. The counter 'MS/TP lost tokens' is an indicator for communication problems on the MS/TP network. If it increases, there is a cabling, ground, or termination problem.

```
BACnet MS/TP Statistics
=====

MS/TP token status      : OK
Rcv OK                  : 200
Send OK                 : 173
Rcv Idle Errors         : 0
Rcv Preamble Timeouts  : 0
Rcv Preamble Errors    : 0
Rcv Header Frame Too Long : 0
Rcv Header Timeouts    : 0
Rcv Header Errors      : 0
Rcv Header BAD CRC     : 0
Rcv Header No Data     : 0
Rcv Header Not For Us  : 0
Rcv Data Timeout       : 0
Rcv Data Error         : 0
Rcv Data Bad CRC       : 0
MSTP Lost Tokens       : 0
MSTP Master Polls     : 0
MSTP Rcvd Tokens       : 0
MSTP Rcvd Unwanted Frame : 0
MSTP Rcvd Unexpected Frame : 0
MSTP Rcvd Invalid Frame : 0
MSTP Rcvd FPM          : 0
MSTP Rcvd Data No Reply : 0
MSTP Rcvd Data Needing Reply : 0
MSTP Rcvd Reply Timeouts : 0
MSTP Rcvd Replies      : 0
MSTP Rcvd Postpone     : 0

Clear BACnet MS/TP statistics (y/n)?
```

Figure 17: BACnet MS/TP Statistics Menu.

5 Web Interface

The LIP-ME201 comes with a built-in Web server and a Web interface to configure the LIP-ME201 and extract statistics information. The Web interface allows configuring the IP settings, BACnet and other configuration settings.

5.1 Device Information and Account Management

In a Web browser, enter the default IP address 192.168.1.254 of the LIP-ME201. Note that if your PC has an IP address in a subnet other than 192.168.1.xxx, you must open a command tool and enter the following route command to add a route to the LIP-ME201.

To Add a Route to the Device

1. Windows **START** → **Run**
2. Enter 'cmd' and click **OK**.
3. In the command window enter the command line

```
route add 192.168.1.254 %COMPUTERNAME%
```
4. Then open your Web browser and type in the default IP address '192.168.1.254'.
5. The device information page should appear as shown in Figure 18.

The screenshot shows the 'Device Info' page of the LIP-ME201 web interface. The page has a dark blue header with the LOYTEC logo and the title 'Device Info'. On the left, there is a sidebar with navigation options: 'Device Info', 'Config', 'Statistics', 'Reset', 'Contact', and 'Logout'. The main content area displays a table of 'General Info' with the following data:

General Info	
Product name	L-IP BACnet Router
Product code	LIP-ME201
Firmware	L-IP BACnet Primary Image
Version	1.2.0
Build date	2010-05-07 11:54:08
Serial number	011101-000AB001C4AE
Free memory	11830K, 622K
Free flash	14121K
CPU load	0.0%
System temperature	40.0°C
Supply voltage	23.8V

At the bottom right of the page, there is a logo for 'goahead WEB SERVER'. The sidebar also contains the text 'networks under control' written vertically.

Figure 18: Device Information Page.

The device information page shows information about the LIP-ME201 and the current firmware version. It also contains operational parameters, such as free memory, system temperature and supply voltage.

Click through the menus on the left hand side to become familiar with the different screens. If you click on **Config** in the left menu, you will be asked to enter the administrator password in order to make changes to the settings as shown in Figure 19. Enter the default administrator password 'admin' and select **Login**.

The screenshot shows the 'Login' page of the LIP-ME201 web interface. The top header includes the LOYTEC logo and the title 'Login'. On the left, a sidebar menu is visible with 'Config' selected, and 'System' is highlighted under the 'Config' section. The main content area is titled 'Enter your username and password'. It features an 'Account' dropdown menu set to 'admin', a 'Password' input field containing 'admin', and a 'Login' button. A vertical label 'networks under control' is positioned between the sidebar and the main content area.

Figure 19: Enter 'admin' as the default administrator password.

The Config menu opens. Click on **Passwords** in the Config menu, which opens the password configuration page as shown in Figure 20. The LIP-ME201 has three user accounts: (1) **guest** allows the user to view certain information only, e.g., the device info page. By default the guest user has no password. (2) **operator** is able to read more sensible information such as calendar data. (3) **admin** has full access to the LIP-ME201 and can make changes to its configuration. Note that the user accounts are also used to log on to the FTP and Telnet server.

The screenshot shows the 'Config Passwords' page of the LIP-ME201 web interface. The top header includes the LOYTEC logo and the title 'Config Passwords'. The left sidebar menu shows 'Config' selected, with 'Passwords' highlighted under the 'System' section. The main content area is titled 'Enter the desired password for the Administrator and Guest accounts. The Administrator has full access to the device, whereas a Guest can only view the status information but not change the configuration. In order to clear a password leave the password field empty.' It features an 'Account' dropdown menu set to 'admin', 'New password' and 'Retype password' input fields, and a 'Change password' button. A vertical label 'networks under control' is positioned between the sidebar and the main content area.

Figure 20: Password Configuration Screen.

Please change the administrator password in order to protect yourself from unwanted configuration changes by anyone else. To do so, select the **admin** account in the drop-down box and enter the new password. If the administrator password is left empty,

password protection is turned off and everyone can access the LIP-ME201 without entering a password. Click on **Change password** to activate the change.

5.2 Device Configuration

The device configuration pages allow viewing and changing the device settings of the LIP-ME201. Here are some general rules for setting IP addresses, port numbers, and time values:

- An empty IP address field disables the entry.
- An empty port number field sets the default port number.
- An empty time value field disables the time setting.

5.2.1 System Configuration

The system configuration page is shown in Figure 21. This page allows configuring the device's system time and other system settings. The **TCP/IP Configuration** link is a shortcut to the Ethernet port configuration. Follow that link to change the IP settings of the device.

The time sync source can be set to **auto**, **manual**, **NTP**, **BACnet**. In the **auto** mode, the device switches to the first external time source that is discovered. Possible external time sources are NTP, BACnet. The option **manual** allows setting the time manually in the fields **Local Time** and **Local Date**. In **manual** mode, the device does not switch to an external time source. Note, that if **NTP** is selected, the NTP servers have to be configured on the IP Configuration page (see Section 5.2.4).

The time zone offset must be defined independently of the time source. It is specified as the offset to GMT in hours and minutes (e.g., Vienna/Austria is +01:00, New York/USA is -06:00). For setting the daylight saving time (DST) predefined choices are offered for Europe and USA/Canada. DST can be switched off completely by choosing **none** or set manually for other regions. In that case, start and end date of DST must be entered in the fields below.

Figure 21: System Configuration Page, e.g., for Vienna, Austria.

The next section on the page allows to configure the LIP-ME201's earth position. This setting defines the longitude, latitude and elevation of the device. The latitude and longitude are entered as degrees, minutes, and seconds. The altitude is entered in meters height above sea level. This setting is used for an astronomical clock. For fixed locations such as a building, the position can be entered on this page.

The CSV delimiter setting can be ignored.

5.2.2 Backup and Restore

A configuration backup of the LIP-ME201 device can be downloaded via the Web interface. Click the backup link as shown in Figure 22 to start the download. The LIP-ME201 device assembles a single file including all required files. A file requestor dialog allows specifying the location where the backup file shall be stored.

To restore the device settings, simply select a previously generated backup file in the **Restore Configuration** section of the page by clicking the button next to the **Filename** field. Then press the **Restore** button.

The backed up configuration data consists of:

- Device settings (Passwords, IP settings, BDT, etc.),

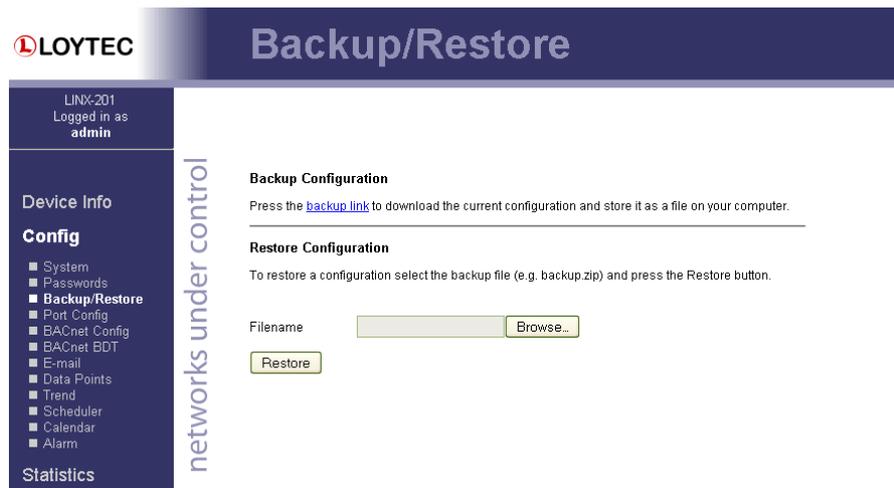


Figure 22: Backup/Restore page.

5.2.3 Port Configuration

This menu allows configuring the device's communications ports. For each communication port, which is available on the device and shown on the label (e.g., Port 1, Port 2, Ethernet), a corresponding configuration tab is provided by the Web UI. An example is shown in Figure 23. Each port tab contains a selection of available communication protocols. By selecting a checkbox or radio button the various protocols can be enabled or disabled on the communication port. Some ports allow exclusive protocol activation only, other ports (e.g., the Ethernet port) allow multiple protocols bound to that port.

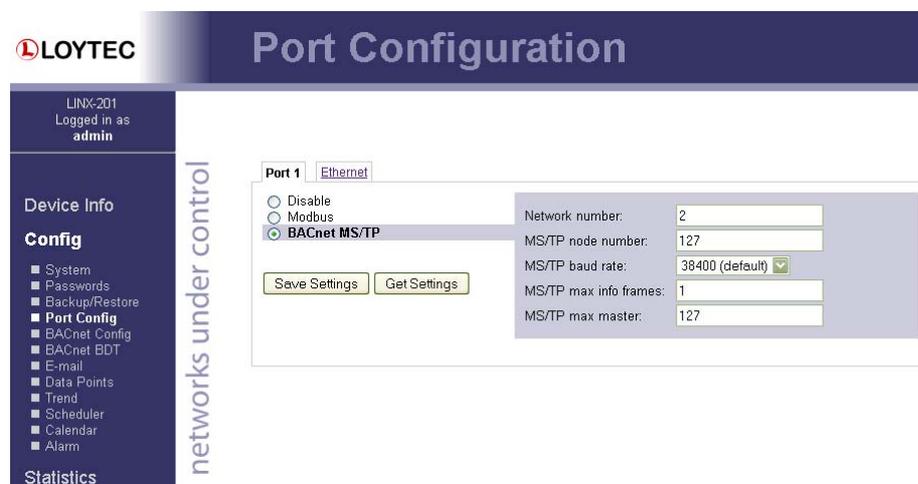


Figure 23: Port Configuration Page.

When selecting a protocol on a communication port, the protocol's communication parameters are displayed in a box on the right-hand side. To save the settings of the currently opened protocol, click the **Save Settings** button. Pressing **Get Settings** retrieves the current settings from the device.

5.2.4 IP Configuration

The TCP/IP configuration is done under the Ethernet port tab as shown in Figure 24. The mandatory IP settings, which are needed to operate the device, are marked with a red asterisk (IP address, netmask, gateway). The **Enable DHCP** checkbox switches between manual entry of the IP address, netmask, and gateway address, and automatic configuration from a DHCP server.

Hostname and **Domainname** are optional entries and can be left empty. For some DHCP configurations it may be necessary to enter a hostname. Please contact your system administrator on how to configure DHCP to acquire an IP address. Further, you can configure up to 3 Domain Name Servers. Currently these entries are not used.

The screenshot displays the 'Port Configuration' interface for the 'Ethernet' port. On the left, a navigation menu includes 'Device Info', 'Config' (with sub-items like System, Passwords, Backup/Restore, Port Config, BACnet Config, BACnet BDT, E-mail, Data Points, Trend, Scheduler, Calendar, Alarm), 'Statistics', 'L-Web', 'Reset', 'Contact', and 'Logout'. The main content area is titled 'networks under control' and shows the 'Ethernet' configuration. Under 'TCP/IP', 'FTP', 'Telnet', and 'HTTP' are checked, while 'Modbus' and 'BACnet/IP' are unchecked. The 'Enable DHCP' checkbox is also unchecked. The IP Address is 192.168.32.201, IP Netmask is 255.255.192.0, and IP Gateway is 192.168.1.1. The MAC Address is 00:0A:E0:01:E3:02, with a 'Use Factory Default' checkbox checked. There are also fields for DNS and NTP servers, and a 'Link Speed & Duplex' dropdown set to 'Auto Detect'. A note at the bottom states: 'The entries marked with (*) are required for proper operation'.

Figure 24: IP Configuration Page.

The device comes configured with a unique MAC address. This address can be changed in order to clone the MAC address of another device. Please contact your system administrator to avoid MAC address conflicts.

The device can be configured to synchronize its clock with NTP time. Enter the IP address of a primary and, optionally, a secondary NTP server. The device will use NTP as a time source if the time sync source in the system configuration page is set to **NTP** (see Section 5.2.1). The field **NTP status** below the NTP server settings displays the current NTP synchronization status (**out-of-sync**, or **in-sync**).

If the device is operated with a 10 Mbit/s-only hub, the link speed should be switched from **Auto Detect** to **10Mbps/Half-Duplex**. With modern 100/10 Mbit/s switches, this setting can be left at its default.

Other standard protocols that are bound to the Ethernet interface are FTP, Telnet, and HTTP (Web server). By deselecting the checkbox, those protocols can be individually disabled. The standard UDP/TCP ports can be changed in the respective protocol settings. An example for the FTP server is shown for FTP in Figure 25. The FTP server is used for instance to update the firmware (see Section 7.1). Note that HTTP for the Web server can only be disabled on the console interface or by using the device configuration of the Configurator.

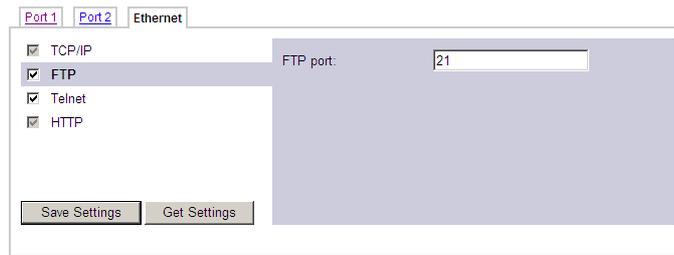


Figure 25: FTP server configuration on the Ethernet port.

5.2.5 BACnet Device Configuration

Figure 26 shows the BACnet device configuration page. This configuration page allows setting the **Device ID**, which is the instance part of the Object_Identifier property of the BACnet Device object. The field **Device name** holds the name of the BACnet device object (property Object_Name).

Important: *The device ID and device name must be unique within the BACnet internetwork.*

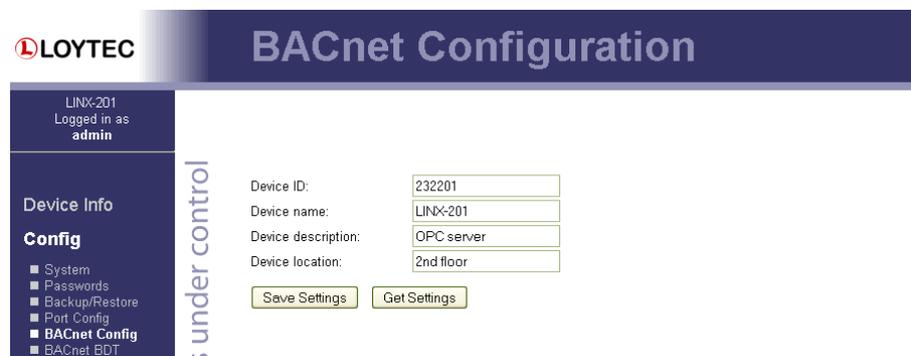


Figure 26: BACnet Device Configuration.

Further, the description and location can be configured. These configuration items correspond to the properties Description, and Location respectively of the BACnet Device object.

5.2.6 BACnet Data Link Configuration

The BACnet data link can be selected in the port configuration menu. BACnet MS/TP can be enabled and disabled under the Port 1 tab, BACnet/IP can be enabled and disabled under the Ethernet tab, see Figure 27 and Figure 28, by selecting the respective protocol and clicking “Save Settings”. Settings will become active after a device reboot.

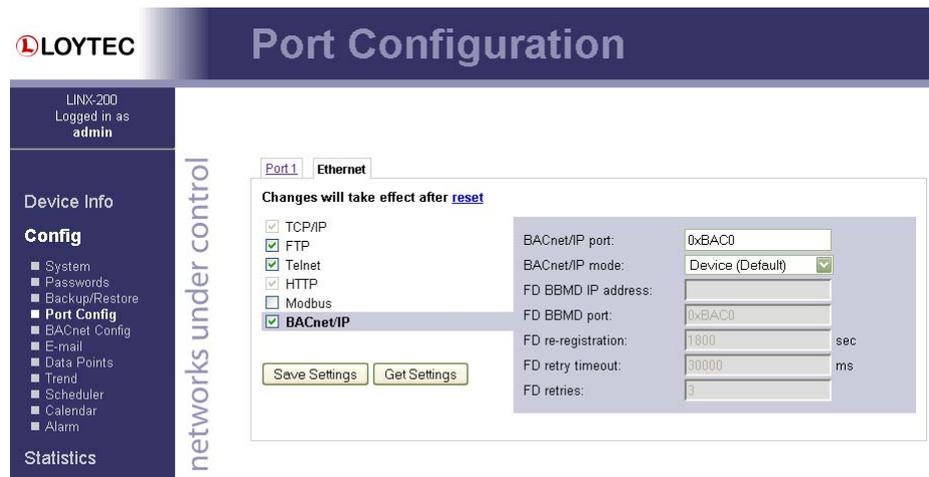


Figure 27: Activate BACnet/IP data link

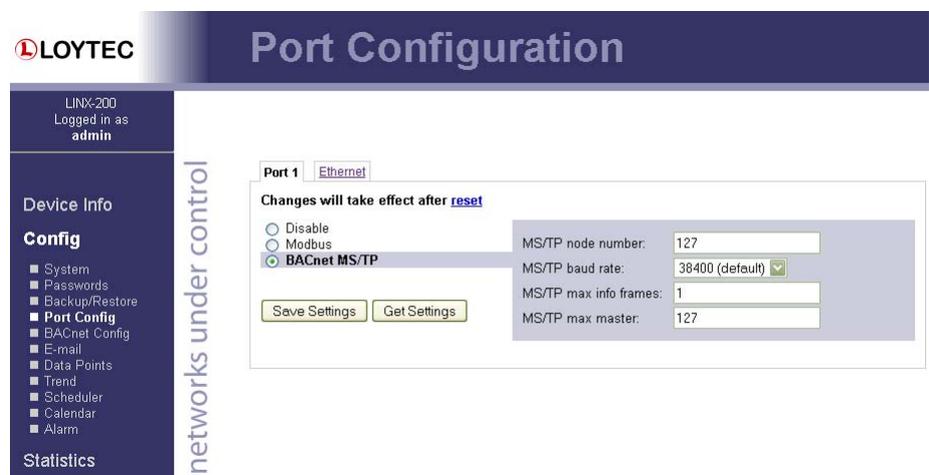


Figure 28: Activate BACnet MS/TP

Depending on the selected **BACnet/IP mode**, applicable fields are enabled and others are grayed-out.

On the settings for BACnet/IP refer to Section 5.2.7. For configuring the BACnet MS/TP data link refer to Section 5.2.8.

5.2.7 BACnet/IP Configuration

If BACnet/IP is enabled, a number of settings can be configured. Figure 29 depicts all available BACnet/IP data link layer settings. The **Network Number** of the BACnet/IP port must be configured to operate the build-in router.

If the BACnet/IP network uses a non-default UDP port number other than 47808/0xBAC0, enter this port in the **BACnet/IP port** field. Enter '0' in this field for switching back to the default setting.

Figure 29: BACnet/IP Data Link Layer Configuration.

In the field **BACnet/IP mode** the operation mode of the device is selected:

- **Device** (Default): In this mode the device operates as a regular BACnet/IP device on the local network without other advanced features.
- **Foreign Device (FD)**: In this mode, the device registers at an existing BBMD in the BACnet/IP network as a foreign device. It is used, if the device is located as a single BACnet/IP device on a remote IP subnet or behind a NAT router. If operated as a foreign device behind a NAT router, port forwarding to the BACnet/IP port (UDP, default port 0xBAC0) and optionally to the Web server and FTP server port (TCP, default port 80 and 21) must be setup in the NAT router. If foreign device is selected, the following, additional settings must be made:
 - **FD BBMD IP address** and **FD BBMD port**: IP address and port of the remote BBMD the device registers at as a foreign device.
 - **FD re-registration**: A foreign device must periodically re-register at a BBMD. Here you can setup the corresponding interval. The default is 1800 seconds.
 - **FD retry timeout** and **FD retries**: Here you can specify the behavior, if registration does not work instantly. These values should be left at default: 30000ms / 3 retries.
- **Broadcast Management Device (BBMD)**: Same as 'Device' but the BBMD function is enabled (see Section 5.2.6). For BBMD-only function, MS/TP can also be disabled (see Section 5.2.8).

For debugging purposes, the BACnet/IP port can be disabled independently of the MS/TP port. See Section 5.2.6 on how to enable and disable individual BACnet data link layers.

5.2.8 MS/TP Configuration

If BACnet MS/TP is enabled, a number of settings can be configured. Figure 30 depicts all available MS/TP. The MS/TP port is enabled by default.

Figure 30: MS/TP Configuration.

The **MS/TP node number** determines the physical address of the device on the MS/TP channel; it must be unique on the MS/TP bus and must lie within the range 0 to **MS/TP max master**. The latter parameter defines the maximal number of MS/TP master devices on the MS/TP channel.

Important: *All masters on the MS/TP channel must have the same setting for MS/TP max master. Decreasing the default value 127 of MS/TP max master may reduce latency on the MS/TP bus.*

The **MS/TP baud rate** must also be the same for all MS/TP devices on the MS/TP channel. The Baud rate can be set to 9600, 19200, 38400, and 76800.

Increasing **MS/TP max info frames** increases the bandwidth assigned to the device at the cost of the bandwidth available to other master devices attached to the MS/TP bus. Changing the default value 1 is not usually necessary.

The **Network Number** of the MS/TP port must be set to a non-zero value in order to operate the build-in BACnet/IP-BACnet MS/TP router

Section 5.2.6 describes how to enable and disable individual BACnet ports.

5.2.9 BACnet BDT (Broadcast Distribution Table)

The BBMD function is needed when a BACnet/IP network spans over several IP subnets separated by IP routers. If the device is configured as a BBMD, i.e. the BACnet/IP mode is set to **Broadcast Management Device**, see Section 5.2.7, the BDT (Broadcast Distribution Table) specifies all other BBMDs of the BACnet/IP network. The BDT is shown in Figure 31.

The screenshot displays the BACnet BDT configuration page. On the left, there is a navigation menu with options like System, Passwords, Backup/Restore, Port Config, BACnet Config, BACnet BDT (selected), E-mail, Data Points, Trend, Scheduler, Calendar, Alarm, and Statistics. The main area shows a table with the following data:

No	IP Address	Port		
0	192.168.84.10	0xBAC0	Edit	<input type="checkbox"/>
1	192.168.20.23	0xBAC0	Edit	<input type="checkbox"/>
2	10.101.17.2	0xBAC0	Edit	<input type="checkbox"/>

Buttons at the top include 'Add Device', 'Reload', 'Distribute', 'Action on Selected' (dropdown), and 'Execute'. A vertical watermark 'networks under control' is visible on the left side of the table area.

Figure 31: BACnet Broadcast Distribution Table.

By clicking **Add Device** new BBMDs (IP address and port) can be added. With **Action on Selected** and selecting existing entries, certain BBMDs can be deleted again from the table.

It is not necessary to reboot the device when changing the table. However, you may want to click **Distribute** in order to propagate the table to all BBMDs in the list.

5.3 Device Statistics

The device statistics pages provide the system log, statistics information about the Ethernet and the BACnet MS/TP interface, as well as a list of registered foreign devices.

5.3.1 System Log

The System Log page prints all messages stored in the system log of the LIP-ME201. An example is shown in Figure 32. This log data is important for trouble-shooting. It contains log entries for reboots and abnormal operating conditions. When contacting LOYTEC support, please have a copy of this log ready.

The screenshot shows the 'System Log' interface. At the top, there is a dark blue header with the text 'System Log'. Below the header, there are three buttons: 'Clear system log', 'Update system log', and 'Save system log'. The main content area displays a list of log entries. On the left side of the log entries, there is a vertical label 'networks under control'. The log entries are as follows:

```

2009-11-27 14:26:55.768|NOTE||Application||Log initialized - LIP-ME200 V1.2.0 Build Thu May 6 12:04:46 2010
2009-11-27 14:26:55.776|NOTE||Application||Reset to factory defaults
2009-11-27 14:27:01.284|NOTE||Application||Boot process finished
2009-11-27 14:28:37.079|NOTE||Application||Log initialized - LIP-ME200 V1.2.0 Build Thu May 6 12:04:46 2010
2009-11-27 14:28:42.609|NOTE||Application||Boot process finished
2009-11-27 14:41:32.111|NOTE||Application||Shutdown
2009-11-27 14:41:33.173|NOTE||Application||Reset
2009-11-27 14:41:33.180|NOTE||OSSI|00000002||OSSI Log terminating
2009-11-27 14:41:52.829|NOTE||Application||Log initialized - LIP-ME200 V1.2.0 Build Thu May 6 12:43:12 2010
2009-11-27 14:41:58.259|NOTE||Application||Boot process finished
2009-11-27 14:44:16.565|NOTE||Application||Backup successfully installed - Device will be restored after reset
2009-11-27 14:44:19.784|NOTE||Application||Shutdown
2009-11-27 14:44:21.853|NOTE||Application||Reset
2009-11-27 14:44:21.860|NOTE||OSSI|00000002||OSSI Log terminating
2009-11-27 15:44:42.587|NOTE||Application||Log initialized - LIP-ME200 V1.2.0 Build Thu May 6 12:43:12 2010
2009-11-27 15:44:42.594|NOTE||Application||Configuration successfully restored from backup file
2009-05-06 13:46:55.547|NOTE||Application||Boot process finished
2010-05-06 14:33:25.016|NOTE||Application||Shutdown
2010-05-06 14:33:25.134|NOTE||Application||Reset
2010-05-06 14:33:25.142|NOTE||OSSI|00000002||OSSI Log terminating
2010-05-06 14:33:43.833|NOTE||Application||Log initialized - LIP-ME200 V1.2.0 Build Thu May 6 12:43:12 2010
2010-05-06 14:33:50.521|NOTE||Application||Boot process finished
2010-05-07 10:37:07.972|NOTE||Application||Shutdown
2010-05-07 10:37:09.079|NOTE||Application||Reset
2010-05-07 10:37:09.087|NOTE||OSSI|00000002||OSSI Log terminating
2010-05-07 10:37:27.855|NOTE||Application||Log initialized - LIP-ME200 V1.2.0 Build Fri May 7 09:28:56 2010
2010-05-07 10:37:34.413|NOTE||Application||Boot process finished

```

At the bottom of the log entries, there are three buttons: 'Clear system log', 'Update system log', and 'Save system log'.

Figure 32: System Log Page.

5.3.2 IP Statistics

Figure 33 shows the IP statistics page. It allows finding possible problems related to the IP communication. Specifically, any detected IP address conflicts are displayed (if the LIP-ME201's IP address conflicts with a different host on the network).

Statistics IP

networks under control

Update IP statistics

Ethernet Interface Statistics	
Rx packets	0
Rx bytes	9738591
Rx dropped	0
Rx no clusters	0
Rx CRC errors	0
Rx missed errors	0
Tx collisions	0
Tx resends	0
Tx packets	0
Tx bytes	4388270
Rx no mbuf	0
Rx oversize errors	0
Rx runt errors	0
Tx ok	0
Tx dropped	0

TCP/IP Statistics	
Total IP packets received	41761
Total IP packets generated here	62840
Total TCP packets sent	138
Total TCP data packets sent	90
Total TCP data bytes sent	75103
Total TCP packets received	106
Total UDP packets received	41032
Total UDP packets sent	62702

Figure 33: IP Statistics Page.

5.3.3 BACnet MS/TP Statistics

The BACnet MS/TP statistics page is only available, when the MS/TP data link layer is enabled, see Section 5.2.8. An example is shown in Figure 34. The separated part on the top of the table contains the most important statistics data.

The MS/TP token status reports the current token passing state. In state **OK**, the token is circulating between the masters. This is the normal state, when multiple masters are on the MS/TP network. The state **SOLE MASTER** is the normal state when the device is the only master on the network. If there are multiple masters on the network, this state is a hint to a broken cable. In state **TOKEN LOST**, the token is currently not circulating.

The counter **MS/TP lost tokens** is an indicator for communication problems on the MST/TP network. If it increases, there is a cabling, ground, or termination problem. The counters **Rcv OK** and **Send OK** reflect the number of successfully received or transmitted MS/TP frames. Check these counters to verify that communication is flowing on the MS/TP segment.

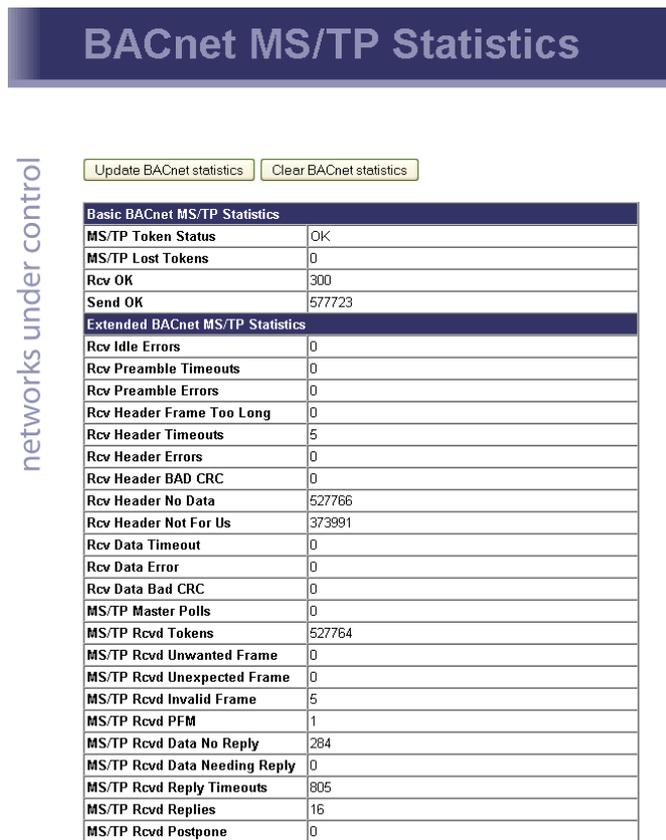


Figure 34: BACnet MS/TP Statistics Page.

5.3.4 BACnet FDT Statistics

The BACnet FDT (Foreign Device Table) Statistics page displays a list of all BACnet/IP foreign devices currently registered with the LIP-ME201, see Figure 35. Note, that foreign devices can only register with the LIP-ME201 if the latter is configured as BACnet **Broadcast Management Device**, see Section 5.2.7.

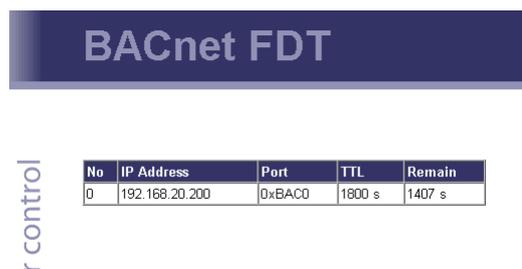


Figure 35: BACnet FDT Statistics page.

5.4 Reset, Contact, Logout

The menu item **Reset** allows rebooting the LIP-ME201 from a remote location.

The **Contact** item provides contact information and a link to the latest user manual and the latest firmware version.

The **Logout** item closes the current session.

6 Operating Interfaces

6.1 BACnet Interface

6.1.1 Device Object

The BACnet interface provides one Device object supporting the properties shown in Table 4. The Conformance Code column determines whether accessing the property via BACnet services is possible in a read-writable (**W**) or read-only (**R**) manner. The following sections describe the Device object's properties in detail.

BACnet Property Identifier	BACnet Datatype	Conformance Code
Object_Identifier	BACnetObjectIdentifier	R
Object_Name	CharacterString	R
Object_Type	BACnetObjectType	R
Vendor_Name	CharacterString	R
Vendor_Identifier	Unsigned16	R
Model_Name	CharacterString	R
Firmware_Revision	CharacterString	R
Application_Software_Version	CharacterString	R
Location	CharacterString	W
Description	CharacterString	W
Protocol_Version	Unsigned	R
Protocol_Revision	Unsigned	R
Protocol_Services_Supported	BACnetServicesSupported	R
Protocol_Object_Types_Supported	BACnetObjectTypesSupported	R
Object_List	BACnetARRAY[N] of BACnetObjectIdentifier	R
Database_Revision	Unsigned	R
Max_APDU_Length_Accepted	Unsigned	R
Segmentation_Supported	BACnetSegmentation	R
Max_Segments_Accepted	Unsigned	R
APDU_Segment_Timeout	Unsigned	W
APDU_Timeout	Unsigned	W
Number_Of_APDU_Retries	Unsigned	W
Max_Master	Unsigned(1..127)	R
Max_Info_Frames	Unsigned	R

BACnet Property Identifier	BACnet Datatype	Conformance Code
System_Status	BACnetDeviceStatus	R
Device_Address_Binding	List of BACnetAddressBinding	R
Active_COV_Subscriptions	List of BACnetCOVSubscription	R
UTC_Offset	Integer	W
Daylight_Savings_Status	Boolean	R
Local_Date	Date	R
Local_Time	Time	R
Time_Synchronization_Recipients	List of BACnetRecipient	W
UTC_Time_Synchronization_Recipients	List of BACnetRecipient	W
Time_Synchronization_Interval	Unsigned	W
Align_Interval	Boolean	W
Interval_Offset	Unsigned	W
Configuration_Files	BACnetARRAY[N] of BACnetObjectIdentifier	R
Last_Restore_Time	BACnetTimeStamp	R
Slave_Proxy_Enable ¹	BACnetARRAY[N] of Boolean	W
Auto_Slave_Discovery ¹	BACnetARRAY[N] of Boolean	W
Manual_Slave_Address_Binding ¹	List of BACnetAddressBinding	W
Slave_Address_Binding ¹	List of BACnetAddressBinding	R

Table 4: Properties of the Device Object.

¹ Only available if the device is a BACnet/IP-BACnet MS/TP router.

6.1.2 Device Name and ID

The following properties of the Device object, which are part of every BACnet object, identify the device uniquely.

Object_Identifier (Read-Only). This property, of type *BACnetObjectIdentifier*, is a number that identifies the object. For the Device object, this number must be unique internetwork-wide.

The *Object_Identifier* number consists of two parts, a number defining the object's type and an instance number. The object type "Device" is assigned the number 8. The instance number of the *Object_Identifier* of the Device object can be configured, see Section 5.2.5. The default value of this instance number is 17800.

Object_Name (Read-Only). The name of the object. For the Device object, this is the BACnet name under which the device is visible in the BACnet inter-network. The device's name shall be unique within the BACnet internetwork. The device's name is configurable, see Section 5.2.5.

Object_Type (Read-Only). A number designating the object's type. For the Device object, this number is 9.

6.1.3 Device Information

A whole set of properties of the Device object provide general purpose information about the device.

Vendor_Name (Read-Only). The value of this property is "LOYTEC electronics GmbH".

Vendor_Identifier (Read-Only). A numerical value identifying the BACnet vendor. The value of this property is 178.

Model_Name (Read-Only). The value of this property is equal to the product code of the device, i.e., its value is "LIP-ME201".

Firmware_Revision (Read-Only). The value of this property gives the current firmware version of the device.

Application_Software_Version (Read-Only). The value of this property gives the build date and the version of the current firmware.

Location (Read-Writable). A string intended to be used to describe the location of the device, e.g., "1st floor". This property can be set via the configuration UI, see Section 5.2.5. The default value is "unknown".

Description (Read-Only). A string intended to hold a user specified description of the device. This property can be changed via the configuration UI, see Section 5.2.5.

Protocol_Version (Read-Only). The BACnet protocol version supported by the device. The value of this property is 1.

Protocol_Revision (Read-Only). The BACnet protocol revision of the BACnet version supported by the device. The value of this property is 5.

Protocol_Services_Supported (Read-Only). A string of bits marking which BACnet services can be executed by the device. For a detailed list of the BACnet services supported, please refer to the product's PICS document.

Protocol_Object_Types_Supported (Read-Only). A string of bits identifying which BACnet object types are supported by the device. For a detailed list of supported object types, please refer to the product's PICS document.

6.1.4 Object Database

The following properties of the Device object provide information about the BACnet objects contained in the device.

Object_List (Read-Only). This property holds a sequence of object IDs (object type, object instance pairs), one object ID for each object within the device that is accessible through BACnet services.

Database_Revision (Read-Only). This property, of type *Unsigned*, is a logical revision number for the device's object database. It is incremented when an object is created, an object is deleted, an object's name is changed, an object's Object_Identifier property is changed, or a restore is performed.

6.1.5 Protocol Parameters

BACnet protocol parameters are accessible via the Device object properties listed below.

Max_APDU_Length_Accepted (Read-Only). The maximal size of a BACnet APDU (Application Protocol Data Unit) accepted by the device. The value of this property is 487 if BACnet MS/TP is used and 1476 if BACnet/IP is used. When the device can act as a router between BACnet/IP and BACnet MS/TP, the value of this property is 1476.

Segmentation_Supported (Read-Only). The value of this property indicates whether and which kind of segmentation is supported by a device. The value of this property is SEGMENTED_BOTH.

Max_Segments_Accepted (Read-Only). The maximum numbers of segments accepted by a device. The value of this property is 16.

APDU_Segment_Timeout (Read-Writable). Time in milliseconds allowed between two consecutive segments. The value of this property is 2000 milliseconds by default.

APDU_Timeout (Read-Writable). Time in milliseconds the device waits for an answer before retrying or giving up on a request; also see *Number_Of_APDU_Retries*. The value of this property is 3000 milliseconds by default.

Number_Of_APDU_Retries (Read-Writable). The number of times the device will try to re-send a packet before giving up on a request; also see *APDU_Timeout*. The value of this property is 3 by default.

Max_Master (Read-Writable). This property is only present if BACnet MS/TP is enabled. It defines the maximal MS/TP MAC number at which the device expects an MS/TP master. The value of this property is configurable, see Section 5.2.8, and must be in the range 1-127.. The default value of this property is 127.

Max_Info_Frames (Read-Writable). This property is only present if BACnet MS/TP is enabled. It defines the maximal number of MS/TP packets the device can send when it holds the MS/TP token. Increasing this value will increase the MS/TP bandwidth of the device at the cost of other device's bandwidth. The value of this property is configurable, see Section 5.2.8. The default value of this property is 1.

6.1.6 Diagnostics

Several Device object properties provide run-time information about the device.

System_Status (Read-Only). The value of this property is always OPERATIONAL.

Device_Address_Binding (Read-Only). This property contains a list of bindings between BACnet device instance numbers (the instance number part of the Device object ID) and BACnet addresses. This property tells a user which BACnet address the device will actually use when trying to communicate with another device known only by its device instance number. This information can be helpful when diagnosing network configuration problems.

Important: *A BACnet address consists of the BACnet network number, which is 0 for the local network, and the BACnet MAC address of the device.*

In particular, if two or more devices in the network have been wrongly assigned the same device instance number, two BACnetAddressBinding entries with the same instance number but different BACnet addresses will be listed—provided the ambiguous instance number is in some way required by the device (e.g., in the course of a client mapping).

Important: *Bindings between device instance numbers and BACnet addresses are only listed in Device_Address_Binding if they are actually required by a given configuration, and are currently known or ambiguous.*

Slave_Address_Binding (Read-Only). This property is only present if the device is a BACnet/IP-BACnet MS/TP router. It lists bindings between BACnet MS/TP slave instance numbers (the instance number part of the slave's Device object ID) and BACnet addresses of slaves on the MS/TP network for which the device serves as a slave proxy, see Section 6.1.10 for details.

Active_COV_Subscriptions (Read-Only). This property lists currently active COV subscriptions.. Each entry of type *BACnetCOVSubscription* provides information about the recipient address, the monitored property ID, whether notification are confirmed or unconfirmed, the remaining time of the subscription, and optionally the COV increment.

Whenever the device receives a valid COV subscription via one of the BACnet services `SubscribeCOV` or `SubscribeCOVProperty`, a new entry is added to the list or an existing entry is updated (re-subscription). An entry is removed from *Active_COV_Subscriptions* when a subscription terminates, either because it times out or because it is actively unsubscribed by the subscriber.

6.1.7 Date & Time

The device's time and date are exposed to the network via the following set of Device object properties.

UTC_Offset (Read-Writable). This *Integer* value specifies the time difference between local time and UTC in minutes, effectively determining the time zone. The value of this property is configurable, see Section 5.2.1.

Important:

Note that UTC_Offset is relative to local time and not relative to UTC, i.e., a time zone offset of +1 (hour) corresponds to UTC_Offset being set to -60 (minutes).

Daylight_Savings_Status (Read-Only). This *Boolean* value indicates whether (TRUE) or not (FALSE) daylight saving correction of the local time is currently active. The daylight saving scheme is configurable, see Section 5.2.1.

Local_Date (Read-Only). The current date according to the device's clock. The value of this property can be changed via the configuration UI, see Section 5.2.1.

Local_Time (Read-Only). The current time according to the device's clock. The value of this property can be changed via the configuration UI, see Section 5.2.1.

6.1.8 Time Master

The device can serve as a BACnet time master, i.e., it can issue `TimeSynchronization` and `UTCTimeSynchronization` request on time synchronization events. A time synchronization event occurs after rebooting, when the device's clock changes, and, if so configured, periodically. The following properties of the Device object are used to configure the time master.

Time_Synchronization_Recipients (Read-Writable). This list of recipients will receive `TimeSynchronization` requests on time synchronization events. A recipients is either specified by its device ID (the object ID of its Device object), or its BACnet address.

UTC_Time_Synchronization_Recipients (Read-Writable). This list of recipients will receive `UTCTimeSynchronization` requests on time synchronization events. A recipients is either specified by its device ID (the object ID of its Device object), or its BACnet address.

Time_Synchronization_Interval (Read-Writable). The *Unsigned* value of this property specified the time interval in minutes in which periodic time synchronization events are created. If set to zero, no periodic time synchronization events are generated.

The actual clock time at which periodic time synchronization events are generated is determined by the properties *Time_Synchronization_Interval*, *Align_Interval*, and *Interval_Offset*; Table 5 outlines how these properties interact.

Time_Synchronization_Interval	Align_Intervals	Periodic Time Synchronization Event At ...
Multiple of 1440 (minutes), i.e., multiple of one day	TRUE	<i>Interval_Offset</i> minutes after midnight, every (<i>Time_Synchronization_Interval</i> /1440) days
Multiple of 60 (minutes) but <i>not</i> multiple of 1440 (minutes), i.e., multiple of one hour	TRUE	<i>Interval_Offset</i> minutes from the current* hour, every (<i>Time_Synchronization_Interval</i> /60) hours
Multiple of 1440 (minutes), i.e., multiple of one day	FALSE	<i>Interval_Offset</i> minutes from the current* minute, every (<i>Time_Synchronization_Interval</i> /1440) days
Multiple of 60 (minutes), but <i>not</i> multiple of 1440 (minutes), i.e., multiple of one hour	FALSE	<i>Interval_Offset</i> minutes from the current* minute, every (<i>Time_Synchronization_Interval</i> /60) hours
Neither multiple of 60 or 1440, but greater than zero	TRUE or FALSE	<i>Interval_Offset</i> minutes from the current* minute, every <i>Time_Synchronization_Interval</i> minutes
Zero	TRUE or FALSE	never

Table 5: Periodic time synchronization events are parameterized by the properties *Time_Synchronization_Interval*, *Align_Interval*, and *Interval_Offset*.

* Current hour or minute refers to the hour or minute at which one of the properties *Time_Synchronization_Interval*, *Align_Interval*, and *Interval_Offset* is set, e.g., the hour or minute the device completes a boot process or one of these properties is modified via BACnet services.

By default, the value of *Time_Synchronization_Interval* is 1440 (minutes), i.e., one day.

Align_Intervals (Read-Writable). The *Boolean* value of this property determines whether or not periodic time synchronization events shall be anchored at the start of a day or hour (TRUE) or not (FALSE), provided *Time_Synchronization_Interval* is a multiple of a day (1440 minutes) or hour (60 minutes). Table 5 details on how this property influences generating periodic time synchronization events. The default value of this property is TRUE.

Interval_Offset (Read-Writable). While *Time_Synchronization_Interval* specifies the period in which time synchronization events are generated, the *Unsigned* value of this property determines the point of time in minutes within this interval at which the time synchronization event is actually triggered. If the value of *Interval_Offset* is larger than the value of *Time_Synchronization_Interval*, the remainder of *Interval_Offset* divided by *Time_Synchronization_Interval* is used. The default value of this property is 0.

6.1.9 Backup & Restore

The following properties of the Device object are related to backup & restore procedures.

Configuration_Files (Read-Only). The contents of this property is an array of object IDs of File objects that can be backed-up or restored during a BACnet backup or restore procedure. Outside a BACnet backup or restore procedure, this property is empty. After a BACnet backup or restore procedure has been initiated, it contains the object ID (*File*, 0), i.e., the File object whose instance number is 0.

Last_Restore_Time (Read-Only). The *BACnetTimeStamp* of the last restore procedure.

6.1.10 Slave Proxy

A device configured as BACnet/IP-BACnet MS/TP router, can serve as a slave proxy i.e., the device can answer Who-Is broadcast requests with I-Am responses for BACnet MS/TP slaves which, by definition, cannot initiate any communication and, thus, cannot answer broadcasts. The following Device object properties allow to configure and monitor the slave proxy.

Slave_Proxy_Enable (Read-Writable). For each BACnet MS/TP port, this property contains a *Boolean* that allows a user to enable (TRUE) or disable (FALSE) the slave proxy for the given port. By default, the slave proxy is enabled on all MS/TP ports.

Auto_Slave_Discovery (Read-Writable). For each BACnet MS/TP port, the slave proxy is capable of auto-detecting slaves on the MS/TP network attached to the port. This auto-detection mechanism can be disabled (FALSE) or enabled (TRUE) by changing the *Boolean* values stored in this property. Aside from auto-detecting slaves, the presence of slaves can also be manually configured using the property *Manual_Slave_Address_Binding*. By default, slave auto-detection is enabled on all MS/TP ports.

Important:

Due to bandwidth and latency limitations on MS/TP networks, the auto-discovery process may initially take up to 10 minutes. However, once, slaves have been discovered, slaves will be quickly re-discovered after reboots or power-outs since the slave proxy caches information about slaves found on the MS/TP networks.

*Too speed up auto-detection of slaves newly added to an existing MS/TP network for which auto-detection is enabled, simply disable and then re-enable auto-detection on given MS/TP port, i.e., set *Auto_Slave_Discovery* for the port to FALSE and then back to TRUE.*

Manual_Slave_Address_Binding (Read-Writable). Aside from auto-detecting slaves, see *Auto_Slave_Discovery*, slave bindings can also be manually configured via this property. Each entry of this list is a *BACnetAddressBinding*, i.e., a pair consisting of a slave device's instance number and its BACnet address. Note, that bindings in this list may not necessarily appear in the property *Slave_Address_Binding*, e.g., if for a given binding no physical slave is present at the respective MS/TP MAC address.

Important:

*Only use *Manual_Slave_Address_Binding* if the slave is not auto-detected. Note, that bindings in *Manual_Slave_Address_Binding* must contain the correct network number of the MS/TP network to which the slave is attached.*

Slave_Address_Binding (Read-Only). This property lists bindings of instance numbers and BACnet addresses of all slaves for which the slave proxy answers Who-Is requests. Thus, this property can be used to check if slaves have been auto-discovered or manually bound successfully. The property is also helpful in discovering network configuration issues involving slaves: If two or more slaves on the attached MS/TP networks have been erroneously assigned the same device instance number (the instance number of the slave's Device object), the given instance number will be listed accordingly often in this property.

7 Firmware Update

The LIP-ME201 firmware supports remote firmware upgrade over the network and the serial console.

To guarantee that the LIP-ME201 is not destroyed due to a failed firmware update, the firmware consists of two images:

- LIP-ME201 fallback image,
- LIP-ME201 primary image.

The LIP-ME201 fallback image cannot be changed. Thus, if the update of the primary image fails or the image is destroyed by some other means, the fallback image is booted and allows reinstalling a valid primary image.

When the LIP-ME201 boots up with the fallback image, the status LED is flashing red.

7.1 Firmware Update via FTP

The LIP-ME201 primary image can be updated using any FTP client. Connect to the LIP-ME201 using its IP address and the admin account (user 'admin', password of admin account, see Section 5.2.4). Then change to the folder 'dev' and overwrite the file 'bacrtr_lc3k_primary.dl' with the new firmware. The LIP-ME201 will automatically reboot after the file has been transferred.

7.2 Firmware Update via the Console

To download the firmware via the console interface, the LIP-ME201 must be connected to the RS-232 port of a PC via its console interface as described in Section 4.1. You will need the LOYTEC serial upgrade tool (LSU Tool), which can be downloaded from our homepage at www.loytec.com.

Please make sure that the LIP-ME201 console shows the main menu otherwise navigate to the main menu or simply reset the LIP-ME201.

To Upgrade via the Console:

1. Double click on the *.dlc file that comes with the new firmware package. This should start the LSU Tool and load the firmware image referenced in the dlc file. Please note that the dlc file and the dl file must be stored in the same folder. The start window of the LSU tool is shown in Figure 36.

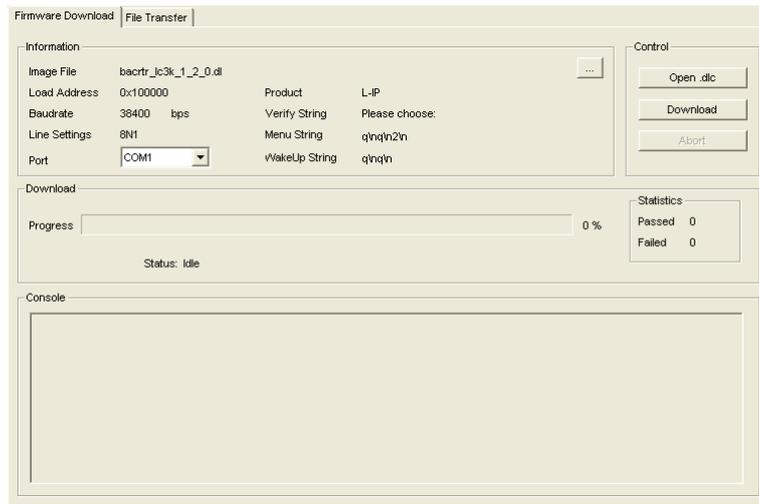


Figure 36: LSU Serial Upgrade Tool in Idle Mode

2. If the LIP-ME201 is not connected to COM1 you can change the port to COM2, COM3, or COM4. Make sure that the product shown under "Product" matches the device you are upgrading. Press "Download" to start the download.
3. Wait till the download completes, which will take several minutes. The end of the download process is marked by a dialog box popping up.
4. Double check that the new firmware is executed by selecting '1' and pressing 'Enter' in the console window. This will bring up the device information which shows the current firmware version.

8 Troubleshooting

8.1 Technical Support

LOYTEC offers free telephone and e-mail support for our LIP-ME201 product. If none of the above descriptions solves your specific problem please contact us at the following address:

*LOYTEC electronics GmbH
Blumengasse 35
A-1170 Vienna
Austria / Europe*

*email : support@loytec.com
web : http://www.loytec.com
tel : +43/1/40208050
fax : +43/1/402080599*

or

*LOYTEC Americas Inc.
11258 Goodnight Lane
Suite 101
Dallas, Texas 75229
USA*

*Email: support@loytec-americas.com
web: http://www.loytec-americas.com
tel: +1/512/402 5319
fax: +1/972/243 6886*

9 Specifications

9.1 LIP-ME201

9.1.1 Physical Specifications

Operating Voltage	12-35 VDC or 12-24 VAC \pm 10%
Power Consumption	typ. 3 W
In rush current	up to 950 mA @ 24 VAC
Operating Temperature (ambient)	0°C to + 50°C
Storage Temperature	10°C to +85°C
Humidity (non condensing) operating	10 to 90% RH @ 50°C
Humidity (non condensing) storage	90% RH @ 50°C
Enclosure	Installation enclosure 6 TE, DIN 43 880
Environmental Protection	IP 40 (enclosure); IP 20 (screw terminals)
Installation	DIN rail mounting (EN 50 022) or wall mounting

10 Revision History

Date	Version	Author	Description
2008-10-07	1.0	AB	Initial revision.
2010-05-07	1.2.0	TP	Add Operating Interfaces section. Revise Web Interface section.