AirLaser IP1000plus

CBL

Communication by light

Gesellschaft für optische Kommunikationssysteme mbH

Manual

Version 2.13.1e   Date: 02/2022
for firmware 2.13

Table of contents

1 Safety instructions and standards

AirLaser IP1000plus is conform to following standards:

Interference voltage following EN55022 class B
150kHz .. 1GHz

Elektrostatic discharge following EN61000-4-2
4kV/8kV

Elektromagnetic RF-field following EN61000-4-3
3V/m, 80MHz .. 1GHz

Transient following EN61000-4-4
2kV @ power, 1kV @ signal

High power pulses following EN61000-4-5
2kV unsymmetrical / 1kV symmetrical on power and data line

RF on cables following EN61000-4-6
150kHz .. 80MHz, 3V on power and data line

Low frequent magnetic fields following EN61000-4-8
1A/m

Voltage reduction following EN61000-4-11
>95% during 0,5 periods, 30% during 25 periods, >95% during 250 periods

Overtons following EN61000-3-2

Flicker following EN61000-3-3

IEC 60825-1: 2007
Safety of radiation of laser-equipment: Certified into **Laser-Class 1M**.

Recommended safety precautions:

- Do not look direct into the laser !
- Do not look with any optical instruments into the laser !

Maximum transmitted power: 10 mW from each transmitter
Duration of pulses: 800 ps
Wavelength: 830 .. 870 nm
Beam divergence: less than 2 mrad

Attention!   At fiber-port F1 on backplane, radiation class 1 will be emitted if open!

Safety precautions:
Do not look into the connector. When push or pull connectors, switch AirLaser off.
Infrared laser radiation – not visible!
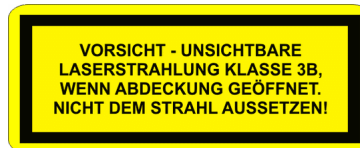
Attention!   When cover open, laser radiation class 3B will be emitted!

AirLaser is waterproof sealed. Under the cover are no switches or indicators.

Warranty is void, if cover was open!

Flash protection:
CBL recommends to connect the installation-pole to protection ground.
AirLaser should be connected with the ground cable to the pole.
Certified flash protection together with the building protection is recommended.

2 The AirLaser System

AirLaser IP1000plus is a free space optical system. It is suited for network coupling of different stations. The system transmits Gigabit-Ethernet-data over approximately up to 800 meter via infrared laserlight through the atmosphere.
Each link consists of two terminals, which are connected via fibre optic cable or twisted pair cable (TP) with the LAN-segments.
The terminals are waterproof and designed for outdoor mounting. Each unit has transmitter, receiver and a telescope for adjustment.

Front view of AirLaser IP1000plus. In all 4 corners are the lenses of the four transmitters. They emit the infrared radiation.
In the middle is the receiver lens. Above that the telescope for adjustment.
Left and right hand side are two planar antennas for the integrated backup.

At the backpanel are the indicators and the waterproof connectors.

3 Installation

Installation of the AirLaser IP1000plus-system is possible quick and easy in three steps:

- Select locations (3.1)
- Cabling (3.2)
- Mounting and adjustment (3.3)

3.1 Select locations

Criteria for the selection of the locations and the beam run:

- Direct line of sight is mandatory. Use only stable and vibration free ground.
- Interruptions by persons should be impossible.
- No chimneys should be near or under the beam run. Smoke absorbs the infrared light.
- No outlets of warm air or water vapour should be near or under the beam rund. Turbulences have influence to the infrared light. Take care with air condition systems.
- Trees or cranes can interrupt the beam.
- Free access to the backpanel is necessary.
- If possible, use a location which is protected against unlimited wind, rain, snowfall and sun radiation.
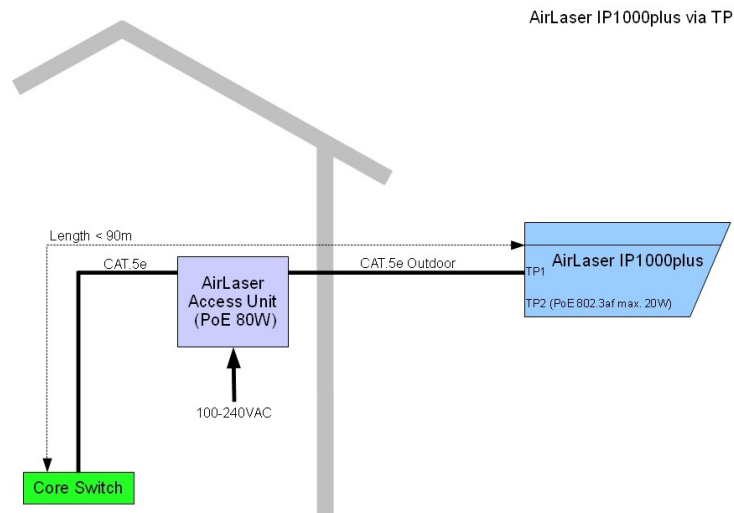
Recommendation:
The extension of the beam should not look to the sun. Interruptions of several minutes can occur, if the sun blinds the receiver.
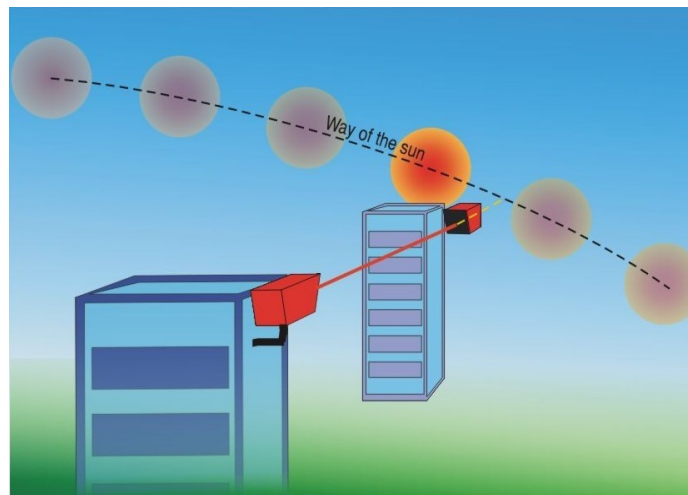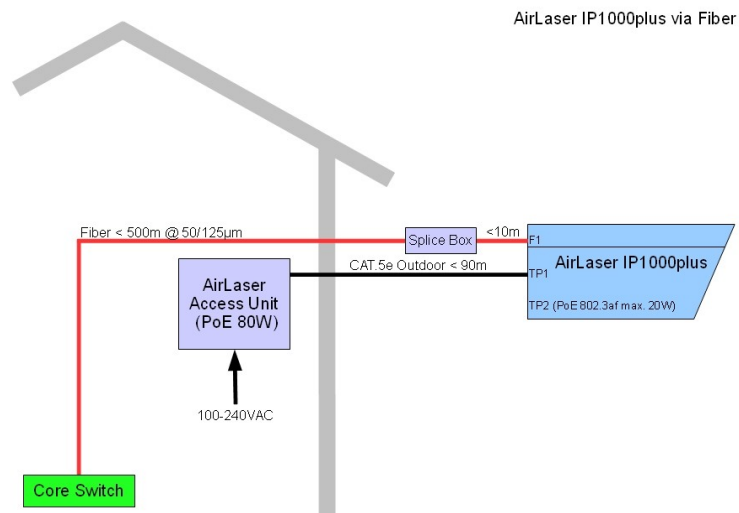

*Orbit of the Sun in the course of a day.*

3.2 Cabeling

Very simple is the connection of AirLaser IP1000plus via TP-cable. Note the maximum cable-length.

AirLaser IP1000plus via TP

Length < 90m

CAT.5e

AirLaser
Access Unit
(PoE 80W)

CAT.5e Outdoor

TP1

AirLaser IP1000plus

TP2 (PoE 802.3af max. 20W)

100-240VAC

Core Switch

If longer cable length are required, connection is also possible with fiber optic cables:

AirLaser IP1000plus via Fiber

Fiber < 500m @ 50/125µm

Splice Box

<10m

F1

AirLaser
Access Unit
(PoE 80W)

CAT.5e Outdoor < 90m

TP1

AirLaser IP1000plus

TP2 (PoE 802.3af max. 20W)
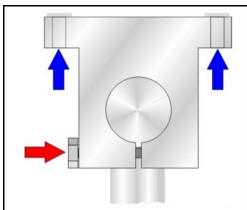
100-240VAC

Core Switch

At port TP2 backup-systems or a webcam can be connected via TP-cable. The connected device can be powered by the AirLaser IP1000plus via PoE. The AirLaser supports the IEEE802.3af PoE standard and a proprietary forced mode with increased power.

AirLaser IP1000plus with external Backup via TP
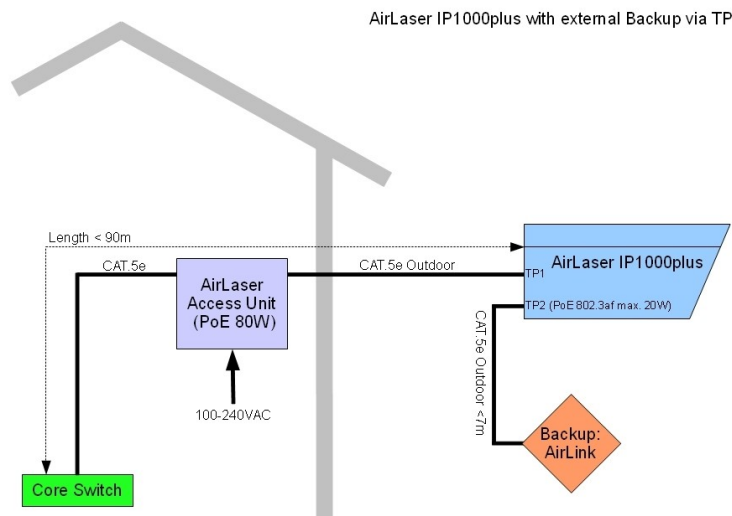
3.3 Mounting and adjustment

- Connect the holder at the foreseen place with stainless and qualified screws. Be sure that the ground is stable and vibration-free.
- Set up the swivel-head and fix it.
  - Adjust the swivel head horizontal.
  - Fix **only one** screw for the vertical adjustment (red arrow).
  - Set up the terminal so that all 4 holes are over the blue arrows. Make sure that there is a plastic disk at all fittings between AirLaser and the swivel head.
  - Use only the 6 x 18 screws together with a spring-lock-washer.
  - Now tighten the second screw for vertical alignment.

Attention: For securing the screws use necessarily a spring ring.
Make sure that a plastic disk is present on all fittings between AirLaser and swivel head.
Do not use longer screws, otherwise damage could be caused to the optics of the AirLaser!
Please note the installation instructions for the swivel head.

4 Operation on the device

4.1 Operation elements, indicators and connectors

Nr.		
1	Push button A	All LED-indicators on the backpanel can be switched on and off. Function is stored permanent. Note: Together with push button B further functions, e.g. Default Reset are possible (see below).
2	Push button B	With the push button B you can select between normal and a zoom display for the optical rx-level. The zoom mode makes fine adjust of the AirLaser easier. To better distinguish the two modes the display in zoom mode is inverse. Press push button B once to switch into zoom mode. The actual receive level is set to the middle of the bar display. Now gently swing the AirLaser. When the level increases, the display goes up, if it decreases it goes down. If you reached the end of scale, you can switch back to normal mode and again in zoom mode. The actual level is then in the middle again.The resolution in the zoom mode is 0,2dB. After 10 minutes the zoom function is automatically disabled. Note: Together with push button B further functions, e.g. Default Reset are possible (see below).
3	Reset	Booting of the terminal. The FSO link will be interrupted. All system configurations are still valid.
	Push button A + B	Push A an hold. Now, push B shortly to select the function you want. The selected function is indicated by LEDs of the Local optical RX-Level indicator. When you are ready, let A loose to execute the function. Following functions are possible with this firmware: Default Reset: Push A, then push B so many times until **all** LEDs of Local optical RX-Level are on. If you let A loose, the factory set up is executed. To indicate this, two lights on the Local optical RX-Level indicator are running. Default Reset deletes all old configurations including network configuration and passwords. All values of the default reset are listed in the appendix B. During this, the link is interrupted.

			LED lights	LED flashes 1:1	LED flashes 15:1	LED flashes 2x
4	FSO-Link	Indicates communication on the free space optical link.	active	blocked	standby	faulty standby
5	F1-Link	Indicates communication on the F1 fibre port	active	blocked	standby	faulty standby
6	TP1-Link	Indicates communication on the TP1 port	active	blocked	standby	faulty standby

Nr.						
7	TP2-Link	Indicates communication on the TP2 port	active	blocked	standby	faulty standby
8	Status LED	Indicates the fundamental status of the terminal.	Terminal has power and is booting.	Booting is finished and default configuration is valid.	Terminal is configured and ready for operation.	-
9	Error LED	Without function.	-	-	-	-
10	Local optical RX-Level	Level indicator for optical receiving power. The indicator consists of 8 LEDs. Up to three LEDs can be on at the same time. The indicator can display optical levels in the range from -31.5dBm up to -2.5dBm. The resolution of the indicator is 1,5dB. In Appendix E you will find a table, which shows the optical receive level and the corresponding LED combination. In zoom mode the resolution is 0,2dB and the display is inverted. (see description of push button B)				
11	Remote optical RX-Level	This indicator means the same as the local, but for the remote terminal. It is necessary, to configure the IP-address of the remote terminal before. If the network connection to the remote terminal is interrupted, even- and odd-numbered LEDs flashes alternating.				
12	Backup Antenna	Not in operation.				
13	TP1 Port	10/100/1000BaseT Autonegotiation Port (PD) Maximum allowable cable length is 100m, if this port is used only for power supply. If data transmission is also used (PoE, special protocol), the maximum cable length is 90m. In the factory default configuration, this port is the interface to network.				
14	TP2 Port	10/100/1000BaseT Autonegotiation Port (PSE). or optional 10/100BaseTX Autonegotiation Port (PSE). Maximum allowable cable length is 7m in forced mode and 100m in IEEE802.3af mode. This port is suited for connection of an integrated backup system or a webcam. TP2 is equipped with PoE and complies to IEEE802.3af (350mA). In the proprietary forced mode the port has an increased current of 525mA. In the factory default configuration, this port and PoE are disabled.				
15	F1 Port (optional)	Optional 1000BaseSX Autonegotiation interface. In the factory default configuration, this port is configured as an interface to network.				

5 Terminal unit

To operate the AirLaser IP1000plus and possibly a backup installed a terminal unit is required for each location. The terminal unit supplies both the AirLaser IP1000plus, and the backup system on the TP data cable with power and protects at the same time through the built-in surge protection type 2 the network against surges, which can occur for example during thunderstorms.

5.1 Installation

The terminal unit is only suitable for indoor use. The mounting location should be near the location of the radio equipment, dry and frost free. An ambient temperature of 55 ° C in the variant 1 and 40°C in variant 2 must not be exceeded.
The terminal unit can optionally be screwed on a flat surface, or it can be installed in 19" cabinets with an optional front panel. The front panel has a height of 2U.
The electrical connection of the terminal unit depending on the version is made to one or two electrical outlets and a separate potential equalization. The electrical connection must only be carried out by appropriately trained personnel!

5.2 Model 1 - Basic Device

The standard version of the terminal unit consists of a mounting plate, on which the switching power supply for the AirLaser IP1000plus and the backup is mounted. Under the metal cover is the PoE injector with integrated surge protection.

At the rear TP port of the PoE injector the AirLaser IP1000plus is plugged, the network port on the front.
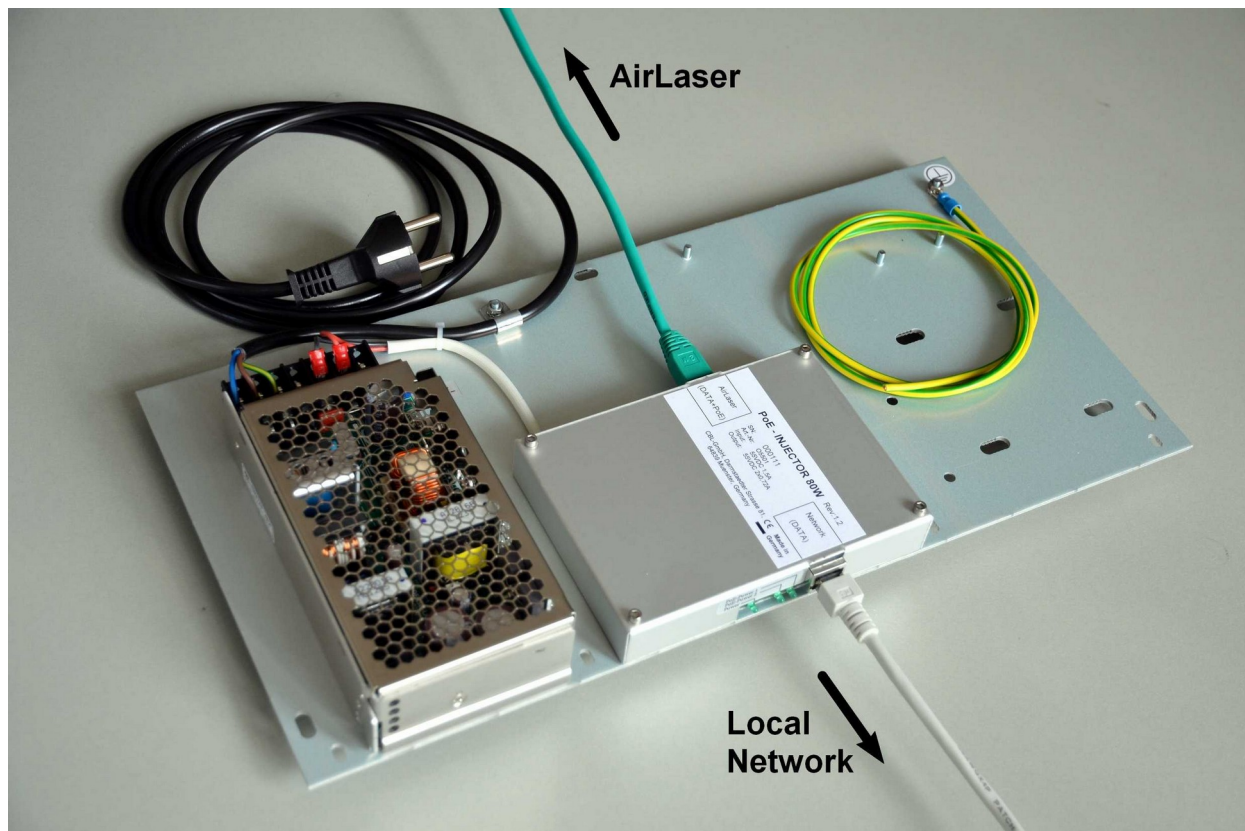
Terminal unit for the AirLaser IP1000plus

5.3 Model 2 - with PoE option for the AirLaser backup

Variant 2 offers additionally a second PoE injector with an integrated power supply and an external surge protection to supply the backup system. This solution is used when switching between optical and backup route is not done by the AirLaser IP1000plus, but by the access switch.

Note: When connecting the radio equipment to the terminal unit, ensure that the TP cable of AirLaser IP1000plus and backups are not reversed. AirLaser IP1000plus and the backup system use different PoE standard!
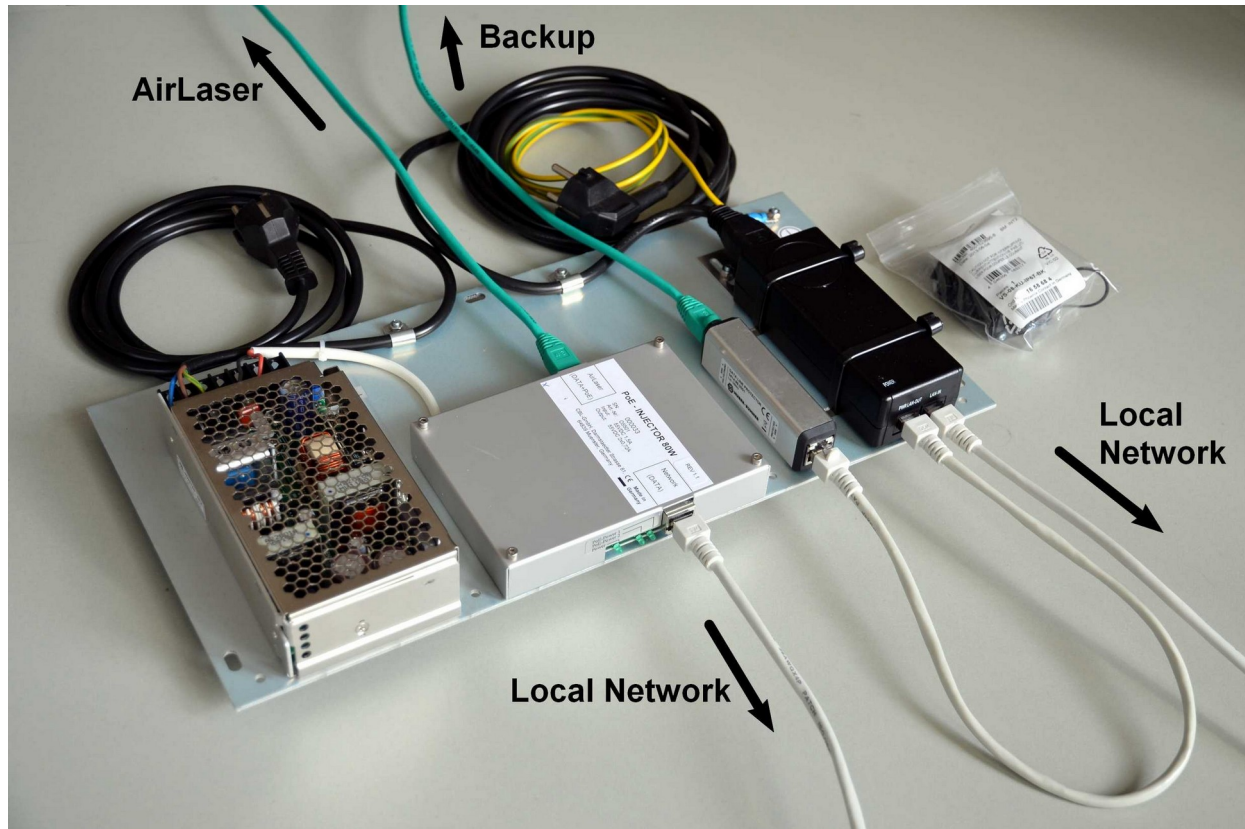
Terminal unit version 2 with separate power supply for the AirLaser IP1000plus and the backup.

Option 2 further provides the ability to be used as a redundant power supply for the radio links. The AirLaser IP1000plus is first inserted as in the variant 1 in the terminal unit (see above). The backup is connected to the port TP2 on the AirLaser IP1000plus. The AirLaser IP1000plus thus takes over the power supply to the backup, and data switching in the event of an interruption of the optical link.
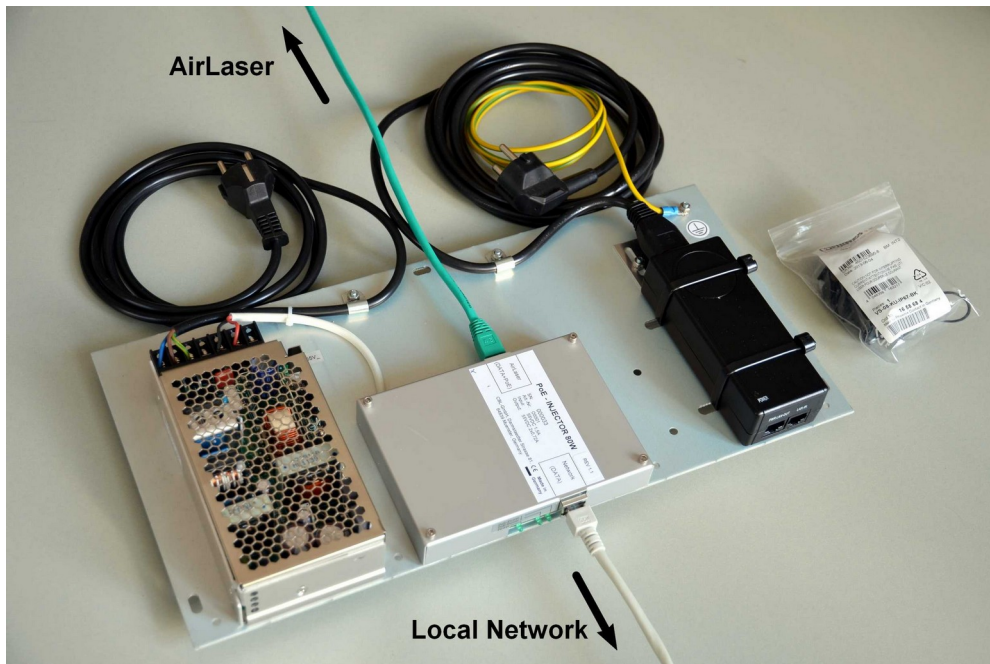
Normal operation. AirLaser and backup are powered from a single power supply.

If the AirLaser IP1000plus or the power supply fails through a technical defect, the backup system can be plugged to the second port of the PoE injector unit. In parallel, the cable must be removed at TP1 and TP2 of AirLaser IP1000plus and connected by the enclosed coupling.
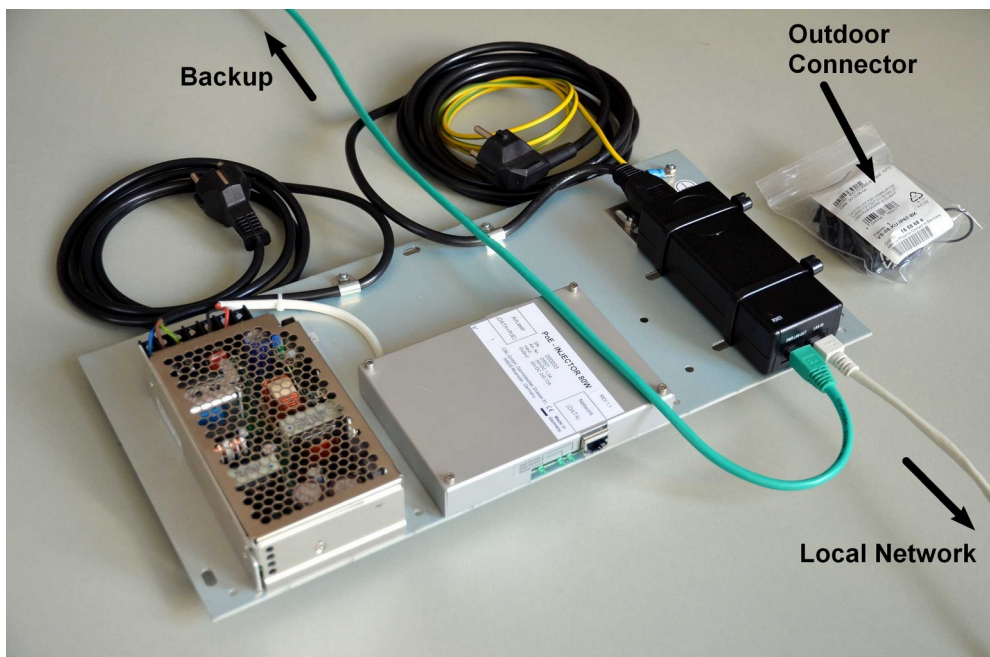
Emergency operation. The backup is supplied from the additional PoE injector.

6 Operation

6.1 Discovery and IP-address

After delivery, AirLaser IP1000plus has no IP-address and DHCP client is deactivated. To change network configurations of the AirLaser IP1000plus, use the program "Airlaser IP1000plus - Configuration Tool". It is free of charge available from cbl.de. Please pay attention to the hard- and software requirements for the software.

Copy this Airlaser Configuration Tool on your PC and start the program. Connect the PC directly or via network to the AirLaser IP1000plus. Use at AirLaser IP1000plus port TP1 or F1 (optional), because port TP2 is disabled at this time!

Note: The protocol of the Airlaser Configuration Tool works on network layer 2. Therefore between your PC and the AirLaser IP1000plus are no routers allowed!
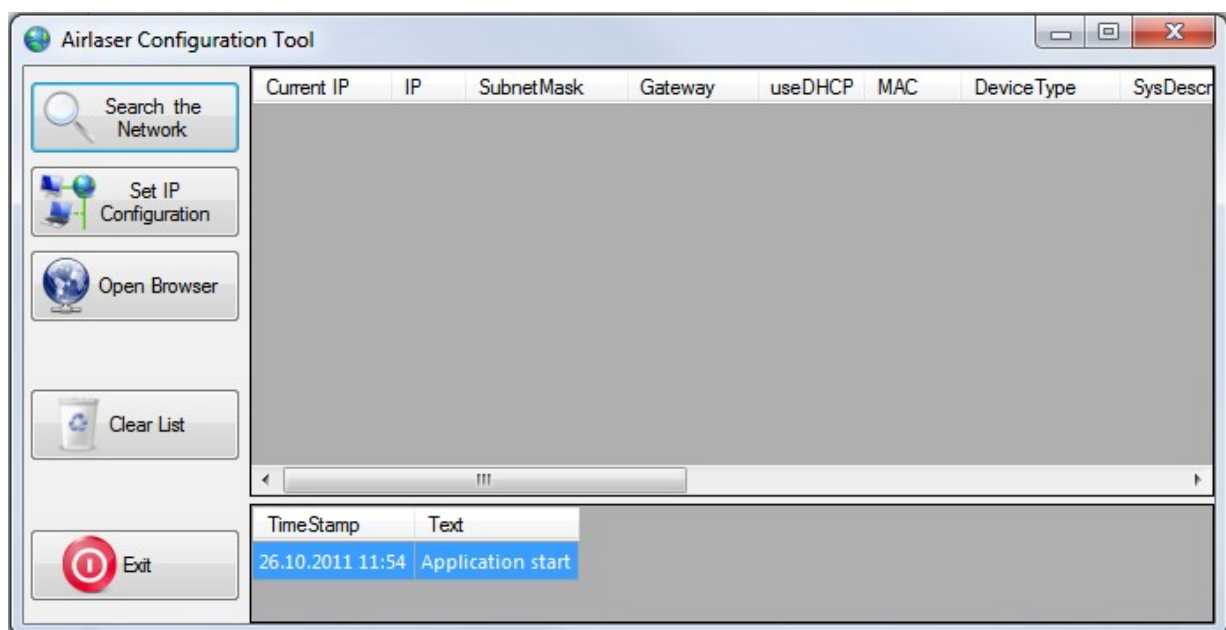
Select the button "Search the Network". In the new window you configure the search for AirLaser IP1000plus terminals.

There are two different search methods. Multicast search and IP search.

Multicast search:
In case of multicast search, your PC will send several multicast discovery packets with IP-address 224.0.0.1 into the network. All AirLaser IP1000plus, which receive this packet, will answer with a broadcast. All answers are listed.
If your PC has several network interfaces or IP-addresses, you can select via which interface the search is executed.

IP search:
In case of IP search, a free configurable IP address range will be used for the search for AirLaser IP1000plus. Because unicast packets are used for discovery, the search in the whole IP network is possible. Assumption is that AirLaser IP1000plus has a valid IP address. The scan takes time, because each IP-address is asked. For that reason, reduce the IP-range to minimum.
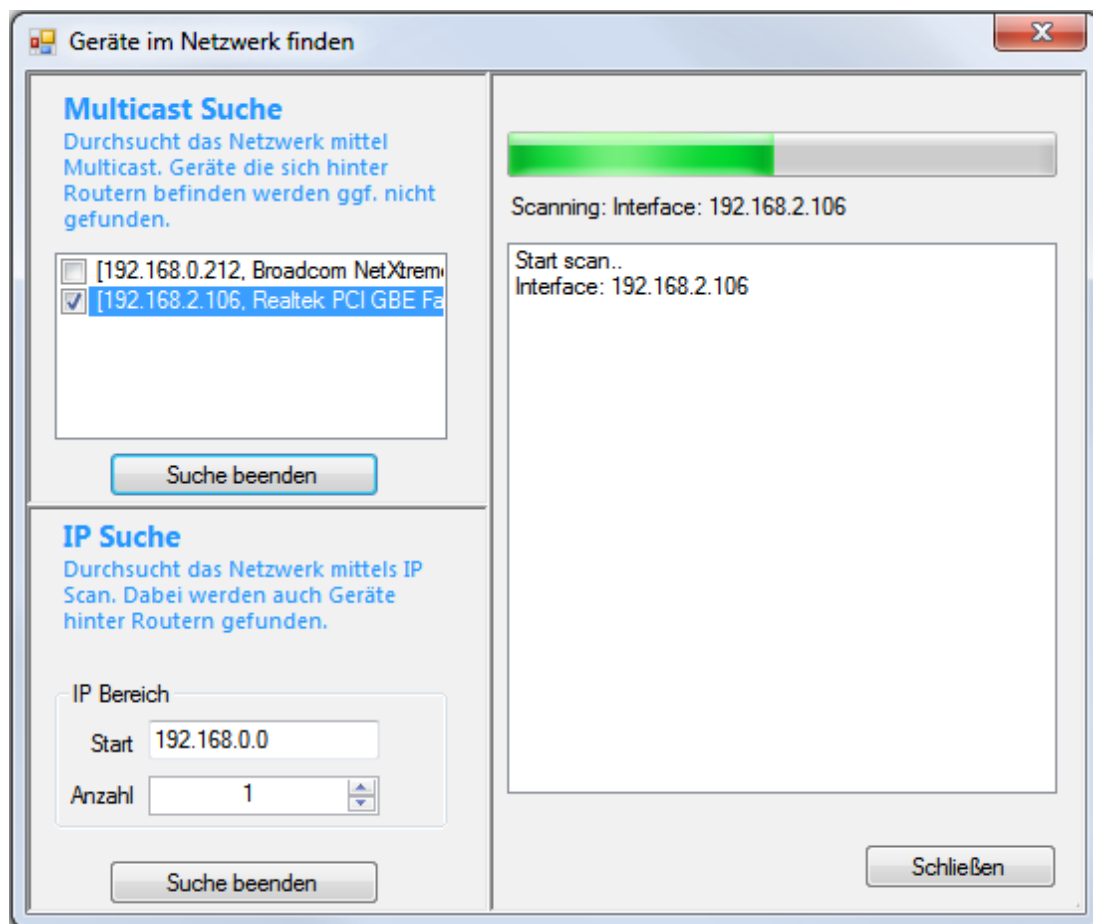
All answers of the AirLaser IP1000plus are listed. Select the right terminal with help of the MAC-address and push "Set IP Configuration".
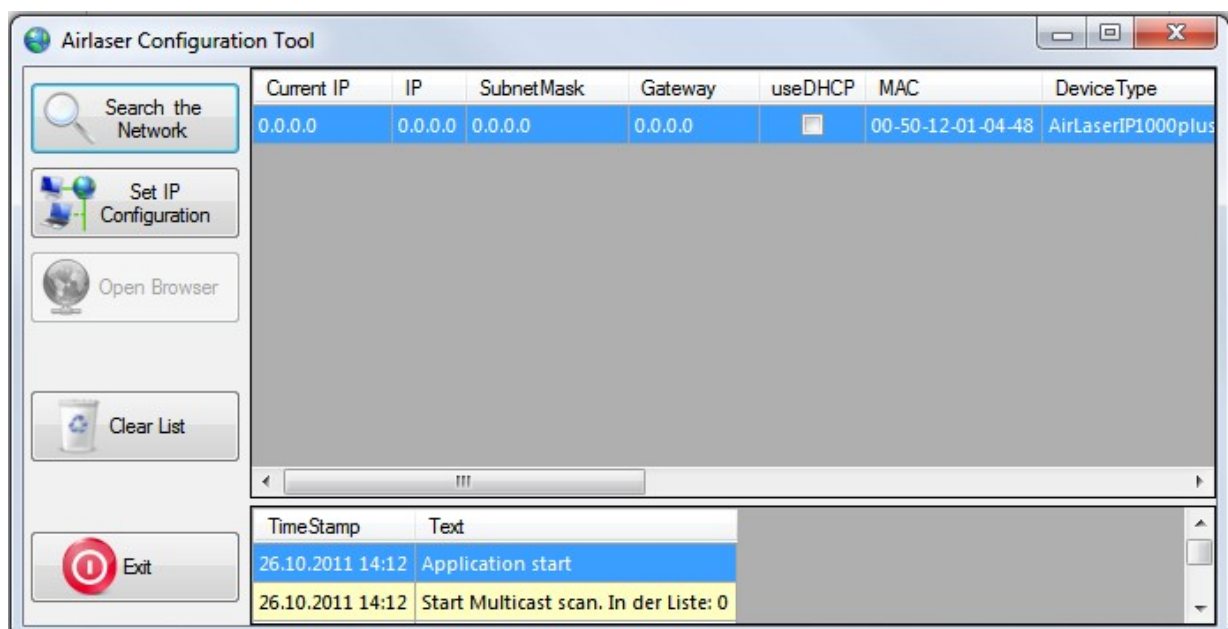
Now, you can give AirLaser IP1000plus an IP-address or you can activate the DHCP client.

Now, the IP access to the terminal is configured and you can log into the webmanagement.

7 Webmanagement

AirLaser IP1000plus has an integrated webmanagement for configuration and supervision of important system parameters. To get access to the management, it is necessary to configure before the terminals with an IP-address. Enter the IP-address into the address-line of your webbrowser. Then you will come to the login side. CBL recommends to use Mozilla Firefox, version 7 or Microsoft Internet Explorer version 8 onwards. Other web browsers should also work.
As of AirLaser IP1000plus firmware version 2.03, the communication between the AirLaser and your Internet browser is encrypted. HTTPS is now used as the protocol. This results in the following changes to a firmware upgrade to version 2.03:

- The HTTPS protocol uses port 443 / TCP. Ensure that any firewalls are configured to access the AirLaser's 443 / TCP port.
- The certificate installed in the AirLaser IP1000plus is self-signed by CBL and the same for all AirLaser IP1000plus. Therefore, when you first connect your Internet browser to the AirLaser, you must confirm the certificate as an exception. Save this exception permanently. For the next logins the query is then no longer.

7.1 Login, accounts and passwords

The access to AirLaser's webmanagement is protected against unauthorised login. The management has two different user levels „Admin" and „Guest". Admin may read and write system-configurations. Guest account may only read. The password for the Guest Account can only be changed by an admin, not from the guest.

Both passwords are in the factory default setup identical with the user names: „admin" and „guest". On the account side, you may set up new passwords. A password can have up to 64 characters. If you don't set up a new password, the former word is remaining.

Basics / Account

Set Admin Password

User: admin

New Password: [ ] Allowed Characters: **A-Z a-z 0-9 ! § % = , . : _ -**

Set Guest Password

User: guest

New Password: [ ] Allowed Characters: **A-Z a-z 0-9 ! § % = , . : _ -**

[commit]

7.2 System

On the system side, you get informations about the hardware of the terminal. You can also configure some items.

	Type	Default	Description
HW Version			Hardware status of the AirLaser IP1000plus.
Serial Number			Serialnumber of the AirLaser IP1000plus.
Max. Range	Integer		Recommended max. distance between both terminals. AirLaser IP1000plus/100: 150m AirLaser IP1000plus/800: 800m
Transmitter	Integer		Number of transmitters. IP1000plus/100: 1 (Single Beam) IP1000plus/800: 4 (Quad Beam)
Hostname	String[32]	Serial-number	Name of the terminal in the network.
Domain	String[32]	unknown	Domain of the AirLaser.
Location	String[32]	unknown	Description of the installation place (e.g. street, number of the building,…)
Link Distance	Integer		Distance to the remote site. (10..999 m). The value is required for calculating the expected received power.

Note: From hostname and domain the email sender address "Hostname@Domain" of the AirLasers will be generated. For that reason, neither spaces nor special characters are allowed.

7.3 Network

Here you configure the network settings of the AirLaser IP1000plus. In factory setting no IP address for the management is assigned and the DHCP Client is deactivated. You make the first configuration of the network settings with " Air laser Configuration Tool" (see chapter 5). You can make each further change of the settings via the Web management.

	Type	Default	Description
MAC-Address	MAC-Addr.	00501201XXXX	MAC-address of the management.
DHCP	boolean	disabled	Enables/disables the DHCP client.
IP-Address	IP	0.0.0.0	IP-address of the management.
Netmask	IP	0.0.0.0	Netmask to IP-address.
DNS 1	IP	0.0.0.0	IP-address of the primary DNS server.
DNS 2	IP	0.0.0.0	IP-Address of the backup DNS server.
VLAN	boolean	disabled	Enables/disables VLAN support of the management
VLAN-ID	Integer	1	Management VLAN-ID
Allow IP-Config via	Boolean	HTML and Config-Tool	When set to "HTML only", the AirLaser configuration tool monitors the AirLaser only. The network settings can therefore not be changed.
Remote Unit Identification	IP	0.0.0.0	IP-address of the remote terminal. Is this configured, both terminals are visible at the same time in the webmanagement.

When DHCP is enabled, the DHCP-address is used instead of a fixed configured address. If a management VLAN is configured, both VLAN-IDs for both AirLasers must be identical. Otherwise the inband management channel will not work and the terminals can not show the remote side.

7.4 Port control

AirLaser IP1000plus has two TP-ports (TP1 and TP2) and optional one fibre port (F1). A fourth port is the free space interface to the remote terminal. These four ports and the management processor are internally connected by a Gigabit Ethernet switch with one another. All external ports can be configured in their function, so that the AirLaser IP1000plus can be adapted to the most different installation scenarios. You can reach the management of the AirLaser IP1000plus independently of the port settings over each active port as long as "outband mng" is not activated.

With the external ports we differentiate in principle between "controlled" and "not controlled" ports or paths. To the controlled paths belong "Default Path" and " Backup Path". Depending upon availability and Backup criteria the management selects one of the controlled paths for the data communication. The other path is blocked, so that it does not come to loops in the network. Not controlled ports are "Local Ports". These are always active and not supervised by the management. Local ports can be used for example for the connection of the AirLaser to the network, for IP cameras or for service access.

If necessary, the management of the AirLaser can be achieved only through a dedicated port. This is done with the "outband mng" option in the select menu. If you choose this option, for example there for the port TP2, then the management is isolated of all other ports and only accessible through this. In return, you can't reach the port TP2 through any other ports of AirLasers. The management and TP2 are an isolated group.

Following items can be configured for each port:

Mode of operation	Type	Description
Default Path	controlled port	Preferred path to the data communication. This path is used, as soon as it is available. Usually one uses the optical free space interface as default Path.
Backup Path	controlled port	The Backup Path is used whenever the default Path is interrupted. As Backup System you can use the optional available integrated backup system, which is attached at the TP2.
Local Port	not controlled port	A local port is always active and it is not controlled by the management of the air laser. Typically you configure the port, which is connected with your network, as local port.
Outband management	not controlled port	This setting separates the management access from the data connection. The management of AirLasers is then only accessible via the outband management port.
Disabled		Switches the port physically off. The PoE functionality at port TP2 is not affected by it. Ensure that you do not deactivate the port, by which you reach the management of the Airlaser.

In a controlled path active managed devices like the integrated backup can exist. If this controlled path is blocked by the management of the AirLaser, then the management of the integrated backup would no longer be accessible. In order to make this possible, you can register two MAC addresses, which may pass the port also in blocked condition. Make sure that the MAC addresses are registered at the correct port. In both AirLaser IP1000plus of a link both MACs of the Backup devices must be registered.

	Type	Default	Description
Static MACs at TP1	MAC-Addr.	none	MAC-Address of the backup system
Static MACs at TP2	MAC-Addr.	none	MAC-Address of the backup system
Static MACs at F1	MAC-Addr.	none	MAC-Address of the backup system

Here we have some configuration examples of typical applications for you.

AirLaser IP1000plus without Backup
The simplest fso-link solution is a AirLaser IP1000plus without Backup. The connection to the network is made by the twisted pair port TP1, which supplies the equipment also at the same time with power. In this case you use the following settings.

Port	Logic	Application
FSO	Default Path	free space path
TP1	Local Port	connection to your network and power supply
TP2	Disabled	not used

With cable lengths of more as 90 meters between the AirLaser IP1000plus and the network connection we recommend the use of glass fibre as data line. The following configuration is suitable for this case.

Port	Logic	Application
FSO	Default Path	free space path
TP1	Disabled	power supply
TP2	Disabled	not used
F1	Local Port	connection to your network

AirLaser IP1000plus with integrated backup
Configure port TP2 as Backup Path, if you connect the integrated backup to it.

Port	Logic	Application
FSO	Default Path	free space path
TP1	Local Port	connection to your network and power supply
TP2	Backup Path	integrated backup

AirLaser IP1000plus as Backup for a dedicated line
If you should use the AirLaser IP1000plus as Backup to a dedicated line, then the change-over in the event of an error can be made by the AirLaser IP1000plus. You can make the connection to your network for example over TP1 and attach the dedicated line (glass fibre) to F1.

Port	Logic	Application
FSO	Backup Path	free space path
TP1	Local Port	connection to your network and power supply
TP2	Disabled	not used
F1	Default Path	dedicated line

AirLaser IP1000plus with Webcam
If you would like to supervise your fso-link with an IP camera, then you can attach this simply to the TP2. The port powers your camera, if this is IEEE802.3af compatible. Here our recommended settings.

Port	Logic	Application
FSO	Default Path	free space path
TP1	Local Port	connection to your network
TP2	Local Port	IP camera

AirLaser IP1000plus with outband management
If the management of AirLasers shall not be accessible via the local port, you can specify a separate port on which you want to address the management.

Port	Logic	Application
FSO	Default Path	free space path
TP1	Local Port	connection to your network
TP2	Local Port	IP camera

7.5 Time + Date

Here is time and date configuration for AirLaser management possible. If the NTP service is enabled, NTP time will be used. Otherwise, the manual configured time is used. The time is needed for the time stamps in the log file and for the creation of the History. If you change date or time of the AirLaser, you should delete afterwards the History, so that it does not come to an inconsistency in the data record of the History. The change between daylight saving time and normal time is made by the AirLaser IP1000plus automatically on the basis of the time zone, if "auto summer time" is activated.

	Type	Default	Description
System Time	Date	not affected by a default reset	current local time and date
Time Zone	Integer	GMT + 1 (Berlin, Rome, Paris)	time zone of location of installation
Auto Summer Time	Boolean	Enabled	enables/disables the automatic daylight saving time
NTP Service	Boolean	Disabled	enables/disables the ntp-service
NTP-Server	String[64]		domain name or IP-address of ntp server
NTP-Port	Integer	123	port number of ntp service

7.6 Services

FSO Characteristics
The free space distance (FSO) can be interrupted by different events briefly or also longer. Short events are caused for example by flying birds or falling leaves. These interruptions last typically some 10 to some 100 ms. Longer interruptions result usually from influences of the weather such as fog and take typically some minutes up to some hours.
To get the maximum availability of the fso-link you should configure the change-over to the backup in such a way, that short events do not lead to switching to the backup path. Short interruptions become hardly apparent in the network. This delay time for switching to the backup path is the so-called Backup Delay.
If the AirLaser switched for example because of fog to the Backup, then it is reasonable to remain a minimum time in the backup so that the system does not constantly switch between backup and optical path in case of fast changing weather conditions. The switch back delay is responsible for switching back from the backup to the optical path.
Except the two time criteria for the change-over there is another criterion for the amplitude of the optical signal, the optical hysteresis. Thereby you specify by which amount the receipt levels after the interruption must rise, so that the system changes over to the optical path. Not until the value of optical hysteresis was exceeded, the switch back time starts to run.

	Type	Default	Description
Optical Hysteresis	Integer	Disabled	By this amount the optical level must exceed the sensitivity limit of the receiver, so that the system changes over to the optical path.
Backup Delay	Integer	500ms	Time interval from the beginning of the interruption of the optical path, until backup path is used.
Switch Back Delay	Integer	30s	Time interval from the end of the interruption of the optical path, until optical path is used again.

TP2 PoE Support
The port TP2 is equipped with a PoE controller (PSE), which makes it possible to supply IEEE802.3af compatible devices directly with power. Also a forced mode is implemented, which can supply a 50% higher current compared to the IEEE802.3af mode.
Maximum current in IEEE802.3af mode: 350mA
Maximum current in forced mode: 525mA

Note! In the forced on mode the TP2 port leads always a voltage of up to 56V, even if no equipment is attached to the port. Devices, which are not suitable for this mode, can be damaged by connecting them to the TP2 port!

	Type	Default	Description
Mode	Integer	Disabled	Selects the operation mode for the PoE controller. Disabled: PoE is off. Auto: Mode for IEEE802.3af compatible equipment Forced On: Proprietary mode e. g. for AirLink
Status			Power Off: PoE is off Delivering Power: PoE is on

MISC

TX-Power
In case of a short distance between the two AirLasers it is necessary to reduce the optical transmitter power, to prevent overloading the receiver. Whether a receiver is overloaded or not, you can recognize by the APD-factor (see status site).

The single beam device has two power levels, the four-beam device has four power levels. To the four-beam device, the stages in which all four lasers are in operation, are preferred. This increases the susceptibility to atmospheric influences (heat shimmer, rain, snow, etc.).

With activated Automatic Transmit Power Control (ATPC) the transmission power is automatically increased to the maximum, if the received power of the remote falls below -25dBm. After reaching -12dBm receive power, the preselected reduction is activated again.

TX Reduction	Leistung in %	IP1000plus/100	IP1000plus/800
0dB	100	1 x 10mW	4 x 10mW
3dB	50	-	2 x 10mW
6dB	25	1 x 2,5mW	4 x 2,5mW
6dB with ATPC	25/100	1 x 2,5mW / 1 x 10mW	4 x 2,5mW / 4 x 10mW
9dB	12,5	-	2 x 2,5mW
9dB with ATPC	12,5/100	-	2 x 2,5mW / 4 x 10mW
LASER off	0	0	0

Display Mode
The AirLaser IP1000plus has an LED display on the device, which serves to align and control the system. If the display is not needed, it can be turned off on the device or the management. Thus, the device will be less noticeable especially at night.

7.7 Firmware

With firmware updates, AirLaser IP1000plus will be on the actual status. First an upload of the firmware from CBL's webserver to your PC is necessary. Next step is the transmission to the AirLaser.
Select on firmware side the version, you want to install and click on "upload". The firmware will now be uploaded from your PC into the RAM of the AirLaser terminal. Afterwards click on "Activate", to bring the new firmware from RAM into the FLASH. You can see the progress in the log window. It needs approximately 4 minutes. After that, the AirLaser IP1000plus boots automatically with the new firmware. Your configuration still applies and if necessary, it will be adjusted to the new config file.

Note: AirLaser has only one storage for firmware. During an update the actual used firmware in the flash will be cancelled. For that reason, during the update, power supply should not be interrupted. Otherwise, firmware can be destroyed!

AirLaser IP1000plus - Web Based Management

Hostname: Dev-1
Location: CBL
Firmware: 1.27

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Welcome admin [logout]

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Logfile
2013/10/13 08:05:41 -crit- spcd: Port[fso] link-down
2013/10/13 08:05:41 -notice- spcd: Active path switched from port[fso] to port[tp2]
2013/10/13 08:05:41 -info- spcd: Port[fso] link-up 1Gb/s FD
2013/10/13 08:06:11 -notice- spcd: Active path switched from port[tp2] to port[fso]

Status
RX-Level: -16.9 [dBm]
FSO-Mode: active
Sys-Temp: 42 [°C]
VCC 3,3V: 3273 [mV]

Advanced / Firmware

Active Firmware

Version: 1.27

Installed: 2013-10-11   14:44:08
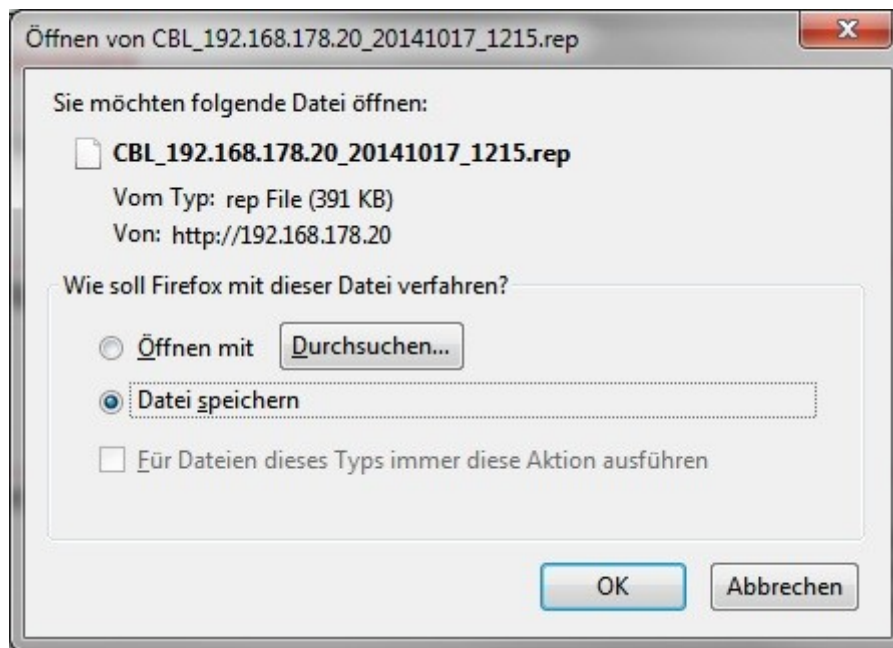
New Firmware

Firmware File: [Durchsuchen..]   Keine Datei ausgewählt.

[upload]

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7.8 Config File

Save Config File to PC
If necessary, the customer-specific configuration of the device is stored externally, and when need it, you can upload it back into the unit. In the configuration file are all configurable settings of the Web-based management stored.

Restore Config File
Here a previously saved, customized device configuration can be played back in the AirLaser. Please note that also all network settings and passwords are overwritten.

System Report

The system report is a file that contains all the available information of the AirLaser and the current state of the optical link. These are for example the config file, the log file, current measured values and the history. The system report is binary coded and encrypted. The file can only be opened and read with a special software by the CBL customer service. Thus, it is the CBL customer service in case of a service request, to quickly get an overview and to provide a comprehensive diagnosis.

Your login datas to AirLaser management that are included in the System Report, are once more encrypted so that it can not be read from the CBL customer service.

By pressing the start button a current system report is created. The preparation takes about 20 seconds. During this time no other point in the management must be selected, otherwise the action is canceled. Is the file on the AirLaser created, a dialog window will open to download the file.

For evaluation, please send the file by email to the address lists of the CBL customer service staff.

7.9 Reset

With "Reboot System", you can start the firmware of the AirLasers again. The actual configuration remains. The optical link is interrupted during booting for approx. 30 seconds.

If you select "Load Factory Settings", the actual configuration will be deleted and a new with factory default set up will be valid. (see appendix B)
After booting, the network configuration must be set up again. Control TX-power configuration for overload. If an external backup system is connected to TP2, this port must be enabled and, if necessary, PoE-support also.

7.10 Tests

In the AirLaser IP1000plus firmware three tests are implemented to check the functionality of the optical link.

Laser Alignment Test

The laser Aligment test is only implemented in the four beam model AirLaser IP1000plus/800. The test tells you whether the local device (the device to which you are logged in) is optimally aligned to the remote site.

For maximum operational reliability, it is important that all four laser meet with nearly the same power the receiver of the remote site. This ensures that the remote station is located in the center of the laser beam, which is generated by the four individual lasers. Optimal alignment makes the optical link robust against slight movements due to thermal influences, heat shimmer and falling leaves or snow.

If the test is started, three lasers are turned off so that only one remains in operation. Now, the received power is measured by the remote station, which is achieved by one laser. The measurement is repeated for all four lasers. At the end of the test, which takes about 5 seconds, the measurement result is shown graphically in web management.

The test is performed using the currently selected laser power reduction, so 0dB or 6dB. During the test, the link remains in the optical mode, unless the receive power goes below the sensitivity limit of the receiver. The AirLaser then automatically switches to the backup.

The measured value of each laser is associated with the laser in the image. The view is to the rear of the unit. From the Link Distance, which is registered on the system site, and the TX-Reduction the Expected RX-Level is calculated. This is the theoretically maximal possible Receiving Level that can be achieved by one laser, at the given distance. In practice the achievable value is in some cases significantly lower due to weather related attenuation of the atmosphere.
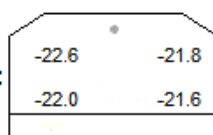
The AirLaser can reliably measure the optical receive level up to -36dBm. Lower levels are shown by "---". If the measured value can not be read from the remote device, this is indicated by "na" in the management.

Small errors in the alignment should not be corrected immediately, but better initially observed. If the error is at any time of day for several days nearly constant, so the device can be refocused on occasion. However, the error changes with the time of day and temperature, an alignment should be chosen that brings the highest possible level of reception in all weather conditions.

If you are not sure if and how you need to change the orientation of your equipment, contact our Customer Service. We advise you gladly.

Ping Test

The Ping Test is used to verify the accessibility of a remote host. This helps to find for example errors in the IP configuration, routing, or VLAN settings.

At the start of the test, three pings are sent sequentially to the specified IP address. The result is shown in the text box.

The interface through which the ping is sent is determined by the Mactable in the AirLaser and can not be selected dedicated.

Ping Test

IP Addr: [   ]

Action: [Start] [Clear]

Result:
```
2013-10-16 10:24:56
PING 192.168.178.21 (192.168.178.21): 56 data bytes
64 bytes from 192.168.178.21: seq=0 ttl=64 time=0.340 ms
64 bytes from 192.168.178.21: seq=1 ttl=64 time=0.417 ms
64 bytes from 192.168.178.21: seq=2 ttl=64 time=0.661 ms
--- 192.168.178.21 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 0.340/0.472/0.661 ms
```

Iperf Test

On the AirLaser a Iperf server is running to which the performance of the optical and especially the backup route can be checked.

By pressing the start button an Iperf client is started on the local machine in addition to the server, which transmits data to the specified server address. The test is thus unidirectional from client to server. Due to the connection of the CPU of the AirLaser only data rates of about 80Mbit/s can be generated. After 10 seconds, the test stops automatically. For a full examination of the link, test should now be started on the remote device.

Note: Start the test on only one device, so that the correct results are displayed.

I-Perf Test (max. 100Mb/s)

Server IP: [192.168.178.21]

Action: [Start] [Clear]

Result:
```
2013-10-16 10:25:15
------------------------------------------------------------
Client connecting to 192.168.178.21, TCP port 5001
TCP window size: 20.2 KByte (default)
------------------------------------------------------------
[ 4] local 192.168.178.20 port 40864 connected with 192.168.178.21 port 5001
[ ID] Interval Transfer Bandwidth
[ 4] 0.0-10.0 sec 100 MBytes 84.0 Mbits/sec
```

Frontscreen Heating Test
Every Monday at 00:00 clock, the system performs an automatic test of the heated frontscreen. For this purpose, the heating of the frontscreen is switched on for a short time and the heating current is measured. If the measured current is outside the permissible range, an alarm message is send and an entry in the log file is made. In this case the frontscreen must be replaced by CBL.

7.11 Status

The status page gives you a quick overview of the status of your wireless connection.
The site is divided in the middle. The left shows the status of the device to which you are logged on. The right part shows you the status of the remote device. By clicking on the link to the remote IP address, you can log in quickly to the remote device.
Below Location and IP Address you see the FSO RX-level. This is the most important measurement to assess the quality of the connection. The display of the RX-FSO levels ranging from -36dBm up to about -2dBm. This corresponds to a received power of about 0.25µW to 630µW.
At levels above -10dBm LED 8 remains on and the system reduces the APD-Factor. This represents a reduction of the gain of the optical receiver. Upon a receipt level of up to -10 dBm the APD-Factor is 0.65. For larger levels the APD-factor is decreased steadily to 0.3. At higher levels than -2dBm it comes to overloading of the receiver and the data transfer is disturbed. In this case, the transmission power of the devices has to be reduced.
In Appendix D you will find a graphics which shows the expected receive level for a given distance.

Note: The usable range of the received signal level is from -32,5dBm to -2dBm. In this range, regardless of the level, the entire bandwidth of 1000Mbit/s full duplex is available. For small levels so there is no reduction in data rate!

Below the level meter the monitor for the ports is shown. Here you can see which port has established a link and which path is used for data transmission.

Admin	default Corresponds to Default Path backup Corresponds to Backup Path local Corresponds to Local Port mngt Corresponds to Outband MNG disabled Corresponds to Disabled
Status	Left aligned good and bad messages are listed and right-aligned, the resulting port status is displayed. Good message (green): 1Gb/s FD Link established with 1000 Mbit/s full duplex. 100Mb/s FD Link established with 100 Mbit/s full duplex. Bad message (yellow or red): Link No link established. RX-Level RX-Level The receive level is too low or too high. APD-Factor APD-Factor The APD-Factor is too low or too high. Loop A reflection has occurred. It receives its own control packets. Remote The remote device sends a bad message. NoRemote It will not receive control packets from the opposite device. Delay The Switchback delay has not yet expired.

	Resulting port status: active Port is currently being used for data transmission. standby (only controlled ports) The port is for data transmission available, but not used, because another path is already active. blocked (only controlled ports) The data transfer is interrupted at this port through the management because, for example, the switchback delay is not yet fully elapsed or a reflection is detected. down The port is not available for data transmission. The cause can be seen from the bad messages.

System Temperature	Temperature inside the unit in the area of the optical receiver.
Screen Temperature	Temperature of the heated front screen.
APD-Factor	The APD-Factor is a measure for the gain of the optical receiver.
Input Power	Status of both PoE input controller.
3.3V-Voltage	Internal 3.3-volt operating voltage.
Defroster	Status of the heated front screen. on Heating is on. off Heating is off
APD-Voltage	BIAS voltage of the APD receiver photo diode.
F1 RX-Level	Receive level at fibre port F1 (optional).

At the bottom of the site you find the System Time, i.e. the current local time of the system and the Uptime, i.e. the time that has elapsed since the last boot.

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AirLaser IP1000plus - Web Based Management

Hostname: Dev-1
Location: CBL
Firmware: 1.29

Welcome admin [logout]

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- Port Control

Advanced
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- Services
- Firmware
- Utilities
- Reset
- Tests

Monitoring
- Status
- Logfile
- Port Counter
- History
- Email
- Remote Syslog

Monitoring / Status

	Location: CBL		Location: Grufina	
	IP Address: 192.168.178.20		IP Address: 192.168.178.21	

		8 7 6 5 4 3 2 1			8 7 6 5 4 3 2 1
FSO RX Level:	-15.2 dBm		FSO RX Level:	-15.7 dBm	
TX Reduction:	0 dB		TX Reduction:	0 dB	

Port	Admin	Status		Port	Admin	Status	
FSO	default	1Gb/s FD	active	FSO	default	1Gb/s FD	active
TP2	backup	100Mb/s FD	standby	TP2	backup	100Mb/s FD	standby
TP1	local	1Gb/s FD	active	TP1	disabled	Link	down
F1	disabled	Link, RX-Level	down	F1	disabled	Link, RX-Level	down

System Temp.:	39 °C	3.3V Voltage:	3266 mV	System Temp.:	34 °C	3.3V Voltage:	3280 mV
Screen Temp.:	19 °C	Defroster:	off	Screen Temp.:	16 °C	Defroster:	off
APD Factor:	0.65 U/U$_{br}$	APD Voltage:	113.20 V	APD Factor:	0.65 U/U$_{br}$	APD Voltage:	109.63 V
Input Power:	P1 P2	F1 RX-Level:	--- dBm	Input Power:	P1 P2	F1 RX-Level:	--- dBm

System Time: 17 Oct 2014 14:42:13	**System Time:** 17 Oct 2014 14:42:15
Uptime: 9d 20h 21m 6s	**Uptime:** 9d 20h 30m 27s

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7.12 Logfile

In the log events that affect the device or the wireless link are documented. The log file can be downloaded from this site on your PC. Swap Order will reverse the sort sequence of the logfile entries. Either the newest entry is in the first row or the oldes entry.
Starting with the firmware version 2.03, there are extensive filters for the logfile, in order to find certain events more easily. If you set one or more checkmarks in the port filter, only the events that affect these ports are displayed. With the event filter you can search the message text for specific terms. This is case-sensitive. You can also enter several search terms separated by comma. Spaces are not allowed here. The Severity filter is used to turn events of a certain severity on or off. When a date jump in the time stamp occurs, a separation line is inserted in the logfile for a better overview.

7.13 Port counter

Portcounter counts received and transmitted bytes and frames at each port of the AirLaser. With this counter, specially the error counter, possible problems can be seen.

AirLaser IP1000plus - Web Based Management

Hostname: Dev-1
Location: CBL
Firmware: 1.27

Welcome admin [logout]

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Monitoring / Port Counter

|	FSO Port	TP1 Port	TP2 Port	F1 Port
RX Unicast Frames	23631560	3364166	1507545	0
RX Broadcast Frames	228	17248	5906	0
RX Multicast Frames	27833293	0	28247423	0
RX Good Oktets	645487541	599131020	2079930820	0
RX Pause Frames	0	0	0	0
RX Undersize Frames	137	0	0	0
RX Oversize Frames	0	0	0	0
RX Fragments	0	0	0	0
RX Symbol Errors	4262	0	0	0
RX FCS Errors	5	0	0	0
TX Unicasts	23699939	3769064	1502378	0
TX Broadcasts	17070	6198	8615	0
TX Multicasts	27846084	1	28253742	0
TX Good Oktets	520618960	1401661831	2057441399	0

[auto refresh]   [clear all counter]

7.14 History

AirLaser takes measurement with several sensors and traffic counters up to one month. These are:

- optical RX-power
- system temperature
- power in the APD
- fso and tp2 monitoring frames
- fso, f1, tp1 and tp2 rx and tx bits
- fso, f1, tp1 and tp2 rx bitserrors

The curves can help to have a look on the quality of the link.
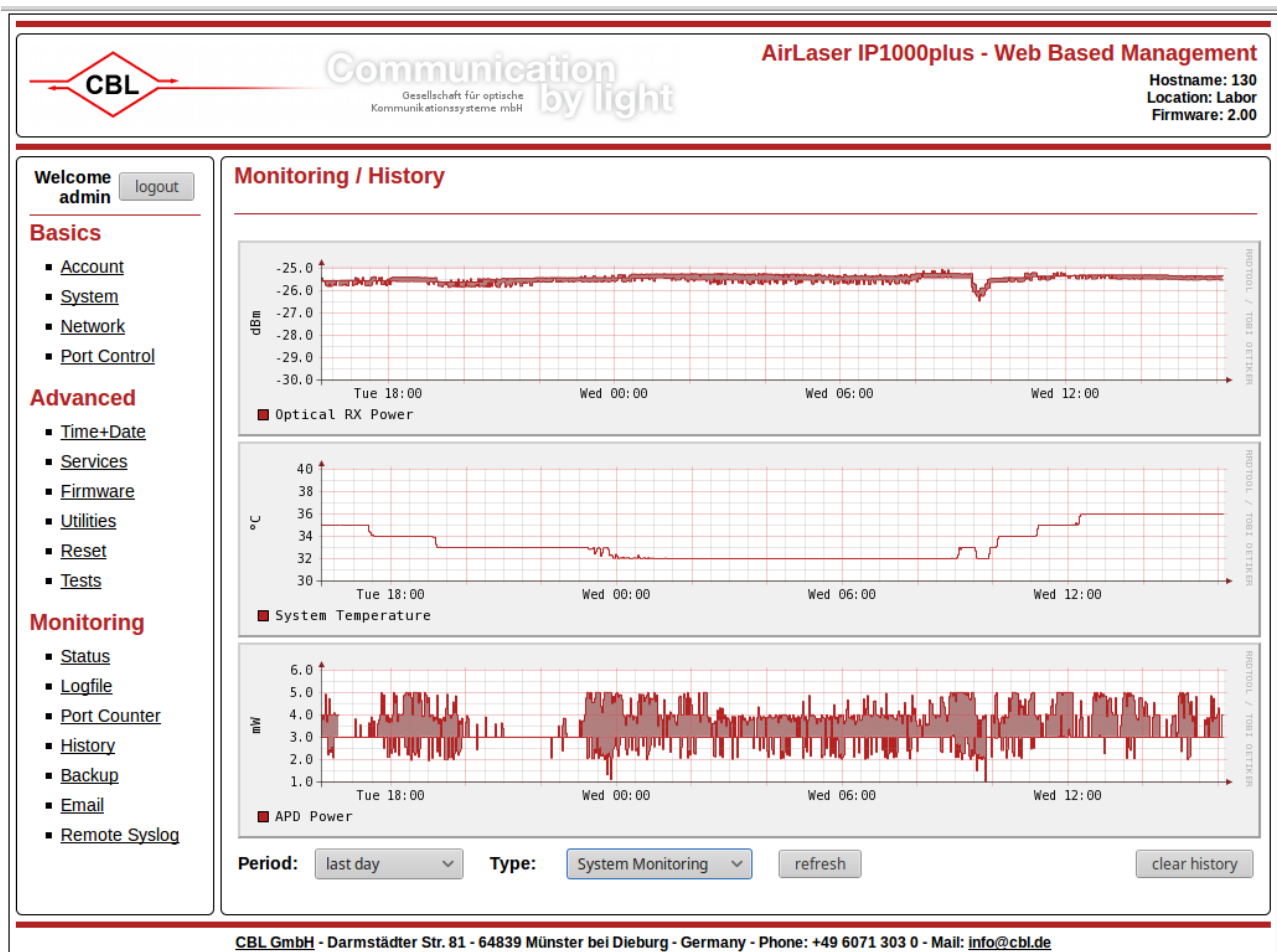
7.15 Backup

As of firmware 2.03, the AirLaser IP1000plus has an extended monitoring of the backup connection, which is connected to port TP2. This monitoring is intended for radio receivers powered by the AirLaser via PoE, such as the CBL AirLink or the integrated AirLaser Backup.

A monitoring packet generated by the AirLaser is transmitted 10 times per second to monitor the optical and backup connections. The received link monitoring packets are counted and graphically displayed in the history in the link monitoring section. If no monitoring packet is received longer than the set link monitoring timeout, the backup device is restarted as a precaution by briefly switching off the supply voltage.

When using the integrated backup, SNMP monitoring can also be activated. The SNMP OIDs of the backup are periodically queried and evaluated by the AirLaser. For example, a frequency change of the integrated backup can be detected. The result is written into the logfile.

The SNMP monitoring menu is only available if the MAC addresses of the integrated backup devices are entered on the Port Control Site.

	Typ	Default	Beschreibung
Link Monitoring	Boolean	disabled	Enables/disables backup link monitoring with auto reboot function
Link Monitoring Timeout	Integer	300	Timeout of the link monitoring packets until a reboot of the backup takes place

	Typ	Default	Beschreibung
SNMP Monitoring	Boolean	disabled	Enables/disables SNMP monitoring of the built-in backup
IP-Address	IP		IP-address of the backup unit
SNMP Port	Integer	161	Port number of the SNMP service in the backup
User Name	String[64]		SNMP V3 username of the backup
Authentication Password	String[64]		SNMP V3 authentication password
Type	Boolean	SHA	Select the hash function
Encryption Password	String[64]		SNMP V3 encryption password
Type	Boolean	DES	Select the hash function
Test SNMP Settings	Checkbox	☐	Queries the sysDescr OID of the backup. This allows the configuration of the SNMP settings to be checked. The check mark is automatically deleted after the test has been carried out. The result is logged in the log file.

The Authentication and Encryption Password fields are of type "write only". This means that the value can not be read back but can only be overwritten. If the field is empty when you send the site with "commit", the old value is retained.

AirLaser IP1000plus - Web Based Management

Hostname: 130
Location: Labor
Firmware: 2.00

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Welcome admin [logout]

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Logfile
2016/12/08 09:06:06 -notice- spcd: Active path switched from port[fso] to port[tp2]
2016/12/08 09:12:18 -info- spcd: Port[fso] link-up 1Gb/s FD
2016/12/08 09:12:48 -notice- spcd: Active path switched from port[tp2] to port[fso]
2016/12/08 10:28:12 -info- bcd: Backup SNMP test passed

Status
RX-Level: -25.5 [dBm] 🟢
FSO-Mode: active 🟢
Sys-Temp: 35 [°C] 🟢
VCC 3,3V: 3280 [mV] 🟢

Monitoring / Backup   [?]

Link Monitoring

Link Monitoring: [Enabled ▼]

Link Monitoring Timeout: [300]

SNMP Monitoring

SNMP Monitoring: [Enabled ▼]

IP Address: [192.168.2.23]   SNMP Port: [161]

User Name: [ucm]

Authentication Password: [   ]   Type: [SHA ▼]

Encryption Password: [   ]   Type: [DES ▼]

Test SNMP settings: ☐

[commit]

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7.16 Email

The AirLaser IP1000plus has an SMTP client, which informs you via email about the events which are related to the unit or the link. In the upper part of the site, you configure the access of AirLasers to the SMTP server. In the second half, you can specify which recipients should be informed about events.

	Type	Default	Description
Sender	String	Seriennummer @unknown	Sender of the event mails will automatically generated from hostname and domain. hostname@domain
SMTP-Server	String[64]		IP-Address or domain name of the SMTP-Servers
SMTP-Port	Integer	25	Portnumber of the SMTP-Server
User	String[64]		Username of AirLaser on the SMTP server
Password	String[64]		AirLaser password for the SMTP access

	Type	Default	Description
Enable	Checkbox	☐	Enable/disable sending emails to a specified address
Address	String[64]		Email address of recipient
Monitored Event Classes	Checkbox	☐☐☐☐☐	Determines what type of events to a particular address should be sent
Initiate a Test Mail	Checkbox	☐	Allowing users to send a test email to one or more email recipients. This allows to check the configuration of email settings. The checkbox is automatically cleared after sending the mail.

7.17 Remote Syslog

For a central monitoring the AirLaser IP1000plus provides the ability to log messages (except the debug messages) to be sent to a remote syslog server. Because the syslog protocol is not secured, it is possible that log entries are lost.

	Type	Default	Description
Remote Syslog	boolean	disabled	Enable or disable sendig messages to a remote syslog server.
Host Address	String [64]		IP-address or domain name of the syslog server.
Portnummer	Integer	514	Portnumber of the syslog server.

7.18 Quality Of Service

If not all ports of the AirLaser work at 1000 Mbit/s, data must be discarded in case of "overload of slow ports". This is the case for example, when a backup is connected via Fast Ethernet to the AirLaser, but the AirLaser is connected to the network by Giga Ethernet. Is the link in backup operation and are now send more than 100Mbit/s data from the network to the AirLaser, a part of the data must be discarded by the AirLaser. The AirLaser has the possibility to detect prioritized data and transmits them preferred. The AirLaser supports prioritization according to IEEE 802.1q, as well as IPv4 / IPv6 based prioritization. If an Ethernet packet contains both prioritization, only the 802.1q variant is evaluated.

Each port of the integrated giga ethernet switch has four output queues. Queue 3 has the highes priority, queue 0 the lowest.

Assignment of 802.1q priority values to the four output queues of the switch								
802.1q priority value	0x0	0x1	0x2	0x3	0x4	0x5	0x6	0x7
Output queue of the switch port	0	0	1	1	2	2	3	3

Assignment of 64 DiffServ or Traffic Class values to the four output queues of the switch				
DiffServ value	0x00 to 0x0F (0 to 15)	0x10 to 0x1F (16 to 31)	0x20 to 0x2F (32 to 47)	0x30 to 0x3F (48 to 63)
Output queue of the switch port	0	1	2	3

The queues are processed by a weighted 8-4-2-1-scheme. This guarantees the queues a minimum bandwidth				
Queue	0	1	2	3
Bandwith	7,00%	13,00%	27,00%	53,00%

Flow Control is disabled on all ports.

Packets that the switch can not store or forward, according to the above described priority rules, are discarded. If required, preferably low-priority packets are discarded so that high-priority packets can be forwarded. The minimum bandwidth for the queues are definitely available.

The settings of the quality of service are not configurable.

Appendix A: Technical Data

Technical data	AirLaser IP1000plus		Unit
	100	**800**	
General			
Distance	30..150	100..800	m
Datarate	1250		Mbit/s
Max. Packet Size	10240		Byte
Protocol	Gigabit Ethernet		
Air-Interface			
VCSEL transmitter	1 laserdiode	4 laserdiodes	
TX power setup	2 steps 0, -6	4 steps 0, -3, -6, -9	dB
Transmitted power max.	1x10	4x10	mW
Transmitter's aperture	1 x 28,25	4 x 28,25	cm^2
Laser class	1M, eye-safe		
Wavelength	830..870		nm
Divergence	1,8		mrad
Optical dynamic	30		dB
Receiver	APD		
RX sensitivity	-32		dBm
Cable Interface			
F1 (optional)			
Fiber optic	Multimode (opt. Singlemode)		
Wavelength	850 (1310)		nm
Connector	SC-RJ (IP67 waterproof)		
Standard	1000BaseSX (opt. 1000BaseLX)		
TX power	-4/-10		dBm
RX sensitivity	-16..0@850nm (-20..-3@1310nm)		dBm
TP1 (PD)			
PoE Standard	proprietary		
Connector	RJ45 (IP67 waterproof)		
Standard	10/100/1000BaseTX, Autonegotiation, Auto Crossover		
TP2 (PSE)			
PoE Standard	IEEE802.3af or forced mode		
Power	20W@48VDC		W
Connector	RJ45 (IP67 waterproof)		
Standard	10/100/1000BaseTX, Autonegotiation, Auto Crossover		
Miscellanous			
Power supply	48..57 (PoE)		VDC
Power consumption	max. 75		W
Temperature range	-25..+50		°C
Weight (without holder)	3		kg
Dimensions	263 x 165 x 343 (Width x Height x Depth)		mm

Last changed: February 2022

Technical data of the terminal unit

Technical data	Value	Unit
AC input voltage	100..240, 50..60Hz	VAC
Power factor	corresponding to EN61000-3-2	
DC output voltage	55	VDC
DC output current	2 x 700	mA
Temperature range	0..+55	°C
Dimensions (without frontpanel)	42x21x4,4 (Width x Depth x Hight)	cm
Weight	1,5	kg
PoE option for backup		
AC input voltage	100..250, 50..60Hz	VAC
Power factor	corresponding to EN61000-3-2	
DC output voltage	48	VDC
DC output current	670	mA
Temperature range	0..+40	°C
Weight	0,25	kg

Last changed: November 2013

Appendix B: Factory settings

User	Password
Admin	admin
Guest	guest

Field	Value
Hostname	Serial number of the AirLasers
Domain	unknown
Location	unknown

Field	Value
DHCP	disabled
IP-Address	0.0.0.0
Netmask	0.0.0.0
Gateway	0.0.0.0
DNS	0.0.0.0
VLAN	disabled
VLAN-ID	1
Allow IP-Config via	HTML and Config-Tool
Remote IP-Address	0.0.0.0

Field	Value
Port Logic	
FSO	Default Path
TP1	Local Port, 1000Mbit/s, Autonegotiation
TP2	disabled
F1 (optional)	Local Port, 1000Mbit/s, Autonegotiation
External Backup Tunnel	
Static MACs at TP1	none
Static MACs at TP2	none
Static MACs at F1	none

Field	Value
Time Zone	GMT + 1 (Berlin, Rome, Paris)
Auto Summer Time	enabled
NTP Service	disabled
NTP Server	none
NTP Port	none (default Port 123 is used)

Field	Value
FSO Characteristics	
Optical Hysterese	disabled
Backup Delay	500ms
Switch Back Delay	30s
TP2 PoE Support	
Mode	disabled
Misc	
TX-Power	Full
Display Mode	enabled

Field	Value
SMTP Configuration	
Server	none
Port	none (default Port 25 is used)
Username	none
Password	none
Recipients	none

Appendix C: Alarm thresholds

Value	Critical Min	Warning Min	Warning Max	Critical Max
3,3 Volt	3,135V (-5%)	3,204V (-3%)	3,399V (+3%)	3,465V (+5%)
2,5 Volt	2,375V (-5%)	2,425V (-3%)	2,575V (+3%)	2,625V (+5%)
APD-temperature	-15°C	-10°C	+70°C	+75°C
Heater-temperature	1°C	3°C	50°C	55°C
Heater-current off	0mA	0mA	20mA	20mA
Heater-current on (till HW 1.2)	650mA	750mA	1200mA	1250mA
Heater-current on (from HW 1.3)	800mA	900mA	1400mA	1450mA
APD-power	0mW	0mW	65mW	95mW
Uapd/Ubr (=>M)	0,3	0,4	0,8	0,9

Appendix D: Expected Receiving Level

Expected Receiving Level for AirLaser IP1000plus / 100

Distance [m]

Receiving Level [dBm]

0dB TX-Reduction ···· 6dB TX-Reduction

Expected Receiving Level for AirLaser IP1000plus / 800

Distance [m]

Receiving Level [dBm]

—— 0dB TX-Reduction ····· 6dB TX-Reduction
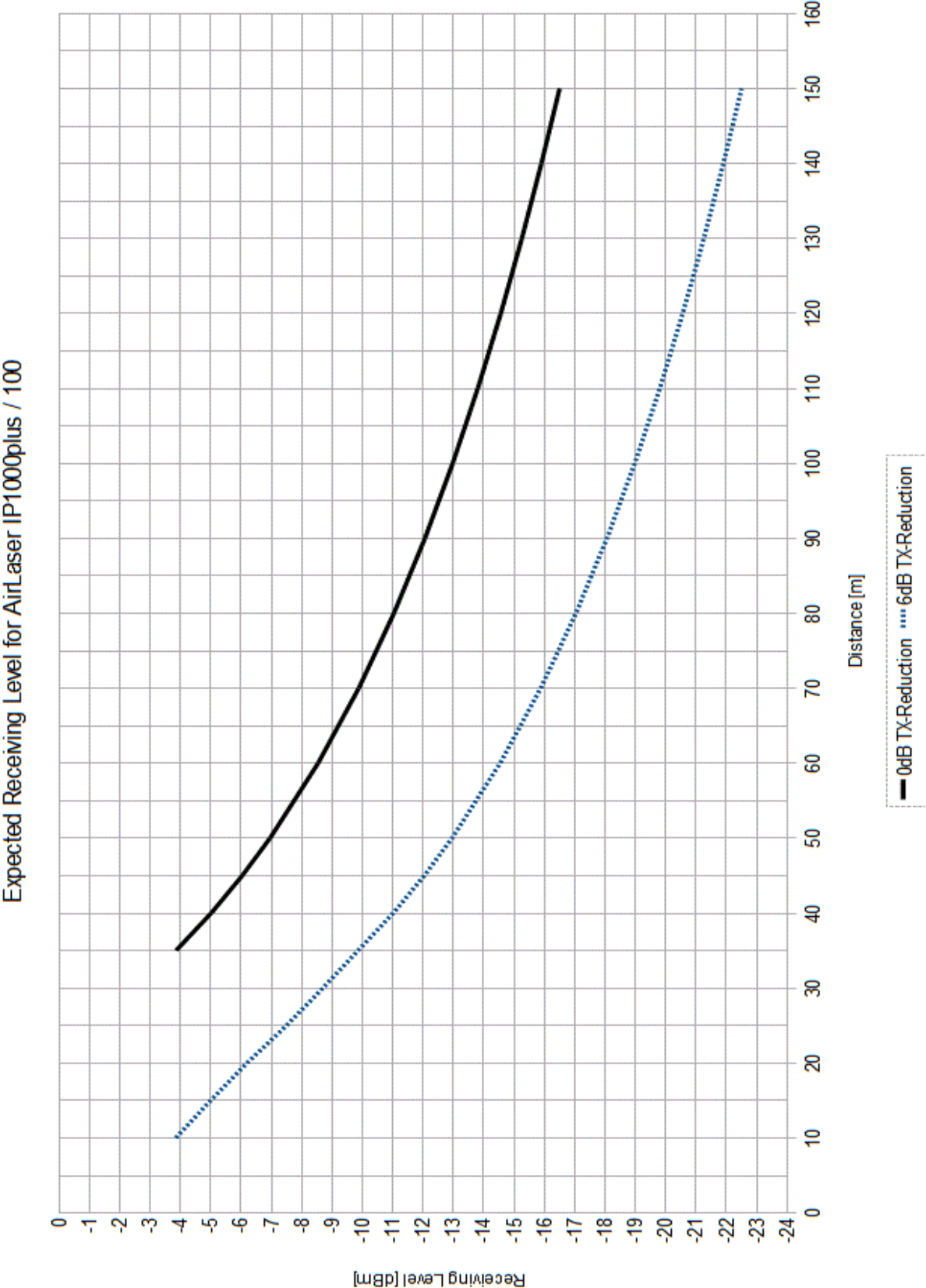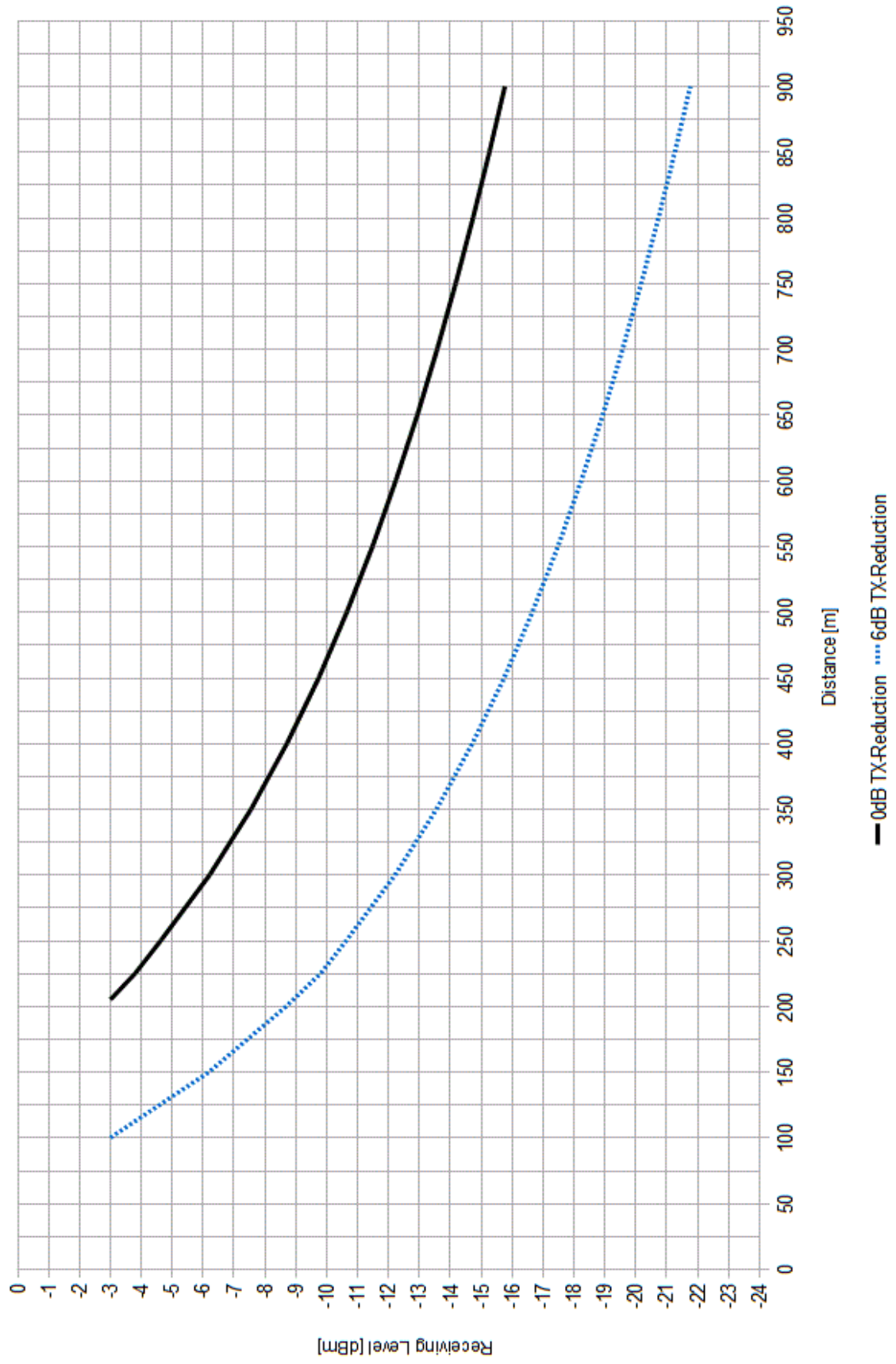
Appendix E: RX-Level Indicator

< -31dBm	>= -31dBm	>= -29,5dBm	>= -28dBm	>= -26,5dBm	>= -25dBm	>= -23,5dBm

>= -22dBm	>= -20,5dBm	>= -19dBm	>= -17,5dBm	>= -16dBm	>= -14,5dBm	>= -13dBm

>= -11,5dBm	>= -10dBm	>= -8,5dBm	>= -7dBm	>= -5,5dBm	>= -4dBm	>=-2,5dBm