Installation and Service Manual
SL60-100-57/64-38-E-O

Revision A.01

Issued: September 2005

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions.

1) This device may not cause harmful interference, and
2) This device must accept any interference received, including interference that may cause undesired operation.

If this product is suspected of causing harmful interference with other equipment, discontinue operation immediately and contact HUBER+SUHNER.

In order to meet FCC RF Exposure requirements, this device must be installed in such a way that a distance of 2 m is always maintained between the device antenna and nearby persons.

Modifications or substitutions made on the unit or parts of it without the written approval of HUBER+SUHNER could void the user's authority to operate the equipment.

FCCID TTDSL60100

1 Introduction

1.1 Purpose

This manual is intended for installation and service personnel who are involved in the planning, installation, operation, and maintenance of the SL60-100-57/64-38-E-O equipment.

Please read the complete manual prior the unpacking and installation of this equipment.

The information in this manual covers the proper installation and setup of a SL60-100-57/64-38-E-0 (SL 60) Ethernet radio link. It should be read and understood by the installation personnel prior to the deployment of the SL 60 equipment.

While the SL 60 is designed for ease of installation and setup, optimum performance can be achieved by following the procedures outlined in this manual.

1.2 Revision

HUBER+SUHNER reserves the right to revise this documentation and to make changes in content from time to time without obligation on the part of HUBER+SUHNER to provide notification of such revision or change.

1.3 Prior Knowledge

This manual assumes that the person installing this equipment has at least basic experience with and understanding of, as well as some familiarity with the configuration and operation of networking equipment. The persons installing this equipment should fully understand the information covered within this manual prior to installing this equipment.

1.4 Safety

The following general safety precautions must be observed during all phases of operation and service of the products covered in this manual. Failure to comply with these precautions or with specific warnings elsewhere in this manual willfully violates standards of design, manufacture, and intended use of the product.

- The SL60-100-57/64-38-E-O meets all FCC electrometric radiation safety requirements for radio equipment; however, it is best to avoid long-term exposure to the front of the radio while operating this equipment.
- The outdoor equipment must be properly grounded to provide some protection against voltage surges and built-up static charges.
- All electrical and mechanical installations must comply with local and/or national electrical and building codes.
- Do not modify the equipment or substitute parts of the equipment.

WARNING and DANGER statements have been strategically placed in the text to alert personnel of possible hazards. These statements must be closely observed.

1.5 Warranty

HUBER+SUHNER warrants to the original end user (purchaser) that this product is free from any defects in materials or workmanship for a period of up to one year from the date of shipment to the end user.

During the warranty period, and upon proof of purchase, should the product have indications of failure due to faulty workmanship and/or materials, HUBER+SUHNER will, at its discretion, repair or replace the defective products or components without charge for either parts or labor, and to whatever extent it shall deem necessary to restore the product or components to proper operating condition. Any replacement will consist of a new or re-manufactured functionally equivalent product of equal value, and will be solely at the discretion of HUBER+SUHNER.

This warranty shall not apply if the product is modified, misused, tampered with, damaged by an act of God, or subjected to abnormal working conditions.

To obtain the services of this warranty, contact HUBER+SUHNER's Service Center; refer to the chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** for your Return Material Authorization number (RMA). Products must be returned Postage Prepaid. It is recommended that the unit be insured when shipped. Any returned products without proof of purchase or those with an out-dated warranty will be repaired or replaced and the customer will be billed for parts and labor. All repaired or replaced products will be shipped by HUBER+SUHNER to the corresponding return address, Postage Paid (USA only). If the customer desires some other return destination beyond the U.S. borders, the customer shall bear the cost of the return shipment. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

1.6 Copyright / Disclaimer

2 System Overview

2.1 General Description

The system SL60-100-57/64-38-E-O operates as a data link in the 60 GHz unlicensed band between 57 GHz and 64 GHz with a full duplex data rate of 100 Mbps over a distance of up to 1 km (3300 ft). In view of the unlicensed status of this band, a Federal Communications Commission (FCC) license or special authorization is not required to operate systems in the US.

Measuring only 16 × 16 cm (6.3" × 6.3"), its compact size is attained by extensively integrating the active and passive components. The use of Power over Ethernet (PoE), the optical alignment tool and the mounting bracket reduce the installation effort to a minimum.

BLOCK DIAGRAM WITH BASIC FUNCIONALITY

2.2 System Components

The system SL60-100-57/64-38-E-O is composed of the following parts.

1. **ODU**
2. **Alignment bracket**
3. **main accessories**
   - ♦ PoE injector
   - ♦ Lightning Protector
   - ♦ Alignment tool
   - ♦ Mast bracket
   - ♦ Hole template
   - ♦ Watertight Ethernet cables

2.2.1 Outdoor Unit (ODU)

The ODU is the main component of the system. It combines the antenna, transmitter and receiver and is connected to the network through a standard Ethernet cable with a RJ-45 connector. A water tight outdoor field attachable RJ-45 connector is enclosed.

Power will be supplied through the Ethernet cable to the ODU. This will need either a PoE (802.3af) compatible router or an extra PoE injector.

2.2.2 Mounting Bracket

The mounting bracket provides ease of installation and pointing, by the use of independent axis course and fine adjustment.

2.2.3 Alignment Tool

An optical alignment tool is provided that easily mounts to the radio unit with a Velcro fastener. By using this optical tool, the ends of the link can be quickly and simply aligned.

2.2.4 PoE Injector

The ODU is powered via Ethernet cable according to PoE standard IEE 802.3af. If the router or switch connected to SencityLink does not provide PoE, a Power Injector can be inserted in line into the Ethernet cable. It is suggested that the recommended PoE supply be used whenever possible.

2.2.5 Data Line Protector

HUBER+SUHNER strongly recommend the installation of Data Line Protectors to provide lightning and surge protection to the building, personnel and equipment.

	
Outdoor version HUBER+SUHNER type 3414.99.0008	Indoor version HUBER+SUHNER type 3414.99.0001

2.2.6 Mast Bracket

The mast bracket (H+S type) is used to mount the bracket onto a mast. The bracket is suitable for pole diameter from 2.36” to 5.12” (60 -130 mm).

2.2.7 Ethernet Cables

The length of the cable from the SencityLink to the Router/Switch can be up to 100 meters (328 ft) in length, but should be kept as short as practical in order to reduce signal loss. All Ethernet cables must be CAT 5e compliant and suitable for outdoor use. The cable must be UV stable, UL approved and must comply with local and/or national building codes.

2.2.8 Accessories

2.2.9

3 Site Planning

It is necessary that the installer performs an inspection of the site and plans the installation prior the physical installation of SL60-100-57/64-38-E-O.

This inspection and planning tasks include:

- Evaluate the appropriate location for the installation of the links (see section 3.1).
- Identifying an appropriate mounting structure (wall or mast) for each link.
- Planning the cable routing from your network component to the link.
- Setting up the proper network configuration for the links (see 4.9)

3.1 Line of Sight

Radio transmission requires a clear path between antennas known as radio line of sight (LOS). To have a clear line of sight there must be no obstructions between the two locations. The clearance necessary to operate can be established visually. The following table helps to decide if an obstacle interferes with the radio line of sight requirements.

link distance [m]	link distance [ft]	Boundary diameter [m]	Boundary diameter [ft]
100	328	0.4	1.2
400	1312	0.7	2.3
600	1968	0.9	2.8
800	2625	1.0	3.3
1000	3281	1.1	3.7

3.2 Radio Location

When selecting the best link location the following factors should be considered:

- Accessibility (roof, etc.)
- Type of mounting (wall / pole)
- Grounding connection point (see 3.6)
- Cable runs (max. 100m)
- Line of sight (see 3.1)

3.3 Link Distance / Link Availability

The link distance or separation between the link ends is directly related to the tolerable BER (Bit error rate) and path availability.

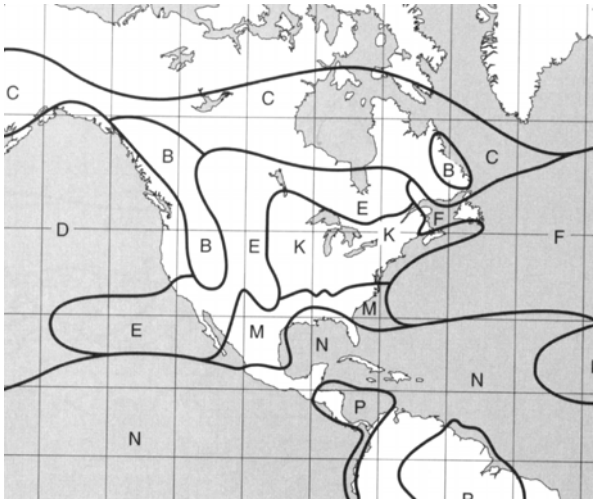
The influence of BER on Ethernet transmission depends on the size of the transmitted packets and their bit sequence. A rough rule of the thumb says good Ethernet connections can be achieved with 10^{-6} BER.

The affordable link availability is influenced by following environmental conditions:

- Rain the lesser the better
- Temperature the higher the better

- Air Pressure the lower the better

To the first order, the relationship of availability and link distance (line of sight) is shown in the map below.



Availability	Rain Zone*								
	A	B	C	D	E	F	K	M	N
99.900%	1014	996	963	923	949	923	877	791	711
99.990%	923	877	848	814	791	751	676	597	514
99.999%	791	727	676	676	575	554	504	468	391

* rain zone according ITU-R Recommendation PN.837
99.900% availability equates to 526 minutes per year of outage due to heavy rains.
99.990% availability equates to 53 minutes per year of outage due to heavy rains.
99.999% availability equates to 5 minutes per year of outage due to heavy rains.

For a more accurate link distance vs. availability number please visit our website (www.hubersuhner.com/sl60), where you will find an online calculation tool.

Knowledge of the link distance (line of sight) is important in estimating the link quality. The web browser based configuration software calculates the quality of the link by using the entered link distance (line of sight).

3.4 Radio Mounting Options

Wall mounting

Use appropriate mounting bolts to mount the radio bracket to a wall mount location. A drilling template is provided in order to properly locate the wall mounting hole locations. The wall mounting location should be strong enough to secure the radio to the wall under all foreseeable environmental conditions (wind, rain, ice, etc). Depending on the material that the bracket is mounted to, different sized mounting hardware may be necessary.

Pole mounting

The pole mounting kit (#23025718) can be used to mount the radio onto poles with diameters between 2.36” to 5.12” (60 – 130 mm).

Radio mount on bracket

To mount the terminal onto the bracket use the enclosed M6 bolts. It is important to install the link on the bracket with the same orientation (antenna polarization) at both ends of the link.

3.5 Cabling

The unit is delivered with a Ethernet cable terminated with a weather-proof RJ45 female connector. To connect the SencityLink to your network use a Ethernet cable cat. 5e with a max length of 100 m. For outdoor use the enclosed Field Attachable Connectors RJ45 connector. For outdoor use please verify that the cable used is designed for outdoor environmental (water, solar UV, etc. applications). Because the power is supplied by the Ethernet cable (POE), please confirm that the used switch or router supports Power over Ethernet. If the switch/router does not provide PoE, please use a POE injector. The PowerDsine model 3001 is recommended as supply (see accessory).

3.6 Grounding / Lightning Protection

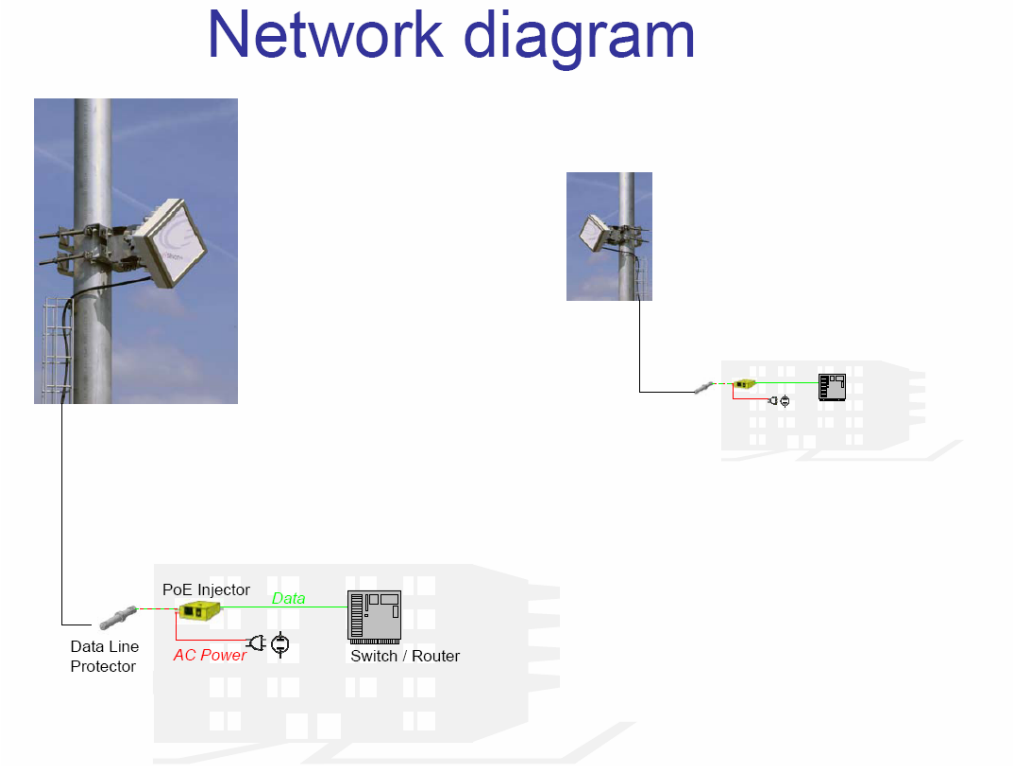
The radio must be properly grounded to provide protection against voltage surges. In the event of a short circuit or lightening strike, proper grounding can prevent damage to building, infrastructure and personnel.

For installations in the U.S.A. refer to Articles 830 of the National Electrical Code (Network-powered broadband communications systems).

For installations in all other countries, implement protection in accordance with the safety standards and regulatory requirements of the country where the equipment is to be installed.

HUBER+SUHNER strongly recommend the use of lightening protectors. For installation details see 4.7.

3.7 Network Diagram



3.8 Co-located Applications

Due to the small size of the SencityLink integrated terminal, it is particularly suitable for co-sited applications. Some possible configurations are given below:

- Back-to-back to double the link distance
- Parallel link double the data capacity, redundancy
- Star point to multipoint

To deploy a co-sited application please contact HUBER+SUHNER to assist with the proper site design.

4 Installation

Due to the small size and integrated design of the SencityLink, the proper installation and setup is relatively simple.

Nevertheless, when working on a roof, ladder, mast or staging, please use extreme caution. Observe all facility and OSHA (or other applicable regulatory agency) required safety precautions.

4.1 Unpacking

The whole equipment and installation material is packed into one box. Within the main box there are three carton with following content:

Carton A:
radio A
bracket
screws and socket wrench
power injector (accessory)
lightening protector (accessory)
field attachable RJ45 connector (accessory)

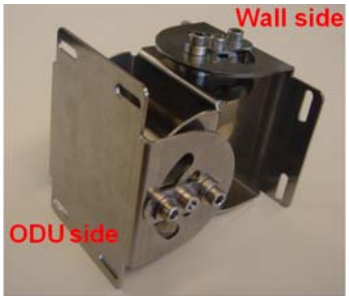
Carton B:
radio B
bracket
screws and socket wrench
power injector (accessory)
lightening protector (accessory)
field attachable RJ45 connector (accessory)

Carton C:
alignment tool (accessory)
manual

4.2 Mount Installation

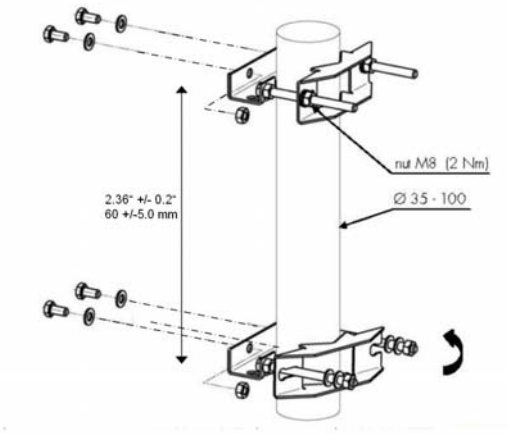
Wall mount

- The wall and mounting screws must be able to support a weight of 11 pounds (5 kg) and the associated wind and potential ice loading factors.
  To ensure the use of the right screws for the installation, HUBER+SUHNER strongly recommends consulting the online **Anchor System Advisor** from HILTI. (http://www.us.hilti.com/holus/modules/adansel/adas_main.jsp).
- Position of the bracket mounting screws by using the enclosed mounting template. Attention: Make sure that the mount is properly positioned in the correct direction noted.



Mast mount

- Ensure that the used mast has a diameter between 2.36” and 5.12” (60 -130 mm).
- Use a 17mm flat wrench (11/16”) to fasten the M8 screw nut.
- The distance between the mounting has to be 2.36” ±0.2” (60 ±5mm).
- To fasten the alignment bracket on the mast bracket use the enclosed stainless steel screws, nuts and washer (M6). DON’T USE ZINK PLATED SCREWS, which will cause corrosion.



4.3 Radio Installation

The ODU has to be mounted on the bracket in a way that the cable entry is on the same side, top or bottom.

The ODU must be mounted on the bracket by using the enclosed stainless steel screws (M6x12) with the socket driver. DON’T USE ZINK PLATED SCREWS, which will cause corrosion.

4.4 Cable Installation

The length of the cable from the SencityLink to the Router/Switch can be up to 100 meters (328 ft) in length, but should be kept as short as practical in order to reduce signal loss. All Ethernet cables must be CAT 5e compliant and suitable for outdoor use. The cable must be UV stable, UL approved and must comply with local and/or national building codes.

To enter the building HUBER+SUHNER recommend to use cable seals from Roxtec (www.roxtec.com).

4.5 Antenna Alignment

An outstanding property of SencityLink is the easy and fast alignment procedure.

The radios can be aligned optically by using the alignment tool. No electrical alignment is required.

The table below shows the precision needed for a proper link operation.

link distance [m]	link distance [ft]	spot diameter [m]	spot diameter [ft]
100	328	0.9	2.9
400	1312	3.5	11.5
600	1968	5.2	17.2
800	2625	7.0	22.9
1000	3281	8.7	28.6
1200	3937	10.5	34.4

4.5.1 Alignment Procedure

The following procedure is used to achieve a fast and precise alignment (for all operations the enclosed 5mm socket driver can be used).

(1) Mount the alignment tool on the most reachable edge of the ODU.

(2) place the course screw of the horizontal axis in the middle position (needle)

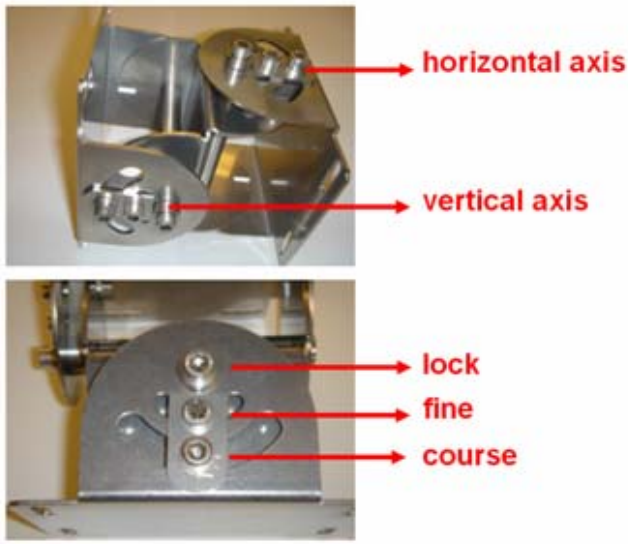
(3) make a rough alignment on the horizontal axis and fasten the fine screw

(4) repeat step (1) and (2) for the vertical axis

(5) Turn the course screw of the horizontal axis by viewing trough the telescope and do the fine alignment.

(6) repeat (5) for the vertical axis

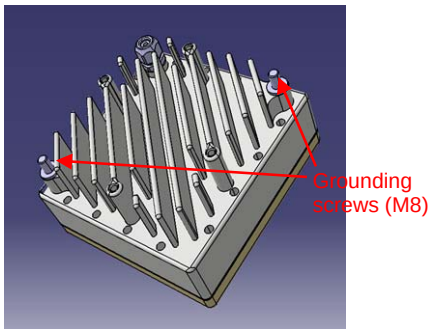
(7) If necessary repeat the fine alignment procedure (5) for both axis till the opposite link is pointed.



(8) Fasten the lock screw on the horizontal and vertical axis.

4.6 Grounding

The radio must be properly grounded.



On the back housing of the ODU screws are provided to properly ground the radio. To fasten the grounding cable onto the ODU, use a lug and serrated washer combined with M8 nut. Use isolated, corrosion resistant cable with min 14AWG and connect the ODU to the nearest connection points for the building-to-earth ground point. The grounding conductor has to be as short as practicable and typically not exceed 20 ft (6m).

For installations in the U.S.A. refer to Articles 830 of the National Electrical Code (Network-powered broadband communications systems).

For installations in all other countries refer to the safety standards and regulatory requirements of the country where the equipment is to be installed.

4.7 Lightning / Surge Protector

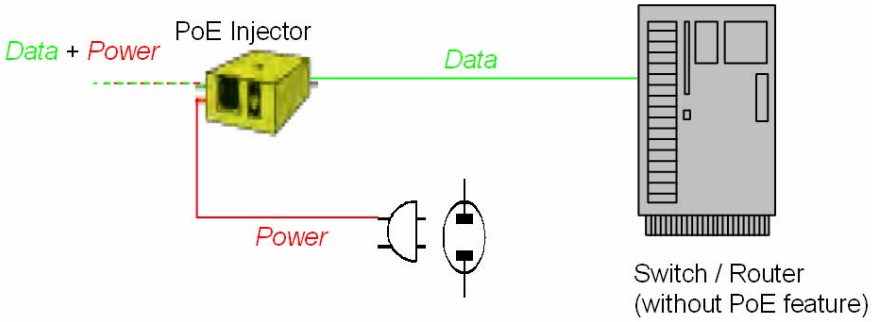
HUBER+SUHNER strongly recommend the use data line protectors.

One protector has to be installed near the ODU and a second protector must be installed where the cable enters the building. For detailed installation instruction please refer to the dedicated document:

Outdoor protector	3414.99.0008	84016716
Indoor protector	3414.99.0001	23033695

4.8 Power Injector

The power injector is connected inline with into the data line. The maximum distance between PoE and SencityLink is 100m (328 ft). The PoE must be IEEE802.3af compliant. To check the proper function of the injector, use the PoE Tester (see accessory).



4.9 Network Configuration / Unit Control Functions

SL60 is using a single wire approach for Data, Control and Power of the unit. External interface is the RJ45 connector allowing all the above mentioned functionalities.

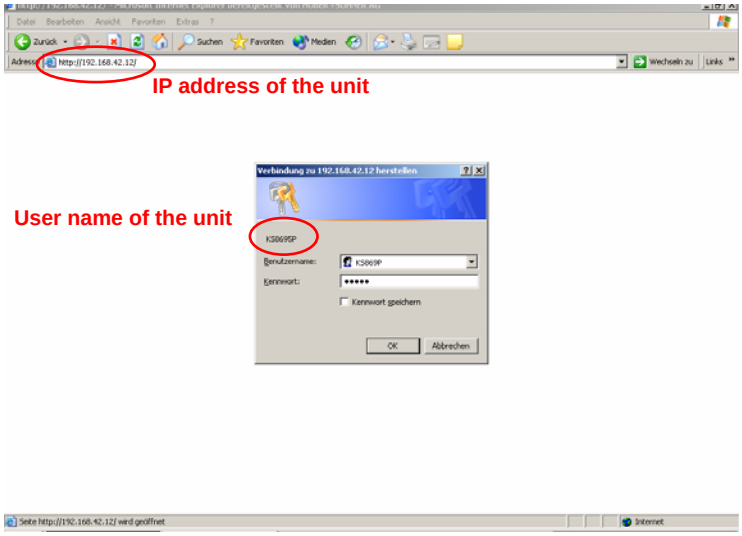
Controller functionality can be addressed with the manufacturer specific default IP address mentioned below. The distinction of the A/B-unit can be made either on the packing box or on the unit label shown below.

	Manufacturer Default IP address
Terminal A	192.168.042.011
Terminal B	192.168.042.012

For an initial configuration use PC or laptop in the below displayed configuration. Address the SL60 unit with the above mentioned IP address corresponding to the SL60 unit. To communicate with the unit make sure that the IP address of the used computer is not allocate automatically by the DHCP server. Enter manually the IP address e.g. 192.186.042.001 with subnet mask 255.255.255.0. Also make sure that your Browser is not using any Proxy server.

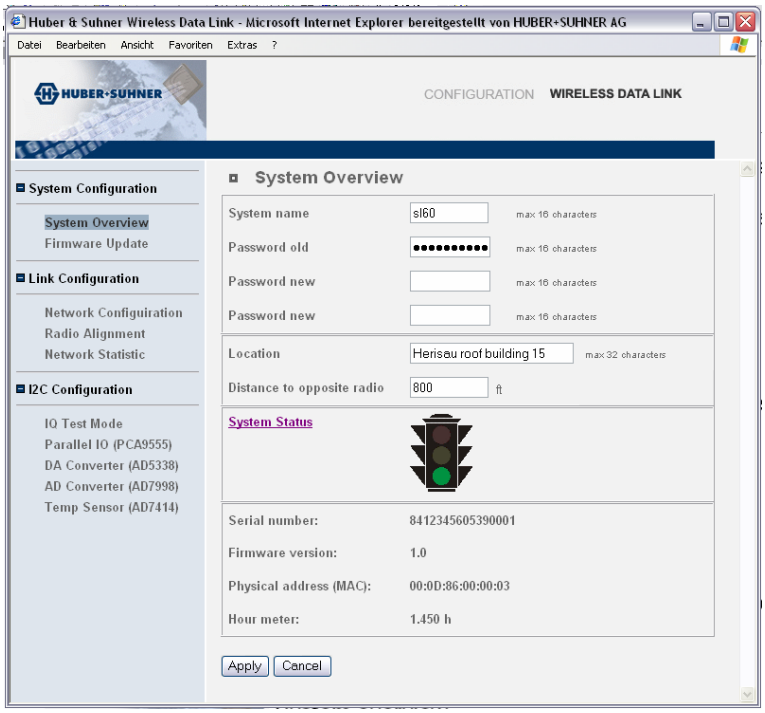
4.9.1 Password Screen

Using the above mentioned IP address you get access to the password screen. The User Name is showed above e.g. KS6453 and the default password is “admin”. By entering correct this information you get access to the System Overview screen.



4.9.2 System Overview Screen

This screen is giving a rough overview of the link and its status. In case of installation problems please set up this page before calling.

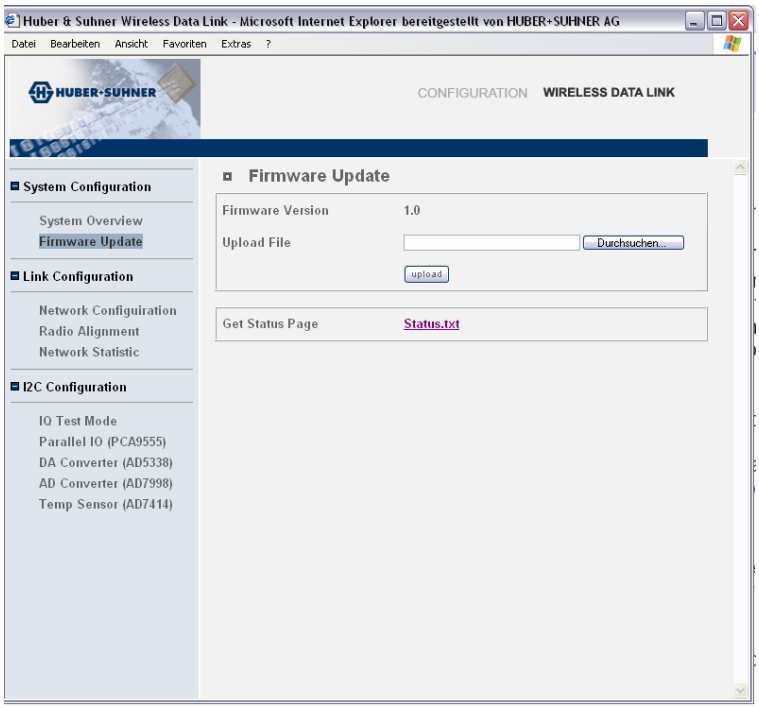


System name	Identifier for the system which max length is limited to 16 characters. Identifiers will help you to better distinguish your links in a complicated network structure.
Password old	In case changing the system password, enter first the old password. The manufacturer default the password is : "SencityLink60"

Password new	In case changing the password use the first new window to enter the new password. Confirm the new password in the below new labeled field
Location	Describe the location either with address, building number or by using absolute geographical data like longitudinal / latitudinal position.
Distance to opposite radio	Define distance between A and B radio by using maps or distance measurement equipment end enter data. Distance will be used to define receive level determining the system status.
System status	System is working fine, incoming signal is detected and synchronized System is working, periodical detection and synchronization, but system performance need to be improved. System is not functional. Detection or sychronisation is not functioning.
Serial number	Unique unit specific manufacturer serial number. For customer service issues, please use this number as equipment reference.
Firmware version	Firmware version defined by manufacturer. In case of upload the version is automatically updated.
Physical address	Unit specific MAC address defined by the manufacturer. Short for Media Access Control address, a hardware address that uniquely identifies each node of a network. In IEEE 802 networks, the Data Link Control (DLC) layer of the OSI Reference Model is divided into two sub-layers: the Logical Link Control (LLC) layer and the Media Access Control (MAC) layer. The MAC layer interfaces directly with the network medium. Consequently, each different type of network medium requires a different MAC layer.

4.9.3 Firmware Update screen

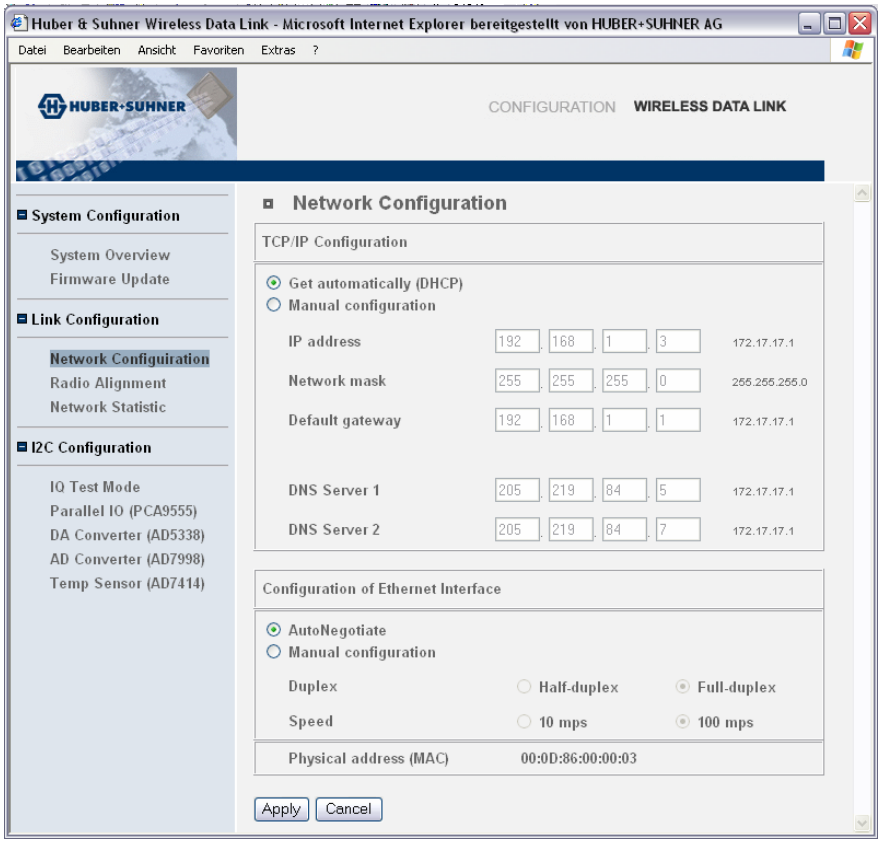
Current firmware can be downloaded from Internet http://www.hubersuhner.com/sl60 or received from our technical support. The downloaded package should be saved on the local network and can then be searched with the implemented search function and uploaded into the unit.



Firmware version	Displays the currently loaded firmware version of the connected unit.
Upload file	Downloaded Firmware can be traced with a search function or the direct path and file information can be entered.

4.9.4 Network Configuration screen

The Network configuration screen is giving you the possibility to change network settings if required. Use automatic network configuration (DHCP) and AutoNegotiation in case you are not an advanced user.



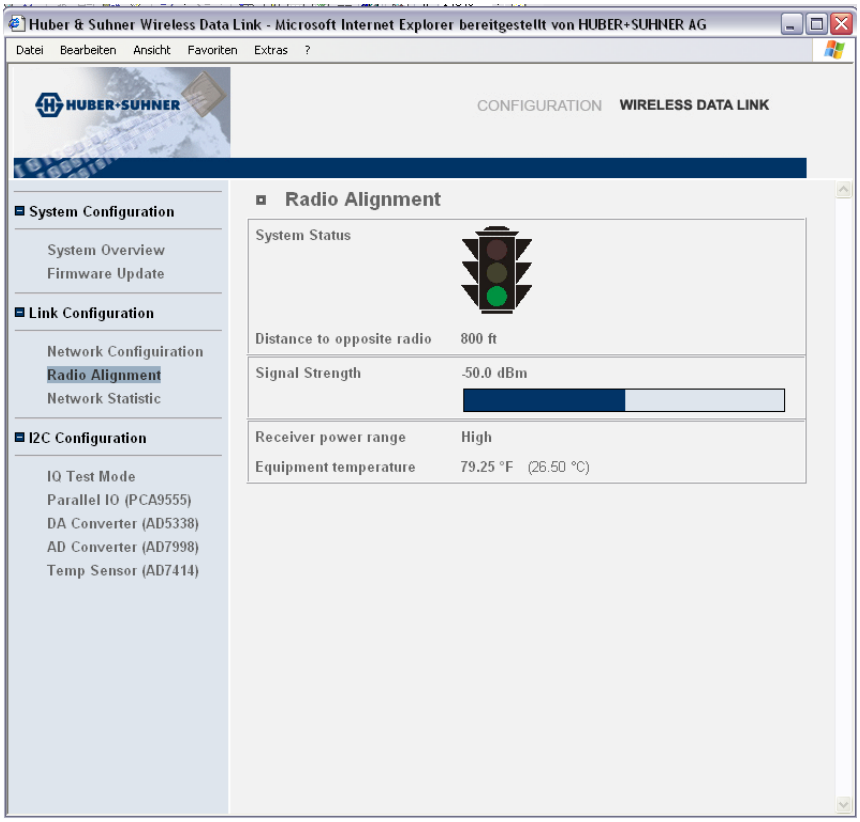
Get automatically (DHCP)	A protocol is automatically assigning dynamic IP addresses to the unit on a network. With dynamic addressing, a device can have a different IP address every time it connects to the network. DHCP (***D**ynamic **H**ost **C**onfiguration **P**rotocol),* also supports a mix of static and dynamic IP addresses. Dynamic addressing simplifies network administration because the software keeps track of IP addresses rather than requiring an administrator to manage the task. This means your new installed and connected unit can be added to a network without the hassle of manually assigning it a unique IP address. Whenever possible use this setting.
Manual configuration (IP)	In case you are not using DHCP you can manually set all the network addressing parameters.
IP address	An identifier for your device on a TCP/IP network. Networks using the TCP/IP protocol route messages based on the IP address of the destination. The format of an IP address is a 32-bit numeric address

	written as four numbers separated by periods. Each number can be zero to 255. For example, 123.160.10.4 could be an IP address. Within an isolated network, you can assign IP addresses at random as long as each one is unique.
Network mask	A Network mask is used to group IP addresses together. Routers use a subnet mask to define the group (or IP subnet) to which an IP address belongs so that it can identify the correct interface from which it should forward an IP packet. Depending on the IP address range, type of network and different sub-structures can be arranged. Below an example of a C Class network number of 192.168.1.0,with some sub-networking options : No of subnets / No of Hosts/net / netmask 2 / 126 / 255.255.255.128 (11111111.11111111.11111111.10000000) 4 / 62 / 255.255.255.192 (11111111.11111111.11111111.11000000) 8 / 30 / 255.255.255.224 (11111111.11111111.11111111.11100000) 16 / 14 / 255.255.255.240 (11111111.11111111.11111111.11110000) 32 / 6 / 255.255.255.248 (11111111.11111111.11111111.11111000) 64 / 2 / 255.255.255.252 (11111111.11111111.11111111.11111100)
Default gateway	Enter the address of the default network device that will be used to access another network. In enterprises, the gateway node often acts as a proxy server and a firewall. The gateway is also associated with both a router, which use headers and forwarding tables to determine where packets are sent, and a switch, which provides the actual path for the packet in and out of the gateway.
DNS Server 1	Address of the equipment providing DNS (Domain Name System) services which translates domain names into IP addresses. Because domain names are alphabetic, they're easier to remember. The network however, is really based on IP addresses. Every time you use a domain name, therefore, a DNS service must translate the name into the corresponding IP address. For example, the domain name www.example.com might translate to 198.105.232.4.
DNS Server 2	Address of an alternative equipment providing DNS (Domain Name System) services.
Auto Negotiate	Ethernet is basically capable to recognize its transmission protocol and negotiates the necessary settings fully automatic. Whenever possible use the AutoNegotiate setting.
Manual configuration (Ethernet)	Is Auto Negotiate not possible use the manual setting options. Especially older equipment is not using the auto negotiation capability.
Half-Duplex (Duplex)	This device contain a switch that lets you select between half-duplex and full-duplex mode. The correct choice depends on which protocol you are using to transmit data through the link. In half-duplex mode, each character transmitted is immediately displayed on the other end of the link. (For this reason, it is sometimes called local echo -- characters are echoed by the local device).
Full-Duplex (Duplex)	Selection for duplex transmission mode. In full-duplex mode, transmitted data is not displayed on the other end of the link until it has been received and returned (remotely echoed) by the other device. If you are running a communications protocol like Ethernet and every character appears twice, it probably means that your device is in half-duplex mode when it should be in full-duplex mode, and every character is being both locally and remotely echoed.

10mbps (Speed)	Option button for local-area network (LAN) architecture developed by Xerox Corporation in cooperation with DEC and Intel in 1976. Ethernet uses a different topology and supports data transfer rates of 10 mbps. The Ethernet specification served as the basis for the IEEE 802.3 standard, which specifies the physical and lower software layers. Ethernet uses the CSMA/CD access method to handle simultaneous demands.
100mbps (Speed)	Option setting for networking standard that supports data transfer rates up to 100 mbps (100 megabits per second). 100BASE-T is based on the older Ethernet standard. Because it is 10 times faster than Ethernet, it is often referred to as Fast Ethernet. Officially, the 100BASE-T standard is IEEE 802.3u.
Physical address (MAC)	Unit specific MAC address defined by the manufacturer. Short for Media Access Control address, a hardware address that uniquely identifies each node of a network. In IEEE 802 networks, the Data Link Control (DLC) layer of the OSI Reference Model is divided into two sub-layers: the Logical Link Control (LLC) layer and the Media Access Control (MAC) layer. The MAC layer interfaces directly with the network medium. Consequently, each different type of network medium requires a different MAC layer.

4.9.5 Radio Alignment screen

The Radio Alignment screen is giving you specific details for alignment of the two radios. Since point to point radios have to have line of sight (LOS) conditions and have to be pointed face to face to each other. This page provides you with all the technical information necessary for the alignment process.

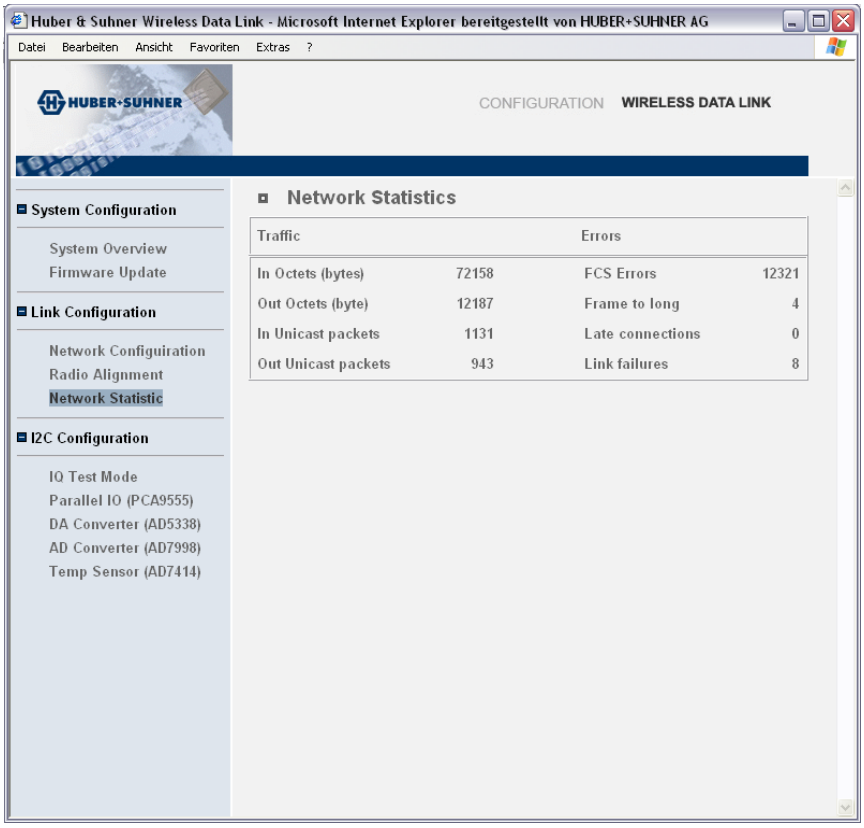


System status	● System is working fine, incoming signal is detected and synchronized

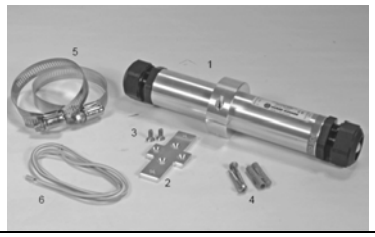
	System is working, periodical detection and synchronization, but system performance need to be improved. System is not functional. Detection or sychronisation is not functioning.
Distance to opposite radio	Define distance between A and B radio by using maps or distance measurement equipment and enter data. Distance will be used to define receive level determining the system status.
Signal strength	Absolute signal level in the receiving path of the device. The signal strength is displayed also in a coloured bar indicating the signal strength with the following values : Signal < -100dB resulting in detection and synchronization problems Signal > -100dB resulting in periodical detection and synchronization with possibility to improve system performance Signal > -90dB resulting in good detection and synchronization
Transmit power level	The status high or low is indicating if RX MPA is active or not. Rain fading can trigger the equipment to additionally switch on MPA's for better receive level.
Equipment temperature	Indication of temperature in the equipment. Typical temperature values are 0 – 40°C or 32 – 104°F

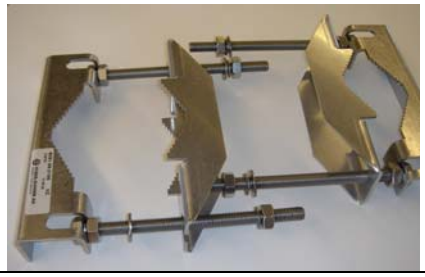
4.9.6 Network Statistics screen

The Network Statistic screen is giving standardized information about network traffic and errors. Traffic status information is continuously updated and specific network errors are listed.



4.10 Optional items

ARTICLE NO	DESCRIPTION	PRICTURE	DATA-SHEET
23033695	Data Line Protector indoor		
23xxxxx	Data Line Protector indoor		
23xxxxx	Data Line Protector indoor		
84014284	Data Line Protector outdoor		
84021330	PoE 802.3af Tester		
84021333	PoE 802.3af Power Injector		
84016575	SL60 Alignment bracket		

23xxxxxx	SL60 Mounting bracket pole 20cm		
23xxxxxx	SL60 Mounting bracket back to back pole 20cm		
84016596	Visual alignment tool 1000m		
23xxxxxx	Protection cap for Outdoor RJ45 IP67		
23xxxxxx	Protection cap for Outdoor RJ45 IP67		
23xxxxxx	Cable Assy RJ45 IP67 Male / RJ45 IP40 Hybrid **3m** UV / UL rated	**3m / 10ft** 	
23xxxxxx	Cable Assy RJ45 IP67 Male / RJ45 IP40 Hybrid **5m** UV / UL rated	**5m / 16ft** 	
23xxxxxx	Cable Assy RJ45 IP67 Male / RJ45 IP40 Hybrid **10m** UV / UL rated	**10m / 33ft** 	

23xxxxxx	Cable Assy RJ45 IP67 Male / RJ45 IP40 Hybrid **30m** UV / UL rated	**30m / 98ft** 	
23xxxxxx	Cable Assy RJ45 IP67 Male / RJ45 IP40 Hybrid **50m** UV / UL rated	**50m / 164ft** 	
23xxxxxx	Cable Assy RJ45 IP40 Hybrid / RJ45 IP40 Hybrid **3m** UV / UL rated	**3m / 10ft** 	
23xxxxxx	Cable Assy RJ45 IP40 Hybrid / RJ45 IP40 Hybrid **5m** UV / UL rated	**5m / 16ft** 	
23xxxxxx	Cable Assy RJ45 IP40 Hybrid / RJ45 IP40 Hybrid **10m** UV / UL rated	**10m / 33ft** 	
23xxxxxx	Cable Assy RJ45 IP40 Hybrid / RJ45 IP40 Hybrid **30m** UV / UL rated	**30m / 98ft** 	
23xxxxxx	Cable Assy RJ45 IP40 Hybrid / RJ45 IP40 Hybrid **50m** UV / UL rated	**50m / 164ft** 	

5 Appendix

5.1 Specification

5.1.1 Receiver

5.1.2 Transmitter

5.1.3 Antenna

5.1.4 Mechanical

5.1.5 Environmental

5.1.6 Network Management

5.2 Troubleshooting

This Chapter provides solutions to problems that can occur during the installation and operation of the SL60-100-57/64-38-E-O. We cover various aspects of the installation and the network setup. Please read the following if you are having problems.

Note

You have to check all the following points at both ends of the Link. Start with the whole procedure at one side (e.g. Terminal A) if the problem is not solved, do all the steps at the opposite terminal.

5.2.1 Power and Network Connection

➔ You have to verify that the terminal gets power. The PoE injector has to be installed and plugged in according to the manual (VERWEIS). Go to the terminal, disconnect the watertight RJ-45 connector and verify with a standard PoE tester (VERWEIS) if there is power on the cable.

➔ Take the cable and plug it into a notebook or a network testing device and verify if there is a proper network connection.

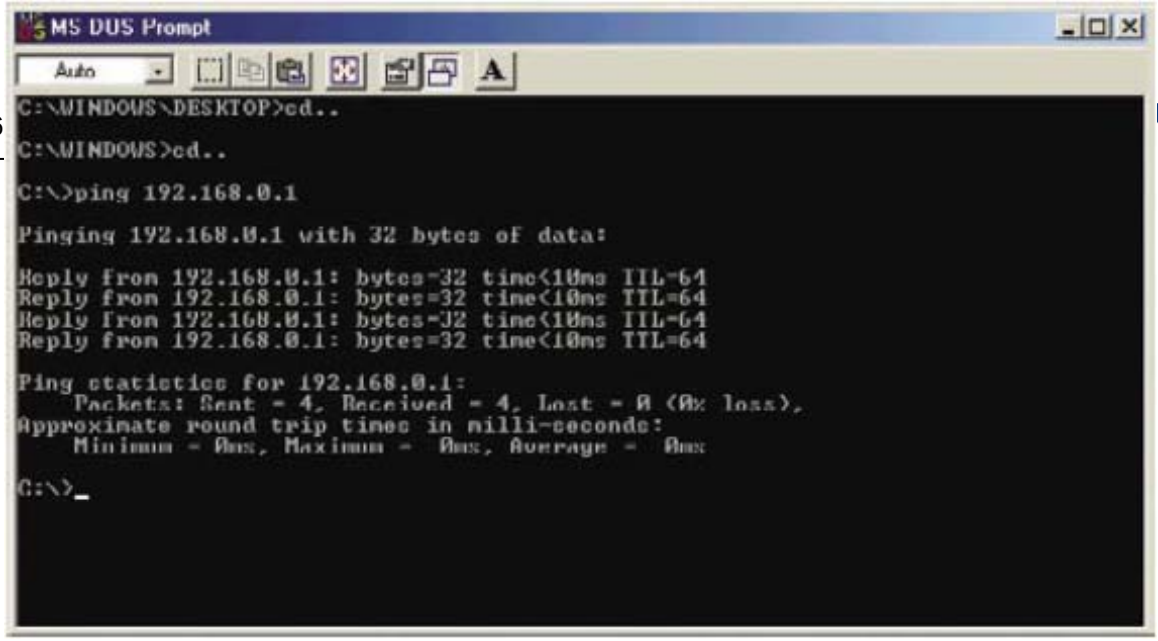
If there is any problem, please replace the cable and validate the proper connection again. We provide special preassembled outdoor CAT-5e cables to ensure a easy installation.

5.2.2 Network Configuration

➔ Check that the IP address is in the same range and subnet as the SL60-100-57/64-38-E-O. Please see VERWEIS section of this manual.

Note:

The IP address of the SL60-100-57/64-38-E-O is 192.168.0.1 for terminal A and 192.168.0.2 for terminal B. All the computers on the network must have a unique IP address in the same range, e.g., 192.168.0.x. Any computers that have identical IP addresses will not be visible on the network. They must all have the same subnet mask, e.g., 255.255.255.0



➔ Do a Ping test to make sure that the SL60-100-57/64-38-E-O is responding. Go to *Start>Run>Type Command>Type ping 192.168.0.50*. A successful ping will show four replies. (GRAPHIK HIER PLATZIEREN)

As soon the network configuration is correct you can access the GUI (Graphical User Interface) and check the settings according to section VERWEIS

5.2.3 Duplex Mismatch

➔ If you have bad network performance you have probably a Duplex mismatch.

➔ To ensure that the terminal of SL60-100-57/64-38-E-O and the connected network component (e.g. switch) do not have a Duplex Mismatch you check first your statistics. If you find many Input Errors, you are on the Full-Duplex side, if you see many Late Collisions, you are on the Half-Duplex side.

➔ To solve the duplex mismatch you have to configure manually both network components and to the same values.

5.2.4 Miss-alignment

➔ Access the configuration interface as described in section VERWEIS. On the page … you see the signal strength in dBm (e.g. -30 dBm). If the value is below -65 dBm the receiver is not in the position to track the signal. Therefore you need to re-align the terminal to its opposite terminal (please follow the instructions at section VERWEIS).

5.3 Contacts

5.3.1 Technical Assistance

Please check the information on the website www.hubersuhner.com (müssen wir mit Salesforce integriert lösen)

5.3.2 Service Center / RMA

Adresse vom Support der eine RMA ausgibt.

6 Glossary

Abbreviation	Description in detail
ADSL	**A**symmetric **d**igital **s**ubscriber **l**ine. Typical data rate is 256-2Mbps downstream and 128k upstream. See xDSL.
BAKOM	Swiss Federal Communication Office (**B**undes**a**mt für **Kom**munikation)
BDP	**B**roadband **d**ata **p**roviders. Broadband data provision is not the core business but existing infrastructure used to diversify or promote core activity
BHU	**B**roadband **h**ome **u**ser. Home User which is an early adopter of technology.
CEPT	**E**uropean **C**onference of **P**ostal and **T**elecommunications Administrations
COM	**COM**unities market segment including all community buildings like administration, community hall, excluding all educational needs
DataCom	Word created to summarise companies working in the **data com**munication area excluding pure computer manufacturer. Typical companies are CISCO or PROXIM which strongly support Network- and Data-Management business.
DHCP	**D**ynamic **H**ost **C**onfiguration **P**rotocol DHCP allows manual and automatic IP address allocation in a network
EDU	**EDU**cation market segment containing all colleges, universities, schools …
ETSI	**E**uropean **T**elecommunication **S**tandards **I**nstitute
FBP	**F**ixed **b**roadband **p**roviders. Incumbent Providers having telecommunication as core business providing rented or leased broadband data lines to most of the time enterprise customers.
FCC	**F**ederal **C**ommunication **C**ommission (North America US)
FSO	**F**ree **S**pace **O**ptics. Free space lasers working in the range of 1.5nm wavelength capable to transmit data of 100-2000 Mbps over a distance of up to 1000m depending on the environment (fog, rain, …)
HOS	**HOS**pital market segment including infrastructure of hospitals
ICMP	**I**nternet **C**ontrol **M**essage **P**rotocol Messages released from routers if irregularities accrue in the message flow
IDSL	**I**SDN over **DSL**. Full duplex 144kbps. See xDSL.
IDU	**I**ndoor **u**nit of the equipment hosting most of the time the data processing unit, encryption and protocol adaptation to the environment the link is use in
ISP	**I**nternet **s**ervice **p**rovider. Private and semi-private providers of

Abbreviation	Description in detail
	broadband internet access depending on the liberalisation of the individual country.
LAN	**L**ocal **a**rea **n**etworks
LE	**L**arge **e**nterprises. In H+S terminology this are companies with more then 100 employees and often having more then just one building in the same location
LOS	**L**ign **o**f **S**ight ; visual contact of point to point without any interruption
LTCC	**L**ow **T**emperature **C**eramic **C**o-fired
MAN	**M**etropolitan **a**rea **n**etworks
MIMO	**M**ultiple **I**nput **M**ultiple **O**utput
ODU	**O**utdoor **u**nit of the **e**quipment. As minimum this could be an antenna, as maximum it could be the total RF and data processing unit.
OFDM	**O**rthogonal **F**requency **D**ivision **M**ultiplex
PoE	**P**ower **o**ver **E**thernet according to IEEE 802.3af providing a standardised powering model
QPSK	**Q**uadrature **P**hase **S**hift **K**eying
xQAM	**Q**uadrature **A**mplitude **M**odulation where x is indicating how many amplitude/phase variations have been used to build the protocol
RAD	**R**esearch and **A**dvanced **D**evelopment
RBS	HUBER+SUHNER internal abbreviation for **R**adio **b**ase **s**tation including the fully populated cabinet up to the first antenna feeder jumper cables.
SDSL	**S**ymmetric **d**igital **s**ubscriber **l**ine. Full duplex up to 2Mbps. See xDSL
SME	**S**mall and **m**edium size **e**nterprises or Business. In H+S we use the threshold of 100 people to define the step to large enterprises. Below 11 people in H+S terms this would be a SOHO.
SNMP	**S**imple **N**etwork **M**anagement **P**rotocol
SOHO	**S**mall **o**ffice and **h**ome **o**ffice user. Office with 1-10 people. Most small offices like home sales office or surgeries…
TL60	**T**ransparent **L**ink **60** GHz project name for technology development
VDSL	**V**ery High speed **DSL**. Possible 52Mbps downstream and up to 2Mbps downstream
WAN	**W**ide **A**rea **N**etwork
WLAN	**W**ireless **l**ocal **a**rea **n**etwork. Today typically unlicensed application non line of site in the frequency range 2-6 GHz according to IEEE 802.11x.
Wli	**W**ireless **li**nk. A wireless link can use frequencies from 2-100GHz by using different modulation and protocols.

Abbreviation	Description in detail
xDSL	All **d**igital **s**ubscriber **l**ine systems from ADSL, SDSL, IDSL and VDSL which generally are derivatives of the technology. Main parameters changed are the bandwidth which is varying from 128kbps to 52Mbps. Another important parameter is the up/downstream ratio (asymmetric to full duplex)
•2•	Point to point configuration. Two transmitting / receiving units connected via narrow beam antennas.
•2••	Point to Multipoint configuration. One central access point is distributing a signal to several other points in a star configuration.