

Installation and User Manual

SL60-401 / SL60-501 / SL60-4010



Revision 2011-03-23.1

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1 INTRODUCTION

1.1 Intended users

This manual is intended for all installation and service personnel who are involved in the planning, installation, operation and maintenance of SL60-401 / SL60-501 / SL60-4010 equipment.

Please read the complete SL60-401 / SL60-501 / SL60-4010 (SENCITY®Link) manual prior to its unpacking, installation, setup and deployment.

Although the SENCITY®Link is designed for easy 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 periodically without any obligation to provide notification of such revision or changes. The latest revision can be downloaded at <http://www.sl60.com>.

1.3 Prior knowledge

This manual assumes that the installer has at least a basic experience and understanding of networking equipment, as well as some familiarity with its configuration and operation. The information covered in this manual should be fully understood prior to installation.

1.4 Used symbols

Danger
Not used

Warning
Risk for human and equipment

Caution
Risk for equipment and functionality

Advice

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 show 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 full operating condition. Any replacement will consist of a new or remanufactured, functionally equivalent product of equal value, and will be offered solely at the discretion of HUBER+SUHNER.

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

To obtain services under this warranty, contact HUBER+SUHNER's Service Center, referring to your Return Material Authorization number (see C.2). Products must be returned Postage Prepaid. It is recommended that the terminal be insured when shipped. Any products returned without either proof of purchase or with an outdated 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 specifies some other return destination beyond US 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

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2 SYSTEM OVERVIEW

2.1 General description

The SL60-401 / SL60-501 / SL60-4010 system operates as a data link in the unlicensed 60 GHz band between 57 GHz and 64 GHz and delivers a full duplex data rate of up to 320 Mbps (SL60-401) over a distance of up to 1600 m (5249 ft) (SL60-501).

Measuring only 18 cm x 18 cm (7" x 7"), the terminal's compact size is attained by extensively integrating the active and passive components.

For more detailed technical data see appendix A.2.



2.1.1 Benefits

- Easy installation – The concept of the SENCITY®Link allows to the end user to install it as easy as any other network component.
The single cable solution reduces the complexity of the installation. The terminal is connected to the network, monitored and supplied with power through a single outdoor rated CAT 6 Ethernet cable.
The visual alignment tool and an alignment bracket allows the user to easily install the link.
Immediate operation without the need of additional configuration is granted.
- Network performance – Guaranteed full duplex 320 Mbps (SL60-401) along the complete range. Unlike typical WLAN equipment the user can transmit a full 320 Mbps (SL60-401) over the link.
- License free operation – The system has been approved and can be operated in many countries.
- System administration – To monitor the status and the traffic the user can access the link statistics either via the HTML user interface or by integrating it into a network management tool via SNMP.
- Security – The proprietary radio interface does not allow any other system to access the 60 GHz transmitted data.
A high level of data security is inherent in the product via signal absorption by atmospheric oxygen and the use of high gain/narrow beam width antennas.

2.1.2 Applications

- LAN extension
- Redundant access
- Campus connectivity
- Disaster recovery
- Wireless backhaul
- Centralization of IT infrastructure
- Temporary connections during events
- Mesh and hub and spoke configuration

2.2 System components

The SL60-401 / SL60-501 / SL60-4010 system is composed of the following components:

- Terminal A and Terminal B
- Alignment brackets
- Alignment tool
- Weather shields
- Sealed Ethernet connections
- Mounting set
- Manual
- Main accessories:
 - PoE injector
 - Data line protector
 - Mast bracket
 - Ethernet cables
- Required tools:
 - Adjustable wrench

2.2.1 Terminals

The terminals are the main system components. They combine the antenna, transmitter and receiver and are connected to the network via a standard Ethernet cable with RJ-45 connector.

Power is supplied through the Ethernet cable to the terminal. This will require either a PoE+ (802.3at) compatible network equipment or an additional PoE injector.



2.2.2 Alignment bracket

The alignment bracket facilitates installation and positioning owing to its independent axis with coarse and fine alignment capabilities.



2.2.3 Alignment tool

The optical alignment tool provided is easily mounted on the terminal using an elastic band. It enables both ends of the link to be aligned quickly, simply and independently.



2.2.4 Weather shield

The weather shield offers an additional protection for the terminal against rain, sun, snow, ice formation and bird droppings.



2.2.5 Sealed Ethernet connector

The seal kit is used to make a watertight connection of the Ethernet coupling. Please use the separate instructions for a proper installation of the seal kit.



2.2.6 Accessories

2.2.6.1 PoE injector

The terminal is powered via Ethernet cable according to the IEEE 802.3at PoE+ standard. Should the network equipment connected to the SENCITY®Link does not offer PoE, a power injector can be inserted in line to the Ethernet cable.

Order information:

Item number	Description
84021333	PoE+ 802.3at Power Injector



2.2.6.2 Data line protector

HUBER+SUHNER strongly recommends the installation of an outdoor data line protector to provide lightning and surge protection for the building, personnel and equipment. Please refer to the local and/or national electrical and building codes.

Order information:

Item number	Description
<on request>	Data line protector (indoor) To use only in combination with an outdoor protector.
<on request>	Data line protector (outdoor)

2.2.6.3 Mast bracket

The mast bracket is used to mount the bracket onto a mast. The bracket is suitable for any pole diameter from 50 mm to 115 mm (2" to 4,5").

Order information:

Item number	Description
84015652	Mast Bracket



2.2.6.4 Ethernet cables

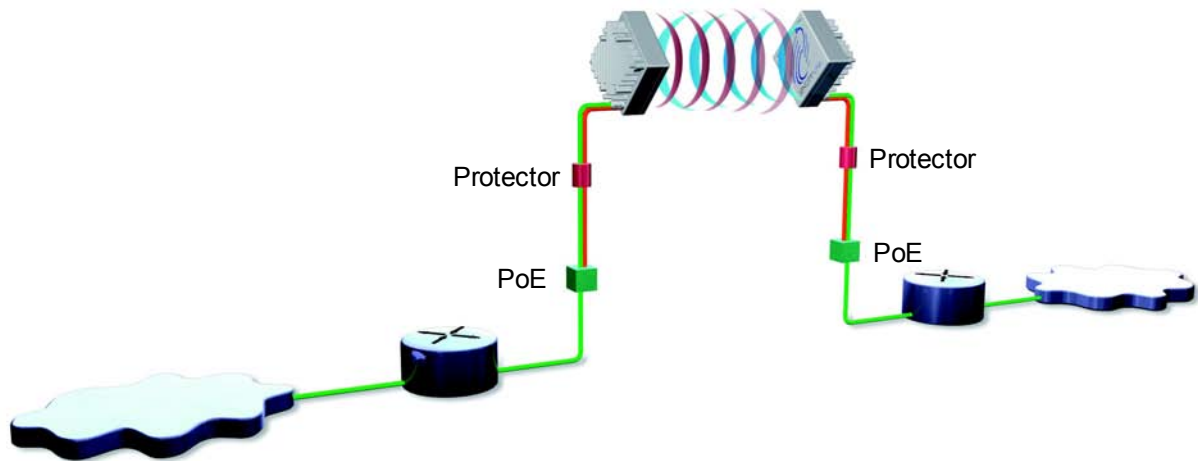
The length of the cable linking the SENCITY®Link to the next network node may be up to 100 m (328 ft) in length. It should, however, be kept as short as practical in order to minimize signal losses. All Ethernet cables must be CAT 5e (or better) compliant and suitable for outdoor use. The cable must be UV stable, UL approved and comply with local and/or national building codes.

Order information:

Item number	Description
84031068	Outdoor Ethernet Cable 2 m
84028025	Outdoor Ethernet Cable 10 m
84028026	Outdoor Ethernet Cable 30 m
84041974	Outdoor Ethernet Cable 50 m
84028029	Outdoor Ethernet Cable 90 m



3 SITE PLANNING



All installers must perform a full site inspection and plan carefully prior to the physical installation of an SL60-401 / SL60-501 / SL60-4010 system.

This preparation must include:

- Evaluating the most appropriate location for the installation of the terminal.
- Identifying an appropriate mounting structure (wall or mast) for each terminal.
- Planning the cable routing from the network component to the terminal.

3.1 Terminal location

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

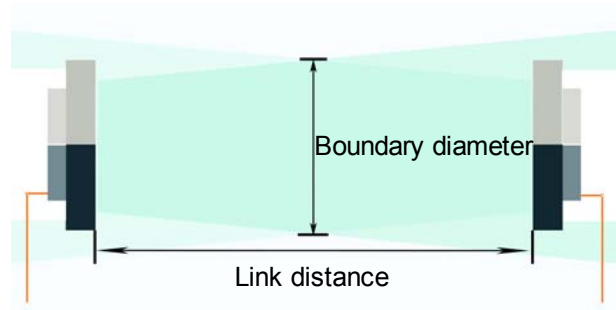
- Accessibility (e.g. roof)
- Type of mounting (e.g. wall or pole)
- Grounding connection point
- Cable runs (max. 100 m / 328 ft)
- Line of sight

Use of given protection against sun, rain, etc. will increase the equipment performance.

3.2 Line of sight

To ensure a clear line of sight, there must be no obstructions between the two terminal locations. The required clearance can be established visually using the following table¹:

Link distance		Boundary diameter	
100 m	(328 ft)	0.7 m	(2.3 ft)
200 m	(656 ft)	1.0 m	(3.3 ft)
400 m	(1312 ft)	1.4 m	(4.6 ft)
600 m	(1968 ft)	1.7 m	(5.6 ft)
800 m	(2625 ft)	2.0 m	(6.6 ft)



3.3 Link distance / Link availability

The link distance is directly related to the weather conditions.

The affordable link availability is influenced by the following environmental conditions:

- Rain: the less, the better
- Temperature: the higher, the better
- Air pressure: the lower, the better

Knowledge of the link distance (line of sight) is important in estimating link quality.

For different maps of the world including the rain regions see appendix A.4.

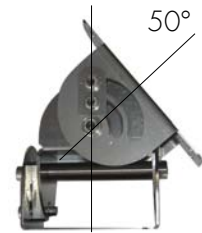
3.4 Terminal mounting options

3.4.1 Wall mounting

The wall mounting location should be strong enough to secure the terminal to the wall, taking into account all foreseeable environmental conditions (e.g. wind, rain, ice).

¹ Fresnel zone calculation

Depending on the material to which the bracket is mounted, differently sized mounting hardware may be necessary. To mount the terminal onto the bracket use the enclosed M6 bolts. The bracket allows a tilt angle of $\pm 50^\circ$ in both axis.



3.4.2 Pole mounting

The pole mounting kit will be needed to mount the terminal onto poles with diameters from 50 mm to 115 mm (2" to 4,5").

3.5 Cabling

The terminal is delivered with an Ethernet cable terminated with a RJ-45 plug connector. To connect the SENCITY®Link to your network, use a CAT 5e (or better) Ethernet cable with a maximum length of 100 m to the next network node. Please verify too that the cable used is designed for outdoor environments (e.g. water, solar UV). Since the power is supplied by the Ethernet cable, please make sure that network equipment used supports Power over Ethernet (PoE). If not, use a PoE injector according to IEEE 802.3at (PoE+). SENCITY®Link can handle crossover and straight cables.

3.6 Grounding / Lightning protection

The terminal must be properly grounded to provide protection against voltage surges.

In the event of a short circuit or lightning strike, effective grounding can prevent damage to building, equipment, infrastructure and personnel. For installations in the USA, refer to Article 830 of the National Electrical Code (Network-powered broadband communications systems), for all other countries, implement protection in accordance with the safety standards and regulatory requirements of the country in which the equipment is installed.

HUBER+SUHNER strongly recommends the use of outdoor lightning protectors.

3.7 Co-located applications

Owing to the compact size of the SL60-401 / SL60-501 / SL60-4010 integrated terminal, it is particularly suitable for co-sited applications. Possible configurations include:

- Back-to-back - e.g. doubles the link distance
- Parallel link - doubles data capacity or redundancy
- Star - hub and spoke

To deploy a co-sited application, please contact HUBER+SUHNER to assist with devising an appropriate site design.

4 INSTALLATION

Owing to the small size and integrated design of the SENCITY®Link, its correct installation and setup is relatively simple.

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

4.1 Mount installation

4.1.1 Wall mount

The wall and mounting screws must be able to support a weight of 11 pounds (5 kg), taking into account associated wind and potential ice loading factors.



Right



Wrong

4.1.2 Mast mount

- Ensure that the mast used has a diameter of between 50 mm to 115 mm (2" to 4.5").
- Use a 13 mm flat wrench (~½") to fasten the M8 screw nut.
- Fasten the alignment bracket onto front part of mast bracket using the enclosed stainless steel screws, nuts and washer (M6).
- Fix the front part of the mast bracket and the attached alignment bracket on the mast.



Do not use zinc plated screws as these will corrode and endanger link performance and environment.

4.2 Terminal installation

It is important to install the terminal on the bracket with the same orientation (antenna polarization) at both ends of the link. The terminal must be mounted on the bracket in such a way that the polarization arrow points to the same direction at both ends of the link. The terminal must be mounted on the bracket by using the allen key with the enclosed stainless steel screws (M6 x 12).

Polarization
direction



Do not use zinc plated screws as these will corrode and endanger link performance and environment.

4.3 Cable installation

The length of the cable from the terminal to the next network component may be up to 100 m (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.



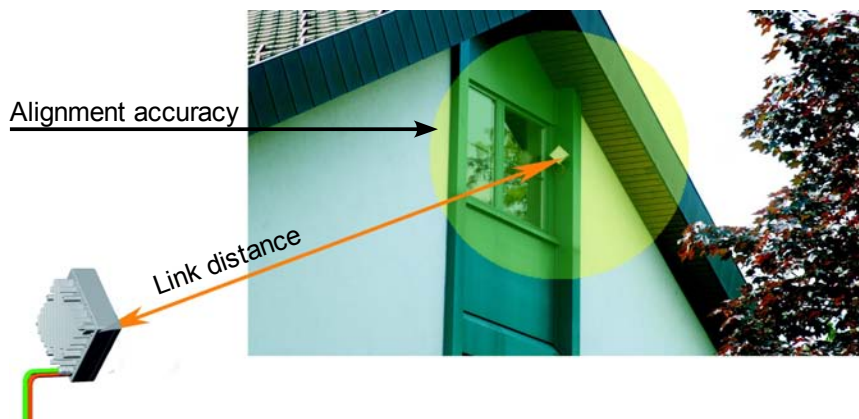
To enter the building, HUBER+SUHNER recommends using cable seals from Roxtec (<http://www.roxtec.com>).

4.4 Antenna alignment

One of SENCITY®Link's biggest advantage is its fast, easy alignment procedure. The terminals can be aligned optically by using the alignment tool. No electrical alignment is required, although possible.

The table below shows the alignment tolerance:

Link distance		Alignment accuracy	
100 m	328 ft	0.9 m	2.9 ft
400 m	1312 ft	3.5 m	11.5 ft
600 m	1968 ft	5.2 m	17.2 ft
800 m	2625 ft	7.0 m	22.9 ft



4.4.1 Alignment Procedure

The following procedure(s) achieves fast, accurate alignment (for all operations, the enclosed 5 mm allen key can be used).

4.4.1.1 Optical alignment

1. Place the alignment tool to the most accessible corner and ensure good visibility to the opposite terminal by rotating the telescope.
2. Loosen the horizontal lock screws (labeled "3")
3. Place the horizontal axis course screw in its middle position (needle).
4. Carry out a rough alignment on the horizontal axis and fasten the screw (labeled "1").
5. Repeat steps b), c) and d) for the vertical axis.
6. Turn the horizontal course screw (labeled "2") by viewing through the telescope and carrying out the fine alignment.
7. Repeat e) for the vertical axis.
8. If necessary, repeat the fine alignment procedure e) for both axes until the opposite link is correctly aligned.
9. Fasten the lock screw (labeled "3") on both horizontal and vertical axes.

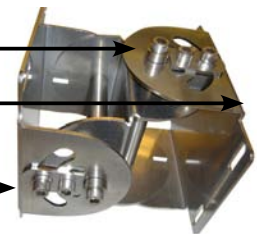
If the power levels are not satisfying enough, please do a power level alignment (see section 4.4.1.2 or 4.4.1.3).



Horizontal alignment

Wall

Vertical alignment



2 Fine alignment

1 Coarse alignment

3 Lock



4.4.1.2 Power level alignment via auxiliary port

On the back of each terminal there is a QMA auxiliary port to which a voltmeter can be connected to. The needed adapter cable is delivered with the system.

The output voltage values are between 0.5 Volt DC and 3 Volt DC. These values give an indication on how high the receive signal level is: the higher the voltage value is, the better the terminals are aligned.

As described in section 4.4.1.1, it is recommended to proceed first with a rough horizontal (respectively vertical) alignment and then to do a fine alignment on each axis. Do not forget to loosen (respectively tighten) the two lock screws before (respectively afterwards).



4.4.1.3 Power level alignment via web interface

The power level can be accessed via the web interface (see section 5.2.4.2) too.

As described in section 4.4.1.1, it is recommended to proceed first with a rough horizontal (respectively vertical) alignment and then to do a fine alignment on each axis. Do not forget to loosen (respectively tighten) the two lock screws before (respectively afterwards).

See chapter A.3 for an estimation of the power levels at different rain rates and link distances.

A power level of -60dBm is better than a power level of -70dBm

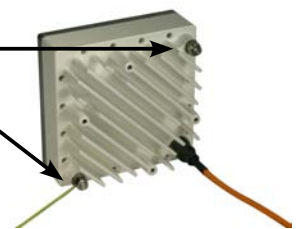
4.5 Grounding

The terminal must be properly grounded.

Two screws are provided on the reverse housing of the terminal to facilitate the correct grounding. To fasten the grounding cable onto the terminal, use a lug and serrated washer combined with an M8 nut.

Connect the terminal to the connection points nearest to the building-to-earth ground point. The grounding conductor must be as short as is practical and should not exceed 6 m (20 ft). For installations in the USA, 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.

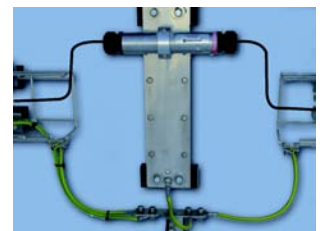
Grounding screws



4.6 Lightning / Surge protector

HUBER+SUHNER strongly recommends the use of outdoor data line protectors.

To protect humans and the building a protector must be installed before the cable enters the building. For detailed installation instructions, please refer to the dedicated documents enclosed to the protectors. Also see chapter 2.2.6.2 for available data line protectors.



4.7 Power injector

The power injector is connected inline into the data line. The maximum distance between the PoE injector and the SENCITY®Link is 100 m (328 ft). The PoE injector must be IEEE 802.3at compliant (PoE+).



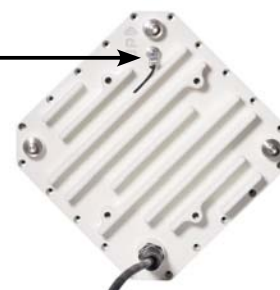
5 TERMINAL MANAGEMENT AND MONITORING FUNCTIONS

5.1 Auxiliary port

The auxiliary port can be used for

- alignment (see section 4.4.1.2)
- parameter reset of the terminal (see section 5.1.1)

Auxiliary port



5.1.1 Parameter reset via auxiliary port

To reset all parameters (IP address, username, password, etc.) to factory default, please proceed as follows:

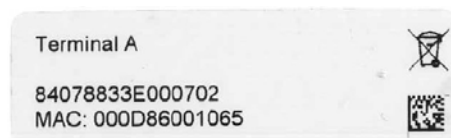
1. Unplug the connector
 - a) Wait for approx. 1 second
 - b) Plug the connector (make sure you hear the "click")
2. Unplug the connector
 - a) Wait for approx. 1 second
 - b) Plug the connector (make sure you hear the "click")
3. Unplug the connector
 - a) Wait for approx. 1 second
 - b) Plug the connector (make sure you hear the "click")

Terminal will then reboot with the default system configuration.

5.2 Web browser interface

For an initial configuration, use a PC or laptop. Address the terminal with the appropriate IP address.

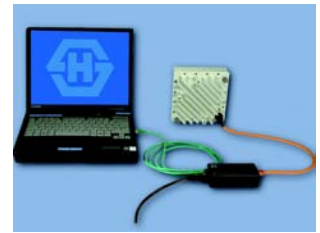
Every terminal is labeled with its terminal type (A or B).



The factory default values are:

Terminal	IP address	Subnet mask	User name	Password
A	192.168.0.21	255.255.255.0	admin	sl60
B	192.168.0.22	255.255.255.0	admin	sl60

To communicate with the terminal, ensure that the IP address of the computer used is not allocated automatically by the DHCP server. Configure the IP address manually (e.g. 192.168.0.1 with subnet mask 255.255.255.0). Remember to ensure that your web browser is not using any proxy server settings.



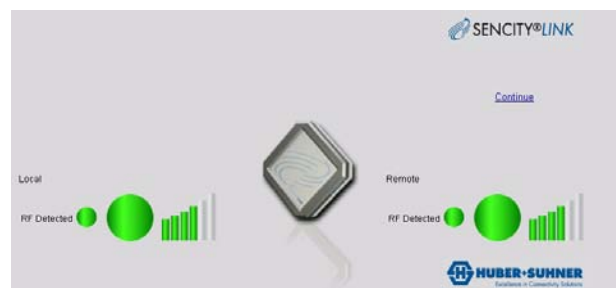
Note:

The IP address settings have no influence on data connectivity. These settings are only needed to access the monitoring functions of the terminal.

5.2.1 Entry page

The entry page gives you a simple overview of the current link status.

The screen is divided into the "local" and "remote" terminal information.



The three graphics show the

- RF detection status
- signal-to-noise ratio
- receive signal level

Receive signal level (RSL)

Signal-to-noise ratio (SNR)

RF detection status



Click "Continue" to enter the detailed web browser interface.

5.2.1.1 Traffic light colors

Green: The system is working correctly

Yellow: The system's link margin is low. The system might work with intermittent detection and synchronization

Red: System is not functional

5.2.2 Overview page

This screen shows an overview of key link information including its current status.

You can configure the system name and system location here. This will also set the following two SNMP values:

- SNMPv2-MIB::sysName
- SNMPv2-MIB::sysLocation

5.2.3 Network Interface page

The network interface page allows to configure the IP, VLAN, Ethernet and QoS settings.

5.2.3.1 Network configuration

The network configuration screen offers the option to change network settings if required. The IP address settings and VLAN settings have no influence on data connectivity.

The "Enable VLAN" check box allows the SL60-401 / SL60-501 / SL60-4010 terminals to be accessed when the link is integrated into a VLAN trunk. The VLAN ID needs to be set then too.

5.2.3.2 Ethernet interface configuration

Choose the speed of the Ethernet interface:

- 10 Mbps
- 100 Mbps
- Auto Neg (this will automatically choose 1000 Mbps if the interface you connect to is capable of Gigabit Ethernet)

Note:

Gigabit Ethernet standards require auto-negotiation to be on in order to operate.

Note:

SL60-4010 does support Ethernet interface speeds of 10 Mbps and 100 Mbps only.

5.2.3.3 Quality of Service (QoS)

Egress limiting (output on air interface) can be either switched of or done on a VLAN base (Class of Service, IEEE 802.1p) or on a content base (using the first three bits of the Type of Service/Differentiated Services field in the IP header).

Four different mappings of the priority level to the priority queue can be set.

Priority Queue Nr.:	1	2	3	4
Assigned Priority Levels:	7/6	5/4	3/2	1/0
Priority Weighting:	strict	57%	29%	14%

Ingress limiting (input on Ethernet interface) can be set to "flow control" or to "random early discard".

Note:

QoS settings are not available for SL60-4010

5.2.4 Air Interface page

The air interface page allows to configure the modem and to view the current RX power level.

5.2.4.1 Local terminal and modem configuration

Modulation types for SL60-401:

- 320hfec (320 Mbps light FEC)

- 320lfec (320 Mbps heavy FEC)

Modulation types for SL60-501:

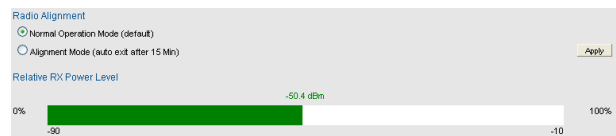
- 160lfec (160 Mbps light FEC)
- 160hfec (160 Mbps heavy FEC)

Note:

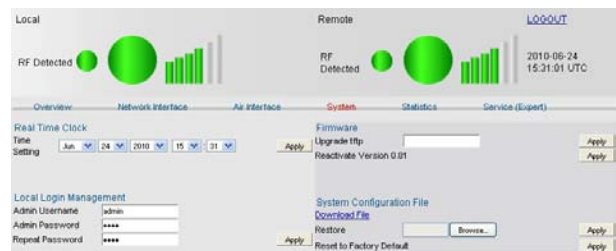
"TX Power Level" and "Modulation Type" are not available on SL60-4010.

5.2.4.2 Radio alignment

The radio alignment screen shows the alignment bar and the receive power level.



5.2.5 System page



5.2.5.1 Real time clock

Real Time Clock

Time Setting Jun 24 2010 15 31

5.2.5.2 Password

Default user name: admin

Default password: sl60

Local Login Management

Admin Username admin

Admin Password ****

Repeat Password ****

5.2.5.3 Firmware update

Current firmware can be downloaded from <http://www.sl60.com>.

The downloaded file(s) should be saved on the local computer and then uploaded to each terminal through the firmware TFTP update form on the web interface. A TFTP server is needed for this.

Please follow the installation instructions given with the upgrade file(s).

Firmware

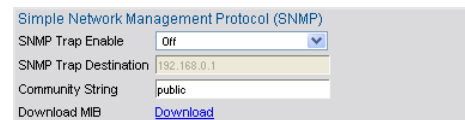
Upgrade tftp

Reactivate Version 0.01

5.2.5.4 SNMP configuration

The SL60-401 / SL60-501 terminal can be integrated into a network management system by using the implemented SNMP agent. This agent supports GET and TRAP functionality. No settings can be performed via SNMP.

The MIB file can be downloaded directly from the terminal.



Simple Network Management Protocol (SNMP)

SNMP Trap Enable: Off

SNMP Trap Destination: 192.168.0.1

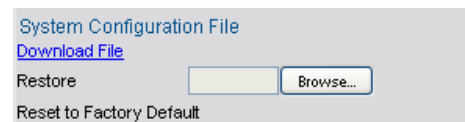
Community String: public

Download MIB: [Download](#)

5.2.5.5 Configuration file and parameter reset

The system configuration file can be stored and restored when needed.

The parameter reset function will reset all terminal parameters (e.g. IP address, username, password) to the factory defaults.



System Configuration File

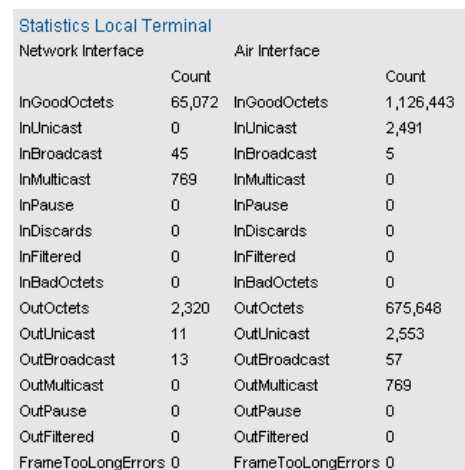
[Download File](#)

Restore:

Reset to Factory Default

5.2.6 Statistics page

The network statistics screen shows standardized information relating to network traffic and errors. Traffic status information is continuously updated and specific network errors are listed.



Statistics Local Terminal			
Network Interface		Air Interface	
	Count		Count
InGoodOctets	65,072	InGoodOctets	1,126,443
InUnicast	0	InUnicast	2,491
InBroadcast	45	InBroadcast	5
InMulticast	769	InMulticast	0
InPause	0	InPause	0
InDiscards	0	InDiscards	0
InFiltered	0	InFiltered	0
InBadOctets	0	InBadOctets	0
OutOctets	2,320	OutOctets	675,648
OutUnicast	11	OutUnicast	2,553
OutBroadcast	13	OutBroadcast	57
OutMulticast	0	OutMulticast	769
OutPause	0	OutPause	0
OutFiltered	0	OutFiltered	0
FrameTooLongErrors	0	FrameTooLongErrors	0

5.2.7 Service (Expert) page

Please use this page only when advised by the customer support.

5.3 SNMP interface

Object	OID	OID type	Description
HUBERSUHNER-MIB sencity2 (.iso.org.dod.internet.private.enterprises.hubersuhnerOID.sencity2.x / .1.3.6.1.4.1.25358.2.x)			
sencityLinkQuality	.1.	Integer	1: Green 2: Yellow 3: Red
sencityReceivePower	.10.	Integer	Receive signal level [dBm]
sencityTemperature	.11.	Integer	Temperature [°C]
sencityLockDetector	.12.	Integer	Lock detector status 1: locked 0: unlocked
sencityFirmwareversion	.21.	String	Installed firmware version
sencityAuxVoltage	.25.	String	Voltage at auxiliary port [V]
HUBERSUHNER-MIB sencitytraps (.iso.org.dod.internet.private.enterprises.hubersuhnerOID.sencity2.sencityTraps.x / .1.3.6.1.4.1.25358.2.22.x)			
sencityLinkQualityImprovedTrap	.1.	Integer	1: from red to green 2: from red to yellow 3: from yellow to green
sencityLinkQualityReducedTrap	.2.	Integer	1: from green to yellow 2: from green to red 3: from yellow to red
sencityTemperatureHighTrap	.3.	Integer	A trap indicating that the temperature within the terminal has crossed the 70° Celcius threshold
sencityTemperatureLowTrap	.4.	Integer	A trap indicating that the temperature within the terminal has crossed the -40° Celcius threshold

A TECHNICAL INFORMATION

A.1 Troubleshooting

This chapter provides solutions to problems that can occur during the installation and operation of the SL60-401 / SL60-501 / SL60-4010. It covers various aspects of installation and network setup.

Note:

Each of the following points must be checked at both ends of the link. Start by performing the entire procedure on one side (e.g. Terminal A). If this does not solve the problem, repeat all the steps at the opposite terminal.

A.1.1 Power and network connection

You must verify that the terminal is connected to the power. The PoE injector must be installed and plugged in. Go to the terminal, disconnect the RJ-45 connector and verify if there is power in the cable using a standard PoE tester.

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

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

A.1.2 Network configuration

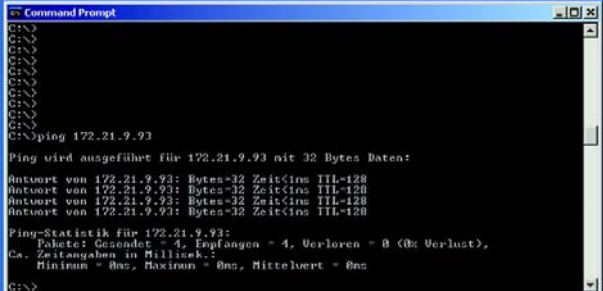
Check that the IP address is in the same range and subnet as the SL60-401 / SL60-501 / SL60-4010.

Note:

The default IP address of the SL60-401 / SL60-501 / SL60-4010 is 192.168.0.21 for Terminal A and 192.168.0.22 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 with identical IP addresses will not be visible on the network. They must all, therefore, have the same subnet mask (e.g. 255.255.255.0).

Do a Ping test to make sure that the SL60-401 / SL60-501 / SL60-4010 is responding. Go to Start → Run → Type "Command" → Type "ping 192.168.0.X". A successful Ping test will generate four replies.

As soon as the network configuration is correct you can access the GUI (Graphical User Interface) and check the settings according to section 4.9.



```
C:\>ping 192.21.9.93

Ping wird ausgefuehrt fuer 192.21.9.93 mit 32 Bytes Daten:

Antwort von 192.21.9.93: Bytes=32 Zeit<ms TTL=128
Antwort von 192.21.9.93: Bytes=32 Zeit<ms TTL=128
Antwort von 192.21.9.93: Bytes=32 Zeit<ms TTL=128
Antwort von 192.21.9.93: Bytes=32 Zeit<ms TTL=128

Ping-Statistik fuer 192.21.9.93:
    Pakete: Gesendet = 4, Empfangen = 4, Verloren = 0 (0% Verlust),
    Ca. Zeitangaben in Millisek.:
    Minimum = 0ms, Maximum = 0ms, Mittelwert = 0ms

C:\>
```

A.1.3 Duplex mismatch

If you encounter bad network performance, you probably have a duplex mismatch.

To ensure that the SL60-401 / SL60-501 / SL60-4010 terminal and the connected network component (e.g. switch) do not have a duplex mismatch you must first check your statistics.

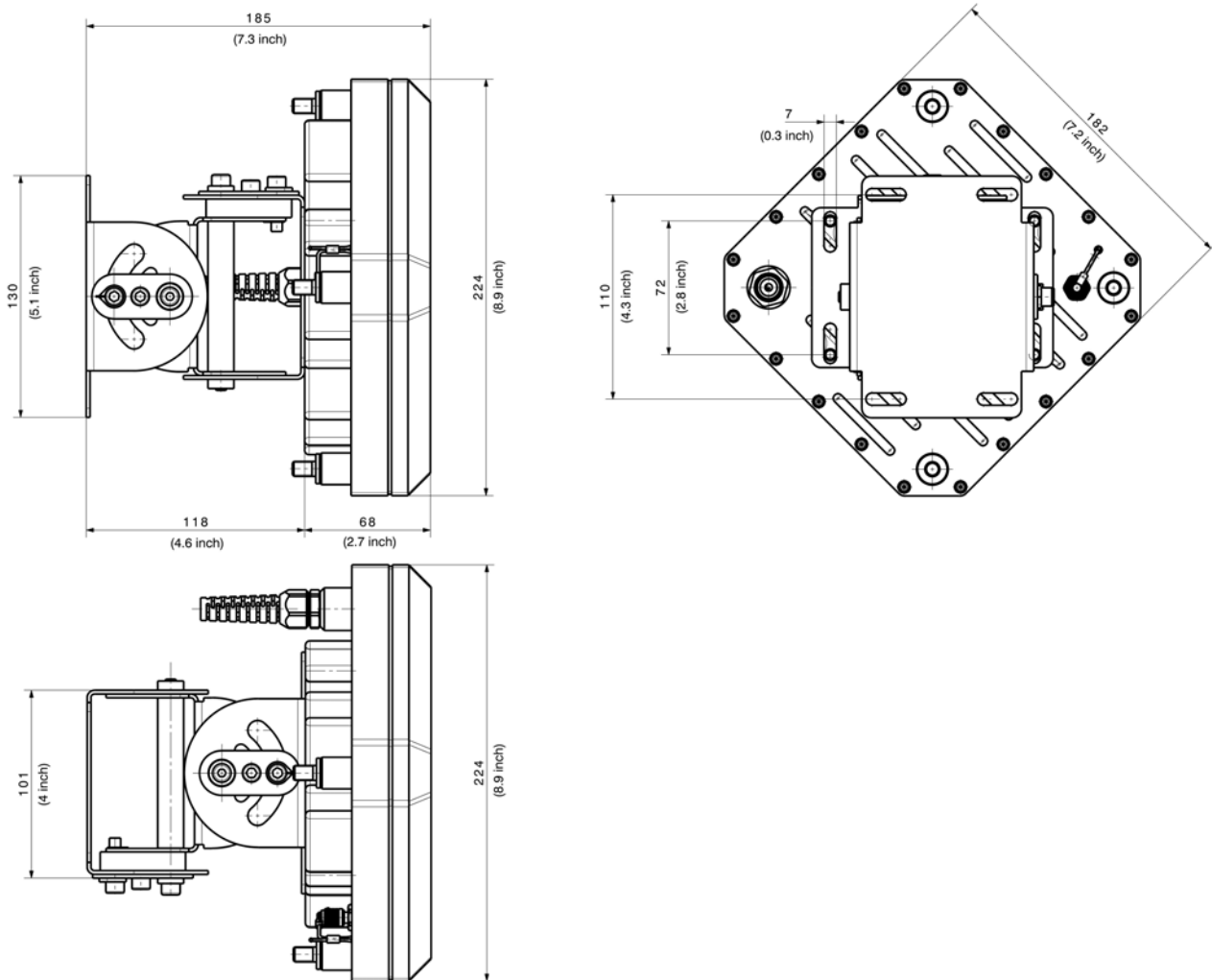
If you find many input errors, you are on the full-duplex side; if you see many late collisions, you are on the half-duplex side.

To solve the duplex mismatch, you must manually configure both network components to the same values.

A.1.4 Miss-alignment

See the configuration interface as described in section 5.2.3.1. On the Radio alignment screen (see section 5.2.4.2) you see the signal strength in dBm (e.g. -30 dBm). If the value is below -95 dBm the receiver is not in the correct position to track the signal. You therefore need to re-align the terminal to its opposite terminal (please follow the instructions in section 4.4.1).

A.2 Specifications



General system information

- Transmission capacity: 320 Mbps full duplex (SL60-401)
160 Mbps full duplex (SL60-501)
100 Mbps full duplex (SL60-4010)
- Interfaces: 10 Base-T (all versions)
100 Base-TX (all versions)
1000 Base-T (SL60-401 and SL60-501 only)
- Latency: < 50 μ s + distance
latency (1 μ s / 300 m)
- Range*: up to 800 m, 2625 ft (SL60-401 and SL60-4010)
up to 1600 m, 5249 ft (SL60-501)
- Availability*: up to 99.999%
- Connection
 - Cable length: max. 100 m (300 ft)
 - Signal wires: CAT 5e

- Connector: RJ-45 (male; including outdoor Ethernet seal kit)

Mechanical data

- Dimension: 182 x 182 x 68 mm (6.4" x 6.4" x 3.5")
- Weight: 2.5 kg (5.5 lb) terminal, 1 kg (2.2 lb) bracket

System administration

- Web browser-based configuration
- SNMP

Power supply

- Standards: Compliant to Power over Ethernet according to IEEE 802.3at
- Voltage: ± 48 V DC
- Power consumption: 18 W

Environmental data

- Working temperature **: - 45 °C ... + 55 °C
(- 49 °F ... + 131 °F)
- Storage temperature: - 30 °C ... + 55 °C
(- 22 °F ... + 131 °F)
- Wind load:

operating	160 km/h (100 mph)
survival	200 km/h (125 mph)

Regulatory compliance

- FCC Part 15
- Industry Canada RSS210
- R&TTE Directive 1999/5/EC

Ordering information


- SL60-401: Item # 84092438
 - SL60-501: Item # 84092442
 - SL60-4010: Item # 84119340
- each composed of:
- 2 terminals
 - 2 alignment brackets
 - 1 manual
 - 2 mounting sets
 - 2 weather shields

* The range depends on the climate zone and the requested availability

** Only if the terminal is powered up

A.2.1 Ethernet cable colour code

Note:
By cutting of the connector the warranty will expire.

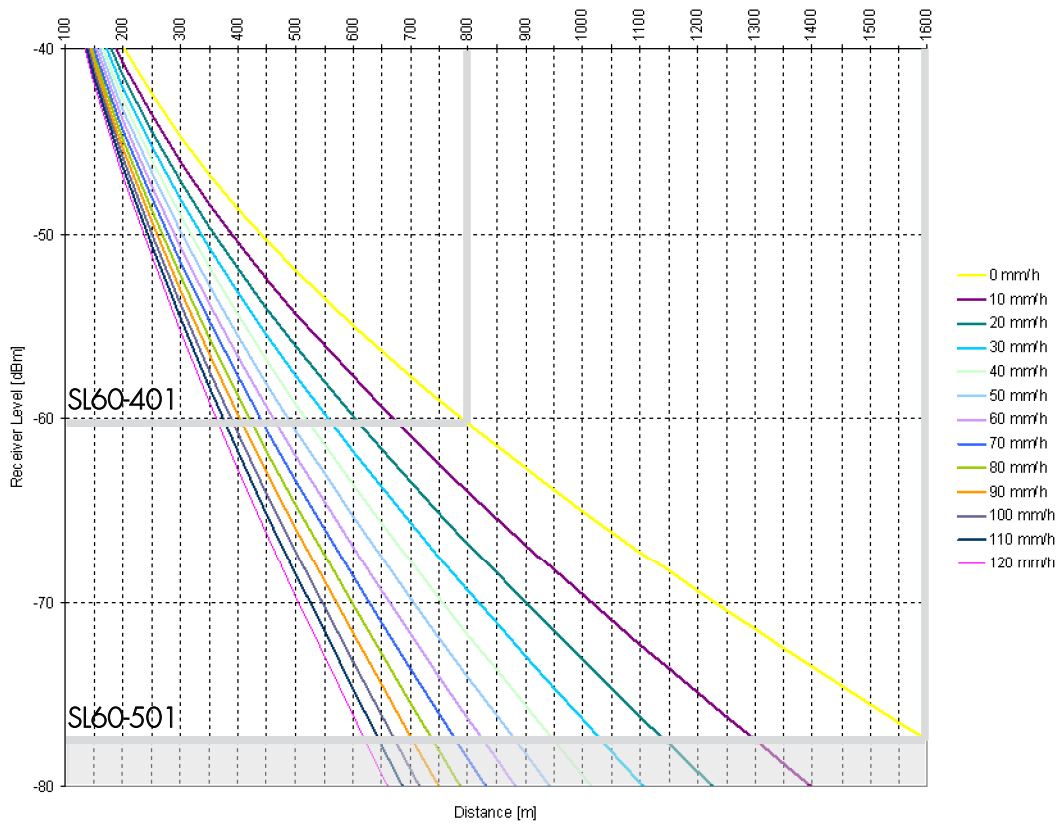
	8 7 6 5 4 3 2 1 
Pin	RJ45 Plug
1	Black
2	Green
3	Red
4	Blue
5	White
6	Orange
7	Yellow
8	Brown

Twisted pairs:

- Black (1) / Green (2)
- Yellow (7) / Brown (8)
- Red (3) / Orange (6)
- Blue (4) / White (5)

A.3 Receiver level / Rain / Link distance

The following diagram shows the approximate receiver levels at different rain rates and distances.



Note:

This diagram is valid for the highest possible output power that can be configured (see chapter 5.2.4.1).

A.4 Availability / Rain zone / Link distance

The link distance is directly related to the weather conditions. The table below refers to a link working at a distance of up to 800m (SL60-401 / SL60-4010), respectively 1600m (SL60-501), for dry weather conditions. Please also refer to the maps in sections A.4.1, A.4.2 and A.4.3.

800m (SL60-401 / SL60-4010):

Availability	Rain zone *														
	Link distance (m)														
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
99%	797	789	785	764	787	770	752	765	701	772	765	741	730	669	597
99.9%	765	752	730	701	719	701	669	684	618	669	648	607	549	461	446
99.99%	701	669	648	624	607	578	569	561	549	524	473	466	405	343	376
99.999%	607	561	524	524	450	434	461	425	486	397	338	370	312	268	320

1600m (SL60-501):

Availability	Rain zone *														
	Link distance (m)														
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
99%	1593	1571	1562	1508	1566	1522	1479	1512	1354	1530	1512	1450	1424	1278	1111
99.9%	1512	1479	1424	1354	1399	1354	1278	1314	1159	1278	1229	1135	1005	817	785
99.99%	1354	1278	1229	1172	1135	1069	1050	1031	1005	951	841	826	701	578	644
99.999%	1135	1031	951	951	794	761	817	742	868	685	569	632	520	438	535

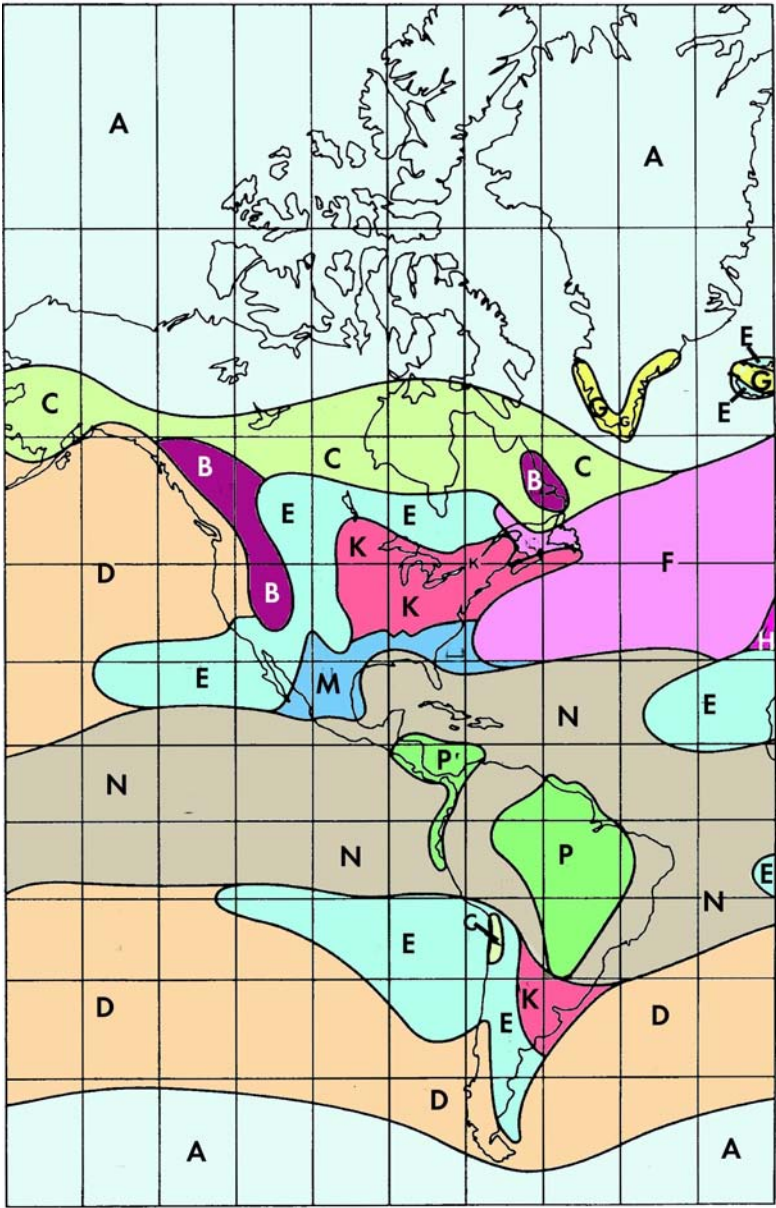
* Rain zone according to ITU-R Recommendation PN.837-1

99.9% availability equates to 526 minutes per year of outage due to heavy rains.

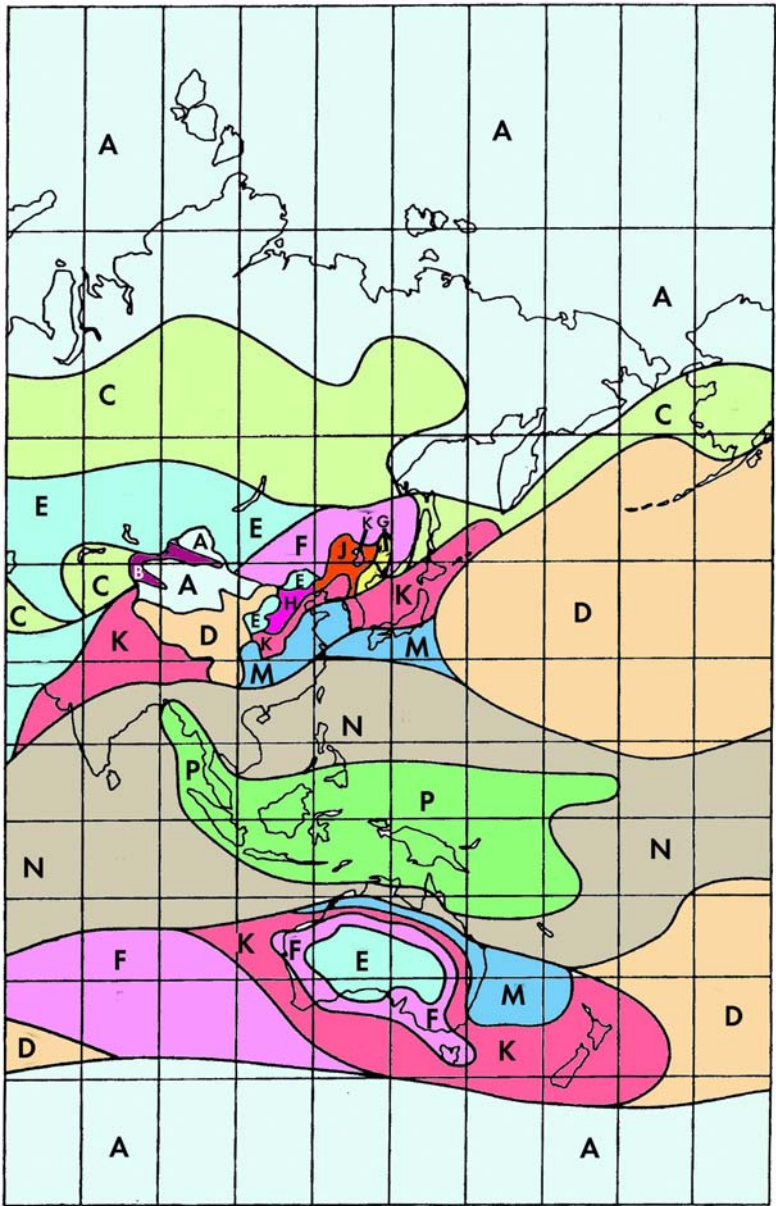
99.99% availability equates to 53 minutes per year of outage due to heavy rains.

99.999% availability equates to 5 minutes per year of outage due to heavy rains.

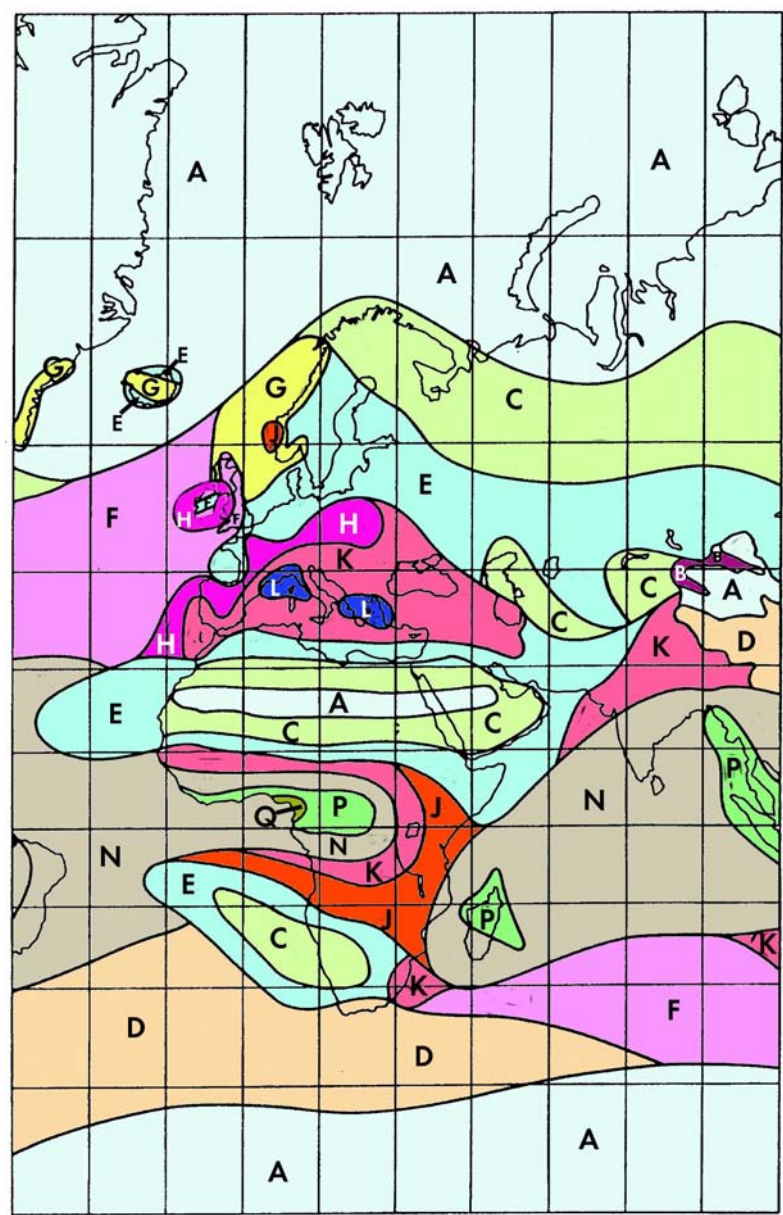
A.4.1 Map of America



A.4.2 Map of Asia and Middle East



A.4.3 Map of Europe



B REGULATORY INFORMATION

B.1 FCC statement

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC NOTICE: To comply with FCC part 15 rules in the United States, the system must be professionally installed to ensure compliance with the Part 15 certification.

It is the responsibility of the operator and professional installer to ensure that only certified systems are deployed in the United States.

The use of the system in any other combination (such as co-located antennas transmitting the same information) is expressly forbidden.

RF Exposure: This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

FCC ID:

- SL60-401: TTDSL60401
- SL60-501: TTDSL60501

B.2 Industry Canada statement

Operation is subject to the following two conditions:

1. this device may not cause interference, and
2. this device must accept any interference, including interference that may cause undesired operation of the device.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment.

IC:

- SL60-401: 6318A-SL60401
- SL60-501: 6318A-SL60501

B.3 CE – Declaration of conformity

We, HUBER+SUHNER AG of Degersheimerstrasse 14, CH-9100 Herisau/Switzerland

declare that the product

SENCITY®Link SL60-401 / SL60-501 / SL60-4010

is in conformity – after consultation with the notified body Phoenix Testlab (No. 0700) – with the following standards and normative documents:

- EN 50371 (2002): Generic standard to demonstrate the compliance of low power electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (10 MHz - 300 GHz)
- EN 55022 (2006): Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
- EN 55024 (1998): Information technology equipment - Immunity characteristics - Limits and methods of measurement
- EN 60950-1 (2006): Information technology equipment - Safety - Part 1: General requirements
- ETSI EN 302 217-3 V1.3.1 (2009-07): Harmonized European Standard (Telecommunications series) Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 3: Equipment operating in frequency bands where both frequency coordinated or uncoordinated deployment might be applied; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
- ETSI EN 302 217-4-2 (2007): Fixed Radio Systems; Characteristics and requirements for point-to-point equipment and antennas; Part 4-2: Harmonized EN covering essential requirements of Article 3.2 of R&TTE Directive for antennas is in accordance with the following Directives:
- R&TTE Directive 1999/5/EC

We hereby declare that the equipment named above has been designed to comply with

the relevant sections of the above referenced specifications. The unit complies with all essential requirements of the Directives.

Herisau, October 2009

B.4 Safety

The following general safety precautions must be observed during all phases of operation and service of those 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 the intended use of the product.

The SL60-401 / SL60-501 / SL60-4010 meets all CE and FCC electrometric radiation safety requirements for radio equipment. However, it is advisable to avoid long-term exposure to the front face of the terminal while operating this equipment.

Outdoor equipment must be properly grounded to provide some protection against voltage surges and built-up static charges (as illustrated in chapters 4.5 and 4.6).

All electrical and mechanical installations must comply with local and/or national electrical and building codes.

This equipment must not be modified. Neither must any of its component parts be substituted.

B.4.1 English

Indication about the correct use of the system:

The devices of this system establish a wireless point to point data connection.

Indication about possible application limitations:

Operation on NIB / NPB (Non interference basis / non protection basis): The equipment is not permitted to cause harmful interference to other radio services. The equipment has to be switched off immediately in the case of interference with other services.

Indication about the network interfaces to which the system can be connected:

The devices are intended to be connected to IEEE standard 802.3at (Power over Ethernet) compliant devices. SL60-401 / SL60-501 / SL60-4010 has to be supplied by a limited power source according to EN 60950-1:2006.

B.4.2 Deutsch

Hinweis auf bestimmungsgemässe Verwendung der Anlage:

Die Geräte dieser Anlage stellen eine drahtlose Punkt-zu-Punkt Datenverbindung her.

Hinweis auf mögliche Verwendungseinschränkungen:

Interferenzen und Schutzvorkehrungen im Betrieb: Die Ausrüstung ist nicht gestattet, andere Funkdienste nachteilig zu stören. Das Gerät muss im Falle von Interferenzen mit anderen Diensten sofort ausgeschaltet werden.

Hinweis auf die Netzschnittstellen, an welche die Anlage angeschlossen werden kann:

Die Geräte sind für den Anschluss an dem IEEE-Standard 802.3at (Power over Ethernet) konforme Geräte bestimmt. SL60-401 / SL60-501 / SL60-4010 muss durch eine Stromquelle begrenzter Leistung gemäss EN 60950-1:2006 gespeisen werden.

B.4.3 Français

Indication concernant l'utilisation correcte de l'installation:

L'équipement de cette installation établis une liaison de données point à point sans fil.

Indication concernant de possible restrictions de l'utilisation:

Interférence et protection pendant le fonctionnement: Le matériel n'est pas permis de causer des interférences nuisibles à d'autres services radio. Le matériel doit être mis hors service immédiatement dans le cas d'interférence avec d'autres services.

Indication concernant les interfaces du réseau auxquelles l'installation peut être raccordé:

L'équipement est conçu pour le raccordement aux appareils conformes au standard IEEE 802.3at (Power over Ethernet). SL60-401 / SL60-501 / SL60-4010 doit être alimenté par une source de courant fini selon EN 60950-1:2006.

B.4.4 Italiano

Indicazione concernente l'utilizzo corretto e l'installazione:

Le componenti installate di questo sistema creano un ponte radio punto-punto.

Indicazione concernente le possibili restrizioni dell'utilizzo:

Interferenze e protezione durante l'utilizzo: il sistema non deve causare alcuna interferenza nociva ad altri servizi radio. Questo sistema deve essere spento immediatamente nel caso di interferenza con altri servizi.

Indicazione concernente le interfacce alle quali il sistema può essere connesso:

Il sistema è concepito per essere connesso all'interfaccia conforme allo standard IEEE 802.3at (Power over Ethernet). SL60-401 / SL60-501 / SL60-4010 deve essere alimentato da un'alimentazione conforme alle specifica EN 60950-1:2006.

D GLOSSARY

BPSK	Binary Phase Shift Keying	QPSK	Quadrature Phase Shift Keying
DHCP	Dynamic Host Configuration Protocol DHCP enables both manual and automatic IP address allocation in a network.	SNMP	Simple Network Management Protocol
DNS	Domain Name System enables the translation from IP address to domain name	TCP	Transmission Control Protocol
CE	The CE marking is a conformity mark on products placed on market in the European Economic Area.	WAN	Wide Area Network
FCC	Federal Communication Commission (USA)	WLAN	Wireless Local Area Network. This typically unlicensed non line of site application operates in the frequency range 2 - 6 GHz according to IEEE 802.11x.
FEC	Forward Error Correction		
IP	Internet Protocol		
LAN	Local Area Networks		
LOS	Line of Sight – uninterrupted, visual, point-to-point contact.		
MAC address	Media Access Control physical, unique address of network component		
OSHA	Occupational Safety and Health Administration		
PoE	Power over Ethernet		