WIMAN Star
WIMAN Access
WIMAN Line

DRAFT

Operation Manual

Software Version: T0.7

- Version E 17 -
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Subjects to change without notice.

Bad Rappenau, July 2000

The actual version of this operation manual can be found at http://www.wiman.net.

FCC-Information:

FCC ID: NB9WIMAN2A24

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.

Caution !

Any changes or modifications not in accordance with the instructions may void the user's authority to operate the equipment.

The WIMAN unit does not contain any user serviceable parts inside and should not be opened by anyone other than authorized service personnel.

Configuration and installation shall be performed by qualified personnel only. Improper configuration may void the right to operate WIMAN units. For more information, please refer to chapter 2.5.1 of this manual.

Conventions

This operation manual uses the following conventions:

Symbols:

Danger!

This symbol is intended to warn the user that improper use of the instruments could result in injury.

Information

This symbol is intended to draw the user's attention to useful information.

Note

This symbol is intended to alert the user to information that may save time or simplify a task.

Attention

This symbol is intended to indicate specific directions and methods necessary for proper operation.

Checklist

This symbol is intended to inform the user of the required steps to complete a task.

Texts:

Commands are shown in ***italics and bold*** typeface.

Parameters are shown in *italics.*

Display outputs are shown in `Courier`.

Keys and names of Menu windows are shown in **bold** typeface.

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1 Introduction to WIMAN technology

The WIMAN product series provides a powerful new technology for the design of flexible data networks. Integrating a multitude of innovative and optimized methods and communication protocols, we've created a wireless network technology, which is available for various applications such as campus networking, high speed access for Internet users, and cellular data networks in conurbation areas, etc.

In contrast to other available wireless products, the WIMAN product line integrates the demand for an economic system with high data rates, a high range and efficient utilization of the frequency-spectrum. The WIMAN System utilizes the most modern spread spectrum technology without using any further encoding algorithm, and features higher security and noise immunity than other existing systems. Applying the frequency hopping technique in combination with an intelligent transmission control algorithm, the ISM frequency range between 2.4 and 2.4835 GHz is optimally used.

The interfaces provided by the WIMAN unit to attach to the customer's terminal equipment complies with the international X.21 and V.24/RS232/RJ45 standards allowing a direct connection to any standard personal computer, workstation or mainframe system. For hooking up wired networks (LAN, MAN, WAN), there are various routers available in the form of hardware or software solutions.

The WIMAN product line provides users with the benefits of high performance and speed in a wireless modem. WIMAN is easily distinguished from other transmission systems through several remarkable features:

1.1 Transmission Speeds / Frequency Range

At present, wireless data network technology can be divided into two categories: The first category consists of wireless modems with a small transmission bandwidth. These products are used for company networks, cellular networks, CDPD (Cellular Digital Packed Data) or GSM (Global System for Mobile communication) networks. The second category consists of wireless modems with large bandwidth in the ISM range (Industrial Scientific Media, frequency range around 2,4 GHz), such as wireless LAN products.

It is possible to cover a large area with the narrow band systems. Some systems are even able to cover a complete country. The other LAN products specified above operate with substantially higher data transmission rates; however, the range of these systems is limited to approx. 300m/900ft. Therefore, the area of application is strongly reduced.

The WIMAN technology offers the advantages of both the narrow band systems and the broadband systems. With a clear line of sight between the antennas, data can be transmitted between two WIMAN radio modems with a rate of up to 2048 KBit/s (at the data interface) / 512KBit/sec at the wireless interface in duplex operation over a distance of up to approx. 40km/25miles (FCC version) or up to approx. 5km/3.2miles (ETSI version).

Furthermore, WIMAN systems are deployed in a highly scalable manner similar in nature to a cellular structure. Therefore, it can overcome some of the need for direct line-of-sight.

1.2 Frequency Hopping Procedure

All WIMAN radio modems operate with the modern frequency hopping procedure. With this procedure, the RF-channel is changed in very short intervals (all 8 ms). A total of 80 non-overlapping radio channels are available.

WIMAN takes advantage of these 80 channels, each with 1 MHz of bandwidth, by use of spread spectrum technology (frequency hopping).

The WIMAN radio modem transmits information packages that hop from one frequency to another, not staying longer than 8 ms in a frequency range.

As data packets are transmitted and received, the ISP selects the order of the channels, producing a truly secured line of data.

This remarkable feature yields the following important advantages:

- High security against eavesdropping due to fast changes of the channel,
- Resistance to jamming,
- Protection against other RF-systems in the same frequency band,
- High performance with high efficiency,
- Possibility of parallel operation of WIMAN connections by use of different frequency-hopping patterns.

1.3 WIMAN Network Topology

With the WIMAN technology, bonding can be structured in a simple point-to-point connection, but it is also possible to set up various other network topologies. The WIMAN product series consists of three different wireless WIMAN radio-modems:

WIMAN STAR: wireless base station for public and private point-to-multi-point networks.

WIMAN ACCESS: wireless access node for public and private point-to-multi-point networks,

WIMAN LINE: wireless point-to-point connection between two computers or computer networks.

1.4 Basic WIMAN Topologies

As previously mentioned, the WIMAN technology is not limited to point-to-point connections. Different network topologies can be structured. The following chapter introduces some simple network configurations using the WIMAN units to illustrate some of the features of each configuration.

1.4.1 Point-to-Point connections with WIMAN LINE

WIMAN LINE radio modems enable point-to-point connections between local area networks, data terminals or individual personal computers. In general, the WIMAN LINE can replace a wire communication or a zero-modem cable. At present the WIMAN LINE supports duplex data transmission rates of 256 kBit/s at 2FSK

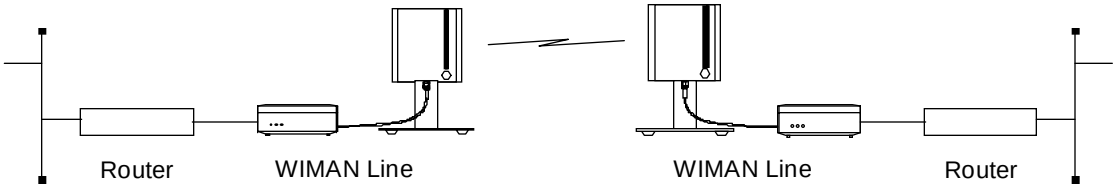


Figure 1 Point-to-Point connection using WIMAN LINE

1.4.2 Cellular Networks using WIMAN STAR and WIMAN ACCESS

One of the outstanding features of the WIMAN series is its ability to support point-to-multi-point networks with technically matured distribution of load between the individual ACCESS devices (load balancing).

Figure 2 shows a typical network environment.

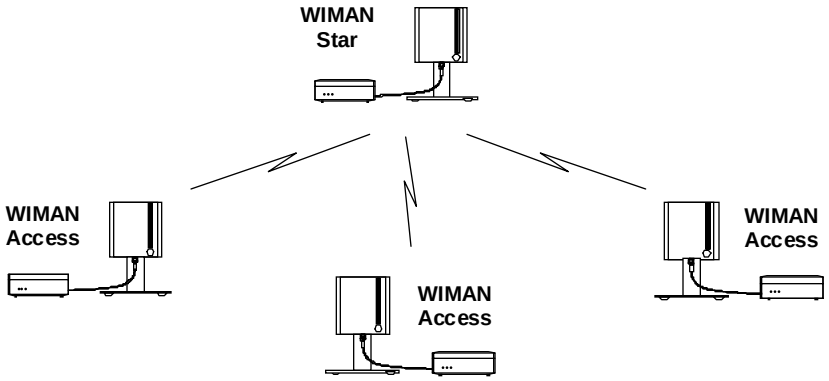


Figure 2 *wireless access networks with WIMAN STAR and WIMAN ACCESS*

This network configuration can be used as a wireless connection to the Internet.

The current software-Version supports up to 9 WIMAN ACCESS per WIMAN STAR. They can be configured to meet higher density of traffic in the networks by use of several synchronized parallel WIMAN radio modems.

Avoid errors by synchronization of the WIMAN units (see chapter 4.5 on page 53).

1.5 Transmission Protocols

1.5.1 Frame Relay

The WIMAN system supports the Frame Relay protocol widely used at many Telephony companies.

It operates smoothly in Frame Relay networks and enables the application of commercial Frame Relay compatible Router as switches on the STAR- and the ACCESS side.

Except for the supply of an Internet access, it is additionally possible to use the WIMAN Frame Relay system for telephony uses. Therefore, commercial Frame Relay multiplexers from companies such as RAD, NUERA, CISCO, etc. can be used.

The Frame Relay support is a software-configurable feature and is starting from the software-Version T.05. This software version does also support leased line functionality.

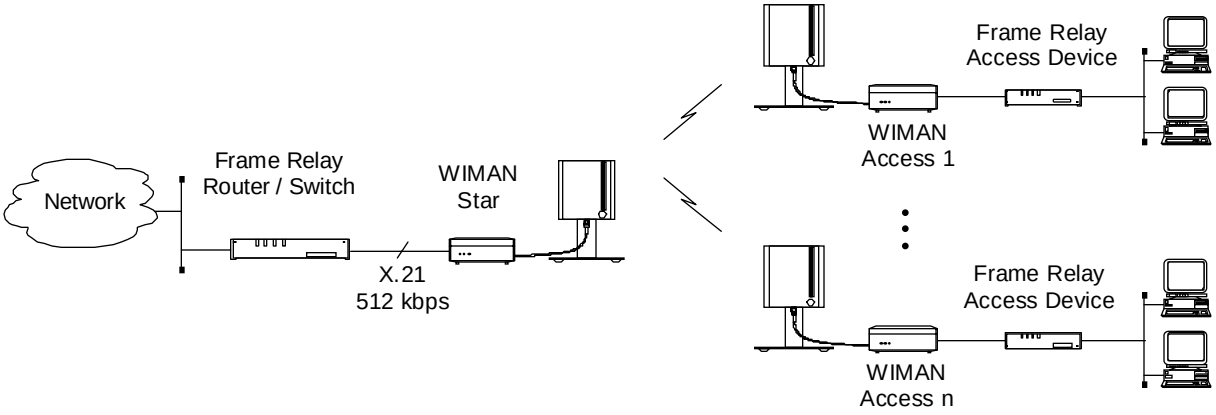


Figure 3 Standard Frame Relay applications

Router *: Any Frame Relay-Router or Switch with Synchronous X.21-port (128 kBit/s), RFC 1490-Standard

- LMI has to be switched off, DLCI is configured statically.

Router **: Any Frame Relay-Router or Switch with synchronous X.21-port (128 kBit/s), RFC 1490-Standard

- LMI has to be switched off, DLCI is configured statically.

2 The WIMAN Command Line Level

The operating system of the WIMAN radio modem has an integrated command line interpreter ("Shell") for configuration of the WIMAN. Input and output is visible on the input or output-window of a PC terminal program (e.g. TELIX, ZOC).

So that communication between the terminal program and the WIMAN can take place, the communication parameters of the terminal program and the WIMAN must correspond.

The configuration of the WIMAN radio modem is executed with instructions on the command line level (“Shell”). There is no distinction between upper- and lower case characters (except for passwords).

The command line level can be accessed via different interfaces. Successful locking on the command line level is acknowledged by display of the command line prompt. The factory setting of the command line prompt is `WIMAN II >.`

The user may personalize the command line prompt (e.g. `DEVICE 1`:).

2.1 Authorization Levels

The command line level has two different authorization levels that differ in the number of changeable parameters. Therefore, the WIMAN radio modem may be configured by diversely qualified and permitted persons (e.g. user, Provider).

The last character of the command line prompt displays the authorization level you are in at that time.

The authorization levels are represented as follows:

- Authorization level 1 WIMAN II >
- Authorization level 2 WIMAN II #

Each authorization level can be protected with a different password. However, a password for authorization level 2 is always needed.

2.2 Passwords

Passwords serve to protect the WIMAN from unauthorized access to the command line level in the different authorization levels. All passwords must have a length from four to eight characters. For the passwords the following characters may be used:

" a... z ", " A... z ", " 0... 9 ", " - ", " @ ", "?", " \ ", " [", "] ", " < ", " > ".

NOTE:

The WIMAN DOES acknowledge case sensitivity characters for passwords.

Attention

Typing in of any other characters than the ones mentioned above may lead to a reset of the WIMAN shell.

If no password is assigned for the authorization level one, the command line appears when the WIMAN is switched on. Otherwise you are asked to enter a password to access the command line level one.

A password for authorization level two is always required. This password cannot be deleted, however it is possible to modify this password.

In case of a false configuration or a forgotten password in the lowest authorization level (e.g. user authorization level) qualified personnel are needed to access the unit (e.g. Provider). It is possible to gain access directly to level two by entering the designated password for that level.

With suitable instruction (see chapter 3.5.1, on page 40) you can reset the password for authorization level one.

If, for any reason, you are unable to arrive at the necessary authorization level any longer and you are thus closed out of the device, it is possible to gain access with a master password. The master password can only be used after the third unsuccessful access attempt and can only be made via the serial interface. Further information on this issue can be obtained from your WIMAN Distributor.

Attention:

The input of the master password can be executed exclusively over the RS-232 port and results in resetting of all parameters to their factory settings. A reconfiguration of the device will be necessary afterwards.

2.3 Operation Modes

On the command line level, the following operating modes are differentiated with respect to each authorization level:

- Command mode and
- Configuration mode.

In command mode you can view the accepted parameters of the present configuration (current config) as well as give the accepted commands for this mode and authorization level (see Chapter 2.6.1 on page 25).

In configuration mode you may change only the parameters allowed for that specific authorization level.

The system software indicates these parameters as “new configuration” (new config). You may render certified instructions for this level and this mode.

Figure 4 shows how to switch between the different authorization levels and operation modes.

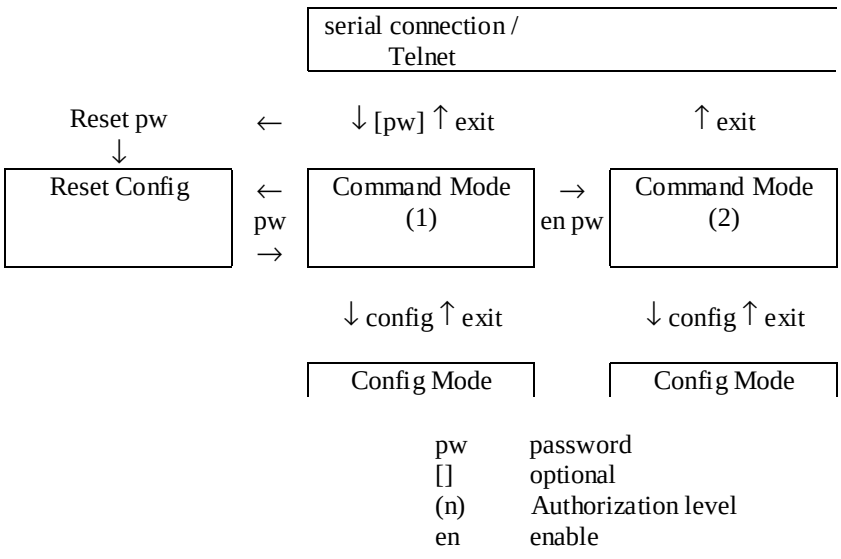


Figure 4 Diagram of the different operating modes

2.4 Configuration Data

The configuration data (values of the adjustable parameters) is classified into the following three types:

- New configuration (new config),
- Present configuration (current config) and
- Non-volatile configuration (boot config).

Figure 5 shows the connections of the three different types of configuration data.

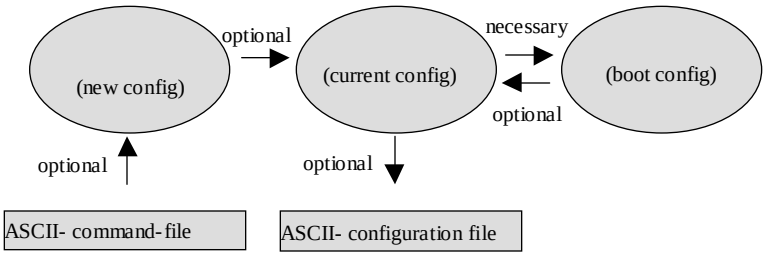


Figure 5 *Configuration data*

The **new configuration** is created by modification of the parameters in the configuration mode (see Chapter 2). This has no effect on the current operation. It is possible to produce a new configuration by manually changing the parameters or by reading-in a parameter text file. In the parameter text file comments may be inserted at the start of a line or after an instruction (See Chapter xxx on page xxx).

The **present configuration** consists of the parameters used by the system at that time. This configuration can be saved as a text file.

The **non-volatile configuration** consists of the parameters called on and made the present configuration at a strat or restart of the device. Modified parameters (new configuration) can either be taken over (transfer for present configuration) or rejected by a query when leaving the configuration mode.

The up-to-date parameters (present configuration) can be permanently taken over by a further query when leaving the command mode (transfer into the non-volatile configuration) or maintained only up to the next restart.

2.5 Configuration Parameters

The WIMAN radio modems are delivered with a factory-installed standard setup. To adjust the WIMAN to your specific requirements you can modify different parameters (depending on the authorization level).

The configurable Parameters are classified into the following groups:

- Parameter for the wireless interface,
- Parameter for the serial interface,
- Parameter for the network,
- Other parameters.

All parameter can only be changed in the configuration mode of the appropriate level.

2.5.1 Parameter for the Wireless Interface

The following parameters affect the wireless interface and serve to set up the network configuration. These parametersalso set up countermeasures against possible disturbances in the operating frequency band.

Destination

The parameter *destination* determines the destination address of the WIMAN, to which all data will be sent.

Note:

This setting is only available on WIMAN LINE units and is not used on WIMAN STAR and ACCESS units.

Authorization Level: 2

Preset value: 1

Scope: 0 ... 250

FTab

The parameter *FTab* determines the frequency-hopping pattern between the 80 channels. Each WIMAN radio-modem comes with a factory installed frequency-hopping pattern that cannot be changed. However, it is possible to create a second frequency-hopping pattern to be used in place of the standard one. In this case the new pattern can be set *with FTab.*

Authorization Level: 2

FTabMode

The user-defined hopping pattern must be switched on with *FtabMode* set to USER.

Authorization Level:	2
Preset value:	System
Scope:	System, User

LoopData

The parameter *LoopData* sets the hexadecimal value to be sent in a *LoopTest*.

Authorization Level:	2
Preset value:	FFFFFFFF
Scope:	00000000 … FFFFFFFF

LoopMode

The parameter *LoopMode* determines, which bit pattern and frame lengths are to be used with the independent back loop test (see loop test below). This parameter is not available on STAR devices.

It is possible to set the values **normal**, **load**, **long** and **high**. The values function as follows:

- Normal

  Pseudo coincidental data is transmitted. All 256 byte values occur equivalently. A break is inserted between two packages. This type of test is to simulate the "normal" data communication in a network.

- Load

  Pseudo coincidental data is transmitted. However, in this type of test it is transmitted with highest possible transfer rate.

- Long

  "Stress" data (bit pattern, which lead to a high utilization) is transmitted at a normal transfer rate.

- High

  "Stress" data is transmitted with high transfer rate.

Attention:

If the looptest is executed in an operating radio net, all values except **normal** should be avoided for the parameter LoopMode. Use of any other value may result in malfunction.

Authorization Level:	2
Preset value:	long
Scope:	normal, load, long, high

LoopTest

The parameter *LoopTest* yields a back loop test. If loop test is set to **True**, the WIMAN begins to transmit test data in back loop operation. Therefore, it is possible to check procedure statistics during the test. This parameter is not available on STAR devices.

Authorization Level:	2
Preset value:	False
Scope:	True, False

MaxRetry

The parameter *MaxRetry* determines the maximum number of a repeated package dispatching. A package is dispatched again only in the case of a failed checksum test. If a package fails the checksum test, the WIMAN tries to send the package again. The number of attempts to resend the package can be determined in *MaxRetry*.

Authorization Level:	2
Preset Value:	9
Scope:	0 ... 9

NetId

The parameter *NetId* determines the network address of the WIMAN. The WIMAN analyses only the data communication that is addressed to the network address configured on it. NetID also determines which frequency-hopping table is used.

Attention:

Please note that if several WIMAN networks are situated in close geographical location identical NetIds may not be used.

Authorization Level:	2
Preset value:	255
Scope:	0 ... 255

NodeID

The parameter *NodeId* determines the non-standard address of a WIMAN radio modem within a network. A NodeID with the value 0 automatically changes the WIMAN radio modem to **MASTER** operation. NodeIDs of 1... 250 automatically switch a WIMAN radio modem into the **SLAVE** operation with appropriate NodeIDs from 1... 250. Two WIMAN radio modems in the same network (same NetId) may not possess identical NodeIDs. Disturbance would occur and communication would be lost until one of the devices is switched off.

This effect does not occur, if a serial number for this NodeID is set with the instruction *peer* (see *peer* below). In this configuration, the WIMAN radio modem with the adjusted serial number

would function perfectly and all other devices with the same NetId and NodeId would be ignored.

Authorization Level: 1

Preset value: 0 (WIMAN Star)

Scope: 0 ... 250

RadioPower

The parameter *RadioPower* activates the normal operation or switches into a low power mode (around 0 dBm, regardless of the *Region* or *Antenna* setting). When there is only a small distance between a STAR and ACCESS the transmitting power can be scaled down to avoid overriding of the input-stage.

Authorization Level: 2

Preset value: Normal

Scope: Normal, Low

Antenna

The parameter *Antenna* specifies the type of antenna used with the WIMAN and thus determines the specific settings (e.g. transmit power) required for that type of antenna.

Authorization Level: 2

Preset value: 8mn360

Scope: 2mn360, 8mn360, 85pl76, 16pl27, 24pf20

Region

In addition to the parameter *Antenna*, the parameter *Region* sets the WIMAN radio to the specific settings required in that specific region (output power, frequency-range, etc.).

Authorization Level: 2

Preset value: depending on region

Scope:
- 1 valid for ETSI-compliant operation
- 2 valid for FCC-compliant operation

Note:

Incorret setting of the parameters 'Antenna' and 'Region' may lead to non-permitted behaviour of the unit and will void the right of operation !

If you are not sure which operation mode the WIMAN unit must comply with, please refer to your local distributor or manufacturer of this system.

MaxNodeId

The parameter MaxNodeId determines the maximum number of devices that are connected to a STAR.

Authorization Level:	2
Preset value:	1
Scope:	1 … 250

Location

The parameter *Location* can be edited freely to determine the location of the IWMAN radio modem, e.g. **Water_Tower01** or **rooftop**.

Authorization Level:	2
Preset value:	default-location
Scope:	No value

2.5.2 Parameter for the Serial Configuration Interface

The following parameters serve for the communication with the serial configuration interface and are important for the correct communication with the command line level.

ConBaudrate

The parameter *ConBaudrate* determines the Baud rate that can be transferred over the RS-232-interface for configuring the WIMAN.

Authorization Level:	1
Preset value:	9600
Scope:	300, 1200, 2400, 4800, 9600, 19200, 38400, 57600

ConDataBit

The Parameter *ConDataBit* determines the length of the data bits when transferring data over the RS 232-interface.

Authorization Level:	2
Preset value:	8
Scope:	7, 8

ConHandShake

The parameter *ConHandShake* determines the handshaking mode during a transfer on RS-232-interface. It can be selected between a software-controlled handshaking and no handshaking. With software-controlled handshaking the control sequences Xon and Xoff are used.

Authorization Level:	2
Preset value:	soft
Scope:	soft, none (no handshaking)

ConPageSize

The parameter *ConPageSize* indicates, how many lines in the respective command line window (terminal window over RS-232-interface) are to be represented, before the continuous output of the parameters is stopped. The size of an output page is thus finally determined.

Authorization Level:	2
Preset value:	24
Scope:	10 ... 100

ConPauseMode

The parameter *ConPauseMode* determines if the output on the display shall be stopped after the number of lines given with *ConPageSize* or not.

Authorization Level:	2
Preset value:	On
Scope:	On, Off

ConParity

The parameter *ConParity* determines the type of the parity check on the serial RS-232-interface.

Authorization Level:	2
Preset value:	none (no parity check)
Scope:	none, odd, even

ConStopBit

The parameter *ConStopBit* determines, how many stop bits are supposed to follow the data bits on the serial RS-232-interface.

Authorization Level:	2
Preset value:	1
Scope:	1, 2

2.5.3 Parameter for the serial data Interface

The following parameters serve for the configuration of the serial data interface and are important for correct data exchange between the Router and the WIMAN radio data modem.

SerBaudrate

The parameter *SerBaudrate* determines the Baud rate for the data communication on the X21-interface.

Authorization Level:	1
Preset value:	2048000

Scope: 19200, 48000, 64000, 128000, 256000, 512000, 1024000, 2048000

SerCRC

The parameter *SerCRC* determines the error correction procedure that can be used (check total of 16 or 32 bits).

Authorization Level: 2

Preset value: 16

Scope: 16, 32

SerEncode

The parameter *SerEncode* determines the coding procedure on the X.21-interface. It can be selected between the values NRZ or NRZI. **NRZ** is for **No Return zero** and **NRZI** for **NO Return zero Inverted**.

Authorization Level: 2

Preset value: NRZ

Scope: NRZ, NRZI

SerControl

Determines whether the external control signal is analyzed (`SerControl normal`) on the synchronous serial interface (e.g. C with X.21) or whether the signal is set internally by the WIMAN device (`SerControl internal`). Latter adjustment is particularly necessary with the application of 10paired (10x2) data cables (between hybrid cables 2 and 3), since the C-line of the DTE is not been transferred here.

Authorization Level: 2

Preset value: Normal

Scope: Normal, Intern

2.5.4 Network-Parameter

IPDefaultGW

The parameter *IPDefaultGW* determines, to which IP address IP packages are to be sent, whose target is not situated in the configured local area network and thus is not known in this network

Authorization Level: 2

Preset value: 0.0.0.0

Scope: valid IP-address

IPEthAddress

The parameter *IPEthAddress* determines the IP address, which is bound to the Ethernet interface (an IP address from the local area network).

Authorization Level: 2

Preset value: 0.0.0.0

Scope: valid IP-address

IPEthMask

The parameter *IPEthMask* determines the subnet-mask for the IP network bound to the Ethernet interface.

Authorization Level: 2

Preset: 0.0.0.0

Scope: valid IP-subnet-mask

IPSerAddress

The parameter *IPSerAddress* determines the IP address, which is bound to the X.21-interface (an IP address from the local area network).

Authorization Level: 1

Preset value: 0.0.0.0

Scope: valid IP-address

IPSerMask

The parameters *IPSerMask* determines the subnet-mask for the IP network bound to the X.21-interface.

Authorization Level: 1

Preset value: 0.0.0.0

Scope: valid IP-subnet-mask

IPWLAddress

The parameter *IPWLAddress* determines the IP address, which is bound to the wireless interface (an IP address from the local area network). This parameter is not available on STAR devices.

Authorization Level: 1

Preset value: 0.0.0.0

Scope: valid IP-address

IPWLMask

The parameter *IPWLMask* determines the subnet-mask for the IP network bound to the wireless interface. This parameter is not available on STAR devices.

Authorization Level: 1

Preset value: 0.0.0.0

Scope: valid IP-subnet-mask

IPTFTPServer

The parameter *IPTFTPServer* indicates the IP address of a Server, from which a software download can be executed.

Authorization Level: 2

Preset value: 0.0.0.0

Scope: valid IP-address

2.5.5 Other Parameter

PS 1

The parameter *PS1* determines the appearance of the WIMAN command line prompt. The factory-installed setting is `WIMAN II >.` However, the user has the option to edit the command line prompt (e.g. `DEVICE 1:`).

Authorization Level: 2

SyncMode

The parameter *SyncMode* determines whether the WIMAN generates the Burst-synchronizing signal (master), or if it will receive an externally generated Burst signal (Slave). Further details to this parameter can be found in chapter 4.5 on page 53

Authorization Level: 2

Preset value: Off

Scope: Off, Master, Slave

2.6 Instructions

Issuing instructions on the command line level configure the WIMAN radio modem. The instructions available for use depend on the authorization level and the operating mode.

The instructions can be roughly divided into three categories:

- Instructions for the manipulation of passwords and authorization levels
- Instructions for manipulating and transferring configuration data
- General instructions

2.6.1 Instructions for the manipulation of Passwords and Authorization Levels

The following commands are available for the designation and modification of passwords:

Note

To execute instructions the device must be in configuration mode (see Chapter 3, page 33)

Passwd console

The instruction ***Passwd console*** permits the definition of a password for access to the first authorization level (console).

When selecting a password, be sure to use the designated characters only (see page 14). For instructions on how to set up a password for authorization level one, see Chapter 3.5.1, page 40.

Del Passwd console

The instruction *del Passwd console* deletes the password for authorization level one (console). For mor information see Chapter 3.5.2, page 41.

Passwd enable

The instruction *passwd enable* permits the designation of a password for access to authorization level two (Enable). When entering the password, be sure tu use the specified characters only (see page 14). For instructions on how to set up a password for authorization level two, please refer to Chapter 3.5.3, page 40.

Enable

The instruction ***Enabl***e enables you to switch from the instruction mode of the authorization level one into the command mode of the authorization level two (see page 25). To enter the authorization level two a password is always required.

2.6.2 Instructions for manipulating and transferring of Configuration Data

checkcfg

The instruction ***Checkcfg*** checks if all the parameters are valid and entered correctly. This instruction can only be issued in configuration mode.

Config

The instruction ***Config*** enables to change from the command mode of the respective authorization level into the configuration mode (see page 25). A successful transition into the configuration mode is displayed by the term *(config)* behind the command-line prompt and before the indication of the authorization levels (located in parentheses). The following example shows the factory-installed command-line prompt for authorization level two:

```
WIMAN II (config) #
```

Del Config

The command ***Del Config*** enables the factory-installed preset parameter-values to be transferred from the non-volatile configuration to the new configuration. All modifications entered before will be overwritten. This command can be given in configuration mode only.

Del <paraname>

The command ***Del*** < ***paraname*** > enables a transferring of the factory-installed preset parameter-value for the parameter defined in < ***parname*** > from the non-volatile configuration into the new configuration. All modifications of < ***parname*** > are overwritten with defined parameters. In contrast to the instruction ***Del Config,*** it is possible to overwrite directed parameters with the factory-installed defaults. This instruction can be issued in the configuration mode only.

Exit

The command ***exit*** enables you to leave the configuration mode or the command mode.

When leaving the **config mode** after having changed at least one parameter, you will be asked whether these modifications should be made the present configuration.

You now have the choice to:

- Make the modifications the present configuration and leave the config mode by entering ‘y’,
- Discard the modifications to the present configuration and leave the config-mode by entering ‘n’, or,
- stay in configuration mode and make the modifications only the new configuration by entering ‘c’.

When leaving the **command mode** after having changed at least one parameter (at least one parameter was modified in the configuration mode and the modification was made the present configuration), You will also be asked if these modifications are to be considered with the next restart (They will be transferred into the non-volatile configuration).

You now have the choice to:

- transfer the modifications to the non-volatile configuration and leave the command mode by entering ‘y’,
- discard all modifications made and leave the command mode by entering ‘n’ or
- stay in the command mode and keep the modification of the parameters exclusively as present configuration by entering ‘c’.

Note

Entering the command ***exit*** at the command line level (Shell) will always allow you to leave the command mode. This procedure ensures that modifications made in a higher authorization level are saved.

Export

The command ***Export*** makes it possible to export the configuration parameter values into an ACSII-file. The Serial number of the WIMAN as well as the encrypted passwords are put out, too. The range of the parameter values depends on the authorization level in which you are when issuing this command. At the end of the configuration file, the passwords for the individual authorization levels are exported in encoded form, excluding the passwords for the authorization levels you have no access to. Figure 6 shows a possible configuration file.

```
#
## WIMAN II configuration file, Version 1.3 (serial number -2122317789)
#

# Air
Destination                          1
TempTest                         False
MaxClients                           5
NetId                              255
NodeId                               0

# Serial
ConBaudrate                       9600
ConPageSize                         20
PSI                             wiman11

passwd console crypt  AvhBscXklqnk66A
```

Figure 6 exported configuration file

<parname> <value>

The instruction <***parname***> <***value***> enables you to occupy the defined parameter <***parname***> with the defined value <***value***>. This is the "classic" command for adapting the WIMAN to your specific requirements. This instruction can be executed in configuration mode only!

Save

The instruction ***save*** transfers the present configuration into the non-volatile configuration. This instruction can be issued only in the command mode.

Restore

The instruction *Restore* enables a transferring of the parameter-values from the non-volatile configuration into the new configuration. All modifications completed before are overwritten. This instruction can be issued in the configuration mode only.

Attention:

Since the parameter-values of the non-volatile configuration do not have to correspond with the values of the present configuration, an operational disturbance can occur. This can happen due

to a false configuration when leaving the configuration mode with simultaneous transfer of the data into the present configuration (the query when leaving the config mode was acknowledged with ***y***).

Before storing of the data into the present configuration, be sure that the parameters are occupied with the values necessary for your configuration.

2.6.3 General instructions

Help

The instruction ***Help*** displays a summarized list of instructions. The output on the command line level appears as follows:

```
WIMAN_Star # help
WIMAN II Wireless Data Communication Equipment
(c) 1999-2000 ALTVATER AIRDATA Systems GmbH & Co. KG, Bad Rappenau Germany

Built-In shell commands:
 config             - enter config mode
 clear              - clears a VT 100 screen
 clear stat <type>  - clears the statistic <type>
 exit               - exit configuration shell
 export             - export configuration
 help               - display these few helpful help lines
 reset              - reset unit
 save               - save running config to boot config
 show               - display running config and differences to boot config
 show <regex>         - display parameter(s) matching <regex>
 stat <type>          - display statistic information of <type>
 swupdate <swlst>     - get software update list <swlst> from TFTP Server

How to use command line editing, the shell history function and
the syntax of a valid <regexp>, please see the user's manual.
```

Figure 7 Help display output

<parname>

The input of a valid parameter name alone leads to textual information available for this parameter. The admissible scope for this parameter is displayed and the factory-installed preset value are displayed, too.

clear

The command CLEAR deletes the display on the command line level of the respective terminal program (e.g. Telix or telnet window).

reset

The instruction ***rese***t restarts the WIMAN (Hardware reset).

2.6.4 Statistics Instructions

The WIMAN radio modem collects statistics data and system information on both software and hardware as. In case of an error, a very exact search for the cause of the error is possible with the help of the statistics explained below.

Stat

The command ***Stat*** displays a list of the available statistics. The display output appears as follows:

```
WIMAN_Star # stat
The following statistics are available:

serial     - serial interface statistics
eth        - ethernet interface statistics
fr         - common frame relay information
fr<dlci>   - traffic on frame relay <dlci>
frmap      - show dlci switching map
wl         - common wireless interface information
wl<n>      - traffic on wireless interface node <n>
qos<n>     - actual quality of services wireless interface <n>
ipif       - IP interfaces
iproute    - IP routing table
tp         - transparent interface statistics
sync       - RF and external synchronisation
hw         - hardware statistics
sw         - software statistics
update     - software update statistics
sysmsg     - system messages
syserr     - system errors
date       - actual date and time
```

Figure 8 the statistics assistance display

Stat <type>

The instruction *Stat <type>* displays the statistics specified with *<type>*. The following statistics can be selected:

- serial

  supplies statistics of all serial interfaces

- fr

  supplies general Frame Relay information

- fr<dlci>

  supplies information of a certain Frame Relay channel (DLCI)

- wl

  supplies general information of the wireless interface

- wl<node>

  supplies information about the data communication to a certain WIMAN ACCESS selected with ***NodeId***

- qos<n>

  Quality of service. Supplies performance information about the grade of transmission

- sync

  supplies information about the synchronization status of the WIMAN.

- sysmsg

  supplies a list with system messages

- syserr

  supplies the system error list

- hw

  supplies a list with hardware statistics

- sw

  supplies a list of software statistics

- tp

  supplies traffic information for the wireless hardware driver

- lbt

  listen before talking

- con

  supplies login-information about the wireless connection

- eth

  supplies information about the ethernet connection

- date

  supplies information about the time and date

- update

  supplies information about the status of a TFTP-update

The parameters *serial*, *fr*, *wl* and *qos* can supply extended information by adding the switch <*ext*> to the instruction, e.g. *stat wl1 ext.*

By adding the switch *cont=<x>* you can achieve continuous output. The <x> gives the amount in seconds how fast the update-interval of the output shall be. This function is especially useful when performing a looptest, e.g. *stat qos1 cont=2* displays information about the Quality of Service on the wireless interface 1 in continuous mode. The display is updated every 2 seconds.

Clear stat <type>

The instruction *Clear stat* <*type*> sets the counter statistics-display of the device specified with <*type*> back to zero. The setting of <*type*> to *ALL* clears all statistics.

3 Configuration of the WIMAN radio modem

To adjust the WIMAN to your specific network needs it is necessary to modify some of the factory-installed preset parameters. This modification of the WIMAN can be executed via three different types of interfaces:

- the wireless interface
- the RS-232-interface
- the X.21-interface.

Access to the command line level via the serial RS-232-interface can take place with the help of a terminal program without previous configuration of the WIMAN. The access to the command line level via the wireless interface and the X.21-interface requires a previous configuration of the WIMAN.

3.1 Access to the Command Line Level over the Wireless Interface

To access the command line level over the wireless interface you have to use a TELNET-Program like NETTERM or the like. Just enter the correct IP-address of the WIMAN you want to administer and connect. You will receive the same display as if connecting via a serial cable.

The big advantage is that you can connect to any WIMAN, no matter where it is situated, and that you have the same functionality as when connecting directly via cable.

Checklist:

To access the WIMAN radio modem via the wireless-interface you need:

- A Terminal program (Telix, Hyperterm, etc.),
- A PC/Laptop with an online connection
- A properly configured WIMAN unit

3.2 Access to the Command Line Level over the RS-232 Interface

Checklist:

To access the WIMAN via the serial RS-232-interface you need:

- Terminal program (e.g. ZOC, TELIX),
- PC/Laptop with a free serial interface (e.g.. Com1, Com2)
- Hybrid cable (see chapter 8.3 on page 72)
- RS-232-connection cable with proper 9- or 25-pin plug/ socket, which fit to the plug/socket of the serial interface of the PC/Laptop as well as to the RS-232-interface of the hybrid cable.
- Power supply for the WIMAN (supplied with the WIMAN hardware)

Follow these steps to access the command line level of the WIMAN:

1. Connect the hybrid cable with the 37pin D-Sub connector at the backside of the WIMAN.
2. Connect one side of the RS-232 cable with the serial interface of the PC and the other side with the RS-232 link of the hybrid cable.
3. Connect the DIN plug of the power supply with the hybrid cable and the plug of the power supply with an AC socket.

   The illuminated power LED on the front of the WIMAN will indicate that the WIMAN is activated.

Figure 9 shows the arrangement of equipment for the configuration of the WIMAN radio modem.

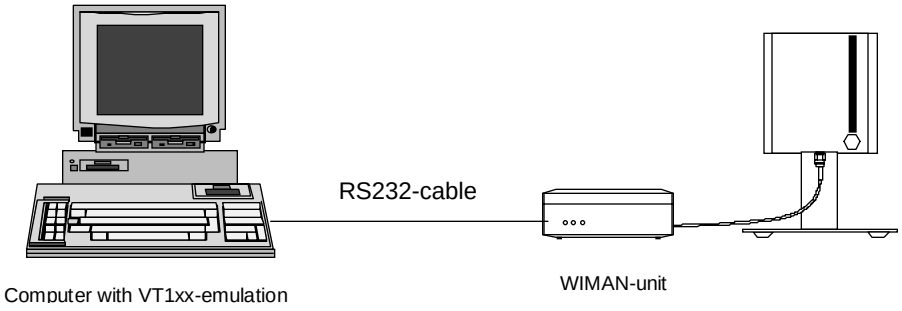


Figure 9 *arrangement of equipment for the configuration of the WIMAN radio modem*

4. Start the PC and afterwards the terminal program.

The operating system of the WIMAN has an integrated command line interpreter ("Shell") for configuration. Input and output is shown on the input/output window of the PC terminal program (e.g. TELIX, ZOC), which must be able to emulate a VT-terminal (DEC). The communication parameters of the terminal program and the WIMAN must correspond so that the WIMAN and the Computer can communicate.

Note:

The default settings of the RS-232-interface of the WIMAN is adjusted to a data rate of 9600 Bit/s, a data length of 8 data bits, one stop bit and no parity check (8N1). As handshaking procedure software handshaking is configured.

To ensure that the terminal program uses the same parameters, set the communication parameters of the terminal program to the values stated above. If these parameters were not set correctly communication with the WIMAN radio modem is not possible.

These values can be preset in the terminal program, thus starting the terminal program immediately with the suitable settings.

After the WIMAN is attached to the operating voltage, it switches itself into the transparent data-communication operating mode. Pressing the INPUT key in your terminal program brings you to the command line level of the WIMAN.

The command line prompt should appear as follows:

```
WIMAN II Configuration Shell (TTY connection)
WIMAN-II >
```

If the WIMAN is not configured to the factory-installed defaults, another command line prompt may appear. It is also possible that the first authorization level of the command line level is protected by a password.

If so, the following message appears:

```
WIMAN II Configuration Shell (TTY connection)
Enter password:
```

In this case you need the password of the supplier of the WIMAN. If the password should not be available, please contact your WIMAN Distributor.

Note:

If you do not arrive at the command line level of the WIMAN or if only “confused” characters are shown on the screen after you have adjusted the above mentioned settings, do not be concerned. It may be that the configuration of the WIMAN has already been modified. In this case test different adjustments regarding the Baud-rate, the Stop-bits, etc.

3.3 Access to the command line prompt via the X.21-interface

Will be created later

3.4 Setting of the Parameters of the Differnt Interfaces

3.4.1 Setting of the Parameters for the Wireless Interface

The settings of the parameters for the wireless interface can be divided into the following two categories:

- base parameter and
- extended parameters.

The base parameters ***destination*** (see page 17), ***LoopTest*** (see page 19), ***NetId*** (see to page 19) and ***NodeId*** (see page 19) can be modified already in authorization level one (e.g. by the final customer).

The extended parameters (all remaining parameters in section 2, on page 38) can only be modified in authorization level two.

To set the base parameters for the wireless interface:

Checklist:

You need the values of the parameters ***destination*** *(only LINE)*, ***NetId*** and ***NodeId***. To obtain these values please check with your Provider.

1. Access the command line level of the authorization level one (see chapter 2) and change into the configuration mode by entering the ***config*** -command. You will receive a similar display output (depending on the prompt configured) like:

```
WIMAN-II (config) >
```

2. Type in the command ***show***.

   You will receive a list of the changeable parameters in authorization level one e.g. in the following display output:

```
WIMAN_Star (config) > show
Config mode                 running config (   new config)

# Wireless
NetId                                  250
NodeId                                   0

# Serial
SerBaudrate                        2048000

# Console
ConBaudrate                           9600

# Network
IPSerAddress                   192.168.40.2
IPSerMask                  255.255.255.224
```

   All changeable parameters for the wireless interface are listed under the category "#Wireless".

3. Modify the parameters according to the specifications of your Provider. Type in the parameter, followed by a blank, next add the value of the parameter and press **ENTER**.

```
NetID 255 ↵
NodeId 2 ↵
```

4. Check with ***checkcfg*** whether all values for the parameters were input correctly. If the inputs were correct, you will receive the following display output:

```
WIMAN-II (config) > checkcfg
parameter check successful
```

   In case of an incorrect input you receive an error message with output of the accepted parameter e.g.:

```
wimanii (config) > checkcfg
bad value: NodeId
configuration invalid
```

5. Type in the instruction ***show*** again to compare the input values with the values given by your Provider. The new configuration of the parameter is displayed in parentheses.

```
Access_01 (config) > show
Config mode             running config (      new config)

# Wireless
NetId                              250 (              255)
NodeId                               1 (                2)
```

6. In order to transfer the modifications into the current configuration leave the configuration mode with ***exit*** (see page 27).

   The following display output appears::

   ```
   Configuration changed, do you want to save (y)es
   / (n)o / (c)ancel ?
   ```

   You now have the choice to do one of the following:

- Transfer the new configuration to the current configuration and to leave the configuration mode by pressing the key " y,
- Leave the configuration mode without transferring the new configuration to the current configuration by pressing the key " n "
- Remain in the configuration mode and repeat the configuration or do another modification of parameters (if necessary) by pressing the key " c ".

In order to maintain the values after a restart it is necessary to store them in the non-volatile configuration. This can be done in two ways:

- With input of the command ***save*** (see page 28) in the command mode.

  All modifications made at this configuration are stored in the non-volatile configuration and are available after a restart.

  The command-mode will not be left.

- With input of the command ***exit*** (see page 17) in the command mode.

  When leaving the command mode the WIMAN radio modem checks whether the present configuration modifications are available for non-volatile configuration. Since you made some modifications the following display output appears:

  ```
  Boot config differs from running config, save
  (y)es / (n)o / (c)ancel ?
  ```

  You now have the choice to do one of the following:

- Transfer the modifications to the non volatile configuration and to leave the command mode by pressing the key "y",
- Discard the modifications and leave the command mode by pressing the key “n“ or
- Don’t take over the modifications but stay in command mode and redo some modifications by pressing the key “c”

To set up the extended parameters for the wireless interface:

Attention:

In order to avoid disturbances in the current line operation, only qualified personnel in arrangment with the Provider may carry out these modifications.

Checklist:

You need a list of the parameters configured by your Provider.

1. Access the command line level of the authorization level two (see chapter 2 on page 13) and change into the configuration mode with the command ***config***.
2. Proceed as shown under point 2. during *adjustment of the base parameters* and replace thereby the term " authorization level one " with " authorization level two ".

3.4.2 Setup of the Parameter of the serial interfaces

The adjustments of the parameters for the serial interfaces can basically be divided into the following two categories:

- Basic parameter and
- extended parameter.

The only base parameter that can already be modified in authorization level one (e.g. of the final customer) is ***ConBaudrate*** (see page 21).

All other parameters (see chapter 2 starting from page 13) may exclusively be modified in authorization level two.

To set the parameters of the serial interfaces:

Proceed as shown in Chapter 3.4.1 on page 36

3.4.3 Setup of the network parameter

The setting of the network parameters can exclusively be executed in the authorization level two. You will find the definitions of the individual parameters in chapter 2 starting on page 23.

To setup the network parameter:

Attention:

In order to avoid disturbances of the current line operation, only qualified personnel in arrangement with the Provider may execute these adjustments.

Checklist:

You need a list of the parameters that can be configured of your Provider.

Proceed as shown in Chapter 3.4.1 on page 36

3.4.4 Setup of the other parameters

The only other parameters are *PS1* and *SyncMode* (see page 25).

Note:

In order to avoid disturbances of the current line operation, only qualified personnel in arrangement with the Provider may execute these adjustments.

Proceed as shown in Chapter 3.4.1 on page 36

3.5 Modification of the WIMAN Passwords

This section deals with the configuration of the passwords of the WIMAN radio modem. Before you alter the factory-installed preset passwords make sure to jot down the new passwords and store them in a safe place.

3.5.1 Setting of a Password for the Authorization Level one (console)

To change/set a password for the authorization level one:

1. Access the command line level one. If the command line prompt appears (for example: `WIMAN II >`), proceed to No.2.

   If you are asked for a password, e.g.:

   ```
   Enter password: ****
   ```

   Type in the correct password and press the ENTER-key. Now the command line prompt should appear, for example:

   ```
   WIMAN-II > _
   ```

Information:

The following instructions can be issued likewise from all higher authorization levels.

2. Change from the command mode of the authorization level one (indicated by the character " > " at the end of the command line prompt) into configuration mode by entering the command ***config***.

   The command prompt of the configuration-mode appears:

   ```
   WIMAN-II (config) >
   ```

3. Type in the command ***passwd console*** and press **ENTER**.

   You are now asked to type in a password:

```
Enter password:
```

4. Type in the new password.

Note:

Keep in mind that the password is case-sensitive

If a password is already set it will be overwritten.

Each entered character is shown as a „*“ on the screen.

The new password is saved in the new configuration and is not yet active.

5. Type in ***exit*** and leave the configuration mode (see page 27).
6. Proceed as shown in chapter 3.4.1 on page 36.

3.5.2 To delete a Password for the Authorization Level one

To delete a password for authorization level one:

1. Access the command line prompt of the authorization level one.

   The display will show the following:

   ```
   Enter password: ****
   ```

   Type in the required password. Remember that passwords are case-sensitive.

   The command-line prompt appears, for example:

   ```
   WIMAN II >
   ```

Information:

The following instruction can be issued likewise from all higher authorization levels.

2. Change from the command mode of authorization level one (indicated by the character " > " at the end of the command line prompt) into the configuration mode by input of the command ***config***.

   The command prompt of the configuration-mode appears:

   ```
   WIMAN-II (config) >
   ```

3. Type in the command ***del passwd console*** and press **ENTER**.

   The former password is now deleted in the new configuration.

4. Leave the configuration mode by entering the command ***exit*** (see page 17).
5. Proceed as shown in chapter 3.4.1 on page 36.

3.5.3 Setting of a Password for Authorization Level two (Enable)

A password for authorization level two is always required. However, it can be changed to suit the requirements of the Provider.

To change the password for authorization level two proceed as follows:

1. Access the command line prompt of authorization level two:
   a) Access authorization level one (See chapter 3.5.1on page 40)
   b) Enter the command ***enable***.
   As a password is always required, you need to enter the correct password

   ```
   Enter password: ****
   ```

   Type in the correct password (pay attention to upper- and lowercase characters) and press ENTER.

   c) The command line prompt appears, e.g.:
   `WIMAN-II #`

   Proceed with No. 2.

   Direct entrance over the password-protected command line level of authorization levels one and two:

   When accessing the command line prompt of authorization level one the following prompt will appear::

   ```
   Enter password: ****
   ```

   Enter the password for the authorization level two (pay attention to upper- and lowercase characters).

   The command line prompt should appear, e.g.:

   ```
   WIMAN-II #
   ```

2. Change from the command mode of authorization level two (indicated by the „#“- sign at the end of the command line prompt) into the configuration-mode by entering the command ***config***.

   The command line prompt may look as follows:

   ```
   WIMAN-II (config) #
   ```

3. Enter the command ***passwd enable*** and press **ENTER**.

4. You are now asked for entering a password:

   ```
   Enter password:
   ```

5. Enter the password.

Note:

Please note that passwords are case-sensitive.

Each typed-in character will be shown on the screen as a „*“. The already existing password will be overwritten.

The entered password will be stored in the new configuration but is not set active yet.

6. Leave the configuration mode by entering the command ***exit*** (see page 17).
7. Proceed as shown in chapter 3.4.1 on page 36.

3.5.4 Deletion of a password of the authorization level two (Enable)

A password for authorization level two (Enable-mode) is always required and cannot be deleted. However, it can only be changed (see 3.5.3, on page 42)

4 Hardware Installation

4.1 Installation instructions for the WIMAN Access-radio modem

The following sections deal with the installation of a WIMAN ACCESS radio modem on a single PC containing the operating system Windows.

Linking to a LAN requires an experienced network administrator. The method of installation depends strongly on the type of LAN

4.1.1 Setup of the WIMAN radio modem with Indoor-Set

A reception test must be successfully completed for accurate set-up (see chapter 5, on page 55)

Checklist:

You will need the following equipment:

- PC/laptop with 10 Mbit/s Ethernet Network interface card (TP-RJ-45-interface) and an available COM port,
- Frame Relay router with X.21 and Ethernet interfaces (inclusive X.21-link cable),
- Crossover cable with RJ-45-interface,
- Hybrid-cable type H1-X21C-37,
- WIMAN radio modem and indoor set.

It is advisable to execute the setup of the indoor installation in following order:

1. Install the antenna to the base foot and connect the antenna lead to the antenna.
2. Connect the antenna cable and the Hybrid-cable to the WIMAN.
3. Connect the X.21-cable of the Router to the Hybrid-cable and the crossover cable with the network card of the computer.
4. Connect the power cable of the WIMAN with the included 24V power supply. Connect the power supply of the Router.

Note:

There is no power switch on the WIMAN. The connection is successful when the operational status indicator on the front side of the WIMAN lights up green.

5. Connect the RS-232-interface to the computer interface. If you use the serial interface of a PC or Notebook, please refer to the configuration specified in Chapter 3 on page 33.

As soon as it is attached to the power supply, the WIMAN ACCESS begins to boot and starts to search for the proper WIMAN STAR. When the synchronization signal is received, the Status LED begins to light up green.

If the status indication does not light up, no data can be transmitted or received.

If this occurs, separate the WIMAN from the power supply and then reattach it. If the status indicator still does not light up, please consult your Internet Provider for support.

4.1.2 Setup of the Outdoor-Set

4.1.3 Required material

Checklist:

The following material should be supplied from your Distributor:

- WIMAN radio modem,
- WIMAN power supply,
- Router (optionally),
- 25 pin loop-back cable
- Outdoor Set consisting of:
  - Outdoor-box with security clips,
  - Planar Antenna,
  - Antenna cable, 50cm,
- X21-Hybrid-cable-set consisting of:
  - Hybrid-cable, type 2,
  - Hybrid-cable, type 3,
  - Socket 25pin and housing (2x each),
- Data cable, 12pin, length depending on installation,

- WIMAN outdoor mounting set. The following three types are available:

- J-shaped wall attachment set,
- Roof pan attachment set,
- Wall attachment set with aluminum mast,

Additionally the following tools and utensils are needed:

- PC-Laptop,
- Voltmeter,
- Phillips- and flat edge screwdrivers,
- Flat-nose pliers and/or wrench,
- Fixing bolts, wearing parts and pegs,
- Insulating tape and cable strap,
- Ladder,
- Soldering irons and tin solder,
- Side cutters,
- Stripping pliers (recommended),
- Tweezers (recommended),

4.1.4 Find a suitable place for the outdoor-set

Before you can begin with the installation you must find a suitable place for the outdoor set.

Try to choose a place on the rooftop where there is a visible line of sight to the central radio tower. Consider the following:

- For best results, the antenna on the outdoor housing should directly face the receiving station (line of sight).
- Trees, plants, other buildings, walls, etc. can prevent a clear line of sight.
- Determine the shortest path for the data cable. The maximum length of the data cable may not exceed 300ft.
- For installation, choose a discreet place that is not directly noticeable from the ground. However, aesthetic views are secondary in respect to a proper operation of the WIMAN.
- Be sure that no other antenna systems operating in the 2,4 GHz ISM band are installed at the selected installation point. If such an antenna system is installed there, contact your WIMAN Distributor.

- Be sure to discuss the details of installation with the customer in respect to the local construction and homeowner regulations.

4.1.5 First Reception Test

This first reception test serves to determine if the optimum field strength can be obtained from the installation place and adjustment of the WIMAN outdoor sets.

Further information about reception tests can be found in chapter 5 on page 55.

4.1.6 Installation of the Attachment Set and the Outdoor Housing

To set up the outdoor housing:

1. Assemble the outdoor housing.
2. Attach the antenna to the outdoor box with the plug facing down.
3. Loosen the four screws on the front of the outdoor housing and remove the cover.
4. Loosen the four fixing bolts for the WIMAN mounting plate on the inside and remove it.
5. Place the WIMAN inside the housing with the LEDs facing upwards and the backside (with the connector) towards the opening of the housing.
6. Lead a cable strap through the two holes in the mounting plate (the cable strap later serves for the attachment of the hybrid cable of the type 3).
7. Secure the mounting plate above the WIMAN.
8. Connect the appropriate ends of the hybrid cable of the type 3 with the 37Pin Sub-D-interface and to the current supply link.
9. Place the excess cable in the space between the WIMAN and the outdoor housing in such a way that the 25pin plug connector is hanging over the front the mounting plate.
10. Connect the data cable with the hybrid cable and secure the plug connectors with the cable strap. To ensure positive connection at all times, install 2 hex nuts between the connectors.
11. Use the screws, wearing parts and pegs to install the appropriate attachment set onto the roof or at the wall.

- Use the j-shaped wall mount if you are installing the WIMAN on the side of the building directly facing the radio tower.

Use the aluminum mast mounting kit if you are installing the WIMAN not facing the radio tower directly due to an obstacle (e.g. rear side of a wall etc.).

Use the tile roof mounting set if you are installing the WIMAN to a roof with roofing tiles.

4.1.7 Second Reception Test

Perform a second reception test to ensure that the selected place of installation and the selected adjustments offer a sufficient radio reception.

Separate the current supply and the RS232-plug from the Hybrid-2-cable on the WIMAN radio modem.

Further information of the execution of a receipt test can be obtained in chapter 5 on page 55.

After the radio test is completed, reconnect the current supply and the RS232-plug to the Hybrid-2-cable on the WIMAN.

4.1.8 Installation of the data cable

With some installations, it is possible to use a prefabricated cable of desired length with two 25pin Sub-D plug connectors. However, this is not possible with most installations. If no prefabricated cable can to be used, it is advisable to attach a plug connector at one end of the cable prior to installation.

Lay the data cable from the outside inward. Make sure the end with the 25pin Sub-D connector is outside. It is substantially simpler to solder the second plug connector on in the internal area than in the external area.

Be sure that the data cable is sufficiently fixed to the mounting sets, the mast and to the wall.

Wind up all surplus cables and stow them away. Wind the cable up in one or two turns. This measure serves as additional lightning protection for the router.

4.1.9 Mounting of the DB25-plug interfaces at the inside end of the data cable

Solder the two 25pin plug connectors to the data cable according to the pin allocation plans specified in chapter 10.

4.1.10 Final reception test with installed data cable

The final reception test is necessary for two reasons: First to examine the assembly position of the WIMAN, second, and more importantly, to test the data link between the Router and the WIMAN.

You will find details to the reception tests in chapter 6 on page 58.

To perform the test, connect your Laptop to the RS232-interface at the Hybrid-cable type 2.

If there is no connection to the WIMAN or if the connection is unusually slow, follow the instructions specified below to locate the source of error.

1. Make sure that the terminal program is adjusted to the correct Baud rate (9600 Bit/s).
2. The power-LED lights up in green when sufficient operating voltage is supplied, and in orange if the WIMAN performs a looptest. If an internal error occurred the power LED lights up in red.
3. Make sure that the RS-232 cable and the power-supply are correctly connected at both ends of the data cable.
4. Double-check the solder joints and the pin-allocation inside the plugs of the data cable.
5. Check the hybrid cables by alternating them one at a time.

4.1.11 Check the statistics of the X.21-interface

To check the statistics of the X.21-interface you must first test the connections between the WIMAN and the Router.

To test the connections you must:

1. Ensure that Router is attached correctly and switched on.
2. Enter the instruction "*stat serial ext*".

   This instruction displays information to the data transmitted via the Serial-interface. The last line of the display-output should look as follows.

```
Line State:     Control (C): ON     Indication (I): ON
```

If “OFF” appears in either of the signals, a connection error has occurred. Follow the instructions given below to locate the source of the error:

1. Check the X.21-connections at both ends of the data cable for correct fit.

2. Double-check the solder joints and the pin-allocation inside the plugs of the data cable.
3. Check the hybrid cables by alternating them one at a time.

4.2 Installation of a WIMAN Star

4.2.1 Additional necessary components

Checklist:

In addition to the parts specified in Chapter 4.1.2, page 45, the following components are needed for the installation of a WIMAN STAR:

- Tower standoffs
- 1 WIMAN Access with Indoor-Set for testing purposes
- 1 Router for testing
- Configuration files for all radio modems

4.2.2 Preparation

To install a WIMAN star:

1. Label all WIMAN units according to the convention: XX-YYY-ZZZ.
   - XX = LM (Line Master), LS (Line Slave), SM (Star Multi-point), AS (Access)
   - YYY= NetId (0-255)
   - ZZZ = adjustment of the antenna (0 -359°) – towards north.
2. Install the WIMAN radio modem and Typ-3-Hybrid cable in the outdoor housings.
3. Label the remaining WIMAN utensils according to the convention indicated above. You should label:

- All data cables (upper and lower end)
- All small external housings (if used)
- All antennas on large external housings (if used)
- the radio modem designated as synchronization masters, with the additional designation "Sync master",

4.3 Installation at the Radio Tower

4.3.1 Installing the tower standoff at the radio mast

4.3.2 Installing the WIMAN hardware at the tower standoff

Attach the WIMAN hardware (external housing and antennas) to the tower standoff at the suitable positions and align. If a WIMAN is to take over the function of the synchronization-master and is not clocked from a remote location, always use the unit aligned to the north (0º) as the synchronization master.

4.3.3 Installation

Install all data cables. Connect the data cables with the Hybrid cables coming from the WIMAN radio modems.

Attention:

For correct function and error-free installation, be sure that the sync cable is installed before testing.

4.3.4 Start tests

Now test all installed components on correct function and installation. You find a specification of the tests in chapter 6 on page 58.

4.3.5 Checking the antenna adjustment

- Check to see that all antennas are facing the correct direction.
- Note the adjustments of all antennas.

4.3.6 Test all devices

- Make sure all devices on the radio tower are switched on and are connected to the synchronization cable.
- Test each WIMAN radio modem again (see chapter 6, page 58.) to make sure that there is no error caused by the synchronization cable.

4.3.7 Save all configuration data of the WIMAN radio modems at the radio tower

- Use the same name conventions used for the cables and WIMAN radio modems.
- Record the following information with a terminal program:
  - Parameter („show“-command)
  - Statistics („stat“-command)

4.4 Grounding

It is extremely important to ground all installed devices on the radio tower. This will reduce the amount of damage should lightning strike. The following steps will also help to reduce possible damage caused by lightning:

- Do not mount the WIMAN at the highest point of the radio tower. This is the point most likely to be struck by lightning.
- Check that the outdoor housing and the tower standoffs form a well-grounded metal-on-metal connection with the tower frame.
- Avoid using rubber washers or seals.
- Install lightning protection devices between the data cable and the hybrid-sets on both the top and bottom of the tower.
- Ground the data cable to the tower at (a minimum of) three different places. (1) to the center of the tower, (2) to the base of the tower where the cable bends (before the bridge from the tower to the shed) and (3) before the cable runs into the equipment shed. The best way to do this is to strip away the outer casing of the cable and affix a grounding clamp to the cable shielding, then connect this clamp to a second one which is fixed to the tower.
- Make sure that all equipment (Switches, Routers, etc.) at the base of the tower is properly grounded to the rack in which it is mounted. Also make sure that the rack itself is properly grounded.

4.5 Burst-Synchronisation

Burst-synchronization is the coordination process of frequency hopping tables, receipt, and points of transmitting time for several WIMAN networks within the same geographical area.

Burst-synchronization is achieved by both hardware and software items. The hardware item is a synchronization cable, which is only a wire, which connects the X.21-interfaces among themselves.

For the X.21 Interface, the synchronization cable is enclosed in the hybrid cable type 3. This is connected to further radio modems with additional cables and special T-connectors.

The software section for synchronization consists of the parameter SyncMode, which is to be entered in the basic configuration of a master or a Slave.

One master radio modem (STAR or LINE) is determined as synchronization master for all radio modems at that location. The synchronization master is adjusted as follows:

- SyncMode = Master

All further master radio modems should be adjusted as follows:

- SyncMode = Slave

4.6 Extended Point-to-Point Connections

An estendet Point-to-Point connection can be structured by arranging two WIMAN LINE “back-to-back”. For this application, additional hardware is necessary. Please contact your WIMAN supplier.

For an extended point-to-point connection the parameter SyncMode has to be set to the base WIMAN LINE configuration.

The example configurations specified below refer to an extended X.21 Point-to-Point-connection. In this structure, the WIMAN LINE Slave 1 is coupled to the WIMAN LINE Master 2.

***Line* Master 1**	***Line* Slave 1**
NetId = 1	NetId = 1
NodeId = 0	NodeId = 1
Destination = 1	Destination = 0
SyncMode = (according to local Network)	SyncMode = Master

Table 1 parameters of an extended point-to-point connection (connection 1)

***Line* Master 2**	***Line* Slave 2**
NetId = 2	NetId = 2
NodeId = 0	NodeId = 1
Destination = 1	Destination = 0
SyncMode = Slave	SyncMode = (according to local Network)

Table 2 parameter of an extended point-to-point connection (connection 2)

5 Reception quality and transmission speeds

For the examination of the receipt quality as well as to error detection, test loops can be generated. The type of test loop can be influenced by the configuration of the parameters L*oopData*, L*oopMode* and L*oopTest*.

The parameter *LoopData* enables the setting of the Byte-values that are to be generated (see page 18). This parameter can be produced on a WIMAN ACCESS only.

The parameter *LoopTest* enables a switching to a test loop, with which the data, which can be transmitted, is produced independently by the WIMAN radio modem (see page 19).

This test loop can already be activated in the lowest authorization level and is, in combination with the statistics analysis on the wireless interface, an outstanding inspection procedure for radio communication.

The parameter *LoopMode* determines, which bit pattern will be transferred with the back loop in the loop test operation from the WIMAN radio modem (see page 18)

Attention:

If the back loop test is execute in an operating radio net, avoid all values except ***normal.*** Use of any other value may result in loss of performance.

5.1 Configuration of a TestLoop with Independently Generated Data Communication

1. Access the command line level of authorization level one (see chapter 2 on page 13) and change into the configuration mode. You will see an output similar to:

   ```
   WIMAN-II (config) >
   ```

2. Type in the command ***looptest true***.

3. Check with ***show looptest*** the value for the parameter *Looptest*. This should now be switched to **true**. The following output appears:

   ```
   WIMAN-II (config) > show looptest
   LoopTest       false (        true)
   ```

   The present and the new configuration (in parentheses) of the parameter are displayed.

4. To take over the modifications into the current configuration leave the configuration mode by entering the command ***exit*** (see page 27).

   The following output appears:

   ```
   Configuration changed, do you want to save (y)es
   / (n)o / (c)ancel ?
   ```

   You now have the choice:

   - To transfer the new configuration into the current configuration and to leave the configuration mode by pressing the key „y“,
   - To discard the modification but to leave the configuration mode anyway by pressing the key „n“ or
   - To not take over the modification into the current configuration but to stay in configuration mode by pressing the key „c“.

   Press the „y“ key to activate the looptest. The modification of the parameter becomes part of the current configuration and the WIMAN starts transmitting bit samples.

5.2 Test after a Radio Tower Installation with Synchronisation

After all devices are correctly installed, a final test must be executed. This final test checks if all devices are installed correctly and whether a trouble free transmitting and receiving mode is possible.

- Switch on the first WIMAN radio modem. Always begin with the WIMAN determined as synchronization master.
- Radio test
  - If the synchronization Master is a WIMAN STAR or a WIMAN LINE Master, conduct a loop back test from a properly configured WIMAN ACCESS or LINE Slave.
  - It the synchronization Master is a LINE Slave, conduct a loop back test from its LINE Master.
- Check the X.21-interface by connecting the X.21-plug of the Hybrid cable type-2 to the Router.

- For the WIMAN STAR enter the commands „stat wl“ and „stat wl<nodeID>“ to ensure proper functioning of the data exchange.
- For the WIMAN LINE enter the command „stat sync“ to check the setting of both signals (both signals have to be set to „On“).

5.2.1 Continue the Tests

- Switch on the WIMAN radio modem next to the synchronization master.
- Switch off the synchronization master.
- Perform a reception test.
- Check the X.21-interface (see chapter X.21-Test above).
- Switch the synchronization master back on.
- Perform another reception test to make sure the synchronization cable does not produce any errors (the radio statistics should not differ substantially from the preceding ones).

5.2.2 Test the Remaining Modules

- Switch on the next WIMAN.
- Switch off all WIMAN radio modems that were tested before.
- Perform a reception test.
- Check the X.21-interface (see chapter X.21-Test above).
- Switch on all WIMAN units that were tested before.
- Connect the synchronization cable to the last tested WIMAN radio modem.
- Perform another reception test to make sure the synchronization cable does not produce any errors (the radio statistics should not differ substantially from the preceding ones).

5.3 Transmission Speeds

5.3.1 FTP-Download from an FTP-Server

The maximum transmission speed of the WIMAN radio modem at optimum conditions is about 25 … 30 Kbytes/s at 2FSK and about 55 … 62 Kbytes/s at 4FSK (depending on the extend of utilization of the network).

6 Frame Relay

6.1 Technical Description of the Frame of Relay Features

The WIMAN STAR supports the multiplexing of Frame Relay packages. In multiplexing procedure, the packages received from the Frame Relay Switches are transferred to the WIMAN ACCESS, which is connected to a Frame Relay Router at the user's site.

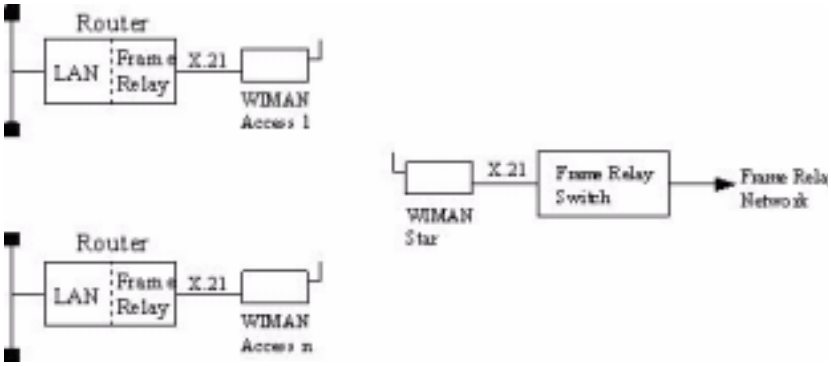


Figure 10 *Frame Relay connections with the WIMAN*

For addressing the WIMAN ACCESS the DLCI number (Data Link Connection Identifier) of the Frame of Relay protocol is used.

The following restrictions apply to the Frame Relay support:

- Only static connections are supported (PVC = Permanent Virtual Connection)
- DLCI numbers must be configured statically on the Frame Relay Switch and the Frame Relay Router
- 2-, 3- or 4- Byte-Frame Relay-address-arrays are supported,
- Since the WIMAN node address is embedded in the DLCI number (10-bit DLCI with implemented WIMAN node identifier), the DLCI allocation of numbers is reduced
- Up to four virtual connections are supported for each Frame Relay user
- Up to 250 Frame Relay users are supported at a WIMAN STAR (currently 9 users possible, Software Version T0.7).
- The following Frame of Relay features are not supported:

- LMI (Local Management Interface of ITU-T Q.933 or ANSI T1.617), since this procedure uses DLCI 1023 or DLCI 0,
- Establishing of connections for SVCs (uses DLCI 0),
- Multiple transmissions (uses DLCI 1019 ... 1022).

6.1.1 Frame Relay-Address array

2-Byte-Adress array

Table 3 shows the structure of the 2 Byte long Address array:

8	7	6	5	4	3	2	1
DLCI 10	DLCI 9	DLC I 8	DLCI 7	DLCI 6	DLCI 5	C/R	EA
DLCI 4	DLCI 3	DLCI 2	DLCI 1	FECN	BECN	DE	EA

Table 3 *Structure of the 2 Byte long address array*

Explanation:

- DLCI
  Data Link Connection Identifier
- C/R
  Command Response Bit
- EA
  Address Array Extension Bit
- FECN
  Forward Explicit Congestion Notification
- BECN
  Backward Explicit Congestion Notification
- DE
  Discard Eligibility Indicator

The node address of the WIMAN is determined by the high order-bits (DLCI 03...DLCI 10) of the DLCI number. The low order bits (DLCI 1...DLCI 2) are used for virtual connections.

DLCI value calculation

The LCI value for the Frame Relay Router of the user is calculated as follows:

$DLCI_m = 512 + NodeId * 4 + m$ m = [0 ... 3]

Table 4 lists the valid DLCI numbers for appropriate node identifiers (NodeId) on use of the 2-Byte-Frame of Relay address array.

WIMAN NodeId	DLCI array	Note
0	512 – 515	reserved (**WIMAN** *STAR*)
1	516 – 519	
2	520 – 523	
3	524 – 527	
4	528 – 531	
5	532 – 535	
6	536 – 539	
7	540 – 543	
8	544 – 547	
9	548 – 551	
10	552 – 555	
11	556 – 559	
12	560 – 563	
13	564 – 567	
14	568 – 571	
15	572 – 575	

Table 4 *NodeId with 2-Byte-Frame Relay address array*

Frame Relay-support of the WIMAN Software

In the following, the implementation of the Frame of Relay Protocol within the WIMAN software is listed briefly. Exclusively the static software-Version of the WIMAN STAR supports the Frame Relay Protocol with the following characteristics:

- The maximum size of the Frame Relay information field amounts to 4096 byte.
- The WIMAN star rejects Frame Relay framework with invalid DLCI number (transmitter and receiver).

6.1.2 DLCI-areas when the 2-Byte-Address array is used (ITU Q.922)

Table 5 lists the allocation of the DLCI numbers on use of the 2-Byte-address array.

DLCI-area	Meaning
0	Signalizing in the transmission channel, if necessary
1 – 15	Reserved
16 – 511	Network option: on not-D channels, usable for the support of user information
512 - 991	logical connecting identifier for the support of user information (the use of semi permanent connections can reduce the DLCI numbers available within this area)
992 - 1007	Layer 2-Management of Frame-transport services
1008	reserved
1023	Layer 2-Management in the transmission channel if necessary (only usable without d-channel)

Table 5 *DLCI allocation in connection with 2-Byte-address array*

DLCI Range	10	9	8	7	6	5	4	3	2	1
0	0	0	0	0	0	0	0	0	0	0
1 -	0	0	0	0	0	0	0	0	0	1
15	0	0	0	0	0	0	1	1	1	1
16 -	0	0	0	0	1	0	0	0	0	0
511	0	1	1	1	1	1	1	1	1	1
512 -	1	0	0	0	0	0	0	0	0	0
911	1	1	1	1	0	1	1	1	1	1
992 -	1	1	1	1	1	0	0	0	0	0
1007	1	1	1	1	1	0	1	1	1	1
1008 -	1	1	1	1	1	1	0	0	0	0
1022	1	1	1	1	1	1	1	1	1	0
1023	1	1	1	1	1	1	1	1	1	1

Table 6 *bit sequence for different DLCI identifiers*

6.2 Frame Relay-configuration samples

6.2.1 Sample configuration with CISCO-Routers

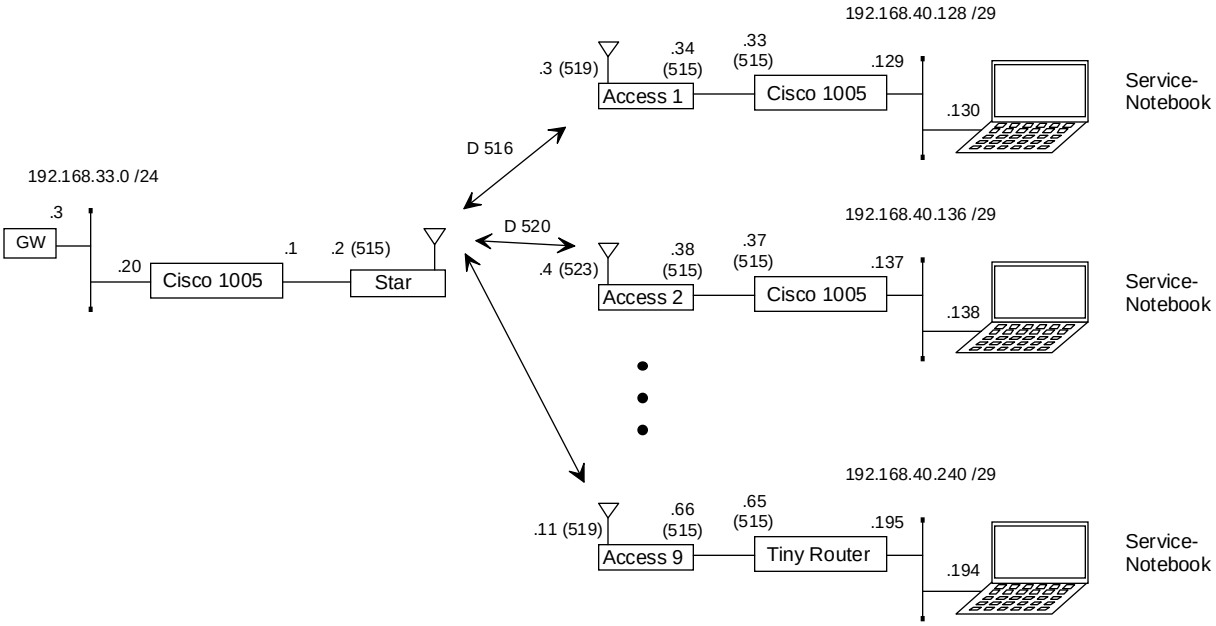


Figure 11 Simple WIMAN Network with CISCO-Router

CISCO1, connected to STAR unit:

```
! Configuration Cisco Star
!
no service password-encryption
no service udp-small-servers
no service tcp-small-servers
!
hostname Cisco_Master
!
enable password wiman
!
ip subnet-zero
!
interface Ethernet0
 ip address 192.168.33.20 255.255.255.0
!
interface Serial0
 no ip address
 encapsulation frame-relay IETF
 no keepalive
 no fair-queue
!
interface Serial0.1 multipoint
 ip address 192.168.40.1 255.255.255.224
 no arp frame-relay
 frame-relay map ip 192.168.40.2 515
 frame-relay map ip 192.168.40.3 519
 frame-relay map ip 192.168.40.4 523
 frame-relay map ip 192.168.40.5 527
```

```
 frame-relay map ip 192.168.40.6 531
 frame-relay map ip 192.168.40.7 535
 frame-relay map ip 192.168.40.8 539
 frame-relay map ip 192.168.40.9 543
 frame-relay map ip 192.168.40.10 547
 frame-relay map ip 192.168.40.11 551
!
interface Serial0.2 point-to-point
 ip unnumbered Ethernet0
 no arp frame-relay
 no cdp enable
 frame-relay interface-dlci 516
!
interface Serial0.3 point-to-point
 ip unnumbered Ethernet0
 no arp frame-relay
 no cdp enable
 frame-relay interface-dlci 520
!
interface Serial0.10 point-to-point
 ip unnumbered Ethernet0
 no arp frame-relay
 no cdp enable
 frame-relay interface-dlci 548
!
ip classless
ip route 0.0.0.0 0.0.0.0 192.168.33.3
ip route 192.168.40.32 255.255.255.252 Serial0.2
ip route 192.168.40.128 255.255.255.248 Serial0.2
ip route 192.168.40.36 255.255.255.252 Serial0.3
ip route 192.168.40.136 255.255.255.248 Serial0.3
ip route 192.168.40.64 255.255.255.252 Serial0.10
ip route 192.168.40.192 255.255.255.248 Serial0.10

!
line con 0
 exec-timeout 0 0
line vty 0 4
 exec-timeout 0 0
 password wiman
 login
!
end
```

CISCO2, connected to ACCESS01:

```
! Configuration Cisco Access 01
!
no service password-encryption
no service udp-small-servers
no service tcp-small-servers
!
hostname Cisco_Access_01
!
enable secret 5 $1$9xE0$1jVP/hVttHmwhWi/b1Dzv0
!
ip subnet-zero
!
interface Ethernet0
```

```
 ip address 192.168.40.129 255.255.255.248
!
interface Serial0
 no ip address
 encapsulation frame-relay IETF
 no keepalive
!
interface Serial0.1 point-to-point
 ip address 192.168.40.33 255.255.255.252
 no arp frame-relay
 no cdp enable
 frame-relay interface-dlci 515
!
interface Serial0.2 point-to-point
 ip unnumbered Ethernet0
 no arp frame-relay
 no cdp enable
 frame-relay interface-dlci 516
!
ip classless
ip route 0.0.0.0 0.0.0.0 Serial0.2
no cdp run
!
line con 0
 exec-timeout 0 0
line vty 0 4
 exec-timeout 0 0
 password wiman
 login
!
end
```

Configuration STAR:

```
## WIMAN II configuration file
#
# Air
Antenna                              8mn360
MaxNodeId                                 1
MaxRetry                                  9
NetId                                   250
RadioPower                           Normal

# Serial
ConBaudrate                            9600
ConDataBit                                8
ConHandShake                           Soft
ConPageSize                              24
ConParity                              None
ConStopBit                                1
PS1                                WIMAN_Star
SerBaudrate                           2048000
SerCRC                                   16
SerEncode                               NRZ

# Network
IPDefaultGW                     192.168.40.1
IPEthAddress                         0.0.0.0
IPEthMask                     255.255.255.0
```

```
IPSerAddress                  192.168.40.2
IPSerMask                   255.255.255.224
IPTFTPServer                 192.168.33.178
Location                            Area_01

# Sync
SyncMode                             Off

passwd enable crypt        Av/WbhGC.i1HA3E
```

Configuration ACCESS01:

```
## WIMAN II configuration file
#
# Air
Antenna                           8mn360
LoopData                              FF
LoopMode                            Long
LoopTest                           False
MaxRetry                               9
NetId                                250
NodeId                                 1
RadioPower                        Normal

# Serial
ConBaudrate                        9600
ConDataBit                            8
ConHandShake                       Soft
ConPageSize                          24
ConParity                          None
ConStopBit                             1
SerBaudrate                      2048000
SerCRC                                16
SerEncode                            NRZ

# Network
IPDefaultGW                  192.168.40.1
IPEthAddress                       0.0.0.0
IPEthMask                  255.255.255.0
IPSerAddress                192.168.40.34
IPSerMask                 255.255.255.252
IPTFTPServer                 192.168.33.178
IPWLAddress                   192.168.40.3
IPWLMask                  255.255.255.224
Location                          Area_1

# Sync
SyncMode                         Master

passwd enable crypt        Av/WbhGC.i1HA3E
```

7 Troubleshooting

7.1 Techniques and Methodologies Used for Troubleshooting

7.1.1 General Problems

This section lists some common problems that may occur and cause a malfunction in the WIMAN system:

Bad RF-Link between STAR (Master) and ACCESS (Slave):

- STAR units are not synchronized → see ***stat sync***
- Bad hardware on the STAR or the ACCESS

- Check RF statistics from the STAR to other ACCESS devices → see ***stat wl ext***

  If all other connections are functioning properly, STAR is not defective.

- If the star is working correctly consider the following questions:

- Is the ACCESS device configured correctly (correct STAR, correct sector)?
- Are there any obstacles between the STAR and the ACCESS?
- Is the antenna cable attached correctly?
- Is the antenna adjustment correctly?
- Is the ACCESS device itself defective (defective transmitting or receiving part)? → If so, exchange the device.
- Are two ACCESS devices within a network configured with the same NodeID? Check the ACCESS configuration, the network configuration and the documentation of the other ACCESS radio modems within in the same network.

No data communication from the STAR to the ACCESS:

- Check the radio connection between the ACCESS and the STAR.
- Check the wiring of the STAR and ACCESS

- Check the other radio modems attached to this STAR

  If data can be transmitted to the other ACCESS devices then the wiring at the STAR is OK.

If you are still uncertain whether there is a problem with the wiring of the STAR, proceed as follows:

Check the statistics with the commands ***stat serial ext*** and ***stat wl<NodeID>.*** If you transmit a Ping, the Rx and Tx-counter should be increased.

Check whether the data cable is wired according to the specifications shown in chapter 10, page 82.

Check all modules for correct wiring.

Check the hybrid cables.

Check the interface converters.

Check the cross over cables.

- Check the wiring on the ACCESS:

Check the statistics with the commands ***stat serial ext*** (see page 49) at the ACCESS-side. If you transmit a Ping, the Rx and Tx-counters should increase.

Check whether the data cable is wired according to the specifications shown in chapter 10 on page 82.

Check the wiring of all modules.

Check the hybrid cables.

Check the routing tables.

- With the instruction ***stat hw*** compare the serial number entered in the device table (peer-table) with the actual serial number of the device. If the serial number does not match, all data packages will be discarded. Enter the following to delete an existing entry in the device table:

```
PEER <NodeID> <ENTER>
```

Afterwards reset the device.

- Check whether the looptest at the ACCESS radio modem is still active (***show looptest***). The Parameter „LoopTest“ must be set to „false“.
- Defective Router at the customer side:
- Check the configuration
- Check the Hardware
- PVC
- PVC was built on the wrong port
- PVC was built with wrong DLCI (according to the appropriate NodeID of the ACCESS)
- Routing tables

- Bad port on the switch

- Check other customers who are attached to the same STAR

- In case no further customers are attached to the same STAR, try attaching the device to another port.

WIMAN Baud rate parameters are not adjusted correctly:

If the WIMAN radio modem does not interface with the terminal program, the Baud rate may be set incorrectly on the WIMAN and/or the terminal program.

Frequency table adjusted incorrectly

If the WIMAN Slave cannot construct synchronized connections and you are using generated frequency tables, check that the parameter "***FtabMode***" is adjusted to "***user***". Make sure that all parameters are configured correctly.

Parameter *destination* not adjusted correctly (LINE only)

This situation cannot occur after a loop test. If the Socket program cannot structure a connection, check the network and ensure that all parameters "***destination***" are set to the correct value.

Baud rate in the Socket program not set correctly

If the Socket program cannot construct a connection, it could be that the Baud rate is set incorrectly on the Socket program and/or the WIMAN.

Parameter *NodeID* not set correctly

If an ACCESS radio modem receives synchronization impulses, but no data can be transmitted, it could be that the parameter *NodeID* is adjusted incorrectly. The double assignment of a node number in the same network leads to malfunctioning.

Serial number does not correspond with the device table (Peertable)

If the WIMAN STAR is adjusted to a serial number that differs from the one used in the Peertable, malfunction may occur.

IP-Parameter in the Socket-program not set properly

If the Socket program over the ACCESS radio modem cannot construct a connection, check whether all IP parameters are adjusted correctly.

Damaged or defective antenna cable
Damaged or defective synchronization cable

Any of these problems may lead to poor or no radio communication. Check the antenna cables for damages. If there are no damages, check the synchronization connection. If the problem persists, the WIMAN may need to be replaced.

7.1.2 Troubleshooting with Radio Tower Installations

- If the WIMAN radio modem can not be accessed over the RS-232-interface, the problem may be caused by:
  - A non-corresponding Baud rate of the terminal program and the WIMAN (usually the Baud rate is adjusted to 9600 Baud)
  - Incorrectly attached cables
  - Faulty Hybrid-2 or Hybrid-3-cables. Exchange the Hybrid-2-cable first and then the Hybrid-3-cable (if necessary).
  - Faulty contacts inside the data cable plug. Check the configuration and transmission with an extra 25pin data cable.
- In case the ACCESS can get no RF-synchronization signal (indicated by the Status-LED at the front side of the unit) or if the synchronization signal reception is periodically interrupted, the problem may be caused by:
  - Incorrect configuration of the ACCESS or STAR. Check whether all parameters are correct.
  - The operating voltage at the star radio modem is too low. If the operating voltage at the WIMAN radio modem drops below the given threshold value, a restart is performed automatically. It is advisable to constantly apply a voltage at the radio modem by at least 12V.
  - Defective or unattached antenna cable,
  - A Faulty Hybrid-2 or Hybrid-3-cable. Replace the Hybrid-2-cable first and then the Hybrid-3-cable (if necessary).
  - Defective RF filters.
  - Defective WIMAN STAR or ACCESS.
  - Faulty contacts inside the data cable plug. Check for perfect configuration and transmission with an additional 25pin data cable.
  - Defective synchronization cable (short-circuit in the plug) of and to the testing device.
  - Defective T-connector (short-circuit)

8 Appendix A: WIMAN Hardware

!!!!!!!!!!Still being revised!!!!!!!!!!!!.

8.1 Technical description

Below you will find pictures of the WIMAN units:

Figure 12 *front side of the WIMAN radio modem*

Figure 13 *rear side of the WIMAN radio modem*

8.2 Antenna systems

Different antenna systems are available for the WIMAN radio modem:

- **Omni-directional** antennas with a gain of 2 dBi.

  These antennas are used typically for the installation of the WIMAN star or WIMAN Bridge stations.

  Dimensions: Length 120cm/4ft, diameter 5cm/2in

- **Planar array antennas** with an opening angle of 75° azimuth, 60° elevation and an antenna gain of 8,5 dBi.

  Another antenna type provides an opening angle of 27° azimuth and elevation and an antenna gain of 16dBi.

  These antennas were developed mainly for the application on the customer side in connection with the WIMAN ACCESS. In addition, they are suitable for point-to-point connections in connection with the WIMAN LINE.

  Dimensions:

  10cm x 10cm x 3cm /4in x 4in x 1.2in (8.5 dBi)

- **Paraflector antennas** with an opening angle of 7,5° azimuth and an antenna gain of 23 dBi.

  These antennas were developed particularly for point-to-point connections over a large distance

  Dimensions: 100cm x 60cm x 60cm/40in x 24in x 24in.

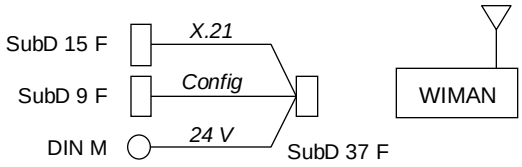
8.3 Hybrid-cable sets

Nachfolgend sind einige Anschlussbeispiele für die verschiedenen Hybridkabel aufgeführt. Eine genaue Beschreibung der einzelnen Hybridkabel ist in Kapitel 8.4 auf Seite 75 nachzulesen.

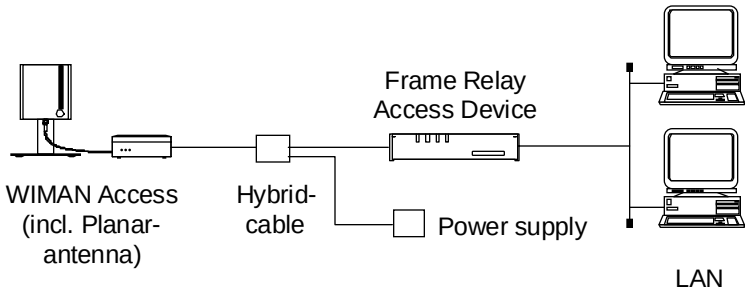
8.3.1 Standard Connection (Indoor) using Hybrid cable Type 1

Hybrid-cable Type 1 is only used when a WIMAN is directly connected to a Router (e.g. CISCO). This type of connection can be used for devices, which are in close range to the Router (In-door-Installation).

(H1-X21C-37)

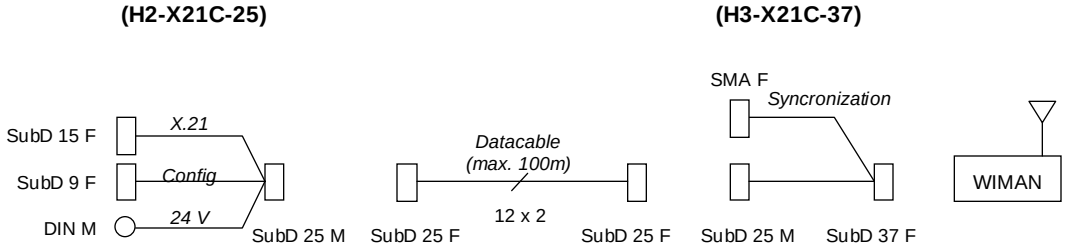


Sample:

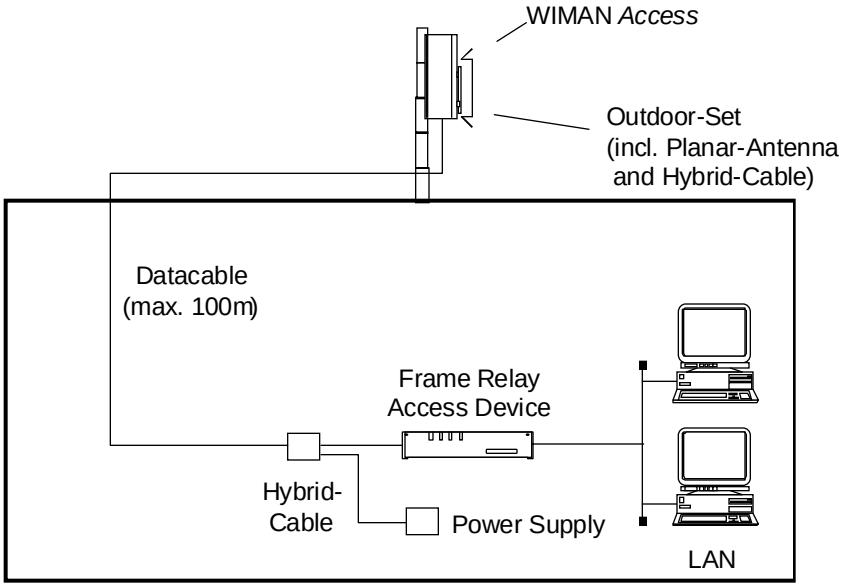


8.3.2 Outdoor Installation using Hybrid cable Type 2 & 3 and Datacable

This connection is used when the WIMAN is installed on a rooftop or a radio tower and is synchronized among other WIMAN devices. In addition a data cable (12x2) is needed.

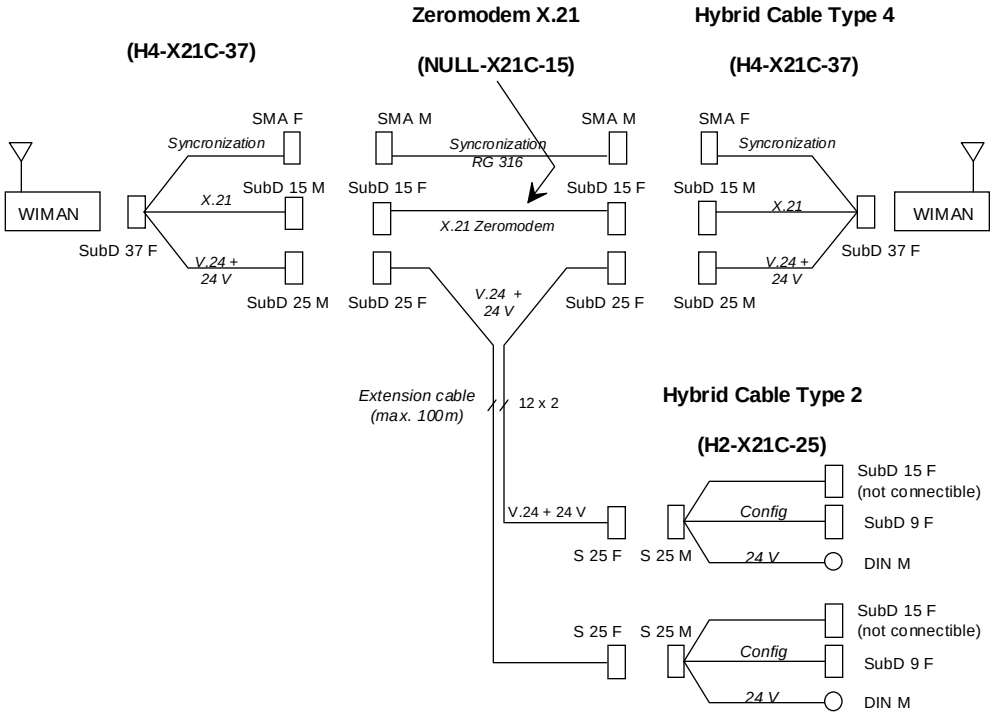


Sample:



8.3.3 Connection of a remote POP with WIMAN LINE and STAR

This link is used for a remote Point Of Presence, if a WIMAN STAR is connected via a WIMAN LINE link. Here the STAR receives the synchronisation impulses likewise via the LINE link.



8.3.4 Connections when using the IP-routing functionality

Still being revised

8.4 Hybridcable

In the following, all hybrid cables with their appropriate area of application are described.

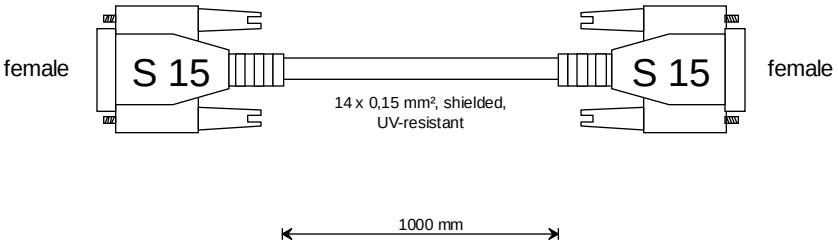
Note:

The 37-pin SubD link (female) is always attached to the 37-pin SubD link (male) of the WIMAN.

8.4.1 Hybridcable used for X21-configurations

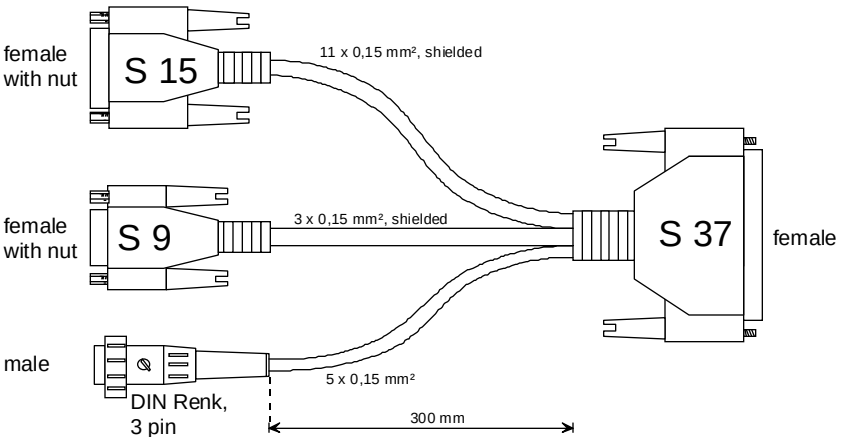
Zeromodemcable (NULL-C21-15)

Zeromodemcable for direct connection of 2 WIMAN devices. In addition a Hybrid cable Type H4 is needed.



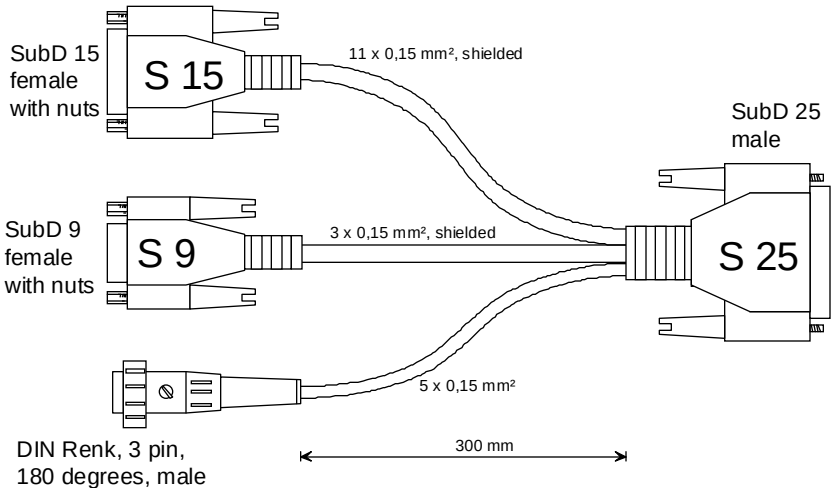
Hybridcable Type1 (H1-X21C-37)

This hybrid cable is used with indoor installations and provides the power connection, a direct link for a Frame Relay capable Router as well as a configuration interface (RS-232).



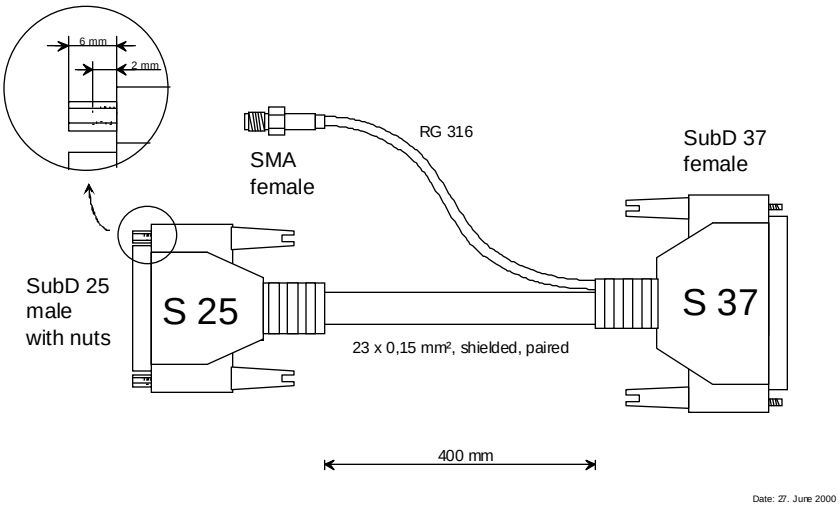
Hybridcable Type 2 (H2-X21C-25)

This Hybrid cable is being used as an internal termination cable when installing a WIMAN on a readio-tower on on a rooftop. The 25pin SubD-plug (male) is connected to the 12x2 Datacable, which leads from the WIMAN to the Router. All other connectors are the same as on Hybrid cable type 1.



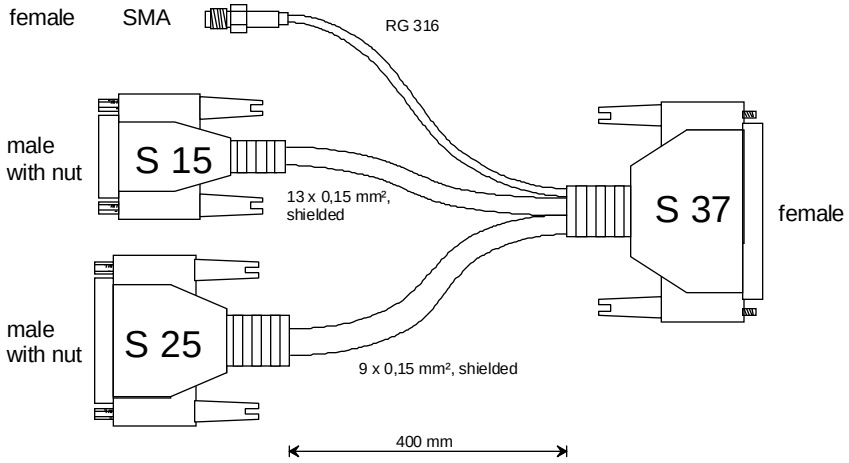
Hybrid cable Type 3 (H3-X21C-37)

This hybrid cable is attached with outdoor installations between the WIMAN and the data cable (12x2). The SMA socket serves for the link to the synchronisation bus, if several WIMAN devices are mounted in direct proximity.



Hybrid cable Type 4 (H4-X21C-37)

This hybrid cable is used with a Peer to Peer structure of a remote POP. For this an additional NULL-X21C-15 cable, a synchronisation bus, a data cable (12x2) and a hybrid cable Typ2 becomes necessary (schematic structure see further above.)

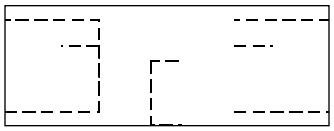


8.4.2 Hybrid cable when using the IP-routing-functionality

RJ45-Connectionbox (HA-ETH-45)

This link box is attached between the Ethernet cable of the local network and the hybrid cable H3-eth-37ext. Into the box the current supply link of the WIMAN, which is connected to the power pack, is integrated.

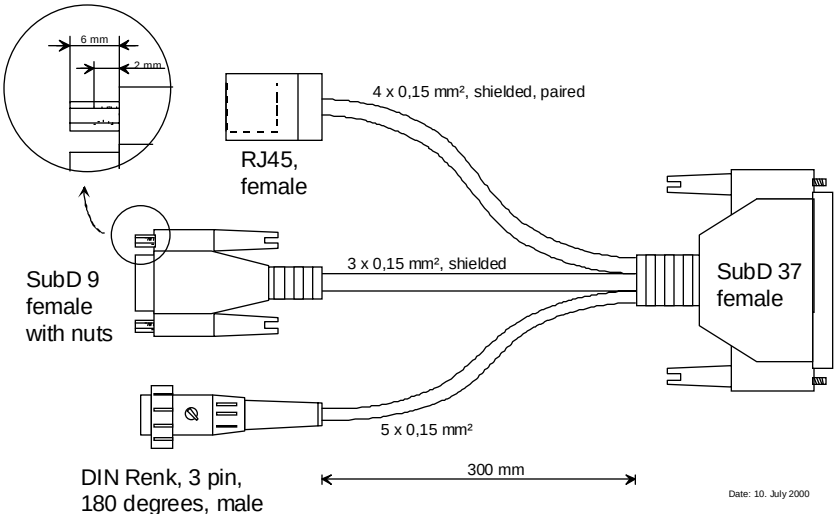
RJ 45 female



RJ 45 female

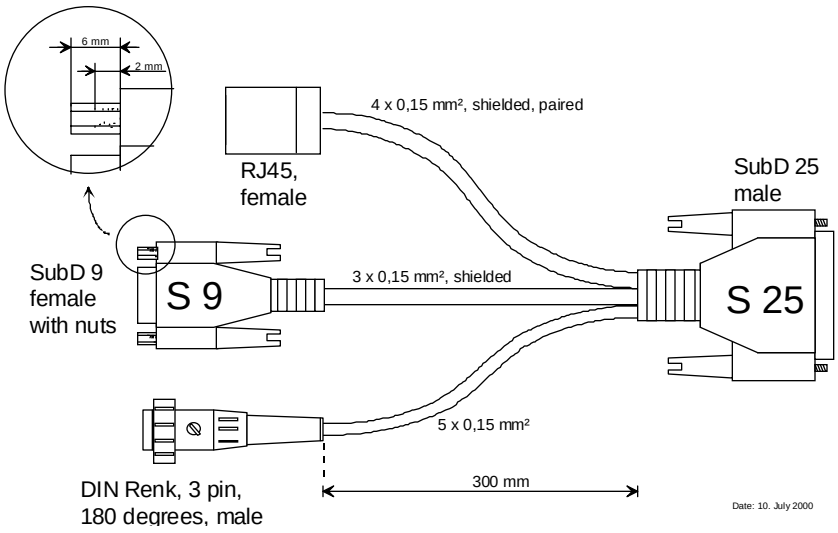
Hybrid cable Ethernet 1 (H1-ETH-37)

This Ethernet hybrid cable is used for indoor installations and provides the power connection, a direct link to the local network (over Ethernet cable) and a configuration interface (RS-232).



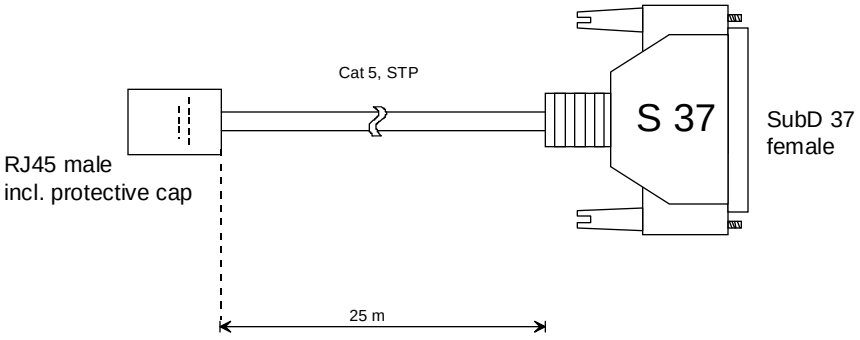
Hybrid cable Ethernet 2 (H2-ETH-25)

This hybrid cable is used as internal terminal cable with radio tower installations or installation of the WIMAN on a rooftop. The 25-pin SubD (male) link is connected to the data cable (12x2), which leads from the WIMAN (outdoor) to the inward. The further interfaces correspond to those of the hybrid cable Type Ethernet 1.



Hybrid cable Ethernet 3 (H3-ETH-37EXT)

This hybrid cable serves for the link of the WIMAN to the local Ethernet. The current supply lines of the WIMAN are already integrated in this cable. This cable can be used only together with the link port HA-ETH-45.



9 Appendix B: Technical data

Product outline	
WIMAN Star, Access	high-speed transfer in point-to-multi-point mode
WIMAN Line	flexible point-to-point transfer
Radio	
Frequency range	2.400 - 2.4835 GHz
Type of modulation	Spread Spectrum Frequency Hopping 2-FSK, 4-FSK
Number of channels	80, non-overlapping
Wireless interface	1 Mbps, 2-FSK 2 Mbps, 4-FSK
Transmitting power	100 mW (ETSI-Version) (E.I.R.P.) 4 W (FCC-Version)
Transfer capacity	256 KBps @ 2-FSK 512 KBps @ 4-FSK
Max. input-level	0 dBm
Recipient-sensitivity	-94 dBm @ 2-FSK -88 dBm @ 4-FSK
Range	up to 5 km (ETSI-Version with planar array antennas) up to 25 mi (FCC-Version)
RF-connector	SMA plug connector
RF interface	
Configurable block-repetition	
CRC-based error correction	
In-slot acknowledgement	
Device-specific data encryption	
Data-interface	
Synchronous	X.21 / V.35 (optional) max. 2 Mbps

Protocols

Point-to-point-mode

Synchronous	Transparent (HDLC-frame structure)

Point-to-Multipoint-mode

Synchronous operation	Frame Relay Packet Switching

Antennas

Mobile antenna	Omnidirectional 2 dBi
Fixed antennas	Omnidirectional 8 dBi Planar 8.5 dBi Planar 16 dBi Paraflector 24 dBi

Mass & weights (without antennas)

WIMAN-device	176 x 110 x 40 mm, 1050 g
Outdoor box	300 x 190 x 85 mm, 2200 g

General

Voltage supply	12 – 26 V =; max. 10 W 110 – 230 V, 50 -60 Hz~
Temperature range	-20°C - +55°C
Humidity	100 %, not condensing
IP enclosure	IP63, mounted in security housing
Display	3 LEDs, two-colored

Administration

Remote looptest

SNMP-based status-query and error signaling

Network access via TCP / IP, password protected

Software-update via TFTP

Individual bandwidth management

10 Appendix C: Pin-allocation of the Data-cables

10.1WIMAN Datacable (10 x 2)

Pin	Wire color (1. line)	Pin	Wire color (2. line)
1	White/Grey	14	White/Green
2	-	15	Brown/Green
3	White/Yellow	16	Pink/Brown
4	Yellow/Brown	17	White/Pink
5	White	18	Grey/Pink
6	Brown	19	Red/Blue
7	-	20	-
8	Grey/Brown	21	Black
9	Green	22	Purple
10	Yellow	23	-
11	Pink	24	Red
12	Grey	25	Blue
13			

Table 7 *WIMAN data cable (10 x 2), pin assortment*

Attention:

Provide a correct grounding of the data cable screen.

Paired-wire	Wire color	Pin number	Wire color	Pin number
1	White	5	Brown	6
2	Green	9	Yellow	10
3	Grey	12	Pink	11
4	Blue	25	Red	24
5	Black	21	Purple	22
6	Grey/Pink	18	Red/Blue	19
7	White/Green	14	Brown/Green	15
8	White/Yellow	3	Yellow/Brown	4
9	White/Grey	1	Grey/Brown	8
10	White/Pink	17	Pink/Brown	16
Shield		Shield		

Table 8 *WIMAN data cable (10 x 2) paired-wire assort-ment*

10.2WIMAN Datacable (12 x 2)

Pin	Wire color (1. line)	Pin	Wire color (2. line)
1	White/Grey	14	White/Green
2	Grey/Brown	15	Brown/Green
3	White/Yellow	16	Pink/Brown
4	Yellow/Brown	17	White/Pink
5	White	18	Grey/Pink
6	Brown	19	Red/Blue
7	White/Blue	20	White/Red
8	Brown/Blue	21	Black
9	Green	22	Purple
10	Yellow	23	Brown/Red
11	Pink	24	Red
12	Grey	25	Blue
13			

Table 9 *WIMAN data cable (12 x 2) pin assortment*

Attention:

Provide a correct grounding of the data cable screen.

Paired-wire	Wire color	Pin number	Wire color	Pin number
1	White	5	Brown	6
2	Green	9	Yellow	10
3	Grey	12	Pink	11
4	Blue	25	Red	24
5	Black	21	Purple	22
6	Grey/Pink	18	Red/Blue	19
7	White/Green	14	Brown/Green	15
8	White/Yellow	3	Yellow/Brown	4
9	White/Grey	1	Grey/Brown	8
10	White/Pink	17	Pink/Brown	16
11	White/Blue		Brown/Blue	
12	White/Red		Brown/Red	
Screen		Screen		

Table 10 *WIMAN data cable (12 x 2) Paired-wire assortment*

11 Appendix D: Alphabetical list of instructions

Instruction	Applicable in command mode starting from authorization level	Applicable in configuration mode starting from authorization level	Remarks
<parname> <value>	-	1	
Checkcfg	-	1	
Clear	1	1	
Clear stat <type>	1	-	
Config	1	-	
Del config	-	1	
Del <parname>	-	1	
Del passwd console	-	1	
Enable	1	-	No help available
Exit	1	-	No help available
Export	1	1	
Help	1	-	
Help <parname>	1	1	
Passwd console	-	1	
Passwd console crypt	-	1	No help available
Passwd enable	-	1	
Passwd enable crypt	-	2	No help available
Reset	1	-	
Reset config	-	1 (configuration password)	No help available
Restore	-	1	
Save	1	-	
Show	1	1	
Show <regexp>	1	1	
Stat <type>	1	1	
Swupdate	1		

Table 11 *alphabetical list of instructions*

12 Index

Will be created later

13 Index of figures

14 Index of tables