HÖFT & WESSEL

Data-Unwired
System Manual

Version 0.92

Important Changes on Page 3

DATA UNWIRED
www.data-unwired.com

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After installation, please perform the following changes:

- **Open file for editing: DUMC.INI (c:\Programme\Hoeft & Wessel AG\DUMC V?????)**
- **Search for the entry OUIEMC and replace the line as follows:**
  `OUIEMC = 00-30-2E-F0/322; 00-30-2E-E0/321; 00-30-2E-C0/2921; 00-30-2E-D0/9650`
- **Save file**
- **Restart DUMC**

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1. Introduction

With the Data-Unwired product line Höft & Wessel AG offers a versatile complete system for radio based data communication. This document describes the application of Data-Unwired products for point-to-point radio links and radio networks. After briefly explaining the basic radio technologies the available system components - Embedded Modules, radio devices with V.24, Ethernet and USB interface - are introduced. Different system architectures are discussed and the necessary software tools are explained.

1.1 Terminology

Term	Description
DECT	Digital Enhanced Cordless Telecommunication
CLDPS	Connection-Less DECT Packet Service
SWAP	Secure Wireless Access Protocol
PPPoE	Point-to-Point Protocol Over Ethernet
LAP	Link Access Protocol
DUMC	Data-Unwired Management Console
MDE	Mobile Data Aquisition Terminal
FT	Fixed Termination = base station
PT	Portable Termination = portable station

1.2 References

Source	Description
Höft & Wessel AG	Firmware Manual HW 86010, HW 86020
Höft & Wessel AG	Integration Manual HW 86010, HW 86020

1.3 Radio Communication

1.3.1 Standards and Frequency Bands

For more than a decade DECT has successfully been used for short range wireless transmission of voice and data in many parts of the world. Especially driven by the cordless telephony market, the industry developed components with increasing integration density. Thus, a wide variety of high quality DECT products are availbale at low costs. Besides voice transmission, DECT is also well suited for data communcations.

In Europe, DECT operates in the exclusive 1880 - 1900 MHz band using time and frequency multiplexing on ten frequencies and 120 time slot pairs. In addition DECT-ISM was specified to mainly serve the northern american market, operating in the 2.4GHz ISM band. Here, a frequency hopping technique is superimposed to the DECT protocol to ensure the required coexistence with other users of this open band.

For both frequency bands Höft & Wessel AG offers embedded modules which can be integrated into various systems. They are core of the different devices available in the Data-Unwired product line. Usually DECT is mentioned in this document, but the methods and procedures also apply analogously to the DECT-ISM products (also called FHSS).

1.3.2 System Architecture and Protocols

A simple DECT system consists of a base station and one or more portable devices. The base station delivers the main system clock to synchonize all portables. Data transmission always is performed between the base and a portable. A direct transmission between portables is not possible.

The attributes fixed (or base) and portable are derived from the DECT standard and apply mainly to the cordless telephony application. Here, a portable may also be a fixed installed device whereas - at least in theory - a fixed station in DECT terms may also be a portable device.

So far DECT data transmission was based on static connections implementing synchronous, symmetrical point-to-point links with a fixed time/frequency relation. This method is perfectly suited for voice application where a constant data stream is to be transferred. Many data applications however will typically generate data bursts with longer idle periods. Hence, valuable channel capacity is lost and - using battery driven devices - precious energy is wasted. In this connection based mode, the number of links to portables a base station can serve at a time is limited to four. The use of radio spectrum is not very efficient in many applications and limits the available transmission capacity.

To overcome these limitations a new transmission protocol was developed: CLDPS (Connection-Less DECT Packet Service) is a method for connection-less, packet based data transmission on DECT. A base station will allocate 12 DECT channels (time / frequency multiplexing) and uses a dedicated slot format, providing a cell data capacity of 500kbit/s (per base station). This capacity can dynamically be shared between the subscribed portables according to the actual demand. Thus CLDPS allows for 64 simultanously connected portables and therefore is capable to support even large wireless networks.

Data-Unwired systems usually support both connection-based DECT and packet-based CLDPS, which can be configured by software.

The following table compares both protocols.

Chracteristic	Connection based	Packet based (CLDPS)
networking capability	no[1]	yes, 64 active subscribers per radio cell (= base station)
data rate	2x26kBit/s for up/downlink, synchronous	500kBit/s per radio cell, asynchronous
symmetry up/downlink	symmetrical	asymmetrical, dynamical
occupied DECT channels	1 duplex	12 duplex per radio cell
real-time capabilities	data are transferred in fixed 10 ms time frame	allocation of timeslots by base station not collision-based 9 traffic slots per 10ms time frame undetermined behaviour with increasing number of subscribers and amount of data
voice transmission	yes, up to 4 simulaneous links per base station	no[2]

1.4 Point-to-Point Connections

Point-to-point connections can be realised with both connection-based and packet-based (CLDPS) modes.

1.5 Wireless Networks

CLDPS is capable of supporting wireless networks and is based upon transmission of ethernet frames. This feature provides easy integration into local area networks (LAN). For PTs the following operational modes are available.

1.5.1 PT Operational Modes

- **Transparent Mode**

  The PT's interface works transparently, user data are are directly transferred, no protocols.

- **ETH Mode**

  The PT's interface works in protocol mode (non transparent), the host application connected to the PT will generate and accept HDLC framed ethernet packets containing the user data.

- **PPP Mode**

  The PT's interface works in PPP (point-to-point protocol) mode. The module integrates a PPP server to which the host system's PPP client connects. Once established, the PPP link carries TCP/IP traffic. Host application runs TCP/IP stack.

[1] present 1:4 protocol mode further supported but not recommeded for new projects.
[2] packet based voice transmission possible

1.5.1.1 Transparent Mode

This mode is useful for many applications as no protocol is necessary on the PT's host system. Just plain user data are transferred on the interface. As an example, an application that used to be operated directly on a serial line can now easily be transferred to wireless operation with Data-Unwired equipment, without changing the host system software.

As the subscribed PTs need to be multiplexed on the FT side, a dedicated protocol is used internally in the modules: SWAP (Secure Wireless Access Protocol) is based on PPPoE (RFC 2516) and LAP and allows for protected data link with adequate performance on the CLDPS radio link and further on the wired network. The Data-Unwired embedded module implements the SWAP client - invisible to the user. The SWAP server is located in the network behind the FT and terminates the SWAP connection. The FT may be a USB or Ethernet base station from the Data-Unwired product line. The host application may, as shown in figure 1, communicate with the SWAP server in various ways. Using multiple base stations allows for roaming infrastructures.

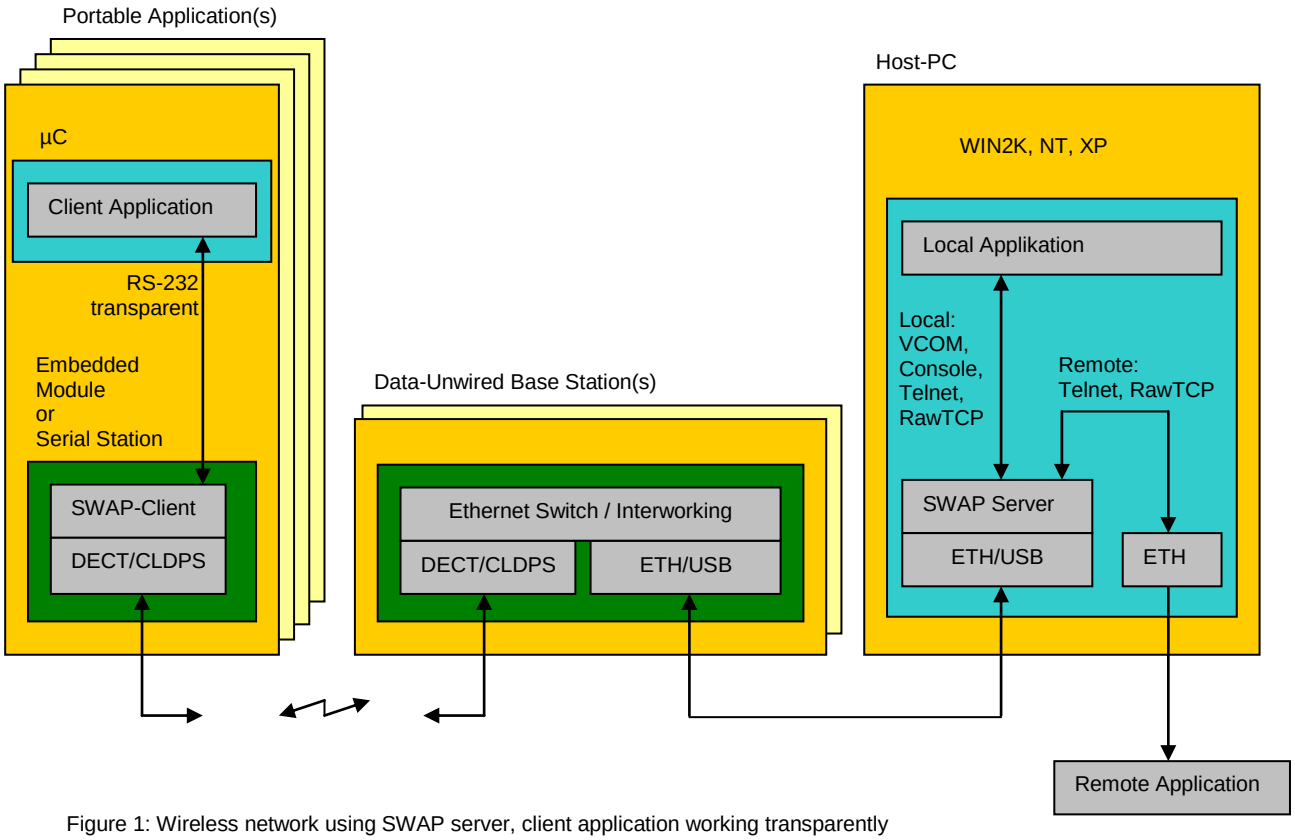


Figure 1: Wireless network using SWAP server, client application working transparently

1.5.1.2 ETH Mode

It may be useful to abandon the SWAP protocol, for example if there is no WIN32 system available in the network. The client application must then transmit and receive its data using HDLC encapsulated ethernet frames. This requires retransmit mechanism to be implemented in the application.

Data-Unwired base stations implement ethernet switch functionality, allowing PTs to address other PTs on the same radio cell. The required serial bus protocol as a data interface to the Data-Unwired system working in ETH mode is explained in detail in section 6.3.

The base station may be any of the Data-Unwired products such as USB, ETH, V24 station or the embedded modules. Using multiple base stations allows for roaming infrastructure.

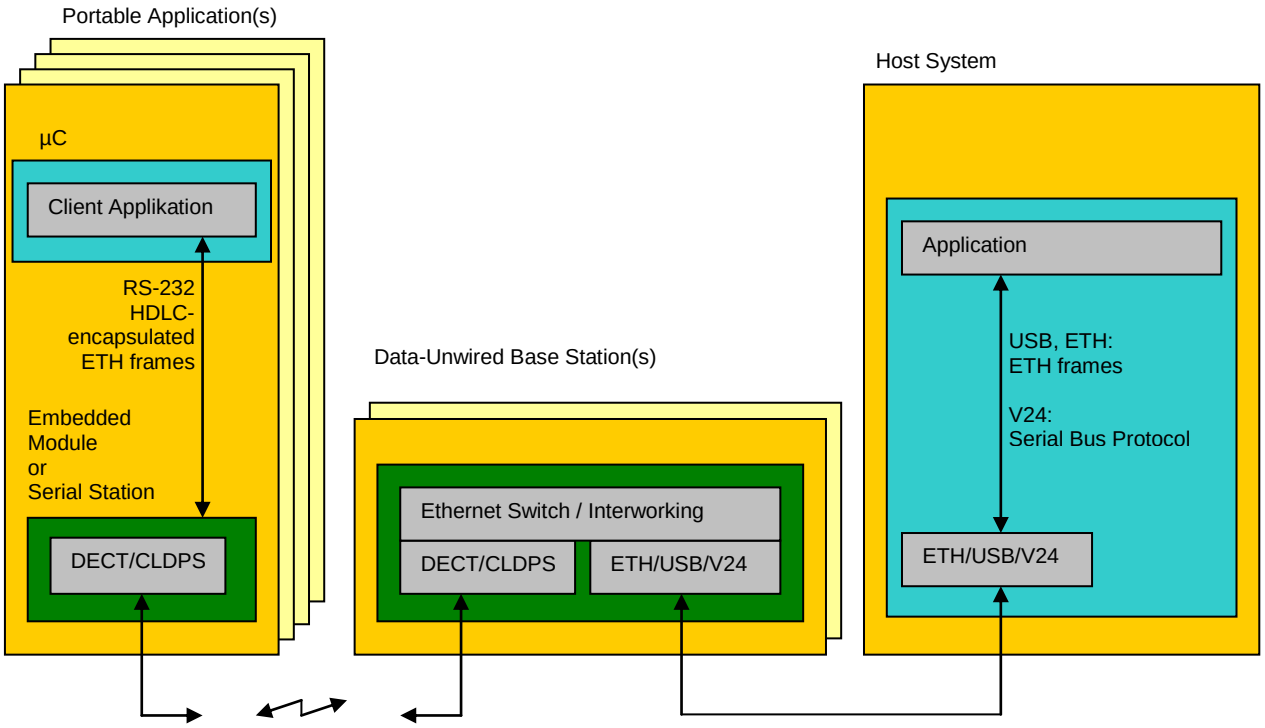


Figure 2: Wireless network without SWAP server, client application and V24 base station running serial bus protocol.

1.5.1.3 PPP Mode

The PT modules may be configured to operate a PPP server. The host application‘s PPP client may initiate a PPP connection to the module, having the opportunity to use it’s own IP address or to trigger the module to receive an IP address from the network via DHCP. DNS and WINS server addresses, net mask and standard gateway may as well be configured automatically.

PPP mode may be used in systems implementing TCP/IP stack and PPP protocol. It allows to connect to the LAN directly through Data-Unwired ethernet base stations. Using multiple base stations allows for roaming infrastructures.

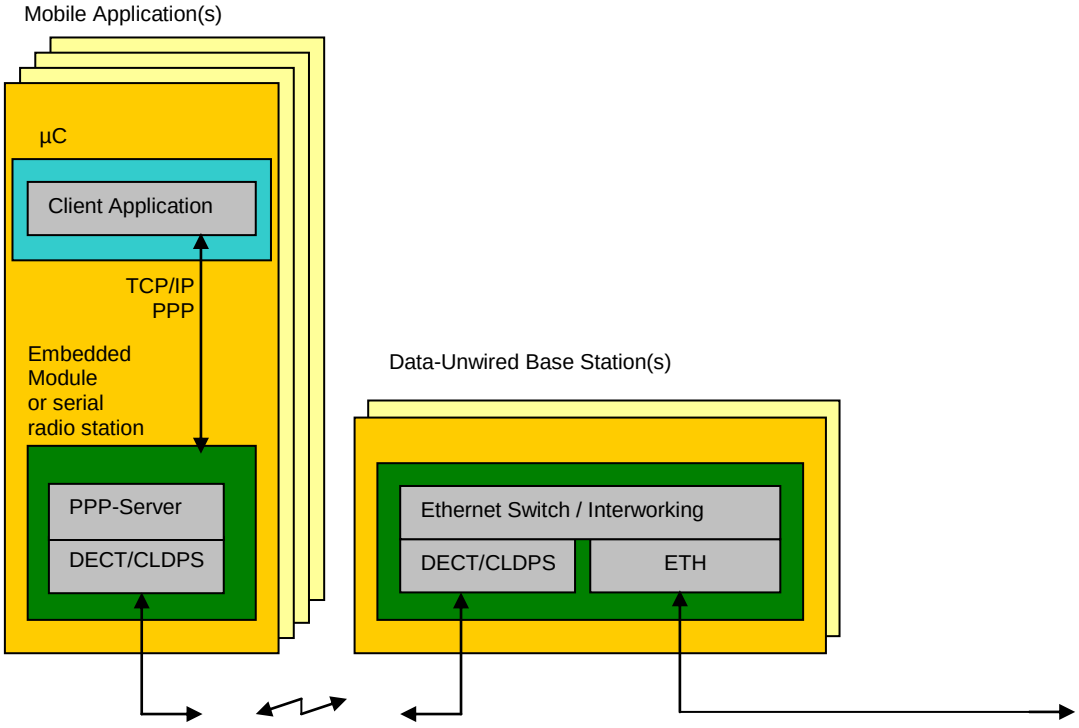
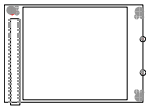
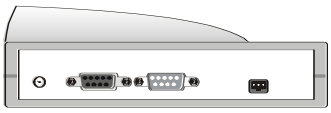
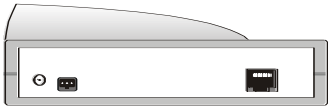
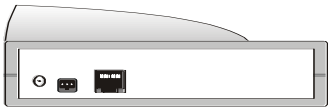
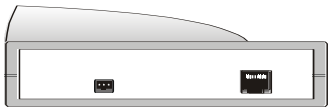


Figure 3: Wireless network in PPP mode

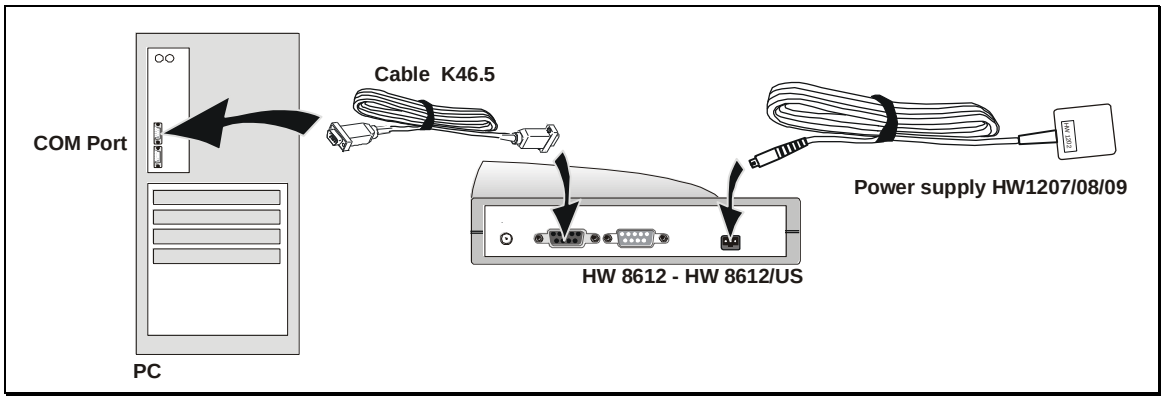
1.6 Data-Unwired Devices

For various applications the Data-Unwired product line offers a suitable device.

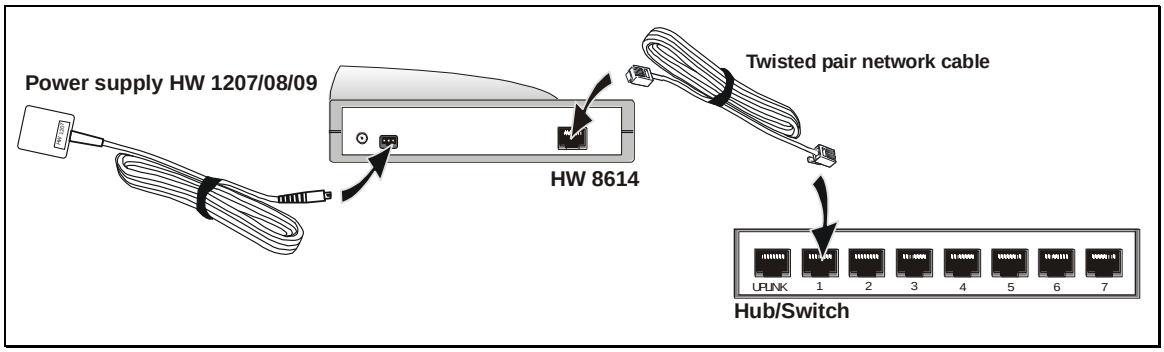
Device	Interface	
Embedded Modules **HW 86010** **HW 86020**	**RS-232** **Parallel Interface**	
HW 8612 **HW 8612/US**	**2x Sub-D 9pol** **V.24/RS-232**	
HW 8614 **HW 8614/US**	**1x RJ-45** **Ethernet 10Base-T**	
HW 8615 **HW 8615/US**	**1x RJ-45** **V.24/RS-232**	 LAN
HW 8617 **HW 8617/US**	**1x USB 1.1**	
HW 8621 - ISDN Modem -	**1x RJ-45** **ISDN**	
HW 8622 - Analog Modem -	**1x RJ-11** **Analog**	

2. Hardware Installation

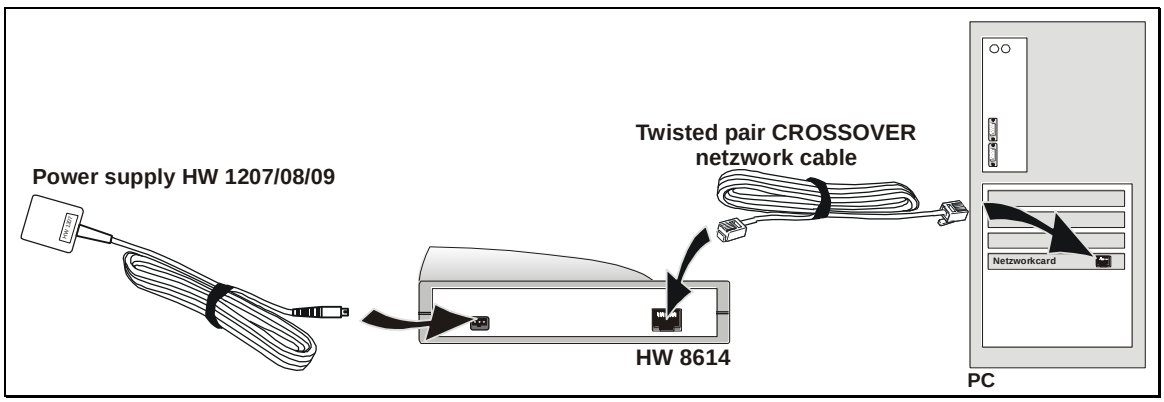
2.1 Connecting Serial Station HW 8612 to a PC



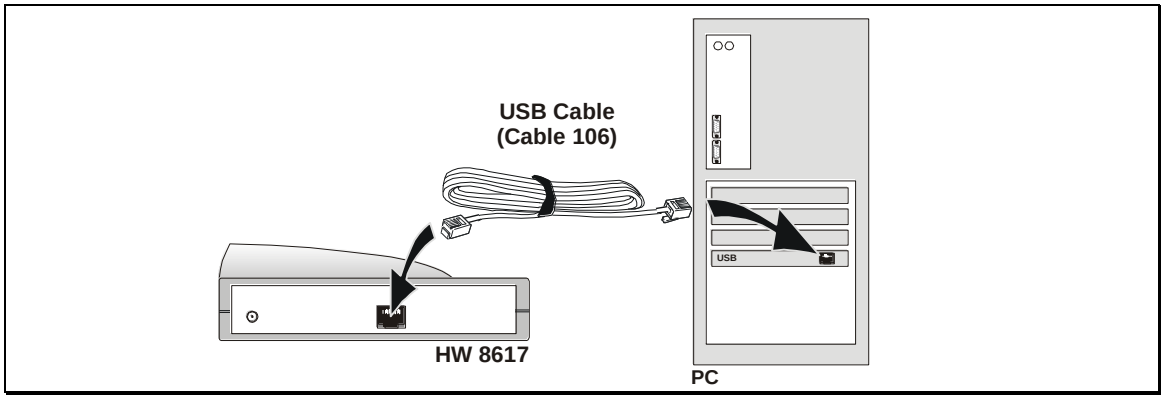
2.2 Connecting Ethernet Base Station HW 8614 to Hub / Switch



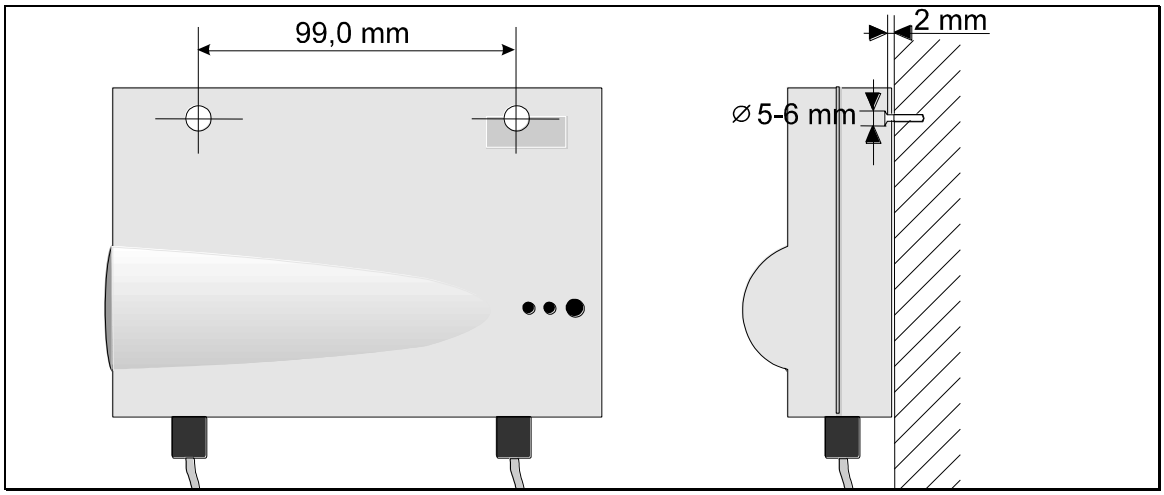
2.3 Connecting Ethernet Base Station HW 8614 to a PC



2.4 Connecting USB Base Station HW 8617 to a PC



2.5 Wall-Mounting Data-Unwired Stations



3. Software

This section describes the software tools that may be necessary to operate Data-Unwired devices. They are delivered Data-Unwired CR ROM.

- **Data-Unwired Mangament Console**: Used to configure and maintain Data-Unwired devices.
- **SWAP Service**: Necessary to terminate radio connections from portables running transparent mode.
- **USB driver**: Only required if the USB station HW 8617 is used.

3.1 Data-Unwired Management Console

Data-Unwired Management Console allows for configuration of all Data-Unwired system components, for firmware download and controlling the availability of the devices.

Supported operating systems are Microsoft‘s Windows 2000 and Windows XP.

The core piece of Data-Unwired Management Console is the device manager, see section 3.1.7. All Data-Unwired system components can be displayed here if connectoed either to the PC, the network or if available through radio link.

3.1.1 Installation

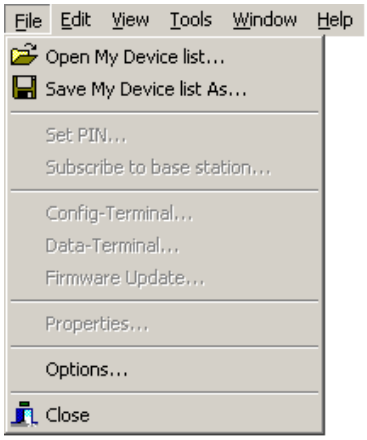
Execute the file **setup.exe** from the **Data-Unwired Management Console** directory on the Data-Unwired CD ROM.

Follow the further instructions of the install program.

ATTENTION!

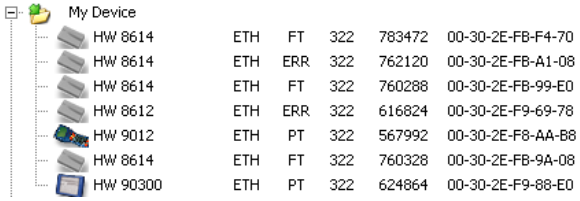
In case an older version of Data-Unwired Management Console is present on your computer, deinstall it using Start->Settings->Software. Also deinstall all versions of WinPcap using Start->Settings->Software.

3.1.2 Main Menu „File“



The different items of main menu „File“ are explained in the following sections. The items „Set PIN...“, „Subscribe to base station...“, “Config-Terminal…”, “Data-Terminal…”, “Firmware-Update…” and “Properties” are explained in section 3.1.7.

3.1.2.1 Menu Item “Open My Device list...”

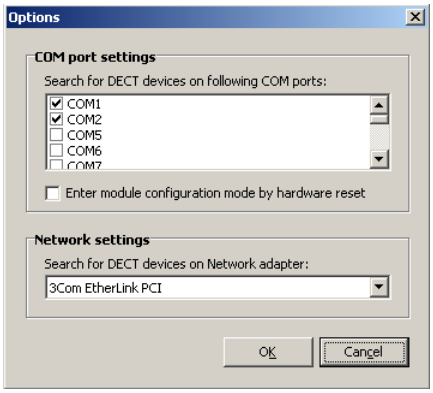


Choose a *.xml file which was previously saved using menu item „Save My Device list...“ (see section 3.1.2.2). All device information stored in the file will be displayed on the node „My Device“. In this file the particular device information may permanently be stored.

3.1.2.2 Menu Item „Save My Device list...“

Choose a file name to save the device information currently displayed under the node „My Device“. The device list may be restored using menu item „Open My Device list...”, see section 3.1.2.1.

3.1.2.3 Menu Item „Options“



COM port settings

Choose a serial port which is directly connected to a Data-Unwired device. It is recommended to activate only required ports in order to reduce the time required for device scan.

Enter module configuration mode by hardware reset

If this function is enabled, all devices connected to serial ports are set into configuration mode by hardware control sequences and will then be operated at 9600 bps. This is useful in case other user baud rates than 115200 bps are applied.

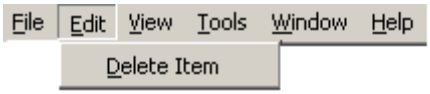
Network settings

Choose a network interface card which is connected to Data-Unwired devices. A HW 8617 USB device will appear as a network interface card. It must be selected in order to control it with the Mangement Console.

3.1.2.4 Menu Item „Close“

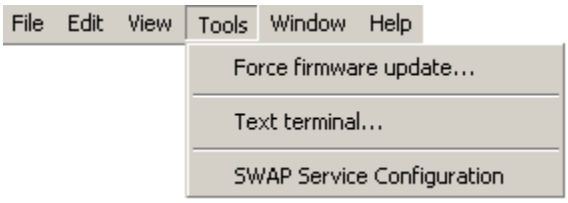
Application will be closed.

3.1.3 Main Menu Item „Edit“

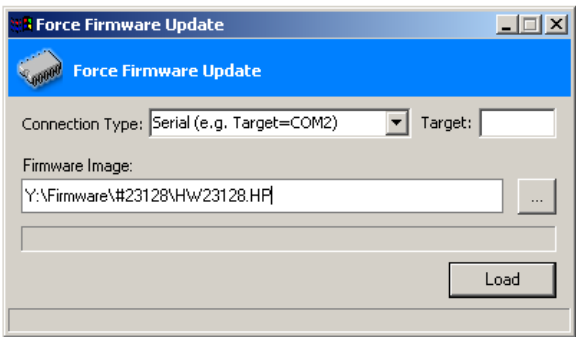


Choose „Delete Item“ to delete the selected device from the device list.

3.1.4 Main Menu Item „Tools“



3.1.4.1 Menu Item „Force firmware update...“



In case a system component may not have an appropriate firmware, for example if a firmware download was aborted, it may not appear in the device list. With this function it is possible to download firmware to that device anyhow.

Normally use the menu item „Firmware Update“ (see section 3.1.7.5).

Connection Type und Target

Identify the type of connection to the desired system component. Enter the COM port (i.e. COM1, COM2) or enter the device’s DECT number in case of an ethernet device.

Now select the firmware image from your disk (*.hp file).

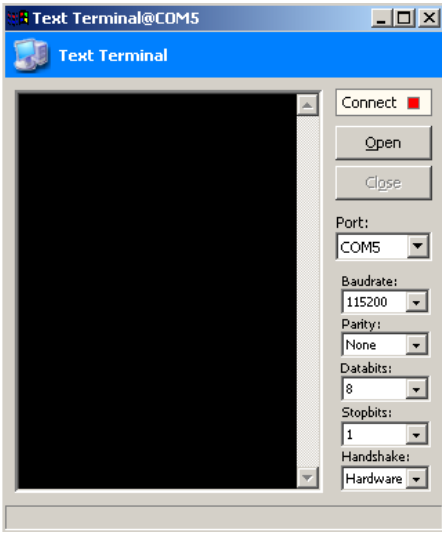
NOTICE!

In case a firmware download is not successful, switch off the device’s power supply for 1 second, then switch it on again and press „Load“.

ATTENTION!

In case of downloading a faulty firmware image the device may become unusable and may only be reactivated by Höft & Wessel service.

3.1.4.2 Menu Item „Text terminal...“



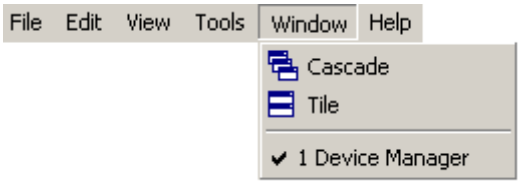
This terminal connects to the selected COM port, which may be a physical COM port or a virtual COM port created by the SWAP server. Through a virtual COM port a connection to a PT is established on the radio link, see section 3.2. A network base station (HW 8614 or HW 8617) will not be connected to a virtual COM port as these devices do not implement a SWAP client.

Multiple terminal windows may be opened in parallel.

3.1.4.3 Menu Item „SWAP Service Configuration...“

This opens the SWAP server control window. If it does not appear install Hoeft & Wessel SWAP Service, see section 3.2.

3.1.5 Main Menu Item „Window“



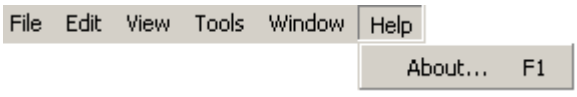
3.1.5.1 Menu Item „Cascade“

Cascades all windows of the application.

3.1.5.2 Menu Item „Tile“

Tiles all windows of the application.

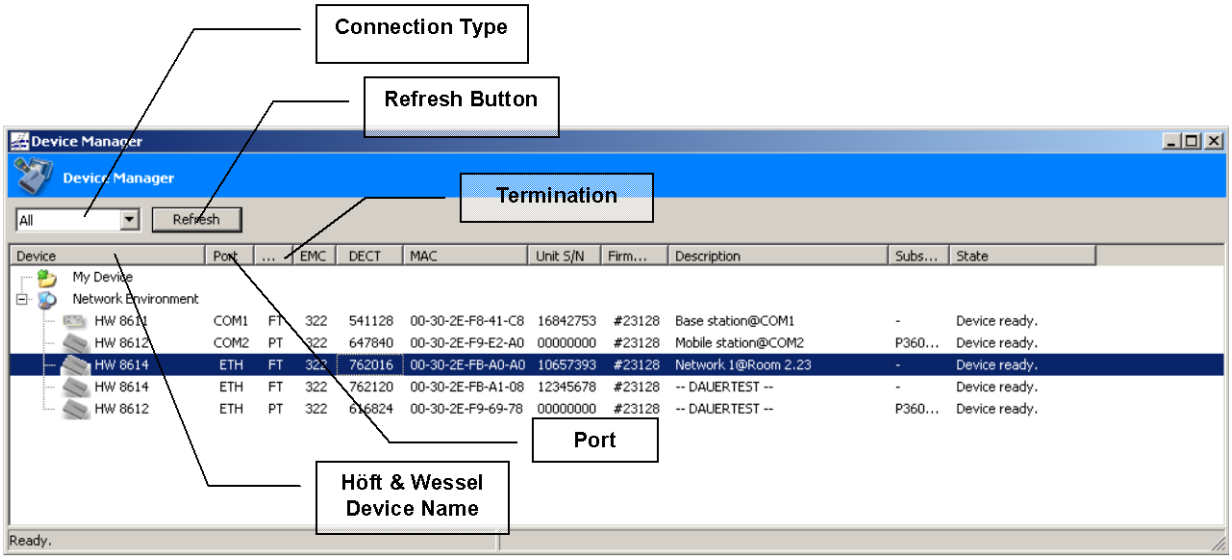
3.1.6 Main Menu Item „Help“



3.1.6.1 Menu Item „About...“

Shows program version.

3.1.7 Device Manager



Choose a connection type and press the [Refresh] button. Now, all available Data-Unwired devices are listed on the „Network Environment“ node.

The Data-Unwired Management Console supports both serial devices and devices that are connected through Ethernet. To list devices connected on both ports choose the connection type „All“.

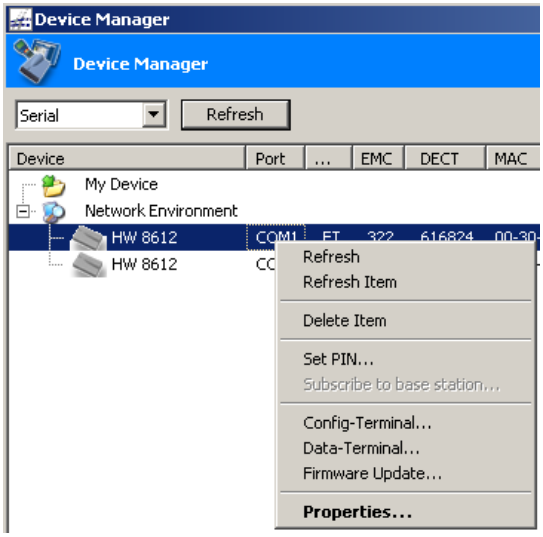
If an already listed device is no longer available, the corresponding entry is removed from the list after the next refresh. Use the node „My Device“ to have a continuous overview on all your devices. To add a device entry left-click on the device and pull in into the node „My Device“. When the program is stopped the „My Device“ list is stored in the file „device.xml“ in the program directory. This list will be restored at the next program launch.

The current „My Device“ list may also be stored using **File→Save My Device list As...** and restored using **File→Open My Device List**.

Meaning of list elements in the Device Manager.

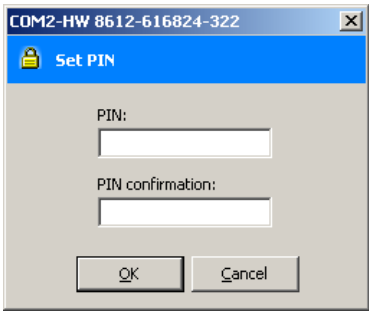
Column	**Decription**
Device	Höft & Wessel device name
Port	Type of connection (ETH or COMx)
Termination	DECT termination (FT of PT)
EMC	ETSI manufacturer code
DECT	unique DECT device identifier
MAC	Ethernet MAC
Unit S/N	Höft & Wessel device serial number
Firmware	Firmware version
Description	User-defined device descriptor
Subscription	only for PT: EMC, DECT and PLI of base station the device is subscribed to
State	Device state

Right-click on a device to be configured in order to have a popup menu with the following entries:



Entry	Description
Refresh	Refeshes all device entries in the list
Refresh Item	Refreshes marked device entry only
Delete Item	Removes device entry
Set PIN	Open „Set PIN“ dialog (see section 3.1.7.1)
Subscribe to base station	Opens „Subscribe to base station“ dialog (see section 3.1.7.2)
Config-Terminal	Opens a configuration window
Data-Terminal	Opens a data terminal window
Firmware-Update	Opens „Firmware Update“ dialog
Properties	Opens „Device properties“ dialog

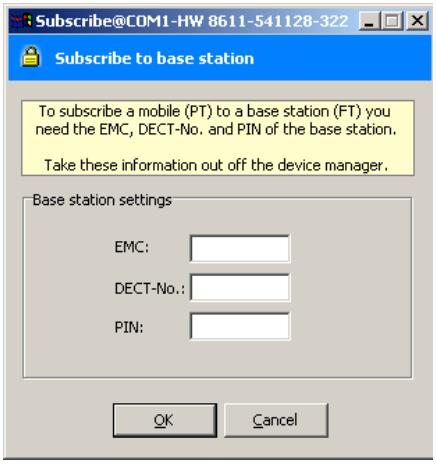
3.1.7.1 Dialog „Set PIN“ - Setting a Base Station PIN



Select a base station from the **Device Manager** list and choose **Set PIN** from the Popup menu (right click)

Now enter your **PIN** and confirm with **OK**.

3.1.7.2 Dialog „Subscribe to base station“ - Subscribe a PT to a FT (Offline)



Before a radio connection can be set up, all mobile system components (PT) must be subscribed to the base station (FT).

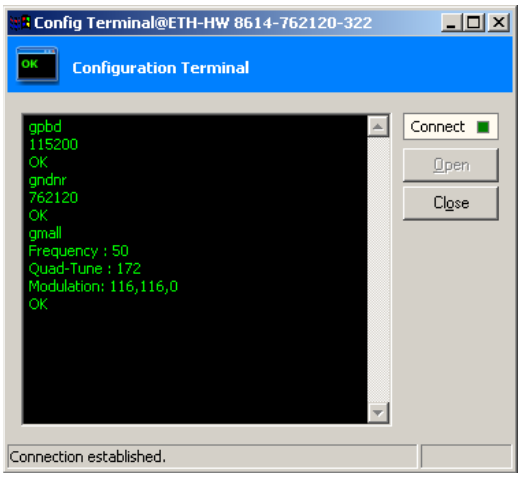
In the device manager, select a device, right-click on it and choose **Subscribe to base station** from the pop-up menu.

Now enter **EMC**, **DECT number** and **PIN** of your base station and press **OK**.

All devices are factory-configured with PIN „0“. Use a different PIN to raise your system‘s security level. Details may be taken from the „Firmware Manual HW 86010“.

In case your base stations are „cloned“ for roaming you need to enter the master device’s data.

3.1.7.3 Dialog „Configuration Terminal“

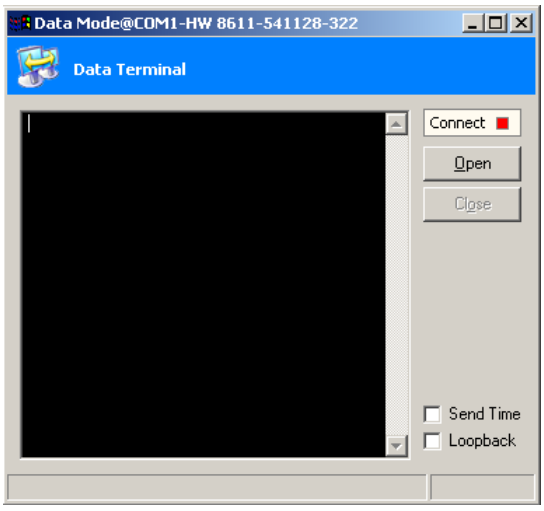


Select a device from the **Device Manager**, right-click on it and choose **Config-Terminal** from the pop-up menu.

The configuration terminal allows for usage of the Höft & Wessel Embedded Module in the system components. Please refer to the „Firmware Manual HW 86010“ for the available command set. Directly connected devices may be configured as well as PT devices which are connected through the air interface, although only a subset of commands is provided then.

If a link to a device is not available, check its power supply and all cables, respectively the network or radio connection.

3.1.7.4 Dialog „Data Terminal“



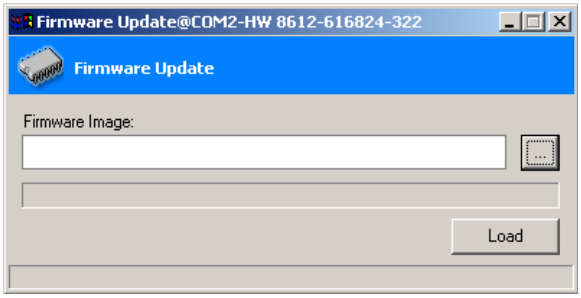
Select a device from the **Device Manager**, right-click on it and choose **Device Manager** from the pop-up menu.

Using the Data Terminal allows for reception and transmission of data through the air interface. It can be used for devices working on the physical serial ports. For a connection to a virtual COM port use the Text Terminal, see section 3.1.4.2. Note that the „Connect“ indication only refers to the link to the attached device, not the radio link. On Data-Unwired devices a radio link is indicated through the green LED.

For endurance testing a time stamp may be send continuously when „Send Time“ is marked. If „Loopback“ is marked, received characters are sent back immediately.

If a link to a device is not available, check its power supply and all cables.

3.1.7.5 Dialog „Firmware Update“



Select a device from the **Device Manager**, right-click on it and choose **Firmware update** from the pop-up menu. Choose a firmware image (*.hp files) and start the update with **LOAD**.

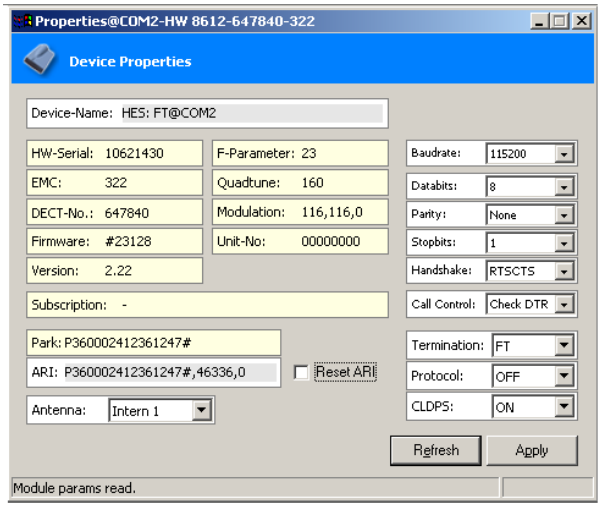
NOTICE!

In case a firmware update is not successfully finished, remove power supply from the device for some seconds and press LOAD again.

ATTENTION!

Loading a invalid or faulty firmware image may in special cases make the device inoperational. This condition may only be solved by Höft & Wessel service.

3.1.7.6 Dialog „Device Properties“



Select a device from the **Device Manager**, right-click on it and choose **Properties** from the pop-up menu. The device parameters are presented and may be changed, refer to section 4 for details.

3.2 Data-Unwired SWAP Service

Data-Unwired SWAP Service is a service for Windows operating systems. It is capable of linking incoming radio connections to a couple of interfaces, such as TELNET or TCP server, virtual COM ports or WIN32 console applications. This allows for a transparent data link on PT applications, see section 1.5.1.1.

Supported operating systems are **Windows NT4.0, Windows 2000, Windows XP**.

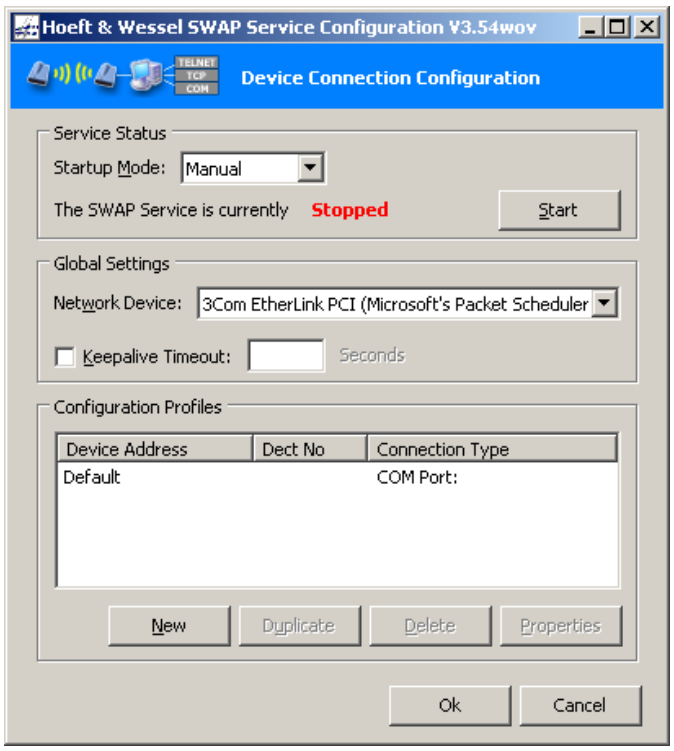
3.2.1 Installation

Run **setup.exe** from the directory **Data-Unwired SWAP Service** on the Data-Unwired CD-ROM and follow the instructions of the setup program.

3.2.2 Configuration

The Data-Unwired SWAP service can be configured through a control applet which can be launched from Start => Settings => System Control => Hoeft Wessel SWAP Service.

3.2.2.1 Main menu Device Connection Configuration



Startup Mode

The startup mode can be configured here. Choose between the following options: „manual“ means the service is started manually, select „automatic“ for startup after system boot or „deactivated“ to completely deactivate the service.

Start / Stop

This button allows to start and stop the service manually.

Network Device

Selects the network device that shall provide connection to the SWAP Service.

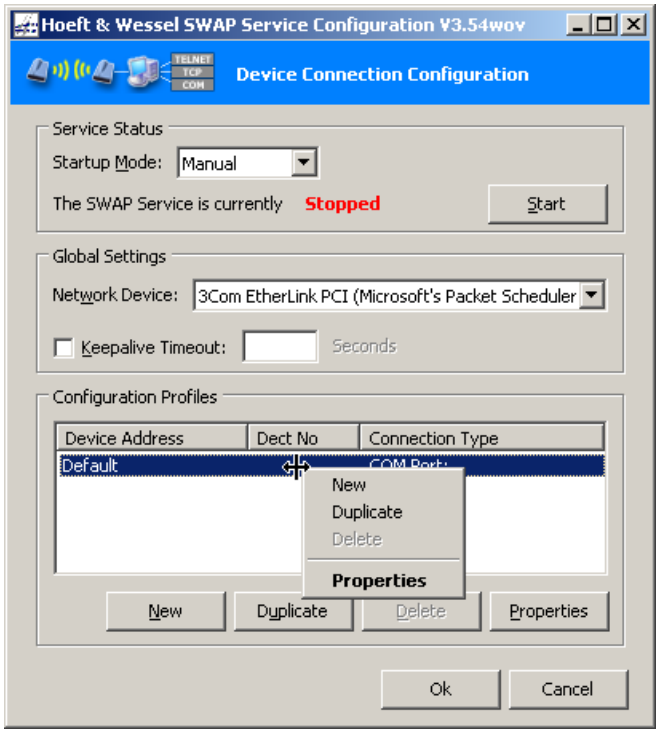
Keepalive Timeout

Configures and activates the keepalive timeout. In case no keepalive message is received from the PT after this time the SWAP connection will be disconnected and will then be ready for a connection restart. Activate this feature only if the corresponding timeout setting is configured on the PT. Configure the timeout on the PT using „sptimeout 5 <ms_timeout>“, where ms is the specified timeout in milliseconds. Recommended values are 10..20s, i.e. 10,000...20,000ms. Refer to HW 86010 Firmware Manual for details.

Configuration Profiles

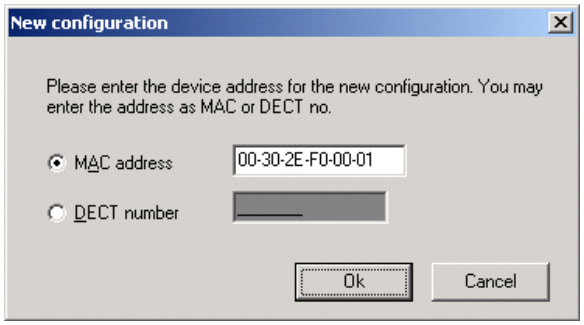
List of configuration profiles for configured devices. After software installation only the „Default“ entry exists. For specified devices additional configuration profiles may be generated. On incoming radio connections the SWAP service will look for a device specific entry. In case this does not exist for the connected PT a default entry will be used.

3.2.2.1.1 Context Menu



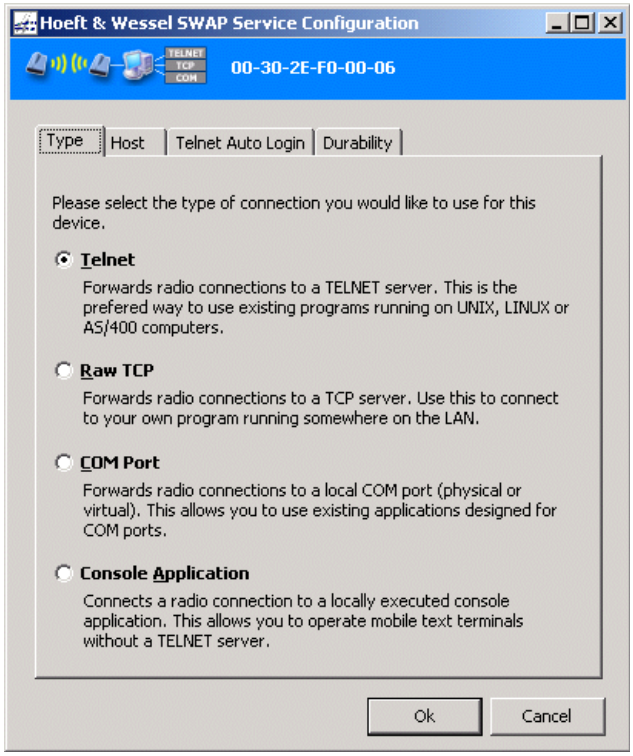
The context specific menu (right click) in the configuration profiles list allows for generating, duplicating and deleting profile entries.

3.2.2.1.2 Generation of new Profiles



A new device specific profile can be generated by identifying the device through the MAC address or the DECT number. Note that the PT’s data are relevant here (not the base station‘s data).

3.2.2.1.3 Profile Properties: Connection Type



The way the radio connection will be forwarded may be configured here.

Telnet

Used to forward data from a radio connection to a Telnet server (e.g. mobile devices of captura series or the skeye.pad running a terminal software).

Raw TCP

A remote PT will be connected to a TCP port. This allows communication to a network application.

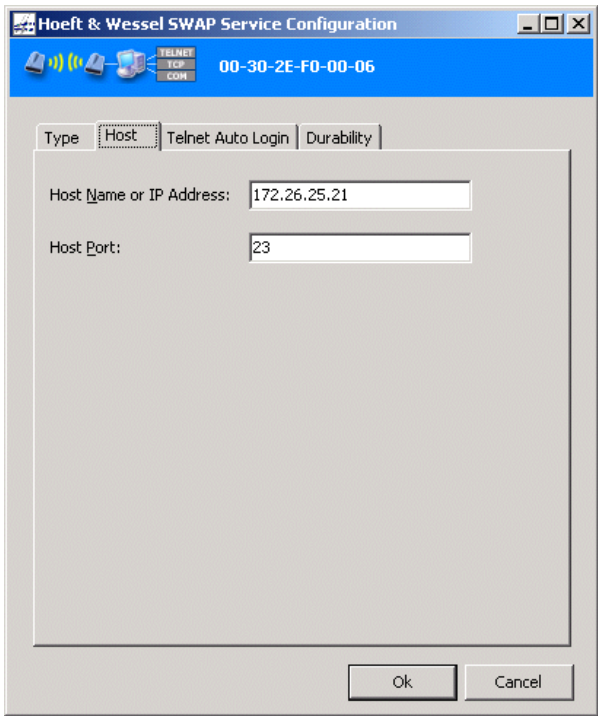
COM Port

This connection type may be used if existing software is able to communicate to COM ports. Virtual COM ports can be generated for individual PTs or the data may be forwarded to a physical COM port.

Console Application

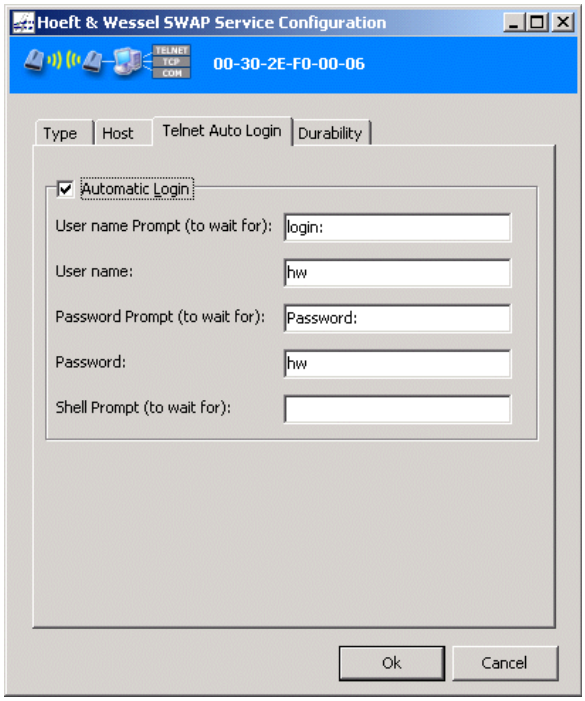
The standard I/O of a specified application is redirected to the remote PT. Application may very easily be developed without the need of network programming.

3.2.2.1.4 Profile Properties: Host



Only for **Telnet** und **Raw TCP** connection types the host's IP address and the port are configured.

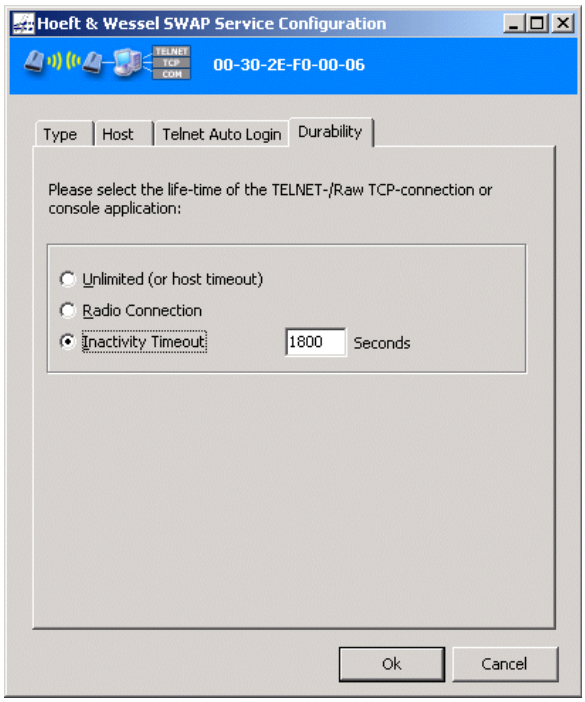
3.2.2.1.5 Profile Properties: Telnet Auto Login



For the **Telnet** connection type the auto login feature is configured:

- Prompt for user name entry, which triggers the user name transmission.
- User name
- Prompt for password entry, which triggers the password transmission.
- Shell prompt, which is waited for to detect successful login (optionally, rarely used).

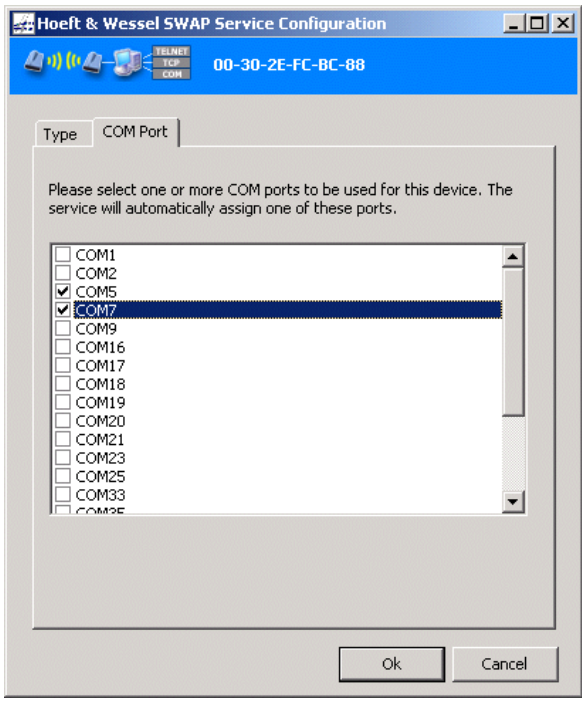
3.2.2.1.6 Profile Properties: Durability



Configures a connection's lifetime, valid only for **Telnet**, **Raw TCP** und **Console Application**.

- Unlimited or host timeout: The connection will only be disconnected by a host timeout.
- Radio Connection: The connection only exists during a valid radio connection to the PT.
- Inactivity Timeout: The connection will be terminated if a radio connection did not exist in the specified time.

3.2.2.1.7 Profile Properties: COM Port

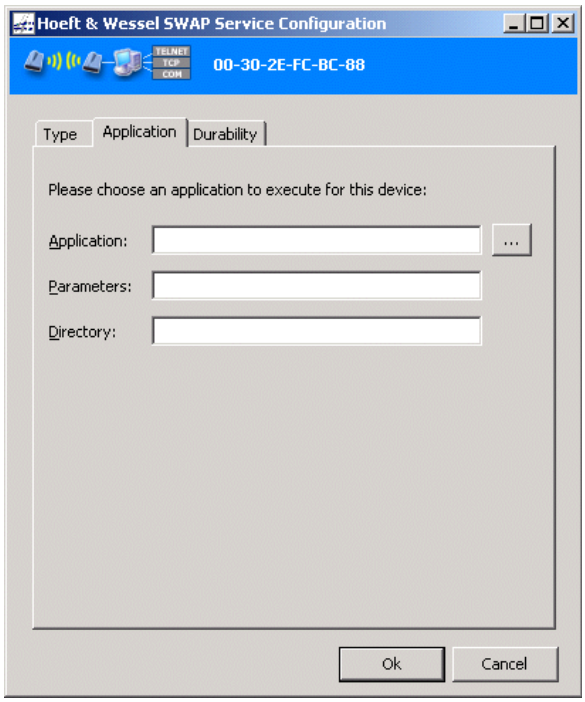


Selects the COM port to which the remote PT is connected when connection type **COM Port** is configured. Both physical and virtual COM ports are supported. More than one port may be selected, in this case a free port will automatically be chosen.

Configuration of a physical COM port is useful if for example a modem is to be connected to the SWAP service PC.

A virtual COM port is useful in case a legacy software or a RAS connection shall be applied, e.g. for WinCE devices.

3.2.2.1.8 Profile properties: Application



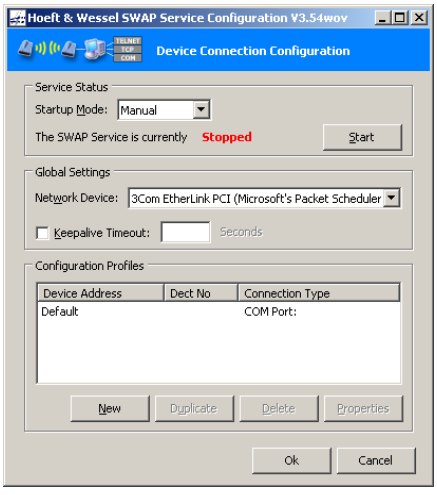
For the connection type **Console Application** an application must be configured which shall be launched with an incoming radio connection.

- Application: Configures the application to be launched.
- Parameters: Configures command line parameters which shall be provided to the application.
- Directory: Configures the application's working directory (will automatically be adjusted when selecting the application)

3.2.3 Quick Start - Configuration of virtual COM Ports

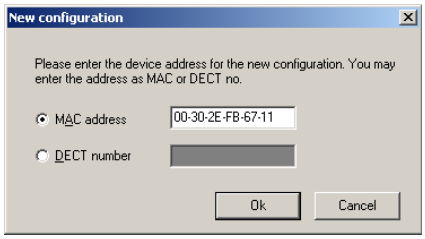
Open the SWAP Service configuration using **Start→Settings→System control→ Hoeft Wessel SWAP Service**. In case this entry is not available, install SWAP Service (see section 3.2.1)

The SWAP configuration may also be launched from the Data-Unwired Management Console using **Tools→SWAP Service Configuration.**



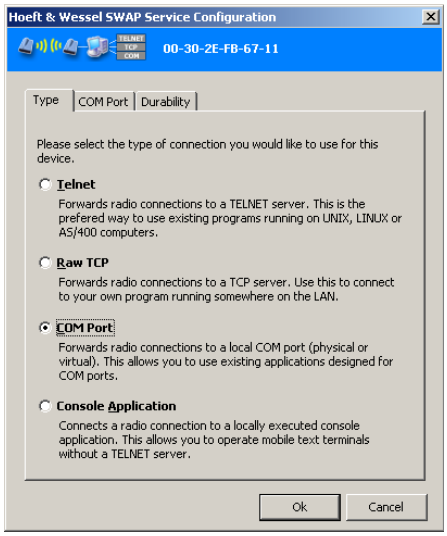
Start the profile entry dialog with the **[New]** button.

The „Default“ entry should not be changed.

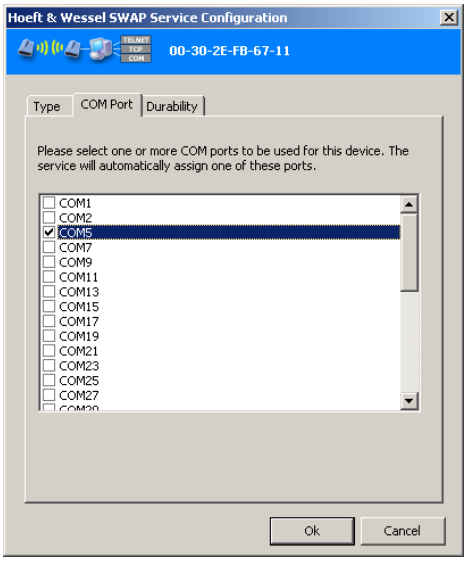


Enter the MAC address or the DECT number of the PT you wish to confugre and confirm using **[Ok]**.

Refer to the Data-Unwired Management Console Device Manager to find out the required MAC address or DECT number.



Select the **COM Port** and open **Index card COM Port**.



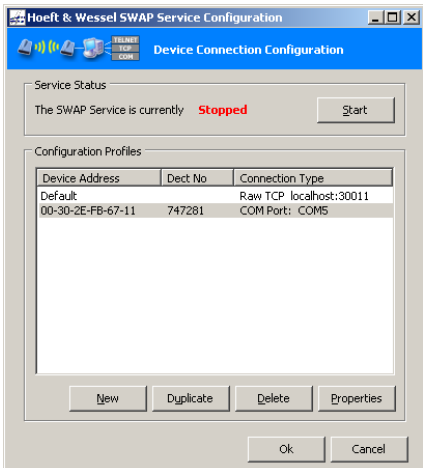
Choose the desired COM port and press **[Ok]**.

Both physical and virtual COM ports appear in the list. In case a physical port is selected, the data traffic will be lead to the COM port.

Due to technical reasons, only odd numbered virtual COM ports are available.

Those settings displayed on the index card **Durability** are not relevant for COM ports.

Repeat the four last steps to configure further PTs.



Press **[Start]** to start the SWAP service.

Use the Data-Unwired Management Console Text-Terminal **Tools→Text terminal** to test virtual COM port connections.

3.3 Data-Unwired USB Driver

The USB base station HW 8617 makes use of Microsoft Windows RNDIS interface and behaves to the system like a network interface card. A USB driver is required and is delivered on the Data-Unwired CD ROM.

3.3.1 Windows 2000 Installation

- Connect device to USB port.
- Dialog "New hardware found " will appear (if not make sure your system's USB peripherals are activated).
- Dialog "Welcome". Accept with [continue].
- Dialog "Install hardware driver". Choose „Search for a suitable driver for the device“ and accept with [continue].
- Dialog "Search for driver files": Deactivate "Disc drives" and "CD ROM drives". Mark „other sources“ and accept with [continue].
- Dialog "Insert data media...". Press [search] and select the file "hw8617.inf" from the directory "Data-Unwired USB" on the DataUnwired CD ROM. Accept with [Open] and finally with [OK].
- Dialog "Driver files - Search results". Accept with [Continue].
- Dialog "Digital signature not found ". Accept with [Yes].
- Dialog "Assistant completion". Accept with [Complete].
- For the operation with Data-Unwired Management Console please see Section 3.1.2.3.

3.3.2 Windows XP Installation

- Connect device to USB port.
- Dialog "New hardware found " will appear (if not make sure your system's USB peripherals are activated).
- Dialog "Welcome". Select "Install software from a list or a specific source (for advanced users)" and accept with [continue].
- Dialog "Select search and installation options." Deactivate "Search removable drives (Disc, CD ROM, ...)“. Activate "Also search the following source:" and select [Search]. Select the directory "Data-Unwired USB" on the Data-Unwired CD-ROM and accept with [OK]. Finally accept with [Continue].
- Dialog "Windows-Logo-Test". Accept with [Continue installation].
- Dialog "Completion of Assistant". Accept with [Complete]. Should the message „Hardware could not be started" appear, accept the message [Complete]. Now remove the HW 8617 device from the USB port and connect it again. The device can now be started.
- For the operation with Data-Unwired Management Console please see Section 3.1.2.3.

4. Configuration of Data-Unwired devices

Data-Unwired system components may act as either base station (FT) or portable station (PT). Devices must be configured before a radio connection may be established.

4.1 Base Station

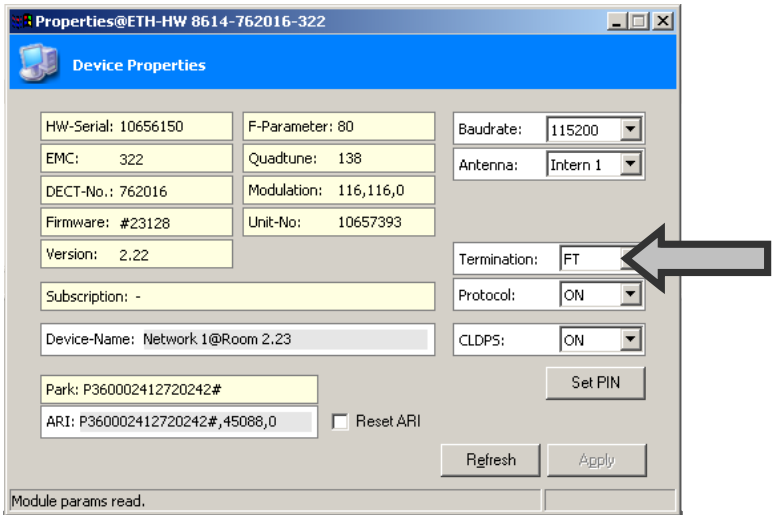


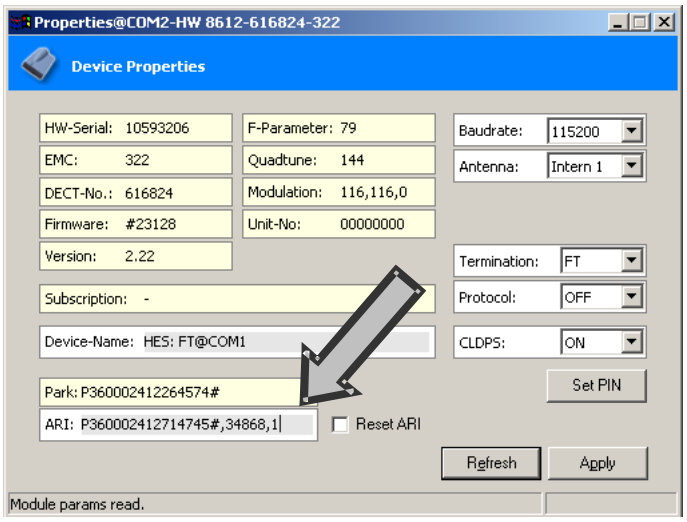
Figure 4: Base station configuration

Open the Device Properties menu by double-clicking on a device listed in the Device Manager. Adjust the Termination setting to **FT**. and accept the settings with the **[Apply]** button.

Consider the proper antenna selection. In case of a Data-Unwired device (HW8612, HW8614, HW8615, HW8617) select **Intern 1** for usage of internal antenna or **Extern** if an antenna is connected to the antenna connector (if provided). On HW 8614 and HW 8617 base stations, if no special mode is required, make sure that **Protocol** and **CLDPS** settings are **ON**.

In case the first part of **ARI** does not match the **PARK** activate **Reset ARI** before accepting settings with **[Apply]**.

4.2 Roaming Infrastructure



For the installation of a radio network infrastructure multiple base stations may be applied. The PTs may move between the radio cells and will automatically change to the strongest station (roaming). For this purpose the base stations need to have a similar indentification on the air interface. This is provided by transferring one base station's (the so called master base station) identity to other base stations (so called slave base stations).

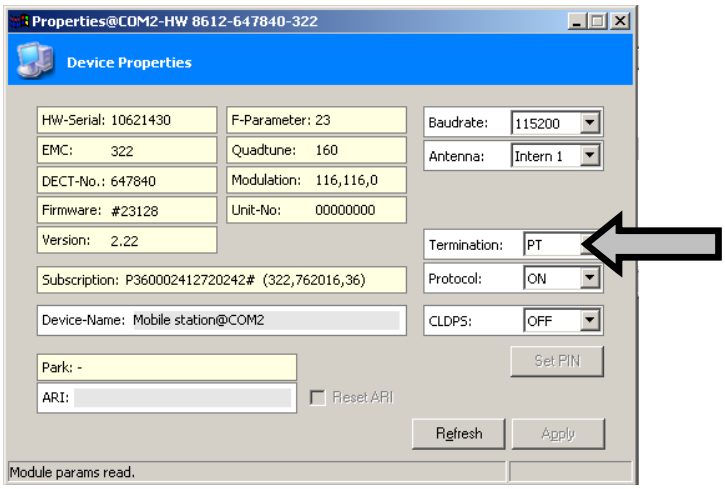
First of all set the last digit of the master base station's **ARI** to 1. Then take a copy of this ARI, increment its last digit by 1 and assign it to the next base station (i.e. the first slave). At last the master base station will have the last digit 1 while up to six slave base stations will use 2..7.

Use the **Device Name** field to assign conclusive descriptions to the devices.

NOTE!

In case your radio network is to comprise more than seven base stations (one master and six slaves) you will require a so called ARI-B that will be allocated by Höft & Wessel AG for you.

4.3 Portable Station

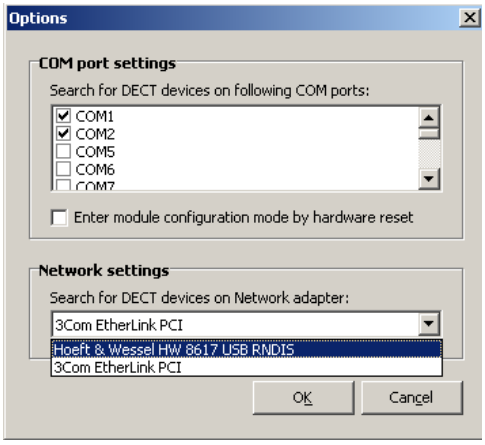


Open the Device Properties menu by double-clicking on a device listed in the Device Manager. Adjust the Termination setting to **PT** and accept the settings with the **[Apply]** button.

Consider the proper antenna selection. In case of a Data-Unwired device (HW 8612, HW 8614, HW 8615, HW 8617) select **Intern 1** for usage of internal antenna or **Extern** if an antenna is connected to the antenna connector (if provided). If no special mode is required, make sure that **Protocol** setting is **OFF** in order to work transparently and adjust **CLDPS** setting to **ON**.

4.4 USB Device

Connect the HW 8617 device to the PC's USB interface.



Open the **File->Options** menu. From **Network settings** select the entry **„Hoeft & Wessel HW 8617 USB RNDIS"**. If this entry is not shown, install the Höft & Wessel USB driver, see section 3.3.

In case the HW 8617 network adapter is activated the Device Manager will only show the HW 8617 and devices connected to it through the radio link. Other devices that may be connected through other network adapters (usually the PC's ethernet card) will not be available now.

5. Planning a wireless Infrastructure

5.1 Introduction

The Data-Unwired radio base stations allow for realisation of even larger radio infrastructures. Those base stations that are to build the network will be set to have the same identity, see section 4.2. They are installed so that radio cells that are defined by the radio coverage of a station will slightly overlap. A PT which moves around the covered area may change from one base station to another nearly seamlessly.

5.2 Range and Antennas

A wireless system's range depends on quite a lot of physical parameters. Even for a well-defined system as DECT a global prediction on the actual radio coverage cannot be given, as the influencing factors from the surroundings are still most decisive.

For example, a dry mortarless construction may easily be penetrated by the DECT radio signals, a concrete, steel armed wall however may absorb or reflect most of the radio energy. Also human bodies will significantly attenuate the radio signal if located in the path between transmitter and receiver.

In addition, reflections on any kind of objects or walls will effect multi path propagation. The signal on the direct path and multiple reflected signals, which differ in phase and amplitude will be combined and superimposed at the receiver. This so called fading effect results in interference and a potentially significant loss in signal strength.

A line-of-sight condition is desirable for best radio connections, however this is not a practical demand in most cases. But in order to have as few obstacles as possible in the direct path between transmitter and receiver, the base stations shall be mounted quite high.

The Data-Unwired devices are equipped with integrated antennas, whose gain is around 0dBi. They provide an omnidirectional characteristics in case antenna 1 is selected with horizontal mounting and antenna 0 is selected with vertical mounting. The antennas will typically provide a range of some 20..60m inside buildings and up to 300m outside buildings, depending on the environment.

For more demands the Data-Unwired Swivel Antenna can be used. Having a gain of some 2dBi, the range may be increased by up to 30%. This antenna again offers omnidirectional characteristics if mounted in a vertical position.

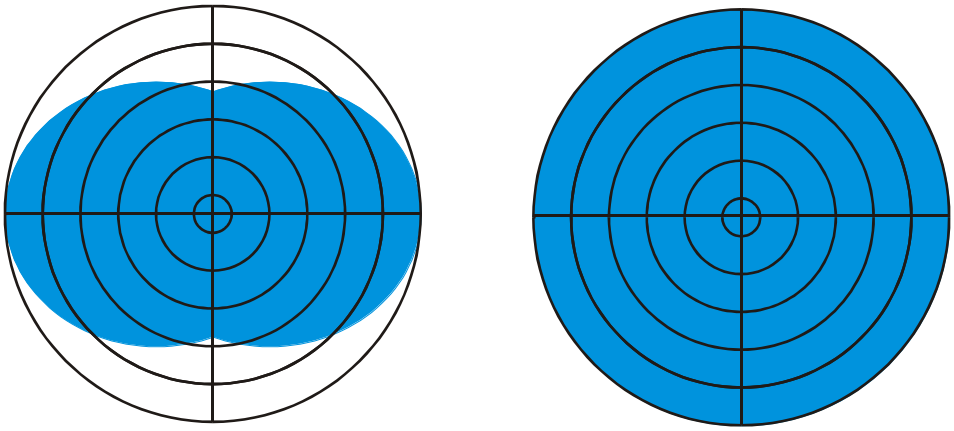


Figure 5: Radiation characteristics of a typical omnidirectional antenna. Left: elevation diagram (vertical cut), right: azimuthal diagram (horizontal cut).

Base stations using omindirectonal antennas are ideally suited in the middle of a radio cell. It is not advisable to mount these antennas in close proximity to stronlgy reflecting items as range and reliablity may be degraded, as described above. Mounting close to metal or steel-armed concrete walls or metal poles may lead to such problems. Using a pole, top mounting should be prefered.

The Data-Unwired directional antennas provide a gain of 7.5dBi. It allows to focus radiation to a certain area and increases range to up to 100% in the direction of maximum gain. These panel antennas may well be mounted in front of metal parts such as described above, as the reflecting surface is now in the radiation minimum.

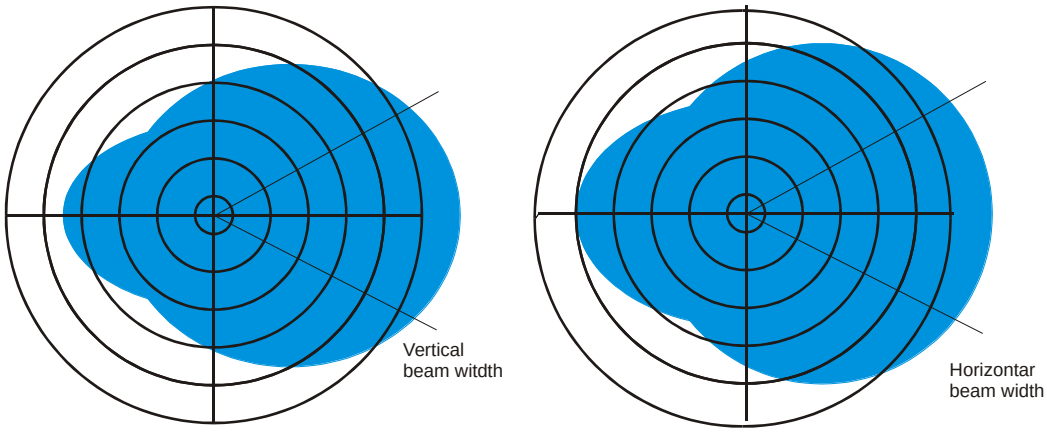


Figure 6: Radiation diagram of a directional antenna. Left: elevation diagram (vertical cut), right: azimuthal diagram (horizontal cut).

Generally try to avoid too small radio cells, as the available capacity of DECT channels may be exhausted in extreme cases. The distance between two base stations shall not be less than about 10..20m, again depending on the environment and the antennas used. The decoupling between two base station transceivers should be larger than 60dB.

5.3 Site Survey

It is advisable to perform a dedicated site survey in order to find out the best base station positions. It is very helpful to have a site plan or similar information on the environment at hand.

A first approach will be to preliminary define positions for base stations that appear to be useful. The coverage provided by the base stations on the defined positions will then be examined.

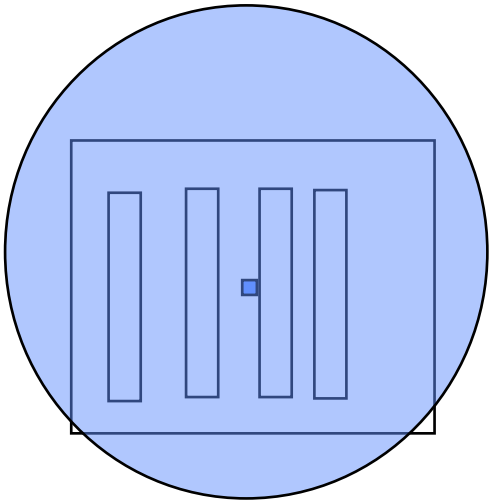
To start with, a base station is mounted on the first position. The radio coverage shall be tested using a PT, preferably of that type that shall be applied. Document results in the site plan. Now, deactivate the first base station, install the next one on the second position and again test the coverage. Continue like this with all the base station positions.

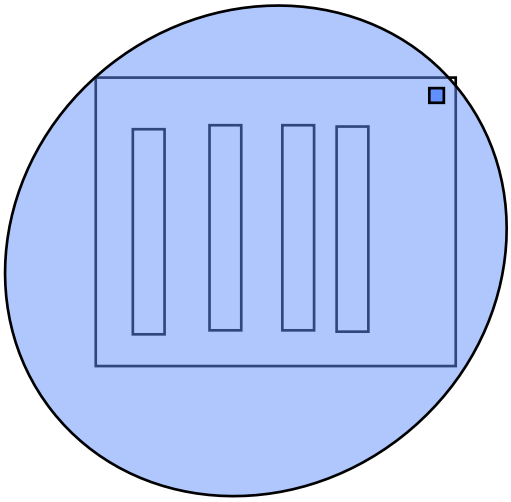
The result will give a detailed illustration of radio cells and their boundaries. There should be no gap in between the required coverage range. A small to medium degree of overlapping is desirable, having the cell boundary regions covered by two base stations. Increasing the degree of overlapping finally results in a redundant layout, where coverage may be ensured even if one base station fails operation. However, care should be taken to follow to the above mentioned recommendations towards base station distances.

During site survey, don‘t forget to consider worst case PT positions, for example the effect of a portable device being shielded towards the base station by the user’s body. Also consider the possibility of items being placed in the area at a later time, potentially degrading radio cell coverage. Try to improve base station positions and also consider the use of different antenna type for optimum results.

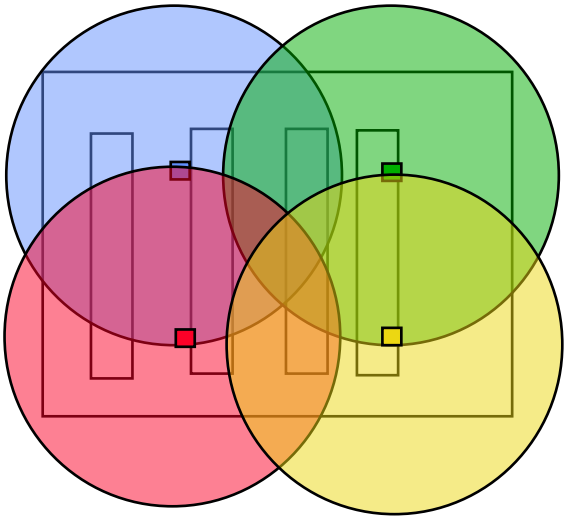
5.4 Examples

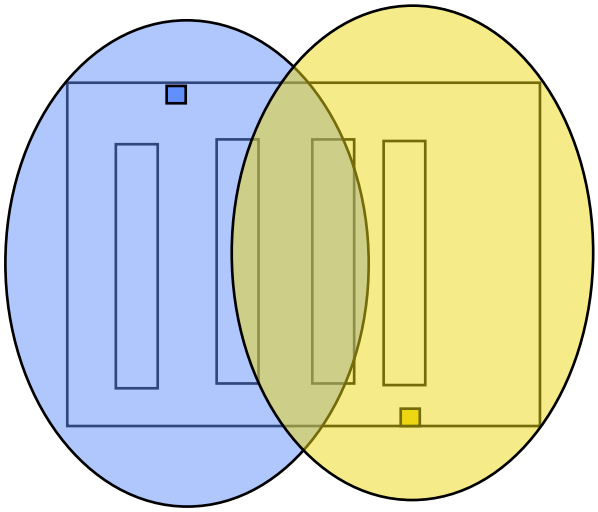
A goods depot may be covered with a base station loacated in the center, using internal or swivel omni antenna. Often the costs of having a power supply and network cable on one of the walls is lower and also mounting may be easier. In this case, the Data-Unwired directional antenna may help. With its help all the room may be covered from one corner.





In the following, the Data-Unwired directional antenna may reduce the amount of base stations needed. Depending on the environment, installation may be easier. Additionally the specific structure of the environments may be covered better as for example the antennas may be able to beam into the corridors.



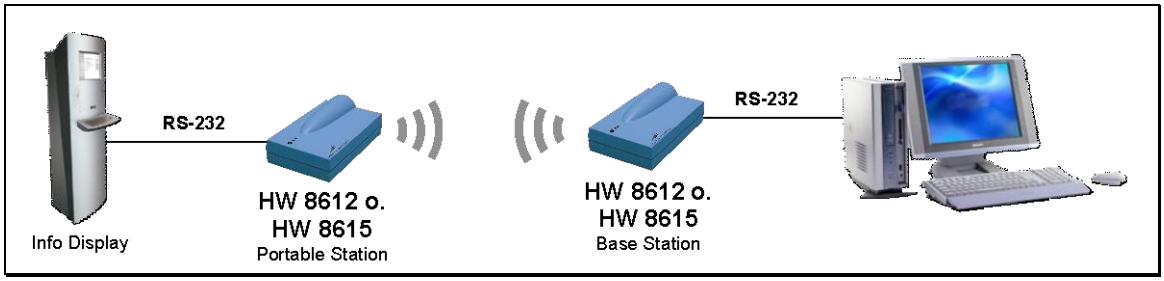


6. Appendix

6.1 Application Examples

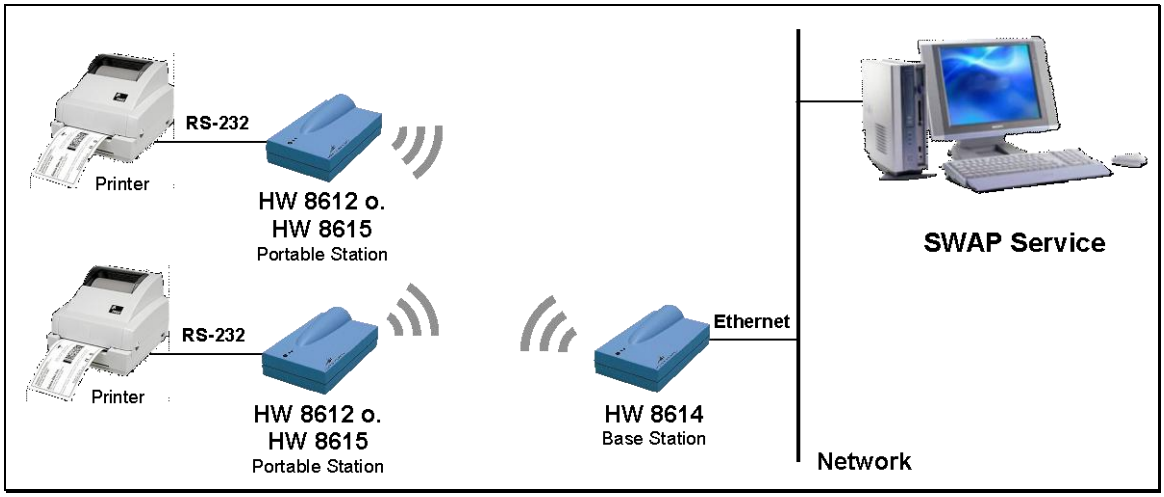
6.1.1 Connecting Serial Devices

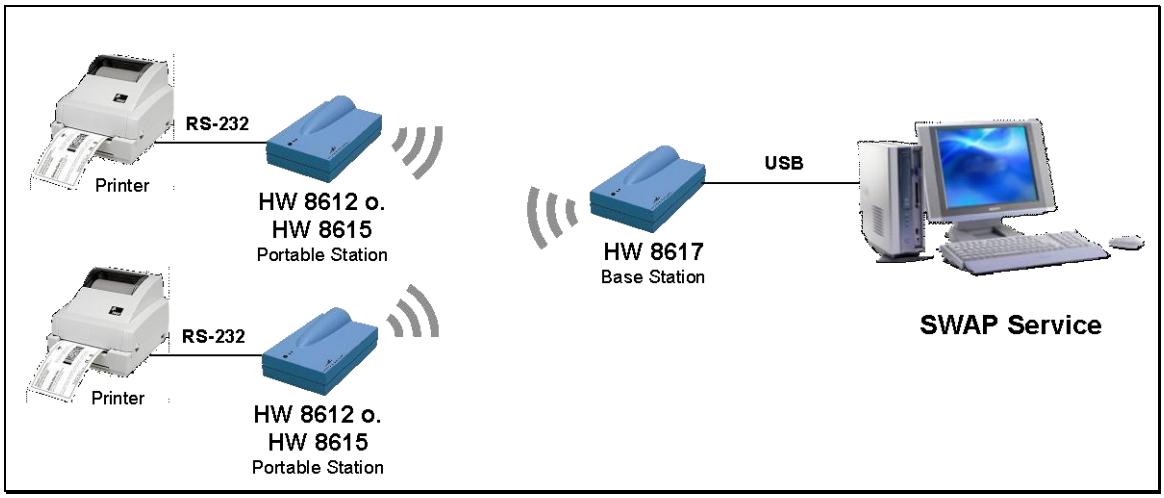
6.1.1.1 Point-to-Point



Transparent link is provided, no driver software required.

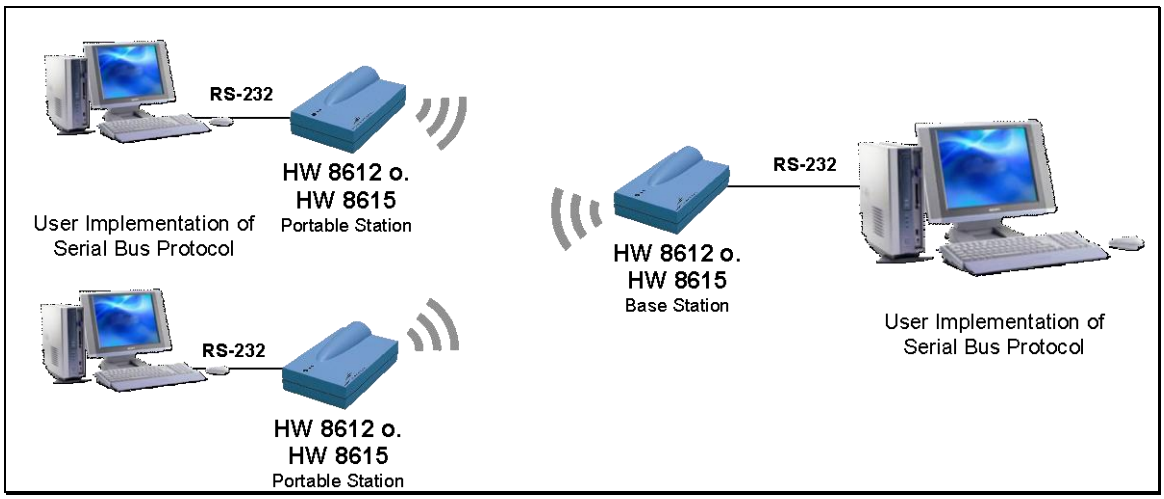
6.1.1.2 Point-To-Multipoint (Transparent Mode)



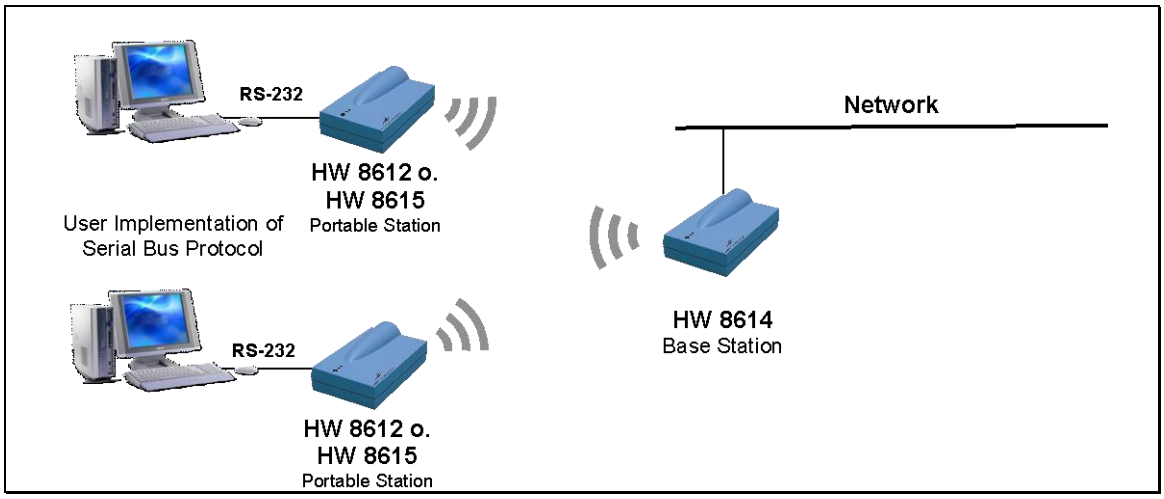


Ethernet or USB Base Station may be used. SWAP Service required.

6.1.1.3 Point-To-Multipoint (ETH Mode)



Serial Bus Protocol implemented on both FT and PT side.

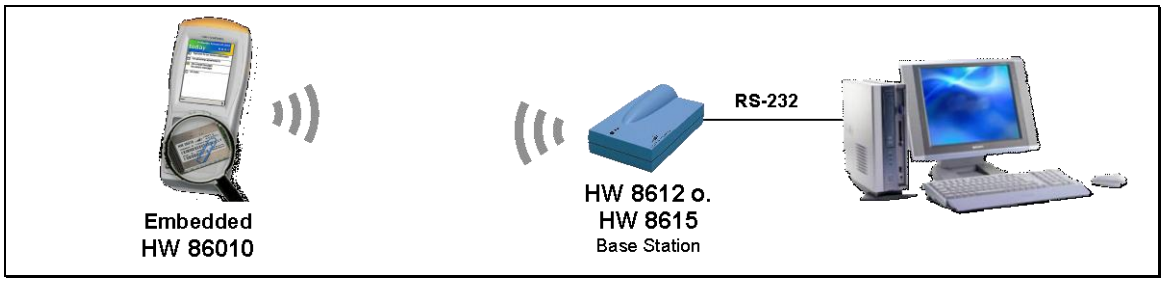


Serial Bus Protocol implemented on PT side. USB Base Station may also be used.

6.1.2 Connecting Embedded Modules

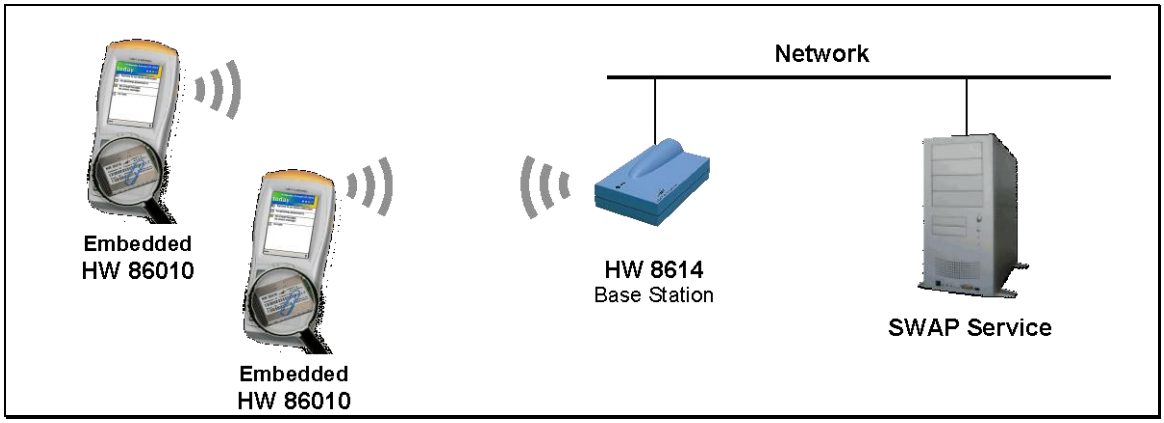
The Embedded Modules HW 86010 and HW 86020 may easily be integrated into miscellaneous systems. An application hosting these modules can simply be connected to the wireless network. Refer to HW 86010 Integration Manual and HW 86010 Firmware Manual for details on interfaces and configuration commands.

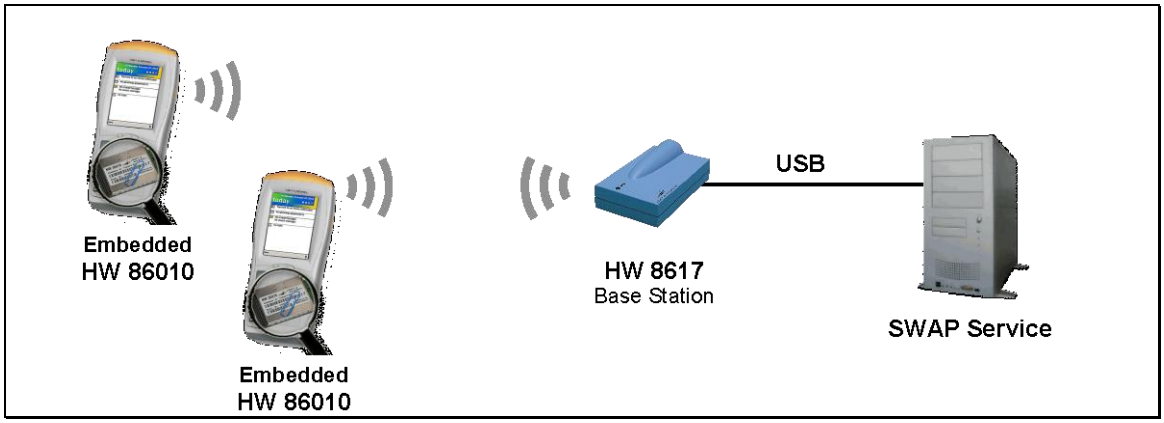
6.1.2.1 Point-to-Point



Transparent link provided, no driver software required.

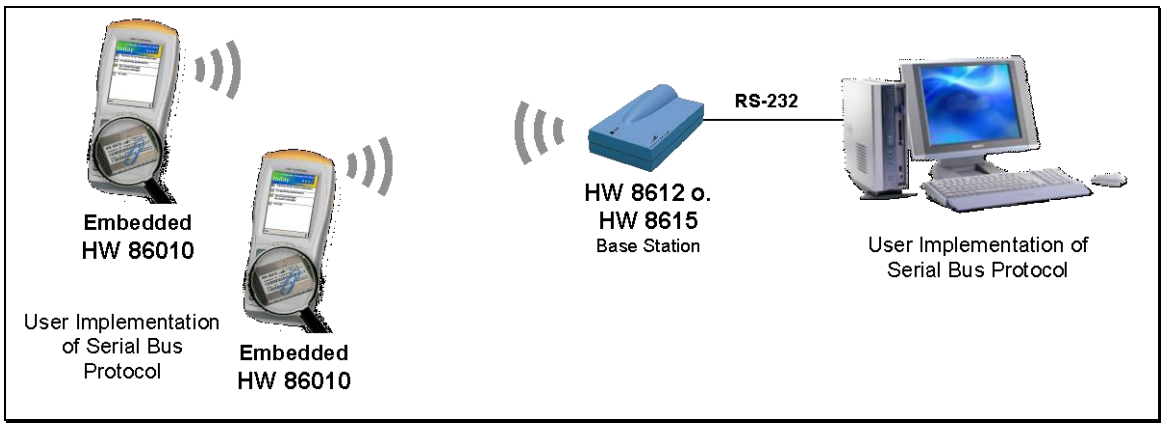
6.1.2.2 Point-To-Multipoint (Transparent Mode)



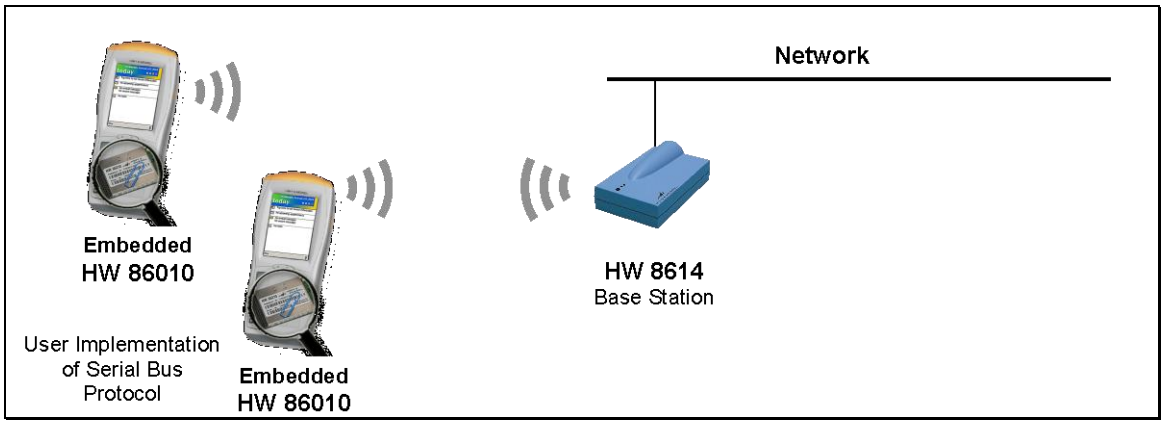


Ethernet or USB base station may be applied. Requires SWAP Service.

6.1.2.3 Point-to-Multipoint (ETH Mode)

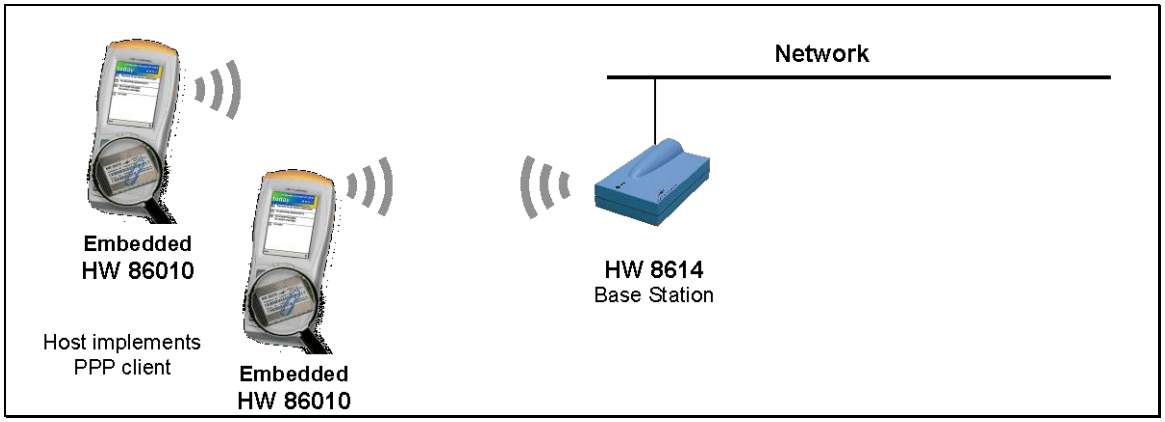


Serial Bus Protocol implemented on both FT and PT side.



Serial Bus Protocol implemented on PT side only. USB Base Station may also be used.

6.1.2.4 Point-to-Multipoint (PPP Mode)

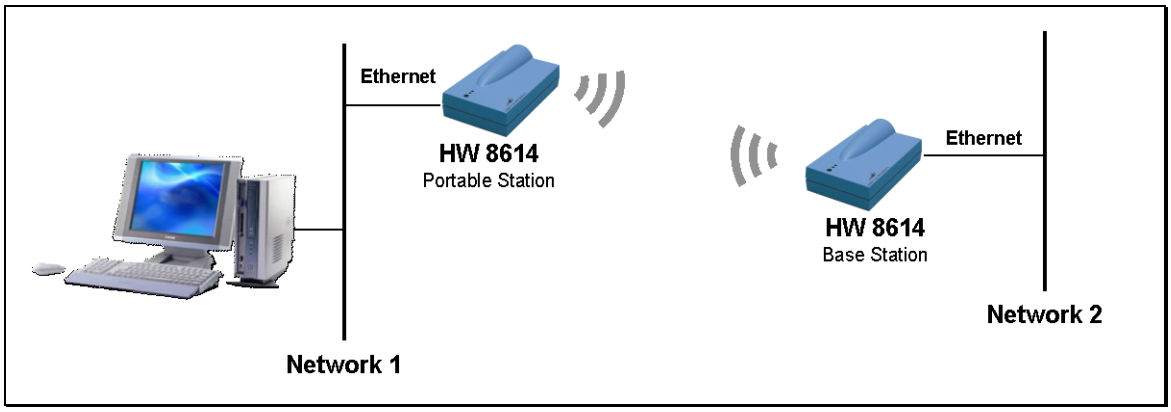


Device hosting the PT module implements a PPP client. USB Base Station may also be used.

6.1.3 Connecting Network Segments

Data-Unwired base stations allow for direct connection of network segments, for setting up a wireless network or for connecting one PC to a network.

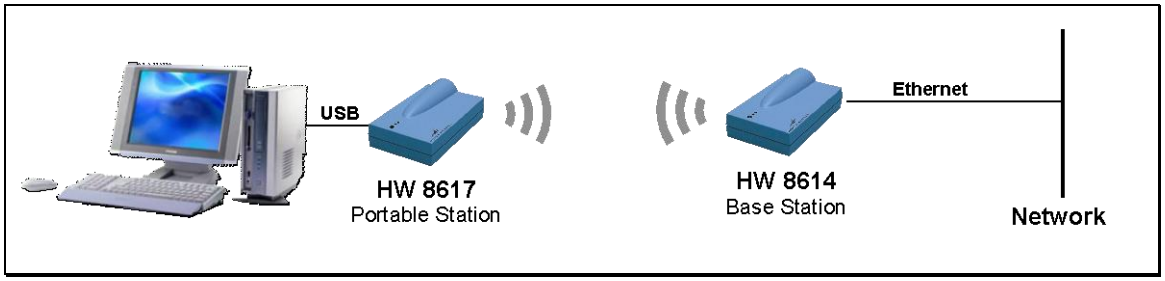
6.1.3.1 Wireless Bridge



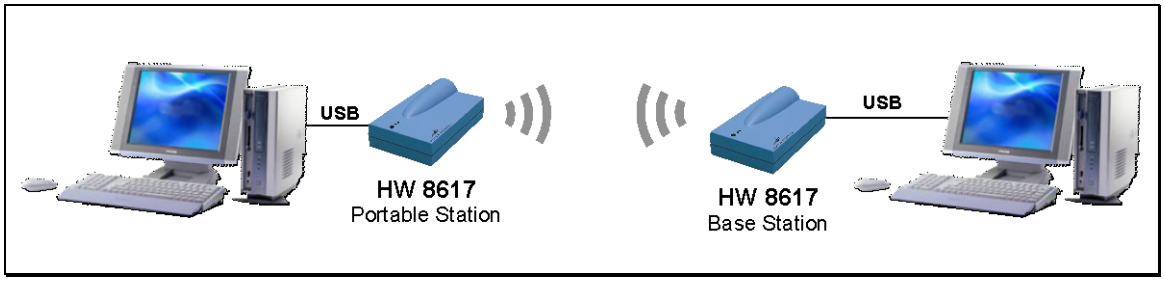
ATTENTION!

Connect only independant network segments with the help of a wireless bridge, otherwise a network loop may occur which may lead to a complete breakdown of communication.

6.1.3.2 Network Connection via USB



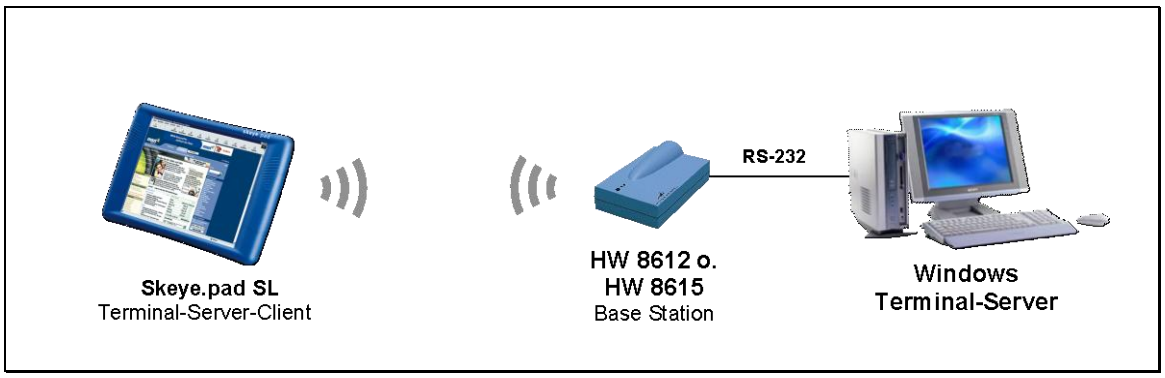
6.1.3.3 PC-to-PC Connection



6.1.4 Connecting Hoeft & Wessel's Skeye.Pad SL

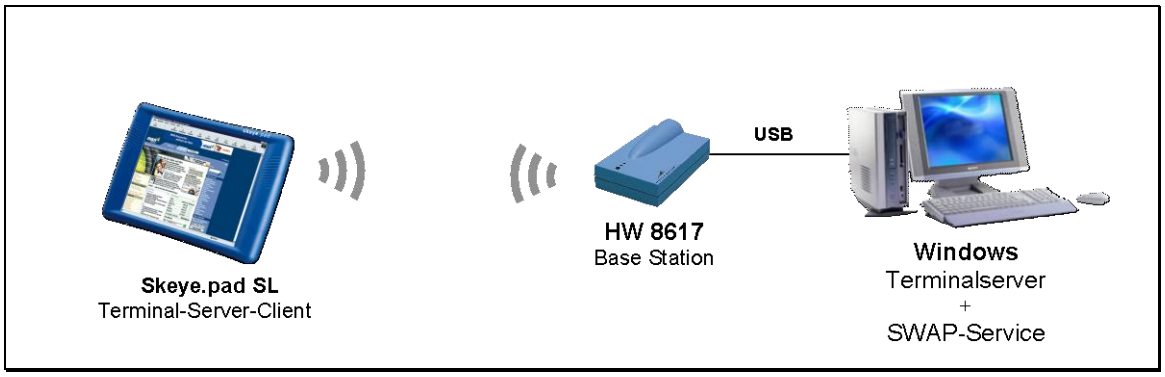
Hoeft & Wessel's Skeye.Pad SL DECT can be connected directly to a Windows Terminal Server.

6.1.4.1 Point-to-Point – Remotedesktop/Terminalserver



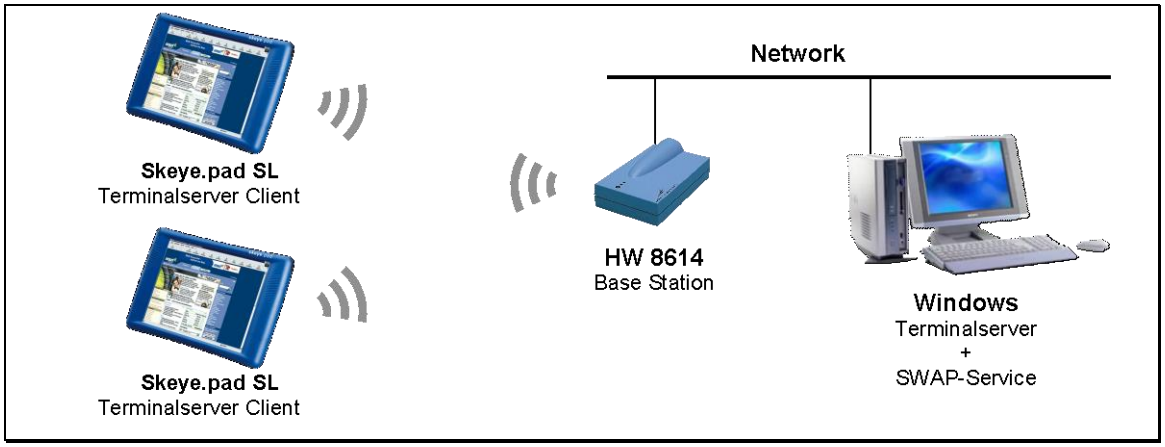
Requires Windows 2000 Server or Windows XP.

6.1.4.2 Point-to-Point – Remotedesktop/Terminalserver (USB)



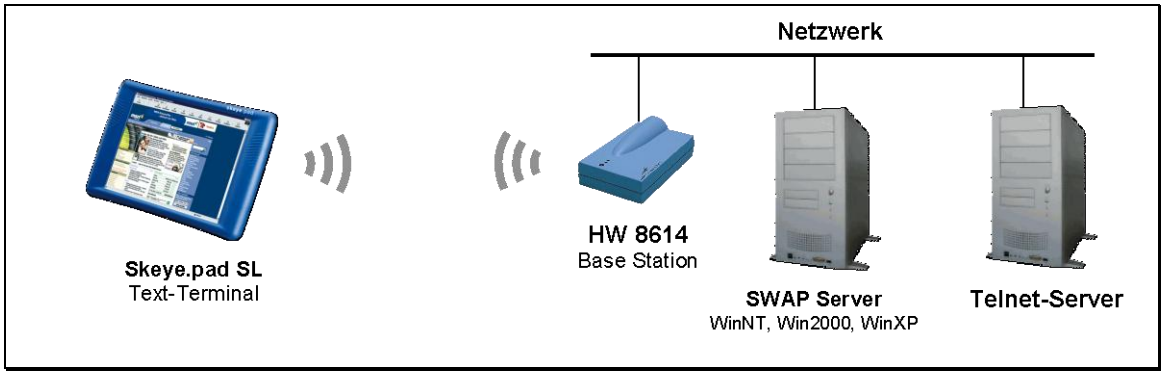
Requires Windows 2000 Server or Windows XP and SWAP Service.

6.1.4.3 Point-To-Multipoint – Remotedesktop/Terminalserver



Requires Windows 2000 Server or Windows XP and SWAP Service.

6.1.4.4 Telnet Forwarding

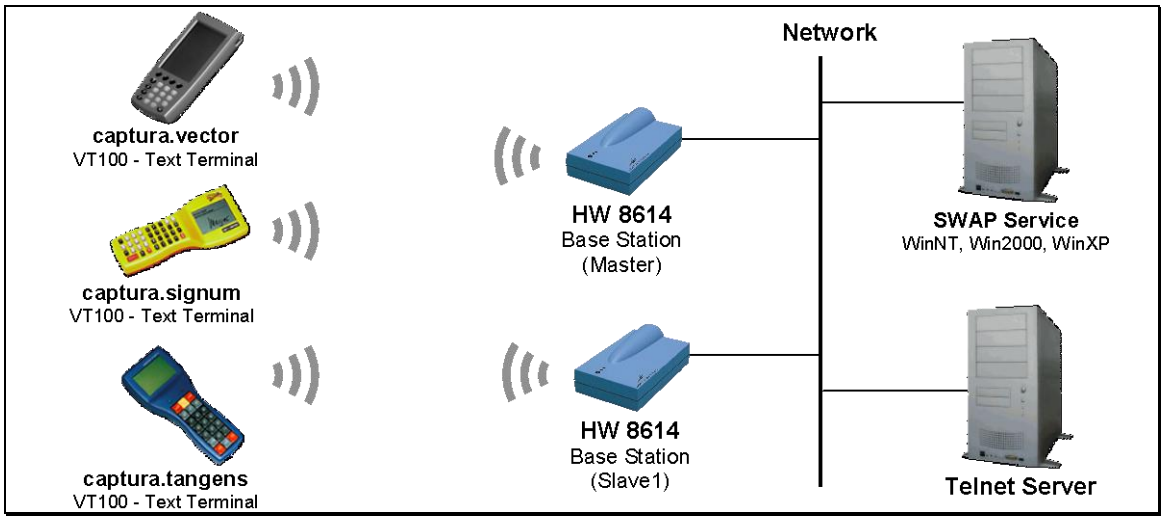


Requires Telnet server and SWAP Service.

6.1.5 Connecting Höft & Wessel's Captura Terminals

Höft & Wessel's captura devices may be applied easily using a terminal application. DECT option required on mobile devices.

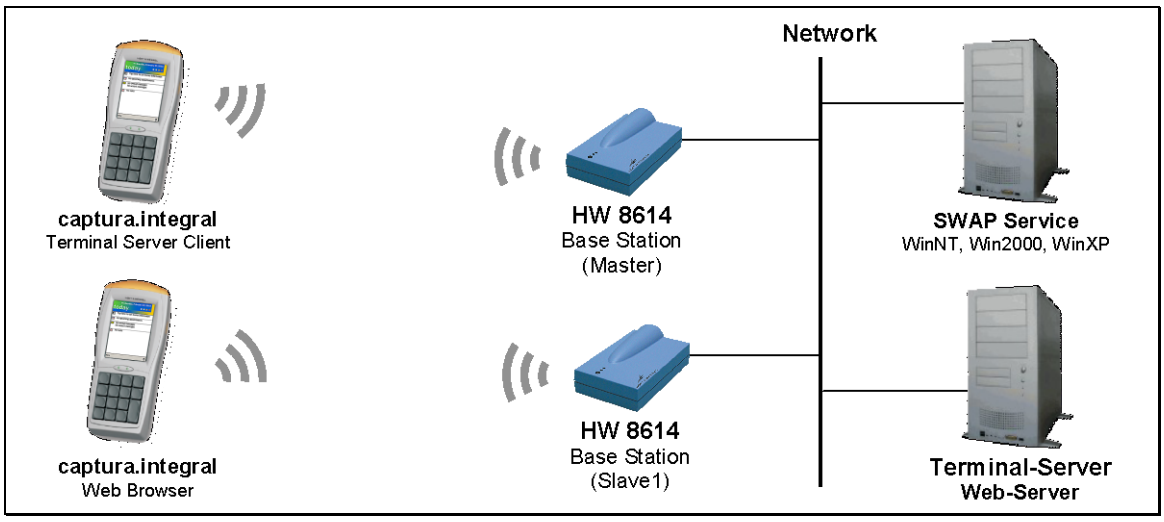
6.1.5.1 Online Terminal Application



Requires Telnet server and SWAP Service.

6.1.5.2 Remote Desktop / Terminal Server / Web Client

Also captura devices based on Windows CE.net can be applied easisly.

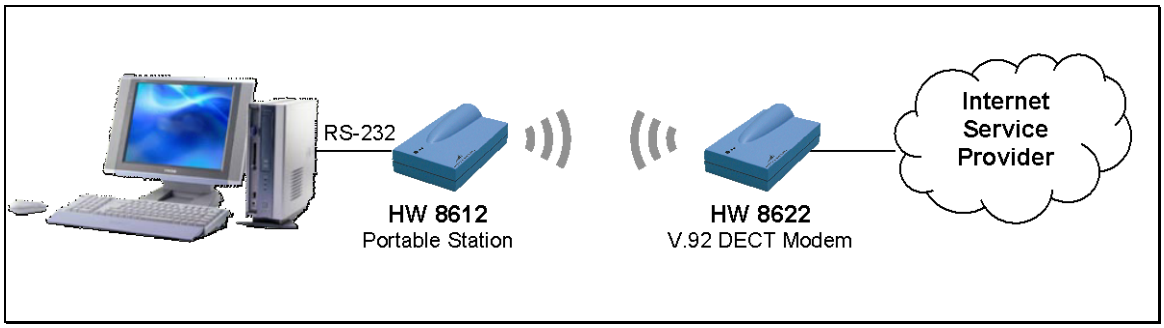


Requires terminal / web server and SWAP Service.

6.1.6 Wireless Internet Access

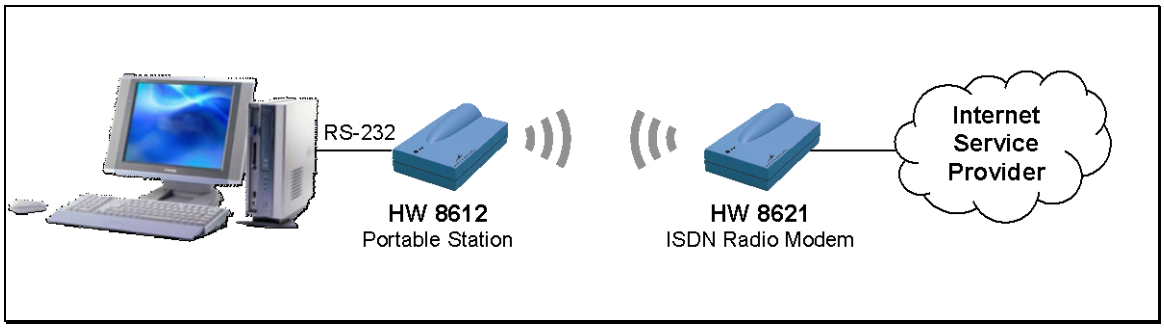
Data-Unwired product allow for wireless Internet access using different technologies.

6.1.6.1 PSTN



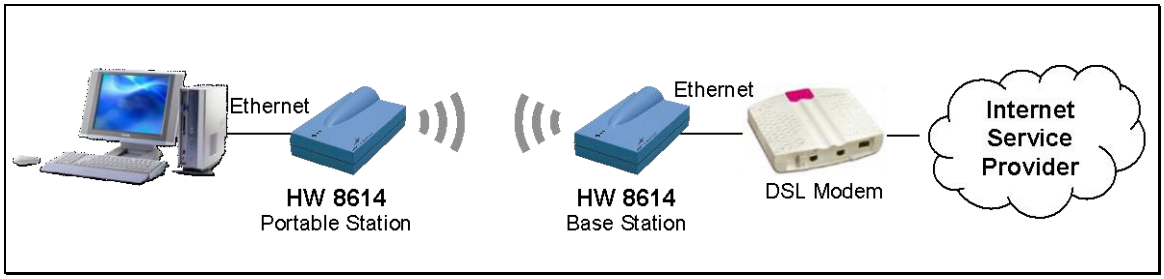
Uses connection based DECT protocol and requires only standard modem drivers.

6.1.6.2 ISDN

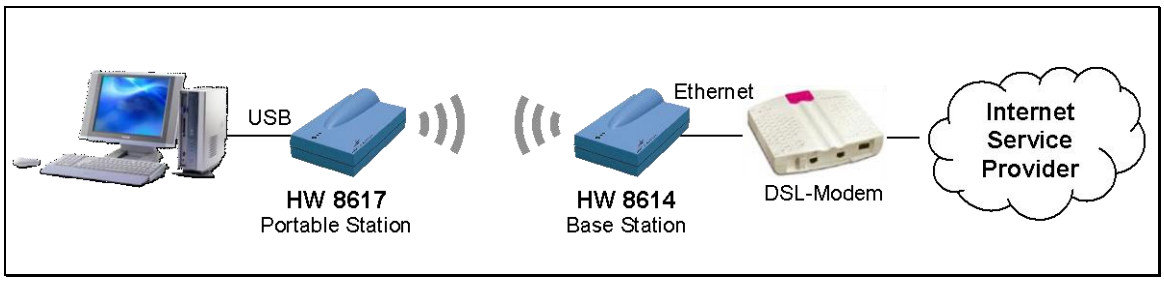


Uses connection based DECT protocol and requires only standard modem drivers.

6.1.6.3 DSL



6.1.6.4 DSL Access using USB port



6.2 Configuration Profiles

Typical configurations are described below. Note that PT devices must be subscribed to a base station before a radio link can be established. Use Data-Unwired Management Console to perform subscription (see section 6.1.3.1).

6.2.1 Point-To-Point Connection-based

Base station (HW 8612/HW 8615/HW 86010/HW 86020)

Parameter	Value	Configuration Command
CLDPS	OFF	SPCLDPS OFF
Protocol	OFF	SPPR OFF
Termination	FT	SPTM FT

Portable Station (HW 8612/HW 8615/HW 86010/HW 86020)

Parameter	Value	Configuration Command
CLDPS	OFF	SPCLDPS OFF
Protocol	OFF	SPPR OFF
Termination	PT	SPTM PT

No driver software required.

6.2.2 Point-To-Point CLDPS

Base station (HW 8612/HW 8615/HW 86010/HW 86020)

Parameter	Value	Configuration Command
CLDPS	ON	SPCLDPS ON
Protocol	OFF	SPPR OFF
Termination	FT	SPTM FT

Portable Station (HW 8612/HW 8615/HW 86010/HW 86020)

Parameter	Value	Configuration Command
CLDPS	ON	SPCLDPS ON
Protocol	OFF	SPPR OFF
Termination	PT	SPTM PT

No driver software required.

6.2.3 Point-To-Multipoint (Transparent mode)

Base Station (HW 8614/HW 8617)

Parameter	Value	Configuration Command
CLDPS	ON	SPCLDPS ON
Protocol	OFF	SPPR ON
Termination	FT	SPTM FT

Portable Station(s) (HW 8612/HW 8615/HW 86010/HW 86020)

Parameter	Value	Configuration Command
CLDPS	ON	SPCLDPS ON
Protocol	OFF	SPPR OFF
Termination	PT	SPTM PT

SWAP Service is required.

6.2.4 Point-To-Multipoint (ETH mode)

Base station (HW 8612/HW 8615/HW 8614/HW 8617/HW 86010/HW 86020)

Parameter	Value	Configuration Command
CLDPS	ON	SPCLDPS ON
Protocol	OFF	SPPR ON
Termination	FT	SPTM FT

Portable Station(s) (HW 8612/HW 8615/ HW 86010/HW 86020)

Parameter	Value	Configuration Command
CLDPS	ON	SPCLDPS ON
Protocol	OFF	SPPR ON
Termination	PT	SPTM PT

Serial Bus Protocol must be implemented.

6.2.5 Point-To-Multipoint (PPP mode)

Base Station (HW 8614/HW 8617)

Parameter	Value	Configuration Command
CLDPS	ON	SPCLDPS ON
Protocol	OFF	SPPR ON
Termination	FT	SPTM FT

Portable Station(s) (HW 8612/HW 8615/HW 86010/HW 86020)

Parameter	Value	Configuration Command
CLDPS	ON	SPCLDPS ON
Protocol	OFF	SPPR OFF
Termination	PT	SPTM PT
PPP	n.a.	SPPP ON

Requires a PPP implementation on the device hosting the PT. PPP setting not supported by Data-Unwired Management Console, needs to be applied through the Data-Unwired Management Console Configuration Terminal.

6.2.5.1 Dial-up Options

The PPP dial-up procedure may applied using AT commands or Microsoft Direct Link protocol.

6.2.5.1.1 AT Commands

The portable device implements an AT command handler, responding „OK“ on all incoming AT commands. Dial-up may be started with „ATD <any number>“. The PT immediately responds with „CONNECT“ and activates the DCD.

6.2.5.1.2 Microsoft Direct Link

Client sends „CLIENT“, the PC responds with "CLIENTSERVER" and sets DCD. This option can not be used if DHCP is not available and gateway and netmask settings must be configured manually.

6.2.5.2 PPP Options

After successful dial-up the PPP options will be negotiated.

6.2.5.2.1 DHCP available

Through DHCP the PT derives the following configurations:
1. IP address for PPP client
2. IP-address DNS server 1
3. IP-address DNS server 2
4. IP-address WINS server 1
5. IP-address WINS server 2
6. IP-address gateway
7. Netmask

1. to 5. are transfered to the client during PPP connection establishment.
6. and 7. are only required by the PT for internal usage.

6.2.5.2.2 DHCP not available

In case a DHCP server is not available parameters 1. to 5. will be configured by the client’s PPP access software. It is possible to configure the gateway address and netmask through PPP options. In case the network consists of several sub-networks those parameters must be set through the following AT commands:

AT+GW=a.b.c.d	configures gateway address
AT+NM=a.b.c.d	configures netmask

6.2.6 Radio Bridge

Base Station (HW 8614)

Parameter	Value	Configuration Command
CLDPS	ON	SPCLDPS ON
Protocol	ON	SPPR ON
Termination	FT	SPTM FT

Protable Station (HW 8614)

Parameter	Value	Configuration Command
CLDPS	ON	SPCLDPS ON
Protocol	ON	SPPR ON
Termination	PT	SPTM PT

No driver software required.

ATTENTION!

Connect only independant network segments with the help of a wireless bridge, otherwise a network loop may occur which may lead to a complete breakdown of communication.

6.2.7 Remotedesktop / Terminalserver

On a PC running Terminal Server the modem type „Communication cable on COMx“, incoming connection, will be configured on a virtual COM port served by the SWAP service. A Skeye.pad may now establish a RAS connection to the Terminal Server.

6.3 Serial Bus Protocol

6.3.1 Introduction

The Data-Unwired products HW 8612, HW 8615, HW 86010 und HW 86020 are equipped with a serial V.24 / RS-232 interface. For using these devices in a point-to-multipoint system the CLDPS protocol was implemented, which is based on the transmission of ethernet frames. In the easiest application, data will be exchanged transparently between module and host on a PT device. Inside the module the SWAP client converts transparent data into ethernet frames in order to address them to the SWAP Service, located in the network. The SWAP service will now redirect data streams from the different PTs to the corresponding interfaces.

In case the SWAP Service can not be used, for example if the system does not support the required operating system, the serial bus protocol may be applied. It implements a procedure to transmit ethernet frames on the serial interface.

The serial bus protocol is described in this section.

6.3.2 Architecture

A serial bus system comprises a FT - bus master – and up to 64 PTs – bus ports. The communcation is based on datagrams which are exchanged serially between FT and PTs. The bus system accepts occasional losses of datagrams and implements its own re-transmit procedures.

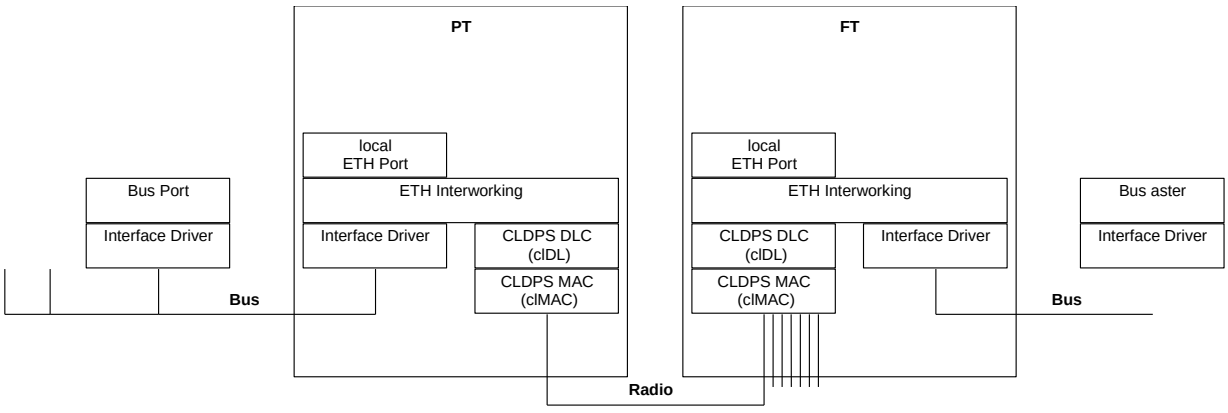
The radio system is based in a cellular structure. A radio cell comprises one FT and several PT. To take part on a radio cell a PT must be attached to the FT. One FT may handle up to 64 PTs being registered simultaneously.

Systems comprising multiple radio cells allow for the PTs to change between cells (roaming). A PT may only be registered to one cell at a time and will have to cancel its current registration before registering to another cell's FT.

CLDPS defines the radio protocol inside a radio cell, namely the MAC and DLC layer of the OSI layer model (in the following refered to as clMAC and clDL). The bus protocol (NWK layer, OSI layer 3) is not part of CLDPS.

Insofar CLDPS only supports data transfers between FT und PTs and vice versa. There is no direct communication between two PTs.

The basic protocol architecture is shown here:



6.3.3 CLDPS

CLDPS is a packet based protocol for connection-less data transfer through the DECT air interface.

The advantages of the connection-less data transfer are:

- the available system data capacity is dynamically distributed to the PTs according to the demand.
- thus a large amount of PTs - with the corresponding low bandwidth - may be operated simultaneously.
- a PT may occupy a high capacity for a short period of time in order to transfer a data burst.
- PTs will only occupy a channel if payload data are to be transferred. The channel capacity will therefore be used efficiently.

6.3.3.1 Addressing

CLDPS addresses a PT through a temporary 8-bit address (PtAddr). A PT obtains its PtAddr dynamically from a FT at registration. It will be valid throughout the session. If a PT changes the radio cell it will obtain a new PtAddr.

As there is one FT per radio cell, CLDPS does not specifiy an FT address.

PtAddr is basically different from bus addresses used in bus systems. According to the system architecture more than one bus ports may be available through a PtAddr, so it is not a 1:1 correlation between addresses.

The CLDPS firmware implements ethernet interworking. This function manages mapping between ethernet MAC address and the corresponding temporary PtAddr.

6.3.3.2 Functionality

CLDPS processes datagrams with variable lengths of up to 1600 bytes.

The datagram's integrity will remain during transmission, i.e. the receiver side will output the complete datagram.

Datagrams may be transferred as either unicast or multicast. A unicast datagram is directed to a specific port whereas a multicast addresses all bus ports.

There is no direct communication between PTs. In case a PT sends a multicast datagram or an unicast datagram to a specific PT, the datagrams are first transmitted to the FT which relays them to their destination.

Internally protocols for error correction are used in order to reliably detect transmission errors and solve this condition by re-transmission. The application may assume that the data delivered by CLDPS are correct. However, complete loss of datagrams is possible. The order of unicast datagrams to and from any PT will remain.

6.3.3.3 Registration to a Base Station

The PT will automatically register to an available FT under control of CLDPS. Of course it must first be subscribed to the FT(s) during configuration.

6.3.3.4 Ethernet Interworking

Hoeft & Wessel's standard firmware provides ethernet frame transfer capabilities and includes the necessary interworking.

Every module is delivered with its own ethernet MAC address, so that it can be directly addressed from the network.

Every device attached to the radio module requires its own MAC address.

Every FT maintains a dynamic list of MAC addresses of all currently associated PTs.

Every PT manages a dynamic list of ethernet MAC addresses which it is able to reach.

The interworking allows for packet transfer between two devices being connected to different PTs. Transfer is realised with the help of the FT serving as a relay station. From the received packet's address the FT firmware derives the information that the packet has to be resent over the air again to reach its destination.

6.3.4 Implementation

The following characteristics must be considered for an implementation of the serial bus protocol.

6.3.4.1 Addressing

Connected devices must have an address which is similar to ethernet MAC addresses.

A MAC address consists of 6 bytes (48 bits) in the representation B0:B1:B2:B3:B4:B5 (in the order of transmission). B0 to B2 respresent the vendor ID. The LSB of B0 identifies if a packet is a unicast (0) or multicast (1). So the vendor ID comprises 23 bit.

B3 to B5 is an unique number in the responsibility of the manufacturer.

The MAC address FF:FF:FF:FF:FF:FF indicates an ethernet broadcast.

As long as the system is not really connected to an ethernet the addresses may in principle be arbitrary if they keep to the basic MAC address structure. The vendor ID 00:00:00 is not assigned as a vendor ID and may therefore be used to generate pseudo MAC addresses for the serial bus protocol, i.e. addresses like 00:00:00:B3:B4:B5 may be used.

In case the system is attached to a real ethernet network the MAC addresses used must be worldwide unique, that means the manufacturer has to purchase his own vendor ID from IEEE.

Hoeft & Wessel uses the vendor ID 00:30:2E. If the available numbering range is exhausted a new Id will be applied.

6.3.4.2 Ethernet Frame Structure

The frame used with serial bus protocol is structured similar to an ethernet frame.

DestAddr (6 Byte)	SourceAddr (6 Byte)	Type/Len (2 Byte)	Data (max. 1500 Byte)

The order of transmission is from left to right.

DestAddr — Destination address. B0 send out first.

SourceAddr — Source address. B0 send out first.

Type/Len — Ethernet uses this field for different purposes. If the value is not larger than 1500 it indicates the data field length, if it is larger than 1500 it indicates the contained protocol. The MSB is transmitted first.

The radio system does not interpret the Type/Len field but accepts all following bytes up to the physical frame end as data bytes. The bus protocol may therefore use the Type/Len field at discretion. Considering a real ethernet application however, the use according to ethernet specification is recommended, i.e. using it as a length indicator in the easy way.

Data — User data (max. 1500 bytes)

The ethernet preamble and the 32 bit CRC checksum are not covered here. Usually the interface controller hardware of ethernet devices will generate and analyse theses fields automatically. They are not transmitted during the transfer on a serial interface as described below.

6.3.4.3 Format at the serial Interface

For the transmission of ethernet frames through a serial interface a HDLC frame format is used. Only so called UI frames are used, which does not require acknowledge messages. I.e. it is not necessary to implement a protocol on the host devices, only the frame format must be supported.

Transmission is done byte-wise in the order of byte numbers. Bit 0 is LSB. The following frame type is applied:

Byte No.	Name	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	Flag	0	1	1	1	1	1	1	0
2	Addr	First	0	1	0	FrameNum		Last	1
3	Ctrl	0	0	0	0	0	0	1	1
4		Ethernet Frame Segment							
...	ETH	...							
L-3		Ethernet Frame Segment							
L-2	CRC	HDLC CRC (low byte)							
L-1	CRC	HDLC CRC (high byte)							
L	Flag	0	1	1	1	1	1	1	0

Flag — Block Start identifier and Block End identifier.

Addr — The Addr byte in the HDLC frame will transport the following information:

First — First=1 means the HDLC frame contains the first segment of an ethernet frame. Ethernet-Frames. For unsegmented frames always apply First=1. [3]

FrameNum — HDLC frame number. Transmitter increments modulo 4 for each new HDLC frame.

[3] Segmentation currently not supported

Last	Last=1 means that HDLC frame contains the last segment of an ethernet frame. For unsegmented frames always apply Last=1.
Ctrl	The Ctrl byte has the fixed value 0x03. It identfies the UI frame type.
ETH	User data contain a ethernet frame segment.
CRC	16 bit HDLC checksum as described in RFC 1662. It is calculated over Adrr, Ctrl and ETH fields

6.3.4.4 Transparency

The HDLC specification demands the value 0x7e never to occur as a character in a HDLC frame, i.e. nor in user data nor in CRC, as an example. The following algorithm is applied:

The transmitter will first compile the complete HDLC frame including CRC. On the output to the serial interface every occurance of 0x7e between flag bytes will be replaced with the sequence 0x7d 0x5e. The same way, 0x7d is replaced by the sequence 0x7d 0x5d.

When reading data from the serial interface, the receiver will first detect frame start and frame end from the flag bytes. In the following, each occurance of 0x7d will be removed and the character following 0x7d will be x-or-ed with 0x20. This way 0x5d becomes 0x7d and 0x5e becomes 0x7e.

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