User's Manual
for
Node C Prototype
Network Elements
with Interface Unit

TABLE OF CONTENTS

FIGURES AND TABLES

1 GENERAL

1.1 ABBREVIATIONS

A/D	Analogue to Digital Converter
ALC	Automatic Level Control
ARFCN	Absolute Radio Frequency Channel Number
BITE	Built In Test Equipment
BTS	Base Transceiver Station
CDMA	Code Division Multiple Access
CF	Center Frequency
CFO	Center Frequency Offset
D/A	Digital to Analogue Converter
D-ICE	Digital Interference Cancellation
DCM	Digital Channel Module
DL	Downlink
DSP	Digital Signal Processor
EMIF	External Memory Interface
ESB	Embedded System Block
ESD	Electrostatic Discharge
ETSI	European Telecommunication Standards Institute
FPGA	Field Programmable Gate Array
FRU	Field Replaceable Unit
I^2C Bus	Inter Integrated Circuit Bus (Philips)
ICE	Interference Cancellation Equipment
ID No	Identification Number
IF	Intermediate Frequency
LE	Logic Elements
LMT	Local Maintenance Terminal
LVPECL	Low Voltage Positive Emitter Coupled Logic
MSPS	Mega Samples Per Second
NCO	Numerically Controlled Oscillator
OMC	Operation and Maintenance Centre
PCMCIA	Personal Computer Modem Communication International Association
PLL	Phase Lock Loop
PSTN	Public Switched Telephone Network
RF	Radio Frequency
RLP	Radio Link Protocol
RSCP	Received Signal Code Power
RSSI	Receive Signal Strength Indication
RTC	Real Time Clock
RX	Receiver
SCL	Serial Clock
SDA	Serial Data
SMS	Short Message Service
TS	Transmitter
UL	Uplink
UMTS	Universal Mobile Telecommunication System
UPS	Uninterruptable Power Supply
VSWR	Voltage Standing Wave Ratio
WCDMA	Wide-band Code Division Multiple Access

1.2 HEALTH AND SAFETY WARNINGS

1. Only suitably qualified personnel is allowed to work on this unit and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual.

2. Read and obey all the warning labels attached to the unit. Make sure that the warning labels are kept in a legible condition and replace any missing or damaged labels.

3. Obey all general and regional installation and safety regulations relating to work on high voltage installations, as well as regulations covering correct use of tools and personal protective equipment.

4. Keep operating instructions within easy reach and make them available to all users.

5. It is the responsibility of the network provider to implement prevention measures to avoid health hazards which may be associated to radiation from the antenna(s) connected to the unit.

6. Make sure, access is restricted to qualified personnel.

7. Use this equipment only for the purpose specified by the manufacturer. Do not carry out any modifications or fit any spare parts which are not sold or recommended by the manufacturer. This could cause fires, electric shock or other injuries.

8. Due to power dissipation, the network element may reach a very high temperature.

9. Before opening the unit, disconnect mains.

10. ESD precautions must be observed! Before commencing maintenance work, use the available grounding system to connect ESD protection measures.

11. This unit complies with European standard EN60950.

12. Make sure the network element settings are according to the intended use (see also product information of manufacturer) and regulatory requirements are met.

13. Although the network element is internally protected against overvoltage, it is strongly recommended to earth the antenna cables close to the network element's antenna connectors for protection against atmospheric discharge.

1.3 PREAMBLE

Mikom An Andrew Company is a leading manufacturer of coverage equipment for mobile radio networks, specializing in low cost, high performance, RF and optical repeaters. Our optical distributed networks and RF repeater systems provide coverage for every application: outdoor use, indoor installations, tunnels, subways and many more.

Mikom has engineering and manufacturing facilities in Germany, Italy and the USA. In addition, it maintains many field engineering offices throughout the world.

Mikom GmbH operates a quality management system which complies with the requirements of ISO 9001. All equipment is manufactured using only highly reliable materials. In order to ensure constant first-rate quality of the products, a comprehensive quality assurance has been conducted at all fabrication stages. Every component leaves the factory only after a thorough final acceptance test, accompanied by a test certificate guaranteeing optimal function.

The declaration of conformity for the product is available on request via the local offices or from Mikom directly.

Any intervention must be carried out by authorized persons only. If technical assistance for the product is required, please contact the local office or Mikom directly at one of the following addresses:

Mikom GmbH An Andrew Company
Industriering 10
86675 Buchdorf
Germany
Phone: +49 (0) 9099 69 0
Fax: +49 (0) 9099 69 930
email: WIsupport.germany@andrew.com

for The Americas:

Mikom US An Andrew Company
Phone: +1 (919) 771-2570
email: WIsupport.us@andrew.com

When set-up is performed according to this manual, the system will operate without complications for a significant length of time.

1.4 INTERNATIONAL CONTACT ADDRESSES

in Australia	in France	in the USA
6 Stuart Street Padstow NSW 2211 Australia Phone: +61 (2) 9774-4200 Fax: +61 (2) 9774-4500 email: WIsupport.australia@andrew.com	Z.I. des Ebisoires 78370 Plaisir France Phone: +33 (1)30-79-15-36 Fax: +33 (1) 30-55-55-37 email: WIsupport.france@andrew.com	108 Rand Park Drive Garner NC 27529 USA Phone: +1 (919) 771-2570 Fax: + 1 (919) 771- email: WIsupport.us@andrew.com
in the UK	**in China**	**in Canada**
Guildgate House Pelican Lane Newbury RG14 1NX, Berkshire, U.K. Phone: +44 (1635) 569-695 Fax: +44 (1635) 569-463 email: WIsupport.uk@andrew.com	Ground Floor, Unit F, Tower 2 The Astoria 198 Argle Street, Mau Tau Wai, Kowloon Hongkong Phone: +852 2778 3187 Fax: +852 2778 3187 email: WIsupport.china@andrew.com	1815 Ironstone Manor, # 12 Pickering, Ontario L1W 3W9 Canada Phone: +1 (905) 839-3474 Fax: +1 (905) 839-4663 email: WIsupport.canada@andrew.com
in Switzerland	**in Italy**	**in Austria**
Tiergartenweg 1 4710 Balsthal Switzerland Phone: +41 (6238) 61260 Fax: +41 (6238) 61261 email: WIsupport.switzerland@andrew.com	Via De Crescenzi 40 48018 Faenza Italy Phone: +39 0546 697111 Fax: +39 0546 682768 email: WIsupport.italia@andrew.com	Weglgasse 10 2320 Schwechat Austria Phone: +43 (1) 706 – 3999 Fax: +43 (1) 706 – 39999 email: WIsupport.austria@andrew.com
in Czech Republic		
U Morusi 888 530 06 Pardubice-Svitkov Czech. Republic Phone: +42 (0406) 301280 Fax: +42 (0406) 301298 email: WIsupport.czechrep@andrew.com		

table 1-1 List of international contact addresses

2 INTRODUCTION

2.1 PURPOSE

Wireless communication systems provide a two-way information transfer (voice and data) between a base station and multiple mobiles within a given area.

Environmental variables such as physical structures both man-made (buildings) and natural (mountains) attenuate signals in the transmission path, which reduce the transport signal's strength. This attenuation leads to a reduction in quality and data rate and eventually prohibits the system's use entirely. A Node C is specifically designed to extend coverage, enhance quality, and increase air-interface capacity.

In the downlink (DL), the Node C picks up signals coming from the base station, filters them, amplifies them, and retransmits them to the mobile. In the uplink (UL), it picks up signals from the mobile, filters them, amplifies them, and retransmits them to the base station. The Node C constantly monitors the quality of the signals passing through it, while simultaneously electronically decreasing isolation requirements.

2.2 THE NODE C NETWORK ELEMENT

The Node C is a primary network element, capable of enhancing up to three adjacent CDMA carriers in a CDMA system. Its primary function is to increase the signal strength between multiple mobiles and a base station in areas where basic voice or high-speed data transmission is not available. It may be used for basic coverage, signal reinforcement, and cell shaping, which can increase a network's coverage area, data rate, and capacity.

The Node C is a dedicated CDMA device. However, several enhancers operating at different frequencies and technologies may share the same hardware (cables and antennas) via a crossband coupler. Within the CDMA frequency band, multiple operators may use the same unit via additional modules, thus reducing cost, while sharing the user interface and antennas.

The Node C may be set-up locally or remotely. A circuit switch or packet data modem may be connected to an integrated controller. This provides the network management system with on-demand, alarm generated, or heartbeat monitoring via the always-connected packet features. The Node C has features and functions that may be monitored and changed by the operators via a web-based browser remotely or locally, or via the SNMP based OMC software platform. The graphical interface of the Node C provides a setup menu including a setup wizard which allows both setup and monitoring capability without any equipment required apart from a laptop or PC.

The Node C network element is self-diagnosing, self-adaptive, and virtually maintenance-free.

2.3 QUICK START CHECKLIST

Read the health and safety warnings in chapter *1.2 Health and Safety Warnings*.

Setting up the Node C is quick and easy. The following step-by-step procedure provides a quick overview for a correct setup and optimization.

  a. **Required Equipment**
- Node C
- donor antenna
- coverage antenna(s) or DAS
- coaxial feeder cable
- connectors
- laptop with connection and mains cable

  b. **Required Information**
Make sure to have the following information at hand:
- important on-site conditions (e.g. base station location, mains supply, etc.)
- channels to be enhanced/amplified
- pilot
- pilot power to total power

  c. **Procedure**
1. Install the donor and coverage antennas.
2. Install the feeder cable from the Node C to the antennas.
3. Install the Node C (see chapter *3 Installation*).
4. Install the Interface Unit (see chapter *3 Installation*).
5. Connect cables between the Interface Unit and the Node C (see chapter *3.2 Electrical Installation*).
6. Connect power and the antenna feeder cables to the Node C.
7. Open the Interface Unit as described in chapter *4.1 General*.
8. Setup the connection computer (see chapter *4.2 Software Setup*) and establish a connection to the Node C (see chapter *4.2.3 Connection Procedures*).
9. Login to the unit and follow the installation wizard option for easy installation.
     a. Optimize the donor antenna performance (see chapter *4.2.4.1 Setup Wizard*).
     b. Select the channels for enhancement.
     c. Enter the desired output power in the downlink.
     d. Enter the pilot power to total power ratio of the donor base station.
     e. Enter the relative uplink gain.
     f. Setup the modem (if applicable) and enter data in the other user fields.
10. The Node C setup is complete.
11. Open the "*Save Configuration to Laptop*" menu for record keeping purposes.
12. Unplug the computer, close the Interface Unit and tighten all screws.

3 INSTALLATION

3.1 MECHANICAL INSTALLATION

3.1.1 General

Read the health and safety warnings in chapter *1.2 Health and Safety Warnings*.

1. **Do not install the unit in a way or at a place where the specifications outlined in the Environmental and Safety Specifications leaflet of the manufacturer are not met.**

2. **It is recommended only to use the mounting hardware delivered by the manufacturer. If different mounting hardware is used, the specifications for stationary use of the unit must not be exceeded.**

☞ **Note: Exceeding the specified load limits may cause the loss of warranty.**

3. ⚠ **The unit is considerably heavy. Make sure that a suitable mounting surface is used. Ensure there is adequate manpower to handle the weight of the system.**

4. **Due to power dissipation, the unit may reach a very high temperature. Ensure sufficient airflow for ventilation. Above and below the units a minimum distance of 300* mm to ceiling, floor, etc. has to be kept. This distance must also be observed between two units if they are mounted one above the other.**

*   This value does not apply to the distance between Interface Unit and Node C. The distance required between the two cabinets is specified in *table 3-1 Mounting distance*.

If any different or additional mounting material is used, ensure that the mounting remains as safe as the mounting designed by the manufacturer. Ensure that the static and dynamic strengths are adequate for the environmental conditions of the site. The mounting itself must not vibrate, swing or move in any way that might cause damage to the unit.

☞ **Note: Both the Node C and the Interface Unit are delivered with a pre-mounted front cover. This cover is of vital importance for the correct forced airflow (of Node C 43) and for passive cooling (of Node C 37 and Interface Unit). Thus, do not operate the units without cover.**

3.1.2 Wall Mounting Procedure

- Check the wall mounting kit and the wall to determine their suitability.

- The maximum distance between the Node C and the Interface Unit depends on the length of the cable bridge by which they will be connected (see *table 3-1 Mounting distance*). Thus, before marking the mounting positions, check the length of the cable bridge and make sure to install the units at a suitable distance.

Mounting style:	beside each other*			one above the other**
Length of cable bridge:	500 mm	800 mm	2000 mm	only 2000 mm possible
Maximum distance	140 mm	400 mm	1600 mm	1000 mm (min.=300 mm)

* Maximum distance is referring to distance between the cabinet sides

** It is recommended to install the Node C above the Interface Unit; max. distance is the distance between top of lower and bottom of upper unit

table 3-1 Mounting distance

☞ **Note:** **The following figures show units that are mounted beside each other. To install one above the other proceed in the same way, also observing the specified mounting distance from *table 3-1*.**

- Mark the position of the eight drilling holes (four per unit) for the Node C and Interface Unit according to *figure 3-1*. Please observe that the figure always shows a pair of drill holes for each position. Only drill one of each pair.
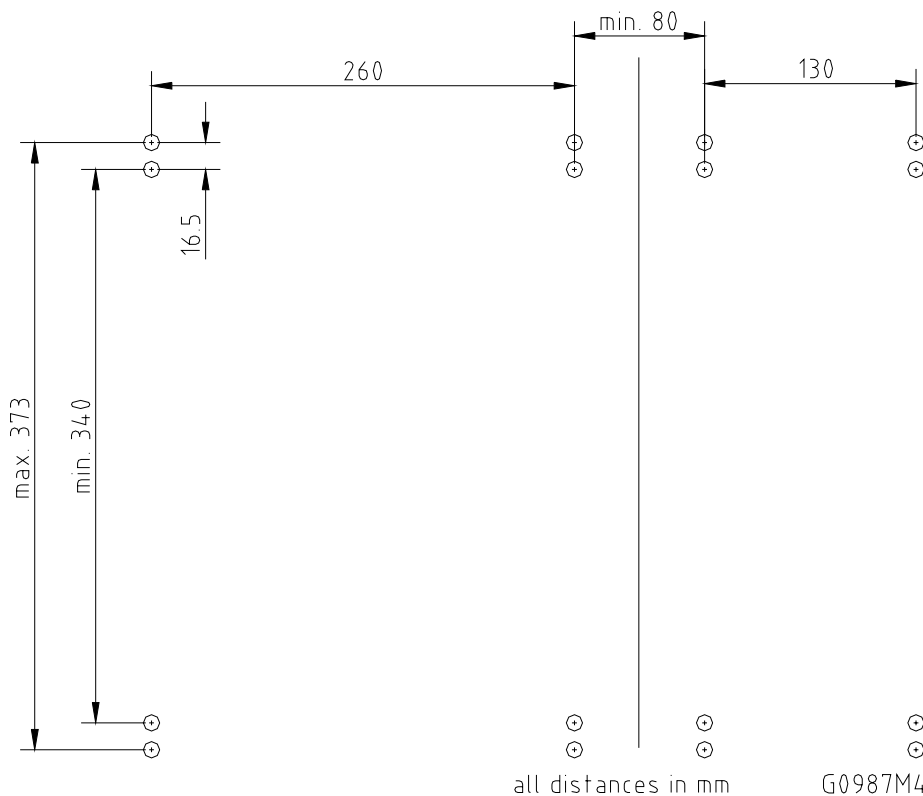
figure 3-1 Positions of drilling holes

☞ **Note:** **Ensure that there is free access to the electrical connections as well as to the cabinet. The approved bending radius of the connected cables must not be exceeded.**

- Drill eight holes (four per unit) at the marked positions and insert dowels*.

* The dowels are not part of the delivery (and thus not illustrated in the figure) since the suitable type depends on the on-site conditions (the material of wall). Therefore, use dowels that are appropriate for the mounting surface.

- Use a cap nut or locknut to screw the eight M8 dowel screws into the dowels.

- Use a hex wrench, opening 17 (old standard) or 16 (new standard), to loosen the M10 hexagon head screws (four per unit) by which the mounting brackets are fastened to the cabinet sides.

- Mount the mounting brackets to the screws, and fasten them using the M8 washers, locking rings, and hex nuts that are part of the wall mounting kit.

- Hang the cabinets into the brackets and fasten them with the M10 hexagon head screws*.
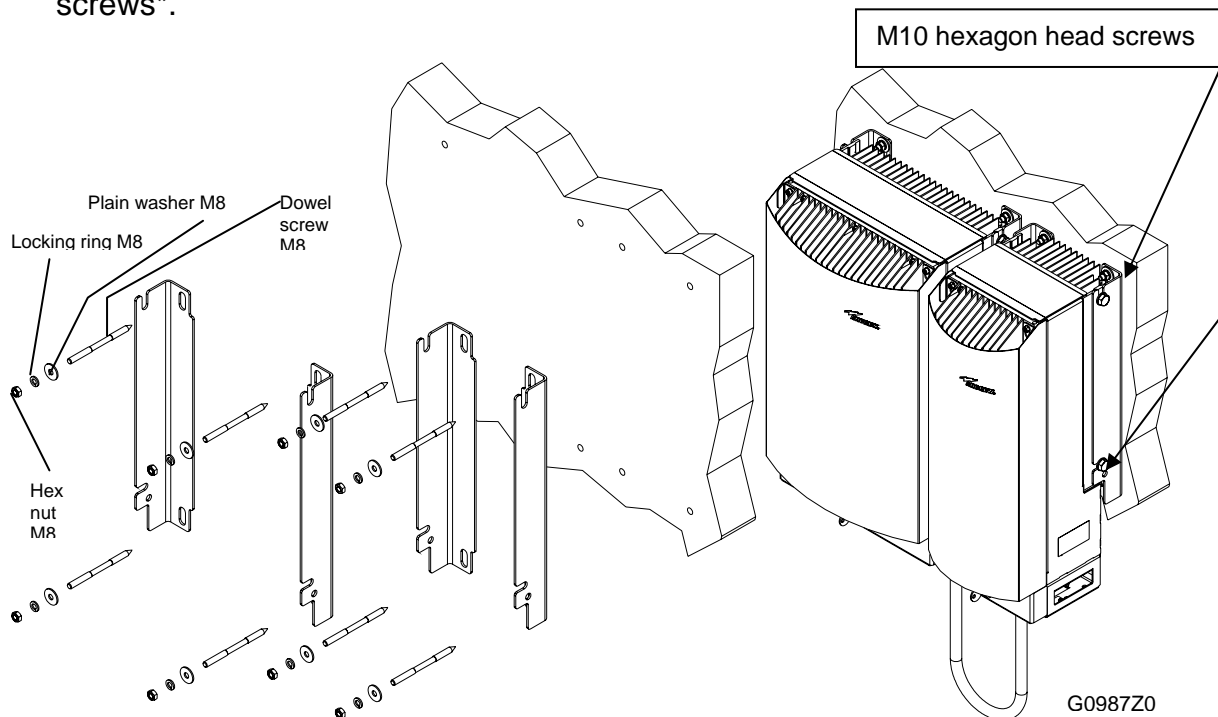
figure 3-2 Wall mounting procedure

* If other screws than the ones delivered by the supplier are used for fastening, these must have a diameter of at least 8 mm and an appropriate length (depending on the dowels). Additionally, make sure they are adequate for supporting a maximum weight of 50 kg per unit.

For mounting both cabinets as one unit, a cabinet combining kit is available. The according mounting procedure is explained in the following chapter.

3.1.3   Connection Option

- In order to mount the system using the cabinet combining kit, dismount the mounting brackets from the cabinets of the units by loosening the hexagon head screws M10x20 by which the brackets are screwed to the housing (four per unit). Do not unscrew those screws, only loosen them by approx. three turns and take off the brackets.

- The two inner brackets are no longer required; exchange the outer brackets and fasten them to the cabinets (as indicated below).
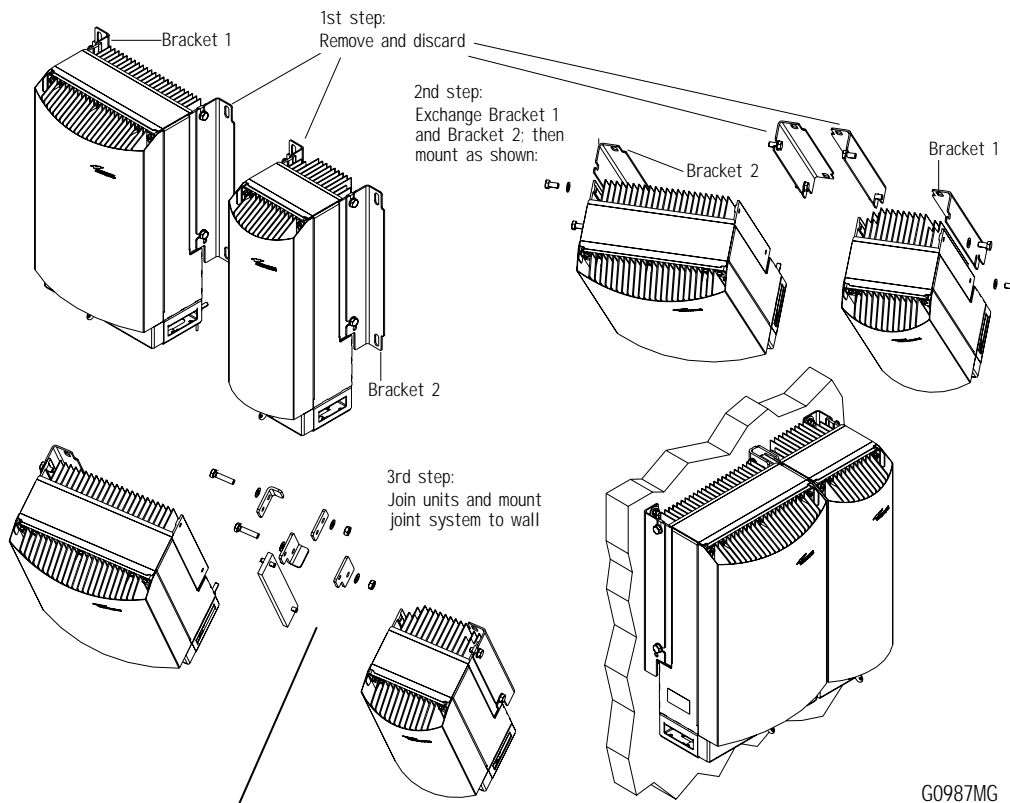
figure 3-3 Connection option
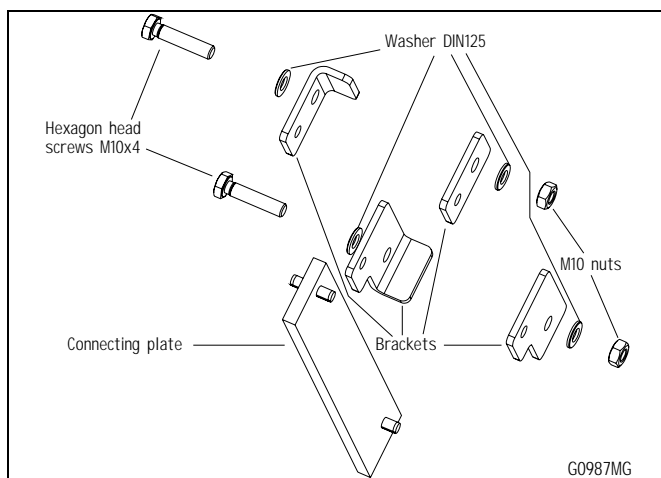
figure 3-4 Cabinet combining kit

- Join the two cabinets using the parts of the cabinet combining kit as indicated.

- Use the special mounting plan supplied as part of the cabinet combining kit for drilling the according holes and mount the system to the wall.

3.1.4 Pole Mounting Procedures

The following figure illustrates the two pole mounting options:
back-to-back (left) and two systems (right).
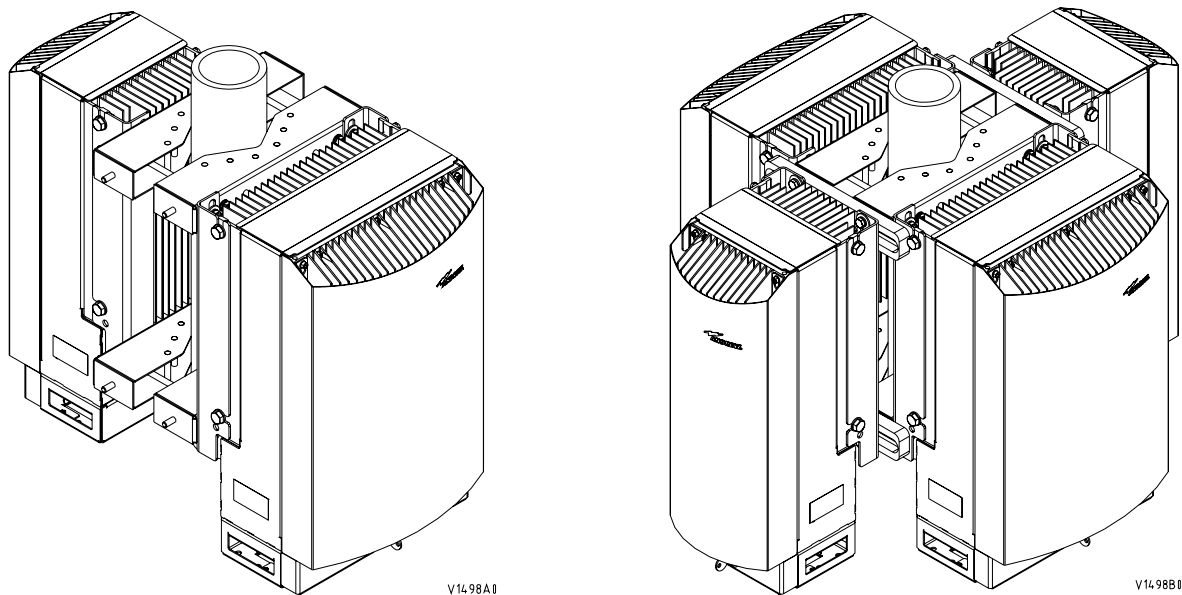
figure 3-5 Pole mounted systems

- Before starting the mounting procedure, check the pole diameter of the pole to which the units will be installed; then, cut the thread-bolts (see *table 3-3 Components of pole mounting kits*, pos. 5) to the required length according to the following table, which also states the appropriate cable bridge lengths:

Pole-diameter (mm)	100	110	120	130	140	150	160	170	180	190	200
Length of Thread-Bolt (mm)	216	226	236	246	256	266	276	286	296	306	317
Length of cable bridge (mm) (back-to-back)	800								2000		
Length of cable bridge (mm) (for 2 systems)	800					2000					

table 3-2 Required length of thread-bolts and cable bridge

Both types of pole mounting kit consist of the following parts (in different quantities):

No	Part		No	Part
1	Pole mounting brace		5	Thread-bolt M8
2	Washer DIN 9021 – 8.4		6	Washer M8 DIN 125
3	Nut M8 DIN 934		7	Hexagon head screw M8
4	Spring ring DIN 127 – A8		8	Fastener

table 3-3 Components of pole mounting kits

The numbers in the above table refer to the numbering of the components in the following figures. Positions 7 and 8 are only required for mounting two systems.
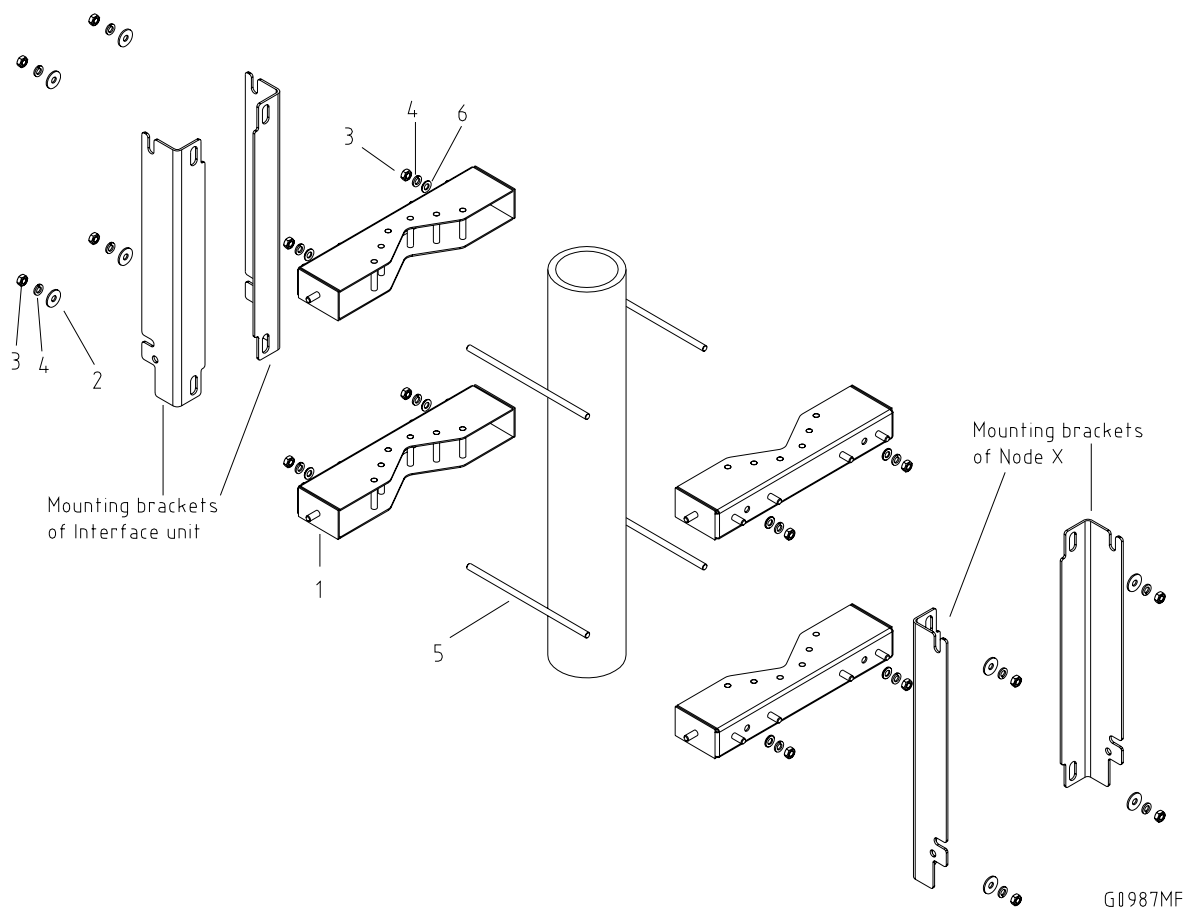
figure 3-6 Back-to-back pole mounting

- Dismount the mounting brackets from the cabinets of the units by loosening the hexagon head screws M10x20 by which the brackets are screwed to the housing (four per unit). Do not unscrew those screws, only loosen them by approx. three turns and take off the brackets.

- Fasten the mounting brackets to the pole using the corresponding mounting kit as illustrated in *figure 3-7 Pole mounting two systems* or *figure 3-6 Back-to-back pole mounting*, respectively.

- In case of two systems (*figure 3-7*) first mount the mounting brackets of the Node C units; then adjust and mount the fasteners (no. 8) accordingly before fastening the mounting brackets of the Interface Units to the fasteners.

- Hang the units into the respective mounting brackets and fasten the hexagon head screws M10x20.
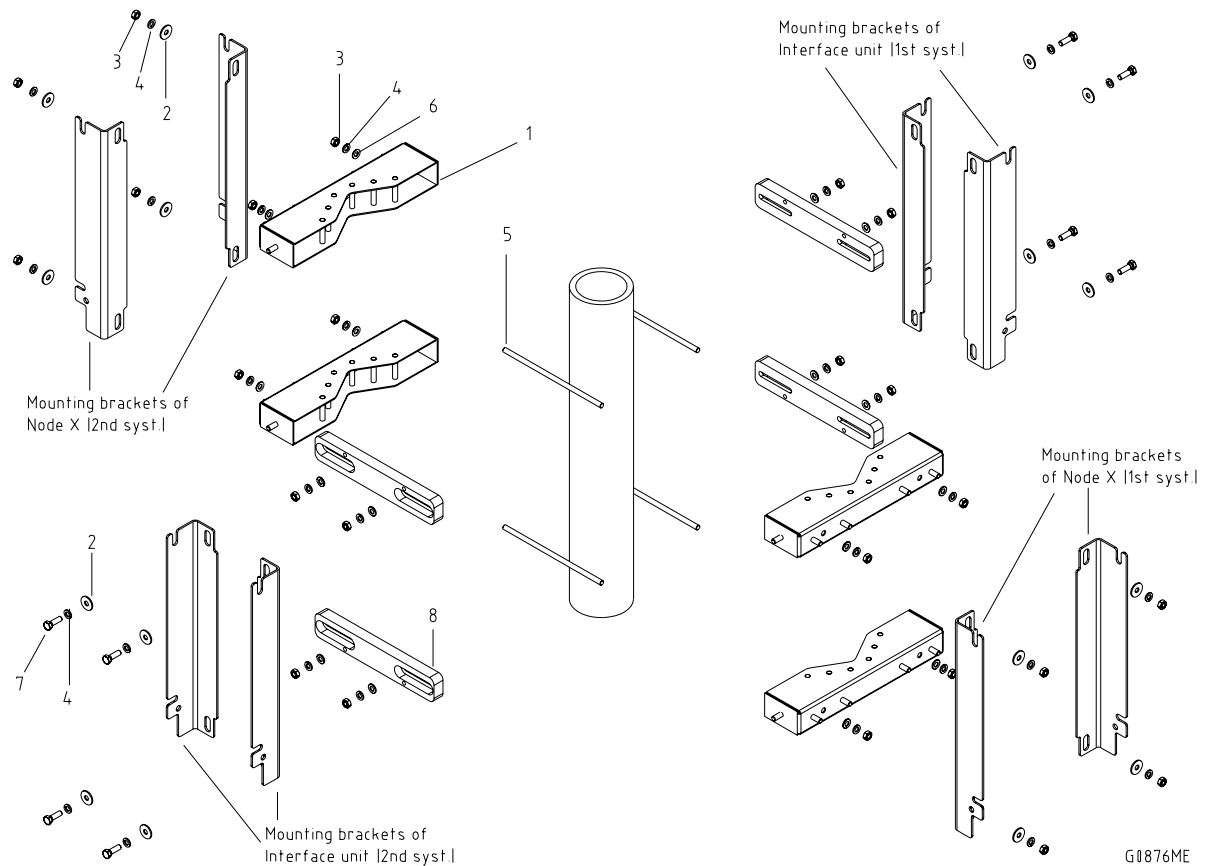
figure 3-7 Pole mounting two systems

3.2 ELECTRICAL INSTALLATION

3.2.1 General

Read the health and safety warnings in chapter *1.2 Health and Safety Warnings*.

1. **This unit contains dangerous voltages. Loss of life, severe personal injury or property damage can be the result if the instructions contained in this manual are not followed.**

2. **It is compulsory to ground the unit before connecting power supply. A grounding bolt is provided on the cabinet to connect the ground bonding cable.**

3. **Although the unit is internally protected against overvoltage, it is strongly recommended to earth the antenna cables close to the unit's antenna connectors for protection against atmospheric discharge. In areas with strong lightning it is strongly recommended to insert additional lightning protection.**

4. **Hard wired installation of mains supply for the unit requires an easily accessible separation device in the mains circuit.**

5. **Make sure that an appropriate circuit breaker and an overcurrent limiting device are connected between mains and the unit.**

6. **A connection of mains supply to a power socket requires the power socket to be nearby the unit.**

7. **The unit might be supplied from IT mains. (The maximum nominal line to line voltage must not exceed 400VAC).**

8. **Incorrectly wired connections can destroy electrical and electronic components.**

9. **To avoid corrosion at the connectors caused by electrochemical processes, the material of the cable connectors must not cause a higher potential difference than 0.6V (see electrochemical contact series).**

10. **It is sufficient to tighten the 7/16 or N antenna connector hand-screwed. Any use of a tool (e.g. pair of pliers) might cause damage to the connector and thus lead to malfunctioning of the unit.**

11. **For unstabilized electric networks which frequently generate spikes, it is advised to use a voltage limiting device.**

12. **The unit complies with the surge requirement according to EN 61000-4-5 (fine protection), however, it is recommended to install an additional medium (via local supply connection) and/or coarse protection (external surge protection) depending on the individual application in order to avoid damage caused by overcurrent.**

13. **Observe the labels on the front panels before connecting any cables.**

3.2.2 Grounding

Grounding the Node C and Interface Unit is mandatory. Connect an earth bonding cable to the grounding connections provided at the cabinets of both the Node C and Interface Unit according to the following illustrations.

Do not use the grounding connections to connect external devices.

Cable bridge connectors

Node C cabinet

Cabinet of Interface Unit
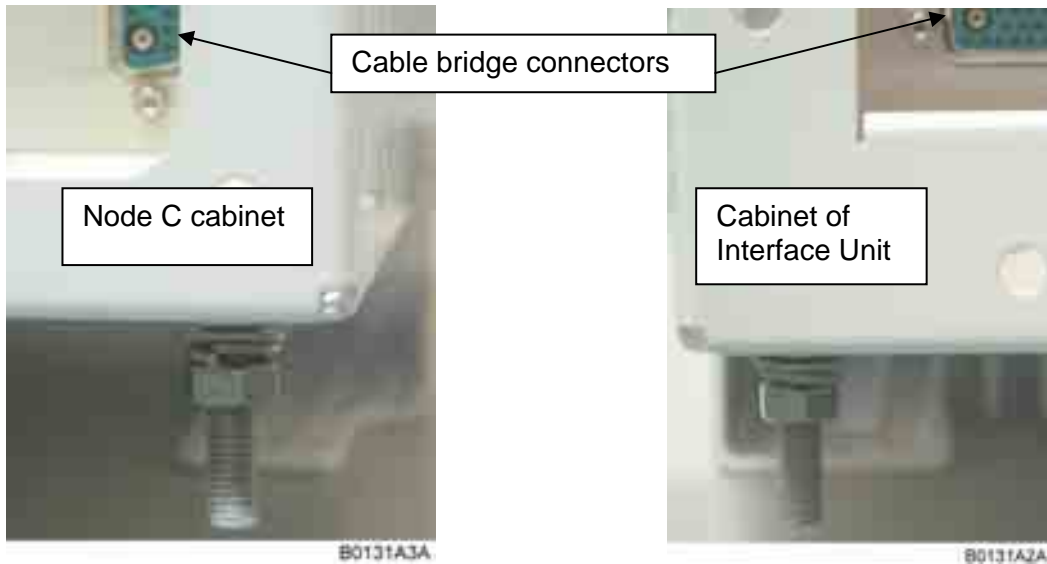
figure 3-8 Grounding bolts

Grounding bolt of Node M repeater

Grounding bolt of interface unit
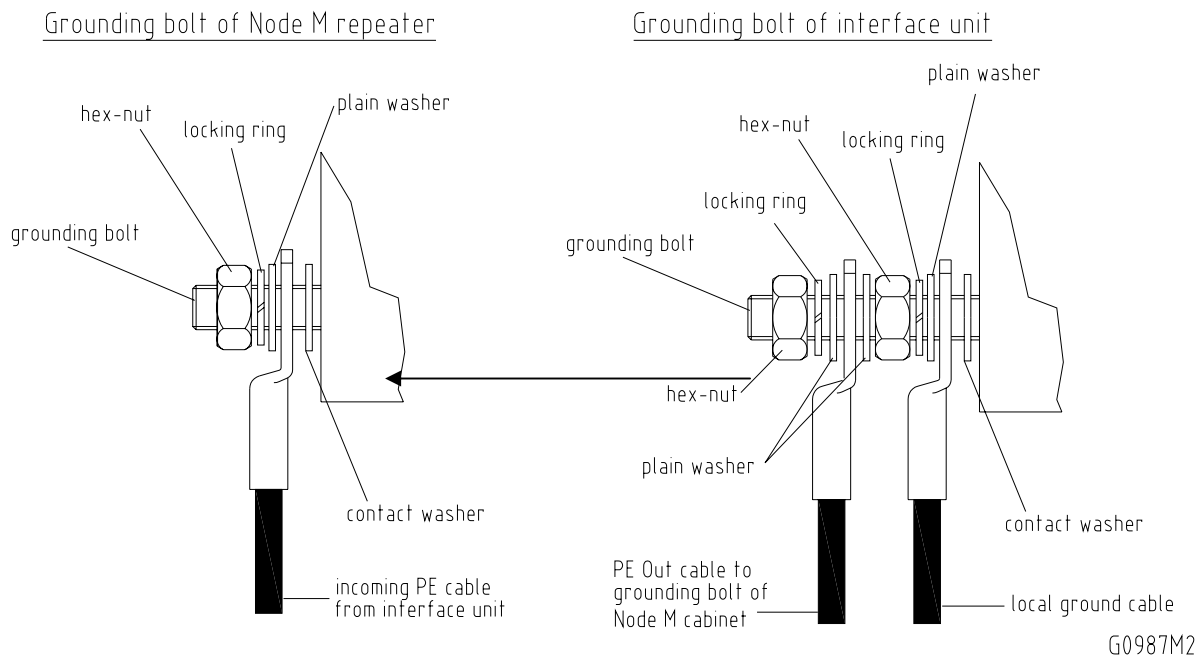
figure 3-9 Grounding a system

⚠ **The PE cables must have a minimum cross section of 10mm².**

3.2.3 Power Connection

Before connecting electrical power to the units, the system must be grounded as described in the previous chapter.

Mains power must be connected at the mains connector of the Interface Unit. The power supply plug is included with the Node C.

The correct wiring of the power supply plug is as follows:

Flangeconnector 380V/16Af.
Pin 1= Phase 1 (brown)
Pin 2= Neutral (blue)
Pin 3= n.c.
⊥ = PE (green/yellow)
G0946Z0
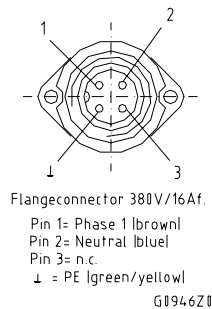
Mains

figure 3-10 Power supply plug   *figure 3-11 Mains connector*
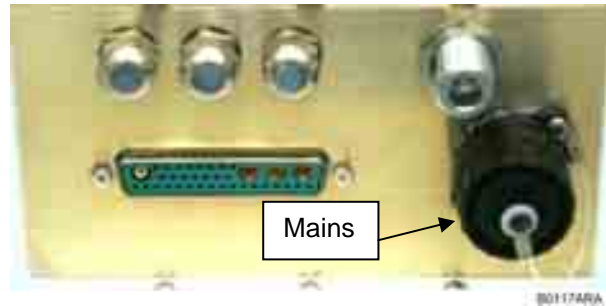
A minimum cross section of 1.5 mm^2 is required for the powersupply connection. Each wire must observe the applicable national regulations regarding loop impedance, voltage drop, and methods of installation. Make sure to connect the correct voltage to the unit.

☞ **Note: Do not connect or disconnect the power cord at the mains connector while power is on. Turn off mains* power before connecting the power cord at the Interface Unit, then, engage mains again.**

* Mains power must be interrupted with an external AC breaker. For the AC breaker, observe the following recommendation:

120 Volt / 20 Amp max. or 240 Volt / 16 Amp, single-phase, 50/60 Hz AC service is needed, i.e. the external AC breaker should be 20 Amps max. for 120-Volt service or 16 Amps for 240-Volt service.

3.2.4 Connection of the Antenna Cables

The Node C's antenna connectors are 7/16 female (N female is an option). All connectors are located at the bottom of the cabinet. An operator should refer to the cable connectors manufacturer's documentation for best mating procedures. Furthermore, the bending radius of the antenna cables should be maintained at all times.

There are several issues to be considered when selecting the cable and antenna types.

- Smaller diameter cables are less expensive and easier to install but have worse performance.
- Highly directional antennas with good front-back-ratios (40 dB is typical) are recommended because they improve isolation and cell site selectivity.

⚠️ Tighten the 7/16 (or N) connectors ONLY by hand. The use of pliers may cause damage to the connector and impair the performance of the Node C.
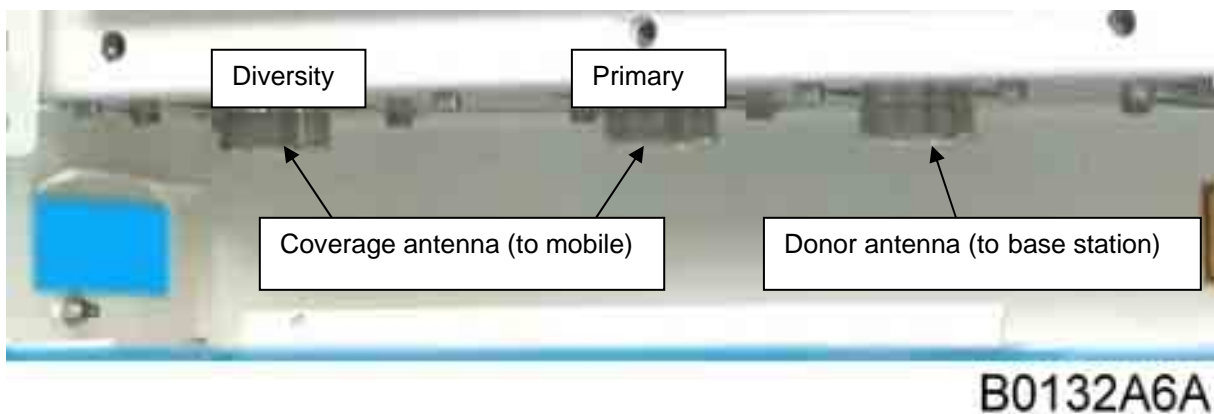
figure 3-12 Front view of antenna connections

3.2.5 Connection of Cable Bridge

The Interface Unit and the Node C are connected via a cable bridge. The bridge ports 12V, 28V, ground, USB, and RS232 between the two units as well as the general alarming and signalling. It is also the interconnection and intercommunication bus between the units.

The cable bridge connectors are located at the bottom of the Node C and Interface Unit.
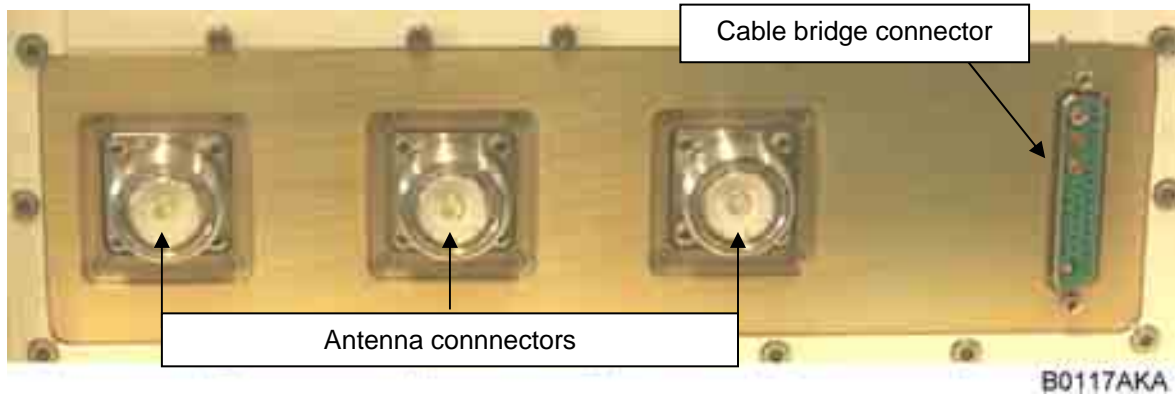
figure 3-13 Connector panel of the Node C
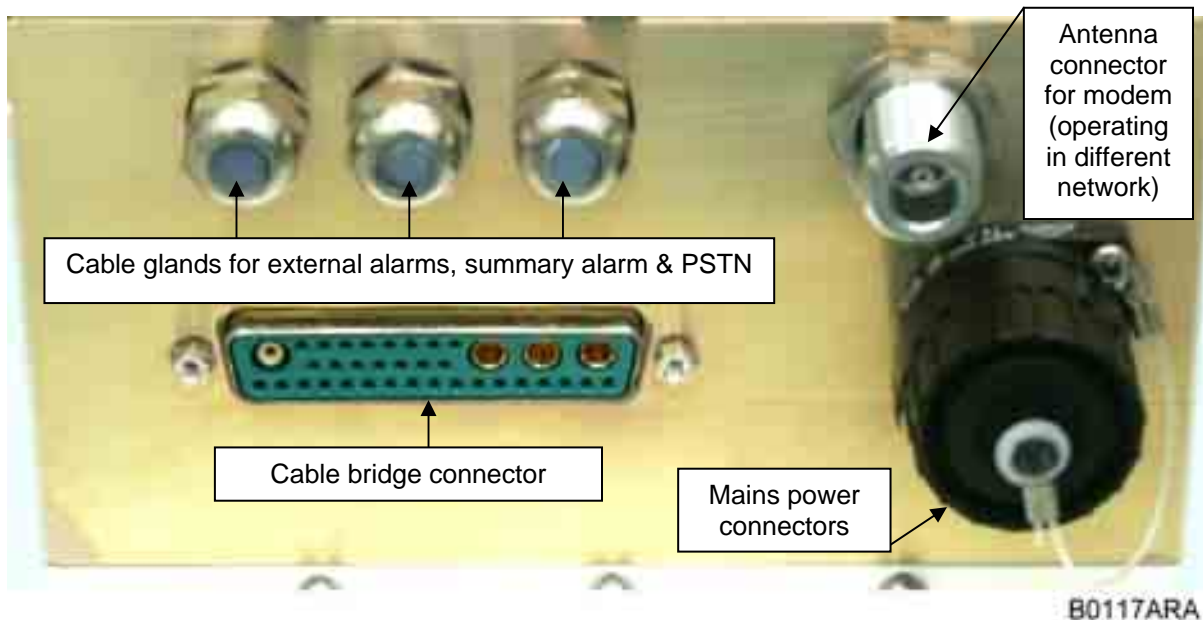
figure 3-14 Connector panel of the Interface Unit

3.2.6 Connections for Optional Equipment

The Interface Unit connector panel has ports for external equipment, such as a modem operating in a different network and external alarms. These connectors may be used entirely at the operator's discretion.

4 COMMISSIONING

4.1 GENERAL

Read the health and safety warnings in chapter *1.2 Health and Safety Warnings* and observe the following step-by-step procedure.

- Do not operate the Node C without terminating the antenna connectors. The antenna connectors may be terminated by connecting them to their respective antennas or to a dummy load.

- Only qualified personnel should carry out the electrical, mechanical, commissioning, and maintenance activities that require the unit to be powered on when open.

- When opening the Node C or interface box do not damage the warranty labels on the internal devices. The warranty is void if the seals are broken.

To open the cabinet of the Interface Unit, first remove the front cover plate by loosening the four M5 socket head cap screws (circle-marked in figure to the left). Do not remove those screws. When they are loosened the front cover plate can be taken off.

To open the housing, unscrew the three M5 socket head cap screws (captive) of the top cover of the Interface Unit.

☞ **Note:**   **Do not forget to reinstall the front cover afterwards to ensure safe operation.**

☞ **Note: Before closing the Interface Unit, make sure that the mains power switch inside is set to On:**

Three top cover screws

Mains power switch

figure 4-1 Front and top cover screws

figure 4-2 Position of mains power switch

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4.2   SOFTWARE SETUP

4.2.1   Remote Control

For remote control and/or supervision of the Node C the following services are provided:
- An OMC-type software platform (see separate manual)
- SMS alarm-forwarding (for details see chapter *5.2.5 Alarmforwarding*)
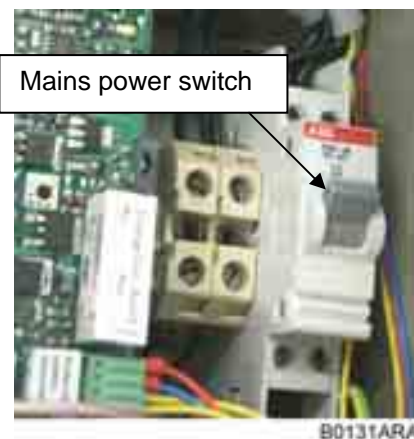- Web page (see chapter *4.2.4* and online-help)

4.2.2   Connection Devices

To connect to the Node C, the following devices are available:

- Locally, via the RS232 interface of the distribution & alarm board of the Interface Unit (see *figure 5-15*) using either the connected USB cable or the null modem cable which is part of the delivery for the connection of a PC or laptop.

- Remotely, if the optional modem is installed in the Interface Unit. All local commands may be issued via the web interface over the remote modem.

4.2.3   Connection Procedures

4.2.3.1   Setup Overview

Four steps are required to set up a connection to the Node C.

1. Install the USB to serial adapter in the computer. The USB adapter is part of the delivery and is already connected to the RS232 connector of the distribution & alarm board (see *figure 4-3*). For the first connection, install the correct driver from the CD (see chapter *4.2.3.2 Installing the USB driver*). For the connection via null modem cable, disconnect the USB connector from the RS232 connector (see *figure 4-3*) and connect the null modem cable.
2. Configure the connection device, i.e. RS232/USB/modem. (See section *a)* of chapter *4.2.3.3*, *4.2.3.4*, or *4.2.3.5* depending on the operating system.)
3. Setup a connection:
   a) Direct connection via PC or laptop: similar to connecting a computer to a standard Internet service provider (ISP); see section *b)* of chapter *4.2.3.3* or *4.2.3.5* depending on the operating system.
   b) Modem connection; see section *b)* of chapter *4.2.3.4*.
4. Establish the connection; see section *c)* of chapter *4.2.3.3*, *4.2.3.4*, or *4.2.3.5* depending on the operating system.

The following instructions are for Windows XP and Windows 2000. This procedure must be done only once with the first setup.

4.2.3.2 Installing the USB driver

The USB adapter and the driver CD are located inside the Interface Unit:

USB adapter with USB cable

Driver CD

Position of optional modem

RS232 connector for USB or null modem cable connection
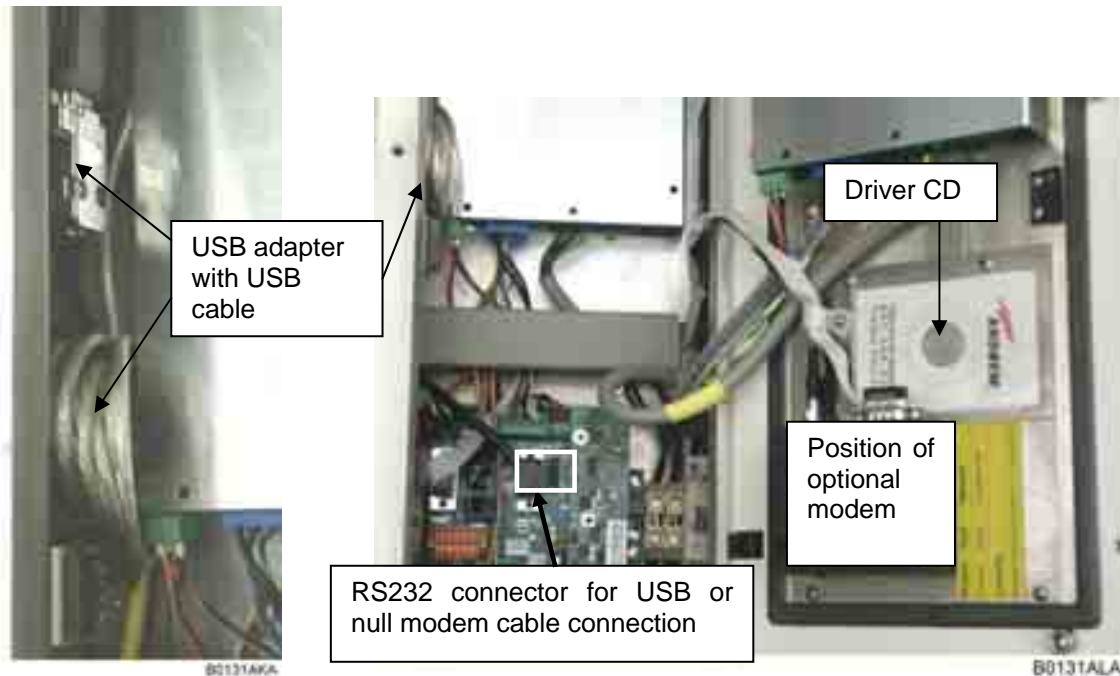
figure 4-3 USB and null modem cable connection

When the USB adapter is connected to a PC for the first time, the USB driver must be installed. The Node C and Interface Unit must be switched on for the procedure. To install the driver, proceed as follows:

- Connect the USB cable of the USB adapter to the USB port of the PC.

- Then, wait until the system (valid from Windows98ME) delivers the message that a new USB device was found and asks for the driver.

- Put the CD into the CD-ROM drive of the PC and the system will ask how to search for the driver.

- Select the automatic search (usually default), confirm, and wait while the system searches for the driver.

- The successful installation will be informed by a message that the new hardware was successfully installed.

- After confirming this message the CD can be taken out of the drive and put back into the plastic cover inside the Interface Unit.

- Reboot the PC.

When the connection is made the next time, this procedure is no longer necessary.

4.2.3.3   Direct connection for Windows XP

a) Setting up the device for the direct connection

1. To start the **Phone and Modem Options**, choose **Start→Control Panel→Phone and Modem Options.**
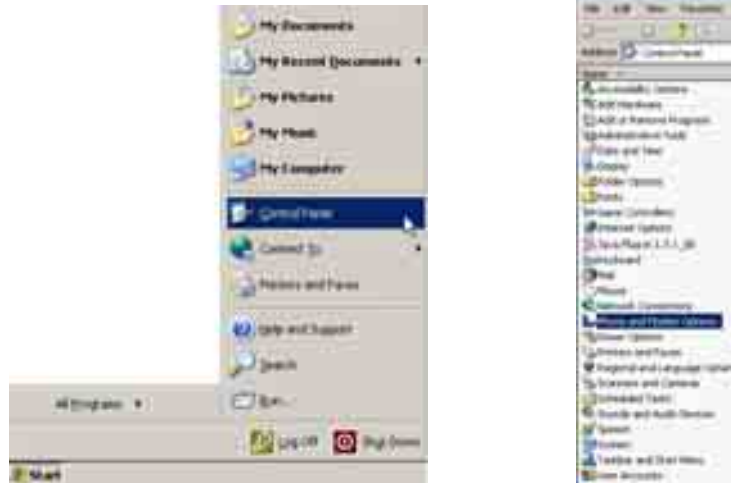
2. Select the **Modems** tab and click the **Add...** button.
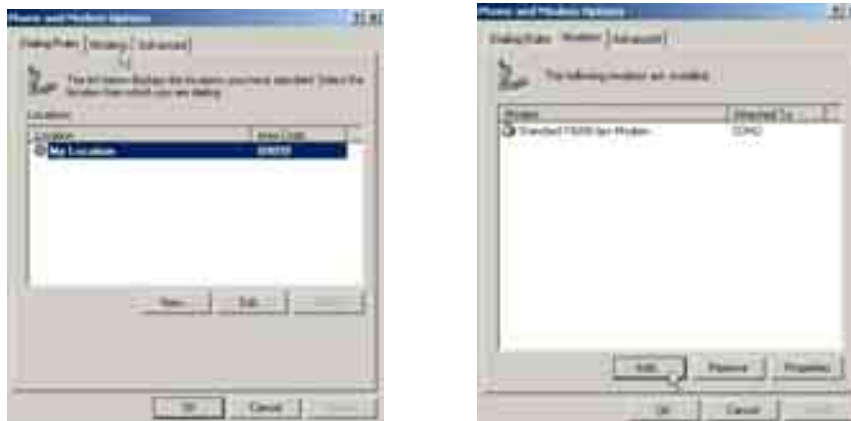
3. Choose to select from a list.

   Click **Next**.

4. For a direct connection choose the **Communication cable between two computers** as device.
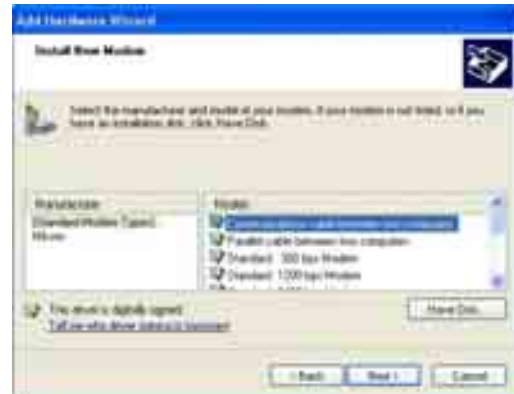
   Click **Next**.

5. Select your port (usually COM1 for a direct connection), continue with **Next**, and in the next window click **Finish**.

b) Setting up a direct connection

1. Choose **Start→Control Panel→Network Connections→New Connection Wizard**.

2. The first page is the **Welcome** window:

   Continue with **Next**.

3. In the **Network Connection Type** window, select **Set up an advanced connection**.

   Click **Next**.

4. In the **Advanced Connection Options**, choose **Connect directly to another computer**.
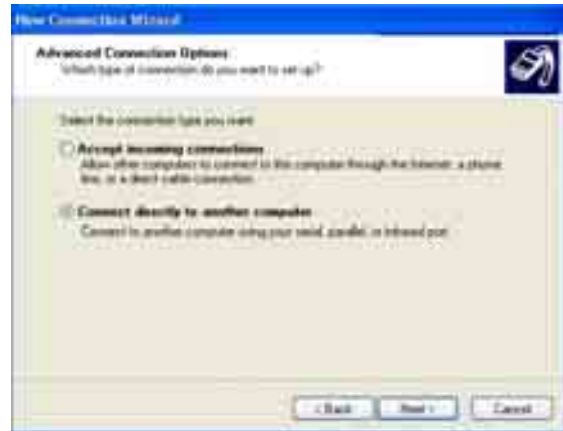
Click **Next**.

5. In the next window choose **Guest**.
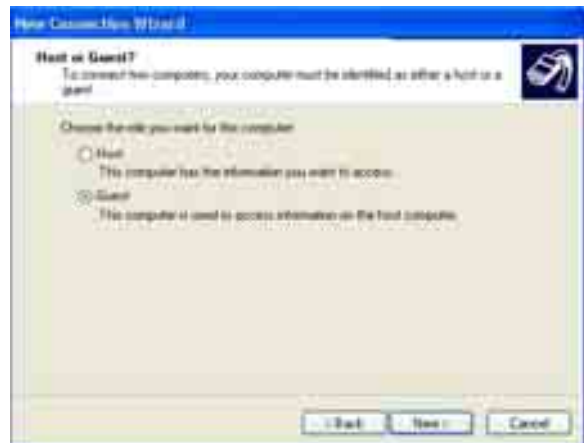
Click **Next**.

6. Next, enter a name for the new connection.
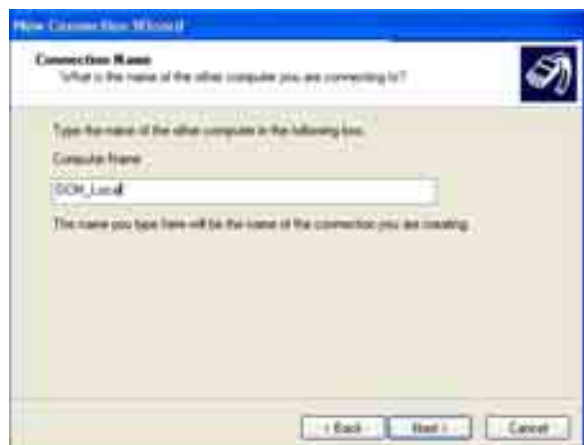
7. The next window is **Select a Device**.
   This window will provide a drop-down list of known communication ports (devices) to choose from. Choose a **serial port.** If the RS232 is used, this port is most likely (COM1)**.** If a USB port is used some other COM port number should be used. In such a case, take care that the USB driver is installed and connected before completing this selection or the connection will not work.

   Click **Next**.

8. The next window is **Connection Availability**. Choose **My use only**.
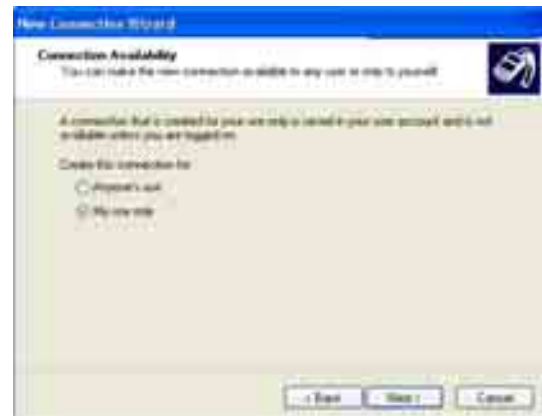
   Click **Next**.

9. In the window **Completing the New Connection Wizard**, choose whether to add a shortcut to the desktop.

   Click **Finish**

In the **Connection** window, enter User name and Password. Select to **Save user name and password ...** for **Me only**.

Enter:

User name: \<username\>
Password: \<password\>

Click **Properties**.

10. Under the **General** tab ensure the correct device is selected. Click **Configure**, and in the Modem Configuration window, choose **57600** for **Maximum speed**. No other box should be checked. Click **OK**.

11. Select the **Options** tab and make sure that all dialling options except the last one (Include Windows logon domain) are checked.

Set the redialling options as required and click **OK**.

12. Select the **Security** tab, select **Advanced (custom settings)**, and click **Settings**.

13. Only allow **Challenge Handshake Authentication Protocol (CHAP)**
Microsoft CHAP (MS-CHAP) and
Microsoft CHAP Version 2 (MS-CHAP v2) protocols.

Click **OK**.

14. Click **Typical** and choose **Require secured password**.

Click **OK**.

15. Select the **Networking** tab and click the **Settings** button. There are 3 PPP settings. Make sure they are all **OFF** and click **OK**.

16. In the **Networking** window, highlight the **Internet Protocol (TCP/IP)** component and click the **Properties** tab.

17. **Obtain an IP address automatically** and **Obtain DNS server address automatically** must be checked.

Click **Advanced**.

18. In the **General** tab, uncheck all boxes.
In the **DNS** tab, make sure **Append primary** and **Append parent** and **Register this connection** are checked.
In the **WINS** tab, make sure **Enable LMHOSTS lookup** is checked. Click **OK**.
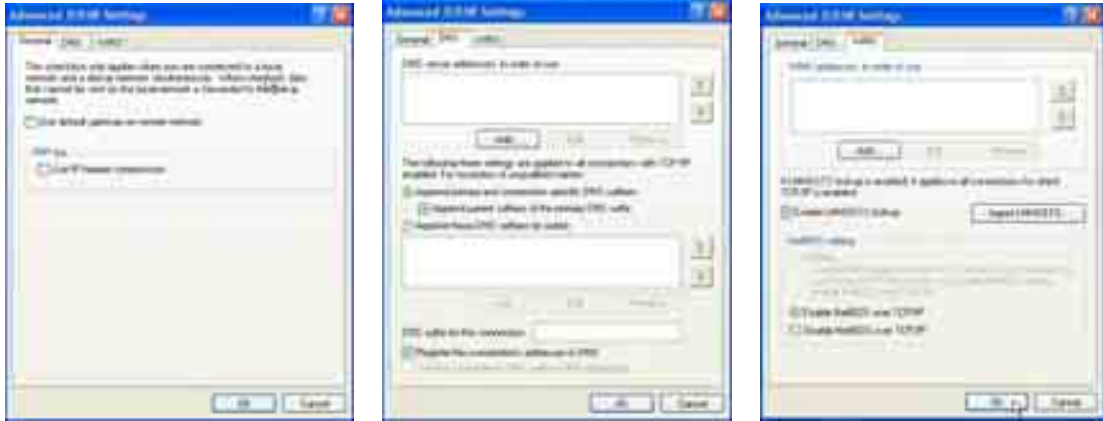
19. For **Internet Connection Firewall** and **Internet Connection Sharing** settings, select the **Advanced** tab. Click **OK** to get back to the **Connect** window.
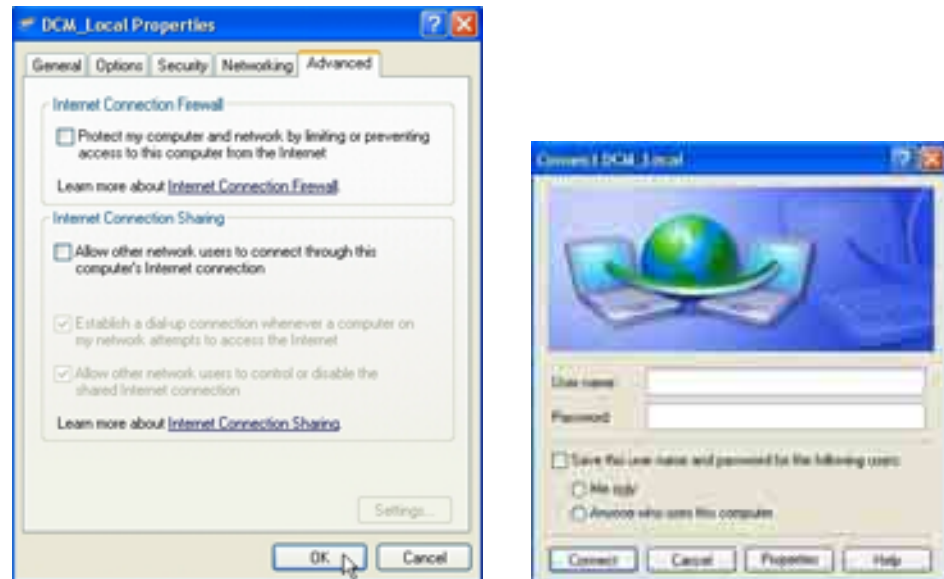
20. The connection procedure is described in the following. If the connection is to be made directly from the **Connect** window, step one of the following description can be skipped.

c) Establishing the connection

1. Choose **Start→Control Panel→Network Connections→<connection name> (i.e. in this example "DCM_Local").**

The properties of this connection should already have been setup.

2. Enter <username> in the **User name** field.
   Enter <password> in the **Password** field.
   Select to **Save this user name and password ...** for **Me only**.

Click **Connect**.

While the connection is established the following window is displayed

When the connection is successful an icon will appear in the system tray. This icon will "light up" to indicate network activity between the computer and the Node C. To check the status of the connection, click on the icon.

Please continue with chapter *4.2.3.6 Accessing the web page .*

4.2.3.4   Modem connection for Windows XP

a) Setting up the device for the modem connection

1. To start the **Phone and Modem Options**, choose **Start→Control Panel→Phone and Modem Options.**
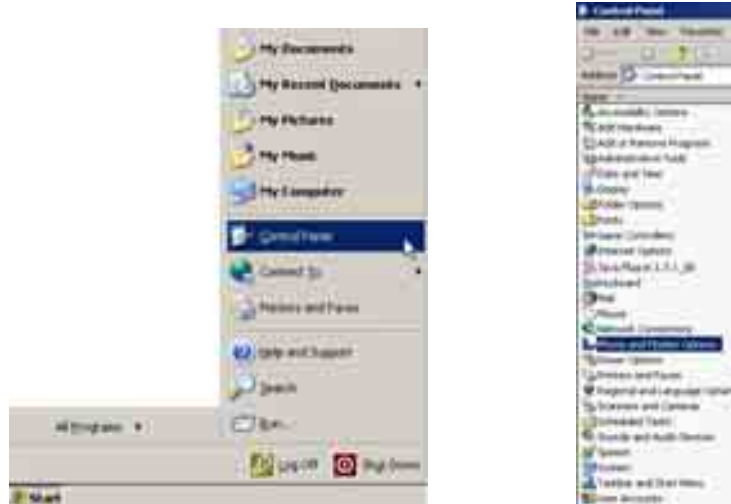
6. Select the **Modems** tab and click the **Add...** button.
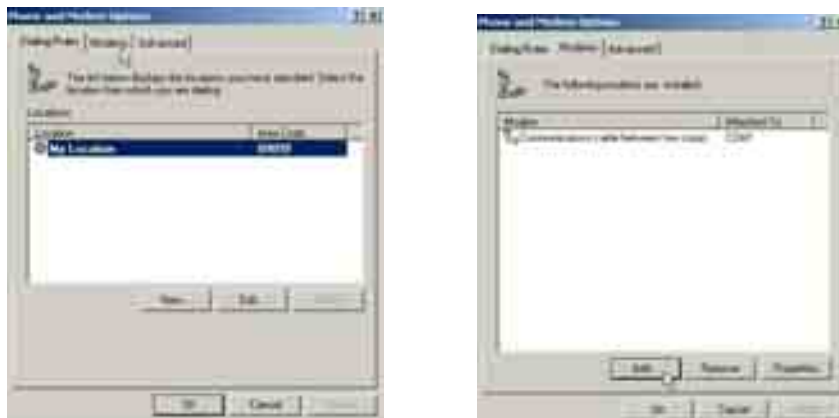
7. Choose to select from a list.

Click **Next**.

8. For a modem connection, choose the **Standard 19200 bps Modem** as device.
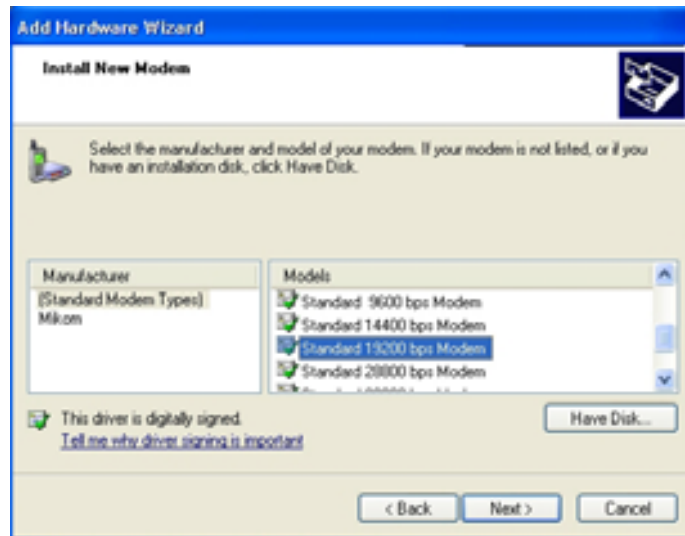
Click **Next**.

9. Select your port (usually COM2 for a modem connection), continue with **Next**, and in the next window click **Finish**.

b) Setting up a modem connection

10. To start, choose **Start→Control Panel→Network Connections→New Connection Wizard**.

11. The first window is the **Welcome** window:

Continue with **Next**.

12. In the **Network Connection Type** window, select **Connect to the network at my workplace**.

Click **Next**.

13. In the **Network Connection window**, choose **Dial-up connection**.
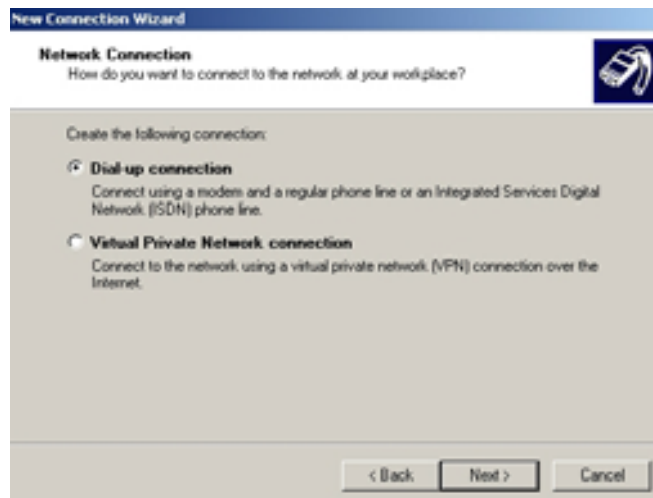
Click **Next**.

14. Select the **Standard 19200 bps Modem** as device.
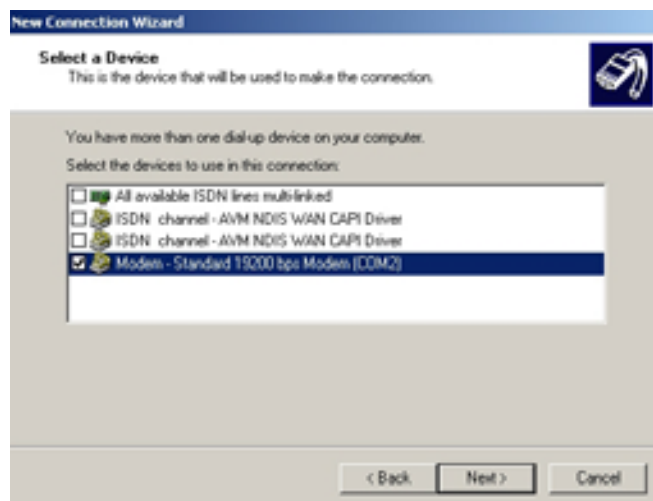
Click **Next**.

15. Next, enter a name for the new connection.
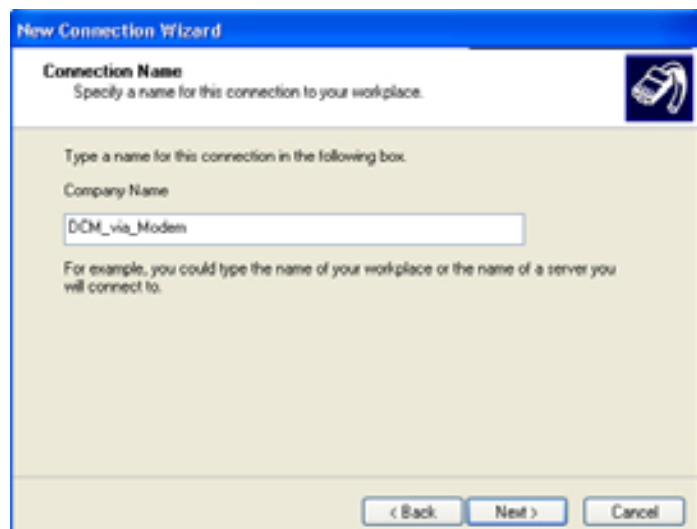
16. In the next window enter the phone number of the modem that is installed in the Node C.

Click **Next**.

17. The next window is **Connection Availability**. Choose **My use only**.

Click **Next**.

18. In the window **Completing the New Connection Wizard**, choose whether to add a shortcut to the desktop.

Click **Finish**

19. In the **Connection** window, enter username and password. Select to **Save user name and password ...** for **Me only**.

Enter:

User name: <username>
Password: <password>

Click **Properties**.

20. Under the **General** tab ensure the correct device is selected. Click **Configure**, and in the Modem Configuration window, choose **19200** for **Maximum speed**. No other box should be checked. Click **OK**.
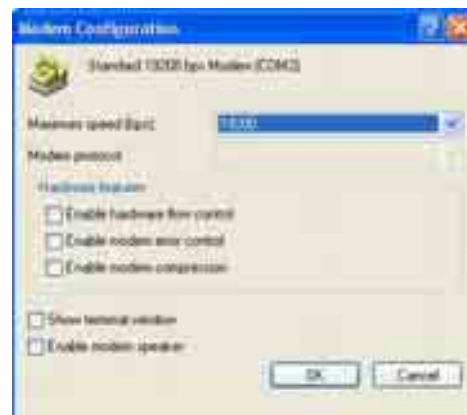
21. Select the **Options** tab and make sure that all dialling options *except* **Include Windows logon domain** are checked.

Set the redialling options as required and click **OK**.

22. Select the **Security** tab, select **Advanced (custom settings)**, and click **Settings**.

23. Only allow **Challenge Handshake Authentication Protocol (CHAP) Microsoft CHAP (MS-CHAP)** and **Microsoft CHAP Version 2 (MS-CHAP v2)** protocols.

Click **OK**.

24. Click **Typical** and choose **Require secured password**.

Click **OK**.

25. Select the **Networking** tab and click the **Settings** button. There are 3 PPP settings. Make sure they are all **OFF** and click **OK**.

26. In the **Networking** window, highlight the **Internet Protocol (TCP/IP)** component and click the **Properties** tab.

27. **Obtain an IP address automatically** and **Obtain DNS server address automatically** must be checked.

Click **Advanced**.

28. In the **General** tab, uncheck all boxes.
In the **DNS** tab, make sure **Append primary** and **Append parent** and **Register this connection** are checked.
In the **WINS** tab, make sure **Enable LMHOSTS lookup** is checked. Click **OK**.
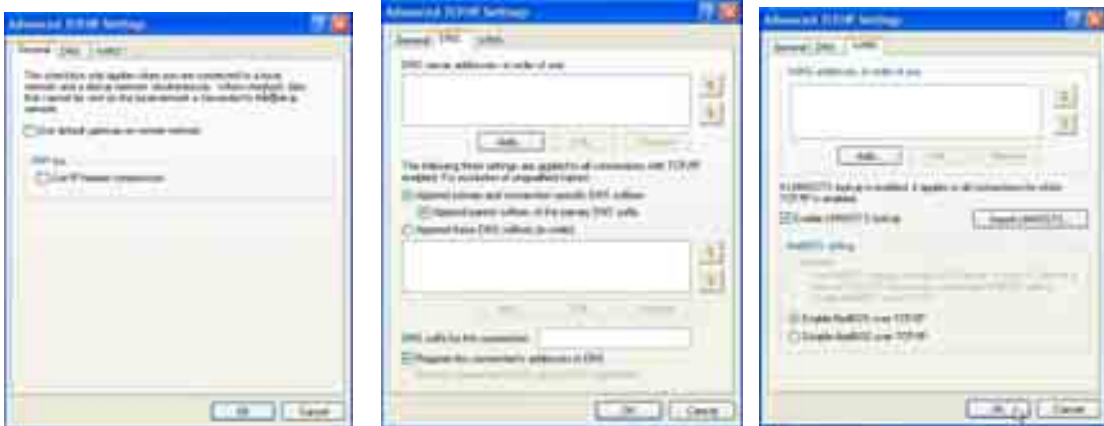
29. For **Internet Connection Firewall** and **Internet Connection Sharing** settings, select the **Advanced** tab. Click **OK** to get back to the **Connect** window.

30. The connection procedure is described in the following. If the connection is to be made directly from the **Connect** window, step one of the following description can be skipped.

c) Establishing the connection

1. Choose **Start→Control Panel→Network Connections→<connection name> (i.e. in this example "DCM_via_Modem").**
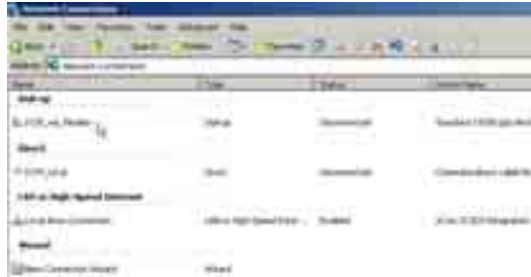
The properties of this connection should already have been setup.

2. Enter the term "username" in the **User name** field and the term "password" in the **Password** field as shown below.
Select to **Save this user name and password ...** for **Me only**.

Click **Connect**.

While the connection is established the following window is displayed:
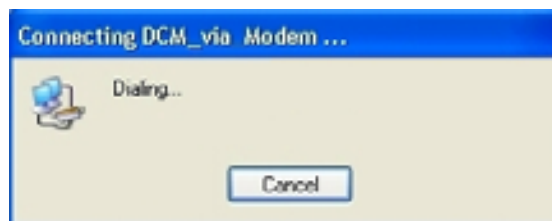
When the connection is successful an icon will appear in the system tray. This icon will "light up" to indicate network activity between the computer and the Node C. To check the status of the connection, click on the icon.

Please continue with chapter *4.2.3.6 Accessing the web page.*

4.2.3.5 Direct connection for Windows 2000

a) Setting up the device for the direct connection

1. To start the **Phone and Modem Options**, click
   Start→Settings→Control Panel→Phone and Modem Options.

2. Click the **Modems** tab and choose **Add...** .

3. Choose to select from a list, click **Next**.

4. Select your port, continue with **Next**, and in the next window click **Finish**.
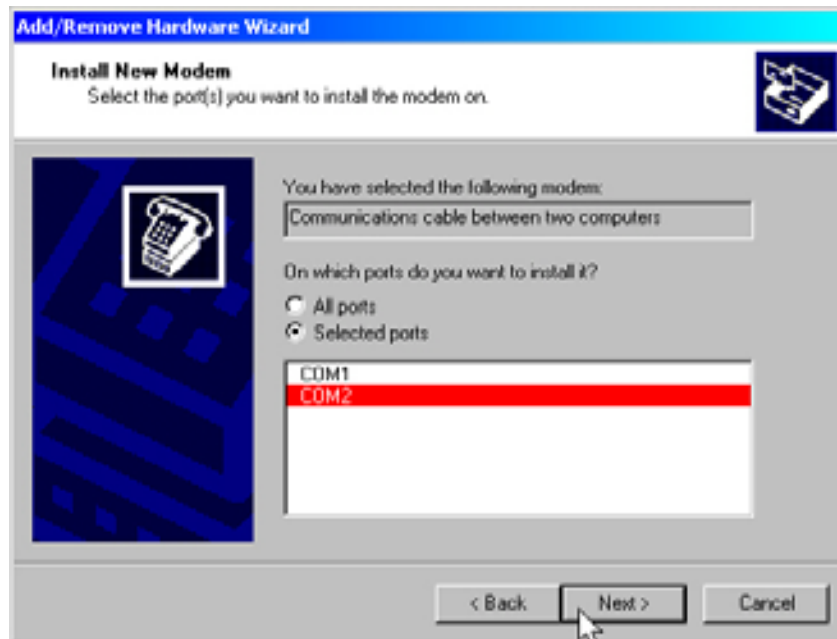
5. Highlight the port associated with the direct connection of the RS232 or USB port. Click **Properties**.
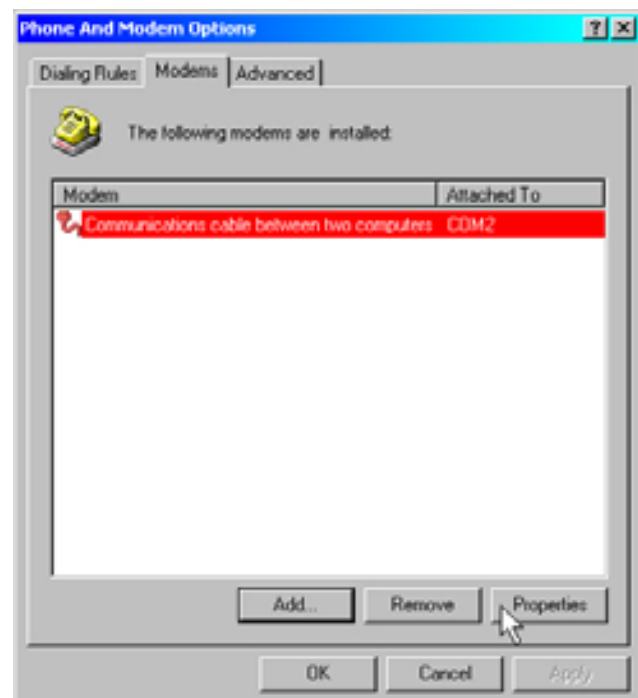
6. In the **General** tab, change the port speed to **57600**.
Click the **Advanced** tab.
Click the **Change Default Preferences** tab.
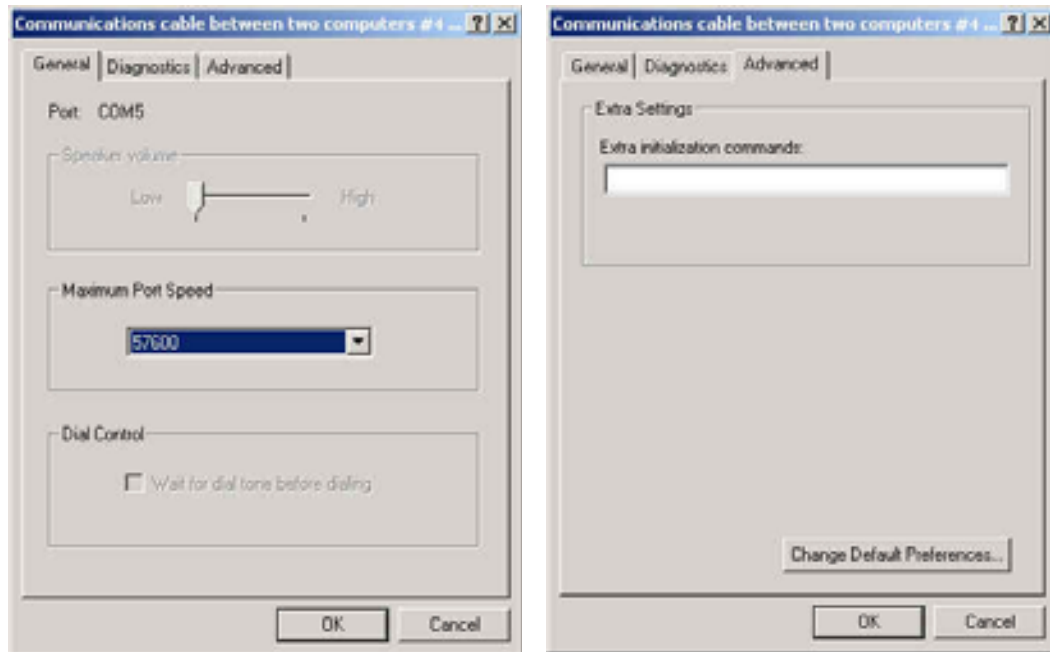
7. Set the **Port speed** to **57600** and the **Flow control** to **None.**
Click the **Advanced** tab.
Set **Data bits** to **8.**
Set **Parity** to **None**.
Set **Stop bits** to **1.**
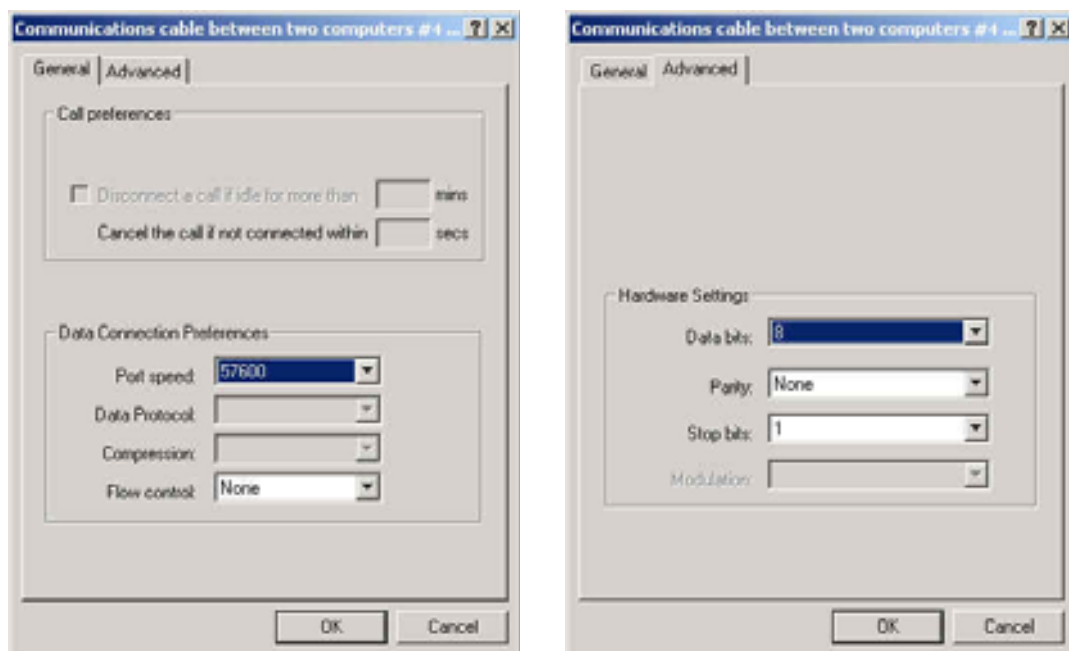
8. Click **OK** several times to exit all the windows. The modem configuration is now complete.

b) Setting up a direct connection

1. Start the **Network Connection Wizard.**
   Click **Start→Settings→Network and Dial-up Connections**
   →Make New Connection.

2. The first window is the **Welcome** window as shown below. Click **Next**.

3. The next window is **Network Connection Type**.
   Select **Connect directly to another computer**. Click **Next**.

4. The next window is **Host or Guest**.
   Choose **Guest**. Click **Next**.

5. The next window is **Select a Device**.
   This window will provide a drop-down list of known communication ports (devices) to choose from. Choose a **serial port.** If the RS232 is used, this port is most likely (COM1)**.** If a USB port is used some other COM port number should be used. Take care that the USB driver is installed and connected before completing this selection or the connection will not work.
   Click **Next**.

6. The next window is **Connection Availability**.
   Choose **Only for myself**. Click **Next**.

7. The next window is the **Complete the Network Connection Wizard**.
   Enter **Node C** as the name for the connection.
   Click **Finish**.

8. The next window is the **Connection** window
   Enter <username> in the **User Name** field.
   Enter <password> in the **Password** field.
   Check **Save Password**.
   Click **Properties**.

9. Under the **General** tab ensure the correct device is selected.
   Click **Configure**.

10. Choose **57600** for **Maximum speed**. All other boxes should not be checked. Click **OK**.

11. Click the **Security** tab.
    Click **Advanced (custom settings)**.
    Click **Settings**.

12. Make sure **Challenge Handshake Authentication Protocol (CHAP)**
    Microsoft CHAP (MS-CHAP)
    Microsoft CHAP Version 2 (MS-CHAP v2)
    are checked and all the rest of the boxes are NOT checked.
    Click **OK**.

13. Click **Typical** and choose **Require secured password**.

14. Click the **Networking** tab.
Click the **Settings** button. There are 3 PPP settings. Make sure they are all **OFF**. Click **OK** on the **PPP Setting** window.
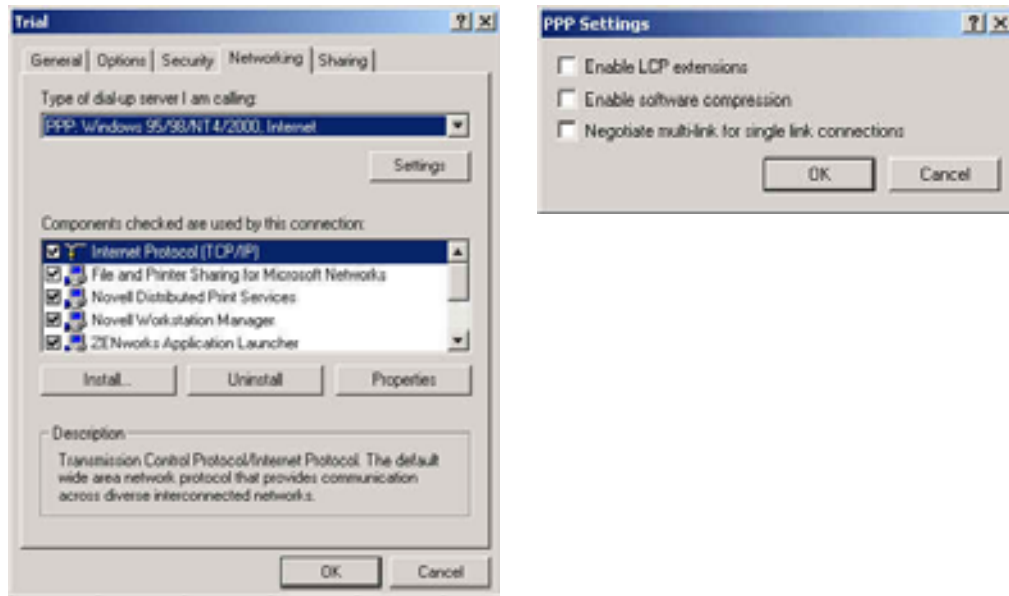
15. Highlight the **Internet Protocol (TCP/IP)** component.
Click the **Properties** tab.
Click **Obtain an IP address automatically.**
Click **Obtain DNS server address automatically**
Click **Advanced**.
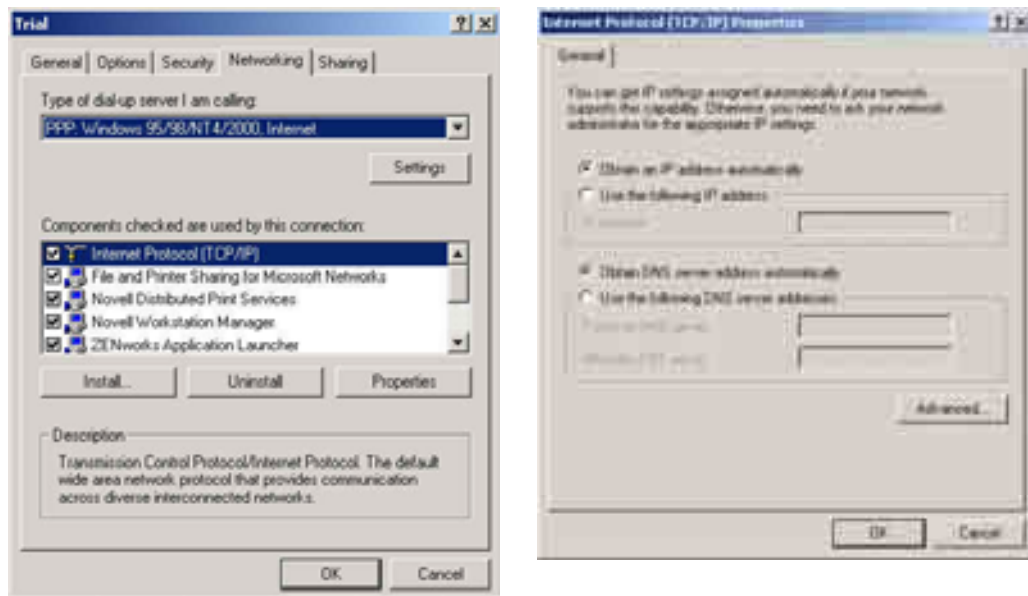
16. In the **General** tab, uncheck all boxes.
    In the **DNS** tab, make sure **Append primary** and **Append parent** and **Register this connection** are checked.
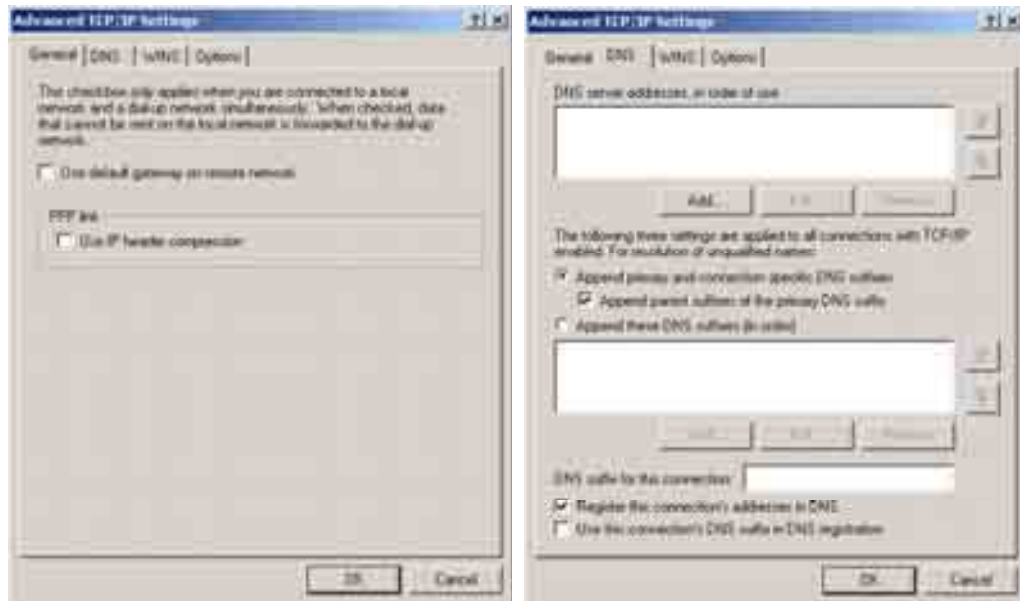
17. Click the **WINS** tab. Make sure **Enable LMHOSTS lookup** is checked.
    Click the **Options** tab. Click **Properties**.
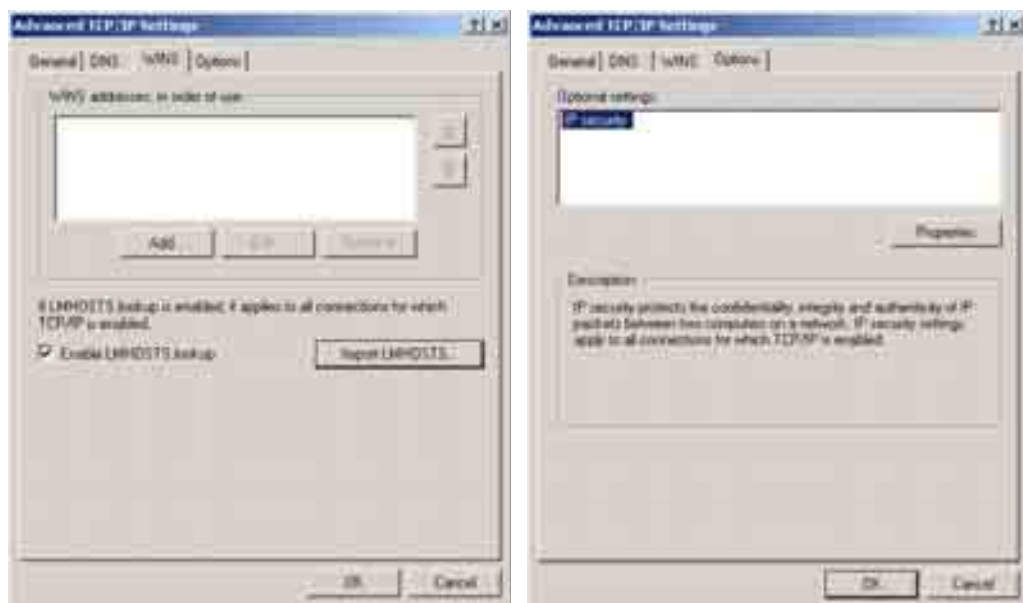
18. Click **Do not use IPSEC**.
    Click **OK**.
    Returning to the **Options** tab click **OK** and return back to the main window.
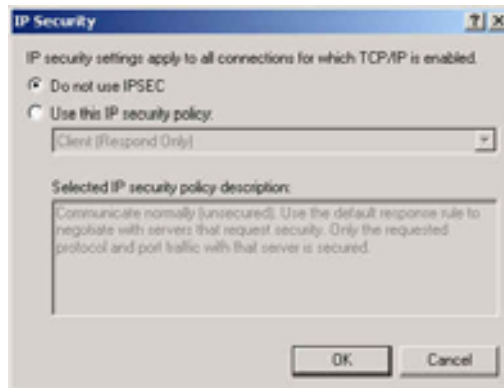
19. Click the **Sharing** tab.
    Make sure that **Shared access** is **OFF**.
    Click **OK**.
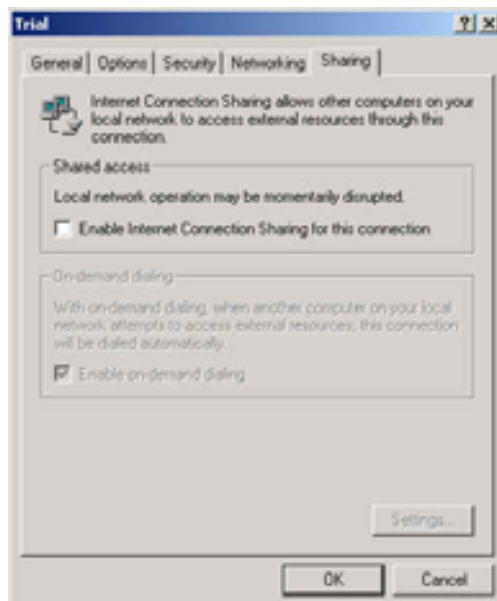
c) Establishing the connection

1. Click **Start→Settings→Network and Dial-up Connections→Node C.**
   The properties of this connection should already have been setup.
   Enter <username> in the **User Name** field.
   Enter <password> in the **Password** field.
   Check **Save Password**.
   Click **Connect** and the following connection windows will appear.
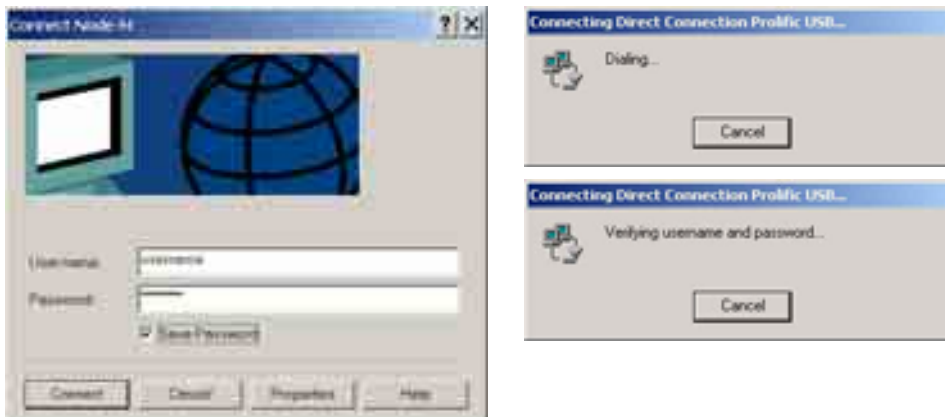
2. When the connection is successful an icon will appear in the system tray. This icon will "light up" to indicate network activity between the computer and the Node C. To check the status of the connection, click on the icon.

3. Please continue with chapter *4.2.3.6 Accessing the web page*.

4.2.3.6   Accessing the web page

1. Open Internet Explorer and enter the **address**: *1.2.1.1*.
    Enter <*Node_M*> in the **User Name** field.
    Enter <*Golden_Node*> in the **Password** field.
    Note that these fields are case-sensitive.

2. After the login, the home page will appear. From this page the entire Node C may be controlled. The most important menus will be explained in the following chapter. **For any further details click the Help button (also available in all of the menus), to open the online help screens.**

figure 4-4 Home page of web interface

The next chapter contains an explanation of the most important menus.

4.2.4 Main Menus of the Web Page

For detailed information about a menu click the "Help" button to open the online help.

4.2.4.1 Setup Wizard

This menu serves to align the donor antenna and provides overviews of all channels on air as wells as channel assignment.

figure 4-5 Setup Wizard

Antenna Alignment Assistant:

The intent of these web pages is to help the user correctly orient the antenna by displaying the total received power in the selected 5MHz band and the power of the strongest pilots within the 5MHz channel.

a) To start the Antenna Alignment Assistant (AAA):

1. Select 'Setup Wizard' from the main page.
2. Select 'Antenna Alignment Assistant'.
3. Select the desired 5 MHz channel by using the dropdown box.
4. Select 'Start Alignment'.
5. Observe the Rx DL Power and Pilot RSCP measurements and orient the antenna to maximize performance.
6. Click 'Home' when completed.

b) Typical Tuning Procedure (See example table below):

1. Point the donor antenna in the general direction of the donor base station.
2. Start the AAA.
3. Verify that the reported DL Rx Power is above –90dBm. If not, orient the antenna until the signal is above –90dBm.
4. Wait for Pilot RSCP results to be reported (indicating that a valid pilot has been found).
5. Verify that the ARFCN and frequency reported at the top of the table matches the ARFCN and frequency of the donor base station.
6. Orient the antenna to maximize the Pilot RSCP from the donor base station. Usually, the best method is to course-tune the antenna based on DL Rx Power measurements and then fine-tune based on Pilot RSCP measurements. However, if multiple pilots are present, then using the DL Rx Power measurements alone may not work well, and the user will have to rely on Pilot RSCP only.
7. If multiple rays are present, then it is usually best to orient the antenna to maximize the level of the first ray (the line-of-sight – or LOS – signal). However, if the first ray is not the strongest signal, then there is an obstruction in the LOS signal, and the strongest signal is a multipath component. This may mean that the donor signal is prone to fluctuation, resulting in sub-optimal performance of the unit.

Assisted Antenna Tuning
Channel 12345 , 2100 MHz

DL Rx Power (dBm)	RSCP of Pilot 111 (dBm)	RSCP of Pilot 111 (dBm)	RSCP of Pilot 333 (dBm)	RSCP of Pilot 444 (dBm)
Multipath Component	1st Ray	2nd Ray	1st Ray	1st Ray
-80	-	-	-	-
-80	-	-	-	-
-80	-91	-92	-93	-94
-80	-	-	-	-
-80	-	-	-	-
-80	-	-	-	-
-80	-91	-92	-93	-94
-80	-	-	-	-
-80	-	-	-	-
-80	-	-	-	-
-80	-90	-91	-92	-93
-80	-	-	-	-
-80	-	-	-	-
-80	-	-	-	-
-80	-90	-91	-92	-93

table 4-1 Assisted antenna tuning

c) Notes on the AAA Measurement Results:

1. The DL RX Power is the total power in the selected 5 MHz channel. The DL Rx Power measurement is updated approximately once per second.
2. The Pilot Received Signal Code Power (RSCP) measurements are updated approximately once every four seconds after the antenna assistant finds a valid pilot channel within the selected 5MHz bandwidth. It may take up to one minute to perform the initial scan and report Pilot RSCP results.
3. The most recent results are displayed in the first row, and previous results move down one row in the table.
4. Data is columnized based on the most recent pilot measurement results.
5. The pilot measurements display up to the four strongest rays. The measurement result could show one pilot with four rays, two pilots with two rays each, one pilot with three rays and one pilot with one ray, or four pilots with one ray each (or fewest results if no additional pilots are found).
6. Multiple rays of the same pilot will be shown if the weaker rays are within 10dB of the strongest ray.
7. The Pilot RSCP data is sorted based on the total power of all multipaths for each particular scramble code. For instance, if one pilot has two rays, each at –63dBm (for a total power of -60 dBm), they will be listed first if all other pilots are less than -60 dBm.
8. If two or more multipath signals are received, then the power of each ray will be displayed in order of arrival. The first ray is the line of sight signal and should be the strongest. However, it is possible for the later rays to be stronger.

4.2.4.2   Connectivity and Upload

This page serves to upload new software (press the *Upload Software* button and follow the instructions) and for entering the modem settings for OMC communication.

figure 4-6 Connectivity and Upload menu

4.2.4.3 Technician Setup

figure 4-7 Technician Setup menu

Description	Explanation
Filter Selection	Select the frequency range for channel 1, 2 and 3; for filter setting refer to chapter *5.2.1 Filters*.
Filter Power to Total Power Ratio	Enter ratio of pilot power to total power (depending on base station).
Downlink Power Downlink Gain	Select Power mode or Gain mode and set the desired power or gain, respectively.
Relative Uplink Gain Absolute Uplink Gain	Select Relative or Absolute Uplink Gain mode and set the respective value.
Downlink DCM path	Enable or disable the respective feature.
Uplink DCM path *	
Downlink PA	
Uplink PA	
Complete Network Element	
Interference Cancellation	

* In the Uplink DCM path it is possible to enable or disable the primary and diversity paths individually.

4.2.4.4 Alarm Management

figure 4-8 Alarm Management menu

	Column	Description
1	ID	Clicking any of the number buttons opens a submenu * for the respective component/feature.
2	Module	All components and features listed in this column can be monitored via software.
3	Current Status	The cell colour (see [4] below) indicates whether an alarm is active. If more alarms of different severity levels are active simultaneously (number of alarms is displayed in column "Alarm Count" to the right), the cell will always show the highest level that is active.
4		This row illustrates the colours by which the individual severity levels are represented in column 3.

* This submenu includes an overview of the alarms available for the respective component/feature and alarms can be disabled. In the column "Alarm Group" the severity level for each alarm can be set. The possible severity levels are illustrated under [4].

In the submenu for "VSWR, ALC, RSSI" [7] it is also possible to set the alarm threshold (level at which an alarm will released) for these features.

Use the submenu [8] for "External, Fan and Door" for naming the external alarms.

4.3 TROUBLESHOOTING

Connection Problem:

After clicking **Connect**, the progression goes from **Dialling** to a **Connection Error** as shown below.
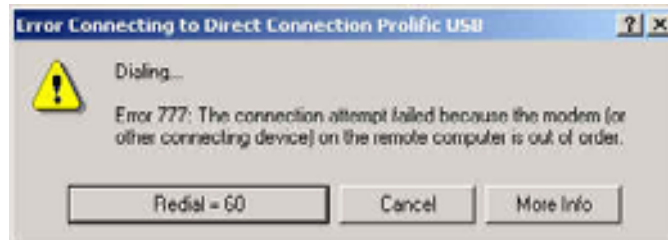
Possible Solutions:

I. The connection is not configured properly.

a. Click **Properties→Configure** in the **Direct Connection** window. Make sure **Speed** is set at **57600**. Make sure **no flow control** is checked.

b. Click **Start→Settings→Control Panel→ Phone and Modem Options**. Go to the **Modem** tab. Highlight the used modem connection. Click **Properties**. In the **General** tab set the **Speed** to **57600**.
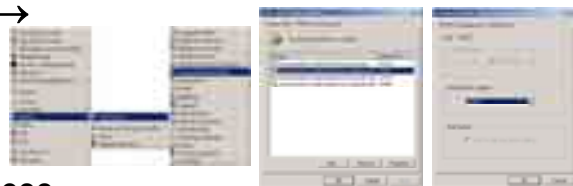
c. Click **Advanced**. Click **Change Default Preferences**. Click on the **General** tab. Make sure **Speed** is set to **57600**. Make sure **Flow Control** is set to **None**.

d. Click **Change Default Preferences** Make sure **Data Bits** are set to **8**. Make sure **Parity** is set to **None**. Make sure **Stop Bits** is set to **1**. Click **OK** to exit.

II. The physical connection is loose.

Connection Problem:

After entering the Node C address, an HTTP error page is returned instead of the login page.

Possible Solution:

I. If the computer is connected to another network, the HTTP request may be going out to that network instead of to the Node C. This is likely if after entering the Node C address, **the Direction Connection** icon does not light up with activity.

    a.   Click **Start→Run**
           Type **cmd** to get a dos prompt.
           Type **ipconfig /all**

    b.   To release the LAN
           Type Click **ipconfig /release**.

    c.   Click the **Direct Connection** icon
           Click **Disconnect**.

    d.   Close **Internet Explorer**.

    e.   Restart the connection procedure.

For your notes:

5 FUNCTIONAL DESCRIPTION

5.1 GENERAL

The following figure shows the DC block diagram of the Node C.
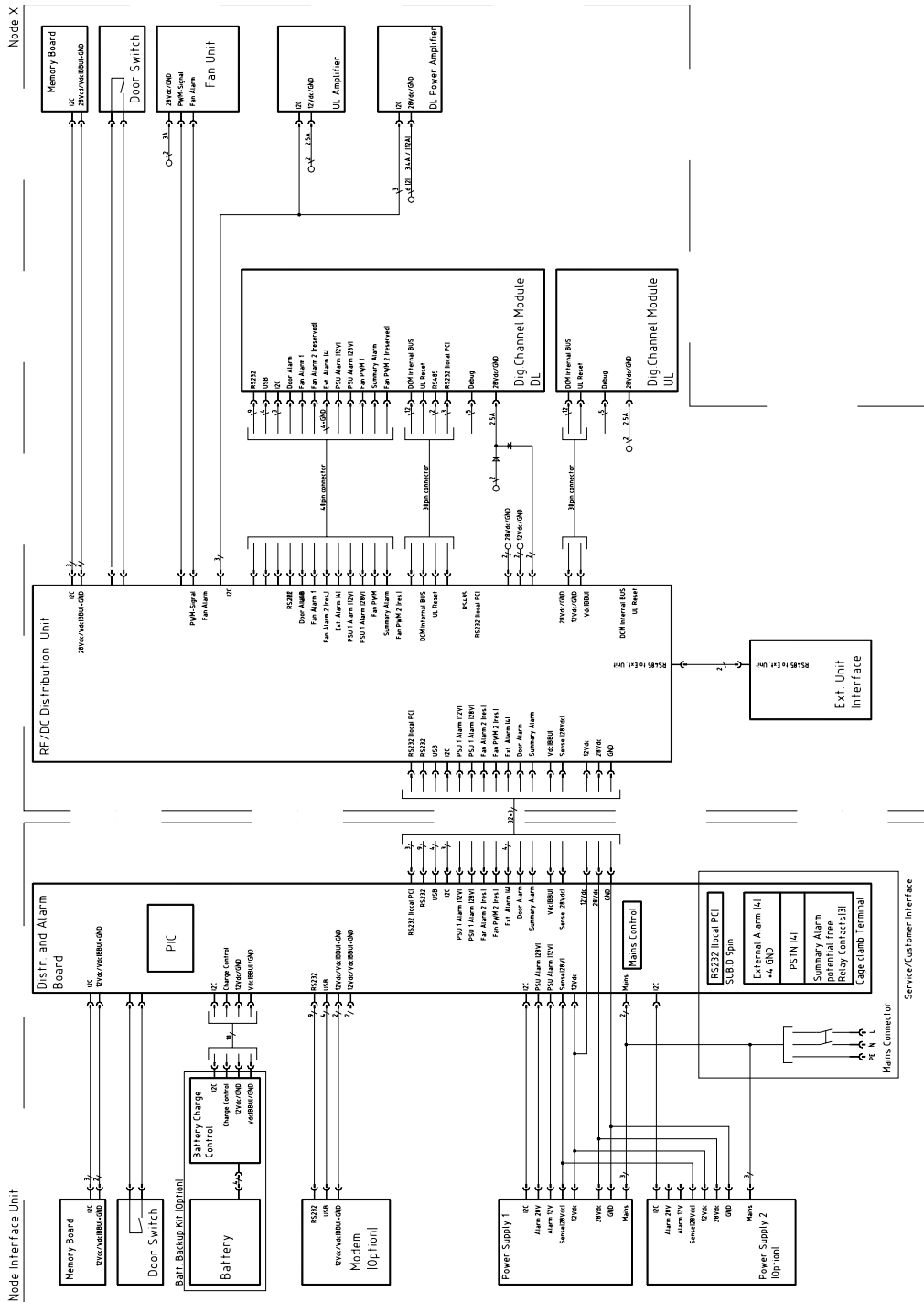
E1065B3

figure 5-1 DC block diagram of a Node C

The following figure shows the RF block diagram of the Node C.
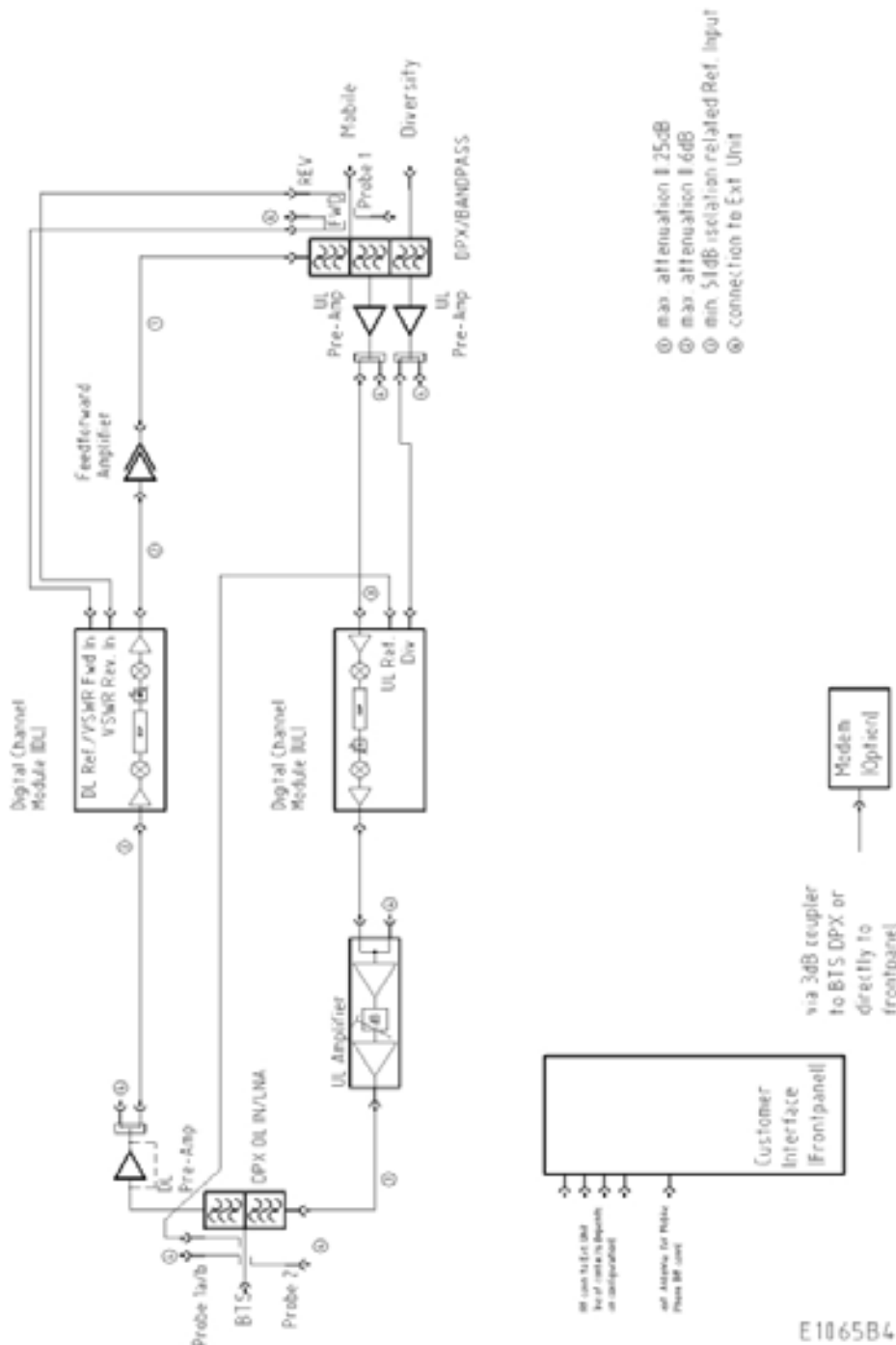
figure 5-2 Configuration of a Node C network element

The Node C is designed to amplify signals between multiple mobiles and a base station in a CDMA system. The unit consists of a filter and amplifier chain in the downlink and one or two filters and amplifier chains in the uplink (primary and diversity). The uplink and downlink paths are connected via a duplexer on both ends of each path.

In the primary uplink path, a signal originating from the mobile is separated from the downlink signal via the primary UL IN duplexer. It is then amplified by an integrated low noise amplifier (LNA) and forwarded to the uplink digital channel module (DCM). The DCM down-converts the signal to base-band, digitally filters it, amplifies it and then up-converts it. In addition the interference cancellation technology is implemented in the DCM. Finally, the signal is sent to the final amplifier and combined with the downlink input signal in the DL IN duplexer. The optional diversity uplink path (via a second filter) is identical except signals enter via the diversity UL IN duplexer and are combined in the DCM with the primary path.

In the downlink path, a signal originating from the base station is separated from the uplink signal in the DL IN duplexer. It is then amplified by an integrated low noise amplifier (LNA) and forwarded to the downlink digital channel module (DCM). The DCM down-converts the signal to base-band, digitally filters it amplifies it and then up-converts it. In addition the interference cancellation technology is implemented in the DCM. Finally, the signal is sent to the final amplifier and combined with the uplink input signal in the primary UL IN duplexer. The downlink DCM is also responsible for communication and control of the entire unit. Using a Node C 1943 as an example, the following figure illustrates the positions of the RF components inside the Node C.

figure 5-3 RF path of a Node C, exemplary

5.2 FEATURES OF THE NODE C

5.2.1 Filters

Filters are set automatically according to the channels set in "Setup Wizard" or "Technician Setup". For further information about these menus refer to chapters *4.2.4.1* and *4.2.4.3*.

Possible filters are:

| One WCDMA channel | two adjacent WCDMA channels | three adjacent WCDMA channels | two WCDMA channels; intermediate channel not used |
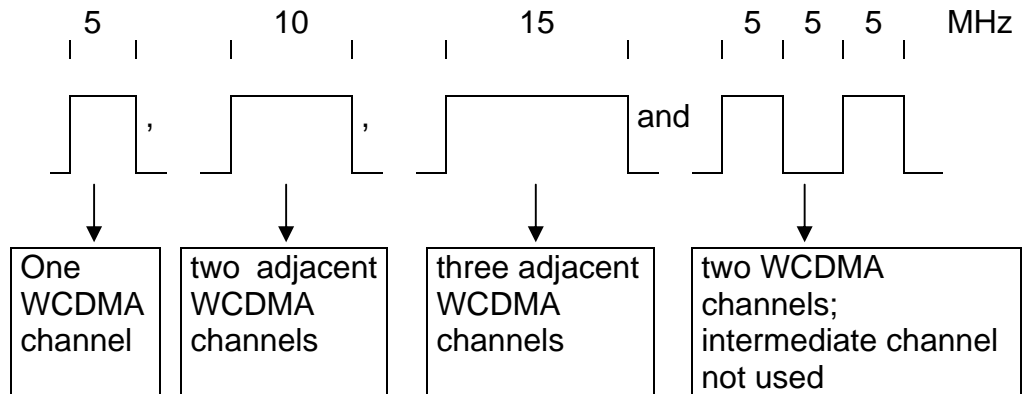
5.2.2 Digital ICE (Digital Interference Cancellation Equipment)

Digital ICE has been developed to enhance antenna isolation. This feature enables the Node C to provide coverage in areas where effectivity is decreased due to physical site limitations which cause insufficient antenna isolation.

Antenna isolation is the RF loss measured between the donor antenna and the coverage antenna. If the gain of the network element exceeds the path loss, feedback in form of oscillation occurs. The isolation is usually dominated by the direct path loss from one antenna to the other, but reflections can contribute to or even affect antenna isolation. Digital ICE cancels the signal from the primary feedback path, thus allowing the gain of the network element to be increased.

The required delay resulting from the on-site conditions is measured by the DCM module and set accordingly.

For software setting commands please refer to the online help screens.

The Digital ICE function can be enabled or disabled in the "Technician Setup" page (see chapter *4.2.4.3*). Isolation and gain margin* can be checked in the "Status and Reports" menu accessible via the home page of the web interface (see *figure 4-4*).

* gain margin = antenna isolation minus Node C gain

5.2.3 VSWR (Voltage Standing Wave Ratio)

This feature enables the provider to query the status of the antenna system (antenna & cable). The voltage standing wave ratio of the DL output antenna port is measured.

If the VSWR falls below the value set in the "Alarming Management" (see chapter *4.2.4.4*), an alarm is released. The alarm can be forwarded to the OMC where the faults and irregularities can be acknowledged and eliminated promptly.

The current VSWR value can be checked in the "Status and Reports" menu accessible via the home page of the web interface (see *figure 4-4*).

5.2.4 RSSI (Receive Signal Strength Indication)

The RSSI provides controlling and monitoring of the receive level of a base station (DL RSSI) or user equipment (UL RSSI) to a Node C. It measures the level of the input signal by detecting the RF and converting the analogue level into a digital value. The data are processed and evaluated by software. An alarm will be released if the measured signal level exceeds the alarm level set by the provider via software.

☞ **Note:** **If the Node C is equipped with a diversity path, both values will be combined before the RSSI evaluation. Thus, only one UL value is reported.**

The current RSSI values can be checked in the "Status and Reports" menu accessible via the home page of the web interface (see *figure 4-4*).

5.2.5 Alarmforwarding

Alarms can be forwarded to a defined phone number or to the OMC if the Node C is equipped with a modem or a mobile station. This enables the provider to control and to query the status of the network. Faults and irregularities can be recognized and eliminated.

With an optional modem the Node C also provides an SMS feature, by which the unit is able to send out alarm messages as SMS. For further details please contact your supplier.

5.2.6 External Alarms

The external alarms are used to monitor the status of one or more external devices via the Node C. A UPS or entry alarm is among the items that might be connected to the contact relay and monitored via the Node C. The cage clamp connectors are located on the distribution & alarm board of the Interface Unit.

Observe that the cross-sectional area of the wires to be connected must be in the range from 0.5 - 1.0 mm^2. Do not use wire-end sleeves (wire cable ends).
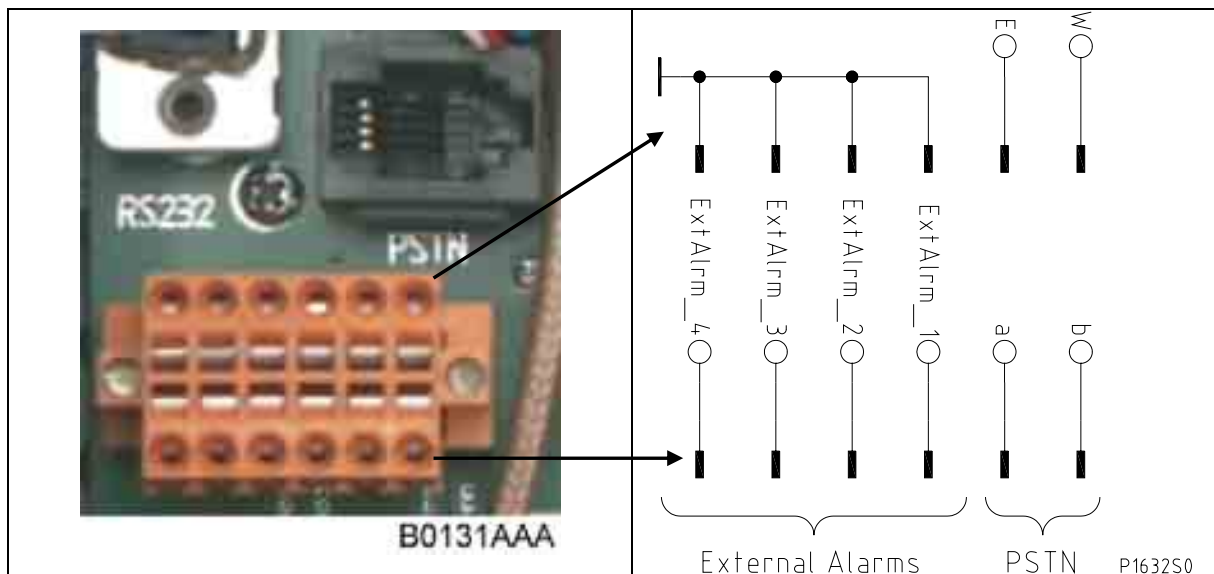
figure 5-4 Configuration of external alarm clamps

There are three external cage glands at the bottom of the Interface Unit, which may be used to connect the external devices.

All external alarms are defaulted to high (5VDC) without connection. This setting may be changed on the external alarm page to active high or active low. The severity levels of the external alarms may be set via the web page. More information about the external alarm settings is available in the web page and online-help.

When not all of the external alarms are required, make sure that the other alarms are set to active low or disable the alarm; otherwise the status will always show an alarm. The names for each external alarm are user-definable on the external alarm page (see chapter *4.2.4.4 Alarm Management*) and it is suggested that they be renamed to indicate the use of these alarms.

Input voltage range	5VDC
Recommended input line	Potential free
Nominal sink current to ground	15mA
Active level	High or low set via software
Connectors	Cage clamps

5.2.7 Summary Alarm

The summary alarm is a DC insulated contact relay.

Observe that the cross-sectional area of the wires to be connected must be in the range from 0.14 - 1.5 mm^2.
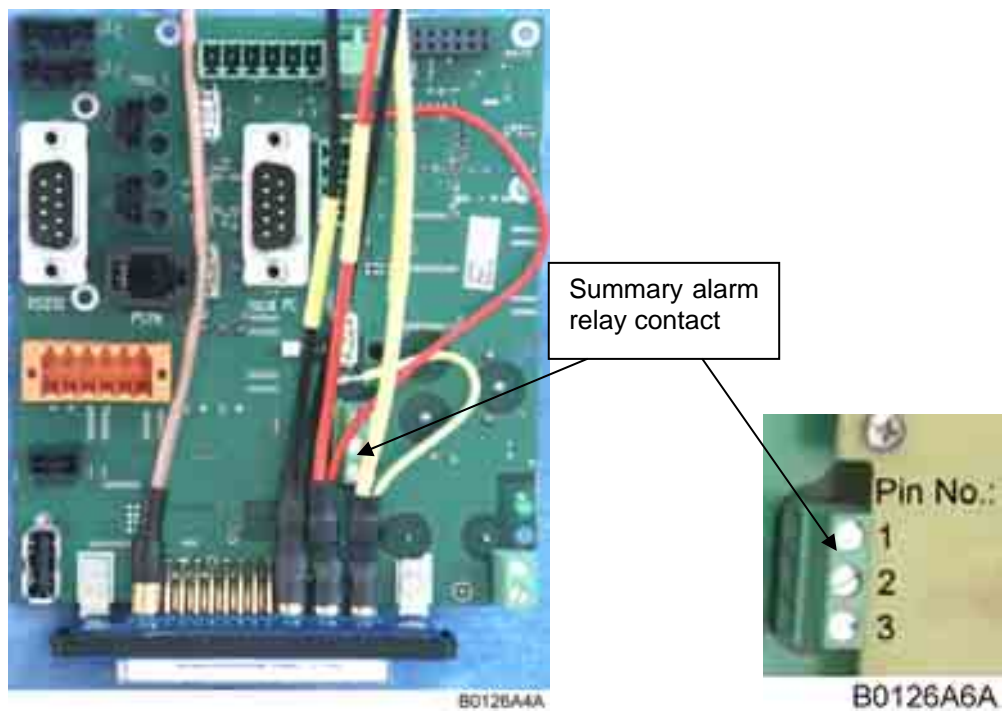
figure 5-5 Summary alarm relay

The following table indicates the three-connector pin out.

Pin No.	Contact	Maximum Resistive Load
1	Normally closed	Max 1A @ 50VDC
2	Common	Max 2A @ 30VDC
3	Normally open	Max 1A @ 230VAC

5.3 COMPONENTS OF THE NODE C AND INTERFACE UNIT

The actual configuration can be seen at the configuration list*, which is part of the delivery.

The following figure shows a Node C 1943** (layout of Node C 843 is the same) and an Interface Unit with PSU redundancy option (two power supplies).

* To be replaced by an electronic door label that will be accessible via software & remote control.

** The layout of a Node C x37 differs from the Node C x43 only in the design of the DL final amplifier (see chapter *5.3.5 Downlink Final Amplifier*).
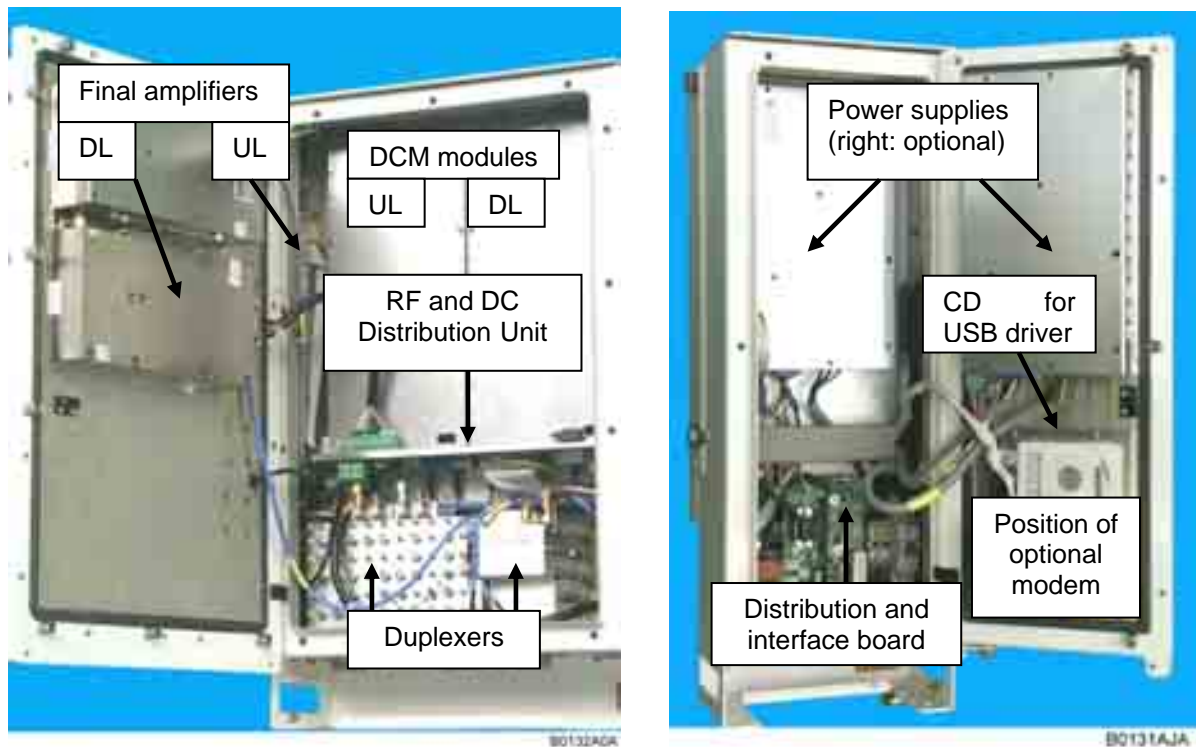
figure 5-6 Layout of a Node C 1943 and Interface Unit

5.3.1 Duplexer

The duplexer is used to isolate the uplink from the downlink, i.e. to separate the transmitting path from the receiving path. The pass band of the duplexer is the full 60 MHz of the CDMA band. This allows the same Node C to be used regardless of its operator's frequency plan.

The integrated LNAs (low noise amplifiers) are biased via the RF cable from the DCM module. The DL/LNA can be bypassed for strong input signals by the DCM module automatically.

The DL duplexer has multiple outputs, including the primary and extension path, plus forward and reverse probes used for auto setup, VSWR, and RSSI functions.

figure 5-7 Duplexer, DL IN

The UL IN duplexer of the Node C is equipped with a diversity filter. The duplexer is used for the primary uplink path and is shared with the downlink output.
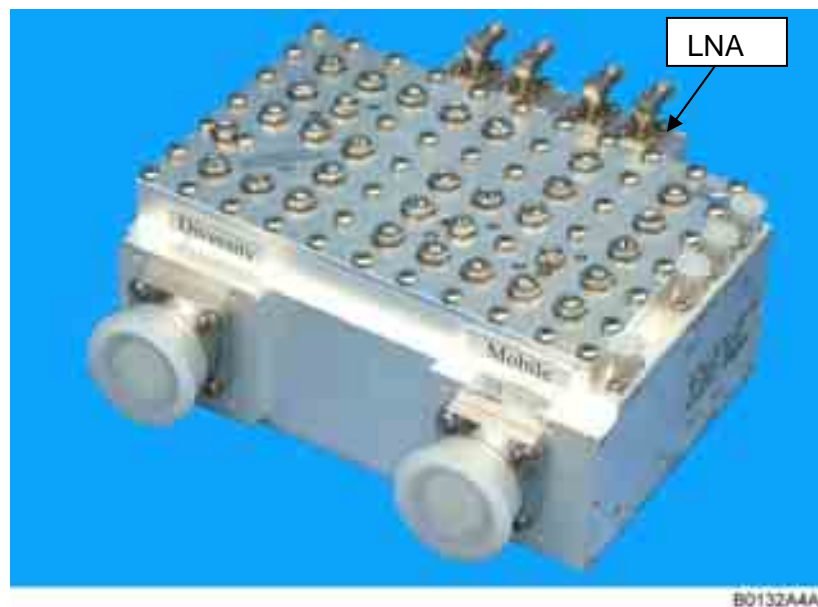
figure 5-8 Duplexer, UL IN, with integrated diversity filter

The diversity filter is equipped to provide increased uplink signals in a multipath environment. The two paths are combined inside the DCM maintaining a time delay between both paths. According to measurements signal strength gain is about 3-5 dB for diversity reception.

5.3.2 RF and DC Distribution Unit

The RF and DC distribution unit is mounted between the duplexers and DCMs.

It is the physical transport layer for communication between the downlink DCM (which has the integrated controller) and other sub-components of the Node C (see also chapter *3.2.5 Connection of Cable Bridge*).
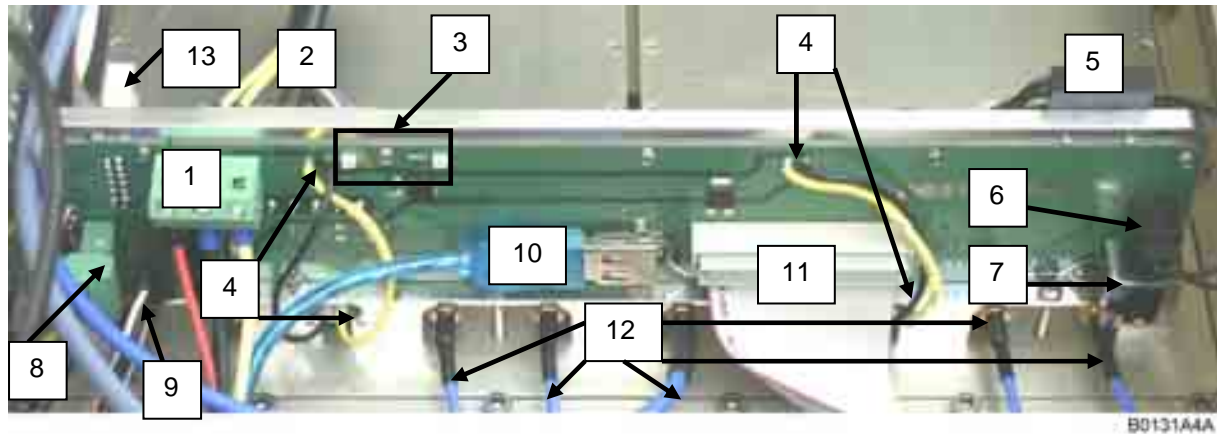
figure 5-9 RF / DC distribution unit

1	To cable bridge connector from Interface Unit for connection of 12V, GND, 28 V
2	DL-PA connector
3	LEDs for voltage indication (left: 28 V, right: 12V)
4	28 V to DCM modules
5	Door contact
6	Connector for door contact
7	RS485 connection to extension unit
8	Fan connector (NodeM 43)
9	Memory board connector
10	To cable bridge connector for USB connection from Interface Unit
11	To cable bridge connector from Interface Unit
12	RF cables
13	UL PA connector

table 5-1 Connections of RF / DC distribution unit

5.3.3 Digital Channel Module (DCM)

The task of the digital channel module (DCM) is to filter and amplify any signals passing through it. In addition it takes measurements of the input and output signals and decodes the air interface to ensure proper setup and operation.

Finally it performs the interference cancellation algorithms, which eliminate the normal problems associated with isolation, and has an integrated controller (in the DL part) for the entire Node C, which maintains a web server for local and remote communication. This process is accomplished by both analogue and digital means.

In case the diversity option is equipped, the module receives signals from both the primary duplexer and diversity filter. Both signals are combined digitally and filtered before being amplified in the uplink amplifier.

The DCM consists of an UL and DL part.

figure 5-10 DCM (UL or DL part)

5.3.4 Uplink Final Amplifier

The UL path is amplified by a final amplifier for high output power.
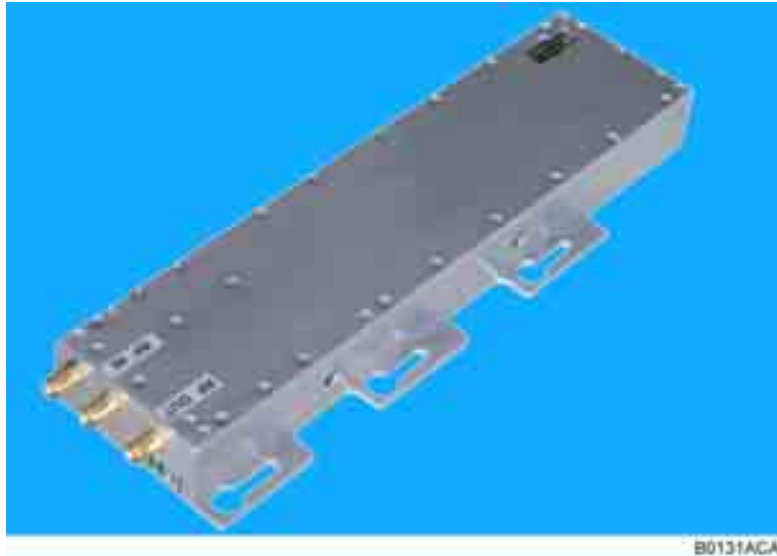
figure 5-11 Uplink final amplifier

5.3.5 Downlink Final Amplifier

In the DL path, an error-correcting feed-forward amplifier, which has a high output power while maintaining superior intermodulation and linearity performance, is used as final stage.

In the Node C x37 a 37 dBm (2 W) average power final amplifier is used.
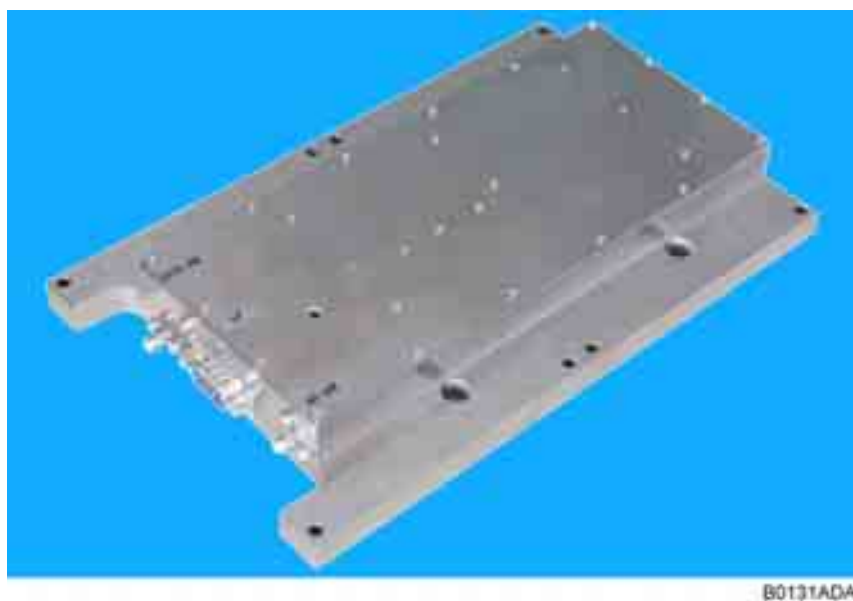
figure 5-12 Node C x37 DL final amplifier

In the Node C x43 a 43 dBm (20 W) average power final amplifier is used.

figure 5-13 Node C x43 DL final amplifier, new type
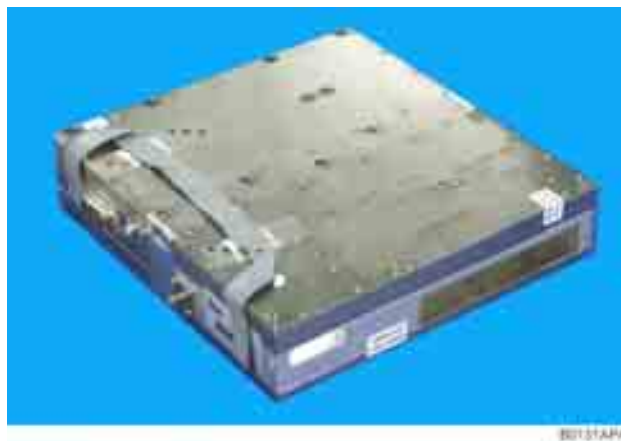
figure 5-14 Node C x43 DL final amplifier, former version

5.3.6 Distribution & Alarm Board

The distribution & alarm board of the Interface Unit is the main connection point for the user. It has the external alarm clamps, RS232 connectors, for local or modem connection, as well as a summary alarm relays. The following figures show one blank board and an installed one with battery backup.

Battery backup connector

Internal I^{2}C

Vdc for modem *

Remote (RS232)*

Internal PSTN connector

External alarms & PSTN *

Door switch

Modem cable (RF connection)

USB connector for modem*

Power supply alarming / I^{2}C

Mains surveillance

Battery load discharge (resistor)

Modem fuses (2.5 A)

Local (RS232) *

Battery charge module

Summary alarm*; see chapter *5.2.7* for pin assignment
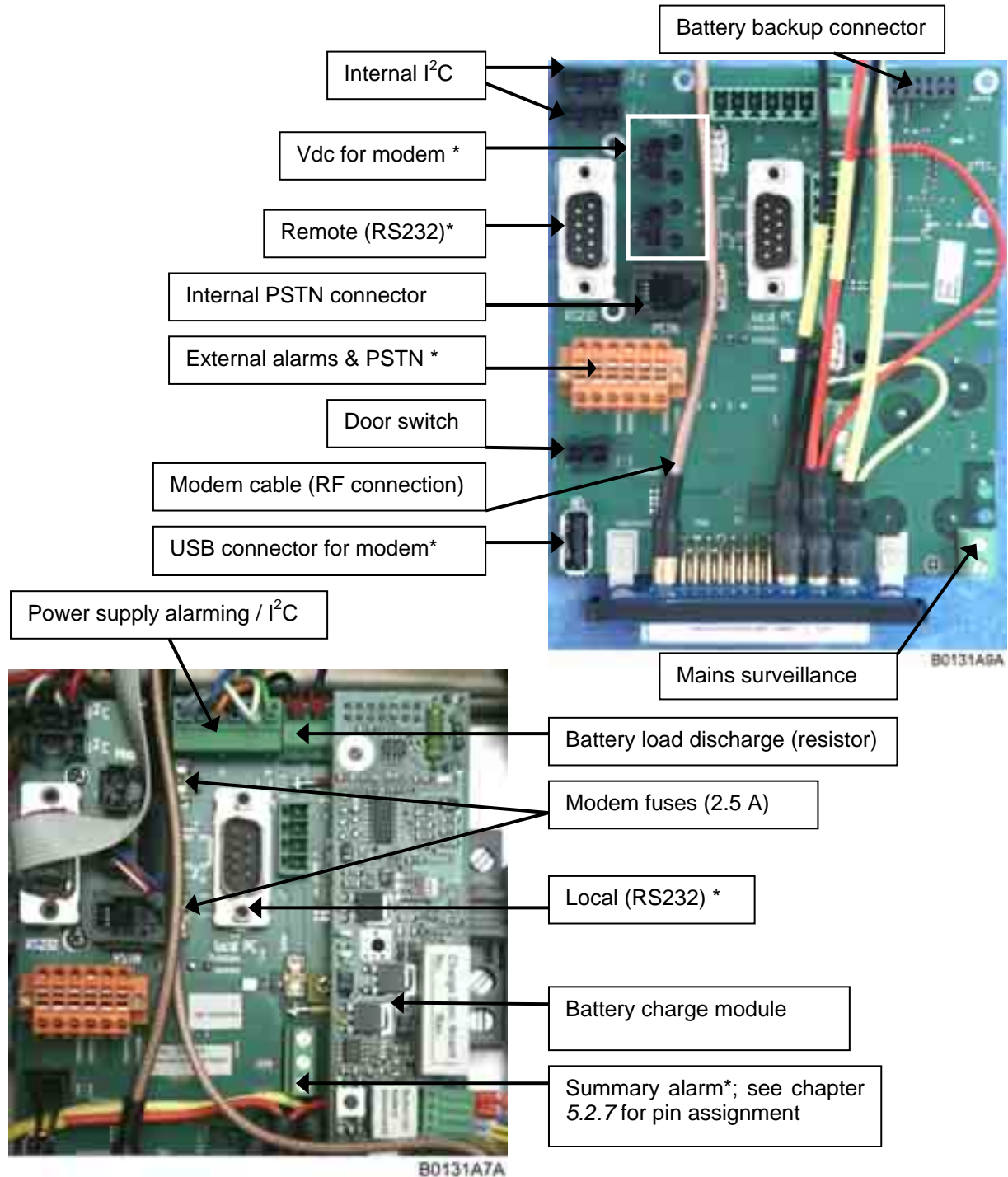
figure 5-15 Distribution & alarm board

* Only these connectors are for general customer use. All others are designated above for informative purposes, and required, only, e.g. for an upgrade or replacement of parts.

5.3.7 Power Supply

The power supply, which is mounted in the Interface Unit, transforms AC mains power into a predefined DC voltage. When performing maintenance, ensure that all circuits are voltage-free and that the Node C is disconnected from mains.

The Node C may be equipped with a second power supply for redundancy.

figure 5-16 Power supply

5.4 OPTIONAL EQUIPMENT

The actual configuration can be seen at the configuration list*, which is part of the delivery.

*   To be replaced by an electronic list that will be accessible via software.

5.4.1 Modem with Battery Backup

The modem is used to establish a remote connection to the Node C. The connection may be used to change the unit's parameters, check and clear alarms or collect measurement and quality statistics.

Furthermore, the modem is at the Node C's request to alert the operator when there is an alarm. The modem may be over-the-air (wireless) or PSTN. It is possible to install the wireless modem or the PSTN modem on site.

➲ Check the communication mode between the modem and the terminal. The following parameters should be set for a GSM modem.

Bit rate / bit per second:	**9600 baud**	Number of data bit:	**8 bit**
Parity bit:	**No parity**	Stop bit:	**1 stop bit**

These settings may only be changed locally. Should a different modem be used, the operator should ensure that the settings are changed prior to leaving the site.

5.4.1.1 Initstrings

The initialization string depends on the operator's network and the modem. It may be necessary to adjust the init string in the field. The following init string is factory set.

Modem	Network	Initstring
not yet available		t.b.d.
via Node C Web Interface:		t.b.d.

table 5-2 Standard initstring for modem

5.4.1.2 Wireless Modem

The wireless modem allows remote control and maintenance of the Node C.

Parameters may be changed; alarm and measurement statistics may be acknowledged and collected in the OMC.

The modem is installed in the cover of the Interface Unit. The antenna connector for the modem is located at the connector panel of the Interface Unit

For technical data of the modem refer to chapter *7.2.3 Specifications for Optional Equipment*.

5.4.1.3   Battery Backup

In case power fails, a battery backup system for controller and modem has been implemented. This provides enough power for the controller that is integrated into the downlink DCM and the modem to operate for a limited period of time (see chapter *7.2.3 Specifications for Optional Equipment* for battery backup time). Within this time, the Node C will initiate a call to the OMC and alert the operator that power has been lost. All other functions will cease to work in case of power failure.

The battery packs are protected from deep discharge by use of a low voltage disconnect unit. When performing preventive maintenance, make sure that all circuits are voltage free by disconnecting the battery cable (C1) from its connector (C2). In case of a power cycle, it is sufficient to press the "Battery disconnect button" to interrupt the voltage supply. After mains is connected again, the battery will be charged and the battery backup function will be activated automatically.

Battery pack

C1; to C2 of charge module

LED

Battery charge module

C2 connector

C3 connector

Battery disconnect button
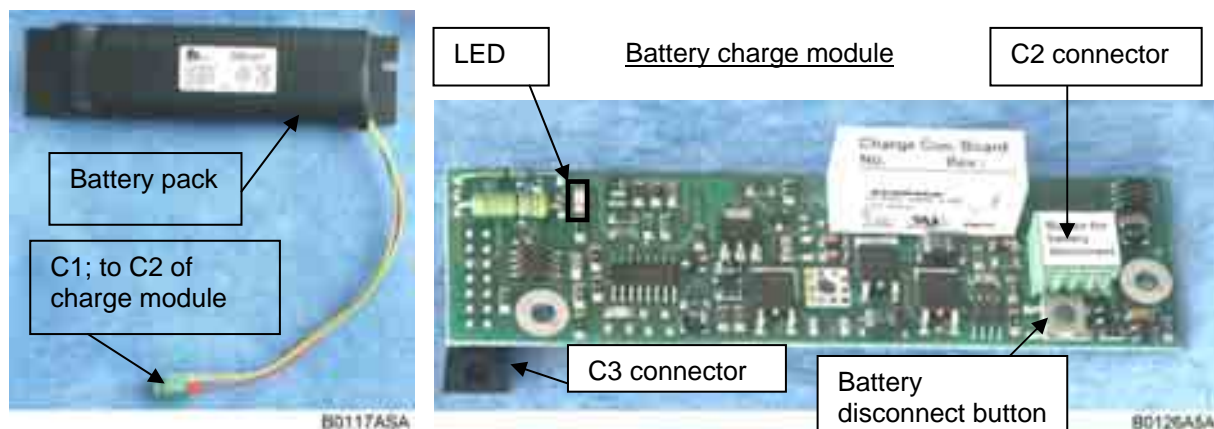
figure 5-17 Battery backup module, exemplary

The battery charge module is plugged directly onto the distribution & alarm board of the Interface Unit through connector C3.

The battery pack should be discharged at regular intervals of about three months to optimize its service life. This service discharge may be activated via software depending on the software version. The time required for the discharge varies depending e.g. on the charge status of the battery pack. A fully charged battery may require up to some hours to be completely discharged. Consider this when activating the discharge and also observe the following note.

☞ **Note: Please be aware that the backup function is not available during discharge. Thus, a primary voltage failure in that time will result in a complete system shut-down.**

It is recommended to replace the battery pack of the battery backup option after two years of usage as a preventive measure. The nominal lifetime of the battery pack is approx. two years under normal environmental conditions.

When the battery is charging, an LED on the module turns on. When the battery is fully charged, the LED will switch off.

The location of the battery backup parts are illustrated in *figure 6-3 Location of battery backup*.

For technical data of the battery backup module refer to chapter *7.2.3 Specifications for Optional Equipment*.

5.4.2   PSU Redundancy

The Node C Interface Unit may be equipped with two power supplies. This guarantees full power redundancy. The PSUs are interconnected by a current control line for current load sharing with a ratio of approx. 50% to each supply.

Currently the PSU redundancy option is only available for Node C x37.

5.4.3   High Rejection Filter

This software option provides a highly sophisticated filter feature that can be controlled via the "Technician Setup" menu of the web page (see *figure 4-7 Technician Setup menu*).

6 MAINTENANCE

6.1 GENERAL

Read the health and safety warnings in chapter *1.2 Health and Safety Warnings*.

☞ **Note:** **The Node C does not require any preventative maintenance measures.**

It is only recommended to replace the battery pack of the battery backup option after two years of usage as a preventive measure. The nominal lifetime of the battery pack is approx. two years under normal environmental conditions.

In the event of a malfunction, the user should check the status of the antennas, feeder cables, connectors, and mains power before replacing any components.

6.2 REPLACEMENT OF COMPONENTS

Read the health and safety warnings in chapter *1.2 Health and Safety Warnings*.

Maintenance of the Node C should be performed on a FRU (Field Replaceable Unit) basis only. Do not damage the warranty labels on the components, as this voids the warranty.

The spare parts list contains only units that can be replaced without tuning or complex soldering work. Those units are all components of the Interface Unit. Do not replace any components inside the Node C itself.

☞ **Note:** **Defect parts should only be replaced by original parts from the supplier. All interventions inside the housing are at one's own risk.**

☞ **Note:** **During maintenance ensure that the unit has been disconnected from mains.**

To open the cabinet of the Interface Unit, observe the instructions in chapter *4.1 General*.

☞ **Note:** **If the optional battery backup is installed, disconnect the battery cable from the charge module connector as described in chapter *5.4.1.3 Battery Backup*, to ensure that all circuits are voltage-free.**

☞ **Note:** **Before disconnecting any cables, label any unlabeled cables to ensure correct reconnection, and check the switch positions of the removed part to set the switches of the new part accordingly.**

To replace a FRU, use the appropriate tools. The tools are provided along with the equipment. Replacement tools may be ordered from the supplier. All screws have a right-hand thread, turn the tool clockwise for tightening and counter-clockwise for loosening.

SMA connectors have a specified torque of 100 Ncm. Use an appropriate tool to fasten and unfasten these. Do no over tighten the connectors or screws. The table below shows various screws with their respective torques.

Screw Type	Tallow-drop	Socket head cap	Countersunk head
Thread size	Specified Torque (in Ncm)		
M 2.0	40	not in use	40
M 2.5	82	not in use	82
M 3.0	145	100	145
M 4.0	330	330	330
M 5.0	650	tbd.	650

table 6-1 Specified torques for various screw types

☞ **Note:** **Depending on the configuration of the Node C the FRU can be equipped with a 50-Ohm termination resistor. In such a case, use the termination resistor of the old FRU to terminate the respective connector of the replacement part.**

☞ **Note:** **After the replacement of a component, check whether the system has to be levelled anew.**

☞ **Note:** **Do not forget to reinstall the front cover after the replacement procedure to ensure safe operation.**

If any FRU not contained in the following chapter needs to be replaced, contact customer service for additional instructions.

6.2.1 Power Supply

- To remove a power supply, first disconnect all cables.

- Unscrew the seven M4 socket head cap screws by which each power supply is fastened to the cabinet.

- Use these screws to fasten the new power supply and reconnect all cables.
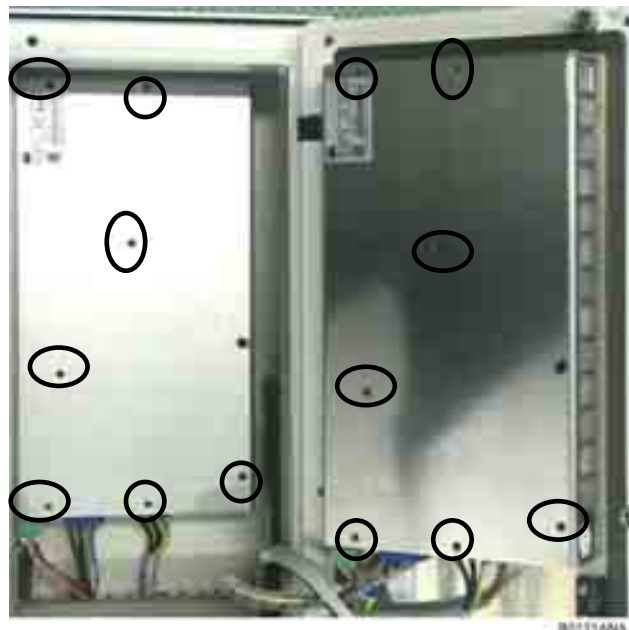

figure 6-1 Power supply screws

6.2.2 Modem

The optional modem is screwed to a mounting plate which is fastened to the cabinet. In order to separate the modem from the plate, the mounting plate has to be taken off first.

- Before starting to remove the mounting plate, disconnect all cables.

- Then, unscrew the four tallow-drop screws M3x6 which fasten the mounting plate to the cabinet.
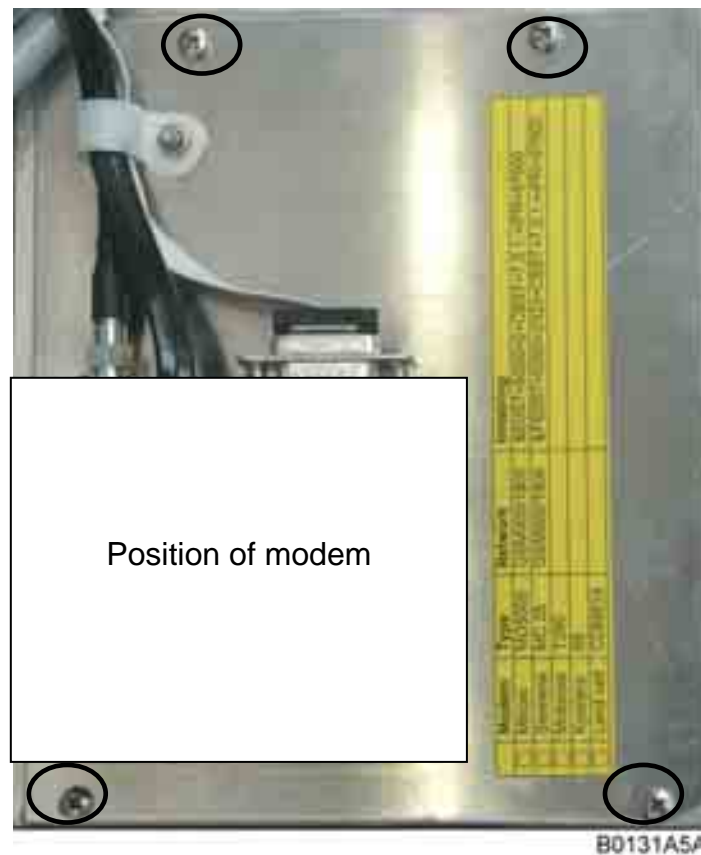

Position of modem

B0131A5A

figure 6-2 Mounting plate of modem

- Take off the plate with the modem attached. The modem is fastened from the back to the plate with two countersunk head screws M4x10.

- Unscrew these screws and use them to fasten the new modem to the mounting plate.

- Fasten the mounting plate again with the four tallow-drop screws M3x6 and reconnect all cables.
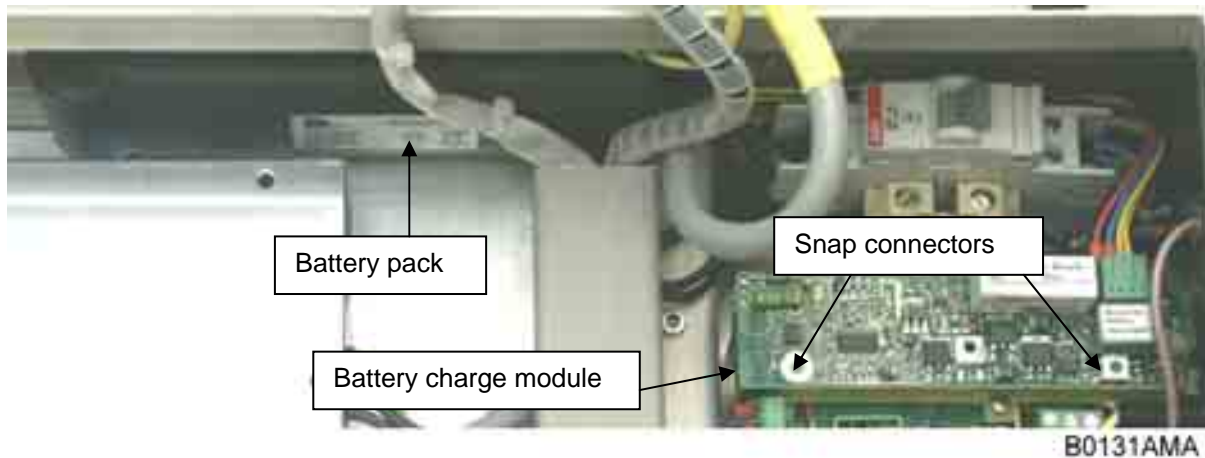
6.2.3   Battery Backup


figure 6-3 Location of battery backup

- Before removing the battery charge module and battery, disconnect the battery cable from the battery charge module (see also *figure 5-17 Battery backup*).

- The battery can now be unplugged easily.

- Release the charger from the two snap connectors by which it is fastened and disconnect it from its socket on the distribution & alarm board.

7 APPENDIX

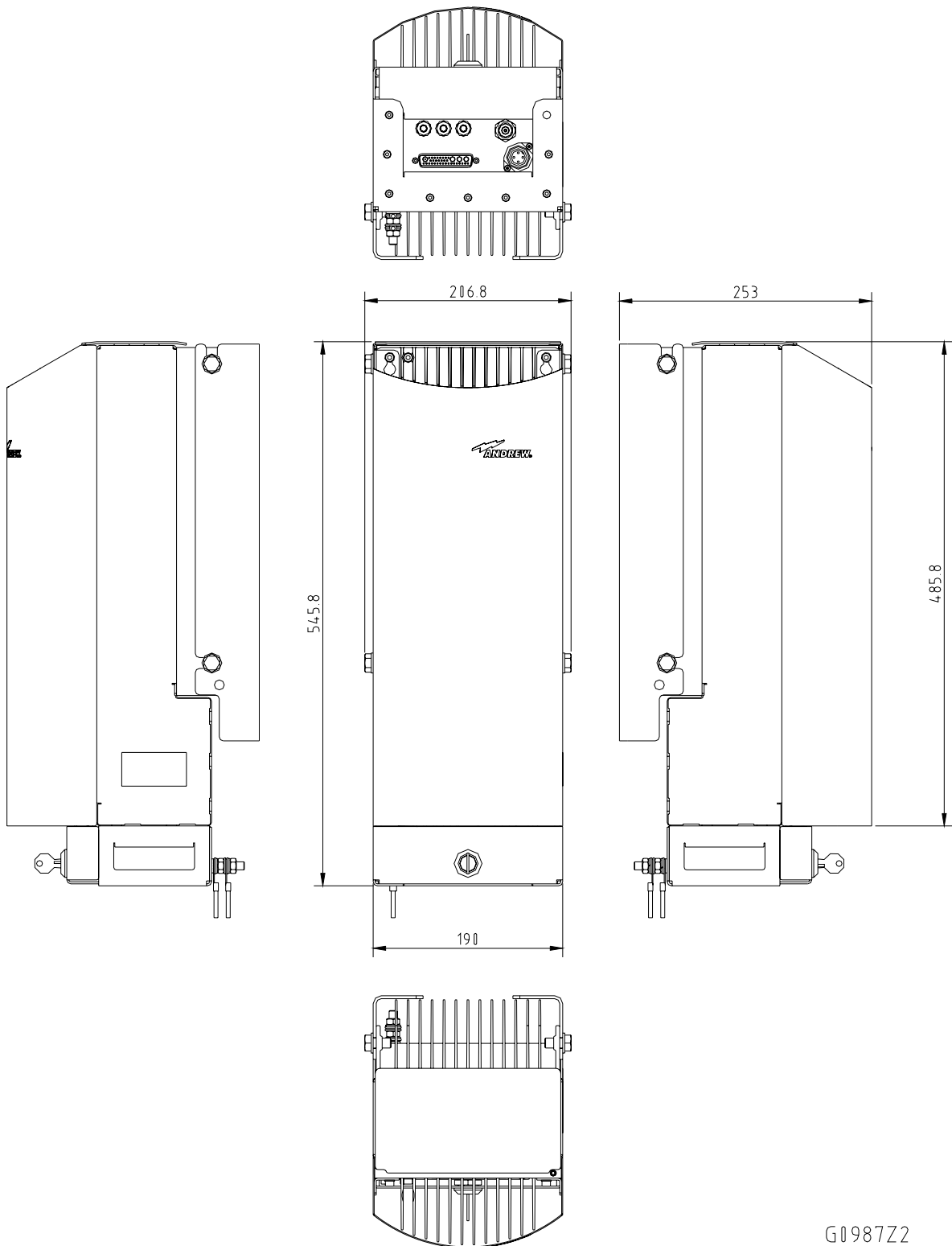## 7.1 ILLUSTRATIONS

7.1.1 Cabinet Drawings
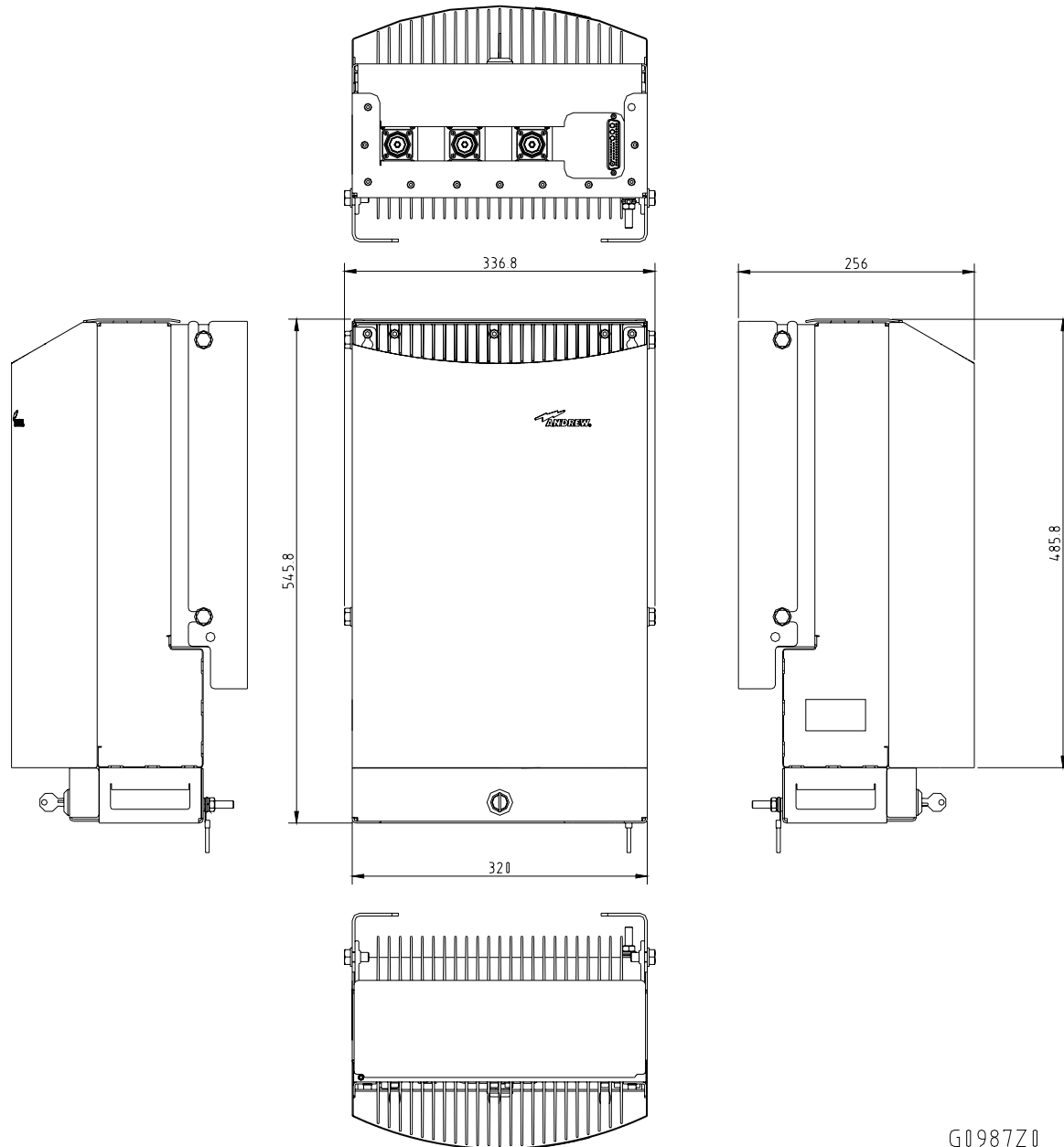
figure 7-1 Cabinet of a Node C

figure 7-2 Cabinet of a Node C Interface Unit

7.1.2 Layout

B0132A3A

figure 7-3 Layout of the Node C 1937, exemplary

B0132A0A

figure 7-4 Layout of the Node C 1943, exemplary

Position for
optional modem

B0131AJA

figure 7-5 Layout of the Interface Unit, exemplary

7.2 SPECIFICATIONS

7.2.1 Electrical Specifications

☞ **Note:** **For detailed information, refer to the Environmental and Safety Specifications leaflet of the supplier.**

Type		*Node C 837*	*Node C 843*
Frequency		Uplink: 824 – 849 MHz Downlink: 869 – 894 MHz	
CDMA carriers	Option 1: Option 2:	1-8 adjacent (per module) 1.23 MHz carriers 1-2 adjacent (per module) 5 MHz carriers	
DL output power	1 CDMA carrier 2 CDMA carriers 4 CDMA carriers	+37.0 dBm +33.0 dBm +30.0 dBm	+43.0 dBm +40.0 dBm +37.0 dBm
UL composite output power		+23 dBm	
Output power step size		1 dB	
Output power accuracy over all conditions		±1.5 dB	
Min. DL input power for full output power		-56 dBm	-60 dBm
Max. input power without damage		+10 dBm	
Min. antenna isolation for max. gain		73 dB minimum	83 dB minimum
UL noise figure		3.5 dB	
Delay	Option 1: Option 2:	< 6.5 µs < 8.0 µs	
Maximum gain		93 dB	103 dB
Gain adjust range		43 dB to 93 dB	53 dB to 103 dB
Return loss		>15 dB	
Uplink diversity		Standard	
Spectral emission mask		-45 dBc @ 750 kHz -60 dBc @ 1.98 MHz	
Out of band gain (rejection)	Option 1: Option 2:	Gain -40 dB in 1.25 MHz Gain -70 dB in 1.25 MHz	
Modulation accuracy		ROH > 0.96	
Spurious emissions		-13 dBm	
Far off selectivity (ultimate rejection)		70 dB	
Power supply	Standard: Optional:	110 VAC / 40-60 Hz 36-72 VDC	
Power consumption		150 W idle 230 W full output power	300 W idle 500 W full output power
RF connectors		7/16 DIN female; N female as an option	
Ingress protection	Cabinet: Fan:	IP66 ---	IP66 IP55
Temperature range		-33°C to +50°C	

All data is subject to change without notice

Type		Node C 1937	Node C 1943
Frequency		Uplink: 1850 – 1910 MHz Downlink: 1930 – 1990 MHz	
CDMA carriers	Option 1: Option 2:	1-11 adjacent (per module) 1.23 MHz carriers 1-3 adjacent (per module) 5 MHz carriers	
DL output power	1 CDMA carrier 2 CDMA carriers 4 CDMA carriers	+37.0 dBm +33.0 dBm +30.0 dBm	+43.0 dBm +40.0 dBm +37.0 dBm
UL composite output power		+23 dBm	
Output power step size		1 dB	
Output power accuracy over all conditions		±1.5 dB	
Min. DL input power for full output power		-56 dBm	-60 dBm
Max. input power without damage		+10 dBm	
Min. antenna isolation for max. gain		73 dB minimum	83 dB minimum
UL noise figure		3.5 dB	
Delay	Option 1: Option 2:	< 6.5 µs < 8.0 µs	
Maximum gain		93 dB	103 dB
Gain adjust range		43 dB to 93 dB	53 dB to 103 dB
Return loss		>15 dB	
Uplink diversity		Standard	
Spectral emission mask		-45 dBc @ 885 kHz -55 dBc @ 1.98 MHz	
Out of band gain (rejection)	Option 1: Option 2:	Gain -40 dB in 1.25 MHz Gain -70 dB in 1.25 MHz	
Modulation accuracy		ROH > 0.96	
Spurious emissions		-13 dBm	
Far off selectivity (ultimate rejection)		70 dB	
Power supply	Standard: Optional:	110 VAC / 40-60 Hz 36-72 VDC	
Power consumption		150 W idle 230 W full output power	300 W idle 500 W full output power
RF connectors		7/16 DIN female; N female as an option	
Ingress protection	Cabinet: Fan:	IP66 ---	IP66 IP55
Temperature Range		-33°C to +50°C	

All data is subject to change without notice

7.2.2 Mechanical Specifications

Description	Node C x37	Node C x43
Height, width, depth	546 x 320 x 260 mm	
Weight *	22 kg	25 kg
Cooling	Natural convection in the door and on the back	Twin redundant fans in the door Natural convection on the back
Acoustic noise	None	45 dBA typ. @ 25°C ambient 58 dBA typ. @ 50°C ambient
Description	**Interface Unit**	
Height, width, depth	546 x 190 x 260 mm	
Weight *	13 kg	
Cooling	Natural convection in the door and in the back	

* in standard configuration

All data is subject to change without notice

7.2.3 Specifications for Optional Equipment

Modem	
Service	t.b.d.
Service connection	t.b.d.
Physical connection	RS232; USB (not yet available)
Power consumption	4W average, 10W peak
Connectors	Data, power, RF
Battery backup	
Battery type	NiCd
Battery capacity	1200mAh
Nominal output voltage	8.4 V
Backup time	>15minutes (25W load @ 25°C)
Charge time	4.5 hours maximum
Maintenance discharge time	2 hours
Major features	Battery charge and discharge control, active HID, battery voltage measurement

All data is subject to change without notice

7.3 PARTSLISTS

The following lists contain a list of all FRUs that are available for the Node C and Interface Unit. The Node C configuration is available in the configuration list[1], which is delivered with the unit.

Please observe that in the following lists only the components marked * may be replaced on site. If the replacement of any other component in this list is required, please contact customer service for assistance.

[1]   To be replaced by an electronic door label that will be accessible via software.

7.3.1 Interface Unit

Interface Unit	159557
Battery Backup Kit	159548 *
Cabinet Combining Kit	161240
Charge Control Board	160098
Connecting- and Sparepart Kit	160069
Cover	160736
Distribution and Alarm Board	160415
Drawer	160734
Modem	t.b.d.
Memory board 1627.2 I2C-ADD 51	159809
Modem Kit USA/BBU L-Cab.	161489 *
NiCd-Akku 8,4V/1200mAh, N-1200SCK,70°C	160188 *
Power Supply In:115Vac±15%, 47-65Hz	159126 *
Power Supply In:230Vac±15%, 47-65Hz	159514 *
Wall Mounting Kit	160068

The manufacturer reserves the right to replace the parts listed above by equivalent substitutes!

7.3.2 Node C

NodeC Type		837	843	1937	1943
Description		ID No.			
Node C		*160546*	*160545*	*160543*	*160544*
Adapter 7/16 male -N female		112425			
Cover		160735			
Dig.Chan. Mod. DL	BW 15 MHz 869-894MHz	160548		---	
	BW 15 MHz 1930-1990MHz	---		160550	
Dig.Chan. Mod. UL	BW 15 MHz 824-849MHz	160547		---	
	BW 15 MHz 1850-1910MHz	---		160549	
Drawer		160733			
Duplexer DL / LNA:824-849/869-894MHz		161464		---	
Duplexer DL / LNA:1850-1910/1930-1990MHz		---		161462	
Duplexer UL / LNA:824-849/869-894MHz		161463		---	
Duplexer UL / LNA:1850-1910/1930-1990MHz		---		161461	
Fan Unit [1]		---	159547	---	159547
Fin.Amp. 26-28V, 47dB, 1930-1990MHz		---			160254
Fin.Amp.4W M,12V,33dB 824-849MHz		160417		---	
Fin.Amp.4W M,12V,33dB 1850-1910MHz		---		160416	
Fin.Amp.30W,26-28V,36dB 1930-1990,Feedf.		---		160255	---
Fin.Amp. 82W, MLPA 28V/46dB/869-894MHz		---	158789	---	
Fin.Amp. 82W, MLPA 28V/36dB/869-894MHz		161235	---		
Memory board 1627.2 I2C-ADD 50		159810			
Pole mounting		160979			
Pole mounting Kit (2 Systems)		161604			
Pole mounting Kit Back to Back (1System)		161605			
RF/DC Distribution Unit		159539			
Wall Mounting Kit		160068			

[1] The fan unit can only be replaced as a whole. Do not replace an individual fan.

The manufacturer reserves the right to replace the parts listed above by equivalent substitutes!

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