

Repeaters

Node M and Node C



Network Elements



**User's Manual
M0121A4A**

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Andrew Wireless Systems GmbH, 05-February -2010

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1. GENERAL

1.1. USED ABBREVIATIONS

| | |
|----------------------|--|
| A/D | Analogue to Digital Converter |
| AGC | Automatic Gain Control |
| ALC | Automatic Level Control |
| ARFCN | Absolute Radio Frequency Channel Number |
| BCCH | Broadcast Control Channel |
| BTS | Base Transceiver Station |
| CDMA | Code Division Multiple Access |
| D/A | Digital to Analogue Converter |
| DAS | Distributed Antenna System |
| DCM | Digital Channel Module |
| DHCP | Dynamic Host Configuration Protocol |
| D-ICE | Digital Interference Cancellation Equipment |
| DL | Downlink |
| DSP | Digital Signal Processor |
| EAC | External Alarm Controller |
| EDGE | Enhanced Data Rates for GSM Evolution |
| ESD | Electrostatic Discharge |
| ETS | European Telecommunication Standard |
| ETSI | European Telecommunication Standards Institute |
| FCC | Federal Communications Commission |
| FRU | Field Replaceable Unit |
| GPRS | General Packet Radio Service |
| GSM | Global System for Mobile Communication |
| HID | Hardware Inventory Data |
| HSN | Hopping Sequence Number |
| I ² C Bus | Inter Integrated Circuit Bus (Philips) |
| ICE | Interference Cancellation Equipment |
| ID No | Identification Number |
| LAN | Local Area Network |
| LED | Light Emitting Diode |
| LMT | Local Maintenance Terminal |
| LNA | Low Noise Amplifier |
| LO | Local Oscillator |
| MAIO | Mobile Allocation Index Offset |
| MCPA | Multi Carrier Power Amplifier |
| Ncm | Newton centimeter |
| NSB | Network Supervision Box |
| OFDM | Orthogonal Frequency Division Multiplex |
| OMC | Operation and Maintenance Centre |
| PA | Power Amplifier |
| PAMR | Public Access Mobile Radio |
| PPP | Point-to-Point Protocol |
| 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 |
| SCPA | Single Carrier Power Amplifier |
| SDA | Serial Data |
| SMS | Short Message Service |
| SNMP | Simple Network Management Protocol |
| TS | Transmitter |
| UE | User Equipment |
| UL | Uplink |
| UMTS | Universal Mobile Telecommunication System |
| UPS | Uninterruptible Power Supply |
| UTC | Universal Time Coordinate |
| UTRA | UMTS terrestrial radio access |
| VCO | Voltage Controlled Oscillator |
| VSWR | Voltage Standing Wave Ratio |
| WCDMA | Wide-band Code Division Multiple Access |

1.2. HEALTH AND SAFETY WARNINGS



1. Only suitably qualified people are 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. **IMPORTANT NOTE:** To comply with FCC RF exposure compliance requirements, the following antenna installation and device operating configurations must be satisfied: A separation distance of at least 400 cm must be maintained between the antenna of this device and all persons. RF exposure compliance may need to be addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of 1.1307(b)(3). Maximum permissible antenna gain is 17 dBi.
7. Make sure, access is restricted to qualified personnel.
8. Only licence holders for the respective frequency range are allowed to operate this unit.
9. 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.
10. Due to power dissipation, the network element may reach a very high temperature. Do not operate this equipment on or close to flammable materials.
11. Before opening the unit, disconnect mains.
12. ESD precautions must be observed! Before commencing maintenance work, use the available grounding system to connect ESD protection measures.



13. This unit complies with European standard EN60950.
14. Make sure the network element settings are according to the intended use (see also product information of manufacturer) and regulatory requirements are met.
15. 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. ABOUT ANDREW SOLUTIONS

Andrew Wireless Systems GmbH based in Buchdorf/ Germany, 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.

Andrew Wireless Systems GmbH belongs to the *Wireless Innovations Group (WIG)*. Being a part of *Andrew Solutions*, *WIG* has unparalleled experience in providing RF coverage and capacity solution for wireless networks in both indoor and outdoor environment.

Andrew Solutions, a *CommScope Company*, is the foremost supplier of one-stop, end-to-end radio frequency (RF) solutions. Our products are complete solutions for wireless infrastructure from top-of-the-tower base station antennas to cable systems and cabinets, RF site solutions, signal distribution, and network optimization.

Andrew Solutions has global engineering and manufacturing facilities. In addition, it maintains field engineering offices throughout the world.

We operate a quality management system in compliance with the requirements of ISO 9001. All equipment is manufactured using highly reliable material. In order to ensure constant first-rate quality of the products, comprehensive quality monitoring is conducted at all fabrication stages. Finished products leave the factory only after a thorough final acceptance test, accompanied by a test certificate guaranteeing optimal operation.

The declaration of conformity for the product is available upon request from the local sales offices or from *Andrew Solutions* directly.

To make the utmost from this unit, we recommend you carefully read the instructions in this manual and commission the unit only according to these instructions.

For technical assistance and support, contact the local office or *Andrew Solutions* directly at one of the following addresses listed in the next chapter.

1.4. INTERNATIONAL CONTACT ADDRESSES FOR WIG CUSTOMER SUPPORT

Wireless Innovations Group (WIG)

Americas:

| <i>Canada</i> | <i>United States</i> |
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| E-mail | Wlsupport.italia@andrew.com | E-mail | Wlsupport.iberia@andrew.com |

table 1-1 List of international contact addresses

For your notes:

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. The Node M and Node C are specifically designed to extend coverage, enhance quality, and increase air-interface capacity.

In the downlink (DL), the Node M and 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 M and Node C constantly monitors the quality of the signals passing through it, while simultaneously electronically decreasing isolation requirements.

2.2. THE NODE M AND NODE C (NODE M/C) NETWORK ELEMENT

Node M and Node C are primary network elements, capable of enhancing up to 20 MHz of continuous spectrum. Their 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. They 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 M is a dedicated UMTS device, but the Node C operates with CDMA technology. However, several enhancers operating at different frequencies and technologies may share the same hardware (cables and antennas) via a crossband coupler.

The Node M or 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 M and Node C have 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 interfaces of Node M and Node C provide 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 M and Node C network elements are self-diagnosing, self-adaptive, and virtually maintenance-free.

In the following, the expression Node M/C stands for Node M and Node C.

2.3. QUICK START CHECKLIST

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

Setting up the Node M/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 M or Node C
- donor antenna
- coverage antenna(s) or DAS
- coaxial feeder cable
- connectors (RF, mains)
- laptop (Win XP or Win 2000) with connection and mains cable
- standard Ethernet cable (CAT5) (see chapter *3 Connection Setup*)

b. Required Information

Make sure to have the following information at hand:

- important on-site conditions (e.g. BTS location, mains supply, etc.)
- channels to be enhanced/ amplified
- pilot power to total power ratio
- data of mandatory fields of Connectivity and Upload page see user's manual for Node software.

c. Procedure

1. Install the donor (linear polarized recommended) and coverage antennas.
2. Install the feeder cable from the Node M/C to the antennas.
3. Install the Node M/C (see chapter *4.1 Mechanical Installation*)

 **Note:** Take care to ground the unit correctly as instructed in chapter *4.2.2 Grounding*.

4. Connect power and the antenna feeder cables to the Node M/C.
5. Open the Node M/C as described in chapter *4.2.5 Opening the Cabinet - Mains Power Switch*.
6. Setup the connection computer (see chapter *3 Connection Setup* and software manual).

7. Login to the unit and follow the installation wizard option for easy installation.
 - a. Optimize the donor antenna performance (see software manual).
 - b. To select the channels for enhancement, choose between the “*Measurement Assisted Channel Assignment*” or “*Unassisted Channel Assignment*” from the Setup Wizard page (see software manual).
 - c. Enter the pilot power to total power ratio of the donor Base Station.
 - d. Enter the desired output power in the downlink.
 - e. Enter the relative uplink gain and click the “*Program*” button.
 - f. Select the “*Connectivity and Upload*” button, to setup the modem (if applicable) and to enter data in the other user fields (see software manual).
 - g. Select the “*Technician Setup*” button (see software manual), to change additional system settings, e.g. ICE, H.R. Filter, Diversity; the “*Technician Setup*” is also accessible from the home page.
8. The Node M/C setup is complete.
9. Open the “*Save Configuration to Laptop*” menu for record keeping purposes.
10. Unplug the computer, close the Node M/C and tighten all screws.

 **Note:** To do a power cycle, disconnect the battery backup by pushing the battery disconnect button on the EAC-board; see chapter 5.2.12 *Battery Pack - Battery On/Off*.

For your notes:

3. CONNECTION SETUP

3.1. SETTING UP A LOCAL / LAN CONNECTION FROM LAPTOP / PC

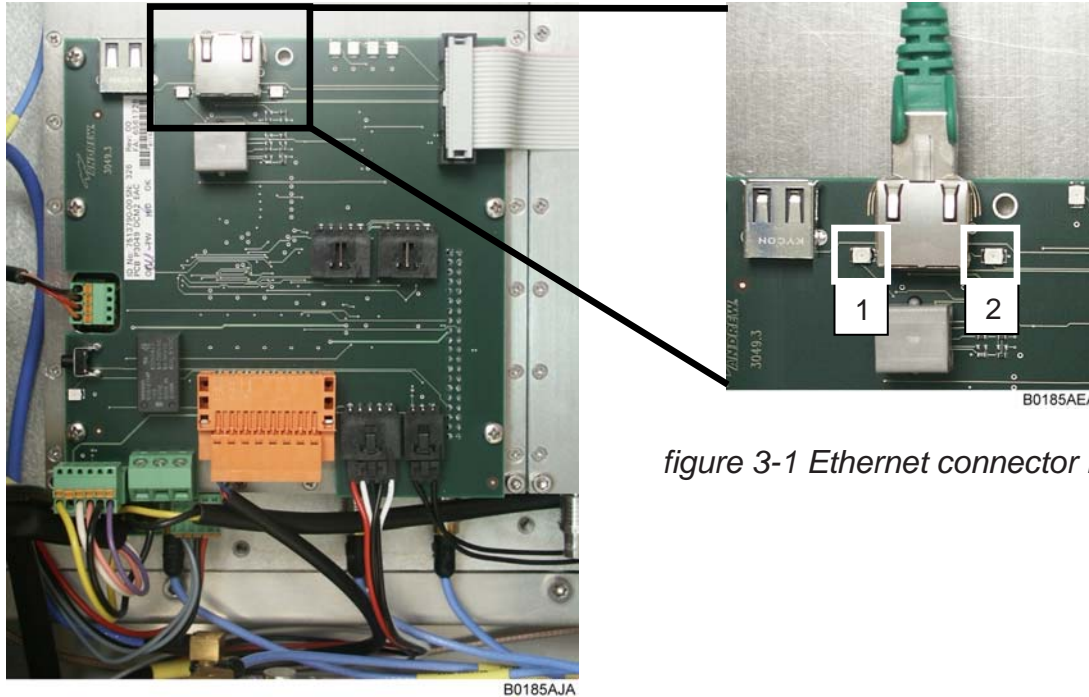


figure 3-1 Ethernet connector RJ45

Ethernet connector - LEDs

After the connection is made properly, the red and green LEDs near the Node C network connector will flash.

| No | Colour | Explanation |
|----|--------|---|
| 1 | Yellow | LED illuminates when a packet is transmitted by the DCM2 DL module. |
| 2 | Green | LED illuminates when a packet is received by the DCM2 DL module. |

A standard CAT5 Ethernet cable is supplied to set up a local connection. Open the Node and plug the cable in the Ethernet connector RJ45 of the EAC-board.

To setup a LAN connection follow the description in the next chapter. A cable is not provided.

3.2. SETTING UP NODE M/C REPEATER TO RUN AS A LAN ELEMENT

3.2.1. Prerequisites

Use the Local Area Network (LAN) mode to activate DHCP clients or to assign a static IP address to the Node M/C.

Note: Before it is possible to configure the LAN settings alarm connectors 7 and 8 must be connected in order to activate External Alarm 1, *figure 3-2 Pin connection*.

A local connection via laptop or PC cannot be setup as long as alarm connectors 7 and 8 are connected.

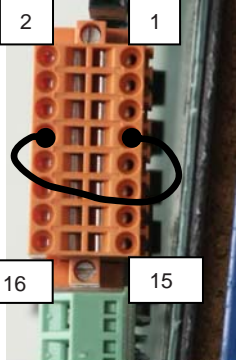
Note: In the software, LAN Information settings will be activated, if the main connectivity is set to LAN. Please refer to the software manual.

For the connection of the Node to the LAN network please use the same type / category of Ethernet cable as for the connection of the computer to the LAN network.

3.2.2. Procedure

1. Switch off repeater and connect Pin 7 and Pin 8 of the External Alarm connector.

| Pin | |
|-----|-----------------|
| 2 | n.c. |
| 4 | GROUND |
| 6 | GROUND |
| 8 | GROUND |
| 10 | PSTN_1_EXTERNAL |
| 12 | PSTN_2_EXTERNAL |
| 14 | GROUND |
| 16 | GROUND |



| Pin | |
|-----|--------------------------|
| 1 | n.c. |
| 3 | EXT_ALARM_3 |
| 5 | EXT_ALARM_2 |
| 7 | EXT_ALARM_1 |
| 9 | PSTN_1_INTERNAL |
| 11 | PSTN_2_INTERNAL |
| 13 | SUMMARY ALARM, LED GREEN |
| 15 | SUMMARY ALARM, LED RED |

figure 3-2 Pin connection

2. Switch on repeater
3. Put an Ethernet CAT5 cable (recommended cable diameter is 4 - 6 mm) through one of the PG7 cable glands into the Node.



figure 3-3 Cable gland position

4. Crimp the RJ45 connector and connect it to the RJ45 jack of the EAC board. This is the same connector as for a local connection. See *figure 3-1 Ethernet connector RJ45* on page 19).
5. Fasten the cable glands properly to ensure waterproofness.
6. Configure **Main connectivity** on the Connectivity page to be LAN so that the LAN section on the Connectivity page will be activated (for details see software manual, chapter **LAN Information**).
7. To enable the DHCP client, set the DHCP check mark. To enter a static IP, DHCP must be disabled and the IP entry fields will become activated, indicated by white colour.

| LAN Information | | | | | | | | | |
|----------------------|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| DHCP | Enabled <input checked="" type="checkbox"/> | | | | | | | | |
| IP Address | <div style="border: 1px solid black; padding: 2px; display: inline-block;"> Entry fields to set static IP (white = active; grey = deactivated) </div> | | | | | | | | |
| Netmask | <table border="1"> <tr> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> </table> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | | | | | | |
| <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | | | | | | |
| Default Gateway | <table border="1"> <tr> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> </table> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | | | | | | |
| <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | | | | | | |

For further details on IP address setting see software manual.

8. Press the Submit button.
9. Connect the Node via the CAT5 cable from Step 3 to the (customer) LAN network and the Node will get a LAN IP. For more information on LAN IP see software manual.

3.3. SETTING UP A REMOTE CONNECTION

Use the manual 'Network and Dial-Up Connections - Setup' to establish a remote connection.

Using the remote connection, the operator can monitor and control the Node M using the Web browser interface remotely.

In addition, the remote connection may be used for:

- An OMC-type software platform (see separate manual)
- SMS alarm forwarding

For your notes:

4. INSTALLATION

4.1. MECHANICAL INSTALLATION

4.1.1. 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.**
5. **When connecting and mounting the cables (RF, mains, ...) ensure no water can penetrate into the unit through these cables.**

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:** **Node M and Node C are delivered with a pre-mounted front cover. This cover is of vital importance for the correct forced airflow and for passive cooling. Thus, do not operate the unit without cover.**

4.1.2. Wall Mounting Procedure

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

Mark the position of the drilling holes - four per unit - for the Node according to *figure 4-1*. Please observe that the figure always shows a pair of drill holes for each position. Only drill one of each pair.

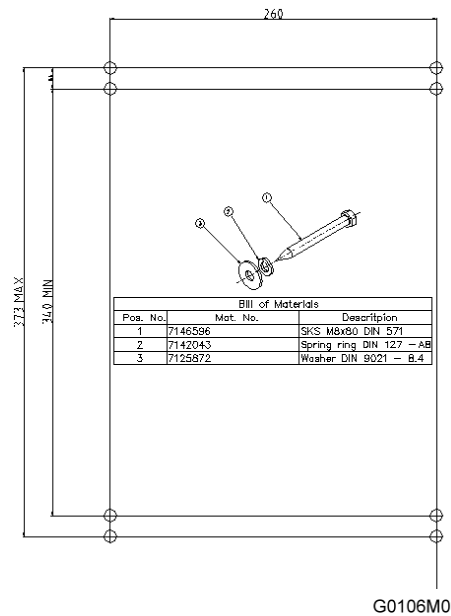


figure 4-1 Positions of drilling holes

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 four 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 four M8 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*.

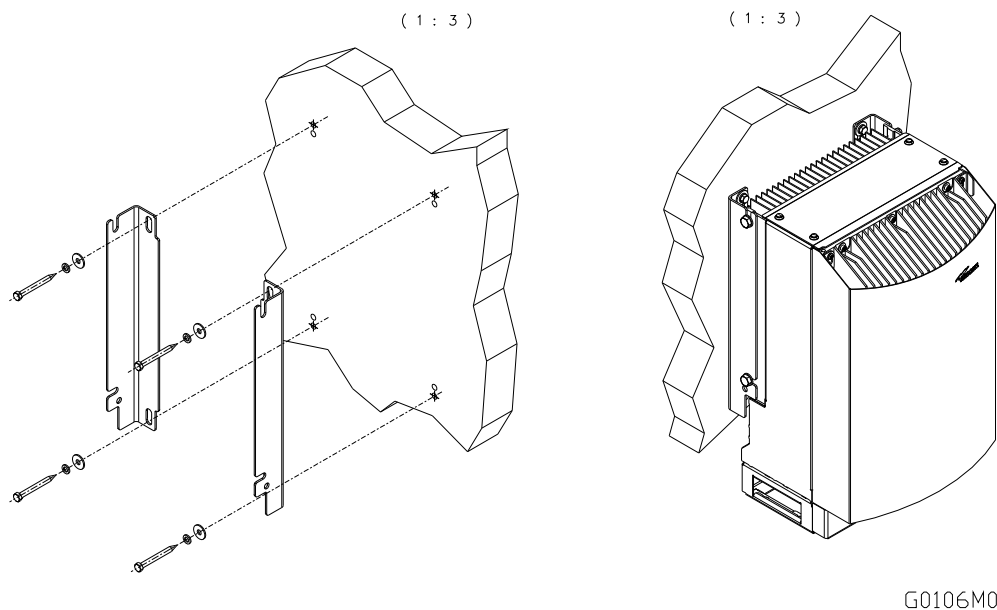
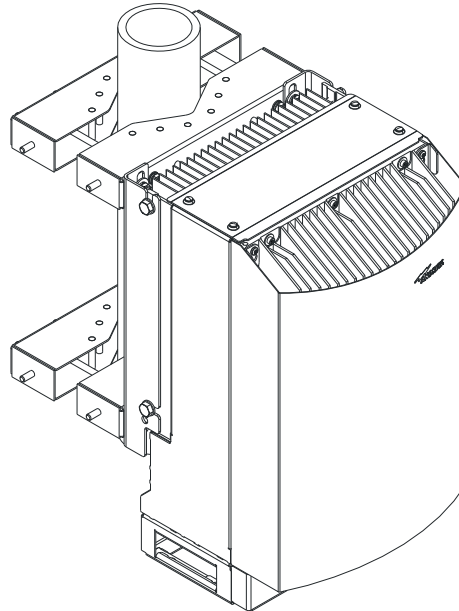


figure 4-2 Wall mounting procedure

- * 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.

4.1.3. Pole Mounting Procedure

The following figure illustrates the pole mounting option back-to-back.



V1498A0

figure 4-3 Pole mounted units

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 4-2 Components of pole mounting kit*, pos. 5) to the required length according to the following table:

| 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 | 316 |

table 4-1 Required length of thread-bolts

The pole mounting kit 'back-to-back' consists of the following parts in different quantities:

| No | Part |
|----|--------------------------|
| 1 | Pole mounting brace |
| 2 | Washer DIN 9021 – 8.4 |
| 3 | Nut M8 DIN 934 |
| 4 | Spring ring DIN 127 – A8 |
| 5 | Thread-bolt M8 |
| 6 | Washer M8 DIN 125 |

table 4-2 Components of pole mounting kit

The numbers in the above table refer to the numbering of the components in the following figure.

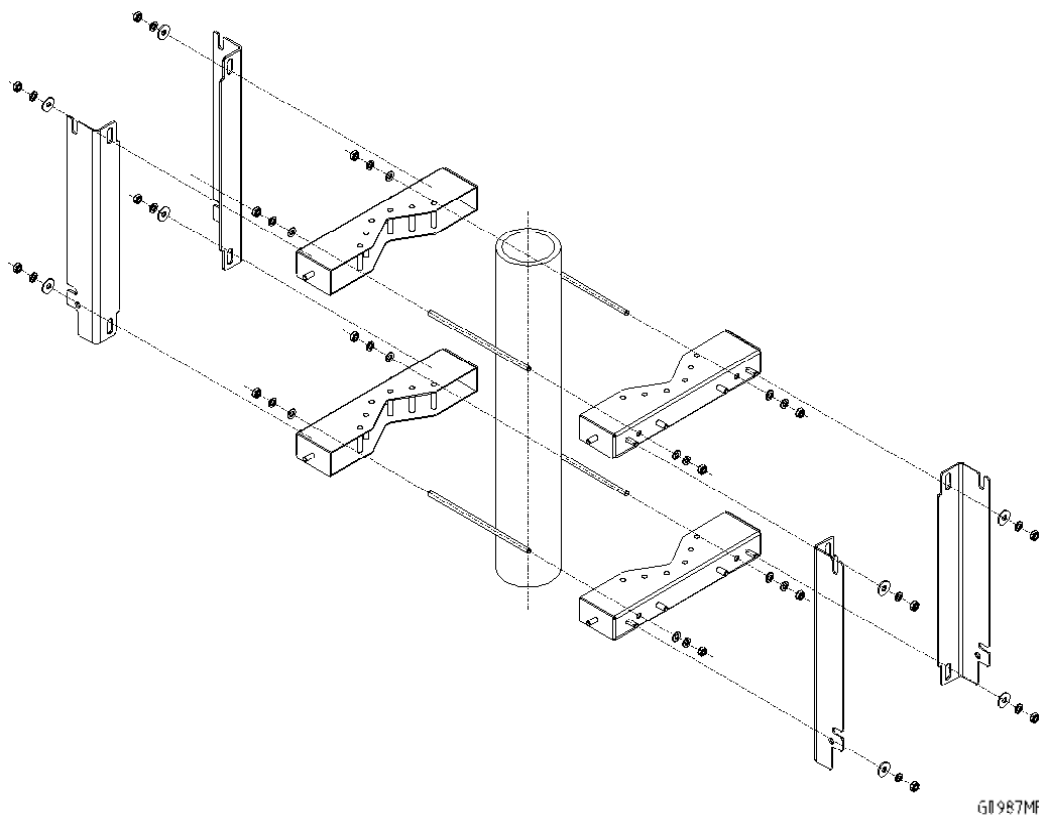


figure 4-4 Back-to-back pole mounting

Dismount the mounting brackets from the cabinets of the units by loosening the hexagon head screws M10x20 by which the mounting 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 above.

For your notes:

4.2. ELECTRICAL INSTALLATION

4.2.1. 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. **For unstable electric networks which frequently generate spikes, it is advised to use a voltage limiting device.**
7. **A connection of mains supply to a power socket requires the power socket to be nearby the unit.**
8. **The mains cable must be used exclusively for the repeater. Do not use this cable for the power supply of other devices.**
9. **Incorrectly wired connections can destroy electrical and electronic components.**
10. **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).**
11. **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.**
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.**

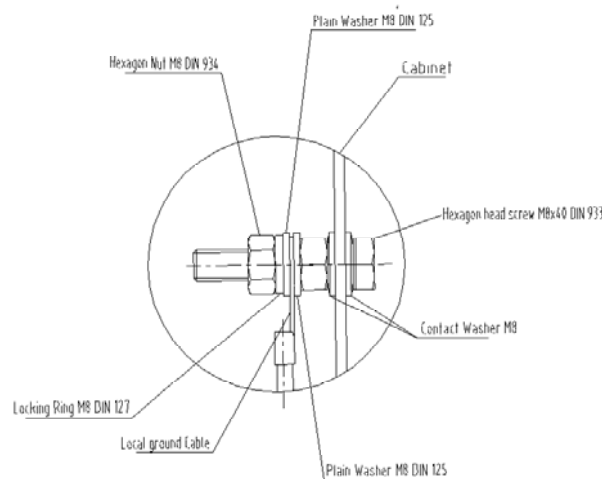
4.2.2. Grounding

Grounding must be carried out. Connect an earth-bonding cable to the grounding connection provided at the outside of the remote unit. Do not use the grounding connection to connect external devices.



B0208A2A

Scale 2:1



B0208A8A

figure 4-5 Grounding bolt

After loosening the hex nut, connect the earth-bonding cable between the two washers as illustrated in the figure above. Then, fasten all parts again with the hex nut.



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

4.2.3. 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. The power supply plug is included with the Node M/C.

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

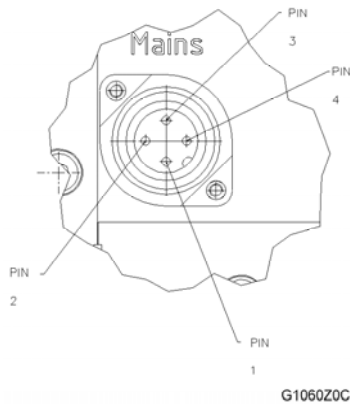


figure 4-6 Power supply plug



figure 4-7 Mains connector of a Node M, exemplary

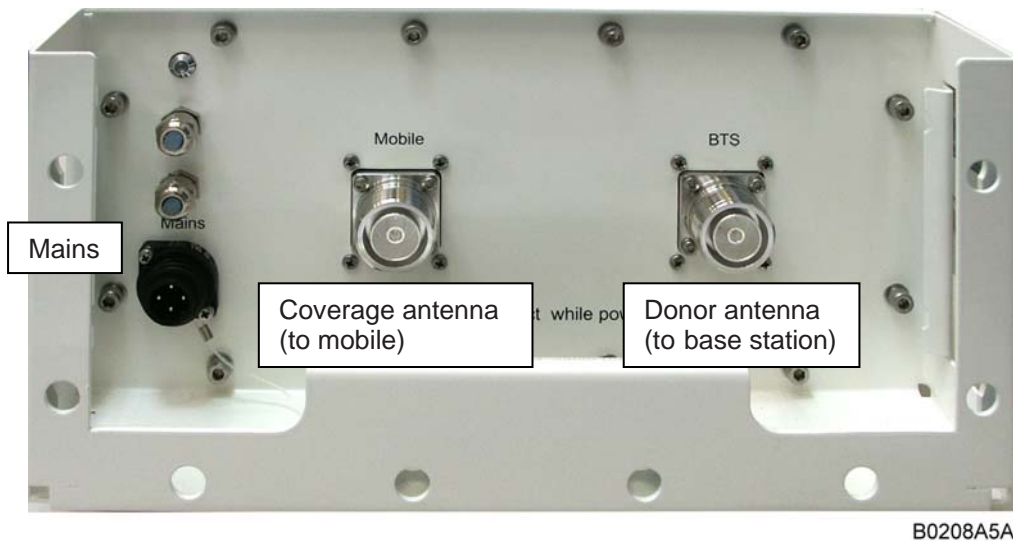


figure 4-8 Mains connector and antenna connections of a Node C, exemplary

| PIN | Mains AC | | Mains DC | |
|-----|---------------|----------------|---------------|----------------|
| | Connection | Colour | Connection | Colour |
| 1 | Phase | brown | not connected | |
| 2 | Neutral | blue | -Vdc* | black |
| 3 | not connected | | +Vdc* | red |
| 4 | PE | green / yellow | PE | green / yellow |

table 4-3 Pin assignment of mains connector



A minimum cross section of 1.5 mm² is required for the power supply 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 units, then, engage mains again.

* Black is always the negative potential while red is the positive one.

** Mains power must be interrupted with an external AC or DC breaker. For the AC or DC 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.

Option: 48 Vdc (36-72 Vdc). The external DC breaker should be 20 Amps.

4.2.4. Connection of the Antenna Cables

The Node M/C's antenna connectors are 7/16 female (optionally equipped with an N female adapter). All connectors are located at the bottom of the cabinet. An operator should refer to the documentation of the cable connector manufacturer 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.

Highly directional antennas with good front-back-ratios (40 dB is typical) are recommended because they improve isolation and cell site selectivity.

Smaller diameter cables are less expensive and easier to install but have worse performance.



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 M/C.

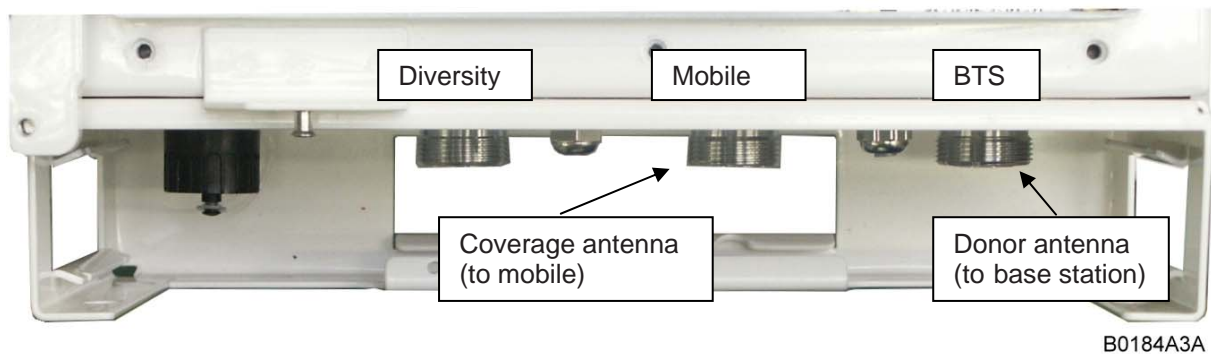


figure 4-9 Front view of antenna connections from Node C, exemplary

4.2.5. Opening the Cabinet - Mains Power Switch

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 M/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 M/C do not damage the warranty labels on the internal devices. The warranty is void if the seals are broken.



B0184A4A

figure 4-10 Front and top cover screws

○ First remove the front cover plate by loosening the four front cover screws. The M5 socket head cap screws are circle-marked in the 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 nine M5 socket head cap screws (captive) of the top cover.

Note: Do not forget to reinstall the front cover afterwards to ensure safe operation!

☞ **Note:** Before closing the unit, make sure that the mains power switch inside is set to ON.



figure 4-11 Position of mains power switch

For your notes:

5. FUNCTIONAL DESCRIPTION

5.1. DIGITAL ARCHITECTURE

The following figure shows the RF block diagram of the Node M/C.

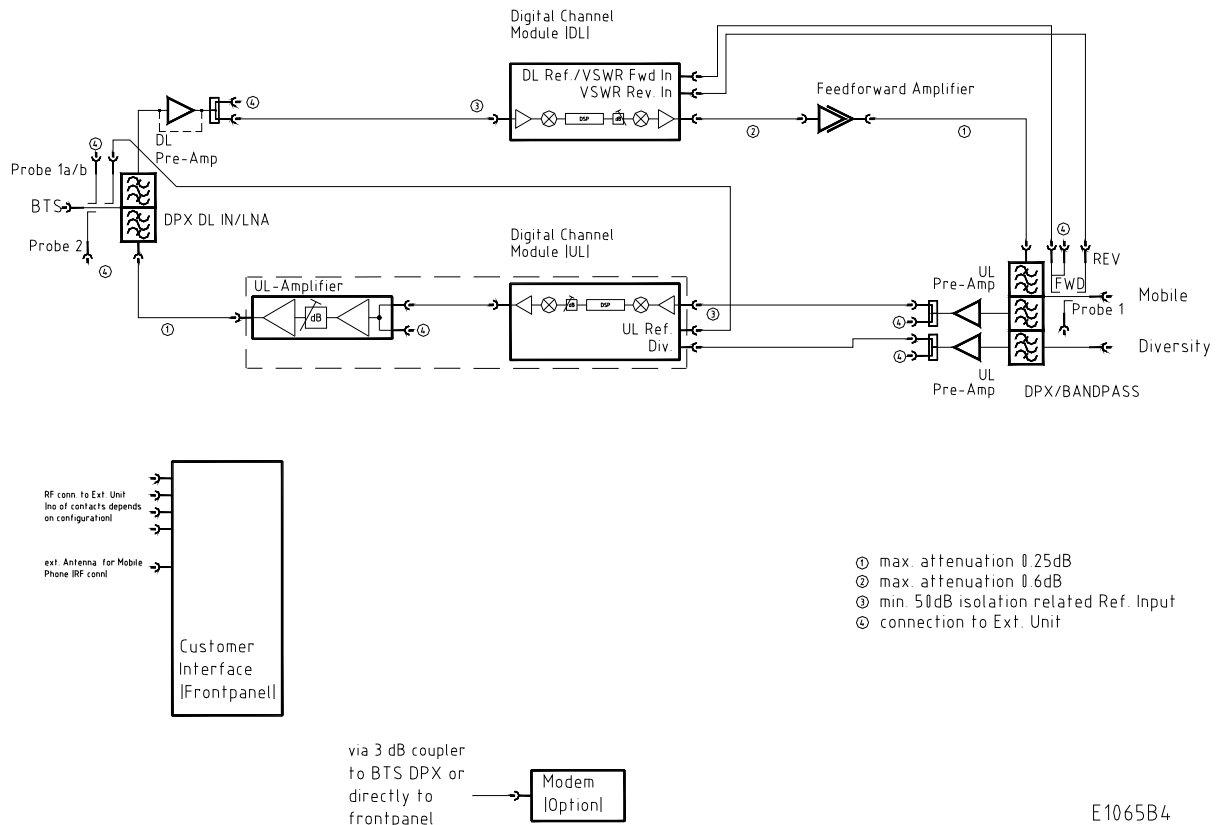


figure 5-1 Configuration of a network element

The Node M/C is designed to amplify signals between multiple mobiles and a base station in a UMTS/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 (included in DCM) 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 843 as an example, the following figure illustrates the positions of the RF components inside the Node M/C.

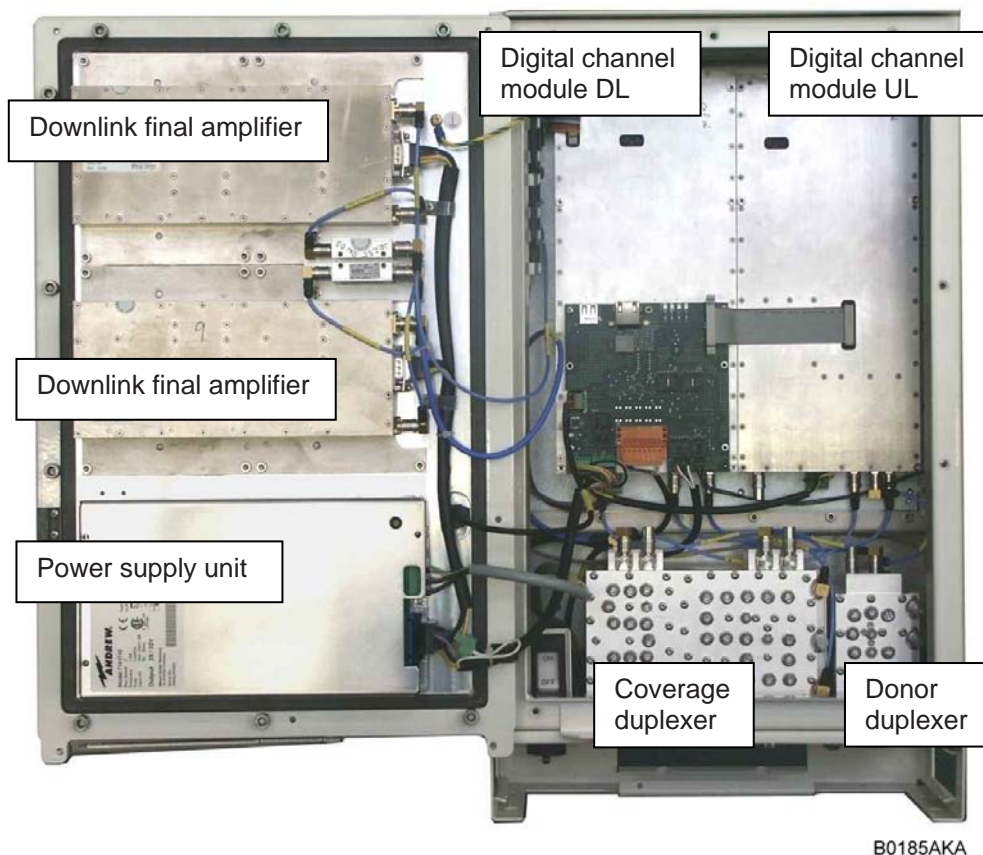


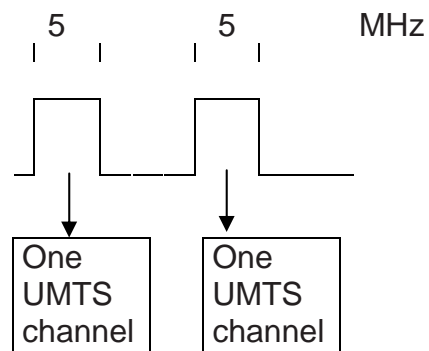
figure 5-2 RF path of a Node C 843, exemplary

5.2. FEATURES

5.2.1. Filters Node M

Filters are set automatically according to the channels set in “Setup Wizard” or “Technician Setup”. For further information about these menus refer to the user's manual for Node software.

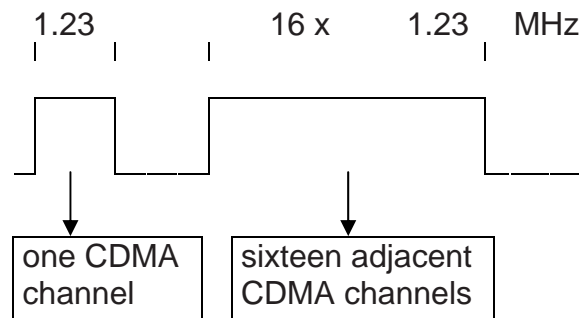
UMTS - Possible filters are:



5.2.2. Filters Node C

Filters are set automatically according to the channels set in “Setup Wizard” or “Technician Setup”. For further information about these menus refer to the user's manual for Node software.

CDMA - Possible filters are:



5.2.3. Digital ICE (Digital Interference Cancellation Equipment)

Digital ICE has been developed to enhance antenna isolation. This feature enables the Node M/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 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. Isolation and gain margin* can be checked in the "Status and Reports" menu accessible via the home page of the web interface (see software manual).

* gain margin = antenna isolation minus Node M/C gain

5.2.4. VSWR (Voltage Standing Wave Ratio)

This feature enables the provider to query the status of the antenna system (antenna and 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** of the software, 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.

5.2.5. 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 M/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 M/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.

5.2.6. Alarm Forwarding

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

With an optional modem the Node M/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.

5.2.7. Downlink Final Amplifier

For the Node M/C x37 an MCPA (multi carrier power amplifier) is used. This is an error-correcting feed-forward amplifier. It has a high output power while maintaining superior intermodulation and linearity performance.



figure 5-3 Node M/C x37 MCPA DL final amplifier

For the Node M/C x43 an MCPA (multi carrier power amplifier) with more output power is used. This is an error-correcting feed-forward amplifier. It has a high output power while maintaining superior intermodulation and linearity performance.

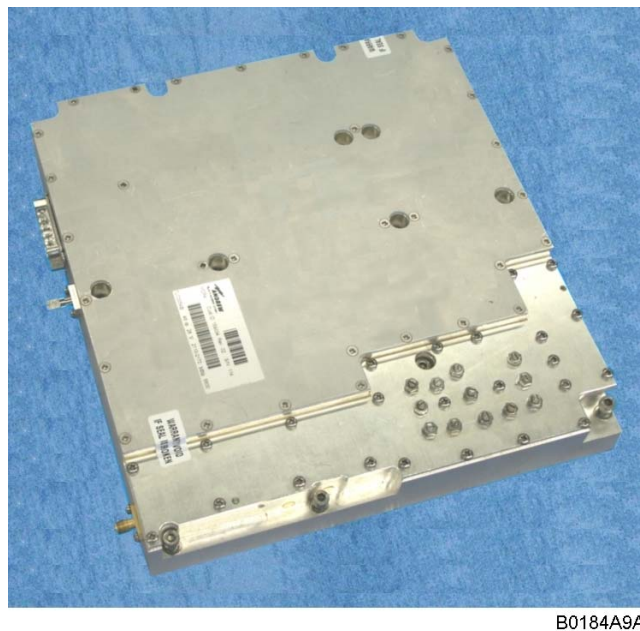


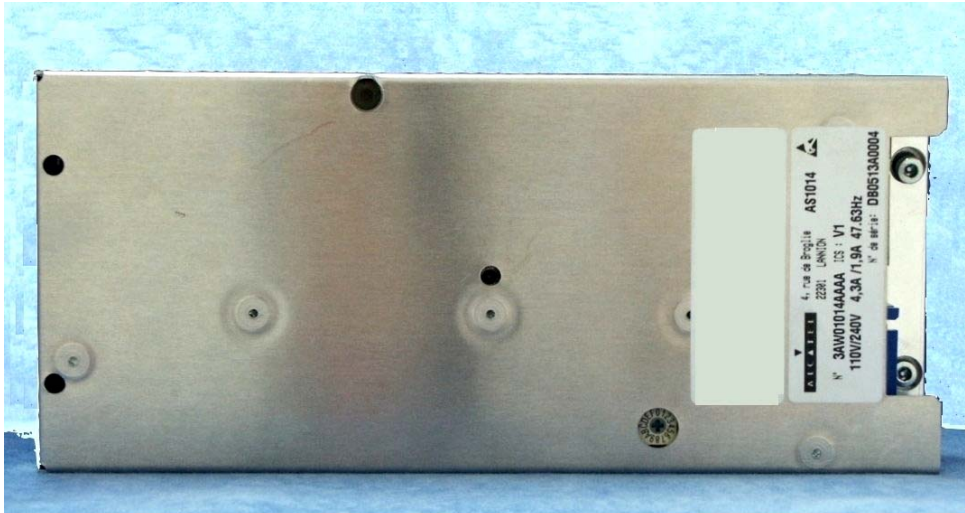
figure 5-4 Node M 2143 and Node M 1943 MCPA DL final amplifier



figure 5-5 Node M/C 843 DL final amplifier

5.2.8. Power Supply Unit

The power supply unit is mounted in the door of the Node.
This device transforms mains power into a predefined DC voltage. When performing maintenance, ensure that all circuits are voltage-free and that the Node M/C is disconnected from mains.



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figure 5-6 Power supply, Node M/C x37



B0184AAA

figure 5-7 Power supply, Node M/C x43

5.2.9. Modems

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

Furthermore, the modem is at the Node M/Cs request to alert the operator when there is an alarm. The modem may be over-the-air (wireless) or public switched telephone network (PSTN). It is possible to install the wireless modem or the PSTN modem on site.

Modem communication 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.

Wireless modems allows remote control and maintenance of the Node.

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

5.2.9.1. Illustrations of Modems



B0185A7A

Note:

The modems MC55, MC56, MC75 and HC25T are similar to modem MC35.

figure 5-8 Modem MC35



B0185APA

Note:

The modem Raven C3211 is similar to modem Redwing.

figure 5-9 Redwing modem (CDMA)



B0185AAA

figure 5-10 Modem AnyDATA iPORT
EMIII Dual / EM IV Dual



B0185ASA

figure 5-11 Modem Raven XT



B0185AMA

figure 5-12 Modem MTCBA-C-N9

5.2.9.2. Modem Output

The modem output is connected to the 20 dB modem coupler port of the DL IN duplexer or to the N-female connector near to the BTS port to connect an external antenna.

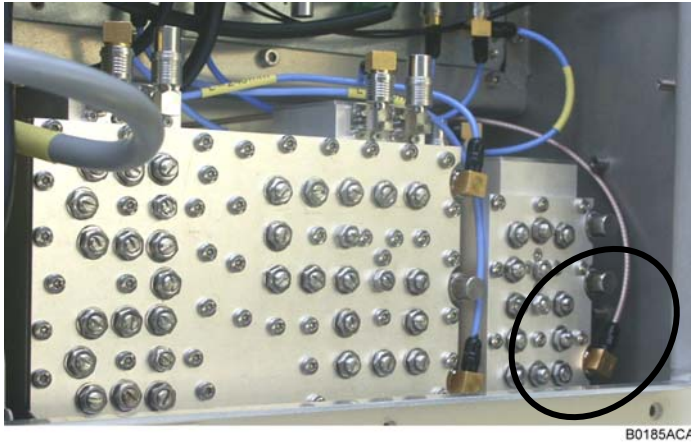


figure 5-13 Cable from modem to donor duplexer



figure 5-14 Cable from modem to external modem antenna port; Node M

5.2.10. 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 M/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 DL and UL part.

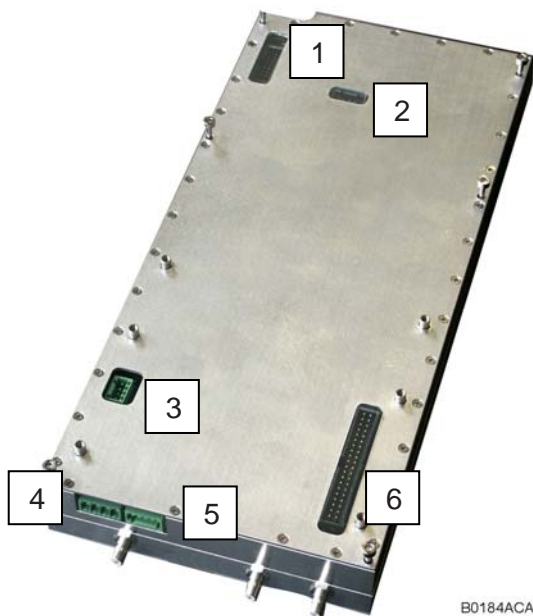


figure 5-15 Digital channel module,
DL part



figure 5-16 Digital channel module,
UL part

| No | Explanation |
|----------------|---|
| 1 ¹ | Vdc and remote (RS232) for modem |
| 2 | Debug-connector |
| 3 | Fan connector (Node x43) |
| 4 | Vdc DL digital channel module |
| 5 | Battery backup connector |
| 6 | EAC-board connector |
| 7 | Internal DCM - DCM interface connection |

¹ Only one modem can be used at the same time.

5.2.11. External Alarm Controller - EAC-Board

5.2.11.1. Connectors on the EAC-Board - Description

The EAC circuit board is used for general purpose housekeeping functions of the Node.

The EAC circuit board is the main connection point for the user. It has the external alarm clamps, the connectors for local or modem connection, as well as a summary alarm relay. The following figure shows an installed EAC-board.

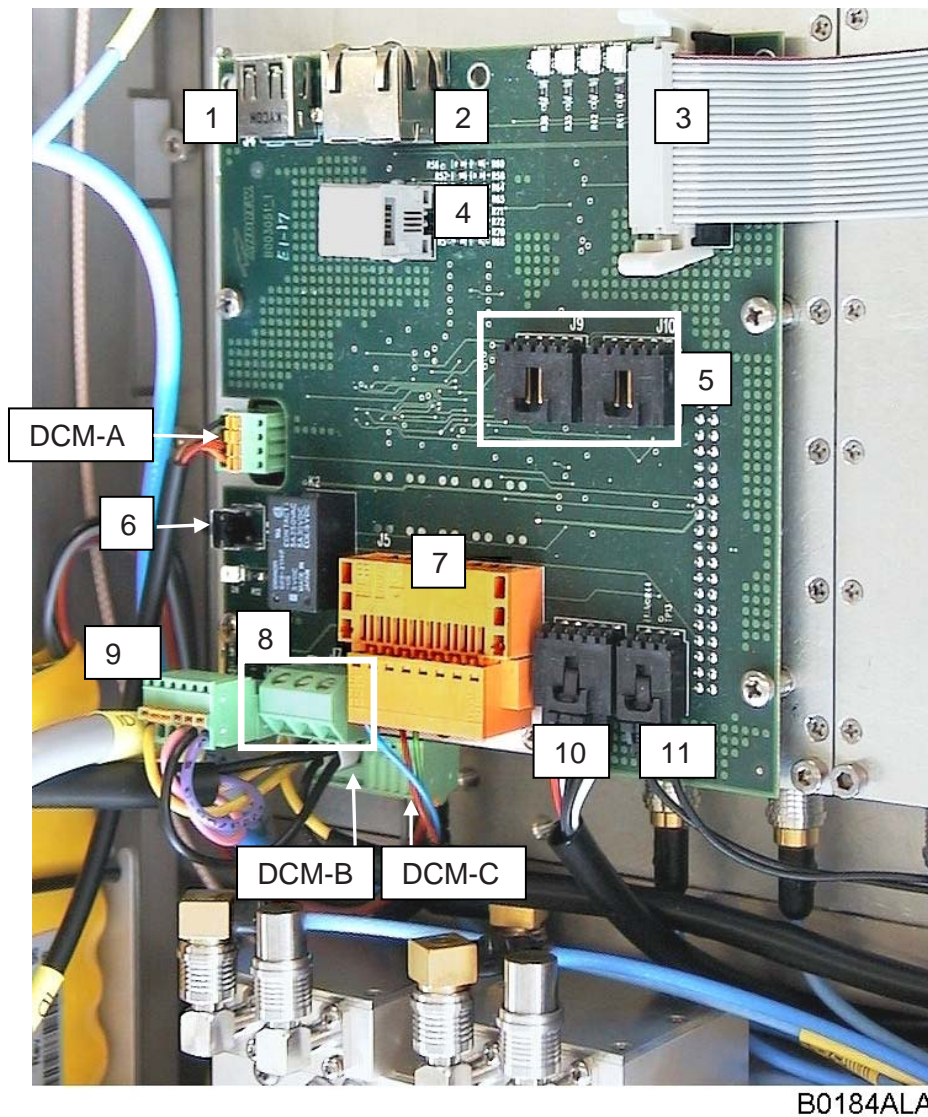


figure 5-17 EAC-board, installed

Connectors on the EAC-board

| No | Explanation |
|------------------|--|
| 1 ^{1,2} | USB connector for modem |
| 2 ¹ | Ethernet connector RJ45 for local and LAN web access |
| 3 | Internal DCM (DL) - DCM (UL) interface connection |
| 4 ¹ | Internal PSTN connector |
| 5 | Internal I ² C (not used) |
| 6 | Battery disconnect button |
| 7 ¹ | External alarms, summary alarm LED & PSTN, see chapter 5.2.11.3 <i>External Alarms</i> |
| 8 ¹ | Summary alarm terminal; for pin assignment see chapter 5.2.11.4 <i>Summary Alarm</i> |
| 9 | Internal PSU and I ² C connection |
| 10 | Internal I ² C (used for electronic door label memory board) |
| 11 | Door switch connector |

¹ Only these connectors are for general customer use. All others designated above are for informative purposes, and required, only, e.g. for an upgrade or replacement of parts.

² Only one modem can be used at the same time.

Connectors on the DCM DL module

See chapter 5.2.10 *Digital Channel Module (DCM)*.

| No | Explanation |
|-------|-------------------------------|
| DCM-A | Fan connector (Node x43) |
| DCM-B | Vdc DL digital channel module |
| DCM-C | Battery backup connector |

5.2.11.2. LEDs - Description

Seven LEDs are included on the EAC-board. They are controlled via the I²C bus.

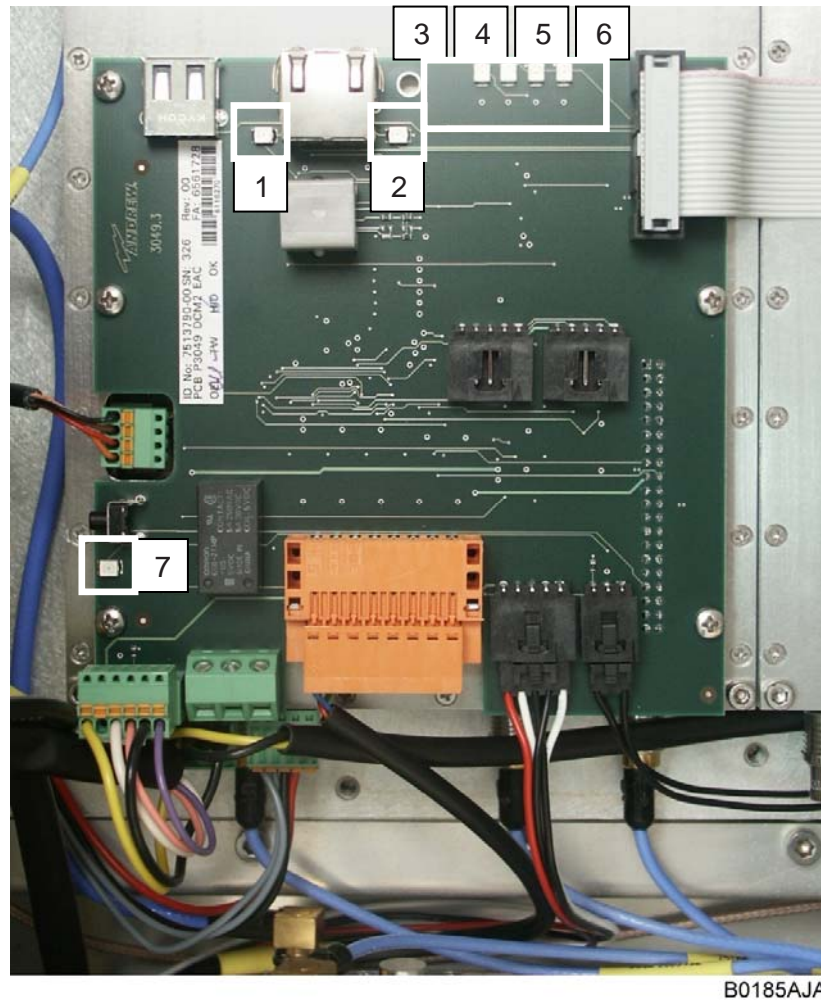


figure 5-18 Function of LEDs on the EAC-board

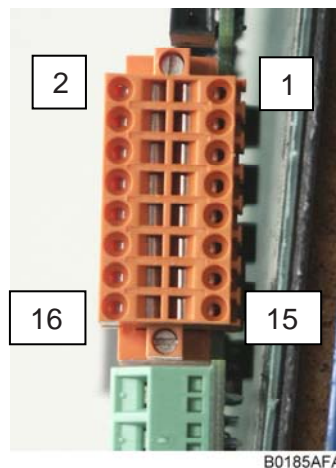
| Colours and illumination functions | | |
|------------------------------------|--------|--|
| No | Colour | Explanation |
| 1 | Yellow | Ethernet connector LEDs, see chapter 3.1 <i>Setting up a Local / LAN Connection from Laptop / PC</i> |
| 2 | Green | |
| 3 | Green | DL PWR - illuminates when the DL Power is "Good" and the DL is NOT in battery backup. |
| 4 | Green | UL PWR - illuminates when the software on the UL sets a bit in the FPGA indicating power is "good". |
| 5 | Blue | USER1 - illuminates when software activates. The LED is controlled by software through the I ² C bus. |
| 6 | Red | ALARM - illuminates when a software defined alarm condition exists. This LED is controlled via the I ² C bus. |
| 7 | Yellow | BBU ACTIVE - when illuminated the DL-DCM is in battery backup mode. |

5.2.11.3. External Alarms

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

Observe that the cross-sectional area of the wires to be connected must be in the range from 0.5 - 1.0 mm². Do not use wire-end sleeves (wire cable ends).

| | |
|----|-----------------|
| 2 | n.c. |
| 4 | GROUND |
| 6 | GROUND |
| 8 | GROUND |
| 10 | PSTN_1_EXTERNAL |
| 12 | PSTN_2_EXTERNAL |
| 14 | GROUND |
| 16 | GROUND |



| | |
|----|--------------------------|
| 1 | n.c. |
| 3 | EXT_ALARM_3 |
| 5 | EXT_ALARM_2 |
| 7 | EXT_ALARM_1 |
| 9 | PSTN_1_INTERNAL |
| 11 | PSTN_2_INTERNAL |
| 13 | SUMMARY ALARM, LED GREEN |
| 15 | SUMMARY ALARM, LED RED |

figure 5-19 Pin assignment

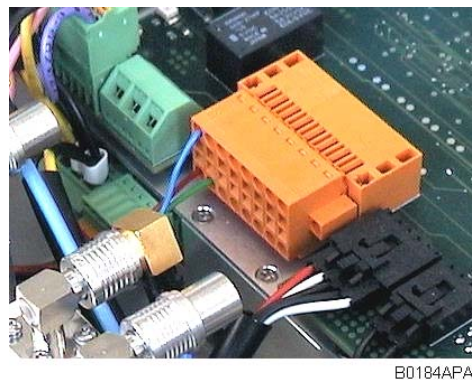
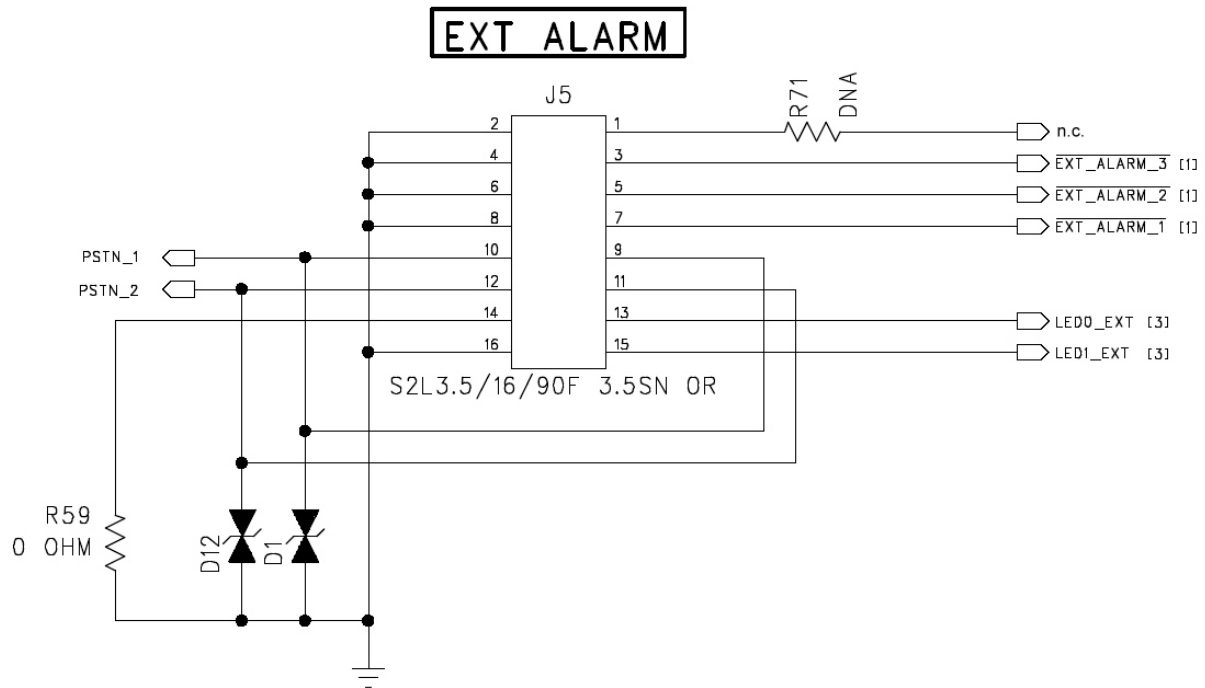


figure 5-20 External alarm clamps, installed

| External Alarms 1 to 3 | |
|--------------------------------|------------------------------|
| Input voltage range | 5 Vdc |
| Recommended input line | Potential free |
| Nominal sink current to ground | 15 mA |
| Active level | High or low set via software |
| Connectors | Cage clamps |



P 1719 B0 A/162730 sheet1
B0184ADA

figure 5-21 Configuration of external alarm clamps

All external alarms are defaulted to high (5 VDC) 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.

Make sure that external alarms which are not required are set to active low or disable them; otherwise the status will always show an alarm.

The names for each external alarm are user-definable on the external alarm page; renaming them to indicate the use of these alarms is recommendable.



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There are two external cable glands (PG7) at the bottom of the Node. They may be used to connect the external devices. Please note that connecting the external devices by a wrong type of cable may result in a loss of the water-proofness. The recommended cable diameter is 4 - 6 mm.

figure 5-22 External cable glands

5.2.11.4. Summary Alarm

The summary alarm is a DC potential-free contact relay.

Observe that the cross-sectional area of the wires to be connected must be in the range from 0.14 - 1.5 mm².

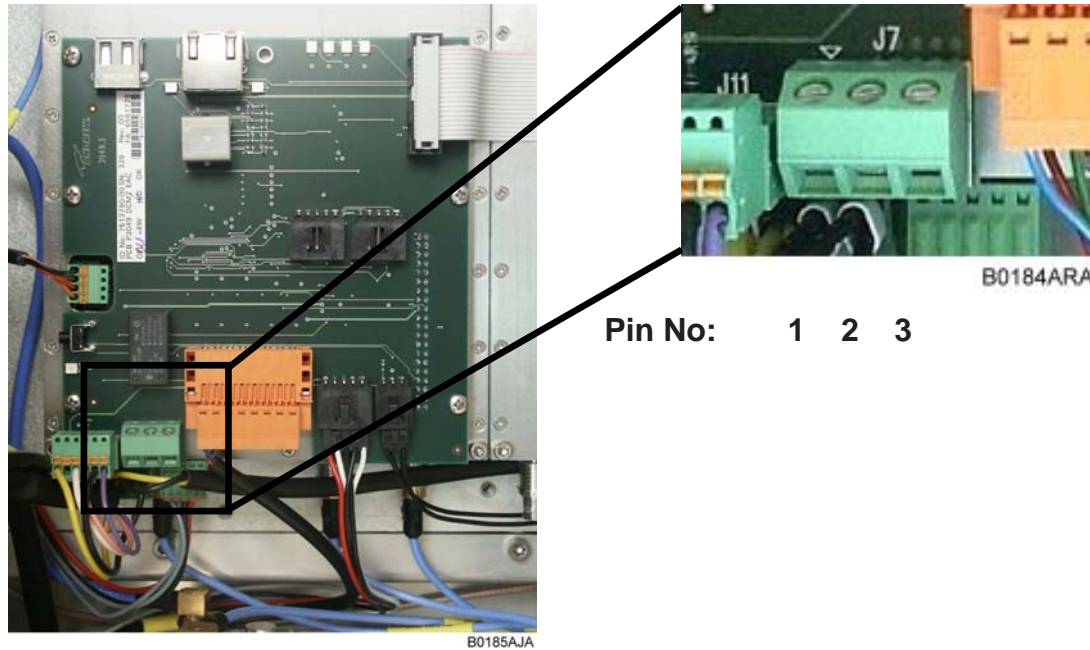


figure 5-23 Summary alarm relay

The following table indicates the three-connector pin out.

| Pin No | Contact | Maximum Resistive Load |
|--------|---------------------------|------------------------|
| 1 | Open in alarm condition | Max 1 A @ 50 Vdc |
| 2 | Common | Max 2 A @ 30 Vdc |
| 3 | Closed in alarm condition | Max 1 A @ 230 Vac |

table 5-1 Pin assignment of relay contacts

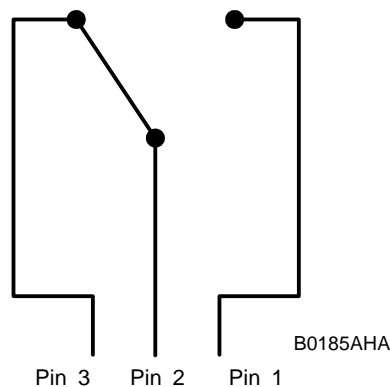


figure 5-24 Relay contacts, alarm condition

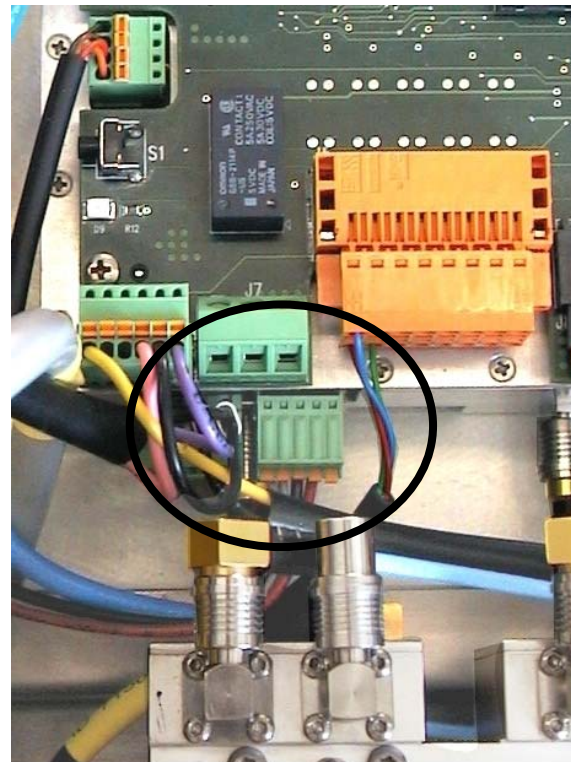
5.2.12. Battery Pack - Battery On/Off

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 DCM and the modem to operate for a limited period of time (battery backup time). Within this time, the Node M/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 pack is protected from deep discharge. When performing preventive maintenance, make sure that all circuits are voltage free by disconnecting the battery cable from the DCM. In case of a power cycle, it is sufficient to press the “Battery disconnect button” on the EAC-board to interrupt the voltage supply. After mains is connected again, the battery will be charged and the battery backup function will be available again.



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figure 5-25 Battery pack, exemplary

B0184AFA

figure 5-26 Battery pack installed and its connection to DCM

Battery On/Off

A pushbutton on the EAC-board is implemented to disconnect the battery pack from the controller. This forces a hard reset of the system.

Once disconnected, the power to the controller will not be restored until the +28V supply is again operational.

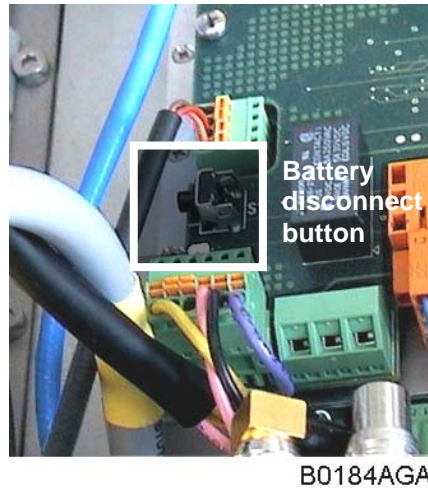
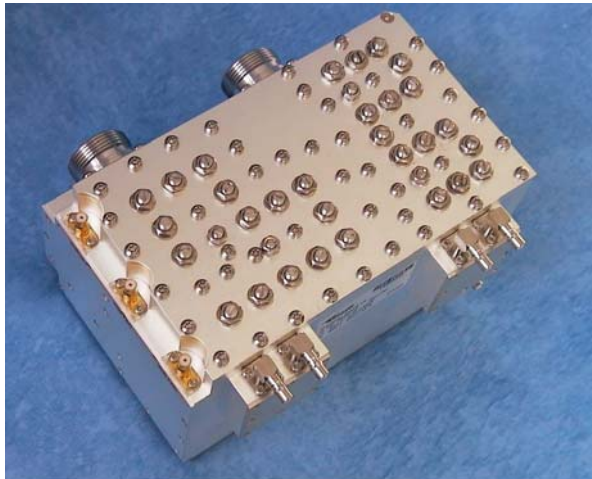


figure 5-27 Position of the battery disconnect button on the EAC-board

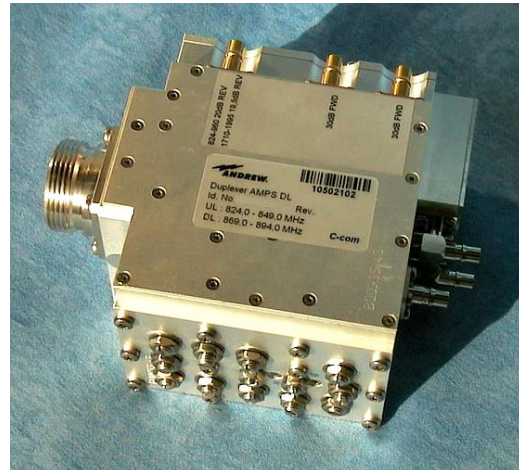
5.2.13. UL and DL Duplexer

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 band (UMTS/CDMA). This allows the same Node M/C to be used regardless of its operator's frequency plan.

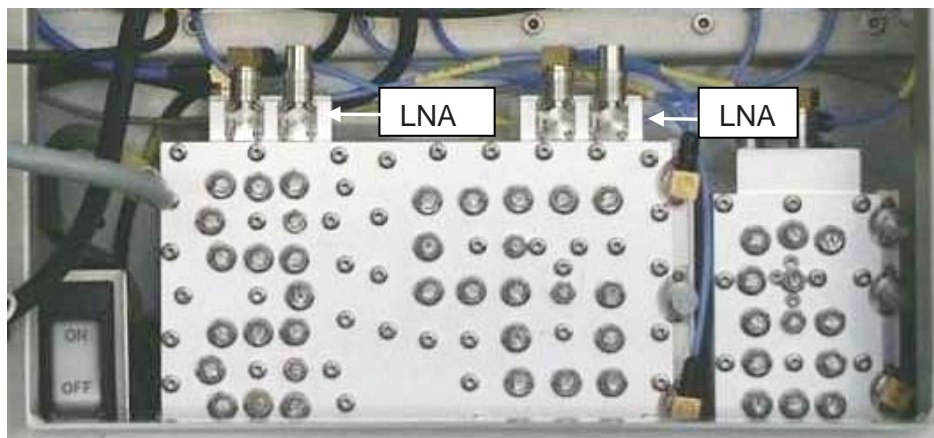
The UL and DL duplexers have multiple outputs, including the primary and extension path, plus forward and reverse probes used for auto setup, VSWR, and RSSI functions.



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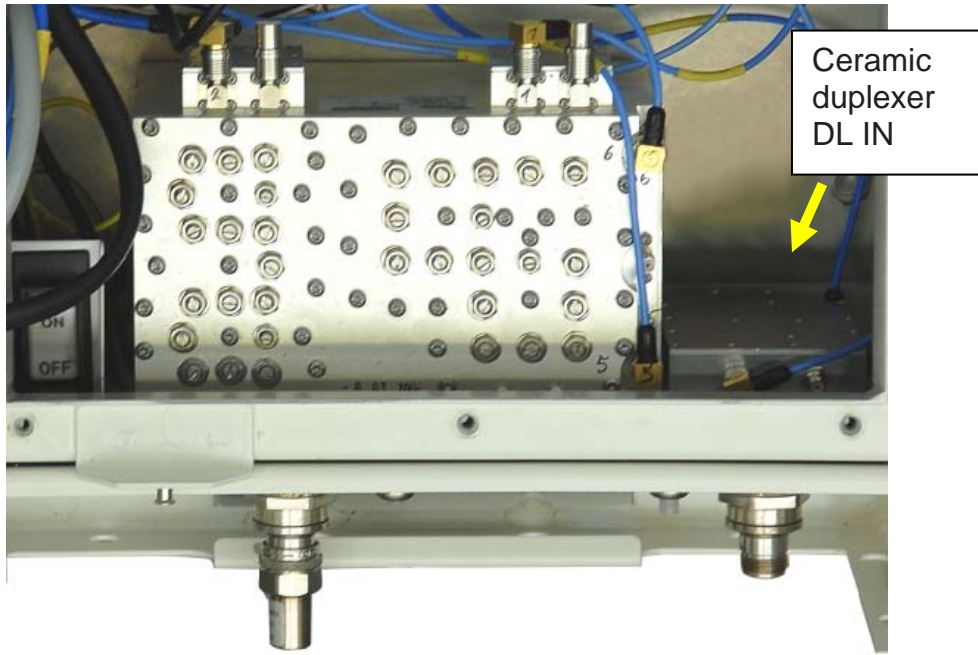
figure 5-28 Duplexer, UL IN

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figure 5-29 Duplexer, DL IN

B0184AKA

figure 5-30 Duplexers installed




B0185ATA

figure 5-31 Duplexers installed, ceramic duplexer DL IN

6. MAINTENANCE AND REPLACEMENT

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

 **Note:** Node M and Node C do not require any preventative maintenance measures.

 **Note:** In case of a defect replace the entire repeater. When sending back the unit, use an appropriate packaging. We strongly recommend using the original packaging!

7. ILLUSTRATIONS

7.1. CABINET DRAWING

The cabinet measures of the Nodes described in this manual are nearly identical.

The following figure of a cabinet drawing exemplifies the proportions of Node M and Node C.

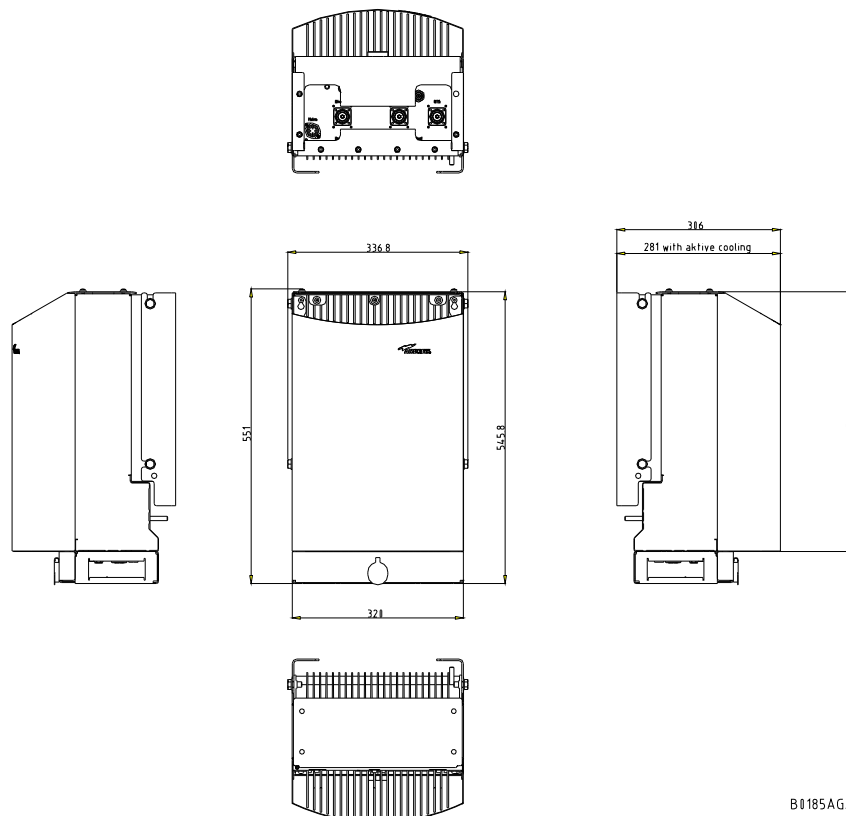


figure 7-1 Cabinet of a Node M, respective Node C, exemplary

7.2. LAYOUT OF THE NODE M/C 843

The following figure is exemplifying the layout of a Node M/C 843.

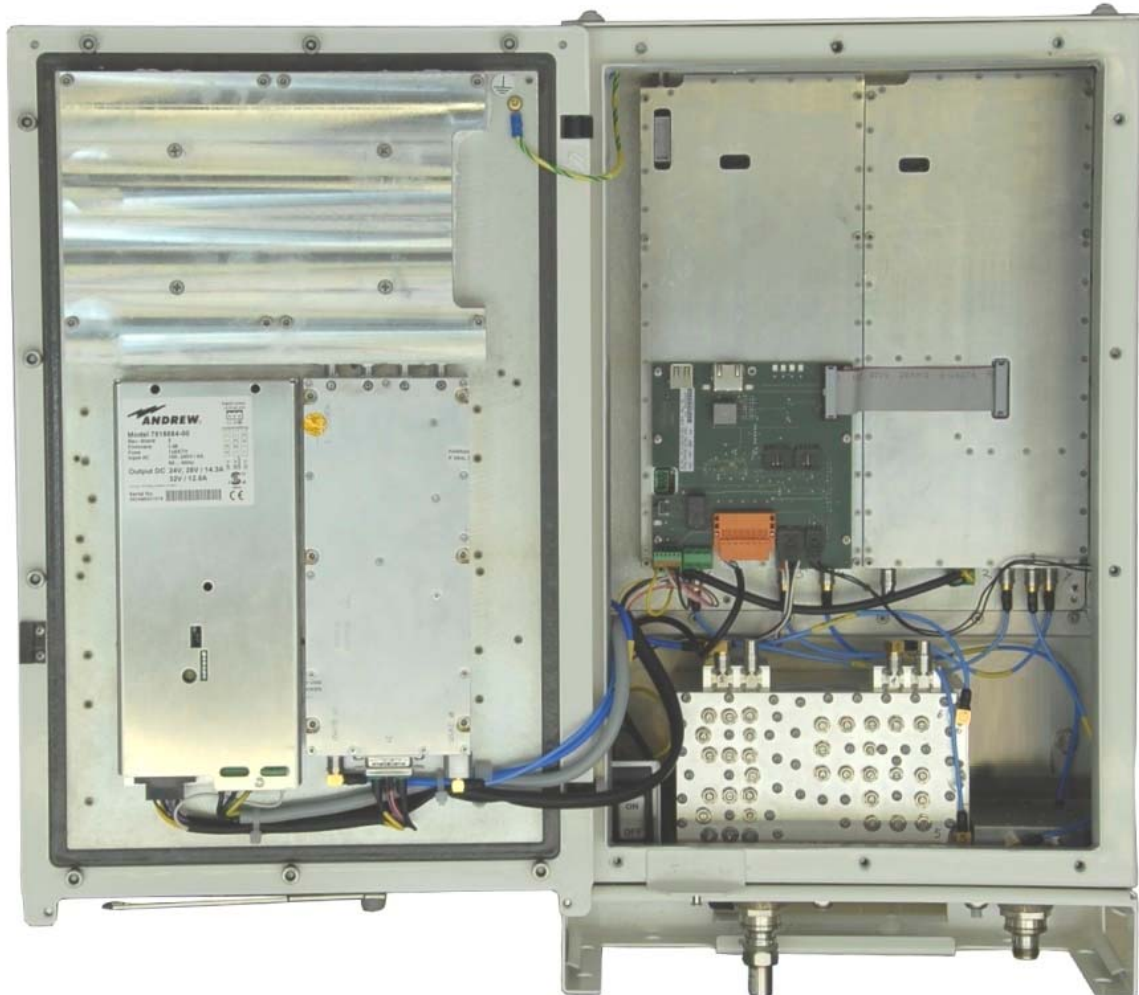


figure 7-2 Layout of the Node M/C 843, exemplary

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