

User's manual for band selective repeater MRx03P



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1. GENERAL

1.1. LIST OF ABBREVIATIONS

ALC	Automatic Level Control
BCCH	Broadcast Control Channel
BITE	Built In Test Equipment
BTS	Base Transceiver Station
DL	Downlink
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
I2C-Bus	Inter Integrated Circuit Bus (Philips)
Id.-No.	Identification Number
MR	MIKOM Repeater
MS	Mobile Station
OMC	Operation and Maintenance Center
PCMCIA	Personal Computer Modem Communication International Association
PCS	Personal Communication System
PSTN	Public Switched Telephone Network
Rev	Revision
RF	Radio Frequency
SCL	Serial Clock
SDA	Serial Data
UL	Uplink

1.2. HEALTH AND SAFETY WARNINGS

- * Note:** The electrical installation has to be performed in accordance with the safety regulation of the local authorities. Due to safety reasons, the electrical installation must be carried out by qualified personnel. The cover of this unit should not be opened while power is applied. Subsequent installation, commissioning and maintenance activities that require the unit to be powered with the cover open shall only be carried out by suitably qualified personnel.
- * Note:** The grounding of the unit has to be performed by all means. A grounding bolt is provided at the outside of the cabinet to connect the earth bonding cable.
- * Note:** Make sure that a suitable mounting surface is used. Only adequate manpower is allowed to handle the system.
- * Note:** ESD precautions must be observed! Before maintenance work, use the available grounding system to connect ESD protection measures.
- * Note:** Due to power dissipation, the repeater may heat up the air volume inside the cabinet and reaches a very high temperature. Therefore, it is recommended to mount the repeater in the vertical plane to a wall or a mast without additional enclosure to provide sufficient ventilation. Between the housing and the wall, a minimum distance must be kept to provide air circulation.
- * Note:** Close the repeater housing only after a thorough control of the cable layout to avoid any damage of the cables.

1.3. PREAMBLE

MIKOM 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, MIKOM maintains many field engineering and sales offices throughout the world.

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.

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

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Industriering 10
86675 Buchdorf
Germany
Tel: +49 (0) 9099 69 0
Fax: +49 (0) 9099 69 31
E-mail: sales@mikom.com
<http://www.mikom.com>

for The Americas:

MIKOM US
Phone: +1 (0) 800-800-7465
E-mail: MIKOM_US_sales@allentele.com

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

1.4. LIST OF INTERNATIONAL SALES OFFICES

Allen Telecom Inc. 31225 Bainbridge Road, Suite J, Cleveland Ohio 44 139-2293 USA Phone: +1 (440) 519-2629 FAX: +1 (440) 519-8607	Allen Telecom Pty Ltd 6 Stuart Street Padstow NSW 2211 Australia Phone: +61 (2) 9774-4200 FAX: +61 (2) 9774-4500	Forem France Z.I. des Ebisoires 78370 Plaisir France Phone: +33 (1)30-79-15-36 FAX: +33 (1) 30-55-55-37
FOREM S.p.A. Via Archimede 22/24 20041, Agrate Brianza Milan Italy Phone: +39 (039)605-4453 FAX: +39 (039) 605-4477	AT Singapore 80 Marine Parade Road #19-1 Parkway Parade Singapore 449269 Phone: +65 (345) 8022 FAX: +65 (345) 8033	AT China CITIC Building, # 11-04 19 Jianguomenwai Avenue Beijing 100004 China Phone: +86 (10) 6508-3088 FAX: +86 (10)6508-3066
AT Canada 1815 Ironstone Manor, # 12 Pickering, Ontario L1W 3W9 Canada Phone: +1 (905) 839-3474 FAX: +1 (905) 839-4663	FOREM UK Unit D Castle Industrial Park Pear Tree Lane, Newbury RG 14 2EZ, Berkshire U.K. Phone: +44 (1635) 569-695 FAX: +44 (1635) 569-463	AT India F-1 Adarshini Plaza 93, Adchini SRI Aurobindo Road New Delhi-110017 India Phone: +91 (11) 653-2126 FAX: +91 (11) 653-2120
MIKOM Austria Weglgasse 10 2320 Schwechat Austria Phone: +43 (1) 706 – 3999 FAX: +43 (1) 706 – 39999	MIKOM Switzerland Tiergartenweg 1 4710 Balsthal Switzerland Phone: +41 (6238) 61260 FAX: +41 (6238) 61261	C-COM Czech Republic U Morusi 888 530 06 Pardubice-Svitkov Czech. Republic Phone: +42 (0406) 301280 FAX: +42 (0406) 301298

2. FUNCTIONAL DESCRIPTION

2.1. GENERAL

Cellular telephone systems transmit signals in two directions between base transceiver station (BTS) and mobile stations (MS) within the signal coverage area.

If weak signal transmissions occur within the coverage area because of indoor applications, topological conditions or distance from the transmitter, a repeater is used to extend transmission range. In the downlink (DL) path, the repeater picks up the signal from a donor antenna of an existing cell, processes and retransmits it into the desired dark spot. In the uplink (UL) direction, the repeater receives a signal from mobile stations present in its coverage area and forwards them to the corresponding BTS.

2.2. REPEATER DESIGN

The repeater MRx03P is a band selective amplifier which bi-directionally amplifies signals between a base transceiver station and mobile stations in the corresponding network. It can provide highly selective amplification, thus enabling radio coverage in regions where satisfactory quality of communication is disabled. The following figure shows the configuration of a MIKOM repeater MRx03P.

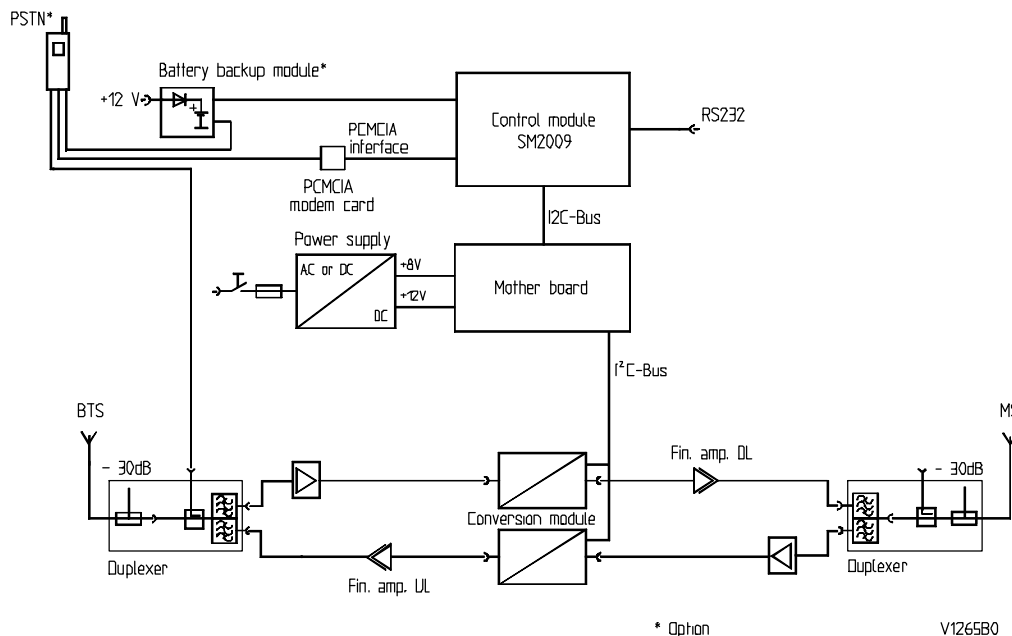


figure 2-1 Configuration of a MRx03P

The MRx03P can also be combined with other repeater systems to create a combined repeater system. When different modules are combined, a common antenna terminal and a common control interface is available.

2.3. COMPONENTS OF THE MRX03P

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

2.3.1. Duplexer

The task of the duplexer is to isolate uplink from downlink, i.e. to separate the transmitting path from the receiving path. The pass bandwidth of the duplexer is the entire width of the UL- and DL band of the corresponding network.

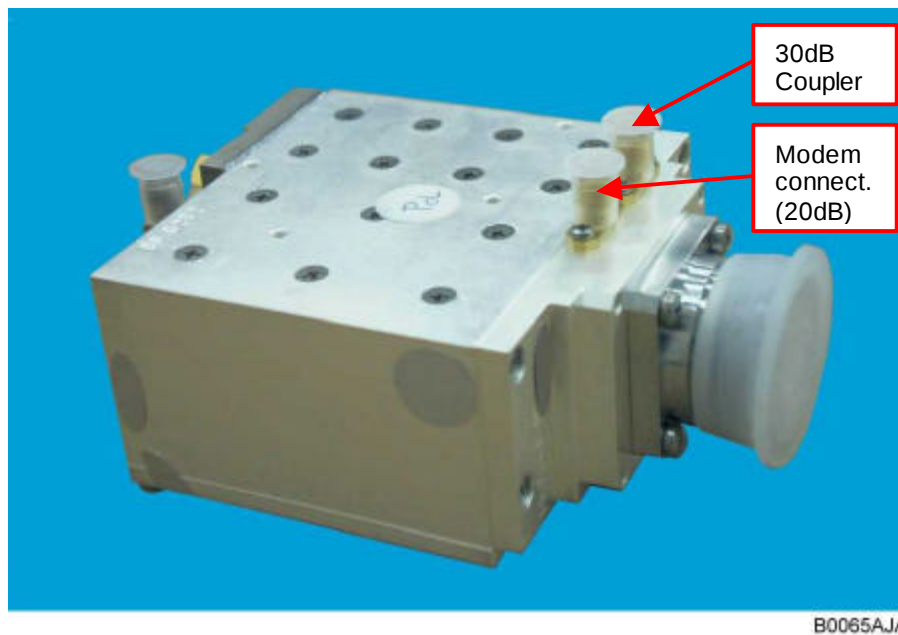


figure 2-2 Duplexer

2.3.2. Measuring Aids

With built-in RF probes at the duplexers, test signals can be applied or detected (see figure 2-2). The probes are provided with different coupling factors, 30 dB for measurements and 20 dB for the optional modem. Each antenna port is equipped with one coupler. This facilitates measurements under all operational conditions while an antenna or a dummy load may be connected.

2.3.3. Conversion Module

The task of the conversion module is to amplify the received signals and to convert them into an intermediate frequency. Then, the signals proceed a filter stage comprising of highly selective filters and run through a digital controllable attenuator.

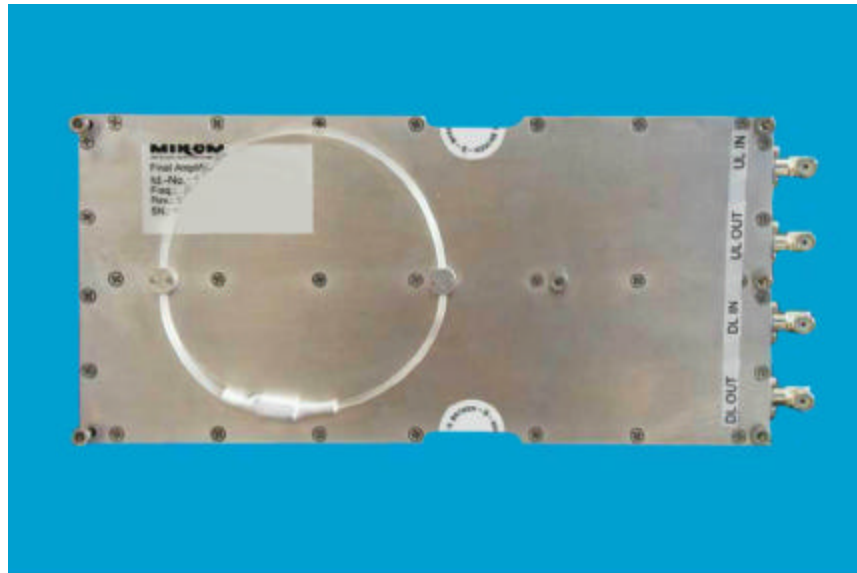


figure 2-3 Conversion module

Each link of a conversion module is provided with filters which guarantee the high selectivity. There the desired bandwidth and the desired centre frequency can be set. By using the same synthesizer frequency, that was used to convert the signals down to intermediate frequency, the intermediate frequency is mixed up to the original frequency. The synthesizer is controlled via an I²C-Bus.

2.3.4. Final Amplifier

The UL- and DL path are amplified by a final amplifier. It is located next to the conversion module.



B0065AAA

figure 2-4 Final amplifier

2.3.5. Control Module

The control module is a DOS compatible micro computer. The whole communication between the provider and the repeater can be done via the control module.

The repeater can be controlled remotely or locally via a VT100 terminal or a PC emulating the VT100 terminal.

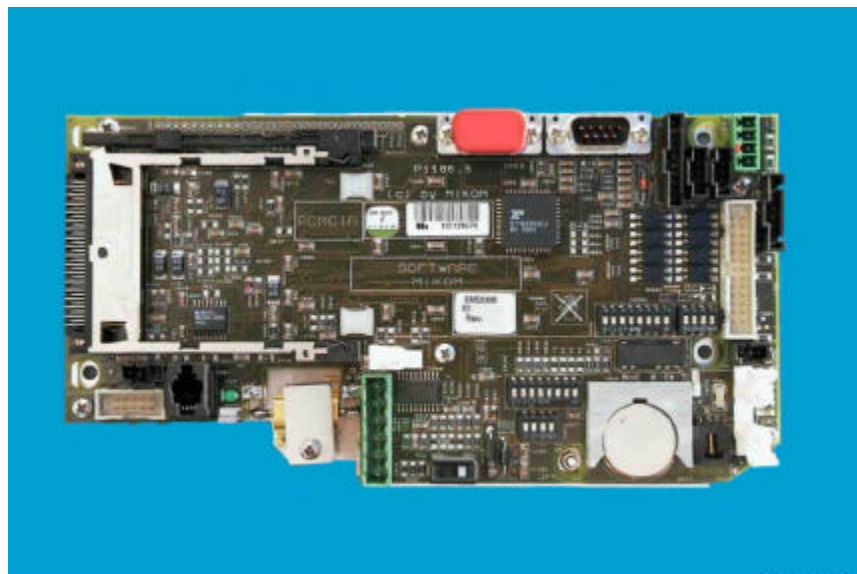
To control the repeater remotely, use either the RS232 interface in connection with a wireless modem or the PCMCIA interface in connection with a modem card and a mobile or PSTN network adapter. The RS232 interface and the PCMCIA interface are located on the control module.

Frequency, gain, power down of RF stages and ALC can be controlled and status messages can be received remotely. In case a PSTN modem or a mobile is connected, automatic alarm messages can be received.

The data transfer between the control module and the mother board is realized by the I²C-Bus system.

The I²C-Bus concept was developed by Philips for the serial connection of integrated circuits within one device. Two wires, serial data (SDA) and serial clock (SCL), carry information between the devices connected to the bus. Each device is recognized by a unique address and can operate either as transmitter or receiver.

All MRx03P configuration parameters are non-volatile stored in an EEPROM on the control module if power supply failure occurs.

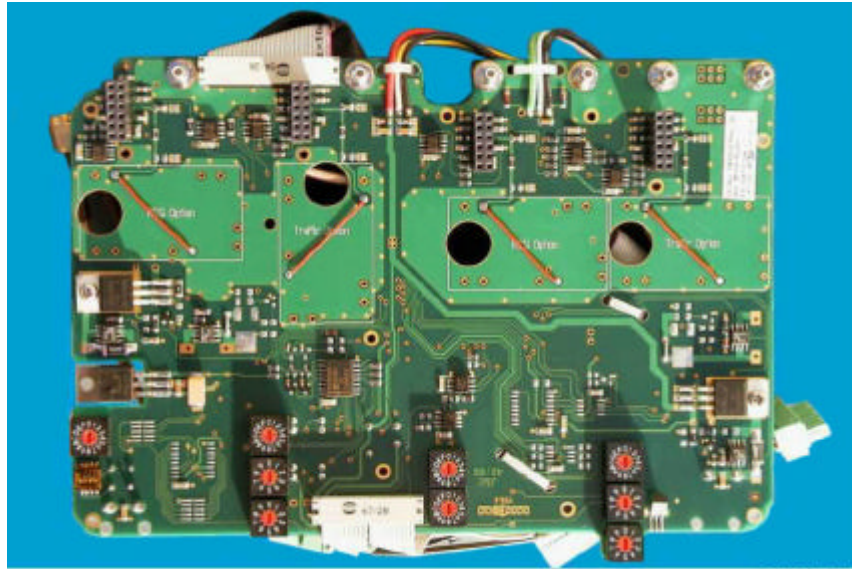


B0065ADA

figure 2-5 Control module

2.3.6. Motherboard

The function of the mother board is the communication between the conversion module and the control module via the I²C-Bus. All signals will be recognized from the mother board logic.



B0065A9A

figure 2-6 Motherboard

2.3.7. Power Supply

The power supply can be provided by different mains power. An external switch, mounted on the power supply, is provided to disconnect the repeater from mains during maintenance work to ensure that all circuits are voltage-free.

The power supply is factory-set and must not be changed. The power supply can be fuse-protected.

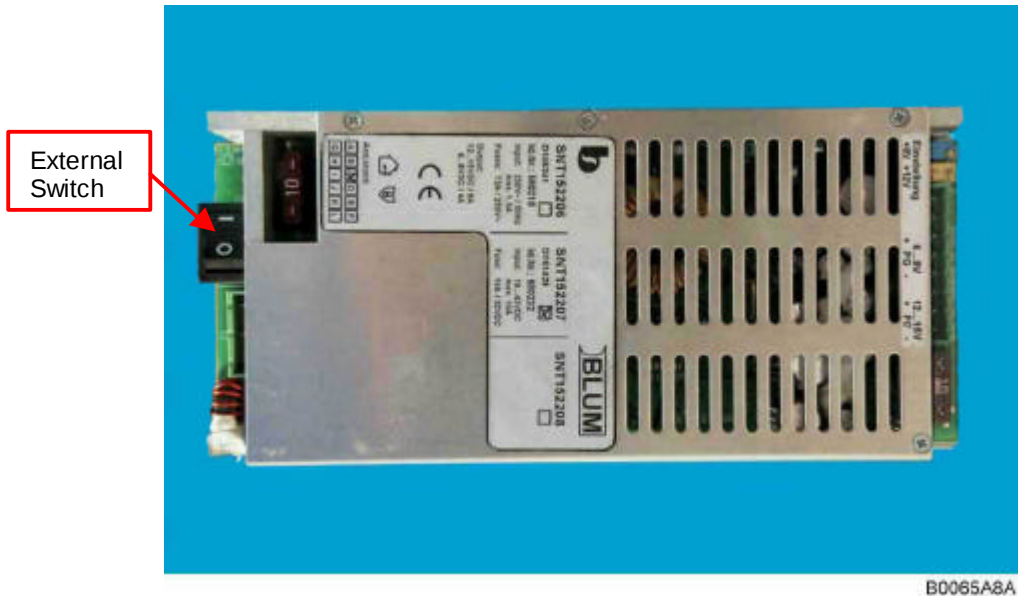


figure 2-7 Power supply

3. OPTIONAL EQUIPMENT

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

3.1. MODEM

The modem option enables the provider to set parameters and to query the status of each repeater remotely. Furthermore, the modem can be set to send all occurred alarms of the repeater directly to a provider's terminal, e.g. to the OMC. This can be done either via a wireless modem or a PSTN modem (Public Switched Telephone Network). Thus, the alarms can be evaluated and eliminated promptly. It is possible to install the wireless modem or the PSTN modem on site!

⌋ Check the communication mode between the modem and the terminal. If necessary, set the following parameters:

Bit rate / bit per second:	9600 baud	Number of data bit:	8 bit
Parity bit:	No parity	Stopbit:	1 stopbit

These settings can only be changed after connection to the terminal. If a different modem is required or if the quality of the line does not allow to use the set parameters, the settings have to be changed in PC mode. The same applies for all other parameters which can be set previously for modem mode by software.

3.1.1. Initstrings

Depending on the provider's network and the used modem type, it is necessary to adjust the initstring. The following initstrings are factory set:

Modem	Network	Initstring
Siemens M1*	GSM900	ATE0S7=60S0=2\N6
Siemens M20*	GSM900	ATZE0S0=2&S0+IFC=0,0+CBST=7,0,1
Motorola Mobile MR30 "Surf-Pro"***	PCS1900	AT*P1&F&K4E0S0=2\N0+CBST=7,0,1
MIKOM MO4000	GSM900/1800	ATE0S7=60S0=2;+CBST=7,0,1
PCMCIA-modem	PSTN	AT&FE0S0=2

* The Siemens M1 modem is no longer available and is replaced by the Siemens M20. In future, it is assigned to replace all wireless modems working in GSM900/GSM1800 networks by the new MIKOM modem MO4000.

***in connection with Collect2 Card

table 3-1 Standard initstrings for modems

For further details to the initstrings, please refer to the user's software manual.

3.1.2. PSTN Modem

A Hayes compatible PSTN modem can be connected to the control module SM2009. The telephone cable has to be fed through a labeled grommet of the connector panel and must be connected to the designated clamps.

For the standard modem type DigiTel 56Euro, use clamps 2 and 3 to connect the telephone lines a and b. Previous standard modems type DigiTel 34P use clamps 1 and 4. In case of failure try both possibilities to check the functionality of the modem connection.

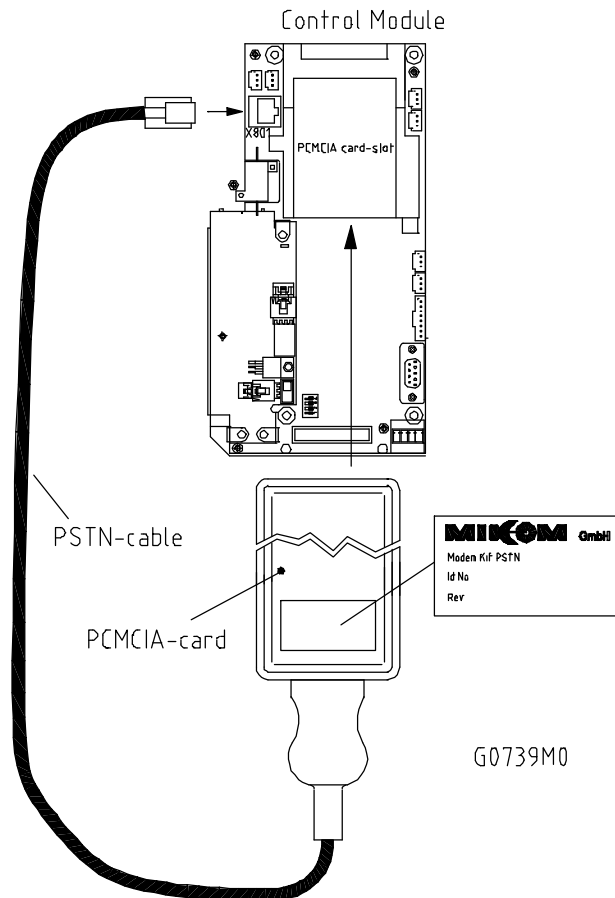


figure 3-1 Location of the PSTN Modem

*** Note:** If a PSTN modem is required, the DIP-switches of the Ext. Alarms-switch [4] on the control module has to be set to position OFF "PSTN Modem". The DIP-switch 2 of the Mode-switch [1] has to be set to position ON "Remote Mode".

3.1.3. Wireless Modem

The wireless modem is mounted in the modem box of the lid.

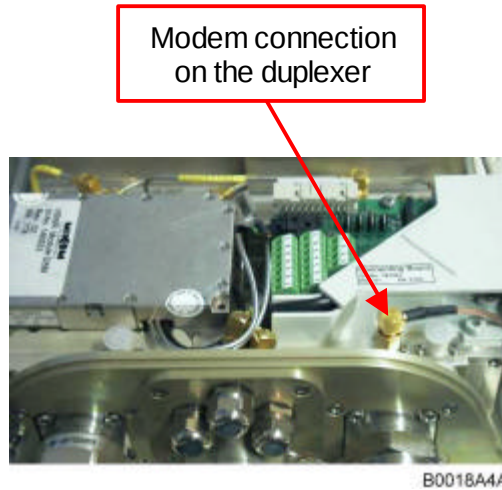


figure 3-2 Modem connection on the duplexer

3.2. EXTERNAL ALARMS

With the external alarms option, it is possible to monitor the status of connected devices via the repeater software, e.g. a UPS. The DIP-switches of the Ext.-Alarms switch on the control module have to be set to position ON "Ext. Alarm 1-4".

*** Note:** If a PSTN modem is required, only two external alarms are available because the PSTN modem reserves two lines!

The connecting clamps are located on the connecting board mounted on the duplexer (BTS side).

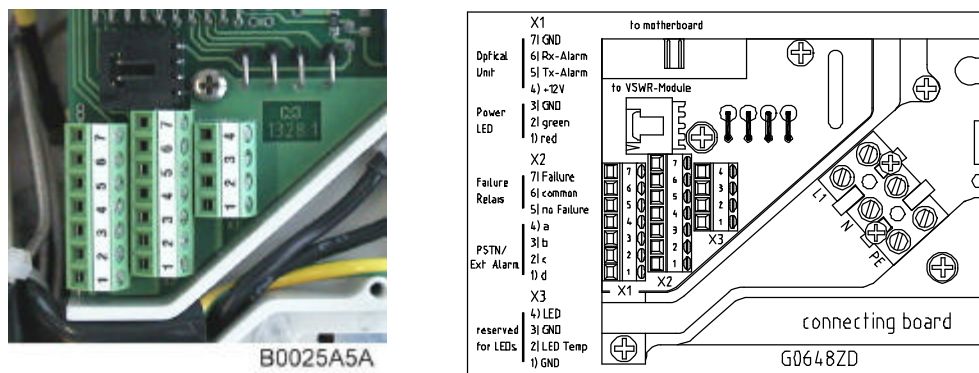


figure 3-3 Location of external alarm clamps

All external alarms are normally high (5V) without connection. Via the software command SET LOGIC, the external alarms can be set to high active (H) or low active (L). Depending on the settings, the external alarms show the status "failure" or "OK" on the display. The configuration for open collector applications is 5V / 0.5 mA.

When only 2 external alarms are required, ensure that the other 2 external alarms are set to low active, otherwise the status will always show an alarm.

*** Note:** The name for each external alarm and the name for the alarm message can be defined by the customer with the corresponding software command (see software manual)!

*** Note:** A special software blocking must be removed to use the external alarm option. This can only be carried out by authorized persons from MIKOM.

3.3. BATTERY BACKUP

The repeater can be provided with the battery backup option to enable alarm calls in case of power failure. The battery backup module supports multiple dial out attempts via modem in case of "System engaged" or other communication problems for about ten minutes under normal environmental conditions.

The batteries are protected from deep discharge by use of a low voltage disconnect unit. A local switch is provided to disconnect the battery backup option during maintenance to ensure that all circuits are voltage-free. The switch is located on the battery backup module.

The module is directly plugged onto the control module and can be installed on site. During the charging process, a green LED on the module indicates that the battery is charged at the moment. After finishing the process, the LED will be switched off.

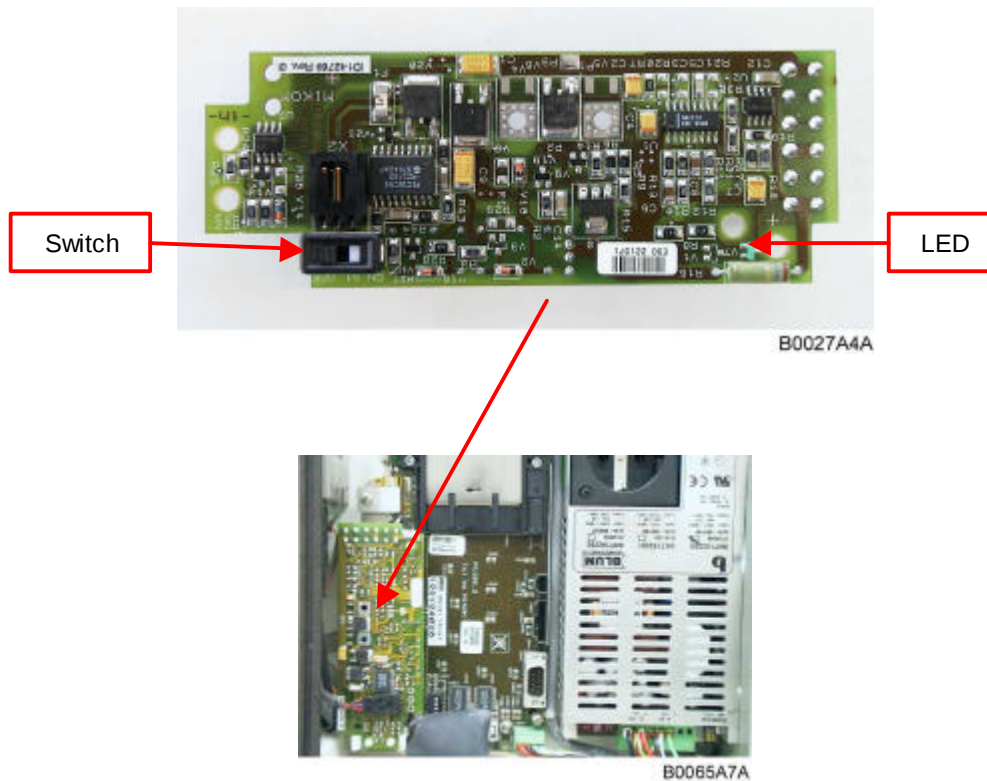


figure 3-4 Location of the battery backup module

4. INSTALLATION

4.1. MECHANICAL INSTALLATION

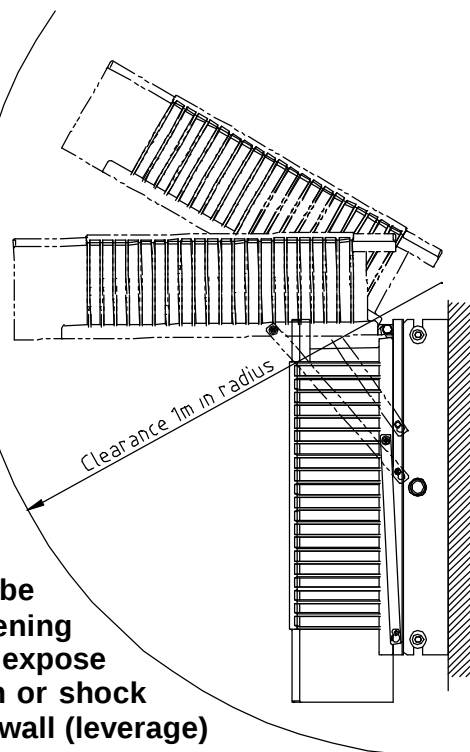
4.1.1. General

Note: Due to power dissipation the repeater may reach a very high temperature. Therefore, it is necessary to mount the repeater vertically to a wall or a mast without additional enclosure. A clearance distance of one metre above and below the unit should be kept to provide sufficient ventilation. Between the housing and the wall, a minimum distance of 20 mm must be ensured.

Note: The weight of the repeater is approximately 14 kg in standard configuration. Only adequate manpower is allowed to handle the weight of the system.

Note: If it is impossible to mount the repeater with the mounting brackets due to an uneven surface (e.g. a bulged wall in a tunnel), alternative fastening devices may be used. These fastening devices must fulfil the following requirements:

Note: The external strain must not be increased by the alternative fastening devices. Holding devices, which expose the repeater to enhanced vibration or shock due to a greater distance from the wall (leverage) or due to a lower rigidity or stability (vibration), must not be used.



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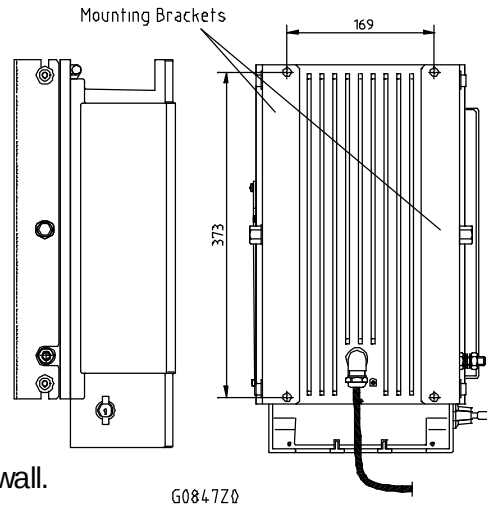
Note: The repeater's external strain specifications must not be exceeded, particularly the exposure to vibration and shock (please refer to the MIKOM "Environmental and Safety Leaflet" for further detailed information).

Note: Exceeding the specified load limits may cause the loss of warranty!

4.2. WALL MOUNTING PROCEDURE

Check the suitability of the wall mounting kit and the wall.

- ⌋ Dismount the mounting brackets which are screwed to the housing with four socket head cap screws M8x16 and two tire bolts.
- ⌋ Use the wall mounting template to mark the position of the drilling holes. Drill four holes and screw the mounting brackets to the wall.
- ⌋ Attach the upper two socket head cap screws M8x16 to the repeater housing. Hang the repeater into the mounting brackets.
- ⌋ Fasten the lower two socket head cap screws M8x16 and the two tire bolts.



Ensure that there is free access to the electrical connections as well as to the individual units inside the cabinet while the door of the repeater is open (clearance distance of 1 m is recommended). The approved bending radius of the connected cables must not be exceeded.

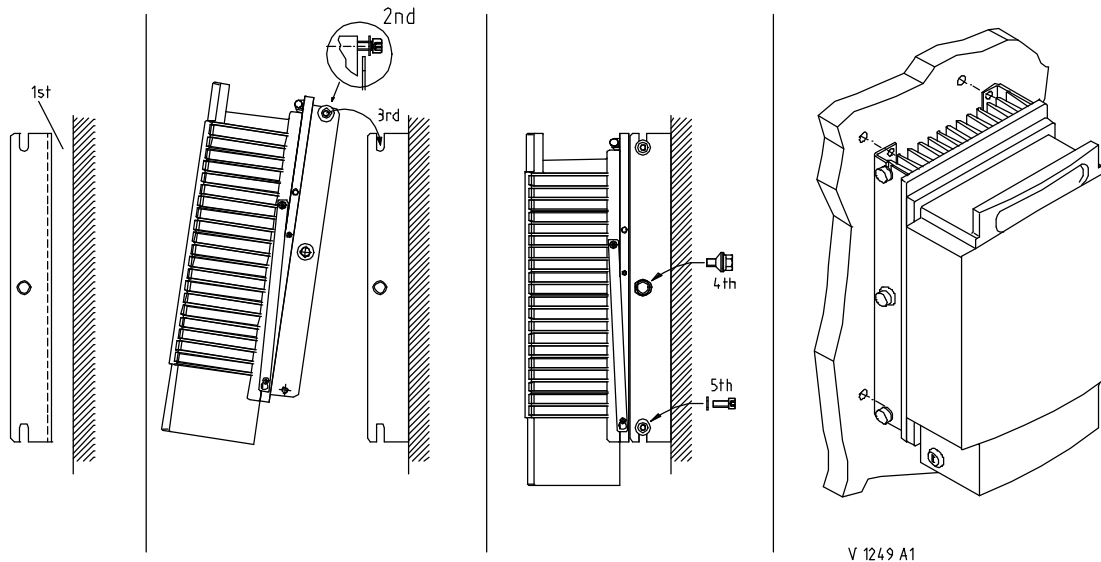


figure 4-1 Installation drawings of a repeater

4.2.1. Pole Mounting Procedure

Standard mounting hardware can not be used to mount the repeater to a pole, a mast or other similar structures. Additional hardware must be used for this type of installation. Such a pole mounting kit could include two threaded rods M8, two U-beams and mounting material like bolts and nuts.

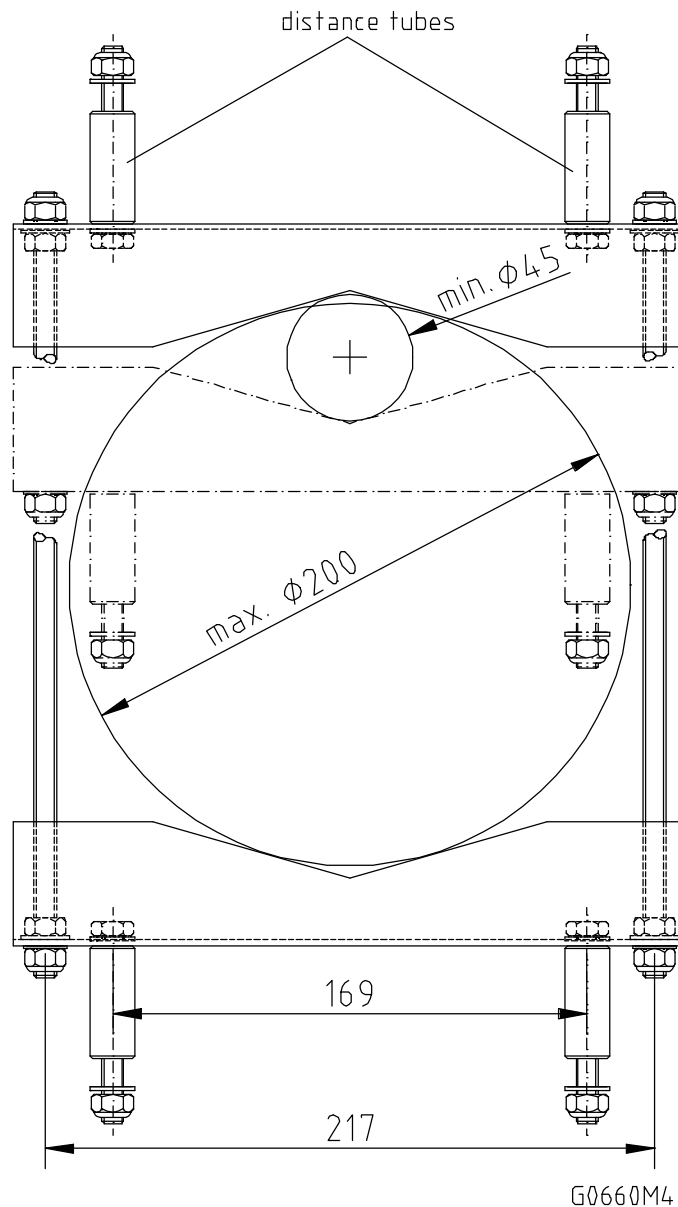


figure 4-2 MIKOM pole mounting kits.

Dismount the mounting brackets which are screwed to the housing with four socket head cap screws M8x16 and two tire bolts (see figure 4-1 Installation drawings of a repeater).

- ┌ Fasten the mounting kits and the mounting brackets to the pole or mast.
- ┌ Attach the upper two socket head cap screws M8x16 to the repeater housing.
- ┌ Hang the repeater into the mounting brackets.
- ┌ Fasten the lower two socket head cap screws M8x16 and the two tire bolts.

Make sure that there is free access to the electrical connections and to the individual units inside the cabinet while the door of the repeater is open (clearance distance of 1 m is recommended). The allowed bending radius of the connected cables must not be exceeded.

 **Note:** Two Mikom pole mounting kits are required to mount the repeater to a pole or a mast.

4.3. ELECTRICAL INSTALLATION

4.3.1. Grounding

Grounding must be carried out under all circumstances. An earth bonding cable must be connected to the grounding bolt provided at the outside of the cabinet on the left-hand side. Do not use the grounding screw for connecting external devices. The complete grounding kit is part of the delivery schedule.

The complete grounding kit is part of the delivery schedule.

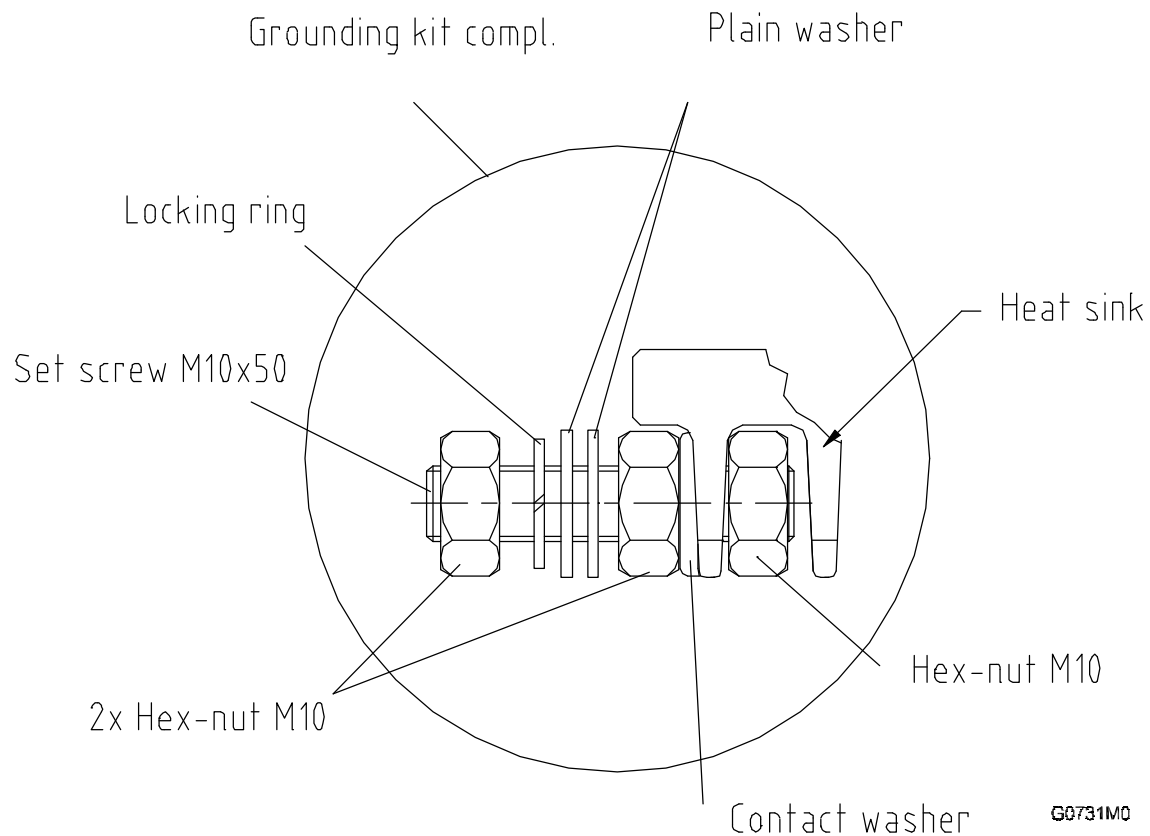


figure 4-3 Grounding bolt

4.3.2. Mains Power Supply

Before connecting electrical power to the repeater, it must be grounded. The repeater is equipped with a firmly connected mains cable which is fed into the housing through a watertight cable gland. Due to safety reasons, the power supply lead must be protected by fuses. Inside the repeater, the mains cable is connected to a screw terminal on the connecting board. In case the length of the power cable should not be sufficient, it can be replaced by a longer cable.

4.3.3. Antennas Connections

The repeater has two female antenna connectors 7/16 (or N with adapter). For mounting the corresponding cable connector, we recommend to refer to the corresponding documentation of the respective connector manufacturer. The bending radius of the antenna cables must remain within its specification

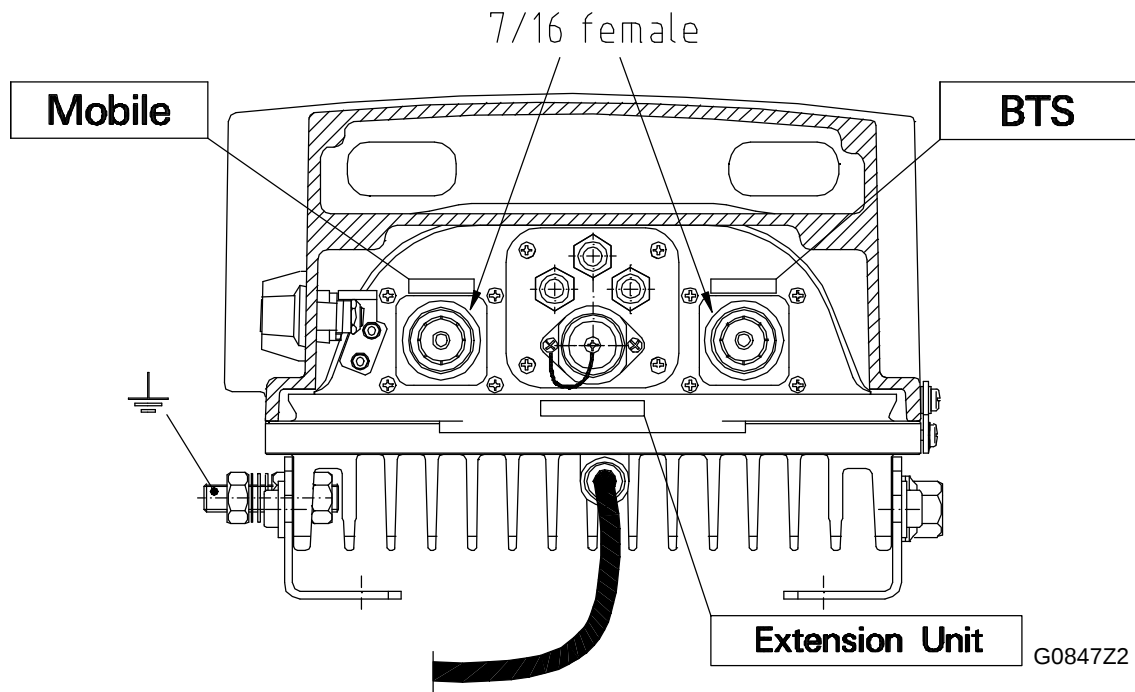


figure 4-4 Top view of antenna connections

5. COMMISSIONING

5.1. PREPARATION

5.1.1. General

Please read the description carefully to avoid mistakes and proceed step by step as described. The repeater must not be operated with open antenna ports. This means that each antenna port has to be terminated with either a 50Ω resistor, a dummy load or a connected antenna. The repeater could be damaged when operated without any 50Ω terminations.

When opening the repeater, do not damage the seals on the devices inside the repeater. Warranty void if the seals are broken!

5.1.2. BCCH-Channel

Apart from the antenna isolation measurement described in chapter 5.1.3, it is also necessary to measure the BCCH level (BCCH=Broadcast Control Channel). The resulting max. allowed repeater gain of the antenna isolation must be compared with the resulting max. allowed repeater gain of the measured BCCH channel. The lower gain has to be set for the repeater.

The following example clarifies how to set the correct gain:

Antenna isolation:

Antenna isolation:	100 dB
Safety Gain Margin (SGM)*:	15 dB

Allowed max. gain:	85 dB

BCCH channel:

Power out**:	+30 dBm
Received level of BCCH:	-(-40) dBm

Allowed max. gain:	70 dB

* Refer to chapter 5.1.3 Antenna Isolation for further information about SGM.

** Max. P_{out} required by customer, but not higher than the rated P_{out} per channel stated for this repeater at the required number of channels.

In this case, 70 dB gain has to be set for the repeater.

*** Note: If a higher gain is set, the ALC will be active! This might affect the quality of the signal!**

5.1.3. Antenna Isolation

Before setting the parameters of the repeater, ensure that the antenna isolation is measured and optimized. The Safety-Gain-Margin (SGM) between the antenna isolation and the maximum gain of the repeater is specified to +15 dB for all RF-repeaters, i.e. the gain has to be -15 dB less than the isolation value of the antennas.

For better antenna isolation, ICE (Interference Cancellation Equipment) has been developed for channel selective repeaters in the GSM900/1800 networks as well as for PCS1900. ICE is specified for a SGM of -5 dB. Following example will show the significant difference of a repeater with ICE-option compared to a repeater without ICE-option.

Assumed case of a poor antenna isolation:

- Repeater without ICE

Antenna isolation:	80 dB
SGM:	- 15 dB

Allowed max. gain:	65 dB

In this case, the antenna isolation should be improved. The operator has to enlarge the distance between both antennas or has to shield each antenna from the other. Sometimes, it is difficult to enlarge the distance or to shield the antenna to reach the necessary value.

The next example clarifies how to solve the antenna isolation problem with an ICE-repeater. The SGM between the antenna isolation and the maximum gain is specified to -5 dB, i.e. the gain can be +5 dB more than the isolation value of the antennas.

Assumed case of the same poor antenna isolation as in the previous example:

- Repeater with ICE-option

Antenna isolation:	80 dB
SGM with ICE-option:	+5 dB higher

Allowed max. gain:	85 dB

For further details to ICE or antenna isolation, please refer to MIKOM "Application Note for Antenna Isolation" or "ICE Datasheet".

5.2. BOOT PROCESS

As soon as the repeater is switched on, the control module of the repeater starts the boot process; LE3 displays "Power on". The initialization of the hardware is part of the boot process. The whole process may take up to several minutes.

After booting the system, LE1 turns red for a few moments, then flashes green. LE2 also flashes red and then green. This is just an optical functionality test of the two-coloured LEDs.

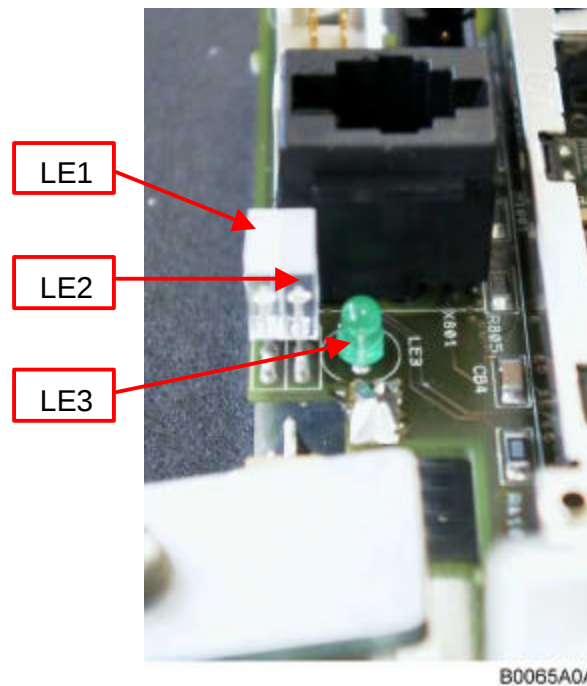


figure 5-1 Control module – Position of LEDs

Internal LED LE1		Internal LED LE2		Internal LED LE3	Cause
				green	Power on Software booting
	Flashes red for a short time		Flashes red for a short time	green	LED test
green		green		green	Software boot successful

table 5-1 LED indication during boot process

5.3. DIP-SWITCHES

The configuration of the DIP-switches on the control module is factory set.

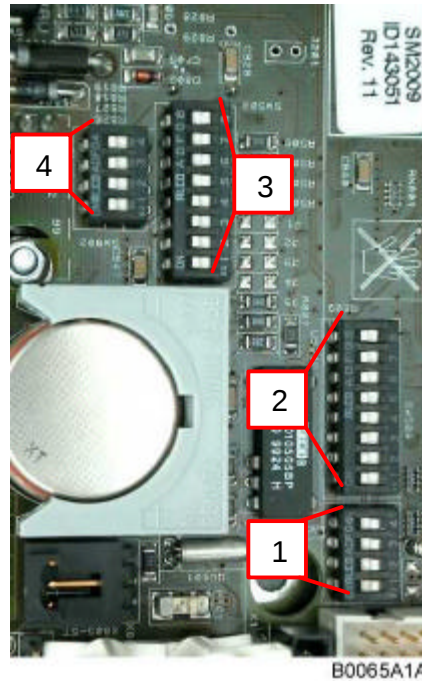


figure 5-2 Control module – Position of the DIP-switches

Mode-switch [1]*			Ext. Alarms-switch [4]		
	ON	OFF		ON	OFF
1	Manual	Auto	1	Ext. Alarm 4	PSTN (d)
2	Remote Mode	Local Mode	2	Ext. Alarm 3	PSTN (c)
3	DO NOT USE!	DO NOT USE!	3	Ext. Alarm 2	PSTN (b)
4	DO NOT USE!	Auto	4	Ext. Alarm 1	PSTN (a)

Switch for additional inputs [2]**			MOR/MR-switch [3]		
	ON	OFF		ON	OFF
1	VCC	O.C.	1	MR	MOR
2	VCC	O.C.	2	MR	MOR
3	VCC	O.C.	3	MR	MOR
4	VCC	O.C.	4	MR	MOR
5	VCC	O.C.	5	MOR	MR
6	VCC	O.C.	6	MOR	MR
7	VCC	O.C.	7	MOR	MR
8	VCC	O.C.	8	MOR	MR

* Switch 1, 3 and 4 are factory set to position Off

** Switch for additional inputs not in use!

table 5-2 DIP-switches of control module

5.4. REMOTE SETTINGS

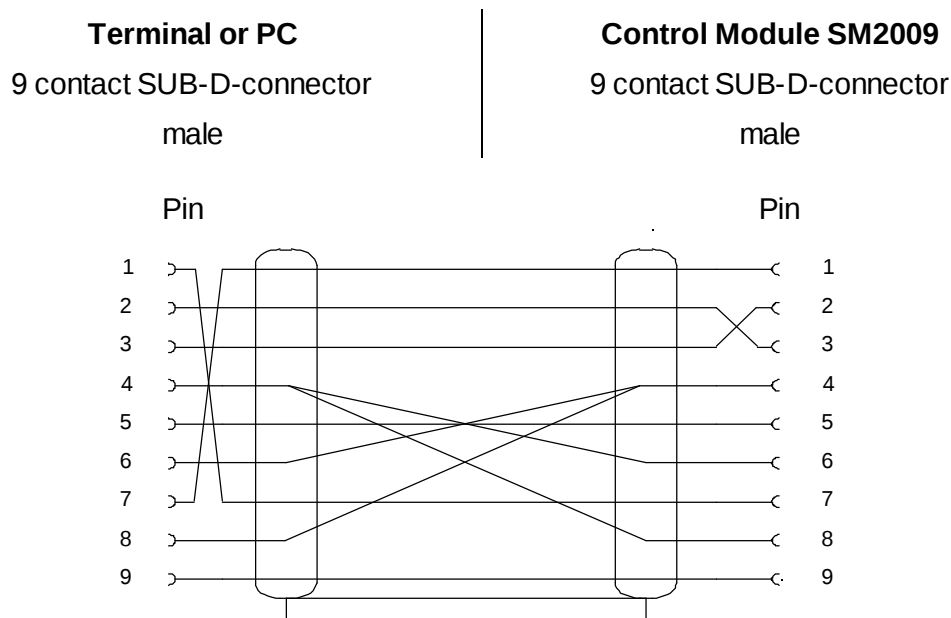
After the boot process, the software login is possible. All parameters of the software can be changed by the provider to optimize the repeater according to the network system. There are two possibilities how to login to the software:

- └ locally via a VT100 terminal or a PC with VT100 terminal emulation
- └ remotely via a modem e.g. with the Operations and Maintenance Center (OMC)

5.4.1. Local Login

The login via VT100 terminal or a PC with VT100 emulation can only be performed at the repeater. Open the repeater carefully and ensure that DIP-switch 2 of mode-switch [1] is in position OFF. Only when DIP-switch 2 is OFF, a local access to the software on the control module is possible (see chapter 5.3 DIP-Switches).

Connect the terminal or PC to the RS232 interface on the control module by means of a standard RS232 interface cable (see picture below).



Check the communication mode at the terminal. If necessary, set the following parameters:

Bit rate / bit per second:	9600 baud	Number of data bit:	8 bit
Parity bit:	No parity	Stopbit:	1 stopbit

*** Note:** **The input is case sensitive, no blanks allowed. The connection will be torn down after three wrong inputs!**

There are two possibilities to login to the repeater software:

ê **Repeater off:** The repeater is switched off, the RS232 interface cable is already connected and the DIP-switch 2 of the mode-switch (1) is set to position OFF.

After switching on the repeater, the boot procedure starts. Subsequently, the display of the terminal shows following report.

AT

MIKOM REPEATER MRXXX - SM2009 -SW: REP 10XX VX.XX

ENTER <.> <CR> TO LOGIN

Please type

<.> (fullstop) and confirm with <CR> (carriage return)

to get to the login orders.

*** Note:** **The following step can only be carried out by qualified personnel in consideration of the health and safety warnings. Pay attention not to touch devices while the repeater is operating!**

ê **Repeater On:** The repeater is operating.

After connecting the RS232 interface cable and changing the mode-switch (1) DIP-switch 2 to OFF, the display won't show a report.

Please type

<.> (fullstop) and confirm with <CR> (carriage return)

to get to the login orders.

*** Note:** **Sometimes it is necessary to type the <.> (fullstop)-command twice or three times to get access to the repeater software.**

After successful login, the USERID is required.

ENTER USER ID :

Please enter

<UserID1>* and confirm with <CR> (carriage return).

* UserID1 is factory set and can be changed by software

Note case sensitivity and blanks!

Now, the correct password is asked. Following order will be displayed on the terminal:

ENTER PASSWORD :

Please enter

<P-word1>** and confirm with <CR> (carriage return).

** P-word1 is factory set and can be changed by software

Note case sensitivity and blanks!

If the software-login procedure was successful, the input request shown below displays on the terminal:

MIKOM >

All parameters of the repeater can now be changed to optimize the repeater to the network system.

5.4.2. Remote Login

A login e.g. via modem at the OMC enables the operator to set parameters and to query the status of each repeater. This can be done either via a wireless modem or a PSTN-modem. The access commands to the repeater-software are the same as described in chapter 5.4.1 *Local Login*. If the OMC is used for the remote login, the input "<.> (fullstop) and <CR> (carriage return)" is skipped and UserID and Password are requested right away.

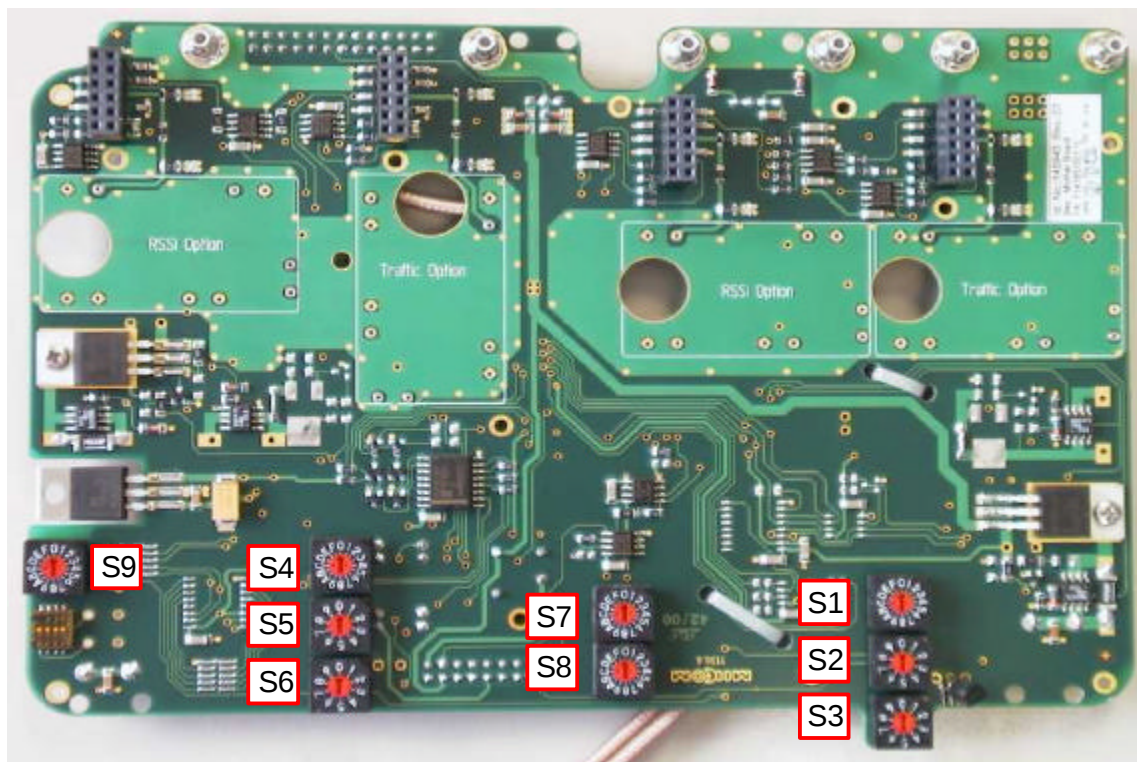
For further details to software-login and software-commands, please refer to the user's software.

5.5. MANUAL SETTINGS

Normally, settings are carried out by a VT100 terminal or PC. Additionally, if manual settings are unavoidable, rotary switches on the motherboard enables the operator to optimize the gain and to set the channels.

To enable the manual setting of attenuation and channels, ensure that the DIP-switch 1 of the mode switch [1] is in position ON (manual mode). An attenuation of 30 dB max. in steps of 2 dB can be set in the UL- and DL path for channel and band selective repeaters. The channel settings are only available for channel selective repeaters.

*** Note:** While DIP-switch 1 of mode switch (1) is in position ON (manual mode), software settings via VT100 terminal are not possible! Querying the status can still be carried out.



B0065A2A

figure 5-3 Motherboard

Example: Position 0 of the rotary switches S7/S8 equals 0 dB attenuation. Position 1 attenuates the signal by 2 dB, position 8 for instance attenuates by 16 dB. To achieve max. attenuation (30dB), turn the rotary switch of the corresponding path to position F.

The following table and the example show how to use the rotary-switches*:

Switch	Description
S1	Channel code x100
S2	Channel code x10
S3	Channel code x1
S4	Channel code x100
S5	Channel code x10
S6	Channel code x1
S7	Attenuation in 2 dB steps upto 30 dB for UL-path
S8	Attenuation in 2 dB steps upto 30 dB for DL-path
S9	Code switch for motherboard

* Factory settings are: S1-S8 in position 0, DIP-switch 1 of mode switch [1] in position "Off" (Automatic mode). Switch S9 can be set to position 0 to 3 depending on the location of the motherboard in the repeater.

table 5-3 Rotary switches of the motherboard

Example:

A gain of 74 dB is required in the UL- and DL-path, module 1 is set to channel 96 and module 2 to channel 113. The repeater has a gain of max. 82 dB.

1. Calculate the difference between the max. repeater gain and the required gain.

Max. repeater gain:	82 dB
Required gain for UL and DL:	74 dB

Required attenuation for UL and DL:	8 dB

2. Turn switch S7 as well as S8 to position 4 to set an attenuation of 8 dB for UL- and DL-path.

3. Set channel 96 for module 1:

Turn switch S1 to position 0:	0
Turn switch S2 to position 9:	90
Turn switch S3 to position 6:	6

Channel:	96

4. Set channel 113 for module 2:

Turn switch S4 to position 1:	100
Turn switch S5 to position 1:	10
Turn switch S6 to position 3:	3

Channel:	113

5.6. LEVELLING OF THE REPEATER

After software-login, the repeater must be levelled so that the highest output power is achieved without reaching the ALC (Automatic Level Control).

*** Note:** **When the local software configuration is finished, don't forget to switch back DIP-switch 2 of the mode-switch to position ON, otherwise the remote mode via modem will not work!**

6. ALARMS

6.1. BITE AND ALARMS

The Built-In Test concept comprises the monitoring of the power supplies, the operational currents in the conversion modules, the motherboard and the remote control interface. Furthermore, the synthesizer lock and the temperature of the repeater are monitored.

All occurred alarms can be checked via software by typing the "STATUS HIST" command. The provider is then able to acknowledge the alarm manually by the software command "ALARMACKN", e.g. ALC active, RSSI, door open or stability control. If all alarms have been acknowledged, the summary error LEDs are set back to green indication.

If monitored via a modem, automatic dialling will generate a summary alarm message. The provider can acknowledge the alarm message and can request a detailed status report.

6.2. HANDLING OF ALARMS

As soon as the software recognizes a valid alarm, a message is transmitted to the operator. In remote mode, the alarm can be acknowledged by simply ringing back and typing ALARMACKN.

If the reason for the alarm has been cleared or if the alarm should continue, a new alarm message will not be repeated. If there was an interruption of at least one second after acknowledgement, a new alarm message will be generated.

6.3. STATUS REPORT

Two instructions enable the operator to get the information of the system status. Typing GET, commands will be responded by a listing of all settings of the repeater. STATUS will be responded by a listing of all individual status information which can be monitored only, but not influenced by SET commands.

The complete listing of the syntax with the processor of the control module including the instructions and the messages as well as all available alarms from the system is obtainable as a separate software manual.

7. TROUBLE SHOOTING

7.1. ERROR INDICATION

- = LED on
- = LED off

1. With implemented battery backup module

Internal LED LE1		Internal LED LE2		Internal LED LE3	Cause
green	red	green	red	green	
-	-	-	-	-	No power. Check presence of power at the input; replace fuse according to chapter, check battery backup module
					Indicates a summary failure
					Mains failure, control module is supplied from battery backup module

2. Without battery backup module

Internal LED LE1		Internal LED LE2		Internal LED LE3	Cause
green	red	green	red	green	
-	-	-	-	-	No power. Check presence of power at the input; replace fuse
					Indicates a summary failure

7.2. BOOT PROCESS

Following signals occur during boot process

Internal LED LE1		Internal LED LE2		Internal LED LE3	Status
green	red	green	red	green	
-	-	-	-	-	Power on state, Software boot starts
	Flashes red short time		Flashes red short time		Software boot starts
					Software is running

The boot process takes about 3 minutes

7.3. ALARM MONITORING WITH THE ALARM HISTORY

Check the alarm history.

1. If a hardware module is damaged, replace corresponding hardware module.
2. Minor alarms with no influence on the system can be cancelled by confirming the alarm with the software command 'alarmackn', e.g., DOOR OPEN.
3. If all alarms have been acknowledged the summary error LEDs will be set back to green indication.
4. In case of mains power failure the contents of the actual alarm history list will be lost.

List with all available alarms in the alarm history.

7.4. POWER SUPPLY

Factory set output voltages (with load)

- 7.8 V $\pm$ 0.1 V
- 12.4 V $\pm$ 0.1 V

In case of an I²C-Bus error, also check the power supplies. They must be switched to position ON.

7.5. GENERAL REMARKS

] After a software download previous user settings (data default values) might be overwritten. Before you start a software download save all user settings:

- attenuation
- ALC threshold
- temperature compensation offset (gain)
- phone numbers etc.

] If an ALC alarm occurs during installation or commissioning an user error might be the cause, due to wrong measurements, e.g.

ALC: Input level too high reduce gain

8. MAINTENANCE

8.1. GENERAL

*** Note** **The repeater does not require preventative maintenance measures.**

It is only recommended to replace the RAM/RTC battery and the whole battery backup module after three years usage as a prophylactic measure. The nominal lifetime of these batteries is five years under normal environmental conditions.

In the event of a malfunction, it is advantageous to check the status of the antenna systems as well as the continuity of the entire cabling including connectors before replacing the modules.

Maintenance on the repeater shall be performed by replacing modules only. Soldering on printed circuit boards shall be avoided. In order to sustain warranty, take care not to damage unintentionally the seals on the modules. To open the housing, the upper screws have to be removed first and then the lower screws (see installation drawing chapter 7.1). Proceed in reverse order to close the housing.

The spare parts list, consequently, contains only units which can be replaced without tuning or complex soldering work. Those units are all MIKOM modules as well as internal and external cables.

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

*** Note** **During maintenance ensure that the repeater has been disconnected from mains and the battery backup module has been switched off.**

8.2. REPLACEMENT OF THE FUSES

The power supply is protected with a primary fuse, type T6.3A / 250V.

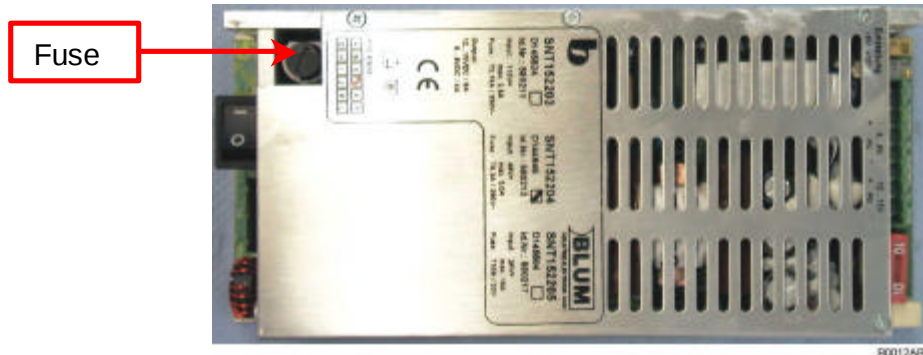


figure 8-1 Fuse replacement

8.3. REPLACEMENT OF THE MAINS CABLE

In case the length of the delivered mains cable should not be sufficient or in case of a defect, the mains cable can be replaced.

*** Note: Disconnect repeater from mains first!**

Remove the cover plate with the lock and open the housing by lifting the fixing clamp

The mains cable is now accessible from the bottom of the heat sink. Unscrew it from the clamps on the connecting board (see figure 8-2 Connecting board) as well as the small bar fixed with one tallow-drop screw M3.

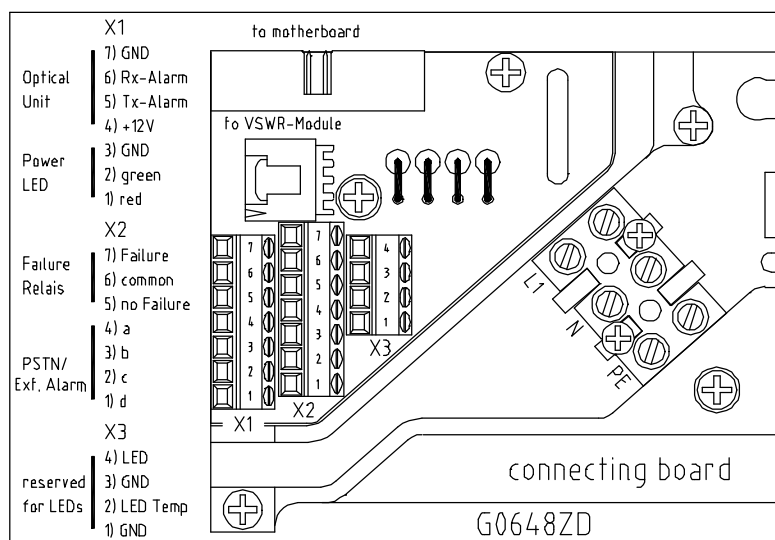


figure 8-2 Connecting board

Loose the mounting screw of cable gland at the outside of the heat sink (see figure 8-3 Cable gland) and pull the cable through the hole.

For mounting a new mains cable proceed in reverse order.

*** Note The diameter of the power supply lead has to be in the range of 9.5 mm max. and 6.5 mm min.**

Strip the isolation of the cable to the length of 18 cm and pull it through the cable gland like depicted in 8.4. Inside the housing, use the insulated tube.

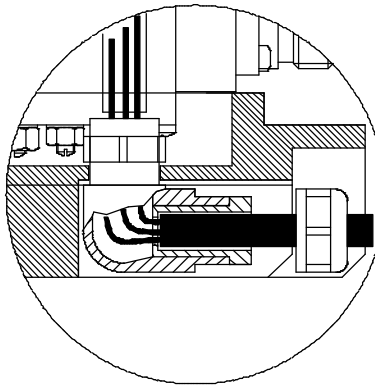


figure 8-3 Cable gland

8.4. REPLACEMENT OF THE RAM / RTC BATTERY

The RAM/RTC battery of the control module has to be replaced in case of memory loss or as a preventive measure after approximately three years usage. The RAM/RTC battery is mounted underneath the battery backup module. It is accessible after opening the housing on the left-hand side in the lid.

First remove the whole battery backup module (see chapter 8.5) which is plugged into the control module. By means of a small screwdriver, placed between the battery and the battery socket, the battery can be taken out of the battery socket.

The type of the battery is CR 2450 Lithium 3V/500mAh, manufacturer is RENATA.

After replacement of the RAM battery, the control module has its basic settings.

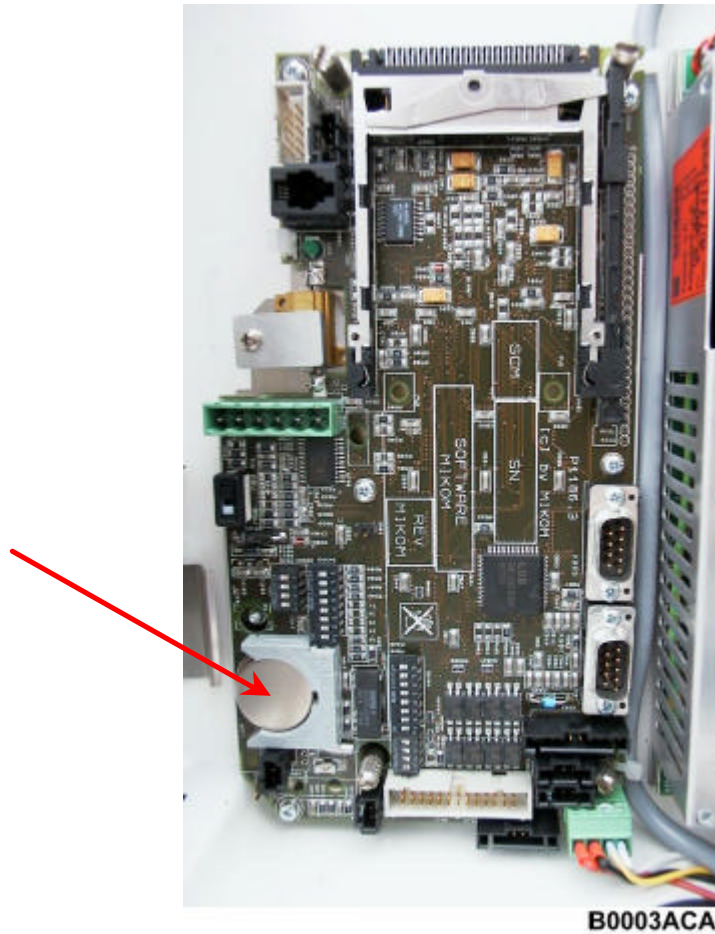


figure 8-4 Position of RAM/RTC battery

- * **Note** Before replacing the battery, disconnect the repeater from mains and take off the battery backup module.
- * **Note** Observe the rules for changing Lithium batteries. Wrong connection or treatment may result in bursting of the battery and dissemination of hazardous substances.
- * **Note** Don't try to charge this battery.

8.5. REPLACEMENT OF THE BATTERY BACKUP MODULE

The battery backup module has to be replaced in case of memory loss or as a preventive measure after approximately three years usage. The nominal lifetime of the accumulator is three years. The battery backup module is accessible after opening the housing on the left-hand side in the lid. It is recommended to replace the whole battery backup module which is plugged into the control module.

Before disconnecting the module from the socket, release the three snap-in lockings.

The control module has its basic settings after replacement.

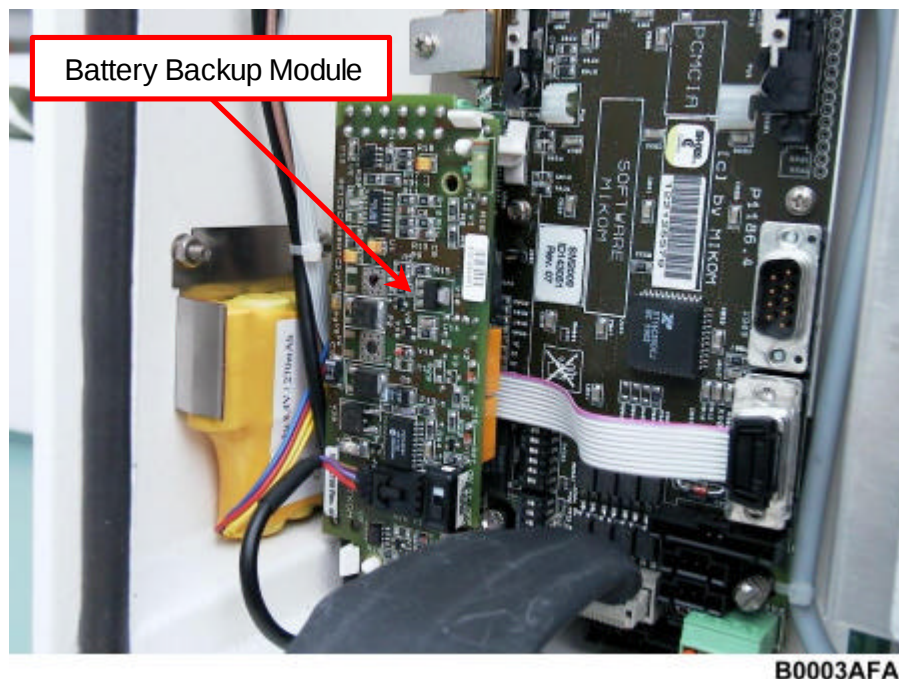


figure 8-5 Battery backup module

8.6. DUPLEXER

- **On side of the BTS antenna connector:**

Dismount connecting board first if the duplexer has to be replaced (see chapter 6.11).

Dismount the amplifier, mounted on the backside of the duplexer on the side of the DL input, by unscrewing two M2.5 Phillips screws. Take off the amplifier carefully. Pay attention not to damage the three pilot pins.

Remove the flat cable to the mother board.

Remove the RF cables on the side of the UL output by loosening the SMA connector by means of a torque wrench.

Unscrew the four counter sunk screws M3 at the connector panel.

Remove the grounding cable.

- **On side of mobile antenna connector:**

Dismount the amplifier, mounted on the backside of the duplexer on the side of the UL input, by unscrewing two M2.5 Phillips screws. Take off the amplifier carefully. Pay attention not to damage the three pilot pins.

Remove the RF cables on DL output by loosening the SMA connector by means of a torque wrench.

Unscrew the four counter sunk screws M3 at the connector panel (see figure 2.2.4-1 Connector panel layout).

Remove the grounding screw which is fixed to the extension module with a Phillips screw.

8.7. CONVERSION MODULE

Disconnect the SMA connectors by means of a torque wrench to remove the module.

Screw off the six hex socket screws by means of a hex socket key.

Pull the mounting strap carefully which is fixed on the conversion module and take off the module.

8.8. CONTROL MODULE SM 2009

The control module is a Printed Circuit Board and is situated in the lid of the housing.

Disconnect the DC cable from power supply.

Disconnect flat cable.

Remove the modem.

Take off the whole control module completely with chassis by unscrewing four nuts M4 or the four knurled screws.

For mounting proceed in reverse order.

8.9. POWER SUPPLY

*** Note Ensure that mains are disconnected and the battery backup module is switched off.**

The power supply is mounted in the lid of the housing. Open the repeater to get access to the device.

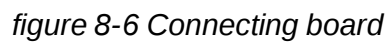
Remove all connected cables from the clamps of the power supply. Remove the ground cable.

The power supply is fastened to the lid of the housing by means of two nuts M4 on the right-hand side. After loosen the screws, the power supply can be removed. A special key with a mobile element will be required to open these screws.

*** Note Don't forget to put heat conducting paste on the mounting side for installation of a new power supply. Use the conducting paste which is included in the spare parts kit.**

The connecting board is mounted on top of the duplexer on the right-hand side in the heat sink.

Disconnect the flat cable, mains cable, the cable to power supply and grounding eyelet bolt.



9. APPENDIX

9.1. ELECTRICAL SPECIFICATIONS

9.1.1. Specifications of MR703P

Specifications	MR703P
Frequency range MR703P-ADB MR703P-EFC MR703P-DBEF	UL:1850-1885 MHz, DL: 1930-1965 MHz UL:1875-1910 MHz, DL: 1955-1990 MHz UL:1865-1895 MHz, DL: 1945-1975 MHz
Bandwidth	0.2-15 MHz, 2.5 dB gain degradation at 200 kHz
Gain	70 dB min., K2 dB over frequency and temperature range
Gain adjust range	30 dB in 2 dB steps
Spurious intermodulation	-13 dBm max.
Noise figure (@ max. gain)	UL and DL 8 dB max.
ALC dynamic range	10 dB
OICP-3	+44 dBm min.
P _{1dB}	+34 dBm min.
Return loss (@ 25°C amb. temp.)	10 dB min.
Power supply	110 Vac, 230 Vac, 24 Vdc or 48 Vdc
Power consumption	95 Watt typ.
Built in test equipment	Current monitor Synthesizer lock monitor Temperature ALC active
Alarm forwarding	Potential free relay contact and automatic alarm call via RS232 or PCMCIA interface
Control functions	Gain Center frequency ALC threshold
RF connectors	2 x 7/16 female, N as an option

*Please contact the MIKOM sales office for further questions to available bandwidths.

	GSM	TDMA	CDMA
P _{out} for 1 channel	34 dBm	31 dBm	27 dBm
P _{out} /channel for 2 channels	24 dBm	24 dBm	22 dBm
P _{out} /channel for 4 channels	20 dBm	20 dBm	19 dBm

table 9-1 Specification of MR703P

All data is subject to change without notice!

9.1.2. Specifications of MR803P

Specifications		MR803P
Frequency range	MR803P-TR MR803P-CE	UL: 806-824 MHz, DL: 851-869 MHz UL: 824-849 MHz, DL: 869-894 MHz
Bandwidth		0.2-25 MHz, 2.5 dB gain degradation at 200 kHz
Gain		70 dB min., K2 dB over frequency and temperature range
Gain adjust range		30 dB in 2 dB steps
Spurious intermodulation		-13 dBm max.
Noise figure (@ max. gain)		UL and DL 8 dB max.
ALC dynamic range		10 dB
OICP-3		+44 dBm min.
P _{1dB}		+34 dBm min.
Return loss (@ 25°C amb. temp.)		10 dB min.
Power supply		110 Vac, 230 Vac, 24 Vdc or 48 Vdc
Power consumption		95 Watt typ.
Built in test equipment		Current monitor Synthesizer lock monitor Temperature ALC active
Alarm forwarding		Potential free relay contact and automatic alarm call via RS232 or PCMCIA interface
Control functions		Gain Center frequency ALC threshold
RF connectors		2 x 7/16 female, N as an option

*Please contact the MIKOM sales office for further questions to available bandwidths.

	Analog	TDMA	CDMA
P _{out} for 1 channel	34 dBm	31 dBm	27 dBm
P _{out} /channel for 2 channels	24 dBm	24 dBm	22 dBm
P _{out} /channel for 4 channels	20 dBm	20 dBm	19 dBm

table 9-2 Specification of MR803P

All data is subject to change without notice!

9.2. MECHANICAL SPECIFICATION

Standard cabinet:

Max. Height x Width x Depth: 445 x 255 x 167*/185 mm (Main Unit)
*without mounting brackets

Volume: < 14 litres

Weight: approximately 14 kg per unit, standard configuration

9.3. ENVIRONMENTAL AND SAFETY SPECIFICATIONS

For detailed information, refer to the environmental and safety specification leaflet for MIKOM indoor/outdoor cell enhancers, related to ETS 300 019 (European Telecommunication Standard).

Operating temperature:

- Normal temperature range: +5°C...+40°C
- Extreme temperature range: -33°C +50°C

Humidity: 90% @ +30°C

9.4. SPARE PARTS LISTS

The following lists contain all parts available for the MRx03P. The configuration of the delivered unit meets the requirements of the customer and can differ depending on the state of the delivery.

9.4.1. Spare Parts List of MR703P

Repeater:	Repeater Id.-No.:		
MR703P-ADB:	154856	---	---
MR703P-EFC:	---	154861	---
MR703P-DBEF:	---	---	154862

Designation:	Id.-Nos.:		
	MR703P ADB	MR703P EFC	MR703P DBEF
PCS-Duplexer UL	144382	144384	151072
PCS-Duplexer DL	144381	144383	151073
Basic Module var. 15 MHz	151463		
Final Amplifier 4 Watt	154737		
Power supply, no plug, 185-320 Vac	148812		
Power Supply, no plug, 230 Vac $\pm 15\%$	144306		
Power Supply, USA plug, 115 Vac $\pm 15\%$	141230		
Power Supply, no plug, 80-130 Vdc	145524		
Power Supply, no plug, 36-72 Vdc	144946		
Power Supply, no plug, 18-43 Vdc	145504		
MO4000 Kit	154633		
I ² C-Board	153144		
Modem Kit PSTN	143112		
Ext. Alarms SW-Option	145067		
2 Ext. Alarms + PSTN	148272		
Battery Backup Module	143052		
SW MOB100 V1.10	143055		
SW REP1009 V1.11	147127		
Mother Board	148968		
Connecting Board	142362		
Control Unit SM4000	151957		
Control Unit SM2009	143051		

table 9-3 Spare parts list of MR703P

Mikom reserves the right to replace the spare parts listed above by equivalent substitutes!

9.4.2. Spare Parts list of MR803P

Repeater:	Repeater Id.-No.:	
MR803P-CE: 806-824 MHz;851-869 MHz	---	155340
MR803P-CE: 824-849 MHz;869-894 MHz	155215	--

Designation:	Id.-Nos.:	
	MR803P-CE	MR803P-TR
PCS-Duplexer UL	148334	148333
PCS-Duplexer DL	148335	148336
Basic Module var. 15 MHz	151976	150150
Final Amplifier 4 Watt	155191	
Power Supply, no plug, 185-320 Vac	148812	
Power Supply, no plug, 230 Vac $\pm 15\%$	144306	
Power Supply, USA plug, 115 Vac $\pm 15\%$	141230	
Power Supply, no plug, 80-130 Vdc	145524	
Power Supply, no plug, 36-72 Vdc	144946	
Power Supply, no plug, 18-43 Vdc	145504	
MO4000 Kit	154633	
I ² C-Board	153144	
Modem Kit PSTN	143112	
Ext. Alarms SW-Option	145067	
2 Ext. Alarms + PSTN	148272	
Battery Backup Module	143052	
SW MOB100 V1.10	143055	
SW REP1009 V1.11	147127	
Mother Board	148968	
Connecting Board	142362	
Control Unit SM4000	151957	
Control Unit SM2009	143051	

table 9-4 Spare parts list of MR803P

Mikom reserves the right to replace the spare parts listed above by equivalent substitutes!

9.5. INSTALLATION DRAWING OF THE REPEATER

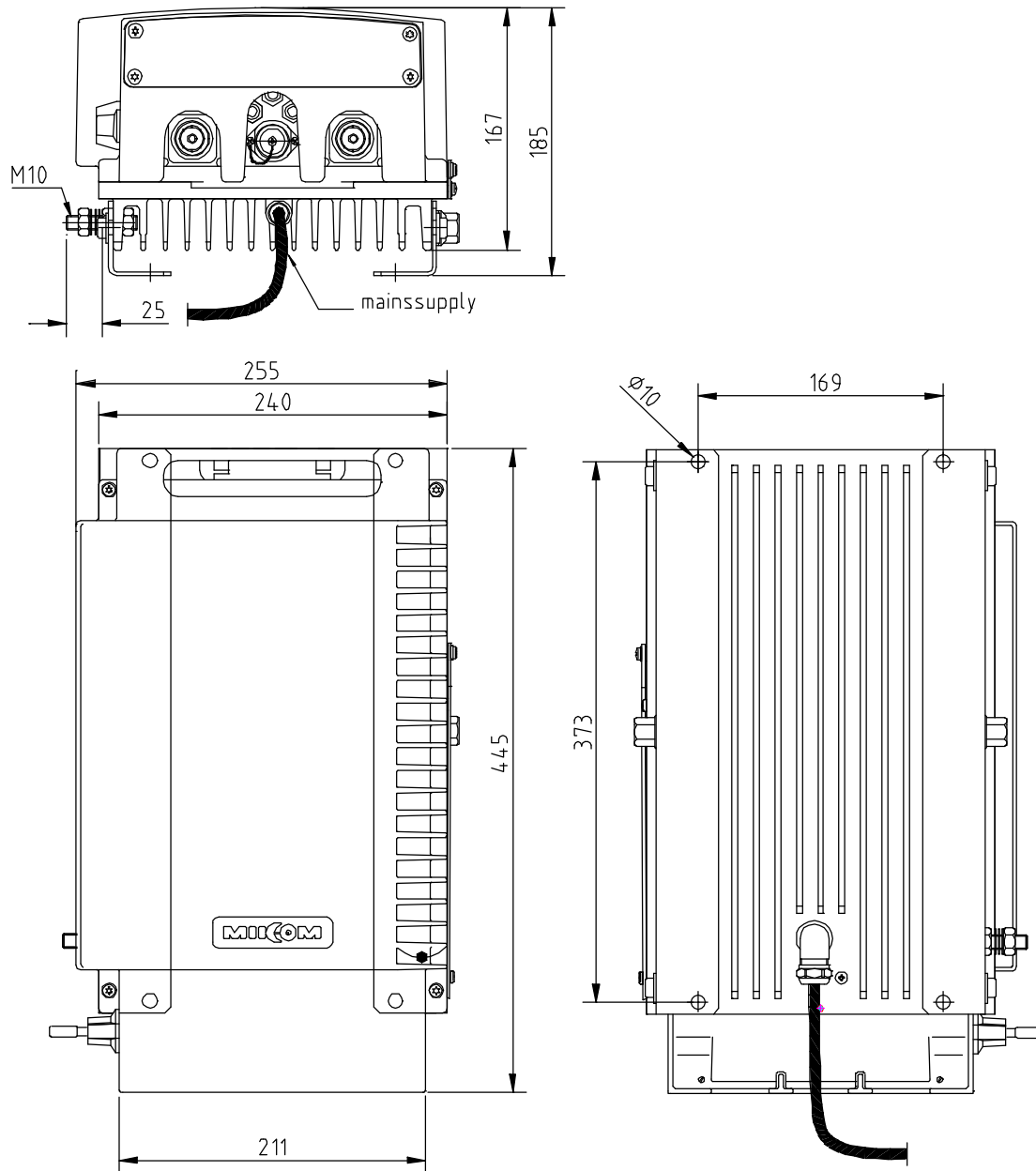


figure 9-1 Installation drawing of MRx03P

9.6. LAYOUT OF THE REPEATER LID

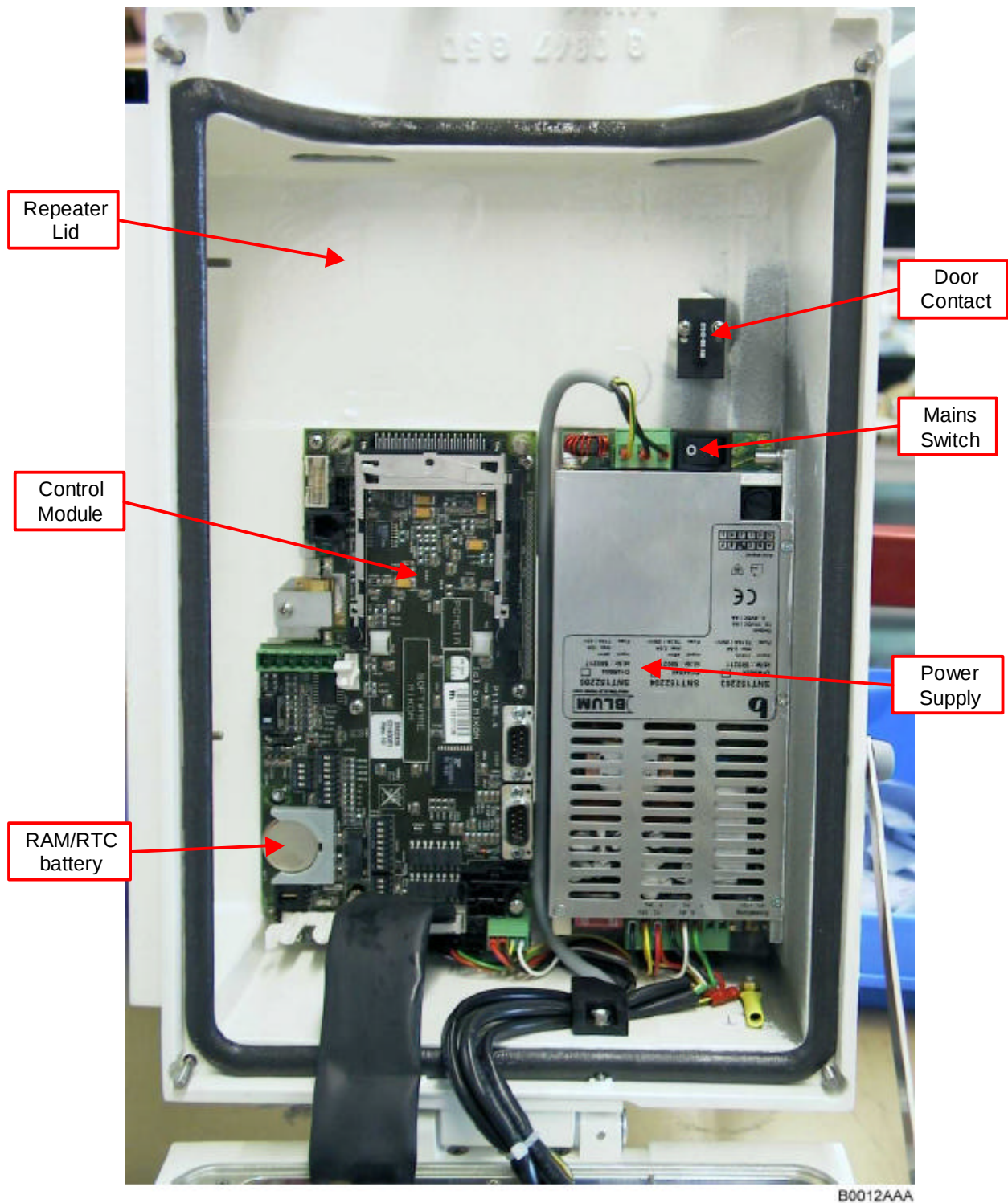


figure 9-2 Repeater lid

9.7. LAYOUT OF THE REPEATER HEAT SINK

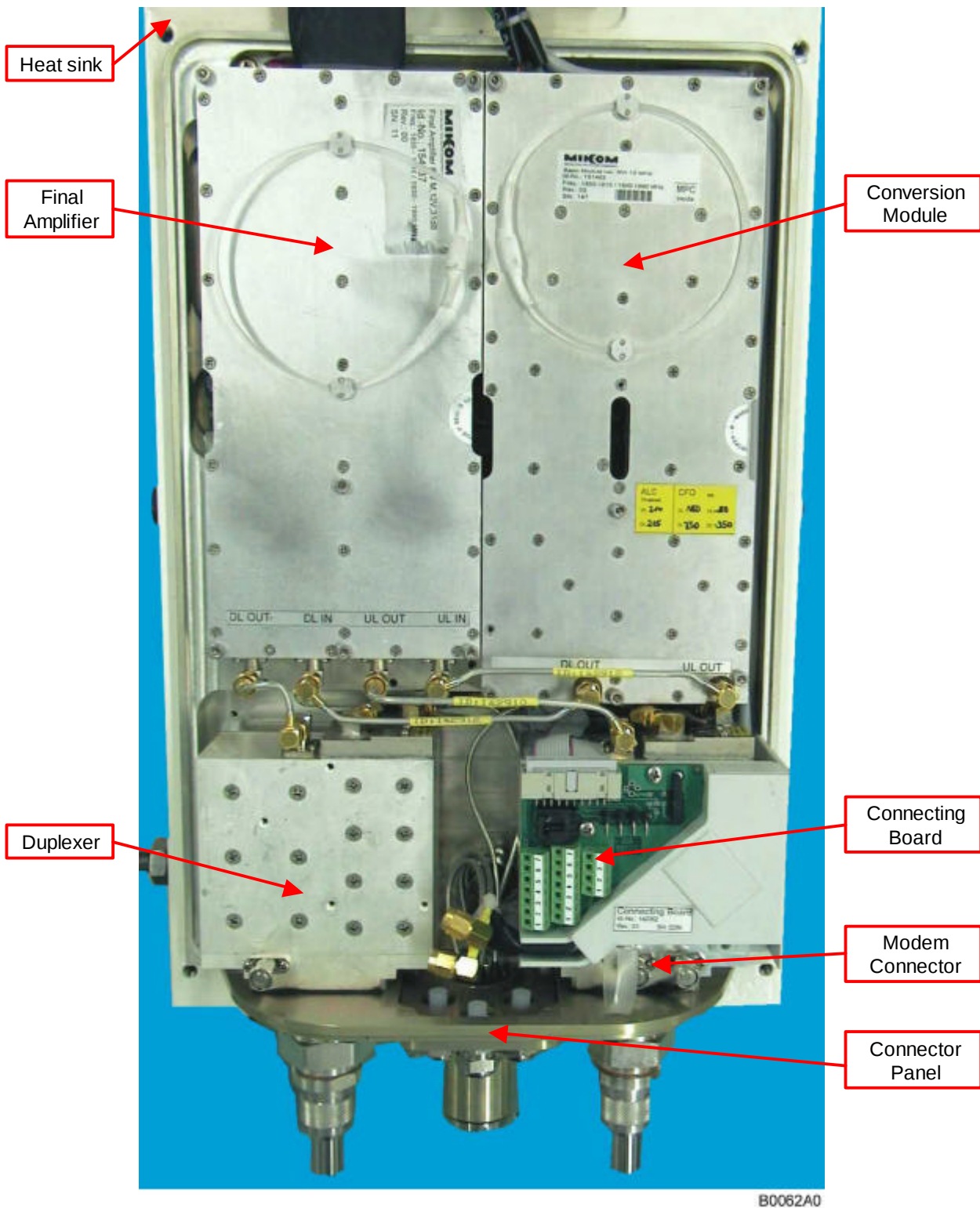


figure 9-3 Repeater heat sink

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