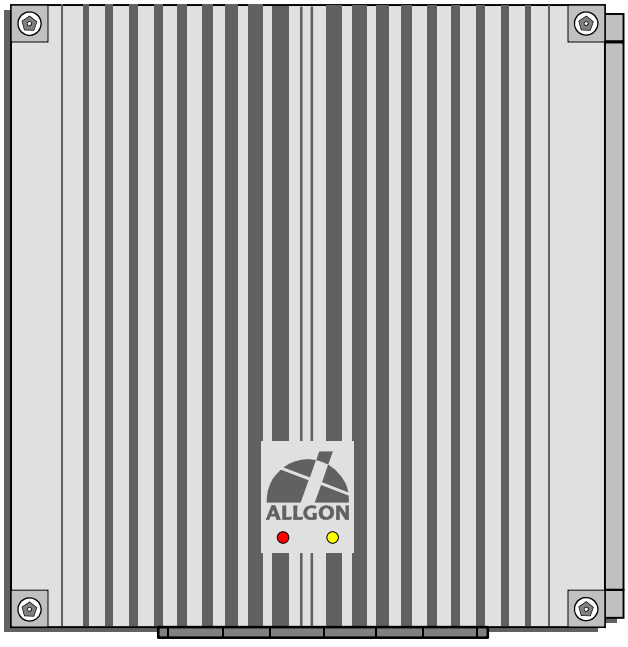
User's Manual

ALR Compact Repeater



ALLGON

Low Power Band Selective Repeater

English

VD203 67/EN

User's Manual

ALR Compact Repeater

Low Power Band Selective Repeater

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English

This document describes installation, commissioning and the design of the Allgon ALR Compact Repeater.

Communication between the Allgon ALR Compact Repeater and an operator is carried out either by using Allgon OMT32 (Operation and Maintenance Terminal), or Allgon OMS (Operation and Maintenance System). OMT32 is described in the *AR Repeaters and OMT32, User's Manual*. OMS is described in the *Advanced Repeater OMS, User's Manual*.

Hardware and software mentioned in this document are subjected to continuous development and improvement. Consequently, there may be minor discrepancies between the information in the document and the performance and design of the product. Specifications, dimensions and other statements mentioned in this document are subject to change without notice.

In this document, the '<>' brackets are used to indicate function keys contrary to a series of key strokes '<Del>' = the Del(ete) key, 'Del' = D, e, l.

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Abbreviations

Abbreviations used in this manual, in the software, and in the repeater:

AGC	Automatic Gain Control
AMPS	Advanced Mobile Phone Service
BCCH	Broadcast Control Channel (GSM broadcast channel time slot)
BS	Base Station, BS antenna = towards the base station
BSC	Band Selective Compact repeater board for adjustable bandwidth
CDMA	Code Division Multiple Access
CMB	Combiner unit
CW	Continuous Wave
DAMPS	Digital Advanced Mobile Phone Service
DCS	Digital Communication System (same as PCN)
DL	Downlink signal direction (from base station via repeater to mobile station)
DPX	Duplex filter
EEPROM	Electrical Erasable Programmable Read Only Memory
EGSM	Extended Global System for Mobile communication
ETACS	Extended Total Access Communication System
ETSI	European Telecommunications Standard Institute
GSM	Global System for Mobile communication
HW	Hardware
LED	Light Emitting Diode
MS	Mobile Station, MS antenna = towards the mobile station
MSC	Mobile Switching Center
NMT	Nordic Mobile Telephone system
OMS	Operation and Maintenance System
OMS/PC	Desktop or notebook with installed OMS software
OMT32	Operation and Maintenance Terminal
OMT32/PC	Desktop or notebook with installed OMT32 software
PCN	Personal Communication Network (same as DCS)
PCS	Personal Communication System
PSM	Power Supply Unit
PTFE	Polytetrafluoro Ethylene (Teflon)
RCC	Remote Control unit for Compact repeater
RF	Radio Frequency
RSSI	Received Signal Strength Indication
RTC	Real Time Clock
SW	Software
TACS	Total Access Communication System
TDMA	Time Division Multiple Access
TMN	DeTe Mobile Network
UL	Uplink signal direction (from mobile station via repeater to base station)
UPS	Uninterruptible Power Supply

1. Safety

Any personnel involved in installation, operation or service of Allgon repeaters **must** understand and obey the following:

- Allgon repeaters are designed to receive and amplify signals from one or more base stations and retransmit the signals to one or more mobile stations. Also, the repeaters are designed to receive signals from one or more mobile stations, amplify and retransmit to the base stations. The repeaters must be used exclusively for these purposes and nothing else.

- Repeaters supplied from the mains must be connected to grounded outlets and in conformity with any local regulations.

- The power supply unit contains dangerous voltage that can cause electric shock. Disconnect the mains prior to any work in the repeater. Any local regulations are to be followed when servicing repeaters.

  Authorized service personnel only are allowed to service repeaters while the mains is connected.

- The repeater cover must be secured in opened position, e.g. by tying it up, at outdoor repeater work. Otherwise, the cover can be closed by the wind and cause your fingers getting pinched or your head being hit.

- When working on a repeater on high ground, e.g. on a mast or pole, be careful not to drop parts or the entire repeater. Falling parts can cause serious personal injury.

- Any repeater, including this repeater, will generate radio signals and thereby give rise to electromagnetic fields that may be hazardous to the health of any person who is extensively exposed to the signals at the immediate proximity of the repeater and the repeater antennas.

HYDROGEN FLUORIDE

- The coaxial cable insulation is made of PTFE, polytetrafluoro ethylene, that gives off small amounts of hydrogen fluoride when heated. Hydrogen fluoride is poisonous. Do not use heating tools when stripping off coaxial cable insulation.

  No particular measures are to be taken in case of fire because the emitted concentration of hydrogen fluoride is very low.

- A lithium battery is permanently mounted on the repeater board. Due to the risk of explosion, this battery must only be removed from the board by an authorized service technician.

Static Electricity

Static electricity means no risk of personal injury but it can severely damage essential parts of the repeater, if not handled carefully.

Parts on the printed circuit board as well as other parts in the repeater are sensitive to electrostatic discharge.

Never touch the printed circuit board or uninsulated conductor surfaces unless absolutely necessary.

If you must handle the printed circuit board or uninsulated conductor surfaces, use ESD protective equipment, or first touch the repeater chassis with your hand and then do not move your feet on the floor.

Never let your clothes touch printed circuit boards or uninsulated conductor surfaces.

Always store printed circuit boards in ESD-safe bags.

2. Introduction

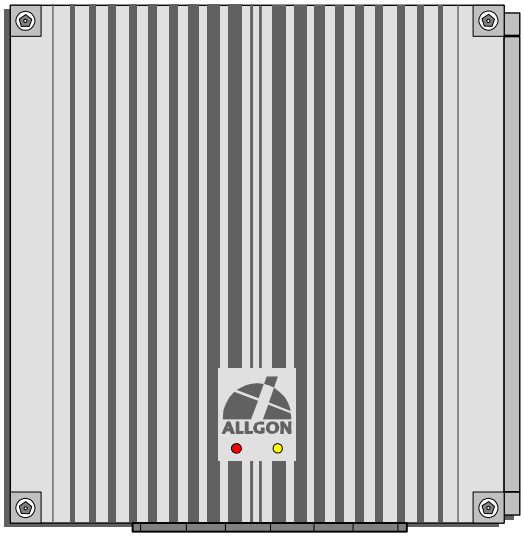


Figure 2-1. Allgon ALR Compact Repeater

Allgon repeaters are used to fill out uncovered areas in cellular mobile systems, such as base station fringe areas, road tunnels, business and industrial buildings, etc.

A repeater receives signals from a base station, amplifies and retransmits the signals to mobile stations. Also it receives, amplifies and retransmits signals in the opposite direction. Both directions are served simultaneously.

To be able to receive and transmit signals in both directions, the repeater is connected to a donor antenna directed towards the base station and to a service antenna directed towards the area to be covered.

Control of the repeaters is performed using a desktop or notebook loaded with the Allgon OMT32, *Operation and Maintenance Terminal*, which can communicate with the repeaters, either locally or remotely via modem. Remote operation can be performed either via a traditional telephone line or via a mobile phone that can be installed inside the repeater.

To be able to control many Allgon AR repeaters in common, there is an Allgon OMS, *Operation and Maintenance System*.

The compact repeater is described in this manual. OMT32 is described in the *AR Repeaters and OMT32, User's Manual*. OMS is described in the *Advanced Repeater OMS, User's Manual*.

Repeater Types

The following repeater types are available:

- Band selective repeater with adjustable bandwidth
- Combined repeater

Band selective repeater with adjustable bandwidth

The band selective compact repeater has filters that can be set to various bandwidths. This repeater type is used for analog or digital systems, such as NMT, TACS/ETACS, AMPS, DAMPS and CDMA.

Combined repeater

Two separate band selective repeater units for different bandwidths or systems can be combined in the same repeater chassis and be in operation in parallel.

Using Repeaters

In areas where the radio signal propagation is poor repeaters can be used to fill out those areas which are not covered by the base station.

The following scenarios are examples on this:

- Sports arenas
- Fair halls
- Large shopping centres
- Road and railway tunnels
- Indoors in buildings with metal or concrete walls

Other examples where repeaters can be used to increase the coverage are:

- Shaded areas
- Fringe coverage areas

In areas where the traffic intensity is low, it is not cost efficient to install a base station. An Allgon repeater, which can be installed with a minimum of investments, is a much better solution. You save installation costs as well as operational costs.

Examples of using repeaters

Two examples are described in the following sections. An outdoor example in a shaded valley and an indoor example in a sports arena.

Shaded Area

A valley is shaded by hills. There is a base station 5 kilometers away, but the lowest signal strength in the valley is less than –100dBm. A mast used for other purposes is available for a repeater installation. The mast height is 42 meter and it is located on a hill. The scenario is illustrated in Figure 2-2.

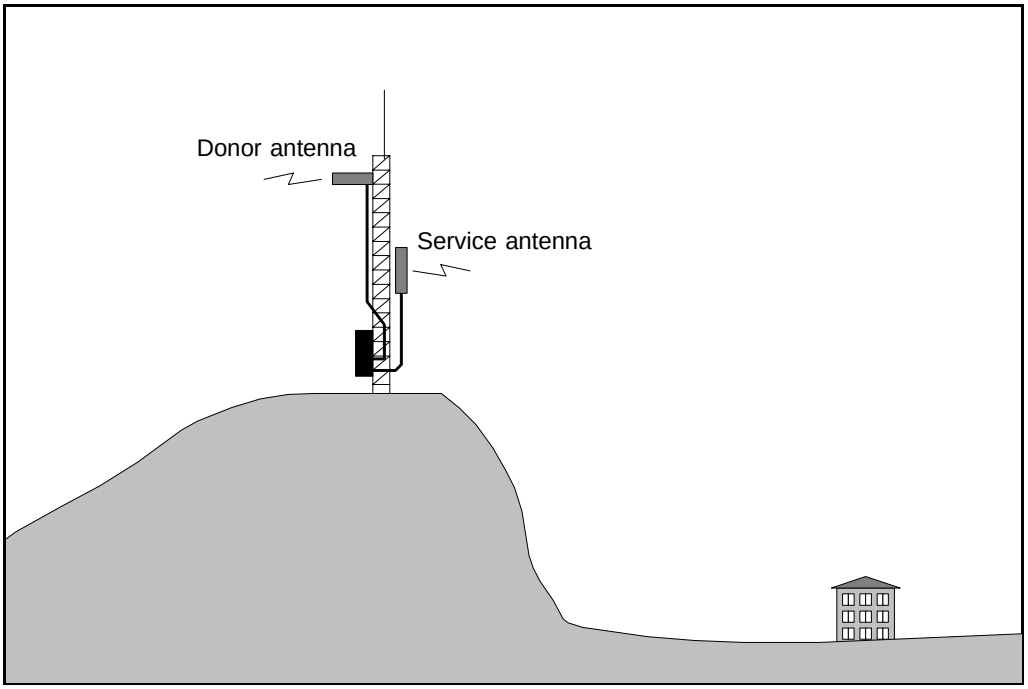


Figure 2-2. Repeater coverage of shaded area

The donor antenna of the repeater was mounted at the top of the mast and the service antenna was mounted at the half mast. The antenna isolation was measured to over 100dB. The repeater was set to max. 80dB gain.

Measured levels:	Received signal level	– 60.0 dBm
	Donor antenna gain	15.0 dBi
	Cable loss	– 5.0 dB
	Repeater input level	– 50.0 dBm
	Adjusted repeater gain	70.0 dB
	Repeater output level	20.0 dBm
	Cable loss	– 5.0 dB
	Service antenna gain	8.0 dBi
	Radiated output level	23.0 dBm

The measured result in the valley was better than –90dBm.

Sports Arena

A 2000 spectators sports arena with metallic roof had an indoor signal strength too low to provide a fair service in most parts of the arena. The nearest base station was 8 kilometers away and it was equipped with one carrier only.

A donor antenna directed towards the base station was mounted on a mast outside the building and a repeater was installed inside the building with the service antenna on the arch vault. The scenario is illustrated in Figure 2-3.

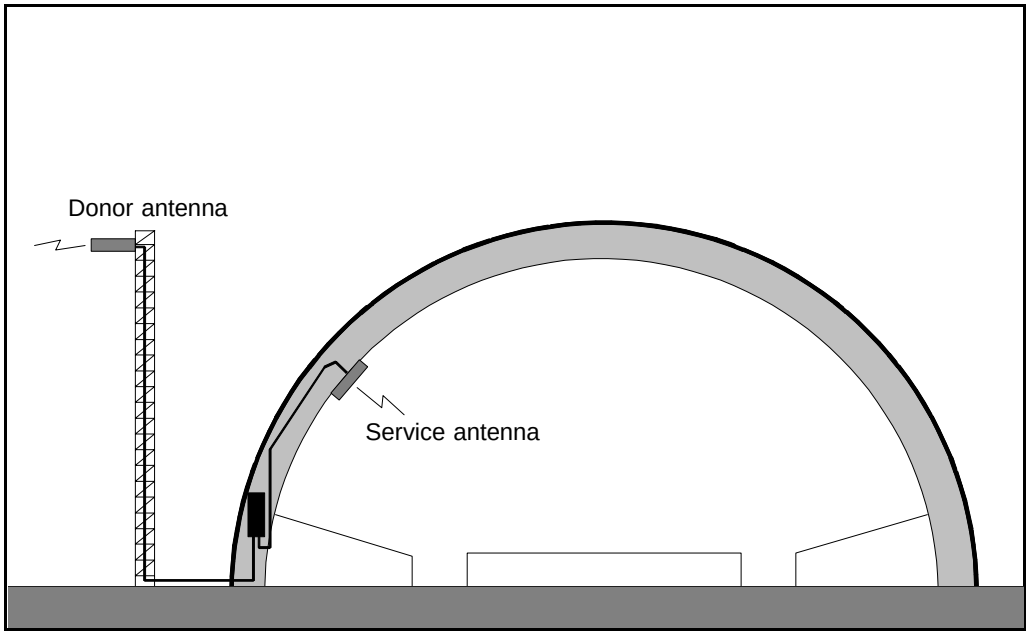


Figure 2-3. Repeater in sports arena

The antenna isolation was measured to over 85dB.

Measured levels:	Received signal level	– 80.0 dBm
	Donor antenna gain	15.0 dBi
	Cable loss	– 5.0 dB
	Repeater input level	– 70.0 dBm
	Adjusted repeater gain	70.0 dB
	Repeater output level	0.0 dBm
	Cable loss	– 2.0 dB
	Service antenna gain	7.0 dBi
	Radiated output level	5.0 dBm

The signal strength was fair for service in the entire arena.

3. Installation

Before installation, read carefully Chapter 1, *Safety*.

Siting the Repeater

Allgon repeaters are designed for outdoor usage. However, humidity and temperature changes may have affect on the reliability. A preferable site for the repeater is thus indoor, in a tempered and ventilated room.

Sunshine

If a repeater is placed outdoor and can be exposed to direct sunshine, it is essential that the air can circulate around the repeater with no obstacle.

The operating temperature must not exceed +55°C. A shelter can be used to shade the repeater from direct sunshine.

Shelter

Allgon repeaters are designed with a weather proof outdoor case that can be mounted without any kind of shelter from rain, snow or hail.

If a repeater is to be opened on the site when raining, snowing, or hailing there must be some kind of permanent or temporary shelter. This is applicable to gentle rainfall, snowfall or hail. Limitations for very bad weather is found in the next section.

Outdoor Installation and Service Limitations

Sited outdoors, the repeater **must not be opened** for installation or service at bad weather, such as:

- Intense rainfall, snowfall or hail
- Storm or high wind
- Extremely low or high temperature
- High humidity of the air

Dimensions and Weights

The dimensions of the repeater, including the mounting bracket, is shown in Figure 3-1. The repeater chassis consists of two main parts, a **cabinet** in which the circuitry is housed, and a **cover**, which can be either a thin cover or a large cover (see the figure) depending on the configuration.

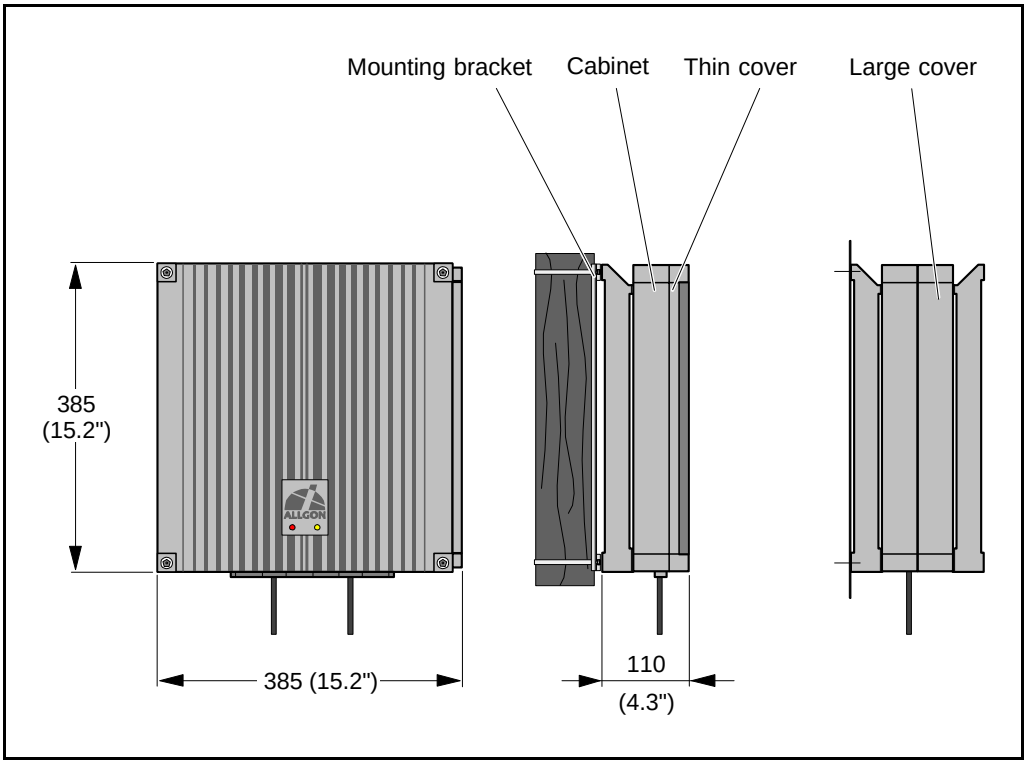


Figure 3-1. Repeater dimensions

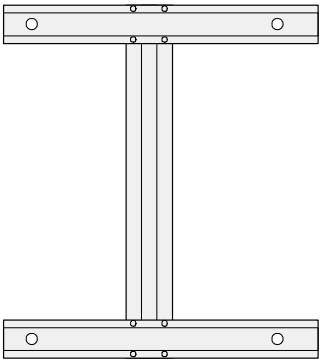
Approximately repeater weight

Repeater with thin cover ..... 10 kg (22 lbs)

It is not recommended to remove the cover from the cabinet at the site.

However, if the cover, for some reason, has to be removed from the cabinet, then disconnect the interconnection cables, close the cover, remove the hinge shafts, and remove the cover.

Mounting



The ALR repeater is easy to mount, either by anchoring the repeater in the fixing holes, or using the an optional mounting bracket.

The mounting bracket is shown in the figure.

1. Mount the repeater.

Normally, the repeater is mounted on a wall, pole, or mast. These mounting cases are shown below.

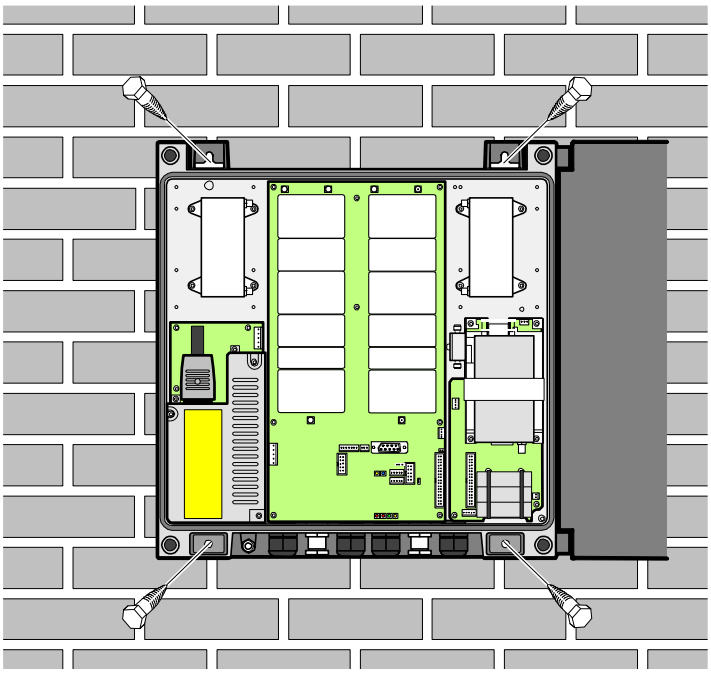


Figure 3-2. Attaching the repeater to a wall

Figure 3-2 shows how to mount the repeater to a wall using four fixing screws.

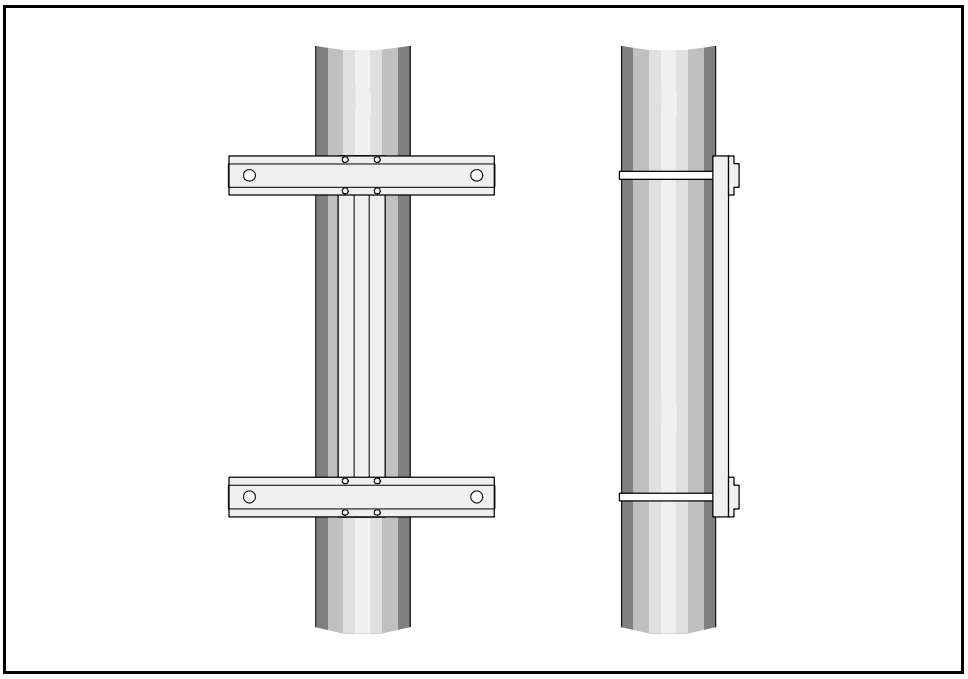


Figure 3-3. Attaching the bracket to a pole

Figure 3-3 shows a bracket attachment to a pole using tensioning devices.

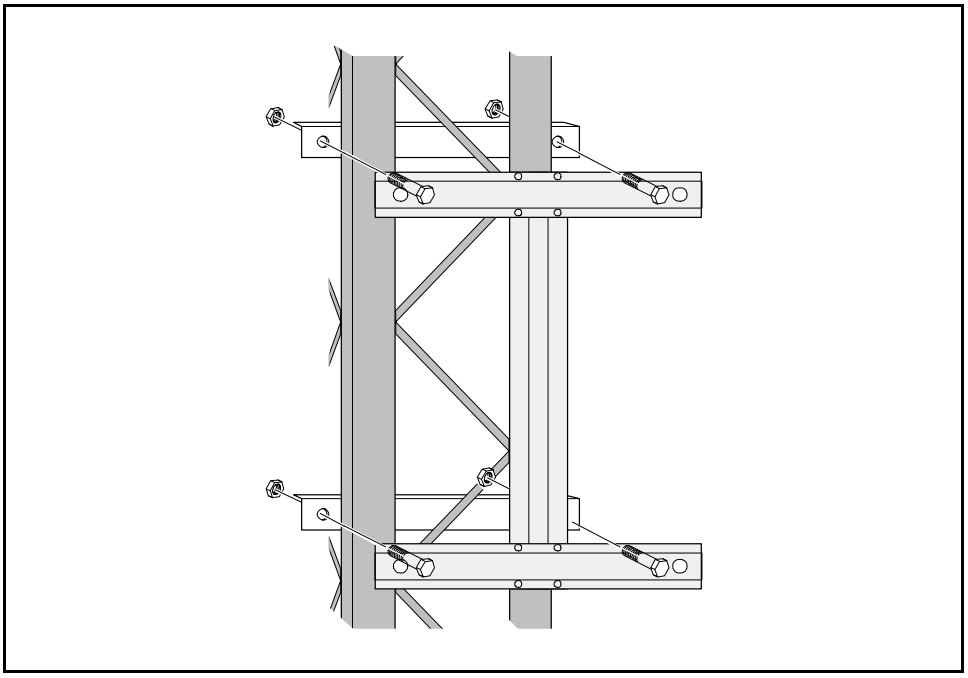


Figure 3-4. Attaching the bracket to a mast

Figure 3-4 shows a bracket attachment to a mast using the two provided angle irons and four screws. The screw heads are slided into the bracket profile.

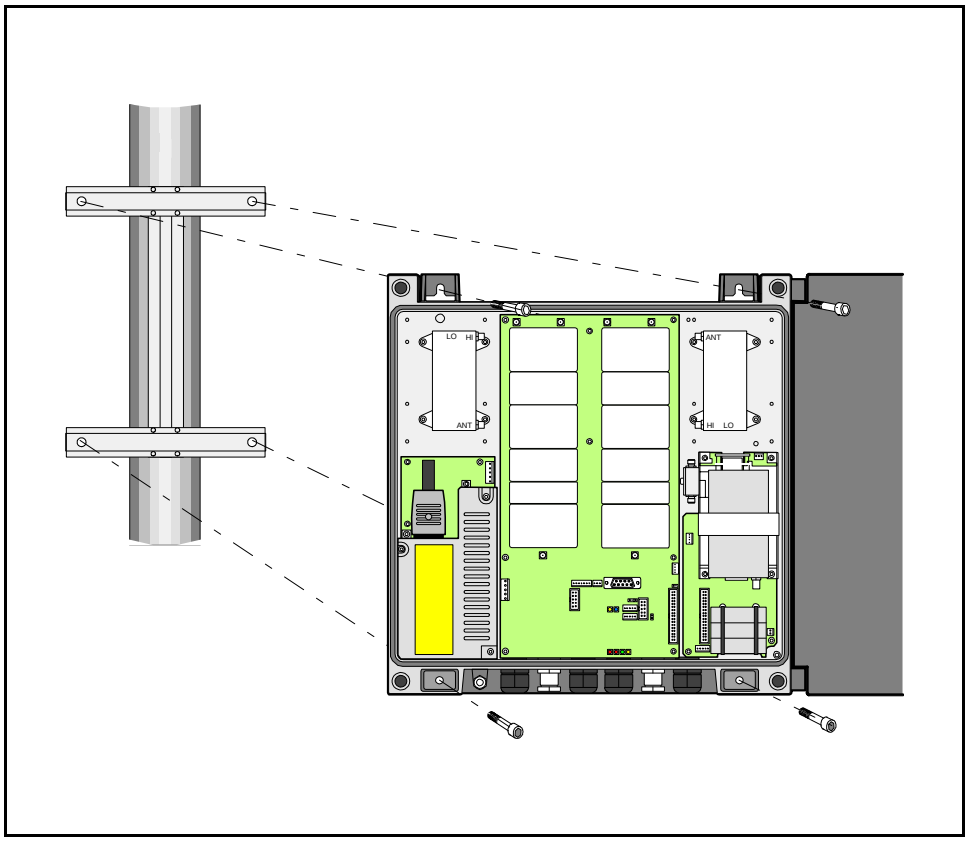


Figure 3-5. Attaching the repeater to the bracket

If the mounting bracket is used, then mount the repeater on the bracket using four fixing screws (see Figure 3-5).

2. Mount the donor antenna directed towards the base station antenna.

3. Mount the service antenna directed towards the area to be covered by the repeater.

Connection

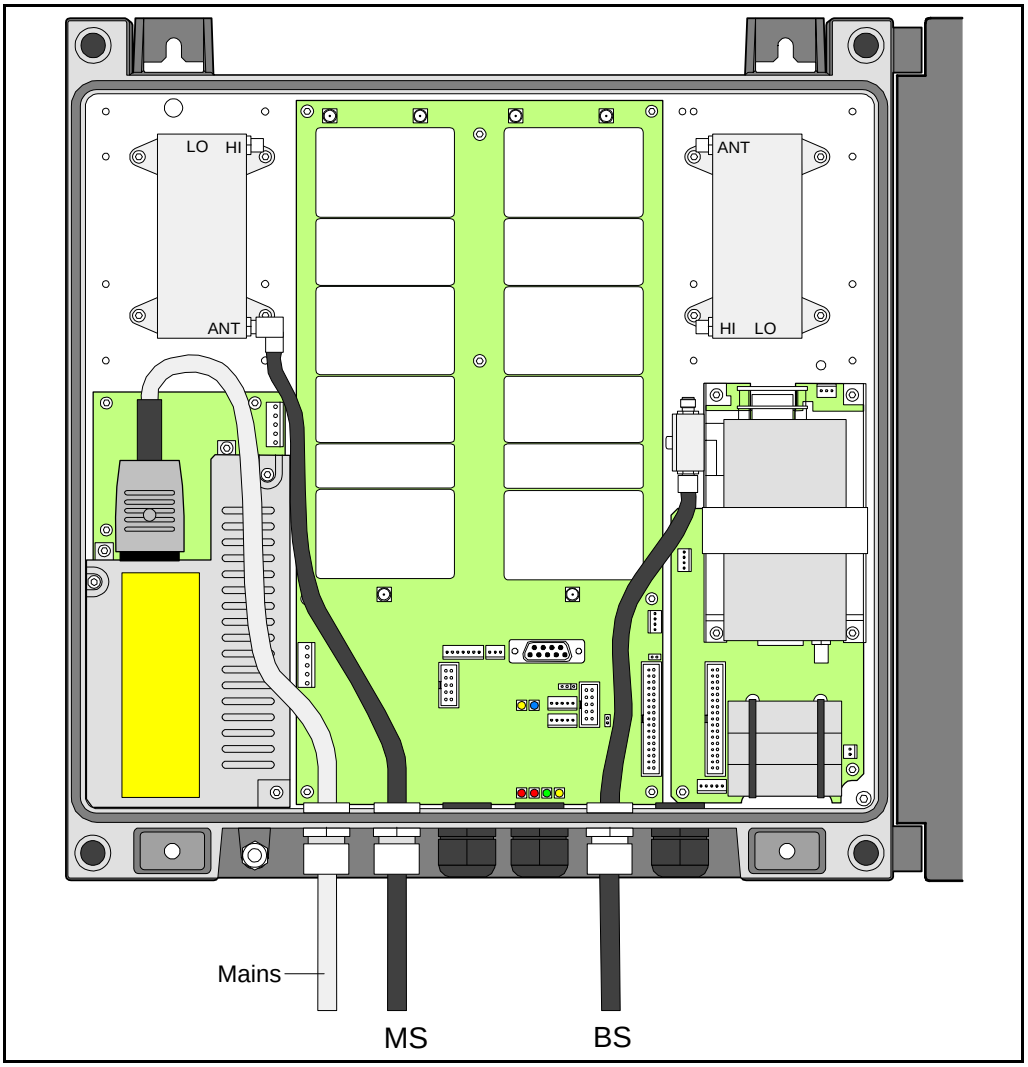


Figure 3-6. MS and BS antenna connections

1. Connect the service antenna (MS) and donor antenna (BS) coaxial cables (see Figure 3-6). N type female connectors are used in the repeater.

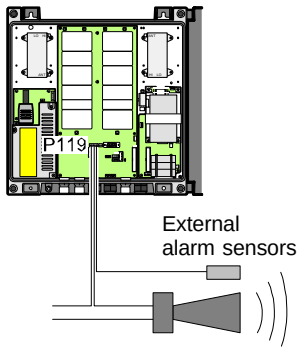
The donor antenna (BS) is connected to the right in the cabinet.

The service antenna (MS) is connected to the left in cabinet.

2. Make sure the mains connector is connected to the power supply unit, PSM.

☞ *For repeaters supplied from the mains, the mains outlet must be grounded. Connect the yellow/green cable part to ground.*

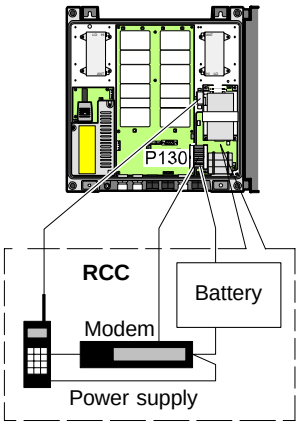
☞ *Both the mains plugs of repeaters equipped with two power supply units must be connected to outlets supplied from the same fuse.*



3. Connect external alarm sensors (burglary, fire, etc.) and other external alarm equipment (optical or acoustic signal, etc.), if any. Cables for this installation is taken through a free strain relief bushing on the bottom of the repeater, in the same way as the mains cable and the antenna cables.

External alarm is connected to the P119 alarm port located in the centra in the cabinet (see Figure 3-7 on page 3-9). Use a 7 pole male connector.

The P119 port is described on page 3-11.



This is a schematic figure of the various RCC parts.

4. Connect the internal phone/modem unit for remote control of the repeater, if any.

The modem and a power backup unit are integrated in an RCC, Remote Control unit for Compact repeater, which is mounted to the right inside the cabinet and connencted to the P130 port located to the right in the cabinet (see Figure 3-7 on page 3-9).

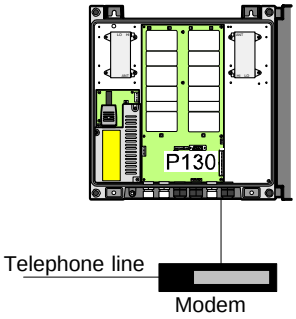
The RCC is also powered by the P130 port.

The mobile phone antenna is connected to the BS antenna via an uplink combiner located at the RCC unit to the right in the cabinet, provided that the phone and the repeater operate in the same system.

Pin 1 and 2 of the P130 port are interconnected with a jumper if no RCC is used. This jumper must be removed before plugging the RCC connector to the P130 port.

If the RCC is removed, the jumper between pin 1 and 2 on the P130 port must be reconnected. Otherwise, a part of the circuitry will have no voltage supply. Do not connect the jumper to another position than between pin 1 and 2 on the P130 port.

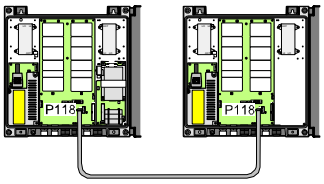
The P130 port is described on page 3-12.



5. Connect a telephone line for remote control of the repeater, if any. The telephone line is connected to a modem, which is connected to the P130 modem port on the repeater.

The P130 port is described on page 3-12.

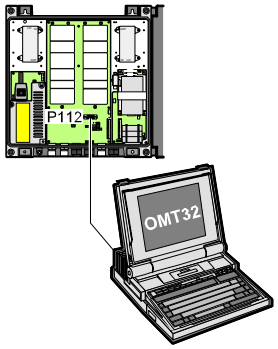
Use a free strain relief bushing at the bottom of the repeater for the external telephone line cable.



6. Connect the *Repeater to Repeater Link* cable, if this optional feature is to be used. The R2R net cable is connected to the P118 or P124 Repeater to Repeater Link ports to the right in the repeater.

The P118 and P124 Repeater to Repeater Link port s are described on page 3-10 and page 3-12.

Free strain relief bushings at the bottom of the repeaters are used for the external net cable.



7. Connect a PC for controlling the repeater. A COM port on the PC is connected to the P112 PC port located to the right in the cabinet (see Figure 3-7 on page 3-9). Use a standard RS-232 serial cable.

Port P112 is described on page 3-10.

Now, you can commission the repeater as described in Chapter 4.

Connection Ports and Station Ground

Connectors involved in the installation are described below.

Station ground is also detailed below.

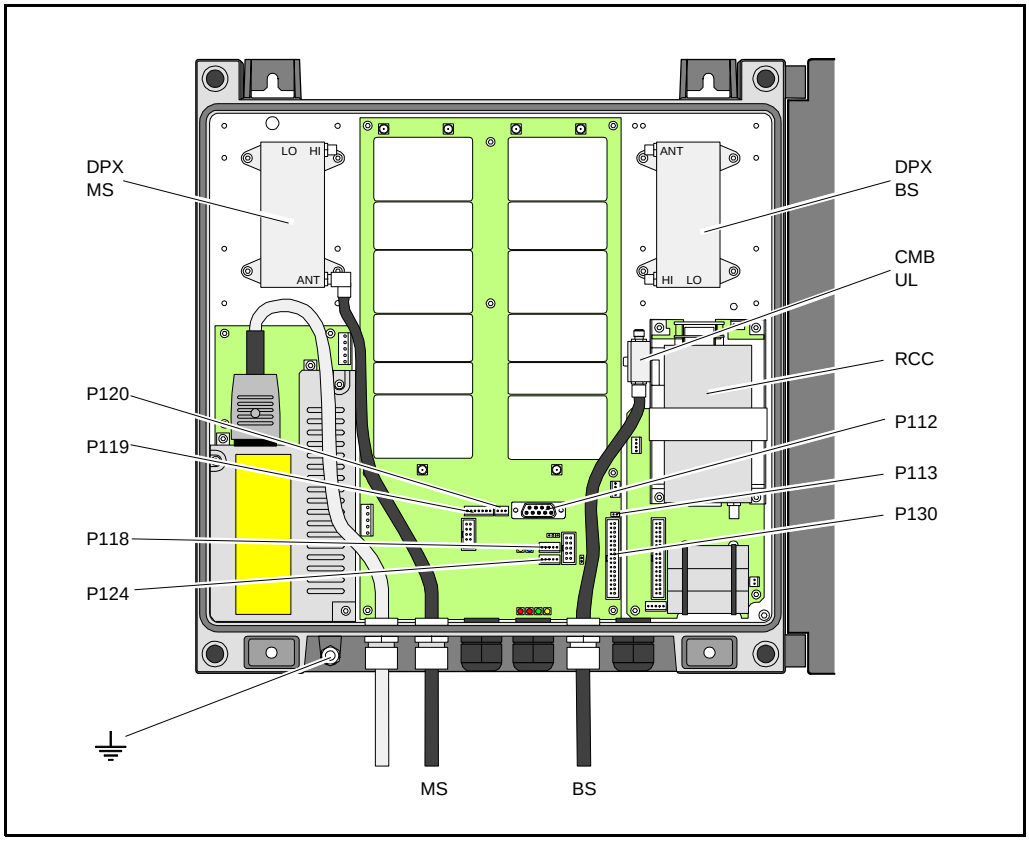
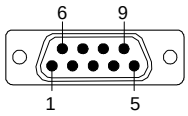


Figure 3-7. Connection ports and station ground

Station Ground

There is a ground screw (M8) on the repeater that is intended for station ground (see Figure 3-7). This screw must be used only for station grounding.

P112 PC Port



PC port P112 is a RS-232 port used for local PC communication.

P112 is a 9 pole D-sub female connector located to the right in the cabinet (see Figure 3-7).

Connector pinning

Pin 1 Not used
Pin 2 Data from repeater to OMT32
Pin 3 Data from OMT32 to repeater
Pin 4 DTR from OMT32 to repeater
Pin 5 GND
Pin 6 DSR from repeater to OMT32
Pin 7 RTS from OMT32 to repeater
Pin 8 CTS from repeater to OMT32
Pin 9 Not used

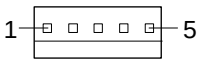
P113 Parking Device

P113 is a parking device for a jumper used for the P130 port. The jumper is used to interconnect pin 1 and pin 2 of the P130 port when there is no RCC remote communication control unit connected to the repeater.

When an RCC unit is connected to the repeater, then the jumper can be placed in P113.

P113 is an unconnected 2 pole male connector located to the right in the cabinet, adjacent to the P130 connector (see Figure 3-7).

P118 Repeater to Repeater Link Port

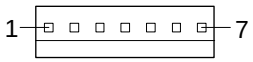


P118 is used for the *Repeater to Repeater Link* feature (R2R net).

P118 is a 5 pole male connector located to the right in the cabinet, adjacent to the P124 connector (see Figure 3-7).

The P118 and P124 ports are identical an connected in series. One of the connectors are intended to be used from the previous repeater in the net chain, and the other connetor to the next repeater in the net chain. Either of P118 or P124 can be used for the first and the last repeater in the net chain.

P119 Alarm Port



Alarm port P119 is used for external alarm sensors and alarm equipment.

P119 is a 7 pole male connector located in the center of the cabinet (see Figure 3-7).

The port has four alarm inputs, EAL1 - EAL4.

The four alarm inputs

The inputs are low-level inputs with common ground (AIC).

Use insulated switch or relay to initiate alarms (open switches in normal operating mode, closed switches cause alarm).

The alarm switch connection can be toggled between being active open or active closed. This is further described in the *AR Repeaters and OMT32, User's Manual*.

The alarm input voltage ratings, related to ground, are:

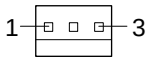
Vin_{max} = 5.5V
Vin_{min} = –0.5V

Connector pinning

Pin 1 AIC Ground
Pin 2 AIC Ground
Pin 3 AI1 External alarm input 1 – EAL1
Pin 4 AI2 External alarm input 2 – EAL2
Pin 5 AI3 External alarm input 3 – EAL3
Pin 6 AI4 External alarm input 4 – EAL4*
Pin 7 Not used

*EAL4 can also be configured as door alarm with settable alarm level, see P120 below.

P120 Door Switch



P120 is used for repeater door alarm. An internal door switch is connected to this port to activate door alarms.

P120 is a 3-pole male connector located in the center of the cabinet, adjacent to the P119 alarm connector (see Figure 3-7).

The alarm level for this input is always *Warning w ceasing*.

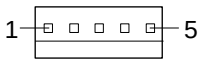
This alarm input is separated from the alarm inputs in the P119 alarm connector. The EAL4 in the P119 alarm port (pin 6) can also be configured as door alarm input with settable alarm level.

The door switch alarm is activated 30 seconds after the door switch has been activated.

Connector pinning

Pin 1 Ground
Pin 2 Alarm input
Pin 3 Power (5V, 10mA for the door alarm circuitry)

P124 Repeater to Repeater Link Port

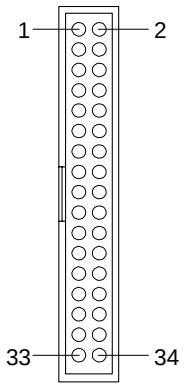


P124 is used for the *Repeater to Repeater Link* feature (R2R net).

P124 is a 5 pole male connector located to the right in the cabinet, adjacent to the P118 connector (see Figure 3-7).

The usage of P118 and P124 is described on page 3-10.

P130 RCC Port



The P130 RCC port is used for connecting an RCC mobile phone/modem remote control unit.

P130 is a 34 pole 2 line male connector located to the right in the cabinet (see Figure 3-7).

The P130 connector contains modem/telephone line connection, RCC power supply, etc.

If there is no RCC remote communication control unit connected to the P130 port, then pin 1 and pin 2 must be interconnected with a jumper (see P113 on page 3-10).

Pin 1 and 2 of the P130 port MUST ALWAYS be interconnected to provide voltage supply to a particular part of the repeater circuitry.

Mains Breakdown Relay

To be able to distinguish PSM faults from power failure, a mains breakdown relay must be used on the repeater mains supply.

The mains breakdown relay is not included in the repeater. So, it has to be mounted outside the repeater chassis. The relay intended for this purpose must fulfil the following specifications:

Relay specifications

Closing time: max. 30 milliseconds

Insulation coil/contact: min. 4KV

Mains connected relay must be in compliance with valid local regulations.

Connection

- Connect a normally closed relay contact to pin AI1 and AIC on the P119 alarm connector (closed contact at no current). Alarm is initiated by short circuiting the AI1 and AIC inputs as shown in Figure 3-8. The P119 alarm connector is detailed on page 3-11.

- Connect the relay coil. It must be supplied from the same fuse as the repeater.

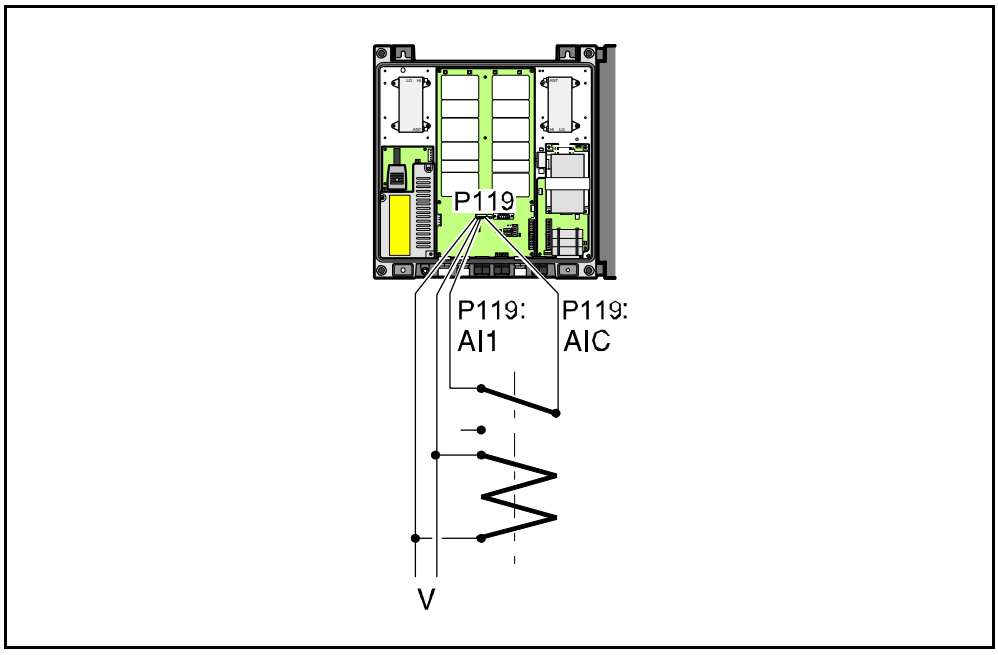


Figure 3-8. Mains breakdown relay connection

- After commissioning, set the mains breakdown feature as described in the *AR Repeaters and OMT32, User's Manual*.

4. Commissioning

Read carefully Chapter 1 *Safety* before commissioning the repeater.

Check all connections made during the installation. Also, ensure that both the mains plugs for repeaters equipped with two power supply units are connected to outlets supplied from the same fuse.

To fulfill the IP65 weather protective requirements, ensure that the cable strain relief bushings are properly tightened. Also, ensure that the gaskets at the cable inlets and on the cabinet are properly fitted and not damaged.

When the installation is checked, commission the repeater as described below.

Starting the Repeater

1. Connect the repeater to the mains.
2. Check the four LEDs downmost in the repeater (see Figure 4-1). A correct power-up is indicated as follows:

   PWR
   Yellow LED which is lit with a steady light after the mains is switched on. Indicates present power.

   BOOT
   Red LED that is lit with a steady light when the system boots, i.e. for 10 - 15 seconds after the mains is switched on. Then, it flashes for the next 5 - 10 seconds. After that, if no error is detected, the LED is off.

   FAULT
   Red LED that flashes 15 - 20 seconds after the mains is switched on. Then, it flashes for less serious alarms (ERROR) and is lit with a steady light for fatal alarms (CRITICAL).

   OPER
   Green LED that lights up approx. 15 seconds after the mains is switched on. It shows, with a steady light, that the repeater is ready for operation.

External indicators on the repeater front

Yellow
Operation LED which lights up approx. 15 seconds after the mains is switched on. At steady light the repeater is ready for operation.

Red
Alarm LED which indicates ERROR alarms with flashing light and CRITICAL alarms with steady light.

When the indicators show operational mode, the repeater can be configured for operation by using an OMT32/PC. This is further detailed in the *AR Repeaters and OMT32, User's Manual*.

Indicators

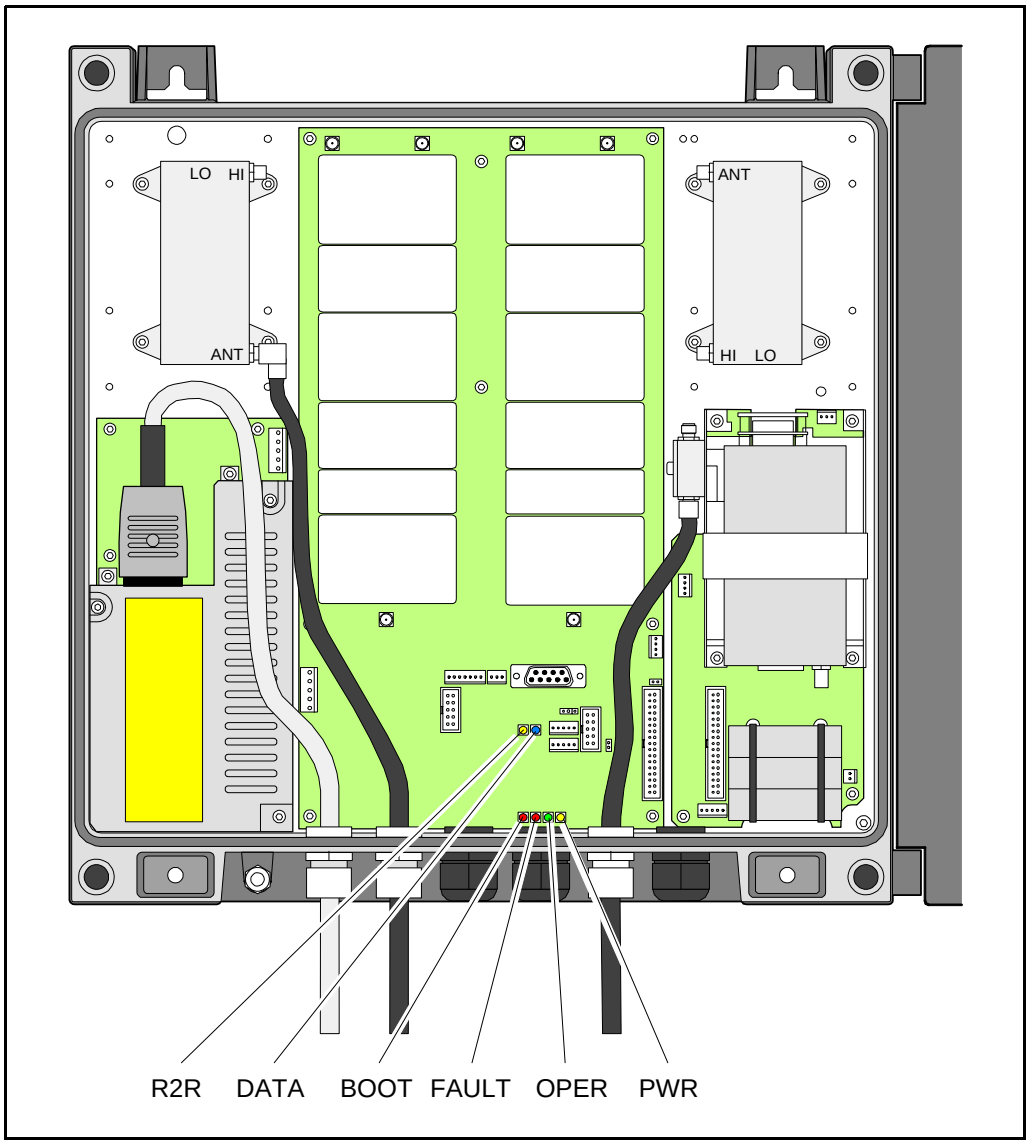


Figure 4-1. Indicators in the cabinet

Figure 4-1 shows the repeater indicators . There are also two external indicators on the repeater front cover.

Repeater to Repeater Link indicators

The two upper indicators, R2R and DATA, indicates the following R2R status:

R2R
Green LED that indicates, with a flashing light, that data is transferred and that the repeater currently is a *Control Station*. A steady light indicates that the repeater is not currently a *Control Station*, or there is no more repeater in the net. Only one repeater in an R2R net can show a flashing green LED at the same time.

DATA
Blue LED that indicates data transmission in the net.

Repeater Configuration

The repeater is now ready to be configured in accordance with the site conditions and system performance requirements. Pay especial attention to the antenna isolation described in the *AR Repeaters and OMT32, User's Manual*.

5. Functional Description and Design

Allgon repeaters work as bi-directional on-frequency amplifiers.

A repeater receives, amplifies, and retransmits signals downlink and uplink simultaneously, i.e. from the base station via the repeater to the mobile stations and from the mobile stations via the repeater to the base station.

The repeater is connected to a BS antenna, directed towards the base station, and to a MS antenna directed towards the area to be covered. These antennas are connected to the repeater with N type male connectors.

To prevent instability due to poor antenna isolation, a built-in antenna isolation supervision feature reduces the gain level automatically when poor antenna isolation is detected.

The Allgon repeaters are controlled by powerful microprocessors.

Alarm and operational LEDs are visible on the repeater front.

The repeater works with convection cooling without fan.

Operational parameters such as gain, power levels, etc. are set using a desktop or notebook and the Allgon OMT32, which communicate, locally or remotely via modem, with the repeater. Remote operation is performed using a telephone line or a built-in mobile phone equipped with a data interface.

Repeater Design

The repeater is housed in a cast aluminium chassis that is waterproof, class NEMA4/IP65, for outdoor use. The chassis has a design suited for outdoor use as well as indoor use.

The chassis consists of a cabinet and a cover joined with hinges. The cabinet contains the repeater circuitry. The cover can either be a thin cover or a large cover. The latter consists of another cabinet which can be used as an empty cover or be equipped as an independent repeater unit.

The cover has two external LEDs for operation and alarm indication.

The cabinet as well as a large cover can be equipped for band selective operation with adjustable bandwidth. A combined repeater can be equipped for different bandwidths or different systems.

Both the uplink and downlink circuitry is built up on a single BSC board inside the repeater. The various amplifiers and RF modules are individually shielded by metal covers.

The BSC band selective compact repeater board

The band selective compact repeater board can handle one wide band repeater channel, uplink and downlink. The band width is adjustable.

Other units

In addition to the BSC repeater board, the repeater contains:

- DPX Duplex filter, located on the upper part of the repeater.
- CMB Combiner unit, located on the RCC unit in repeaters with an RCC unit that works in the same system as the repeater.
- RCC unit (optional), see Chapter 6, *Optionals*. This is located to the right in the cabinet.
- PSM Power Supply unit, located to the left in the cabinet, and in the cover, if equipped.
- The repeater is equipped with an *R2R, Repeater to Repeater Link* feature that can be used between different repeaters or between the cabinet repeater unit and the cover repeater unit.

Single Band Repeater Units

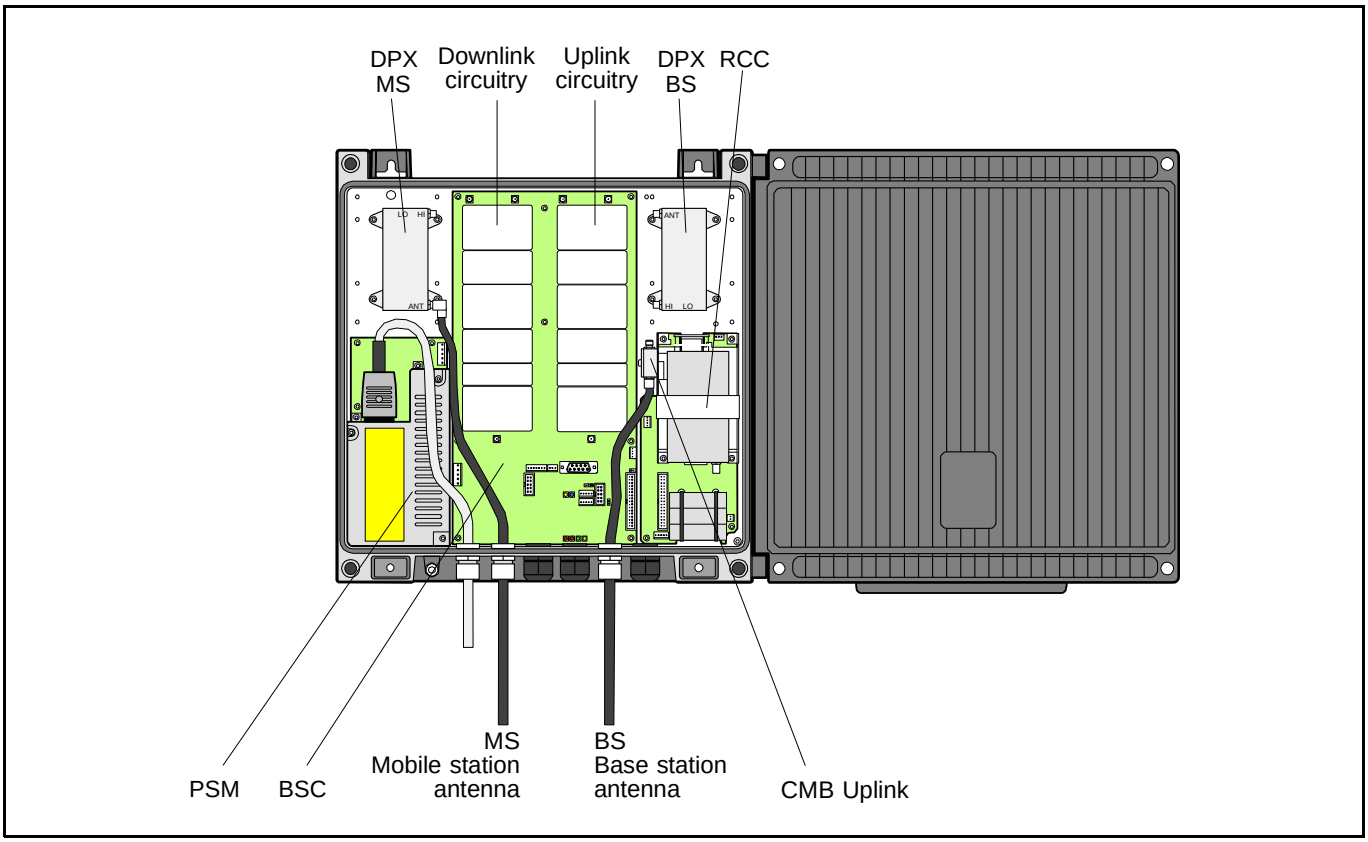


Figure 5-1. Single band repeater units

A cabinet (the left part in Figure 5-1) for a band selective repeater is equipped with a BSC board including the downlink and uplink circuitry. The described cabinet is equipped for bi-directional band selective operation and RCC remote control.

The BSC board is used for band selective systems with an adjustable bandwidth within 890 – 915MHz uplink and 935 – 960MHz downlink.

Main units:

BSC	Band Selective Compact board, adjustable bandwidth
CMB	Combiner unit, uplink, for RCC antenna
DPX	Duplex filter
PSM	Power Supply unit
RCC	Repeater Communication Control unit

Dual Band Repeater Units

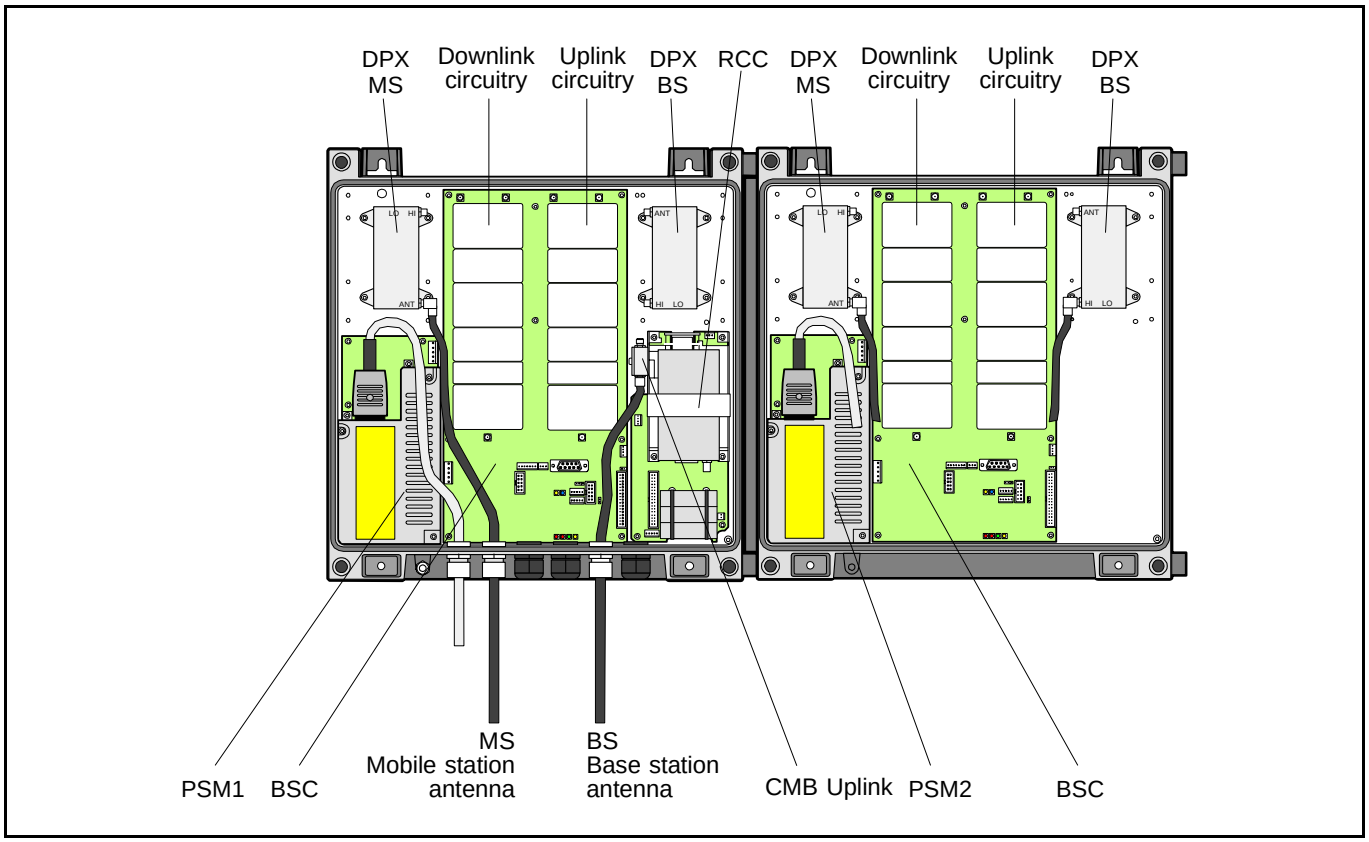


Figure 5-2. Dual band repeater units

Figure 5-2 shows an example of a combined band selective repeater for dual bands. The repeater part in the cabinet is equipped with an RCC unit that is used for communication between both the repeater parts via the R2R feature. This feature can also be used to communicate with other repeaters, ALR Compact repeaters as well as standard AR repeaters.

Both the BSC boards are used for band selective systems with an adjustable bandwidth within 890 – 915MHz uplink and 935 – 960MHz downlink.

If both the repeater parts are linked to the same base station, then the BS antenna cables are connected to the same antenna via a combiner unit (CMB). Otherwise separate antenna cabels are used from the repeater to the antennas.

If both the repeaters cover the same area, then the same thing is applicable to the MS antenna cables.

Main units:

BSC	Band Selective Compact board, adjustable bandwidth
CMB	Combiner unit, uplink, for RCC antenna
DPX	Duplex filter
PSM1	Power Supply unit 1 (in the cabinet)
PSM2	Power Supply unit 2 (in the cover)
RCC	Repeater Communication Control unit

Block Diagram

A band selective compact repeater block diagram is found on page 5-6.

The signal path and some of the most important features are described after the block diagram.

Downlink Signal Path

The downlink signal path, i.e. from the base station through the repeater to the mobile station, is described after the block diagram.

Uplink Signal Path

The uplink signal path, i.e. from the mobile station through the repeater to the base station, is identical to the downlink path the other way round. Only some levels and component values differ.

Band Selective Compact Repeater Block Diagram

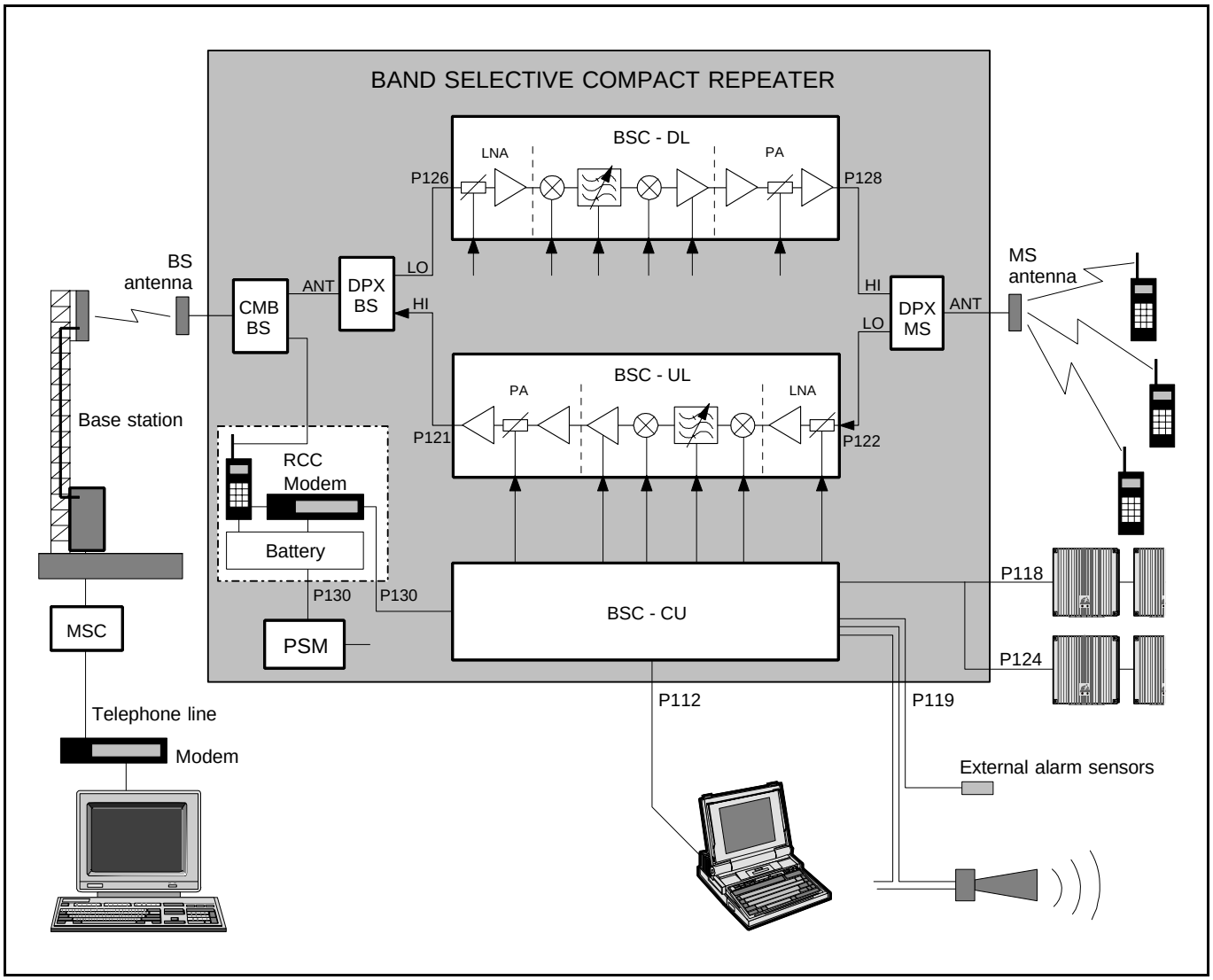


Figure 5-3. Block diagram

Figure 5-3 shows a block diagram of the band selective compact repeater. This diagram is applicable to repeaters for e.g. NMT, TACS/ETACS and AMPS/DAMPS systems.

Downlink signal path

The signal from the base station is received via the repeater BS antenna and is forwarded through a combiner (CMB) to the ANT input of a duplex filter (DPX). The signal from the LO output of the duplex filter is, via the P126 port, fed to the BSC board. On the BSC board, the signal is amplified in a low noise amplifier (LNA) and is then entered the band selective amplifier circuitry.

The first mixer stage in the BSC amplifier, which is controlled by a synthesizer, converts the received frequency down to the IF frequency. The signal is then filtered by a SAW bandpass filter and, not shown in the

figure, amplified before it is fed to the second mixer stage, controlled by the same synthesizer as the previous one, for converting back to the original frequency.

The SAW filter is adjustable and can be software changed from within OMT32 (or OMS) to cover various band widths.

The following power amplifier (PA) is controlled by the Control Unit (CU). The output gain can be reduced to avoid instability due to poor antenna isolation.

A detector in the PA stage measures continuously the output level. The signal from this detector is used by the automatic gain control, AGC, to supervise and, if necessary, reduce the output power to keep it under a maximum level. The AGC gain control affects all the amplification stages.

The output signal from the BSC board is taken from the P128 port and it is fed to the HI port of a duplex filter (DPX). The output signal from the ANT port of the duplex filter is fed to the repeater MS antenna.

RCC

The optional RCC Remote Communication Control unit is located inside the repeater, see Figure 5-1 on page 5-3.

Communication with the base station is performed by means of a built-in mobile feature that has the antenna connected to the BS combiner (CMB). Data is transferred between the repeater CU and the built-in mobile feature via the P130 port.

The RCC unit is powered via the P130 port and the unit has a battery with capacity to send a number of alarms if a mains power failure occurs.

R2R

The *Repeater to Repeater Link* feature makes it possible to communicate with a number of repeaters via one RCC unit in one of the repeaters in an R2R net. Several RCC units can be used in the same net.

The repeaters in the R2R net are connected to the P118 port and to the P124 port.

The R2R feature is further described on page 5-18.

Alarm

Alarm signals from external sensors are received via the P119 alarm port.

The software on the BSC board is able to activate acoustic or visual alarm or direct the alarm to the P130 PCC port to be forwarded, via the RCC unit (or modem and telephone line) to OMT32 (or OMS) located in an operation and maintenance central.

Alarms can be configured from OMT32 (or from OMS).

Repeater Setup

The repeater parameters can be set locally by means of a desktop or notebook loaded with the OMT32 software (or the OMS software). The PC or notebook is connected to the repeater via the P112 PC port.

The repeater parameters can also be set remotely by means of an RCC Remote Communication Control unit (or via a telephone line and a modem) connected to the repeater via the P130 PCC port.

Board and Unit Descriptions

Cabling between boards and units is found on page 5-16 (with RCC unit) and page 5-16 (without RCC unit).

CMB - Combiner

There is one BS combiner in a single band repeater equipped with an RCC Remote Communication Control unit.

This unit combines the uplink/downlink signal from the BS antenna with the RCC mobile antenna.

Connection

To the right in the cabinet CMB/BS

Port	Connected to
IN?	MS antenna.
OUT1?	ANT on the DPX/BS duplex filter.
OUT2?	RCC mobile antenna.

DPX - Duplex Filter

The DPX duplex filters on the BS and MS sides are identical.

Connection

To the left in the cabinet DPX/MS

Port	Connected to
ANT	MS antenna port.
HI	P128 on the BSC board (downlink PA power amplifier).
LO	P122 on the BSC board (uplink LNA low noise amplifier).

To the right in the cabinet DPX/BS

Port	Connected to
ANT	OUT1 on the CMB/BS combiner (BS antenna signal).
HI	P121 on the BSC board (uplink PA power amplifier).
LO	P126 on the BSC board (downlink LNA low noise amplifier).

BSC Band Selective Compact Board

The compact band selective orepeater is built up mainly on a single BSC board that contains all the amplification circuitry for uplink and downlink and the CU, Control Unit, circuitry. This board contains also all the ports for alarm, local control, remot control, etc.

Figure 5-4 shows the BSC board in the compact repeater.

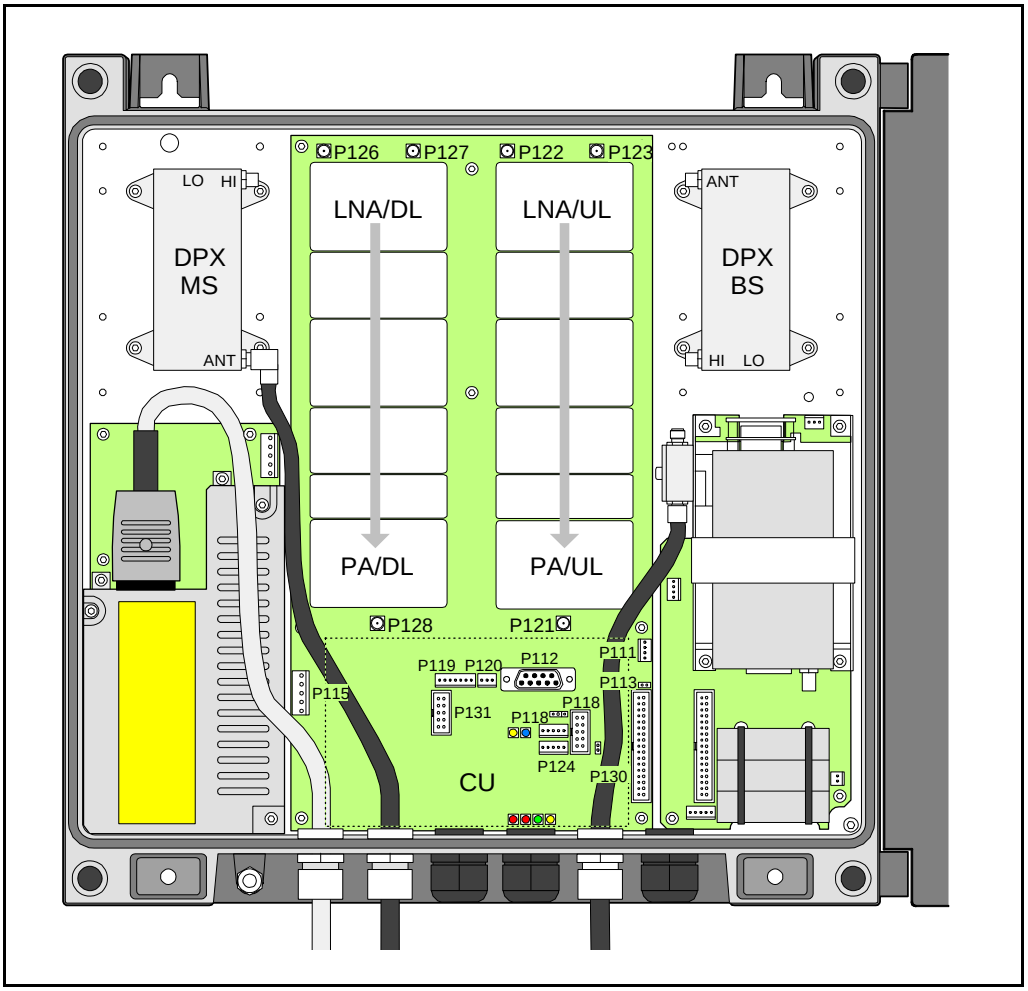


Figure 5-4. BSC, Band Selective Compact board

The left upper part of the BSC board contains the downlink circuitry. The downlink signal path starts from port P126, is fed to the LNA, Low Noise Amplifier, then it passes a number of amplifiers, and is finally fed to the PA, Power Amplifier before it is fed, via port P128, to the DPX/MS HI port to be forwarded to the MS antenna.

The right upper part of the BSC board contains the corresponding circuitry for the uplink signal path, from port P122, via port P121, DPX/BS HI port and to the BS antenna.

CU Control Unit

The CU unit is the central part of the repeater, located in the lower part of the BSC board (inside the dotted line in Figure 5-4).

The CU unit contains a microprocessor, main memory, flash memory for the CU software, EEPROM memory for parameters, memory for the event log and statistics, a REFO reference oscillator, ports for local and remote communication, battery powered real-time clock, etc.

The CU unit supervises and controls operational parameters such as gain control, etc. The CU takes also care of alarms and the event log, password, logon, and many other tasks.

The CU is also a control interface when communicating with an OMT32 or OMS, locally or remotely.

The CU software can be downloaded from OMT32 or OMS either locally or remotely.

The real-time clock in the CU unit is used for alarm and for the event log.

CU software

The CU unit on the BSC board can be run with the SAXXX XX/X CU software. The unit can store two versions of CU software, located in segment 1 and segment 2 of the flash memory as *Application 1* and *Application 2*. The repeater will boot on that software which is set as *Primary* (a description of the *Primary* application is found in the *AR Repeaters and OMT32, User's Manual*.

The compatibility between the BSC board and CU software is detailed in the next section.

Caution

A lithium battery is permanently mounted on the BSC board. Due to the risk of explosion, this battery must only be removed from the board by an authorized service technician.

Connection and connector types

The BSC board is also a distribution board with most of the repeater ports. The connector types are chosen to prevent unintentional mixing up.

Port	Connected to	Connector type
P111	LED board in the cover.	4 pole 1 line male.
P112	PC (serial RS-232).	9 pole D-sub female.
P113	Not connected (jumper parking device).	2 pole 1 line male.
P115	PSM - Power Supply unit	5 pole 1 line male.
P118	R2R connection to P118 or P124 in the next compact repeater, or to the R2R connector board in a standard AR repeater.	5 pole 1 line male.
P119	External alarm sensors and alarm equipment.	7 pole 1 line male.
P120	Door switch (internal alarm).	3 pole 1 line male.
P121	HI on DPX/BS duplex filter (uplink output signal).	Coaxial
P122	LO on DPX/MS duplex filter (uplink input signal).	Coaxial
P123	P122 on the cover BSC board (expansion output), if equipped.	Coaxial
P124	R2R connection to P118 or P124 in the next compact repeater, or to the R2R connector board in a standard AR repeater.	5 pole 1 line male.
P126	LO on DPX/BS duplex filter (downlink input signal).	Coaxial
P127	P126 on the cover BSC board (expansion output), if equipped.	Coaxial
P128	HI on DPX/MS duplex filter (downlink output signal).	Coaxial
P130*	RCC Remote Communication Control unit, or modem for traditional telephone line.	34 pole 2 line male.

*Pin 1 and 2 of the P130 connector must be interconnected with a jumper if the connector is not used.

Testpoints

There are no testpoints intended for field maintenance or calibration. Availalbe testpoints on the board are used for factory calibration only.

LNA - Low Noise Amplifier

Two LNA, Low Noise Amplifiers, are located uppermost on the BSC board in shielded covers. LNA/DL (downlink) is located to the left and LNA/UL (uplink) to the right.

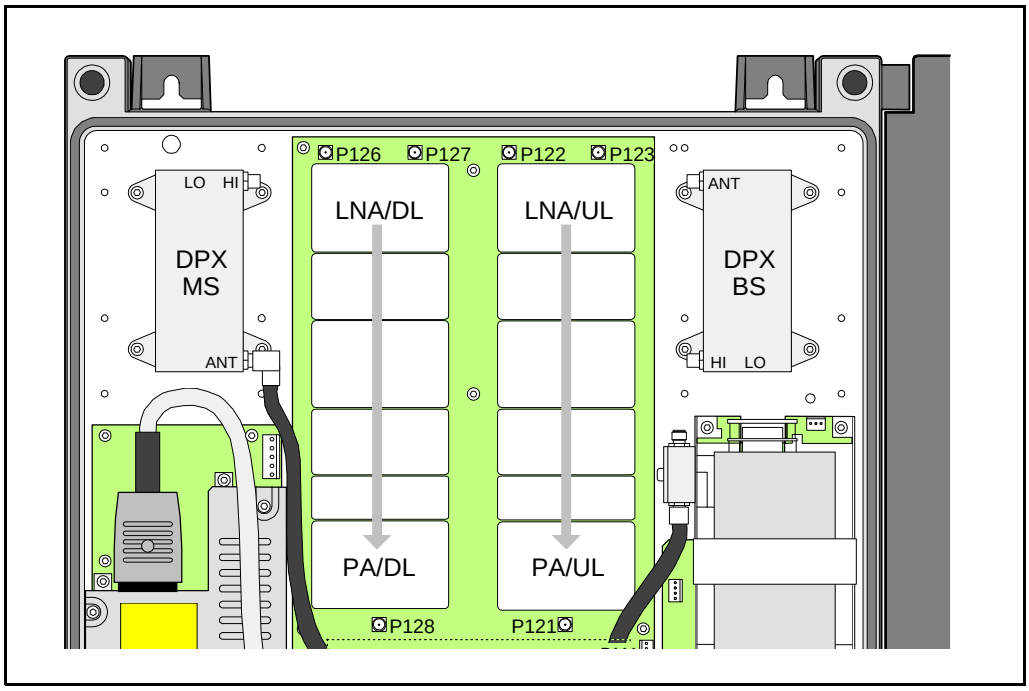


Figure 5-5. LNA, Low Noise Amplifiers

Received signals from the duplex filters are fed to the LNA input connectors P122 (uplink) and P126 (downlink). The output signals from the LNA amplifiers are fed to the next amplifier stages for uplink and downlink on the BSC board.

The P123 and P127 ports are expansion outputs used as inputs for an additional repeater in the cover, if the repeater has an equipped cover that works in the same system. The gain to this connector is +2dB.

Connection

The P122, P123, P126 and P127 ports are connected as shown on page 5-12.

PA - Power Amplifier

Two PA, Power Amplifier, are located in the middle of the BSC board in shielded covers. PA/DL (downlink) is located to the left and PA/UL (uplink) to the right.

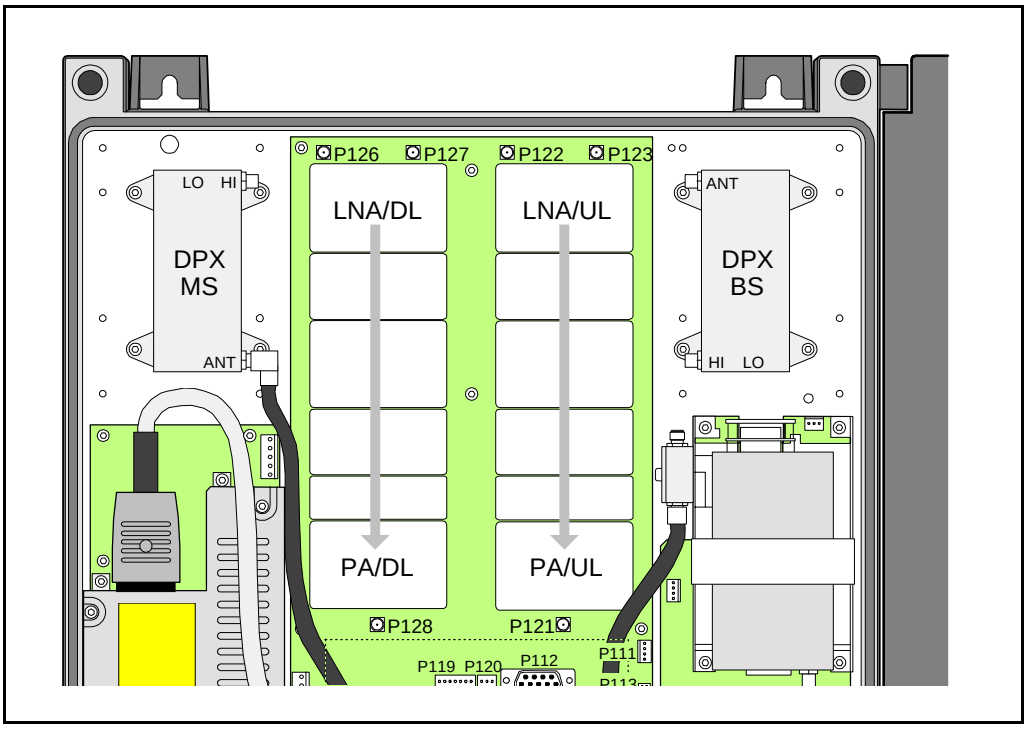


Figure 5-6. PA, Power Amplifiers

The final power amplification for the downlink signal is performed in the PA/DL stage. Then the signal is fed via the P128 port to the HI port of the DPX/MS duplex filter and from this filter to the MS antenna.

The uplink final power amplification is performed in the same way and is fed to the BS antenna via the P121 port and the HI port of the DPX/BS duplex filter.

Connection

The P121 and P128 ports are connected as shown on page 5-12.

Repeater CU Software and Hardware Compatibility

There are different versions of repeater CU software, which can be combined with boards of various revisions. These have unique part numbers and revision information. Below, you will find a table of repeater software currently available in combination with BSC board revisions.

CU Software Part #	**Software Revision**	**Compatible with BSC board**	**Comments**
SA??? ??/?	R??	K???/?	????????
SA??? ??/?	R??	K???/?	????????

This information is updated 2000-06-04. As new versions of hardware and software are released without prior noticing, contact your Allgon sales representative if in doubt about the latest revision status.

For detailed information, refer to the release notes for the CU software to be downloaded (normally found in the *readme.txt* file, which is supplied with the program files).

Cabling

On the following pages, you will find cabling information for:

- Compact Repeater With RCC Unit, page 5-16.
- Compact Repeater Without RCC Unit, page 5-17.

Compact Repeater With RCC Unit

Figure 5-7 shows the compact repeater main cabling with an RCC Remote Communication Control unit.

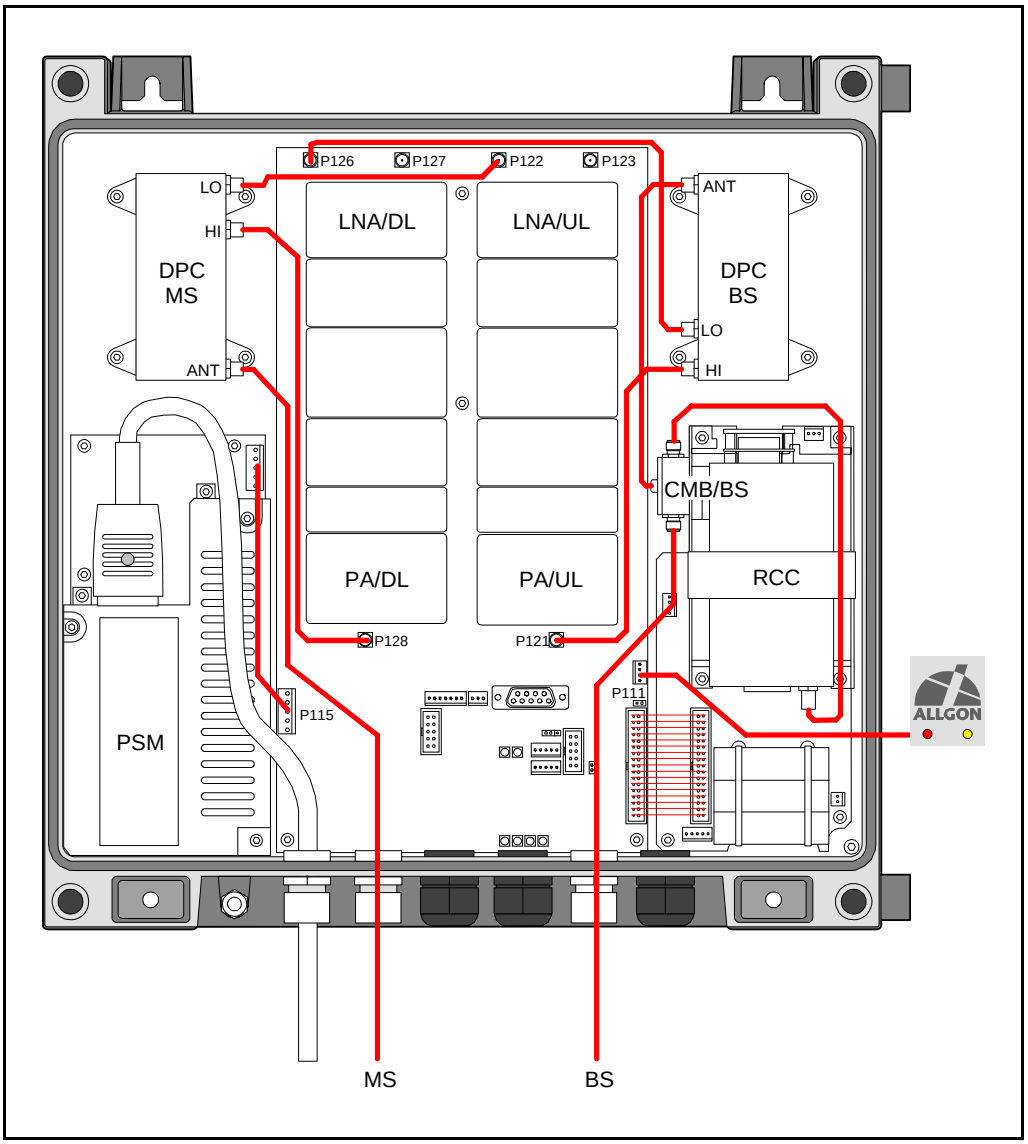


Figure 5-7. Cabling with RCC unit

Compact Repeater Without RCC Unit

Figure 5-8 shows the compact repeater main cabling without RCC unit.

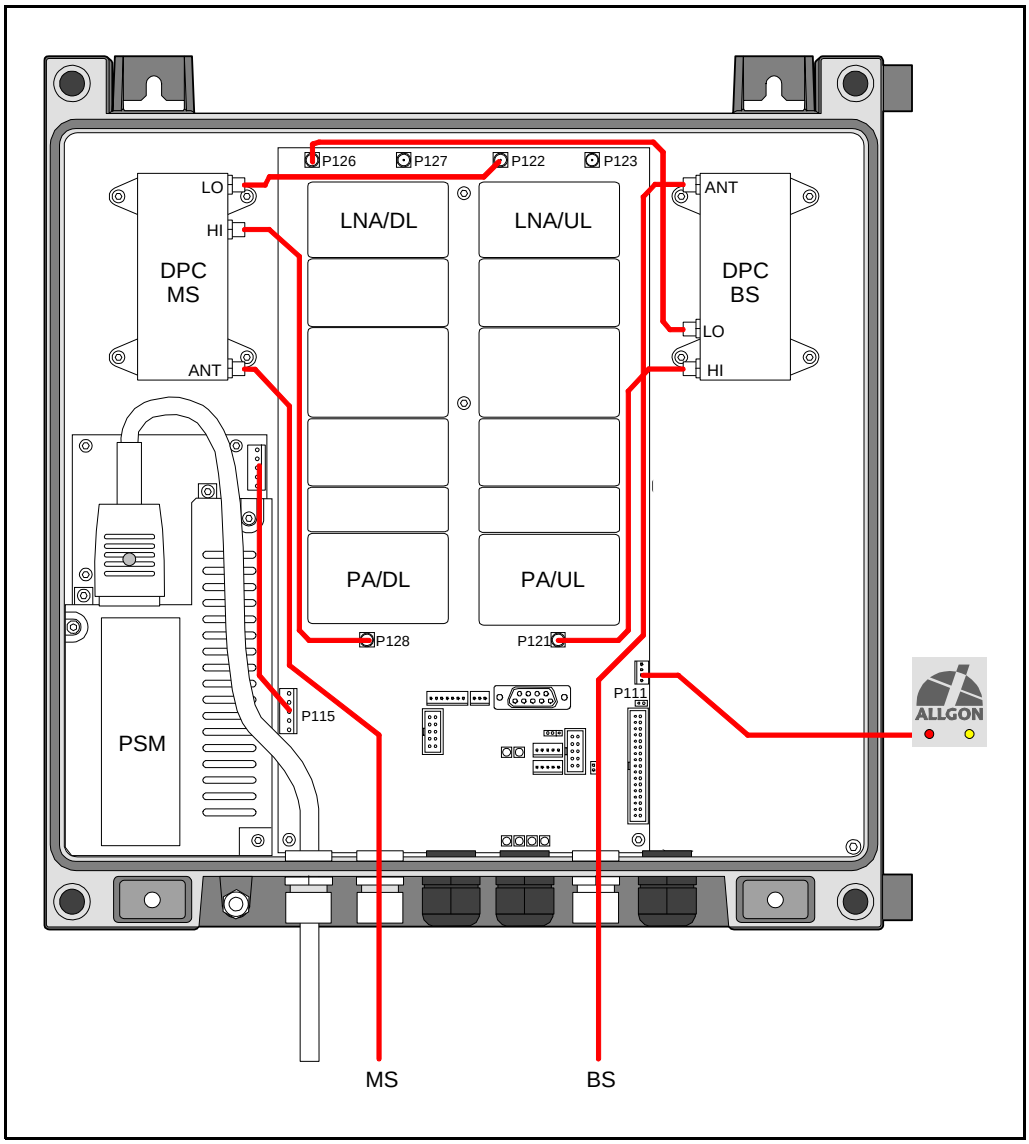


Figure 5-8. Cabling without RCC unit

R2R, Repeater To Repeater Link

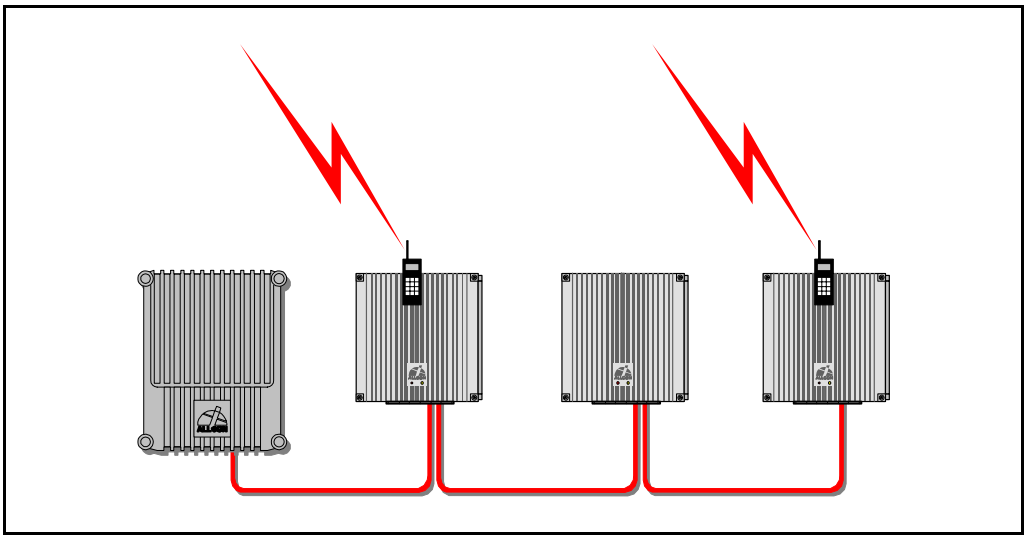


Figure 5-9. Repeater to Repeater Link

The Allgon *Repeater to Repeater Link* can be used in order to establish a repeater network with up to 13 repeaters, one or several of which can contain a phone line for communication with an OMT32 or an OMS.

All Allgon standard Compact repeaters include this feature.

All Allgon repeaters can be mixed in R2R nets (see Figure 5-9). For standard AR repeaters, the R2R *Repeater to Repeater Link* feature is optional and require certain hardware and CU software versions.

Installation

All required R2R, *Repeater to Repeater Link*, circuitry is included in the compact repeater. Only interconnecting cables are required to set up an R2R net.

At least one RCC unit (or telephone line with modem) is required for the remote communication.

Configuration

Configuration is described in *AR Repeaters and OMT32, User's Manual*.

6. Optionals

This chapter describes the following optional accessories available for the Allgon repeaters:

RCC, Remote Communication Control Unit

As the mobile phone technology is developing very fast, this RCC may be modified after issuing this manual. New types may also have been added. For the latest details, please contact your local Allgon representative.

For remote control of Allgon Compact repeaters in band selective systems an RCC Remote Communication Control unit is available. This unit contains an integrated mobile phone, modem and power supply backup.

The RCC unit for the Compact repeater is mounted to the right inside the repeater cabinet, see Figure 6-1.

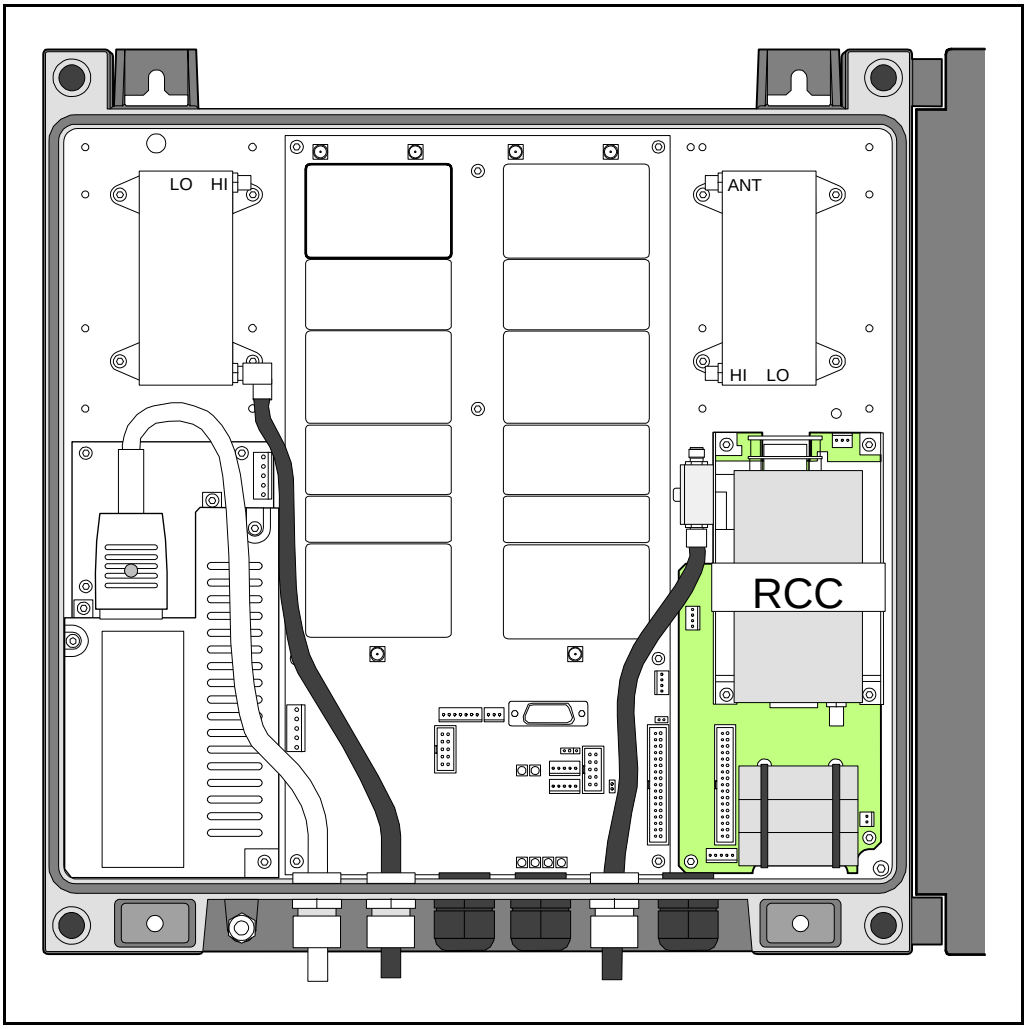


Figure 6-1. The RCC unit

The RCC is connected to the P130 port as described in the *Connection* section in Chapter 3.

Do not forget to put a jumper between pin 1 and 2 on the P130 connector if the RCC unit is disconnected.

A jumper should be located in the P113 parking device (a 2-pole connector used for this purpose).

OMT32, Operation and Maintenance Terminal

The *OMT32, Operation and Maintenance Terminal* is an Allgon software package for configuration and controlling a repeater by using a computer with Windows 95/98 or NT 4.

The OMT32 can be used either locally, i.e. connected to the repeater, or remotely via an RCC unit or a traditional telephone line and modem.

All repeater parameters and settings can be configured by menas of the OMT32.

OMS, Operation and Maintenance System

The *OMS, Operation and Maintenance System* is an Allgon software package for controlling a large repeater fleet by using computers with Windows NT in networks with a common database.

The OMS is capable of operating a large number of repeaters. Multiple modems can be used for several incoming and outgoing parallel activities, such as polling, radio parameter configuration, software downloading, etc.

Battery Backup

Battery backup can be arranged by completing the repeater with an 25Ah or 50Ah Allgon *BBU, Battery BackUp* unit. The Allgon BBU has an exterior similar to the repeater which means that it can preferably be mounted adjacent to the repeater.

Fiber Optic Unit

A *FOU, Fiber Optic Unit* that includes transmitter, receiver, alarm board and power supply is available for the Allgon Compact repeater. The fiber optic interface can be adapted for separate uplink and downlink fiber as well as for bi-directional one-fiber distribution.

7/16" Antenna Cable Connectors

A 7/16" antenna cable kit is available for the Allgon Compact repeater. This kit includes 7/16" antenna connectors for uplink and downlink antennas

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Questionnaire

The aim of this manual is to guide you when installing and operating the Allgon repeaters, and to answer questions that may turn up. To ensure that we provide appropriate information for these purposes, we would appreciate your views and suggestions on how to improve the manual in this direction. Please, fill out the following questionnaire and send it to us.

1

Have you read entire sections or do you use the manual to look up specific information when needed?

❑ Read entire sections ❑ Look up specific information

Comments: _____

_____

2

Do you think the information is easy to find and understand?

❑ Yes ❑ No

Comments: _____

_____

3

Do you find any function of the Allgon repeater hard to understand, a function which should be subjected to more detailed description?

❑ Yes ❑ No

If yes, which one: _____

_____

4

Do you have any suggestions on how we can improve this manual?

_____

_____

_____

Title (Mr/Ms/Other): _____ Initial: _____

Surname: _____ Job title: _____

Company: _____ Address: _____

City: _____ Country: _____ Phone: _____

Thanks for your kind help. It's very valuable to us.

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Customer Support Centre
Box 541
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If you prefer to send by mail, fold here and tape.
No envelope required.

If you prefer to send by fax, use this number: +46 8 540 824 85