

MBF-40

SMR 700/800 Repeater for Public Safety

High Selectivity Digital Multi-Band Repeater



This document is valid for the MBF-40 high selectivity digital multi-band repeater supporting the following frequency bands: SMR700, SMR800 (SMR700 includes support for Band 14)

Part Number	Description
MBF-3707-3708-PS	MBF Dual band SMR 7/8 37 dBm
MBF-3708-PS	MBF SMR 800 37 dBm
MBF-3707-PS	MBF SMR 700 37 dBm

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1 About This Manual

This Product Manual provides the following information:

Description of the Repeater unit

Procedures for setup, configuration and checking the proper operation of the unit

Maintenance and troubleshooting procedures

For whom it is intended

This Product Manual is intended for experienced technicians and engineers. It is assumed that the customers installing, operating, and maintaining PBE Axell Repeaters are familiar with the basic functionality of Repeaters.

Notice

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Safety Instructions and Warnings

Throughout this manual, important safety warnings and admonishments are included to warn of possible hazards to persons or equipment. A safety warning identifies a possible hazard and then describes what may happen if the hazard is not avoided. The safety warnings - in the form of Dangers, Warnings and Cautions must be followed at all times. These warnings are flagged by the use of a warning icon, usually the triangular alert icon seen below. The exclamation point within the triangular alert icon is intended to warn the operator or service personnel of operation and maintenance from factors relating to the product and its operating environment, which could pose a safety hazard.

Guarantees

All antennas must be installed with lightning protection. Damage to power modules as a result of lightning are not covered by the warranty.

Switching on AC or DC power prior to the connection of antenna cables is regarded as faulty installation procedure and therefore not covered by the PBE Axell warranty.

The repeater box should be closed using the two screws. The screws must be fully tightened. Failure to do so may affect the IP65 compliancy and therefore any warranty.

1.1 Copyright notice

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This document has been prepared to be used by professional and properly trained personnel, and the customer assumes full responsibility when using them. PBE Axell welcomes customer comments as part of the process of continual development and improvement of the documentation in the best way possible from the user's viewpoint. Please submit your comments to the nearest PBE Axell sales representative.

1.2 Contact Information

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2 Compliance and Safety Notices

2.1 FCC Compliance

Part 90 Signal Boosters		THIS IS A 90.219 CLASS B DEVICE
	WARNING: This is NOT a CONSUMER device. This device is designed for installation by FCC LICENCEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENCE or express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.	
	The installation procedure must result in the signal booster complying with FCC requirements 90.219(d). In order to meet FCC requirements 90.219 (d), it may be necessary for the installer to reduce the UL and/or DL output power for certain installations.	

2.1.1 FCC Part 15

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

If not installed and used in accordance with the instructions, this equipment generates, uses and can radiate radio frequency energy. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to RF reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the Donor antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into a power outlet on a circuit different from that to which the receiver is connected.

	WARNING: This product is a booster and it is the responsibility of the licensee / installer to select the correct cabling and antennas for its particular deployment scenario.
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2.1.2 FCC RF Exposure Limits

This unit complies with FCC RF exposure limits for an uncontrolled environment. This equipment can only be installed in applications, driving passive or active DAS systems. All antennas must be operated at a minimum distance of 20 cm between the radiator and any person's body.

2.1.3 Antenna Installation

Installation of an antenna must comply with the FCC RF exposure requirements. The antenna used for this transmitter must be mounted on permanent structures.

The FCC regulations mandate that the ERP of type B signal boosters should not exceed 5 W, this is equivalent to 8.2 W EIRP.

Therefore the max antenna gain allowed for this type of signal booster should be limited to the values given by equation 1 (below) for the service antenna.

Equation (1) - Max SERVICE antenna gain

Max SERVICE antenna gain (dBi) = $39.1 - (37 \text{ dBm} - \# \text{ of antennas in dB} - \text{cable losses in dB})$.

For example:

No. of Antennas	Cable Losses	Max Allowed Antenna Gain
4	3	$39.1 - (37-6-3) = 11.1 \text{ dBi}$
1	3	$39.1 - (37-0-3) = 5.1 \text{ dBi}$
10	3	$39.1 - (37-10-3) = 15.1 \text{ dBi}$

2.1.4 Unauthorized Changes to Equipment

Changes or Modifications not expressly approved by the manufacturer responsible for compliance could void the user's authority to operate the equipment

2.1.5 Only for in-building applications

Use only for in-building applications in sites located in regions that require FCC compliance.

One must be aware that FCC regulation mandates that this repeater is to be used only for in-building applications and thus feed passive or active DAS (Distributed Antenna Systems) accordingly.

2.2 Compliance with ISED/ Conformité avec ISDE



WARNING! This is NOT a CONSUMER device. This device is designed for installation by an installer approved by an ISED LICENSEE. You must have an ISED LICENSE or express consent of an ISED Licensee to operate this device.

Under Innovation, Science and Economic Development Canada (ISED) regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by ISED. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

This equipment complies with ISSED RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the antenna and your body.



The installation procedure must result in the Industrial Zone Enhancer complying with the relevant parts of Radio Standard Specification RSS-131. In order to meet the requirements, it may be necessary for the installer to reduce the UL and/or DL output power for certain installations.

RF Exposure info

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website: <https://www.hc-sc.gc.ca/>



ATTENTION! Ce n'est pas un appareil consommateur. Cet appareil est conçu pour être installé par un installateur agréé par un licencié ISDE. Vous devez avoir une licence ISDE ou le consentement exprès d'un détenteur de licence ISDE pour utiliser cet appareil.

Conformément à la réglementation Innovation, Sciences et Développement économique Canada (ISDE), le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par ISDE. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. La puissance de sortie nominale indiquée par le fabricant pour cet appareil concerne son fonctionnement avec porteuse unique. Pour des appareils avec porteuses multiples, on doit réduire la valeur nominale de 3.5 dB, surtout si le signal de sortie est retransmis et qu'il peut causer du brouillage aux utilisateurs de bandes adjacentes. Une telle réduction doit porter sur la puissance d'entrée ou sur le gain, et ne doit pas se faire au moyen d'un atténuateur raccordé à la sortie du dispositif.

Cet appareil est conforme aux limitations de la norme ISDE RSS-102 concernant l'exposition aux radiations dans un environnement non contrôlé. Cet appareil doit être installé et utilisé avec une distance minimale de 20 cm entre l'antenne et le corps de l'utilisateur.



La procédure d'installation doit permettre à l'amplificateur de zone industrielle de se conformer aux parties pertinentes de la spécification radio standard RSS-131. Afin de répondre aux exigences, il peut être nécessaire pour l'installateur de réduire la puissance de sortie UL et/ou DL pour certaines installations.

Informations sur une exposition aux radiofréquences

L'installateur de cet équipement radio doit s'assurer que l'antenne est localisée ou dirigée de façon à ce qu'elle n'émette pas de champ RF qui excède les limites fixées sur le site Santé Canada pour la population générale ; veuillez-vous référer au code de sécurité 6 consultable sur le site Santé Canada: <https://www.hc-sc.gc.ca/>

2.3 FCC & ISSED deployment compliance/Conformité de déploiement ISDE et FCC

2.3.1 Compliance with FCC & ISSED deployment rules regarding the radiation of noise

The deployment rules require that the ERP of intermodulation products should in general not exceed -30 dBm in a 10 kHz measurement bandwidth. Also that the ERP of in-band noise should not exceed -43 dBm in a 10 kHz measurement bandwidth and finally that the ERP of noise in spectrum more than 1 MHz outside of the passband should not exceed -70 dBm in a 10 kHz measurement bandwidth. This is not a formidable task since in most of the passive DAS installations, the signal loss in the DAS due to splitting to multiple antenna and cable losses is significant.

As well as the above the MBF-3707-3708 series repeater is more likely to be used in a multicarrier environment (more than 2 carriers), which in turn will reduce the intermodulation products produced by the device.

Good engineering practice must be used regarding the signal booster's in-band noise radiation. Thus, the gain of the signal booster should be set so that the ERP of the output noise from the signal booster (allowing for losses after the booster) should not exceed the level of -43 dBm in 10 kHz measurement bandwidth.

If the noise level measured exceeds the aforementioned values, the signal booster gain should be decreased accordingly.

Similarly, the maximum O/P power per carrier of the booster and associated passive infrastructure should be set so that any intermodulation products generated do not exceed a level of -30 dBm ERP in any 10 kHz measurement bandwidth.

If the level of intermodulation exceeds the aforementioned value, maximum power per carrier should be decreased accordingly.

Finally, the ERP of noise on a spectrum more than 1 MHz outside of the pass band should not exceed -70 dBm in a 10 kHz measurement bandwidth.

In the event that the out of band noise measured at the service antenna input is more than -70 dBm per 10 kHz measurement bandwidth, an external band pass filter should be added to attenuate the out of band noise level.

The MBF-3707-3708 Series Repeater has a noise level of <-44 dBm in 10 kHz measurement at 1 MHz spectrum outside the passband of the signal booster, an in-band noise level <-43 dBm in a 10 kHz bandwidth and intermodulation products better than -13 dBm.

System integrators must ensure that the ERP of noise and intermodulation products generated in the booster meet the deployment rules, to do this they must ensure the following criteria is met for all intentional radiators within the DAS.

Cable Loss (dB) + Splitter Loss (dB) - antenna gain (dBi) - 2.15 dB (EIRP to ERP conversion) must be greater than or equal to 26 dB.

The noise and intermodulation products at the antenna input port should be calculated based on the following equation.

Equation - Input Noise or intermodulation products to service antenna

Equipment noise dBm + Service Antenna gain – Antenna splitter losses in dB – cable loss in dB

Or

Equipment intermodulation products dBm + Service Antenna gain – Antenna splitter losses in dB – cable loss in dB

Example: In band Noise

Signal booster connected to 10 service antennas with a 100 m long ½ inch cable.
Losses of such a cable with the connectors = ~ 12 dB
Gain = ~ 2 dBi
Assuming 10 service antennas: antenna splitter losses = 11 dB
Based on the above equation the in-band input noise to the antenna should be:
 $-43 + 2 - 12 - 11 = -64$ dBm

NOTE: In this example there is no need to reduce the gain of the equipment to attenuate the in- band noise.

Example: Intermodulation products

Signal booster connected to 10 service antennas with a 100 m long ½ inch cable.
Losses of such a cable with the connectors = ~ 12 dB
Gain = ~ 2 dBi
Assuming 10 service antennas: antenna splitter losses = 11 dB
Based on the above equation the Intermodulation products to the antenna should be:
 $-13 + 2 - 12 - 11 = -34$ dBm

NOTE: In this example there is no need to reduce maximum power per carrier of the equipment to reduce the level of intermodulation products.

Example: Out of band noise

Signal booster connected to 10 service antennas with a 100 m long ½ inch cable.
Losses of such a cable with the connectors = ~ 12 dB
Gain = ~ 2 dBi
Assuming 10 service antennas: antenna splitter losses = 11 dB
Based on the above equation the out of-band input noise to the antenna should be:
 $-44 + 2 - 12 - 11 = -65$ dBm

NOTE: In this example there is a need to add an external band pass filter to attenuate the out of band noise by at least a further 5 dB 1 MHz away from the band edge. If fewer antennas are deployed, then additional filtering will be required.

Conclusion:

Good engineering practice requires that in general when the in-band noise measured at the service antenna input is more than -43 dBm per 10 kHz measurement bandwidth, the gain of the device reduced until the levels are within the required limits.

Good engineering practice requires that in general when the levels of intermodulation products noise measured at the service antenna input is more than -30 dBm per 10 kHz measurement bandwidth, the maximum power per carrier is reduced until the levels are within the required limits.

Good engineering practice requires that in general when the out of band noise measured at the service antenna input is more than -70 dBm per 10 kHz measurement bandwidth at 1MHz away from the passband, an external band pass filter should be added to attenuate the out of band noise level. All PBE Axell repeaters include high selectivity duplexers and filters to attenuate the out of band noise. Should additional filtering be required, we have a comprehensive range of interference filters which can be supplied upon request.

2.3.2 Conformité aux règles de déploiement FCC et ISDE concernant le rayonnement du bruit

Les règles de déploiement exigent que l'ERP des produits d'intermodulation ne dépasse en général pas -30 dBm dans une bande passante de mesure de 10 kHz. Elles exigent également que l'ERP du bruit dans la bande ne dépasse pas -43 dBm dans une bande passante de mesure de 10 kHz et enfin, que l'ERP du bruit dans le spectre de plus de 1 MHz en dehors de la bande passante ne dépasse pas -70 dBm dans une bande passante de mesure de 10 kHz. Ce n'est pas difficile à respecter car dans la plupart des installations DAS passives, la perte de signal dans le DAS due à la division en plusieurs antennes et aux pertes de câble est importante.

En plus de ce qui précède, le MBF-3707-3708 est plus susceptible d'être utilisé dans un environnement multi-porteuses (plus de 2 porteuses), ce qui à son tour réduira les intermodulations produites par l'appareil.

Les bonnes pratiques d'ingénierie doivent être utilisées en ce qui concerne le rayonnement de bruit dans la bande de l'amplificateur de signal.

Ainsi, le gain de l'amplificateur de signal doit être réglé de manière à ce que l'ERP du bruit de sortie de l'amplificateur de signal (en tenant compte des pertes après l'amplificateur) ne dépasse pas le niveau de -43 dBm dans une bande passante de mesure de 10 kHz.

Si le niveau de bruit mesuré dépasse les valeurs susmentionnées, le gain de l'amplificateur de signal doit être diminué en conséquence.

De même, la puissance O/P maximale par porteuse de l'amplificateur et l'infrastructure passive associée doivent être paramétrées de manière à ce que tout produit d'intermodulation généré ne dépassent pas un niveau d'ERP de -30 dBm dans une bande passante de mesure de 10 kHz.

Si le niveau d'intermodulation dépasse la valeur susmentionnée, la puissance maximale par porteuse doit être diminuée en conséquence.

Enfin, l'ERP du bruit sur un spectre supérieur à 1 MHz en dehors de la bande passante ne doit pas dépasser -70 dBm dans une bande passante de mesure de 10 kHz.

Dans le cas où le bruit hors bande mesuré à l'entrée de l'antenne de service est supérieur à -70 dBm par bande passante de mesure de 10 kHz, un filtre passe-bande externe doit être ajouté pour atténuer le niveau de bruit hors bande.

Le répéteur de la série MBF-3707-3708 a un niveau de bruit de -44 dBm avec une mesure de 10 kHz et un spectre de 1 MHz en dehors de la bande passante de l'amplificateur de signal, un niveau de bruit dans la bande d'environ -43 dBm dans une bande passante de 10 kHz et des produits d'intermodulation meilleurs que -13 dBm.

Les intégrateurs doivent s'assurer que l'ERP (puissance rayonnée effective) des produits de bruit et d'intermodulation générés dans le booster respecte les règles de déploiement. Pour ce faire, ils doivent s'assurer que les critères suivants sont respectés pour tous les éléments rayonnants intentionnels au sein du DAS.

Le résultat de la Perte du câble (dB) + Perte du répartiteur (dB) – Gain antenne (dBi) -2,15 dB (conversion EIRP à ERP) doit être supérieur ou égal à 26 dB

Les produits de bruit et d'intermodulation au port d'entrée de l'antenne peut être calculés sur la base de l'équation suivante.

Equation – Bruit d'entrée ou produits d'intermodulation au port de l'antenne de service

Bruit équipement en dBm + Gain antenne de service – Pertes du répartiteur d'antenne en dB – perte du câble en dB

Ou

Produits d'intermodulation dBm + Gain antenne de service – Pertes du répartiteur d'antenne en dB – perte du câble en dB

Exemple: Bruit dans la bande

Amplificateur de signal connecté à 10 antennes de service avec un câble ½ pouce de 100 m de long.

Pertes d'un tel câble avec les connecteurs = ~ 12 dB

Gain = ~ 2 dBi

En supposant 10 antennes de service : pertes du répartiteur d'antenne = 11 dB

Sur la base de l'équation ci-dessus, le bruit d'entrée dans la bande vers l'antenne devrait être de:

$$-43 + 2 - 12 - 11 = -64 \text{ dBm}$$

REMARQUE : Dans cet exemple, il n'est pas nécessaire de réduire le gain de l'équipement pour atténuer le bruit intra bande.

Exemple: Produits d'intermodulation

Amplificateur de signal connecté à 10 antennes de service avec un câble ½ pouce de 100 m de long.

Pertes d'un tel câble avec les connecteurs = ~ 12 dB

Gain = ~ 2 dBi

En supposant 10 antennes de service : pertes du répartiteur d'antenne = 11 dB

Sur la base de l'équation ci-dessus le produit d'intermodulation vers l'antenne devrait être de:

$$-13 + 2 - 12 - 11 = -34 \text{ dBm}$$

REMARQUE : Dans cet exemple, il n'est pas nécessaire de réduire la puissance maximale par porteuse de l'équipement pour réduire le niveau des produits d'intermodulation.

Exemple: Bruit hors bande

Amplificateur de signal connecté à 10 antennes de service avec un câble ½ pouce de 100 m de long.

Pertes d'un tel câble avec les connecteurs = ~ 12 dB

Gain = ~ 2 dBi

En supposant 10 antennes de service: pertes du répartiteur d'antenne = 11 dB

Sur la base de l'équation ci-dessus, le bruit d'entrée hors bande vers l'antenne devrait être de:

$$-44.5 + 2 - 12 - 11 = -65 \text{ dBm}$$

REMARQUE : Dans cet exemple, il est nécessaire d'ajouter un filtre passe-bande externe pour atténuer le bruit hors bande d'au moins 5 dB 1 MHz de plus par rapport au bord de la bande. Si moins d'antennes sont déployées, un filtrage supplémentaire sera nécessaire.

Conclusion:

Les bonnes pratiques d'ingénierie exigent qu'en général, lorsque le bruit dans la bande mesuré à l'entrée de l'antenne de service est supérieur à -43 dBm par bande passante de mesure de 10 kHz, le gain de l'appareil soit réduit jusqu'à ce que les niveaux se situent dans les limites requises.

Les bonnes pratiques d'ingénierie exigent qu'en général, lorsque les niveaux de bruit des produits d'intermodulation mesurés à l'entrée de l'antenne de service sont supérieurs à -30 dBm par bande passante de mesure de 10 kHz, la puissance maximale par porteuse soit réduite jusqu'à ce que les niveaux se situent dans les limites requises.

Les bonnes pratiques d'ingénierie exigent qu'en général, lorsque le bruit hors bande mesuré à l'entrée de l'antenne de service est supérieur à -70 dBm par bande passante de mesure de 10 kHz, à 1 MHz de la bande passante, un filtre passe-bande externe soit ajouté pour atténuer le niveau de bruit hors bande. Tous les répéteurs PBE Axell incluent des duplexeurs et des filtres à haute sélectivité pour atténuer le bruit hors bande. Si un filtrage supplémentaire est nécessaire, nous disposons d'une gamme complète de filtres antiparasites qui peuvent être fournis sur demande.

2.4 General Safety Warnings Concerning Use of System

Always observe standard safety precautions during installation, operation, and maintenance of this product.



Caution labels!

Throughout this manual, there are "Caution" warnings. "Caution" calls attention to a procedure or practice, which, if ignored, may result in injury or damage to the system, system component or even the user. Do not perform any procedure preceded by a "Caution" until the described conditions are fully understood and met.



Danger:
Electrical
Shock

To prevent electrical shock when installing or modifying the system power wiring, disconnect the wiring at the power source before working with uninsulated wires or terminals.



Caution:
Safety to
personnel

Before installing or replacing any of the equipment, the entire manual should be read and understood.

The user needs to supply the appropriate ac or dc power to the repeater. Incorrect power settings can damage the repeater and may cause injury to the user.

Please be aware that the equipment may, during certain conditions become very warm and can cause minor injuries if handled without any protection, such as gloves.

RF radiation, arising from transmitter outputs connected to PBE Axell's equipment, must be considered a safety hazard.



Caution:
RF Exposure

This condition might only occur in the event of cable disconnection, or because a 'spare' output has been left un-terminated. Either of these conditions would impair the system's efficiency. No investigation should be carried out until all RF power sources have been removed. This would always be a wise precaution, despite the severe mismatch between the impedance of an N type connector at 50 ohm, and that of free space at 377 ohm, which would severely compromise the efficient radiation of RF power. Radio frequency burns could also be a hazard, if any RF power carrying components were to be carelessly touched!

Antenna positions should be chosen to comply with requirements (both local & statutory) regarding exposure of personnel to RF radiation. When connected to an antenna, the unit is capable of producing RF field strengths, which may exceed guideline safe values especially if used with antennas having appreciable gain. In this regard the use of directional antennas with backscreens and a strict site rule that personnel must remain behind the screen while the RF power is on, is strongly recommended.

Where the equipment is used near power lines or in association with temporary masts not having lightning protection, the use of a safety earth connected to the case-earthing bolt is strongly advised.



Caution:
Safety to
equipment

When installing, replacing or using this product, observe all safety precautions during handling and operation. Failure to comply with the following general safety precautions and with specific precautions described elsewhere in this manual violates the safety standards of the design, manufacture, and intended use of this product.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

PBE Axell assumes no liability for the customer's failure to comply with these precautions. This entire manual should be read and understood before operating or maintaining the repeater.



Warning:
Restricted
Access
Location

Access to the unit installation location is restricted to SERVICE PERSONNEL who have been instructed on the restrictions and the required precautions to be taken. The unit should therefore be installed in location where children are unlikely to present.



Attention:
Electrostatic
Sensitivity

Observe electrostatic precautionary procedures.

ESD = Electrostatic Discharge Sensitive Device.

Static electricity can be conducted to the semiconductor chip from the centre pin of the RF input connector, and through the AC connector pins. When unpacking and otherwise handling the repeater, follow ESD precautionary procedures including use of grounded wrist straps, grounded workbench surfaces, and grounded floor mats.

The repeaters described in this manual are equipped with class 1 lasers, as per definition in EN 60825-1

Caution - Un-terminated optical receptacles may emit laser radiation. Exercise caution as follows:

Use of controls or adjustments or performances of procedures other than those specified herein may result in hazardous radiation exposure



Caution:
Class 1 Laser

Do not stare into beam or view with optical instruments. Optical transmitters in the Fibre optic converter can send out high energy invisible laser radiation. There is a risk for permanent damage to the eye.

Always use protective cover on all cables and connectors which are not connected.

Never look directly into a Fibre cable or a connector.

Consider that a Fibre can carry transmission in both directions.

During handling of laser cables or connections, ensure that the source is switched off.

Regard all open connectors with respect and direct them in a safe direction and never towards a reflecting surface. Reflected laser radiation should be regarded as equally hazardous as direct radiation.

3 Introduction to MBF-40 SMR 700/800 Repeater for Public Safety

The Multi-Band Fibre optic fed system encapsulates solutions for single or multi-operator use. It offers seamless coverage in any indoor environment such as tunnels, subways, and large buildings. Signals are coupled off from a nearby base station using an Optical Master Unit (OMU) and then distributed via Fibre to one or more MBF-40 repeaters.

The MBF-40's high output power allows for greater coverage whilst deploying fewer units. Even though providing high output power, the MBF-40 uses convection cooling, subsequently increasing the repeater's MTBF. These remote units can be installed at a distance of up to 20 km from the base station site, offering great flexibility when providing RF coverage in areas where off air transmission is not a preferable solution.

A distributed antenna system (DAS) can be used to distribute the signal throughout the area to be covered. PBE Axell can provide a complete solution including design, site surveys and equipment related to the POI (Point Of Interface) such as combiners, filters, cross band couplers, etc.

Note the following:

- For sites requiring FCC compliance, the system can only be installed for in-building applications.
- For sites requiring IC compliance (Canada), the system can be installed for both in-building and outdoor applications.

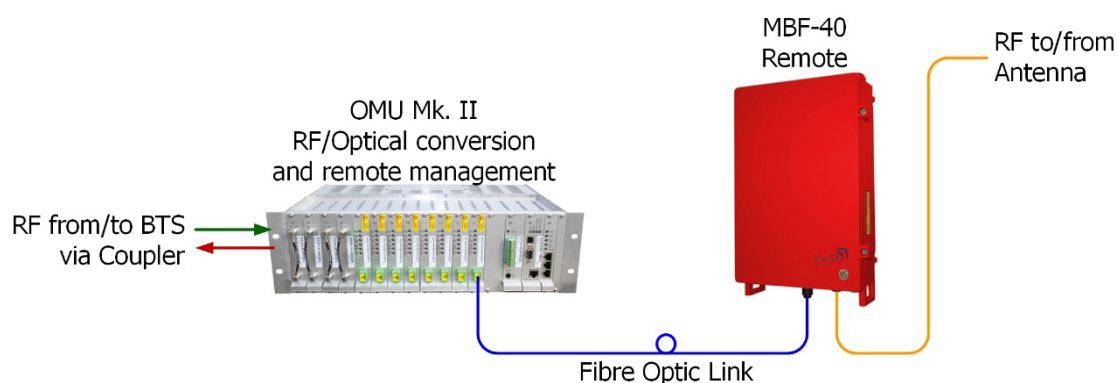


Figure 3-1: Illustration of a standard OMU II MBF Remote Application

3.1 Features and Capabilities

- High-power indoor/outdoor unit dual-band model, supporting SMR at 700/800 MHz.
- Output power at the antenna (composite): 37 dBm.
- Very low noise factor - minimizes interference to BTS and increases high speed data throughput
- Single or Dual Fibre feed models available
- Remote commissioning and monitoring:
 - Via OMU II intuitive Web GUI
 - Via AEM – no local setup required
 - SNMP v1/v2c support
- Plug-and-Play: Automatic detection and Optical Gain Setting via the OMU
- Automatic Level Control (ALC) - provides constant gain in both uplink and downlink paths according to the defined maximum output level
- Backup battery for 'last gasp' indication (sending fault error before power failure)
- Optional - two internal power supplies provided for some models ensure robust unit operation
- Power source: 115 V ac or -48 V dc power (model dependent)

3.2 ALC

The repeater has a constant gain in both uplink and downlink paths. The repeater has a defined maximum output level. If the input signal amplified by the gain set exceeds the set output limit, an ALC (Automatic Level Control) loop is activated. This ALC ensures that the amplifier does not add distortion to the radio signal. Below are examples of the ALC function for one and two carriers.

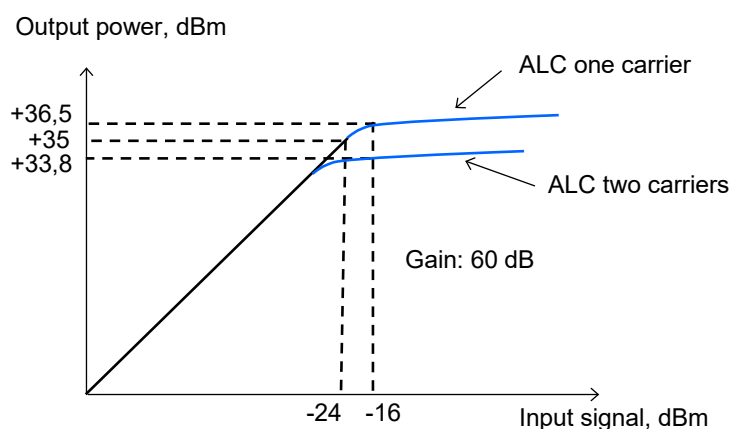


Figure 3-2: ALC

3.3 Operating Temperature

The MBF-40 is designed primarily for multi carrier purposes. If the repeater is run at full output power over a long period of time, additional, external cooling may be required; this can take the form of air-conditioning or an external fan assembly.

NOTE: The repeater is equipped with a power management function that steps down the power and, if needed, fully shuts down the amplifier chains until temperature reaches normal values.

3.4 MBF-40 Management Web GUI

MBF-40 is remotely commissioned and monitored via an OMUII session. Local access to the unit is not required for commissioning.

Additional configuration and troubleshooting options are available via a direct connection to the MBF-40 IP address. A direct session can be opened locally or remotely.

NOTE: Direct remote communication requires connecting the MBF-40 to an Ethernet network.

3.5 MBF-40 Basic Interfaces

The MBF unit provides several types of interfaces:

- Lock and screws for protection and security
- External service antenna and GND connections
- Internal connections for power, Fibre optics and alarm cables routed via openings in the front panel.
- Internal USB and Ethernet connections for local setup via Web GUI

3.5.1 External Interfaces

NOTE: The external connections at the bottom of the repeater can be protected with a cover which is screwed in place.

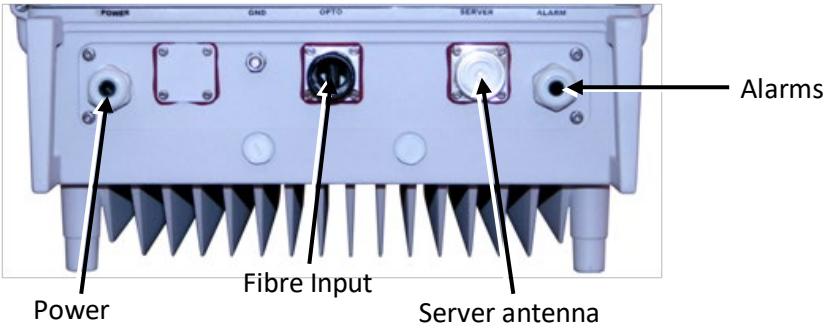


Figure 3-3: External Interfaces

Port	Description
Server	Service antenna connection - 7/16 DIN connector, female
Optic	SC/APC Fibre optic inlet through which the optic Fibre is routed for internal connections (section 4.2.12).
Power	Plinth connection for routing power for internal connection (section 4.2.14.1)
Alarms	Plinth connector for routing external alarms and relay wiring cable for internal connections (section 4.2.15).
GND	Grounding lug (section 4.2.11)

3.5.2 Securing the Unit

The repeaters are secured with two hex screws (M8) and can also be locked with a key.

NOTE: The two screws must be fully tightened. Failure to do so may affect the IP66 compliancy and therefore any warranty.



Figure 3-4: Securing the Repeater

3.5.3 Internal Interfaces

This section shows the internal interfaces relevant to the following operations:

- Connect power
- Connect optic Fibres
- Connect alarms (if relevant)
- Power-on (Power-ON switch)
- Optional – USB/Ethernet port for local setup

NOTE: The internal view of your repeater may be different, but the general location of the relevant items is the same.

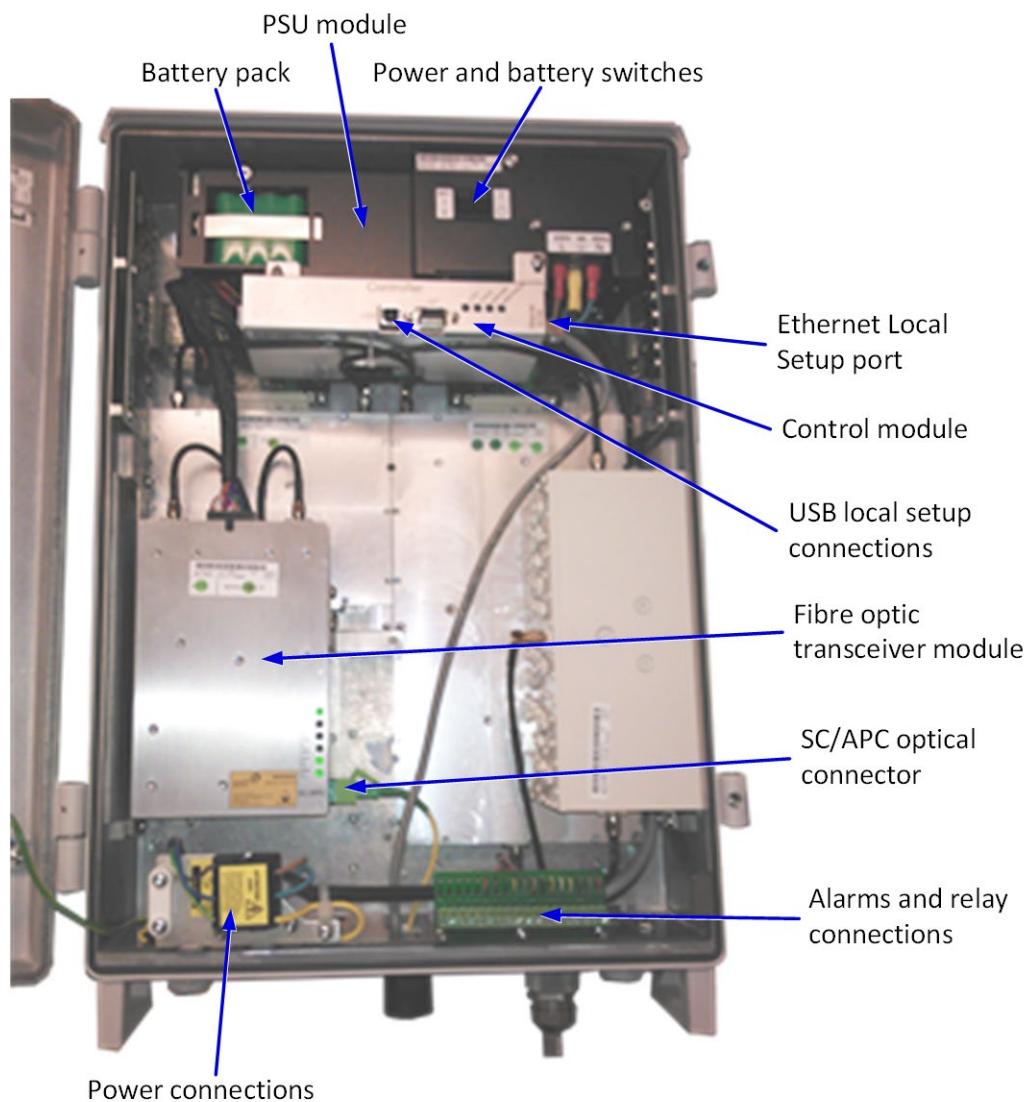


Figure 3-5: MBF Repeater with Door Open

4 Installation requirements and procedure

This chapter provides information on the service antenna requirements, general installation requirements and the installation procedure. The unit shall be installed in accordance with the relevant National Code and requirements. Access to the unit installation location is restricted to SERVICE PERSONNEL who have been instructed on the restrictions and the required precautions to be taken. The unit should therefore be installed in location where children are unlikely to be present.

4.1 Service Antenna Requirements

This section provides the service antenna requirements in English and in French.

4.1.1 Service Antenna Requirements (English)



ATTENTION!

- The installer is held accountable for implementing the rules required for deployment.
- Good engineering practice must be used to avoid interference.
- Output power should be reduced to solve any IMD interference issues.

4.1.1.1 Required Antenna Information

NOTE: The Service antenna is installed indoors, where the type of antenna depends on the application.

The following antenna requirements, specifications and site considerations should be met:

- Type of installation – indoor or outdoor
- Service area type and size
- Antenna type and characteristics
- Height
- Length and type of coaxial cable required for connecting the antenna to the Repeater and the attenuation.

4.1.1.2 Indoor Installations FCC & IC Required Compliance

Recommended Antennas

The following describes the requirements for an omni-directional mobile used for indoor applications.

- One or a combination of the following antennas can be used: Ceiling Mount Patch antenna, Wall Mount Patch antenna, Corner Reflector.
- Maximum antenna gain for indoor operation 4.14 dBi.
- Antenna impedance 50-ohms
- Cable and jumper loss is at least 2 dB.
- [Gain Antenna – Cable loss] should not exceed 2.14 dB.

4.1.1.3 Indoor Installation Antenna Installation Criteria

Determine the antenna installation configuration, according to the transmission requirements and the installation site conditions.

Installation requirements:

- An indoor antenna should be installed at a convenient location. It should be free of metallic obstruction.
- Install the Service Antenna at the designated height and tune it roughly toward the Service coverage area.
- Installation of this antenna must provide a minimum separation distance of 36 cm from any personnel within the area.

4.1.1.4 Outdoor Installations Requirements

For applications in which the Service/Mobile antenna is installed outdoor, the antenna type is chosen according to the available infrastructure (single-pole or horizontal installation). In addition, isolation between the donor and service antennas must be taken into account when selecting the location of the antennas.

Installation of this antenna must provide a minimum separation distance of 36 cm from any personnel within the area.

4.1.1.5 Outdoor Installations FCC & ISED Compliance Requirements

The antenna type depends on the installation:

- For outdoor applications a Yagi antenna should be used.
- Maximum antenna gain for outdoor operation 16.14 dBi.
- Antenna impedance 50 ohms
- Cable and jumper loss is at least 3 dB.
- Internal Downlink attenuation set to a minimum of 11 dB.
- (Gain antenna- (cable loss + internal attenuation)) should not exceed 2.14 dB.
- For Lower Gain antennas, the internal attenuation can be reduced by the equivalent reduction in antenna gain, from the maximum specified above.

4.1.2 Exigences d'antenne de Service (Français)



ATTENTION!

- La technicien qui installe l'unité tenu pour responsable de la mise en œuvre des règles requises pour le déploiement.
- Les bonnes pratiques d'ingénierie doit être utilisée pour éviter les interférences.
- Puissance de sortie doit être réduite pour résoudre tous les problèmes d'interférence de l'IMD

4.1.2.1 Antenne Informations Requises

Notez bien: L'antenne de service est installé à l'intérieur, où le type d'antenne dépend de l'application.

Les exigences d'antenne suivants, les spécifications et considérations du site doivent être remplies:

- Type de montage - intérieur ou extérieur
- Type de zone de service et la taille
- Type et les caractéristiques de l'antenne
- Hauteur
- La longueur et le type de câble coaxial requis pour relier l'antenne au répéteur et l'atténuation.

4.1.2.2 FCC et ISDE conformité de l'installation intérieure

Ci-dessous décrit les exigences pour un portable omnidirectionnel utilisé pour des applications intérieures:

- Un ou une combinaison des antennes suivantes peuvent être utilisées: Antenne Patch pour montage au plafond, antenne Patch pour montage mural, Réflecteur en Coin.
- gain d'antenne maximal pour une utilisation en intérieur 4.14 dBi
- Impédance d'antenne: 50 ohms
- Câble et la perte de cavalier est d'au moins 2 dB.
- [Gain Antenna - la perte de câble] ne doit pas dépasser 2.14 dB

4.1.2.3 Critères d'installation de l'antenne d'installation d'intérieur

Déterminer la configuration de l'installation de l'antenne, selon les exigences de transmission et les conditions du site d'installation.

Exigences d'installation:

- Une antenne intérieure doit être installée à un endroit pratique. Il doit être libre de tout obstacle métallique.
- Installez l'antenne de service à la hauteur désignée et l'accorder à peu près vers la zone de couverture du service.
- L'installation de cette antenne doit fournir une distance minimale de séparation de 36 cm de tout le personnel dans la région

4.1.2.4 Installations Extérieures

Pour les applications dans lesquelles le antenne du service / mobile est installé extérieure, du type d'antenne est choisi en fonction de l'infrastructure existante (unipolaire ou installation horizontale). En outre, l'isolement entre le donneur et les antennes de service doit être pris en compte lors du choix de l'emplacement des antennes.

L'installation de cette antenne doit fournir une distance minimale de séparation de 36 cm de tout le personnel dans la région.

4.1.2.5 FCC et ISDE conformité pour Installation à l'extérieur

Le type d'antenne dépend de l'installation

- Pour les applications extérieures une antenne Yagi doit être utilisé.
- Gain d'antenne maximal pour l'utilisation en extérieur 16.14 dBi.
- Impédance d'antenne: 50 ohms
- La perte de câble et la perte de cavalier est d'au moins 3 dB.
- Downlink interne atténuation est définie à un minimum de 11 dB.
- [Gain Antenna – (a perte de cable + interne atténuation)] ne doit pas dépasser 2.14 dB
- Pour les antennes Basse Gain, l'atténuation interne peut être réduite par la réduction équivalente du gain d'antenne, à partir de la valeur maximale spécifiée ci-dessus.

4.2 Infrastructure and Cabling Considerations

This section includes the following information:

- RF and grounding cabling guidelines
- Power requirements
- F/O installation guidelines
- EMV protection requirements
- External alarm and relay considerations
- Criteria for selecting the repeater location

4.2.1 RF Cable Installation Guidelines

- For all coaxial connections to/from the Repeater – use high performance, low-loss, 50-ohm coaxial communication cables.
- All cables shall be weather-resistant type.
- Cable length – determined by the Repeater installation plan. When calculating the cable length, take into account excess cable slack so as not to limit the insertion paths.
- Make sure the cable and the connector are compatible. Using cables and connectors from the same manufacturer is helpful.
- All connectors must be clean and dry.
- Waterproof all outdoor connections using silicon, vulcanizable tape or any other suitable substance, as moisture and dust can impair RF characteristics
- Make sure enough room has been allocated for the bending radius of the cable. RF cables must not be kinked, cut, or damaged in any way.
- Connect the RF cable to the antenna tightly but without damaging threads.
- Fasten cable tightly to cable ladder or aluminium sheet.
- For short length feeder cables, use ½"; for longer feeder cables, use ⅝". Choose thicker coax cables for lower attenuation. Minimize the length of the coax cables to reduce attenuation.
- Use jumper cable for easy installation. The RF coaxial cable can be substituted at each end with a jumper cable.

4.2.2 Grounding Wires Requirements



WARNING! Do not use the repeater grounding bolt to connect external devices.

Requirements for grounding wires

- Ensure that good grounding protection measures are taken to create a reliable repeater site.
- Make sure to use adequately dimensioned grounding cables. The minimum recommended conductive area for a grounding cable is 16 mm²
- Make sure the grounding product used is suitable for the type and size of used cable.
- Connect the repeater box bolt to the same ground.

4.2.3 Power Requirements

This section describes the circuit breaker requirements and power cabling and connection considerations for 115 V ac power source and for -48 V dc power sources.

4.2.3.1 Circuit Breaker Requirements

The power connections to the unit are hard-wired. To disconnect the unit (either manually or automatically in case of overcurrent), it is required to install a circuit breaker on the wall near the unit, at an easily accessible distance and location from the unit. Units are intended to be supplied from normal building wiring where transient does not exceed 1500 Vpk.

Circuit-breaker minimum requirements

- 115 V ac and 48 V dc - maximum current 10 A
- Needs to be SAFETY approved
- Use only a two-pole disconnect device.
- Requires minimum contact separation of 3 mm.
- Install on the wall near the unit.

4.2.3.2 Selection of ac or dc power supply cord and plug

Cable requirements:

The cable shall be certified sheathed copper weather resistant cord with certified plug suitable to serve as power disconnect device. The cord and plug shall be compliant with relevant National Code and requirements. Socket outlet for the plug shall be readily accessible. The cord shall be 6-11 mm in diameter.

The cord sheath shall extend from the cord anchorage into the equipment to a length of at least one half of the cord diameter. ac or dc plug shall have a rated current of min. 6 A for ac unit and 8 A for dc unit for countries other than US/Canada.

Cord shall be minimum 2.5 mm² or 14 AWG per conductor and maximum 4mm² or 12 AWG per conductor. For US/Canada the cable shall be UL Listed and CSA Certified weather resistant cord (marked "W") with certified plug rated min. 8 A for AC unit and 10 A for dc unit.

For US/Canada cord length shall be minimum 1.5 m. Caution: do not use actype plug for dc unit and vice versa. For safety, the GND cable shall be 10 mm longer than the Phase and Neutral cables. In US/Canada flexible power supply cords are required to be compatible with Article 400 of the NEC, and Tables 11 and 12 of the CEC.

4.2.3.3 -48 V dc Power Source Connection Requirements

Note: The -48VDC version of the power supply is designed to turn off if the supply voltage falls below -36V ($\pm 1V$), not to drain the feeding battery. It will turn on again as the supply voltage reaches -43V ($\pm 1V$).

-48 V dc power supply requirements

The 48 V dc power supply must comply with SELV requirements, as defined in EN60950, which implies double isolation. The output power needs to be 48 V dc +20%/-15%. The maximum input current is 8A.

Recommended cable areas for 48VDC

Distance	Cable Area
0 to 10 meters between repeater and power supply	2,5 mm ²
10 to 50 meters between repeater and power supply	4 mm ²
Over 50 meters between repeater and power supply	Recommendation is to reconfigure the installation, or to make special arrangements to increase cable area

4.2.4 F/O Cable Installation Guidelines

This product is equipped with **Class 1 Lasers**, as per definition in EN 60825-1.

	CAUTION! Un-terminated optical receptacles may emit laser radiation. Do not stare into beam or view with optical instruments.
	WARNING! Maximum input power should not exceed (zero) 0 dBm Clean the Fibre connectors (receptacles and cables) before connecting. See Appendix B – F/O cleaning procedure for details on F/O cleaning procedures.

Note the following:

- This procedure requires opening the repeater.
- Use angled APC connectors at 8deg angle over the complete link between the Repeater and OMU
- Use APC type ODF connections
- Required Fibre cable: single mode 9/125
 - Cable length - determined by the Remote installation plan. When calculating the cable length, take into account excess cable slack so as not to limit the insertion paths.

4.2.5 EMV Protection



CAUTION!
Ensure good EMV protection. If insufficient Electromagnetic Protection is provided, or if EMV measures are not taken, warranties issued by PBE Axell are not valid.

Connect the lightning protection

The lightning hazard to electric and electronic equipment consists in the interferences of direct lightning current infections and high surge voltages induced by the electromagnetic field of nearby lightning channels or down conductors. Amplitudes from cloud-to-earth lightning amounts to several 10kA and may last longer than 2ms. The damage caused depends on the energy involved and on the sensitivity of the electronics systems. Ensure that lightning protection measures are taken to create a reliable repeater site. Protect all coaxial cables and power cables from the transients caused by lightning. Fit all cables with suitable lightning protection devices.

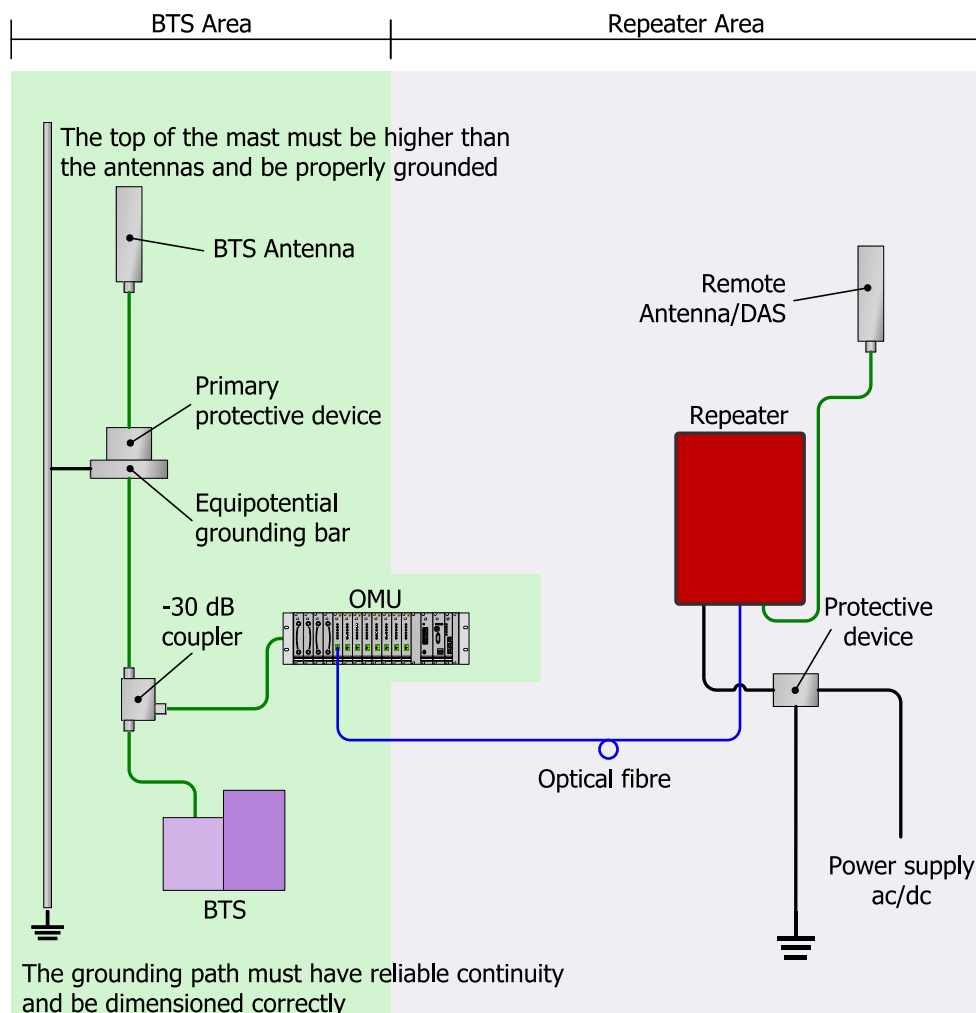


Figure 4-1: Example of EMV protection for a repeater system

For detailed information please refer to IEC 61024-1 and 61312-1 for international standards for protection of information systems against LEMP (Lightning Electromagnetic Pulse), including radio transmitters. They define proper planning, installation, and inspection of effective lightning protection systems.

PBE Axell repeaters comply with the EN standard ETS 301 498-8 which stipulates demands on lightning/surge protection for typical infrastructure telecom equipment installations.

Several lightning protection devices should be used in series with declining threshold voltages to help attenuate the pulse component which makes it through the first layer of protection.

The primary protective device is part of the site installation and is not supplied by PBE Axell. Coaxial lightning protection is normally one of these three types: Gas capsule, High-pass and Bandpass. There also need to be a protective device installed on the power supply cord.

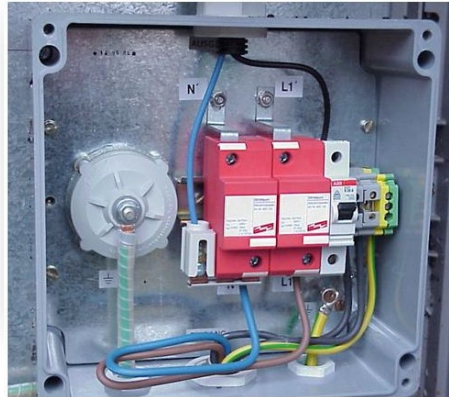


Figure 4-2: Protective device installed in connection with the power supply

4.2.6 External Alarm and Relay Considerations

For installations that include connections of external alarms and relays

- The connector plinth for the external alarms is located inside the repeater.
- The strain relief fitting in is a Pg 13.5 suitable for a 6-12 mm cable diameter.
- Four external alarm sources can be connected to the repeater.
- Alarm operating voltage: between 12 and 24 V dc.
- The relay supplies 50 mA maximum current

4.2.7 Location Criteria

Location criteria

- **For wall mount installations:**
 - **Wall compatibility** - check the suitability of the wall on which the unit is to be fitted.
- **Plan mount** - check the actual fixing centres (see below) and overall dimensions of the unit enclosure. The unit is supplied with two wall mounting brackets; when the unit is mounted on these brackets adequate ventilation is provided between the unit and the wall to which it is fixed.
- **Plan connection cable clearances** - the Optical, RF and power connections located on the underside of the unit will need at least 300mm vertical clearance below the unit to enable the connections to be made. The minimum bend radius for Optical and RF cables must not be less than the recommendations made by the cable manufacturer. Plan the cable runs and ensure adequate space is available.
- **Allow for door opening** - ensure that there is sufficient space at the front of the unit to allow the door to be fully opened and for maintenance engineers to get access to the unit with test equipment such as a spectrum analyser. Allow an additional 500 mm of space in front of the unit when the door is fully open.
- **Allow for heat dispersion** - Mount the repeater so that heat can be dispersed from it. The repeater wall mounting kit ensures an optimum airflow between the wall and the repeater.) Do not block this air channel as it will cause the MTBF of the repeater to drop dramatically, or even in the worst case cause the repeater to fail completely. If possible, use a wall in the shade to minimize the overall sun loading. If sufficient shielding cannot be obtained, an additional sun shield should be mounted.



Figure 4-3: Example of a sun shield Repeater Installation

4.2.8 Unpacking

Upon receiving the MBF-40 Repeater perform the following:

1. Examine the shipping container for damage before unpacking the unit.
2. Perform a visual inspection to reveal any physical damage to the equipment.
3. Verify that all of the equipment (listed below) is included. Otherwise contact PBE Axell. The MBF-40 Repeater is shipped with the following equipment:

Package Contents

USB Flash Drive or CD-R media containing User Manual and USB driver		
Repeater Mounting Brackets. Two identical brackets used for wall mount and for rackmount		
Additional (supplied) installation components:	Qty.	Description
	4x	M8x12 bolts for securing the Repeater to the brackets
	1x	Insex tool for bolts
	1x	Power Cable
	1x	Fibre Conduit inlet hose fitter (may be pre-assembled)
	2 x	Sets of keys

4.2.9 Rack Mount Installation

The supplied brackets are used to mount the repeater either on a wall or in a 19" rack. The same brackets are used for both medium and high-power repeaters.

IMPORTANT!



- The weight of the unit requires that two people mount the unit onto the rack.
- The signal booster must always be installed vertically with the connectors on the underside for protection. *Horizontal installation on a bench for long time may cause damage to the signal booster due to over-heating.*

To mount the repeater in a rack

1. Use the Qty. 4 (provided) **M8 Fixing Bolts** and Qty. 4 **Spring Washers** to assemble the brackets as illustrated below.

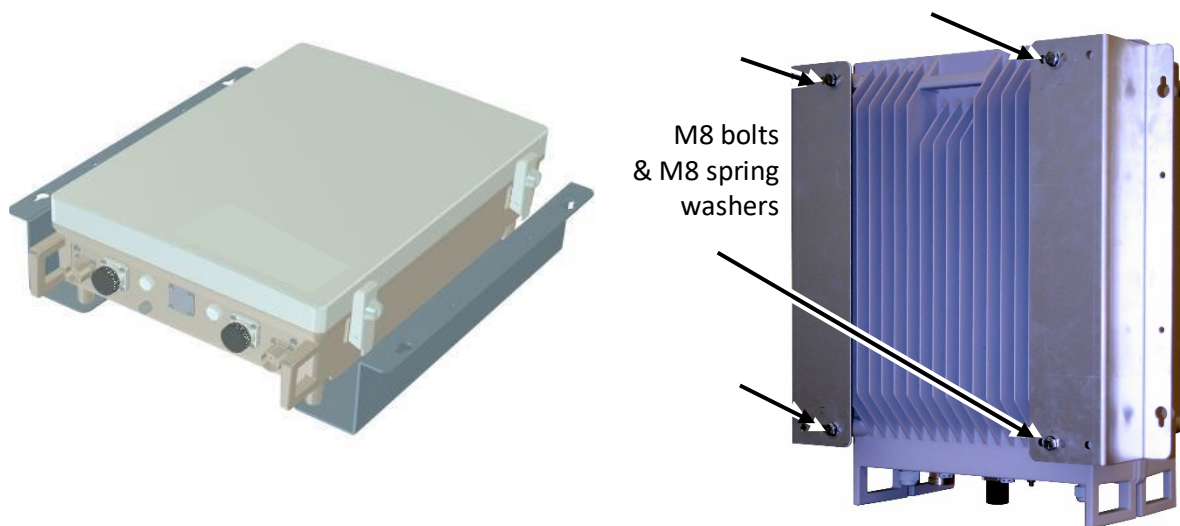


Figure 4-4: Rack-mount bracket position

2. Mount the repeater *vertically* in the rack, while adhering to standard rack mounting procedures, and secure.



Figure 4-5: Rack-mount Repeater position

4.2.10 Wall Mount Installation



IMPORTANT!

- The repeater mounting procedure is for concrete or brick walls only.
- The weight of the unit requires that two people mount the unit on the wall.
- The signal booster must always be installed vertically with the connectors on the underside for protection. *Horizontal installation on a bench for long time may cause damage to the signal booster due to over-heating.*

4.2.10.1 Wall Mount Bracket Assembly

NOTE: In addition to the mounting brackets, it is recommended to use additional fixings as described in section 4.2.10.4.

To assemble the brackets

Assemble the brackets to the Repeater using the supplied M8 bolts and Spring Washers as shown in the following figure.

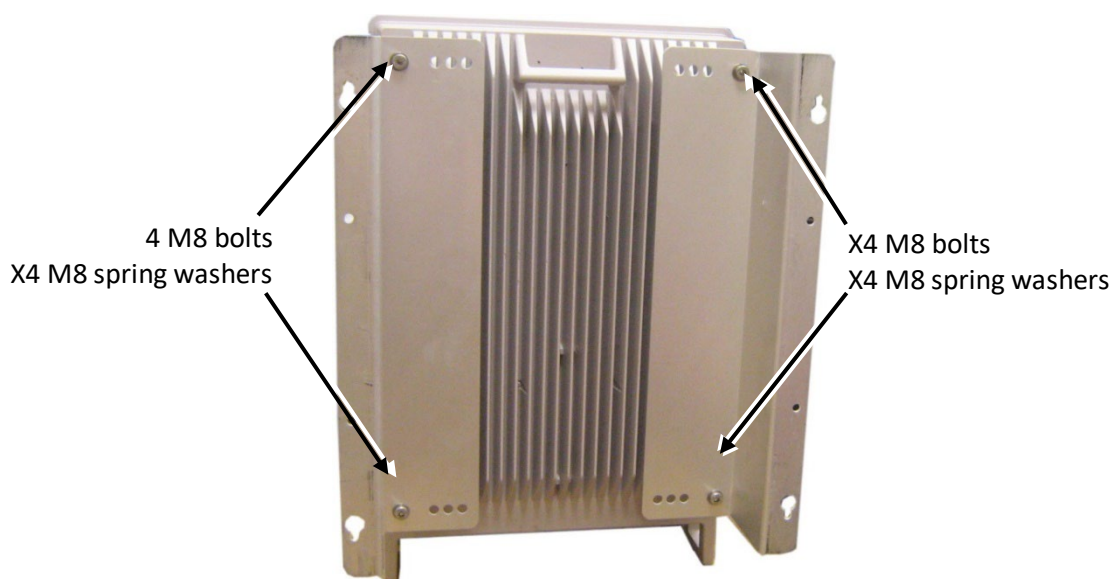


Figure 4-6. Position of Brackets for Wall mount

4.2.10.2 Wall Marking and Drilling

	WARNING!! • Due to the weight of the Repeater, it is NOT recommended to fix to a hollow wall!. • The Repeater wall mount brackets assembly should be fixed to a solid wall (these include brickwork, block work, and concrete). • Always check that there are no pipes or cables hidden in the wall beneath the area to be drilled. Various pipe and cable detectors are available for this type of inspection.
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- To provide secure fixing to a solid wall, the most common method is drilling and plugging. The size of fixing is dependent on the item to be fixed and the nature of the wall, The Repeater should be fixed with mild steel, M6 (50mm to 75mm) rawlbolts or similar.
- Care must be taken to ensure the alignment of the four fixings. A spirit level or plumb line should be used to ensure horizontal/vertical alignment.

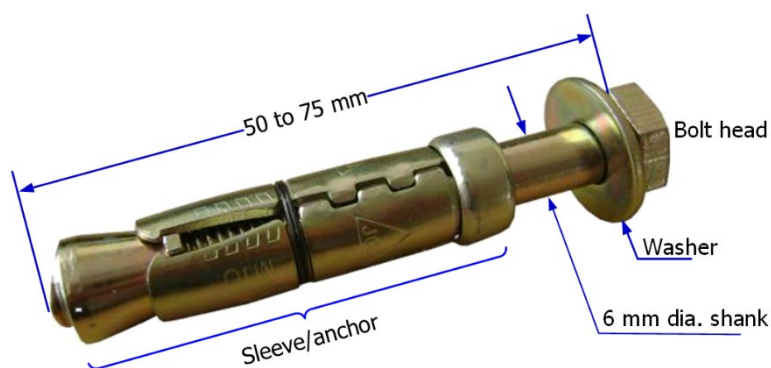


Figure 4-7: M6 Rawlbolt – recommended for wall mount.

To mark and drill the wall

1. Using the provided *drill template*, mark out the fixing centres of the repeater on the chosen wall. The repeater dimensions are shown below.

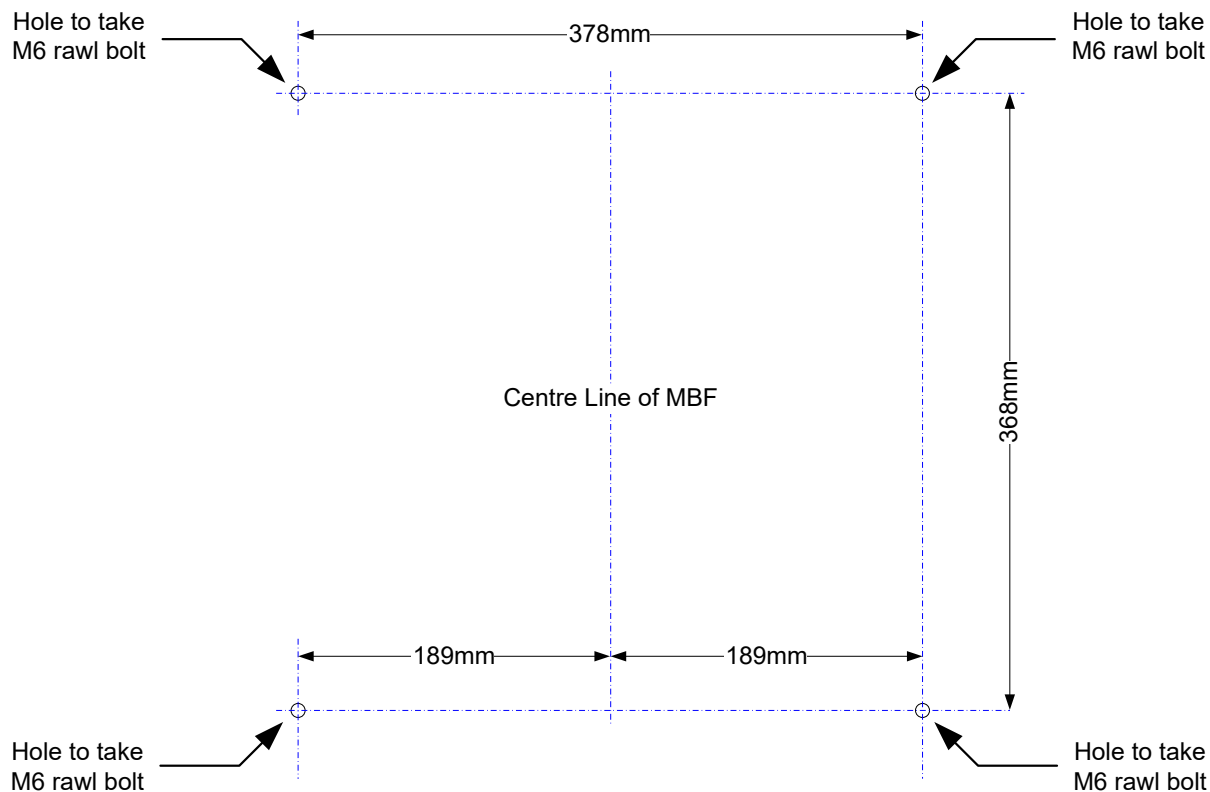


Figure 4-8: Fixing Centres

2. Mark and drill the wall with the correct size masonry bit as specified by the fixing manufacturer.
- NOTE: It is good practice to wear goggles to protect your eyes from flying debris when using power tools.
3. Hold the drill bit against the mark and begin drilling slowly so that the bit does not wander from the position. The wall should be drilled to a depth which is sufficient to accommodate the full length of the fixing.
 4. Insert the fixings so that the top of the sleeve/anchor section is level with the wall surface.
 5. Gently tighten the bolt by hand so that the anchor section of the fixing expands and grips the inside of the hole.

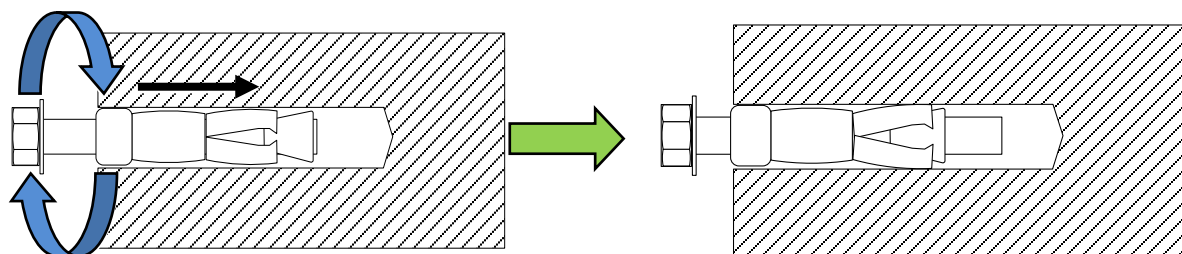


Figure 4-9: Inserting Fixing and Tightening.

6. As the bolt pulls its way in, the sides of the anchor section are forced outwards, gripping the surrounding surface.

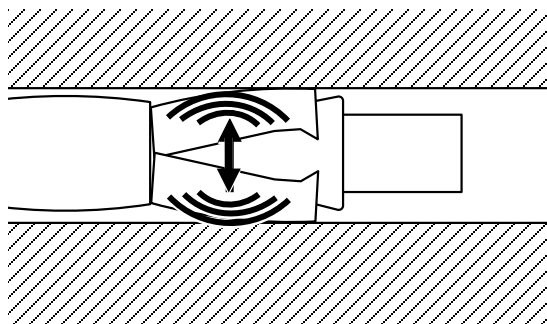


Figure 4-10: Anchor Sides Pushed Outwards.

7. Once all four fixings are in place, carefully withdraw the four bolts.

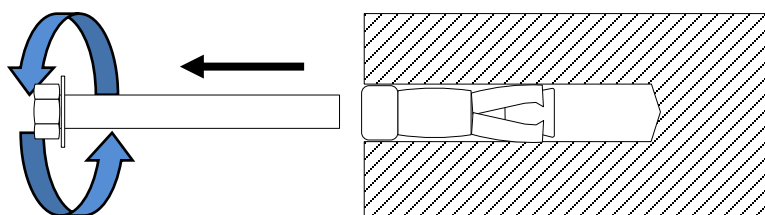


Figure 4-11: Withdraw Bolts.

4.2.10.3 Mount the Repeater



CAUTION! It is recommended that two people lift the repeater since (depending upon the configuration) the repeater weighs between 20 and 38 kg (44 and 84 lb)

To mount the repeater

- Align repeater with the four fixings. Great care should be exercised here as the repeater is very heavy. (A suitably rated heavy duty scissor lift table/trolley may be suitable for this operation.)
- Once repeater is held in the chosen position, carefully insert the fixing bolts through the mounting lugs of the Repeater and into the sleeve/anchor sections of the fixing in the wall and tighten the bolts.

Note: The repeater needs to be mounted tightly to eliminate vibration.

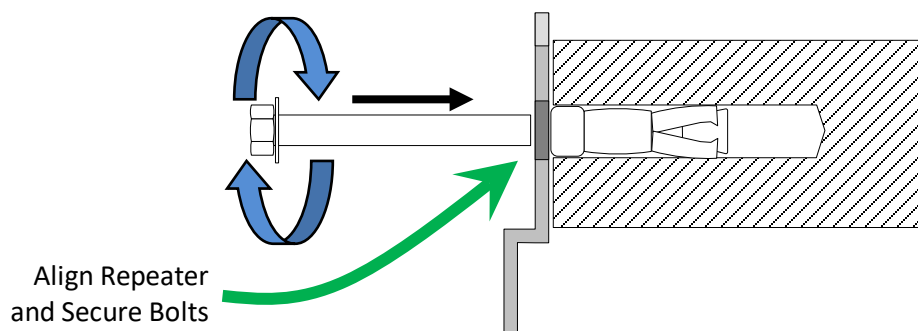


Figure 4-12: Mount Repeater

4.2.10.4 Recommended Additional Fixing



ATTENTION! It is the installer's responsibility to ensure the repeater is installed in a secure manner.

Suggested precautionary measure:

- A bracket is provided to securely mount the repeater on the wall; however, as an ADDITIONAL precautionary measure, it is recommended to further secure the repeater to the wall (in addition to the bracket).
- This can be done using any appropriate method.

The following figures provide *examples* of additional fixings. In the examples, support is provided in the form of a cable harness loop that is looped around the repeater handle and secured to the wall or part of the building support structure.

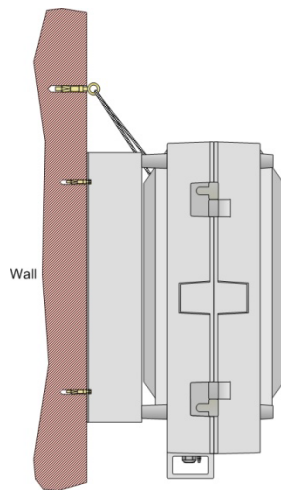


Figure 4-13: Example 1 – Additional Fixing to Wall

Another example is of a repeater installed on a stadium gantry. Again, the support can be in the form of a cable harness loop, using the handle of the repeater and part of the gantry structure.



ATTENTION! Any other SECURE method can be used.

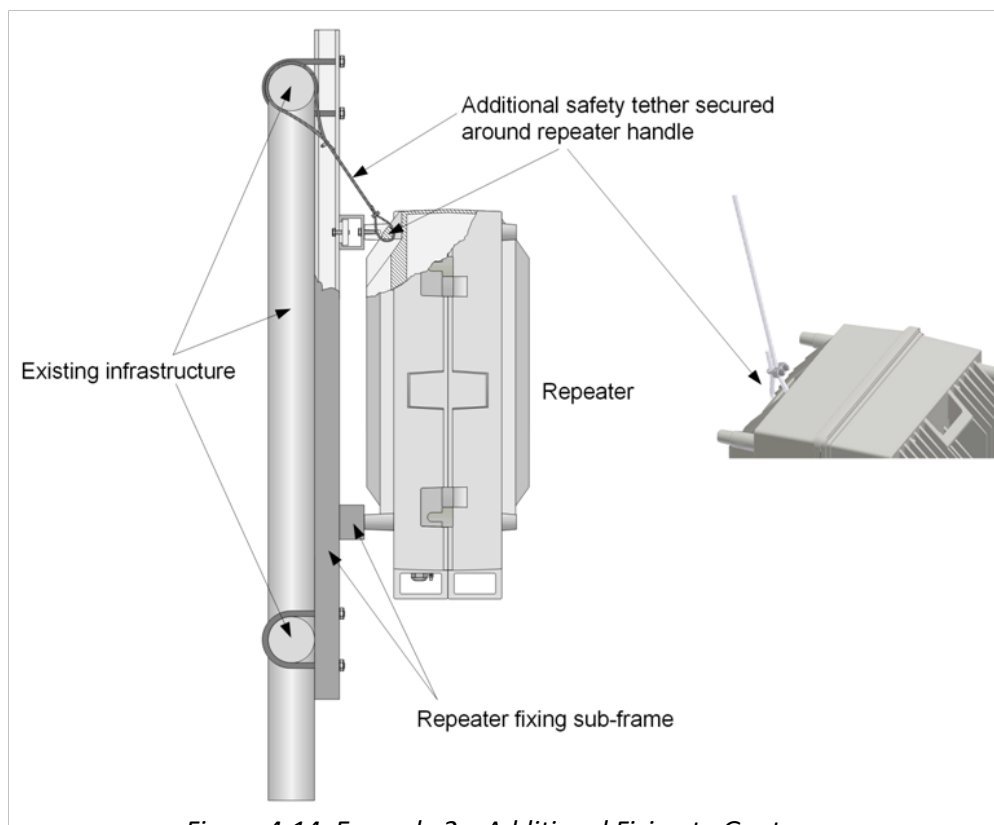


Figure 4-14: Example 2 – Additional Fixing to Gantry

4.2.11 Grounding



WARNING! Do not use the repeater grounding bolt to connect external devices.

To ground the repeater

- Refer to the grounding requirements described in section 4.2.2.
- Connect the grounding protection to the repeaters ground lug.



Figure 4-15: Grounding the MBF-40

4.2.12 Fibre Optic Connection

This product is equipped with **Class 1 Lasers**, as per definition in EN 60825-1.

	Warning! Maximum input power should not exceed 0 (zero) dBm Clean the Fibre connectors (receptacles and cables) before connecting. See Appendix B for details on F/O cleaning procedures.
	CAUTION! Un-terminated optical receptacles may emit laser radiation. Do not stare into beam or view with optical instruments.

To connect the optic fibre

1. Refer to the optic fibre cable installation guidelines described in section 2.2.4.
2. Open the repeater door to access the optic fibre port(s).

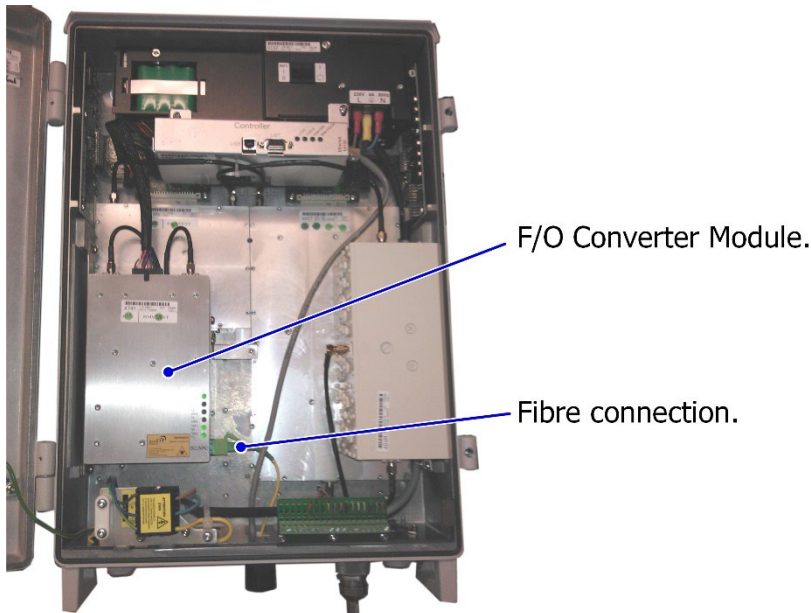


Figure 4-16: Single Optic Fibre Repeater

3. It is recommended to run the optical fibre through a short length of polyamide corrugated sleeve (not supplied) such as those supplied by Reiku GmbH, this is to provide protection to the fibre optic cable where it enters the repeater and to ensure that the optic cable input gland meets the IP65/NEMA4 standard. Reiku part number: PA R N B-17F is recommended as this has an outside diameter of 21.5 mm and an internal diameter of 16.5 mm.

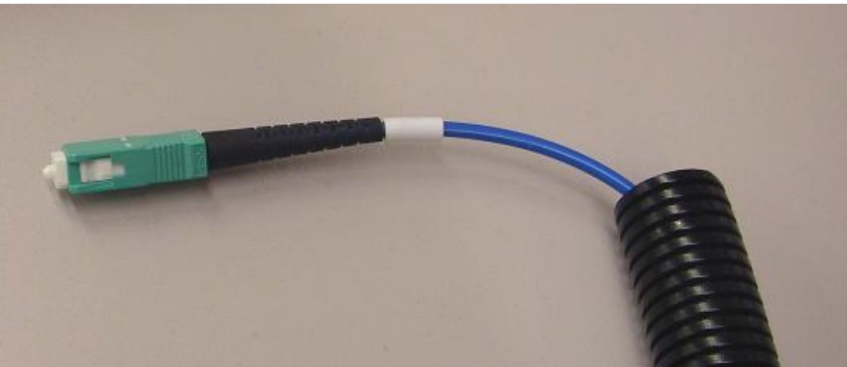


Figure 4-17: Run Optic Fibre(s) through polyamide corrugated sleeve

4. Route the optic cable(s) via the optic cable input gland fitted on the front panel.

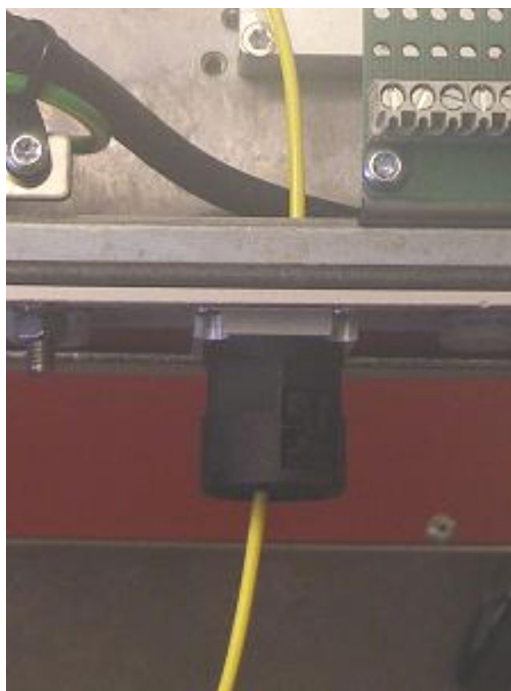


Figure 4-18: Route via the optic cable input gland

5. Place the Fibre(s) in the supplied rubber seal



Figure 4-19: Run Fibre in the Rubber Seal

6. Insert the rubber seal into the optic cable input gland and adjust the length of the fibres inside the unit so that they comfortably reach the optical connectors on the fibre optic modules.



Figure 4-20: Adjust F/O cable length

7. Connect the Fibre(s) to the Fibre Optic Converter inside the repeater.
 - For dual fibres, connect two fibres to the two optic converters installed in the repeater.
 - Make sure the Fibre is not bent too sharply inside the repeater as to avoid communication disruptions.

Note: Clean the Fibre connector before connecting it to the system. See instructions in Appendix B.

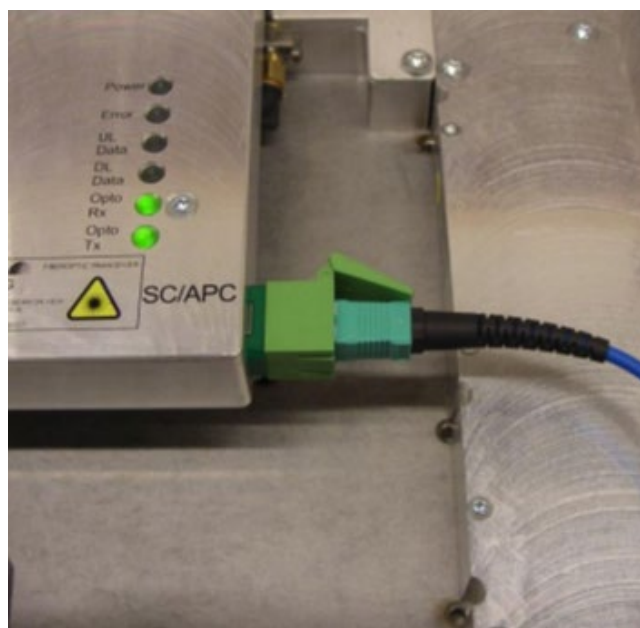


Figure 4-21: Single F/O Connection

8. Attach the polyamide corrugated sleeve to the optic cable input gland, it should be a push-fit and the rubber seal should sit snugly inside the sleeve. This completes the procedure.

NOTE: The corrugated sleeve (not supplied), together with the rubber seal, meets the protection standard IP66/NEMA4.

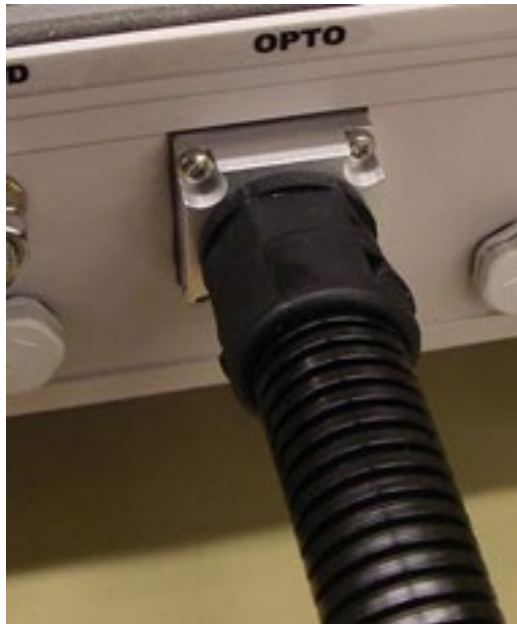


Figure 4-22: Connect Sleeve

4.2.13 Service Antenna Connections



WARNING! Be sure the antennas are connected BEFORE applying power to the repeater.

Connect the Server antenna to the Repeater 7/16 DIN server antenna connection.

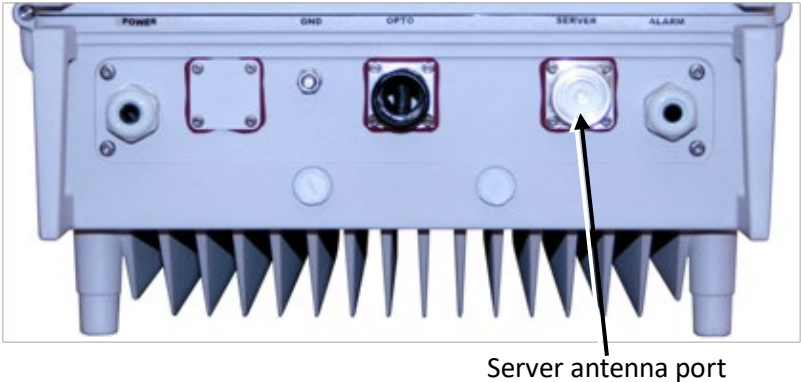


Figure 4-23: Service Antenna Connection

4.2.14 Power Connections and Power On

This section describes how to connect the power source to the repeater and power on the repeater. This section also provides information about the backup battery pack.

4.2.14.1 Power Connections



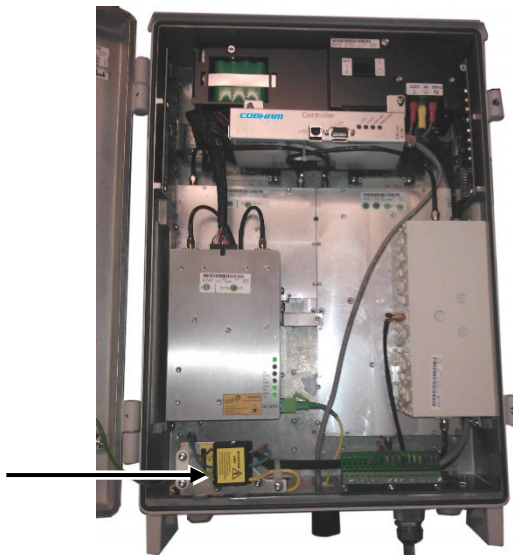
- CAUTION!!**
- Make sure the antenna cables or 50 ohm terminations are connected to the repeater’s antenna connectors before the repeater is turned on.
 - Be sure a CIRCUIT BREAKER meeting the instructions given in section 4.2.3.1 is connected near the unit at an easily reachable and accessible location from the unit.
 - Be sure the POWER SOURCE TO THE REPEATER IS DISCONNECTED before connecting the power wires to the repeater power plinth.
 - Please be aware that the equipment may, during certain conditions become very warm and can cause minor injuries if handled without any protection, such as gloves.

For -48VDC models - the -48 V dc version of the power supply is designed to turn off if the supply voltage falls below -36 V (± 1 V), so as not to drain the feeding battery. It will turn on again as the supply voltage reaches -43 V (± 1 V).

To connect the power cables

1. Refer to the power requirements as described in section 4.2.3.
2. Open the repeater door.
3. According to the repeater model, route the power cable through the power interface and towards the power plinth.

Connect wires to plinth



Route power cable
through front panel

Figure 4-24: Example of MBF-40 Model

4. **-48 V dc**, connect wires to the plinth as follows:
 - **Phase** linked to **brown** cable
 - **Neutral** linked to the **blue**
 - **Ground** to the **yellow/green**.

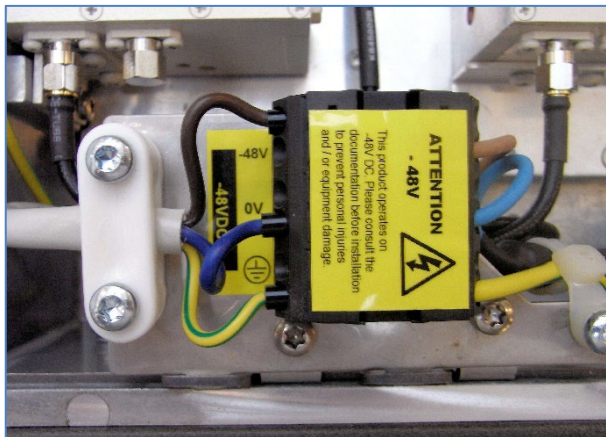


Figure 4-25: -48VDC Power Connections

5. **115 V ac** connect wires to the plinth as follows:
 - **Phase** linked to **Black** cable
 - **Neutral** linked to the **White** cable
 - **Ground** to the **Green** cable

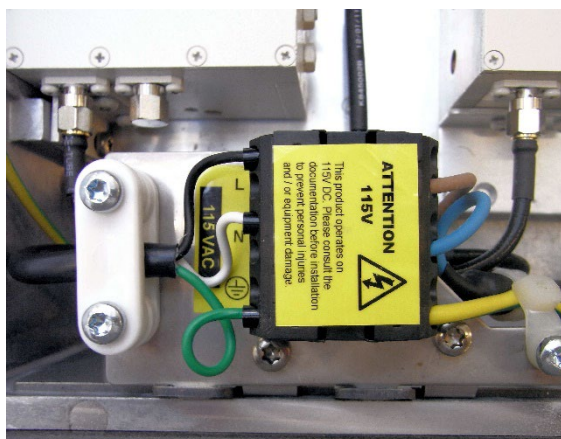


Figure 4-26: 115 V ac Power Connections

4.2.14.2 Power ON

The power supply has a switch which allows it to be set in two positions:

- ON – repeater is operational
- STAND-BY - the repeater is still connected to the power supply but not operational.



CAUTION! Make sure the antenna cables or 50-ohm terminations are connected to the repeater's antenna connectors before the repeater is turned on.

To power on the repeater

1. Locate the power supply switches inside the repeater.



Figure 4-27: Example of Single Power Supply Model

2. Switch on the **Power Switch**.
3. Switch on the **BATT** power.

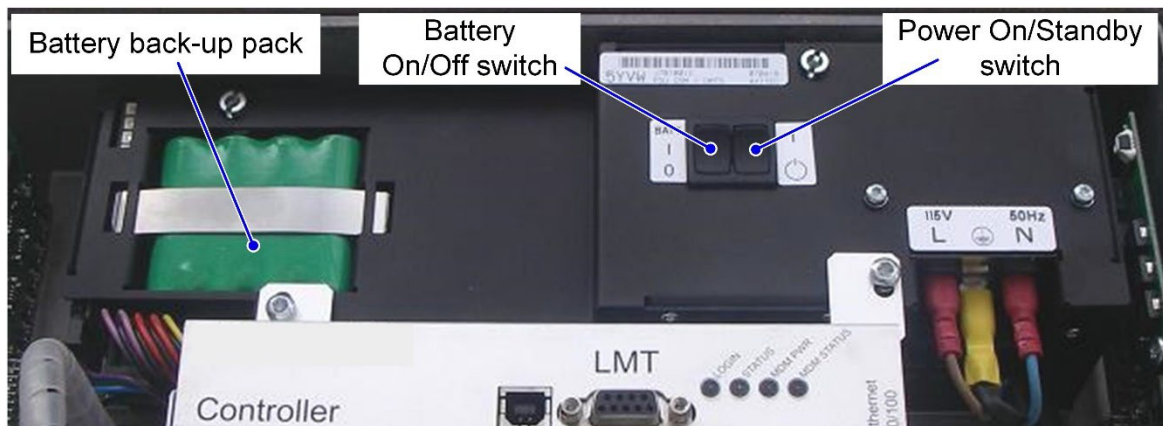


Figure 4-28: Power and Battery Switches

4. Referring to section 7.3, verify the LEDs from the following modules are indicating correct operation:
 - Control module
 - F/O converter(s)
 - Power supply module(s)

4.2.14.3 About the Backup Battery

- On the Power Supply unit a rechargeable battery pack is mounted. This part also includes charging and supervision electronics.
- The backup battery will provide the Control Module with enough capacity to send an alarm in case of input power failure.
- The battery can be switched on and off. The switch is placed adjacent to the main power switch on the power supply.
- At delivery the back-up battery is connected.
- The battery is replaced by lifting the battery pack out of the crate and disconnecting the cable.

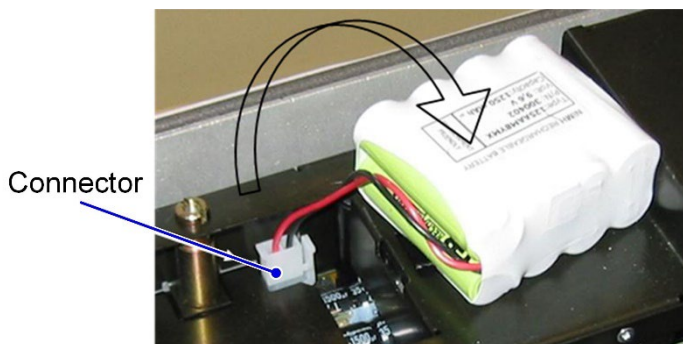


Figure 4-29: Backup Battery

4.2.15 Optional - External Alarm and Relay Connections

The connector plinth for the external alarms is located inside the repeater.
To connect external alarms or relay

- 1. Refer to section 4.2.6 for the external alarms and relay considerations.
- 2. Locate the alarms plinth inside the repeater.

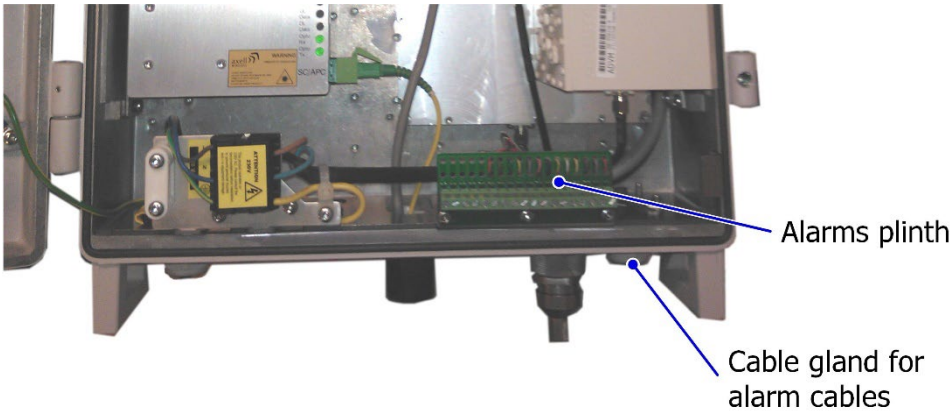
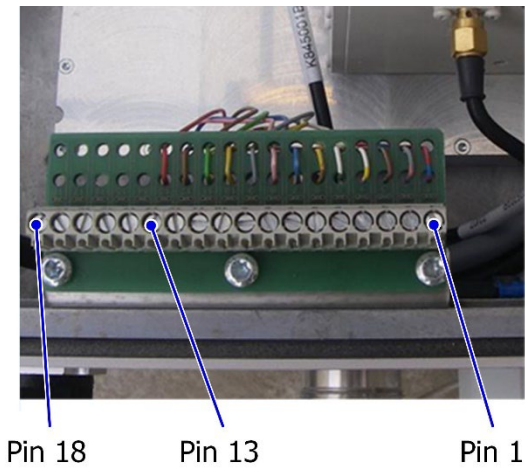


Figure 4-30: Example of Repeater Showing the Location of the Alarms Plinth

- 3. Connect the alarm cords to the plinth according to the pin layout below (in the standard version pins 14 – 18 are not used).



Pin	Signal
1	External alarm 1A
2	External alarm 1B
3	External alarm 2A
4	External alarm 2B
5	External alarm 3A
6	External alarm 3B
7	External alarm 4A
8	External alarm 4B
9	Alarm +15V
10	Alarm 0V
11	Relay Output 1A
12	Relay Output 1B
13	GND
14	NC
15	NC
16	NC
17	NC
18	NC

Figure 4-31: External Alarm and Relay Pinout

Note the following

- Four external alarm sources can be connected to the repeater:
 - It is required to configure the external alarm polarity (part of the setup procedure – section 6.3.3).
 - The repeater can supply +15 V dc to an external alarm source through pin 9 and 10. The maximum allowed load is 50 mA.
- Relay (pin 11 and 12) can be connected to an external device to indicate an alarm.
The Relay Can be configured to trigger on any number of internal and external alarms. The maximum current that can be supplied is 50mA.

4.2.16 Closing and Securing the Repeater

The repeaters are secured with two hex screws (M8) and can also be locked with a key.

NOTE: Failure to do so may affect the IP66 compliancy and therefore any warranty.



Figure 4-32: Securing the Repeater

5 Getting Started

This chapter includes the following information:

- Opening a repeater session
- Navigating the WEB GUI
- Initial setup procedure

5.1 Opening a Repeater Session

Two types of session can be opened to the repeater:

- Direct session – this is usually a direct local session to the repeater
- Remote session – this is usually done by opening a session to the OMU II and then connecting to the repeater (via the OMU II)

5.1.1 Opening a Direct Local Session

NOTE: This connection requires downloading the USB driver from the provided setup disk (or connection to the internet, where the driver is automatically loaded).

To open a local session:

1. Open the MBF-40 cover
 - Connect to the USB port on the Controller module. If the USB driver is not already installed on your laptop, the system will search for the driver on the provided setup disk or on the internet (if a network connection is available).
 - Run a browser and login according to the following section.

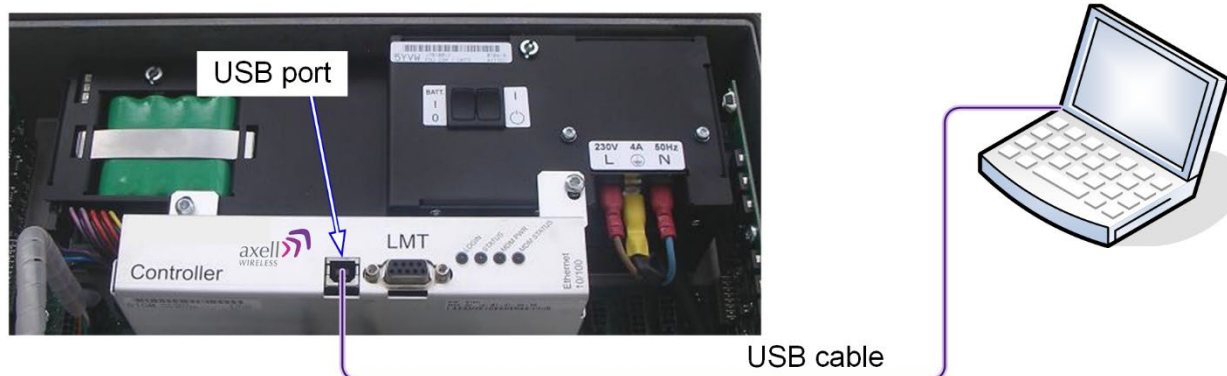


Figure 5-1: MBF-40 Controller Module Connection

2. Open the web browser and enter **192.168.152.1** in the address bar.

The login dialog appears.



Figure 5-2: Login Screen

3. Use the following username and password to login:

- Username: **axell**
- Password: **AxellPasswd**

Note: It is highly recommended to change the default password according to section 6.5.3.

The Web GUI Main Window appears. This is the same window is also viewed via the OMU II.

5.1.2 Opening an Indirect Session (via the OMU II)

1. Open a local or remote session to the host OMU II:
 - Remote session – open a Browser session in the same subnet as the host OMU II and enter the IP of the host OMU II (see OMU user manual for detailed procedure). Enter the OMU II User Name (e.g. **axell**) and Password (provided by your system administrator).
 - Local session– connect to the OMU II Control Module's USB or Ethernet ports. Enter the OMU II User Name (e.g. **axell**) and Password (provided by your system administrator).
 - After accessing an OMU II session, commission the MBF-40 according to the following section.

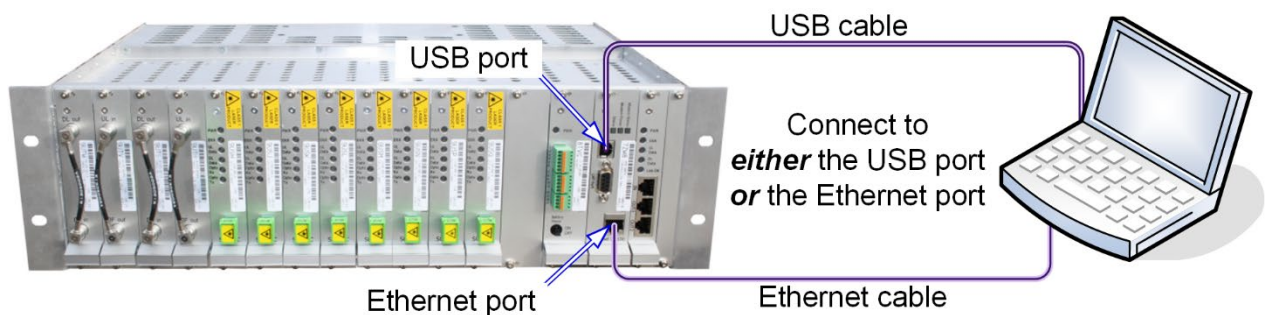


Figure 5-3: Connection to OMU II

5.2 Navigating the Web Interface

MBF-40 is managed via WEB GUI, where the WEB GUI options differ according to the type of session. This section describes the following WEB GUI options:

- Home screen – always available when a session is opened to the repeater.
- Menu buttons – available only when a DIRECT session is opened to the repeater; when an OMU II session is opened to the repeater, the menu button options are NOT available.

5.2.1 The Home Screen

The Home screen described below is always displayed when a session is opened to the repeater; however, the Menu options are only available with a direct session (not via OMU II).

The Home screen WITH the menu options is shown below. The various areas are briefly described in the following page.

Menu options - available ONLY with a DIRECT session to the repeater (not via OMU II)

General

External Alarms

UL and DL Output Control Options

Fibre Optic Options

Power Monitoring Options

Figure 5-4: MBF-40 Home Screen

The screen is divided into four basic areas:

- Controller – shows general information on the MBF-40 device such as identification and temperature level.
- External Alarms – shows status of external alarms and the defined names.
- Repeater Status – RF connection status is divided into two sections:
 - Band – shows general band status and band name (e.g. 800MHz GSM).
 - Uplink/Downlink – gain, attenuation and connection status in the specific direction.
- Fibre Optic Unit – shows status on connection to remote OMU and allows for optical link adjustment.
- Sub-systems – overall status of all sub-systems such as power supplies, battery, communication etc.

5.2.2 Menu Options Buttons

The menu options described below are only available via a direct session to the repeater.



Tab	Description
	Provides a general status and alarm information. Switching to <i>Advanced View</i> will toggle a more detailed view of each band and module.
	Lists the remote nodes – corresponding OMU and units connected the specific OMU.
	List of recent operations. Section 7.2.
	Provides a range of MBF-40 configuration procedures such as communication, RF, Date and Time, Password, etc. Section 6.3.
	Logout of the system.

5.3 Commissioning the Repeater

After the repeater is connected to the OMU II, it is automatically identified by the OMU II via the Fibre connection and the unit can then be commissioned from the OMU II. The commissioning process consists of a few simple steps.

MBF-40 Setup and Commissioning consists of the following

1. Opening an **OMU II session** – for accessing the MBF-40 configuration window (via OMU II)
2. Recommended - configuring the MBF-40 Tag (site identification).
3. Performing **Optical Loss Adjustment** on the connected MBF-40
4. Setting the required **RF attenuation and gain levels** on the remote MBF-40
5. Assigning the unit a **recognizable name** (according to its location)

5.3.1 Defining Site Information – MBF-40 Identification

It is recommended to assign each MBF-40 a recognizable name that will identify the location, site name, etc.
To set MBF-40 TAG

1. In the **Home** window, click the edit button next to **Tag**.

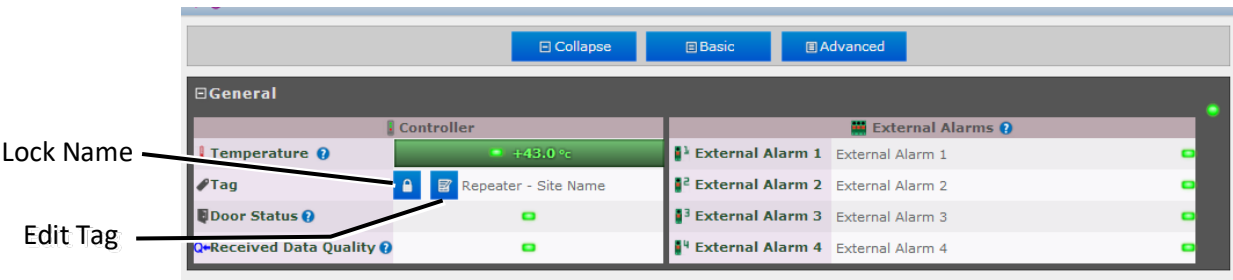


Figure 5-5. Set MBF-40 TAG Name

2. Enter the Name (up to 30 characters), click OK and click **Apply**.

5.3.2 MBF-40 Optical Loss Adjustment (OLA)

MBF-40 OLA is performed from the OMU II. For MBF-40 remotes, the maximum compensation is increased to 26dB to support shorter Fibre optic distances.

NOTE: It is assumed that you have opened and OMU II session.

To perform MBF-40 OLA (via OMU II)

1. From the **OMU II main window**, click the **Opto Adjust** button.

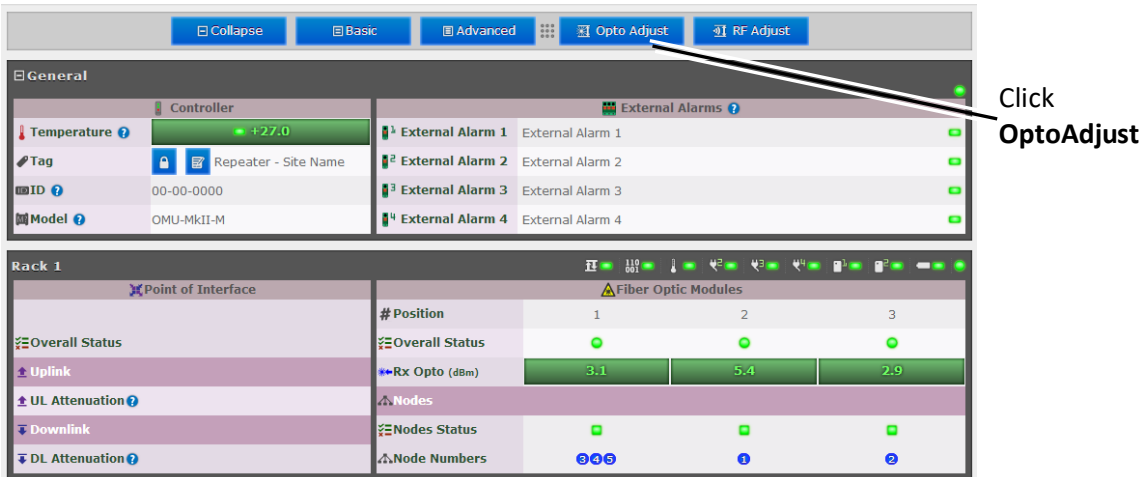


Figure 5-6: OMU II Main window

The OLA screen appears.

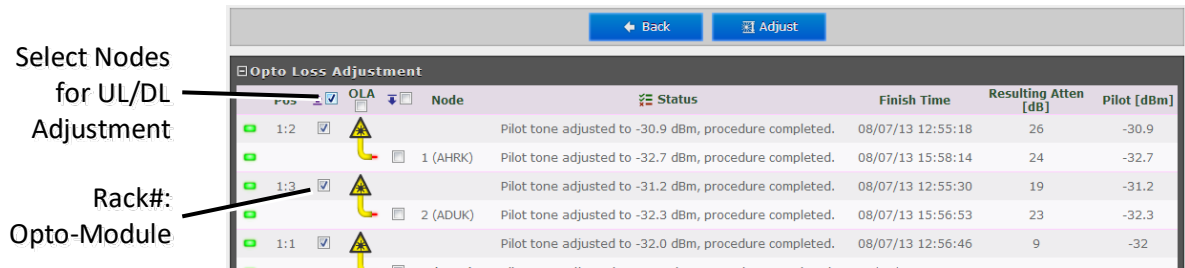


Figure 5-7. Configure and Initiate Optical Loss Adjustment

The screen lists the OLA options (and status) for each link. (The links are listed according to the OMU II slot to which the remote is connected.).

A brief description of the OMU II OLA screen is given below.

Column	Description
Pos	Each Rack corresponds to an OMU unit whereas each Slot corresponds to an Opto-Module. Slots are numbered according to their position in the OMU Chassis (numbered left to right).
Select All	Batch selection options:  - mark all remotes for UL opto-adjustment.  - mark all remotes for DL opto-adjustment.  - mark all remotes for DL and UL adjustment.
Node	Node list number and identification (e.g. AHFK)
Status	Displays an Error if process failed. If successful the pilot tone used and the adjustment level will be displayed.
Resulting Attenuation	Compensation level used for the opto-module (in dB).

3. Mark the check-boxes corresponding to the MBF UL/DL node to be adjusted.

NOTE: The process may take several minutes depending on the size of the system and remote distance.

5.3.3 RF Balancing

The MBF-40 RF Balancing procedure can be performed manually (the automatic option specified in section 5.3.3.2 will be available in the future) via the OMU II web interface.

5.3.3.1 Manual RF Balancing

NOTE: If connected locally, enter the MBF-40 Home screen and skip to step 2.

The manual balancing procedure consists of the following steps:

- Verifying the DL RF output level is maximized by setting the required DL attenuation of the signal.
- Setting the UL attenuation according to the DL.
- In case of noise, adjusting the UL attenuation to reduce noise

To balance the MBF-40 UL and DL outputs

1. Access the MBF-40 Configuration window:

- Click on the **Nodes** button. The below pane appears
- Click **Control** next to the node to be balanced.

Note!
Before moving a node from one slot to another, you must delete it from the node list. After moving the node to the new slot, it should be power-cycled to be registered by the OMU in the new location.

System Nodes

6 nodes in the system

#			Model	Tag	Serial		Software Version	Control
0			OMU-MkII-M	Repeater - Site Name	1111	-:-	"2.0.5" "2.2.3.2" "OMU 2.1.2.2"	
1			BSF3604-S	Repeater - Site Name	ADUK	1:1	"2.0.3" "2.1.0" "BSF3604 2.0.0"	>Control
2			MBF-T-7-8-19-S	Repeater - Site Name	AHRK	1:3	"2.0.3" "2.1.0" "MBF 2.0.2"	>Control
3			MBF-20-D-2308-2319-S	New F-DAS unit	AV48	1:2	SW03910AX9 -	>Control
4			MBF-20-D-2308-2319-S	New F-DAS unit	AV45	1:2	SW03910AX9 -	>Control
5			MBF-20-D-2308-2319-S	New F-DAS unit	AV46	1:2	SW03910AX11 -	>Control

Reload

The repeater Home window appears.

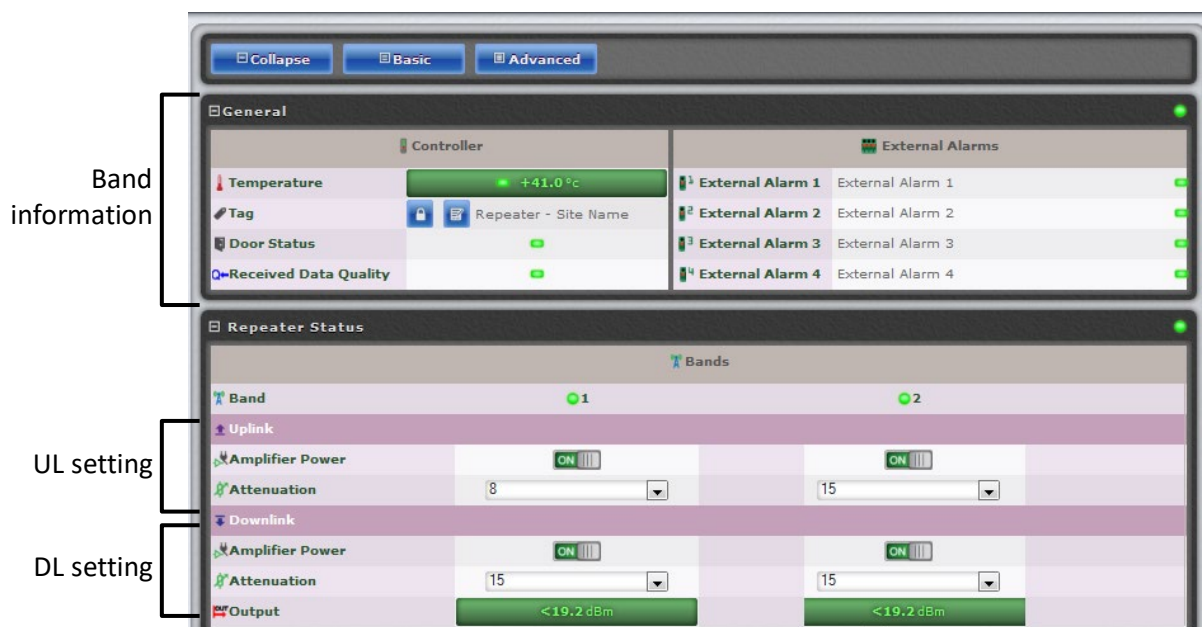


Figure 5-8: Partial view of the MBF-40 Configuration window

2. In the Downlink:
 - Verify the **Amplifier** for each band is ON.
 - Set **Attenuation** to maximum value (15dB).
 - Lower the **Attenuation** level step by step until the desired Output power level is reached (Zero attenuation = maximum gain).
 - Verify the amplifier saturation is green.
3. In the Uplink:
 - Verify the **Amplifier** for each band is ON.
 - Set **Attenuation** equal to the value set in the DL (above).
 - Verify the amplifier saturation is green.

NOTE: If noise is detected on the link, reduce only the Uplink for optimal signal.

5.3.3.2 Automatic MBF-40 RF Balancing

NOTE: This feature will be available in future release.

To access the Automatic RF Adjustment pane

1. Access the OMU II **Home** window and click on **RF Adjust**.

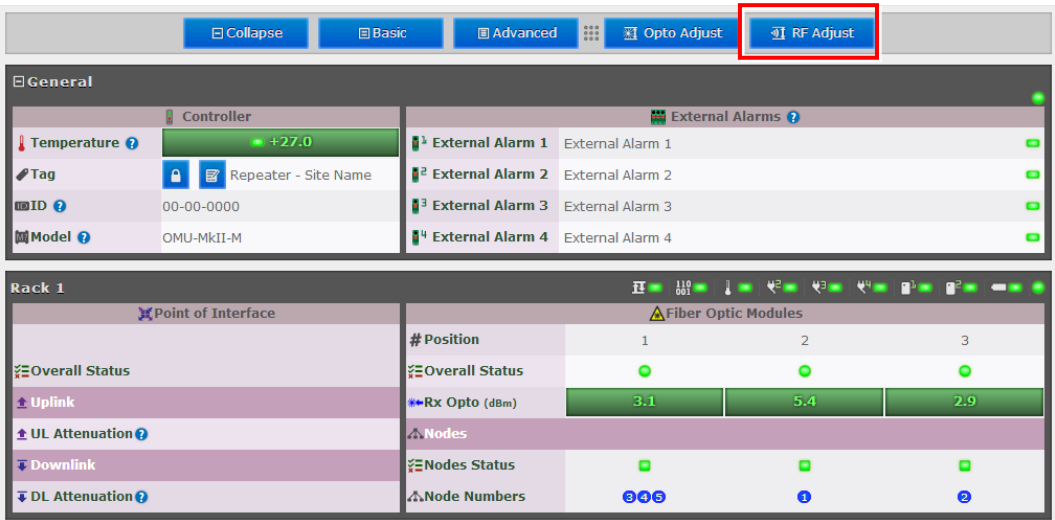


Figure 5-9: OMU II Main window

2. The following pane appears.

Remote with
selected bands
to adjust

Select All Select None Adjust

Note:
The automatic RF Adjustment procedure will adjust the output in the downlink path for each chain to the nominal level and then set uplink gain according to the Delta configuration. For this to work, there must be a downlink signal enabled in the downlink from the base station allowing to reach the desired output power level. Before performing RF Adjustments it is strongly recommended to adjust corresponding opto links in the opto adjustment page.

Node #3, AV48, MBF-20-D-2308-2319-S, New F-DAS unit, 1:1						
Freq [MHz]	Nominal Level [dBm]	Uplink Delta [dB]	Status	Finish Time	Resulting Atten [dB]	Output Level [dBm]
☐ 850	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:40	3	-
☒ 1900	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:29	3	-

Node #4, AV46, MBF-20-D-2308-2319-S, New F-DAS unit, 1:1						
Freq [MHz]	Nominal Level [dBm]	Uplink Delta [dB]	Status	Finish Time	Resulting Atten [dB]	Output Level [dBm]
☒ 850	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:23	3	-
☐ 1900	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:17	3	-

Node #5, AV45, MBF-20-D-2308-2319-S, New F-DAS unit, 1:1						
Freq [MHz]	Nominal Level [dBm]	Uplink Delta [dB]	Status	Finish Time	Resulting Atten [dB]	Output Level [dBm]
☒ 850	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:11	3	-
☒ 1900	0	5	MBF-20 RF Adjustments failed. Cannot read OPL, Verify you have input power.	08/07/13 14:43:05	3	-

3. Select the bands of each remote to be adjusted.
4. Adjust the following for each band:
- Nominal Level (dBm)
 - Uplink Delta (dB)
5. Click **Adjust**. The procedure may take several minutes depending on the number of units selected.

5.3.4 Integration into the AEM

NOTE: Integration into the AEM is only performed from the AEM side – no action is required from the MBF-40 side.

The AEM automatically connects to the repeater and downloads all the repeater information. The AEM then configures the repeater with the IP address where alarms and reports should be sent to, and optionally with a secondary IP address where the repeater can connect to in case connection to primary IP fails.

When heartbeat reports and alarms are sent from the repeater to the AEM also the latest information about the status and RF-configuration is included. This means that the AEM operator always has information about the current status in the AEM database (and does not need to call the repeater to find this out).

NOTE: Once the repeater is integrated to the AEM, all changes to the repeater should preferably be done from the Element Manager in order to ensure that the database always contains correct information.

5.3.5 What Next?

The MBF-40 unit is now ready for operation. You may monitor the unit's general status via the OMU II Main window and if the node is faulty (red LED), access the dedicated configuration screen in Basic or Advanced view for more information.

NOTE: Consult the OMU II User Manual for additional information on RF and Optical adjustments.

6 Direct access menu options

This chapter describes the menu options available ONLY when opening a *direct* session to the MBF-40.

6.1 Overview

The available menu options can be used to configure remote management options and for detailed fault sourcing and troubleshooting.

Menu options - available ONLY with a DIRECT session to the repeater (not via OMU II)

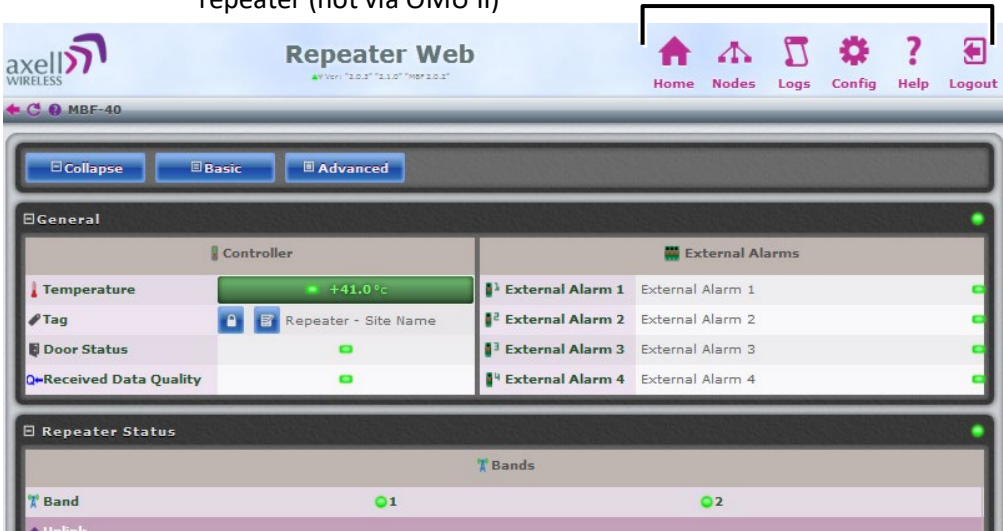


Figure 6-1: MBF-40 Partial Home Screen with Menu Options

Two of the buttons are of special interest:

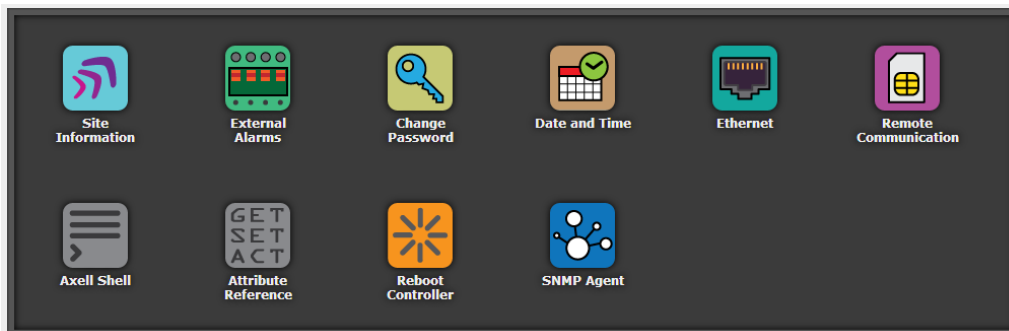
	Provides a range of MBF-40 configuration procedures such as communication, RF, Date and Time, Password, etc. Section 6.3.
	List of recent operations. Section 7.2.

6.2 Configuration Screen Overview

The configuration screen provides access to a range of configuration and management options.
To access the configuration screen



Click on the **Config** menu option. The following screen appears.



Option	Description
Site Information	Configure and display MBF-40 identification information. See section 6.3.1
External Alarms	Used to activate and assign names to external alarms. See section 6.3.3
Change password	Used to update system login password for the logged-in user. See section 6.5.3
Date and Time	Used to configure the time stamp for dating MBF-40 events. See section 6.3.2.
Ethernet	Used to define the IP Address for remote access via Ethernet. See section 6.3.4
Remote Communication	Used to configure remote communication parameters and AEM integration. See section 6.4
Axell Shell	Command line used to communicate with the remote units. List of commands is found under Help. See section 6.7
Attribute Reference	CLI commands and attributes directory. See section 6.8
Reboot controller	Soft restarts the MBF-40 device. See section 6.6
SNMP Agent	SNMP Agent configuration. See section 6.4.2

6.3 General Parameters

This section describes the following options:

- Viewing site information and repeater information (repeater ID, SW and HW versions, etc.)
- Date and Time
- Configuring external alarms
- Setting Ethernet IP Address

6.3.1 Viewing MBF-40 Site Identification and General Information



The Site Information button provides access to MBF-40 hardware and software version information. To view MBF-40 Site Information

Click the **Config** menu button and click on the **Site Information** icon. Two areas are displayed:

- Control Module – provides hardware and software version information.
- Site Information – provides MBF-40 identification information.

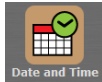
Control Module	
Serial Number	ADGR
Hardware Version	H481003J
Target Version	MBF 2.2.0
Common Version	2.4.0
System Version	2.0.9E
Boot Version	AviBoot 2.0.0

Site Information	
Model	MBF-T-9-18-22-S
Serial Number	AHRK
Article Number	A2170001A
TAG	Repeater - Site Name
ID	00-00-AHRK

Reload

Figure 6-2. MBF-40 Site Information

6.3.2 Date & Time



The repeater date and time are automatically set from the OMU II. However, the option for direct settings is available as well.

To set the Date & Time:

1. Click the **Config** button.
2. Click on **Date & Time**.
3. Do one of the following:
 - Either, enter the correct date and time according to the displayed formats.
 - Or, click on **Local Time** to set the time according to the PC running the Web-GUI.
4. Click **Apply**.

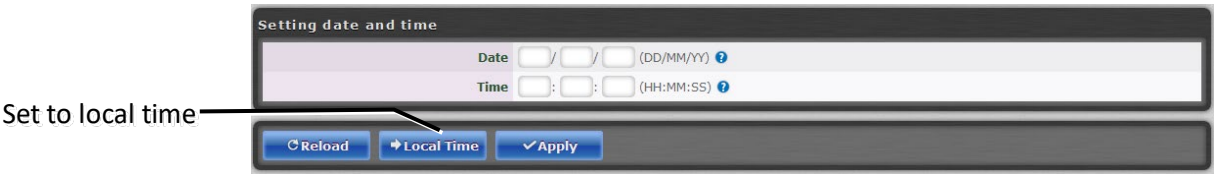


Figure 6-3. Configure Date and Time

6.3.3 Configure External Alarms



It is required to configure any connected external alarms according to the trigger (high or low) and it is recommended to assign the alarms recognizable names (such as Door Open, High Temperature, etc.)

To configure the external alarms

1. In the Main menu, click the **Config** button.
2. Click on the **External Alarms** icon.
3. For each alarm:
 - Set the Trigger as High or Low as required.
 - Assign the alarm a recognizable description
4. Click **Apply**.



Figure 6-4: Configure External Alarms

6.3.4 IP Address



This procedure describes how to set up the IP address either manually or configure for acquisition via DHCP (usually configured for local management options).

To configure the IP address

1. In the Main menu, click the **Config** button.
2. Click on **Ethernet**.
3. For manual IP address configuration:
 - Select Manually Configure IP Address.
 - Set the IP, Subnet Mask, Default Gateway and DNS addresses.
 - Click **Apply**.
4. For DHCP IP address configuration:
 - Select Automatically Obtain IP Address (DHCP).
 - No other settings are required.
 - Click **Apply**.

The Manual configuration settings are illustrated below.

The screenshot displays the 'Network IP' configuration window. At the top, a yellow warning banner reads: 'WARNING! Changing the IP settings on the controller may make it inaccessible. If you change these settings, you may not be able to correct them via this web interface. You may have to use the serial connection (COM PORT) to get or set the value of NIC according to the instructions.' Below the banner, the 'Network IP' section has two radio buttons: 'Automatically obtain IP address (DHCP)' (unselected) and 'Manually Configure IP address' (selected). Under the manual configuration section, there are input fields for 'IP' (172.16.24.101), 'Subnet Mask' (255.255.252.0), 'Default Gateway' (172.16.24.1), 'DNS 1' (126.1.24.14), 'DNS 2' (192.168.100.141), and 'DNS 3' (192.168.100.146). At the bottom, there are 'Reload' and 'Apply' buttons.

Figure 6-5: Configure Local Network Parameters

6.4 Remote Communication Setup



This section describes the Ethernet and SNMP setup.

6.4.1 TCP/IP and Ethernet

1. Click on the **Config** menu button.
2. From **Device: Method** select **ETH:TCP** (Ethernet: TCP/IP).
3. Click **Apply**.

Remote Communication

All Remote Communications: **ON**

Device:Method: ETH:TCP

Communication Device: Ethernet Connection

Communication Method: TCP/IP connection

TCP

AEM Main IP Address: -

AEM Main Port: 1024

AEM Secondary IP Address:

AEM Secondary Port: 1025

Reload Apply

Figure 6-6: Remote ETH Configuration

6.4.2 SNMP Support

The MBF-40 includes SNMP support, including an SNMP Agent and SNMP traps (alarms). All SNMP queries and traps are supported either via the OMU II or a direct connection to the unit.

6.4.2.1 SNMP Traps Parameters

The MBF-40 sends SNMP traps to user defined destination addresses.

NOTE: One destination address can currently be defined via the Web. Seven more destination addresses can be defined via the Shell application.

To configure the SNMP traps destination address

1. Click on the **Configure** button (top right corner).
2. Select **Remote Communication**.
3. In the **Device: Method** field, select **ETH:SNMP**

The screenshot displays the configuration interface for SNMP traps. It is divided into two main sections: 'Remote Communication' and 'SNMP'. In the 'Remote Communication' section, 'All Remote Communications' is set to 'ON'. The 'Device:Method' dropdown is set to 'ETH:SNMP'. The 'Communication Device' is 'Ethernet Connection' and the 'Communication Method' is 'Simple Network Management Protocol'. The 'SNMP' section contains three input fields: 'SNMP Trap Address' (126.124.18), 'SNMP Trap Port' (162), and 'SNMP Trap Community' (public). Each field has a help icon. At the bottom of the interface are two buttons: 'Reload' and 'Apply'.

4. Define the SNMP trap destination IP address (additional addresses can be defined via the Axell Shell.).
5. Enter the (destination address device) Trap Port and its Community parameters.
6. Click **Apply**.

6.4.2.2 SNMP Agent - Activating and Configuring

The SNMP agent provides inventory management for hosted repeaters (on which the SNMP agent is enabled) and a table of active alarms in the controller or Fibre system for remote querying.

The SNMP Agent is responsible for responding to queries and carries out requests.

The SNMP Agent also provides the proprietary Axell MIB (AXELL-AM-MIB), accessible via any SNMP manager (e.g. HP OpenView).

All SNMP queries to the remote are implemented via an OMU session.

To allow SNMP agent queries

- To allow SNMP queries of the OMU II – the SNMP agent must be enabled on the OMU II.
- To allow SNMP queries of the remote devices via OMU II – the SNMP agent must be enabled on the OMU II *and* on the remote devices.
- Remote units configured with an IP address and connected to the communication infrastructure, can be queried directly.

To activate the MBF-40 SNMP Agent

1. Click on the **Config** button (top right corner) and select **SNMP Agent Config**.

The following pane appears:

The image shows the 'SNMP Agent Configuration' pane in a web interface. It contains the following fields and controls:

- SNMP Agent:** A toggle switch set to 'ON'.
- SNMP Agent:** A dropdown menu showing 'Standard SNMP Alarm Management'.
- SNMP MIB:** A dropdown menu showing 'AXELL-AM-MIB'.
- Port:** A text input field containing '161'.
- Read-Only Community:** A text input field containing 'public'.

At the bottom of the pane are two buttons: 'Reload' and 'Apply'.

2. Set the **SNMP Agent** toggle to **ON**.
3. Set the **port** and the **Read-Only community**.
4. Click **Apply**.

6.5 User Accounts

The MBF-40 comes pre-configured with default usernames and passwords in the various administration levels. At the moment, updating user accounts is available only via Command Line Interface (CLI) or Axell Shell. See the Common Commands and Attributes v2.4.0 document for detailed commands and syntax or click on the **Help** button at the top right of the Web-GUI screen.

6.5.1 Default User Accounts

User Name	Default Password	Details
Axell	AxellPasswd	Default user name.
omcuname	iwnkhoob	Element Manager (AEM) user account. This account will not generate VLI, LGO or CLR alarms.
sysadmin	AxellAdmin4050	This is the system administration password which is used for firmware upgrades and user administration. Escalation to this level is achieved by issuing command SYSADMIN from the user prompt.
useradmin	UseradminPwd23	This account contains user administration privileges. Escalation to this level is achieved by issuing command USERADMIN from the user prompt.

NOTE: It is strongly recommended to change the default user names and passwords immediately at commissioning. This is done by using the command **ACT PASSWORD**. Please refer to the User Administration section in Common Commands and Attributes document for detailed syntax.

6.5.2 User Access Levels

In this generation of the system, standard users can be promoted to login via the Web Interface, inheriting the Read-Write or Read-Only access to this interface.

There are five different access levels:

Access Level	Default User Levels
Read-Only	axell, omcuname, useradmin, sysadmin
Read-Write	axell, omcuname, useradmin, sysadmin
Web	axell
User Administrator	omcuname, useradmin, sysadmin
System Administrator	omcuname, sysadmin

Note: New users added to the system have read-only access.

Users may be promoted to read-write and/or web access using the **ACT USERPROMOTE** command. See **Common Commands and Attributes** document for details on promoting users.

Note: Users omcuname, sysadmin and useradmin cannot be promoted to Web Access due to security reasons.

6.5.3 Change Password

To prevent unauthorized access, it is highly recommended to change the default password of the user.

NOTE: Note that you can only change the password for the User Name with which the session was accessed.



To change the Password

1. In the Main menu, click the **Config** button.
2. Click the **Change Password** button.
3. For the current User Name (e.g. **axell**):
 - Enter the New password.
 - Repeat the entry.
4. Click **Apply**.

NOTE: The password is not encrypted during transmission.

If the connection to the repeater is not safe, do not use this screen.

Use the CLI commands using an encrypted connection, if possible (i.e. SSH).

6.6 Reboot

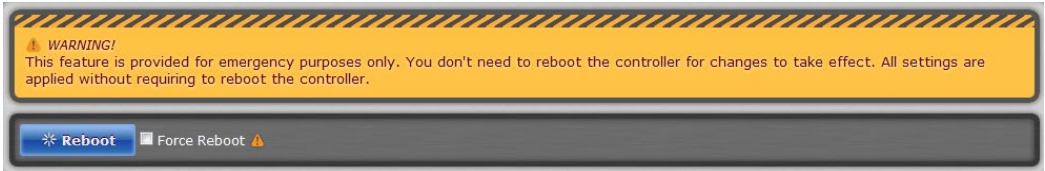


CAUTION! USE THE REBOOT FUNCTION ONLY IN CASE OF EMERGENCY!



To reboot the Control Module:

1. Click the **Config** tab.
2. Click on the **Reboot** icon.
3. Approve the Reboot sequence.

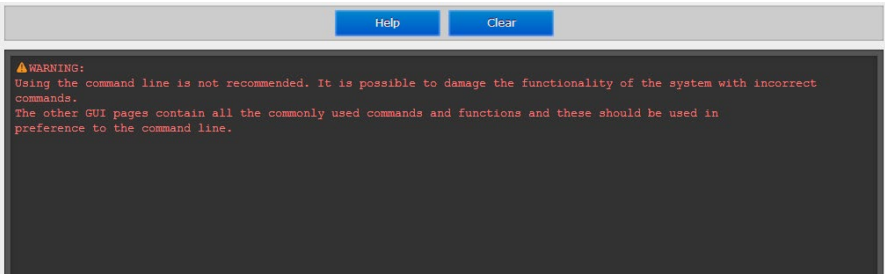


6.7 Axell Shell (Command Line Interface)



To access the Axell Shell:

1. Click on the **Config** button.
2. Select the **Axell Shell** option.



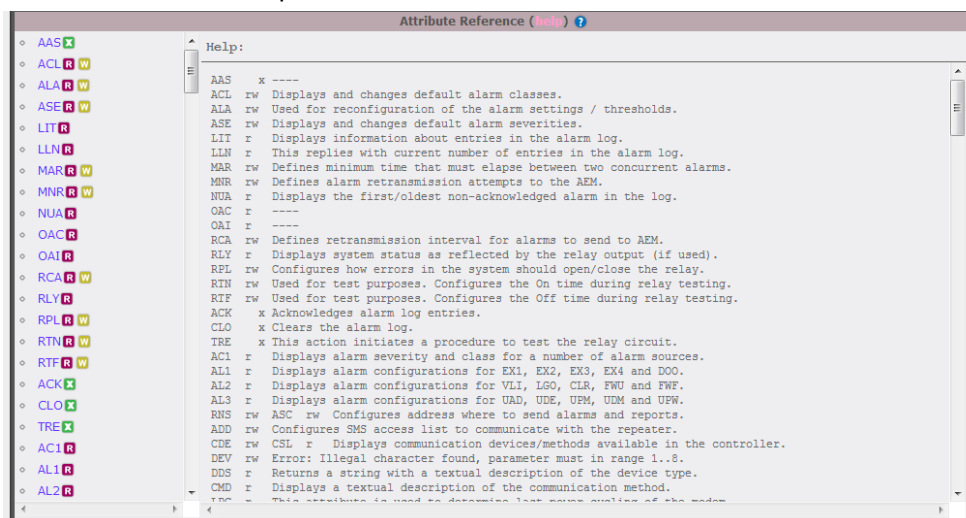
The **Axell Shell** button invokes the CLI pane. It is used to run some of the commands that are currently not provided by the Web GUI (user privileges and administration) and/or for advanced troubleshooting and configurations procedures.

All configuration and management procedures can be implemented using this interface. Please refer to the *Attribute Reference* section (by clicking the **Config** button on the top right and selecting **Attribute Reference** – see 6.8) for detailed syntax and available commands. You may also consider viewing the *MBF-40 Commands and Attributes* document.

6.8 Attribute Reference

To access the Attribute Reference

1. Click on the **Config** button.
2. Select the **Attribute Reference** option.



The Attribute Reference lists all available CLI commands and includes details and examples on how to use the commands. Additional information may be found in the *MBF-40 Commands and Attributes* document.

7 Monitoring and fault sourcing

MBF-40 provides the following monitoring and fault sourcing options:

- Web GUI Home screen Advanced mode – shows general status of system and components
- Web GUI Logs screen – provides logs of faults and operations
- Module LEDs – can be seen locally when opening the Repeater

This chapter describes these fault sourcing tools.

Note the following

- The Input / Output RF level power level monitoring windows are for indication only and should not be considered a replacement for laboratory test equipment accuracy of measurement of actual signal levels. The error of measurement will be high at low input levels.
- The normal operating range of signal measurement is as follows:
 - Downlink Output range +20dBm to +43dBm
 - Uplink Output range -10dBm to +5dBm

7.1 Monitoring Via the MBF-40 Home Screen

In addition to RF settings and readings, the MBF-40 Home screen provides detailed information on the operation status of internal modules. This information can be used to aid in remotely troubleshooting the Remote.

To access the MBF-40 Main Monitoring and Configuration window

1. Access the OMU II main windows, click the **Nodes** button, choose the remote related node and click the adjacent **Control** button. The MBF-40 Home window appears in Basic View. To view more details, click **Advanced**.

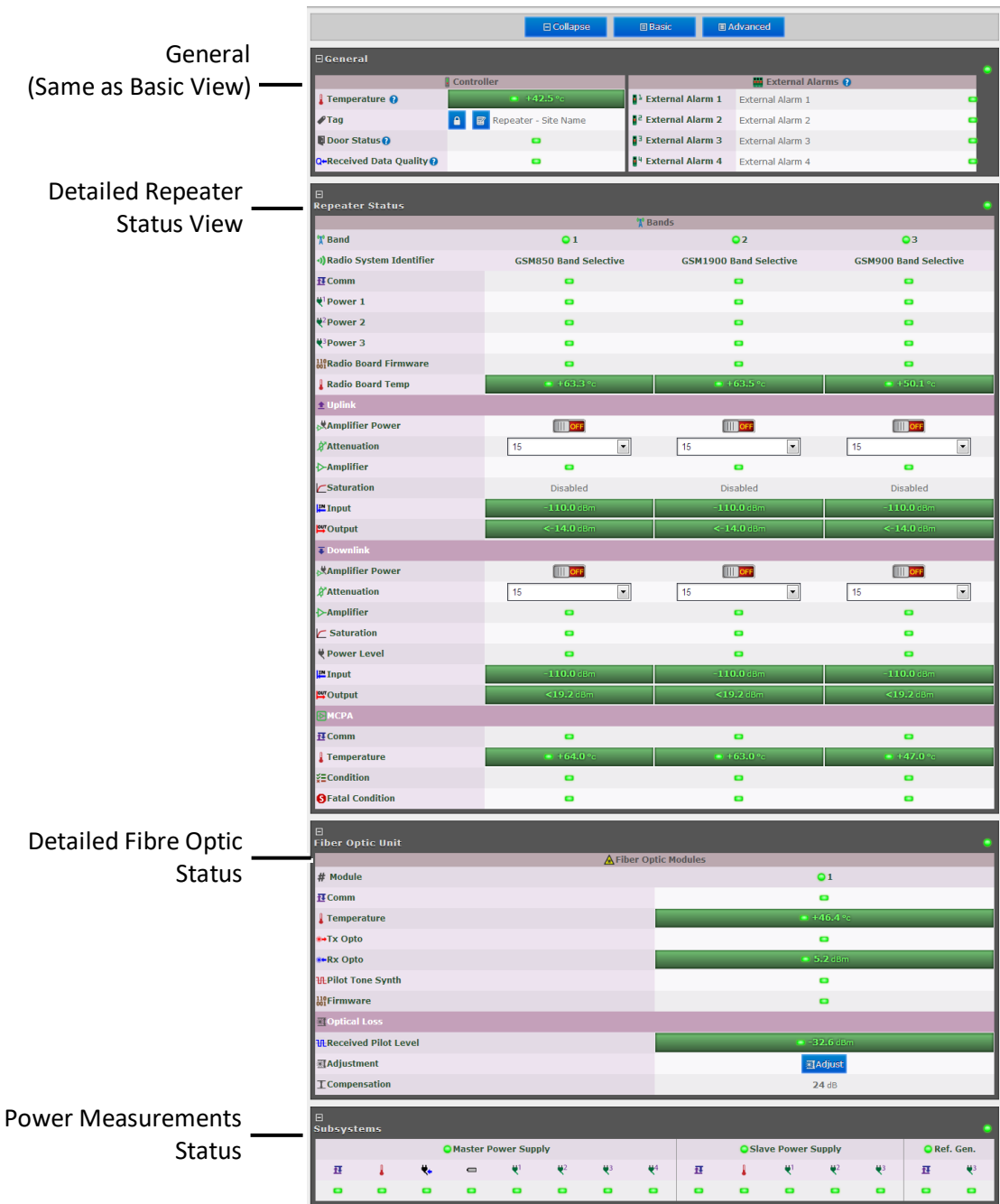


Figure 7-1: MBF-40 Main Screen Advanced

7.1.1 General Page Area

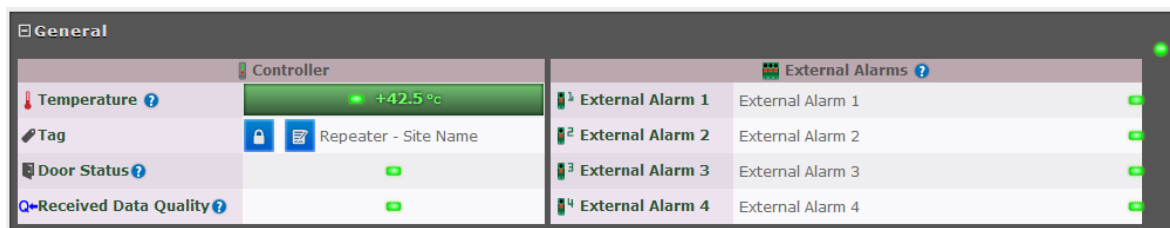


Figure 7-2: MBF-40 General

Indicator	Description
Temperature	Current ambient temperature
Tag	Name of Repeater, user customizable
Door Status	Green if closed
Received Data Quality	Check data for consistencies

7.1.2 Detailed view of the MBF-40

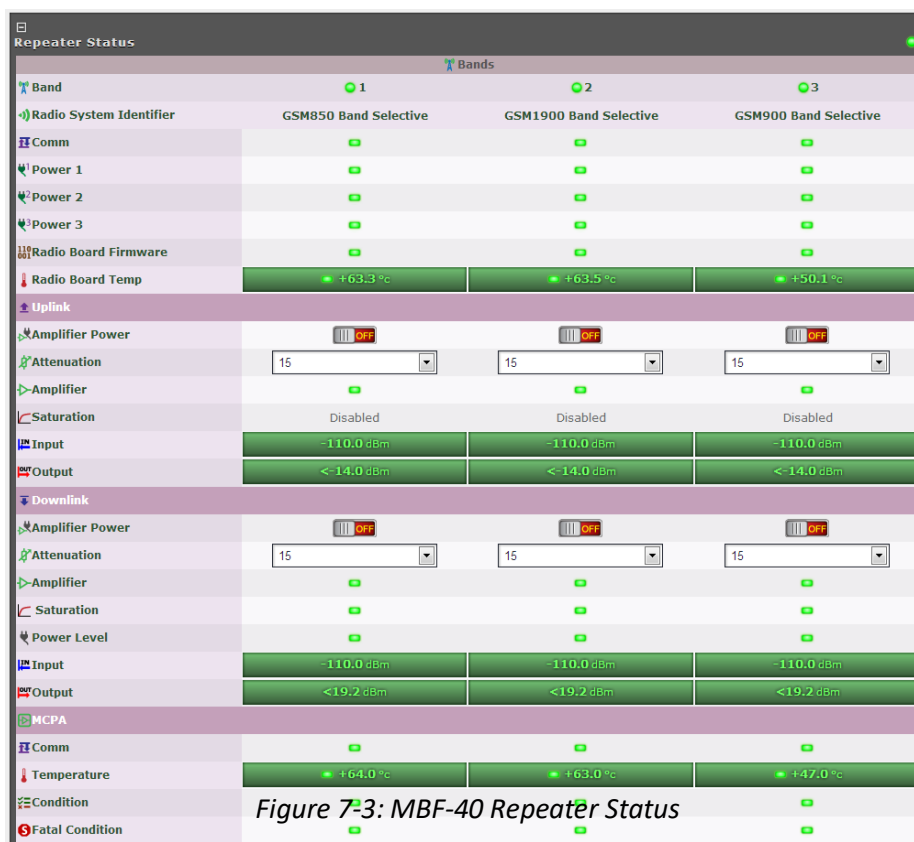


Figure 7-3: MBF-40 Repeater Status

Indicator	Description
Band	Overall band status.
Radio System Identifier	Band(s) and technologies in use
Comm	DL/UL status
Power	Power indication
Radio Board Firmware	Firmware related error
Radio Board Temp	Radio board temperature indicator
Amplifier Power	Turn amp. on/off.
Attenuation	Use to define DL/UL RF attenuation level per band
Amplifier	Amplifier status
Saturation	Saturation level status
Power Level	Power supply status
Input/Output	Input/output power levels
Comm	Communication status
Temperature	Temperature level and status indicator
Condition	Signal conditioning status
Fatal Condition	Critical condition indicator (RED = fault)

7.1.3 Detailed view of Fibre Optic Unit

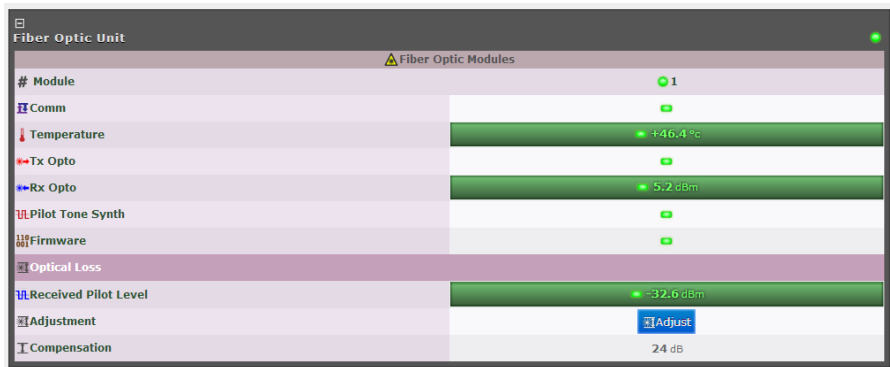
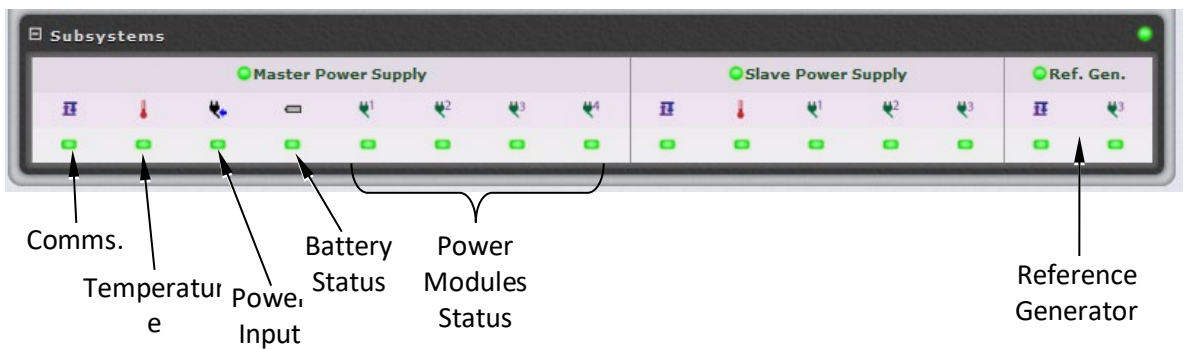


Figure 7-4: MBF-40 F/O Status

Indicator	Description
#Module	Overall optic module status
Comm	Optic connection status
Temperature	Temperature level and status indicator
Tx Opto	DL optic signal status
Rx Opto	UL optic signal strength and status
Pilot Tone Synth	Pilot tone synthesizer status
Firmware	Firmware related error
Received Pilot Level	Pilot tone level received in optic module
Adjustment	Perform UL OLA (on repeater side)
Compensation	Compensation performed on the optic link

7.1.4 Subsystems



7.2 Logs Screen

The Alarms Log displays the last 100 alarms and/or user actions on the remote system in a chronological order. By hovering with the mouse over each alarm, full alarm details are available, including alarm descriptions, severities, alarm classes and time of event.

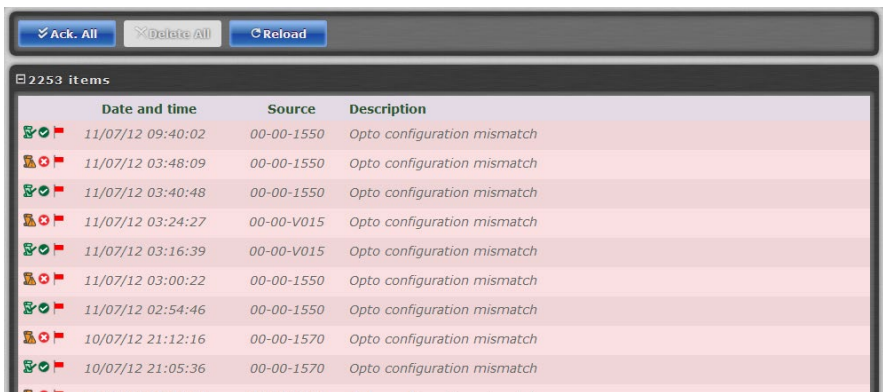


Figure 7-5: Logs

To receive a summary containing all information on a reported incident in the Log list, simply hover with the mouse over the specified Log and view all details contained in the Log (see below).



Figure 7-6: Logs – Summary

Column	Description
Date & Time	Time of occurrence
Source	ID of reporting source
Description	Additional alarm information (e.g. Open Door)

Icon	Description
	Alarm attended to and cleared.
	System alarm – displayed when system functionality may be compromised.
	Alarm status: OK
	Alarm status: Error
	Acknowledge alarm – Green = Acknowledged.
	Click to change acknowledgement. Use the Ack All button to acknowledge all alarm logs.

7.3 Module LEDs

This section describes the LEDs of the internal modules. The modules are accessed if the remote is opened. An example of the MBF-40 model is given below:

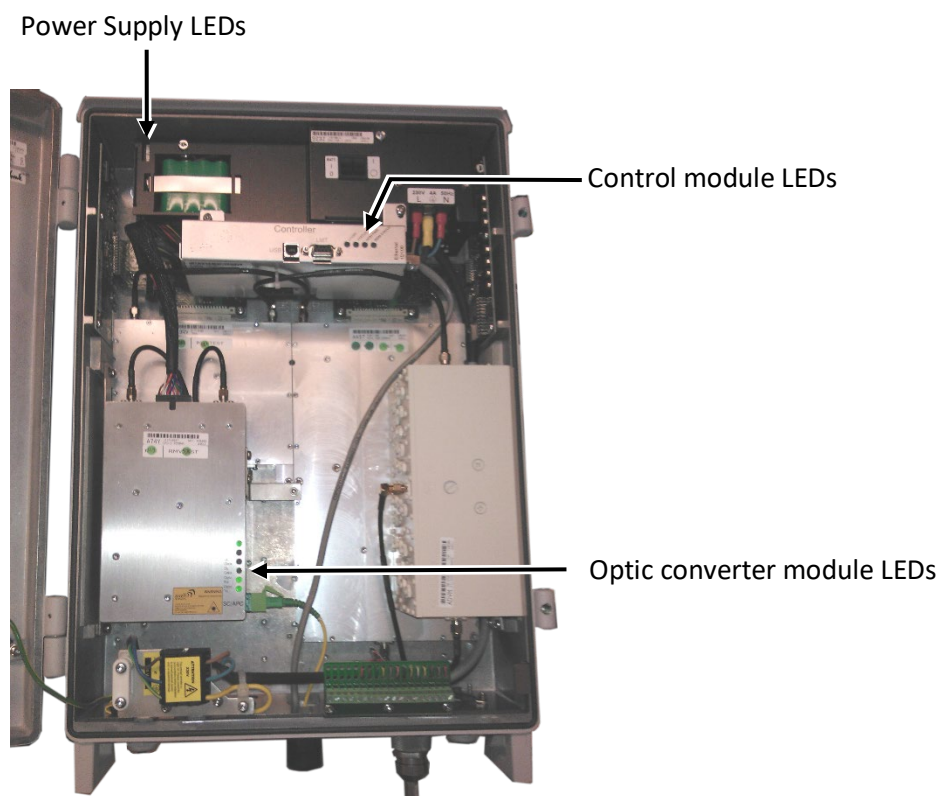
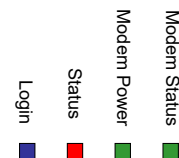


Figure 7-7: Internal View (Door Open)

7.3.1 Control Module LEDs

The Control Module has four LEDs which give information regarding the status of the MBF-40.

The two LEDs “Modem Power” and “Modem Status” do not fill any function and can be disregarded.



Blue LED - Login		
	Quick flash	Control Module switched on, someone logged in locally and/or remotely
	Off (except for a quick flash every 10th second)	Control Module switched on, no one logged in
	Off (permanent)	Control Module switched OFF
Red LED - Status		
	Quick flash	Control Module switched on, one or more errors/alarms detected
	Off (except for a quick flash every 10th second)	Control Module switched on, status OK
	Off (permanent)	Control Module switched off

7.3.2 F/O Converter LEDs

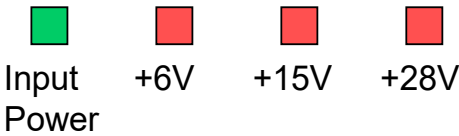
There are 6 LEDs on the module to indicate the status.



LED 1, Power, Green	
On	Unit is powered on
Off	Unit has no power
LED 2, Error, Red	
On	Error detected
Off	No error
LED 3, UL Data, Yellow	
On	Communication is ongoing in the uplink direction
Off	No communication
LED 4, DL Data, Yellow	
On	Communication is ongoing in the downlink direction
Off	No communication
LED 5, Opto Rx, Green	
On	Received RF signal on Fibre channel is above threshold
Off	Input level below threshold
LED 6, Opto Tx, Green	
On	Transmitted RF signal on Fibre channel is above threshold
Off	Output level below threshold

7.3.3 Power Supply LEDs

This section provides a detailed description of the LEDs and fault examples.



LED 1, Input Power, Green	
Slow flash	Power supply unit operating on AC or DC
OFF	Power supply unit not operating
LED 2, +6V, Red	
Slow flash (every 10 seconds)	+6V power supply operating
Quick flash	+6V power supply not operating or operating with malfunction
LED 3, +15V, Red	
Slow flash (every 10 seconds)	+15V power supply operating
Quick flash	+15V power supply not operating or operating with malfunction
LED 4, +28V, Red	
Slow flash (every 10 seconds)	+28V power supply operating
Quick flash	+28V power supply not operating or operating with malfunction

Examples	
Diagram showing all four LEDs (Input Power, +6V, +15V, +28V) flashing slowly.	LED 1 is flashing slowly, LED 2 – 4 are flashing slowly (once every 10 seconds) => power supply unit is operating without problem
Diagram showing the Input Power LED flashing slowly and one or two of the red LEDs flashing quickly.	LED 1 is flashing slowly, one or two of the red LEDs are flashing quickly => Input power is operating but there is a problem with some of the other voltages
Diagram showing the Input Power LED flashing slowly and all three red LEDs flashing quickly.	LED 1 is flashing slowly, all of the red LEDs are flashing quickly => Input power is out and unit is operating on backup battery

8 Maintenance

8.1 System Maintenance

- The system normally operates without any operator intervention or maintenance. If in the unlikely event of any unit failure, the faulty repeater should be replaced. A failed unit can be removed and replaced with a spare while the rest of the system (other repeaters) is still operating. However, the power supply of the failed repeater should be isolated from the power before anything is replaced.
- In the event of a failure PBE Axell's support service should be contacted for advice on a possible module replacement or other action to be taken.
- If a shipment of a repeater back to PBE Axell is made within the period of guarantee the original packing must be used.
- Component Replacement - None of the modules in the repeater can be replaced without removing the repeater from its mounting and opening the cover of the repeater.
- In the event of a malfunction in the system, the status of the antenna systems as well as the continuity of the cabling should be checked before replacing any modules within the repeater.

8.2 Cautions and General Statements

- The Input / Output RF level power level monitoring windows are for indication only and should not be considered a replacement for laboratory test equipment accuracy of measurement of actual signal levels. The error of measurement will be high at low input levels.
- The normal operating range of signal measurement is as follows:
 - Downlink Output range +20 dBm to +43 dBm
 - Uplink Output range -10 dBm to +5 dBm

8.3 Product Disposal



CAUTION! Disposal of this product must be handled according to all national laws and regulations. For detailed information regarding materials, please refer to PBE Axell.

8.4 Batteries

The Repeater contains two types of batteries:

- A battery pack in the power supply unit, consisting of 8X NiMh batteries.
- A button cell, CR1225 by Renata, on the controller board.



CAUTION! Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to local laws and instructions.

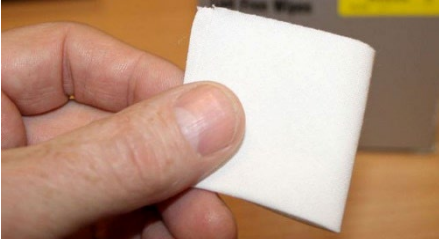
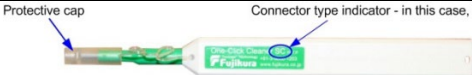
9 Appendix A – Specification

Frequency Range	Downlink (DL)	Uplink (UL)	Operational BW UL/DL	Composite Output Power
SMR700 ⁽¹⁾	758 MHz to 775 MHz	788 MHz to 805 MHz	17 MHz	+37 dBm
SMR800	851 MHz to 869 MHz	806 MHz to 824 MHz	18 MHz	+37 dBm
⁽¹⁾ Includes support for Band 14				
General Parameters				
Noise Figure	3 dB Typical (maximum gain)			
Ripple	<2 dB			
Propagation Delay	< 2 μs			
Gain UL/DL	SMR 700/800 – nominal 30 dB, adjustable, in 1 dB steps			
System Impedance	50Ω			
Return loss at antenna connections	>16 dB			
Antenna Connectors	7/16 DIN, female duplex			
Optical Parameters				
Wavelength DL/UL	1310/1550nm			
Optical output power (UL)	0 dBm			
Max optical Loss	10 dBo			
F/O Connector	SC/APC			
Power Specifications				
Power Supply options	115 V ac or -48 V dc			
Power consumption	140 W for single band 220 W for dual-band			
Mechanical				
Dimensions	21.3” x 15” x 7.8” (540 mm x 382 mm x 198mm)			
Weight	Single band: 44.0 lbs (20 kg) Dual band: 48.5 lbs (22 kg)			
Enclosure	NEMA 4 (IP66)			
Environmental				
EMC	FCC			
Operating Temperature	-13°F to +122°F (-25°C to +50°C)			
Storage Temperature	-22°F to +158°F (-30°C to +70°C)			
Humidity	0 to 95% RHNC			
Complies With				
Radio	FCC in accordance with part 90, ISED in accordance with RSS131			

10 Appendix B – F/O cleaning procedure

NOTE: The process is demonstrated on an OMU F/O module and is similar to all F/O equipment supplied by PBE Axell.

10.1 Tools

Tool Description	Illustration
Fibrescope connected to a PC running the appropriate viewing software. It is highly recommended that some form of Fibre viewing equipment such as a Fibrescope is used to ensure that all Fibre connections are clean before termination; failure to do so could result in poor system performance	
Lint-free swabs (box)	
Lint-free wipes (pack)	
Fujikura “One Click” cleaner	
99% isopropyl alcohol (can)	
Cletop type S Cassette Cleaner	

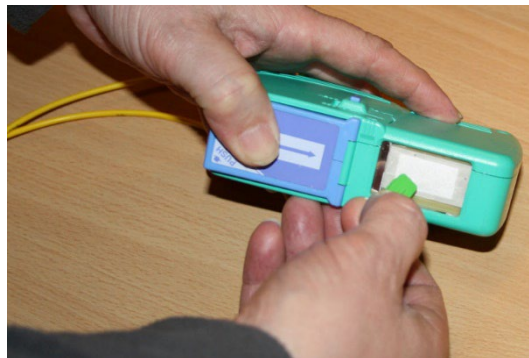
10.2 Dry F/O Cleaning Procedure:



WARNING! Invisible laser radiation might be emitted from disconnected Fibres or connectors. Do not stare into beams or view directly with optical instruments.

1. Before cleaning the optical connectors on the OMU it is advisable to clean the connector of the mating cable being attached to the optical port.

An unclean optical connector is often the cause for reduced system performance. A bit of dust or oil from a finger can easily interfere with, or block light. Fortunately, it is very easy to clean the connector. Be sure to use the correct procedure for the given connector. When disconnected, cap the SC/APC connector to keep it clean and prevent scratching the tip of the ferrule. Use a product specially designed for the purpose, such as the Cletop type S Cassette Cleaner.



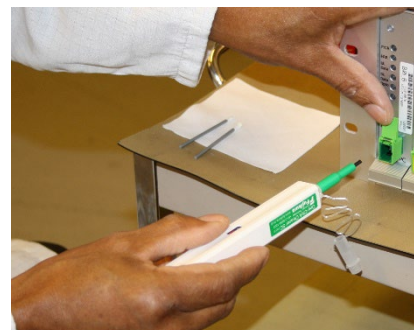
2. Begin by dry cleaning the F/O bulkhead connector (shown below is the Fujikura One-Click in use).



IMPORTANT!

Always make sure there is a way of inspecting the connector after cleaning. Cleaning can actually leave the end-face in a worse condition, since alcohol residue is one of the most difficult contaminants to remove.

3. Remove the protective cap from the cleaning-head end of the "One Click" cleaner, lift the protective end-cap on the Fibre connector and offer-up the end to the Fibre connector



4. With the cleaning-head end fully engaged in the connector, push until an audible "click" is heard
5. Without fully withdrawing the cleaning head end push it in again twice more, each time until an audible "click" is heard.
6. Withdraw the "One Click" cleaner and replace the protective end cap.



7. Inspect the Fibre connector using a Fibrescope. On the PC monitor, verify that there is no contamination present on the connector end-face.
8. If the connector is dirty, clean it with a wet cleaning technique followed immediately by dry cleaning. This is to remove any remaining residue from the wet clean (the following steps demonstrate a wet cleaning technique).

10.3 Wet F/O Cleaning Procedure



ATTENTION!

Invisible laser radiation might be emitted from disconnected fibres or connectors.
Do not stare into beams or view directly with optical instruments.

1. Lightly moisten a new lint-free wipe with 99% isopropyl alcohol. (Step 1 below).
Tip: Have a dry lint-free swab available for immediately drying after performing the wet-cleaning.
2. Lightly press and turn a clean lint-free swab in the moistened area of the wipe to moisten the swab. It is important that the swab is not too wet. (Step 2 below).
3. Insert the moistened lint-free swab into the bulkhead adapter. Lightly press and rotate several times in the same direction. (Step 3 below).

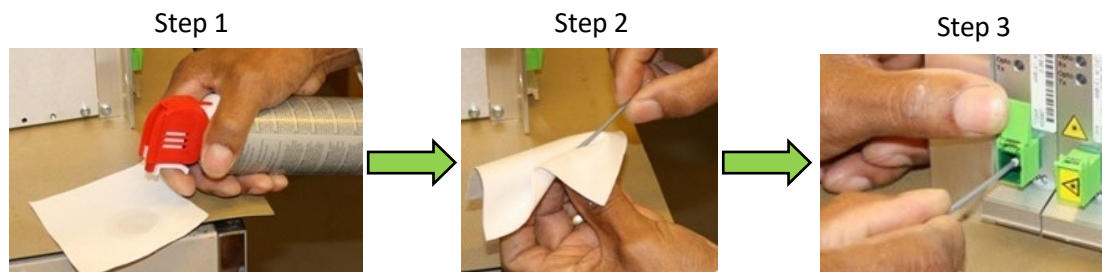


Figure 10-1: Wet-Cleaning Technique

4. Immediately use a dry lint-free swab to clear any remaining alcohol residue.

NOTE: Do **not** re-use any of the wipes and/or swabs. Dispose of them properly.

5. Follow steps 3 to 6 of Dry Cleaning above
6. Re-inspect the Fibre using the Fibrescope. On the PC monitor, verify that there is no contamination present on the connector end-face.
7. If the Fibre is still dirty, go back to step 1 (Wet Cleaning) and repeat the entire process.

NOTE: The entire wet/dry cleaning cycle should only be used twice. If the Fibre is still dirty after two cycles of wet/dry cleaning seek advice from the PBE Axell Support Desk.