axell WIRELESS

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# OMU
# OPTICAL MASTER UNIT

# Optical Master Unit, OMU

## Product Description and User's Manual

This manual is valid for Firmware release version

- Common Commands and Attributes v 1.3.0
- OMU Commands and Attributes v 1.0.0

# Table of Contents

# Safety Instructions and Warnings

## 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 Axell Wireless warranty.

## 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 OMU System. Incorrect power settings can damage the OMU System and may cause injury to the user.

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.

**Caution**

This notice calls attention to a procedure or practice that, if ignored,
may result in personal injury or in damage to the system or system component.
Do not perform any procedure preceded by a "Caution" until described
conditions are fully understood and met.

## Safety to Equipment

When installing, replacing or using this product, observe all safety precautions during handling and operation. Failure to comply with the 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. Axell Wireless 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 OMU System.

## Class 1 Laser

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.

Optical transmitters in the opto module can emit 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 straight 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.

## Electrostatic Sensitivity

Observe electrostatic precautionary procedures.

| **Caution** |
| --- |
| ESD = Electrostatic Discharge Sensitive Device |

Semiconductor transmitters and receivers provide highly reliable performance when operated in conformity with their intended design. However, a semiconductor may be damaged by an electrostatic charge inadvertently imposed by careless handling.

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 OMU, follow ESD precautionary procedures including use of grounded wrist straps, grounded workbench surfaces, and grounded floor mats.

## References

References to standards apply as relevant to the repeater type being connected to the OMU. Please see respective repeater manual for details.

# Contact Information


| | |
|---|---|
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# Definitions, Abbreviations and Acronyms

| | |
|---|---|
| AEM | Axell Element Manager<br>A software tool for operation and monitoring a network consisting of Axell Wireless elements such as OMUs and repeaters. |
| ALC | Automatic Limit Control |
| BCCH | Broadcast Control Channel |
| BTS | Base Transceiver Station, one part of a base station.<br>A base station is composed of two parts, a Base Transceiver Station (BTS) and a Base Station Controller (BSC). A base station is often referred to as BTS.<br>The BTS is also sometimes called an RBS or Remote Base Station. |
| Channel | In all Axell Wireless documentation a channel is the same as a carrier. |
| Channel Selective Repeater | A repeater that operate on a specified channel within the operating band of the repeater. |
| DL | Downlink, RF signals transmitted from base stations to mobile radio equipment |
| EMC | Electromagnetic Compatibility<br>The ability of a device or system to function in its intended electromagnetic environment |
| GND | Ground |
| LED | Light Emitting Diode |
| LMT | Local Maintenance Terminal |
| LNA | Low Noise Amplifier |
| MS | Mobile Station (e.g. mobile phone) |
| MTBF | Meantime Between Failures |
| NA | Not Applicable |
| NC | Not Connected |
| NF | Noise Figure |
| NMS | Network Management System |
| Node | In this manual a node is the OMU or a repeater |
| ODF | Optical Distribution Frame, used for connection and patching of optical cables |
| OMC | Operations and Maintenance Center |
| PSTN | Public Service Telephone Network |
| Repeater | A bi-directional Radio Frequency (RF) amplifier that can amplify and transmit a received Mobile Station (MS) signal in the MS transmit band. Simultaneously it amplifies and transmits a received Base Transceiver Station (BTS) RF signal in the BTS transmit band. |
| RF | Radio Frequency, 9 kHz – 300 GHz |

| Designation | Abbreviation | Frequencies |
|---|---|---|
| Very Low Frequency | VLF | 9 kHz - 30 kHz |
| Low Frequency | LF | 30 kHz - 300 kHz |
| Medium Frequency | MF | 300 kHz - 3 MHz |
| High Frequency | HF | 3 MHz - 30 MHz |
| Very High Frequency | VHF | 30 MHz - 300 MHz |
| Ultra High Frequency | UHF | 300 MHz - 3 GHz |
| Super High Frequency | SHF | 3 GHz - 30 GHz |
| Extremely High Frequency | EHF | 30 GHz - 300 GHz |

| | |
|---|---|
| RMC | Repeater Maintenance Console<br>Software tool to monitor and control Axell Wireless repeaters. |
| RS232 | Serial interface standard |
| RS485 | Serial Interface standard |
| SIM | Subscriber Identity Module |
| SMS | Short Messaging Service |
| SMSC | Short Messaging Service Center |
| SW | Software |
| UE | User Equipment |
| UL | Uplink, RF signals transmitted from mobile radio equipment to a base station |
| WDM | Wavelength Division Multiplexing |

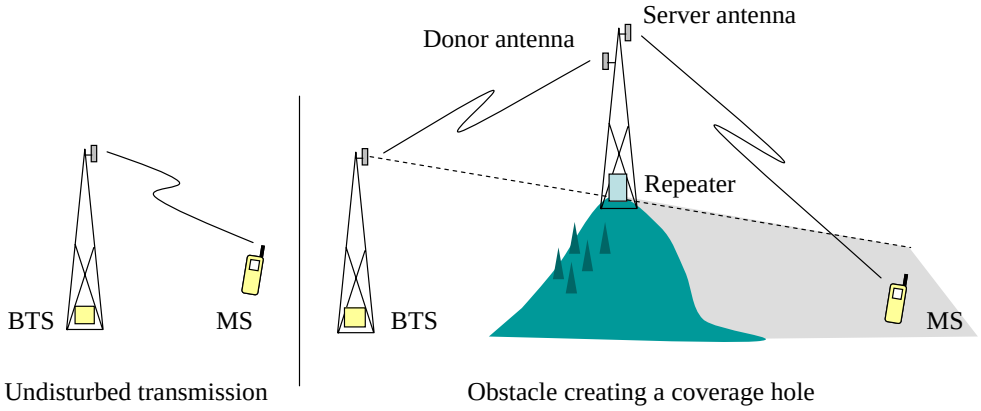
# 1 Repeater Technology

## 1.1 Basic Repeater Features

A basic feature of a mobile communication system is to transmit RF signals between base stations and mobile radio equipment.

When there is a blocking object, such as a mountain or a building, preventing the base station signal to reach the mobile equipment, a repeater can be used to extend the base station's coverage area.

In the downlink path (from the base station to the mobile phone) the repeater picks up the signal in the air via a donor antenna, amplifies it and re-transmits it into the desired coverage area via a server antenna. In the uplink path (from the mobile phone to the base station) the repeater receives the signals from mobile transmitters in the covered area and re-transmits them back to the base station.




A repeater can work off-air, as the repeater in the example above, or be fed over fibre from an optical master unit, OMU. The OMU taps the signal directly off a base station via a coupler, converts it to light and transmits it to a number of repeaters via fibre.

## 1.2 Software Overview

There are three types of software products; dedicated firmware for each Axell Wireless repeater or OMU, Repeater Maintenance Console (RMC) and Axell Element Manager (AEM).

### 1.2.1 Firmware

The firmware is the software inside the Control Module of the repeater or OMU. It is command line based, with simple SET and GET commands. A rich variety of commands is available to control and monitor all subsystems of the repeater from a normal VT100 terminal emulation program, such as HyperTerminal™. This also means that any standard laptop is able to control a repeater without additional software installed.

The firmware has three main tasks:

- Set and configure parameters in the repeater, such as channel numbers, gain, power levels, and different report configurations
- Monitor and measure alarm sources, alarm parameters and repeater utilization
- Send reports and alarms to the repeater OMC

Communication with the repeater or OMU can be performed either locally or remotely via a modem or Ethernet.

### 1.2.2 The RMC, Repeater Maintenance Console

RMC is an online software program with an intuitive graphical interface that simplifies control and installation of the repeater or OMU. The RMC is a graphical shell for the repeater's Control Module. It reads commands and attributes from the Control Module and displays them in an intuitive layout. This eliminates the need to learn commands and attributes for controlling the repeater or OMU.

Login can be made locally via the LMT port or remotely via a modem or via Ethernet. As soon as the RMC is connected it constantly polls the repeater or OMU for parameters such as power supply levels, in and out levels, temperature, traffic, etc. If the repeater is a slave type repeater, the OMU manages the data collection from the repeater.

The RMC program can be installed from a CD. It is a Windows based application that runs on Windows 2000 and Windows XP.

### 1.2.3 The AEM, Axell Element Manager

AEM is a complete operations and maintenance centre for Axell Wireless repeater networks.

The AEM takes control of the repeater – or the OMU-Repeater system - once the installation at site is completed. The repeater gets integrated into the network and will be controlled by the Element Manager. During integration all repeater parameters and statuses are downloaded into a database. The database is regularly updated with all incoming alarms and reports, and will hence contain a copy of the repeater configuration so that current repeater information will be accessible without setting up communication with the repeaters.

Communication between the AEM and the repeaters are message based. This means that the operator does not have to await message delivery, but will be informed when the message is delivered to the repeater

The Axell Element Manager is a Windows™ based application that runs on Windows 2000, Windows 2003 Server and Windows XP.

For more information please refer to the separate AEM User's Manual.

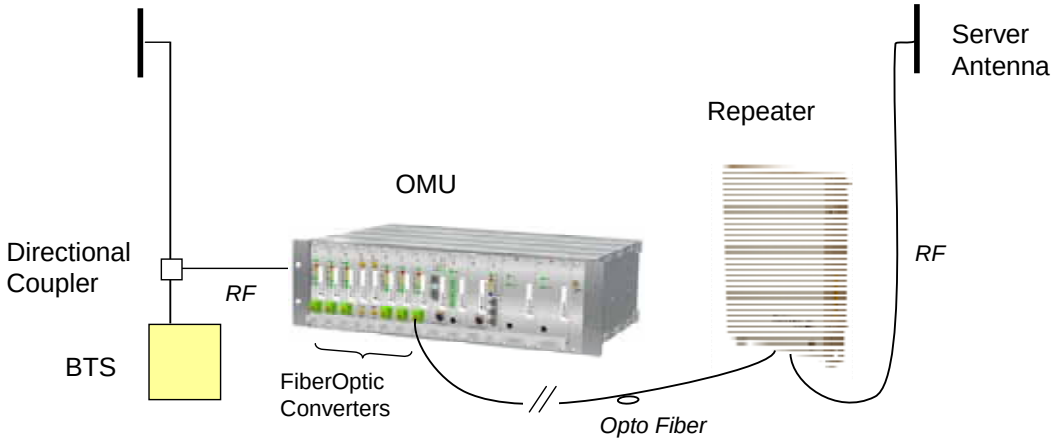
# 2 Product and System Description

## 2.1 Overview

The Axell Wireless OMU is a product used in combination with fibre fed repeaters. An OMU can be equipped to be used for frequency ranges from 88MHz to 2 170MHz.

An OMU's basic function is to translate RF signals to light to be sent over an optical fibre, and vice versa.

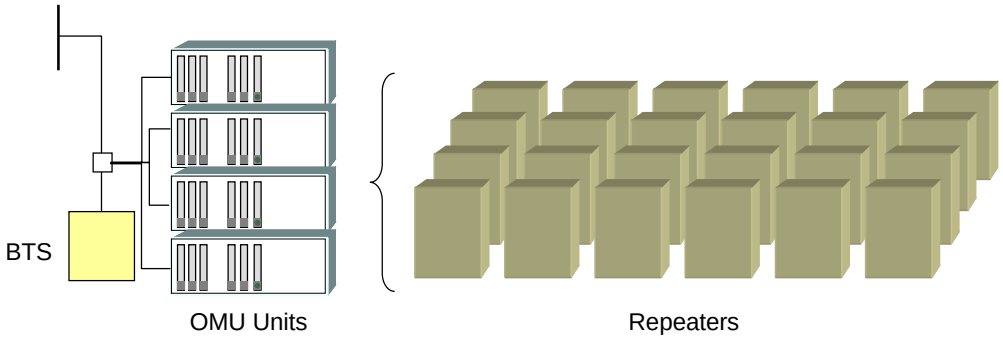
- In the downlink direction the OMU picks up the signal from the base station via an RF coupler system, converts it into an analogue optical signal and transfers it over a fibre optical cable to the repeater were it is translated back to RF and sent out via an antenna. An OMU can also be connected to a repeater. In that case the signal is tapped from the repeater's server antenna.
- In the uplink direction the OMU receives the signal from the repeater via the fibre optical cable, converts it to an RF signal and sends it back to the base station.




An OMU-Repeater system consists of one or more Optical Master Units, OMUs and one or several fibre fed repeaters. An OMU-Repeater system can be expanded to handle up to 24 repeaters, and cover a distance of to up to 20 km of fibre between the OMU and the most distant repeater.

Each OMU can be equipped with up to 6 fibre optic converters. If more than 6 repeaters are needed in the network there are two ways of expanding the system: link several OMUs together or use laser systems with three or four colors.

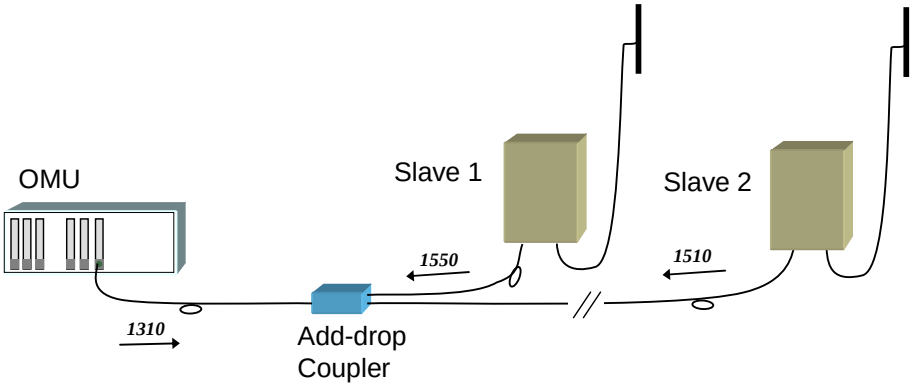
- Up to 4 OMUs can be cascaded and operate up to 24 repeaters as one system. When OMUs are cascaded only one is equipped with a Control Module. This OMU is called an OMU Master and the other three OMU slaves. The OMU Master manages the OMU slaves as well as the connected repeaters.




*Four OMUs cascaded in one system*

- A laser system with two colors can operate one repeater for each fibre optic converter in a OMU-Repeater system – one color is used for the uplink and one for the downlink. A laser system with three or more colors can operate two or more repeaters per fibre optic converter. One color is used for the downlink which is the same for all repeaters, and in the uplink each repeater has its own color.

  The connection from one repeater to the next is done via so called add-drop couplers. The difference in distance between the repeaters and the OMU can be compensated for automatically.




*Two repeaters are connected to the same converter in the OMU via the same fibre but the wavelength for the uplink differs between the units. Slave 1: 1550 ± 3 nm, Slave 2: 1510 ± 3 nm. The downlink signal is the same for both repeaters.*

### 2.1.1 Access to the System

**Important Generic Information**

Axell Wireless repeaters and OMUs can be configured in three different ways as regards communication and control. They can be "stand-alone units", "node masters" or "slaves".

**Stand-alone units** do not control any other unit or take control from any other unit. All communication with a stand-alone unit needs to be made directly with the unit – either locally or remotely via a modem or Ethernet. Most stand-alone units are equipped with Ethernet and/or a modem for this purpose.

**Node Masters** keep track of the slaves that are connected to it. It is the single point of contact for alarm reports and for heart beats in the entire system, and communicates with the AEM. All configuration and control of all units in the network go through this Node Master. Most Node Masters are equipped with Ethernet and/or a modem for this purpose.

**Slaves** are linked to a Node Master and contain a slave interface allowing for a Node Master to communicate with the slave.

An OMU-Repeater system can be designed using repeaters that operate as slaves to the OMU or as stand alone units regarding communication, configuration, alarms etc. Either all communication is handled by the OMU that acts as a node master and the repeaters are slaves, or each repeater (and the OMU) handles this communications and reporting separately.

The most common configuration is the master-slave set up which has several advantages:

- All nodes can be reached from any node in the system. An operator can log in from any node in the system and access all parameters in all nodes, including those in the OMU
- Only one modem is needed for remote communication and configuration of the whole system
- Since the communication runs on the same fibre as the RF, this arrangement gives a reliable supervision of the radio link. If communication between the OMU and a repeater is broken, an alarm can be generated immediately.

Several users at a time can be logged on to the system, for instance one locally via the RS232 interface and one remotely via modem or Etthernet. Only one user at a time can be logged in remotely.

**Note!** If the network has an OMU from an earlier generation[1], there are some limitations of what can be accessed via a local login to a slave repeater.

#### 2.1.1.1 Local Access

Local access is achieved via an RS232 interface to the LMT port in the repeater or the OMU. This port is accessible on the front of the OMU and inside the repeater.

#### 2.1.1.2 Remote Access

Remote access is achieved via modem or Ethernet. Different types of modems are supported, for example GSM, GSM-R, HSDPA/UMTS, TETRA, GPRS and PSTN.

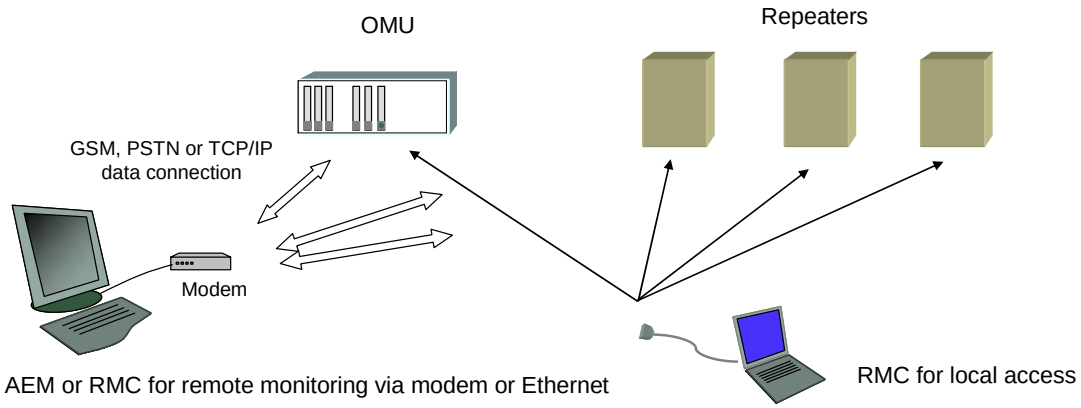
The modem is either placed on the Control Module or as a separate unit. When cascaded OMUs are used, the modem is placed in the OMU unit that holds the Control Module. Ethernet connection is available on the Control Module.

[1] The earlier versions of the OMU where called HUBs.

### 2.1.2 SW for Configuration and Control

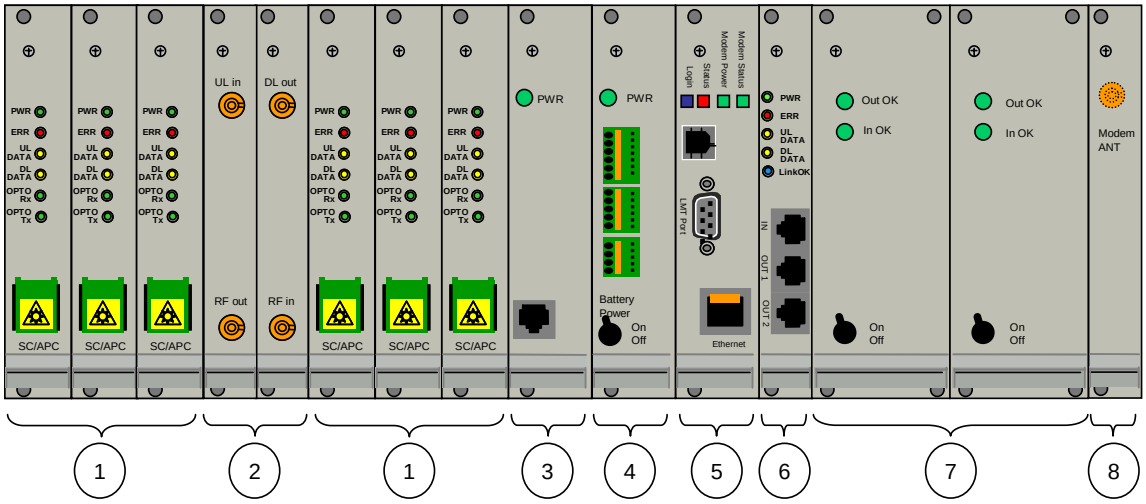
There are two SW tools for configuration and control of the Axell Wireless OMU-Repeater system. The RMC, Repeater Maintenance Consol and the AEM, Axell Wireless Element Manger.

- The RMC is an on-line tool that can be used locally or remotely for configuration and monitoring of all parameters in the system. It is installed on a lap-top computer and holds pre-configured screens for each repeater type or OMU that shows the parameters live in a user-friendly manner. All parameters can be accessed and changed on-line. In the RMC there is also a terminal mode that allows for command based communication.
- The AEM is a tool for monitoring and control of a whole network. Data from the network elements are collected at regular intervals and alarm information are sent to the AEM as they occur. All data are stored in a data base and can be presented in maps, reports and diagrams.



## 2.2 Building Blocks

The OMU is built in a 19" sub rack.




An OMU unit can contain the following modules:

1. Fibre Optic Converters (1 to 6 pcs can be installed)
2. Uplink (UL) Combiner and Downlink (DL) Splitter. These modules are always installed.
3. Modem Unit. This module is optional. This unit is used for modems that are not mounted on the Control Module
4. External Alarm and Battery Module. This module is optional. This module is only used for Master OMUs
5. Control Module. This module is only used for Master OMUs
6. Rack Communication Board. This module is always installed.
7. Power Supply A and B (B is optional)
8. Modem Antenna Connection. This module is optional. This is used for OMUs with wireless modems installed that need a separate antenna. This module can also be equipped with two connectors. For details, see section 2.2.8 Modem Antenna Connection

In the next sections all modules are described in detail.

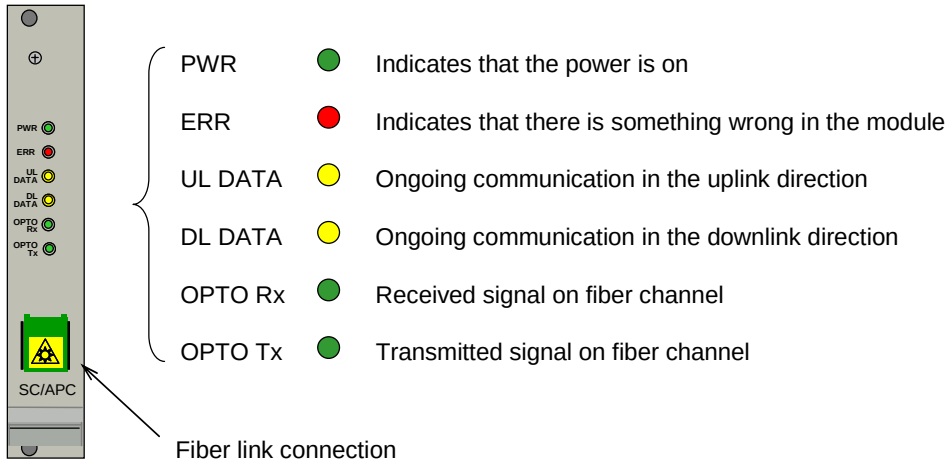
### 2.2.1 Fibre Optic Converter

The Fibre Optic Converters are placed in slots 1, 2, 3 and 6, 7, 8.

A Fibre Optic Converter translates back and forth between RF and optical signals. The optical signals are analogue. Each module contains both an optical receiver and a transmitter. The optical signals for downlink and uplink are combined utilizing WDM technology (Wavelength Division Multiplexing). Hence only one fibre is necessary for the transmission to and from the repeater.

Each Fibre Optic Converter in the OMU works in parallel with a corresponding unit in the repeater which is linked via the fiber. A pilot tone can be sent between the Fibre Optic Converters in the OMU and the repeater to define the loss in the fibre. Based on this information the repeater automatically adjusts the attenuation to compensate for the fibre loss.

On the Fibre Optic Converter module there are six LED indicators; one for power status, one for error, two for the data communication and two for the RF signals.




- UL DATA and DL DATA reflect the ongoing data communication
- OPTO Rx reflects received RF signal
- OPTO Tx reflects transmitted RF signal

The fibre connector is SC/APC. The connector house is SC, the connector type is APC.

**Note!**

Angled connectors, APC, need to be used throughout the whole link between the OMU and the repeater. The angle needs to be 8 degrees.
Also the ODF connections need to be APC type.

The fibre must be monomode type.

**Caution**


Un-terminated optical receptacles may emit laser radiation. Do not stare into beam or view with optical instruments.

### 2.2.2 UL Combiner and DL Splitter[2]

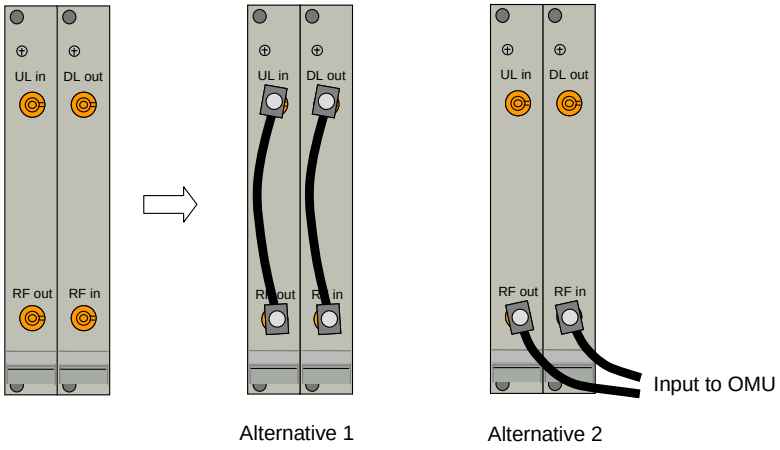
The UL Combiner and DL Splitters are placed in slots 4 and 5.

These two modules contain the combiners and splitters that combine and distribute the RF signals between the OMU's RF port and the Fibre Optic Converters. They also contain attenuators that are used for setting the master signal levels in the downlink and uplink.

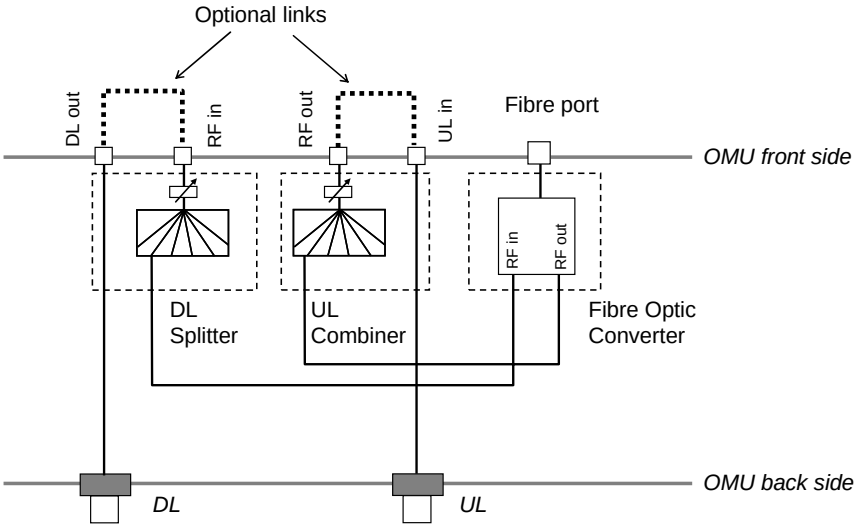
Via these modules the RF in/out can be connected on the front of the OMU instead of the back, if needed.

The connectors are QMA type.

The modules can to be configured in two ways as shown in the illustration below.




- In Alternative 1 the connectors on each module are linked and the input to the OMU is made via the N-connectors on the back of the OMU. See also illustration below.
- In Alternative 2 the input to the OMU is made via the QMA connectors marked RF in/RF out.



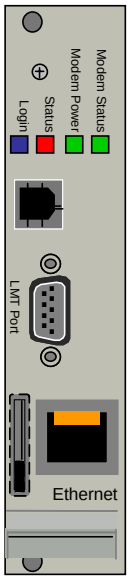

**Note!** In the illustration above only one Fibre Optic Converter is shown. The other converters are connected in a corresponding way.

The configuration at delivery is Alternative 1.

[2] In some cases, for specific needs, these modules can be designed in alternative ways.

### 2.2.3 Control Module

The Control Module is placed in slot 9 or 11. **Note!** If there is a wireless modem mounted in the Control module it has to be placed in slot 11 to access the modem antenna. See section 2.2.8 Modem Antenna Connection.




The Control Module manages and controls the OMU and handles alarms. The Control Module keeps track of all modules in the OMU based on their serial numbers. The Control Module collects data from active modules within the OMU such as Optic Fibre Converters and Rack Communications Board. The collected data is processed and if an error is detected the Control Module can send an alarm via a built in modem to an Operations and Maintenance Center (OMC). All alarms are also stored for later access via the LMT port.

The Control Module can collect the status of 4 external alarm sources connected to the External Alarm and Battery Module. The summary alarm status of the OMU and the whole system can be indicated via a relay port. This relay can be used to indicate to external equipment if the OMU-Repeater system is functioning properly.

The Control Module includes a Real Time Clock (RTC). The RTC keeps track of at what time alarms and events occur. This RTC has its own backup battery.

The Control Module can be configured in two different modes:

- Standalone Mode – the OMU only reports its own status
- Node Master – being a node master means that the OMU controls all slaves (repeaters) connected to it and manages all communication to the AEM for the whole OMU-Repeater system.

#### 2.2.3.1 Connectors

The Control Module contains a RS232 port used for local access to the repeater, the LMT Port.

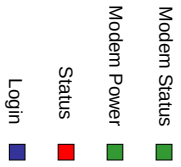
The Control Module has an Ethernet connection for remote access placed on the front panel.

If the Control Module is equipped with a wireless modem, a SIM card holder is accessible on the front panel.

**Note!** The USB connector is not used in this version of the product.

The Control Module has four LEDs which give information regarding the status of the OMU.

If the OMU is configured for Ethernet communication 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 |

| Green LED – Modem Power | | |
|---|---|---|
| ■ | On | Modem Power is on |
| □ | Off | Modem Power is off |

| Green LED – Modem Status | | |
|---|---|---|
| ■ | On | Depending on type of call:<br>Voice call: Connected to remote party<br>Data call: Connected to remote party or exchange of parameters while setting up or disconnecting a call |
| ■ | Flashing<br>(irregular) | Indicates GPSR data transfer. When a GPRS transfer is in progress the LED goes on within 1 second after data packets were exchanged. Flash duration in approximately 0.5s. |
| ■ | 75ms on/75ms off/75ms on/3s off | One or more GPRS contexts activated |
| ■ | 75ms on/3s off | Logged to network (monitoring control channels and user interactions). No call in progress |
| ■ | 600ms on/600ms off | No SIM card inserted, or no PIN entered, or network search in progress, or ongoing user authentications, or network login in progress |
| □ | Off | Modem is off |

### 2.2.4 External Alarm and Battery Module

The External Alarm and Battery Module is placed in slot 10.

This module has two functions.

- It holds a rechargeable battery pack
- It has plinths for external alarms and a sum alarm relay

#### 2.2.4.1 Battery

The rechargeable battery pack will provide the Control Module in the OMU and the modem with enough capacity to send an alarm in case of an input power failure. This battery can be switched on and off with the switch on the front of the module.

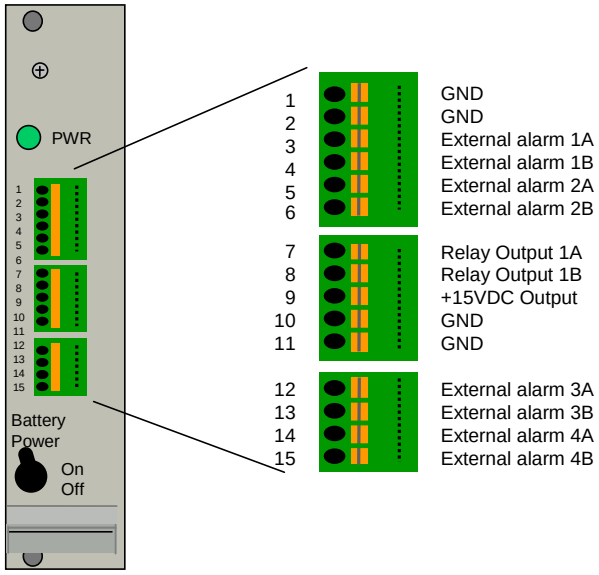
#### 2.2.4.2 External Alarms

Four external alarm sources can be connected to the External Alarm and Battery Module via the patch panels. These sources must generate a voltage between 12 and 24VDC. The presence or absence of this voltage will trigger the alarm depending on how the alarm thresholds have been configured. The module can also supply +15V to external alarm sources. The maximum allowed load on this supply is 100mA.

#### 2.2.4.3 Relay

The module contains a relay that 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 through the relay is 100mA.

### 2.2.4.4 Patch Panels




*External Alarm and Battery Module with pin out for external alarms and relay*

The external alarm wires are linked to the module via patch panels. These panels can be released from the module for easier access at installation.

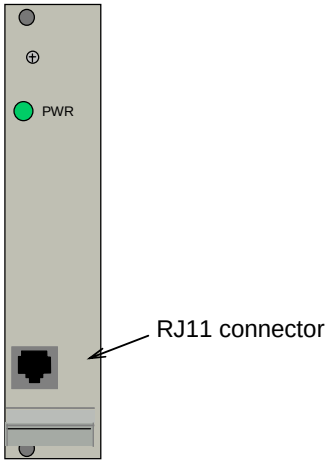
The panels can be used for wires of up to 0.5mm$^2$. To connect a wire, press the yellow lever with a pen or other pointy item, insert the wire and release the lever.

## 2.2.5 Modem Unit

The Modem Unit is placed in slot 9 or 11. **Note!** If there is a wireless modem in the Modem Unit it has to be placed in slot 11 to access the modem antenna. See also section 2.2.8 Modem Antenna Connection.

The Modem Unit is used for modems that are not placed on the Control Module. This can be for instance PSTN modems or wireless modems with a form factor that prevents it from being integrated with the Control Module.

The access to a PSTN modem is via an RJ11 connector on the font of the module.



### 2.2.6 Rack Communication Board

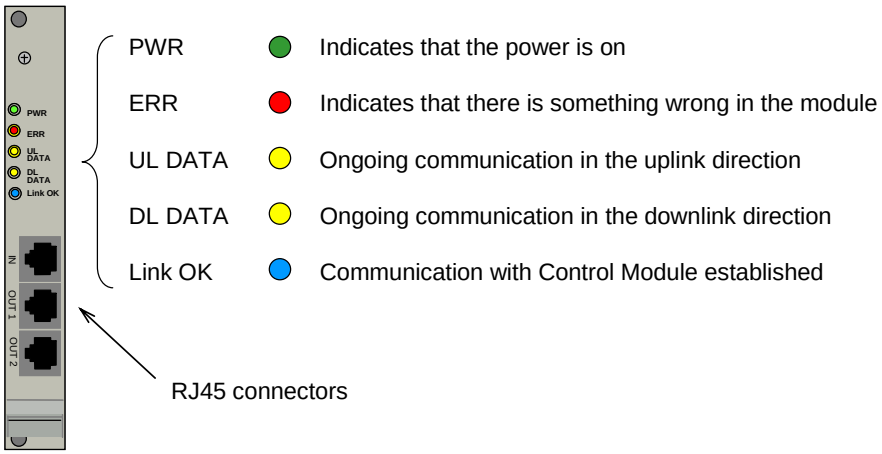
The Rack Communication Board is placed in slot 12.

This module serves as a communications link between the Control Module and the Fiber Optic Converters.

The unit is also used when several OMUs are to be linked together. The cables for cascading OMUs are provided by Axell Wireless in case these are needed. The connections are RJ45. How to link the OMUs to one another is described in section *6 Installation*.

There are three LEDs that reflect the status of the communication between the Control Module and the Fiber Optic Converters.

- UL DATA and DL DATA reflect the data communication that is ongoing between this module, the Control Module and the Fibre Optic Converters.
- Link OK is lit when the communication between this unit and the Control Module has been established.



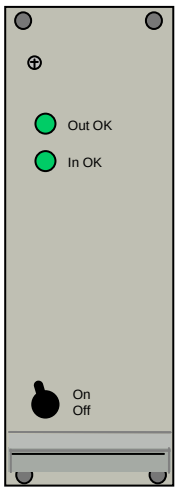

### 2.2.7 Power Supply

The Power Supplies are placed in slot 13 and 14.

Each OMU unit is equipped with one or two power supplies. There are power supplies for 115 - 230VAC 50/60 Hz and 24 - 48VDC.

It is possible to mount two different power supplies (with different voltage) if they are fed from two different sources.

The power supplies works in parallel and are independent of each other.




There are two green LEDs on the Power supplies

Out OK — "Out OK" indicates that the power levels the unit is delivering are OK

In OK — "In OK" indicates that the input power to the unit is OK

Each Power Supply can be switched off using the switches on the front panel.

**Note!** Even when the power supplies are switched off the OMU still has live power from the power input on the back.

## 2.2.8 Modem Antenna Connection

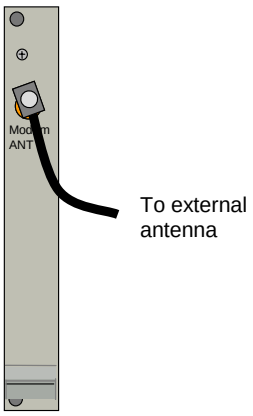
If a wireless modem is installed din the OMU, an antenna is needed. Either a separate antenna is connected to the modem antenna port, or the connection is be made via a coupler connected to the RF input to the OMU. The latter alternative can only be used if the OMU runs on the same frequency as the wireless modem and is equipped with a duplex filter.

### 2.2.8.1 OMU without Duplex Filter

OMUs that are not equipped with a duplex filter and use a wireless modem has a modem antenna port to the rightmost side of the rack.

An external antenna can be connected to the "Modem Ant" port.

The connector is SMA type.




### 2.2.8.2 OMU with Duplex Filter

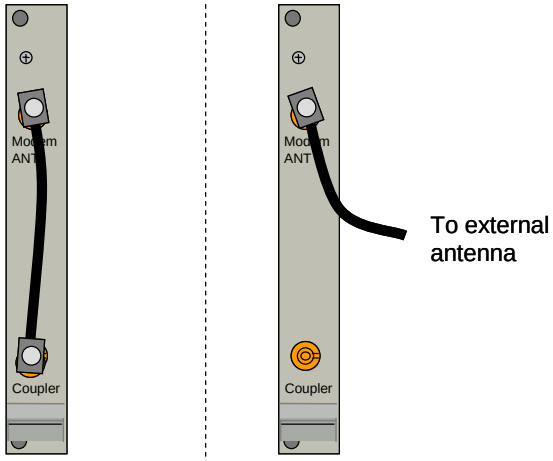
OMUs that are equipped with duplex filters and a wireless modem are of two kinds:

#### Alternative 1

The OMU and the wireless modem operate on the same band (for example an OMU for GSM with a GSM modem).

In this case the OMU will have two ports with a link between them.

- If the link is in place the modem will be connected to the OMU's RF in/out via a coupler. The coupler is either a separate unit or included in the duplex filter.
- If the link is removed an external antenna can be connected to the top connector.




The wireless modem is linked to the RF in/out via a coupler

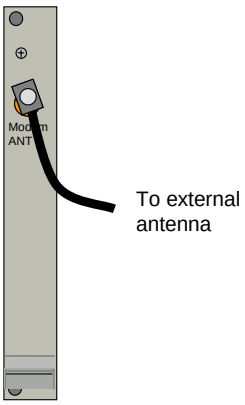
An external antenna is connected

### Alternative 2

The OMU and the wireless modem operate on different bands (for example an OMU for TETRA with a GSM modem)

In this case the OMU will have one port where an external antenna can be connected.

The connector is SMA type.




## 2.3 Block Diagram

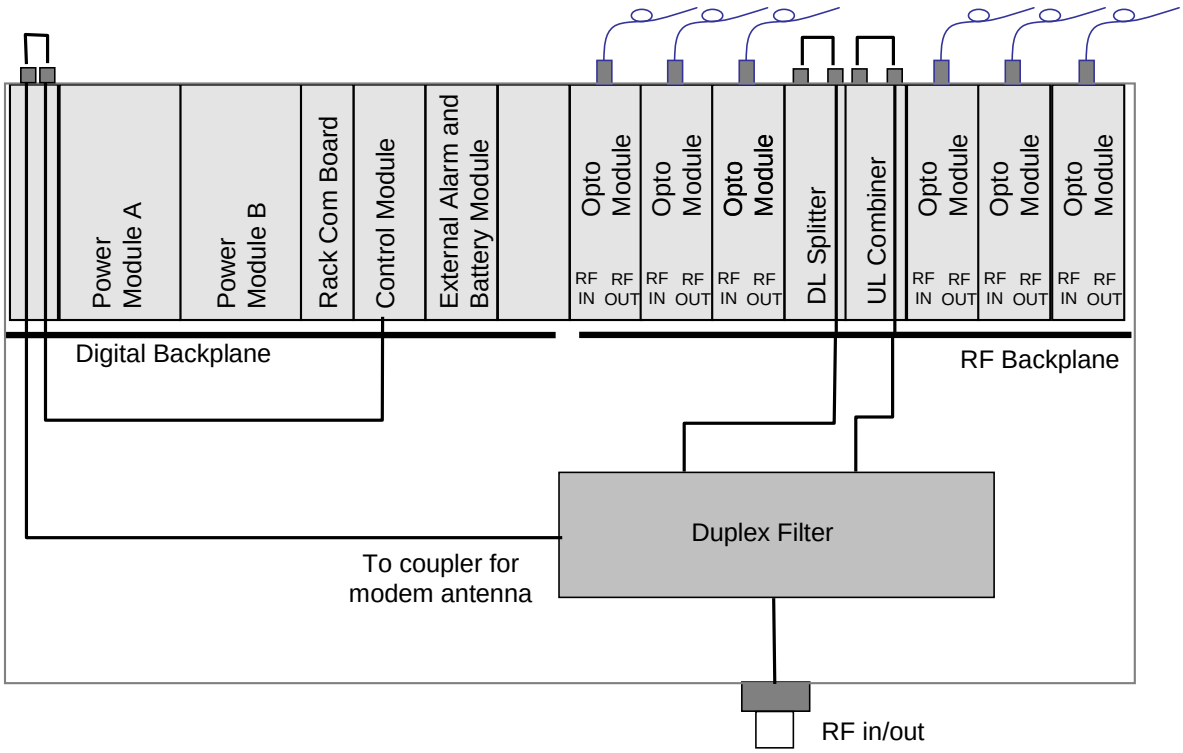
An OMU can be configured in many different ways. These are two examples.

*Example 1*

In this example the OMU is fed from the back so the links on the UL Combiner and the DL Splitter units are mounted.

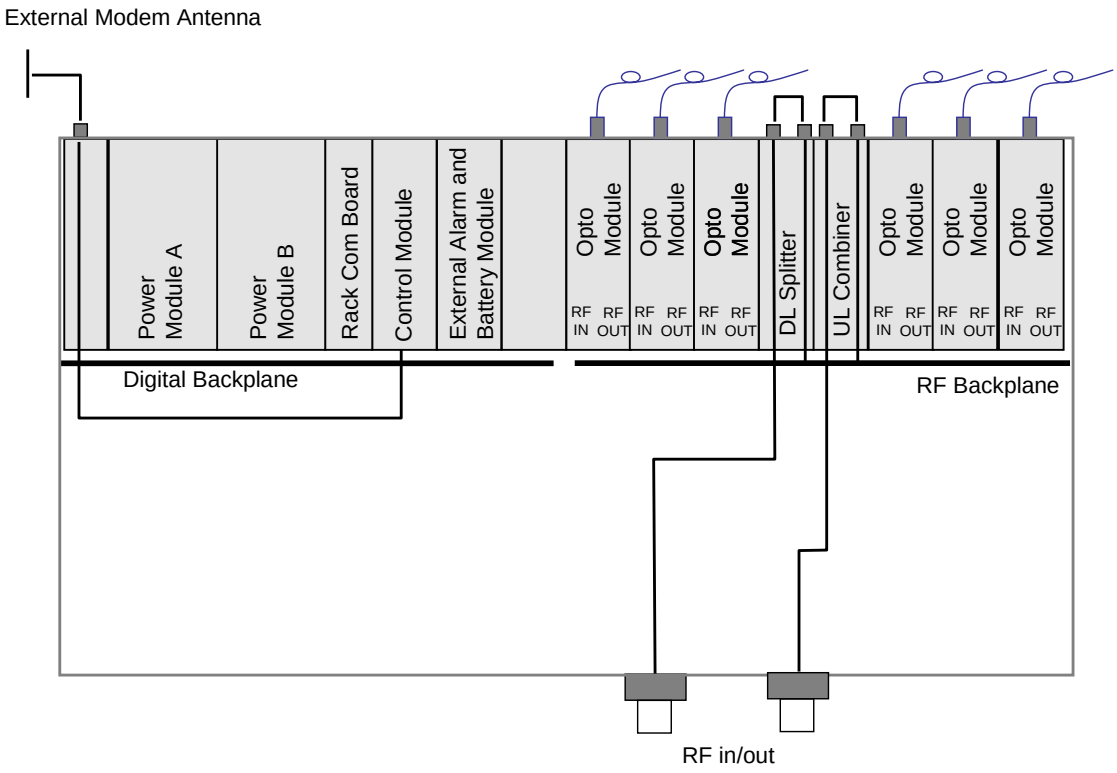
There is a duplex filter and therefore a combined RF in/out.

The wireless modem, which is placed on the Control Module, is connected to the coupler in the filter via the Modem Antenna Connection Module.



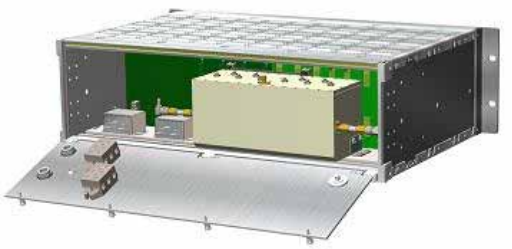
*Example 2*

In the example below there are separate inputs for Rx and Tx and no duplex filter. An external modem antenna is connected and linked to the modem on the Control Module.




## 2.4 Back Panel

*An OMU with one RF in/out*



*The inside of the back lid with two plinths for power connections, a duplex filter and one RF in/out*

The back panel of an OMU unit has a layout as illustrated above. The layout can vary depending on the configuration.

The connections are:

- Plinths for power connections are found on the inside of the back panel. There are two plinths. If two modules with the same power feed are installed these plinths should be interconnected.
- Screw for earthing
- N-connector for RF input. There is one connector if the Rx/Tx input is combined and two connections if the Rx and Tx are to be fed separately.

To gain access to the plinths for power connections, duplex filter, optional attenuators and optional coupler the back panel needs to be opened. It is fastened with 4 screws.

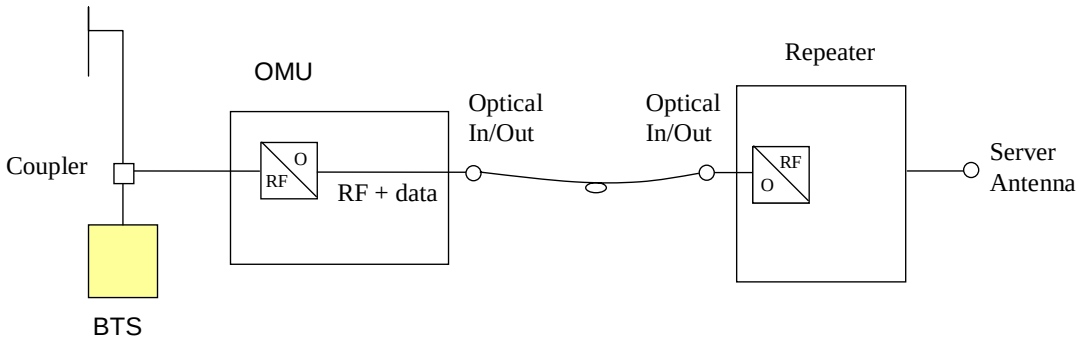
## 2.5 Radio Signal and Data Communication Paths

In the downlink the radio signal is tapped from a BTS using a coupler installed in series with the BTS's antenna cable. The Fibre Optic Converter in the OMU converts the RF signal to an optical signal and sends it to the repeater over a fibre.

In the uplink the Fibre Optic Converter receives the optical RF signal from the repeater, converts it to electrical RF signal and sends it to the BTS. The signal is transferred to the antenna cable using a coupler.

The Control Module in the OMU monitors all units in the OMU.

The Control Module also monitors and controls the repeaters (if they are set up as slaves). The data communication with the repeaters is handled over the same fibre as the RF signals.



# 3 Monitoring and Control

The Optical Master Unit, OMU as well as the whole OMU-Repeater system can be accessed locally on site through a Local Maintenance Terminal (LMT) port on any of the units in the system, or remotely via modem or Ethernet.

When an RS232 cable is plugged in to the LMT port or a remote access has been established, there are two options for communication; terminal mode or RMC mode.

- Terminal mode is accessed by using a terminal emulation software, such as HyperTerminal™ or MiniCom (Linux/Unix) Settings should be ANSI or VT100 emulation, baud rate 9600, 8 data bits, 1 stop bit, No parity and No flow control. A simple command language is used to control the repeater in this mode.
- Repeater Maintenance Console (RMC) mode allows configuration and control of the repeater via a user friendly Windows software.

**Note!** All instructions in this chapter assumes that the OMU is controlled using the Repeater Maintenance Console, RMC.

For terminal mode commands please refer to the documents "*Common Commands and Attributes*" and "*OMU Commands and Attributes*" which contain detailed description of all attributes and commands.

### Firmware Documentation Structure

The documents "*Common Commands and Attributes*" and "*OMU Commands and Attributes*" together describe all functionality in the OMU. The Common part contains functionality that is common for all Axell Wireless repeaters as well as the OMU, and the OMU part contains functionality that is specific for the OMU. For repeaters there are corresponding documents available.

### Help Functions

When being logged in to a unit using the terminal mode the command

```
HELP
```

lists all attributes and their modes of operation and displays them in alphabetic order on the screen.

Further help regarding specific commands can be obtained by typing

```
INF <command>
```

The INF attribute gives detailed information about a specific attribute.

## 3.1 Software Features - Overview

The firmware in the Control Module controls and monitors all parameters in the unit. If the OMU is configured as a node master it also handles alarms and heartbeats from slave repeaters connected to it. Statuses and measured levels can be read online via the RMC. This includes for instance voltage levels, RF-levels and temperatures.

In the event of a failure, an alarm is logged in the OMU. If the OMU is intergraded in the AEM, the alarm is also transmitted to the AEM. The OMU can be configured to handle alarms concerning a number of different parameters. Each alarm can also be individually configured in a number of ways. The OMU stores approximately 2 000 alarms in a local alarm log. The data stored regarding each alarm is the time at which an alarm occurred and the alarm information which consists of alarm source, alarm severity, alarm attributes and in some cases an additional alarm description.

On regular intervals, the OMU can send a heartbeat report to the AEM to confirm that the unit is functioning. The heartbeat message contains information about the RF-configuration and the alarm sources. It ensures that the data communication from the OMU to the AEM is working properly. The latest 2 000 heartbeats (approximately) are stored in a log.

The Control Module contains a battery backed-up real time clock, which will stay active even during a power failure. The real time clock is used for instance to keep track of when an alarm occurred, when to retransmit an alarm and at what time of the day to send traffic report to the AEM. If the OMU is controlled by the Axell

Element Manager, the AEM will automatically time synchronize repeaters, to ensure that the time is always set correctly in the entire repeater network. Slave repeaters are synchronized from the OMU.

## 3.2 Network Nodes

**Note!** The description in this section is based on a master-slave set-up of the system, where the OMU is the node master and the repeaters are the slaves.

An Axell Wireless OMU-Repeater system consists of an OMU and a number of remote nodes (repeaters) connected to the OMU unit via fibre. During software setup of the system, all nodes installed in the system are configured in the Control Module. Hence, the node master contains a list of all the repeaters in the system. Once a node is added to the system, it is also written to all the nodes installed. This means that all nodes in the repeater system have information about all other nodes, allowing for a very good overview of the entire repeater system no matter what node the repeater system login is made from.

### 3.2.1 Node Identification

All nodes have a unique address within the system. This address is based on the serial number of the node. When the system is installed to the Axell Element Manager, the node master unit is assigned a unique repeater ID within the AEM database.

This number is on the form:

```
XX-YY-ZZZZ
```

where
XX is the AEM installation number within the network
YY is the region number within the AEM-system
ZZZZ is the site installation number

Within the repeater system, all slave nodes (repeaters) are given a unique ID, based on the AEM assigned ID. The nodes share the XX-YY- part of the master ID, but the ZZZZ is replaced by the node's serial number.

*Example:*

If the node master's ID is 17-42-4711 and the serial number for a node in the system is 23BJ. The node's ID will be 17-42-23BJ.

### 3.2.2 Node Addressing Modes

When logging in to the OMU-repeater system, it is possible to view information about any of the nodes in the system, as long as they are added to the node list. All nodes can be addressed in four different ways, all starting with the @-sign.

#### Numeric Addressing

Each node in the network gets a unique ID-number in the Node List as they are added to the system. Node 0 is always the master node.

Addressing is on the format:

```
@K
```

K from 0 to N where N is number of nodes

Reading a parameter from node 3 is entered as:

```
AVITEC AB> @3 GET ATD
14
```

#### Serial Number Addressing

A node can be accessed using the serial number of the node.

*Example:*

```
AVITEC AB> @2J34 GET MDL
BSF424-I
AVITEC AB>
```

### Node ID Addressing

A node can also be addressed using the full Node ID.

*Example:*

```
AVITEC AB> @01-01-2J34 GET TAG
SITE3_TUNNEL_OPENING
AVITEC AB>
```

### Direct Node Addressing

When many attributes are intended for another node, the user can enter Direct Node Access mode, where the node the user is logged in redirects all commands to the destination node. This mode is configured by sending the command:

```
SET DNA [Node Address]
```

where any of the node addressing modes can be used as Node Address.

When going into direct node addressing, the command prompt is changed to reflect what node is currently addressed:

```
AVITEC AB> SET DNA 2J34
AVITEC AB @2J34>
```

Refer to attribute DNA in *OMU Command and Attribute Summary* for further details on direct node addressing.

## 3.2.3 System Wide Parameters

System Wide Parameters are parameters that when configured should be written to all nodes in the system. When setting a system wide parameter, the parameter is always set in the node master, which is then responsible for setting the parameter to all other nodes. If attempting to set a system wide parameter from a node as access to the node master is not available, setting the parameter will fail.

The following "standard" parameters are treated as system wide parameters (please refer to *OMU Command and Attribute Summary* for details):

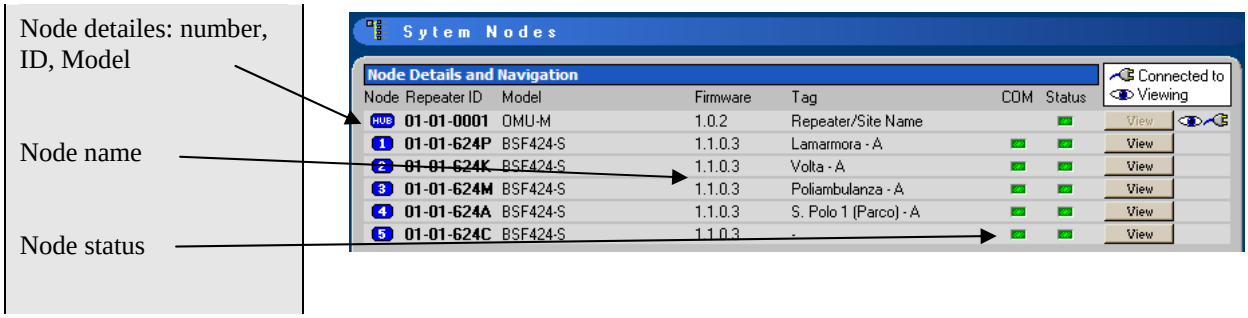
| | |
|---|---|
| LMT | Local Maintenance Terminal timeout |
| TIM | Setting the time |
| DAT | Setting the date |
| TPD | Setting the time for sending traffic / utilization report to the AEM |
| UID | User ID's |
| PWD | Passwords |
| RID | Repeater ID |

In slave repeaters the OMU is responsible for the communication with the AEM.

## 3.2.4 Node Access

An operator can login to the OMU-Repeater system from any node in the network and access all parameters in all nodes, including those in the node master unit. This can be done using a serial cable connected to the node's LMT-port or by remote access over a modem or Ethernet.

| | |
|---|---|
| Select "System Nodes" |  |




Select a node by clicking on View. The RMC will connect to the selected node.

The OMU unit polls the connected repeaters / nodes regularly and keeps control of login requests. If a user at a repeater site wants to log in to the system, the OMU Control Module is responsible for granting / denying the login request. If a user forgets to log out from the node when a session is finished, the system will automatically log the user out after a configurable number of minutes of inactivity.

## 3.3 Fibre Loss Compensation and Master Volume

The OMU has a master attenuation that can be set in downlink (DL) and uplink (UL) separately. This attenuation is useful for balancing of the whole system. See section 4.9 Balance the System for more information about this feature.

Each fibre optic link in the system will induce a loss. This loss will also differ in magnitude from one link to another since the distances between each repeater and the OMU is different. The Axell Wireless OMU-repeater system can automatically calculate this loss, compensate for the loss in each link and by that also balance the system.

This is accomplished by using a pilot tone of a well defined level which is sent from the master node to the slave and vice versa. The received level of the pilot tone is measured and the loss is calculated. The Fibre Optic Converter is automatically adjusted to compensate for the loss. The adjustment is made towards a target value which means that the system will be balanced, i.e. all fibers will appear to have the same loss. The maximum compensation is 10dB which equals an unbroken fibre distance of 20 km. For each connection in the link (for instance at the ODF) approximately 0.5 dB of loss will have to be added.

The loss compensation function is activated as the system is set up. Please see section 4.8 Set Up OMU-Repeater System. Each time the system has been changed or fibres have been exchanged or moved for some reason, it is recommended to re-activate this function.

**Note!**

If the OMU is connected to repeaters of an earlier release that has a fibre optic convert of the type in the photograph, the Fibre optic loss cannot be measured with this command.

## 3.4 Alarm System

The OMU monitors a number of parameters to see that the unit works as intended. Furthermore, the Control Module constantly polls all the nodes for new alarms. If a new alarm is detected, it is stored in the OMU alarm log. If the OMU is integrated to the Axell Element Manager, the OMU dials up the AEM using the built in modem and delivers the alarm.

### 3.4.1 Alarm Sources

#### Temperature Related Alarms

| Alarm | Code | Description | Trigger |
|---|---|---|---|
| Temperature | TEM | Measures the temperature in the Control Module. | Temperature too high or too low |
| Radio Board Temperature | RBT | Measures the temperature on the Rack Communication Board or Fibre Optic Converter | Temperature too high or too low |

#### Power Related Alarms

| Alarm | Code | Description | Trigger |
|---|---|---|---|
| Power Supply 1 | PW1 | Measures the +28V generated by the repeater's power supply. | Level too high or too low |
| Power Supply 2 | PW2 | Measures the +15V generated by the repeater's power supply. | Level too high or too low |
| Power Supply 3 | PW3 | Measures the +6.45 V generated by the repeater's power supply | Level too high or too low |
| Power Supply 4 | PW4 | Measures the backed up +6.45 V in rack 1 generated by the repeater's power supply | Level too high or too low |
| Battery Level | BAT | Measures the power level in the battery | Level too high or too low |

#### Communication Related Alarms

| Alarm | Code | Description | Trigger |
|---|---|---|---|
| Communication with Active Devices | COM | Detects errors in the communication between Control Module and Rack Communication Board/Fibre Optic Converter | Errors in the communication |
| Node Communication Status | NCO | Detects error in the communication between the Control Module and slave repeaters | Errors in the communication |
| EEPROM CRC Check In Active Devices | CRC | Controls checksum in Radio Communication Board and Fibre Optic Converter | Checksum wrong |

### Opto Related Alarms

| Alarm | Code | Description | Trigger |
|---|---|---|---|
| Received Optical Level | RXO | Measures the received optical signal level | Optical signal level too low |
| Transmitted Optical Level | TXO | Measures the transmitted optical signal level | No transmission |
| Synthesizer Pilot Tone Generator | SZP | Measures the pilot tone frequency | Error on pilot tone |
| Input Signal Level Downlink | ILD | Measures the signal level in to the fibre optic converters in the downlink | Signal level too low (default setting) or too high (can be reconfigured to use an upper threshold) |

### User Related Alarms

| Alarm | Code | Description | Trigger |
|---|---|---|---|
| Valid Login to repeater | VLI | Detects a login to the unit, either locally or via remote connection. | A successful login |
| User logged out from repeater | LGO | Detects a logout from the repeater. | A logout |
| Changes made by logged in user | CLR | Detects all changes made to repeater settings by a user logged in to the repeater. | Changes made by a user |
| Firmware upgraded | FWU | Detects when a successful firmware upgrade has been made | Upgrade successful |
| Firmware Upgrade Failure | FWF | Detects failure in the upgrade | Upgrade failed |

### User Administration Alarms

| Alarm | Code | Description | Trigger |
|---|---|---|---|
| User Added | UAD | Detects when a user is added to the system | User added |
| User Deleted | UDE | Detects when a user is deleted from the system | User deleted |
| User Promoted | UPM | Detects when a user gets escalated user privileges | User promoted |
| User Demoted | UDM | Detects when a user gets downgraded user privileges | User demoted |
| User Password | UPW | Detects when a password is changed | Changed password |

### External Alarms

| Alarm | Code | Description | Trigger |
|---|---|---|---|
| External Alarm 1-4 | EX1-4 | Monitors any alarm source connected to the external interface. | Error from alarm source |

### Relay Output for Sum Alarm

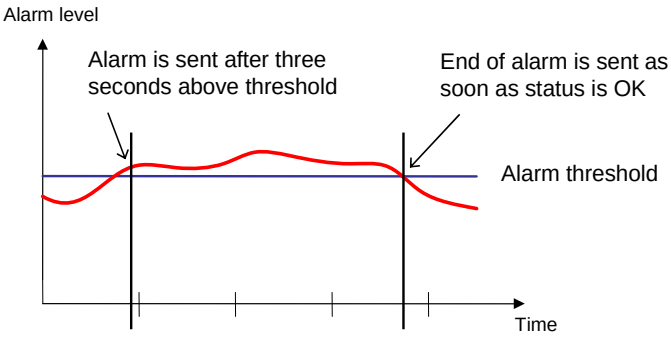
The External Alarm and Battery Module contains a relay output. The relay can be used to indicate the summary status of the OMU. Each alarm source can be configured to affect the relay or not.

## 3.4.2 Alarms and End of Alarms

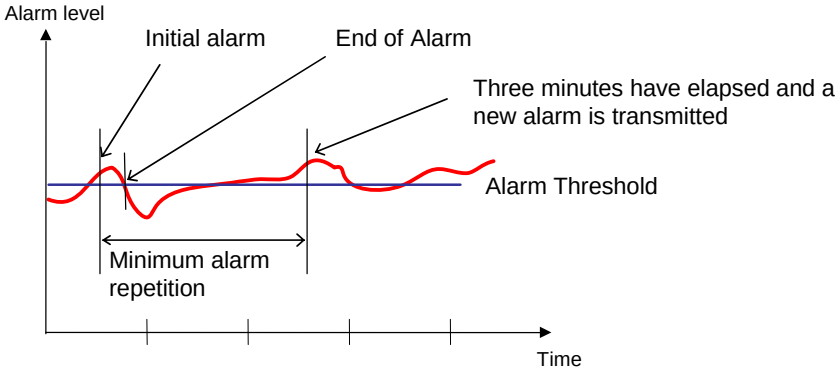
When the Control Module detects a failure, an alarm is transmitted to the Axell Element Manager, informing the operator about the error condition. When the alarm has ceased, an end of alarm is sent to the AEM, stating that the alarm source is now OK.

Each "alarm" and "end of alarm" updates the AEM database with the latest status of the alarm source, ensuring that the AEM operator always has the correct repeater status in the system.

- To generate an alarm a number of consecutive measurements must first show an error state. This can be configured for each alarm source separately.
- To generate an end of alarm only one OK measurement is needed.



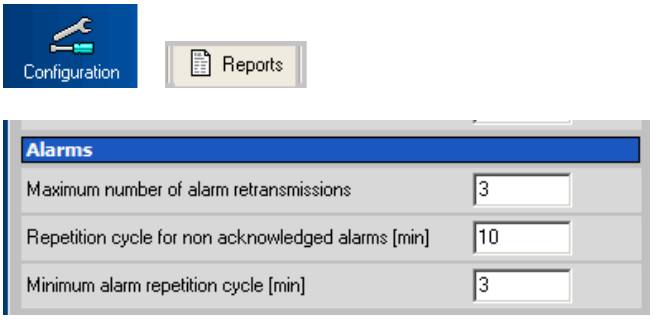

If an alarm should constantly toggle between OK and ERROR the communications interface might be blocked. To prevent this there is a parameter called Minimum Alarm Repetition Cycle. This parameter defines how many minutes must elapse before a new alarm can be transmitted from the same alarm source.




*This illustration shows an alarm source with an upper threshold, and a fluctuating level around the alarm threshold. The initial alarm will be sent as indicated. The next alarm will be transmitted after three minutes, when the minimum alarm repetition period has elapsed.*

### Set Minimum Alarm Repetition Cycle

Select "Configuration " and "Reports"




## 3.4.3 Alarm Retransmissions and Acknowledgements

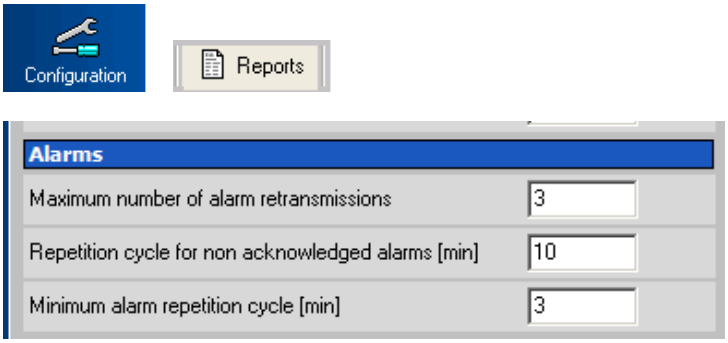
As soon as the OMU detects an alarm or an end of alarm, a connection to the Axell Element Manager is established and the alarm event is reported.

The 2 000 latest alarms and end of alarms are stored in the OMU's local alarm log. In case an alarm is not acknowledged the alarm will be retransmitted to the AEM after a configurable number of minutes. Allowed values are 0 to 999. Default retransmit interval is 10 minutes.

The retransmission will be repeated a configurable number of times. This variable can be set from 0 to 99. Default number of retries is three

### Set Number of Retransmissions and Repetition Cycle for Non-acknowledged Alarms

Select "Configuration " and "Reports"




### 3.4.3.1 Alarm Acknowledgement using the RMC

Each alarm can be manually acknowledged using the Repeater Maintenance Console. However, if the OMU is controlled by the Axell Element Manager, a manual acknowledgement of the alarm means that the AEM will not be aware of the change in the repeater status.

### 3.4.3.2 Alarm Acknowledgement using the Axell Element Manager

If the OMU is integrated to and controlled by the Axell Element Manager, an alarm is considered acknowledged when the alarm has been delivered to the AEM. Once delivered to the AEM, the acknowledgement of the event is taken care of at the site of the AEM, why no dial-back needs to be performed to acknowledge the alarms.

### 3.4.3.3 Alarm Acknowledgement using SMS

**Note!** SMS functionality is not implemented in this SW release.

If the OMU is configured to send alarms using SMS, alarm acknowledgement can be made in two different ways.

- the alarm is acknowledged as soon as the alarm SMS is successfully received by the Short Message Service Centre

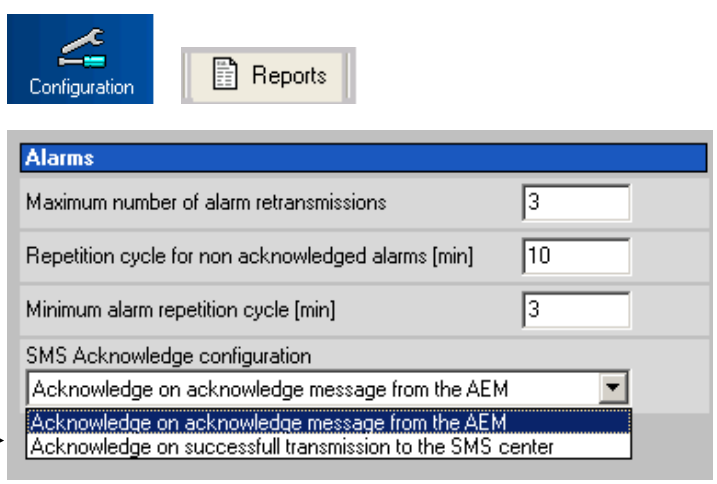
or

- the alarm is acknowledged by sending a special alarm acknowledgement SMS back to the repeater from the alarm destination.

### Set Acknowledgement Type for SMS Alarms

Select "Configuration " and "Reports"

Pick one alternative from the drop-down menu




All alarms transmitted from the OMU contain a message number. Acknowledgement of an alarm is done by sending an SMS to the repeater containing this message number.

**Note!** Only the defined "Primary SMS address" can acknowledge alarms.

The table below displays the format of alarm acknowledgement messages.

| Message field | Format | Description |
|---|---|---|
| Repeater ID | XX-YY-ZZZZ | ID of the repeater that the message is intended for |
| Message number | NNNNN | Message number set by originator |
| Command | ACT | Action command |
| Argument | ACK | Acknowledge action |
| Argument | MMMMM | Message number of the alarm message to acknowledge |

The message fields are separated with blanks.

For example, sending an SMS to the repeater with the text

```
01-42-4711 00242 ACT ACK 00023
```

will acknowledge alarm number 00023 from repeater 01-42-4711.

### 3.4.4 Alarm Format

Each alarm transmitted from the OMU contains a number of fields, in detail describing the event that caused the alarm. The alarm is transmitted as an ASCII text string, each field separated by a blank/white space.

Using the Axell Element Manager to control the OMU, the alarm string is delivered to the transceiver for further processing in the AEM system.

When SMS is used to control the OMU, the string is sent as clear text to the alarm address (main address).

**Note!** The SMS functionality is not implemented in this SW release.

| Message field | Format | # of char. | Description |
|---|---|---|---|
| Repeater ID | XX-YY-ZZZZ | 10 | ID of the repeater causing the alarm. When monitoring the repeater using the AEM, this repeater ID is set by the AEM during the repeater installation phase. Using SMS, this repeater ID should be modified to uniquely identify the repeater in the network. |
| Message # | N | 1 to 10 | This integer value uniquely identifies this message from the repeater and may be from 0 to 2147483648 (231). |
| Message type | ALARM | 5 | This text string identifies the message as being an alarm (or end of alarm) |
| Date | DDMMYY | 6 | Day, month and year when the alarm was detected |
| Time | HHMMSS | 6 | Hour, minute and second when the alarm was detected |
| Alarm Name | CCC | 3 | Identifies the alarm type (e.g. PW1, SZU, PDL, etc) |
| Alarm Severity | CC | 2 | Abbreviation for severity of the alarm. This severity varies between the different alarm sources.<br>CR = critical<br>MA = major<br>MI = minor<br>WA = warning<br>CL = cleared<br>When an and of alarm is sent, the severity is CL = cleared |
| Alarm Class | CC | 2 | Abbreviation for kind of alarm<br>CO = communication alarm<br>EN = environmental alarm<br>QS = quality of service alarm<br>PR = processing alarm<br>EQ = equipment alarm |
| Status | C | 1 | This status identifier is 0 if end of alarm and 1 if alarm. |
| Hardware Enumeration | CCCC | 1 to 5 | Denotes what hardware module the alarm originates from. If not used, a '-' (dash) is replied. |
| Position Identifier | CCCCCCCCCCCC | 1 to 12 | Gives detailed information about certain alarm sources. For some alarms, such as VLI, LGO and CLR, this may contain user information. If not used, a '-' (dash) is replied. |
| Additional text | <Text> | 60 | This quoted string contains additional alarm information, such as measured levels when the alarm condition was detected. |

### 3.4.5 Alarm Class

Each alarm belongs to a class.

| Class | Description |
|---|---|
| CO | communications |
| QS | quality of service |
| PR | software or processing |
| EQ | hardware equipment |
| EN | environment (enclosing or surrounding equipment) |

All alarms are configured to a class at delivery but can be changed by the user. The external alarms do not have a classification at delivery, but can be set by the user.

### 3.4.6 Alarm Severity

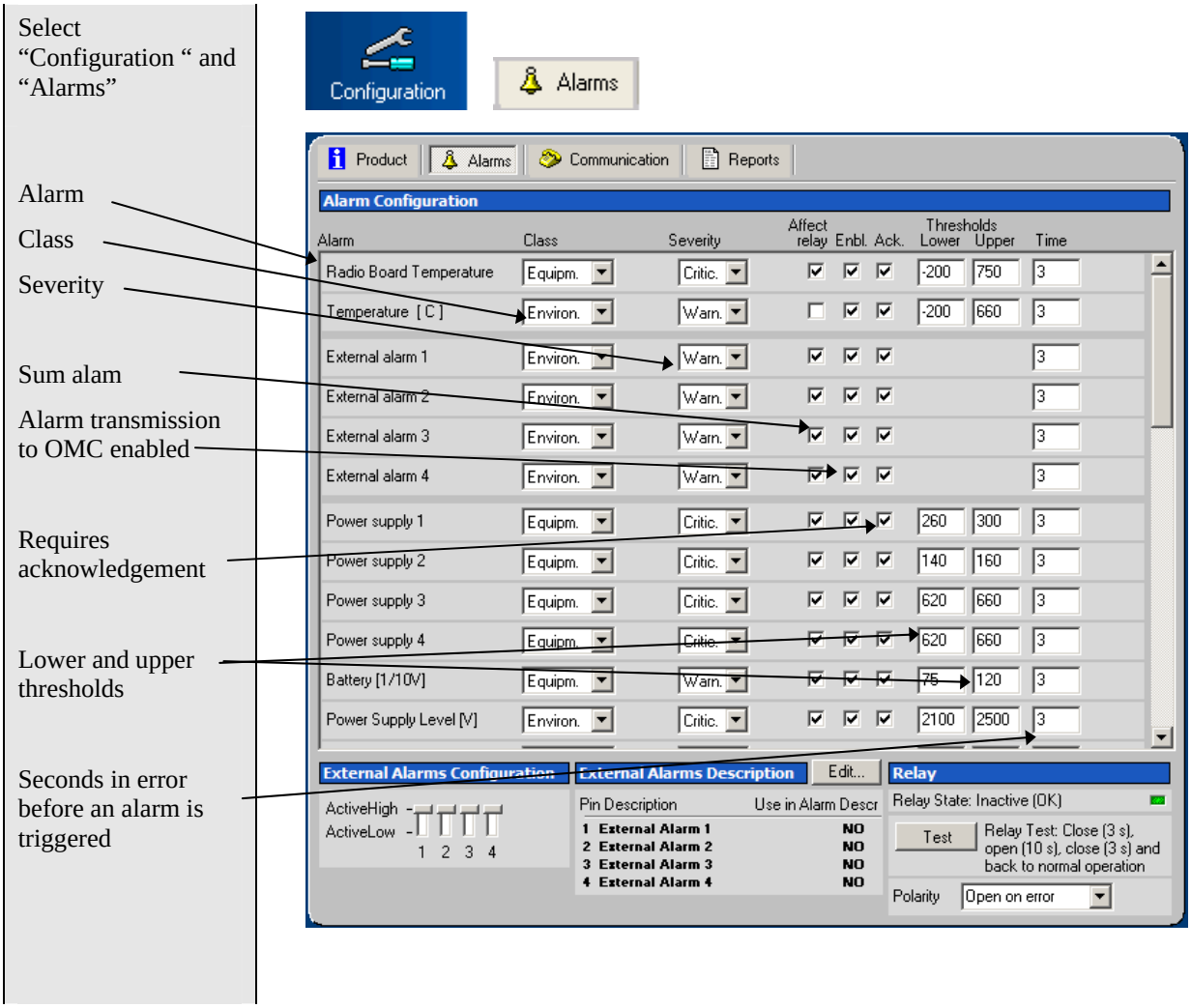
Alarms can be of five different severity levels.

| Severity Level | Description |
|---|---|
| Critical | A critical error has occurred which affects the functionality of the OMU. This type of alarm requires immediate action. |
| Major | A major error has occurred. This type of alarm should be investigated within a short time. |
| Minor | A minor error has occurred. This type of alarm should be investigated, but is not urgent. |
| Warning | Something has occurred that does not affect the operation of the OMU but may be important to notice. For example, someone has logged on to the repeater. |
| OK Cleared | A cleared alarm. This is the end of alarm. |

The severity can be defined for each alarm source in the Alarm Configuration screen in the RMC. It is recommended not to change the default settings.

## 3.4.7 Alarm Configuration

A number of different parameters can be configured for how the alarms are transmitted to the repeater OMC. Each alarm source can also be individually configured in a number of different ways.




- Class – Each alarm can be linked to one of the following classes: Common, Quality, Process, Equipment or Environment. The class is used when the information is presented in the AEM
- Severity – Each alarm can be classified regarding severity - Critical, Major, Minor or Warning
  **Note!** It is recommended not to change the default settings.
- Enabl. – If this box is ticked the alarm is transmitted to the repeater OMC (AEM)
  **Note!** This only affects the transmission of the alarm. The alarm is still measured, and corresponding alarm status is still displayed in the repeater status screen and in the heartbeat reports transmitted to the repeater OMC.
- Ack. – All alarms will by default be transmitted to the repeater OMC (AEM) requiring acknowledgement (the box is checked). Disabling this checkbox removes this requirement, which means that an alarm will only be transmitted once, regardless if an acknowledgement is received or not.
- Upper and lower thresholds can be set for some of the alarms. Please refer to BSR421 Command and Attribute Summary for details on the usage of thresholds for each alarm source.
  **Note!** The default settings should normally not be changed.
- Time – Defines how many seconds an alarm source should be in ERROR before an alarm is triggered.

## External Alarms

Four external alarm sources can be connected to the External Alarm and Battery Module. These can be for instance fire alarms or external door sensors.

The alarm sources must generate a voltage between 12 and 24 VDC. The presence or absence of voltage will trigger the alarm depending on how alarm thresholds have been configured in the controller software. Each alarm can also be given a unique name.

The external alarms can be set as "active high" or "active low".

As for all alarm sources a delay can be set that defines how many seconds an alarm should be in error state before an alarm is generated

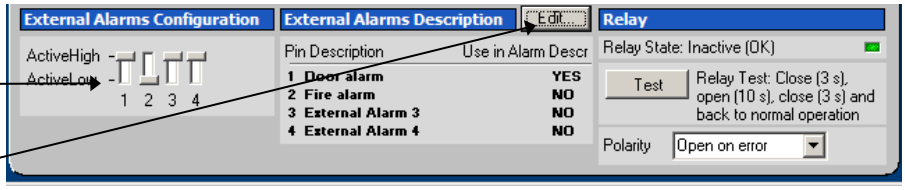
To define names and polarity of the external alarms use the lower part of the Alarm Configuration screen.

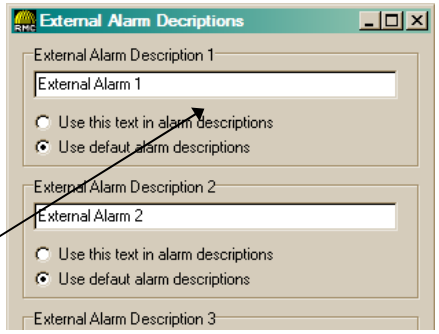
Set the dip-switches to configure the external alarms

Give the alarms unique names

The external alarms can be given individual names of up to 19 characters. Click on Edit and insert the new names.

New name for external alarm 1




## Sum Alarm

The External Alarm and Battery Module contains a relay output. The relay can be used to indicate a summary status of the repeater. Each alarm source can be configured to be affecting the relay or not.

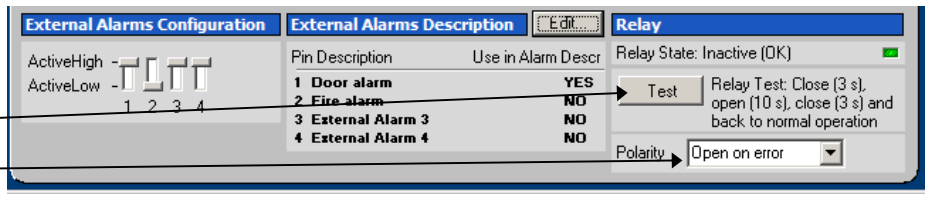
**Note!** The relay status is never affected by the login / logout alarm parameters.

For installation testing purposes, it is possible to test the open / close function of the relay. This test procedure closes the relay for 3 seconds, then opens it for 10 seconds, and finally closes it for 3 seconds before going back to original state.

The relay can be set to close or open to indicate an alarm. This can be changed by changing the polarity.

Click on Relay Test

Relay polarity



## 3.4.8 Alarm Monitoring

The alarms can be monitored via the RMC. Each alarm has an indicator on the screen that is either green or red.

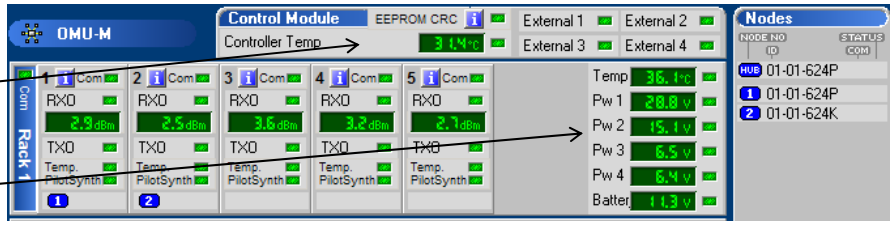
See also reference to section 3.4.1 Alarm Sources.

Ensure online communication with the OMU


Select "HUB Status" for this window

Control Module related alarms

Power supply related alarms




### Control Module Related Alarms

| | |
|---|---|
| EEPROM CRC, CRC | Faulty checksum in Rack Communication Board or Fibre Optic Converter. Click on for information regarding checksums in all Rack Communication Boards as well as all Fibre Optic Converters |
| Controller Temp, TEM | Temperature in Control Module too high or too low |
| External Alarms, EX1-4 | Alarm from external source |

### Power Supply Related Alarms

| | |
|---|---|
| Power P1-4, PW1-4 | +28VDC, +15VDC, +6,45VD and backed up +6,45 VDC too high or too low |
| Battery, BAT | Power level in battery too high or too low |

### Rack Related Alarms

Communication alarm

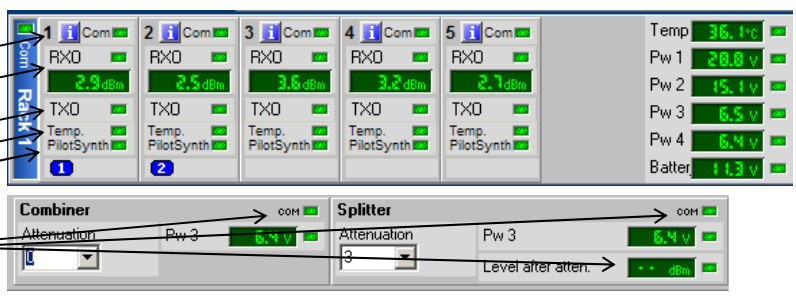
Temperature alarm


| | |
|---|---|
| Com, COM | Error in communication between Rack Communication Board and Control Module |
| Temperature, RBT | Temperature in Rack Communication Board too high or too low |

### Fibre Optic Converter Related Alarms

Alarms for each fibre optic converter

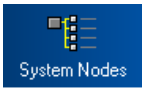
Alarms for combiner and splitter units



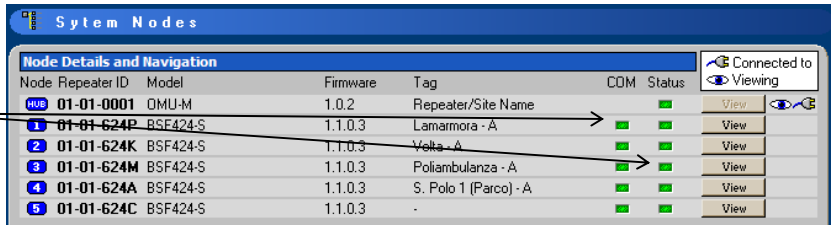
| | |
|---|---|
| Com, COM | Error in communication between Fibre Optic Converter and Control Module |
| Received Level, RXO | Received optical level too low |
| Transmitter, TXO | No detectable transmitted optical signal |
| Temperature, RBT | Temperature in Fibre Optic Converter too high or too low |
| Pilot Tone Gen Synth, SZP | Pilot tone frequency faulty |
| Com, COM | Error in communication between Combiner or Splitter and Control Module |
| Level after attenuator, ILD | Signal level in to fibre optic converter too low (or too high) |

## System Node Alarms

System node alarms




Select "System Nodes" for this window



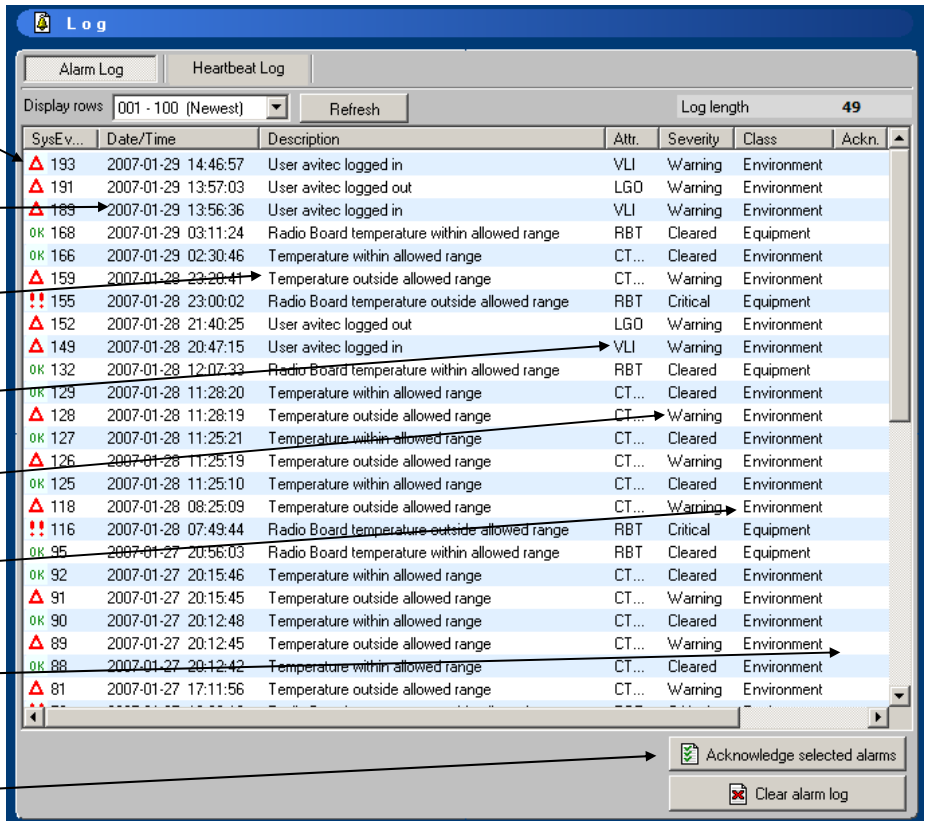

| | |
|---|---|
| Node Communication, NCO | Error in communication with slave (repeater) |
| Status | Summary status of slave repeater |

### 3.4.9 Alarm Log

The logged alarms can be viewed in an alarm log.

#### Monitor Alarm Log via the RMC

Select "Alarm Log" and "Alarm Log"


Message No

Date/Time

Description

Attribute/Alarm Source

Severity

Class

Alarm acknowledged

Acknowledgement using RMC

## 3.5 OMU Heartbeat

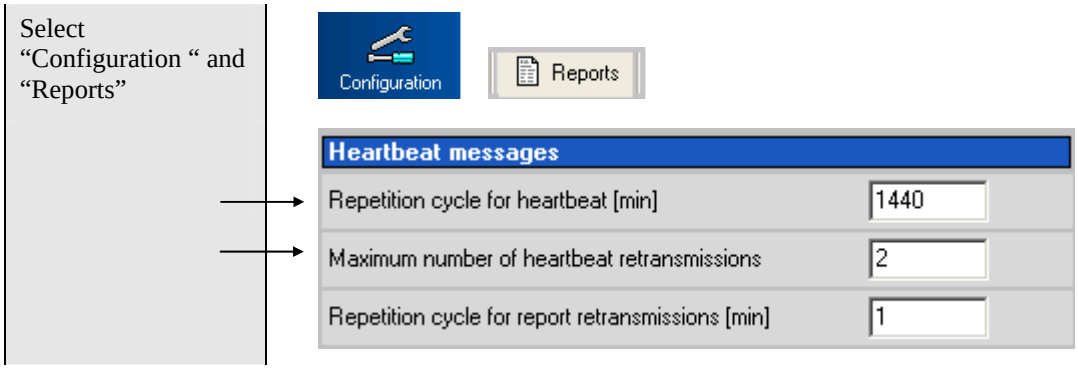
The OMU and connected repeaters can be configured to transmit heartbeat reports to the Axell Element Manager, AEM with regular intervals. If the AEM does not receive a heartbeat report within expected interval, an alarm can be generated and displayed to the operator. In this way, the AEM is ensured that the communication with the OMU works as intended.

Each heartbeat contains a complete status report regarding the sending unit at the time of the report. This ensures that the AEM always has the correct status information even if some alarm reports should fail to transmit successfully.

When it is time for the OMU to send a heartbeat report, a connection to the AEM is established, after which heartbeat reports from all nodes in the repeater system is transmitted. This is the sequence of events.

- A connection to the AEM is established
- All non-acknowledged alarms in the alarm log are transmitted
- The OMU polls the heartbeat from all the nodes and transmits them to the AEM
- Heartbeat is transmitted for the OMU unit
- The OMU disconnects from the AEM

The heartbeat interval can be set from 1 to 1440 minutes. Setting the heartbeat to 0 disables the transmission of heartbeats.




### 3.5.1 Heartbeat Tasks

With the heartbeat reports, a number of tasks are carried out.

#### 3.5.1.1 Ensuring OMU to AEM Communications path

By configuring the OMU to regularly establish a connection to the AEM, the functionality of the data communications path between the OMU and the AEM is verified. This ensures that for instance the alarms will be transmitted properly.

If an expected heartbeat is not received by the AEM, an alarm is generated to the AEM operator. Reasons for a heartbeat message failing to be delivered can be:

- No power – the OMU site might experience a power failure, and the battery backing up the Control Module and modem is empty
- Failing modem communication – The modem might be broken, the modem antenna compromised or the service down in the modem's frequency area
- Broken link to BTS - If the link to the BTS has been tampered with, the OMU might not get adequate signal to establish a connection to the AEM
- Failing BTS – If the feeding BTS for some reason goes down, the OMU will loose its network connection, and hence fail to establish a connection to the Axell Element Manager.

#### 3.5.1.2 AEM Database Synchronization

The Axell Element Manager stores all OMU parameters in a database. This database is populated during the OMU integration into the AEM when the AEM downloads all the OMU parameters. If the AEM operator wants to monitor the configuration of the OMU, the parameters can be read from the database without having to connect to the repeater.

In case of an alarm, the AEM updates the database with the status of the alarm source. In case the OMU fails to deliver the alarm to the AEM there will be a discrepancy between the OMU configuration and the configuration in the database. For this reason, each heartbeat report contains all the relevant parameters and status of all the alarm sources in the OMU. This means that each heartbeat report will update the AEM with all status and RF parameters.

**Note!** Once the OMU is integrated to the Axell Element Manager, it is recommended that all reconfigurations are made from the AEM.

**Note!** If a user logs in to the OMU making changes, as soon as the user logs out, an alarm will be transmitted to the AEM informing the operator that a change has been made. When this alarm is received, the operator can initiate OMU synchronization where all OMU parameters will be updated.

#### 3.5.1.3 Time Synchronization

Each heartbeat message transmitted to the AEM contains a time stamp of the local time inside the OMU. Upon reception in the AEM, the time stamp is compared to the Axell Element Manager time. If the difference between the OMU and AEM time is too big, time synchronization is initiated by the AEM, adjusting the time in the OMU. In this way it is ensured that an OMU integrated to the Axell Element Manager always contains the correct time information.

**Note!** If the time is adjusted by a user logged in to the OMU, once the user logs out, a heartbeat is sent to the AEM to ensure that the time is correctly synchronized.

### 3.5.2 Heartbeat Format

The heartbeat report is transmitted as an ASCII text string, with a number of fields representing the status parameters, each field separated by a blank/white space.

| Field | Format | Description | # of chars |
|---|---|---|---|
| Repeater ID | XX-YY-ZZZZ | | 10 |
| Message no | NNNNNNNNN | | 9 |
| State | STATE | | 5 |
| Date | DDMMYY | | 6 |
| Time | HHMMSS | | 6 |
| BAT | N | Status of Battery Charge | 1 |
| COM-RCB | NNNN | Status of communication with Rack Communication Boards | 4 |
| COM-FO Rack 1 | NNNNNN | Status of communication with FiberOptic Modules in Rack 1 | 6 |
| COM-FO Rack 2 | NNNNNN | Status of communication with FiberOptic Modules in Rack 2 | 6 |
| COM-FO Rack 3 | NNNNNN | Status of communication with FiberOptic Modules in Rack 3 | 6 |
| COM-FO Rack 4 | NNNNNN | Status of communication with FiberOptic Modules in Rack 4 | 6 |
| CRC | KLMNXYZ | Status of CRC in the different modules.<br>These values are Hex Coded, and should be used in conjunction with COM status for actual device. | 7 |

<table>
<tr>
<td></td>
<td></td>
<td>
For example, the Byte 1 status is sent as Hex '8', which is extracted to 1000.<br>
Byte 1
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>CRC for RCB in Rack 1</td><td>CRC for RCB in Rack 2</td><td>CRC for RCB in Rack 3</td><td>CRC for RCB in Rack 4</td></tr>
</table>
Byte 2
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>CRC for Rack 1 Slot 1</td><td>CRC for Rack 1 Slot 2</td><td>CRC for Rack 1 Slot 3</td><td>CRC for Rack 1 Slot 4</td></tr>
</table>
Byte 3
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>CRC for Rack 1 Slot 5</td><td>CRC for Rack 1 Slot 6</td><td>CRC for Rack 2 Slot 1</td><td>CRC for Rack 2 Slot 2</td></tr>
</table>
Byte 4
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>CRC for Rack 2 Slot 3</td><td>CRC for Rack 2 Slot 4</td><td>CRC for Rack 2 Slot 5</td><td>CRC for Rack 2 Slot 6</td></tr>
</table>
Byte 5
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>CRC for Rack 3 Slot 1</td><td>CRC for Rack 3 Slot 2</td><td>CRC for Rack 3 Slot 3</td><td>CRC for Rack 3 Slot 4</td></tr>
</table>
Byte 6
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>CRC for Rack 3 Slot 5</td><td>CRC for Rack 3 Slot 6</td><td>CRC for Rack 4 Slot 1</td><td>CRC for Rack 4 Slot 2</td></tr>
</table>
Byte 7
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>CRC for Rack 4 Slot 3</td><td>CRC for Rack 4 Slot 4</td><td>CRC for Rack 4 Slot 5</td><td>CRC for Rack 4 Slot 6</td></tr>
</table>
</td>
<td></td>
</tr>
<tr>
<td>NCO</td>
<td>KLMNXY</td>
<td>
Status of communication with the node slaves.<br>
These values are Hex Coded, and should be used in conjunction with NON attribute to know how many nodes are installed.<br>
For example, the Byte 1 status is sent as Hex '8', which is extracted to 1000.<br>
Byte 1
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>NCO for node 1</td><td>NCO for node 2</td><td>NCO for node 3</td><td>NCO for node 4</td></tr>
</table>
Byte 2
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
</table>
</td>
<td></td>
</tr>
</table>

<table>
<tr><td></td><td></td><td>
<table>
<tr><td>NCO for node 5</td><td>NCO for node 6</td><td>NCO for node 7</td><td>NCO for node 8</td></tr>
</table>
Byte 3
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>NCO for node 9</td><td>NCO for node 10</td><td>NCO for node 11</td><td>NCO for node 12</td></tr>
</table>
Byte 4
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>NCO for node 13</td><td>NCO for node 14</td><td>NCO for node 15</td><td>NCO for node 16</td></tr>
</table>
Byte 5
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>NCO for node 17</td><td>NCO for node 18</td><td>NCO for node 19</td><td>NCO for node 20</td></tr>
</table>
Byte 6
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>NCO for node 21</td><td>NCO for node 22</td><td>NCO for node 23</td><td>NCO for node 24</td></tr>
</table>
</td><td></td></tr>
<tr><td>PW1</td><td>NNNN</td><td>Status of 28 V Power Supply distribution</td><td>4</td></tr>
<tr><td>PW2</td><td>NNNN</td><td>Status of 15 V Power Supply distribution</td><td>4</td></tr>
<tr><td>PW3</td><td>NNNN</td><td>Status of 6.45 V Power Supply distribution</td><td>4</td></tr>
<tr><td>PW4</td><td>N</td><td>Status of 6.45 V Backup Power Supply distribution</td><td>1</td></tr>
<tr><td>RBT</td><td>KLMNXYZ</td><td>Status of board temperatures in the different modules.<br>These values are Hex Coded, and should be used in conjunction with COM status for actual device.<br>For example, the Byte 1 status is sent as Hex '8', which is extracted to 1000.
Byte 1
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RBT for RCB in Rack 1</td><td>CRC for RCB in Rack 2</td><td>RBT for RCB in Rack 3</td><td>RBT for RCB in Rack 4</td></tr>
</table>
Byte 2
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RBT for Rack 1 Slot 1</td><td>RBT for Rack 1 Slot 2</td><td>RBT for Rack 1 Slot 3</td><td>RBT for Rack 1 Slot 4</td></tr>
</table>
Byte 3
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RBT for Rack 1 Slot 5</td><td>RBT for Rack 1 Slot 6</td><td>RBT for Rack 2 Slot 1</td><td>RBT for Rack 2 Slot 2</td></tr>
</table>
Byte 4
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RBT for Rack 2</td><td>RBT for Rack 2</td><td>RBT for Rack 2</td><td>RBT for Rack 2</td></tr>
</table>
</td><td>7</td></tr>
</table>

<table>
<tr>
<td></td>
<td></td>
<td>
<table>
<tr><td>Slot 3</td><td>Slot 4</td><td>Slot 5</td><td>Slot 6</td></tr>
</table>
Byte 5
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RBT for Rack 3 Slot 1</td><td>RBT for Rack 3 Slot 2</td><td>RBT for Rack 3 Slot 3</td><td>RBT for Rack 3 Slot 4</td></tr>
</table>
Byte 6
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RBT for Rack 3 Slot 5</td><td>RBT for Rack 3 Slot 6</td><td>RBT for Rack 4 Slot 1</td><td>CRC for Rack 4 Slot 2</td></tr>
</table>
Byte 7
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RBT for Rack 4 Slot 3</td><td>RBT for Rack 4 Slot 4</td><td>RBT for Rack 4 Slot 5</td><td>RBT for Rack 4 Slot 6</td></tr>
</table>
</td>
<td></td>
</tr>
<tr>
<td>RXO</td>
<td>KLMNXY</td>
<td>
Status of received optical level.<br>
These values are Hex Coded, and should be used in conjunction with COM status for actual device.<br>
For example, the Byte 1 status is sent as Hex '8', which is extracted to 1000.<br>
Byte 1
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RXO for Rack 1 Slot 1</td><td>RXO for Rack 1 Slot 2</td><td>RXO for Rack 1 Slot 3</td><td>RXO for Rack 1 Slot 4</td></tr>
</table>
Byte 2
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RXO for Rack 1 Slot 5</td><td>RXO for Rack 1 Slot 6</td><td>RXO for Rack 2 Slot 1</td><td>RXO for Rack 2 Slot 2</td></tr>
</table>
Byte 3
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RXO for Rack 2 Slot 3</td><td>RXO for Rack 2 Slot 4</td><td>RXO for Rack 2 Slot 5</td><td>RXO for Rack 2 Slot 6</td></tr>
</table>
Byte 4
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RXO for Rack 3 Slot 1</td><td>RXO for Rack 3 Slot 2</td><td>RXO for Rack 3 Slot 3</td><td>RXO for Rack 3 Slot 4</td></tr>
</table>
Byte 5
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>RXO for Rack 3 Slot 5</td><td>RXO for Rack 3 Slot 6</td><td>RXO for Rack 4 Slot 1</td><td>RXO for Rack 4 Slot 2</td></tr>
</table>
Byte 6
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
</table>
</td>
<td>6</td>
</tr>
</table>

<table>
<tr><td></td><td></td><td>
<table>
<tr><td>RXO for Rack 4 Slot 3</td><td>RXO for Rack 4 Slot 4</td><td>RXO for Rack 4 Slot 5</td><td>RXO for Rack 4 Slot 6</td></tr>
</table>
</td><td></td></tr>
<tr><td>SZP</td><td>KLMNXY</td><td>
Synthesizer in Pilot Tone Generator.<br>
These values are Hex Coded, and should be used in conjunction with COM status for actual device.<br>
For example, the Byte 1 status is sent as Hex '8', which is extracted to 1000.<br>
Byte 1
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>SZP for Rack 1 Slot 1</td><td>SZP for Rack 1 Slot 2</td><td>SZP for Rack 1 Slot 3</td><td>SZP for Rack 1 Slot 4</td></tr>
</table>
Byte 2
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>SZP for Rack 1 Slot 5</td><td>SZP for Rack 1 Slot 6</td><td>SZP for Rack 2 Slot 1</td><td>SZP for Rack 2 Slot 2</td></tr>
</table>
Byte 3
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>SZP for Rack 2 Slot 3</td><td>SZP for Rack 2 Slot 4</td><td>SZP for Rack 2 Slot 5</td><td>SZP for Rack 2 Slot 6</td></tr>
</table>
Byte 4
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>SZP for Rack 3 Slot 1</td><td>SZP for Rack 3 Slot 2</td><td>SZP for Rack 3 Slot 3</td><td>SZP for Rack 3 Slot 4</td></tr>
</table>
Byte 5
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>SZP for Rack 3 Slot 5</td><td>SZP for Rack 3 Slot 6</td><td>SZP for Rack 4 Slot 1</td><td>SZP for Rack 4 Slot 2</td></tr>
</table>
Byte 6
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>SZP for Rack 4 Slot 3</td><td>SZP for Rack 4 Slot 4</td><td>SZP for Rack 4 Slot 5</td><td>SZP for Rack 4 Slot 6</td></tr>
</table>
</td><td>6</td></tr>
<tr><td>TEM</td><td>N</td><td>Status of Controller Temperature</td><td>1</td></tr>
<tr><td>TXO</td><td>KLMNXY</td><td>
Status of Optical Transmitter.<br>
These values are Hex Coded, and should be used in conjunction with COM status for actual device.<br>
For example, the Byte 1 status is sent as Hex '8', which is extracted to 1000.<br>
Byte 1
<table>
<tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr>
<tr><td>TXO for Rack 1 Slot 1</td><td>TXO for Rack 1 Slot 2</td><td>TXO for Rack 1 Slot 3</td><td>TXO for Rack 1 Slot 4</td></tr>
</table>
</td><td>6</td></tr>
</table>

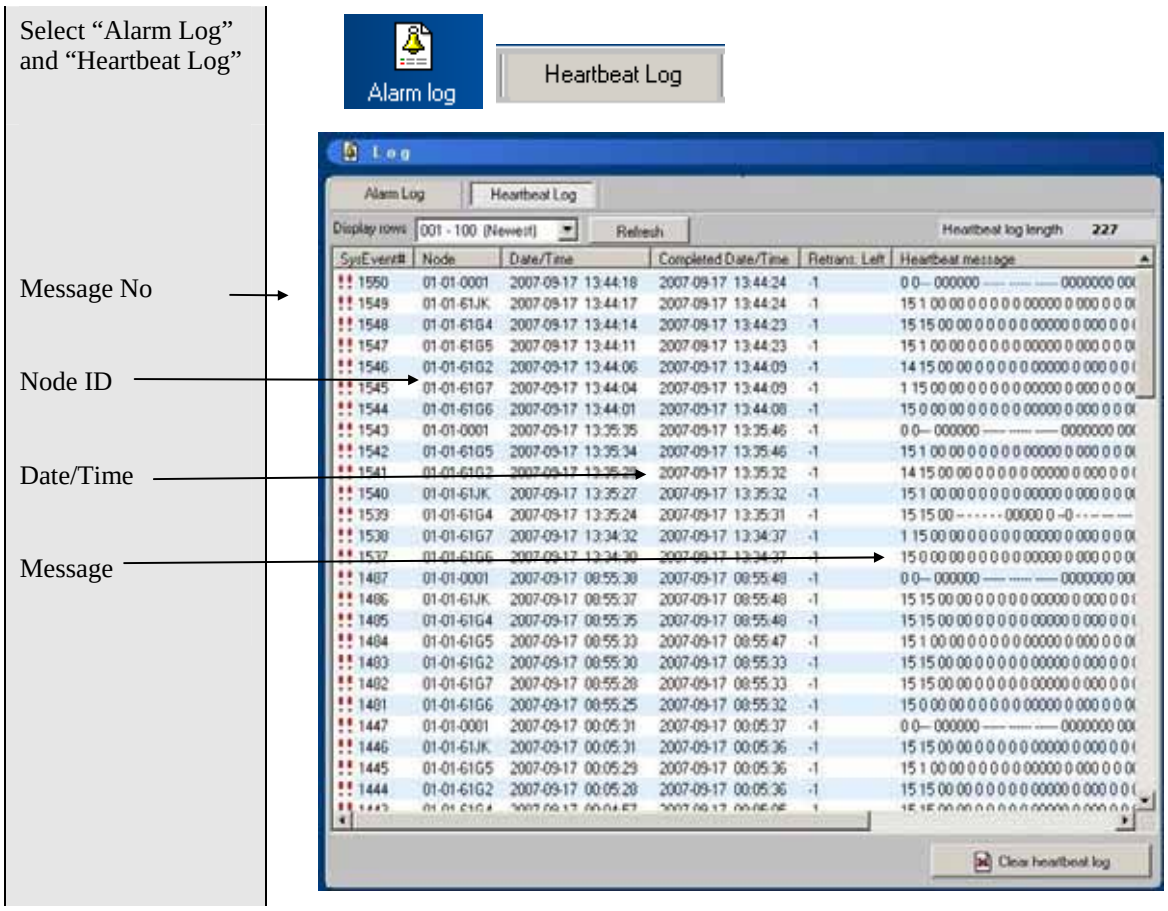
<table>
<tr><td></td><td></td><td>Byte 2<br><table><tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr><tr><td>TXO for Rack 1 Slot 5</td><td>TXO for Rack 1 Slot 6</td><td>TXO for Rack 2 Slot 1</td><td>TXO for Rack 2 Slot 2</td></tr></table>Byte 3<br><table><tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr><tr><td>TXO for Rack 2 Slot 3</td><td>TXO for Rack 2 Slot 4</td><td>TXO for Rack 2 Slot 5</td><td>TXO for Rack 2 Slot 6</td></tr></table>Byte 4<br><table><tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr><tr><td>TXO for Rack 3 Slot 1</td><td>TXO for Rack 3 Slot 2</td><td>TXO for Rack 3 Slot 3</td><td>TXO for Rack 3 Slot 4</td></tr></table>Byte 5<br><table><tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr><tr><td>TXO for Rack 3 Slot 5</td><td>TXO for Rack 3 Slot 6</td><td>TXO for Rack 4 Slot 1</td><td>TXO for Rack 4 Slot 2</td></tr></table>Byte 6<br><table><tr><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th></tr><tr><td>TXO for Rack 4 Slot 3</td><td>TXO for Rack 4 Slot 4</td><td>TXO for Rack 4 Slot 5</td><td>TXO for Rack 4 Slot 6</td></tr></table></td><td></td></tr>
<tr><td>EX1/EX2/EX3/EX4</td><td>NNNN</td><td>Status of external alarm inputs</td><td>4</td></tr>
<tr><td>NON</td><td>NN</td><td>Number of nodes monitored.</td><td>2</td></tr>
<tr><td>RCH</td><td>NNNNNN</td><td>Repetition Cycle for Heartbeat reports</td><td>6</td></tr>
</table>

### 3.5.3 Heartbeat Log

Recent heartbeats can be viewed in a log that shows details about the heartbeats.

Each heartbeat event contains information from all nodes that are connected to the OMU. The first row is the OMU itself and the following rows are the repeaters.

The information follows the heartbeat format described in the previous section.



## 3.6 Hardware Identification

An OMU contains a number of different modules. Some of these are active devices containing a micro controller, and some are passive devices.

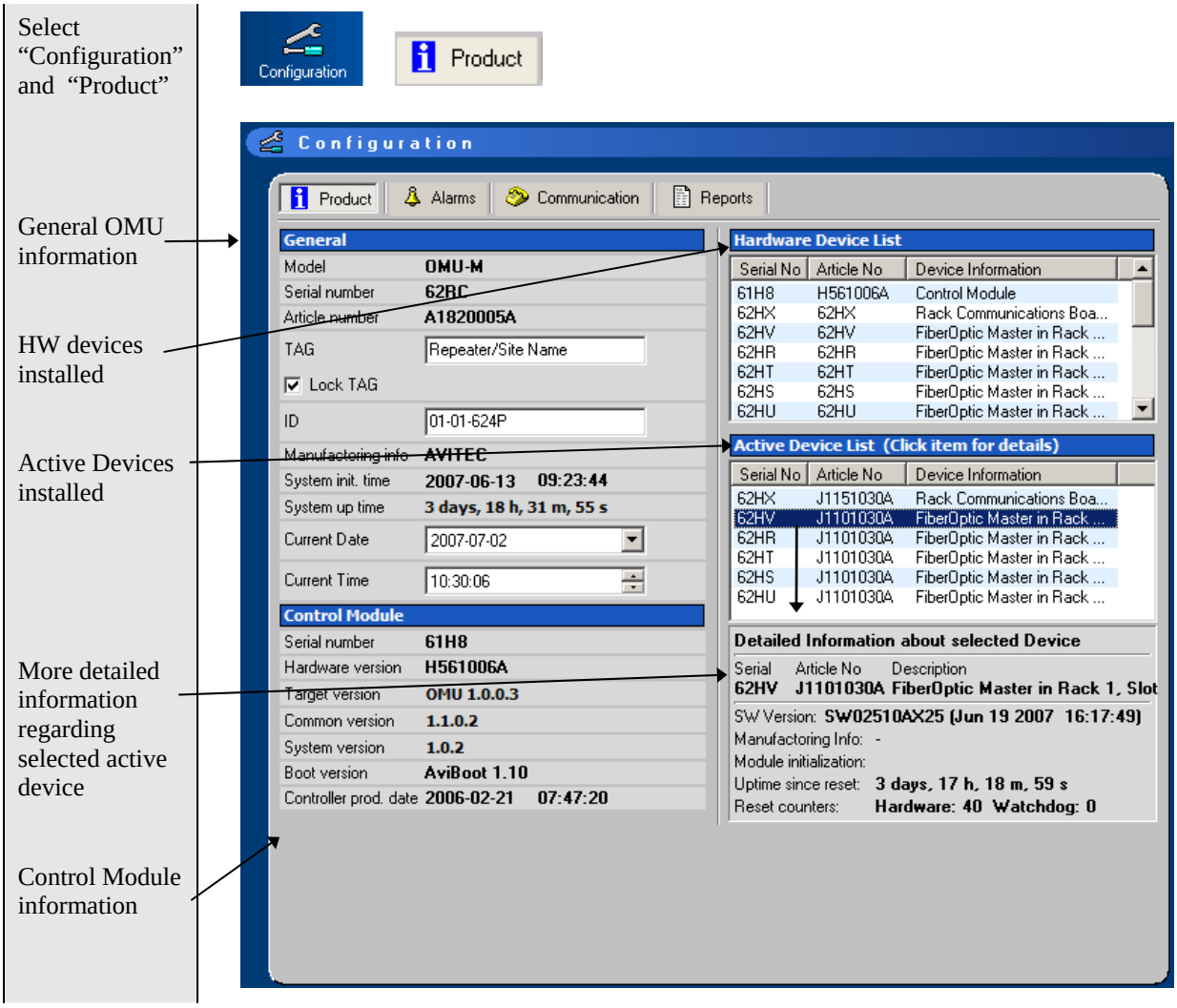
The Control Module communicates with the active devices using a master/slave configuration, where the Control Module is the master and the active devices are slaves. Each active device uses its serial number as an address. A slave only replies to requests with the correct address information.

During manufacturing the OMU is configured with all the serial numbers of all the devices in the system. For passive devices, the article number of the device is added. Once the system is configured, the Control Module polls all the active devices for article numbers and production information as well as software versions and statistics of the active devices.

Via the RMC the full repeater inventory can be read, including statistics of the active devices.

When a login to an OMU is made using the Repeater Maintenance Console, the RMC detects that it is an OMU and adjusts the user interface correspondingly. The same RMC can be used also for all repeater types.

Via the RMC basic information about the OMU configuration can be monitored.




## 3.7 ID and TAG

When the OMU is integrated into the Axell Element Manager the OMU is assigned an ID, which is a unique identifier in the repeater network. This ID is used by the AEM to keep track of the OMUs and repeaters in the AEM database.

The TAG can be used to give the OMU a more logical name. If the Tag is set during site installation, this can easily be read by the AEM during AEM integration, giving the AEM operator a clear identification of the site.

The Tag can be locked so that the tag can not be accidentally changed from the AEM.

Refer to section *4.7.1 Set OMU Name (TAG)* for information about how to set the Tag.

## 3.8 User Access

Several users at a time can be logged on to an OMU, for instance one locally via the RS232 interface and one remotely via modem. There is one default user name and password defined for the OMU.

| User Name | Password |
|---|---|
| avitec | AvitecPasswd |

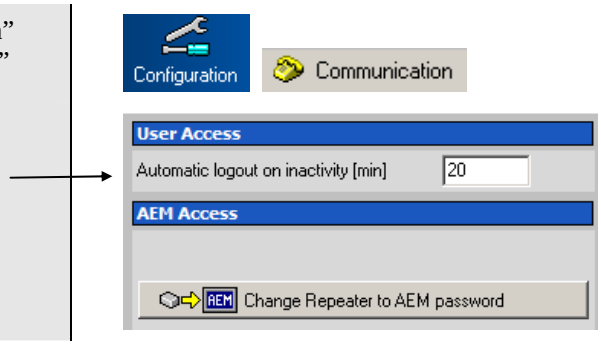
**Note!** Both the user name and the password are case sensitive.

The password can be changed and new accounts be added once a logon has been made. This is made in terminal mode. Please refer to the OMU Command and Attribute Summary.

A user will be logged out after a configurable number of minutes of inactivity. This time can be defined via the RMC.

### 3.8.1 Configure Automatic Logout

Select "Configuration" and "Communication"




**Note!** A password for the OMU's communication with the AEM can be set in the box above but it is recommended that it is done from the AEM, and NOT from here.

### 3.8.2 User Access in a Network Application

An operator can login to the system from any node in the network and access all parameters in all nodes, including those in the Node Master unit. This can be done using a serial cable connected to the node's LMT-port or by remotely over a modem or via Ethernet.

In an OMU-Repeater system with slave-type repeaters the OMU unit polls the connected repeaters / nodes regularly and keeps control of login requests. If a user at a repeater site wants to log in to the repeater system, the OMU Control Module is responsible for granting / denying the login request. If a user forgets to log out from the node when a session is finished, the system will automatically log the user out after a configurable number of minutes of inactivity.

All nodes contain a copy of all user accounts (username and password). These are updated as soon as there is a change or at system start-up.

All configuration and changes of this information needs to be made when the node has connection with a master. A node in stand alone mode cannot change the username or password.

## 3.9 Integration into AEM

When the OMU has been installed at site and the remote communication has been enabled the OMU can be integrated to the Axell Element Manager. This is done by the operator of the AEM. After entering the telephone number to the OMU, the AEM dials up the OMU, downloads all the OMU parameters and statuses into a database. When all parameters have been downloaded, the AEM configures the OMU with the telephone number where alarms and reports should be sent, and optionally with a secondary telephone number where the OMU can dial in case connection to primary number fails.

When heartbeat reports and alarms are sent from the OMU 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 do not need to call the repeater to find this out).

**Note!** Once the OMU is integrated to the AEM, all changes to the OMU should preferably be done from the Axell Element Manager in order to ensure that the database always contains correct information.

## 3.10 Upgrading Firmware

The firmware can be upgraded via a terminal emulation program or z-modem protocol. For instructions please see Common Command and Attributes, section 15 Firmware Upgrade.

# 4 Installation

## 4.1 Unpack the OMU

Unpack the OMU

Inspect the shipped material before unpacking the equipment, document any visual damage and report according to routines.

A delivery of an OMU from Axell Wireless contains:

- Checklist with delivered items
- OMU
- CD containing RMC and User's Manual
- Any other specifically ordered item

## 4.2 Mount the OMU

The OMU is designed to be mounted in a 19" sub rack.

Above the OMU a fiber guide unit can be mounted to support the fibers as they are run from the front of the OMU to the back side of the rack. This unit is 1 HU.

## 4.3 Ensure Proper Grounding

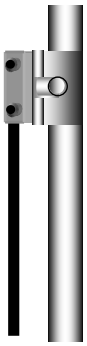
Connect the grounding protection

Ensure that good grounding protection measures are taken to create a reliable OMU site. Make sure to use adequately dimensioned grounding cables.

The antenna cabling should be connected to ground every 10m by a reliable grounding kit.

Make sure the grounding product used is suitable for the kind and size of cable being used.

Connect the OMU ground bolt to the same ground.

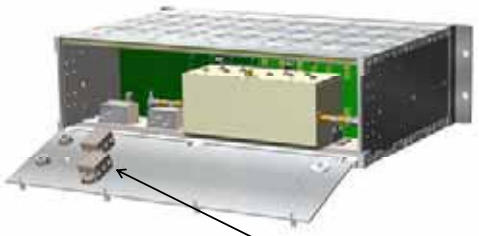



*Ground connector on OMU*

## 4.4 Attach Cabling

### Supply Power to the OMU

The power feed to the OMU is attached via plinths found on the inside of the back cover.




Each OMU unit can be equipped with one or two power supplies. Either two of the same type or two of different voltage.

There are power supplies for 115 - 230VAC 50/60 Hz and 24 - 48VDC. .

**Note!** Be careful to get the polarity right.

Each Power Supply can be switched off using the switches on the front panel.

> **Caution!**
>
> Even if the power supplies are switched off the OMU still has live power from the power input on the back.

### Connect the OMU to the BTS or to the repeater.

The connector for the uplink and the downlink connector are N-type and placed on the back panel of the OMU.

### Attach the coupler

The OMU is connected to the BTS or the repeater via a directional coupler.


*Example of directional coupler from Avitec*

The coupler is connected in series with the BTS antenna or the repeater's server antenna. J1 and J2 are connected in-between the unit and the antenna. It makes no difference which side is connected to which.

J3 or J4 is connected to the OMU unit. If J1 is connected to the donor unit (BTS or repeater) J3 is to be connected to the OMU. If J2 is connected to the donor unit; J4 is to be connected to the OMU.

> **Caution**
>
> The connector not used (J3 or J4) must be capped to prevent ingression of dust and water.

- J3 and J4 are N-type connectors
- J1 and J2 are 7/16 connectors

A Band Selective Filter can be installed between the coupler and the antenna to prevent signal disruptions from the OMU.

**Connect the modem**

If the OMU is equipped with a wireless modem an antenna for the modem is necessary. This can be realized either via a separate antenna or via a coupler on the RF in/out port in the OMU.

The coupler can only be used if the OMU runs on the same frequencies as the modem and the Rx/Tx is combined (there is a duplex filter).

The separate antenna is plugged in to the Antenna connector on the far right end of the OMU. The connector is SMA.

If the OMU is equipped with a PSTN modem the connector is placed in the Modem Unit. The connector is RJ11

The Ethernet connection is placed on the Control Module. The connector is RJ45.

**Connect the fibers**

The fibre connectors on the Fibre Optic Converters are SC/APC type.

**Note!**

Angled connectors, APC, need to be used throughout the whole link between the OMU and the repeater. The angle needs to be 8 degrees.
Also the ODF connections need to be APC type.

The fibre must be monomode type.

The fibre from each Fibre Optic Converter is connected to an ODF (Optical Distribution Frame) unit. The ODF is a cross connection for fibre cabling. At the site of the repeater, there is also an ODF for further connection to the repeater.

**Note!** Be careful with the fibers. They cannot be bent too sharply. Make sure there is enough room to safely close the door of the sub rack. Clean the fibers before they are connected. See instruction below.

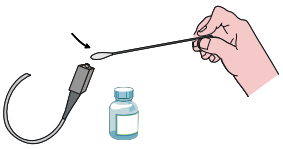
**Caution**

Un-terminated optical receptacles may emit laser radiation. Do not stare into beam or view with optical instruments.

## Cleaning Optical Connectors

Optical reflections from a discontinuity such as a poor connector interface appear on an RF spectrum analyzer trace as stable variations in the noise floor amplitude that are periodic with RF frequency. If the reflection is bad enough, it could impact the system performance. By far, the most common cause for a large discrete reflection is a dirty optical connector. A bit of dust or oil from a finger can easily interfere with, or block this 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.



Alternative 1

Swipe the tip of the ferule 2-3 times with a cotton swab soaked in alcohol. Let it air dry.

Alternative 2

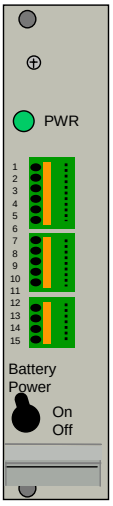
Use a product specially designed for the purpose.

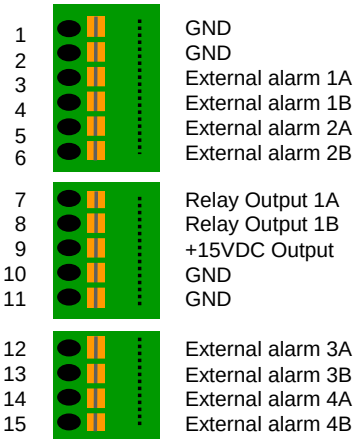
## Connect external alarms

Four external alarm sources can be connected to the External Alarm and Battery Module via the patch panels. These sources must generate a voltage between 12 and 24VDC. The presence or absence of this voltage will trigger the alarm depending on how the alarm thresholds have been configured. The module can also supply +15V to the external alarm sources. The maximum allowed load on this supply is 100mA.

The External Alarm and Battery Module contains a relay that 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 run through the relay is 100mA.

The external alarm wires are linked to the module via patch panels. These panels can be released from the module for easier access at installation. The panels can be used for wires of up to 0.5 $mm^2$. To connect a wire, press the yellow lever with a pen or other pointy item, insert the wire and release the lever.

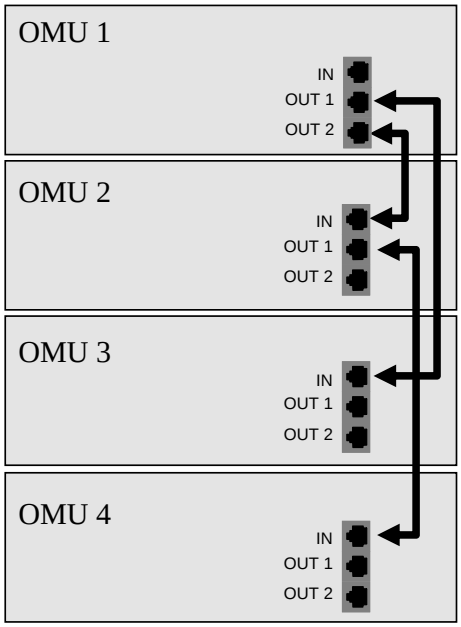



## Cascade connection of OMUs

If several OMUs are to be cascaded, the links between the OMUs are managed via the Rack Communication Boards in each unit.

The connections are made via straight Ethernet cables with RJ45 connectors. These cables can be provided by Axell Wireless in configurations where they are needed.




*Link pattern for cascaded OMUs. OMU 1 and OMU 3 is on "bus "0 and OMU 2 and OMU 4 in on" bus 1".*

## 4.5 Start-up the OMU

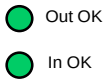
**Caution!**

Make sure the antenna cables or 50 ohm terminations are connected to the OMU's antenna connectors before the OMU is switched on.

### Switch the OMU on

Switch on the OMU using the switches on the Power modules. The modules operate in parallel and are independent of each other.

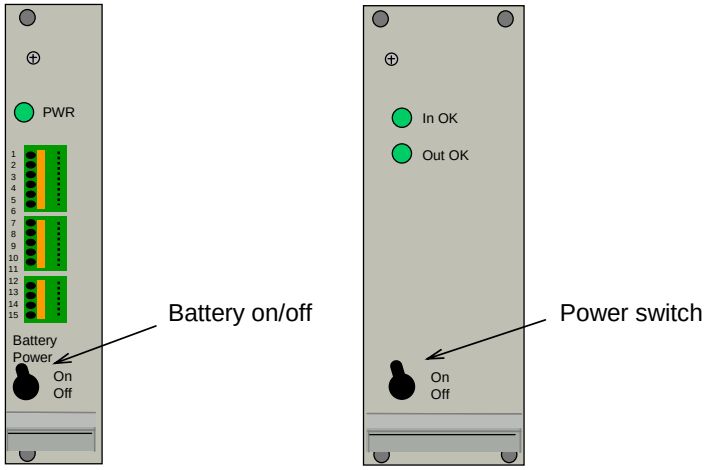
Also switch on the battery. When the battery is switched on it will be recharged and ready to use when needed. If it is switched off it is not in any way operational.




There are two green LEDs on the Power supplies

"Out OK" indicates that the power levels the unit is delivering are OK

"In OK" indicates that the input power to the unit is OK



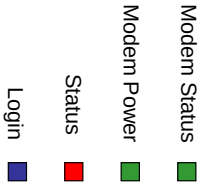

**Caution!**

Even if the power supplies are switched off the OMU still has live power from the power input on the back.

### Check Control Module LEDs

The Control Module has four LEDs which give information regarding the status of the OMU.

If the OMU is configured for Ethernet communication 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 | Control Module switched on, no one logged in |

| | | |
|---|---|---|
| | every 10th second) | |
| ☐ | 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 |

| Green LED – Modem Power | | |
|---|---|---|
| | On | Modem Power is on |
| ☐ | Off | Modem Power is off |

| Green LED – Modem Status | | |
|---|---|---|
| | On | Depending on type of call:<br>Voice call: Connected to remote party<br>Data call: Connected to remote party or exchange of parameters while setting up or disconnecting a call |
| | Flashing<br>(irregular) | Indicates GPSR data transfer. When a GPRS transfer is in progress the LED goes on within 1 second after data packets were exchanged. Flash duration in approximately 0.5s. |
| | 75ms on/75ms off/75ms on/3s off | One or more GPRS contexts activated |
| | 75ms on/3s off | Logged to network (monitoring control channels and user interactions). No call in progress |
| | 600ms on/600ms off | No SIM card inserted, or no PIN entered, or network search in progress, or ongoing user authentications, or network login in progress |
| ☐ | Off | Modem is off |

# 4.6 Initiate Local Communication

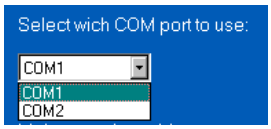
## 4.6.1 RMC Communication

Connect to the LMT port

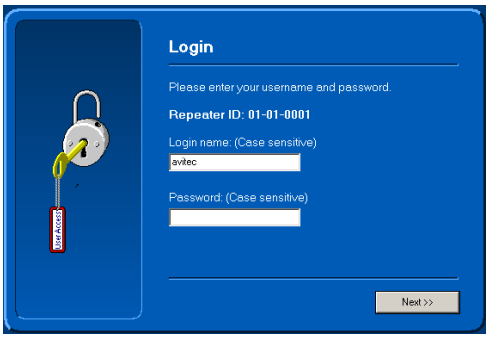
Connect the computer to the LMT port on the Control Module via a DB9 male connector with serial RS232 interface.

The communication parameters are set automatically by the RMC

Select "Cable" connection and communication port


Enter user name and password




Several users at a time can be logged on, for instance one locally via the RS232 interface and one remotely via modem or Ethernet.

There is one default user name and password defined for the OMU.

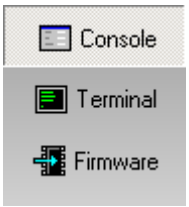
| User Name | Password |
|---|---|
| avitec | AvitecPasswd |

**Note!** Both the user name and the password are case sensitive.

**Note!** Do not use the number pad when entering numbers.

## 4.6.2 RMC Work Views

There are three different work views to choose from in the RMC




### Console Mode

The console mode displays a large number of repeater parameters and contains a number of console pages. It adjusts its user interface to adapt to the features of the connected repeater.

### Terminal Mode

The terminal mode is used for communication with the repeater using its native command line interface. This interface follows the VT100 standard. For some special actions and error tracing, this mode gives an enhanced availability of the repeater.

### Firmware Mode

The firmware mode is used for monitoring the currently installed software and for uploading new software to the repeater.

**Note!** This description is based on using the Consol work view.

## 4.7 Configure the OMU

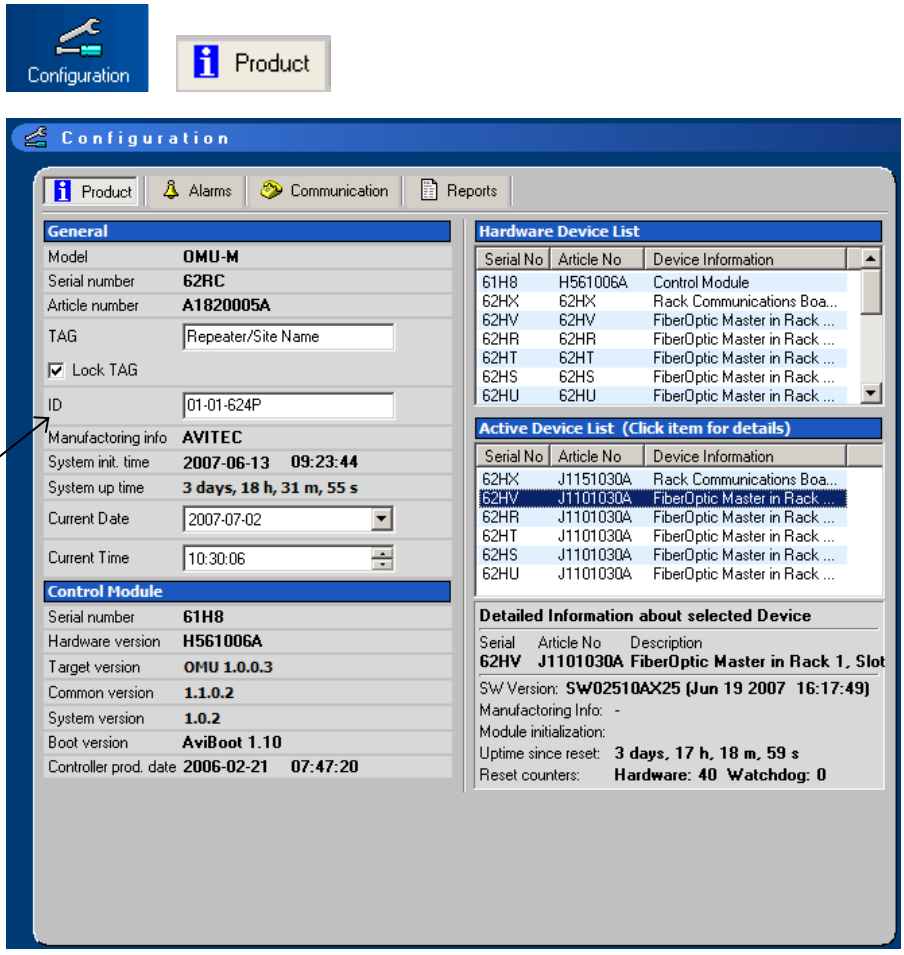
### 4.7.1 Set OMU Name (TAG)

The TAG can be chosen freely to give the OMU a name that is linked to the location, the site name, etc. The TAG may contain up to 30 characters including spaces.

Select "Configuration" and "Product"

Insert the OMU's name (TAG) in this box.

**Note!** The ID should not be assigned from here. The AEM will do this automatically when the repeater is integrated in the system.




### 4.7.2 Configure Alarms

Please see section 3.4.7 Alarm Configuration.

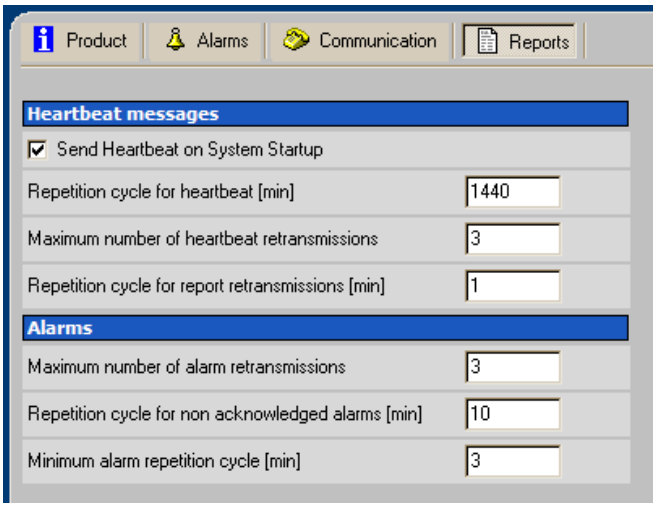
### 4.7.3 Configure Reports

In this screen the reports from the OMU can be configured.

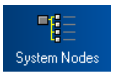
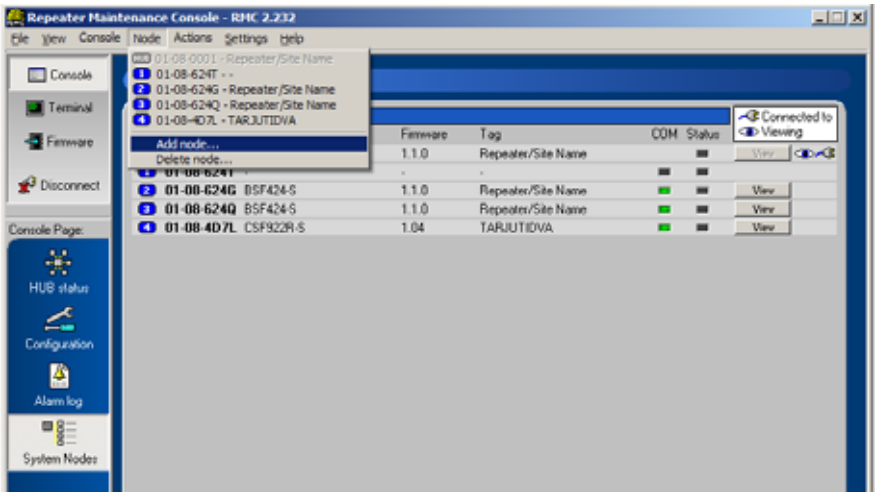
Select "Configuration" and "Reports"

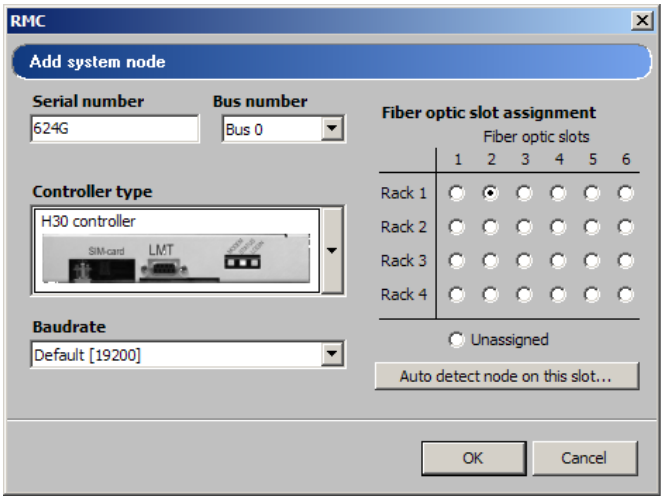

Heartbeat reports →

Alarms reports →




## 4.8 Set Up OMU-Repeater System

| | |
|---|---|
| Install the repeaters | Install the fibre fed repeaters. See the User's Manual for the repeaters. |
| Install the fibers to the repeaters | Make sure the fibre link between the OMU and all of the repeaters are working.<br>Make sure all connectors in the link have APC type connectors. |
| Add all nodes to the OMU-Repeater System. | Select "System Nodes"  <br>Chose "Add node…" from the "Node" drop down menu.<br>  <br>Fill in the information for each repeater in the pop up window. |




| | |
|---|---|
| Serial number | The serial number consists of 4 letter and/or digits. It is printed on the yellow label on the repeater |
| Bus number | When OMUs are cascaded they run on different buses. OMU 1 and OMU 3 is on "bus "0 and OMU 2 and OMU 4 in on" bus 1". See 4.4 Attach Cabling. |
| Controller type | Select the correct repeater controller based on the illustrations |
| Baud rate | The default value changes when the controller type is selected. (Other values are also available for specific situations not described in this manual.) |
| Slot Assignment | Tick the button that corresponds to the fiber optic converter the repeater is connected to.<br>**Note!** To confirm an installation or to check the present configuration select a fiber optic converter and click the button Auto detect node on this slot... . If a repeater is installed in this position the repeater serial number will be presented. |

Check the LEDs on the Fibre Optic Converters

The Fibre Optic Converter contains two optical alarm sources. These are alarms for transmitted and received optical signal level.

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

Power
Error
UL Data
DL Data
Opto Rx
Opto Tx

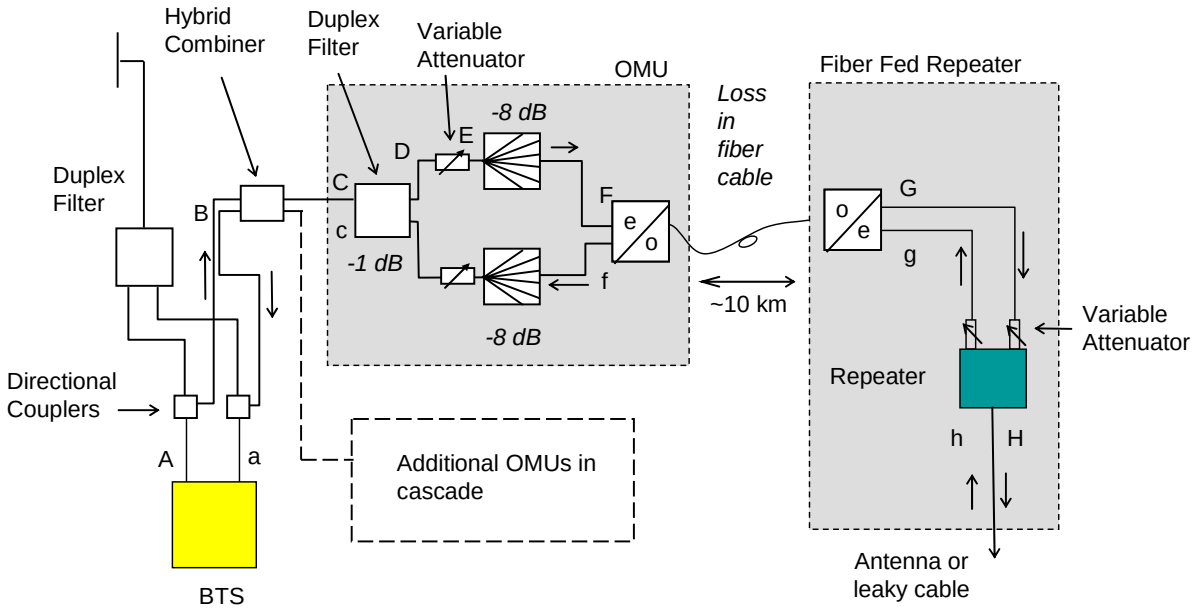
| LED 1, Power, Green | |
|---|---|
| On | Unit is powered on |
| Off | Unit has no power |
| LED 2, Error, Red | |
| On | Error detected |
| Off | No error |
| LED 3, UL Data, Yellow | |
| On | Communication via the opto module is ongoing in the uplink direction |
| Off | No communication |
| LED 4, DL Data, Yellow | |
| On | Communication via the opto module is ongoing in the downlink direction |
| Off | No communication |
| LED 5, Opto Rx, Green | |
| On | Input opto level OK |
| Off | Input opto level below threshold |
| LED 6, Opto Tx, Green | |
| On | Output opto level OK |
| Off | Output opto level below threshold |

Select HUB Status


Check the levels of the received optical signals via the RMC

## 4.9 Balance the System

To get an appreciation of the signal levels, a link budget should be prepared before the system is made operational. This is one example with a BTS at the OMU site.




Several parameters need to be considered in an OMU-Repeater installation.

### Downlink Path

Important is to feed the Fibre Optic Converters in the OMU with the right signal level in the downlink, position F above. This level should be close to -3dBm for optimal performance. It may not exceed +2dBm.

Link from A to F:

- Directional coupler (between A and B), normally 30dB attenuation
- Hybrid combiner (between B and C), normally 2 dB attenuation
- Duplex filter (between C and D), normally 1 dB attenuation
- Variable attenuator in OMU (between D and E), can be set to max 21 dB in 3 dB steps
- Splitter (between E and F), 8 dB attenuation

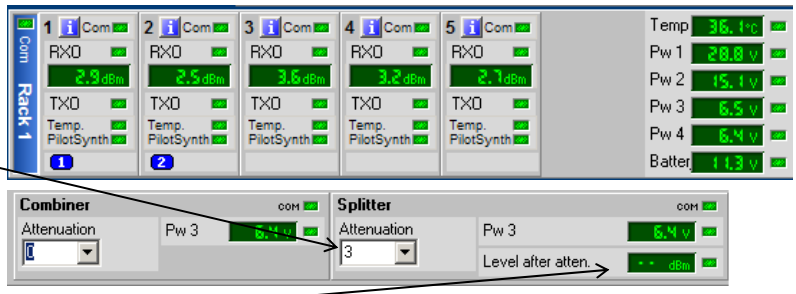
=> -30dB + -2dB + -1dB + -8dB = -41dB attenuation between A and F

If the BTS has a +43dB output power the variable attenuator in the OMU can be set to 6, which gives an input level to the fiber optic converters of -4dB. This attenuation is set in the box within the "Splitter" field, see below.

Select "HUB Status"


Seet the attenuation in the downlink in this box.

The level in position F can be monitored in the RMC




## Fiber Loss Compensation

Activate the fibre loss compensation in both the downlink (from the OMU) and in the uplink (from the repeaters) paths. See 4.10 Initiate Fibre Loss Compensation.

## Uplink Path

In the uplink direction the system should be transparent, i.e. the signal level on the BTS input connector should be the same as the level on the repeater input connector.

*Example*

We assume an input level to the repeater of -70dBm

h = -70dB

The repeater gain is set to 57dB => g = -13

The loss in the fibre is 20dB RF (10dBo) => f = -33

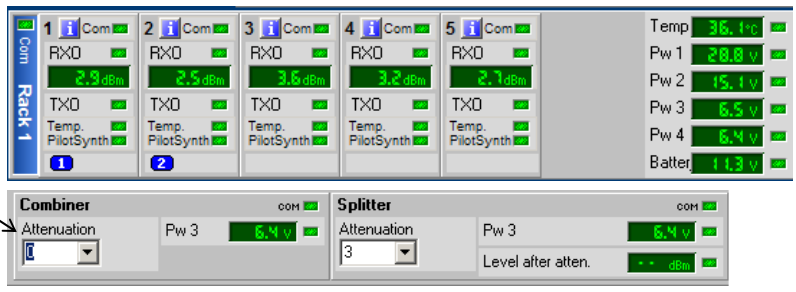
The loss in the splitter and the duplex filter 9dB => c = -42

A 30dB directional coupler is used => a = -72

A level of -72 at the BTS is OK. If this level needs to be reduced the attenuator in the combiner can be set to max 21 dB in 3 dB steps

Select "HUB Status"


Seet the attenuation in the uplink in this box.



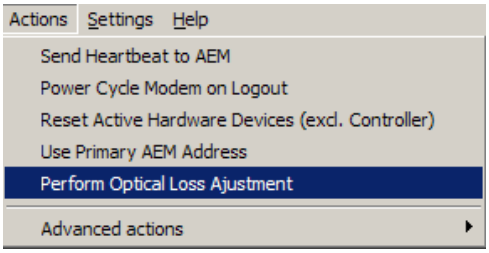
### Consider the noise situation

Another issue that needs to be taken into account is the noise figures. If several repeaters are connected to the same base station the aggregated noise level in relation to the signal level will become too high – the sensitivity of the base station is decreased. A way to deal with this problem is lower the output power from the base station.

**Note!** If the output power is lowered the calculation above regarding input levels to the OMU needs to be revised.

## 4.10 Initiate Fibre Loss Compensation

See section 3.3 Fibre Loss Compensation for information about this feature.

| | |
|---|---|
| Start with the OMU | Chose "Actions/Perform Optical Loss Adjustment" from the drop down menu.<br>  |
| Go through all racks and all fibre optic converters one by one and initiate the compensation process | First chose the rack and then the fibre optic converter.<br>  <br>In an OMU that contains only one sub rack – this rack is called "Rack 1"<br>Additional sub-racks/slave OMUs that are linked to the master OMU are named "Rack 2, 3 and 4".<br>  <br>Each fiber optic converter is numbered from left to right in each sub-rack.<br>For each rack/fibre optic converter please wait for the system to respond.<br>The system will respond with a description as below. |


In the response above the Status is "OK" (6 lines from the bottom).

If the system responds with an error message the fibre link need to be checked. If there is nothing wrong with the link it is possible that the fibre loss is too big for the system to be able to compensate for it.

Go through all racks and all fibre optic converters one by one and initiate the compensation process.

**Note!** Earlier repeater versions

If the OMU is connected to repeaters of an earlier release, which has a fibre optic converter of the type in the photograph, these commands will not work.

Instead a default value needs to be defined by using the command OLC.

Please see OMU Command and Attributes for more detailed information regarding this command.

The OLC value should be set to 6dB. This value ensures that the amplification value on the link will be 0dB at 0dB optical loss.

Example

```
SET OLC 1:2 6
```

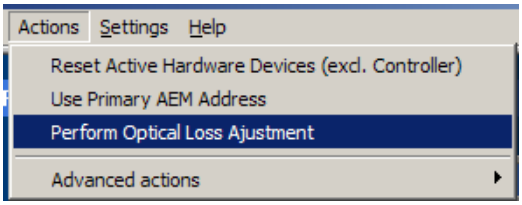
Adjusts the attenuation in the fibre optic converter unit in rack 1, slot 2 to 6 dB.

Go through all racks and slots that are connected to a repeater of this kind and send this command.

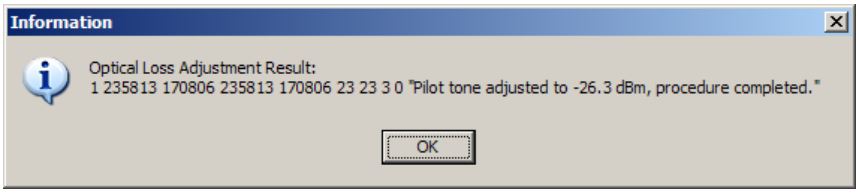
Continue with the

Chose "Actions/Perform Optical Loss Adjustment" from the drop down menu.

repeaters




The system will respond with a description as below.




**Note!**

This command does not exist in repeaters with the earlier type of fibre optic converters, equivalent to the note above regarding OLC. For these repeaters disregard this step.

# 4.11 Set up Remote Communication

The OMU can be configured with a wireless modem, a PSTN modem or an Ethernet link for the remote communication.

## 4.11.1 Communication via Modem

The Control Module is responsible for enabling the power to the modem, unlocking the SIM-card, using the configured PIN-code and making sure the modem is logged in to the network correctly. Depending on network configuration and modem usage, the modem might require different modem initialization strings to work properly. This modem initialization string is set and verified during repeater setup.

### 4.11.1.1 Modem Initialization

After a power failure, or upon user request, the Control Module performs a full initialization of the modem. This consists of three steps:

- If the SIM-card in the modem has the PIN code enabled, the Control Module unlocks the PIN code. In case wrong PIN-code is configured, the Control Module will not try to unlock the SIM again until the PIN-code is changed. This avoids the SIM card being locked by a Control Module repeatedly trying to unlock the SIM with the wrong PIN code.
- Once the SIM is unlocked, the Control Module waits for the SIM to log in to the network. Depending on signal quality and network configuration this might take a while. The Control Module will wait a configurable number of seconds (default 50 seconds) for the modem to login to the network. In case no network is found, a modem power cycle will be initiated.
- When the modem is successfully logged in to the network, the Control Module configures the modem with the modem initialization string as configured when setting up the remote configuration. The modem initialization string is a network dependent string. The default string is suitable for most networks, but some networks might require some tweaking of this string.

### 4.11.1.2 Monitoring Modem Connection

The Control Module constantly monitors the status of the modem connection to ensure that it is working properly, and that the modem is logged in to the network.

In case the modem is not registered to the network, or the Control Module cannot properly communicate with the modem, a power cycling of the modem is initiated, after which the modem will reinitialized.

### 4.11.1.3 Scheduled Modem Power Cycling

In addition to polling the modem to ensure the repeater online status, the Control Module can be configured to perform an automatic power cycling on a scheduled time of the day. Power cycling the modem ensures the latest network configuration for the modem, such as the HLR Update Interval etc.

**Note!** By default, the scheduled modem power cycling is disabled.

## 4.11.2 Communication via Wireless Modem

There are two different ways of communication for a wireless (GSM) modem:

- Using data call / modem connection.
  **Note!** This requires the SIM-card in the modem to be configured with data service.
- Using SMS to configure the repeater with simple text messages
  **Note!** SMS functionality is not implemented in this SW release.

The Axell Element Manager always uses data call communication with the repeater, why all repeaters being controlled by the AEM must have data service enabled on the SIM card.

Configuring the repeater to send alarms and reports via SMS it is still possible to establish data calls to the repeater, as long as the SIM card is data service enabled.

### 4.11.2.1 Modem Configuration, not using GPRS

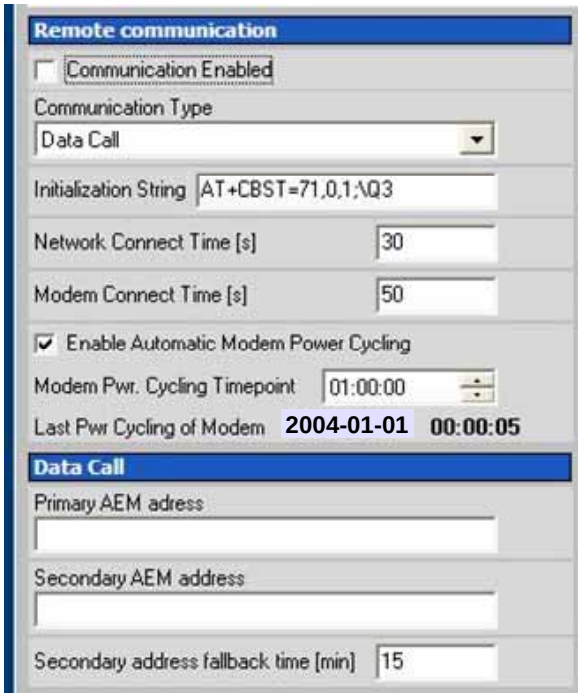
Select "Configuration" and "Communication"


Select Data Call

Initialization string

Connect times

AEM addressed are set via the AEM



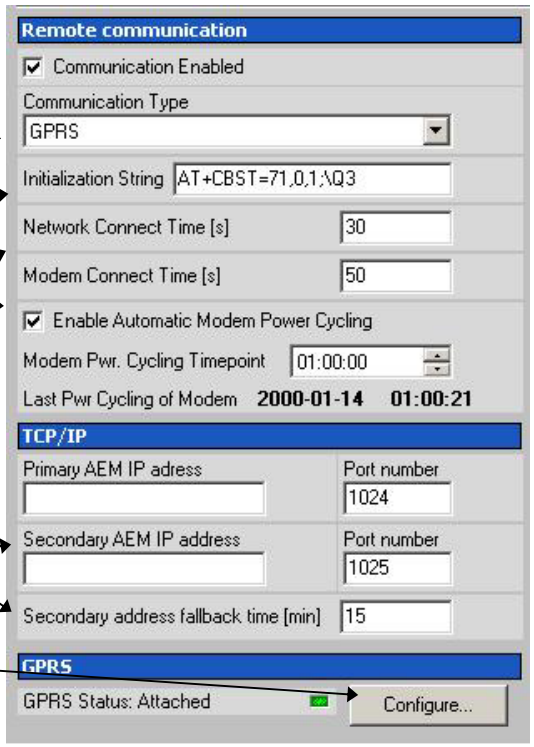

Select Data Call

Set the modem initialization string. This string differs between networks. Primary recommendation is AT+CBST=71,0,1;\Q3. If remote communication cannot be established try 7,0,1 or 0,0,1 or 7,0,3. For more information please refer to the section on Troubleshooting Remote Communication.

Tick "Enable Automatic Modem Power Cycling" for the modem to be power cycled once every 24 hours. Set the time at which the modem should be tested. This function ensures that the repeater always is logged in to the network.

### 4.11.2.2 Modem Configuration, using GPRS

Select "Configuration" and "Communication"




Select GPRS

Initialization string

Connect times

AEM addressed are set via the AEM

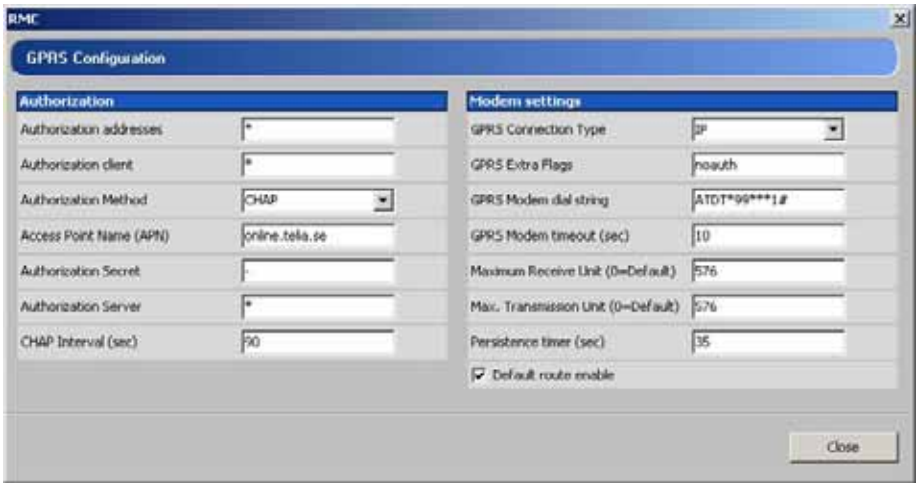
Configure GPRS

Select GPRS

Set the modem initialization string. This string differs between networks. Primary recommendation is AT+CBST=71,0,1;\Q3

Tick "Enable Automatic Modem Power Cycling" for the modem to be power cycled once every 24 hours. Set the time at which the modem should be tested. This function ensures that the repeater always is logged in to the network.

Click on Configure…



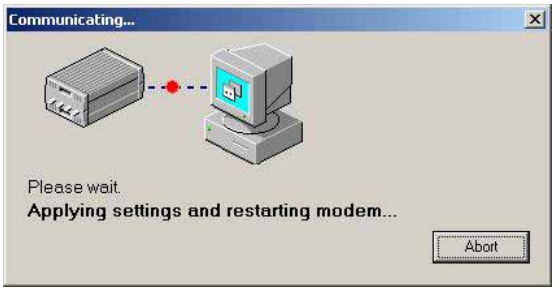

Each parameter is described in *Common Commands and Attributes*, section 14 GPRS Configurations.

Set the Access Point Name. It needs to be defined by the telecom operator

Set Maximum Receive Unit and maximum Transmission Unit. These differ depending on access type: 576 for GSM, 1476 for EDGE and 1500 for WCDMA.

Click on Close, and then on "Yes".


Wait for the modem to restart. This can take a few minutes.




When the modem settings are ready the LED turn green.


### 4.11.2.3 AEM Addresses

The Control Module can be configured with two different addresses (telephone numbers) to which alarms and reports are delivered. In case the repeater cannot deliver alarms and reports to the primary address, the next call will be made to the secondary address.

A fallback functionality is available, which means that the Control Module falls back to the primary address after a configurable number of minutes. If this interval is set to 0, the fallback will not be performed. A user can always force the Control Module to fall back to the primary address.

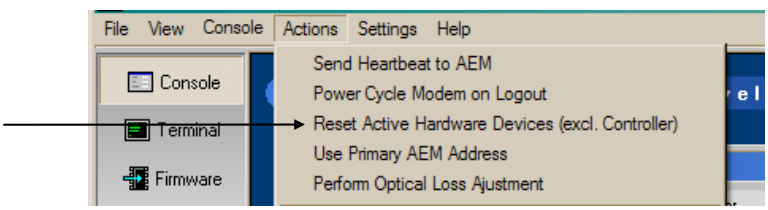
**Note!** When the repeater is integrated to the Axell Element Manager system, these addresses are set by the AEM, why they need not be configured during site installation.

### 4.11.2.4 Modem Verification

When the remote configuration has been set up the communication can be verified using the modem feature of the RMC and dialling the data number. The remote communication is verified as soon as a successful remote login to the repeater has been performed.

However, as a first step, it is recommended to verify that the modem is initialized correctly. After configuring the modem using the RMC, make sure to initiate a power cycling of the modem. This is done from the RMC menu.

Click on the drop-down menu Actions, choose Power Cycle Modem on Logout



An immediate power cycling is initiated after which the modem is initialized and registered onto the network. The modem is now ready for remote access.

Ensure a successful configuration by observing the modem LED as described below.

**Note!** This LED behaviour is valid only for GSM modems. Other modem types will be added in later editions.

| **Green LED – Modem Status** | | |
|---|---|---|
|  | On | Depending on type of call:<br>Voice call: Connected to remote party<br>Data call: Connected to remote party or exchange of parameters while setting up or disconnecting a call |
|  | Flashing<br>(irregular) | Indicates GPSR data transfer. When a GPRS transfer is in progress the LED goes on within 1 second after data packets were exchanged. Flash duration in approximately 0.5s. |
|  | 75ms on/75ms off/75ms on/3s off | One or more GPRS contexts activated |
|  | 75ms on/3s off | Logged to network (monitoring control channels and user interactions). No call in progress |
|  | 600ms on/600ms off | No SIM card inserted, or no PIN entered, or network search in progress, or ongoing user authentications, or network login in progress |
|  | Off | Modem is off |

Verify the remote communication either by having someone attempting to integrate the repeater from the Axell Element Manager, or by dialling the repeater using the Repeater Maintenance Console.

**Note!** It is very important to dial the data number of the SIM. In case the voice number is dialled, the call is answered, but almost immediately the call will be hung up.

#### 4.11.2.5 SIM-card Using Single Numbering Scheme

If the network is configured using Single Numbering Scheme (SNS), some special considerations apply.

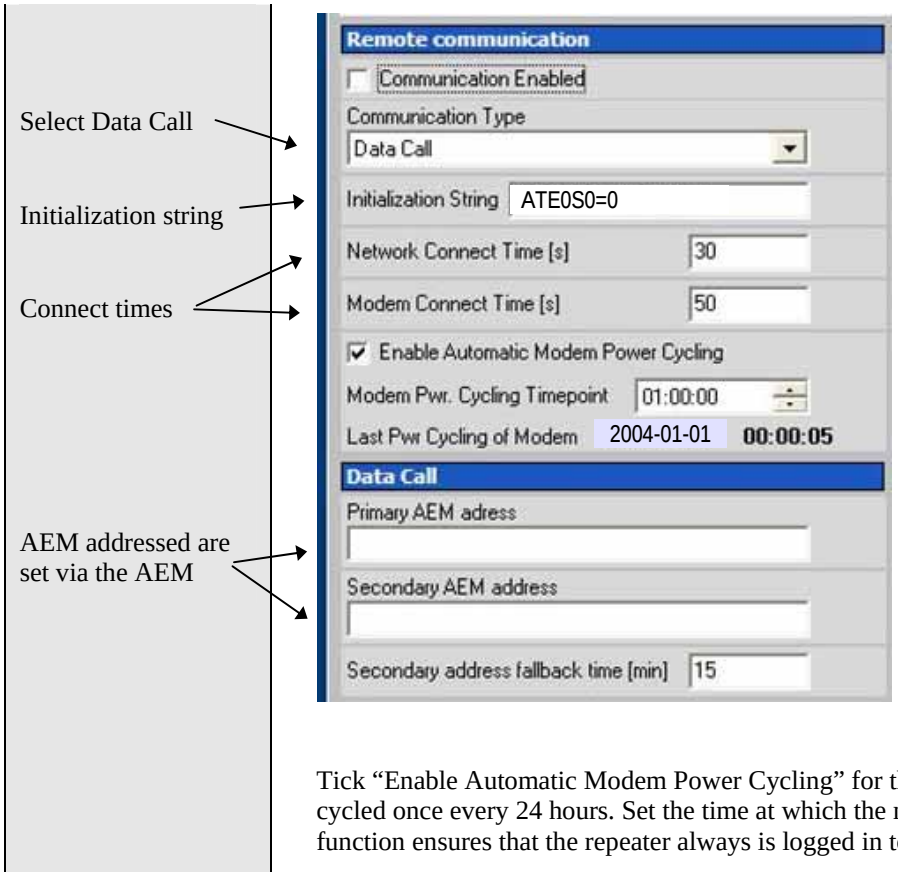
The repeaters are by default configured so that networks using SNS always will have calls routed to the data service in the modem. When dialling from within the network to a repeater having an SNS-configured SIM will operate normally, since the call originator informs the system that the bearer is of type DATA. However, when dialling from outside the network trying to connect to the repeater can be difficult. Depending on the interface to the roaming network or to the PSTN network if an analogue modem is used, the bearer type can default to voice. If the bearer is set to voice, the data service cannot be converted to DATA, and a call setup cannot be completed.

**Note!** This is not a repeater related problem; the solution is to verify how the external network interfaces handles the VOICE vs. DATA bearer type.

### 4.11.3 Communication via PSTN (Fixed) Modem

Also for PSTN modems data call shall be used.

| | |
|---|---|
| Select "Configuration" and "Communication" |  |



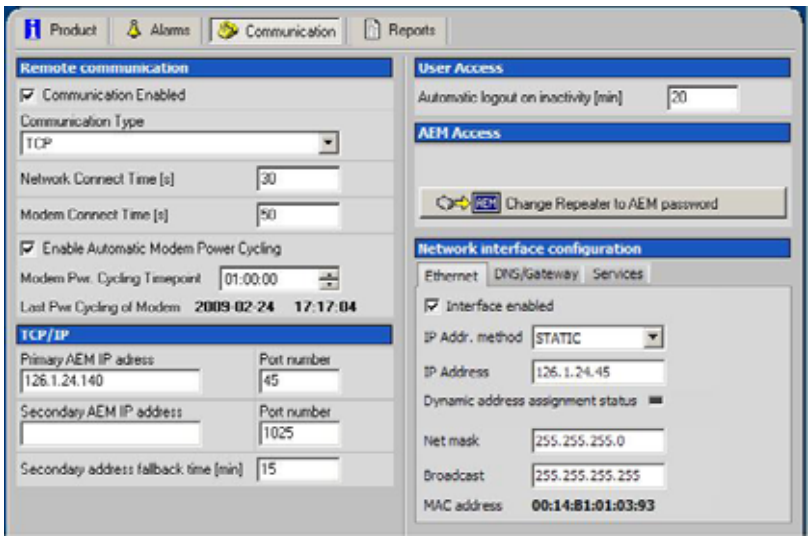

Tick "Enable Automatic Modem Power Cycling" for the modem to be power cycled once every 24 hours. Set the time at which the modem should be tested. This function ensures that the repeater always is logged in to the network.

### 4.11.4 Communication via TCP/IP and Ethernet

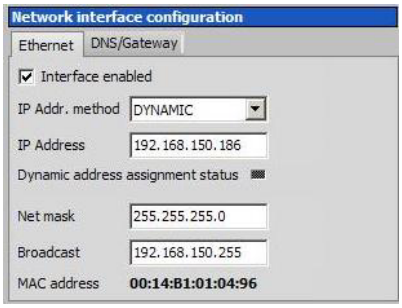
A TCP/IP communication is run over a company's network. Therefore each company needs to define the details regarding the configuration, IP addresses, etc. For more information please refer to *Common Commands and Attributes*, section 13 Network Configurations.

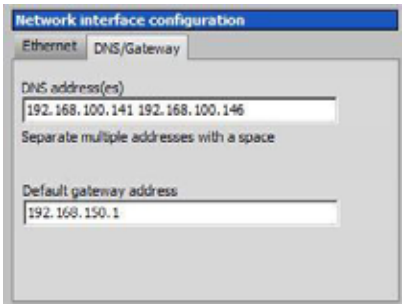
Select "Configuration" and "Communication"


Set IP address and other relevant information here



In these screens the Ethernet and/or DNS Gateway parameters can be set

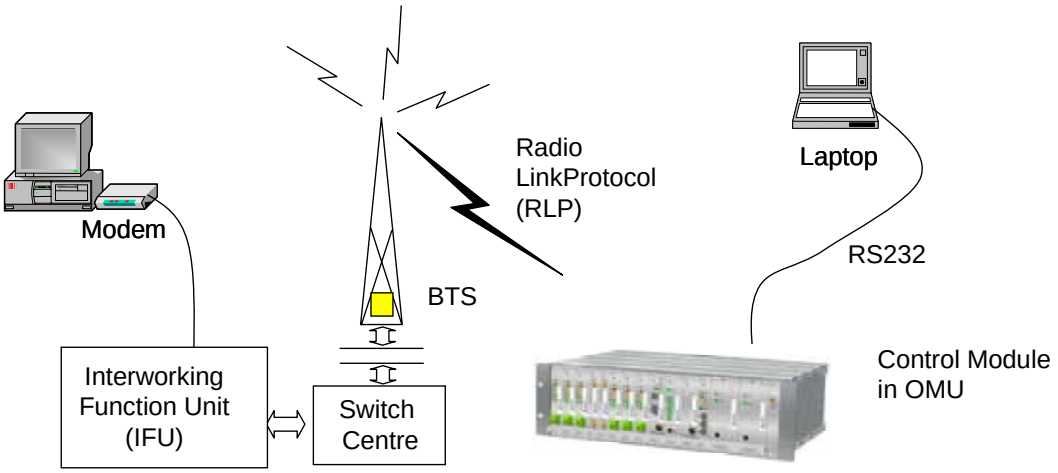



## 4.11.5 Troubleshooting Remote Communication

Since many networks have their own "personality", performing first time configuration of the remote communication sometimes requires tweaking of the modem parameters.

This section describes some trouble shooting techniques if configuring the OMU for remote access fails.



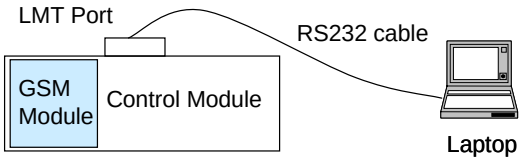

This illustration is a simplified schematic of the remote communication between a GSM module in an OMU and an analogue modem. The analogue modem in the computer communicates with the Interworking Function Unit (IFU), which is the GSM network analogue network interface. The call is routed via the switch centre over the air interface to the data call number in the SIM-card of the GSM module.

The Control Module is responsible for establishing connections with the Axell Element Manager, and to answer incoming calls to the OMU.

As described in previous sections, the Control Module only accepts one login at a time, either via Local Maintenance port (LMT) or modem connection. Hence, when verifying the remote access of the OMU, it is important to log out from the OMU locally before trying to access the OMU remotely.

### Direct Modem Access

To allow for advanced trouble shooting of the communications, it is possible to access the modem directly via the Control Module from a laptop computer.



Log in to the OMU, either with RMC, or with a terminal emulation program, such as HyperTerminal™. When the login is completed, select Terminal Mode, this will give access to the OMU command prompt in the same way as with HyperTerminal.

When the OMU prompt is accessible, type in the command

```
ACCESS MODEM <Enter>.
```

When typing ACCESS MODEM, the controller will send all the characters that are typed directly out to the modem port. All characters replied back from the modem will go directly to the LMT port and back to the computer.

To abort an ACCESS MODEM session, press three '-' in a row (all three within one second) to come back to the OMU command prompt.

**Note!** When accessing the modem port the modem might be configured with "echo off", meaning that the characters entered will not be echoed back to the screen. In order to enable "echo", press Enter.

Type

```
ATE1 <enter>
```

(invisible)

The modem replies with

```
OK
```

indicating that the echo is enabled. All characters entered will now be echoed back to the terminal program.

Below is a list of handy modem commands for trouble shooting via Direct Modem Access. Please refer to the modem manual for details on the commands below.

| Command | Description |
|---|---|
| ATE1 | Enables the echo between the modem and the Control Module. |
| ATDT<Telephone Number> | Causes the modem to dial <Telephone Number>. This can be used to verify that the modem correctly can dial a remote modem. |
| ATA | Answer incoming call |
| ATH | Hang up call. Note, if being online to the remote peer, you need to go to command mode to hang up the call. This is done by waiting at least one second since last entered character, then press +++ (three plus signs), all within one second. After one second, the modem will reply OK, meaning that command mode is entered. |
| ATM0 | Disables the loudspeaker in the modem |
| ATM1 | Enables the loudspeaker in the modem |
| AT&W | Saves the current modem configuration into NVRAM. This means that this configuration will be used directly after modem power up |
| AT&F | Loads the modem factory configuration |
| ATZ | Resets the modem, and loads the default settings as saved with command AT&W |

## Trace Modem

For troubleshooting purposes it is possible to trace the actual progress of initializing the modem. This trace is useful when having problems with the modem initialization.

Go to Terminal Mode and type

```
TRACE MODEM
```


To end session type CTRL-Z

## Manually Answering Incoming Calls

It is possible to manually answer incoming calls without involving the OMU software at all, to verify that the remote access and the network itself works as intended. In order to verify the remote communication, make sure to have someone stand by to dial up the OMU with a terminal emulation program, for example HyperTerminal™.

Go in to Direct Modem Access as described earlier. When in direct access mode, ask the person standing by to dial up the OMU.

As soon as a call is received, the text

```
RING
```

will repeatedly be displayed on the screen.

Type

```
ATA <enter>
```

This will inform the modem to answer (ATtention Answer).

When the connection is established, a connect message will be displayed including the connection speed. Sometimes the information comes together with some miscellaneous information, such as error correction protocols etc.

**Note!** Make sure the remote peer dials the Data Call number

If the voice number is dialled instead of the data number, or if the modem contains an illegal modem initialization string, the message

```
OK
```

or

```
NO CARRIER
```

will be displayed almost immediately.

Try to change the modem initialization string. The modem initialization string mainly used to configure the remote communication is AT+CBST.

Successful modem initialization strings used by Axell Wireless includes (most common first):

```
AT+CBST=71,0,1;\Q3
AT+CBST=7,0,1;\Q3
```

```
AT+CBST=0,0,1;\Q3
AT+CBST=0,0,1;\Q3
AT+CBST=7,0,3;\Q3
```

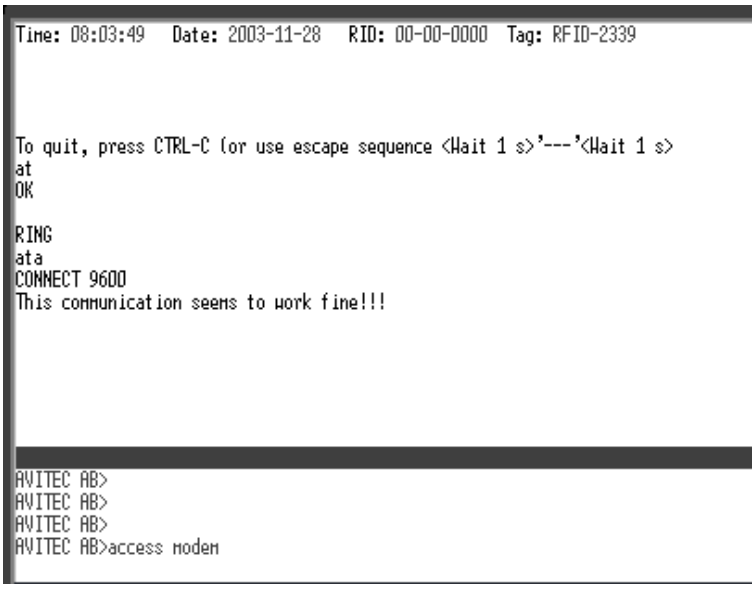
Once the modem initialization string is entered, try again to dial up the OMU. For details on the different modem initialization strings, please refer to the modem's user guide.

If the setup is successful, the connect message will be brought up;

```
CONNECT 9600
```

This means that an online connection is established to the remote peer. From now on, all characters typed on the keyboard will end up on the remote peer's screen. Similarly, all characters typed by the remote peer will be displayed on the screen.

In the example, the incoming call was successfully answered, and the remote user entered the text message.




In order to come back to modem command mode, press +++ (three pluses) rapidly (within one second).

Receiving

```
OK
```

means that the modem is back in command mode.

Type

```
ATH <enter>
```

This terminates the connection to the remote peer. The message

```
NO CARRIER
```

will be displayed.

## Common Problems

**Problem 1**

When enabling the remote access for the OMU, the modem fails to log in to the network.

**Solution**

Signal strength from the donor site is too low. The signal strength can be read directly from the modem. Go in to Direct Modem Access as described earlier. Use the command AT+CSQ (documented below) to read out the signal strength.

In order to have good signal quality, Axell Wireless recommends that the signal strength should be better than -95 dBm. If signal strength is lower, try to adjust the antennas to get a better signal strength from the donor.

## 6.1 Signal Quality +CSQ

### 6.1.1 Description :

This command is used to know the *received signal strength indication* (<rssi>) and the *channel bit error rate* (<ber>) with or without any SIM card inserted.

### 6.1.2 Syntax :

Command syntax : AT+CSQ

| Command | Possible responses |
|---|---|
| AT+CSQ | +CSQ: <rssi>,<ber><br>OK<br>*Note : <rssi> and <ber> as defined below* |

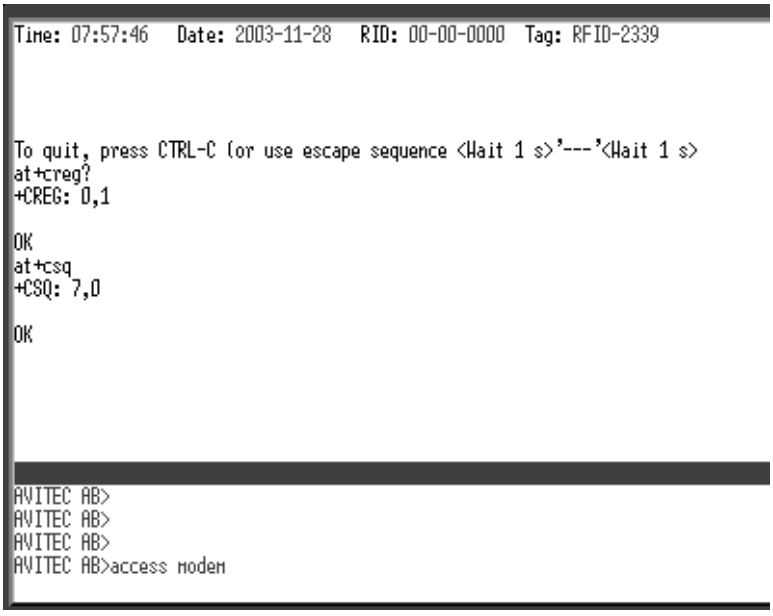
### 6.1.3 Defined values :

**<rssi> :**
0 : -113 dBm or less
1 : -111 dBm
2...30 : -109 to -53 dBm
31 : -51dBm or greater
99 : not known or not detectable

**<ber> :**
0...7 : as RXQUAL values in the table GSM 05.08
99 : not known or not detectable

*Documentation of +CSQ command from a modem's manual.*

In the example the reply to AT+CSQ is 0,7 meaning 7*2 dB above -113 dBm; the modem detects a signal level of -99 dBm.




**Problem 2a**

OMU is configured properly, and answers the incoming call, but when trying to dial the OMU using an analogue mode, no modem handshaking is heard from the dialling modem.

**Problem 2b**

When dialling the OMU, the OMU answers the incoming call, but no connection is established, and after a while the OMU disconnects the call.

**Solution**

The most common cause is that the number called is the voice number of the SIM, not the data number. Therefore, make sure to dial the data number.

If data call is used, the problem probably is an illegal modem initialization string.

In order to change the modem string, go to the OMU command prompt. Try changing the modem initialization string and log out to let the controller reinitialize the modem.

If problem remains, try a few different modem initialization strings. Axell Wireless has been successful with the following modem initialization strings:

```
AT+CBST=71,0,1;\Q3
AT+CBST=7,0,1;\Q3
AT+CBST=0,0,1;\Q3
AT+CBST=0,0,1;\Q3
AT+CBST=7,0,3;\Q3
```

Please refer to the modem manual for detailed description of the modem initialization strings.

**Problem 3**

It is possible to call the OMU from another GSM mobile, but not from an analogue modem.

**Solution**

This problem is most likely related to the modem configuration and/or the configuration of the IFU unit. Try to decrease the communications speed and make sure that the modem error correction is supported by the IFU. Verify the IFU configuration to see if there are any known problems with the modem connections.

**Problem 4**

When dialling the OMU, or when the OMU is dialling the Element Manager, the connection is terminated before the handshaking is completed.

**Solution**

When an OMU is answering an incoming modem call, or calling up the OMC to deliver an alarm or a report, the OMU will wait a configurable number of seconds for the call to be established. If no communication is established within this time, the call will be hung up. If this interval is set too low, the handshaking is terminated too fast. In the RMC, verify the Modem Connect Time to see that it is set to at least 30 seconds.

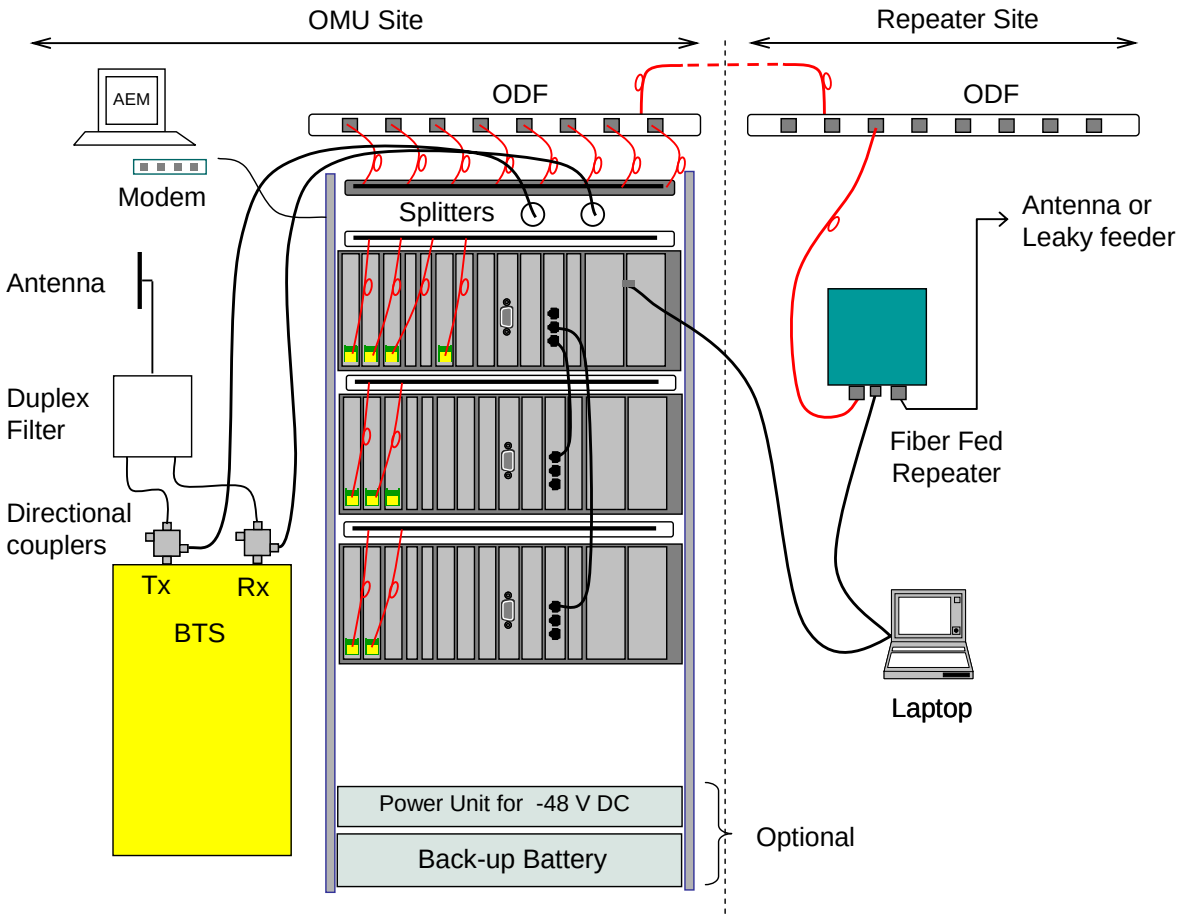
## 4.12 Integrate into the AEM

When the OMU has been installed at site and the remote communication has been enabled, the OMU can be integrated to the Axell Element Manager. This is done by the operator of the AEM. After entering the telephone number to the OMU, the AEM dials up the OMU, downloads all the OMU parameters and statuses into a database. When all parameters have been downloaded, the AEM configures the OMU with the telephone number where alarms and reports should be sent, and optionally with a secondary telephone number where the repeater can dial in case connection to the primary number fails.

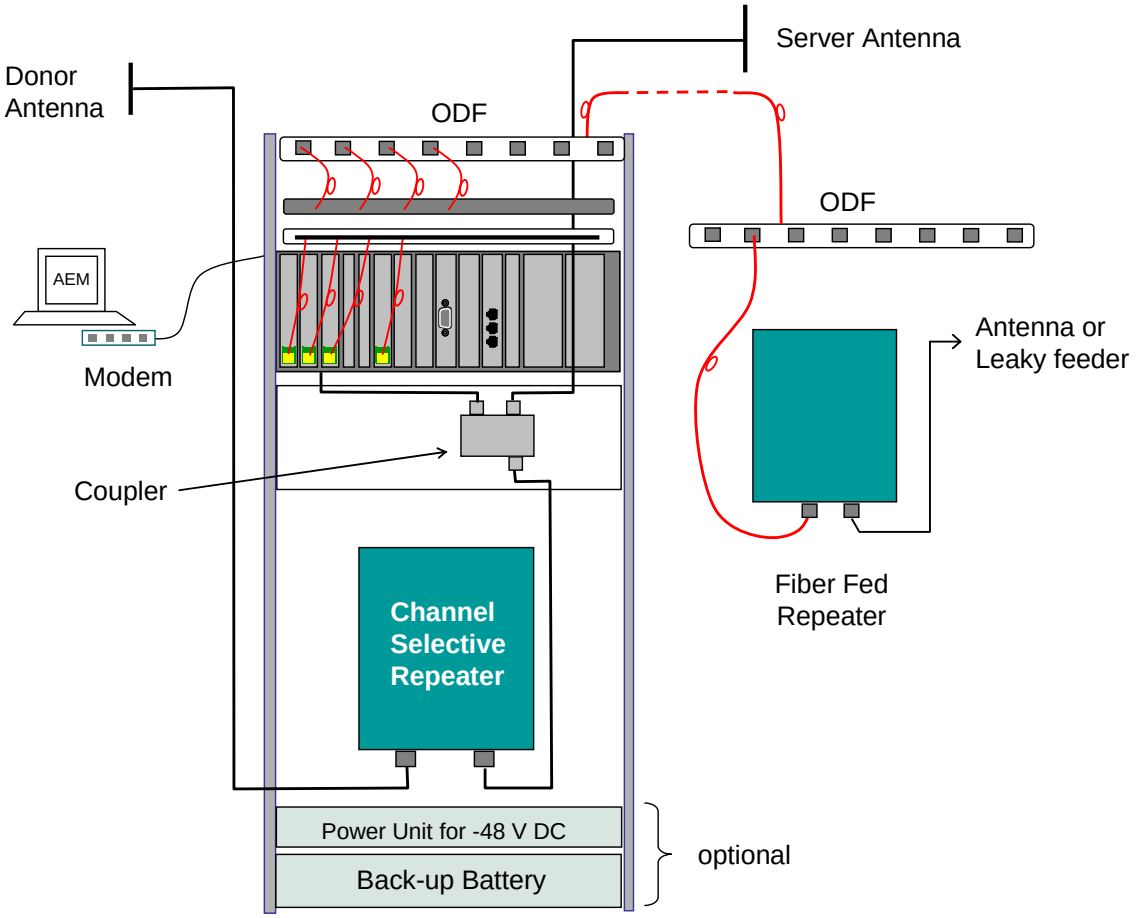
When heartbeat reports and alarms are sent from the OMU to the AEM also the latest information about the status and RF-configuration is included. This means that the AEM operator always has information about the current status in the AEM database (and do not need to call the repeater to find this out).

**Note!** Once the OMU is integrated to the AEM, all changes to the OMU should preferably be done from the Axell Element Manager in order to ensure that the database always contains correct information.

## 4.13 Installation Examples




*An example of a site installation where the FR signal to the OMU is tapped off a BTS*




*An example of a site installation where the FR signal to the OMU is tapped off a repeater*

# 5 Maintenance

## 5.1 General

The system normally operates without any operator intervention or maintenance.

Should the system malfunction, the condition of the antenna systems as well as the continuity of the cabling should be checked before replacing any of the OMU units.

In the unlikely event of a unit failure, the field replaceable components (antenna unit, cables, etc.) should be checked and replaced if faulty and the system restored.

A failed unit can be removed and replaced with a spare while the rest of the system (other OMUs) is still in operation.

**Caution**


Un-terminated optical receptacles may emit laser radiation. Do not stare into beam or view with optical instruments.

**Note!** The power supply of the failed OMU should be isolated from AC mains and DC power before any module is replaced.

## 5.2 Preventive Maintenance

The OMU does not require any preventative maintenance apart from changing the battery every three years.

**Caution**

Risk of explosion if battery is replaced by an incorrect type.

Dispose of used batteries according to local laws and instructions.

## 5.3 Product Disposal

Disposal of this product must be handled according to all national laws and regulations.

# 6 Specifications

## RF Parameters

| | |
|---|---|
| Frequency Response | 88-960 / 1710-2170 MHz |
| Gain Flatness | Typical 2 (p-p) dB |
| Nominal RF input power | +10 dBm composite power |
| Maximum RF input power | +23 dBm composite power |
| Fibre optic loss compensation | Implemented |

## Optical Modules

| | |
|---|---|
| Number of optical modules | 1-6 |
| Laser class | Class 1 |
| Wavelength | 1310 ± 10 nm or 1330 ± 10 nm |
| Optical output power | +5 ± 2 dBm |
| Maximum Optical Input Power | +5 dBm |
| Output Power (Tx) max | +7 dBm |
| Operating Temperature | +5 ~ +45°C |

## Power Requirements

| | |
|---|---|
| Power Requirements | 24 - 48 VDC / 115 - 230 VAC |
| Power Consumption | Typical 50 W (fully equipped) |

## External Electrical Interfaces

| | |
|---|---|
| Local Maintenance Terminal | RS232 |
| RF Ports | N-type Connector Female |
| Optical Ports | SC/APC |
| Power Input | Plinth |
| External alarms | Plinth |
| Modem connector (PSTN) | RJ11 |
| Modem antenna connector | SMA Female |
| Ethernet connector | RJ45 |

## Mechanical Specifications

| | |
|---|---|
| Dimensions (w x h x d) | 84 TE x 3 HE x 420 mm |
| Weight | 15 kg (fully equipped) |
| IP rating | IP20 |

## Reliability Specification

| | |
|---|---|
| Lifetime (MTBF) | >70 000 hrs |

# Repeater Maintenance Console Short Guide

Valid from RMC version 2.2

# 1 Installation

## 1.1 Requirements

| | |
|---|---|
| CPU | Pentium, 200 MHz (Pentium III, 500 MHz recommended) |
| RAM | 64 MB (128 MB recommended) |
| Hard Drive | 10 MB free disk space |
| CD-ROM | Required for installation |
| Video resolution | 800 x 600 with at least 15 bit color depth (approx. 32000 colors)<br>24 bit color depth (16.7 million colors) recommended<br>It is possible to run the program in 256 or 16 color modes, but colors will appear distorted |
| Operating system | Windows 98SE/NT/2000/XP |

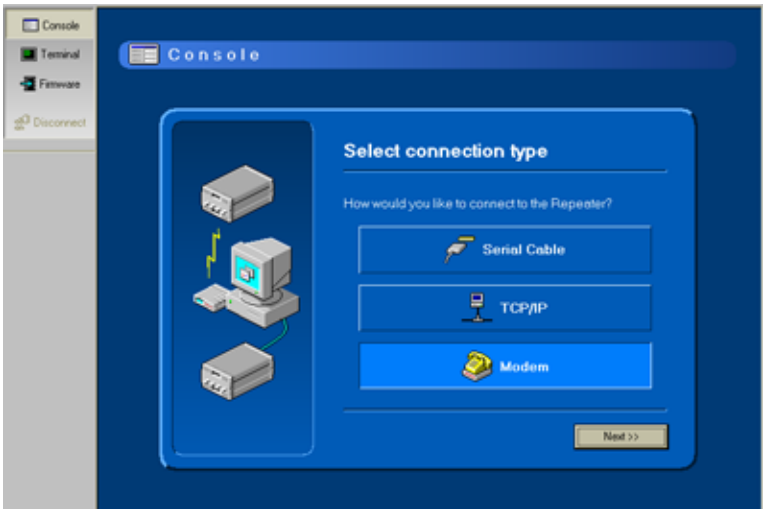
## 1.2 Installation Procedure

1. Ensure the computer and operation system complies with the requirements above.
2. Insert the CD-ROM into your CD-ROM reader. This will in most cases auto-start the setup program. If not select your CD-ROM drive and double-click the file “Setup.exe”.
3. Follow the setup program guide through the installation process. Specify where the program should be installed.
4. When the installation is finished, start the RMC from the” Start” menu (no reboot is needed)

## 1.3 Connection Setup

The RMC opens in Console mode.

The repeater connection can be made via serial cable, TCP/IP or Modem.

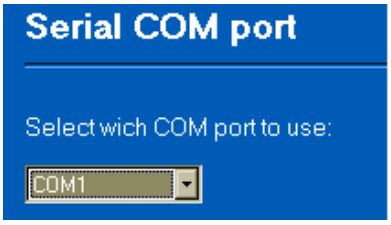


### 1.3.1 Cable Connection Set up

Select “Serial Cable” and “Next”


Select the serial port to be used.

Select “Connect”




### 1.3.2 TCP/IP Connection Set up

Select “TCP/IP” and “Next”

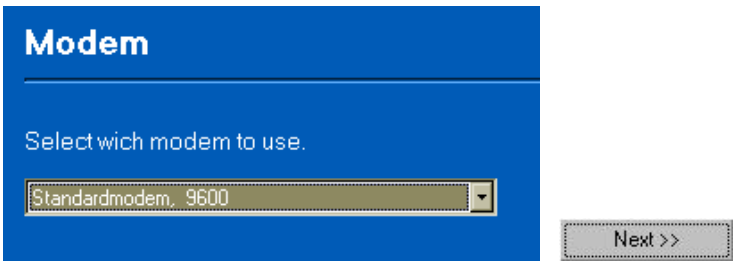

Enter the IP address and port or choose one from the phone book.


### 1.3.3 Modem Connection Set up

Select “Modem” and “Next”


Select the modem to use.

Select “Next”



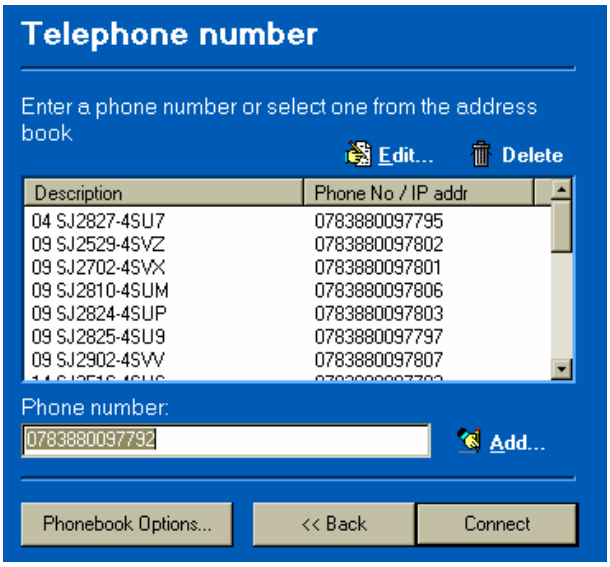

The RMC automatically receives a list of available modems from the Windows operation system.

**Note!**

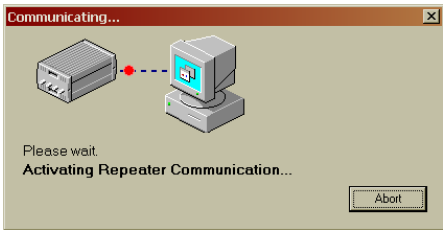
It is important that the modem is installed in Windows according to the manual provided by the modem manufacturer.

Enter the phone number.

Type the number or choose one from the phone book.




Select “Connect” and wait for the connection to be established




## 1.3.4 Login

Enter username and password (in terminal mode the login prompt is text based).

Select “Next”


Default usernames and passwords differ for different repeater generations. Please consult the manual for the repeater that is to be connected.

User name and password structure 1

| User Name | Password | Authority |
|---|---|---|
| USERNAM1 | PASSWRD1 | read/write |
| USERNAM2 | PASSWRD2 | read/write |

| | | |
|---|---|---|
| USERNAM3 | PASSWRD3 | read only |
| USERNAM4 | PASSWRD4 | read only |

User name and password structure 2

| User Name | Password |
|---|---|
| avitec | AvitecPasswd |

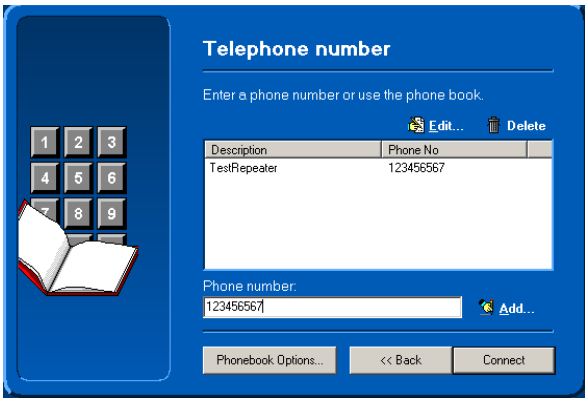
## 1.4 How to Change a Parameter

There is a two step procedure to change a parameter in RMC.

| | |
|---|---|
| Change the value | A value can be changed by typing it or by choosing a value from a drop down menu<br>  <br>In this case there is a drop down menu. Click on "▾" to the right of the box and chose a value. |
| Apply or cancel the change | As soon as a change is made or a value is inserted this symbol appears<br>  <br>The change is applied by clicking the green "accept button"<br>The change is canceled by clicking the red cross (or by pressing Esc) |

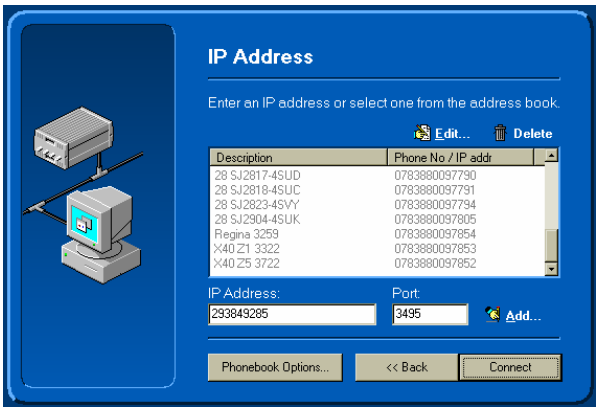
## 1.5 How to Use the Phone Book

Modem phone numbers and /or IP addresses can be stored in the RMC phone book. Each computer user is allocated an individual RMC phonebook which is stored in the windows registry.

| | |
|---|---|
| Select Modem during login.<br>Initial screen |  |

Select TCP/IP during login.

Initial screen




## 1.5.1 Add a Phone Number or TCP/IP Address

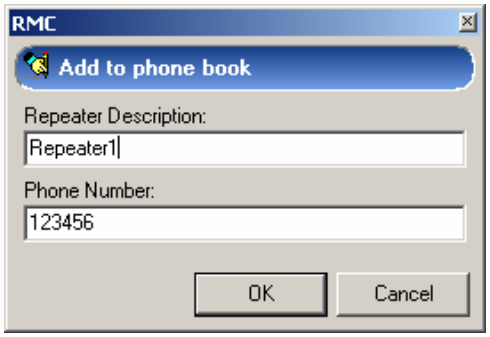
Type the number in the edit box

Click “Add”

This brings up a dialog box

Enter a description of the phonebook entry

Click “Ok”




## 1.5.2 Edit a Phone Number or TCP/IP Address

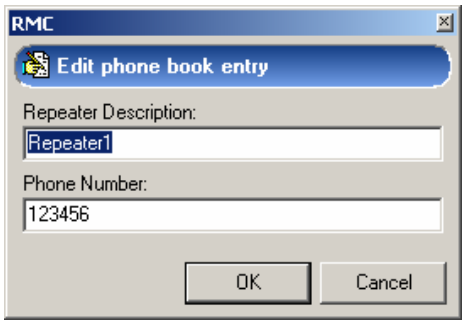
Select a number in the list

Select “Edit”

This brings up a dialog box

Make the changes

Select “Ok”

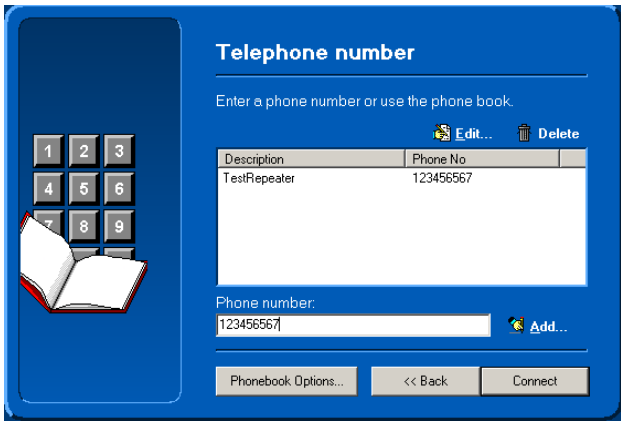


## 1.5.3 Delete a Phone Number or TCP/IP Address

Select a n entry in the list

Select “Delete”

Confirm




## 1.5.4 Import/Export Phonebook Data

Select “Phonebook Options”

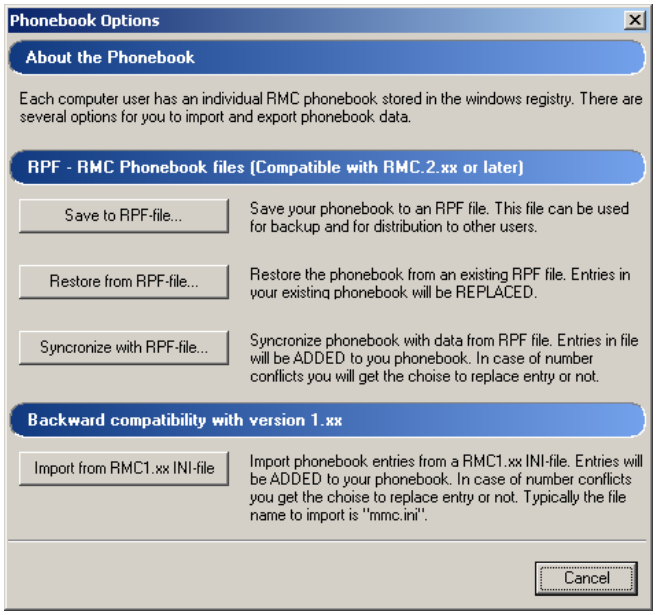
Choose between the options:

- Save
- Restore
- Synchronize

The file extension is RPF.

Files can be used in RMC versions 2.00 and later.

Phonebook data from RMC version 1.xx (INI-files) can also be imported.



# AXELL WIRELESS
# Common Commands and Attributes
# v1.3.0

# Change Log

| Version | Change by | Date | Description |
|---|---|---|---|
| 1.0 | MW | 29/01/09 | Changes from 1.2.0 and 1.2.1 to 1.3.0<br><br>13.4.2 Added comment on DHCP via GPRS<br>13.7.2 Added Note 2 reagarding GPRS interface.<br>13.7.8 Added Note 5 regarding setting of GPRS parameters.<br>13.8.2 Added Note 4 regarding restarting of GPRS interface.<br>Added chapter 14 – GPRS Configurations |
| 1.1 | MW | 17/03/09 | 14.1.5.2 Changed behavior of GET GPR ASC attribute. |
| 1.2 | MW | 19/03/09 | 14.1.8.2 Added comments on ACT GPR APPLY |
| | | | |

# Legal Information



The manufacturer has made every effort to ensure that the instructions contained in the documents are adequate and free of errors and omissions. The manufacturer will, if necessary, explain issues which may not be covered by the documents. The manufacturer's liability for any errors in the documents is limited to the correction of errors and the aforementioned advisory services.

This document has been prepared to be used by professional and properly trained personnel, and the customer assumes full responsibility when using them. The manufacturer 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 AXELL WIRELESS sales representative.

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# TABLE OF CONTENTS

# 1 OVERVIEW

Axell Wireless network elements* equipped with a controller contains a Local Maintenance Terminal (LMT) port, and optionally a modem. This allows for configuration of the element locally and optionally remotely.

Using a terminal emulation software, such as HyperTerminal (Windows) or MiniCom (Linux/Unix) it is possible to configure the equipment using a simple command structure (terminal emulation should be set to VT100 or ANSI).

Axell Repeater Command and Attributes documentation consists of two parts;

- the Common part defines all functionality available for all Axell repeaters with the new generation of controllers (H40 and H50 series).
- the Target part defines all commands and attributes available for the specific repeater type in a separate document.

This document specifies the functionality for all commands and attributes available in the H40 and H50 controllers common parts, i.e. the functionality that is common to all repeaters and nodes, regardless of the target implementation.

* Network elements are for instance repeaters, Optical Master Units etc.

# 2 AXELL WIRELESS VERSUS AVITEC

Summer of 2007 Avitec AB (Sweden) and Aerial Facilities Ltd (UK) joined forces to form Europe's largest manufacturer of coverage solution equipment.
During winter 2008 the companies were brought together under one common name, Axell Wireless.

However, since the base of this firmware was designed before companies were merged, certain places in the firmware still mentions Avitec, such as the login screen and the prompt. Yet, the product is sold, marketed and supported via Axell Wireless and it's sales and support organisation.

# 3 VERSION COMPATIBILITY

Commands and attributes described in this document refers to Common firmware 1.2.1.

Firmware version of the controller can be obtained (once logged in) by using the attribute SWV.

# 4 USING COMMANDS AND ATTRIBUTES

When logged in to the repeater, a number of different commands and attributes are available. Commands have interaction with the user, or displays the reply on multiple rows, while attributes are worked on using GET, SET or ACT syntax which gives a reply normally on a maximum of one row.

Read-only attributes are read using GET.

**Example:**
```
AVITEC AB> GET MDL
MBF-D-9-18
AVITEC AB>
```

Read and write attributes are either read or written
**Example:**
```
AVITEC AB> GET TAG
Repeater Name: Earl
AVITEC AB> SET TAG Site at Sundbyberg Centrum
AVITEC AB> GET TAG
Site at Sundbyberg Centrum
AVITEC AB>
```

Actions are used to perform actions.
**Example:**
```
AVITEC AB> ACT RCD
AVITEC AB>
```
which resets the communications device/modem.

# 5 BUILT IN HELP SYSTEM

## 5.1 HELP command

By entering the command
```
HELP
```
a list of all attributes and their modes of operation are displayed in alphabetic order.

Three different columns are displayed. First column is the actual attribute. Second column displays valid attribute access methods.
r – this means attribute can be GET
w – this means attribute can be SET
x – means attribute can be worked on with ACT (action).

Each row ends with a brief description of the attribute.

**Example:**

```
AVITEC AB>help
AC1   r    Displays alarm severity and class for a number of alarm sources.
AC2   r    Displays alarm severity and class for a number of alarm sources.
ACK     x  Acknowledges alarm log entries.
ACL   rw   Displays and changes default alarm classes.
ADC   r    Returns number of active devices in the system.
ADD   rw   Configures SMS access list to communicate with the repeater.
AGC   r    This displays status of the AGC in uplink and downlink.
AL1   r    Displays alarm configurations for EX1, EX2, EX3, EX4 and DOO.
AL2   r    Displays alarm configurations for VLI, LGO, CLR, FWU and FWF.
ALA   rw   Used for reconfiguration of the alarm settings / thresholds.
ALL   r    Replies with the same information as in the heartbeat sent to the
AEM.
...
```

## 5.2 INF command

The INF attribute gives detailed information about a specific attribute (similar to information in this document).

**Example:**

```
AVITEC AB> INF DOO
```

This read-only attribute displays the status of the door, 0=OK, 1=ERROR.
Reply format:
X
X=0 means status is OK
X=1 means status is ERROR
X=- (dash) means status is indeterminable, or alarm source is not measured.
**Example:**

```
GET DOO
```

**Replies:**

```
0
```

meaning status is OK.

# 6 EXTERNAL ALARMS, DOOR AND CONTROLLER TEMPERATURE

Depending on configuration, the repeater might be equipped with an external alarm interface, allowing to monitor external alarm inputs and optionally the door status.

This section documents attributes related to that functionality.

## 6.1 CTM – Controller Temperature

### 6.1.1 Overview

This read-only attribute replies with current temperature in Celsius, and can be used for production verification. A comprehensive reply for each target is implemented in the target specific ALV attribute.

### 6.1.2 Usage

**Reply format:**

```
X
```

where X is reply in degrees Celsius with one decimal point.
**Example:**

```
GET CTM
```

**Reply:**

```
-23.7
```

meaning that current temperature is -23.7 degrees Celsius
**Reply:**

```
42.8
```

means current temperature is +42.8 degrees Celsius.

## 6.2 DOO – displays status of the door alarm source

### 6.2.1 Overview

This read-only attribute displays the status of the door, and is read from the alarmd shared memory.

### 6.2.2 Usage

**Reply format:**

```
X
```

X=0 means status is OK
X=1 means status is ERROR
X=- (dash) means status is indeterminable, or alarm source is not measured.

**Example:**

```
GET DOO
```

**Replies:**

```
0
```

meaning status is OK.

## 6.3 DST – displays status of the door

### 6.3.1 Overview

This read-only attribute displays the current status of the door, and can be used to speed up testing of the repeater or to show actual door status in the RMC as opened or closed, regardless of if door status is in error.

### 6.3.2 Usage

**Format:**

```
X
```

where
X is actual door status.
Reply = 0 means door is closed, while 1 means door is open.

**Example:**

```
GET DST
```

**Reply:**

```
1
```

means door is currently open.

## 6.4 EAC – External alarm configuration

### 6.4.1 Overview

This read and write attribute displays and configures usage of the external alarm

descriptions.

### 6.4.2 Usage

Attribute type: Read and Write

The External Alarm Configuration is used in conjunction with the EAD attribute to configure what additional text is transmitted together with alarms EX1-EX4.

**Format on getting parameter:**

```
GET EAC
```

**Replies:**

```
XYZW
```

where
X is configuration for EX1
Y is configuration for EX2
Z is configuration for EX3
W is configuration for EX4
X, Y, Z, W = 0 means that default text will be attached to alarms EX1-EX4, and
X, Y, Z, W = 1 means that text entered in corresponding External Alarm Description will be attached to the alarm message transmitted to the Axell Element Manager.

**Example:**

```
GET EAC
```

**Replies:**

```
0010
```

means that default alarm message is used in external alarm 1,2 and 4, while external alarm three will have text as configured with SET EAD 3 attached to the alarm message.

**Format on setting parameter:**

```
SET EAC XYZW
```

where X, Y, Z, W configures the usage for alarm description for external pin 1,2, 3 or 4.

**Example:**

```
SET EAC 1100
```

configures EX1 and EX2 to attach alarm description as configured with SET EAD to the alarms transmitted to the Axell Element Manager.

## 6.5 EAD – External alarm description

### 6.5.1 Overview

This read and write attribute displays and configures the external alarm descriptions.

### 6.5.2 Usage

The External Alarm Description allows for giving each external alarm input a unique tag. This allows for easier information about what is connected to each alarm input. Optionally (as configured using attribute EAC), this tag can be included in the additional text field for the alarms transmitted to the repeater OMC.

**Format on getting parameter:**

```
GET EAD X
```

where X indicates the alarm description for external pin 1,2, 3 or 4.
**Example:**

```
GET EAD 3
```

**Replies:**

```
UPS Power Failure
```

meaning that external alarm 3 description is "UPS POWER FAILURE".
**Format on setting parameter:**

```
SET EAD X [Alarm Pin Description]
```

where X indicates the alarm description for external pin 1,2, 3 or 4.
[Alarm Pin Description] is the actual description for this alarm source. Maximum length of string is 35 characters including any spaces.
**Example:**

```
SET EAD 4 Radio Hut Door
```

sets the alarm description for external alarm pin 4 to Radio Hut Door

**Note!** Any extra spaces between words will be removed, ensuring that only one space separates each word in the alarm pin description. If extra spaces are required between words, the description can be put in double quotes, such as
SET EAD 2 "Description with many spaces"

## 6.6 EST – External Input Status

### 6.6.1 Overview

This read-only attribute displays the current status of the external alarm input pins, and is mainly used for advanced trouble shooting and production test. The actual levels are displayed without any mapping to the EXT attribute.

### 6.6.2 Usage

**Format:**

```
X Y Z W
```

where
X is level on external alarm pin 1.
Y is level on external alarm pin 2.
Z is level on external alarm pin 3.
W is level on external alarm pin 4.
Reply = 0 means input on pin is 0, while 1 means input is high.
**Example:**

```
GET EST
```

**Reply:**

```
0 1 1 0
```

means that pins 3 and 4 have high inputs while pin 1 and 4 have low inputs.

## 6.7 EX1 – status of external alarm input 1

### 6.7.1 Overview

This read-only attribute displays the status of the external alarm input 1.

### 6.7.2 Usage

**Reply format:**

```
X
```

X=0 means status is OK
X=1 means status is ERROR
X=- (dash) means status is indeterminable, or alarm source is not measured.

**Example:**

```
GET EX1
```

**Replies:**

```
0
```

meaning status is OK.

## 6.8 EX2 – displays status of external alarm input 2

### 6.8.1 Overview

This read-only attribute displays the status of the external alarm input 2.

### 6.8.2 Usage

**Reply format:**

```
X
```

X=0 means status is OK
X=1 means status is ERROR
X=- (dash) means status is indeterminable, or alarm source is not measured.

**Example:**

```
GET EX2
```

**Replies:**

```
0
```

meaning status is OK.

## 6.9 EX3 – displays status of external alarm input 3

### 6.9.1 Overview

This read-only attribute displays the status of the external alarm input 3.

### 6.9.2 Usage

**Reply format:**

```
X
```

X=0 means status is OK
X=1 means status is ERROR
X=- (dash) means status is indeterminable, or alarm source is not measured.

**Example:**

```
GET EX3
```

**Replies:**

```
0
```

meaning status is OK.

## 6.10 EX4 – displays status of external alarm input 4

### 6.10.1 Overview

This read-only attribute displays the status of the external alarm input 4.

### 6.10.2 Usage

**Reply format:**

```
X
```

X=0 means status is OK
X=1 means status is ERROR
X=- (dash) means status is indeterminable, or alarm source is not measured.

**Example:**

```
GET EX4
```

**Replies:**

```
0
```

meaning status is OK.

## 6.11 EXT – External alarm pin configuration

### 6.11.1 Overview

This read and write-attribute configures if absence or presence of signal should cause an alarm on the external alarm inputs.

### 6.11.2 Usage

This read and write attribute configures the polarity of the external alarm inputs.

**Format:**

```
X Y Z W
```

X is configuration for alarm pin 1
Y is configuration for alarm pin 2

Z is configuration for alarm pin 3
W is configuration for alarm pin 4
0 means that no voltage is the OK state, i.e. a voltage applied to the pin generates an alarm
1 means that applied voltage is the OK state, i.e. absence of voltage generates an alarm

**Note!** If the pin is not used for alarm input, the configuration should be '0'.
**Example:**

```
GET EXT
```

**Replies:**

```
0 0 1 0
```

means that pin 3 normally should have a voltage applied, and that the other pins either normally should NOT have a voltage applied, or are not in use.
**Example:**

```
SET EXT 0 0 1 1
```

Configures alarm pins 1 and 2 to report OK if no voltage is available, and pin 3 and 4 to require a voltage applied in order to be in OK state.

# 7 ALARM CONFIGURATIONS

This section defines all attributes used to configure each individual alarm source. It also describes attributes related to the relay output / summary alarm which is used in certain repeaters.

## 7.1 ACL – Alarm Class Configuration

### 7.1.1 Overview

This attribute allows for reconfiguration of the default alarm classes.

### 7.1.2 Usage

Attribute type: Read and Write

This attribute allows for reconfiguration of the default alarm classes.

**Format on setting alarm class:**

```
<attribute> <class>
```

<attribute> is the alarm attribute to configure, such as DOO, EX1 etc
<class> is one of the X.733 and X.721 alarm classification, and can be any of the following
CO – meaning that this is a communications related command.
QS – indicates that the alarm affects quality of service.
PR – this alarm class is normally associated with software or processing faults.
EQ – equipment alarms means that something is wrong with the actual hardware.
EN – environmental alarm types indicates that the alarm is related to the enclosing or surroundings of the equipment.

**Examples:**

```
SET ACL DOO EN
```

configures the door alarm to be an environmental alarm.

```
SET ACL PW1 EQ
```

configures the PW1 alarm source to be an alarm related to equipment failure.

```
GET ACL PDL
```

Reply:

```
QS
```

means that PDL alarm affects quality of service on the equipment.

**Note!** Axell Wireless equipment is always delivered with recommended alarm configurations, why reconfiguring the alarm class should only be performed under special circumstances, except for the EX1-EX4 alarms, which are implementation specific.

## 7.2 AC1 – Compressed Alarm Severity and Alarm Class Configurations

### 7.2.1 Overview

A compact message retrieving alarm severity and alarm class for a number of alarm sources.

### 7.2.2 Usage

Attribute type: Read only

This is a compact message to retrieve Severity and Class of the different alarm sources EX1, EX2, EX3, EX4, DOO, VLI, LGO, CLR, FWU, FWF, UAD, UDE, UPM, UDM, UPW and RXQ.

**Format:**

```
<SevEX1> <ClassEX1> <SevEX2> <ClassEX2> .. <SevRXQ> <ClassRXQ>
```

**Example:**

```
GET AC1
```

**Replies:**

```
CR EN CR EN CR EN CR EN WA EN WA EN WA EN MI EN WA PR WA PR WA PR WA PR WA PR WA EN
```

which are the severities and classes for the alarm sources EX1..RXQ.

**Note!** The alarm severities and alarm classes can also be read and set with commands

```
GET/SET ASE
```

and

```
GET/SET ACL
```

## 7.3 AL1 - Compressed Alarm Format

### 7.3.1 Overview

A compact message retrieving alarm configurations for EX1, EX2, EX3, EX4 and

DOO.

### 7.3.2 Usage

Attribute type: Read only

This is a compact message of the alarm configuration strings. This attribute replies with the configuration of the alarm sources EX1, EX2, EX3, EX4 and DOO.

The use of the attribute is mainly to increase the speed of repeater installations into the Axell Element Manager and to present parameters in the Repeater Maintenance Console.

**Example:**

```
GET AL1
```

**Replies:**

```
2 0 4 0 0 3 2 0 4 0 0 3 2 0 4 0 0 3 2 0 4 0 0 3 2 0 4 0 0 3 10 2 0 1 -30 60 3
```

which are the alarm configuration strings received as if using the commands

```
GET ALA EX1
GET ALA EX2
GET ALA EX3
GET ALA EX4
GET ALA DOO
GET ALA TEM
```

For a detailed description of the different alarm attributes and alarm strings, please refer to attribute ALA.

## 7.4 AL2 - Compressed Alarm Format

### 7.4.1 Overview

A compact message retrieving alarm configurations for VLI, LGO, CLR, FWU, FWF and RXQ.

### 7.4.2 Usage

Attribute type: Read only

Same as attribute AL1, but replies with configuration for alarm sources VLI, LGO, CLR, FWU, FWF and RXQ.

## 7.5 AL3 - Compressed Alarm Format

### 7.5.1 Overview

A compact message retrieving alarm configurations for UAD, UDE, UPM, UDM and UPW.

### 7.5.2 Usage

Attribute type: Read only

Same as attribute AL1, but replies with configuration for alarm sources UAD, UDE, UPM, UDM and UPW.

## 7.6 ALA – Configuring the alarm parameters

### 7.6.1 Overview

This attribute allows for reading and writing of the alarm configurations.

### 7.6.2 Usage

Attribute type: Read and Write

This attribute configures the alarm measurements and alarm handling on an attribute by attribute basis.

**Format:**

```
<attribute> <enab> <ack> <usage> <lower> <upper> <time>
```

<attribute> is the alarm source to configure, such as TEM, EX1 etc.
<enab> has double functionality. It determines whether an alarm should be send if error is detected, and it also configures whether the alarm relay should be affected by the alarm source.
<enab> = 0 means alarm transmission enabled, but alarm doesn't affect the relay output
<enab> = 1 means alarm transmission disabled, and does not affect the relay.
<enab> = 2 means alarm transmission is enabled, and alarm affects the relay output.
<enab> = 3 means alarm transmission is disabled, but alarm affects relay output

<ack> determines whether an alarm requires to be acknowledged or not.
<ack> = 0 means Acknowledge required
<ack> = 1 means No acknowledge required

When using circuit switched data, an alarm is considered acknowledged when the repeater has successfully logged in to the OMC, and delivered the alarm. In case of SMS, an alarm is considered acknowledged when an acknowledge message is received from the main address or when delivered to the SMSC, depending on configuration in the SAC attribute. The alarms can also be acknowledged with the command ACT ACK when logged in locally or remotely. If an alarm is not acknowledged, it will be retransmitted up to MNR (maximum number of retransmissions) times, with RCA (repetition cycle for alarms ) minute's interval. Refer to attributes MNR and RCA on how to configure these settings.

<usage> is a threshold indicator, indicating how thresholds are used for this particular alarm source.
<usage> = 1 means that both thresholds are used for alarm calculation.
<usage> = 2 means that lower threshold is used
<usage> = 3 means that upper threshold is used
<usage> = 4 means that thresholds are ignored, i.e. digital measurement.

**Note!** Changing <usage> parameter will change the way the alarm source is measured. In order to avoid erroneous system behaviour, this parameter should never be changed.

<lower> is the value of the lower threshold used for alarm calculation.

<upper> is the value of the upper threshold used for alarm calculation.

<time> is the time an alarm has to be in erroneous state before an alarm is triggered.

**Example:**

```
GET ALA TEM
```

**Returns:**

```
0 0 1 -15 60 5
```

This means that alarm is enabled and acknowledge required. Both thresholds are used in measuring the alarm, lower threshold is -15 (degrees), 60 (degrees) is the upper threshold and that the temperature has to be higher than 60 for 5 seconds before an alarm is triggered.

**Example:**

```
SET ALA TEM 0 0 1 0 60 20
```

Modifies the above alarm source to generate an alarm when the temperature has been above 60 degrees or below 0 degrees for more than 20 seconds.

## 7.7 ASE – Alarm Severity Configuration

### 7.7.1 Overview

This attribute allows for reconfiguration of the alarm severity.

### 7.7.2 Usage

Attribute type: Read and Write

This attribute allows for reconfiguration of the default alarm severity on an attribute by attribute basis..

**Format on setting alarm severity:**

```
<attribute> <severity>
```

<attribute> is the alarm attribute to configure, such as DOO, EX1 etc
<severity> is one of the X.733 specified alarm severities, and can be any of the following:

CR – A Critical alarm is an alarm which affects the functionality of the equipment. This type of alarm requires immediate action.

MA – A Major alarm can cause degradation of the equipment functionality and should be investigated within a short time.

MI - A Minor alarm should be investigated but is not urgent.

WA – The Warning severity level indicates that something has occurred that does not affect the operation of the equipment but may be important to notice. For

example, someone has logged on to the system.

**Examples:**

```
SET ASE DOO WA
```

configures the door alarm to have severity level Warning

```
SET ASE PW1 CR
```

configures the PW1 alarm to be a Critical alarm.

```
GET ASE EX1
```

**Reply:**

```
MI
```

means that EX1 alarm severity level is configured as Minor.

**Note!** Axell Wireless equipment is always delivered with recommended alarm configurations, why reconfiguring the alarm severity should only be performed under special circumstances, except for the EX1-EX4 alarms, which are implementation specific.

## 7.8 LIT – Alarm Log Item

### 7.8.1 Overview

This attribute returns information about entries in the alarm log.

### 7.8.2 Usage

Attribute type: Read only

This attribute returns an entry in the alarm log,
**Format:**

```
GET LIT <ItemNo>
```

Reads alarm log entry number <ItemNo> from the alarm log, where the oldest entry in the alarm is number 1. <ItemNo> might be from 1 to value replied by GET LLN.
**Reply format in NON Node Masters:**

```
<Alarm Time> <Alarm Date> <System Event Number> <Attribute> <Hardware Enum> <Position
Identifier> <Alarm Status> <Severity> <Class>  <Ack> <Retransmissions Left>
<Completed At Time> <Completed At Date> <Additional Text>
```

<Alarm Time> - Time on the format HHMMSS when alarm occurred.
<Alarm Date> - Date on the format DDMMYY when alarm occurred
<System Event Number> - Unique identifier for the system event in the interval 0..231.
<Attribute> - Attribute name identifying alarm type, i.e. DOO, TEM, EX1 etc.
<Hardware Enum> - Unique identifier for the hardware being the originator of the alarm, such as HIB1, LUL2, FDM1 etc. If not used, a '-' (dash) is reported.
<Position Identifier> - Unique identifier for the position within hardware being the originator of the alarm. Can also contain user information in case of alarms VLI, LGO, CLR and ILI.
<Alarm Status> - this determines the actual status of the measurement. 0 means OK, 1 means ERROR. If parameter is not used, a '-' (dash) is reported.
<Severity> - Alarm Severity, which is one of CR (Critical), ID (Indeterminate), WA (Warning), MA (Major), MI (Minor), CL (Cleared / Alarm Ceased).

<Class> - Alarm Class, which is one of EN (Environmental), EQ (Equipment), CO (Communications), PR (Processing) or QS (Quality of Service)
<Ack> - Indicates whether alarm is acknowledged or not. 0 = No, 1 = Yes
<Retransmissions Left> - Number of Retransmissions Left before giving up to try transmitting alarm to the AEM.
<Completed At Time> - Time on the format HHMMSS when alarm was successfully transmitted to the OMC. If alarm is not yet delivered, a '-' (dash) is replied.
<Completed At Date> - Date on the format DDMMYY when alarm was successfully transmitted to the OMC. If alarm is not yet delivered, a '-' (dash) is replied.
<Additional Text> - A quoted string containing additional information about the alarm, such as "Current out level is +26 dBm".

**Reply format in Node Masters:**

```
<Originating Node> <Alarm Time> <Alarm Date> <System Event Number> <Attribute>
<Hardware Enum> <Position Identifier> <Alarm Status> <Severity> <Class>  <Ack>
<Retransmissions Left>  <Completed At Time> <Completed At Date> <Additional Text>
```

<Originating Node> - indicates node that alarm was generated on. Node Master is always node zero.
<Alarm Time> - Time on the format HHMMSS when alarm occurred.
<Alarm Date> - Date on the format DDMMYY when alarm occurred
<System Event Number> - Unique identifier for the system event in the interval 0..231.
<Attribute> - Attribute name identifying alarm type, i.e. DOO, TEM, EX1 etc.
<Hardware Enum> - Unique identifier for the hardware being the originator of the alarm, such as HIB1, LUL2, FDM1 etc. If not used, a '-' (dash) is reported.
<Position Identifier> - Unique identifier for the position within hardware being the originator of the alarm. Can also contain user information in case of alarms VLI, LGO, CLR and ILI.
<Alarm Status> - this determines the actual status of the measurement. 0 means OK, 1 means ERROR. If parameter is not used, a '-' (dash) is reported.
<Severity> - Alarm Severity, which is one of CR (Critical), ID (Indeterminate), WA (Warning), MA (Major), MI (Minor), CL (Cleared / Alarm Ceased).
<Class> - Alarm Class, which is one of EN (Environmental), EQ (Equipment), CO (Communications), PR (Processing) or QS (Quality of Service)
<Ack> - Indicates whether alarm is acknowledged or not. 0 = No, 1 = Yes
<Retransmissions Left> - Number of Retransmissions Left before giving up to try transmitting alarm to the AEM.
<Completed At Time> - Time on the format HHMMSS when alarm was successfully transmitted to the OMC. If alarm is not yet delivered, a '-' (dash) is replied.
<Completed At Date> - Date on the format DDMMYY when alarm was successfully transmitted to the OMC. If alarm is not yet delivered, a '-' (dash) is replied.
<Additional Text> - A quoted string containing additional information about the alarm, such as "Current out level is +26 dBm".

**Note!** If no log entry exists in log at this position, a single '-' (dash) is replied.

## 7.9 LLN – Alarm Log Length

### 7.9.1 Overview

This replies with number of alarms in alarm log at the moment.

### 7.9.2 Usage

Attribute type: Read only

**Format:**

```
<Number of alarm log entries>
```

where <Number of alarm log entries> is an integer indicating how many alarms are currently in the alarm log.

**Example:**

```
GET LLN
```

**Returns:**

```
89
```

meaning that there are 89 alarms that can be read out from the alarm log, starting with log item 1.

## 7.10 MAR – Minimum Alarm Repetition Cycle

### 7.10.1 Overview

This attribute defines minimum time that must elapse between two concurrent alarms from the same alarm source.

### 7.10.2 Usage

Attribute type: Read and Write

If there is an alarm toggling between OK and ERROR, the controller will continuously send alarms to the Axell Element Manager, with the new alarm detected, and then directly end of alarm, causing the communications interface between the controller and the AEM to be blocked for a long time. If lots of alarms are received at the AEM, the operator must be able to send a message to disable the particular alarm at the controller until service of the unit has been performed. The Minimum Alarm Repetition Cycle takes care of this problemby defining a minimum time between two consecutive alarms from the same alarm source. Typically the MAR should be set to a minimum of two or three times the time it takes for the controller to report the alarm to the OMC.

**Format:**

```
<Minimum Alarm Repetition>
```

<Minimum Alarm Repetion> is an integer representing number of minutes between each alarm. Allowed interval is from 0 (disabling this functionality) to 99 minutes.

**Example:**

```
GET MAR
```

**Reply:**

```
3
```

meaning that the minimum time between two consecutive alarms is three minutes.

**Example:**

```
SET MAR 4
```

changes this interval to four minutes.

**Note!** The first error will always be detected with the normal threshold time, only the repeated alarms will be blocked/delayed.

## 7.11 MNR – Maximum Number of Alarm Retransmissions

### 7.11.1 Overview

This attribute defines how many consecutive retransmissions will be attempted when trying to transmit alarms to the Axell Element Manager.

### 7.11.2 Usage

Attribute type: Read and Write

**Format:**

```
<Max Retransmissions>
```

where <Max Retransmission> indicates maximum number of retransmissions for each alarm. When using circuit switched data, an alarm is considered acknowledged when the repeater has successfully logged in to the OMC, and delivered the alarm. In case of SMS, an alarm is considered acknowledged when an acknowledge message is received from the main address or when delivered to the SMSC, depending on configuration in the SAC attribute. Every alarm is sent to the OMC up to MNR number of times, or until it is acknowledged. The alarms are retransmitted with RCA minutes intervals. The alarms can also be acknowledged with the command ACT ACK when logged in locally or remotely.

**Example:**

```
GET MNR
```

**Reply:**

```
3
```

means that each alarm will be retransmitted up to three times.

**Example:**

```
SET MNR 4
```

changes maximum number of retransmissions to 4.

**Note!** When setting the MNR parameter, all non acknowledged alarms have their corresponding alarm retransmission counter cleared, i.e no more attempts will be made to transmit alarms from the alarm log.

## 7.12 NUA – Next Unacknowledged Alarm

### 7.12.1 Overview

This attribute returns information about the first/oldest non-acknowledged alarm in the alarm log, still having retransmissions left before giving up trying to transmit the alarm.

## 7.12.2 Usage

Attribute type: Read only

This attribute returns an entry in the alarm log on the same format as the LLN attribute, with an additional leading Alarm Log Item number, identifying at what position in the alarm log this item is available.

**Format:**

```
GET NUA
```

Reads alarm log for the oldest entry not being acknowledged.

**Reply format for NON-Node Masters:**

```
<Log Item#> <Alarm Time> <Alarm Date> <System Event Number> <Attribute> <Hardware
Enum> <Position Identifier> <Alarm Status> <Severity> <Class>  <Ack> <Retransmissions
Left>  <Completed At Time> <Completed At Date> <Additional Text>
```

<Log Item#> - Position in the alarm log where this alarm message currently is available (this might vary over time, as new alarms might arrive during the login session).
<Alarm Time> - Time on the format HHMMSS when alarm occurred.
<Alarm Date> - Date on the format DDMMYY when alarm occurred
<System Event Number> - Unique identifier for the system event in the interval 0..231.
<Attribute> - Attribute name identifying alarm type, i.e. DOO, TEM, EX1 etc.
<Hardware Enum> - Unique identifier for the hardware being the originator of the alarm, such as HIB1, LUL2, FDM1 etc. If not used, a '-' (dash) is reported.
<Position Identifier> - Unique identifier for the position within hardware being the originator of the alarm. Can also contain user information in case of alarms VLI, LGO, CLR and ILI.
<Alarm Status> - this determines the actual status of the measurement. 0 means OK, 1 means ERROR. If parameter is not used, a '-' (dash) is reported.
<Severity> - Alarm Severity, which is one of CR (Critical), ID (Indeterminate), WA (Warning), MA (Major), MI (Minor), CL (Cleared / Alarm Ceased).
<Class> - Alarm Class, which is one of EN (Environmental), EQ (Equipment), CO (Communications), PR (Processing) or QS (Quality of Service)
<Ack> - Indicates whether alarm is acknowledged or not. 0 = No, 1 = Yes
<Retransmissions Left> - Number of Retransmissions Left before giving up to try transmitting alarm to the AEM.
<Completed At Time> - Time on the format HHMMSS when alarm was successfully transmitted to the OMC. If alarm is not yet delivered, a '-' (dash) is replied.
<Completed At Date> - Date on the format DDMMYY when alarm was successfully transmitted to the OMC. If alarm is not yet delivered, a '-' (dash) is replied.
<Additional Text> - A quoted string containing additional information about the alarm, such as “Current out level is +26 dBm”.

**Reply format for Node Masters:**

```
<Log Item#> <Originating Node> <Alarm Time> <Alarm Date> <System Event Number>
<Attribute> <Hardware Enum> <Position Identifier> <Alarm Status> <Severity> <Class>
<Ack> <Retransmissions Left>  <Completed At Time> <Completed At Date> <Additional
Text>
```

<Log Item#> - Position in the alarm log where this alarm message currently is available (this might vary over time, as new alarms might arrive during the login session).
<Originating Node> - indicates node that alarm was generated on. Node Master is always node zero.
<Alarm Time> - Time on the format HHMMSS when alarm occurred.
<Alarm Date> - Date on the format DDMMYY when alarm occurred

<System Event Number> - Unique identifier for the system event in the interval 0..231.
<Attribute> - Attribute name identifying alarm type, i.e. DOO, TEM, EX1 etc.
<Hardware Enum> - Unique identifier for the hardware being the originator of the alarm, such as HIB1, LUL2, FDM1 etc. If not used, a '-' (dash) is reported.
<Position Identifier> - Unique identifier for the position within hardware being the originator of the alarm. Can also contain user information in case of alarms VLI, LGO, CLR and ILI.
<Alarm Status> - this determines the actual status of the measurement. 0 means OK, 1 means ERROR. If parameter is not used, a '-' (dash) is reported.
<Severity> - Alarm Severity, which is one of CR (Critical), ID (Indeterminate), WA (Warning), MA (Major), MI (Minor), CL (Cleared / Alarm Ceased).
<Class> - Alarm Class, which is one of EN (Environmental), EQ (Equipment), CO (Communications), PR (Processing) or QS (Quality of Service)
<Ack> - Indicates whether alarm is acknowledged or not. 0 = No, 1 = Yes
<Retransmissions Left> - Number of Retransmissions Left before giving up to try transmitting alarm to the AEM.
<Completed At Time> - Time on the format HHMMSS when alarm was successfully transmitted to the OMC. If alarm is not yet delivered, a '-' (dash) is replied.
<Completed At Date> - Date on the format DDMMYY when alarm was successfully transmitted to the OMC. If alarm is not yet delivered, a '-' (dash) is replied.
<Additional Text> - A quoted string containing additional information about the alarm, such as “Current out level is +26 dBm”.

**Note!** If no log entry exists in log, a single '-' (dash) is replied.

## 7.13 RCA – Repetition Cycle for Alarms

### 7.13.1 Overview

This attribute configures the interval in minutes between each consecutive attempt to send non-acknowledged alarms to the Axell Element Manager.

### 7.13.2 Usage

Attribute type: Read and Write

Every alarm is sent to the OMC up to MNR number of times, or until it is acknowledged. The alarms are retransmitted with RCA minutes intervals. When using circuit switched data, an alarm is considered acknowledged when the repeater has successfully logged in to the OMC, and delivered the alarm. In case of SMS, an alarm is considered acknowledged when an acknowledge message is received from the main address or when delivered to the SMSC, depending on configuration in the SAC attribute. Every alarm is sent to the OMC up to MNR number of times, or until it is acknowledged. The alarms are retransmitted with RCA minutes intervals. The alarms can also be acknowledged with the command

```
ACT ACK
```

when logged in locally or remotely.
**Format:**

```
<Repetition Cycle>
```

<Repetition Cycle> is the interval in minutes between each consecutive attempt to send alarms to the Axell Element Manager.

**Example:**

```
GET RCA
```

**Reply:**

```
10
```

meaning that the interval between retransmissions is 10 minutes.
**Example:**

```
SET RCA 12
```

sets the interval to 12 minutes

## 7.14 RLY – Relay Status

### 7.14.1 Overview

This attribute can be used to readout what system status the relay reflects.

### 7.14.2 Usage

Attribute type: Read only

By reading this attribute, the system status as reported according to relay configurations can be read out.
**Format:**

```
<Status>
```

<Status> is 0 or 1
0 means no alarms configured to activate relay is detected.
1 means that ne or more of the alarms configured to activate the relay is detected.
Please refer to attribute attribute RPL for details on configuration of relay polarity (active open or active closed).

## 7.15 RPL - Relay Polarity

### 7.15.1 Overview

This attribute configures whether one or more error conditions in the system should open or close the relay circuitry.

### 7.15.2 Usage

Attribute type: Read and Write

This attribute is used to configure how the relay circuitry should treat an error condition.
**Format:**

```
N
```

N is 0 or 1
0 means that a detected error closes the relay circuit (relay is active closed)
1 means that a detected error opens the relay circuit (relay is active open)
**Example:**

```
SET RPL 1
```

configures the controller to open the relay circuit in case a failure is detected.

```
SET RPL 0
```

configures the controller to close the relay circuit in case a failure is detected.

# 7.16 RTN – Relay Test On Interval

## 7.16.1 Overview

This parameter is used for special test purposes and configures the On time during relay testing.

## 7.16.2 Usage

Attribute type: Read and Write

In order to test the external relay output it is possible to force a test procedure, causing the relay to be turned off for a while, then turned on and finally turned off again during a configured interval before going back to the original state. This attribute configures number of seconds the relay should be in ON-state during the test phase.

**Format:**

```
<On-time>
```

where <On-time> is the number of seconds in on state.

**Example:**

```
GET RTN
```

**Reply:**

```
10
```

means that the relay is in on state for 10 seconds.

**Example:**

```
SET RTN 5
```

changes this value to 5 seconds.

# 7.17 RTF – Relay Test Off Interval

## 7.17.1 Overview

This parameter is used for special test purposes and configures the Off time during relay testing.

## 7.17.2 Usage

Attribute type: Read and Write

In order to test the external relay output it is possible to force a test procedure, causing the relay to be turned off for a while, then turned on and finally turned off again during a configured interval before going back to the original state. This attribute configures number of seconds the relay should be in OFF-state during the

test phase.

**Format:**

```
<Off-time>
```

where <Off-time> is the number of seconds in off state.
**Example:**

```
GET RTF
```

**Reply:**

```
3
```

means that the relay is in off state for 3 seconds.
**Example:**

```
SET RTF 2
```

changes this value to 2 seconds.

## 7.18 ACT ACK – Acknowledge Alarm

### 7.18.1 Overview

This action acknowledges alarm log entries, causing them not to be transferred to the Axell Element Manager.

### 7.18.2 Usage

Attribute type: Write-Only Action

This action acknowledges entries in the alarm log and requires Read and Write access when logged in. Via SMS, this can only be performed by the Main Address.
**Format:**

```
ACT ACK <SysEvent>
```

X is alarm log entry having system event numberssage number <SysEvent>, which might be a number in the interval 0..231.
**Example:**

```
ACT ACK 197
```

acknowledges alarm with system event number 197

**Note!** No reply is given to this action (unless a illegal command or system failure occurs). This means that acknowledging non existing alarms or alarms already being acknowledged is possible.

## 7.19 ACT CLO – Clear Alarm Log

### 7.19.1 Overview

Executing this action clears the alarm log.

### 7.19.2 Usage

Attribute type: Write-Only Action

This action clears all alarms from the alarm log, and requires Read and Write access when logged in. Via SMS, this can only be performed by the Main Address.

## 7.20 ACT TRE – Test relay

### 7.20.1 Overview

This action initiates a procedure to test the relay circuit.

### 7.20.2 Usage

Attribute type: Write-Only Action

For installation testing purposes, it is possible to test the open / close function of the relay. This test procedure makes sure the relay is closed for a configurable number of seconds seconds, then opens for a configurable number of seconds, and finally closes for configurable seconds before going back to original state. Please refer to attribbutes RTF and RTN for configuratio details.
This action requires Read and Write access when logged in. Via SMS, this can only be performed by the Main Address.
**Example:**

```
ACT TRE
```

will initiate a relay circuit test, where default values are OFF for 3 seconds, ON for 10 seconds and finally OFF for 3 seconds again.

**Note!** During this test interval, the relay connection will be unaffected by all alarms.

## 7.21 LOGDUMP ALARM

### 7.21.1 Overview

This command generates a list of alarms.

### 7.21.2 Usage

By using the command LOGDUMP ALARM, it is possible to read out alarms from the alarm logs. The format of each line is the same as read out using the LIT attribute.

**Format:**

```
LOGDUMP ALARM <Start> <Stop>
```

where
<Start> is the first entry that should be read from the log, <Start> must be greater than 0.
<Stop> is the last entry that should be read from the log, and must be greater than or equal to <Start>.
**Example:**

```
LOGDUMP ALARM 15 20
```

**Reply:**

```
040820 020100 375 EX1 CTRL - 1 WA EN 0 -1 000001 010170 "Error on external alarm 1"
033023 020100 374 UDE - testing 1 WA PR 0 3 000001 010170 "User testing deleted from
system."
032932 020100 373 LGO - useradmin 1 WA EN 0 3 000001 010170 "User logged out"
032910 020100 372 VLI - useradmin 1 WA EN 0 3 000001 010170 "User logged in from IP
126.1.24.163"
032854 020100 371 UPW - useradmin 1 WA PR 0 3 000001 010170 "Password changed for
useradmin by user root"
032643 020100 370 VLI - avitec 1 WA EN 0 3 040813 020100 "User logged in from IP
126.1.24.163"
```

**Note 1!** A maximum of 100 log items can be read out at a time. If item does not exist, no reply is given.
**Note 2!** If this is a node master, LIT will contain a leading node number, indicating what node this alarm was originated on. Node master is always node number zero.

# 8 MODEM AND COMMUNICATION SETTINGS

This section describes all attributes related to modem settings and remote communication parameters.

## 8.1 ADD – SMS Access List

### 8.1.1 Overview

This attribute configures what numbers are allowed to communicate with the repeater using SMS.

### 8.1.2 Usage

Attribute type: Read and Write

When SMS is used for communication, addresses 1 to 4 indicates addresses that are allowed to read and write attributes from the controller. All addresses have read access to the controller, but only address one and two can set parameters and perform ACT commands.
**Reply format:**

```
1 X 2 Y 3 Z 4 W
```

X is address 1, Y address 2, Z address 3 and W is address 4. If no address is available, a '-'(dash) is replied.
**Example:**

```
GET ADD
```

**Reply:**

```
1 +46705511125 2 – 3 +46705521334 4 –
```

**Format on setting address:**

```
SET ADD N <MSISDN>
```

where N denotes which of the addresses from 1-4 that should be configured, and <MSISDN> is the telephone number to set. Max length of<MSISDN> is 20 characters.
**Example:**

```
SET ADD 3 +46705511125
```

Configures address number three to be +46705511125. When data call communication is used, this attribute is obsolete.

**Note!** Using the attribute MAD it is possible to configure which of these four addresses should receive alarms and reports.

## 8.2 ASC – Address of Service Center

### 8.2.1 Overview

This defines the address (MSISDN or IP-address) where to send alarms and reports.

### 8.2.2 Usage

Attribute type: Read and Write

The address to the service center is where to send alarms and reports, and can be either a telephone number, or if TCP/IP is used (GPRS or Ethernet), the IP address or host name of the Axell Element Manager.

**Format:**

```
<Address>
```

where address is a number or server name (if using TCP/IP or GPRS) with a maximum length of 30 characters.

**Example:**

```
GET ASC
```

**Reply:**

```
+46705008999
```

means that the controller will connect to MSISDN +46705008999 to deliver alarms and reports (assuming data call is used for remote communication). The controller can optionally call a secondary OMC address in case message is undeliverable to the ASC address. Please refer to attribute SSC attribute for details.

**Example:**

```
SET ASC axell_element_manager
```

uses the address axell_element_manager address for delivery of alarms and reports (assuming TCP/IP or GPRS communication and that DNS is configured properly).

**Note!** Setting the address to an empty string will disable the sending of alarms to the Axell Element Manager, while the controller is still available for remote login.

**Example:**

```
SET ASC
```

disables the sending of alarms and reports.

## 8.3 CDE – Communications Device Enabled

### 8.3.1 Overview

This attribute enables and disables the remote communication (both incoming and outgoing).

### 8.3.2 Usage

Attribute type: Read and Write

**Format:**

```
<Enabled>
```

where <Enabled> = 1 means that remote communication is enabled, and <Enabled> = 0 means remote communication is disabled.

**Example:**

```
GET CDE
```

**Reply:**

```
0
```

means remote communication is disabled.

**Example:**

```
SET CDE 1
```

enables remote communication with method as configured by attribute DEV.

## 8.4 CSL – Communications Support List

### 8.4.1 Overview

This presents a list of all communication devices and corresponding supported communication methods available in the controller.

### 8.4.2 Usage

Attribute type: Read-Only

This attribute produces a reply with all communication methods available over each device.

**Format:**

```
<Dev1:Method1> <Dev1:Method2> ... <DevM:MethodN>
```

where Dev1..DevM enumerates all the modem types supported by the system, and Method1..MethodN denotes the different communication methods supported by this is one token, and each field is separated by space. If no modems supporting data call are available, a '-' (dash) is replied.

**Example:**

```
GET CSL
```

**Reply:**

```
MC45:DTC MC45:SMS MC45:GPRS ETH:TCP
```

means that the modem MC45 available on this controller supports DataCall, SMS, GPRS, and that the controller contains an Ethernet device, which can transmit alarms and reports using a normal TCP connection to the AEM. By using the attribute DDS, a textual description of the device type can be obtained, and by using the attribute CMD a textual description of the communications method can be obtained.

## 8.5 DEV – Device type and Communications Method

### 8.5.1 Overview

This determines and configures the device type and communications method for remote communications to and from the controller.

### 8.5.2 Usage

Attribute type: Read and Write

This attribute handles the device and method used for remote communication to the Axell Element Manager.

**Format:**

```
<Device>:<Method>
```

where <Device> denotes what communications device should be used, and <Method> informs about the communications method used.

**Example:**

```
GET DEV
```

**Reply:**

```
MC55:SMS
```

meaning that communications device used is the MC55 module, and that SMS is used for alarm and report transmission.

**Example:**

```
SET DEV MC55:DTC
```

changes this to use Data Call over the MC55 module.

**Note!** Use attribute CSL to determine all combinations of <Device> and <Method> supported by the system.

## 8.6 DDS – Device Description

### 8.6.1 Overview

This returns a string with a textual description of the device type as supplied in the GET message.

### 8.6.2 Usage

Attribute type: Read-Only

This attribute replies with a textual description of a device type. This can be used to get more detailed information about the current modem / device type used for remote communication.

**Format:**

```
GET DDS <Device>
```

**Reply:**

```
<Device Description>
```

where <Device> is a valid device type supported by the system and <Device Description> is a textual description of the device.

**Example:**

```
GET DDS TRM-1
```

**Reply:**

```
TrioRail GSM-R Module
```

which in detail describes the device type.

## 8.7 CMD – Communications Method Description

### 8.7.1 Overview

This returns a string with a textual description of the communication method as supplied in the GET message.

### 8.7.2 Usage

Attribute type: Read-Only

This attribute replies with a textual description of a communications method. This can be used to get more detailed information about the current communications method used for remote communication.

**Format:**

```
GET CMD <Method>
```

**Reply:**

```
<Method Description>
```

where <Method> is a valid communications method supported by the system and <Method Description> is a textual description of the method.

**Example:**

```
GET CMD DTC
```

**Reply:**

DataCall/Circuit Switched Data using modem connection.
which in detail describes the communications method.

## 8.8 LPC – Last Power Cycling of modem

### 8.8.1 Overview

This attribute is used to determine last power cycling of the modem.

### 8.8.2 Usage

Attribute type: Read only

The controller can be configured to automatically turn off and turn on the modem once per day. This feature can be used to ensure that the modem parameters when using for example GSM modems contain the latest network parameters such as HLR update interval etc.

This attribute displays when last power cycling of the modem was performed.
**Format:**

```
HHMMSS DDMMYY
```

HHMMSS is the time point, with 24 hours notation, and DDMMYY is the date when last modem power cycling (more precisely last modem power ON) was performed.
**Example:**

```
GET LPC
```

**Reply:**

```
201300 110503
```

indicating that the modem was last power cycled on 11'th of May 2003 at 20:13.
Attribute MPE is used to configure if automatic modem power cycling should be enabled. Timepoint for when to power cycling the modem can be set with attribute MPT.

In order to perform an instant modem power cycling, please refer to attribute ACT RCD.

## 8.9 MAD – Main Address

### 8.9.1 Overview

Main address configures which address from the SMS access list should receive alarms and reports.

### 8.9.2 Usage

Attribute type: Read and Write

When SMS is used for communication, the controller contains a list of four addresses that are allowed to read and write attributes from the controller (refer to attribute ADD for a description of how to modify the list). All addresses have read access to the controller, but only address one and two can set parameters and perform ACT commands. However, alarms and reports are always sent to the main address.
Main Address select which one of the four addresses in the list is the main address.
**Format:**

```
<Main Address>
```

<Main Address> is a selector from 1 to 4.
**Example:**

```
GET MAD
```

**Reply:**

```
3
```

means that address number three is the main address.
**Example:**

```
SET MAD 2
```

changes main address to two.
**Note!** When communication is done via Data Call (refer to attribute DEV), attribute MAD is obsolete.

## 8.10 MCT – Modem Connect Time

### 8.10.1 Overview

Used to configure timeout when attempting to setup a modem connection.

### 8.10.2 Usage

Attribute type: Read and Write

When a repeater is dialling the OMC to deliver an alarm or a report, the controller will wait up to MCT seconds for the call to be established. If no communication is established within this time, the call will be hung up.

**Format:**

```
<Timeout>
```

<Timeout> is the maximum connection time in seconds.

**Example:**

```
GET MCT
```

**Reply:**

```
45
```

meaning that the repeater will wait up to 45 seconds for a call to be established.

**Example:**

```
SET MCT 50
```

changes the timeout to 50 seconds.

## 8.11 MIS – Modem Initialization String

### 8.11.1 Overview

This is used to configure the modem initialization string.

### 8.11.2 Usage

Attribute type: Read and Write

In order for some modems to work correctly in a network, they might require different configurations. The configuration is modified with this attribute.

**Format:**

```
<String>
```

<string> is the actual modem initialization string.

**Example:**

```
GET MIS
```

**Reply:**

```
AT+CBST=7,0,1
```

which is the modem specific modem initialization string.

**Example:**

```
SET MIS AT+CBST=71,0,1
```

modifies the modem initialization string.

**Note 1!** Modem string must NOT contain any white space (blanks).

**Note 2!** If logged in remotely, the changes will not take effect until the user logs out from the controller. As soon as the user logs out and disconnects, the initialization of the modem will be initiated.

## 8.12 MPE – Automatic Power Cycling Enabled

### 8.12.1 Overview

By configuring this, the modem can be automatically power cycled once per day.

### 8.12.2 Usage

Attribute type: Read and Write

The controller can be configured to automatically turn off and turn on the modem once per day. This feature can be used to ensure that the modem parameters when using for example GSM modems contain the latest network parameters such as HLR update interval etc. This attribute configures whether automatic power cycling should be enabled or not.
**Format:**

```
<Enabled>
```

<Enabled> = 1 means modem power cycling is enabled
<Enablde> = 0 means modem power cycling is disabled
**Example:**

```
GET MPE
```

**Reply:**

```
1
```

means that the modem power cycling is enabled.
**Example:**

```
SET MPE 0
```

disables the automatic modem power cycling.
Timepoint for when to power cycling the modem can be set with attribute MPT. In order to read out modem Power Cycling timepoint, use attribute LPC. In order to perform an instant modem power cycling, please refer to attribute ACT RCD.

## 8.13 MPT – Automatic Power Cycling Timepoint

### 8.13.1 Overview

Configures at what time of the day automatic modem power cycling should be performed.

### 8.13.2 Usage

Attribute type: Read and Write

The controller can be configured to automatically turn off and turn on the modem once per day. This feature can be used to ensure that the modem parameters when using for example GSM modems contain the latest network parameters such as HLR update interval etc. This attribute configures at what timepoint the modem power cycling should be performed.

**Format:**

```
HHMMSS
```

HH is the hours (in 24 hour notation), MM is minutes and SS is seconds specifying the modem power cycling timepoint.

**Example:**

```
GET MPC
```

**Reply:**

```
010000
```

means that the modem power cycling is performed att one in the morning.

**Example:**

```
SET MPC 160000
```

configures modem power cycling to be performed at 4 in the afternoon. Enabling / Disabling of the automatic power cycling can be configured with attribute MPE. Timepoint for when to power cycling the modem can be set with attribute MPT. In order to read out Last modem Power Cycling timepoint, use attribute LPC. In order to perform an instant modem power cycling, please refer to attribute ACT RCD.

## 8.14 NCT – Network Connect Time

### 8.14.1 Overview

This configures how long to wait for modem initialization after a modem power up.

### 8.14.2 Usage

Attribute type: Read and Write

This attribute is used to configure how long to wait before trying to initialize a modem after power up or a modem power cycle.

**Format:**

```
<Timeout>
```

<Timeout> is in seconds.

**Example:**

```
GET NCT
```

**Reply:**

```
15
```

meaning modem connect time is set to 15 seconds.

**Example:**

```
SET NCT 30
```

sets this time to 30 seconds.

# 8.15 PIN – PIN-code for communications device

## 8.15.1 Overview

This configures the PIN code used to unlock the communications equipment.

## 8.15.2 Usage

Attribute type: Write-Only

This attribute is used to configure the PIN code used to unlock the communications equipment (GSM modems etc).

**Format:**

```
SET PIN XXXXXXXX
```

XXXXXXXX is a number, up to 8 characters long, representing the PIN code of the SIM card.

**Note!** If wrong PIN code is entered, the controller will only try to open it up once. After that it will not try to lock it up again until the PIN code is changed. This is to avoid that the SIM card is blocked if wrong PIN code is configured.

# 8.16 PIS – PIN-code Supported by device

## 8.16.1 Overview

This attribute is used to determine if configured modem supports SIM PIN-code.

## 8.16.2 Usage

Reading this attribute displays if the configured modem supports SIM PIN-code. If PIN-code is supported it can be configured using the attribute SET PIN.

**Format:**

```
<Supported>
```

where <Supported> = 0 means no PIN-code is supported and <Supported> = 1 means modem type does not support PIN-code.

**Example:**

```
GET PIS
```

**Reply:**

```
1
```

means that this modem type supports PIN-code.

**Note!** Supporting PIN-code does not mean that PIN-code necessarily is required by SIM, since this can be configured on a SIM by SIM basis.

# 8.17 PPO – Primary Port Number

## 8.17.1 Overview

This configures what port number to use on primary address when using TCP/IP.

## 8.17.2 Usage

Attribute type: Read and Write

This attribute is used together with ASC to build complete connection parameters when using TCP/IP to connect to the Axell Element Manager.

Attribute configures what port number on the Axell Element Manager should be connected to.

**Format on getting parameter:**

```
GET PPO
```

**Reply:**

```
<Port>
```

where <Port> is the port number that Axell Element Manager on IP address as defined by attribute ASC is listening on. Valid <Port> values are 1-65 535.

**Example:**

```
GET PPO
```

**Reply:**

```
23
```

meaning that controller will attempt to connect on port 23 on the Axell Element Manager when delivering alarms and reports.

**Example:**

```
SET PPO 4711
```

changes this port number to 4711.

# 8.18 ROP – Repeater to OMC password

## 8.18.1 Overview

This configures what password the controller should use when logging in to the OMC.

## 8.18.2 Usage

Attribute type: Write-Only

When the controller is configured for data call, and alarms or reports are to be transmitted to the repeater OMC / Axell Element Manager, the controller needs to supply a user name and password. The user name is the equipment ID (attribute RID), and the password is set with this attribute, ROP.

**Format:**

```
<Password>
```

<Password> is the password, up to 8 characters, no space allowed.
**Example:**

```
SET ROP REPEATER
```

sets the password to REPEATER.

**Note!** This password should normally be changed from the Element Manager, since a wrong configured password will cause the login to the Element Manager to fail.

## 8.19 SAC – SMS Acknowledge Configuration

### 8.19.1 Overview

This configures in what way alarms sent via SMS should be acknowledged.

### 8.19.2 Usage

Attribute type: Read and Write

This command affects controllers using SMS for alarm transmission. SAC configures how the controller determines whether an alarm is acknowledged or not.
**Format:**

```
<Val>
```

<Val> = 0 means that the alarm is considered acknowledged when an acknowledge message is received from the OMC.
<Val> = 1 means that an alarm is considered acknowledged when the alarm is successfully transmitted to the Short Message Service Center (SMSC), i.e. when the message is successfully delivered to the network.
**Example:**

```
GET SAC
```

**Reply:**

```
0
```

meaning that the controller requires an acknowledge message back from the OMC (if the individual alarm source is configured for that).
**Example:**

```
SET SAC 1
```

changes the behavior to consider the alarm acknowledged when the message is sent successfully to the SMSC.

**Note!** This configuration will work in conjunction with the other alarm attributes (ALA XXX, RCA and MNR). If for example SAC is set to "1", and RCA is set to 3 and MNR 3, the controller will try to send the message to the SMSC center up to 3 times with 3 minute intervals. If the individual alarm source is configured to not require an acknowledge, it will only try to send it once to the SMSC.

## 8.20 SFT – Secondary Fallback Timer

### 8.20.1 Overview

This defines after how long the controller should fall back primary AEM address in

case switched over to secondary address.

### 8.20.2 Usage

Attribute type: Read and Write

This configures how many minutes the controller will wait before going back to the primary address again after calling the secondary OMC address. If this parameter is set to zero, no fallback will be done, i.e., the controller will toggle between the addresses for every failure to deliver messages.
See also attributes SSC, ASC and command ACT UPA.
**Format:**

```
<Time>
```

<Time> is number of minutes to wait before fall back to primary OMC address, and allowed interval is from 0 to 1440 minutes.
**Example:**

```
GET SFT
```

**Reply:**

```
15
```

meaning that the controller will use the secondary address for 15 minutes before going back to primary/normal OMC address.
**Example:**

```
SET SFT 10
```

changes this value to 10 minutes.

## 8.21 SMC – Address of SMS Service Center

### 8.21.1 Overview

This configures the address of the SMS Center when using SMS for remote communication.

### 8.21.2 Usage

Attribute type: Read and Write

When using SMS for alarming purposes, it is necessary to configure the address of the Short Message Service Center, which is a network node to which all messages are sent before being transmitted to its final destination. The SMSC is an MSISDN number which is written to the communications equipment during initialization.
**Format:**

```
<Address>
```

where address is a number  with a maximum length of 20 characters.
**Example:**

```
GET SMC
```

**Reply:**

```
+46705008990
```

meaning that the secondary address is set to +46705008990.
**Example:**

```
SET SMC +46705008999
```

changes the SMSC address to +46705008999.

# 8.22 SPO – Primary Port Number

## 8.22.1 Overview

This configures what port number to use on secondary address when using TCP/IP.

## 8.22.2 Usage

Attribute type: Read and Write

This attribute is used together with SSC to build complete connection parameters when using TCP/IP to connect to the Axell Element Manager.

Attribute configures what port number on the Axell Element Manager should be connected to.

**Format on getting parameter:**

```
GET SPO
```

**Reply:**

```
<Port>
```

where <Port> is the port number that Axell Element Manager on IP address as defined by attribute SSC is listening on. Valid <Port> values are 1-65 535.

**Example:**

```
GET SPO
```

**Reply:**

```
1025
```

meaning that controller will attempt to connect on port 1025 on the Axell Element Manager when delivering alarms and reports.

**Example:**

```
SET SPO 8087
```

changes this port number to 8087.

# 8.23 SSC – Secondary Service Center

## 8.23.1 Overview

Used to configure the backup OMC address in case it is not possible to contact primary address.

## 8.23.2 Usage

Attribute type: Read and Write

When controller is configured for data call or if TCP/IP is used (GPRS or Ethernet), and the controller fails to connect to the primary service center (configured with the attribute ASC), the controller will automatically switch over to the secondary service

center address. If secondary address is not set, it will be neglected. Furthermore, if controller experiences problems connecting to secondary address, it will switch back to primary address. A fallback timer can be configured so that the controller goes back to primary address after a specified interval (please refer to attribute SFT for details).

**Format:**

```
<Address>
```

where address is a number or server name (if using TCP/IP or GPRS) with a maximum length of 30 characters.
Note! The controller will always check if first address is set. If not, the secondary address will be ignored.

**Example:**

```
GET SSC
```

**Reply:**

```
118118
```

meaning that the secondary address is set to 118118.

**Example:**

```
SET ASC backup_aem_address
```

uses the address backup_aem_addres for delivery of alarms and reports (assuming TCP/IP or GPRS communication and that DNS is configured properly).

**Example:**

```
SET SSC
```

Disables the use of a secondary address.

## 8.24 ACT MDS - Poll for Modem Status

### 8.24.1 Overview

This command is used to poll the modem with pre-configured modem strings.

### 8.24.2 Usage

To be implemented in later versions.

## 8.25 ACT RCD – Reset Communications Device

### 8.25.1 Overview

This command forces a power cycling of the communications device / modem.

### 8.25.2 Usage

Attribute type: Write-Only Action

This command is used to perform a power cycle of the modem. In case command is launched when logged in remotely, the power cycling will be performed after after the next logout.

**Format:**

```
ACT RCD [Delay]
```

where the optional delay parameters denotes how many seconds from entering the command the modem should be power cycled. If Delay is left out, an immediate power cycling of the modem will be performed (assuming local login).

**Example:**

```
ACT RCD
```

will, if logged in locally, perform an immediate power cycling of the modem.

**Note!** The controller can also be configured to automatically turn off and turn on the modem once per day. This feature can be used to ensure that the modem parameters when using for example GSM modems contain the latest network parameters such as HLR update interval etc. Attribute MPE is used to configure if automatic modem power cycling should be enabled. Time point for when to power cycling the modem can be set with attribute MPT. In order to read out Last modem Power Cycling time point, use attribute LPC.

## 8.26 ACT UPA – Use Primary Address

### 8.26.1 Overview

This forces an immediate fall back to dial primary AEM address in case of alarms or reports.

### 8.26.2 Usage

Attribute type: Write-Only Action

The controller can be configured to use both primary and the backup address (as configured with attribute ASC and SSC) for delivery of alarms and reports to the Axell Element Manager. In case connection to the first address fails, the controller automatically attempts to connect to the secondary address instead. Using the attribute SFT (Secondary fall back Timer) it is possible to configure after how long the controller will go back to the primary address again. By using this attribute it is possible to force an immediate fall back to the primary address again. This can for example be used if the primary address has been down for any reason to force all network elements to go back to primary address again.

**Format:**

```
ACT UPA
```

causes the immediate fall back to the primary address.

**Note!** Executing this action when controller is already dialing primary address has no effect.

## 8.27 ACCESS MODEM

### 8.27.1 Overview

This command can be used for advanced trouble shooting of the modem configurations.

### 8.27.2 Usage

When typing ACCESS MODEM, the controller will send all the characters typed directly out the modem port. All characters replied back from the modem will be presented directly to the user. This command is useful for advanced remote communication trouble shooting issues.

**Format:**

```
ACCESS MODEM [-B Baud Rate]
```

where the optional switch -B allows to connect to the modem using any of the standard baud rates 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 or 230400.
Using other baud rates than the default will only work if modem is configured for this speed or is using auto bauding.

If the modem is busy dialing to the Axell Element Manager, or if someone is logged in remotely to the repeater, the controller will attempt to access the modem for a limited amount of time before giving up. This might also happen if the controller is busy initializing the modem. If this is the case, it is normally possible to access the modem again after a short while.

To abort an ACCESS MODEM session, press three '-' in a row (all three within one second) to come back to the repeater command prompt.

**Note 1!** When accessing the modem port the modem might be configured with "echo off", meaning that the characters entered will not be echoed back to the screen. In order to enable "echo", press Enter. After that, type

```
ATE1
```

(invisible), followed by Enter. The modem should then reply with

```
OK
```

indicating that the echo is enabled. All characters entered will now be echoed back to the user.

**Note 2!** Command will not work when logged in to the controller remotely over the modem connection, since modem is busy communicating.

## 8.28 MODEM

### 8.28.1 Overview

This command gives an overview of the actual modem settings.

### 8.28.2 Usage

By launching the command MODEM, all modem configuration settings are displayed.

# 8.29 MP – Modem Power

## 8.29.1 Overview

This command enables or disables the modem power.

## 8.29.2 Usage

For trouble shooting purposes it is possible to disable or enable the power to the modem by using the commands

```
MP OFF
```

and

```
MP ON
```

**Note 1!** Since controller regularly polls the status of the modem, it will power up and initialize the modem in case it is left without powered.

**Note 2!** Use this command with extreme caution, since it will kick out any remotely logged in users, or disconnect any remote connections to the Axell Element Manager.

# 8.30 TRACE MODEM

## 8.30.1 Overview

This command gives a trace of the modem initialization procedure.

## 8.30.2 Usage

For troubleshooting purposes it is possible to trace the actual progress of initializing the modem. This trace is useful when having problems with the modem initialization.

For example, when remote initialization is enabled (SET CDE 1), it is useful to see that modem registers properly onto the network.

To abort TRACE MODEM session, press Ctrl-C.

**Example:**

```
AVITEC AB>set mis at+cbst=71,0,1
AVITEC AB>trace modem
Starting modem trace.
To abort, press Ctrl-C.
-----------------------------------------------------
Modem initialization completed successfully!
Modem initialization string changed, re-initializing modem.
Initializing modem...
Disabling modem echo...
Modem echo successfully disabled.
Checking PIN status...
SIM already unlocked.
Checking Network Registration...
Registered on home network.
Initializing modem specific parameters....
Sending modem initialization string at+cbst=71,0,1
Modem initialization completed successfully!
```

# 9 HEARTBEAT REPORT CONFIGURATIONS

This section defines all attributes related to the heartbeat transmissions of the repeater.

## 9.1 HIT – Heartbeat Log Item

### 9.1.1 Overview

This attribute returns information about entries in the heartbeat log.

### 9.1.2 Usage

Attribute type: Read only

This attribute returns an entry in the heartbeat log,
**Format:**

```
GET HIT <ItemNo>
```

Reads heartbeat log entry number <ItemNo> from the heartbeat log, where the oldest entry in the heartbeat log is number 1. <ItemNo> might be from 1 to value replied by GET HLN.
**Reply format in NON Node Masters:**

```
<Heartbeat Time> <Heartbeat Date> <System Event Number> <Retransmissions Left>
<Completed At Time> <Completed At Date> <Heartbeat Message>
```

<Heartbeat Time> - Time on the format HHMMSS when message was generated.
<Heartbeat Date> - Date on the format DDMMYY when message was generated.
<System Event Number> - Unique identifier for the system event in the interval 0..231.
<Retransmissions Left> - Number of Retransmissions Left before giving up to try transmitting alarm to the AEM.
<Completed At Time> - Time on the format HHMMSS when heartbeat was successfully transmitted to the OMC. If heartbeat is not yet delivered, a '-' (dash) is replied.
<Completed At Date> - Date on the format DDMMYY when heartbeat was successfully transmitted to the OMC. If heartbeat is not yet delivered, a '-' (dash) is replied.
<Heartbeat Message> - A quoted string containing the actual heartbeat message.

**Reply format in Node Masters:**

```
<Originating Node> <Heartbeat Time> <Heartbeat Date> <System Event Number>
<Retransmissions Left>  <Completed At Time> <Completed At Date> <Heartbeat Message>
```

<Originating Node> - indicates node that heartbeat was generated on. Node Master is always node zero.
<Heartbeat Time> - Time on the format HHMMSS when message was generated.
<Heartbeat Date> - Date on the format DDMMYY when message was generated.
<System Event Number> - Unique identifier for the system event in the interval 0..231.
<Retransmissions Left> - Number of Retransmissions Left before giving up to try transmitting alarm to the AEM.
<Completed At Time> - Time on the format HHMMSS when heartbeat was successfully transmitted to the OMC. If heartbeat is not yet delivered, a '-' (dash) is

replied.
<Completed At Date> - Date on the format DDMMYY when heartbeat was successfully transmitted to the OMC. If heartbeat is not yet delivered, a '-' (dash) is replied.
<Heartbeat Message> - A quoted string containing the actual heartbeat message.

**Note!** If no log entry exists in log at this position, a single '-' (dash) is replied.

## 9.2 HLN – Heartbeat Log Length

### 9.2.1 Overview

This replies with number of heartbeats in the heartbeat log at the moment.

### 9.2.2 Usage

Attribute type: Read only

**Format:**

<Number of heartbeat log entries>

where <Number of heartbeat log entries> is an integer indicating how many heartbets are currently in the heartbeat log.
**Example:**

```
GET HLN
```

**Returns:**

```
42
```

meaning that there are 42 heartbeats that can be read out from the log, starting with log item 1.

## 9.3 HOS – Heartbeat on System Startup

### 9.3.1 Overview

This configures whether an heartbeat should be sent on system startup.

### 9.3.2 Usage

Attribute type: Read and Write

When the controller is integrated to the Axell Element Manager it sends heartbeat reports on regular intervals to let the AEM know the repeater is up and running. In case of a long power failure, or when the equipment has been down for maintenance, the controller can be configured to send a heartbeat directly on power on, to ensure that the Axell Element Manager is aware that the system is back online. In most cases this is handled by the controller sending an end of power supply alarm, but in certain applications it might be useful to have the controller sending a heartbeat on system boot.
**Format:**

```
<Enabled>
```

where <Enabled> = 0 means that no heartbeat will be transmitted on startup, and <Enabled> = 1 means heartbeat will be transmitted on startup.

**Example:**

```
GET HOS
```

**Reply:**

```
0
```

means that no heartbeat will be transmitted on startup.

**Example:**

```
SET HOS 1
```

configures the heartbeat to be transmitted on system startup.

## 9.4 MRR – Maximum Report Retransmission

### 9.4.1 Overview

This defines maximum number of retransmissions that will be attempted when sending reports to the AEM.

### 9.4.2 Usage

Attribute type: Read and Write

Every report is sent to the Axell Element Manager up to MRR number of times, or until it is successfully delivered. The reports are retransmitted with RCR minutes intervals. When using data call, report is considered successfully delivered when the controller has successfully logged in to the AEM, and delivered the report. In case of SMS, report is considered successfully delivered when it has been successfully transmitted to the SMSC.

**Format:**

```
<Attempts>
```

where <Attempts> denotes maximum number of attempts that will be made to deliver the report. Allowed interval is from 0 to 9 retransmissions.

**Example:**

```
GET MRR
```

**Reply:**

```
3
```

meaning that the repeater will try to retransmit a report 3 times.

**Example:**

```
SET MRR 2
```

sets maximum number of retransmissions to 2.

## 9.5 RCH – Repetition Cycle for Heartbeats

### 9.5.1 Overview

The repetition cycle for heartbeats defines with what interval the reports should be

transmitted to the AEM.

### 9.5.2 Usage

Attribute type: Read and Write

Sets the interval for how often the heartbeat reports are sent to the Axell Element Manager. The heartbeat report is a report containing all relevant status parameters of the system. If a report fails to be sent, attempts will be made to retransmit the reports with a settable interval. Refer to attributes RCR and MRR for information on how to change the number of retransmissions and retransmit interval.

**Format:**

```
<Interval>
```

<Interval> is the heartbeat interval in minutes. Valid values are from 0 to 100 000 minutes. Setting the interval to 0 (zero) means no heartbeat reports will be transmitted.

**Example:**

```
GET RCH
```

**Reply:**

```
1440
```

meaning that a heartbeat will be sent to the Axell Element Manager every 1440 minutes (once per day), starting from when last report was successfully transmitted to the AEM.

**Example:**

```
SET RCH 10080
```

changes this interval to 10080 minutes (once per week)

**Note!** As soon as the heartbeat interval is changed, and the user is logged out, a new heartbeat will be sent to the Axell Element Manager in order to cause resynchronization of the heartbeat intervals between the controller and the AEM.

## 9.6 RCR – Repetition Cycle for Reports

### 9.6.1 Overview

This configures with what intervals the controller will attempt to retransmit reports to the AEM.

### 9.6.2 Usage

Attribute type: Read and Write

Every report is sent to the Axell Element Manager up to MRR number of times, or until it is successfully delivered. The reports are retransmitted with RCR minutes intervals. When using data call, report is considered successfully delivered when the controller has successfully logged in to the OMC, and delivered the report. In case of SMS, report is considered successfully delivered when it has been successfully transmitted to the SMSC.

**Format:**

```
<Interval>
```

where <Interval> is the retransmit interval in minutes. Valid intervals range from 1

to 20 minutes.
**Example:**

```
GET RCR
```

**Reply:**

```
3
```

meaning that after a failed report transmission, a new attept will be made after 3 minutes.
**Example:**

```
SET RCR 2
```

sets the time between retransmissions to 2 minutes.

## 9.7 ACT HBT – Request Heartbeat Transmission

### 9.7.1 Overview

This command forces a transmission of a heartbeat report.

### 9.7.2 Usage

Attribute type: Write-Only Action

This command is used to transmit heartbeat reports to the Axell Element Manager. This can be used to force a heartbeat synchronization.
**Format:**

```
ACT HBT
```

caused the heartbeat report to be transmitted as soon as the configured communications interface is available.
**Example:**

```
ACT HBT
```

will, if logged in locally, perform an immediate connection to the Axell Element Manager, and the heartbeat report to be delivered.

## 9.8 ACT CHB – Clear Heartbeat Log

### 9.8.1 Overview

This command is used to clear all the entries in the heartbeat log.

### 9.8.2 Usage

Attribute type: Write-Only Action

This action clears all heartbeats from the heartbeat log, and requires Read and Write access when logged in. Via SMS, this can only be performed by the Main Address.

# 9.9 LOGDUMP HEARTBEAT

## 9.9.1 Overview

This command generates a list of heartbeat reports.

## 9.9.2 Usage

By using the command LOGDUMP HEARTBEAT, it is possible to read out heartbeat report log entries. The format of each line is exactly the same as for the HIT attribute.

**Format:**

```
LOGDUMP HEARTBEAT <Start> <Stop>
```

where
<Start> is the first entry that should be read from the log, <Start> must be greater than 0.
<Stop> is the last entry that should be read from the log, and must be greater than or equal to <Start>.

**Example:**

```
LOGDUMP HEARTBEAT 1 5
```

**Reply:**

```
040843 221206 379 -1 000001 010170 "17 14 0 0 0 0 0 0 0 0 0 0 0 0 1111 1440"
030120 231206 367 3 030617 020100 "17 14 0 0 - - - - - 0 - - - - ---- 1440"
030105 241206 366 3 030546 020100 "17 14 0 0 0 0 0 0 0 0 0 0 0 0 1111 1440"
025740 251206 365 0 025916 020100 "17 14 0 0 0 0 0 0 0 0 0 0 0 0 1111 1440"
025718 261206 364 1 025914 020100 "17 14 0 0 0 0 0 0 0 0 0 0 0 0 1111 1440"
```

which are the 5 latest heartbeat reports.
**Note 1!** A maximum of 100 log items can be read out at a time. If item does not exist, no reply is given.
**Note 2!** If this is a repeater system node master, HIT will contain a leading node number, indicating what node this heartbeat was collected from. Node master is always node number zero.

# 10 SYSTEM ADMINISTRATION AND INVENTORY MANAGEMENT

This section defines attributes related to system configuration and inventory management, such as hardware lists and software versions.

## 10.1 ADC – Active Devices Count

### 10.1.1 Overview

This attribute returns number of active devices in the system, and is used for inventory management.

### 10.1.2 Usage

Attribute type: Read only

Active Device Count indicates how many active devices configured in and monitored by the controller. An active device is a hardware device containing a microprocessor which is polled by the controller, such as a Power Supply, Reference Generator or different interface boards.

**Format:**

```
<Device Count>
```

where <Device Count> returns number of active devices in the system .

**Example:**

```
GET ADC
```

**Replies**:

```
4
```

meaning that there are 4 active devices configured in the system. Please refer to attribute HDI and DDI on how to retrieve information about the different devices.

## 10.2 DAT – System Date

### 10.2.1 Overview

Used to get and set the system date.

### 10.2.2 Usage

Attribute type: Read and Write

The controller contains a real time clock, which is used to keep track of when certain events occurs, and to be able to send reports on configurable times of the day. This attribute reads and sets the date of the system clock.

**Format:**

```
DDMMYY
```

where DD=Date, MM=Month, YY=Year
**Example:**

```
GET DAT
```

**Replies**:

```
181005
```

means the repeater date is set to 18'th of October, 2005.
**Example:**

```
SET DAT 241205
```

sets the repeater date to 24'th of December, 2005.
**Note!** When setting the date, a heartbeat will be sent immediately (or if logged in via modem, as soon as user logs out), the traffic / uplink activity logs (if supported) will be cleared and all alarms in the log will have the number of retransmissions of non-acknowledged alarms set to the value MNR.

## 10.3 DDI – Detailed Device Information

### 10.3.1 Overview

This is used to read out details of a device / node that is monitored by the controller, and is used for inventory management.

### 10.3.2 Usage

Attribute type: Read only

Each node monitored by the controller contains a number of parameters that are common between all the nodes. This attribute displays all common parameters.
**Format:**

```
GET DDI <Device No>
```

where <Device No> is a number from 1 to max number of attributes (as read out by ADC attribute).
**Format on reply:**

```
<Serial Number> <ArtNo> <SWV> <SW Build Time> <SW Build Date>  <Manufacturing Info>
<Module Init Time> <Module Init Date> <Uptime> <HW Reset Counter> <WD Reset Counter>
<Device Description>
```

where
<Serial Number> is the Serial Number of the device
<ArtNo> is Article Number / Hardware Revision
<SWV> is a string delimited by " (double quote) signs, containing software version of the device/node.
<SW Build Time> is a string delimited by "(double quote) signs, containing software build time.
<SWBuildDate> is a string delimited by "(double quote) signs, software build date.
<ManufacturingInfo> is a string delimited by "(double quote) signs, containing manufacturing specific information. If no information is available, a '-'is reported.
<ModuleInitTime> contains the repeater initialization time on the format HHMMSS, with 24 hours notation. If no information is available, a '-'(dash) is reported.
<ModuleInitDate> contains the repeater initialization date on the format DDMMYY. If no information is available, a '-'(dash) is reported.
<Uptime> shows how many seconds the device has been up and running since last

reset.
<HWResetCounter> shows how many times the device has been started since device was initialized.
<WDResetCounter> shows how many times the watchdog has forced the device to reset since device initialization
<Device Description> is a string delimited by "(double quote) signs, containing a textual description of the hardware device.

**Note!** If <Device No> is greater than ADC, a single '-' (dash) will be reported.

## 10.4 HDC – Hardware Device Count

### 10.4.1 Overview

This attribute returns number of hardware devices in the system, and is used for inventory management.

### 10.4.2 Usage

Attribute type: Read only

Hardware Device Count indicates how many hardware items are configured in the system monitored by the controller.
**Format:**

```
<Device Count>
```

where <Device Count> returns number of hardware devices in the system (including controller itself).
**Example:**

```
GET HDC
```

**Replies:**

```
12
```

meaning that there are 12 hardware devices (both active and passive) configured in the system. Please refer to attribute HDI on how to retrieve information about the different devices.

## 10.5 HDI – Hardware Device Item

### 10.5.1 Overview

This attribute gives information about the different hardware devices in the system, and is used for inventory management.

### 10.5.2 Usage

Attribute type: Read only

This command returns device information about a specific device.
**Format:**

```
GET HDI <Device No>
```

<Device No> is from 1 to HDC.

**Reply format:**

```
<Serial> <ArticleNo> <Device Information String>
```

<Serial> is 4 characters containing the device serial number.
<ArticleNo> is the Axell Article Number, up to 12 characters.
<Device Information String> contains a quoted textual description of the hardware device. String can be up to 40 characters wide.
**Example:**

```
GET HDI 1
```

**Reply:**

```
4711 H411001A "Control Module"
```

which indicates that this is a control module with serial number 4711 and article number H411001A.
**Note!** If <Device No> doesn't exist, a dash '-' is replied.
**Example:**

```
GET HDI 4000
```

**Reply:**

```
-
```

## 10.6 HWV - Hardware Version

### 10.6.1 Overview

This attribute returns hardware version of the controller.

### 10.6.2 Usage

Attribute type: Read only

Using this attribute it is possible to determine the hardware version of the control module.

**Format:**

```
<Hardware Version>
```

which is a string identifying hardware version and revision.
**Example:**

```
GET HWV
```

**Replies:**

```
H421001C
```

meaning that the controller version is H121001C.

## 10.7 LTG – Lock Tag

### 10.7.1 Overview

This configures if the TAG should be possible to modify or not.

### 10.7.2 Usage

Attribute type: Read and Write

When commissioning the repeater, the actual site ID is often of high importance, and is normally configured by using the attribute TAF. During integration of the repeater into the Axell Element Manager, it is possible to set the TAG from the AEM itself. By using the attribute LTG (Lock Tag) it is possible to lock the tag from accidently being modified.

**Format:**

```
<Locked>
```

where <Locked> = 0 means that it is possible to modify the tag, and <Locked> = 1 means that the Tag is locked from modification.

**Example:**

```
GET LTG
```

**Reply:**

```
0
```

means that no tag is unlocked and that it is possible to change the tag.

**Example:**

```
SET LTG 1
```

disables the possibility to change the tag.

## 10.8 MDL – Target Model Identification

### 10.8.1 Overview

This attribute returns a string containing the equipment type being monitored by the controller.

### 10.8.2 Usage

Attribute type: Read only

The model identification string is a unique identifier indicating exactly what kind of equipment is monitored by the controller. This information is essential for the Repeater Maintenance Console and for the Axell Element Manager integration to know exactly what parameters are supported by the controller.

**Format:**

```
<Model Identification String>
```

uniquely identifying the equipment type.

**Example:**

```
GET MDL
```

**Reply:**

```
CSFT922-ER
```

indicating that this is a Channel Selective Frequency Translating 2-channel repeater for the 900 band of Remote type with External combining.
For a textual description of the equipment model, please refer to attribute MDD.
**Note!** For detailed information on the different models and their interpretation, refer to corresponding product manual.

## 10.9 MDD – Target Model Description

### 10.9.1 Overview

This attribute returns a textual string, describing the type of equipment being controlled.

### 10.9.2 Usage

Attribute type: Read only

The target model description replies with a verbose output of the type of equipment being monitored by this controller.

**Format:**

```
<Textual Model Description>
```

being a string with a maximum length of 140 characters.

**Example:**

```
GET MDD
```

**Reply:**

Channel Selective EDGE/GSM 4-channel Repeater on 900 MHz band
being a detailed description of the actual equipment type.

## 10.10 MSG - Message Counter

### 10.10.1 Overview

This displays the value of the system event counter.

### 10.10.2 Usage

Attribute type: Read only

For each report or alarm being transmitted to the Axell Element Manager, a message counter is increased, giving each alarm and report a unique system event number in the system. This attribute displays current value of the counter.

**Format:**

```
<Message Counter>
```

where the <Message Counter> value is from 0 to 231.

**Example:**

```
GET MSG
```

**Reply:**

```
16471
```

indicating that the value of the system event counter currently is 16471.

# 10.11 RID – Repeater ID

## 10.11.1 Overview

The repeater ID is a unique identifier for the element within the network, and is set by the AEM.

## 10.11.2 Usage

Attribute type: Read and Write

The repeater ID gives the Axell Element Manager a way to give the each network element a unique number in the network.
**Format:**

## 10.11.3 XX-YY-ZZZZ

XX,YY,ZZZZ are unique numbers to identify the element. The length of the repeater ID is exactly 10 characters.
**Example:**

```
GET RID
```

**Reply:**

```
01-01-0334
```

which is the unique ID for this element.
**Example:**

```
SET RID 02-01-0077
```

Modifies the repeater ID.
**Note!** If the element is installed into and controlled by the Axell Element Manager, this attribute should NEVER be modified. This ID is unique in the Element Manager database. Changing this ID will cause the Axell Element Manager database to be corrupted, and monitoring of the network element to fail.

# 10.12 SHW – Supported Hardware

## 10.12.1 Overview

This attribute informs about some of the supported hardware in the system.

## 10.12.2 Usage

Attribute type: Read only

This attribute displays if certain system functionality is supported by the hardware configurations. This function is mainly used by Repeater Maintenance Console and Axell Element Manager to adjust user interface depending on configurations.
**Format:**

```
<EX1><EX2><EX3><EX4><DOO><RLY>
```

where each field can be

0 – meaning that corresponding functionality is not supported by target.
1 – meaning that corresponding functionality is supported by target.

**Example:**

```
GET SHW
```

**Reply:**

```
111101
```

meaning that EX1-EX4 and RLY are supported by target, while DOO is not supported.

## 10.13 SIS – System Information String

### 10.13.1 Overview

This attribute displays miscellaneous information about the controller.

### 10.13.2 Usage

Attribute type: Read only

This compact string containing various controller and system versions and system dates. The string contains the following data, separated by spaces:

```
<Boot Ver> <Controller Serial Number> <Ctrl HW Version> <Equipment Serial Number>
<Equipment Art No> <Controller Initialization Time> <Controller Initialization Date>
<System Initialization Time> <System Initialization Date>  <Manufacturing specific
information>
```

<Boot Ver> is a string delimited by " (double quote) signs, containing the controller Boot version. If no information is available, an empty string ("") is replied.
<Controller Serial Number> reports the serial number of the controller (4 characters). If no information is available, a '-' (dash) is reported.
<Ctrl HW Version> is a string delimited by " (double quote) signs, containing the controller hardware version.
<Equipment Serial Number> reports the serial number of the equipment being controlled (4 characters). If no information is available, a '-' (dash) is reported.
<Equipment ArtNo> contains the article number of the product in which the controller is mounted.
<Controller Initialization Time> contains the controller initialization time on the format HHMMSS, with 24 hours notation. If no information is available, a '-' (dash) is reported.
<Controller Initialization Date> contains the controller initialization date on the format DDMMYY. If no information is available, a '-' (dash) is reported.
<System Initialization Time> contains the equipment  initialization time on the format HHMMSS, with 24 hours notation. If no information is available, a '-' (dash) is reported.
<System Initialization Date> contains the equipment initialization date on the format DDMMYY. If no information is available, a '-' (dash) is reported.
<Manufacturing specific information> is a string delimited by " (double quote) signs, containing information entered during manufacturing.

**Example:**

```
GET SIS
```

**Reply:**

```
"AviBoot 1.02" 42JG H501001A 4JF3 A1013410A 120333 051101 174200 051220 "MWTST"
```

indicating that Boot version is "AviBoot 1.02", control module has the serial number 4JG5 and hardware version H501001A, the equipment serial is 4JF3 and article number A1013410A, the controller was initialized at 12:03.33 on Nov 1, 2005 the system (equipment) was initialized at 17:42.00 on Dec 20, 2005,. Finally, factory information is "MWTST".

## 10.14 SIT – System Initialization Timepoint

### 10.14.1 Overview

This displays the time point for initialization when controller/system was first initialized.

### 10.14.2 Usage

Attribute type: Read only

Returns a string containing the system initialization time, i.e. when the controller was initialized for the first time.

**Format:**

```
HHMMSS DDMMYY
```

where HHMMSS is the time point, with 24 hours notation, and DDMMYY is the date of the initialization.

**Example:**

```
GET SIT
```

**Reply:**

```
135207 211005
```

indicating that the controller was initialized on Oct 21 2005, 13:52:07
Note! By supplying the switch -n a numeric reply is given where the time point is represented in seconds from the 00:00:00 1970-01-01.

**Example:**

```
GET SIT -N
```

**Reply:**

```
1129895527
```

which indicates number of seconds that elapsed from 00:00:00 1970-01-01 until the system was initialized (which converts to Oct 21 2005, 13:52:07).

## 10.15 SUT – System Uptime

### 10.15.1 Overview

This displays the system uptime, which is defined as the time elapsed since last system startup.

### 10.15.2 Usage

Attribute type: Read only

The system uptime is defined as the time that has elapsed since last system startup.

**Format:**

```
<Uptime>
```

where <Uptime> is the number of seconds that has elapsed since last system reset, or since last power up.

**Example:**

```
GET SUT
```

**Reply:**

```
10987735
```

meaning that the system booted up 10 987 735 seconds ago.

**Note!** By supplying the switch -f a formatted reply is given where the elapsed time is converted to format

**Example:**

```
GET SUT -F
```

**Reply:**

```
127 days, 4:08.55
```

which indicates an uptime of 127 days, 4 hours, 8 minutes and 55 seconds.

## 10.16 SWV – Software Versions

### 10.16.1 Overview

This attribute replies with the different software versions in the system.

### 10.16.2 Usage

Attribute type: Read only

The software system consists of three different software versions.

**Format:**

```
<System Version> <Common Version> <Target Version>
```

where
<System Version> is a quoted string indicating what version of the core system.
<Common Version> is a quoted string displaying the version for the so called common libraries used.
<Target Version> indicates the version of the target software is configured on the system.

**Example:**

```
GET SWV
```

**Reply:**

```
"1.0.1" "1.1.1" "OnBoard1.1.3"
```

indicating that system version is 1.0.1, common version is 1.1.1 and the target version being OnBoard1.1.3.

# 10.17 TAG – Repeater Tag

## 10.17.1 Overview

The TAG allows to give each Axell element a textual name in the network.

## 10.17.2 Usage

Attribute type: Read and Write

The TAG allows for giving each Axell element an easy to understand name within the network. This can for example be the network site ID or the name of the location where equipment is installed. By using the attribute LTG (Lock Tag) it is possible to lock the tag from accidently being modified during for example the AEM integration.

**Format:**

```
<Tag>
```

where <Tag> is a text string up to 30 characters long.

**Example:**

```
GET TAG
```

**Replies:**

```
SiteID:VF37 Sundbyberg Metro
```

identifying the TAG.

**Example:**

```
SET TAG SiteID:VF3777 Sumpan Metro
```

modifies the tag.

**Example:**

```
SET TAG Testing Tag Lock
```

**Reply:**

```
Error: Cannot modify tag, tag locked (unlock using LTG attribute).
```

**Note!** Any extra spaces between words will be removed, ensuring that only one space separates each word in the tag. If extra spaces are required between words, the description can be put in double quotes, such as

```
SET TAG “Tag with many      spaces”
```

# 10.18 TIM – System Time

## 10.18.1 Overview

Used to get and set the system time.

## 10.18.2 Usage

Attribute type: Read and Write

The controller contains a real time clock, which is used to keep track of when certain events occurs, and to be able to send reports on configurable times of the day. This attribute reads and sets the time of the system clock.

**Format:**

```
HHMMSS
```

where HH is 24-hour representation of the hours, MM is minutes, and SS is seconds.

**Example:**

```
GET TIM
```

**Reply:**

```
145000
```

meaning the repeater time is 10 minutes to three in the afternoon.

**Example:**

```
SET TIM 150542
```

modifies the time to 15:05.42.

**Note!** When changing the time, a heartbeat will be sent immediately (or if logged in via modem, as soon as user logs out), the traffic / uplink activity logs (if supported) will be cleared and all alarms in the log will have the number of retransmissions of non-acknowledged alarms set to the value MNR.

## 10.19 ACT RHW – Action Reset Hardware

### 10.19.1 Overview

This is used to perform a reset of all active modules monitored by the controller.

### 10.19.2 Usage

By executing ACT RHW, a hard reset of all active devices monitored by the system is performed.

**Example:**

```
ACT RHW
```

will cause the software in all active devices to be reset immediately.
Note! Reset of the hardware devices will be almost immediate, and certain radio devices might cause a short disruption of service, why this command should only be used with caution.

## 10.20 HARDWARE REPLACE

### 10.20.1 Overview

This command is used to reconfigure a system after replacing a physical hardware device.

### 10.20.2 Usage

This command is used to change the configuration in a system when a hardware device has been changed. This is normally performed when replacing a failing module to ensure that inventory list matches the devices, and to get the communication between the controller and the hardware to work properly. Hardware can be of two different kinds:

- Active devices. These devices contains a microprocessor for monitoring of parameters. Active devices contain the article number and hardware revision in the device. Typical active devices are radio boards, opto modules, reference generators etc. The controller communicates with active devices using the device serial number as an address, why it is important to configure the exact serial number for the communication to work.

- Passive devices. These do not have a microprocessor, and hence article number and hardware revision has to be configured manually.

Serial Numbers are always exactly four characters long. Letter 'o' is not used (to avoid confusion between letter 'o' and digit zero).
Article Numbers are between 8 and 12 characters long. Letter 'o' is not used (to avoid confusion between letter 'o' and digit zero).

**Format on replacing Active devices:**

```
HARDWARE REPLACE <Old Serial> <New Serial>
```

where <Old Serial> is the serial number of replaced module, and <New Serial> is the serial number of the new module.
**Example:**

```
HARDWARE REPLACE 4711 56AR
```

replaces serial number of active device with serial number 4711 with a new hardware having serial number 56AR.

**Format on replacing Passive devices:**

```
HARDWARE REPLACE <Old Serial> <New Serial> <New Article Number>
```

where <Old Serial> is the serial number of replaced module, and <New Serial> is the serial number of the new module and <New Article Number> is article number of new hardware.

**Example:**

```
HARDWARE REPLACE 540R 56UU J691030A
```

Each change of hardware is kept in a log. In order to read out the log, use command

```
HARDWARE LOG
```

which displays all hardware changes that has been made to the system, including local time point for replacement.
**Example:**

```
HARDWARE LOG
```

**Reply:**

```
2007-10-12 14:45:35 Replaced active device serial 4711 with 56AR. Device type:
Reference Generator.
2007-10-12 14:50:03 Replaced passive device serial 540R with 56UU article number
J691030A. Device type: External Alarm Interface
```

**Note!** In order to read out current hardware configuration, refer to attributes HDC, HDI, ADC and DDI.

## 10.21 SYSADMIN – Log in as system administrator

### 10.21.1 Overview

Enters System Administration mode with full user access to all system aspects

### 10.21.2 Usage

Certain operations on the controller, such as installing new firmware and rebooting the system requires system administration privileges.

In order to enter system administration mode, enter command

```
SYSADMIN
```

This will prompt for the System Administration password. If entered correctly, system administration mode is entered.

In order to leave system administration mode, use command

```
exit
```

## 10.22 REBOOT – Reboot the system

### 10.22.1 Overview

Reboot the controller

### 10.22.2 Usage

This command is used when rebooting the system. Only system administrator is allowed to do this, so run command

```
sysadmin
```

and enter system administrator password. After this, enter

```
reboot
```

to reboot the system.

Rebooting the system normally leaves the system non accessible for roughly 45 seconds. However, RF performance of the equipment will remain fully operational during that time.

In order to reset hardware devices in the system, please refer to attribute ACT RHW (reset hardware).

# 11 USER ADMINISTRATION AND SESSION CONFIGURATIONS

This chapter defines all commands, attributes and actions related to user administration and repeater access.

## 11.1 LIU – Logged In Users

### 11.1.1 Overview

Gives a list of all users currently logged in to the controller.

### 11.1.2 Usage

Attribute type: Read only

The LIU attribute replies with all list of all users currently logged in to the system.
**Format:**

```
<user 1> <user 2> ... <user N>
```

where all users are separated by a space. If no user is logged in, a '-' is reported.
**Example:**

```
GET LIU
```

**Reply:**

```
omcuname zaphod
```

indicating that users omcuname and zaphod are logged in to the system.

## 11.2 LMT – Login Timeout

### 11.2.1 Overview

Indicates after how long inactivity a logged in user should be logged out from the system.

### 11.2.2 Usage

Attribute type: Read and Write

If a logged in user does not perform any activity within LMT minutes, the controller will initiate an automatic logout of the user. This attribute configures the automatic interval.
**Format:**

```
<LMT>
```

where <LMT> is the interval in minutes of inactivity. Allowed interval is from 1 to 99 minutes.
**Example:**

```
GET LMT
```

**Reply:**

```
20
```

meaning that the user will be logged out after 20 minutes of inactivity.
**Example:**

```
SET LMT 15
```

changes this time to 15 minutes of inactivity before user is automatically logged out.

## 11.3 MNU – Maximum Number of Users

### 11.3.1 Overview

This attribute defines maximum number of users allowed to add to the system.

### 11.3.2 Usage

Attribute type: Read only

This attribute displays maximum numbers of users accounts that can be added to the system (excluding the omcuname and useradmin account).
**Format:**

```
<MaxNo>
```

where <MaxNo> is an integer defining maximum number of user accounts allowed.
**Example:**

```
GET MNU
```

**Reply:**

```
10
```

meaning that a maximum of 10 user accounts can be added to the system.

## 11.4 UAC - User Account Count

### 11.4.1 Overview

This defines number of user accounts that are added to the system.

### 11.4.2 Usage

Using the UAC attribute it is possible to read out how many user accounts are currently configured in the system, not including the omcuname and useradmin accounts.
**Format:**

```
<AccountCount>
```

indicates current number of accounts in the system.
**Example:**

```
GET UAC
```

**Reply:**

```
3
```

meaning that there are 3 user accounts currently configured in the system, not including the useradmin and omcuname accounts.

## 11.5 UAI - User Account Item

### 11.5.1 Overview

This gives information about a certain user account in the system, including access level.

### 11.5.2 Usage

Reading the User Account Items it is possible to get information about all users added to the system.
**Format:**

```
GET UAI <ItemNo>
```

reads user account entry number <ItemNo> from the user account list, where first account is 1. <ItemNo> might be from 1 to value replied by GET UAC.
**Reply format:**

```
<User Name> <Access Level>
```

where <User Name> is the login username and <Access Level> replies ReadOnly or ReadWrite, depending on user previleges.
**Note!** If no log entry exists in log at this position, a single '-' (dash) is replied.
**Example:**

```
GET UAI 5
```

**Reply:**

```
Arthur ReadWrite
```

which means that user Arthur has ReadWrite access to the system.

## 11.6 ACT USERADD

### 11.6.1 Overview

This attribute is used to add users to the system.

### 11.6.2 Usage

Attribute type: Write-Only Action

This attribute is used to add a user to the system. Only users “useradmin” and “omcuname” are allowed to administer users on the system.
Any other user will be prompted for the “useradmin” password when launching ACT USERADD.
The system has an upper limit for how many user accounts can be added to the system. Please refer to attribute MNU (Max Number of Users) for details.
**Format:**

```
ACT USERADD [-rw] <user name>
```

where <user name> must be at least 6 characters long. <user name> is case sensitive, meaning that it is important to differ between upper and lowercase.
Valid user names follow these rules:
* First character must be a letter (a-z, A-Z)
* Allowed characters in the rest of the user name are a-z, A-Z, 0-9 and special characters '-' (dash), '_' (underscore) and '.' (dot).
* Length of user name must be from 6 is 32 characters.
If command switch -rw is used, the user will be added with read and write access, otherwise user will be added with read-only access.
In order to escalate user to read and write access at a later stage, use ACT USERPROMOTE. [user name].
**Example 1 , user is not useradmin:**

```
AVITEC AB> ACT USERADD Marvin
Password: *********
User Marvin added.
AVITEC AB>
```

**Example 2, user is useradmin (see USERADMIN command for details):**

```
USERADMIN> ACT USERADD Marvin
Error: User already exists.
USERADMIN> ACT USERADD Zaphod
User Zaphod added.
USERADMIN>
```

**Note 1!** When adding the user to the system, the password is not set, and the user cannot login. In order to activate the account, use command ACT PASSWORD.
**Note 2!** Adding a user to the system will cause an alarm to be posted to the Axell Element Manager informing about this new user (except for when omcuname adds the user).

## 11.7 ACT USERDEL

### 11.7.1 Overview

This attribute is used to delete a current user from the system.

### 11.7.2 Usage

Attribute type: Write-Only Action

Only users “useradmin” and “omcuname” are allowed to administer users on the system.
Any other user will be prompted for the “useradmin” password when launching ACT USERDEL.
**Format:**

```
ACT USERDEL <user name>
```

where <user name> is one of the users in the system. <user name> is case sensitive, meaning that the system differs between uppercase and lowercase characters.
Users currently logged in to the system cannot be deleted.
**Note!** Users omcuname and useradmin cannot be deleted from the system.
**Example 1 , user is not useradmin:**

```
AVITEC AB> ACT USERDEL Trillian
Password: *********
User Trillian deleted.
AVITEC AB>
```

**Example 2, user is useradmin (see USERADMIN command for details):**

```
USERADMIN> ACT USERDEL zaphod
Error: User does not exist.
USERADMIN> ACT USERDEL Zaphod
User Zaphod deleted.
USERADMIN>
```

**Note!** Deleting a user to the system will cause an alarm to be posted to the Axell Element Manager informing about the removed user (except for when omcuname deletes the user).

# 11.8 ACT USERPROMOTE

## 11.8.1 Overview

Promoting a user means to increase user access from read-only to read-write access.

## 11.8.2 Usage

Attribute type: Write-Only Action

Only users "useradmin" and "omcuname" are allowed to administer users on the system.
Any other user will be prompted for the "useradmin" password when launching ACT USERPROMOTE.

**Format:**

```
ACT USERPROMOTE <user name>
```

where <user name> is one of the users in the system. <user name> is case sensitive, meaning that the system differs between uppercase and lowercase characters.

**Note!** Users omcuname and useradmin cannot be promoted within the system.

**Example 1 , user is not useradmin:**

```
AVITEC AB> ACT USERPROMOTE Arthur
Password: *********
User Arthur promoted to read and write access.
AVITEC AB>
```

**Example 2, user is useradmin (see USERADMIN command for details):**

```
USERADMIN> ACT USERPROMOTE Slartibartfast
Error: User does not exist.
USERADMIN> ACT USERPROMOTE slartibartfast
User slartibartfast promoted to read and write access.
USERADMIN>
```

**Note!** Promoting a user in the system will cause an alarm to be posted to the Axell Element Manager informing about this new user access level (except for when omcuname promotes the user).

# 11.9 ACT USERDEMOTE

## 11.9.1 Overview

Demoting a user means to decrease user access from read and write to read-only access.

### 11.9.2 Usage

Attribute type: Write-Only Action

Only users "useradmin" and "omcuname" are allowed to administer users on the system.
Any other user will be prompted for the "useradmin" password when launching ACT USERDEMOTE.
**Format:**

```
ACT USERDEMOTE <user name>
```

where <user name> is one of the users in the system. <user name> is case sensitive, meaning that the system differs between uppercase and lowercase characters.
Users currently logged in to the system cannot be demoted.
**Note!** Users omcuname and useradmin cannot be promoted within the system.
**Example 1 , user is not useradmin:**

```
AVITEC AB> ACT USERDEMOTE Ford
Password: *********
User Ford demoted to read-only access.
AVITEC AB>
```

**Example 2, user is useradmin (see USERADMIN command for details):**

```
USERADMIN> ACT USERDEMOTE FordPerfect
Error: User does not exist.
USERADMIN> ACT USERDEMOTE Ford_Perfect
User Ford_Perfect demoted to read-only access.
USERADMIN>
```

**Note!** Demoting a user in the system will cause an alarm to be posted to the Axell Element Manager informing about this new user access level(except for when omcuname demotes the user).

## 11.10 ACT PASSWORD

### 11.10.1 Overview

This is used to change passwords of a user.

### 11.10.2 Usage

Attribute type: Write-Only Action

**Format on changing own password:**

```
ACT PASSWORD
```

which will prompt for old password and new password.
Passwords may include any printable characters, but must be at least 5 characters long.
**Example (assuming user Rutger):**

```
AVITEC AB> ACT PASSWD
Changing password for Rutger
Old password:
New password should be at least 5 characters long, and preferably contain a
combination of upper and lower case  letters and numbers.
Enter new password:
Re.enter new password:
Password changed.
AVITEC AB>
```

**Format on changing other users password:**

```
ACT PASSWORD [user name]
```

which will change the password for [user name]. If [user name] is the same as currently logged in user, this will behave in the same way as changing own password.
If not being logged in as useradmin, the useradmin password will first be prompted for, after which the password can be changed.
**Example (assuming user is not useradmin):**

```
AVITEC AB> ACT PASSWORD Rutger
User Admin Password: ******
New password should be at least 5 characters long, and preferably contain a
combination of upper and lower case letters and numbers.
Enter new password:
Re-enter new password:
Password changed.
AVITEC AB>
```

**Example (user is useradmin)**:

```
USERADMIN> ACT PASSWORD Rutger
New password should be at least 5 characters long, and preferably contain a
combination of upper and lower case letters and numbers.
Enter new password:
Re-enter new password:
Password changed.
```

**Note!** For user account omcuname, changing passwords have slightly different behavior.
**Format on changing password when user is omcuname:**

```
ACT PASSWORD [user name] [password]
```

This will change password of the [user name] instantly.
**Example (user is omcuname):**

```
AVITEC AB> ACT PASSWORD Rutger Wibba45Res
Password for Rutger changed successfully.
AVITEC AB>
```

**Note!** Changing a user password in the system will cause an alarm to be posted to the Axell Element Manager informing about the changed password. Alarm message will not include the password itself, but only inform about the change (except for when omcuname changes the password).

## 11.11 USERADMIN

### 11.11.1 Overview

This command is used to escalate rights and run the system with useradmin rights.

### 11.11.2 Usage

This command is used to enter the system in as user administrator. Running the controller with useradmin rights is especially useful when configuring many user accounts in a row to avoid having to enter the useradmin password for each administration task being performed.
**Format:**

```
USERADMIN
```

will prompt the user for the useradmin password.
**Example:**

```
AVITEC AB> USERADMIN
Password:
USERADMIN>
```

where the prompt indicates that escalating to useradmin was successful.
**Note!** In order to leave user administration mode use command EXIT.

## 11.12 EXIT

### 11.12.1 Overview

This command is used to leave user administration mode.

### 11.12.2 Usage

This command is used to leave the user administration mode.
**Note!** Being in user administration mode is indicated by having the prompt

```
USERADMIN>
```

rather than the normal

```
AVITEC AB>
```

**Format:**

```
EXIT
```

leaves the user administration mode.
Executing the exit command when being in normal user mode will cause an error.
**Example:**

```
USERADMIN> EXIT
AVITEC AB>
```

where the Avitec prompt indicates that the function is exited.
**Note!** Command LOGOUT might also be used to leave the user administration mode.

# 12 AXELL WIRELESS REPEATER SYSTEM SETTINGS

This chapter defines commands and attributes related to repeaters being masters or slaves in an Axell Wireless Repeater System.

An Axell Wireless Repeater System contains two different node types:

Node Master is the node containing the communications interface towards the Axell Element Manager. The node master is responsible for polling all slave nodes for new alarms and events that should be transmitted to the Axell Element Manager.

Slaves are nodes that does not have an interface towards the Axell Element Manager. Slaves contain a slave interface allowing for a node master to communicate with the system slave.

A typical example of an Axell Wireless Repeater System is an Optical Master Unit (OMU) containing a remote communications device such as a modem, and which monitors a number of fiber optic fed repeaters using the fiber as a data communications channel (using a sub carrier in the fiber).

## 12.1 System Node Identification

Node Masters and Repeater System Slaves can always be identified using the GET MDL command, where node masters always replies with a trailing -M and system slaves always replies with a trailing -S.

**Example 1:**

```
GET MDL
```

**Reply:**

```
OMU-M
```

indicating that this is an optical master unit, also being a node master in an Axell Wireless Repeater System.

**Example 2:**

```
GET MDL
```

**Reply:**

```
BSF424-S
```

indicating that this is BSF424 (Band Selective FiberOptic Fed 400MHz repeater) acting as a repeater system slave.

As an exception to the above identification, the first generation of Axell Node Masters, the HUB-unit always replies as:

```
GET MDL
```

**Reply:**

```
HUB
```

even though the HUB unit is a node master.

## 12.2 Node Addressing

When addressing nodes in a Axell Wireless Repeater System, three different methods can be used:

### 12.2.1 Numeric Addressing

Each node in the network gets a unique ID-number in the Node List as they are added to the system. Node 0 is always the master node.
Addressing is on the format

```
@K
```

where K is from 0 to N where N is number of nodes.
Reading a parameter from node 3 is entered as:

```
AVITEC AB> @3 GET ATD
14
AVITEC AB>
```

### 12.2.2 Serial Number Addressing

Node can be accessed using the serial number of the node.

**Example:**

```
AVITEC AB> @3J34 GET MDL
BSF414
AVITEC AB>
```

### 12.2.3 Node ID Addressing

Node can also be addressed using the full Node ID.
**Example:**

```
AVITEC AB> @01-01-5S45 GET TAG
SITE3_TUNNEL_OPENING
AVITEC AB>
```

## 12.3 Master Slave Common Configurations

### 12.3.1 DNA – Direct Node Access

#### 12.3.1.1 Overview

Sets the user interface in direct node access to another node in a repeater system.

#### 12.3.1.2 Usage

Attribute type: Write only

This attribute is only used in repeaters / elements being a part of an Axell Wireless repeater system (this can be determined with command GET SNI).
When many attributes are sent to another node, the user can enter Direct Node Accessing mode, where the node where the user is logged in redirects all commands to another node. This mode is configured by sending the command:

```
SET DNA [Node Address]
```

where node address can be any of the following addressing modes:
* Numeric Addressing using the node number, such as @3
* Serial Addressing using node serial number, such as @5TTR
* Full Node ID Addressing using the complete node ID, such as @01-10-5TTR

When going into direct node access, the destination address is displayed in the prompt in the same way as they where addressed, for example

```
AVITEC AB@5TTR>
```

Leaving the direct access node is done using the SET DNA command with the node address left out, or by entering the command EXIT.

```
AVITEC AB>SET DNA @01-10-5TTR
AVITEC AB@01-10-5TTR>GET DOO
1
AVITEC AB@01-10-5TTR>SET DNA
AVITEC AB>
```

Other nodes can still be addressed when using the Direct Node Addressing mode.

For example, being at node 3 and having direct node access to node 0, node 5 can still be accessed:

```
AVITEC AB>SET DNA @0
AVITEC AB@0>GET ASC
+46705008999
AVITEC AB@0>@3 GET DOO
1
AVITEC AB@0>EXIT
AVITEC AB>
```

## 12.3.2 MID – Master ID

### 12.3.2.1 Overview

If part of an Axell Wireless Repeater System, this displays ID of the master node.

### 12.3.2.2 Usage

Attribute type: Read only

If node is part of an Axell Wireless Repeater System, this attribute replies with the ID of the master node of the entire system.

**Format:**

```
XX-YY-ZZZZ
```

where XX, YY and ZZZZ are numbers. These numbers are assigned by the Axell Element Manager during integration of the repeater system to the Axell Element Manager.

**Example:**

```
GET MID
```

**Reply:**

```
01-17-0042
```

meaning that the node ID for the master unit is 01-17-0042.

**Note 1!** On node masters, Master ID (MID) is always the same as Repeater ID (RID).

Note 2! If node is not part of a repeater system, an error message will be produced:

```
"Error: Node not part of a repeater system, parameter not supported."
```

## 12.3.3 NIN – Node Information

### 12.3.3.1 Overview

Displays information about a certain node in an Axell Wireless Repeater System.

### 12.3.3.2 Usage

Attribute type: Read only

This is a read only parameter, returning information about a certain node.
**Format:**

```
GET NIN N
```

N is one of the Node Addressing Modes without the leading @ sign.
**Reply format:**

```
<Node Status> <Node Serial Number> <Node Repeater Model> <Node Tag> <Node Software Version>
```

<Node Status> is 0 if node is OK, or 1 if node has one or more errors. If node communication is in error, a '-' (dash) is reported, indicating that node status is

unknown.
<Node Serial Number> is the serial number of the node / repeater.
<Node Repeater Model> is the repeater model identifier, as replied by attribute MDL.
<Node Tag> is the name of the node site, as replied by attribute TAG, wrapped in two “”.
<Node Software Version> replies with the software version of the node controller, as replied in SWV attribute. This consists of three tokens, all wrapped in two ‘”.
**Example:**

```
GET NIN 1
```

gets information about node 1.
**Reply:**

```
1 56FR BSF424-S “Emergency exit 7” “1.1.0” “1.0.2” “BSF424 1.0.0”
```

**Note!** If node is not part of a repeater system, an error message will be produced: “Error: Node not part of a repeater system, parameter not supported.”

## 12.3.4 NNO – Node Number

### 12.3.4.1 Overview

Displays node number for this node in an Axell Wireless Repeater System.

### 12.3.4.2 Usage

Attribute type: Read only

This is a read only parameter determining the node number for this node in an Axell Wireless Repeater System.

**Format:**

```
GET NNO
```

**Reply:**

```
N
```

N determines this node’s number in the node list
**Note 1!** For master nodes, this will always reply '0' (zero).
**Note 2!** If this parameter is read from a slave node and the master has not yet updated the node, a ‘-‘ is replied.
**Note 3!** If node is not part of a repeater system, an error message will be produced:

```
“Error: Node not part of a repeater system, parameter not supported.”
```

## 12.3.5 NON – Number Of Nodes

### 12.3.5.1 Overview

This attribute displays number of nodes configured in an Axell Wireless Repeater System.

#### 12.3.5.2 Usage

Attribute type: Read only

This attribute is used in Axell Repeater systems to determine how many nodes are configured in the Repeater System.

**Format:**

```
GET NON
```

**Reply:**

```
N
```

where N determines the number of nodes configured in the system, including the master.

**Note 1!** If this parameter is read from a slave node, and the master has not yet updated the node, 0 is replied.
**Note 2!** If node is not part of a repeater system, an error message will be produced:

```
"Error: Node not part of a repeater system, parameter not supported."
```

### 12.3.6 NST – Node Status

#### 12.3.6.1 Overview

Displays summary status for each node configured in an Axell Wireless Repeater System.

#### 12.3.6.2 Usage

Attribute type: Read only

Node status attribute is used to give an overview of the status for all nodes in the network, including the master unit.

**Format:**

```
<Master Status><N1><N2>…<N24>
```

<Master Status> is the summary status for the Master unit. Status is 0 if node is OK,or 1 if node has one or more errors.
<Nk> is status for node k. Status is 0 if node is OK or 1 if node has one or more errors. If node is not installed, or node status is unknown (such as communications alarm between node master and slave), a '-' is reported.

**Example:**

```
GET NST
```

**Reply:**

```
000100-------------------
```

This means that the system is configured with 6 nodes, and that slave node number 3 is in error.

**Note!** If node is not part of a repeater system, an error message will be produced: "Error: Node not part of a repeater system, parameter not supported."

### 12.3.7 SNI – System Node Identification

#### 12.3.7.1 Overview

This parameter can be used to identify if this is a node in an Axell Wireless Repeater System.

#### 12.3.7.2 Usage

Attribute type: Read only

This is a read only parameter that can be used to identify if this is part of an Axell Wireless Repeater system, or if this is a standalone node.

**Format:**

```
GET SNI
```

**Reply:**

```
N
```

N = '-' means that this node is NOT part of a repeater system
N = 'M' means that this node acts as a Master node in a repeater system
N = 'S' means that his node acts as a Slave node in a repeater system

### 12.3.8 NODES

#### 12.3.8.1 Overview

Prints information about all nodes configured in an Axell Wireless repeater system.

#### 12.3.8.2 Usage

nodes is a command printing out configuration for all repeaters in the network.

The Node Master is responsible for informing all repeaters in the repeater system about status, model and firmware version of all other nodes in the network.

Executing this command on a slave that is not yet integrated to the repeater network, or that is recently started might report some nodes to be unkown.

## 12.4 Slave Specific Configurations

### 12.4.1 DSA – Direct Slave Access

#### 12.4.1.1 Overview

Enables direct access to the slave from the node master.

#### 12.4.1.2 Usage

Attribute Type: Action-Only

When performing advanced configurations on a node, it is sometimes desirable to have a direct access mode to the node, where all commands are available rather than just GET, SET and ACT commands.

This attribute pauses the slave from listening to data packets from the master and launches a login prompt on the slave interface instead.

**Format:**

```
ACT DSA
```

causes the controller to pause the slave interface and launch a login session via the slave interface instead.

**Example:**

```
ACT DSA
```

**Reply:**

```
Direct Slave Access initiated.
```

displaying that Direct Slave Access is initiated.

**Note 1!** When running direct access, no alarm polling is made from the master to any of the slave nodes connected to this bus.

**Note 2!** If launching the login prompt via slave interface and no login have been made within one minute, the controller goes back to normal operations again.

**Note 3!** The inactivity timeout for idle activity when accessing the slave from the node master is three minutes, meaning that if no activity has been detected during this time, the slave will go back to normal operation.

**Note 4!** Please refer to command DIRECT ACCESS on how to obtain direct access from the node master to the slave.

## 12.4.2 NLS – Network Login Status

### 12.4.2.1 Overview

Determines if it is possible to send commands to other nodes in a repeater system.

### 12.4.2.2 Usage

Attribute Type: Read-Only

This attribute determines if Node Master has detected login to this node and granted access to read and set parameters on other nodes in the repeater network.
**Format:**

```
N
```

where
N=0 means node master has not yet granted us network access, or, if node master is the HUB unit, someone else is logged in to the network either from a HUB or from elsewhere in the network. It is not possible to read or write parameters from other parts of the network.
N=1 means node has granted us access to the network, and it is possible to read or write parameters from other nodes in the network.

**Example:**

```
GET NLS
```

**Reply:**

```
1
```

means that we have full access to the repeater network, and can get and set parameters on other nodes.

**Note!** If node is not part of a repeater system, an error message will be produced: "Error: Node not part of a repeater system, parameter not supported."

## 12.4.3 NMC – Node Master Capabilities

### 12.4.3.1 Overview

Display capabilities of the Node Master from a communications point of view.

### 12.4.3.2 Usage

Attribute Type: Read-Only

This attribute determines if master unit is a HUB (old) or a new generation Node Masters with enhanced performance and functionality.
This parameter is used by System Slave to adjust certain parameters and behaviors to the capabilities of the Node Master.
**Format:**

```
N
```

where
N=0 indicates that Node Master is a HUB unit with first version of controller.
N=1 indicates that Node Master is the enhanced Node Master with capabilities matching the capabilities of the System Slave.

**Example:**

```
GET NMC
```

**Reply:**

```
1
```

meaning that node master has the full capabilities.

**Note!** If node is not part of a repeater system, an error message will be produced: "Error: Node not part of a repeater system, parameter not supported."

## 12.4.4 RXQ – Status of Received Data Quality

Displays status of the RXQ alarm source.

### 12.4.4.1 Usage

Attribute Type: Read-Only

The system slave constantly runs statistics on the last 1000 data packets received from the Node Master, and once per second calculates number of packets with errors (such as CheckSum errors or illegal length of received data packets). If percentage of correctly received packets decreases below a configurable threshold,

an RXQ alarm is triggered.

This attribute reply with status of the Received Data Quality alarm source.

**Format:**

```
<RXQ>
```

where
<RXQ> is status of the received data quality.
0 if status is OK
1 if status is ERROR
- (dash) if measured data is not available (for example, not sufficient data available).

**Example:**

```
GET RXQ
```

**Reply:**

```
1
```

indicating that received data packets contains a too high percentage of errors.

**Note!** If node is not part of a repeater system, an error message will be produced:

```
"Error: Node not part of a repeater system, parameter not supported."
```

## 12.4.5 RQL – Received Data Quality Level

### 12.4.5.1 Overview

Displays quality of the received data packets from node master.

### 12.4.5.2 Usage

Attribute Type: Read-Only

The system slave constantly runs statistics on the last 1000 data packets received from the Node Master, and once per second calculates number of packets with errors (such as CheckSum errors or illegal length of received data packets). If percentage of correctly received packets decreases below a configurable threshold, an RXQ alarm is triggered.

This attribute replies with the last measured level of the Received Data Quality.

**Format:**

```
N
```

where N is the value in % * 10 for valid data packets received.

**Example:**

```
GET RQL
```

**Reply:**

```
998
```

meaning that 99.8% of data packets were error free/correctly received.

**Note!** If node is not part of a repeater system, an error message will be produced:

```
"Error: Node not part of a repeater system, parameter not supported."
```

## 12.4.6 ACT SSP – System Slave Pause

### 12.4.6.1 Overview

This action causes a temporary stop in accepting packets from node master.

### 12.4.6.2 Usage

Attribute type: Write-Only Action

This command is used to temporarily stop handling data packets from the node master, and is mainly used for testing purposes.

**Format:**

```
ACT SSP [N]
```

where the optional parameter N determines number of seconds that the interface should pause the remote communications.
N is from 1 to 120 seconds. If N is not provided, slave will pause communications for 5 seconds.

**Example:**

```
ACT SSP 12
```

will pause the system slave interface for 12 seconds.

**Note 1!** When executing this command, no communication with other nodes in the network will be possible.
**Note 2!** If node is not part of a repeater system, an error message will be produced:

```
"Error: Node not part of a repeater system, parameter not supported."
```

## 12.4.7 SST – System Slave Statistics

### 12.4.7.1 Overview

Displays detailed statistics of the system slave interface.

### 12.4.7.2 Usage

Attribute Type: Read-Only

This attribute replies with statistics on the System Slave, and is mainly intended for troubleshooting during system setup.

Two different packets can be received by the node, a broadcast, which is sent to all nodes in the system and a data packet, which his intended for a specific node. Broadcasts never requires replies back to the master, while all data packets expects a reply to be transmitted back to the node master (assuming packet destination was this slave node). For each packet received, a number of error checks are performed to see that data packets are not corrupted, such as Checksum Errors and Length Errors.

**Format:**

```
<Rx Bytes> <Tx Bytes> <Rx Broadcast> <Rx Data Packets> <Rx Data to me> <CSUM Errors>
```

```
<Length Errors> <Other Errors> <Unknown Broadcasts> <Unknown Packets> <Tx Packets>
<Tx Fail> <Throughput> <Last Valid Rx Packet> <Last Tx Packet>
```

where
<Rx Bytes> is total number of received bytes since slave started.
<Tx Bytes> is total number of transmitted bytes since slave started.
<Rx Broadcast> is total number of received valid broadcasts.
<Rx Data Packets> is total number of valid data packets.
<Rx Data to me> is total number of received data packets addressed to this node.
<CSUM Errors> is total number of packets received, where a checksum error is detected.
<Length Errors> is total number of packets received where length did not match expected length.
<Other Errors> is total number of packets received with unspecified errors.
<Unknown Broadcasts> is number of received error free broadcasts where actual packet format is unknown (typically this is where node master contains a newer software version with enhanced command structure that slave doesn't understand).
<Unknown Packets> is number of received error free data packets where actual packet format is unknown.
<Tx Packets> is total number of packets transmitted to the node master.
<Tx Fail> is total number of packets that for some reason failed to be transmitted to the node master.
<Throughput> is number of packets / second sent by the master with one decimal resolution.
<Last Valid Rx Packet> is time point of last error free received packet. Time point is on the format HHMMSS DDMMYY, where time is on 24 hours notation.
<Last Tx Packet> is time point of last successfully transmitted packet to the node master. Time point is on the format HHMMSS DDMMYY, where time is on 24 hours notation.

For any parameter not detectable, a '-' is presented in corresponding position, except time points, which are displayed as 000000 010170.

**Example:**

```
123444 10023 1234 2233 839 2 0 0 0 0 839 0 3.4 122334 070507 122331 070507
displaying all statistics as described above.
```

**Note!** If node is not part of a repeater system, an error message will be produced:

```
"Error: Node not part of a repeater system, parameter not supported."
```

## 12.5 Node Master Configurations

This section describes attributes only available when configuring the repeater / element as a Node Master, monitoring a number of slave nodes in an Axell Wireless Repeater System

### 12.5.1 NCO – Node Communications Status

#### 12.5.1.1 Overview

Displays status of communication with nodes.

#### 12.5.1.2 Usage

Attribute type: Read only

This attribute replies with status of communication with all nodes in the repeater system.

**Format:**

```
<Node1><Node2>..<Node24>
```

<NodeX> is the status for communication with node X.
0 means communication is OK
1 means communication failure with node (ERROR).
- (dash) means node is not configured.

**Example:**

```
GET NCO
```

**Reply:**

```
00100000----------------
```

meaning that the system is configured for 8 remote nodes, and that communication with node 3 is in ERROR state (no contact with node).

**Note!** If node is not configured as a node master, an error message will be produced:

```
"Error: Node not a System Node Master, parameter not supported."
```

## 12.5.2 NLU – Nodes With Logged In Users

### 12.5.2.1 Overview

Displays what nodes have a user currently logged in to the repeater system.

### 12.5.2.2 Usage

Attribute type: Read only

This attribute gives information about what nodes in the repeater system that currently has a user logged in.
Format:
<Node1><Node2>..<Node24>
<NodeX> is the login status for node X.
0 means no user is logged in to node.
1 means user logged in to node.
- (dash) means node is not configured or status unknown (communications error with node).

**Example:**

```
00100000----------------
```

meaning that the system is configured with 8 remote nodes, and that a user is logged in to node 3.

**Note!** If node is not configured as a node master, an error message will be produced:

```
"Error: Node not a System Node Master, parameter not supported."
```

## 12.5.3 NST – Node Statuses

### 12.5.3.1 Overview

Displays status of all nodes in the network.

### 12.5.3.2 Usage

Attribute type: Read only

Node status attribute is used to give an overview of the status for all nodes in the network, including the Node Master.

**Format:**

```
<Master><Node1><Node2>..<Node24>
```

<Master> is the summary status for the Master unit and <NodeX> is status for node X.
0 if status is OK
1 if status is ERROR
- (dash) if measured data is not available, or there is a communications error with node.

**Example:**

```
GET NST
```

**Reply:**

```
000100-------------------
```

This means that the system is configured with Master plus 5 nodes, and that slave node number 3 is in error.

**Note!** If node is not configured as a node master, an error message will be produced:

```
"Error: Node not a System Node Master, parameter not supported."
```

## 12.5.4 NSC – Node Status Configuration

### 12.5.4.1 Overview

Configures if an error in node status should affect relay and/or LED in Node Master.

### 12.5.4.2 Usage

Attribute type: Read and write

This attribute is used to configure if status of slave nodes should be reflected in controller Error LED and / or in controller relay status.

**Format:**

```
<LED><Relay>
```

where
<LED> is 0 means that slave node errors not should be reflected in LED, and 1 means that an error in a slave node should cause the controller Error LED to indicate an error.
<Relay> is 0 means that slave node errors not should affect the relay output, and 1

means that an error in a slave node should cause the controller relay output to indicate an error.

**Example 1:**

```
GET NSC
```

**Reply:**

```
00
```

meaning that neither the LED or Relay will affect status in the slave nodes.

**Example 2:**

```
SET NSC 01
```

reconfigures the settings so that an error in a slave node will cause the controller relay to indicate an error.

**Note!** If node is not configured as a node master, an error message will be produced:

```
"Error: Node not a System Node Master, parameter not supported."
```

## 12.5.5 ACCESS NODE

### 12.5.5.1 Overview

This is used to get a direct access to a system slave such as a fiber optic repeater.

### 12.5.5.2 Description

Communications between the master and a slave is normally performed using GET, SET and ACT attribues that are sent between the nodes.
For more advanced troubleshooting and in order to perform firmware upload, it is required to get a transparent channel between the node master and the system slave, for example between the OMU and the fiberoptic fed repeater in a fiber optic repeater system.

**Format:**

```
ACCESS NODE <Node Number>
```

where <Node Number> is any of the node addressing modes (list position, serial or RepeaterID).

An ACCESS NODE session can always be aborted using the escape sequence Wait 1 s, three dash within one second and Wait 1 s, which will bring the standard userprompt back.

However, if logging in is completed into the remote node it is recommended to perform a logout from the remote node instead. Otherwise the remote node might stay logged in and cause the node to be unavailable for a while.

**Note 1!** ACCESS NODE is only available from master nodes to system slaves.

**Note 2!** When having direct access to a system slave, no communication will occur to slaves on the same bus, meaning that no alarms will be monitored in the system until logged out from the system slave.

Example of an ACCESS NODE session

```
AVITEC AB>access node 2
Use escape sequence <Wait 1s>---<Wait 1s> to abort.
Entering Direct Access mode.
```

```
Avitec     Controller
Repeater ID: 01-10-624T
1/23/2009 23:43:23
login: avitec
Password:
You are now logged in to the Avitec Control Module.
Time: 23:43:30   Date: 2009-01-23   RID: 01-10-624T   Tag: Repeater/Site Name
SYSEVENT: User logged in with full access
AVITEC AB>get mdl
MBF-S-9-S
AVITEC AB>
AVITEC AB>exit
User logged out from Control Module.

Remote node logged out, aborting.
Shutting down connection.
Over and out.
AVITEC AB>access node 2
```

## 12.5.6 NODE

### 12.5.6.1 Overview

Command node is used to add or remove nodes from a master slave system, and can only be ran on node masters.

### 12.5.6.2 Description

When setting up a repeater system, the node master needs to have information on all the nodes in the network.

By using the node command, nodes can be added to or removed from the repeater system. In order to get an overview of configured nodes in the network, refer to command nodes.

**Format on adding nodes:**

```
NODE ADD <Node Serial> <Bus> <Rack>:<Slot> <Capabilities> [Baud Rate]
```

where
<Node Serial> is the serial number of the node (controller or repeater / element serial number) that should be added. Serial Numbers are always exactly four characters long. Letter 'o' is not used (to avoid confusion between letter 'o' and digit zero).
<Bus> determines which one of the two data communication channels in the controller that should be used (refer to target documentation for details). Valid values are 0 and 1.
<Rack> is used in some targets (such as Optical Master Unit) to specify what communications device is used for communication with remote node. If not used, a '-' (dash) should be entered instead.
<Slot> is used in some targets (such as Optical Master Unit) to specify what communications device is used for communication with remote node.
<Capabilities> is used to determine what kind of network element is to be monitored. This should be set to 1 for H40/H50-controller based slaves, and 0 for older slave types (H30/H12-controller based).
[Baud Rate] is an optional parameter that defines what baud rate to use on communication between node master and actual nodes / slaves. If not supplied, 57600 is assumed. Baud rate is normally configured when adding nodes with <Capabilities> set to 0, where data rate between node master and slaves is lower.
Example on adding node:

NODE ADD 60FY 0 -:- 1
which adds node 60FY on bus zero. <Slot> and <Rack> are ignored, and <Capabilities> is set to 1, meaning that node is probably using a H40 or H50 based controller.

**Format on deleting nodes:**

```
NODE DEL | DELETE <Node Identifier>
```

where <Node Identifier> identifies the node using one of the node addressing methods (serial number, node number or full Node ID)

**Example on deleting node:**

```
NODE DELETE 12
```

deletes the 12'th node in the node list.

**Note 1!** Command NODES gives an overview of all commands configured in the system.
**Note 2!** If node is not configured as a node master, an error message will be produced:

```
"Error: Node not a System Node Master, command not supported."
```

# 13 NETWORK CONFIGURATIONS

Depending on hardware configuration, the controller might be equipped with an Ethernet interface.

This section describes commands and attributes configure and trouble shoot IP settings and how to get remote communication to the controller via the network up and running.

## 13.1 DAS – Dynamic Address Status

### 13.1.1 Overview

Determines if an address has been received from the DHCP server or not.

### 13.1.2 Usage

Attribute type: Read only

When configuring an interface for dynamic IP-address (using DHCP), this parameter indicates if an IP address has been received.
**Format:**

```
GET DAS <Interface>
```

**Reply:**

```
<Status>
```

<Status> = 0 means no address has been received yet.
<Status> = 1 means address is received (and can be read using NIC attribute).
<Status> = '-' (dash) means that interface is not configured for DHCP.
**Example:**

```
GET DAS
```

**Reply:**

```
0
```

which means that no address has yet been received from the DHCP server.

**Note!** In order to re-request an IP-address, refer to attribute NRS.

## 13.2 DNS – DNS Address Configurations

### 13.2.1 Overview

This displays and configures the DNS server(s).

### 13.2.2 Usage

Attribute Type: Read and Write

This attribute is used to read and configure the DNS servers for the controller.
**Note!** If using DHCP for address configuration (as configured using the NIC attribute), the DNS servers are normally supplied from the DHCP server.

**Format on getting parameters:**

```
GET DNS
```

**Reply:**

```
<DNS 1> <DNS 2> ... <DNS N>
```

where
<DNS x> is the IP address to the DNS servers.
**Example:**

```
GET DNS
```

**Reply:**

```
192.168.1.45 192.168.1.46
```

which are the IP-addresses for the two configured DNS addresses.
**Format on setting parameters:**

```
SET DNS [DNS 1] [DNS 2] [DNS 3]
```

where
[DNS x] are IP-addresses for the DNS servers on the format X.Y.Z.W
0<X<255, 0<=Y<=255, 0<=Z<=255, 0<W<255.
Up to three different DNS servers can be configured.
**Example 1:**

```
SET DNS
```

clears all DNS server addresses.
**Example 2:**

```
SET DNS 192.168.4.177 192.168.4.178 192.168.4.179
```

configures IP addresses of three DNS servers.

## 13.3 EEN – Ethernet Enabled

### 13.3.1 Overview

This attribute enables or disables the Ethernet Interface.

### 13.3.2 Usage

Attribute Type: Read and Write

This attribute configures whether Ethernet interface should be enabled or disabled.
**Format on getting parameter:**

```
GET EEN
```

**Reply:**

```
<Enabled>
```

where
Enabled = 0 means Ethernet interface is disabled.
Enabled = 1 means Ethernet interface is enabled.
**Format on setting parameter:**

```
SET EEN <Enabled>
```

where
Enabled = 0 disables the Ethernet Interface.
Enabled = 1 enables the Ethernet Interface.

**Example:**

```
GET EEN
```

**Reply:**

```
0
```

meaning that Ethernet Interface is disabled and that no communication can be established using Ethernet interface.
**Example:**

```
SET EEN 1
```

enables the Ethernet Interface.
**Note!** Enabling the Ethernet interface still requires proper IP configuration in order to be able to communicate with the controller over the network.

## 13.4 GWY – Default Gateway

### 13.4.1 Overview

This configures the default gateway to use for the controller.

### 13.4.2 Usage

Attribute Type: Read and Write

This attribute is used to configure the default gateway for the system.

**Format on getting parameters:**

```
GET GWY
```

**Reply:**

```
<Gateway>
```

where <Gateway> is the IP address for the default gateway.
**Format on setting parameters:**

```
SET GWY <Gateway>
```

where <Gateway> is the IP address on the format X.Y.Z.W, where 0<X<255, 0<=Y<=255, 0<=Z<=255, 0<W<255.

**Example:**

```
SET GWY 192.168.1.1
```

configures the default gateway.

**Note!** If network interface is configured using DHCP, such as via GPRS, gateway is normally configured by the DHCP reply.

## 13.5 MAC – MAC address

### 13.5.1 Overview

This attribute replies with the MAC-address of the controller Ethernet interface.

### 13.5.2 Usage

Attribute type: Read only

This attribute replies with the MAC address of the controller Ethernet interface.

**Format:**

```
XX:XX:XX:XX:XX:XX
```

is the 48 bit MAC address.

**Example:**

```
GET MAC
```

**Reply:**

```
00:14:B1:01:03:E5
```

which is the MAC address for the Ethernet interface of the controller.

## 13.6 NID – Network Interface Descriptions

### 13.6.1 Overview

This attribute replies with a textual description of an interface.

### 13.6.2 Usage

Attribute type: Read only

This attribute replies with a textual description of the supplied interface.

**Format:**

```
GET NID <Interface>
```

replies with a textual description of the actual interface.

**Example:**

```
GET NID ETH0
```

**Reply:**

```
Ethernet Interface 10/100 Mbit/s
```

describing the requested interface.

**Note!** Attribute NIL gives a list of all available interfaces.

## 13.7 NIL – Network Interface List

### 13.7.1 Overview

This attribute replies with the different interfaces supported in the controller.

### 13.7.2 Usage

Attribute type: Read only

This attribute replies with a list of supported interfaces supported in the controller. For a textual description of each of the interfaces, refer to attribute NID.

**Format:**

```
GET NIL
```

**Reply:**

```
<Interface 1> <Interface 2> .. <Interface N>
```

where interfaces is the list of available interfaces.

**Example:**

```
GET NIL
```

**Reply:**

```
lo eth0
```

indicating that the controller supports a Loopback and an Ethernet interface.
**Note 1!** What interfaces are available mainly depends on hardware version of the controller.
**Note 2!** The GPRS interface will be added dynamically once the GPRS attach is performed successfully.

## 13.8 NIC – Network Interface Configuration

### 13.8.1 Overview

This attribute displays and configures the IP settings for a certain interface.

### 13.8.2 Usage

Attribute Type: Read and Write

This attribute is used to configure IP address of a certain interface. Depending on interface type, both dynamic and static IP can be configured.

**Format on getting parameters:**

```
GET NIC <Interface>
```

where <Interface> is the network interface to read configuration for.
**Reply:**

```
<Method> <IP Address> <Net mask> <Broadcast>
```

where
<Method> is DYNAMIC for interfaces using DHCP, and STATIC for interfaces using static IP-address assignment.
<IP Address> is the IP address of the interface (0.0.0.0 if not configured or not received by DHCP) on the format X.Y.Z.W, where 0<X<255, 0<=Y<=255, 0<=Z<=255, 0<W<255.
<Net mask> is the net mask for the interface on the format X.Y.Z.W
0<X<255, 0<Y<255, 0<Z<255, 0<W<255.
<Broadcast> is the broadcast address for the interface on the format X.Y.Z.W
0<X<255, 0<Y<255, 0<Z<255, 0<W<255.

**Format on setting dynamic IP:**

```
SET NIC <Interface> DYNAMIC
```

causing <Interface> to automatically attempt to retrieve an IP address from the DHCP server.

**Format on setting static IP:**

```
SET NIC <Interface> STATIC <IP Address> <Net mask> <Broadcast>
```

configuring <Interface> to use the static IP address
where
<IP Address> is the on the format X.Y.Z.W, where 0<X<255, 0<=Y<=255, 0<=Z<=255, 0<W<255.
<Net mask> is the net mask on the format X.Y.Z.W
0<X<255, 0<Y<255, 0<Z<255, 0<W<255.
<Broadcast> is the broadcast address for the interface on the format X.Y.Z.W
0<X<255, 0<Y<255, 0<Z<255, 0<W<255.

**Example on configuring dynamic IP address:**

```
SET NIC ETH0 DYNAMIC
```

will cause ethernet interface to attempt to retrieve address from the DHCP server immediately. Refer to attribute DAS for details on when IP address is received.
**Example on configuring static IP address:**

```
SET NIC ETH0 STATIC  192.168.1.52 255.255.255.0 255.255.255.255
```

configures ethernet interface for static IP address 192.168.1.52 and associated net mask and broadcast address.

**Note 1!** Loop back interface cannot be configured using the NIC attribute.

**Note 2!** For each change in NIC parameters, corresponding interface will, if enabled, be shut down and then started again so that all parameters are initialized correctly.

**Note 3!** When configuring DYNAMIC IP addressing, parameter DAS determines if an address has been received from the DHCP server.

**Note 4!** If this controller should access addresses outside this subnet, default gateway must be configured using the GWY attribute.

**Note 5!** Addresses for GPRS may not be altered using this attribute. Please refer to attribute GPR for altering GPRS settings.

## 13.9 NRS – Network Restart

### 13.9.1 Overview

This action is used to cause a refresh of the network interface.

### 13.9.2 Usage

Attribute Type: Write-Only Action

Performing this action causes a refresh of the interface. This can for example be used to retrieve a refresh of the address from a DHCP-server.

**Format:**

```
ACT NRS <Interface>
```

where <Interface> is one of the supported interfaces (attribute NIL can be used to display all available interfaces).

**Example:**

```
ACT NRS ETH0
```

restarts the ethernet interface.

**Note 1!** It is not possible to perform a restart of the loopback interface.
**Note 2!** If interface is disabled, no restart will be performed.
**Note 3!** If dynamic address is used, status of interface can be obtained using attribute DAS.
**Note 4!** Refer to attribute GPRS RESTART of restarting of GPRS interface.

## 13.10 SSR – Supported Services

### 13.10.1 Overview

This displays a list of supported network services in the system.

### 13.10.2 Usage

Attribute type: Read only

This attribute displays all supported network services in the system.
**Format:**

```
<service 1> .. <service N>
```

were <service X> is a textual description of the network service ( defined in RFC1700 ).
**Example:**

```
GET SSR
```

**Reply:**

```
ssh telnet
```

indicating that network services supported are Secure Shell and Telnet.

In order to configure the use of the services, refer to attribute SRV.

## 13.11 SRV – Service Configurations

### 13.11.1 Overview

This reads and configures usage of network services in the system.

### 13.11.2 Usage

This attribute can be used to enable or disable the different network service in the controller, and also to change port numbers.

**Format on getting service configurations:**

```
GET SRV <Service>
```

where <Service> is the network service to display configuration for.
**Reply:**

```
<Enable> <Port Number>
```

where
<Enable> is 0 if this service is disabled, and 1 if service is enabled.
<Port Number> is the port that this service is listening on.

**Format on setting / configuring service:**

```
SET SRV <Service> <Enable> <Port Number>
```

where
<Service> is the service to reconfigure (must be one of the services as displayed using attribute SSR).
<Enable> is 0 if this service should be disabled, and 1 if service should be enabled.
<Port Number> is the port that this service should be listening on.
**Example on getting parameter:**

```
GET SRV SSH
```

**Reply:**

```
0 22
```

indicating that the service is disabled, and that if it was enabled should listen on port 22 (which is the standard SSH port).
**Example on setting parameter:**

```
SET SRV TELNET 1 16455
```

enables the telnet service but reconfigures it to listen on port 16455.

**Note 1!** In order for the system to work with the Axell Element Manager, the telnet service must be enabled (but not necessarily on default port 23).

**Note 2!** Port numbers 10 000 and 10 001 are used by internal systems in the controller, why they cannot be used for network services.

**Note 3!** If performing these configurations remotely, connection might be lost when applying changes to the system.

# 13.12 IFCONFIG

## 13.12.1 Overview

Displays an overview of configured network interfaces.

## 13.12.2 Usage

This command gives an overview of configured interface(s), and can be used for advanced IP trouble shooting.
**Format:**

```
ifconfig [interface]
```

where the optional [interface] is one of the network interfaces in the system. If no parameter is supplied, all interfaces are printed.
**Example:**

```
AVITEC AB> ifconfig eth0
eth0  Link encap:Ethernet  HWaddr 00:14:B1:01:03:E5
      inet addr:126.1.24.131  Bcast:126.255.255.255  Mask:255.255.255.0
      UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
      RX packets:61833 errors:0 dropped:0 overruns:0 frame:0
      TX packets:15743 errors:0 dropped:0 overruns:0 carrier:0
      collisions:0 txqueuelen:100
      RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
      Interrupt:24 Base address:0xc000
AVITEC AB>
```

# 13.13 PING

## 13.13.1 Overview

Tool to verify that communications path to remote peer is operational.

## 13.13.2 Usage

This command is used to ping (send an ICMP packet) to other addresses, and can be used during connection troubleshooting. For example, successfully pinging the configured IP address of the Axell Element Manager is a good way of knowing that communication between controller and AEM is set up correctly, and that the AEM hardware is up and running.
**Format:**

```
ping [-c Count] <destination>
```

where <destination> is either the IP address or the host name to ping.
The optional parameter -c can be used to provide number of pings.
**Note!** If parameter -c is not provided, ping will proceed until Ctrl-C is pressed.
**Example:**

```
AVITEC AB> ping -c 5 192.168.1.42
Pinging 192.168.1.42 5 times. Press <Ctrl-C> to abort.
PING 192.168.1.42 (192.168.1.42): 56 data bytes
64 bytes from 192.168.1.42: icmp_seq=0 ttl=64 time=1.4 ms
64 bytes from 192.168.1.42: icmp_seq=1 ttl=64 time=0.9 ms
64 bytes from 192.168.1.42: icmp_seq=2 ttl=64 time=0.9 ms
64 bytes from 192.168.1.42: icmp_seq=3 ttl=64 time=0.9 ms
64 bytes from 192.168.1.42: icmp_seq=4 ttl=64 time=0.8 ms
--- 192.168.1.42 ping statistics ---
```

```
10 packets transmitted, 10 packets received, 0% packet loss
round-trip min/avg/max = 0.7/0.8/1.4 ms
AVITEC AB>
```

## 13.14 TRACEROUTE

### 13.14.1 Overview

Tool to trouble shoot connection problems with remote peers.

### 13.14.2 Usage

This command can be used for troubleshooting when there is a problem establishing a connection between the controller and the Axell Element Manager. By running a traceroute it is possible to see where communications link is broken.

**Format:**

```
traceroute <destination>
```

where <destination> is either the IP address or the host name to run a trace to.
**Note!** Trace can be aborted by pressing <Ctrl-C>.

## 13.15 NETWORK

### 13.15.1 Overview

Command to get an overview of network settings.

### 13.15.2 Usage

This command displays an overview of network configurations in the system.

**Format:**

```
network
```

displays miscellaneous information related to the network configurations.

# 14 GPRS CONFIGURATIONS

## 14.1 GPR – GPRS attribute

This attribute is used to configure all parameters in the GPRS functionality.

### 14.1.1 GPR AAD – Authorization address

#### 14.1.1.1 Overview

This lists the IP-addresses that are acceptable for the clients named in the ACL parameter.

#### 14.1.1.2 Usage

Attribute Type: Read / Write

The addresses may be given in dotted quad notation or as hostnames that are looked up with the resolver.

**Usage for setting parameter:**

```
SET GPR AAD <address1> [<address2> ... <addressN>]
```

This will sett the acceptable address list to the addresses indicated. To allow ANY address use an asterisk instead "*".

**Example:**

```
SET GPR AAD 126.1.24.1 126.1.24.2
```

Sets the accebable addresses to 126.1.24.1 and 126.1.24.2.

**Usage for getting parameter :**

```
GET GPR AAD
```

**Reply:**

```
126.1.24.1 126.1.24.2
```

Indicating the acceptable addresses set.

### 14.1.2 GPR ACL – Authorization Client

#### 14.1.2.1 Overview

Controls the client authorization parameter.

#### 14.1.2.2 Usage

Attribute Type: Read / Write

This should be the name of the controller if it is used. In most cases an asterisk "*" is used to indicate that ANY name is acceptable. Setting this to the wrong name will make the authentication process to fail.

This name is only used in the CHAP/PAP negotiation process. If authorization method is set to None it does not matter.

**Usage for setting parameter:**

```
SET GPR ACL <name>
```

This will set <name> as the client name for the CHAP/PAP negotiation

**Example:**

```
SET GPR ACL voyager.local.system
```

Sets the client name to voyage.local.system.

**Usage for getting parameter:**

```
GET GPR ACL
```

**Reply:**

```
*
```

Indicating that ANY name should be acceptable.

## 14.1.3 GPR APN – Access Point Name

### 14.1.3.1 Overview

Sets the Access Point Name to attach to when negotiating a GPRS attach.

### 14.1.3.2 Usage

Attribute Type: Read / Write.

IMPORTANT: This parameter is different from network to network and operator to operator. Make sure this string is correct, otherwise the GPRS modem will not attach to the network properly!

This information should be given by the operator of the network.

**Format on setting parameter:**

```
SET GPR APN <name>
```

Where <name> should be the APN (Access Point Name) given by the network operator to get a GPRS attach properly.

**Example:**

```
SET GPR APN internet.provider.com
```

This will set the APN to "internet.provider.com".

**Format in getting parameter:**

GET GPR APN

**Reply:**

```
<name>
```

Where <name> is the currently configured Access Point Name.

**Example:**

```
GET GPR APN
```

**Reply:**

```
network.bbdb.com
```

Indicating that the current APN is set to "network.bbdb.com".

## 14.1.4 GPR APPLY – Apply changes made to the GPRS configurations

### 14.1.4.1 Overview

Used to apply changes made to the GPRS configurations.

### 14.1.4.2 Usage

Attribute Type: Action

When configuring the GPRS interface, lots of changes normally needs to be made at the same time without having to restart the GPRS interface for every configuration.

Running command

```
ACT GPR APPPLY
```

means that all changes are stored to the system and that they will be used with the next GPRS detach/attach cycle

## 14.1.5 GPR ASC – Authorisation Secret

### 14.1.5.1 Overview

Sets the "secret" for negotiating CHAP/PAP authentication.

### 14.1.5.2 Usage

Attribute Type: Read -Only

This sets the authorization "secret" for negotiating a PAP or CHAP authentication with the server. This is also known as "password" or "passphrase".

To set a blank secret use a dash "-" instead of the secret.

**Format on setting parameter:**

```
SET GPR ASC <secret>
```

Where <secret> is the secret enclosed in quotes if it is more than one word.

**Example:**

```
SET GPR ASC secret
```

Sets the PAP/CHAP secret to the word "secret".

**Example:**

```
SET GPR ASC "another day in paradise"
```

Sets the PAP/CHAP secret to the phrase "another day in paradise".

**Format on getting parameter:**

```
GET GPR ASC
```

**Reply:**

```
<Reply>
```

The command replies with 10 '*' if a passphrase is set and a '-' if no passphrase is set.

**Example:**

```
GET GPR ASC
```

**Reply:**

```
**********
```

meaning that passphrase is configured in the controller.

## 14.1.6 GPR ASV – Authorization server

### 14.1.6.1 Overview

Controls the server authorization parameter.

#### 14.1.6.2 Usage

Attribute Type: Read / Write

This should be the name of the server to authenticate with if it is used. In most cases an asterisk "*" is used to indicate that ANY name is acceptable. Setting this to the wrong name will make the authentication process to fail.

This name is only used in the CHAP/PAP negotiation process. If authorization method is set to None it does not matter.

**Usage for setting parameter:**

```
SET GPR ASV <name>
```

This will set <name> as the client name for the CHAP/PAP negotiation

**Example:**

```
SET GPR ASV voyager.local.system
```

Sets the client name to voyage.local.system.

**Usage for getting parameter:**

```
GET GPR ASV
```

**Reply:**

```
*
```

Indicating that ANY name should be acceptable.

### 14.1.7 GPR ATH – Authentication method

#### 14.1.7.1 Overview

Sets the GPRS authentication method to be used.

#### 14.1.7.2 Usage

Attribute type: Read / Write

This attribute is used to set the authentication method used to authenticate the PPP/LCP connection with the server. There are three possible settings for this attribute, none, PAP and CHAP. They are represented by a single letter (N, P, C) describing the authentication method.

**Usage for setting parameter**

```
SET GPR ATH <method>
```

Where <method> can be one of the following:

N: None, no authentication method will be used when negotiating a PPP connection with the server.

P: PAP authentication mechanism will be used when negotiating a PPP connection with the server.

C: CHAP authentication mechanism will be used when negotiating a PPP connection. This is probably the default setting that most networks will use today.

**Example:**

```
SET GPR ATH C
```

Sets the authentication method to CHAP.

**Usage for getting parameter:**

```
GET GPR ATH
```

**Reply:**

```
<method>
```

Where <method> is either N, P or C. N means no authentication method will be used, C indicated CHAP authentication will be used and P indicates PAP authentication method should be used.

**Example:**

```
GET GPR ATH
```

**Reply:**

```
C
```

Indicating that CHAP is the method to be used when negotiating a PPP connection with the peer server.

## 14.1.8 GPR CHANGES – Changes made in GPRS configuration

### 14.1.8.1 Overview

Indication if there are parameters changed in the GPRS configurations

### 14.1.8.2 Usage

Attribute Type: Read-only

This parameter indicates if there has been changes made to the GPRS interface that requires the parameters to be applied and interface to be restarted

**Format:**

```
<Changes>
```

where <Changes> = 0 means that no changes made and <Changes> = 1 means that changes are made to the GPRS configuration and that ACT GPR APPLY and ACT GPR RESTART should be performed to get the new parameters operational.

**Example:**

```
GET GPR CHANGES
```

**Reply:**

```
1
```

indicating that changes have been made to the GPRS configuration and that they need to be applied and GPRS interface to be restarted.

**Note!** This will be cleared by the ACT GPR APPLY command, but some changes might require a restart of the connection why it is recommended to perform the restart after each ACT GPR APPLY.

## 14.1.9 GPR CPI – CHAP Interval

### 14.1.9.1 Overview

Set the CHAP interval timer.

### 14.1.9.2 Usage

Attribute type: Read / Write.

This attribute is used to set a timer that can be used to force a re-negotiation of the CHAP authentication every <interval> seconds. This is used for two reasons, if there is not traffic the GPRS can be detached so it serves as a keep-alive function. It also checks that the connection is actually valid and working. If the negotiation fails for whatever reason the PPP is dropped.

If the GPRS functionality is started as "PERSISTENT" it will then restart and attempt to re-negotiate the whole PPP link with the server.

A good starting point for this parameter is to set it somewhere between 1-3 minutes (60-180 seconds).

**Usage for setting parameter:**

```
SET GPR CPI <value>
```

Where <value> should be in the interval of 10-300 seconds.

**Example:**

```
SET GPR CPI 90
```

Sets the CHAP renegotiation interval to 90 seconds.

**Usage for getting parameter :**

```
GET GPR CPI
```

**Reply:**

```
90
```

Indicating that the interval has been set to 90 seconds previously.

**Example:**

```
GET GPR CPI
```

**Reply:**

```
90
```

## 14.1.10 GPR CTY – GPRS connection type

### 14.1.10.1 Overview

Sets the connection type of GPRS to either PPP or IP.

### 14.1.10.2 Usage

Attribute Type: Read / Write.

The link to the GPRS network can use different type of protcols. Normally the

protocol used is "IP" but in rare cases it may be necessary to change this to "PPP" in order to connect. This information should be given by the network operator.

**Format on setting the parameter:**

```
SET GPR CTY <type>
```

Where <type> can be one of either IP or PPP determining the connection type. Default is IP which should work in most networks.

**Example:**

```
SET GPR CTY IP
```

Sets the connection type to "IP".

**Format on getting parameter:**

```
GET GPR CTY
```

**Reply:**

```
<format>
```

Where format may be either PPP or IP in the reply.

**Example:**

```
GET GPR CTY
```

**Reply:**

```
PPP
```

Indicating that the current method of communicating is PPP.

## 14.1.11 GPR EXF – GPRS extra flags

### 14.1.11.1 Overview

This sets any extra flags for the GPRS negotiations.

### 14.1.11.2 Usage

Attribute Type: Read / Write.

If you need this please contact Axell Wireless for more information on the various flags that can be used.

**Usage for setting parameter :**

```
SET GPR EXF ["<flag1> ... <flagN>"]
```

where <flag1> and so on are the various flags.

**Example:**

```
SET GPR EXF noauth
```

Which will set set use no authorization with the peer when connecting (CHAP/PAP disabled).

**Usage for getting parameter :**

```
GET GPR EXF
```

**Reply:**

```
<flag1 flag2 ... flagN>
```

Returns any flags set or blank if there are none.

**Example:**

```
GET GPR EXF
```

**Reply:**

```
noauth
```

Meaning that the noauth flag has been set.

## 14.1.12 GPR MDS – GPRS modem dial string

### 14.1.12.1 Overview

Sets / displays the current modem dial string for GPRS attach.

### 14.1.12.2 Usage

Attribute Type: Read / Write.

This attribute sets the dialstring used to attach to the GPRS network with the proper PDP context. This should normally not have to be changed. It is by default set to "ATDT*99***1#" which indicated PDP Context #1 which is always the context used by this controller.

Do not change the profile number 1 to something else unless you know exactly what you are doing.

**Format on setting parameter:**

```
SET GPR MDS <string>
```

Where <string> is the new string replacing the old one.

**Example:**

```
SET GPR MDS ATDT*99#
```

Will set the dial string to the "short form" of attaching with the default profile. Normally the dialstring should be "ATDT*99***1#" to indicate the we are using profile number 1.

**Format on getting parameter:**

```
GET GPR MDS
```

**Reply:**

```
ATDT*99***1#
```

Meaning that the dial string is set to "*99***1#" currently.

## 14.1.13 GPR MDT – Modem timeout

### 14.1.13.1 Overview

This set the communication timeout with the modem.

### 14.1.13.2 Usage

Attribute type: Read / Write

This attribute handles the communication timeout with the modem. It is not the connection timeout with the network but the time allowed for the modem to respond to an settings command. Normally this is set to 10 seconds which should be fine for most environments.

**Format on setting parameter:**

```
SET GPR MDT <seconds>
```

Where <seconds> range from 5-30 seconds.

**Example:**

```
SET GPR MDT 15
```

This will sett the timeout to 15 seconds.

**Format on getting parameter:**

```
GET GPR MDT
```

**Reply:**

```
<timeout>
```

Where the <timeout> is the current modem timeout setting.

**Example:**

```
GET GPR MDT
```

**Reply:**

```
15
```

Meaning the current timeout is set to 15 seconds.

## 14.1.14 GPR MRU – Maximum Receive Unit

### 14.1.14.1 Overview

Configures maximum receive unit for the GPRS interface.

### 14.1.14.2 Usage

Attribute Type: Read/Write

The maximum receive unit is a part of the configuration that determines largest data packet that can be sent over the GPRS interface before defragmentation is required. In certain cases this can be used to optimize communications interface speeds.

Providing value zero normally works, but some networks might require some tweaking.
Recommended values for the various communication types are
GPRS over GSM/GMSK: 576
GPRS over GSM/EDGE: 1476
GPRS over UMTS/WCDMA: 1500

**Format on getting parameter:**

<MRU>

where <MRU> is the maximum receive unit, <MRU> >= 0.

**Example:**

```
GET GPR MRU
```

**Reply:**

```
576
```

indicates that default value is used.

**Format on setting parameter:**

```
SET GPR MRU <MRU>
```

**Example:**

```
SET MRU 0
```

changes Maximum Transmission Unit to 0.

## 14.1.15 GPR MTU – Maximum Transmission Unit

### 14.1.15.1 Overview

Configures maximum transmission unit for the GPRS interface.

### 14.1.15.2 Usage

Attribute Type: Read/Write

The maximum transmission unit is a part of the configuration that determines largest data packet that can be sent over the GPRS interface before defragmentation is required. In certain cases this can be used to optimize communications interface speeds.

Providing value zero normally works, but some networks might require some tweaking.
Recommended values for the various communication types are
GPRS over GSM/GMSK: 576
GPRS over GSM/EDGE: 1476
GPRS over UMTS/WCDMA: 1500

**Format on getting parameter:**

<MTU>

where <MTU> is the maximum transmission unit, <MTU> >= 0.

**Example:**

```
GET GPR MTU
```

**Reply:**

```
0
```

indicates that default value is used.

**Format on setting parameter:**

```
SET GPR MTU <MTU>
```

**Example:**

```
SET MTU 1500
```

changes Maximum Transmission Unit to 1500.

## 14.1.16 GPR PTR – Persistence timer

### 14.1.16.1 Overview

Sets the timer on how often the system should check for a GPRS interface.

### 14.1.16.2 Usage

Attribute Type: Read / Write

This timer sets the time how often the system should check that the network is enabled and operational.

Valid values are between 5 seconds to 600 seconds.

**Format on setting parameter:**

```
SET GPR PTR <time>
```

Where <time> is 5 to 600 indicating the check timer interval in seconds.

**Example:**

```
SET GPR PTR 90
```

Sets the timer to 90 seconds (1½ minute) intervals.

**Format on getting parameter:**

```
GET GPR PTR
```

**Reply:**

```
<time>
```

Where time is the current time of the interval to check for the existence of a GPRS interface.

**Example:**

```
GET GPR PTR
```

**Reply:**

```
35
```

Indicating that the system should check for an existing interface every 35 seconds.

## 14.1.17 GPR RTE – Default route enable

### 14.1.17.1 Overview

This tells the system to use network default route to GPRS or not.

### 14.1.17.2 Usage

Attribute Type: Read / Write.

**Format on setting parameter:**

```
SET GPR RTE <enable>
```

Where <enable> is 1 to enable default route through this interface and 0 is to disable the default route through this interface.

**Example:**

```
SET GPR RTE 1
```

This will enable default route through the interface as soon as it is connected to the GPRS network.

**Format on getting parameter :**

```
GET GPR RTE
```

**Reply:**

```
<enable>
```

Where <enable> is either 1 for default route enable or 0 for no default route through this interface.

## 14.1.18 GPR STATUS – Reports status of GPRS interface

### 14.1.18.1 Overview

Indication if GPRS interface is operational.

### 14.1.18.2 Usage

Attribute Type: Read-only

This attribute is used to see if the GPRS interface is operational and that the GPRS attach has been successfully made.

**Format:**

```
<Status>
```

where <Status> = 0 means GPRS is not up and running and <Status> = 1 that GPRS is operational.

**Example:**

```
GET GPR STATUS
```

**Reply:**

```
0
```

meaning that GPRS interface is not operational.

**Note!** If interface is configured and supposed to work, the system will poll the status every 15 seconds and then try to reattach again.

## 14.1.19 GPR RESTART – Restart GPRS

### 14.1.19.1 Overview

Restarts the GPRS interface.

### 14.1.19.2 Usage

Attribute Type: Action

When changing parameters to the GPRS configuration, the GPRS interface normally

have to be restarted for the parameters to take effect.

Running the command

```
ACT GPR RESTART
```

will cause a GPRS detach followed by a GPRS attach session.

# 14.2 GPRS – Handle GPRS functionality

## 14.2.1 Overview

Commands to alter the GPRS interface.

## 14.2.2 Usage

### 14.2.2.1 GPRS CONFIGURE – GPRS Configurations Wizard

The GPRS CONFIGURE simplifies the GPRS configuration by providing a simple text based wizard.

The configrations dialog is issued by entering command

```
GPRS CONFIGURE
```

which will guide through the configuratioins process. Once the configuration is completed, the settings are stored and will be activated on next GPRS attachs.

**Note 1!** All parameters can configured with the GPR attributes, but this guide simplifies the setup.

**Note 2!** In order to perform a new attach to the GPRS network, please refer to attribute ACT GPR RESET.

### 14.2.2.2 GPRS DOWN – Perform a GPRS detatch

Will perform a temporary detach from the GPRS network. The GPRS interface will be brought up again when the modem processing daemon performs a new modem check, which normally happens within one minute.

**Format:**

```
GPRS DOWN
```

This will initiate the GPRS detach procedure.

### 14.2.2.3 GPRS UP – Perform a GPRS attach

This will perform an attach to the GPRS network with the settings currently configured.

**Format:**

```
GPRS UP
```

brings up the interface. In order to read out GPRS status, please refer to attribute GPR STATUS.

#### 14.2.2.4 GPRS APPLY – Apply changes made to GPRS settings

When configuring GPRS parameters using attribute GPR, these parameters are stored in the system. However, in order to make them permanent, they need to be applied, meaning that the parameters will be used in the next GPRS attach procedure.

**Format:**

```
GPRS APPLY
```

applies the currently changed parameters.

**Note 1!** In order to determine if there are parameters that needs to be applied refer to attribute GPR CHANGES.

**Note 2!** This functionality is also available by executing ACT GPR APPLY.

**Note 3!** In order to perform a GPRS detach/attach procedure to run the new parameters, refer to attribute ACT GPR RESTART.

## 14.3 TRACE GPRSDEBUG – Debug GPRS attach

### 14.3.1 Overview

Command used to perform advanced debugging of the GPRS attach procedure.

### 14.3.2 Usage

If problems arise when attempting to get the GPRS attach to work properly, it is possible to reconfigure the interface to provide debug output on the PPP connection setup between the controller and the GPRS network.

In order to enable the debugging, add the parameter DEBUG to the GPR EXF attributes, apply changes using ACT GPR APPLY and then restart the GPRS attach procedure using ACT GPR RESTART.

After this, issuing the command

```
TRACE GPRSDEBUG
```

will provide detailed information about progress of the GPRS attach procedure.

**Note!** Once debugging is completed, make sure to disable debugging. Leaving debugging enabled can cause the system to fill up with files and to slow down. Run

```
GPRS CONFIGURE
```

or reconfigure using attribute GPR EXF, remove debug flag and perform

```
ACT GPR RESTART
```

# 15 FIRMWARE UPGRADE

## 15.1 Overview

From Common firmware version 1.2.0 of the controller, it is possible to upload and

install firmware into the controller using normal terminal emulation programs and Z-modems protocols.

Axell Firmware Upload files have the file extension .arf2, and the name should normally reveal upgrade information such as

```
OMU-1.0.1_to_OMU-1.0.2.arf2
```

The firmware package itself contains all information on version compatibilities, meaning that it is not possible to install firmware unless criterias on current software versions and available memory in the controllers are met.

Normally, the firmware upgrade consists of uploading the firmware using Z-modem, and then issue an installation of the firmware.

The installer reads through the packet and calculates the checksums to ensure that the uploaded packet is valid for installation. It also checks a number of prerequisites prior to installing the firmware, such as correct System, Common and Target firmwares version for this upgrade packet and enough space to install the packet.

Once the installation procedure is started, the system will reboot after completing the installation procedure, successful or unsuccessful.

Once booting up again, the new controller will if firmware upgrade was successful be executed, and a FWU (Firmware Upgraded) alarm posted to the Axell Element Manager containing information about the new firmware version.

If firmware upgrade failed, a FWF (Firmware Upgrade Failure) alarm is posted to the Axell Element Manager informing about the upgrade failure.

## 15.2 Upgrade Procedure

The firmware upgrade procedure consists of a few different steps

1. Log in to the controller using any terminal emulation program supporting Z-modem such as HyperTerminal for Windows or minicom for Unix/Linux/OS X.

2. Initiate firmware upload by issuing the command
```
firmware upload
```
and then start the file transmission from the terminal emulation program.
**HyperTerminal:** Menu item Transfer->Send file, browse to correct arf2 file.
**MiniCom:** File transfer dialog normally is brought up automatically.

3. Once file is uploaded correctly, switch to System Administrator mode using command
```
sysadmin
```
and provide the sysadmin password.

4. Enter
```
firmware list
```
to get a list of all uploaded packages.

5. Issue installation of desired packet by issuing
```
firmware install <package>
```
such as
```
firmware install OMU-1.0.1_to_OMU-1.0.2.arf2
```

6. Wait for installation procedure to complete. After this the controller will reboot and start executing the new firmware.

Firmware upgrade completed.

## 15.3 Upgrading Fibre Optic Repeaters

In order to perform a firmware upgrade to a fibre optic repeater over the fibre, a direct access to the node has to be performed. This is done by issuing the command

```
ACCSS NODE <Node ID>
```

which will establish a transparent channel to the node. Log in to the controller as usual and perform the standard firmware upload / firmware install procedure as described in previous chapter.

Please refer to ACCESS NODE command for details on the direct access over fibre.

## 15.4 Firmware Command Reference

The following firmware command options are available

**firmware** - replies with current firmware version.

**firmware help** – prints help text on the screen.

**firmware cleanup** – performs cleanup of the system, removes old packages and log files. This command can be issued if the installer informs that there is not enough memory to install file.

**change** - change versions of common and/or target from current to older or to new version. Fallback functionality.
***Note!*** *This functionality is only for testing purposes and might severely destroy the entire system.*

**delete** - removes a specific upgrade package. This command is to be used if a package was not possible to install due to checksum errors in the package.

**upload** - starts a Z-Modem transfer in order to facilitate uploading of a new firmware to the controller using any type of terminal software such as Microsoft Windows Hyper Terminal.

**status** - displays status of controller resources available for firmware upgrade such as application and system free flash memory and free RAM.

**list** - displays uploaded firmware packages currently available for installation.

verify - validates that this is a firmware that can be installed.
**Note!** This will also be performed prior to performing an installation. It is not possible to install an invalid/broken firmware packet.

**version** - displays current firmware version (running version).

**install <packet>** - installs the firmware pointed to by <packet> on the target. Install also verifies the packet so it is not necessary to run both verify and install in the same session.

# Axell Wireless
# OMU
# Commands and Attributes

Document Revision: 1.0
Firmware Version: OMU 1.0.0
Document Release Date: 2007-10-23

Note! Avitec and AFL have merged to form the new company Axell Wireless. In this manual the name Avitec still appears in prompts etc.

## REVISION LOG

| Revision | Date | Author | Description |
| --- | --- | --- | --- |
| 1.0 | 07-10-23 | MW | First release. |
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## INDEX

# 1 OVERVIEW

All Axell Wireless network elements* equipped with a controller contains a Local Maintenance Terminal (LMT) port, and optionally a modem. This allows for configuration of the element locally and optionally remotely.

Using a terminal emulation software, such as HyperTerminal (Windows) or MiniCom (Linux/Unix) it is possible to configure the equipment using a simple command structure (terminal emulation should be set to VT100 or ANSI).

Axell Wireless Repeater Command and Attributes documentation consists of two parts;

- the Common part defines all functionality available for all Axell Wireless repeaters with the new generation of controllers (H40 and H50 series).
- the Target part defines all commands and attributes available for the specific repeater type in a separate document.

This document specifies the functionality for all commands and attributes available in the OMU target implementation.

* Network elements are for instance repeaters, Optical Master Units, etc.

# 2 VERSION COMPATIBILITY

Commands and attributes described in this document refers to Optical Master Units with Target firmware version OMU 1.0.0.

Firmware version of the controller can be obtained (once logged in) by using the attribute SWV.

# 3 USING COMMANDS AND ATTRIBUTES

When logged in to the repeater, a number of different commands and attributes are available. Commands have interaction with the user, or displays the reply on multiple rows, while attributes are worked on using GET, SET or ACT syntax which gives a reply normally on a maximum of one row.

Read-only attributes are read using GET.

**Example:**

```
AVITEC AB> GET MDL
BSF424-S
AVITEC AB>
```

Read and write attributes are either read or written

**Example:**

```
AVITEC AB> GET TAG
Repeater Name: Earl
AVITEC AB> SET TAG Site at Sundbyberg Centrum
AVITEC AB> GET TAG
Site at Sundbyberg Centrum
AVITEC AB>
```

Actions are used to perform actions.

**Example:**

```
AVITEC AB> ACT RCD
AVITEC AB>
```

which resets the communications device/modem.

# 4 BUILT IN HELP SYSTEM

## 4.1 HELP command

By entering the command
`HELP`
a list of all attributes and their modes of operation are displayed in alphabetic order.

Three different columns are displayed. First column is the actual attribute. Second column displays valid attribute access methods.
r – this means attribute can be GET
w – this means attribute can be SET
x – means attribute can be worked on with ACT (action).

Each row ends with a brief description of the attribute.

**Example:**

```
AVITEC AB>help
AC1   r    Displays alarm severity and class for a number of alarm sources.
AC2   r    Displays alarm severity and class for a number of alarm sources.
ACK     x  Acknowledges alarm log entries.
ACL   rw   Displays and changes default alarm classes.
ADC   r    Returns number of active devices in the system.
ADD   rw   Configures SMS access list to communicate with the repeater.
AGC   r    This displays status of the AGC in uplink and downlink.
AL1   r    Displays alarm configurations for EX1, EX2, EX3, EX4 and DOO.
AL2   r    Displays alarm configurations for VLI, LGO, CLR, FWU and FWF.
AL3   r    Displays alarm configurations for UAD, UDE, UPM, UDM and UPW.
AL4   r    Retrieving alarm configurations for AMU, AMD, SZU, SZD, COM and
TEM.
AL5   r    Retrieving alarm configurations for OTM, PW1, PSU, WRM and CFC.
ALA   rw   Used for reconfiguration of the alarm settings / thresholds.
ALL   r    Replies with the same information as in the heartbeat sent to
the AEM.
...
```

## 4.2 INF command

The INF attribute gives detailed information about a specific attribute (similar to information in this document).

**Example:**

```
AVITEC AB> INF DOO
This read-only attribute displays the status of the door, 0=OK, 1=ERROR.
Reply format:
X
X=0 means status is OK
X=1 means status is ERROR
X=- (dash) means status is indeterminable, or alarm source is not
measured.
Example:
GET DOO
Replies:
0
meaning status is OK.
```

# 5 OMU COMMANDS

## 5.1.1 Overview

NODEPNP command is used to automatically identify new nodes in the network.

## 5.1.2 Usage

The OMU communicates with slave repeaters over the optical fibers, and all communication is master/slave based where the OMU is the master polling all slave nodes/FiberOptic repeaters. When communicating with the repeaters, the serial number of the repeater (or repeater controller) is used as an address. This means that the node master must have knowledge of the serial numbers of all repeaters in the network.

When adding new nodes in an existing repeater system (or when configuring a new system), nodes are configured using the NODE ADD command, which requires knowledge of the serial number for the installed repeater, and what opto module the fiber is connected to.

The NODEPNP command is used to find nodes/repeaters connected to the different fiber optic modules.

Older generation of Axell Wireless repeaters (H30 or H12 controllers) do not support NODEPNP, why address needs to be determined at repeater site.

**Format:**

```
NODEPNP [--maxwait <MilliSeconds>] [--reset] [--noack] [--verbose]
<Rack>:<Slot>
```

where the following applies:

*--maxwait* - this optional parameter defines number of milliseconds that the node master should wait on reply from the slave nodes (slave nodes wait a random number of milliseconds before replying to a request). If not supplied, 2000 milliseconds will be used.

*--reset* - A node will only reply to PnP requests if node has not been communicated with before. If supplying this flag, all nodes will have the PnP functionality reset, meaning that all nodes will be answering on the request.

*--noack* – when a node is found, the PnP routine will send a message to this node to ensure that it will not answer to the next PnP request. By supplying this optional parameter, no message will be sent, meaning that replies will be made to consecutive requests too.

*--verbose* – by supplying this parameter, progress on the Plug and Play activities will be printed out. This is normally used for advanced trouble shooting.

<*Rack*> is the rack containing the Opto Module performing plug and play for.

<*Slot*> is the slot number within <Rack> to perform plug and play for.

**Example 1:**

```
NODEPNP 1:3
```

**Reply:**

```
Found node 5644 in rack 1, slot 3.
```

This example showed a successful retrieving of node data.

Command

```
NODE ADD 5644 1:3 1
```

should be used to add node to the system.

**Example 2:**

```
NODEPNP 1:3
```

**Reply:**

```
No nodes found in rack 1, slot 3. No nodes available, or nodes answered
at the same time. You might want to try again.
```

This either means that all nodes already are added, or that other nodes on this slot are of old type not supporting plug and play functionality.

**Example 3:**

```
NODEPNP 1:4
```

**Reply:**

```
Failure to find nodes in rack 1, slot 3, probably more than one node
answering. Try again!
```

This probably means that two or more nodes answered at the same time, giving corrupt data back. Running this command again, optionally with a longer delay, might cause the nodes not to answer at the same time.

**Note 1!** When performing a plug and play operation, communication with repeaters will be stopped during the plug and play routine.

**Note 2!** When nodes are found, they can be added using the NODE ADD command.

**Note 3!** If node is not configured as a node master, an error message will be produced:

```
"Error: Node not a System Node Master, command not supported."
```

## 5.2 STATUS

The STATUS command gives an overview of the entire repeater RF-configuration and status of all alarm sources in the system.

```
          1:1   1:2   1:3   1:4   1:5   1:6      SPLIT/DL CMB/UL|Rack Com. Board
RXO/TXO ER/OK ER/ER OK/ER OK/OK OK/OK OK/OK Atten(dB): 21     21|     1  2  3  4
SZP/RBT OK/OK OK/OK OK/OK OK/OK OK/OK OK/OK PW3/ILD OK/OK  OK/--|PW1 ER ER ER ER
CRC/COM OK/OK OK/OK OK/OK OK/OK OK/OK OK/OK CRC/COM OK/OK  OK/OK|PW2 OK ER OK OK
          2:1   2:2   2:3   2:4   2:5   2:6                     |PW3 OK OK OK OK
RXO/TXO ER/OK ER/ER OK/ER OK/OK OK/OK OK/OK Atten(dB): 21     21|PW4 OK  -  -  -
SZP/RBT OK/OK OK/OK OK/OK OK/OK OK/OK OK/OK PW3/ILD OK/OK  OK/--|BAT OK  -  -  -
CRC/COM OK/OK OK/OK OK/OK OK/OK OK/OK OK/OK CRC/COM OK/OK  OK/OK|RBT OK OK OK OK
          3:1   3:2   3:3   3:4   3:5   3:6                     |CRC OK OK OK OK
RXO/TXO ER/OK ER/ER OK/ER OK/OK OK/OK OK/OK Atten(dB): 21     21|COM OK OK OK OK
SZP/RBT OK/OK OK/OK OK/OK OK/OK OK/OK OK/OK PW3/ILD OK/OK  OK/--|---------------
CRC/COM OK/OK OK/OK OK/OK OK/OK OK/OK OK/OK CRC/COM OK/OK  OK/OK|External Alarms
          4:1    4:2   4:3   4:4   4:5   4:6                      |1 ER First 10ch
RXO/TXO ER/OK ER/ER OK/ER OK/OK OK/OK OK/OK Atten(dB): 21     21|2 OK Descr. 2
SZP/RBT OK/OK OK/OK OK/OK OK/OK OK/OK OK/OK PW3/ILD OK/OK  OK/--|3 OK Descr. 3
CRC/COM OK/OK OK/OK OK/OK OK/OK OK/OK OK/OK CRC/COM OK/OK  OK/OK|4 OK Descr. 4
--------------------------------------------------------------------------------
Ctrl Temp: -22.0(ER)| Relay:Closed(ER)| Node Statuses: 000001000----------------
```

# 6 ALARM CONFIGURATIONS

The following commands and attributes are implemented for the OMU target alarm configurations, as an add-on to the Common part.

## 6.1 AC2 – Compressed Alarm Severity and Alarm Class Configurations

A compact message retrieving alarm severity and alarm class for a number of alarm sources.

### 6.1.1 Usage

Attribute type: Read only

This is a compact message to retrieve Severity and Class of the different alarm sources. BAT, COM, CRC, NCO, PW1, PW2, PW3, PW4, RBT, RXO, SZP, TEM , TXO and ILD

**Format:**

```
<SevBAT> <ClassBAT> <SevCOM> <ClassCOM> .. <SevILD> <ClassILD>
```

**Example:**

```
GET AC2
```

**Replies:**

```
WA EQ CR EQ WA EQ CR EN CR EQ CR EQ CR EQ CR EQ CR EQ CR EN CR EN WA EN
CR EN CR EN
```

which are the severities and classes for the alarm sources BAT..ILD.

**Note!** The alarm severities and alarm classes can also be read and set with commands
GET/SET ASE
and
GET/SET ACL

## 6.2 AL4 - Compressed Alarm Format

A compact message retrieving alarm configurations for BAT, COM, CRC, NCO and PW1.

### 6.2.1 Usage

Attribute type: Read only

Same as attribute AL1, but replies with configuration for alarm sources BAT, COM, CRC, NCO and PW1.

## 6.3 AL5 - Compressed Alarm Format

A compact message retrieving alarm configurations for PW2, PW3, PW4, RXO and RBT.

### 6.3.1 Usage

Attribute type: Read only

Same as attribute AL1, but replies with configuration for alarm sources PW2, PW3, PW4, RXO and RBT.

## 6.4 AL6 - Compressed Alarm Format

A compact message retrieving alarm configurations for SZP, TEM, TXO and ILD.

### 6.4.1 Usage

Attribute type: Read only

Same as attribute AL1, but replies with configuration for alarm sources SZP, TEM, TXO and ILD.

## 6.5 ALL - Compact Message Status Parameters in Optical Master Unit

A compact message of all RF and status parameters in the repeater.

### 6.5.1 Usage

Attribute type: Read only

This attribute replies with the same information as in the heartbeat sent to the Axell Element Manager, except the header information (Repeater ID, STATE, Message # , Time and Date ). Please refer to Heartbeat Reports format.

## 6.6 BAT – Status of battery charge

Displays status of the battery charge.

### 6.6.1 Usage

Attribute Type: Read-Only

The optical master unit is equipped with a battery backup, which feeds controller and the modem with power during a power failure. This battery backup ensures that the optical master unit is able to inform the Axell Element Manager that the repeater network coverage is out.

This attribute replies with the status of the battery charge. A too low battery charge probably means that the optical master unit is back from a power failure and that the battery is not fully charged yet, while a too high battery voltage might indicate that the battery pack needs replacement.
Current battery level can be read out with attribute PLV, while battery level configurations are manipulated with attribute ALA BAT.

Battery Level is measured in the Rack Communication Boards (RCB) of the master rack.
**Format:**
```
<BAT>
```
where
<BAT> is battery status.
0 if status is OK
1 if status is ERROR
- (dash) if measured data is not available (communications error or improperly configured system).
**Example:**
```
GET BAT
```
**Reply:**
```
1
```
indicating that battery status is in error.

## 6.7 COM – Status of Communication with Active Devices

Displays status of communication between controller and active devices.

### 6.7.1 Usage

Attribute type: Read only

Gives status of the communication between the controller and the active devices. A communications alarm might indicate a failing module an improperly configured module or a broken cable
**Format:**
```
<RCB1>..<RCB4> <SPLIT1>..<SPLIT4> <COMB1>..<COMB4>
<FOMASTER1:1>..<FOMASTER1:6> <FOMASTER2:1>..<FOMASTER2:6>
<FOMASTER3:1>..<FOMASTER3:6> <FOMASTER4:1>..<FOMASTER4:6>
```
where
<RCB1>..<RCB4> is status on communication with Rack Communications Board 1 to 4.
<SPLIT1>..<SPLIT4> is status on communication with Splitter Board 1 to 4.

<COMB1>..<COMB4> is status on communication with Combiner Board 1 to 4.
<FOMASTER1:1>..<FOMASTER1:6> is status on communication with Fiber Optic Modules 1 to 6 in rack 1.
<FOMASTER2:1>..<FOMASTER2:6> is status on communication with Fiber Optic Modules 1 to 6 in rack 2.
<FOMASTER3:1>..<FOMASTER3:6> is status on communication with Fiber Optic Modules 1 to 6 in rack 3.
<FOMASTER4:1>..<FOMASTER4:6> is status on communication with Fiber Optic Modules 1 to 6 in rack 4.
Value can be:
0 means status is OK
1 means status is ERROR, or data not currently available (configurations error).
- (dash) means module is not installed.

**Example:**

```
GET COM
```

**Reply:**

```
01-- 00-- 00-- 000000 0000-- ------ ------
```

meaning that two racks are installed with 6 modules in first rack and two in second. Communication between controller and Rack Communications Board 2 is failing, while communications with all other modules are OK.

## 6.8 CRC – Status of EEPROM CRC

Displays status of the EEPROM CRC in active devices.

### 6.8.1 Usage

Attribute type: Read only

Each active device stores all settings and configurations in its own EEPROM memory so that an immediate startup can be performed after power outage, and so that radio coverage works as intended even if controller malfunctions.
On regular intervals the controller requests a checksum calculation of the EEPROM in the radio devices.

If a failure is detected, the CRC error is flagged in the EEPROM of the active device so that alarm status is known even after a power failure. This status is checked in EEPROM of the Rack Communication Boards (RCB), Splitter Boards (SPLIT), Combiner Boards (COMB) and the Fiber Optic Master Units (FOMASTER).

CRC alarms normally indicates a failing EEPROM and that module should be replaced.

This attribute replies with CRC status of the polled devices.

**Format:**

```
<RCB1>..<RCB4> <SPLIT1>..<SPLIT4> <COMB1>..<COMB4>
<FOMASTER1:1>..<FOMASTER1:6> <FOMASTER2:1>..<FOMASTER2:6>
<FOMASTER3:1>..<FOMASTER3:6> <FOMASTER4:1>..<FOMASTER4:6>
```

where
<RCB1>..<RCB4> is status on CRC check in Rack Communications Board 1 to 4.
<SPLIT1>..<SPLIT4> is status on CRC check in Splitter Board 1 to 4.
<COMB1>..<COMB4> is status on CRC check in Combiner Board 1 to 4.
<FOMASTER1:1>..<FOMASTER1:6> is status on CRC check in Fiber Optic Modules 1 to 6 in rack 1.
<FOMASTER2:1>..<FOMASTER2:6> is status on CRC check in Fiber Optic Modules 1 to 6 in rack 2.
<FOMASTER3:1>..<FOMASTER3:6> is status on CRC check in Fiber Optic Modules 1 to 6 in rack 3.
<FOMASTER4:1>..<FOMASTER4:6> is status on CRC check in Fiber Optic Modules 1 to 6 in rack 4.
Value can be:

0 means status is OK
1 means status is ERROR.
- (dash) means module is not available.

**Example:**

```
GET CRC
```

**Reply:**

```
00-- 00-- 00-- 000000 0100-- ------ ------
```

meaning that two racks are installed with 6 modules in first rack and two in second. CRC error is detected in FiberOptic module 2 in rack 2, while CRC status in all other modules is OK.

## 6.9 PW1 - Status of Power Supply 1

Gives status of the power supply 1 as measured in the different racks.

### 6.9.1 Usage

Attribute type: Read only

This attribute replies with status of the Power Supply 1 (+28 V) in the different racks of the Optical Master Unit.
Power Supplies are measured in the Rack Communication Boards (RCB) of the system.

**Format:**

```
<Rack1><Rack2><Rack3><Rack4>
```

where
<Rack1> is status of the +28 V as measured in the RCB of the first rack (Master Rack).
<Rack2> is status of the +28 V as measured in the RCB of the second rack (Slave Rack).
<Rack3> is status of the +28 V as measured in the RCB of the third rack (Slave Rack).
<Rack4> is status of the +28 V as measured in the RCB of the fourth rack (Slave Rack).
where
0 means status is OK
1 means status is ERROR
- (dash) means data is not available (not yet measured or communications error with RCB).

**Example:**

```
GET PW1
```

**Reply:**

```
001-
```

meaning that power supply 1 is in error in third rack, and that fourth error is not installed, or there is a communications error with fourth rack.

## 6.10 PW2 - Status of Power Supply 2

Gives status of the power supply 2 as measured in the different racks.

### 6.10.1 Usage

Attribute type: Read only

This attribute replies with status of the Power Supply 2 (+15 V) in the different racks of the Optical Master Unit.
Power Supplies are measured in the Rack Communication Boards (RCB) of the system.

**Format:**

```
<Rack1><Rack2><Rack3><Rack4>
```

where
<Rack1> is status of the +15 V as measured in the RCB of the first rack (Master Rack).
<Rack2> is status of the +15 V as measured in the RCB of the second rack (Slave Rack).
<Rack3> is status of the +15 V as measured in the RCB of the third rack (Slave Rack).
<Rack4> is status of the +15 V as measured in the RCB of the fourth rack (Slave Rack).
where
0 means status is OK

1 means status is ERROR
- (dash) means data is not available (not yet measured or communications error with RCB).

**Example:**
```
GET PW2
```
**Reply:**
```
010-
```
meaning that power supply 2 is in error in second rack, and that fourth error is not installed, or there is a communications error with fourth rack.

## 6.11 PW3 - Status of Power Supply 3

Gives status of the power supply 3 as measured in the different racks.

### 6.11.1 Usage

Attribute type: Read only

This attribute replies with status of the Power Supply 3 (+6.45 V) in the different racks of the Optical Master Unit.
Power Supplies are measured in the Rack Communication Boards (RCB) and the Splitter/Combiner Boards of the system.

**Format:**
```
<PW3:RCB:1><PW3:RCB:2><PW3:RCB:3><PW3:RCB:4><PW3:SPLIT:1><PW3:SPLIT:2><PW
3:SPLIT:3><PW3:SPLIT:4><PW3:COMB:1><PW3:COMB:2><PW3:COMB:3><PW3:COMB:4>
```
where
<PW3:RCB:1> is status of the +6.45 V as measured in the RCB of the first rack (Master Rack).
<PW3:RCB:2> is status of the +6.45 V as measured in the RCB of the second rack (Slave Rack).
<PW3:RCB:3> is status of the +6.45 V as measured in the RCB of the third rack (Slave Rack).
<PW3:RCB:4> is status of the +6.45 V as measured in the RCB of the fourth rack (Slave Rack).
<PW3:SPLIT:1> is status of the +6.45 V as measured in the Splitter Board of the first rack (Master Rack).
<PW3:SPLIT:2> is status of the +6.45 V as measured in the Splitter Board of the second rack (Slave Rack).
<PW3:SPLIT:3> is status of the +6.45 V as measured in the Splitter Board of the third rack (Slave Rack).
<PW3:SPLIT:4> is status of the +6.45 V as measured in the Splitter Board of the fourth rack (Slave Rack).
<PW3:COMB:1> is status of the +6.45 V as measured in the Combiner Board of the first rack (Master Rack).
<PW3:COMB:2> is status of the +6.45 V as measured in the Combiner Board of the second rack (Slave Rack).
<PW3:COMB:3> is status of the +6.45 V as measured in the Combiner Board of the third rack (Slave Rack).
<PW3:COMB:4> is status of the +6.45 V as measured in the Combiner Board of the fourth rack (Slave Rack).
where
0 means status is OK
1 means status is ERROR
- (dash) means data is not available (not yet measured or communications error with RCB or Splitter).

**Example:**
```
GET PW3
```
**Reply:**
```
010-000-
```

meaning that there are three racks installed, power supply 3 in Rack Communications Board second rack is in error, and that all other measured power supplies are OK.

## 6.12 PW4 - Status of Power Supply 4

Gives status of the power supply 4 as measured in the first rack.

### 6.12.1 Usage

Attribute type: Read only

This attribute replies with status of the Power Supply 4 (+6.45 V) as measured in the first rack (master rack).
Power Supply 4 feeds the controller and modem with power that is battery backed up, meaning that in case of a power failure it is still possible to report that repeater coverage has disappeared.

Power Supplies are measured in the Rack Communication Boards (RCB) of the system.

**Format:**
```
<PW4>
```
where
<PW4> is status of the backup power supply +6.45 V as measured in the RCB of the first rack.
Value can be:
0 means status is OK
1 means status is ERROR
- (dash) means data is not available(not yet measured or communications error with RCB).

**Example:**
```
GET PW4
```
**Reply:**
```
1
```
meaning that power supply 4 is measured as not being within allowed interval in first rack (master rack).

## 6.13 RBT – Status of Radio Board Temperatures

Gives status of the radio board temperatures as measured throughout the optical master unit.

### 6.13.1 Usage

Attribute type: Read only

This attribute replies with status of the Radio Board Temperature alarm sources as measured throughout the repeater.

**Format:**
```
<RCBD1>..<RCBD4> <FOMASTER1:1>..<FOMASTER1:6>
<FOMASTER2:1>..<FOMASTER2:6> <FOMASTER3:1>..<FOMASTER3:6>
<FOMASTER4:1>..<FOMASTER4:6>
```
where
<RCBD1>..<RCBD4> is status of board temperatures in Rack Communications Board 1 to 4.
<FOMASTER1:1>..<FOMASTER1:6> is status of radio board temperatures in Fiber Optic Modules 1 to 6 in rack 1.
<FOMASTER2:1>..<FOMASTER2:6> is status of radio board temperatures in Fiber Optic Modules 1 to 6 in rack 2.
<FOMASTER3:1>..<FOMASTER3:6> is status of radio board temperatures in Fiber Optic Modules 1 to 6 in rack 3.
<FOMASTER4:1>..<FOMASTER4:6> is status of radio board temperatures in Fiber Optic Modules 1 to 6 in rack 4.

Value can be:
0 means status is OK
1 means status is ERROR.
- (dash) means module is not available.

**Example:**

```
GET RBT
```

**Reply:**

```
00-- 000010 0000-- ------ ------
```

meaning that two racks are installed with 6 modules in first rack and two in second. Temperature error is detected in FiberOptic module 5 in rack 1, while temperature status in all other modules is OK.

## 6.14 RSP – Optical Master Unit Status Parameters

This attribute replies with status of all alarm sources in the Optical Master Unit.

### 6.14.1 Usage

Attribute type: Read only

This attribute replies with status of all alarm sources in the repeater and is used to get a quick overview of the entire repeater status.

For certain parameters (as noted below) some parameters are hex coded. This means that a byte replied as "A" should be converted to 1010 for corresponding position. These parameters should be used in conjunction with COM attribute to determine if parameter is valid or not.
Parameter NON should be used to determine number of nodes when interpreting NCO data.

**Format:**

```
<BAT> <COM-RCB> <COM-Split> <COM-Comb> <COM-FO Rack 1> <COM-FO Rack 2>
<COM-FO Rack 3> <COM-FO Rack 4> <CRC> <NCO> <PW1> <PW2> <PW3> <PW4> <RBT>
<RXO> <SZP> <TEM> <TXO> <ILD> <EX1/EX2/EX3/EX4>
```

where

<BAT> is status of Battery Charge for controller and modem backup.
<COM-RCB> is status of communication with Rack Communication Boards.
<COM-Split> is status of communication with Splitter Boards.
<COM-Comb> is status of communication with Combiner Boards.
<COM-FO Rack 1> is status of communication with fiber optic modules in rack 1.
<COM-FO Rack 2> is status of communication with fiber optic modules in rack 2.
<COM-FO Rack 3> is status of communication with fiber optic modules in rack 3.
<COM-FO Rack 4> is status of communication with fiber optic modules in rack 4.

<CRC> is status of EEPROM CRC in Rack Communication Boards and FiberOptic Modules. Hex Coded as:
**Byte 1:** <CRC:RCB:1><CRC:RCB:2><CRC:RCB:3><CRC:RCB:4>
**Byte 2:** <CRC:SPLIT:1><CRC:SPLIT:2><CRC:SPLIT:3><CRC:SPLIT:4>
**Byte 3:** <CRC:COMB:1><CRC:COMB:2><CRC:COMB:3><CRC:COMB:4>
**Byte 4:** <CRC:FO 1:1><CRC:FO 1:2><CRC:FO 1:3><CRC:FO 1:4>
**Byte 5:** <CRC:FO 1:5><CRC:FO 1:6><CRC:FO 2:1><CRC:FO 2:2>
**Byte 6:** <CRC:FO 2:3><CRC:FO 2:4><CRC:FO 2:5><CRC:FO 2:6>
**Byte 7:** <CRC:FO 3:1><CRC:FO 3:2><CRC:FO 3:3><CRC:FO 3:4>
**Byte 8:** <CRC:FO 3:5><CRC:FO 3:6><CRC:FO 4:1><CRC:FO 4:2>
**Byte 9:** <CRC:FO 4:3><CRC:FO 4:4><CRC:FO 4:5><CRC:FO 4:6>

<NCO> is status of communication with remote nodes. Hex Coded as:
**Byte 1:** <NCO:1><NCO:2><NCO:3><NCO:4>
**Byte 2:** <NCO:5><NCO:6><NCO:7><NCO:8>

...
**Byte 6:** <NCO:21><NCO:22><NCO:23><NCO:24>

<PW1> is status of Power Supply 1 as measured in Rack Communication Boards
<PW2> is status of Power Supply 2 as measured in Rack Communication Boards

<PW3> is status of Power Supply 3 as measured in Rack Communication Boards and OMU Splitters. Hex Coded as:
**Byte 1:** <PW3:RCB:1><PW3:RCB:2><PW3:RCB:3><PW3:RCB:4>
**Byte 2:** <PW3:SPLIT:1><PW3:SPLIT:2><PW3:SPLIT:3><PW3:SPLIT:4>
**Byte 3:** <PW3:COMB:1><PW3:COMB:2><PW3:COMB:3><PW3:COMB:4>

<PW4> is status of Power Supply 4 as measured in Rack Oommuncations Board 1.

<RBT> is Radio Board Temperature as measured in Rack Communication Boards and Fiber Optic Modules. Hex Coded as:
**Byte 1:** <RBT:RCB:1><RBT:RCB:2><RBT:RCB:3><RBT:RCB:4>
**Byte 2:** <RBT:FO 1:1><RBT:FO 1:2><RBT:FO 1:3><RBT:FO 1:4>
**Byte 3:** <RBT:FO 1:5><RBT:FO 1:6><RBT:FO 2:1><RBT:FO 2:2>
**Byte 4:** <RBT:FO 2:3><RBT:FO 2:4><RBT:FO 2:5><RBT:FO 2:6>
**Byte 5:** <RBT:FO 3:1><RBT:FO 3:2><RBT:FO 3:3><RBT:FO 3:4>
**Byte 6:** <RBT:FO 3:5><RBT:FO 3:6><RBT:FO 4:1><RBT:FO 4:2>
**Byte 7:** <RBT:FO 4:3><RBT:FO 4:4><RBT:FO 4:5><RBT:FO 4:6>

<RXO> is status of Received Optical Level as measured in Fiber Optic Modules. Hex coded as:
**Byte 1:** <RXO:FO 1:1><RXO:FO 1:2><RXO:FO 1:3><RXO:FO 1:4>
**Byte 2:** <RXO:FO 1:5><RXO:FO 1:6><RXO:FO 2:1><RXO:FO 2:2>
**Byte 3:** <RXO:FO 2:3><RXO:FO 2:4><RXO:FO 2:5><RXO:FO 2:6>
**Byte 4:** <RXO:FO 3:1><RXO:FO 3:2><RXO:FO 3:3><RXO:FO 3:4>
**Byte 5:** <RXO:FO 3:5><RXO:FO 3:6><RXO:FO 4:1><RXO:FO 4:2>
**Byte 6:** <RXO:FO 4:3><RXO:FO 4:4><RXO:FO 4:5><RXO:FO 4:6>

<SZP> is synthesizer lock status for Pilot Tone Generator as measured in Fiber Optic Modules. Hex coded as:
**Byte 1:** <SZP:FO 1:1><SZP:FO 1:2><SZP:FO 1:3><SZP:FO 1:4>
**Byte 2:** <SZP:FO 1:5><SZP:FO 1:6><SZP:FO 2:1><SZP:FO 2:2>
**Byte 3:** <SZP:FO 2:3><SZP:FO 2:4><SZP:FO 2:5><SZP:FO 2:6>
**Byte 4:** <SZP:FO 3:1><SZP:FO 3:2><SZP:FO 3:3><SZP:FO 3:4>
**Byte 5:** <SZP:FO 3:5><SZP:FO 3:6><SZP:FO 4:1><SZP:FO 4:2>
**Byte 6:** <SZP:FO 4:3><SZP:FO 4:4><SZP:FO 4:5><SZP:FO 4:6>

<TEM> is temperature status as measured in controller.

<TXO> is status of Transmitted Optical Level as measured in Fiber Optic Modules. Hex coded as:
**Byte 1:** <TXO:FO 1:1><TXO:FO 1:2><TXO:FO 1:3><TXO:FO 1:4>
**Byte 2:** <TXO:FO 1:5><TXO:FO 1:6><TXO:FO 2:1><TXO:FO 2:2>
**Byte 3:** <TXO:FO 2:3><TXO:FO 2:4><TXO:FO 2:5><TXO:FO 2:6>
**Byte 4:** <TXO:FO 3:1><TXO:FO 3:2><TXO:FO 3:3><TXO:FO 3:4>
**Byte 5:** <TXO:FO 3:5><TXO:FO 3:6><TXO:FO 4:1><TXO:FO 4:2>
**Byte 6:** <TXO:FO 4:3><TXO:FO 4:4><TXO:FO 4:5><TXO:FO 4:6>

<ILD> is status of input level downlink as measured in Splitter Boards.

<EX1/EX2/EX3/EX4> is status of external alarms 1 – 4.
Value can be:
0 means status is OK
1 means status is ERROR
- (dash) means data is not available (not yet measured).

**Example:**
```
GET RSP
```
**Reply:**
```
0 000- 000- 000- 000000 000000 00000- ------ 000000000 000000 000- 000-
000 0 0000000 000000 000000 1 000000 000- 0000
```
which indicates that all alarm statuses are OK, except temperature, which is in error.

## 6.15 RXO – Status of Received Optical Level

This attribute replies with the status of the Received Optical Level alarm sources.

### 6.15.1 Usage

Attribute type: Read only

The Fiber Optic Master constantly monitors received optical level. A too low optical input level might indicate that there is something wrong with the transmitter, a bad optical connection (poor soldering or cleaning) or a broken fiber.

A drop in received optical level most likely means that received RF-signal level also has dropped and that repeater coverage area is affected / decreased.

This attribute replies with the status of the Received Optical Level alarm sources for all opto masters.
**Format:**
```
<RXO1:1>..<RXO1:6><RXO2:1>..<RXO4:6>
```
0 if status is OK.
1 if status is ERROR.
- (dash) if measured data is not available (communications error or improperly configured system).
**Example:**
```
GET RXO
```
**Reply:**
```
00001-0000--000---------
```
indicating that received optical level in module in rack 1, slot 5 is lower than expected level, and that reason for the dropped input signal level should be investigated.

## 6.16 SZP – Status of Pilot Tone Generator Synthesizer

Replies with the status of the Pilot Tone Generator Synthesizer alarm sources.

### 6.16.1 Usage

Attribute type: Read only

When commissioning an Axell Wireless Repeater System it is essential that all fiber optic links are optimized and RF-limits adjusted accordingly. To accomplish this, a pilot tone is transmitted from Optical Master Units to the Fiber Optic Slaves and on request from slaves to masters. By transmitting with a known level and measuring received pilot tone level it is possible to calculate the path loss and hence compensate system gain accordingly.

To generate the correct pilot tone frequency, a synthesizer is used. If there is a failure generating the correct pilot tone frequency, an Synthesizer Pilot Tone generator alarm is triggered.

This attribute replies with the status of the Pilot Tone Generator Synthesizers.
**Format:**
```
<SZP1:1>..<SZP1:6><SZP2:1>..<SZP4:6>
```
where reply is
0 if status is OK/Synthesizer locked onto desired frequency.
1 if status is ERROR/Synthesizer not locked onto desired frequency.
- (dash) if measured data is not available (communications error or improperly configured system).

**Example:**
```
GET SZP
```
**Reply:**
```
000000000010000---------
```
indicating that synthesizer in rack 2, slot 4 is unlocked, and that reason for failure should be investigated.

## 6.17 TEM – Status of Controller Temperature

Displays status of temperature as measured in the repeater controller.

### 6.17.1 Usage

Attribute type: Read only

This attribute replies with status of the temperature as measured in the repeater controller.

**Format:**
```
<TEM>
```
where
0 means status is OK
1 means status is ERROR
- (dash) means data is not available (not yet measured).
**Example:**
```
GET TEM
```
**Reply:**
```
1
```
indicating that temperature as measured in controller is outside allowed interval (as configured with attribute ALA TEM).
Current temperature can be read out using attribute TEL.

## 6.18 TXO – Status of Transmitted Optical Level

This attribute replies with the status of the transmitted optical level alarm source.

### 6.18.1 Usage

Attribute type: Read only

Transmitted optical power level is constantly monitored to ensure functionality of the system. In case the optical transmitter for some reason fails (hardware failure), an alarm is triggered.

This attribute replies with the status of the transmitted optical level alarm source.
**Format:**
```
<TXO1:1>..<TXO1:6><TXO2:1>..<TXO4:6>
```
where reply is
0 if status is OK.
1 if status is ERROR.
- (dash) if measured data is not available (communications error or improperly configured system).
**Example:**
```
GET TXO
```
**Reply:**
```
00000000000010----00----
```
indicating that something is malfunctioning with the optical transmitter in rack3, slot 1. Reason for failure should be investigated.

# 7 OPTO INTERFACE CONFIGURATIONS

This section describes attributes used to read out and configure settings related to the FiberOptic modules and corresponding pilot tone functionality.

## 7.1 OLA – Optical Loss Adjustment

This attribute is used to read and adjust link between master and optical slave unit.

### 7.1.1 Usage

Attribute type: Read and Action

This attribute is used to perform an automatic adjustment of the fiber optic link to compensate for losses, and to read status of last performed adjustment.
Adjustments are made to get a well balanced and optimized system, maintaining desired gain over the entire link from input of Optical Master Unit to output of repeater. When performing the adjustment from slave to master, a pilot tone with a well defined level is sent form the slave to the master. To start the measurements, the master must first enable pilot tone signal in the slave (Fiber Optic Slave in repeater), after which pilot tone adjustments can be performed.
Once routine is finished, Pilot Tone in slave is disabled again

**Format on ACT:**

```
ACT OLA <Rack>:<Slot> [-v] [-l]
```

performs automatic adjustment of the opto link from the repeater to the optical master unit in rack <Rack> and <Slot>.
If supplying parameter -v (as verbose) progress information is printed out on the screen as the adjustments proceed.
If supplying parameter -l (as local) enabling / disabling pilot tone on remote node is disabled.

**Example:**

```
ACT OLA 1:3
```

performs an optical link adjustment of link from repeater to opto module in rack one, slot 3.

Reading OLA replies with status of last performed adjustments.

**Format on GET:**

```
GET OLA <Rack>:<Slot>
```

reads last fiber optic adjustment for link from slave repeater to opto module in rack <Rack>, slot <Slot>.

**Reply**:

```
<Status> <Start Time> <Stop Time> <Initial Attenuation> <Resulting Attenuation> <Resulting Pilot Tone Level> <Number of Iterations> <Result String>
```

where
<Status> is status of last measurement, 0 means adjustments were successfully completed, 1 means adjustments failed.
<Start Time> is on the format HHMMSS DDMMYY, where HHMMSS is the time with 24 hours notation, and DDMMYY is the date for when last measurement started.
<Stop Time> is on the format HHMMSS DDMMYY, where HHMMSS is the time with 24 hours notation, and DDMMYY is the date for when last measurement finished.
<Initial Attenuation> is the attenuation set before starting the adjustment routine.
<Resulting Attenuation> is the attenuation that was set when routine was completed.
<Resulting Pilot Tone Level> indicates the received pilot tone level in dBm * 10 when adjustment was completed (for optimal performance, pilot tone should be adjusted to -32.0 dBm).
<NumberOfIterations> indicates number of iterations (Set Attenuation- Read Pilot Tone

Level) that was needed to complete adjustment.
<Result String> is a quoted string containing additional information about measurement or reason for failure.
**Example:**
```
GET OLA 1:6
```
**Reply**:
```
0 144503 220507 144511 220507 23 25 -314 3 "Pilot tone adjusted to -31.4 dBm, procedure completed."
```
indicating result for last adjustment.

If no adjustment has been performed, a '-' (dash) is reported instead.

**Note!** In order for opto adjustments to work, what node is installed as slave repeater must be known. This is configured using the attribute NCP ( Node Communications Path ).

## 7.2 OLC – Optical Loss Compensation

Displays (and optionally configures) compensation for optical loss for all fiber optic masters in the system..

### 7.2.1 Usage

Attribute type: Read and Write

During automatic optimization of the FiberOptic link, the node master reads the received pilot tone level and compensates for the optical loss. This is to ensure that the input RF level from the Optical Slave Unit is at the correct level to obtain the correct system gain.
**Format on getting parameter:**
```
<OLC:1:1> .. <OLC1:6> <OLC2:1> .. <OLC4:6>
```
where OLC1:1..OLC4:6 indicates attenuation in dB configured for fiber optic masters in <rack 1, slot 1> .. <rack4, slot 6> to obtain optimal uplink performance of the system.
If optical master is not configured, a '-' (dash) is reported in corresponding position.
**Example:**
```
GET OLC
```
**Reply:**
```
10 10 9 10 8 - 10 11 10 - - - - - - - - - - - - - - -
```
indicating optical loss attenuation for installed opto masters.

**Note!** This parameter should normally be adjusted during commissioning, and not changed afterwards.
**Format on setting parameter:**
```
SET OLC <Rack>:<Slot> <Atten>
```
where <Rack> indicates rack number from 1 to 4, and <Slot> indicates slot from 1 to 6 within rack.
<Atten> is the desired attenuation in dB. Valid range is 0 to 25 dB.
**Example:**
```
SET OLC 2:1 18
```
adjusts the attenuation in FiberOptic Master unit in rack 2, slot 1 to 18 dB.

## 7.3 OLV – Optical Level

Replies with optical signal level as received from the optical slave units.

### 7.3.1 Usage

Attribute type: Read only

Knowing the fixed optical transmission level of the optical slave unit and measuring the received optical level, it is possible to calculate optical loss between slave and master unit.

This attribute displays the received optical level in dBm.
**Format:**
```
<OLV:1:1> .. <OLV1:6> <OLV2:1> .. <OLV4:6>
```

where OLC1:1..OLC4:6 replies with received optical level in dBm with one decimal resolution for fiber optic masters in <rack 1, slot 1> .. <rack4, slot 6>.
If level is lower than lowest detectable, '<[LowDet]' is replied.
If value is not available (such as not FiberOptic Master not installed or configured, or communications error with FiberOptic Master), a '-' (dash) is reported.

**Example:**

```
GET OLV
```

**Reply:**

```
-7.1 -7.5 -8.3 -6.2 -6.6 - -11.2 -10.1 - - - - - - - - - - - - - - -
```

meaning that received optical level is from -6.2 to -11.2 dBm. In this example, knowing that optical transmitted level is 3 dBm, optical loss is varying from 9.2 to to 14.2 dB.

## 7.4 OMP – Opto Master Parameters

Displays different parameters on the optical master.

### 7.4.1 Usage

Attribute type: Read only

This attribute replies with parameters and constants of the FiberOptic Master. Values are used by the repeater to perform calculations and to present user with opto master performance data.

**Format:**

```
GET OMP <Rack>:<Slot>
```

**Reply:**

```
<Rx Opto LowDet> <Pilot Offset Attenuation> <Pilot LowDet> <PilotARFCN>
```

where
<Rx Opto LowDet> is the lowest detectable received opto signal in dBm with one decimal resolution.
<Pilot Offset Attenuation> is a frequency offset in dB set during production of the repeater, and is used to compensate for frequency variations in the opto module.
<Pilot LowDet> is the lowest detectable pilot tone level in dBm with one decimal resolution.
<PilotARFCN> is the channel used for the pilot tone.
**Note!** If data is not available (communications error with note, or wrong configuration), four dashes separated by space are replied.

**Example:**

```
GET OMP 3:6
```

**Reply:**

```
-15.0 3 -50.0 500
```

indicating that for fiber optic module in rack 3, slot 6, lowest detectable optical level is -15.0 dBm, pilot tone offset is 3 dB, lowest detectable pilot tone is -50.0 dBm and ARFCN used for generated pilot tone is 500.

## 7.5 PTL – Pilot Tone Level

This attribute replies with received pilot tone levels from optical slaves.

### 7.5.1 Usage

Attribute type: Read only

This attribute replies with received pilot tone level from optical slave unit. This value is used during automatic optical loss compensations to ensure that the repeater system is commissioned with optimal performance.

**Format:**

```
<PTL:1:1> .. <PTL1:6> <PTL2:1> .. <PTL4:6>
```

where PTL1:1..PTL4:6 replies with received pilot tone level in dBm with one decimal resolution for fiber optic masters in <rack 1, slot 1> .. <rack4, slot 6>. If lower than lowest detectable pilot tone level, a <[Lowest Detectable Pilot Tone Level] is presented.

If value is not available (such as not FiberOptic Master not installed or configured, or communications error with FiberOptic Master), a '-' (dash) is reported.

**Example:**

```
GET PTL
```

**Reply:**

```
<-50.0 <-50.0 <-50.0 <-50.0 - - -27.1 - - - - - - - - - - - - - - - -
```

indicating that level of received pilot tone for the different modules are lower than lowest detectable, except for module in position rack 1, slot 1, which has a level of-27.1 dBm. This is the typical scenario when adjusting system in the uplink path, where only one module at a time is transmitting the pilot tone.

## 7.6 PTN – Pilot Tone Nominal Level

This attribute replies with the nominal level for the received pilot tone level.

### 7.6.1 Usage

Attribute type: Read only

This attribute replies with the nominal pilot tone level that should be received from the slave node when a system is properly commissioned. This value serves as the value that received pilot tone should be adjusted to in order to have an optimized system.

**Format on getting parameter:**

```
GET PTN
```

**Reply:**

```
<PTN>
```

where <PTN> is nominal level in dBm * 10.

**Example:**

```
GET PTN
```

**Reply:**

```
-250
```

meaning that nominal pilot tone level is -25.0 dBm.

# 8 RF-RELATED CONFIGURATIONS

## 8.1 ATD – Attenuation Downlink

Reads and configures attenuation in the downlink path.

### 8.1.1 Usage

Attribute Type: Read and Write

The input attenuation in the downlink path is used to adjust the input levels to the system before being fed to the opto converters. By adjusting the attenuation correctly, maximum range of the gain settings can be utilized in the fiber optic fed repeaters. It is possible to set up a threshold to monitor that input signal level to the system is within desired interval. If input signal level is below configured threshold, this means that output from the repeaters also has dropped and that desired coverage is not achieved, causing an alarm to be triggered.

**Note!** In order to read out actual received input levels, refer to attribute ILV. To read status of input power level measurements, refer to attribute ILD and to set corresponding alarm thresholds use attribute ALA ILD.

**Format on getting parameters:**

```
<Attenuation:1> <Attenuation:2> <Attenuation:3> <Attenuation:4>
```

where downlink attenuation for the different racks 1-4 are displayed. If rack is not installed, a '-' (dash) is reported in corresponding position.

**Example:**

```
GET ATD
```

**Reply:**

```
6 6 9 -
```
indicating that rack 1 and 2 have attenuation set to 6 dB, rack three to 9 dB and fourth rack is not configured.

**Format on setting parameters:**
```
SET ATD <Rack K> <Atten X> [<Rack L> <Atten Y>] [<Rack M> <Atten Z>]
[<Rack N> <Atten W>]
```
where
<Rack K> is the rack selector (1..4)
<Attenuation X> is downlink attenuation to set in rack K. Interval is 0 to 21 dB in 3 dB steps. Optionally attenuation in rack L to N can be set at the same time.

**Example:**
```
SET ATD 2 9 3 9
```
sets attenuation in rack 2 and 3 to 9 dB.

## 8.2 ATU – Attenuation Uplink

Reads and configures the attenuation in the uplink path.

### 8.2.1 Usage

Attribute Type: Read and Write

The attenuation in the uplink path is used to configure the system according to downlink gain settings to get a well balanced system. The attenuation is set in the combiner board.

**Format on getting parameters:**
```
<Attenuation:1> <Attenuation:2> <Attenuation:3> <Attenuation:4>
```
where uplink attenuation for the different racks 1-4 are displayed. If rack is not installed, a '-' (dash) is reported in corresponding position.

**Example:**
```
GET ATU
```
**Reply:**
```
9 9 12 -
```
indicating that rack 1 and 2 have attenuation set to 9 dB, rack three to 12 dB and fourth rack is not configured.

**Format on setting parameters:**
```
SET ATU <Rack K> <Atten X> [<Rack L> <Atten Y>] [<Rack M> <Atten Z>]
[<Rack N> <Atten W>]
```
where
<Rack K> is the rack selector (1..4)
<Attenuation X> is uplink attenuation to set in rack K. Interval is 0 to 21 dB in 3 dB steps. Optionally attenuation in rack L to N can be set at the same time.

**Example:**
```
SET ATU 2 9 3 9
```
sets attenuation in rack 2 and 3 to 9 dB.

## 8.3 ILD – Status of Input Level Downlink

Displays status of the input power level in the downlink.

### 8.3.1 Usage

Attribute Type: Read-Only

The controller constantly monitors the input signal level to the rack in the downlink path. If input signal level is below configured threshold, this means that output from the repeaters has dropped too and that desired coverage is not achieved. This causes an alarm to be triggered.

This attribute is used to read status of the Input Level alarms.

**Format:**
`<Rack1><Rack2><Rack3><Rack4>`
where
<Rack1> is status of the input signal level as measured in the Splitter Board of the first rack (Master Rack).
<Rack2> is status of the input signal level as measured in the Splitter Board of the second rack (Slave Rack).
<Rack3> is status of the input signal level as measured in the Splitter Board of the third rack (Slave Rack).
<Rack4> is status of the input signal level as measured in the Splitter Board of the fourth rack (Slave Rack).
where
0 means status is OK
1 means status is ERROR
- (dash) means data is not available (not yet measured or communications error with Splitter Board).
**Example:**
`GET ILD`
**Reply:**
`010-`
meaning that input signal level is outside configured interval in the second rack, and that fourth error is not installed, or there is a communications error with fourth rack.

**Note 1!** Input signal level is measured after attenuation, to ensure that desired level is distributed throughout the repeater system.

**Note 2!** To configure downlink attenuation, refer to attribute ATD. To read out actual received input levels, refer to attribute ILV and to set input signal alarm thresholds use attribute ALA ILD.

## 8.4 ILV – Input Levels Downlink

Displays RF input levels in the downlink.

### 8.4.1 Usage

Attribute Type: Read-Only

This attribute replies with the input signal level to the system in the downlink path. This can be used to adjust the downlink levels for optimal performance. Signal is measured after the downlink attenuator. This level is also used when configuring threshold for the Input Level Downlink (ILD) alarm.
**Format:**
`<ILV:1> <ILV:2> <ILV:3> <ILV:4>`
where
<ILV:1> .. <ILV:4> is the input signal level in dBm with one decimal tolerance for Splitter Board in rack 1 to 4.
If input power is lower than lowest detectable signal, '<x' is replied instead, where x is lowest detectable input signal level.
If rack is not installed, or there is a communications alarm with Splitter Board, a '-' (dash) is reported in corresponding position.
**Example:**
`GET ILV`
**Reply:**
`2.0 <-5.0 - -`
which indicates that rack one has an input signal level after attenuation of 2.0 dBm, rack 2 has an input signal level of less than -5.0 (lowest detectable) while rack 3 and 4 are not installed, or there is a communications error with corresponding rack.

## 8.5 RFC – Radio Frequency Parameters for Combiner

Displays Radio Frequency related parameters of the combiner board.

### 8.5.1 Usage

Attribute type: Read only

This attribute displays Radio Frequency related parameters of the combiner board.

**Format on getting parameters:**
`GET RFC <N>`
reads status from combiner installed in rack N (1..4).
**Reply:**
`<Lower Frequency> <Upper Frequency>`
where
<Lower Frequency> is the lowest frequency in Hz that this combiner can be used for.
<Upper Frequency> is the highest frequency in Hz that this combiner can be used for.
If data is not retrieved (such as a communications error with the combiner) or module is not installed, two dashes are reported.
**Example:**
`GET RFC 1`
**Reply:**
`380000000 2250000000`
meaning that frequency range for combiner is 380.0 MHz to 2250.0 MHz.

## 8.6 RFS – Radio Frequency Parameters for Splitter

Displays Radio Frequency related parameters of the Splitter board.

### 8.6.1 Usage

Attribute type: Read only

This attribute displays Radio Frequency related parameters of the splitter board.

**Format on getting parameters:**
`GET RFS <N>`
reads status from Split installed in rack N (1..4).
**Reply:**
`<Lower Frequency> <Upper Frequency> <Lowest Detectable>`
where
<Lower Frequency> is the lowest frequency in Hz that this splitter can be used for.
<Upper Frequency> is the highest frequency in Hz that this splitter can be used for.
<Lowest Detectable> is the lowest signal level in dBm * 10 that the splitter can detect.
If data is not retrieved (such as a communications error with the splitter) or module is not installed, three dashes are reported.
**Example:**
`GET RFS 1`
**Reply:**
`380000000 2250000000 -50`
meaning that frequency range for splitter is 380.0 MHz to 2250.0 MHz, and that lowest detectable input signal level is -5.0 dBm.

# 9 TEMPERATURE AND POWER SUPPLY LEVELS

This section describes attributes used to read out temperature and power supply levels and configurations.

## 9.1 PLV – Power Supply Levels

Displays power supply levels as measured in the different racks.

### 9.1.1 Usage

Attribute Type: Read-Only

Depending on configuration, an optical master unit can consist of one to four racks, where rack 1 is the master rack and rack 2 to 4 are slave racks. This attribute displays a number of voltages as measured in the configured racks.
Levels are displayed for all racks configured in the system, and if rack is not available, a '-' (dash) is reported in corresponding position.

**Format:**
```
<PW1:1> .. <PW1:4> <PW2:1> .. <PW2:4> <PW3-RCB:1> .. <PW3-RCB:4> <PW3-SPLIT:1> .. <PW3-SPLIT:4> <PW3-COMB:1> .. <PW3-COMB:4> <PW4:1> <BAT:1>
```
where
<PW1:1> .. <PW1:4> is the +28.0 V levels with one decimal resolution and a leading + sign as measured in rack 1 to rack 4.
<PW2:1> .. <PW2:4> is the +15.0 V levels with one decimal resolution and a leading + sign as measured in rack 1 to rack 4.
<PW3-RCB:1> .. <PW3-RCB:4> is the +6.45 V levels with two decimals resolution and a leading + sign as measured in Rack Communications Board in racks 1 to 4.
<PW3-SPLIT:1> .. <PW3-SPLIT:4> is the +6.45 V levels with two decimals resolution and a leading + sign as measured in Splitter Board in racks 1 to 4.
<PW3-COMB:1> .. <PW3-COMB:4> is the +6.45 V levels with two decimals resolution and a leading + sign as measured in Combiner Board in racks 1 to 4.
<PW4:1> is the +6.45 backup power level with two decimals resolution and a leading + sign as measured in rack 1.
<BAT:1> is the battery level with one decimal resolution and a leading + sign as measured in rack 1.
**Example (assuming system is equipped with master and one slave rack power supplies):**
```
GET PLV
```
**Reply:**
```
+28.1 +28.0 - - +15.0 +15.0 - - +6.41 +6.43 - - +6.42 +6.45 - - +6.41 +6.42 - - +6.46 +11.1
```
displaying the power supply distribution throughout the optical master unit.

## 9.2 TEL – Temperature Levels

Displays temperatures as measured throughout the Optical Master Unit.

### 9.2.1 Usage

Attribute type: Read only

This attribute displays all temperatures as measured in the different boards of the optical master unit.

**Format:**
```
<CTRL> <RCB:1> .. <RCB:4> <Fiber Optic Module 1:1> .. <Fiber Optic Module 4:6>
```
where temperature for each of the devices is presented with one decimal resolution and a leading + or minus sign.
If data is not available, or hardware for position is not configured, a '-' (dash) is presented in corresponding position.

**Example:**
```
GET TEL
```
**Reply:**
```
+31.4 +31.1 +30.1 - - +30.9 +31.2 +30.0 +30.9 +31.1 - +31.5 +31.4 +32.0 - - - - - - - - - - - - - - - -
```
indicating the different temperature levels throughout the Optical Master Unit.

# 10 DATA COMMUNICATION SETTINGS

This section describes attributes used to configure and read out misc data communication settings.

## 10.1 NCP – Node Communications Path

This attribute reads and configures node communications path.

### 10.1.1 Usage

Attribute type: Read and write

This attribute is used to read and configure what rack position the fiber optic repeater / slave node is connected. This configuration is used when performing optical loss adjustments (ACT OLA) from slaves to masters and for trouble shooting purposes. For this reason it is important to configure the Node Communications Path.

**Format on getting parameter:**
`Rack1:Slot1 Rack2:Slot2 .. Rack24:Slot24`
where
RackN:SlotN indi  cates rack (1..4) and slot (1..6) where node N is installed.

If configuration for node is not made, 0:0 is replied.
If node is not configured, a '-' (dash) is replied.
**Example:**
`GET NCP`
**Reply:**
`1:1 1:2 1:3 1:4 0:0 2:1 2:2 2:3 3:1 - - - - - - - - - - - - - - - -`
meaning that system has 9 nodes, but node 5 does not have node communications path configured.

**Format on setting parameter:**
`SET NCP <Node#> <Rack>:<Slot>`
where
<*Node#*> determines node to be configured (1..24).
<*Rack*> is the rack (1..4) and
<*Slot*> is the slot (1..6) containing Fiber Optic master used to communicate with slave.
**Example:**
`SET NCP 5 1:5`
configures node 5 as being connected to fiber optic module in rack 1, slot 5.

## 10.2 OCP – Opto Communication Path Configurations

This attribute is used to read and enable/disable communications over opto fiber.

### 10.2.1 Usage

Attribute type: Read and Write

For trouble shooting purposes and to disable data from a fiber optic device that pollutes communications data with other slaves it is possible to enable or disable data communications over the opto fiber connected to a certain FiberOptic Master Unit.

**Format on getting parameter:**
`<OCP:1:1> .. <OCP1:6> <OCP2:1> .. <OCP4:6>`
where OCP1:1..OCP4:6 indicates enable / disable communication over fiber connected to fiber optic masters in <rack 1, slot 1> .. <rack4, slot 6>.
0 means communications path is disabled.
1 means communications path is enabled.
If optical master is not configured, a '-' (dash) is reported in corresponding position.
**Example:**
`GET OCP`
**Reply:**
`1 1 1 1 0 1 1 1 1 1 1 - 1 1 1 1 1 - - - - - - - -`

indicating that all installed opto links have data communications enabled, exept for module in position rack 1:slot 5.

**Format on setting parameter:**
`SET OCP <Rack>:<Slot> <Enable>`
where <Rack> indicates rack number from 1 to 4, and <Slot> indicates slot from 1 to 6 within rack.
<Enable> configures if data communications should be enabled (1) or disabled (0).
**Example:**
`SET OCP 2:1 0`
disables communication over fiber connected to FiberOptic Master unit in rack 2, slot 1.

**Note 1!** Communications path for all opto links are always enabled during startup of the Optical Master Unit.
**Note 2!** Disabling communication over an opto fiber will cause communications alarm with any nodes/repeaters communicating over this link.

## 10.3 RCP - Rack Communications Path Configuration

This attribute is used to read and enable/disable communications to opto modules.

### 10.3.1 Usage

For trouble shooting purposes and testing it is possible to enable or disable data communications from all opto modules in a rack..

When disabling a communications path it means that communications alarm with all opto modules in that rack and all nodes/repeaters connected to corresponding fiber connections will be triggered.

**Format on getting parameter:**
`<RCP:1> <RCP:2> <RCP:3> <RCP:4>`
where RCP:1..RCP:4 indicates enable / disable status for communications path from RCB:1 .. RCB:4 to fiber optic modules in corresponding rack.
0 means communications path is disabled.
1 means communications path is enabled.
If optical master is not configured, a '-' (dash) is reported in corresponding position.
**Example:**
`GET RCP`
**Reply:**
`1 1 0 -`
indicating that rack 1 and 2 have communication to fiber optic devices enabled, while rack three communication is disabled and fourth rack is not configured.

**Format on setting parameter:**
`SET RCP <Rack> <Enable>`
where
<Rack> indicates rack number from 1 to 4
<Enable> configures if data communications should be enabled (1) or disabled (0).
**Example:**
`SET RCP 2 0`
disables communication with fiber modules in rack 2

**Note!** Communications path for all racks enabled during startup of the Optical Master Unit.

# 11 ALARM ATTRIBUTE THRESHOLDS

This section defines alarm sources in the Optical Master Unit target.

The following alarms are NOT described in this chapter, but are optionally generated by the repeater:
* External Alarm Interface board alarms EX1-EX4.
* User activity alarms VLI, LGO and CLR.
* User administration alarms (UAD, UDE, UPM, UDM and UPW).
* Firmware upgrade / fall back alarms (FWU and FWF).

## 11.1 BAT – Battery Level

### 11.1.1 Description

The battery level alarm source ensures that the battery charge is within expected levels. A battery charge outside configured interval might mean that the battery is drained and needs replacement.

### 11.1.2 Threshold Usage

By default, both upper and lower thresholds are used in the BAT alarm.

### 11.1.3 Time

Time threshold defines how many seconds the alarm should be measured as in error before an alarm is triggered.

### 11.1.4 Upper

Upper threshold is maximum voltage level * 10 of the battery charge before an alarm is triggered. For example, configuring the upper level as 126 means that if battery charge exceeds 12.6 V, an alarm is triggered.

### 11.1.5 Lower

Lower threshold is minimum voltage level * 10 of the battery charge before an alarm is triggered. For example, configuring the lower level as 92 means that if battery charge drops below 9.2 V, an alarm is triggered.

## 11.2 COM – Communications with Active Devices

### 11.2.1 Description

The repeater controller communicates with active devices using a serial bus. In case there is a failure in communications with an active device it might indicate that the active device or bus is broken, or that there is a configurations error.

COM alarm is triggered on failure in communication with Rack Communication Boards (RCB), Splitter Boards (SPLIT), Combiner Boards (COMB) and FiberOptic Master Units (FOMASTER).

### 11.2.2 Threshold Usage

This is a digital measurement, i.e, upper and lower thresholds are ignored.

### 11.2.3 Time

Time threshold configures how many failed communication attempts in a row that is allowed before an alarm is triggered.

### 11.2.4 Upper

Not used.

#### 11.2.5 Lower

Not used.

### 11.3 CRC – EEPROM CRC Check in Active Devices

#### 11.3.1 Description

On a regular interval, the controller polls the active devices for the Checksum of the EEPROM (where all radio parameters are stored). If CRC differs from expected CRC, an alarm is triggered. This status is checked in EEPROM of the Rack Communication Boards (RCB), Splitter Boards (SPLIT), Combiner Boards (COMB) and FiberOptic Modules (FOMASTER).

If a failure is detected, the CRC error is flagged in the EEPROM of the active device so that alarm status is known even after a power failure.

CRC alarms normally indicates a failing EEPROM and that module should be replaced.

#### 11.3.2 Threshold Usage

This is a digital measurement, i.e, upper and lower thresholds are ignored.

#### 11.3.3 Time

Time threshold configures after how many seconds in error the CRC alarm should be triggered. Normally this is set to 1 (one).

#### 11.3.4 Upper

Not used.

#### 11.3.5 Lower

Not used.

### 11.4 ILD – Input Signal Level Downlink

#### 11.4.1 Description

The Optical Master Unit can be configured to monitor the input signal level after the input attenuator. This is used to ensure that signals from the donor (BTS or antennas) always are above a defined level. If input signal level drops it means that output power for repeaters in the system will drop too, causing decreased coverage.

#### 11.4.2 Threshold Usage

By default, only lower threshold is configured, but it is possible to configure upper thresholds too.

#### 11.4.3 Time

Defines after how many consecutive seconds outside allowed interval that an alarm should be triggered.

#### 11.4.4 Upper

Defines above what downlink input signal level in dBm * 10 that an alarm should be triggered.

#### 11.4.5 Lower

Defines below what downlink input signal level in dBm * 10 that an alarm should be triggered.
For example, configuring lower threshold as -40 means that if input signal level drops below -4.0 dBm, an alarm will be triggered.
**Note!** If defining the threshold lower than lowest detectable level (as investigated with attribute RFS), alarm source will always be measured as OK.

## 11.5 NCO – Node Communications Status

### 11.5.1 Description

If Optical Master Unit is configured as a node master monitoring a number of slave repeaters over the optical fiber, this alarm is used to indicate status of the actual communication.

A communications alarm might indicate that fiber connection is unplugged or that repeater is down.

### 11.5.2 Threshold Usage

This is a status measurement, either OK or ERROR. Hence, upper and lower thresholds are ignored.

### 11.5.3 Time

Time threshold configures after how many consecutive communication errors with node that an alarm should be triggered.

### 11.5.4 Upper

Not used.

### 11.5.5 Lower

Not used.

## 11.6 PW1 – Power Supply 1

### 11.6.1 Description

The Power Supply 1 is the +28 V distribution as measured in the  in the Rack Communication Board in the different racks of the Optical Master Unit.

If level is outside configured interval, an alarm is triggered.

### 11.6.2 Threshold Usage

By default, both upper and lower thresholds are used in the PW1 alarm.

### 11.6.3 Time

Time threshold defines how many seconds the alarm should be measured as in error before an alarm is triggered.

### 11.6.4 Upper

Upper threshold is maximum voltage level * 10 of the power supply before an alarm is triggered. For example, configuring the upper level as 295 means that if voltage level exceeds 29.5 V, an alarm is triggered.

### 11.6.5 Lower

Lower threshold is minimum voltage level * 10 of the power supply before an alarm is triggered. For example, configuring the lower level as 270 means that if voltage level drops below 27.0 V, an alarm is triggered.

## 11.7 PW2 – Power Supply 2

### 11.7.1 Description

The Power Supply 1 is the +15 V distribution as measured in the  in the Rack Communication Board in the different racks of the Optical Master Unit.

If level is outside configured interval, an alarm is triggered.

#### 11.7.2 Threshold Usage

By default, both upper and lower thresholds are used in the PW2 alarm.

#### 11.7.3 Time

Time threshold defines how many seconds the alarm should be measured as in error before an alarm is triggered.

#### 11.7.4 Upper

Upper threshold is maximum voltage level * 10 of the power supply before an alarm is triggered. For example, configuring the upper level as 155 means that if voltage level exceeds 15.5 V, an alarm is triggered.

#### 11.7.5 Lower

Lower threshold is minimum voltage level * 10 of the power supply before an alarm is triggered. For example, configuring the lower level as 143 means that if voltage level drops below 14.3 V, an alarm is triggered.

### 11.8 PW3 – Power Supply 3

#### 11.8.1 Description

The Power Supply 1 is the +6.45 V distribution as measured in the Rack Communication Boards, Splitter Boards and Combiner Boards in the different racks of the Optical Master Unit.

If level is outside configured interval, an alarm is triggered.

#### 11.8.2 Threshold Usage

By default, both upper and lower thresholds are used in the PW3 alarm.

#### 11.8.3 Time

Time threshold defines how many seconds the alarm should be measured as in error before an alarm is triggered.

#### 11.8.4 Upper

Upper threshold is maximum voltage level * 100 of the power supply before an alarm is triggered. For example, configuring the upper level as 660 means that if voltage level exceeds 6.60 V, an alarm is triggered.

#### 11.8.5 Lower

Lower threshold is minimum voltage level * 100 of the power supply before an alarm is triggered. For example, configuring the lower level as 610 means that if voltage level drops below 6.10 V, an alarm is triggered.

### 11.9 PW4 – Power Supply 4

#### 11.9.1 Description

The Rack Communications Board in rack 1 constantly monitors the backed up 6.45 V power supply level feeding the controller, modem and Rack Communications Board. If the level increases above or drops below configured thresholds, an alarm is triggered.

PW4 alarm is measured in Rack Communications Board (RCB).

**Note!** Since controller runs on this power supply, it is only possible to alarm when power supply changes slightly, not when it disappears completely.

#### 11.9.2 Threshold Usage

By default, both upper and lower thresholds are used in the PW4 alarm.

#### 11.9.3 Time

Time threshold defines how many seconds the alarm should be measured as in error before an alarm is triggered.

#### 11.9.4 Upper

Upper threshold is maximum voltage level * 100 of the power supply before an alarm is triggered. For example, configuring the upper level as 660 means that if voltage level exceeds 6.60 V, an alarm is triggered.

#### 11.9.5 Lower

Lower threshold is minimum voltage level * 100 of the power supply before an alarm is triggered. For example, configuring the lower level as 610 means that if voltage level drops below 6.10 V, an alarm is triggered.

### 11.10RBT – Radio Board Temperature

#### 11.10.1Description

Temperature is constantly monitored on the Rack Communications Board (RCB) and in the FiberOptic Masters (FOMASTER).

An alarm will be triggered temperature board temperature is outside allowed interval. A radio board with a too high temperature might cause decreased radio performance and will lower MTBF on the entire Optical Master Unit.

#### 11.10.2Threshold Usage

By default, both upper and lower thresholds are used in the RBT alarm.

#### 11.10.3Time

Time threshold defines how many seconds the alarm should be measured as in error before an alarm is triggered.

#### 11.10.4Upper

Upper threshold is maximum temperature in Celsius * 10 allowed on the board before an alarm is triggered.
For example, upper threshold set to 750 means that if board temperature increases above 75.0 Celsius, an alarm is triggered.

#### 11.10.5Lower

Lower threshold is minimum temperature in Celsius * 10 allowed on the board before an alarm is triggered.
For example, lower threshold set to -100 means that if board temperature drops below -10.0 Celsius, an alarm is triggered.

### 11.11RXO - Recieved Optical Level

#### 11.11.1Description

The Fiber Optic Masters constantly monitors received optical level. A too low optical input level might indicate that there is something wrong with the slave transmitter, a bad optical connection (poor soldering or cleaning) or a broken fiber.

#### 11.11.2Threshold Usage

By default, only lower threshold is used.

#### 11.11.3Time

Time threshold defines how many seconds the alarm should be measured as in error before an alarm is triggered.

#### 11.11.4Upper

Not used.

#### 11.11.5Lower

Defines the lowest acceptable optical level in dBm * 10 before an alarm is triggered. For example, setting Lower alarm threshold to -20 means that if optical input level drops below -2.0 dBm, an alarm is triggered.

### 11.12SZP – Synthesizer Pilot Tone Generator

#### 11.12.1Description

When commissioning an Axell Wireless Repeater System it is essential that all fiber optic links are optimized and RF-limits adjusted. To accomplish this, a pilot tone is transmitted from Optical Master Unit to the Fiber Optic Slaves, and upon request by Fiber Optic Slaves to Optical Master Unit. By transmitting with a known level, it is possible to read out the path loss by monitoring the received pilot tone level.

To generate the correct pilot tone frequency, a synthesizer is used. If there is a failure generating the correct pilot tone frequency, an Synthesizer Pilot Tone generator alarm is generated.

#### 11.12.2Threshold Usage

This is a digital measurement, i.e, upper and lower thresholds are ignored.

#### 11.12.3Time

Time threshold configures how many seconds the synthesizer should be unlocked before an alarm is triggered.

#### 11.12.4Upper

Not used.

#### 11.12.5Lower

Not used.

### 11.13TEM – Controller Temperature

#### 11.13.1Description

In order to know that repeater works in an allowed temperature range, the controller contains a temperature sensor that continuously is polled.

If temperature goes outside configured thresholds, an alarm is triggered.

#### 11.13.2Threshold Usage

Both upper and lower temperature can be monitored.

#### 11.13.3Time

Time threshold configures how many seconds the synthesizer should be unlocked before an alarm is triggered.

#### 11.13.4Upper

Defines above what temperature in Celsius * 10 that an alarm is triggered. For example, by defining upper threshold as 650, an alarm is triggered if temperature exceeds 65.0 Celsius.

#### 11.13.5Lower

Defines below what temperature in Celsius * 10 that an alarm is triggered. For example, by defining lower threshold as -250, an alarm is triggered if temperature in controller drops below -25.0 C.

### 11.14TXO – Transmitted Optical Level

#### 11.14.1Description

Transmitted optical power level is constantly monitored to ensure functionality of the system. In case the optical transmitter for some reason fails (hardware failure), an alarm is triggered.

#### 11.14.2Threshold Usage

This is a digital measurement, i.e, upper and lower thresholds are ignored.

#### 11.14.3Time

Time threshold configures how many seconds the optical transmitter should be in error before an alarm is triggered.

#### 11.14.4Upper

Not used.

#### 11.14.5Lower

Not used.

## 12 HEARTBEAT FORMAT

The heartbeat report is transmitted to the Axell Element Manager on configurable intervals (0-99 999 min). In case the heartbeat report is not received by the Axell Element Manager within expected interval, an alarm is triggered at the AEM.

If optical master unit is configured as a node master, heartbeats are collected from all slaves for transmission to the Axell Element Manager.

In the heartbeat report, all fields are separated by space.

<table>
<tr><th>Field</th><th>Format</th><th>Description</th><th># of chars</th></tr>
<tr><td>Repeater ID</td><td>XX-YY-ZZZZ</td><td></td><td>10</td></tr>
<tr><td>Message no</td><td>NNNNNNNNN</td><td></td><td>9</td></tr>
<tr><td>State</td><td>STATE</td><td></td><td>5</td></tr>
<tr><td>Date</td><td>DDMMYY</td><td></td><td>6</td></tr>
<tr><td>Time</td><td>HHMMSS</td><td></td><td>6</td></tr>
<tr><td>ATD</td><td>JJKKLLMM</td><td>Attenuation in downlink for Splitter Boards 1-4, zero padded.</td><td>8</td></tr>
<tr><td>ATU</td><td>JJKKLLMM</td><td>Attenuation in uplink for Combiner Boards 1-4, zero padded.</td><td>8</td></tr>
<tr><td>BAT</td><td>N</td><td>Status of Battery Charge</td><td>1</td></tr>
<tr><td>COM-RCB</td><td>NNNN</td><td>Status of communication with Rack Communication Boards</td><td>4</td></tr>
<tr><td>COM-SPLIT</td><td>NNNN</td><td>Status of communication with Splitter Boards</td><td>4</td></tr>
<tr><td>COM-COMB</td><td>NNNN</td><td>Status of communication with Combiner Boards</td><td>4</td></tr>
<tr><td>COM-FO Rack 1</td><td>NNNNNN</td><td>Status of communication with FiberOptic Modules in Rack 1</td><td>6</td></tr>
<tr><td>COM-FO Rack 2</td><td>NNNNNN</td><td>Status of communication with FiberOptic Modules in Rack 2</td><td>6</td></tr>
<tr><td>COM-FO Rack 3</td><td>NNNNNN</td><td>Status of communication with FiberOptic Modules in Rack 3</td><td>6</td></tr>
<tr><td>COM-FO Rack 4</td><td>NNNNNN</td><td>Status of communication with FiberOptic Modules in Rack 4</td><td>6</td></tr>
<tr><td>CRC</td><td>JKLMNXYZW</td><td>Status of CRC in the different modules.<br>These values are Hex Coded, and should be used in conjunction with COM status for actual device.<br>For example, the Byte 1 status is sent as Hex ‘8’, which is extracted to 1000.<br>Byte 1
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>CRC for RCB in Rack 1</td><td>CRC for RCB in Rack 2</td><td>CRC for RCB in Rack 3</td><td>CRC for RCB Rack 4</td></tr>
</table>
Byte 2</td><td>8</td></tr>
</table>

| Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|
| CRC for Split in Rack 1 | CRC for Split in Rack 2 | CRC for Split in Rack 3 | CRC for Split in Rack 4 |

Byte 3

| Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|
| CRC for Comb in Rack 1 | CRC for Comb in Rack 2 | CRC for Comb in Rack 3 | CRC for Comb in Rack 4 |

Byte 4

| Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|
| CRC for Rack 1 Slot 1 | CRC for Rack 1 Slot 2 | CRC for Rack 1 Slot 3 | CRC for Rack 1 Slot 4 |

Byte 5

| Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|
| CRC for Rack 1 Slot 5 | CRC for Rack 1 Slot 6 | CRC for Rack 2 Slot 1 | CRC for Rack 2 Slot 2 |

Byte 6

| Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|
| CRC for Rack 2 Slot 3 | CRC for Rack 2 Slot 4 | CRC for Rack 2 Slot 5 | CRC for Rack 2 Slot 6 |

Byte 7

| Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|
| CRC for Rack 3 Slot 1 | CRC for Rack 3 Slot 2 | CRC for Rack 3 Slot 3 | CRC for Rack 3 Slot 4 |

Byte 8

| Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|
| CRC for Rack 3 Slot 5 | CRC for Rack 3 Slot 6 | CRC for Rack 4 Slot 1 | CRC for Rack 4 Slot 2 |

Byte 9

| Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|
| CRC for Rack 4 Slot 3 | CRC for Rack 4 Slot 4 | CRC for Rack 4 Slot 5 | CRC for Rack 4 Slot 6 |

<table>
<tr><td>NCO</td><td>KLMNXY</td><td>Status of communication with the node slaves.<br>These values are Hex Coded, and should be used in conjunction with NON attribute to know how many nodes are installed.<br>For example, the Byte 1 status is sent as Hex ‘8’, which is extracted to 1000.<br>Byte 1<table><tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr><tr><td>NCO for node 1</td><td>NCO for node 2</td><td>NCO for node 3</td><td>NCO for node 4</td></tr></table>Byte 2<table><tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr><tr><td>NCO for node 5</td><td>NCO for node 6</td><td>NCO for node 7</td><td>NCO for node 8</td></tr></table>Byte 3<table><tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr><tr><td>NCO for node 9</td><td>NCO for node 10</td><td>NCO for node 11</td><td>NCO for node 12</td></tr></table>Byte 4<table><tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr><tr><td>NCO for node 13</td><td>NCO for node 14</td><td>NCO for node 15</td><td>NCO for node 16</td></tr></table>Byte 5<table><tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr><tr><td>NCO for node 17</td><td>NCO for node 18</td><td>NCO for node 19</td><td>NCO for node 20</td></tr></table>Byte 6<table><tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr><tr><td>NCO for node 21</td><td>NCO for node 22</td><td>NCO for node 23</td><td>NCO for node 24</td></tr></table></td><td>6</td></tr>
<tr><td>PW1</td><td>NNNN</td><td>Status of 28 V Power Supply distribution</td><td>4</td></tr>
<tr><td>PW2</td><td>NNNN</td><td>Status of 15 V Power Supply distribution</td><td>4</td></tr>
<tr><td>PW3</td><td>NNN</td><td>Status of 6.45 V Power Supply distribution as measured in RCB, Splitter and Combiner.<br>These values are Hex Coded, and should</td><td>3</td></tr>
</table>

<table>
<tr><td></td><td></td><td>be used in conjunction with COM status for actual device.<br>For example, the Byte 1 status is sent as Hex ‘8’, which is extracted to 1000.<br>Byte 1
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>PW3 for RCB in Rack 1</td><td>PW3 for RCB in Rack 2</td><td>PW3 for RCB in Rack 3</td><td>PW3 for RCB Rack 4</td></tr>
</table>
Byte 2
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>PW3 for Split in Rack 1</td><td>PW3 for Split in Rack 2</td><td>PW3 for Split in Rack 3</td><td>PW3 for Split in Rack 4</td></tr>
</table>
Byte 3
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>PW3 for Comb in Rack 1</td><td>PW3 for Comb in Rack 2</td><td>PW3 for Comb in Rack 3</td><td>PW3 for Comb in Rack 4</td></tr>
</table></td><td></td></tr>
<tr><td>PW4</td><td>N</td><td>Status of 6.45 V Backup Power Supply distribution</td><td>1</td></tr>
<tr><td>RBT</td><td>KLMNXYZ</td><td>Status of board temperatures in the different modules.<br>These values are Hex Coded, and should be used in conjunction with COM status for actual device.<br>For example, the Byte 1 status is sent as Hex ‘8’, which is extracted to 1000.<br>Byte 1
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>RBT for RCB in Rack 1</td><td>RBT for RCB in Rack 2</td><td>RBT for RCB in Rack 3</td><td>RBT for RCB Rack 4</td></tr>
</table>
Byte 2
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>RBT for Rack 1 Slot 1</td><td>RBT for Rack 1 Slot 2</td><td>RBT for Rack 1 Slot 3</td><td>RBT for Rack 1 Slot 4</td></tr>
</table>
Byte 3
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>RBT for Rack 1 Slot 5</td><td>RBT for Rack 1 Slot 6</td><td>RBT for Rack 2 Slot 1</td><td>RBT for Rack 2 Slot 2</td></tr>
</table>
Byte 4
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
</table></td><td>7</td></tr>
</table>

| | | | |
|---|---|---|---|
| | | RBT for Rack 2 Slot 3 \| RBT for Rack 2 Slot 4 \| RBT for Rack 2 Slot 5 \| RBT for Rack 1 Slot 6<br>Byte 5<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>RBT for Rack 3 Slot 1 \| RBT for Rack 3 Slot 2 \| RBT for Rack 3 Slot 3 \| RBT for Rack 3 Slot 4<br>Byte 6<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>RBT for Rack 3 Slot 5 \| RBT for Rack 3 Slot 6 \| RBT for Rack 4 Slot 1 \| RBT for Rack 4 Slot 2<br>Byte 7<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>RBT for Rack 4 Slot 3 \| RBT for Rack 4 Slot 4 \| RBT for Rack 4 Slot 5 \| RBT for Rack 4 Slot 6 | |
| RXO | KLMNXY | Status of recieved optical level.<br>These values are Hex Coded, and should be used in conjunction with COM status for actual device.<br>For example, the Byte 1 status is sent as Hex '8', which is extracted to 1000.<br>Byte 1<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>RXO for Rack 1 Slot 1 \| RXO for Rack 1 Slot 2 \| RXO for Rack 1 Slot 3 \| RXO for Rack 1 Slot 4<br>Byte 2<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>RXO for Rack 1 Slot 5 \| RXO for Rack 1 Slot 6 \| RXO for Rack 2 Slot 1 \| RXO for Rack 2 Slot 2<br>Byte 3<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>RXO for Rack 2 Slot 3 \| RXO for Rack 2 Slot 4 \| RXO for Rack 2 Slot 5 \| RXO for Rack 1 Slot 6<br>Byte 4<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>RXO \| RXO \| RXO \| RXO | 6 |

<table>
<tr><td></td><td></td><td>
<table>
<tr><td>for Rack 3 Slot 1</td><td>for Rack 3 Slot 2</td><td>for Rack 3 Slot 3</td><td>for Rack 3 Slot 4</td></tr>
</table>
Byte 5
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>RXO for Rack 3 Slot 5</td><td>RXO for Rack 3 Slot 6</td><td>RXO for Rack 4 Slot 1</td><td>RXO for Rack 4 Slot 2</td></tr>
</table>
Byte 6
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>RXO for Rack 4 Slot 3</td><td>RXO for Rack 4 Slot 4</td><td>RXO for Rack 4 Slot 5</td><td>RXO for Rack 4 Slot 6</td></tr>
</table>
</td><td></td></tr>
<tr><td>SZP</td><td>KLMNXY</td><td>Status of Synthesizer in Pilot Tone Generator.<br>These values are Hex Coded, and should be used in conjunction with COM status for actual device.<br>For example, the Byte 1 status is sent as Hex ‘8’, which is extracted to 1000.<br>Byte 1
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>SZP for Rack 1 Slot 1</td><td>SZP for Rack 1 Slot 2</td><td>SZP for Rack 1 Slot 3</td><td>SZP for Rack 1 Slot 4</td></tr>
</table>
Byte 2
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>SZP for Rack 1 Slot 5</td><td>SZP for Rack 1 Slot 6</td><td>SZP for Rack 2 Slot 1</td><td>SZP for Rack 2 Slot 2</td></tr>
</table>
Byte 3
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>SZP for Rack 2 Slot 3</td><td>SZP for Rack 2 Slot 4</td><td>SZP for Rack 2 Slot 5</td><td>SZP for Rack 1 Slot 6</td></tr>
</table>
Byte 4
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>SZP for Rack 3 Slot 1</td><td>SZP for Rack 3 Slot 2</td><td>SZP for Rack 3 Slot 3</td><td>SZP for Rack 3 Slot 4</td></tr>
</table>
Byte 5
<table>
<tr><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>SZP for</td><td>SZP for</td><td>SZP for</td><td>SZP for</td></tr>
</table>
</td><td>6</td></tr>
</table>

| | | | |
| --- | --- | --- | --- |
| | | Rack 3 Slot 5 \| Rack 3 Slot 6 \| Rack 4 Slot 1 \| Rack 4 Slot 2<br>Byte 6<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>SZP for Rack 4 Slot 3 \| SZP for Rack 4 Slot 4 \| SZP for Rack 4 Slot 5 \| SZP for Rack 4 Slot 6 | |
| TEM | N | Status of Controller Temperature | 1 |
| TXO | KLMNXY | Status of Optical Transmitter<br>These values are Hex Coded, and should be used in conjunction with COM status for actual device.<br>For example, the Byte 1 status is sent as Hex '8', which is extracted to 1000.<br>Byte 1<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>TXO for Rack 1 Slot 1 \| TXO for Rack 1 Slot 2 \| TXO for Rack 1 Slot 3 \| TXO for Rack 1 Slot 4<br>Byte 2<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>TXO for Rack 1 Slot 5 \| TXO for Rack 1 Slot 6 \| TXO for Rack 2 Slot 1 \| TXO for Rack 2 Slot 2<br>Byte 3<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>TXO for Rack 2 Slot 3 \| TXO for Rack 2 Slot 4 \| TXO for Rack 2 Slot 5 \| TXO for Rack 1 Slot 6<br>Byte 4<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>TXO for Rack 3 Slot 1 \| TXO for Rack 3 Slot 2 \| TXO for Rack 3 Slot 3 \| TXO for Rack 3 Slot 4<br>Byte 5<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>TXO for Rack 3 Slot 5 \| TXO for Rack 3 Slot 6 \| TXO for Rack 4 Slot 1 \| TXO for Rack 4 Slot 2<br>Byte 6<br>Bit 3 \| Bit 2 \| Bit 1 \| Bit 0<br>TXO for Rack 4 Slot 3 \| TXO for Rack 4 Slot 4 \| TXO for Rack 4 Slot 5 \| TXO for Rack 4 Slot 6 | 6 |

| | | | |
|---|---|---|---|
| ILD | NNNN | Status of Input Level Downlink as measured in Splitters 1-4 | 4 |
| EX1/EX2/EX3/ EX4 | NNNN | Status of external alarm inputs | 4 |
| NON | NN | Number of nodes monitored. | 2 |
| RCH | NNNNNN | Repetition Cycle for Heartbeat reports | 6 |