

Cave-Link



VLF- Communication system for cave research and rescue

Cave-Link V2.1x

User Manual

Ingenieurbüro Felix Ziegler
Schönau 3
CH-8825 Hütten
Tel. +41 44-788 28 40
Fax +41 44-788 28 45
www.cavelink.com

© 2013 Ingenieurbüro Felix Ziegler
Änderungen vorbehalten

Table of content

| | | |
|-----------|---|-----------|
| 1 | Introduction..... | 6 |
| 1.1 | Formatting conventions | 6 |
| 2 | Overview Appliance and Keyboard | 7 |
| 2.1 | Front | 7 |
| 2.2 | Meaning of LED colours | 8 |
| 2.3 | Rear..... | 8 |
| 2.4 | Before use | 9 |
| 3 | Start up of the appliance in a new location..... | 10 |
| 3.1 | Antenna installation | 10 |
| 3.2 | Connect unit to the net (assisted routing)..... | 11 |
| 3.3 | Connect unit to the net (manual routing) | 12 |
| 4 | Appliance settings..... | 13 |
| 4.1 | Language..... | 13 |
| 4.2 | Display..... | 13 |
| 4.3 | Acoustic signale..... | 13 |
| 5 | Normal use, send and receive Messages | 14 |
| 5.1 | Switch on the display..... | 14 |
| 5.2 | Send a message..... | 14 |
| 5.3 | Read and edit a message..... | 15 |
| 6 | Remove station..... | 16 |
| 7 | Assess the link (=connection) quality | 17 |
| 8 | Extended Expert mode..... | 18 |
| 8.1 | Switch to Extended menu..... | 18 |
| 8.2 | Menu <i>Settings</i> | 18 |
| 8.2.1 | Menu 31 <i>Settings, Power save mode</i> | 18 |
| 8.2.2 | Menu 32 <i>Settings, Routing setup</i> | 18 |
| 8.2.3 | Menu 33 <i>Settings, Link</i> | 19 |
| 8.2.4 | Menu 34 <i>Settings, GSM</i> | 20 |
| 8.3 | Turn off extendend menu | 20 |
| 9 | Examples of manual routing configuration | 21 |
| 9.1 | Basic principle | 21 |
| 9.2 | Two Stations without GSM | 21 |
| 9.3 | Two Stations with GSM | 22 |
| 9.4 | Simple line net mit GSM | 22 |
| 9.5 | Network with GSM..... | 23 |
| 9.6 | Route via GSM | 25 |
| 9.7 | Route via radio (future capability)..... | 26 |
| 10 | Send and receive SMS | 27 |
| 11 | Cave-Link using 2-wire-line | 28 |
| 12 | Frequency selection..... | 29 |
| 12.1 | Quality and frequency selection | 29 |
| | Frequency selection..... | 29 |
| 12.2 | Recording frequency spectra..... | 30 |

| | | |
|--------------|---|-----------|
| 13 | Surface station with GSM | 31 |
| 13.1 | Content | 31 |
| 13.2 | Assembling the Station | 32 |
| 13.3 | GSM-Modul: Insert/Exchange SIM card | 32 |
| 13.4 | Testing of the GSM connection | 32 |
| 14 | Remote configuration of Cave-Link units..... | 34 |
| 14.1 | Sending commands | 34 |
| 14.2 | Commands only requesting information | 35 |
| 14.3 | Commands to change settings | 36 |
| 15 | Menu structure overview | 37 |
| 15.1 | Normal menu | 37 |
| 15.2 | Extended Menu..... | 38 |
| 16 | Abbreviations | 40 |
| 17 | Technische Daten | 41 |
| Index | 42 | |

1 Introduction

Cave-Link is a data communication system developed particularly for data transmission in cave research and communication during cave rescue.


It is a text based communication system which enables reliable and save transmission also in case of strong interferences.

1.1 Formatting conventions

Keys

The appliance handling is designed in a way that everyone can send an SMS with a mobile phone should get along well with Cave-link.



Keys like  are marked with < >, menu entries are written in *italics*.

Operating instructions

Steps using keystrokes in combination with menu item selection are shown in the following example:

<Menu>, *1 Messages*, *1 Inbox*, <OK>

Menu selection

To make the system more user-friendly, three menus exist with varying details. The extended and the full menu are normally only required for configuration of the appliance and attached recording boxes. For use as communication appliance the normal menu is fully sufficient. If commands are not configured in the normal menu the following convention is used:

- Normal Menu (Menu)
- Extended Menu (MenuE)

Navigation

The menu navigation can also be shown in **abbreviated form**: e.g. **321** means: select in the first menu item 3, in the subsequently appearing menu, select item 2, in the following menu item 1, etc. Alternatively the corresponding keystrokes can be used.

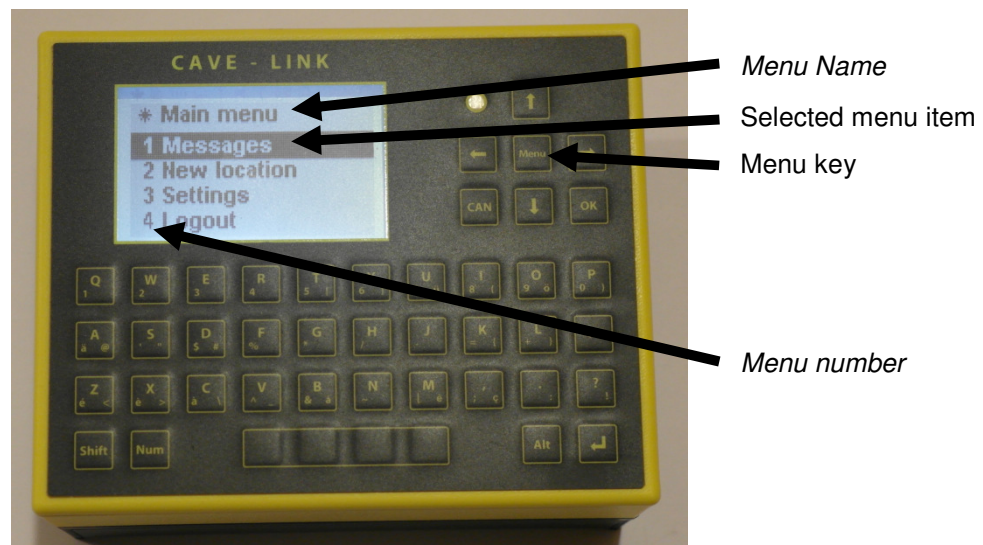


Figure 1: Formatting conventions used for this manual

2 Overview Appliance and Keyboard

2.1 Front

Turn on

To turn on the appliance, press **<Menu>** key for a few seconds.

Figure 2: Front view after turn on



Turn on: **<Menu>**

Selection: **<OK>**

Cancel: **<CAN>**

Navigation: arrow keys  **<up>**, **<down>**, **<left>**, **<right>**

or enter the menu number using the keyboard

Function keys

To enter text and numbers there are 35 keys that have multiple uses. With the three function keys **<Shift>**; **<Num>**, **<Alt>** the key response/level is controlled.

Pressing a function key once, the selection applies to the next character. Pressing the function key twice will lock the level, e.g. the selected level applies until released by the same or changed through another function key again.

While entering text, the selected function level is displayed at the top left. When the system requires numbers or telephone numbers automatically the numbers layer is active.

<Shift> = capital;

<Num> = Numbers and special characters (bottom left of the key)

<Alt> = Special characters (bottom right of the key)

:

| | |
|------|-------|
| none | Shift |
| NUM | ALT |

At the right top corner a small square indicates if and which function key is active

Examples: **<Num> <D>** = \$ **<Alt> <D>** = #

Once the appliance is installed, configured and part of the web, its use is very easy.

2.2 Meaning of LED colours

- every 10 sec short green = standby mode
- every 1.5 sec short green = ready to receive
- continuous red = Send message
- red with short green = receiving message (and sending receipts)
- every 0.5 sec short red = time synchronization with the time signal transmitter

2.3 Rear

Antenna connector
Cave-Link Bus

The antenna connectors and the Cave-Link bus, which is used for the battery charger and all auxiliary appliances (horn, printers, measuring boxes, etc.) are located at the rear.

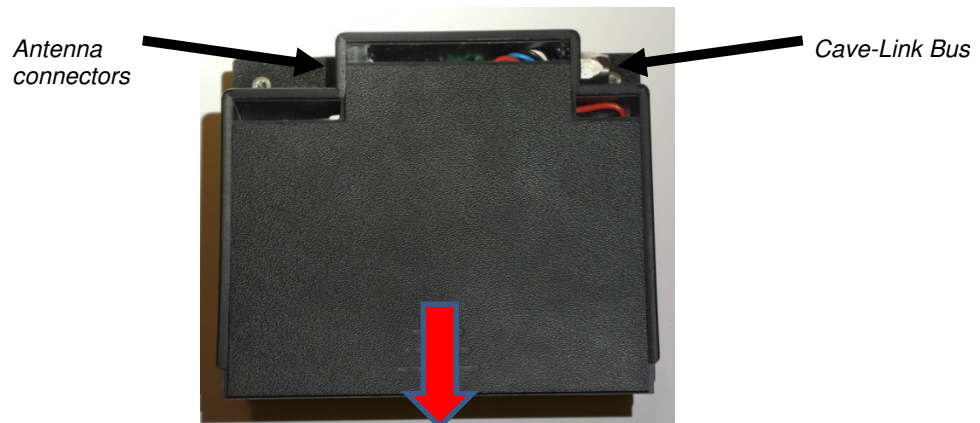


Figure4: Rear view

Power supply

Also at rear the unit can be opened with light pressure downwards to give access to the battery storage.



Figure 5 : Li-Akku



Figure 6 : AA-Bateries

Cave-Link appliances can be operated with Li-Akku or 8 AA batteries. Used with AA-batteries the transmitting power is lower than with Li-Akku. Li-Akkus normally outlast AA-battery sets up to three times. The selected power supply has to be configured:

Select Battery Type

In menu *Settings, Battery type* choose between the two internal possibilities:

- int. Lithium-Polymer
- int. 8x AA



Note:

- The selection contains also several other, external power supply options

2.4 Before use

To ensure proper communication of Cave-Link units during a mission the following aspects should to be observed/checked for each device:

Unique device address

Each station requires a unique address (C01, C02, C14) which is displayed in the top left corner of the initial screen.

| | |
|-----------------|---------|
| * 01 ⇒ Surface | 10:41 * |
| Inbox | 01/06 |
| Outbox | 01 |
| Battery | 70% |
| Transmitting in | < 1 Min |

The unit name however is irrelevant.

The addresses are not required to be used in ascending sequence. It is possible to e.g. only deploy the addresses C02, C05 and C14.

Should two units have the same address, at least one appliance has to be adjusted using the extended menu MenuE **321** (Kapitel **Fehler! Verweisquelle konnte nicht gefunden werden.** & 8.2.2).

Frequency selection

All stations must be configured for the same frequency (MenuE **334**). The selection of the most appropriate frequency is describen in chapter 8.2.3.

Power save mode/
Transmission interval

All stations should be set to the same power save mode (MenuE **31**). If various power save modes are used, the communication is slowed down to the rhythm of the device with the longest transmission brakes (see chapter 8.2.1). If the mission lasts less than two days, the “always on” mode should be considered. Wenn der Einsatz weniger als zwei Tage dauert, kann das Gerät auf „immer ein“ eingestellt werden.

Power supply mode

Every unit should have the power supply configured correctly (akku or batteries; chapter 2.3. For longer missions, it should be ensured that there is enough energy reserves (check battery status at the main display). Charge the akku if needed or include additional batteries or akkus.

Antenna direction

Agree on direction of anntennas – as parallel as possibel in space (e.g. vertical)

3 Start up of the appliance in a new location

There are two possibilities to configure the appliances for connections:

- Manually by a subject matter expert prior to the mission start
- Semiautomatically (assisted) at the location of use (requires to know the address of the next station in reach).

In the chapter 3.2 the assisted routing configuration is described. The instructions for manual routing configuration (optimized net structure) are explained in chapter 8.2.2.

3.1 Antenna installation

The goal is to send the most electricity as far as possible through the rock. The better the earthing, the stronger is the power.

Parallel antennas

The antennas of the different stations should be as parallel as possible (± 30 degrees), but never at right angle to each other! A good antenna setting helps saving battery! (Double length = about 10 times less power).



Note:

Parallel does not necessarily mean horizontal. In caves with a lot of pits a vertical placement of antennas should be considered to simplify the placement using the pit volume.

Short orange antenna

Well connect one earthing plate to the rock close to the location of the unit (damp clay, water, possibly with salt water or urine). Join the station and the first plate with a short cable (5 m or 2x5 m, for newer antennas orange coil).

Plug in the cable reel (60 or 80 m) to the station, unwind cable and set the second earthing plate. Never transmit through the coil, thus always unwind the cable to next tap (every 10m) and reel off the remaining wire on the floor. In passages with debris on the ground try grounding at the rock wall.

Guideline antenna length

Values for antenna lengths: minimum 1 / 10 of the transmitting distance.

If both stations are located in the cave, longer distances can be bridged (less atmospheric interference). Plan the surface connection with minimum horizontal distance. (100m depth and 500m horizontal distance equal approximately 1000m vertical distance or depth).

In case of poor earthing conditions use if possible two earthing plates on each side or enlarge the electrodes using household aluminium foil. The aluminium foil should be cleaned with abrasive paper (oxide layer) and should adhere to the rock as close as possible.

For very long distances take 2 wire coils.



Note: In well-known caves it is recommended to create an antenna map (with their directions) in advance and list from where to where connections are possible.

3.2 Connect unit to the net (assisted routing)

Execute Menu *New Location*

For the assisted configuration it is a prerequisite that it is known at the new location which station can be reached from that location.

After assembling the unit and connecting the antenna, switch on the appliance by continuously pressing the menu key. Subsequently work through the five menu points in the menu *New Location*.

To allow communication between units, each appliance has a so called routing table (chapter 9) which defines to where messages are sent. This is particularly relevant if a unit is only accessible via several other stations.

Internal login procedure

During the login process, the new station contacts its known partner station. The partner station reports the existence of the new station to all stations known to its part (according to the partner's routing table). This reporting triggers a response of all stations to the newly placed one and addresses and names are recorded into the new station's routing table.

After completion of the process the know station is know to all previously existing stations as well as all existing station can now be selected on the new station to post messages.

First Station

For the first station in a communication net, set *Next station* to *unkown*. This way the station is ready to be contacted by a second station.

Step by step instructions:

- Deploy and connect antenna (see 3.1)
- Turn on appliance using **<Menu>**.
- *New Location* **<ok>**
- *Enter location/name* **<ok>** , type name, **<ok>**
- *Test antenna* **<ok>** , the better the earthing the better the connection or the least energy consumption, -> e.g. improve earthing and retest.
- *Clock Synch* **<ok>** , the internal clock gets synchronised with radio clock DCF77. This can take up to 5 minutes. A synchronisation in the same ime zone is only required every 2-3 days and can potentially be skipped.
- *Next station* **<ok>**, select the address of the next station using the **<up>** or **<down>** arrow keys, **<ok>**
- *Login* **<ok>**



Note:

Depending on the number of already existing stations and the transmission intervals, the login process can take some time. The display may switch to the standby mode, but the station remains active in the background and no user intervention is required. He replys of the other stations will arrive as messages to the inbox.

3.3 Connect unit to the net (manual routing)

Manual Configuration Manual programming of the routing tables normally happens prior to the mission start. This requires knowledge about the network structure to be used and that each station is used exactly in the location as planned. Information and considerations for the structure build and its configuration are described in chapter 9.

Once the unit is assembled and the antenna connected complete the following steps:

Test antenna

- *Test antenna <ok>* , the better the earthing the better the connection or the least energy consumption, -> e.g. improve earthing and retest.

Clock synchronisation

- *Clock Synch <ok>* , the internal clock gets synchronised with radio clock DCF77. This can take up to 5 minutes. A synchronisation in the same time zone is only required every 2-3 days and can potentially be skipped.

The station is ready to use.

4 Appliance settings

4.1 Language

At the moment, the menus are available in Englisch, German, French and partly in Italian and Spanish.

The language can be selected / changed using Menu -> *Language*

4.2 Display

For the display, the brightness and the illumination time can be adjusted to personal preference:

Menu -> *Settings* -> *Backlight*

Menu -> *Settings* -> *Backlight time lag*

4.3 Acoustic signale

The appliance announces the receipt of new message with an acoustic signal. The volume of the signal can be adjusted using Menu -> *Einstellungen* -> *Beep*

In a very noisy environment (e.g. close to a waterfall) an external horn can be connected via the Cave-Link-bus.

Available selections:

| | |
|-------------------|--------------------------------------|
| off | No signal |
| quiet | |
| loud | |
| extern long | Only long external signal |
| extern short | Only short external signal |
| loud + ext. Long | Only externes SMS (ti-ti-tit) signal |
| loud + ext. Long | Internal and external signals |
| loud + ext. short | |
| loud + ext. short | |

5 Normal use, send and receive Messages

5.1 Switch on the display

Press **<Menu>** (ev. 2x), the following screen will appear:

The screenshot shows a display with the following text:

| | |
|-----------------|---------|
| * 01 = Surface | 10:41 * |
| Inbox | 01/06 |
| Outbox | 01 |
| Battery | 70% |
| Transmission in | < 1 Min |

Arrows point from the explanatory text on the right to the corresponding elements in the screenshot:

- 01 = Own Address; Station name (e.g. location); Time
- 1 new und 6 read messages
- 1 message ready to be transmitted
- Battery capacity
- If a power save mode is activated, transmission will only be possible every 2, 5, 10, 15, 30, 60 Min
- The display shows the time until the next transmission starts.



Note:

The display automatically switches off after some time to a standby mode. The station remains in power and there is no user intervention required.

5.2 Send a message

Select recipient

In case the display is switched off: Press **<Menu>** (ev. 2x) to turn it on **<Menu>**, *1 Messages, 2 New message*, choose recipient

- **Cave Link addr.** Message will be sent to another cave station, **<OK>**, select receiving cave station
- **GSM-Group** (at the surface station programmed GSM number(s) will receive the message as SMS)
- **GSM number** Message is sent as SMS to the GSM number entered
- **All excl. GSM group** Message is sent to all stations not belonging to the GSM group
- **All incl. GSM group** Message is sent to all stations including the GSM group.

The GSM menu items (GSM Group, GSM Nummer etc.) will only be available if there is a unit with GSM connection in the net.

Write text

Write the message:

Up to max. 200 characters or max. 128Byte (text compression) can be written. If the message is sent as an SMS, only 150 characters can be used.

The text compression method works best with small letters, therefore try to avoid capital letters, numbers and special characters if possible.

End the text with **<OK>** and confirm *Post Msg* with **<OK>** in the appearing text menu

Other text menu options

The menu text also provides the option to return to editing (*back to text*), save the text as draft (*to drafts*) or to discharge the whole message (*delete*).

5.3 Read and edit a message

Messaging programs (SMS, Email) commonly allow reading, editing, forwarding and printing received messages or their status can be switched from read back to non-read.

Navigate

In case the display is switched off: Press **<Menu>** (ev. 2x) to end the standby mode

- **<Menu>**, 1 *Messages*, 1 *Inbox*
- Select the message with **<arrow keys>**
 - **<up>**, **<down>**: Scroll text
 - **<left>**, **<right>**: select the messages

Edit

- **<Menu>** selects a sub-menu which provides the following options:
 - *Reply* - provides a reply to the sender (also to GSM-no.)
 - *Forward to* - sends the message to new addressee
 - *Delete*
 - *Print* – prints the message in case a printer is connected
 - *Unread* - not yet in use
 - *to drafts* - message is saved in draft folder
 - *Graphik* – displays messages with graphical content (e.g. spectra) in graphic mode

6 Remove station

The energy consumption of an appliance in standby mode is minor. To avoid clock re-synchronization with radio clock DCF77 after switch on, it is recommended to use the standby mode if the appliance is not used for a short period of time (up to several days).

Logoff unit

To temporarily turn off the appliance e.g. to deploy to another location, it is sufficient to logoff the unit and keep it in standby mode.

- Menu *Logoff*: The unit gives notice to all other units and its address will be deleted from all routing tables
- Wait until the Outbox is empty (*Outbox* shows 00)
- Unplug antenna cable pack up antenna cable / grounding plates
- Pack up station

Idle unit

To idle the appliance (e.g. for longer storage), execute the following steps:

- Menu *Logoff*: The unit gives notice to all other units and its address will be deleted from all routing tables
- Wait until the Outbox is empty (*Outbox* shows 00)
- Unplug antenna cable pack up antenna cable / grounding plates
- Switch off unit using menu item *Switch off*, pack up station



Note:

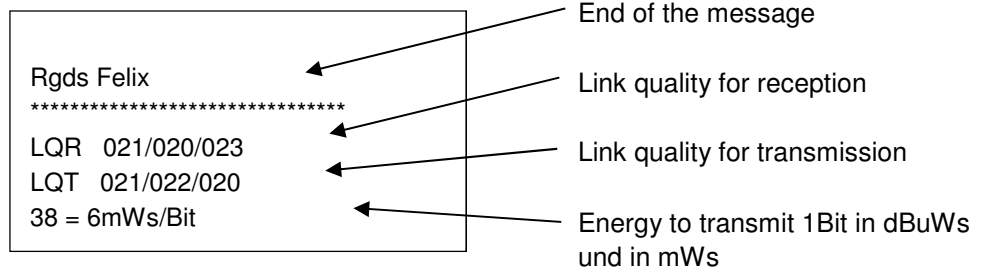
It is normal that the LED indicator light continues to blink for several minutes after shut down of the appliance

7 Assess the link (=connection) quality

Transmission principles

To ensure transmission without error, the actual data transmission by Calve-Link is executed in blocks of 2 bytes. The system repeats the transmission process until the recipient confirms the completed and correct receipt of the block. For sent messages (*Outbox-> Sent Cave Link*) the connection quality (link quality) and the energy required to transmit one bit is provided at the end of each message:

(
At the end of a forwarded message the following appears:



Link quality

Link quality

The transmission takes place in blocks of 2 bytes each. The following is displayed:

Number of blocks data / no. repetitions of blocks / no. repetitions of receipts

The transmission power is controlled to keep repetitions at 50%.

For received messages (Inbox) only LQR is available.

If the LQR on a sent message is missing, the message was created on this station.

Example high quality link

Example of a high quality link:

LQT 017/002/001 almost no repetitions with minimal transmission power
38 = 6 mWs / bit

Example moderate quality link

Example of moderate quality link:

LQT 017/015/018 approx. 50% repetitions, transmission power is adjusting 1000 mWs / bit

Example poor quality link

Example of poor quality link:

lots of repetitions even though running at maximal

LQT 017/242/415 transmission power
74 = 25119mWs/bit ca. 25Ws/bit

This last link is very poor and the transmission lasts very long. To transmit the actual 17 blocks transmission of total 674 blocks was required. 6.5 blocks can be sent per second -> $674 / 6.5 = 104\text{sec}$.

This means that only approximately every 39th block was transmitted successfully.

Note:



If the connection between these two units needs to be maintained, prolong the antennas and/or try to improve earthing.

The link quality may vary substantially due to atmospheric conditions. Although antennas and earthing remain unchanged, in the Hölloch cave energies between 0.080 Ws/bit and 85Ws/bit are measured for the same data transfer link.

Experience showed that connectivity is better during the day compared to night.

8 Extended Expert mode

In order not to confuse the standard user normally a reduced menu is displayed. To change settings or configure anything, the menu must be changed to the advanced menu. However configuration changes should be done by experts only as misadjustments may lead to diabeling connections.

8.1 Switch to Extended menu

Extended Menu

<Menu>, *Settings, operation mode, Menu Pin E*, enter pin = 1234 <OK>
<Menu>, *Settings, operation mode, operation mode*, <OK> select: extended <OK>
<CAN>, <CAN>, <CAN> back to overview.
Now you are back to the main menu but in the extended mode "Main MenuE".

This Menu allows changing nearly everything (even so that nothing works any longer...)

8.2 Menu Settings

8.2.1 Menu 31 Settings, Power save mode

Power save mode

To make best use of the battery power, power save modes exist. Depending on the setting the appliance gets turned off and only switches on for about 20 secs at fixed intervals for transmission and receiving.
The following intervals can be selected:

| psmode | time | | psmode | time |
|--------|-----------|--|--------|----------|
| 0 | Always on | | 6 | 1 Hour |
| 1 | 1.25 Min | | 7 | 2 Hours |
| 2 | 2.5 Min | | 8 | 4 Hours |
| 3 | 5 Min | | 9 | 8 Hours |
| 4 | 15 Min | | 10 | 24 Hours |
| 5 | 30 Min | | | |

Always on after about 3 days, half of the battery is used. (e.g. for a weekend)
1.25 min after about 7 days, half of the battery is used.
2.5 min after about 14 days, half the battery is used. (e.g. exploration week)

If larger intervals are used the battery power lasts longer (for transmission of recording stations).



Caution!

Only units with the identical transmission intervals (psmode) can connect. If a station has a longer interval, the others keep trying to transmit (using battery) until that station is active and can be reached. All stations should therefore have the same interval setting.

8.2.2 Menu 32 Settings, Routing setup

Own Address:

Each station must have assigned a unique address. (1. .14)

Menu 321

- Menu 322 **Routing Mode:**
Three different Routing Modes exist:
- *manual* – normal transmission of messages. Suitable for assisted routing configuration with login.
 - *revers Route* – all units that are passed through by the message sent from this unit (except measuring data) get the return path (back to Sender) configured.
 - *revers R. pms=0* – same functionality as revers Route, but in addition all receiving units are changed to power save mode „always on“ (psmode = 0).
- Menu 323 **GSM CL-Address:**
Address of the station to which the GSM modem is connected.
If no GSM modem is connected to the network, select *no GSM*
- Menu 324 **Stationen 1 – 9:**
Routing information for the stations 1 to 9
See examples
- Menu 325 **Stationen 10 – 14:**
Routing information for the stations 10 to 14
See examples

8.2.3 **Menu 33 Settings, Link**

In case there is an active link (sending, receiving, time synchronization) this may lead to an error message.

- Menu 332 **Bat Imax**
Maximum power from the battery. Use for the internal rechargeable battery 3000mA, for long phone wires 100mA as of 2km 500mA. Only the maximum current can be set. In case of good connections the transmitter down-regulates automatically. Do not use the setting automatic! For testing purpose you may want to go down to 100mA to check if it is possible to establish a link, but ensure to switch back again!
- Menu 333 **RX Attenuator**
To avoid Intermodulation, the receiver input can be reduced by 20dB for very long antennas (> 100m) in particular on the surface.
- Menu 334 **Frequency settings**
Transmission and receiving frequency in Hz. Currently only one channel is active. Normally 42kHz.
- Menu 335 **Clock Synch**
In power save mode, all clocks have to be synchronized. The stations have built-in time signal receivers.
- Menu 335.1 **Clock Synch, manual**
The station aligns its clock to a radio clock (e.g. DCF77). This may take up to 5 minutes during which the LED blinks in fast red.
- Menu 335.2 **Clock Synch, Intervall**
A clock synchronisation within the same time zone is only needed every 2-3 days. Number of hours after which the station re-synchronizes its clock with the radio clock

(typically 24 h). If the clock can not be synchronized (e.g. no antenna or no signal) a new attempt will be made after ¼ of the time set.

Menu 335.3

Clock Synch, Station

Selection of time signal transmitter, currently available:

- DCF77 (77.5 kHz, Senderstandort Mainflingen, bei Frankfurt/Main)
- HBG (75 kHz, Senderstandort Prangins, bei Bern).

8.2.4 Menu 34 Settings, GSM

Menu 342

Network status

Shows if GSM is part of the network and displays the receiver level.
The receiver level should be higher than -91dBm (eg-80dBm).

Menu 343

Alarm group

A set of the (mobile) phone numbers could be defined. If a message is sent to the group, every subscriber who's number starts with a + sign will receive the SMS. For rescue exercises, we use this group with the phone number of the officer in charge and his deputy. The advantage is that the people in the cave do not need to know any phone numbers. In addition there are savings for the transmission too as there is no need to transmit the number(s) each time.
If the number does not start with a + sign it is ignored.

8.3 Turn off extendend menu

In order to not confuse less experienced users the "Main MenuE" should be turned back to the normal "Main Menu":

<Menu>, *Settings, operation mode, operation mode* <OK> *normal* <OK>

Potentially delete Menu Pin: <Menu>, *Settings, operation mode, Menu Pin E*, enter Pin = 0, <OK>,

<CAN>, <CAN>, <CAN> back to the overview. Now press <Menu> und you are back to the regular Menu „*Main menu*“.

9 Examples of manual routing configuration

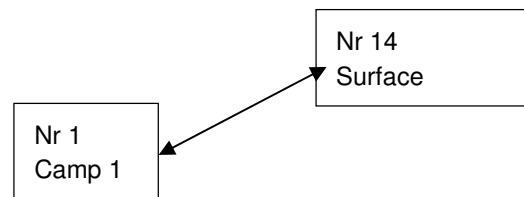
9.1 Basic principle

In case of manual routing, each unit requires information about any other existing station. For each other existing station configuration has to occur using the appropriate menu options (3.2.x.y). x=5 covers stations 1 to 9 and x=6 the stations 10-14. Y denotes the address number of the station to be configured.

Information required:

- Name of the station (Menu 3.2.5.x.y.1)
- Next station to reach that station (Menu 3.2.5.x.y.2). For own station the own address has to be selected.
- Type of connection (Menu 3.2.5.x.y.3) via Cave-Link or GSM
- If the connection uses GSM in addition the phone number to be called needs to be recorded (Menu 3.2.5.x.y.4)

9.2 Two Stations without GSM



Station Nr. 1

Menu 321 : Own Address = 1; Menu 322 : Routing mode = Manual ;
Menu 323 GSM-CL-Address= no GSM; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|---------|--------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link |
| 3252 | Station 2 | | no route | Cave-Link |
| 3253 | Station 3 | | no route | Cave-Link |
| 3254 | Station 4 | | no route | Cave-Link |
| 3455 | Station 5 | | no route | Cave-Link |
| 3256 | Station 6 | | no route | Cave-Link |
| 3257 | Station 7 | | no route | Cave-Link |
| 3258 | Station 8 | | no route | Cave-Link |
| 3259 | Station 9 | | no route | Cave-Link |
| 3261 | Station 10 | | no route | Cave-Link |
| 3262 | Station 11 | | no route | Cave-Link |
| 3263 | Station 12 | | no route | Cave-Link |
| 3264 | Station 13 | | no route | Cave-Link |
| 3265 | Station 14 | Surface | Address 14 | Cave-Link |

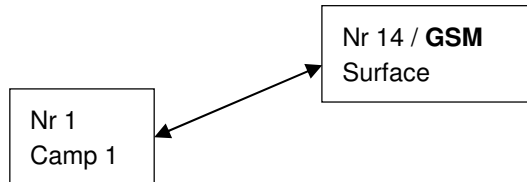
Station Nr. 14

Menu 321 : Own Address = 14; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= no GSM; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|---------|--------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link |
| 3252 | Station 2 | | no route | Cave-Link |
| ... | ... | ... | ... | ... |
| 3265 | Station 14 | Surface | Address 14 | Cave-Link |

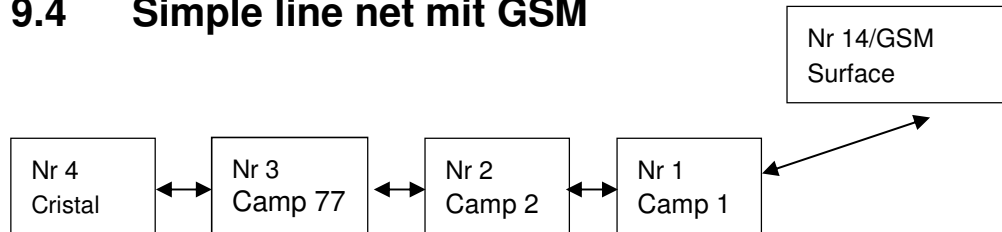
9.3 Two Stations with GSM



Menu 323 GSM-CL-Address= **Address 14**; for both units

There is no need to change the routing of example 9.2 !

9.4 Simple line net mit GSM



Station Nr. 1

Menu 321 : Own Address = 1; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|---------|--------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link |
| 3252 | Station 2 | Camp 2 | Address 2 | Cave-Link |
| 3253 | Station 3 | Camp 77 | Address 2 | Cave-Link |
| 3254 | Station 4 | Cristal | Address 2 | Cave-Link |
| 3455 | Station 5 | | no route | Cave-Link |
| .... | .... |  | no route | Cave-Link |
| 3265 | Station 14 | Surface | Address 14 | Cave-Link |

Station Nr. 2

Menu 321 : Own Address = 2; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|---------|--------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link |
| 3252 | Station 2 | Camp 2 | Address 2 | Cave-Link |
| 3253 | Station 3 | Camp 77 | Address 3 | Cave-Link |
| 3254 | Station 4 | Cristal | Address 3 | Cave-Link |
| .... | .... |  | no route | Cave-Link |
| 3265 | Station 14 | Surface | Address 1 | Cave-Link |

Station Nr. 3

Menu 321 : Own Address = 3; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|---------|--------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 2 | Cave-Link |
| 3252 | Station 2 | Camp 2 | Address 2 | Cave-Link |
| 3253 | Station 3 | Camp 77 | Address 3 | Cave-Link |
| 3254 | Station 4 | Cristal | Address 4 | Cave-Link |
| .... | .... |  | no route | Cave-Link |
| 3265 | Station 14 | Surface | Address 2 | Cave-Link |

Station Nr. 4

Menu 321 : Own Address = 4; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|---------|--------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 3 | Cave-Link |
| 3252 | Station 2 | Camp 2 | Address 3 | Cave-Link |
| 3253 | Station 3 | Camp 77 | Address 3 | Cave-Link |
| 3254 | Station 4 | Cristal | Address 4 | Cave-Link |
| .... | .... |  | no route | Cave-Link |
| 3265 | Station 14 | Surface | Address 3 | Cave-Link |

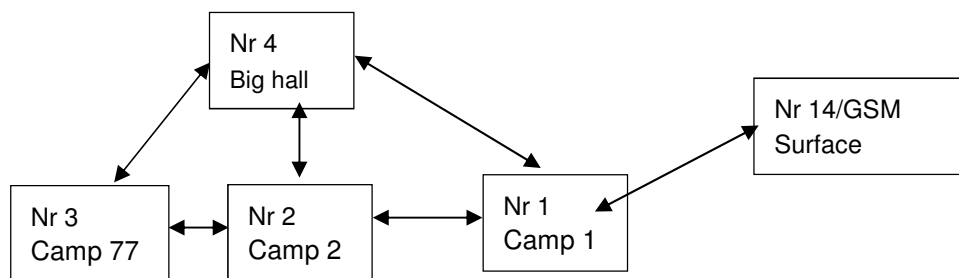
Station Nr. 14

Menu 321 : Own Address = 14; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|---------|--------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link |
| 3252 | Station 2 | Camp 2 | Address 1 | Cave-Link |
| 3253 | Station 3 | Camp 77 | Address 1 | Cave-Link |
| 3254 | Station 4 | Cristal | Address 1 | Cave-Link |
| .... | .... |  | no route | Cave-Link |
| 3265 | Station 14 | Surface | Address 14 | Cave-Link |

9.5 Network with GSM



Station Nr. 1

Menu 321 : Own Address = 1; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|----------|------------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link |
| 3252 | Station 2 | Camp 2 | Address 2 | Cave-Link |
| 3253 | Station 3 | Camp 77 | Address 2 oder 4 | Cave-Link |
| 3254 | Station 4 | Big hall | Address 4 | Cave-Link |
| .... | .... |  | no route | Cave-Link |
| 3265 | Station 14 | Surface | Address 14 | Cave-Link |

Station Nr. 2

Menu 321 : Own Address = 2; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|----------|--------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link |
| 3252 | Station 2 | Camp 2 | Address 2 | Cave-Link |
| 3253 | Station 3 | Camp 77 | Address 3 | Cave-Link |
| 3254 | Station 4 | Big hall | Address 4 | Cave-Link |
| .... | .... |  | no route | Cave-Link |
| 3265 | Station 14 | Surface | Address 1 | Cave-Link |

Station Nr. 3

Menu 321 : Own Address = 3; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|----------|------------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 2 oder 4 | Cave-Link |
| 3252 | Station 2 | Camp 2 | Address 2 | Cave-Link |
| 3253 | Station 3 | Camp 77 | Address 3 | Cave-Link |
| 3254 | Station 4 | Big hall | Address 4 | Cave-Link |
| .... | .... |  | no route | Cave-Link |
| 3265 | Station 14 | Surface | Address 2 | Cave-Link |

Station Nr. 4

Menu 321 : Own Address = 4; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|----------|--------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link |
| 3252 | Station 2 | Camp 2 | Address 2 | Cave-Link |
| 3253 | Station 3 | Camp 77 | Address 3 | Cave-Link |
| 3254 | Station 4 | Big hall | Address 4 | Cave-Link |
| .... | .... |  | no route | Cave-Link |
| 3265 | Station 14 | Surface | Address 1 | Cave-Link |

Station Nr. 14

Menu 321 : Own Address = 14; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type |
|------|------------|----------|--------------|-----------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link |
| 3252 | Station 2 | Camp 2 | Address 1 | Cave-Link |
| 3253 | Station 3 | Camp 77 | Address 1 | Cave-Link |
| 3254 | Station 4 | Big hall | Address 1 | Cave-Link |
| .... | .... |  | no route | Cave-Link |
| 3265 | Station 14 | Surface | Address 14 | Cave-Link |

Note:

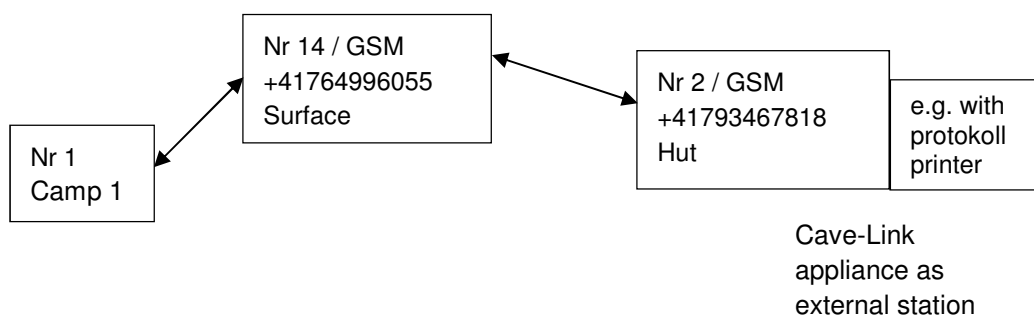
Assisted routing will always lead to a linear or branched net (depending on the login sequence of the stations) but never result in a true network

z.B. Big hall
↓
C77 -> C2 -> C1 -> Surface

Big hall
↙ ↘
C77 C2 -> C1 -> Surface

The net resulting from assisted routing can be optimized by manual adjustment of the routing tables.

9.6 Route via GSM



Station Nr. 1

Menu 321 : Own Address = 1; Menu 322 : Routing mode = Manual ;
Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type | GSM Nummer |
|------|------------|---------|--------------|-----------------|------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link | |
| 3252 | Station 2 | Hut | Address 14 | Cave-Link | |
| .... | .... |  | no route | Cave-Link | |
| 3265 | Station 14 | Surface | Address 14 | Cave-Link | |

Station Nr. 2

Menu 321 : Own Address = 2; Menu 322 : Routing mode = Manual ;
Menu 323 **GSM-CL-Address= 2**; Routing:

| Menu | Station | Name | Next station | Connection type | GSM Nummer |
|------|------------|---------|--------------|-----------------|------------------|
| 3251 | Station 1 | Camp 1 | Address 14 | GSM | +41 76 499 60 55 |
| 3252 | Station 2 | Hut | Address 2 | Cave-Link | |
| .... | .... |  | no route | Cave-Link | |
| 3265 | Station 14 | Surface | Address 14 | GSM | +41 76 499 60 55 |

Station Nr. 14

Menu 321 : Own Address = 14; Menu 322 : Routing mode = Manual ;
Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type | GSM Nummer |
|------|------------|---------|--------------|-----------------|------------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link | |
| 3252 | Station 2 | Hut | Address 1 | GSM | +41 79 346 71 18 |
| .... | .... |  | no route | Cave-Link | |
| 3265 | Station 14 | Surface | Address 14 | Cave-Link | |

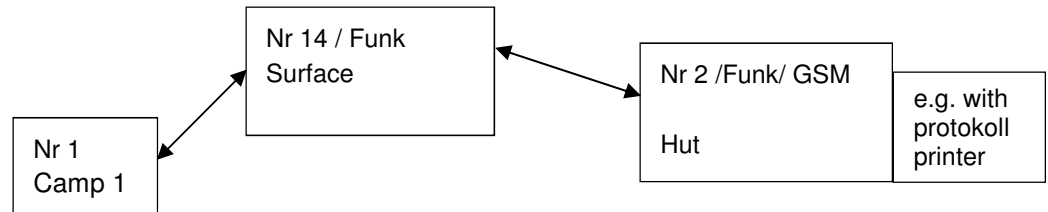
In theory this way also different Cave-Link nets could be connected by GSM links (but when would this be needed?)

9.7 Route via radio (future capability)

If radio modules are connected instead of GSM modules, communication can also be routed via radio.

However radio modules are still in development. It is envisioned to first offer a combination of radio and GSM.

In the configuration table of the following example it would be possible to send a SMS out of the cave although the surface station does not have any mobile phone reception. The messages are transmitted by radio to Unit 2 with reception and from there fed to the net.



Station Nr. 1

Menu 321 : Own Address = 1; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type | GSM Nummer |
|------|------------|---------|--------------|-----------------|------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link | |
| 3252 | Station 2 | Hut | Address 14 | Cave-Link | |
| .... | .... |  | no route | Cave-Link | |
| 3265 | Station 14 | Surface | Address 14 | Cave-Link | |

Station Nr. 2

Menu 321 : Own Address = 2; Menu 322 : Routing mode = Manual ;

Menu 323 **GSM-CL-Address= 2**; Routing:

| Menu | Station | Name | Next station | Connection type | GSM Nummer |
|------|------------|---------|--------------|-----------------|------------------|
| 3251 | Station 1 | Camp 1 | Address 14 | Funk | |
| 3252 | Station 2 | Hut | Address 2 | Cave-Link | |
| .... | .... |  | no route | Cave-Link | |
| 3265 | Station 14 | Surface | Address 14 | Funk | +41 76 499 60 55 |

Station Nr. 14

Menu 321 : Own Address = 14; Menu 322 : Routing mode = Manual ;

Menu 323 GSM-CL-Address= 14; Routing:

| Menu | Station | Name | Next station | Connection type | GSM Nummer |
|------|------------|---------|--------------|-----------------|------------|
| 3251 | Station 1 | Camp 1 | Address 1 | Cave-Link | |
| 3252 | Station 2 | Hut | Address 1 | Funk | |
| .... | .... |  | no route | Cave-Link | |
| 3265 | Station 14 | Surface | Address 14 | Cave-Link | |

10 Send and receive SMS

| | |
|----------------------------------|--|
| General | When sending an SMS to the GSM network, avoid using umlauts and special characters, because the correct implementation of these characters can not be guaranteed. |
| SMS from Cave-Link to GSM-Number | <p>Any SMS transmitted from the cave to the GSM network gets an opening sequence containing the station number and creation time of the message.</p> <p>E.g.</p> <pre>C02 12:25 // opening sequence Hallo // Message</pre> |
| SMS from GSM-Number to Cave-Link | <p>When an SMS is received by the GSM number of the surface station, it checks if the text begins with a cave address, e.g. "C02 (space or New Line)".</p> <p>If an opening sequence is included in the message, the message is sent to the appropriate station.</p> <p>If there is no prefix (station address) the software at the surface station checks in a table, if there was past communication between a cave station and this GSM number. If so, the message is forwarded to that cave station. The table includes max. 16 entries.</p> <p>If no entry exists, the SMS will be discarded.</p> |
| Example 1 | <p>Out of the cave an SMS is sent to the number of a friend. He does not know anything about Cave-link and responds to the message without opening sequence. The message will never the less arrive at the right cave station because there is an entry in the table of the GSM station.</p> |
| Example 2 | <p>Station 4 contacts a caving colleague by GSM number. Shortly after Station 1 does the same.</p> <p>A little later the colleague replies to Station 4 without using the prefix. This response will end up at Station1 as this is the last contact for the GSM number recorded by the GSM station. To respond to Station 4 the colleague will need to start his SMS with the corresponding station opening sequence (e.g. C04 Hello...) to reach the correct station.</p> |
| Example 3 | <p>The wife of a caver wants to know when her husband, currently at station 4, comes home and sends an SMS without opening sequence to the GSM. As the husband never contacted the wife out of the cave the GSM station will discharge this message (unable to assign to any station). The wife would have needed to use C04 to start the message.</p> |

11 Cave-Link using 2-wire-line

Cave-Link can also be operated using a long 2-wire-line. Most suitable are symmetrically twisted phone cables, e.g. for field telephones.



Caution!

If using transmission by 2-wire-line pay attention to the following points:

To avoid destruction of the receiver at the opposite end, the transmitting capacity of both stations **has to be lowered**.

Reduce the electricity to **50 mA** in the extended menu MenuE, *Settings, Link, Bat I(max)*.

If the 2-wire-line is longer than 2 km, the electricity potentially has to be increased to 100 mA to ensure a distortion-free reception.

Note:



If a very symmetric 2-wire-line is used, it is possible that the clock synchronisation with DCF77 or HBG does not work. In that case power save modes can not be used and the system needs to be set to *always on*.

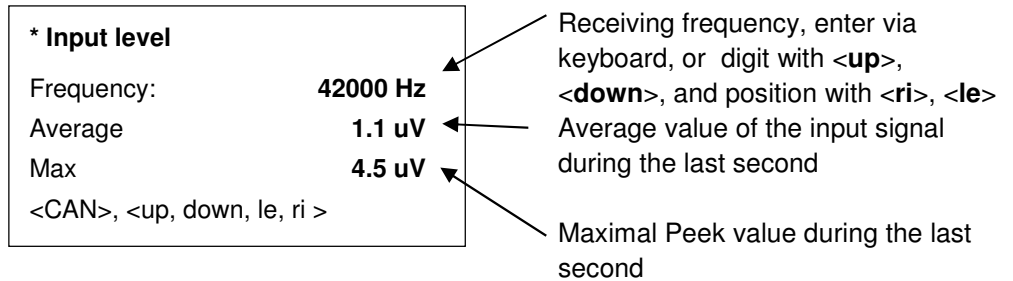
For very long cables consider using a lower frequency (e.g. 25.2 kHz).

12 Frequency selection

12.1 Quality and frequency selection

Quality

To check how busy a frequency is, there is a special option in the advanced menu: *Options, Measurements, S-Meter, <OK>*



| | |
|-----------|--|
| Frequency | Enter the receiving frequency directly using the keyboard or select it using the arrow keys: - number with mit <up>, <down> - Stelle mit <right>, <left> The frequency measured is the selected +-150Hz |
| Mittel | Average of the in-signal during the last second |
| Max | Max peak value during the last second |

An open frequency under quiet conditions has an average value of <2uV and peak values <10 uV.

During static discharges in the atmosphere (only very strong ones are visible as lightning), the paek value can easily rise over 100uV. Obviously, for that case the average value increases also slightly.

If the frequency is occupied and the average has a value of 20 uV instead of 2 uV, the opposite side will have to send at 100x higher power to ensure the data can be decoded. ($P = U^2 / R$)

If the max value is constantlz high, there likely is a technical disruptor (e.g. electrical fence with regular electrical impulses)

Frequency selection

Selection

The system allows for frequencies between 20 and 140 kHz. The entry has to be in Hz.

- The lower the frequency the smaller the attenuation by the rock
- The higher the frequency the more efficient gets the antenna (ration of wire length to waive length)
- The higher the frequency the lower the atmospheric noise
- In addition, the frequency should be free of other interferences (e.g. other transmitters)

For short distances (<300m) normally higher frequencies, e.g. 132.5 kHz are more efficient. Apparently the gain in antenna efficiency overrules the rock attenuation.

For long distance connections (>1000m) 25.2 kHz is a good choice. Unfortunately during summer times the atmospheric noise is so high that this frequency normally is only suitable in winter.

A good compromize for all applications in central Switzerland is 42 kHz.

12.2 Recording frequency spectra

Record Spectrum

It might be cumbersome to measure all possible frequencies with the S-meter. Therefore functionality was made available to measure frequencies with the spectra function.

The appliance records at the frequency the peaks with a bandwidth of ± 150 Hz and saves the average and the maximum peak. Subsequently the frequency is increased by steps of 200 Hz. For each round 50 points are measured resulting in 10 kHz to be covered. It is possible to repeat the process several times.

The results are stored in *Messages, Inbox meas. data*. These messages can be displayed using the menu *graphics*

At the moment it is not possible to print neither the spectrum nor the values in tabular form.

A frequency spectrum of another unit can be requested using commands. The frequency is measured by the other unit and the result sent to the requesting stations (see 14.2 Commands requesting information)

Menu Options, Measurements, Spektrum

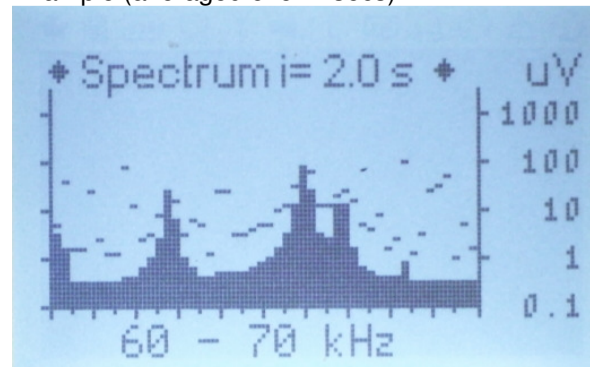
| | |
|---------------------|--|
| Start Frequ. | Frequency where the measurements start (20..140kHz) |
| measuring time | Time span for measuring a frequency and averaging the peaks |
| No. of measurements | Number spectra repetitions (blocks of 10 kHz) |
| Start | Starts the measurement. Each completed spectrum (10kHz) is stored in the inbox, measurements |

If the area of 40-80kHz should be measured, the following settings are needed:

Start Frequ. 80
measuring time 1000 (über 1 sec)
No. of measurements 4
Start

➔ 4 spectra ranging from (40-50, 50-60, 60-70 und 70-80kHz) are recorded and stored in the inbox, measurements

Example (averaged over 2 secs):



Frequencies suitable for transmission in this example are 60.5-61.5, 63.7, 68.5-70kHz (areas with low interferences)

13 Surface station with GSM

13.1 Content

The case contains a Cave-Link-Unit, a GSM and an additional battery.



Pocket with GSM antenna, pole, and screw driver for SIM card exchange

Cave-Link

GSM Modul

Cable – GSM Modul

Additional battery at the bottom of the case (not visible)

Surface station compiled



For power supply either two 6V 12Ah Accumulator (ca. 4kg) or 3 Li-Ionen batteries (= 11.4V, 18Ah) are used (ca. 1 kg).

Both battery types can be charged from the outside of the case using the Cave-Link-bus

3x Li-Ionen batteries at the bottom

13.2 Assembling the Station



For use in Switzerland there are 2 pre-paid SIM cards (Swisscom und Sunrise) included (see envelope in the cover behind the rubber foam pad).

13.3 GSM-Modul: Insert/Exchange SIM card

- Deactivate the PIN function on the SIM card. Located on most phones under security settings. The cell phone must work without entering PIN when switched on. The SC number for SMS delivery must be stored on the SIM too. (today, this is likely always the case)
- Loosen the 4 screws. Although they are secured against loss they still like to drop.
- Push SIM support towards the cable connector and open it. Insert the new SIM into the open support, close the support and push back. Do not use force!
- Tighten 4 screws crosswise

13.4 Testing of the GSM connection

A menu item *GSM Info* (normal menu) or *Settings, GSM, Network Status* in the extended menu exist. It may take a few seconds until the information is visible. If the module is busy (sending or receiving SMS) or not connected an error message

is displayed.

The display is only updated every 5-10sec.

It is indicated if the module was able to connect (OK, or no Network) and the receiving signal strength in dBm. Up to -91dBm a stable SMS functionality is guaranteed. Starting at -80dBm data traffic to the server is reliable (data transfer for measuring stations).

If necessary, the station should be slightly moved or look for a place higher up for the GSM module (tree, pole, etc.).

If connectivity is really at the low end, it might be easier to first search for a more suitable position using a mobile phone (this is faster and easier to carry around).

If a test message is sent from a cave-link to the GSM number of surface station, the message will sent back to the Cave-Link even if several stations are in between.

14 Remote configuration of Cave-Link units

Commands can be used to re-program remote Cave-Link stations. These functions are intended for technically experienced users who can imagine before every command what all could go wrong...

The commands are only processed if the station is in standby mode (no active use and display off)

14.1 Sending commands

Info request and configuration commands can be triggered by Cave-Link messages or using SMS/GSM connections.

The response is always returned to the sender (Cave-Link or GSM-Number)

Via Cave-Link

Messages, New message. Compose message then *Post Msg to -> Command*, select Cave-Link Address of the station that should get queried or newly configured:

Enter commands as text, after each command use return (new line, also after the last command).

Example:

```
rpsmode
```

Via GSM

Start message with C67xx (use return), enter commands as text, after each command use return (new line, also after the last command). xx designates the Cave-Link Address to be contacted

Example:

```
C6703  
rpsmode
```

Above example request the power save mode of station C03.

14.2 Commands only requesting information

The following commands only request information. As they do not change any configuration, they therefore are not risky....

| | |
|-----------------|---|
| rvbat | Requests battery capacity Response: vbat voltage in 0.1V, temp in 0.1C battery in % Caution: the % value is only correct provided the correct battery type is configured. |
| rpsmode | Get Power Save Mode Response: psmode x, where x=0= always on, 1 = 1.25min, 2=2.5min, 3 = 5 min, 4=15min, 5=30Min, 6=60min, 7=2h, 8= 4h, 9 = 8h, 10=24h |
| rroute x | Get Routing info to Station x Response: route x y abc, x=Route to station, y=Next station, abc=Name of station x |
| rgsmi | Request GSM Server interval = intervals when data is sent to the internet server Response: gsmi x, where x = interval in hours |
| reeprom adr typ | Read data from configuration EEPROM. With this function all configuration data can be viewed, see also eeprom command |
| mspec x y z | Recording of a frequency spectrum, where x = Frequency in kHz (10...140) y = Time in 100mSec z = Number of Spectrums |

14.3 Commands to change settings

| | |
|------------------|--|
| routeh x y | Set Next Station y to reach Station x |
| routenx abc | Sets the station name as abc for Station x |
| psmode x | Sets Power save mode (see rpsmode und chapter Fehler! Verweisquelle konnte nicht gefunden werden.) |
| gsmi x | Sets the interval (x in Hours) for logged data tot he internet server |
| reset | restarts the unit |
| eeprom adr typ w | Writes value w of type typ (1=char, 2=interger, 3 long) to adresse adr on the eeprom. This command allows changing or configuring everything. During normal use the following addresses are of relevance: |

| Adresse | Typ | Value w |
|---------|-----|------------------------------------|
| 10256 | 3 | Frequency in Hz (20'000 – 140'000) |
| 10010 | 1 | Rx attenuator 0=off, 1=20dB |
| | | |

| | |
|-------|--|
| msint | Sets the measuring interval for the data logger box accrding tot he following table: |
|-------|--|

| | | | |
|-----------|------------|--------------|---------------|
| 0 = off | 4 = 10 min | 8 = 1 hour | 12 = 6 hours |
| 1 = 1 min | 5 = 15 min | 9 = 2 hours | 13 = 8 hours |
| 2 = 2 min | 6 = 20 min | 10 = 3 hours | 14 = 12 hours |
| 3 = 5 min | 7 = 30 min | 11 = 4 hours | 15 = 24 hours |

15 Menu structure overview

15.1 Normal menu

| Menu | * Main menu |
|-------------|-----------------------|
| 1 | Messages |
| 1 1 | Inbox |
| 1 2 | New message |
| 1 3 | Drafts |
| 1 4 | Outbox |
| 1 4 1 | Outbox |
| 1 4 2 | Sent Cave Link |
| 1 4 3 | Sent GSM/radio |
| 1 5 | Delete |
| 1 5 1 | Inbox |
| 1 5 2 | Drafts |
| 1 5 3 | Outbox |
| 1 5 4 | Sent Cave Link |
| 1 5 5 | Sent GSM |
| 1 5 6 | Inbox meas. data |
| 1 5 7 | Delete all |
| 1 6 | Inbox meas. data |
| 2 | New location |
| 2 1 | Enter location/name |
| 2 2 | Test antenna |
| 2 3 | Time Synch |
| 2 4 | Next station |
| 2 5 | Login |
| 3 | Settings |
| 3 1 | Backlight |
| 3 2 | Backlight time lag |
| 3 3 | Beep |
| 3 4 | Battery type |
| 3 5 | Operation mode |
| 3 5 1 | Operation mode |
| 3 5 2 | Menu Pin E |
| 3 5 3 | Menu Pin V |
| 4 | Logout |
| 5 | Switch off |
| 6 | Network status |
| 7 | Language |
| 7 1 | German |
| 7 2 | French |
| 7 3 | Italian |
| 7 4 | English |
| 7 5 | Espanol |

15.2 Extended Menu

| | | | |
|--------------|----------------------|-----------|------------------|
| MenuE | * Hauptmenu E | 3 2 5 2 | CL station 2 |
| | | 3 2 5 2 1 | Name |
| 1 | Messages | 3 2 5 2 2 | Next station |
| 1 1 | Inbox | 3 2 5 2 3 | Connection type |
| 1 2 | New message | 3 2 5 2 4 | GSM number |
| 1 3 | Drafts | 3 2 5 3 | CL station 3 |
| 1 4 | Outbox | 3 2 5 3 1 | Name |
| 1 4 1 | Outbox | 3 2 5 3 2 | Next station |
| 1 4 2 | Sent Cave Link | 3 2 5 3 3 | Connection type |
| 1 4 3 | Sent GSM/radio | 3 2 5 2 4 | GSM number |
| 1 5 | Delete | 3 2 5 4 | CL station 4 |
| 1 5 1 | Inbox | 3 2 5 4 1 | Name |
| 1 5 2 | Drafts | 3 2 5 4 2 | Next station |
| 1 5 3 | Outbox | 3 2 5 4 3 | Connection type |
| 1 5 4 | Sent Cave Link | 3 2 5 4 4 | GSM number |
| 1 5 5 | Sent GSM | 3 2 5 5 | CL station 5 |
| 1 5 6 | Inbox meas. data | 3 2 5 5 1 | Name |
| 1 5 7 | Delete all | 3 2 5 5 2 | Next station |
| 1 6 | Print message | 3 2 5 5 3 | Connection type |
| 1 6 1 | Inbox new | 3 2 5 5 4 | GSM number |
| 1 6 2 | Outbox new | 3 2 5 6 | CL station 6 |
| 1 6 3 | all new | 3 2 5 6 1 | Name |
| 1 6 4 | all | 3 2 5 6 2 | Next station |
| 1 7 | Deleted objects | 3 2 5 6 3 | Connection type |
| 1 8 | Inbox meas. data | 3 2 5 6 4 | GSM number |
| | | 3 2 5 7 | CL station 7 |
| | | 3 2 5 7 1 | Name |
| | | 3 2 5 7 2 | Next station |
| 2 | New location | 3 2 5 7 3 | Connection type |
| 2 1 | Enter location/name | 3 2 5 7 4 | GSM number |
| | | 3 2 5 8 | CL station 8 |
| 2 2 | Test antenna | 3 2 5 8 1 | Name |
| 2 3 | Time Synch | 3 2 5 8 2 | Next station |
| 2 4 | Next station | 3 2 5 8 3 | Connection type |
| 2 5 | Login | 3 2 5 8 4 | GSM number |
| | | 3 2 5 9 | CL station 9 |
| | | 3 2 5 9 1 | Name |
| | | 3 2 5 9 2 | Next station |
| 3 | Settings | 3 2 5 9 3 | Connection type |
| 3 1 | Power save mode | 3 2 5 9 4 | GSM number |
| 3 2 | Routing setup | 3 2 6 | Stations 10 - 14 |
| 3 2 1 | Own address | 3 2 6 1 | CL station 10 |
| 3 2 2 | Routing mode | 3 2 6 1 1 | Name |
| 3 2 3 | GSM CL - Adresse | 3 2 6 1 2 | Next station |
| 3 2 4 | Delete all routes | 3 2 6 1 3 | Connection type |
| 3 2 5 | Stations 1 - 9 | 3 2 6 1 4 | GSM number |
| 3 2 5 1 | CL station 1 | 3 2 6 2 | CL station 11 |
| 3 2 5 1 1 | Name | 3 2 6 2 1 | Name |
| 3 2 5 1 2 | Next station | 3 2 6 2 2 | Next station |
| 3 2 5 1 3 | Connection type | 3 2 6 2 3 | Connection type |
| 3 2 5 1 4 | GSM number | 3 2 6 2 4 | GSM number |

| | | | |
|-----------|--------------------|----------|-------------------|
| 3 2 6 3 | CL station 12 | 3 6 | Operation mode |
| 3 2 6 3 1 | Name | 3 6 1 | Operation mode |
| 3 2 6 3 2 | Next station | 3 6 2 | Menu Pin E |
| 3 2 6 3 3 | Connection type | 3 6 3 | Menu Pin V |
| 3 2 6 3 4 | GSM number | 3 6 4 | Change menu Pin E |
| 3 2 6 4 | CL station 13 | 3 6 5 | Change menu Pin V |
| 3 2 6 4 1 | Name | 3 7 | Language |
| 3 2 6 4 2 | Next station | 3 7 1 | German |
| 3 2 6 4 3 | Connection type | 3 7 2 | French |
| 3 2 6 4 4 | GSM number | 3 7 3 | Italian |
| 3 2 6 5 | CL station 14 | 3 7 4 | English |
| 3 2 6 5 1 | Name | 3 7 5 | Spanish |
| 3 2 6 5 2 | Next station | 3 8 | Serial interface |
| 3 2 6 5 3 | Connection type | | |
| 3 2 6 5 4 | GSM number | | |
| 3 3 | Link | | |
| 3 3 1 | Link on/off | 4 | Logout |
| 3 3 2 | Battery I(max) | | |
| 3 3 3 | RX attenuator | | |
| 3 3 4 | Frequency settings | | |
| 3 3 4 1 | Frequency mode | 5 | Switch off |
| 3 3 4 2 | Channel 1 | | |
| 3 3 4 3 | Channel 2 | | |
| 3 3 4 4 | Channel 3 | | |
| 3 3 4 5 | Channel 4 | 6 | Standby |
| 3 3 5 | Clock synch. | | |
| 3 3 5 1 | Manual | | |
| 3 3 5 2 | Time interval | | |
| 3 4 | GSM | 7 | Options |
| 3 4 1 | GSM on/off | | |
| 3 4 2 | Network status | | |
| 3 4 3 | Alarm group | | |
| 3 4 3 1 | Subscriber 1 | | |
| 3 4 3 2 | Subscriber 2 | | |
| 3 4 3 3 | Subscriber 3 | | |
| 3 4 3 4 | Subscriber 4 | | |
| 3 4 3 5 | Subscriber 5 | | |
| 3 4 3 6 | Subscriber 6 | | |
| 3 4 3 7 | Subscriber 7 | | |
| 3 4 3 8 | Subscriber 8 | | |
| 3 4 4 | Server interval | | |
| 3 4 5 | Server offset | | |
| 3 5 | Display/Keyboard | | |
| 3 5 1 | Backlight | | |
| 3 5 2 | Backlight time lag | | |
| 3 5 3 | Beep | | |
| 3 5 4 | Battery type | | |
| 3 5 5 | Contrast | | |
| 3 5 6 | Status-MSG | | |

16 Abbreviations

- Content follows –

GSM Global System for Mobile Communications
SMS Short Messaging Service

17 Technische Daten

Cave-Link

Abmessungen:

Gewicht:



Stromversorgung: LiOn-Akkumulator

Achtung, Brand- oder Explosionsgefahr!

Den Akkumulator nur mit dem zugelassenen Ladegerät laden,
nicht kurzschliesse, nicht zerlegen, nicht ins Feuer werfen

Umgebungstemperatur:

Antenne:

Länge:

Anzapfungen:

Querschnitt:

Gewicht:

Erdplatten

Anschlüsse: 4mm Bananenstecker bzw. Buchsen

Netzteil

Abmessungen:

Gewicht:

Stromversorgung:

Umgebungstemperatur:

=> oder "siehe Aufdruck auf dem Gerät"

xxx

xxx

| xxx | xxx | xxx | xxx | xxx |
|-----|-----|-----|-----|-----|
| xxx | | | | |
| | | | | |
| xxx | | | | |
| | | | | |

Index

Keine Indexeinträge gefunden.

Ingenieurbüro Felix Ziegler
Schönau
CH-
Tel. +41 44-788 28 40
Fax +41 44-788 28 45
www.zie.ch

© 2014 Ingenieurbüro Felix Ziegler
Änderungen vorbehalten