

User Manual

Underground Communication and Alarm System

SEFAR - AB1

No. 1096

This User Manual includes:

Instructions for assembly, installation, commissioning, use, operation, settings, maintenance and servicing, disassembly, disposal and technical conditions.

Keep this manual for future use.

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User Manual

This User manual includes instructions for assembly, installation, commissioning, use, operation, setting, maintenance and servicing, disassembly and disposal, and technical specifications.

All workers installing, putting into operation, operating, maintaining and servicing the unit must be demonstrably familiarized with these operating instructions. **Keep this manual for future use.**

Use

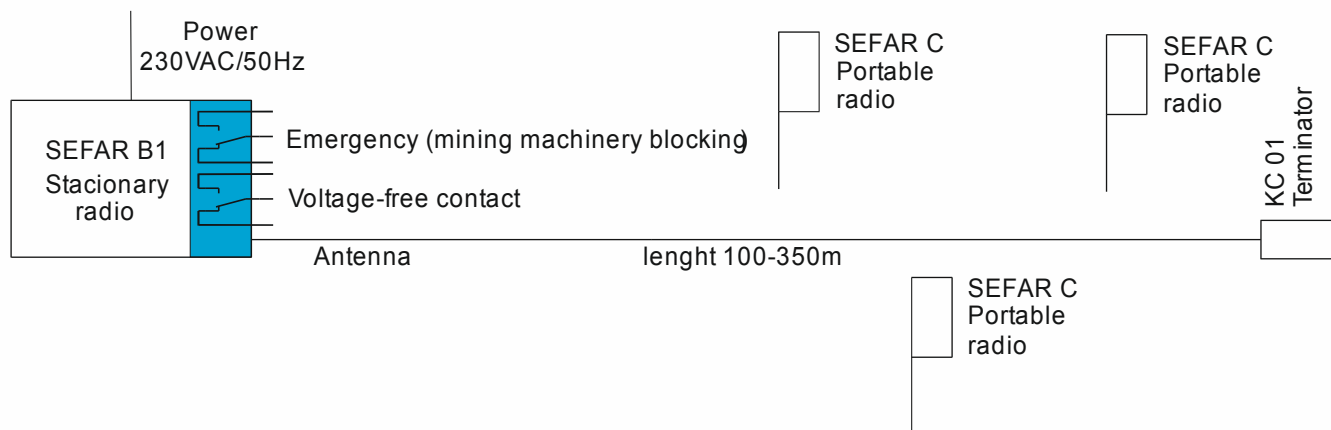
- The Underground Communication and Alarm System is intended for provision of voice communication and safety in the area worked, belt conveyor areas, but also in all the other mine areas and it meets the following functions:
 - a) Semi-duplex, single-channel voice communications between portable SEFAR-C radios (hereinafter radios only).
 - b) Mining machine blocking using the disconnect switch from all the radios within reach of radio communication.

Description and functions

- The SEFAR-AB1 system communication frequency is in the 162 to 172 MHz band. The system consists of the following components:
 1. - The portable radio, identified as SEFAR-C type, serves for voice communications among workers working underground and for mining machinery halt
 2. - The stationary radio, identified as SEFAR-B1 type, serves for bi-directional communications of portable radios through the radiating antenna; it analyses the requirement for mining machinery halt and it opens the appropriate control contact and for connection to intrinsically safe phone line or to the one not intrinsically safe
 3. - The radiating VLCAY coaxial cable of 50Ω impedance serves as the antenna
 4. - The SEFAR-KC 01 type of terminator for antenna termination
 5. - The splitter, identified as SEFAR-R type, serves for connection of other SEFAR-B1 stationary radios to increase the number of channels or to distribute the antenna routes.

6. - The SEFAR-LZ type of line amplifier to amplify the levels of voice and control signals for communications at distances exceeding 350m
7. - The SEFAR-Z type of power supply to feed the line amplifiers. (1 to 19 amplifiers)
8. - The SEFAR-GO type of galvanic separation serves for galvanic separation of antenna sections fed by various SEFAR-Z power supplies

The system makes it possible to select as many as four voice channels with 15kHz bandwidth. The basic structural member is the SEFAR-B1 stationary radio equipped with the 100-350m long antenna and the KC-01 terminator enabling communication between portable radios and blocking the mining machinery on one channel. For any other channel, one SEFAR-B1 stationary radio is necessary which is connected in the system using the SEFAR-R splitter. Furthermore, it enables to transmit the mining machinery halt signal on a separate channel. The basic configuration without antenna power supply and signal amplification enables communication and blocking in the working up to 350m, according to the installation site. For longer distances, you need to insert the SEFAR-Z type of power supply and the SEFAR-LZ type of amplifiers in the system and you can extend communication over a longer distance. By inserting other amplifiers, up to a total number of 19 (9 amplifiers for each side from the basic one, which is fed by an intrinsically safe SEFAR-Z power supply), you can cover a distance of 6650m.



Basic wiring of Underground Communication and Safety System

SEFAR-B1 stationary radio (I M2(M1) Ex d [ia] I)

The stationary radio electronics is implemented on dual layer PCBs. The STACRX, STACBL receivers and the STACTX transmitter are a reduced version of portable radio electronics. The electronic PCBs are housed in the box - explosion-proof enclosure along with the power supply. The power supply is fed from 230V mains. The antenna (radiating cable) is connected to the communication part through blocking capacitors – RF type of bushings for application of the parasitic antenna.

Moreover, the EMERGENCY blocking command for mining machinery halt is taken from the communication part and one voltage-free contact for controlling from the portable radio or for indication of other states is taken through the PD D36 type of bushing. In the communication part there is a glass window where you can see a LED indicator, indicating the operational status of the system and the display, showing the selected communication channel and other settings as well as the system status. This information items vary on the display after every 2 seconds approximately. .

SEFAR-C portable radio (I M1 Ex ia I)

In order to operate the SEFAR-C radio, you need to switch on the SEFAR-B1 stationary radio!

How to switch on SEFAR-C: The radio is put in operation by turning the volume knob from its leftmost to its rightmost positions. After some 1 sec, the SEFAR-C radio is ready for operation in receiving mode.

Reception: the SEFAR-C signal reception mode, volume increasing/decreasing is performed by turning the volume control knob to the right/left.

Transmission: If you wish to transmit, press down the PTT button; the LED indicator is lit in red and then you can speak to the microphone. You must keep the PTT button pressed down for the entire period of transmission. Transmission is terminated as soon as you release the PTT button / SEFAR-C is switched to reception mode/.

EMERGENCY (mining machinery blocking): By pressing down and holding the EMERGENCY button for about 3 sec, the blocking function is activated. The SEFAR-C transmits the blocking signal every 3 seconds and it is further processed in the stationary radio. The blocking mode is indicated by flashing the red LED indicator and by EMERGENCY lettering on LCD display. . In this SEFAR-C operational mode you can receive and transmit, but you need to count with interruption of communication after every 3 seconds for a period of some 250msec. **The EMERGENCY mode is cancelled by switching off the portable SEFAR-C radio and switching it on.**

Voltage-free contact controlling: In the SEFAR-C radio menu, you can control the voltage-free contact on the SEFAR-B1 stationary radio (you can take out as many as four such contacts), by which means you can implement any signalling or safety function in connection with an evaluation system connected to this contact.

To switch off the SEFAR-C radio: The radio is switched off by turning the volume knob to its leftmost position.

SEFAR-R splitter

It is used for splitting the radiating antenna in underground roads It is housed in a plastic box and it has 3 bushings for connecting the antenna cable. For assembling, refer to the diagram below. The maximum length of the coaxial cable between 2 SEFAR-LZ intermediate amplifiers is up to 350m according to the installation site. This situation is indicated in Fig. 2. When using the SEFAR-R splitter between the appropriate intermediate amplifiers /before and after splitting/ additional 4dB attenuation is inserted. That is why you need to cut the length of the coaxial cable between 2 SEFAR-LZ intermediate amplifiers by 70m against the version without the splitter. This situation is indicated in Fig. 3.



Fig. 2: Cabling without splitter

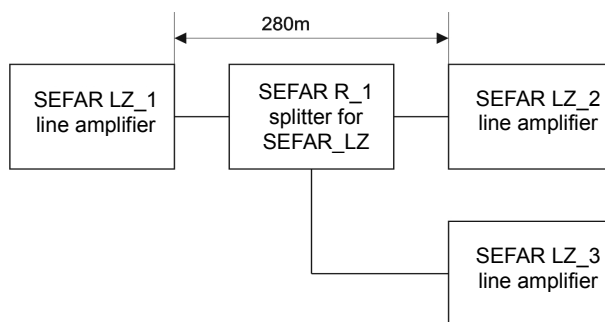


Fig. 3: Cabling with splitter

Radiation antenna

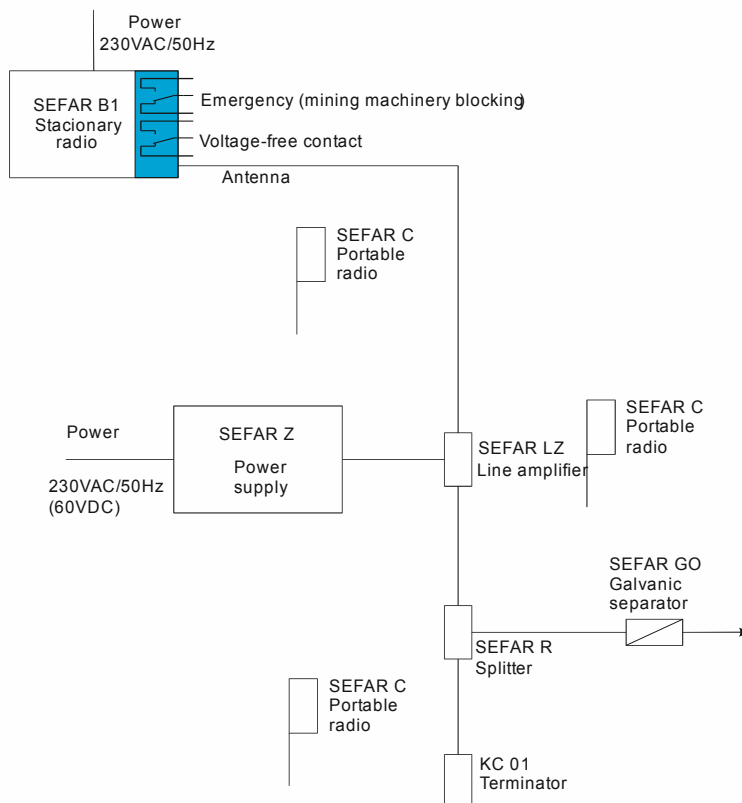
Specifications:

- Solid core 2.24mm diameter
- Dielectric medium, foamed PE
- The external conductor consists of conductors laid down, with the total cross-section of 3.8mm²
 - The cable jacket is made of softened PVC in yellow (black or grey) colour

SEFAR-KC01 terminator

The terminator is made up of a 50Ω resistor, series connected, 2n2 capacitors and the terminal board located in the box. The unit is in Ex ia I intrinsically safe design.

Example of the underground communication and security system with one amplifier and splitter

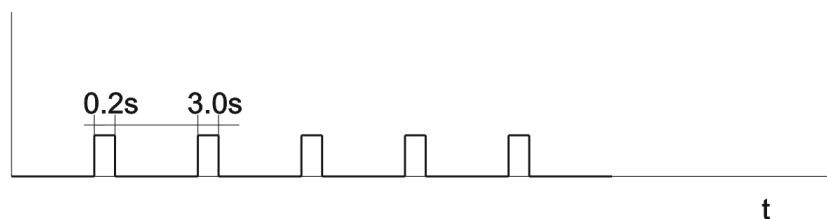


Description of signalling and blocking

After powering up the SEFAR-B1 radio, the "EMERGENCY" signal (output relay opening) is generated in 5 seconds, the red LED indicator is lit and the 300Hz audio signal is sent out to the portable radios for 3secs. Then the red LED is off and the relay operates. After arrival of the "EMERGENCY" command, the 300Hz from the first radio is sent out to the other portable radios on the appropriate channel for 3 seconds and the red LED is lit on the stationary radio / radios and the EMERGENCY output relay is opened. At the same time, the red LEDs on all portable radios start flashing. In this mode, the radio that initiated the EMERGENCY mode can be heard in all portable stations on any channel. If any radio needs to be connected with this radio by voice, such radio must have activated the EMERGENCY mode as well. All portable radios within the reach of the antenna can be blocked on the given channel at the same time. It is similar also in the case when multiple SEFAR-B stationary radios with different channels are used. When the EMERGENCY signal is transmitted from any radio on any channel, the EMERGENCY output relays in all SEFAR-B1 stationary radios operate and red LEDs in all radios on all channels used will be flashing. After the EMERGENCY mode in all portable radios is terminated, the EMERGENCY output contact is closed within a preset period and the red LEDs in all SEFAR-B1 stationary radios are turned off. At the same time, the red LEDs in all SEFAR-C portable radios stop flashing.

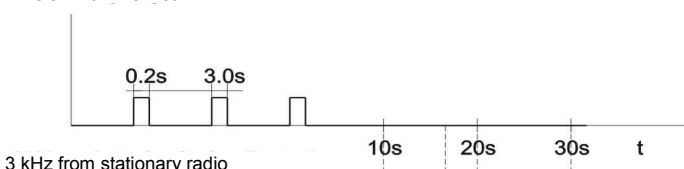
Time behaviour:

BLOCK from stationary radio

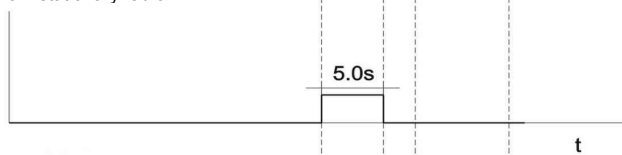


Time behaviours:

BLOCK from helmet



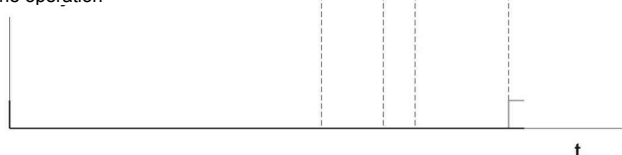
3 kHz from stationary radio



UNBLOCK from stationary radio

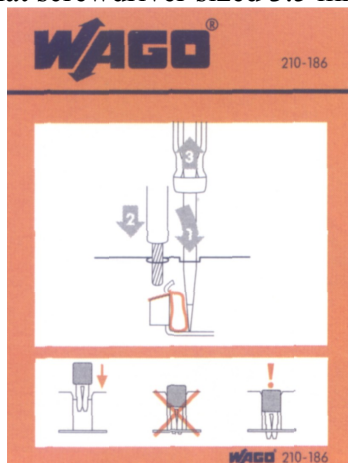


Machine operation



Installation and assembly

- The stationary radio is usually located in the protective bay at the entrance to the underground mining workplace. The explosion-proof enclosure is attached to a suitable steel structure using four M8 screws; the retainers are part of the radio enclosure. The line voltage is brought through the disconnect switch into the relevant bushing in the terminal board section. The information to stop (blocking) the mining machine (drive) is accomplished as an intrinsically safe output (voltage-free relay contact). The same applies to the other output controlled from the portable radio. The output for the special radiating coaxial cable is also in intrinsically safe design. These intrinsically safe cables (blue part of the enclosure) must be kept apart from the power cables spatially and they must be led separately. The explosion-proof entry bushings are sealed and fastened down; the cables from outlets are suitably attached.
- Antenna (coaxial cable) installation.
 1. The antenna is placed in the laying of cables for the powered support into the upper layer. It must be laid freely with allowance for movement of supports.
 2. The antenna must be attached in an insulated way; it must not be attached using metal hooks and binding wires. The terminator is connected to one end of the antenna. The other end of the antenna is connected to the appropriate terminals of the stationary radio.
- Before the cable is put into the PNV outlet, it is necessary to slacken 2 socket head screws so that the clamp and the sealing ring cannot prevent the cable from insertion in the enclosure. The contact surface of the cable casing with bushing must be cleaned from any dirt and inserted into the bushing in such manner that the casing end protrudes over the plane of flange surface by 8mm at least. Screw in the bushing body carefully and tighten the rubber sealing ring. That will expand the O-ring and seal the cable inside box. Then insert the bushing with a sleeve and place the blocking device from the top. The blocking device is screwed into the bushing body over the sleeve using 2 screws. That ensures blocking the cable against mechanical tearing out of the box. The blocking cog serves as a safety to prevent unauthorised disassembly of bushing from the box.
- Unused outlets must be blinded with original caps.
- M8 screws on the lid must be tightened to the prescribed torque of 7-9 Nm after completion of the installation.
- There may be no loose conductor ends.
- All screws on appliances and terminals inside the rack must be tightened properly. This also applies to unused screws.
- Length of wire stripping:
 1. WAGO 281
 1. cross-section of connected wires 0.08 mm² to 4 mm².
 2. length of wire stripping 9 mm to 10 mm.
 3. terminal opening tool: flat screwdriver sized 3.5 mm x 0.5 mm.



Supplementary documentation

1. SEFAR-B1 stationary radio	No. 20009-000	User Manual
2. SEFAR-C portable radio	No. 21219-00	User Manual
3. SEFAR-KC01 terminator	No.	Technical Report
4. SEFAR-R splitter	No. 20617	User Manual
5. SEFAR-LZ line amplifier	No. 1096/1	User Manual
6. SEFAR-Z power supply for SEFAR-LZ	No. 1096/2	User Manual
7. SEFAR-GO separator	No. 20701	User Manual
8. SEFAR-NAB 1 portable radio charger	No.	

Operating instructions

- The operator is obliged to check the function of the unit, communication and blocking every time the SEFAR system is switched on. In the case that the integrity of antenna is broken, they must eliminate the fault at first.

Maintenance

- Check the sealing and condition of explosion-proof enclosure bushings; check the coaxial antenna route, including the KC 01 terminator. Keep the glass window in the enclosure clean. Apply a thin film of grease - plastic grease NH2 or K4 (red vaseline) to surface contacts of the explosion-proof enclosure.
- Keep the surface clean, any dirt and dust must be removed using a piece of clean and dry cloth, a brush or broom, further cleaning of the surface must be done using a piece of damp cloth.
- When unit is operated, make sure that impurities and dust cannot get into the module through air vents as these impurities may be electrically conductive and may affect the intrinsic safety of the level meter. Remove dust and moisture (leakage) from contact sensors.
- The manufacturer determines regular inspections one a year carried out by ZAM Servis s.r.o. workers or by their authorized representative.

Repairs and spare parts

- All repairs and spare parts are provided by the manufacturer.
- Equipment for repairs must be properly cleaned and have enclosed description of the defect and conditions, under which defect is shown.

Delivery, transport and storage

- The delivery shall include:
 - This User Manual
 - Copy of FTZÚ certificate
 - Declaration of Conformity.
 - Product Quality and Completeness Certificate.
 - The product itself.
- Components are delivered unpacked.
- All components shall be transported with attention to reduce potential shocks and vibrations. Items shall be stored in dry environment at temperature between 0 and 40 °C in a single layer only.

- The delivery includes:
 - This User Manual
 - A copy of the Declaration of Conformity
 - The product itself

Fire safety, ecology, disposal, recycling

- Do not expose to open flame; harmful substances are produced by burning.
- When used properly during operation it doesn't affect the environment and ecology.
- After expiration of the lifetime, return the product to the manufacturer for disposal. The address is given in this document.



- After expiration of the lifetime, the electrical and electronic equipment must not be disposed of as ordinary municipal waste. The product must be forwarded to a relevant collection point for proper processing, regeneration and recycling of the electrical and electronic equipment.
- For more information about the collection point and recycling of this product, please contact the local authorities, a municipal waste management firm at your place or the shopkeeper where you purchased this product.

Manufacturer and service organization

- ZAM - SERVIS s.r.o. Křišťanova 1116/14, 702 00 Ostrava - Přívóz, phone: 596 135 422 e-mail: zam@zam.cz

Related standards, regulations and documents

LVD:

ČSN 33 2000-4-41 ed.2: Low voltage electrical installations – Electric installations – Part 4: Safety – Chapter 41: Protection against electric shock.

ČSN EN 60529 Degrees of protection provided by enclosures (IP Code)

ATEX:

ČSN EN 50303 Group I, Category M1 equipment intended to remain functional in atmospheres endangered by firedamp and/or coal dust

ČSN EN 50394-1 Electrical apparatus for potentially explosive atmospheres - Group I - Intrinsically safe systems

ČSN EN 60079-0 ed.4 Explosive atmospheres – Part 0: Equipment General requirements

ČSN EN 60079-1 ed.2: Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures „d“

ČSN EN 60079-11 ed.2: Explosive atmospheres – Part 11: Equipment protection by intrinsic safety “i”.

ČSN EN 1127-1 ed.2: Explosive atmospheres – Explosion prevention and protection – Part 1: Basic concepts and methodology

ČSN EN 1127-2 + A1: Explosive atmospheres - Explosion prevention and protection -Part 2: Basic concepts and methodology for mining

Technical specifications and appearance

SEFAR-B1	Find out more in: User Manual 20009-000
Supply voltage	230 V AC 50/60 Hz
Current consumption:	0.35 A
Cross-section of connected wires	1.5 – 2.5 mm ²
Protection	IP 54
Temperature range	0 to +40 °C
Dimensions	230 x 530 x 177 (mm)
Weight	23.5 kg
Design	I M2(M1) Ex d [ia] I
SEFAR-C	Find more in: User Manual 21219-00
Rated voltage	7.4 V
Operating voltage	5.5V to 8.4 V
Rechargeable battery capacity	2800 mAh
Temperature range	-20 °C to +50 °C
Relative humidity	95 %, no condensation
Protection	IP 54
Design	I M1 Ex ia I Ma
Dimensions of radio, including antenna	247.5x62.5x41.5 mm
Rechargeable battery dimensions	92.0x56.0x25.0mm
Weight	0.298 kg
SEFAR-Z	Find more in: User Manual 1096/2
Supply voltage	60 VDC +-10 % 230 VAC (90-240 V AC), 50Hz
Current consumption:	0.16 A at 60 VDC 0.05 A at 230 VAC
Cross-section of connected conductors, max.	2.5 mm ²
Protection	IP 54
Temperature range	0 to + 40 °C
Dimensions (w x h x d)	240 x 430 x 145 mm
Weight	12.5 kg
Design	I M2(M1) Ex d [iaMa] I Mb
SEFAR-LZ	Find more in: User Manual 1096/1
Supply voltage	9-12 V / DC
Current consumption:	approx. 10 mA
Temperature range	-20 °C to +40 °C
Dimensions	79 x 236 x 75 mm
Weight	0.42 kg
Design	I M1 Ex ia I

SEFAR-R	Find more in: User Manual 20617
Temperature range	0 to 40 °C
Dimension, excluding bushings and aerials	
Polyester housing	110 x 75 x 58 mm
Stainless steel box	130 x 130 x 65 mm
Protection	IP54
Cross-section of connected wires	2.5 mm ²
Design	I M1 Ex ia I
SEFAR-GO	Find more in: User Manual 20701
Temperature range	0 to 40 °C
Dimension, excluding bushings and retainers	190 x 75 x 58 mm
Total weight	0.3 kg
Protection	IP54
Cross-section of connected wires	2.5 mm ²
Design	I M1 Ex ia I Ma
EMC:	
According to ČSN EN 61 000-4-2, ČSN EN 61 000-4-3, ČSN EN 61 000-4-4, ČSN EN 61 000-4-8, ČSN EN 61 000-4-11, ČSN EN 55 022.	

Figures enclosed

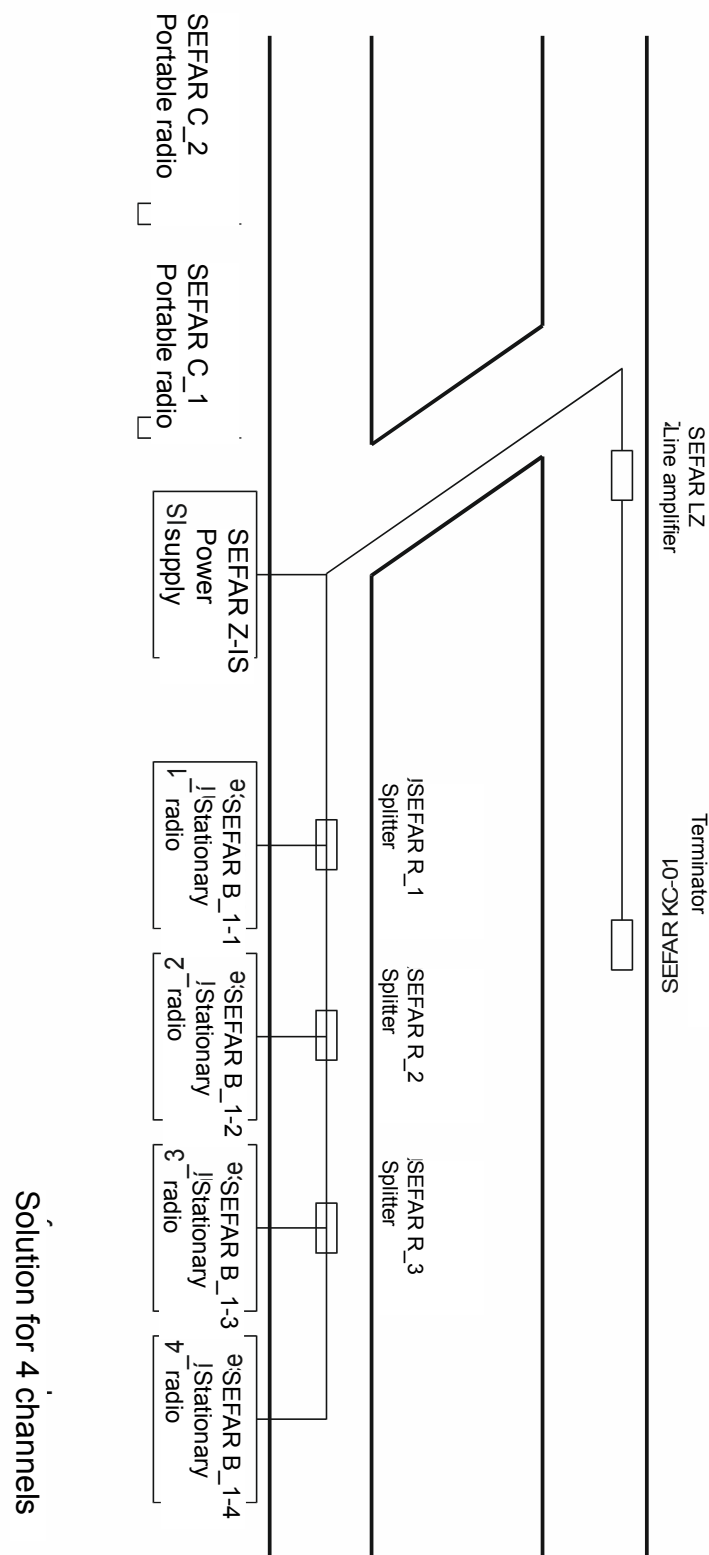


Fig. 3 Example for four-channel wiring



Fig.8: SEFAR-B1



Fig.9: SEFAR-Z



Fig.10: SEFAR-LZ



Fig.11: SEFAR-KC01 and SEFAR-R



Fig.12: SEFAR-C



Fig.13: SEFAR-NAB1

Document revision

20/05/2005	Initial document version
14/10/2013	Reformatting and supplementation of text, variation in figures