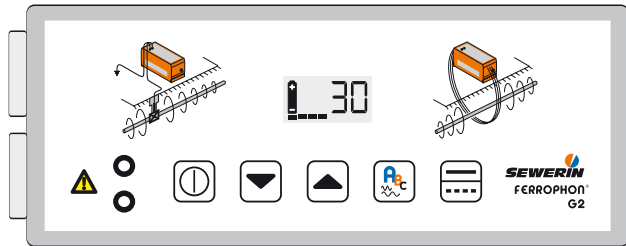
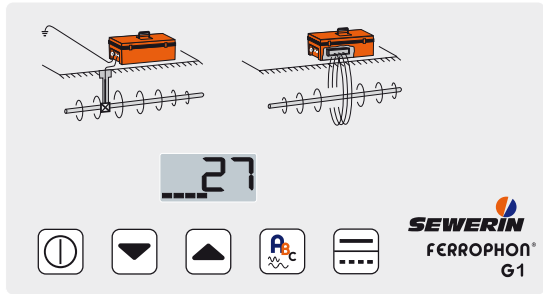


FERROPHON® G1/G2

Operating Instructions



Measurable success by Sewerin equipment

Congratulations. You have chosen a quality instrument manufactured by Hermann Sewerin GmbH.

Our equipment will provide you with the highest standards of performance, safety and efficiency. They correspond with the national and international guide-lines.

Please read and understand the following operating instructions before using the equipment; they will help you to use the instrument quickly and competently. If you have any queries we are available to offer advice and assistance at any time.

Yours

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Figure FERROPHON G1

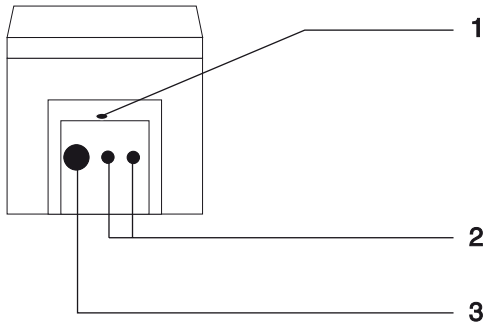


Fig. 1: Side view G1

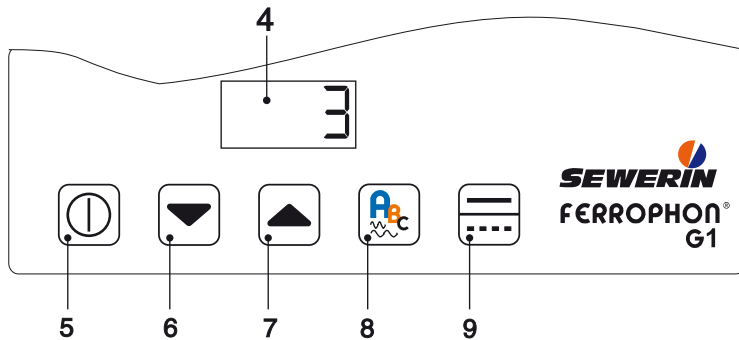


Fig. 2: Section of front plate G1

Item	Description	Function
1	Service socket	for service purposes only
2	Output	Galvanic transmission
3	Input 2	Charge with 12 V= or operate with 12 V=
4	Display	
5	ON/OFF key	Switch device on or off
6	Arrow-down key	Reduce transmission current
7	Arrow-up key	Increase transmission current
8	ABC key	Change transmission frequency
9	Impulse/Permanent current key	Switch between permanent and impulse current

Figure FERROPHON G2

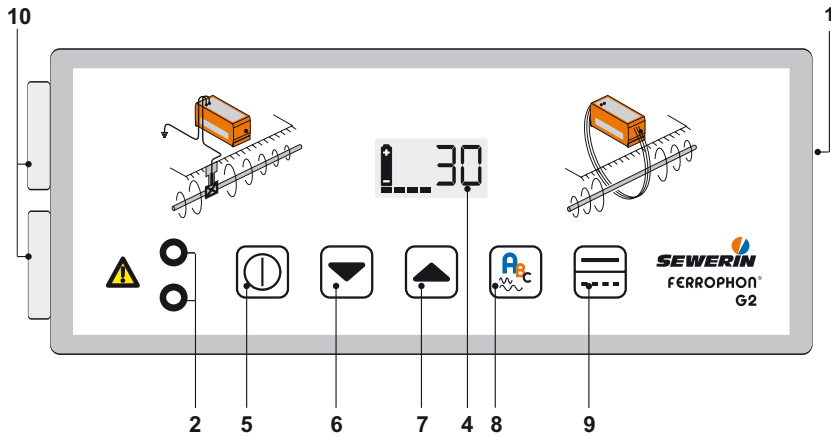


Fig. 3: FERROPHON G2

Item	Description	Function
1	Input 1	Operate with 12 V=
2	Output	Galvanic transmission
4	Display	
5	ON/OFF key	Switch device on or off
6	Arrow-down key	Reduce transmission current
7	Arrow-up key	Increase transmission current
8	ABC key	Change transmission frequency
9	Impulse/Permanent current key	Switch between permanent and impulse current
10	Battery compartments	To change the batteries

Operating Instructions

FERROPHON[®] G1/G2

26.11.2009 – 103415 – en

Note

These operating instructions describe the

- Software version 3.X (G1)
- Software version 1.X (G2)

where „X“ represents a number. The software version used by your **FERROPHON generator** will be shown when you carry out a self-test (see section 7.2).

Explanation of symbols



CAUTION! Risk of material damage!

This symbol is followed by safety instructions which must be observed to avoid material damage!



Note:

This symbol is followed by additional information beyond the scope of product operation.

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1 General

1.1 Warranty

The following instructions must be complied with in order for any warranty to be applicable in respect of the functionality and safe operation of this equipment.

Hermann Sewerin GmbH cannot be held responsible for any damages resulting from non-compliance with these instructions. The warranty and liability provisions of the terms of sale and delivery of Hermann Sewerin GmbH are not affected by the information given below.

- The product must only be operated after the relevant operating instructions have been read and understood.
- This product may only be operated by qualified professionals who are familiar with the legal requirements (Germany: DVGW).
- The product must only be used for its intended purpose.
- Repairs must only be carried out by a specialist technician or by other suitably trained personnel.
- Changes or modifications to this product must not be carried out without approval from Hermann Sewerin GmbH. The manufacturer cannot be held responsible for damages if non-approved modifications have been made.
- Only accessories supplied by Hermann Sewerin GmbH may be used with this product.
- All repairs must be carried out using replacement parts that have been approved by Hermann Sewerin GmbH
- Only use the appropriate type of disposable/rechargeable battery, otherwise the device will not be explosion-proof.
- The manufacturer reserves the right to make technical modifications in the course of further development.

Generally applicable safety and accident-prevention regulations must be complied with, in addition to the information provided in this manual.

1.2 Introduction

The following instruments are described in this operating manual:



Generator G1/G2

Device for inductive and galvanic transmission of electrically conductive, earth-laid lines.

1.3 Use and operation

The **generators G1/G2** are used to generate an alternating current in electrically conductive earth-laid line, herein after referred to as „lines“.

The line can be located by using a receiver and transmitting the suitable current intensity and frequency.

The alternating current can also be used to locate damage on cathode-protected lines, or cable faults.

2 Operation

The **generator G1/G2** can be coupled to the line with two different types of coupling.

- Galvanic coupling

There must be at least one means of connecting to the libe to be transmitted to.

- Inductive coupling

One point of the line must be known, but not necessarily be accessible. However, the approximate direction of the line at this point must be known.

2.1 Keys

2.1.1 ON/OFF key



The ON/OFF key is used to switch the **generator G1/G2** on and off.

2.1.2 Arrow keys



The Arrow keys are used to set the intensity of the transmission current.

Arrow-up key:

Increase current

Arrow-down key:

Reduce current

2.1.3 ABC key



The transmission frequency can be changed by pressing the ABC key. The following frequencies are available:

A = 41666 Hz

B = 9950 Hz

C = 1100 Hz

If a line is transmitted to inductively, frequency „C“ is not available. On **generator G2** frequency „A“ is also not available.

2.1.4 Impulse/Permanent current key



Switch between impulse and permanent current by pressing the impulse/permanent current key.

With impulse current there is a pulsating alternating current. It has a clock ratio of 1 : 1 (impulse : pause). The display blinks.

When impulse current is set, a transmission rate can be set that is up to twice as great as the transmission rate with permanent current.

Operation with impulse current increases the operating time of the generator by up to double that when using permanent current.

Intermittent Current

The permanent current can be switched, so that it is switched on for 12 seconds and off for 3 seconds. This corresponds to the operation of some systems for active cathodic protection of pipes and is therefore preferred by their operators.

1. Switch from permanent current to impulse current.
2. Press the impulse/permanent current key for more than 3 seconds.

3. With this mode there is a slow signal in the LCD.

2.2 Display

2.2.1 Digital display



The digital display shows the current intensity of transmission current. When the line is transmitted to galvanically, the current intensity is shown in [mA]. With inductive transmission it is shown as a [% of the maximum output].

2.2.2 Battery symbol



When the battery symbol appears in the display, it means that the batteries or accu are so discharged that the generator can only be run for a few more minutes.

To avoid excessive discharge and thus damage to the accu, the generator switches itself off automatically.

2.2.3 Segments (G1 only)



The charge status of the replaceable accu is shown during operation by the number of segments in the display.

The display only shows the voltage in the accu. It can therefore only be used as a guide as to the charge status of the accu. This means, the more segments shown, the higher the charge status of the accu.

2.3 Connections



G1

2

3



G2

3

1

2.3.1 Output

The cable for galvanic transmission to a line are connected to **output 3**. The poling is arbitrary.

2.3.2 Input 1 (generator G2 only)

The external power supply (12 V=) is connected to input 1.

Thus the **generator G2** can be operated without using internal batteries resp. accumulators. Charging of inserted batteries is not possible.

The following accessories can be connected to input 1:

- AC/DC adapter M4 (operation from mains supply)
- Vehicle cable M4 (operation from car battery)

2.3.3 Input 2 (generator G1 only)

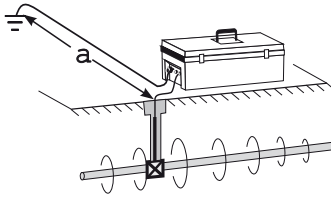


2

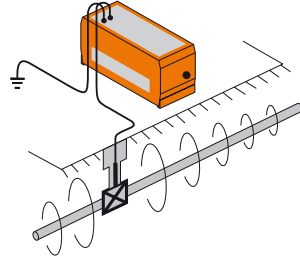
The external power supply (12 V=) is connected to input 2 by using the vehicle cable L. It allows charging the built-in accumulator and operation of **generator G1**.

3 Coupling

3.1 Galvanic coupling



G1



G2

If there is a means to connect to the line, a direct cable connection (usually with an auxiliary earth) can be made between the generator and the line.

At the connection sockets there is potentially dangerous electrical voltage. When working with **generator G1/G2** you should therefore proceed as follows:



- If the generator is switched on, use the ON/OFF key to switch it off.

- Connect all the cable for transmission to a line.

Examples of connection are given in the sections entitled „Example connections“ and „Examples and information“.



- Switch on the generator at the ON/OFF key.

The digital display shows the intensity of the transmission current.



- If the display shows „Ind“, the external resistance is so great that the generator must be switched by hand to „galvanic transmission“.



- To switch by hand to „galvanic transmission“, press the two Arrow keys simultaneously.
- Use the Arrow keys to set the desired transmission current intensity. The intensity can be set in steps.



Note:

If resistance in the earth is very great, it may not be possible to obtain the desired transmission current. In this case, the maximum obtainable current is set.

If the display shows „3“ (**generator G1**) or „1“ (**generator G2**), only a very low transmission current is possible.



- Set the desired frequency using the ABC key. With good or well insulated lines preferably -C- or -B-; otherwise -A-.
- When the ABC key is first pressed, the current set frequency is shown. After this, the frequency changes each time the key is pressed.
- Locate the line with a suitable receiver, e.g. with a **FERROPHON EL** or **AQUAPHON AF 100**. At the receiver there must be the same frequency set as on the **generator G1/G2** (see also the operating instructions for the receiver).



- If the line can not be located, the transmission current or also the frequency can be changed at any time. It is also possible to switch between impulse and permanent current using the impulse/permanent current key.



- Switch off the generator using the ON/OFF key.
- Remove the connection cable.



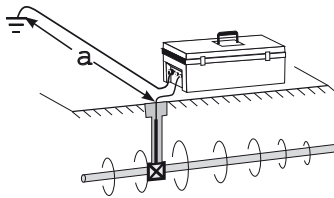
Notes:

In a radius of approx. 10 m from **generator G1/G2** there is only a very limited possibility to locate a line. A minimum distance of 10 m to the generator should therefore be maintained.

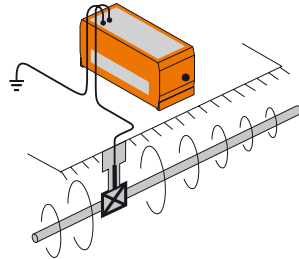
If the line can not be located, the transmission current can be increased or reduced. It is possible to select steps under „30“. This is practical when attempting to locate in the vicinity of the generators, or to save energy.

3.1.1 Example connection

The following illustration shows an example of galvanic coupling using an earthing spike (auxiliary earth).



G1



G2



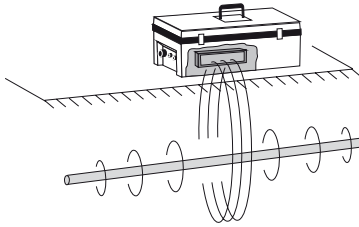
Caution - high voltage!

Only connect the cables when the generator is switched off. There may be high voltage at the outputs!

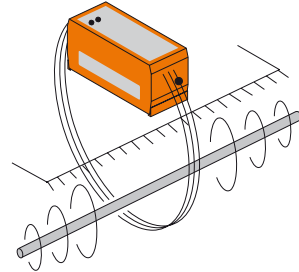
- If the generator is switched on, switch **generator G1/G2** off using the ON/OFF key.
- Find an accessible point for the line to be located.
- Using a clamp, fasten a cable to the accessible point of the line. Plug the other end of this cable to the output of the generator.
- Knock in an earthing spike with a minimum distance (a) of 2 – 3 m to the side of the cable to be located.
- Using a clamp, fasten a cable to the earthing spike. Plug the other end of this cable to the output of the generator.
- Then switch on the generator and carry out the measurement as described in section 3.1 „galvanic coupling“.

3.2 Inductive coupling

The illustration shows an example of inductive coupling using the internal frame coil.



G1



G2

If there is no means to connect to the line, coupling can also be achieved without a cable connection. The **generators G1/G2** are equipped with an internal coil for this purpose.



- If the generator is switched on, switch it off at the ON/OFF key.

- To obtain a good coupling, it is important to place the generator as precisely as possible in the longitudinal (**generator G1**) or latitudinal direction (**generator G2**) on the route (see illustration above).



- Switch on the generator at the ON/OFF key.

The generator is automatically in „inductive coupling“ mode.

„Ind“ is shown on the display.



- Set the desired transmission current intensity using the Arrow keys. The current intensity can be set in steps.



With inductive coupling, the transmission current is shown in [% of maximum output] in the display.

With **generator G1** permanent current is not available in current stages 75 % and 100 %, only impulse current can be used.

- The current set frequency is shown on the display the first time the ABC key is pressed. After this, the frequency changes each time the key is pressed.

When a line is transmitted to inductively, frequency „C“ is not available. With **generator G2** only frequency „B“ is available.

- Locate the line with a suitable receiver, e.g. with a **FERROPHON EL** or **AQUAPHON AF 100**. At the receiver there must be the same frequency set as on the **generator G1/G2** (see also the operating instructions for the receiver).
- If the line can not be located, the transmission current or also the frequency can be changed at any time. It is also possible to switch between impulse and permanent current using the impulse/permanent current key.
- Switch off the generator using the ON/OFF key.





Note:

A distance of up to 15 m (depending on the output rate) must be maintained in order avoid disruptions through direct receipt to the generator.

4 Power supply

4.1 Charge status



The displayed number of segments indicates the approximate charging status of the accu during operation and charging. The more segments shown, the higher the charging status of the accu.



When the battery symbol appears in the display, it means that the batteries or accu are so discharged that the generator can only be run for a few more minutes.

To avoid excessive discharge and thus damage to the accu, the generator switches itself off automatically.

4.1.1 Charging the accu using the generator G1

The **generator G1** can only be charged when switched off.



- If **generator G1** is switched on, switch it off using the ON/OFF key.



2

- The external power supply (12 V=) is connected to input 2 by using the vehicle cable L. It allows charging the built-in accumulator and operation of **generator G1**.

- As external power supply may be used:
 - car battery (cigarette-lighter socket)
 - AC/DC adapter L
100 – 240 V~ / 12 V= / 3.8 A



Charging:

The remaining charging time is shown in the display (in hours). For fully discharged accumulators this is 13 hours. The battery symbol is shown.

Buffering:

The „buffering“ automatically starts after the charging process.

All segments and the battery symbol are shown on the display.

4.1.2 Hints for care-taking of the accumulator of the Generator G1

Buffering:

To keep the **generator G1** ready for operation permanently it has to be connected to an external power supply. With „buffering mode“ the accu will only be charged, if the accu voltage drops below 12 V by self-discharge. The charging process is always finished as soon as the accu reaches a voltage of 14,5 V.

Storage:

The **generator G1** can be stored from one week up to three weeks without any considerable capacity loss. Permanent current consumption of the AC/DC adapter L can be avoided this way.

The **generator G1** can be stored for a period of up to 6 months without being connected to any charger. Prior to the next use the G1 must be fully charged.

**Caution!**

Longer storage leads to damage of the accumulator

4.1.3 Operating time of generator G1 with galvanic coupling

The operating time varies depending on the load to which the device is subjected:

Operating mode:

With impulse current the operating time (with the same transmission current) is twice as long compared with permanent current.

External resistance:

The operating time sinks if there is great resistance in the earth or in the line (with the same transmission current). You should therefore be sure to make a good coupling to the line (remove rust or paint, if necessary). The earth plug should be knocked into moist ground where possible, and the ground should be moistened if necessary.

Transmission current intensity

The operating time reduces the higher the transmission current is. The operating time limits with external resistance of 100 Ohm are:

30 mA / Impulse current approx. 21 hours

500 mA / Permanent current approx. 1.3 hours.

4.1.4 Operating time of generator G1 with inductive coupling

The resistance of the internal frame coil is constant, so the operating time only depends on the selected output:

Transmission frequency -A-: 7 – 13 hours

Transmission frequency -B-: 3.6 – 7.8 hours

4.1.5 External power supply with generator G1



2

The external power supply is connected to input 2 by using the vehicle cable L. It allows charging the built-in accumulator and operation of **generator G1**.

As external power supply may be used:

- car battery 12 V (cigarette-lighter socket)
- AC/DC adapter L
100 – 240 V~ / 12 V= / 3.8 A

Connect the generator to the external power supply. (The **generator G1** switches to charging mode)

To select operating mode (connected to external power) instead of charging the **generator G1** must be switched on. External power supply is preferably used instead of internal (built-in accumulator)

4.2 Generator G2

4.2.1 Internal power supply

Non-rechargeable batteries and rechargeable batteries (accus) can be used to supply power. The accus can not be recharged in the device.

The operating time depends on the load to which the device is subjected.

Operating time with galvanic coupling

The operating time varies, depending on the load to which the device is subjected:

Operating mode:

With impulse current the operating time (with the same transmission current) is twice as long as with permanent current.

External resistance:

The operating time sinks if there is great resistance in the earth or in the line (with the same transmission current). You should therefore be sure to make a good coupling to the line (remove rust or paint, if necessary). The earth plug should be knocked into moist ground where possible, and the ground should be moistened if necessary.

Transmission current intensity:

The operating time is less, if the transmission current is higher.

Operating time with inductive coupling

The resistance of the internal coil is constant, so the operating time only depends on the selected output.

4.2.2 External power supply with generator G2



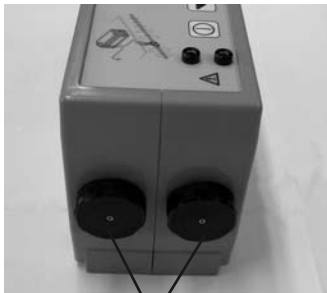
1

If the internal batteries are discharged, you can also supply **generator G2** externally. The batteries can remain inside the device. Use **input 1** (12V=).

When operating from the mains: AC/DC adapter M4.

When operating from the car battery: vehicle cable M4.

4.2.3 Changing the batteries on generator G2



2

The batteries are located in 2 pipes behind the **screw connections 2** of the battery compartments. The markings on the inside of the screw connections (+) show that the batteries must be inserted with the positive pole visible.



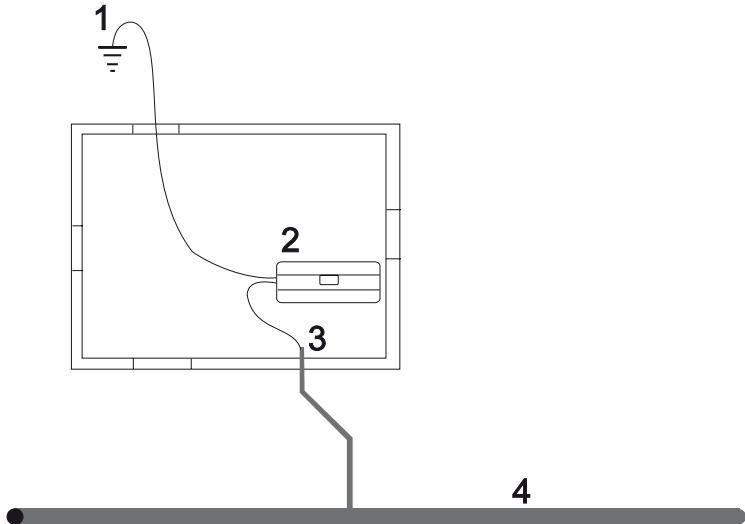
Note:

The screw connections can be closed best if pressure is applied to the middle of the lock when turning the connections with the fingers.

The great versatility of the **FERROPHON**-System can not be demonstrated fully in the following examples. The examples given provide important information.

5 Examples and information

5.1 Locating a house connection line

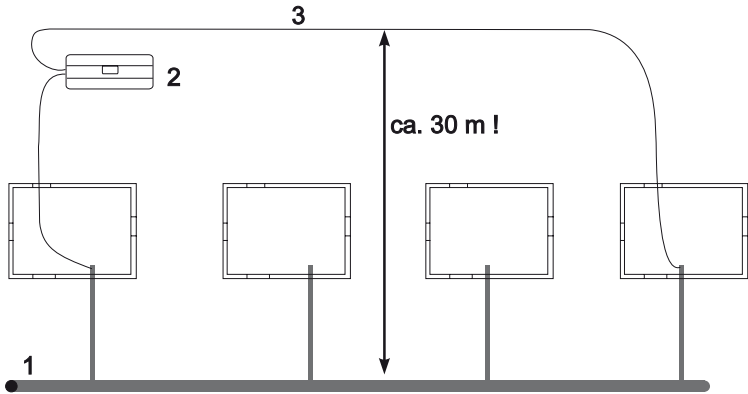


- 1 Earthing spike behind house front
- 2 Generator
- 3 Connection to house connection line
- 4 Main line

Always connect in the house - not to the main line -, because the transmission current flows only poorly into a „dead end“.

The earthing spike should not be knocked in at random over another line. The transmission current would use this line, which could lead to incorrect results.

5.2 Conductor loop



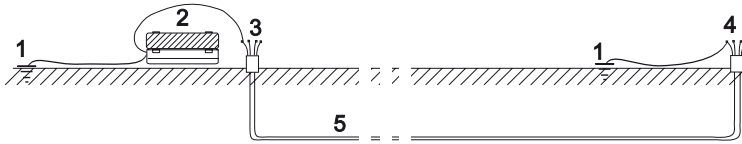
- 1 Main pipeline with outgoing house connection lines
- 2 Generator
- 3 Auxiliary line

Preferably frequency -C- or -B-, low transmission current intensity.

A conductor loop is only used when the line, for example, conducts poorly because of rubber seals or is not insulated. Increased work can usually be avoided by using a higher frequency.

However, with high frequency the transmission current can also be transmitted other lines lying parallel.

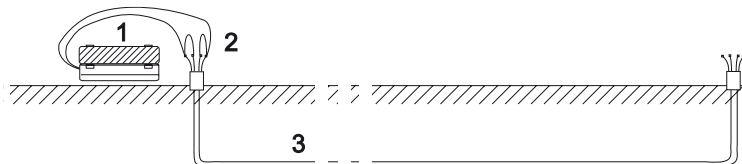
5.3 Locating a cable with auxiliary earth



- 1 Earthing spike
- 2 Generator
- 3 Connection to one or more wires
- 4 Connection to the same wires as with 3
- 5 Cable line

The illustration shows the ideal coupling, since equal current flows over the entire line length. Location is also possible if the earthing spike (4) is not set. However, the intensity of transmission current drops constantly over the length of the line, because it flows back to the earthing spike at (2) through the earth.

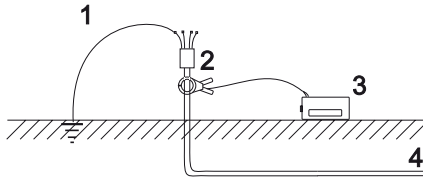
5.4 Locating a cable without auxiliary earth



- 1 Generator
- 2 Connection to two wires or wire bundle
- 3 Cable line

The illustration shows a circuit in which the transmission current is purely capacitive, since the electrical wires are electrically insulated. To obtain as high a transmission current as possible, not just two wires but two wire bundles should be connected to each output of the generators. Preferably frequency -A- or -B-.

5.5 Using the cable clamp



- 1 Earthing spike or earthed
- 2 Cable clamp
- 3 Generator
- 4 Cable line

The cable clamp allows inductive coupling to a line. An electrical line does not require to be switched free. Against the internal frame coil only the enclosed line is transmitted to (selective transmission). Important: The power circuit is only closed when on both sides of the cable clamp at least one wire is in contact with the earth line or auxiliary earth.



Caution - high voltage!

Caution must be exercised when dealing with individual highly charged wires of high current cables, because high voltages can be induced in the clamp. These voltages can lead to dangerous fows or destroy the receiver. The current in the high current cables must not exceed 300 A!

Accessories: connection cable (jack socket 2x banana plugs) for coupling to the generator.

Further informations can be found in the respective product information/operating instructions for the „cable clamp“.

5.6 Correct frequency and transmission current intensity

When locating lines, the transmission frequency and the transmission current intensity can be adapted to local conditions, so that

- lines that conduct electricity poorly can also be located,
- the generator does not have to be used over long distances (km). (This is interesting not only when locating lines, but also with locating insulation faults)
- energy can be saved.

The influence of the frequency

With a high frequency the current intensity in the line may be lower because high induction is generated in the antenna. This means that less energy is needed in the generator.

However, the current flows off to the earthing spike after only a short distance, location is not possible over long distances, and more couplings are required. This effect is more intense, the worse the electrical insulation of the conductor is.

The current couples easily to the close (parallel) line. Defining a specific line among several is difficult, if not impossible.

Ohm resistance in the line (eg, Tyton-Muffs...) are „skipped“ better. Poorly conducting lines can only be located with higher frequencies.

The influence of current intensity

The locatability of a line depends exclusively on the magnetic alternating field around the line. The field strength is directly dependent on the current intensity.

The possible current intensity is chiefly defined by the external resistance.

For this reason, the current intensity is shown on the display of the **generator G1/G2**, the output rate or external resistance are completely irrelevant. For this reason also, only the current intensity is adjustable in addition to the frequency. The required voltage results from this.

With very high current there is a strong field, particularly in the vicinity of the coupling point (several metres) which can be difficult to locate.

Energy consumption is high. But this is not the case if a cable loop is laid, and therefore no great earth resistance must be bridged.

To obtain a high current intensity the voltage at the output of the generator must be correspondingly high. Safety features to prevent electrical contact are therefore recommended for the voltage carrying components.

Insulation fault location requires high current in the line.

The influence of the transmission output

The output from the generator is not the decisive factor for locating a line. A comparison of output only make sense when the external resistance (impedance) is identical. However, the external resistance is very dependent on the locality, and can hardly be influenced.

6 Technical specifications

Fabrication number (G1): 034 01 ...

Fabrication number (G2): 034 21 ...

Inductive transmission:

Transmission frequency A = 41666 Hz (only G1), B = 9950 Hz

Transmission currents 5, 10, 25, 50, 75, 100 %
permanent and impulse signal

Default setting B / 25 % / permanent signal (G1)
B / 10 % / permanent signal (G2)

Galvanic transmission:

Transmission frequencies A = 41666 Hz, B = 9950 Hz,
C = 1100 Hz

Transmission currents 1, 3, 5, 10, 30, 50, 100, 500
(only G1), 1000 (only G1) mA
permanent and impulse signal

Default setting B / 30 mA / permanent signal (G1)
B / 10 mA / permanent signal (G2)

Output rate: max. 50 Watt (G1)
max. 2 Watt (G2)

Output voltage: max. 130 V (G1)
max. 50 V (G2)

Type of protection: IP54, spray-protected
(only G1 and with lid closed)

Operating time/charging time/capacity: 1.3 – 21/ max. 13 hrs / 7.2 Ah (G1)
2 – 80 hrs./ - / - (G2)

Temperature ranges:

Operation -10 °C – +50 °C

Storage -25 °C – +75 °C

Weight: 6.6 kg (G1)
incl. batteries 1.7 kg (G2)

Dimensions: 60 x 19 x 21 cm (G1)
28 x 14 x 10 cm (G2)

7 Special functions

7.1 Customer-specific frequency (only G2)

For galvanic transmission it is possible to program a customer specific frequency.

Please refer also to Sewerin Service.

7.2 Self-test/Software version



- When switching on the **generator G1/G2** hold down the **ABC** key. The **generator G1/G2** performs a self-test.
- The version number is displayed.
- ROM-Check. In the event of a fault, error code F50 is shown on the display.
- LCD-Check (all segments are signalled in sequence)

8 Error messages

The devices are able to detect faults and display error messages.

8.1 Generator G1

Error code	Cause of fault
F33	Temperature cut-out. May occur if outside temperature is high (> 50 °C) and transmission rate is high. Allow generator to cool down.

8.2 Generator G2

Error code	Cause of fault
F37	Inductive load too high (eg, during inductive transmission to a large metal surface with high output)

9 Appendix

9.1 Accessories

The generators **G1/G2** are a part of the **FERROPHON** system, which also feature a receiver as a major component.

9.2 Accessories for line location



Cable clamp AZ5

Art. no: SS14-10000

- Can be used as a transmission and receiver clamp; for pipelines and cables up to 50 mm diameter.



Cable clamp AZ9

Art. no.: SS11-10000

- Can be used as a transmission and receiver clamp; for pipelines and cables up to 110 mm diameter.



Electro Mains Adapter ENA

Art. no: ZL06-10000

- To connect a generator to power sockets, to transmit a signal on to internal installation lines. The electrical separation allows transmission without separating the lines from the mains.

Glass fibre probe system

- For locating non-metallic lines

9.3 General accessories



Vehicle cable L 12 V= mobile (G1 only)

Art. no.: ZL05-10200

- incl. connection plug for cigarette lighter; maximum current load 7 A.



Vehicle cable M4 12 V= mounting (G2 only)

Art. no.: ZL07-10000

- with built-in fuse and blade receptacles, for hard wiring to vehicle electrics



Vehicle cable M4 12 V= mobile (G2 only)

Art. no.: ZL07-10100

- with built-in fuse and connector for cigarette lighter, for mobile vehicle mounting



AC/DC adapter L (G1 only)

Art. no.: LD26-10000



AC/DC adapter M4 (G2 only)

Art. no.: LD10-10001



Set of cables Generator

Art. no.: SZ15-10000

- 2 cables 2.5 m with small and large connection terminals, earthing spike (54 cm), measuring cable 1m



Cable reel 25 m

Art. no.: SZ09-10000

- as extension when coupling galvanically



Cable drum

Art. no.: SZ01-10000

- with 250 m measuring cable, to create a „cable loop“ at galvanic coupling.



Accumulator NiMh, type C (Baby) (G2 only)

Art. no.: 1354-0008

9.4 Advice on disposal

The European Waste Catalogue (EWC) governs the disposal of appliances and accessories.

Description of waste	Allocated EWC waste code
Device	16 02 13
Battery, accumulator	16 06 05

Old instruments

Old instruments can be returned to Hermann Sewerin GmbH. We will arrange for the appliance to be disposed of appropriately by certified specialist contractors free of charge.

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