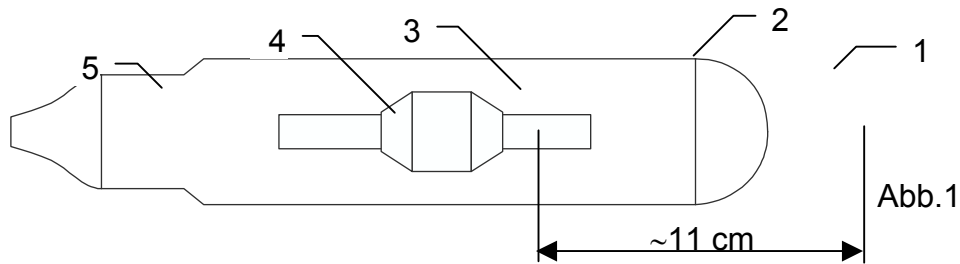


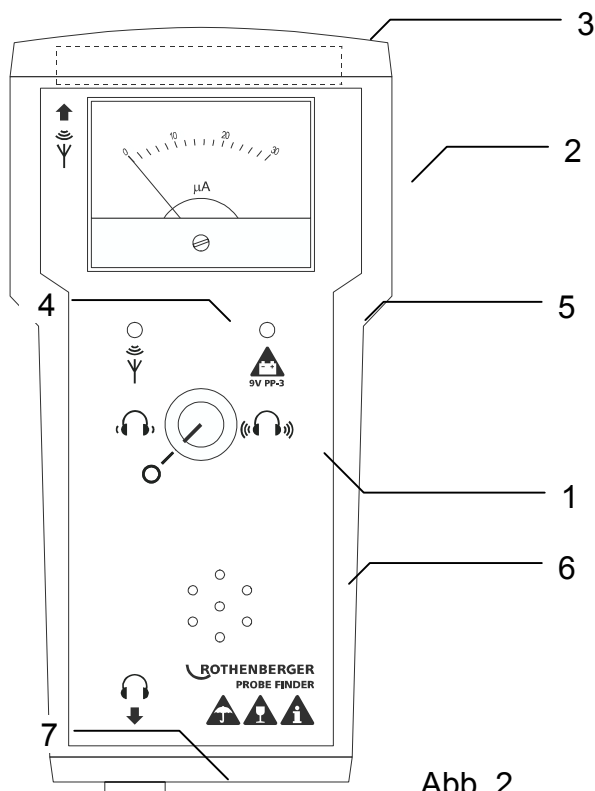
**1. Locating Probe (Camera Probe with Locating Transmitter**



- 1 Camera head black and white or colour with integrated transmitter
- 2 Spiral
- 3 Transmitter coil, encapsulated
- 4 Transmitter antenna with camera lead inside
- 5 Plug

**2. Locating Receiver**

Control and Adjusting Devices



- 1 On/off with level controller
- 2 Display
- 3 Receiver coil (inductor inside)
- 4 LED green for receive level
- 5 LED red for battery – low voltage indication
- 6 Loudspeaker
- 7 Headphone terminal with loudspeaker deactivation

## 3. Description

The ROCAM localization system is designed to locate ROCAM camera probes. It is able to locate a ROCAM camera probe during a TV-inspection.

The main application for ROCAM Localization Systems is the house installation where the camera usually is inside a waste pipe in the wall – invisible from the outside. With the localization system it is possible to locate the position of the camera which has been used to detect a leak inside the pipe. Thus it is possible to minimize the area where the wall has to be opened for repair.

The ROCAM localization system consists of

- locating probe
- locating receiver

The locating probe is a ROCAM camera probe with an integrated transmitter. The locating probe can only be recognized by the encapsulated transmitter coil with antenna inside the spiral (see image 1).

The transmitter is always included in a complete camera probe equipped with localization system. **Any conventional ROCAM can be upgraded to a ROCAM with localization system by exchanging the camera probe and adding a locating receiver.** This unique configuration makes the ROCAM localization system expandable and flexible.

The locating receiver is a separate, battery powered unit to detect the locating probe. The locating signal is transmitted acoustically via headphone or loudspeaker and optically through the LED and pointer indication.

The measuring method is based on an intensity measurement of the received signal. This means that when the locating receiver comes closer to the locating probe which is sending a constant signal, the signal is received louder and the pointer throw is higher and vice versa.

This method uses the human perception. Together with the maximum/minimum locating method which is described in the following chapter, it enables the exact localization by centimetres with a comparably uncomplicated use of devices.

#### 4. Physical Foundations of the ROCAM Localization System

The basic principle of the ROCAM Localization System is the sending out of a magnetic field by the probe. The magnetic field is recognized by the locating receiver and is made noticeable for the user. The field itself is an alternating field with a frequency of 640 Hz (Europe) and 512 Hz (USA and Japan).

The field is positioned around the probe as it is shown in image 3.

It is perceived and amplified by the receiver coil in the probe so that it can be heard via headphones or loudspeaker, additionally it is indicated by the LED and the pointer instrument, in dependant from its intensity.

The field distribution reminds of the magnetic field of a magnetic bar, well-known from physics books in school.

Two physical characteristics of the magnetic field generated by the transmitter antenna are used for the localization:

The field **intensity decreases** if the distance from the transmitter increases

The direction of the field extension shown by the lines is depending on the position

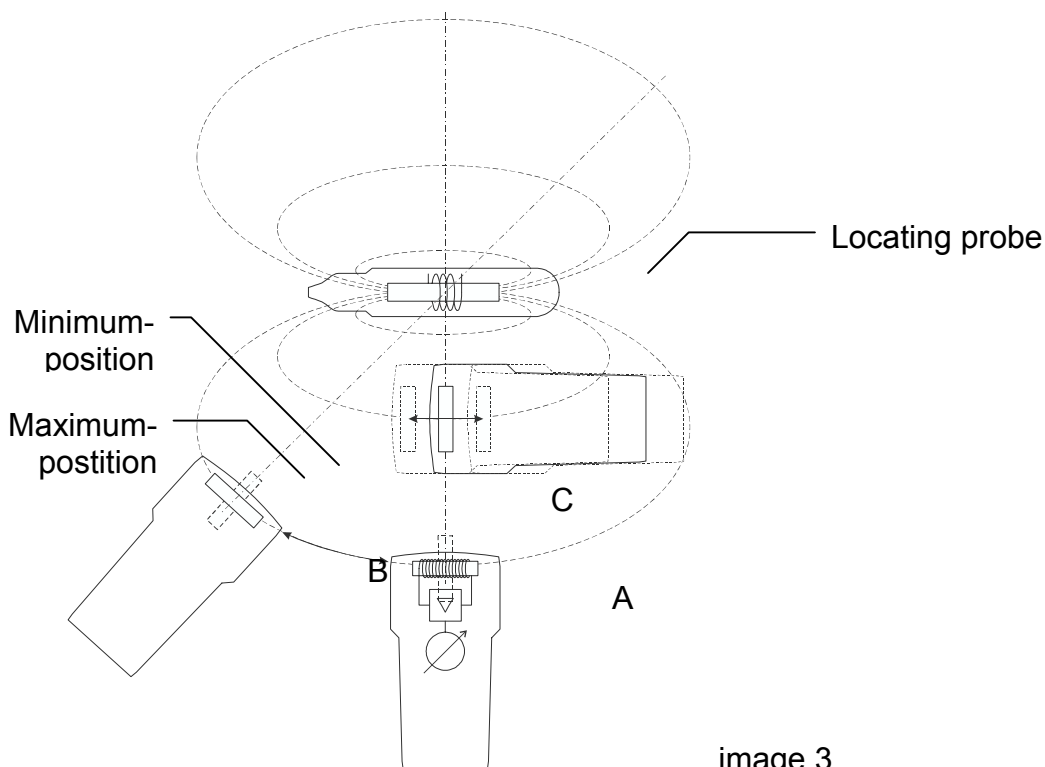


image 3

For example, if the locating receiver is at position A and the receiver coil is in the marked position, the maximum signal level is received. If the coil is turned around its lateral axis (seen from above) the signal level is decreasing until at a 90° rotation it is no longer noticeable. (drop out). If the coil rotates further the signal becomes louder again until after a rotation of 180° it reaches its original level again.

At position B the situation is similar but here the signal does not reach the maximum level if the receiver is positioned parallel to the transmitter, but if it is positioned diagonally in a certain angle to the transmitter. In both cases the receiver lies longitudinal, i.e. tangential to the field direction as can be seen from image 3.

For position B counts also: if the coil is rotated by 90° the signal drops out.

For our application, the localization of the transmitter this means:

- receiver coil in field direction => max. signal level
- receiver coil vertical to field direction => signal drop out

As image 3 shows clearly, both receiver positions have one thing in common:

To receive a minimum signal the prolongation of the receiver coil is directed towards the transmitter.

This minimum localization is extremely useful if a probe has to be located just by bearing.

According to image 3 you have to position the receiver at two points, A and B, there you have to catch the maximum signal level by rotating the coil, then the minimum signal level by rotating it by another 90° - **the minimum level is indicated more exact than the maximum level..**

Then you have to imagine the prolongations of the receiver coil in point A and B. These lines cross each other somewhere and **this is exactly the position of the transmitter** (see image 3).

Another possibility for locating the probe is shown with position C:

Once the maximum signal level at point A and through rotation by 90° also the minimum level is detected, the axis in the prolongation of which the locating probe is positioned can be constructed by making a translatory movement at point C.

For this the locating receiver has to be moved slowly parallel as shown in image 3 point C while the signal level has to be watched carefully. As soon as the receiver antenna is directed exactly towards the transmitter coil of the probe, the signal drops out. The accuracy of this method is remarkable as the area where the signal drops out is not bigger than a few centimetres, even if the probe is positioned within a distance of some meters.

After locating the transmitter with this method it is usually easy to locate the exact position of the transmitter by approaching the imagined intersection. Other methods for the exact localization are described in chapter 6. "Practice of Locating Measurements".

### 5. Practical Measurements

The ROCAM localization system is a low-frequency measuring system which is able to send its signal even through cast iron and other metal pipes.

This is not possible with medium- and high frequency systems, e.g. those with 32.8 Hz transmitter frequency as these frequencies are absorbed almost completely by metal bodies.

The tricky point about low-frequency signals and their ability to penetrate metals is, that in normal houses and industrial surroundings their domain is occupied by strong potential interference fields which are created by other low-frequency magnetic fields generated by current conductions, transformers, motors, TV and PC monitors, fluorescent lamps or energy saving lamps.

This means that many potential interference fields have to be considered which might make it difficult to recognize the locating signal when you start to work with the ROCAM.

Therefore it is recommended **to disconnect all before mentioned instruments, machines, etc. in the near of the probe and the receiver during the locating process** if possible. It is also important not to forget instruments like e.g. PC monitors in the standby mode. A dark screen seems not to be in operation, however, it may cause interferences if it is not completely cut off from power supply. These unwanted emissions would be received by the locating receiver and would make the recognition of the „actual“ signal more difficult.

Please do the following test in order to find out if there are strong interferences in your operating area:

- Turn on the locating receiver without using headphones and turn the level controller into medium position. If you can now hear interfering noises or humming and buzzing sounds through the loudspeakers which do not disappear if you move the locating receiver by 1 – 2 meters, then there are strong magnetic interference sources in your operating area which you should disconnect from power before you begin with your work.

Working with the ROCAM localization system takes some attention to avoid mistaking the locating signal with interfering signals, especially as long as the level of the locating signal is still low (e.g. due to large distance to the probe). More about this in the following chapter.

## 6. Practice of Locating Measurements

The ROCAM locating receiver indicates the signal

- acoustically via loudspeaker or
- acoustically via headphones and
- via LED display (green) and
- pointer instrument

Each of these indications has special advantages which are explained in the following.

### Localization via Headphones

Localization via headphones is the most sensitive and most accurate method; it is used if the signal level is still low and as long as there is only a rough idea where the probe is positioned. In this situation unwanted emissions cause the worst interferences and it takes some „training“ to distinguish the locating signal from interferences like for example harmonic waves from the mains frequency.

When you are working with headphones, please note:

- to turn the loudness of the signal as low as the ambient noise level allows, because at low levels the ear can more easily ignore interfering signals, the ear's ability to discern is better.
- that the locating signal is a constant sound at a defined tone pitch which is clearly different from interfering signals. In order to learn how it sounds, you may place the locating receiver at a short distance from the probe (1.5 m), put the ROCAM on and off and memorize the sound. You should be able to recognize it before you start „chasing“ the probe.

- If there are many interfering noises and the locating signal is weak the sound may be faint and quavering. It becomes more continuous and loud the closer the probe is approached.
- This tremolo effect which results from the superimposition of the locating signal and mains frequencies, can be very useful when you have to check if your locating receiver is within the receive operating margin of the probe at all.

For a test, put the ROCAM on and off again:

If the tremolo effect disappears when the ROCAM is not in operation **you can be sure that the receiver is already within the receive operating margin of the probe**. If the tremolo effect is still there, **the locating receiver does not yet receive a noticeable signal**. In this case you should start with a different method to roughly localize the position of the probe.

If the locating signal is very low you may try the locating method (points A and B) as described under 4. „Physical Foundations of the ROCAM Localization System“. Now, you will be able to approach the probe and to receive an increasing signal so you can localize the probe more precisely.

As soon as you have reached a distance where the pointer instrument shows a clear reaction or the LED shows green light, you can continue the measurement without headphones.

You may now unplug the headphones from jack 7 (**attention: the 6/3.5 m adapter has also to be unplugged, otherwise the loudspeaker remains inactive**) and detect the exact position of the probe via the loudspeakers and the pointer instrument.

### Localization With Loudspeakers and Pointer Instrument

This method is always recommended if you have already localized the probe roughly, i.e. if you have placed the receiver within a distance of approx. 1 –2 m from the probe.

The loudspeakers are controlled in a way that there is no fidelity of signals below a certain level as these are mostly interferences. This makes it easier to recognize the locating signal and to distinguish it from interfering noises.

Within the short-range the loudspeaker produces a clearly noticeable signal the loudness of which depends on the distance to the probe and which therefore indicates its position, e.g. in the wall. This is also valid for pointer throw.

Now move the receiver towards the direction where the signal gets louder and the pointer throw is increasing constantly. When the signal is getting louder it is recommended to slightly turn the loudness level down so that minor differences in the loudness level can be noticed more distinctively.

The point where you receive the loudest signal and where the pointer throw reaches the max. position is the point where the probe is located in the pipe inside the wall.

### Finding the Probe in the Wall with Minimum Localization

After you have found the point with the maximum loudness and maximum pointer throw, you can now with the minimum localization method determine the exact position of the probe with centimetres accuracy.

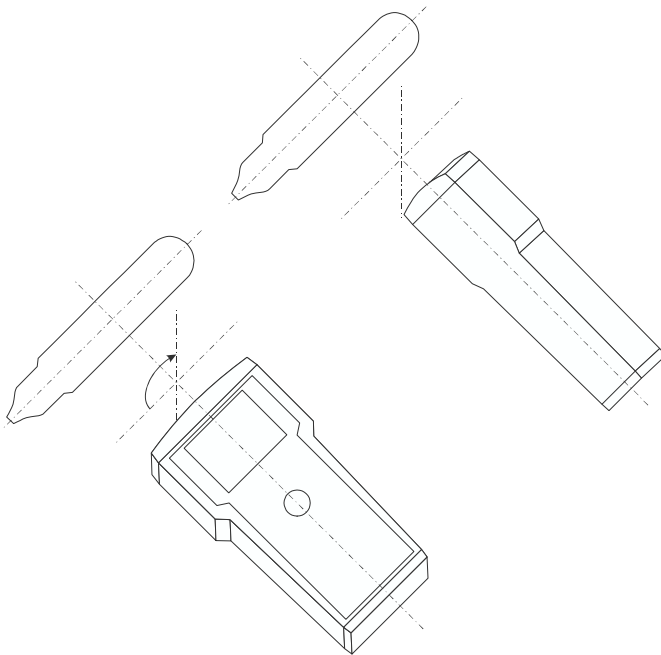


image 4

Place the locating probe with its front as exactly as possible onto the point of the wall where you receive the loudest signal. Now, as shown in image 4 rotate the locating receiver slowly around its longitudinal axis and watch the changes of the signal level and the pointer throw.

At a certain position signal level and pointer throw will be at the minimum. The minimum can be recognized best from the pointer throw.

In this position the receiver spiral of the locating receiver is located exactly vertical over the transmitter of the probe – see image 4.

In other words: **the probe in the wall lies exactly vertical below the position of the receiver front**, in dependant from the position of the receiver being vertical, horizontal or lateral. **That means that this method does not only indicate the position of the probe in the wall but also the direction of the pipe.**

If you do not find the point with the minimum level immediately by rotating the locating receiver you should move the receiver slightly to and fro and try again to find the definite minimum position. Even deviations of only a few centimetres cause a deterioration of the minimum signal indication – proving the accuracy of the ROCAM Localization System.

Another tip for the exact localization of the probe:

see image 1

When locating the exact position of the probe the receiver always takes a bearing of the middle of the antenna – this is the point where the transmitter is located.

The front of the camera head however, lies 11 cm ahead of this „middle“ in the push-direction.

If the probe camera has taken a picture e.g. of a leak in the pipe and this defect can only be seen marginally it must always be considered that between the defect and the localized centre there is a distance of 11 cm, provided that the probe had been localized exactly. Taking into account the position and direction of the probe which are meanwhile known thanks to the described localization methods the area where the wall has to be opened must be corrected by this distance of 11 cm.

## 7. Technical Data

Locating method:	Magnetic Fiel Localization
Transmitter-/ Receiver: Frequency:	640 Hz (Europe) 512 Hz (USA, Japan)
Operating Distance: instrument)	1-2 m      3-5 m      (Headphones) (Loudspeaker,      LED,      pointer

### Locating Probe

Power Supply: 8.5 -18 V / < 30 mA

Penetration of Cast Iron and  
Iron Pipes: Yes

Possibility of Upgrading  
Standard Probes: Yes

### Locating Receiver

Power Supply: 9 V alkaline battery

Current Consumption: approx. 15 mA

Field strength Indicator: Pointer instrument /LED green

Battery- Low Voltage Indicator: 6.8 V

Locating Signal Recognition: Headphones /Loudspeaker

Suppression of Interfering Signals: via Loudspeaker

## 8. Safety

### 8.1. Appropriate Application

The ROCAM Localization System is only to be used for inspection of empty and cleaned pipes, hollow bodies and pieces within the limits you find in the „Technical Data /Applications“. Other applications are not allowed.

All valid norms and regulations have to be adhered to, as there are:

- Law on Technical Working Media (Safety) and relevant regulations
- Low Voltage Directive
- UW VBG 1 „General Rules“
- UW VBG 4 „Electrical Installations and Resources“
- Guidelines for works in containers and small rooms (BG-rule 77)
- Guidelines for Display Workstations

### 8.2 Safety of Persons and Instruments

See operating manual ROCAM