

# Rescue Radar Application Notes for Disaster Rescue

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# 1. What is the RescueRadar?

The RescueRadar/LifeSense Radar is an assisting life detecting/ locating device, which comes into use in areas where disasters have occurred. The RescueRadar is capable of detecting buried living beings. The ease-of-use of the device enables to locate living individuals who are buried under destroyed buildings or even under avalanches.

# 2. When and where can we apply the Rescue Radar?

# When:

The RescueRadar comes into use if people are buried alive underneath a building. In this case, survivors are not capable of moving themselves or to speak as they are mostly in a condition of unconsciousness.

In the case that survivors have a clear sense, they will shout, make big sounds, or try to move out of the underground by themselves when a rescue team approaches them. Other devices as for example search cams or geo phones are in this particular case more efficient than the RescueRadar.

Therefore, the RescueRadar is mostly efficient in the case of rescuing unconsciousness human beings.

Where: (refers to conditions for application of the RescueRadar)

# Favourable conditions

- Concrete (to a width of 20cm)
- Soil
- Sand
- Snow
- Wood
- Plastic
- Rubber
- Glass

The RescueRadar is capable to transmit its signals through those materials. Therefore it is possible to receive life signals of survivors underneath ruins.





### Unfavourable conditions:

- Concrete (above a width of 20 cm)
- Pure metal
- Water

Facing these conditions, the RescueRadar is reaching its limitations. The signals of the RescueRadar will be completely reflected by the mentioned surface and hence be blocked. The Radar has no chance in detecting any life indicators from buried individuals.

An exception represents concrete above a width of 25 cm in form of bulk material or if it is broken. Therefore it is important to seize the gaps in between the broken concrete as those allow to be penetrated with signals of the RescueRadar. Even if the concrete contains metal in its core, you could use the bulk material as a reflection for the signals of the RescueRadar. In order to seize those possibilities, it is imperative to train heavily with the rescue team in charge to acquire this expertise.

# 3. How could we use the RescueRadar?

- a. The rescue plan is created by the rescue team in charge
  - (1) Ideal situation: Scan the area with rescue dogs
  - (2) Dogs identify bodies
  - (3) However, many times dogs are not capable of differing between living and dead bodies
  - (4) Application of RescueRadar starts
  - (5) The RescueRadar is capable of identifying a body to be alive or dead
  - (6) Supports the rescue mission in its efficiency





# b. Make a scan mapping for team with Rescue Radar

The success of RescueRadar application depends on the location of the device itself.





**Red circle** demonstrates the location of the RescueRadar

**Green circle** illustrates the location of the buried person

**Result:** Buried person not within the 55° degree localizing cone, therefore negative result

**Red circle** indicates location of RescueRadar.

Green circle demonstrates the location of victim

**Result:** The signal is weak and not enough to illustrate Life Indicator

# **Rescue**Radar



**Red circle** indicates location of RescueRadar.

Green circle demonstrates the location of victim

**Result:** Perfect location for RescueRadar. Life indicator appears and informs Rescue team to dig at that position.



Conclusion: Adding to success of the RescueRadar application, it is important to create a map that illustrates the history of scanning the place of disaster.

# **Rescue**Radar



c. Re - Locate position of the RescueRadar









d. Understanding the software of Rescue Radar

### Display "Signal view"

- Wave
  - Rescue Radar is similar to a bat using eco signals to test the movement of objects
- No movement of objects
  - The illustrated graph will be a horizontal line
- Regular movement of objects (breathing movement of body)
  - The wave graph will be a regular curved line
- Many objects are moving regularly (curtains moving, plants moving through wind)
  - The wave graph will look irregular and demonstrate non-consistent movements

### FFT Graph (Fast Fourier Transition graph):

The FFT graph demonstrates the received echo decomposed into its frequencies contribution. It splits and summarizes any frequency for the time frame as defined in the signal window length. Small but permanent signals are cumulating to a peak, short but strong signals do not cumulate that much.

#### Frequency:

Indicates the repetition of a movement in one second. Usually the human breath frequency is between 0.3-0.5Hz. Therefore, it means that a human breath occurs 0.3-0.5 times in one second. However, it also means, that humans are able to breathe one time in 2 seconds or 3 seconds. This would be the case for example of an unconscious person.

#### Sensitivity:

Indicates how quickly the RescueRadar is able to say "YES", Life is possible or very likely. If the sensitivity is high, then it could say "YES" Life is possible or very likely in a very short time. However, it is also easier to make mistakes as the sampling data is very limited in short time.

If sensitivity is low, then it could say "YES" Life is possible or very likely within a longer time period. However, in this case the result would be more reliable as the sampling data is more and we could bypass the disturbing movements.





For a better application of the Rescue Radar we recommend to use a sensitivity level 36 seconds.

# Disturbing movements:

Indicates the signals you do not want to receive, as they affect your decisions. However, even disturbing movements on the field are not able to repeat themselves constantly as the human breath movement.

Conditions to say "YES" Life is possible/ very likely:

- (1) Frequency is about 0.3-0.5 Hz (software could set the frequency range, filter the unnecessary frequency signals). If frequency is out of the range, then it will not say "YES" Life is possible.
- (2) The Signal could repeat many times in the sensitivity time. For example, Sensitivity time is 36 seconds, one signal is about 0.3 Hz, and this signal should repeat about 36/(1/0.3)=10 times. If it only repeat 5 times or 6 times or less than 10 times, then the Rescue Radar will not say "YES".

For above 2 conditions happening, then we could say "YES" Life is possible or very likely with an estimated confidence of 90%. However, we have to take into consideration, that many disturbing movements at the field are capable to influence our result in a negative way. Patience and training are the key to make right decisions. If a right signal appears but not constantly and did not repeat enough times, then it is difficult to make decisions fast and correctly.

# 4. How to use the Rescue Radar step by step?

- (1) Locate Rescue Radar at one place to check the signals. If the wave on your "signal display" appears to be horizontal, then it means that at this particular location the probability to find survivors is minimal or out of test range. Move to another location to check for survivors.
- (2) The display illustrates very weak signals, hence it is difficult to make a decision. Try to relocate the RescueRadar around this location to receive stronger signals.
- (3) Regular signals as in combination with the above mentioned conditions are a good indication for "YES" Life is possible/ very likely.





# 5. Why some field test failed by Rescue Radar?

- (1) The survivor is out of the test range of the RescueRadar. Normally the radar is able to identify a survivor with a small movement (minimal breath movement) within 5 meters. Survivors representing big movements (body or even arm movement) within 10 meters. However, it is difficult to identify a big movement as a human movement. Usually those disturbing movements are caused by other influences, as for example plants or even curtains moved by the wind.
- (2) Metal plates or cabinets buried the survivors underneath them and the signal of the RescueRadar was not able to penetrate those surfaces.
- (3) Locate Rescue Radar in a wrong way which may cause many disturbing movements. For example, the user of the RescueRadar should stay away from the Rescue Radar at least 5 meters, and make sure there are no moving things above the top area of Rescue Radar.
- (4) Users have not enough patience and not enough training with the device and its software to understand the RescueRadar in its completeness nor its application.

# 6. Very important recommendations

It should always be clear to the user, the RescueRadar needs an extensive time of training and usage by the executing team in preparation for the success of its application. Recommended would be regular training sessions within each week. In other words, a regular training amount of approximately 6 hours per week over a time period of at least 10 weeks should be planned. This intensive training is essential to understand the RescueRadar and its application.

Furthermore it should be clear, that the RescueRadar is an assisting device for rescue operations. Therefore being an effective assisting device but with advantages and disadvantages as a search cam or acoustic devices.

Workshops with European rescue teams in Germany have proven, that the ideal application of the RescueRadar would be in cooperation with rescue dogs.

Dogs are still the quickest form of scanning an area of disaster. Once locating human beings through the smell, an assisting technical device as the RescueRadar supports the dog.

