RFID – Radio Frequency IDentification

Overview:

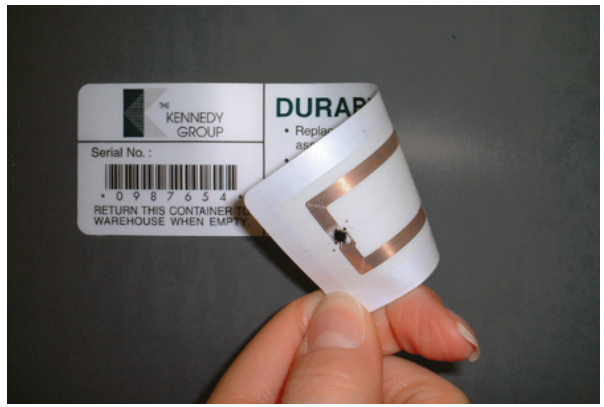
1. Basics about RFID
2. Terms of radio transmission (Frequency, Wave length, Signal, Power)
3. Antenna characteristics
4. Mounting hints for Hamster-R and antennas
5. Communication with Hamster-R
6. Software demonstration
7. Outlook automatic functions

ELPRO

RFID Systems

Passive systems

- inductive, electromagnetic field
- no power supply
- for very short distances
- typical application: "intelligent labels"



Active systems

- Radio transmission
- Power supply needed
- for middle distances
- typical application: **HAMSTER-R**

RFID Components

Each RFID System consists of:

Host	Reader	Antenna	Transponder
PC	Hamster-Port		Hamster-R

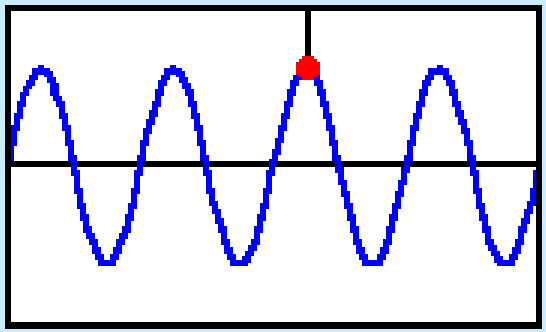
Network Cable
(max. 100m)

Antenna Cable
(max. 10m)

Radio Transmission
(max. 70-100m)

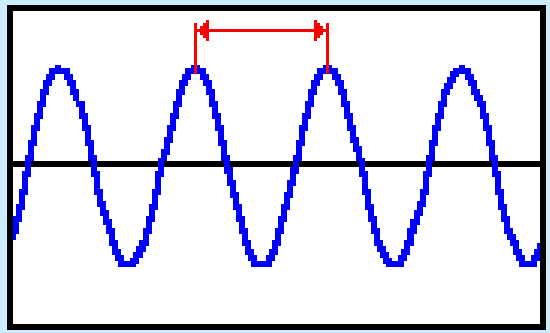
Frequency / Wave length

Frequency [Herz]



How many peaks pass a fix point in one second.

Wave length [Meter]

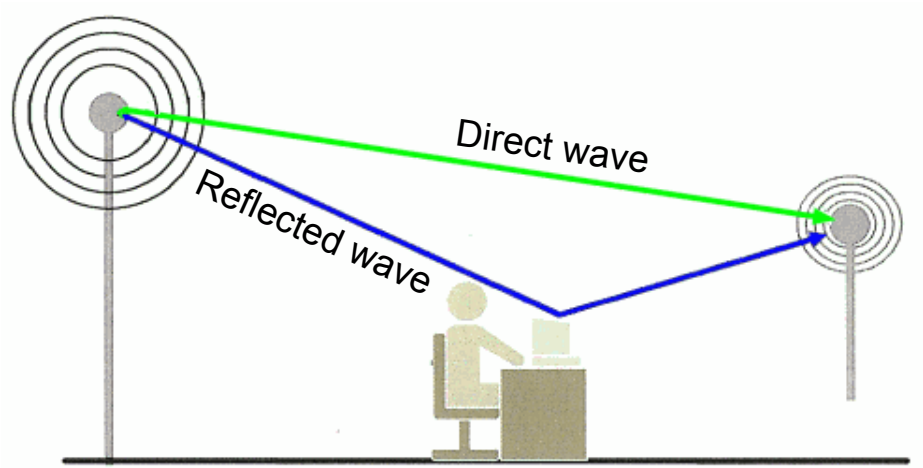


Distance between two peaks.

Examples

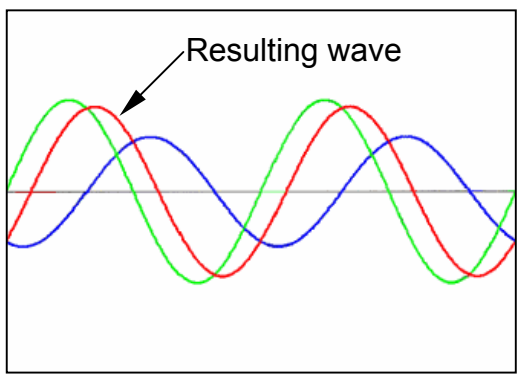
Application	Frequency	Wave length
Hamster-R RFID	868 MHz	0.345 m
GSM Mobile Phone	1.8 GHz	0.167 m
Wireless LAN	2.4 GHz	0.125 m

Reflections / Signal superposition

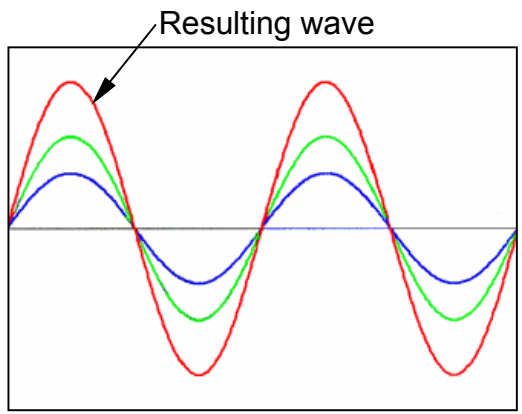


Reflections can produce unforeseeable results. Mostly they are helpful and increase the change to find a datalogger.

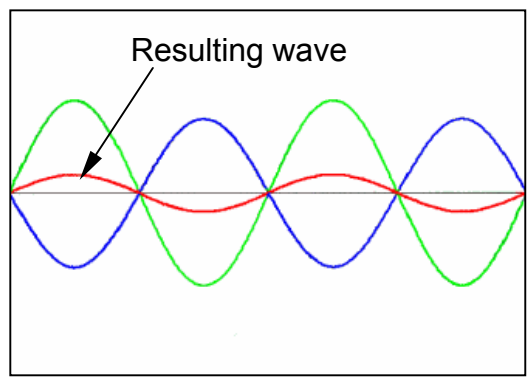
Recommendation:
Use always two antennas to prevent problems.



no significant signal change



singnal improvment



signal reduction

Hamster-R Type Approval

868 MHz

- Austria
- Belgium
- Brazil
- China
- Denmark
- Finland
- France
- Germany
- India
- Ireland
- Italy
- Luxembourg
- Mexico
- Netherlands
- Norway
- Portugal
- Singapore
- Slovenia
- Spain
- Sweden
- Switzerland
- Czech. Republic
- Turkey
- United Kingdom

..others

916 MHz

- Australia
- Canada
- Colombia
- India
- Mexico
- USA

Investigation in progress

- Near East
- Philippine
- South Africa
- Taiwan

Signal strength

Signal strength [dB]

The signal strength defines the power of a transmission.

Dezibel is a logarithmic scale with the definition that 0 dB = 1 mW.

Therefore it is possible to have negative values.

Signal strength [Dezibel]	Signal strength [Milliwatt]
20 dBm	100 mW
17 dBm	50 mW
0 dBm	1 mW
-10 dBm	0.1 mW
-80 dBm	10 pW (Picowatt)

Hamster-R works with very small transmission power. (< 0.75 mW)

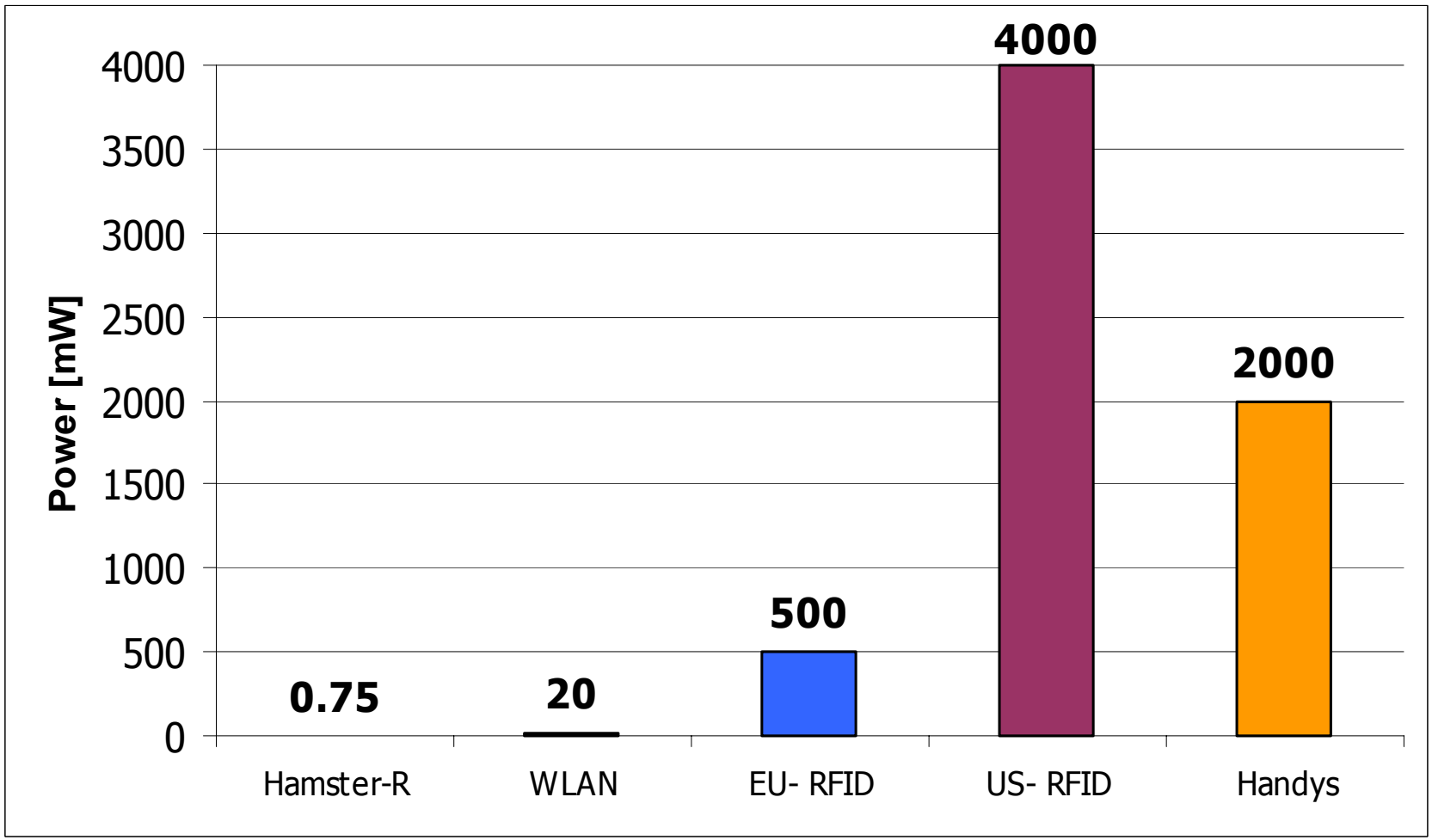
Advantages:

- very low battery consumption
- no health hazard

Disadvantages:

- shorter transmission range

Maximum transmission power



Antenna gain / Signal loss

Antenna gain [dB]

Defines how "strong" an antenna is.
Higher antenna gain results in longer transmission range.

Cable loss [dB]

Signal loss in the cable.
Depends on cable length.
Depends on the cable quality.

Cable length	Cable loss
1 m	0.5 dB
5 m	2.3 dB
10 m	4.7 dB
20 m	9.3 dB
50 m	23 dB

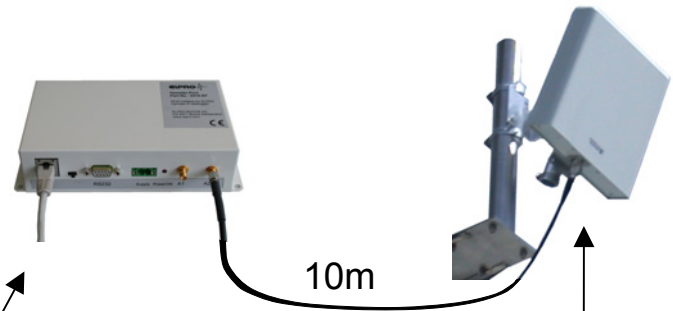
Path loss [dB]

Signal loss in the air.
Depends on transmission distance
Depends a little on weather.

Distance	Path loss
1 m	27 dB
10 m	46 dB
20 m	53 dB
50 m	60 dB
70 m	64 dB
100 m	67 dB

Use short antenna cables.
You can win transmission distance!

Calculation example



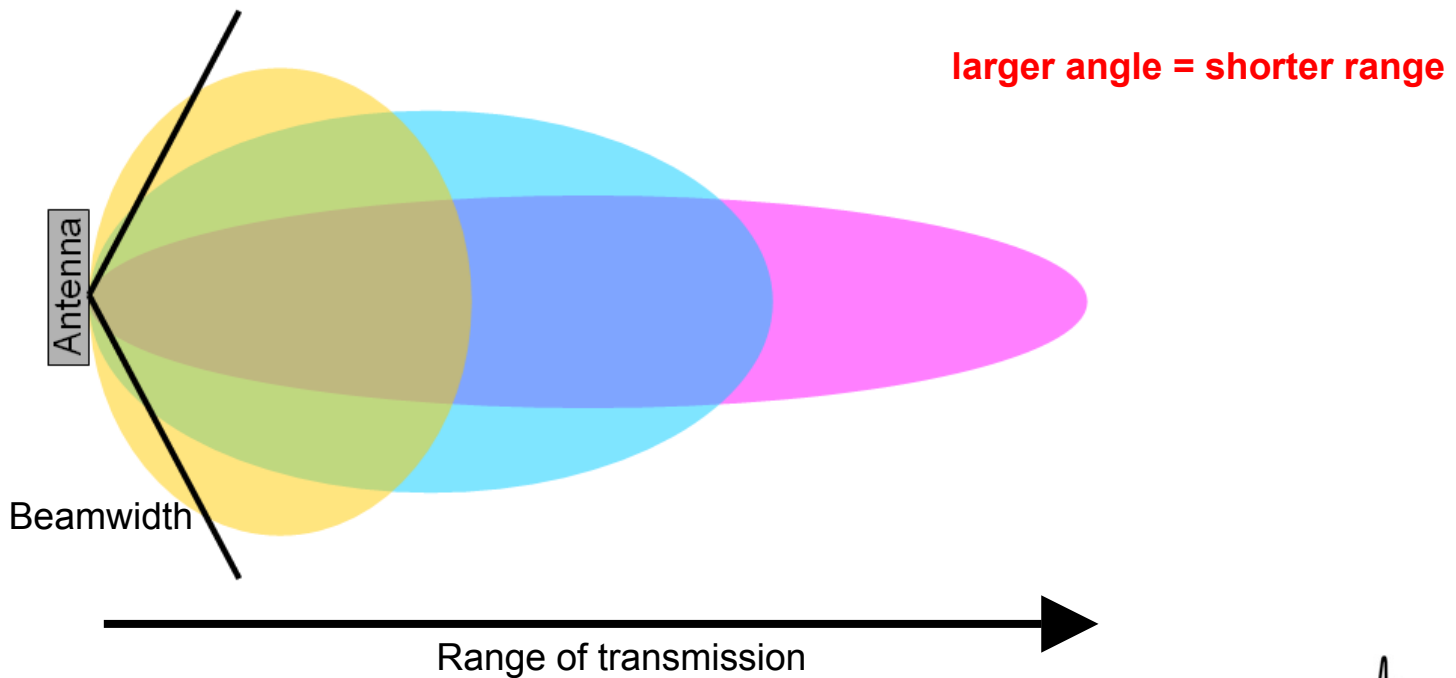
Reader Transmitting Power: 10 dB **–** Cable loss 5 dB **+** Antenna gain 8 dB **–** Path loss 60 dB **=** Signal at logger -47 dB ca.20 pW

Typical values for Hamster-R communication is between -45 .. -75 dB

Antenna Characteristics

Each antenna is characterized by:

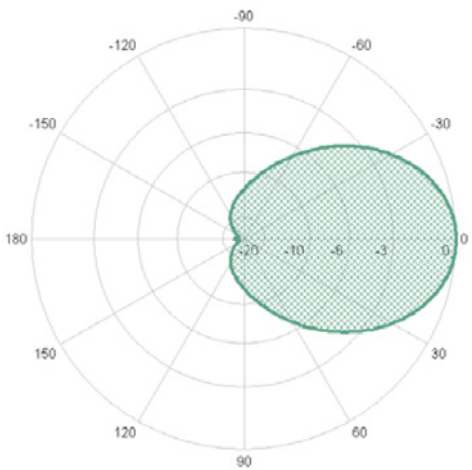
- Frequency range
- Gain (strength)
- Horizontal and vertical beamwidth (aperture angle)



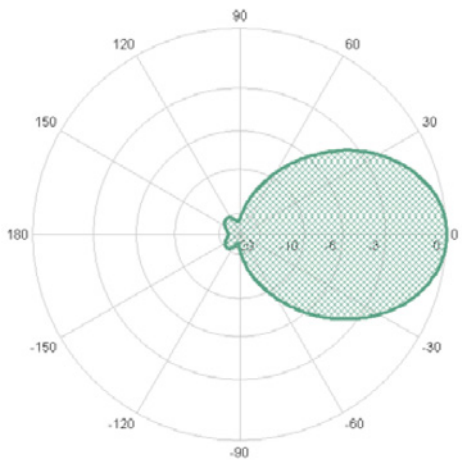
Hamster-R Antenna

The Hamster-R antenna is a good compromise between transmission range and angle.

- Frequency range	806 - 960 MHz
- Gain	8.0 dBi
- beamwidth horizontal	75°
- beamwidth vertical	70°



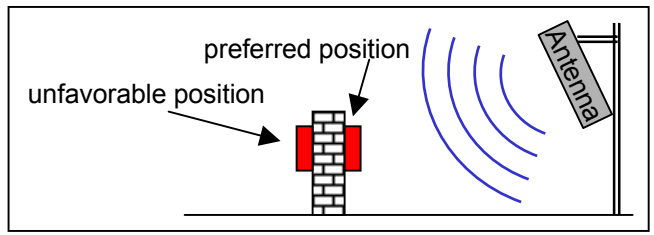
horizontal



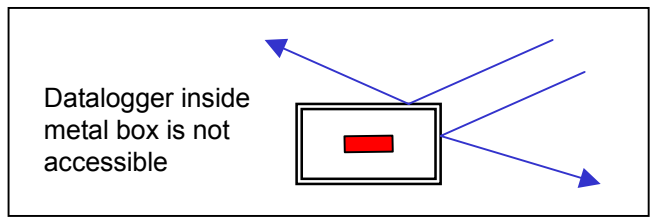
vertical

Hamster-R mounting hints

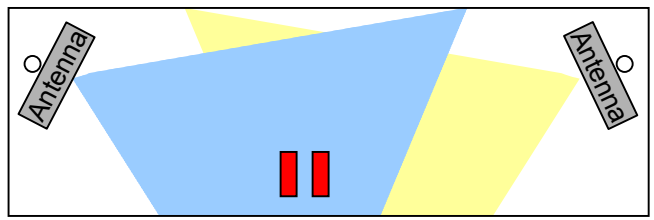
Place antennas in visual contact to datalogger.



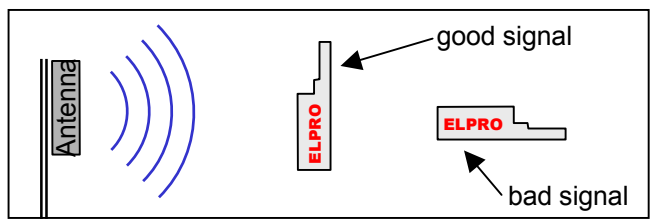
Do not place datalogger behind metal. Metal shields the radio signal.



Use always 2 antennas to prevent problems with signal superposition.



Dataloggers parallel to antenna have the better signal than datalogger vertical to it.



Sitesurvey is essential

Communication with Hamster-R

- Every Hamster-R has a worldwide unique identification number (ID).
- Up to 2000 dataloggers can be addressed in the antenna filed at the same time.
- If the ID is known, the dataloggers can be addressed directly (stationary installation).
- Are the dataloggers not known, a scan can be initiated to find all present devices (transportation).
- The dataloggers wake up every 300 ms and listen if there is a communication. If there is no signal for them, they fall to sleep again.
- At the end of a communication they fall to sleep automatically.
- The dataloggers send only data by request from a reader. Therefore it should not be a problem for air cargo (investigation in progress).

Hamster-R Software

Similar user interface to well known elproLOG

Readout datalogger

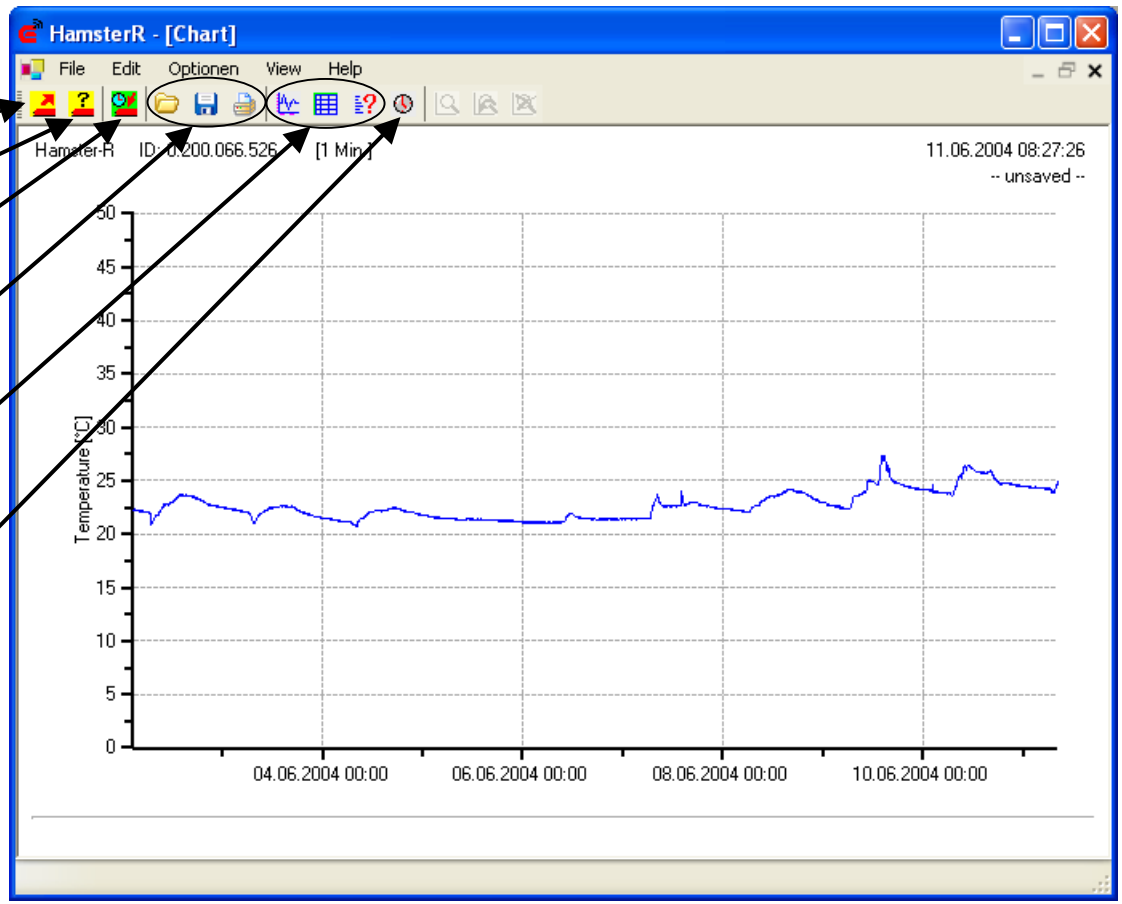
Readout status

Datalogger setup

Open, Save, Print file

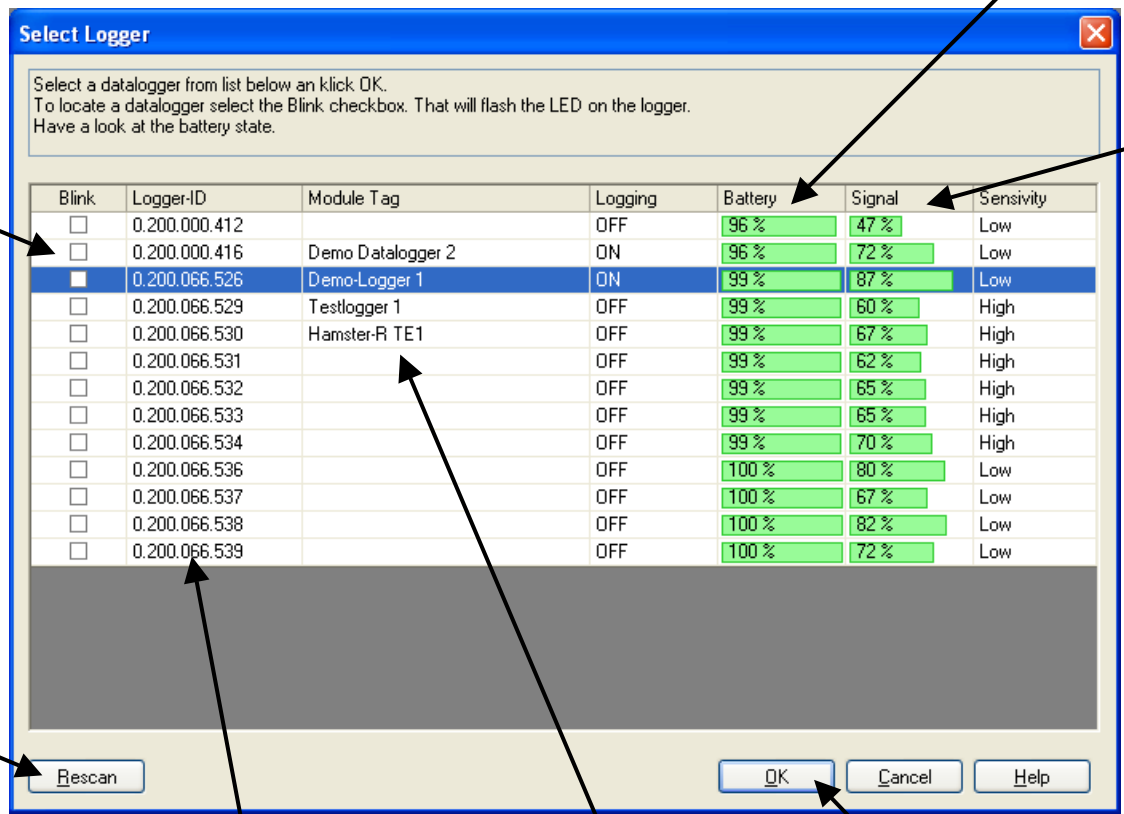
Switch between
Chart, Table, Status

Real time temperature
monitoring



Hamster-R Software

How to select a datalogger



Battery level

Quality of radio transmission

Flash LED to identify Logger

Search again for dataloggers

Unique ID Number

Module Tag

Proceed with selected datalogger

Hamster-R automated services

Planned features:

1. **Detect datalogger automatically when they enter antenna field**
2. **Readout datalogger and save to file**
3. **Notification when detected logger has an alarm**
4. **Generate a report from all saved files**

Fully automated temperature monitoring without user intervention.

the datalogger company

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