Specifications

and Operator Manual of the Ferrite Antenna

RFA1A / B

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Specifications

Dimensions (W x H x D):	1A: 200 mm x 93 mm x 32 mm (without connectors and knob) 1B: 160 mm x 93 mm x 32 mm (without connectors and attachments)
Frequency range:	130 kHz … 11 MHz
Frequency deviation:	<= 3%
Intrinsic noise power (Q=99%):	<= -130 dBm/Hz (at 1 MHz)
IP3 Out (Q=99%):	>= +20 dBm (2x -10 dBm measuring tone at 1 MHz)
Maximum output voltage:	>= 0.7 V_{eff}, 1 dB compression
Power supply voltage:	+5.7 V … +13.8 V, **maximum +15.0V!**
Power supply:	max. 50 mA
HF output:	1A: BNC 50 ohms 1B: SMA 50 ohms
Weight:	<= 0.4 kg
Environmental conditions:	1A: 0 °C ... +40 °C ambient temperature, <=90 % rel. humidity non condensing 1B: -25 °C ... +40 °C ambient temperature, IP65
Compliance:	CE according to DIN EN 55013, EN 55020, EN 60065 RoHS / WEEE Directive, ear-Reg. 27676700

All specifications are subject to design changes!

Safety precautions

Please always keep the following safety precautions in mind!

Never connect the device to any other voltage than indicated in the specifications. Under no circumstances should the the device come into contact with the mains voltage of 230 V ~!

It is essential to observe the lightning protection regulations for the outdoor operation of electrotechnical systems! The antenna must be properly equipped with lightning protection when installed outside a protected area (e.g. house). The HF bypass must be equipped with overvoltage protection. In case of lightning hazard, immediately take the antenna out of operation and disconnect it safely from other devices (remove HF connection)!

Observe the permitted temperature range for starting up the device! Do not switch the device on or off again if this range is exceeded or fallen below!

Devices for indoor use: Do not expose it to moisture, never put liquid-filled containers on top of the unit. Do not allow frost, dew, condensation or rain reach the device! If moisture (like rainwater) came in contact or has accidentally entered the device, switch it off immediately! Send the device to the manufacturer for inspection!

Always transport the device either in solid cardboard or wooden boxes (e.g. the delivery packaging), or transport it by firmly gripping the housing! The device may cause injury in the event of a fall due to its own weight!

Do not expose this equipment to mechanical stress caused by impact, pressure, vibration or shock which exceed that commonly used in the home with the use of electronic devices! The control elements and specifically the front window of the display are very sensitive to pressure or impact. Never operate a control element with a force that exceeds the required level.

If you notice any damage to the device, immediately take it out of operation (remove power supply)! If necessary, send it to the supplier for repairs.

Would you like to dispose the device due to damage or no more usability, send it back to the supplier or return it to your local waste collection center. Never dispose of the appliance elsewhere, such as household waste. It pollutes our environment!

Basic function

The RFA1 is a receiving antenna for use with a receiver's 50 Ohm coaxial input. It operates in a narrow band as a tuned active antenna with an integrated antenna element (ferrite rod) and an integrated amplifier. The power is supplied via the HF cable, a hollow-pin DC socket or an installable battery. The antenna is switched on / off and tuned using a rotary knob on the device or by remote control via the HF cable. An illuminated black and white LC display is available for displaying the tuning frequency and other parameters.

The antenna and its associated electronics are built into a plastic housing. All components including the ferrite rod, its winding as well as an electrostatic shielding of the winding and the amplifier ("Faraday cage") are located on a circuit board. An externally accessible battery compartment is located in the housing in which a battery of size 6LR61 (also called 6F22 or "9V block") can be inserted. The use of NiMh or Li-Ion batteries is advantageous. All types with voltages from a minimum of 5.7 V can be used.

With the ferrite rod, the RFA1 operates as a "magnetic antenna" with predominantly the magnetic component of the EM field. Like all magnetic antennas, it has a bidirectional 8-shaped directional characteristic. The main reception directions are transverse to the longitudinal axis of the housing (to the right and left), the zeros in the longitudinal direction (to the front and back). All-round reception can be approached upwards and downwards, but with reduced sensitivity. The antenna must be properly aligned for optimal reception. "Optimal" reception can be achieved by maximizing the desired useful level or minimizing any interfering signals that may be present.

Ferrite antennas are selective antennas (resonant circuit). They must be tuned to the desired reception frequency. For this purpose, an electronic circuit in the RFA1 realizes the tuning by means of switchable or variable capacitors and switchable inductance of the ferrite rod's coil. It is controlled by a microprocessor. A non-locking (optical) rotary encoder is available to set the desired frequency. Turning the rotary encoder ("On/Off Tune" knob) adjusts the tuning to higher or lower frequencies.

In order to ensure sufficient selectivity and reception voltage despite the relatively small built-in ferrite rod and the large frequency range, the RFA1 has a quality multiplier circuit ("Q multiplier"). The so-called quality of an oscillating circuit determines its bandwidth and its resonance voltage. As the quality increases, the bandwidth decreases and the voltage increases. A feedback is used in the RFA1 to increase the quality. It is automatically set by the microprocessor in such a way that a high quality is available without too much signal being fed back. Otherwise this would lead to self-excitation (oscillation) and the antenna itself would become the transmitter.

The quality can be set with the rotary knob from a maximum (display "99%") to a minimum (display "0%"). By reducing the quality, the bandwidth of the antenna can be increased (retuning is not necessary as often when changing frequencies). However, this is done at the expense of the reception voltage. With the reception voltage, however, the inherent noise or the received ambient noise also decreases. Therefore, smaller quality settings are often useful, since they hardly or not at all deteriorate the SNR. High quality settings are only required for high selection requirements or for very small reception signals in a low-noise and low-interference environment.

The quality display values are relative values between maximum quality (shortly before the start of self-excitation) and complete shutdown of the multiplication factor. Without quality multiplication (0%), the reception level and bandwidth result according to the currently active inductances and capacities of the tuning. The values are therefore strongly frequency dependent. A quality setting of 99% also results in a frequency-dependent bandwidth, but the reception level is always calibrated so that it only changes by a maximum of ± 2 dB between adjacent tuning steps.

With high quality settings, the bandwidth becomes so narrow (approx. 2 - 6% of the frequency) that the adjustment error in the tuning becomes noticeable. The error depends on the ferrite rod and the temperature and causes the point with the highest reception level (middle of the bandwidth) to deviate from the set frequency. By using close-tolerance components (1%) and tuning capacitors with adapted temperature coefficients to compensate for the deviation of the ferrite rod, the error remains smaller than half the bandwidth under almost all circumstances. This means that even if the tuning deviates, a reception level of at most 3 dB less than the possible maximum level is still achieved. The desired reception frequency can always be brought into the middle of the current bandwidth (highest reception level) by adjusting the tuning slightly.

The main reception range of the RFA1 consists of the long, medium and lower shortwave range. In these ranges, it operates with a high sensitivity. The reception power decreases steadily above approx. 3 MHz and only reaches moderate values at the upper limit frequency (approx. 10.5 - 11 MHz depending on each individual RFA). In order to still achieve good reception in the upper frequency range, an additional auxiliary antenna can be connected to the RFA1. An SMA socket is available for this purpose. A short rod antenna (e.g. telescopic antenna) or a short wire antenna can be screwed on it.

To activate the auxiliary antenna, the SMA socket must be switched on via the "Rod" setting on the display. It then acts as an active, tunable "electrical" antenna and feeds the received signal into the amplifier in addition to the internal ferrite rod. The various lengths of the auxiliary antenna in combination with their alignment and the alignment of the RFA1 itself result in a wide range of reception options. This allows reception in the upper shortwave range to be optimized on a trial basis. The auxiliary antenna has almost no effect below approx. 1 MHz (depending on length and alignment).

Note: When the auxiliary antenna is connected and activated, the ferrite antenna is detuned towards lower frequencies. The amount of detuning depends on the auxiliary antenna and the reception frequency. To compensate, the tuning of the RFA1 must be set higher so that the maximum reception level is reached at the desired reception frequency.

Connections and controls

The RFA1A has 3 connection sockets:

- SMA socket "Rod Antenna" on top of the front panel. This is the connection for an auxiliary antenna to improve reception in the shortwave range. Caution! Provide surge protection!

- BNC socket "RF 50 Ohm" on the side of the device. The cable to the receiver input is connected here. Remote powering and remote control of the antenna are also possible via this socket.

- Hollow pin socket 2.5 mm on the side of the device. The RFA1A can be supplied with voltage here. The positive pole is on the pin.

A battery can also be installed for power supply. This enables operation independently of external power sources and / or control units. The battery compartment is available on the underside of the antenna after removing 2 screws and removing the cover. The battery of the type 6LR61 (6F22 / 9V block) is connected via a clip with push buttons. The polarity is unmistakable due to the different designs of the buttons (the clip can only be attached to the battery in one direction).

Caution! Never try to put the connection clip upside down! This can destroy the antenna!

Note: A normal 9V alkaline battery is only sufficient for approx. 3 - 4 hours of operation. The use of a rechargeable battery is recommended. With modern Li-Ion types, an uninterrupted operating time of over 12 hours can be achieved.

The device is operated exclusively via the "On/Off Tune" knob.

The knob enables the following operations:

- Switching the device on / off when supplied by battery or external DC power supply at the "DC + 9V" socket. The device is switched on by pressing the knob. The knob must be pushed until a message appears on the display. If the knob is pressed for more than approx. 6 s while it is switched on, **without** turning it, the message "!OFF!" appears in the lower right of the display. When the knob is released, the device switches off.

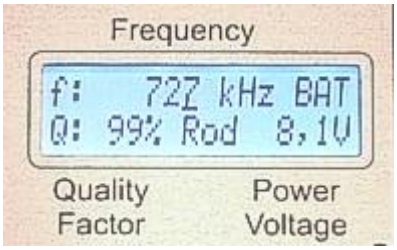
- Selection of different step sizes of the frequency setting and other device settings. If the knob is pressed in the switched-on state and then turned, the cursor on the display moves to another position (see description of the display).

- Tuning, changing the quality and switching the auxiliary antenna on / off. Depending on the cursor position, these functions are executed when the knob is turned while not pressed (see description of the display).

The background lighting is always switched on when the knob is pressed. Its brightness depends on the current power supply of the device. After releasing the knob, the lighting remains switched on for approx. 15 s before it switches itself off automatically.

Display indicators and setting options

An LC display is installed to display various values and to select the functions of the RFA1A. The essential values are labeled on the front panel.



- Frequency f: Display of the currently set frequency in kHz. There is a cursor (horizontal line) under one position of the display. When turning the rotary knob, the frequency is always changed with the smallest increment from this point. Positions on the right remain unchanged.

- Quality Factor Q: Display of the set quality of the ferrite antenna. With the rotary knob pressed, the cursor can be moved under the 1% digit. It is then possible to change the quality setting in 1% steps.

- Power Voltage: Display of the current supply voltage. The voltage actually used in the antenna is always displayed, regardless of the source from which it comes (see further explanations on the power supply). The "BAT" display above always appears when power is drawn either from the built-in battery or from the DC + 9V socket.

The voltage display switches to "! OFF!" if the rotary knob is pressed for longer than approx. 6 s and no turning movement (moving the cursor) is made. If the RFA1 is only supplied from the battery and / or the DC socket (no remote power supply / control via the HF cable), the antenna switches completely off when the knob is released. At this moment, the settings for the parameters frequency, quality and auxiliary antenna are also saved. When the device is switched on again, these parameters are automatically set again.

- "Rod" display: The cursor can be moved to the position of the middle letter. In this position, turning the knob toggles between active auxiliary antenna (display "Rod") or inactive auxiliary antenna (no display).

Note: Even when the auxiliary antenna is switched off, there is a certain sensitivity at the SMA socket, especially in the upper frequency range. If only the built-in ferrite antenna is to be used for reception, no auxiliary antenna may be connected to the socket. The socket should also always be switched off if no auxiliary antenna is connected. The activated socket generates an increased frequency error in the tuning.

Power supply and remote control

The RFA1A allows for power supply from 3 different sources:

- Internal battery / accumulator (5.7… 9.0 V).
- DC socket + 9V (5.7 ... 15 V).
- HF cable / BNC socket (5.7… 15 V).

If possible, only one source should be connected at a time. If several sources are connected at the same time, the following principle applies: **The highest voltage is taken for the power supply!** No current is drawn from the other voltage sources. The voltage used is shown in the display as "BAT" if it is the battery or the +9 V socket (cable remote supply: no display).

The most frequent operation with several sources will be the installation of a battery, whereby an external supply can be provided via the DC socket or the HF cable to protect the charge.

Caution! A built-in accumulator cannot be charged internally! To do this, it must be removed and charged in a suitable charger.

- Supply from battery and DC socket. In this case both sources are connected directly in parallel via diodes. This means that current is only drawn from the higher voltage source. Example: The battery has 9 V, the DC socket has 12 V. Current never flows from the battery, only from the socket. Vice versa: 9 V battery, 7.5 V DC socket: Current is always drawn from the battery, not from the socket.

The device regards the parallel supply from battery and DC socket as a single combined power source "BAT" and is thus displayed or switched on and off.

- Supply from battery and / or DC socket and simultaneous supply via the HF cable. In this case, too, either the common source "BAT" or the remote supply takes over the power supply of the RFA1, depending on which voltage is higher. However, the remote power supply can never be switched off on the device, the "BAT" source can. That means, as soon as a remote supply voltage of sufficient level is connected, the RFA1 is always switched on.

The power supply from the battery or DC socket can still be switched on or off as usual with the rotary knob. However, this only has an effect if the battery or DC voltage is higher than the remote feed voltage. The power is then supplied from these sources (the one with the higher voltage) when the device is switched on (display “BAT” visible). If the remote supply voltage is higher, it takes over the power supply despite the display that the battery is switched on (basic principle: "The highest voltage always supplies").

If you try to switch off the device, although the remote supply voltage is present, the display "! OFF!" appears, but after releasing the knob the RFA1 remains switched on. It is now supplied exclusively via the HF line, even if its voltage is lower than that of the battery or the DC socket. Therefore the BAT display goes out after a short time and the voltage of the remote supply is displayed.

Caution! Pressing the knob always switches on the battery / DC socket, possibly unintentionally! If the RFA1 is powered remotely, the battery should be removed and no DC supply connected. If the antenna is also to be remote controlled, **no other** supply voltage can be used.

The RFA1 can also be remotely controlled when powered via the HF cable. It is possible to set the frequency and the quality. The auxiliary antenna cannot be switched. The control takes place via a data telegram according to the RS-232 standard with the parameters 9E2 125 baud. A "1" bit is transmitted by a low voltage (open circuit voltage of the power supply, min. 5.7 V), a "0" bit by a voltage increased by at least 1 V (max. 15 V).

The generation of these data telegrams and thus the remote control can take place with the help of the control unit RSW4 or directly by remote feed from a receiver RDR51 "Reuter Pocket", RDR53 "Reuter sPocket" or RDR55 (from certain serial numbers of the devices). The transmission of the data telegrams is relatively slow due to the low data rate, in contrast to the fast tuning in the devices or with direct tuning of the antenna.

Important note: Do not operate the RFA1A close to metallic or other conductive objects. When receiving the RFA1A, do not place it on conductive surfaces such as a receiver housing. Even poorly conductive surfaces, like different types of paintwork on table tops, can impair reception and cause interference.

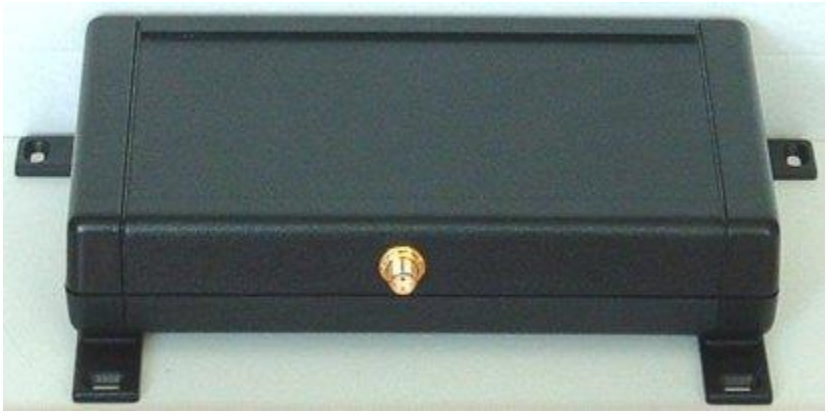
Firmware change

The built-in display generates slight intrinsic interference due to its close proximity to the ferrite rod. These can mask the minimum reception levels on some frequencies. In this case the display can be switched off as follows: Move the cursor to the position for switching the input socket "Rod Antenna". The display is switched off approx. 6 s after releasing the knob (regardless of the "Rod" setting). Each operation of the knob switches the display on again. If the cursor is on any other position, there is no shutdown.

Operator manual version 1B

Basic function

In terms of circuitry, the RFA1B corresponds to the RFA1A. All that is missing is the internal control (display and rotary knob) and the option to connect an auxiliary antenna and an external power supply or battery supply. Control and power supply is only possible via the coaxial connection. The RSW4 control unit is available for this purpose (see separate description "RSW3 / 4 control units"). The current versions of the RDR receivers can also control the RFA1 directly.



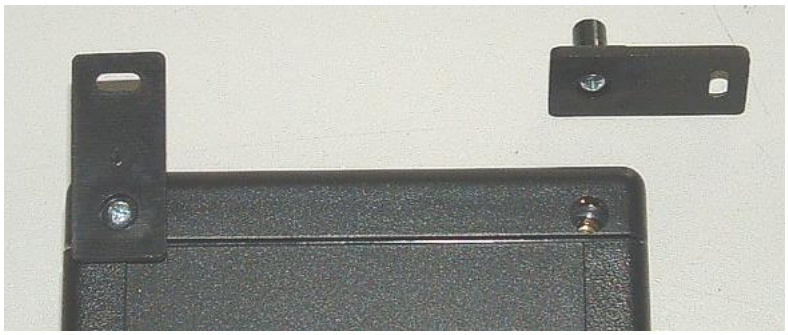
The housing of the RFA1B is slightly smaller than that of the 1A, has no special front panel and is waterproof. A waterproof (only when connected!) SMA socket is installed as the HF connection. This means that the antenna can be installed outdoors. The coaxial cable with plug should then also be suitable for outdoor use. In the case of permanent external installation, the connection point should be securely sealed with vulcanizing tape or similar.

Caution! If the antenna is exposed to direct sunlight for a long time, it can become very warm. It should be set up so that it is in the shade for most of the day (especially around the middle of the day).

Note: The antenna is hermetically sealed. However, extreme pressure changes can be compensated for by the seal between the housing shells and by the coaxial socket. In the case of permanent outdoor installation, however, it is recommended to drill a small hole (approx. 1 - 1.5 mm) at the lowest point (closest to the ground) of the housing. (**Caution**, do not drill further into the housing to avoid damaging the electronics!) This makes pressure equalization easier and enables any condensation liquid that may develop to run off or to evaporate.

4 mounting feets are available for mounting the antenna on any non-conductive (!) surface. These can be inserted into the holes in the housing screw connection on the rear. They can be rotated freely (any angle to the side of the housing is possible). Fastening takes place by inserting into the holes and screwing in short self-tapping screws to spread the sleeves and thereby clamping them in the housing holes. This means that after screwing the feet to a wall or the like, the antenna can be pulled off with a little force and then put back on again. This allows the antenna to be removed without tools, e.g. for theft protection, in extreme weather conditions or long periods of non-use.

Note: To screw the feet firmly to the housing, the hole in the sleeve of the feet can be drilled to 3 mm. The original housing screws must be removed (attention, do not separate the housing shells!) and the foot can be screwed directly to the housing with an M3x20 cylinder head screw. Make sure that it is watertight (put the rubber seal back on the original screw)!



The housing feet are only pushed on and clamped in the holes of the housing screw connection.