

Specifications

and Operator Manual

Control Unit RSW3 / 4 for RLA4 / RFA1



Version: 1.8

Created: 15.02.2020

Specifications

| | |
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| Dimensions (W x H x D): | 80 mm x 28 mm x 130 mm (without connectors / control elements) |
| Frequency range: | 10 kHz ... 156 MHz |
| Power supply: | +9,0 ... +15,0 V- / max. 250 mA |
| Connectors: | BNC 50 Ohm, hollow pin 2.5 mm, SMA female (not "reversed") |
| Maximum cable length from control unit to antenna: | depends on HF cable, max. 10 ohm DC resistance |
| Weight: | <= 500 g |
| Environmental conditions: | 0 ... +40 °C ambient temperature, <=90 % rel. humidity non-condensing, indoor application |
| Compliance: | CE according to DIN EN 55013, EN 55020, EN 60065 RoHS / WEEE Directive, ear-Reg. 27676700 |

Changes are reserved in the course of technical development!

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 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! When connecting an antenna outside the protected area (e.g. your house), it must be professionally provided with lightning protection. 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 and power supply)!

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!

Always provide a safe placement on a flat, straight and solid base of sufficient carrying capacity! 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!

Never expose the device to mechanical stress due to impact, pressure, vibration or shock which exceed a normal 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!

Operator Manual RSW3 (also for RSW4)

The RSW3 control unit is designed to operate the RLA4 in a remote configuration and to control mode and direction switching. Wireless remote control via a WiFi connection is possible.

The RLA4 can be supplied with power via the HF cable ("remote power supply" to the "+12 V" socket). The control unit supplies the antenna cable with the necessary voltages (socket "ANT"). The HF voltage supplied by the antenna can be taken from the "RX" socket and fed to the receiver (DC-free). An antenna for radio connection to an access point can be connected to the "WiFi" socket.

Various settings can be selected via the rotary knob. A small OLED display shows the current setting:

- Turn the knob all the way to the left ("Off"): Shutdown of the antenna. There is a delay of about 2 s before the antenna is actually switched off. This avoids constant switching back and forth in case of accidental turning to the Off-range (e.g. when fine adjusting to 0°). In position "Off", no voltage is conducted to the antenna. However, the control unit itself still needs some supply current. For complete shutdown of all devices, the power supply must be removed! ***For environmental protection reasons, please always do this if the control unit and antenna are not to be used for a long time (> a few minutes). Do not forget a possibly existing power supply!***

- Rotary knob between "Off" and "Max": Directional control of the antenna. The RLA4 is supplied with a voltage of approx. 8 V. With every movement of the rotary knob (noticeable latching step) that changes the direction setting, a data word is sent to the antenna (RS-232 inverse, approx. 10 V level for low bit). After switching on the antenna, the values start at 0° (transition "Off" to direction control). In this case, a "transition state" occurs: After switching on, the antenna can not be controlled for approx. 2 s (as when using the antenna without control device). After approx. 2s, the first control word is sent to the antenna. This switches the antenna to the current direction according to the rotary knob / display.

The RLA4 has 4 main reception directions. At 0° (or 180°), only loop 1 operates (the one going from the RX socket on the antenna to the left front). At 90° (= 270°) only loop 2 is in operation (from DC jack to the front right). At 45° (= 225°) or 135° (= 315°) both loops are active with the same gain. When setting directions between these main receiving directions, the loops (or their respective amplifiers) are operated with different gains.

Caution! The RLA4 does not linearly follow the setting of the rotary knob or the degree indicator on the display! It prefers the main directions for a long time and switches between them in a narrow range with just a few steps.

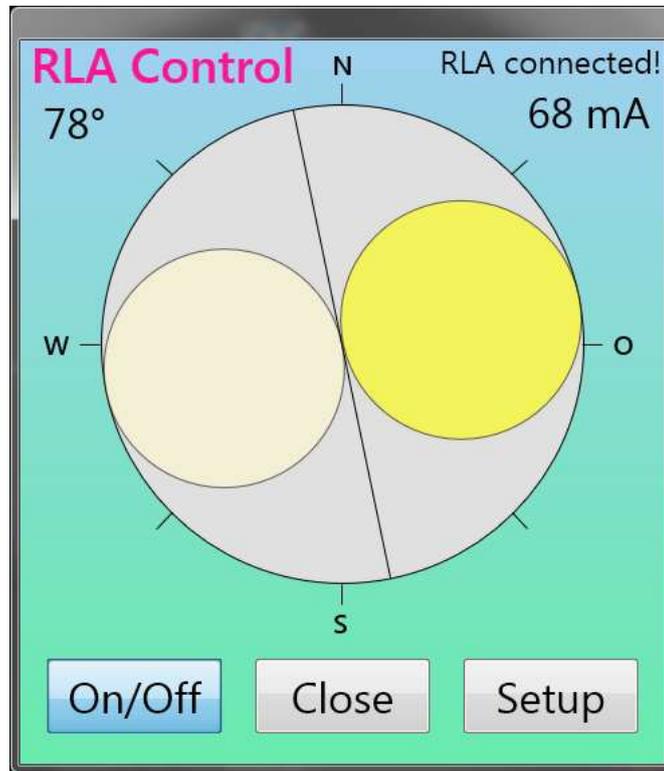
A pointer in the upper area of the display enables quick graphic orientation of the current setting. The far left corresponds to 0°, the far right corresponds to 180°.

The current indicator on the display can be used to check the proper function of the RLA4. If a constant switching between smaller values and a maximum value (approx. 150 mA) occurs, there is a short circuit in the antenna cable. The control unit is permanently short-circuit proof, so the overcurrent is only displayed briefly and then switched off immediately. If "0 mA" is displayed despite the setting being "Off" or "0°", there is an interruption.

Remote control

The RSW3 possesses a network controller with appropriate software ("TCP/IP Stack") and a 2.4 GHz transceiver for establishing network connections via a WLAN ("WiFi"). The RSW3 can be controlled via such a connection as well as by direct operation on the rotary knob. That means it can be switched on and off remotely and the direction setting of the RLA4 can be remotely controlled. Due to the standardized IP connection, control by any suitable software is possible via any available connection (e.g. Internet).

In addition to device-specific software (e.g. user interface of the RDR53 "sPocket"), remote control software for Windows-compatible PCs for the RSW3 is available: RLFA_Vxx.EXE (xx = 2-digit version number, download on the RLA4's and RFA1's product page, at the very bottom at "Software"). It allows the RLA4 to be controlled via the RSW3 control unit by remote control.



After opening the file RLFA_Vxx.EXE the program window appears. It contains the graphic replica of the antenna diagram of the RLA4 as well as some displays and buttons. The degree indicator on the top left and the power display on the top right correspond to the displays on the control unit. A text box above the current display shows the current connection status between the software and the control unit. The buttons in the lower area can be used to switch the RLA4 on or off (corresponds to turning the control unit all the way to the left until "Off" appears or turning to the right on a degree display), the program can be ended or another window for further settings ("Setup", see below) can be opened.

The antenna diagram can be rotated within the circle by clicking with the mouse (or tapping on devices with a touchscreen) and then dragging it to a desired position. The two reception lobes of the RLA4, stylized here as a circle, indicate the direction of the maximum reception. The degree indicator on the top left (or that on the display of the control unit) always refers to the right, darker side of the reception diagram. Its maximum (point of contact with the gray circle of the compass direction) corresponds to the degree indicator.

Note: If the RLA4 is set up with its main receiving direction facing north, when the degree display is set to 0°, the antenna diagram shows the correct direction. However, attention should be paid to the sometimes large deviation of the actual antenna diagram from the ideally displayed diagram in the software or the degree indicator (see comments above for the control unit). Without the inclusion of a correction table for the exact assignment of the actual reception diagram to the displayed diagram, the RLA4 can only be used to a very limited extent for direction finding purposes.

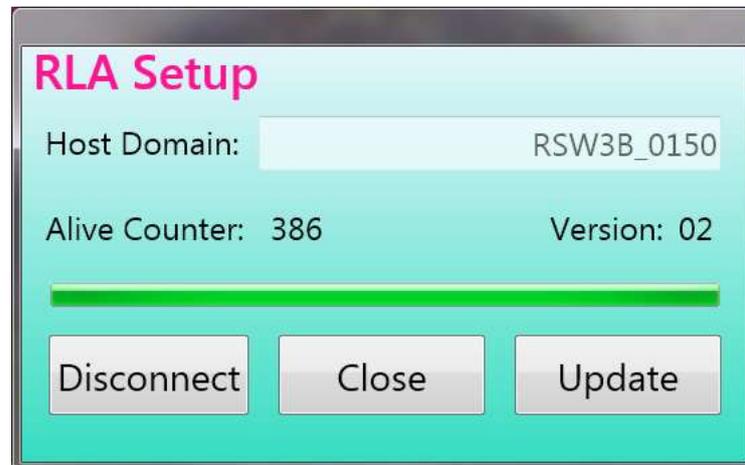
The alignment of the maximum reception is not so necessary with the RLA4, because the reception lobes are very wide and even larger deviations hardly result in a reduction in the reception level. Rather, the exact positioning of the zero point (minimal reception) is important to suppress signals from very specific directions (attenuation of unwanted transmitters or interference). In the diagram, the zero point is displayed by the line between the circles. The line is always located at a 90° angle to the main reception direction.

The diagram can be rotated very quickly in the program window, much faster than the RLA4 can actually react (relatively slow transmission of the control words from the control unit to the antenna). For this reason, intermediate steps are omitted in the case of a fast rotation, and the then valid data is only transferred when the desired position is reached (stopping the rotation by releasing the mouse button or lifting the finger). The diagram and the degree indicator always display the position reported by the control unit and that is actually transferred to the antenna. Delays during data exchange (for instance, because of a slow internet connection) can lead to jerky movements.

An exact and sensitive adjustment can be achieved with the computer mouse's scroll wheel. Moving the scroll wheel one step exactly advances the antenna position by one level. This corresponds to the operation as with the control unit's rotary encoder of the antenna (its operation is also displayed by rotating the directional diagram and updating the degree indicator within the program). Please note that a position step does not exactly correspond to a 1° change in direction, but approx. 0.776° (the RLA4 has 232 steps for 180° rotation). However, there is no representation of decimal places within the degree indicator due to the anyway existing inaccuracy of the real antenna diagram.

Setup

To set the connection parameters from the RLFA_Vxx.EXE program to the RSW3 control unit, another window can be opened with the "Setup" button.



When the antenna is connected (note "RLA connected!" at the top right of the main program window), an "Alive Counter" (activity counter) counts the data that is constantly exchanged between the program and the control unit (at least 2 data packets per second). To the right of this, the firmware version contained in the RSW3 is displayed (see below under "Update").

By pressing the "Disconnect" button, the connection to the RSW3 can be disconnected. The counter then stops, the name of the button changes to "Connect" and the input field for the network name of the RSW3 becomes active. This state is also present when the setup window is opened if there is no connection to the control unit.



In the text field "Host Domain" (called "RSW Name_S/N" in newer versions) the address under which the control unit can be reached by the program must be entered. Depending on how it is coupled with other devices (computer, router, ...) (see below) and the connections via which the program can access these devices (LAN connection, Internet, WiFi Direct, cellular network, ...) different possibilities exist. 2 basic variants exist:

1. The RSW3 and the computer on which the RLFA_Vxx program is started are located in a common network with free access between the devices. Example: Home or corporate network under Windows.

In this case, the control unit can be directly accessed via its designation in the network. The designation is always made up of the word "RSW3B" (from software version 3 "RSW34") with the following underscore "_" and the four-digit serial number of the device. This is indicated on the type plate on the bottom of the housing and is briefly shown on the display when it is switched on (when the power supply is connected). The serial number must always be entered with 4 digits, i.e. with shorter numbers with leading zeros.

2. The RSW3 and the computer on which the RLFA_Vxx program is started are in separate networks. The connection is established via various media and is usually secured by protection software (firewall) in such a way that no arbitrary access from one network to the other is possible. Example: Remote control via the internet.

In this case, additional preparations must be made to make the RSW3 control unit or its network "visible" for the program. Various options and additional software exist for this purpose, which cannot be described in more detail here. In principle, all of these variants enable the program or the computer on which it is running to use an address or a name with which the control unit can be accessed. This address / name must then be entered in the Setup.

Example: Access via port forwarding in the network's router, in whose WiFi access point the control unit has logged in.

In this case, the RSW3 is connected to a WiFi router and all computers that are also connected to this router have direct access via the designation of the control unit (variant 1). If the router is connected to the internet (e.g. via DSL), other computers on the Internet cannot normally access the network or the devices in it (meaning the RSW3 and other computers).

In order to "forward" a connection from the internet to the RSW3, the router must explicitly allow this connection(s) for certain addresses (ports). This so-called port forwarding can be configured in any conventional router. Please utilize the router's documentation for this process. The following variables must be set:

- The device to be accessed via the forwarded ports. The RSW3 is listed in the router either under its designation "RSW3" (possibly with appended additions such as version and serial number), or under the designation "espressif" (the name of the network processor in the RSW3).
- The port or ports to be forwarded. In case of the RSW3, it is always the same port number: 55556.
- The protocol(s) with which the RSW3 can be accessed via the forwarded port. The protocols "TCP" and "UDP" must be enabled for the RSW3. Depending on the router, this can be achieved with one setting (both protocols can be selected in the port forwarding dialog at the same time), or you have to set up port 55556 for each protocol individually.

After confirming these settings, the RSW3 can be accessed via the internet. To do this, the IP4 address of the router that contains the port release and the RSW3 is logged in must be entered within the RLFA_Vxx.EXE program. This address is displayed within the router configuration program if it is connected to the internet.

The problem with variant 2 consists in the automatic changing of this "public IP address" each time the router is reconnected to the internet. This means that every time this happens, you would have to look up the address and enter it in the remote control software again. There are many ways to avoid this problem. For example, it is common to use a "DNS service" that always assigns a unique designation to the router, regardless of the current IP address. The router manufacturer often offers a service like this, e.g. "MyFritz" for the widespread Fritz Box router. After setting up this service, the designation assigned to the router can be permanently entered in the Setup of the program.

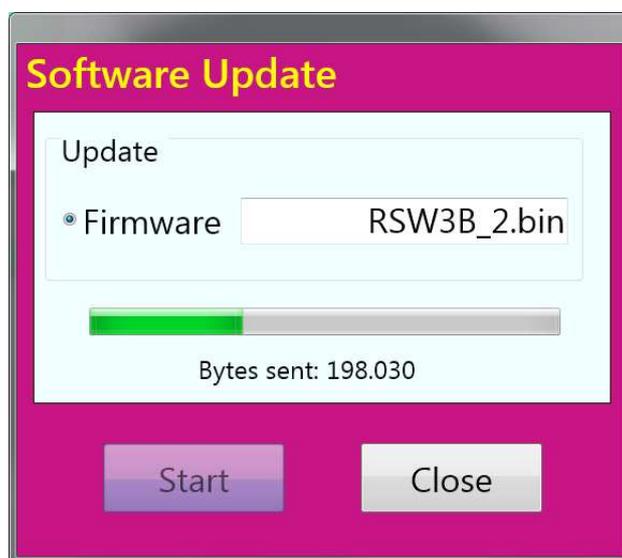
Pressing the "Connect" button initiates the establishment of the connection to the control unit. The green progress bar shows the progress. If the connection is successful, the button name changes to "Disconnect" and the Alive Counter begins to count. The version number appears on the firmware display.

If the progress bar completes to the end without a connection being established, the attempt is terminated and the setup window remains in the disconnected state. In this case, it must be checked whether all the necessary conditions for establishing a connection are met (RSW3 switched on, logged into a WLAN, access to this WLAN from the program possible, correct address / correct designation entered in the Setup, ...).

The software access to the RSW3 occurs according to the motto: "First come, first served!" As soon as any device (PC) has established a data connection with the RSW3 ("S" in the RSW3 display), it has exclusive control and other devices can no longer access it. Only after the connection has been closed (in the Setup dialog or by closing the application) can another one get access. Only a single instance of the RLFA_Vxx program should be started on each device. The control of several antennas from one device is only possible by changing the connection according to the set value in the Setup.

Firmware Update

The control unit contains integrated software ("firmware"), which controls its function and the connection via WiFi. If there is a connection, this firmware can be updated from the RLFA_Vxx.EXE program. To do this, press the "Update" button in the Setup. Another window opens.



The "Firmware" field is initially empty. With a double click / tap on it, the program searches for transferable files. These files must always have the extension .BIN and be located directly in the folder of the program file RLFA_Vxx.EXE. If there are several such files in the folder, the first one that can be found (depending on the arrangement of the files in the folder) is used. To avoid confusion, there should always be only one update file in the folder, namely exactly the (new) firmware to be transferred.

Pressing the "Start" button starts the transfer to the RSW3.

Caution! The transfer can only take place if the control unit is connected to the software (see above) and the control of the RLA4 works correctly (the antenna diagram reacts and the alive counter in the Setup ticks)!

The progress of the transfer is indicated by the green progress bar and the count of the transferred bytes. If an error message appears (transmission could not be started or was canceled due to long interruptions in the connection), the Update window must be closed. After a few seconds, the connection must be re-established in the Setup, if this has not already been done automatically. The update can then be retried. In the event of multiple cancellations, the reliability of the connection between the program and RSW3 must be checked or established (perfect and largely delay-free operability of the antenna).

Caution! Only start the update if you have direct manual access to the control unit! Depending on the changes in the firmware or in the event of serious data errors, it may be necessary to disconnect the RSW3 from the power supply and reconnect it. In addition, the network data (names, addresses, password ...) may have changed so that the WiFi connection of the RSW3 must be set up again (see below).

The successful end of the transmission is reported with a message window. An automatic reset then takes

place in the RSW3 and the device starts with the new firmware. Now the connection between the program and the RSW3 must be re-established (this can also occur automatically, please wait a few seconds). The Update window must be closed and the old connection must be interrupted in the Setup window with the button "Disconnect". The button now called "Connect" allows the connection to be re-established as specified in the description of the Setup window. The software version of the new (previously transferred) firmware must now appear in the version display (corresponds to part of the name of the firmware's BIN file).

Note: The version number always contains the sequential version number of new firmware in the second digit, the first digit changes between "0" and "8" with each successful update (detection of a successful retransmission of the same firmware with the same number already contained in the RSW3). On the RSW4 control unit, the first digit changes between the number 4 and the letter C.

If the old version number appears again, there were errors while transferring or restarting the RSW3. In this case, the update must be repeated. If a connection is no longer possible, there may be various errors:

- The connection between the program and RSW3 was interrupted by one of the devices involved. For example, the restart of the RSW3 requires an automatic or manual re-establishment of its WiFi connection (see below), or the connection of the computer with the program RLFA_Vxx.EXE to the internet was interrupted by the computer or the internet access device (router, mobile device, ...) and must first be re-established again.
- No valid (not originally downloaded from the manufacturer) or incorrect (data error, virus attack, ...) BIN file was transferred. In the vast majority of cases, the RSW3 recognizes faulty data, aborts the transmission and starts again with the old firmware. Executable new, but possibly defective firmware can still be started and can permanently disable the function of the RSW3 if there are errors. In this case, the device must be sent to the manufacturer for basic reprogramming.

Connection of the RSW3 to a WiFi access point

For remote control of the RSW3, it must be connected ("logged in") to an access point (also called a hotspot, access point or similar) according to the WiFi standard in the 2.4 GHz band. Such an access point can e.g. be a WLAN router, a suitably configured personal computer, a smartphone, a WiFi-capable radio unit or the like. From this device, which provides the access point, the further connection to the control software (e.g. RLFA_Vxx.EXE or user interface of the RDR53 "sPocket") takes place as described above.

To log in to the access point, the RSW3 uses a secure connection according to "WPA2-PSK". This requires the specification of a password with which the access point allows WLAN subscribers (stations) to log in. The participant (in this case the RSW3) must know the name ("SSID") of the access point in which it wants to log in and query it to be allowed to participate in the network using the password. If the access point grants participation (it "authenticates" the station), the requester is logged in as a station and can now exchange data via the network.

Note: The access point must be configured so that it actually grants the request of the RSW3 with the correct password and does not e.g. deny it by blocking his MAC address or the like (see notes further below).

The RSW3 does not have the option (keyboard or similar) for alphanumeric entry of names and passwords. For this reason, certain simplifications and / or restrictions regarding the selection of access points must be observed.

1. Simplified / automatic login using the "WPS push button" method.

Many access points (especially routers) allow stations to log in using this method. The access point must be switched to this mode (usually automatically limited to 2 minutes), in which case it then transmits its authentication data (name and password) to all requesting stations. They therefore have all the data to be able to log in. The access point (or its operator) can then decide whether it really wants to authenticate the logged-in stations (e.g. the RSW3) or exclude it from participating in the network (e.g. unknown stations, spies and hackers).

Caution! Depending on the control unit's firmware, it can be displayed in the list of stations found via WPS with the designation "RSW3" (possibly followed by further numbers) or as "espressif". This device must

remain in the list of allowed devices.

To connect the RSW3 to the access point using the WPS push button, proceed as follows:

- Disconnect the RSW3 from the power supply, connect the antenna to the "WiFi" socket.
- Start the WPS push button method within the access point (Physical button on the router or button in configuration software). Wait a few seconds.
- Press the rotary knob on the RSW3 as far as it will go and connect the power supply (RSW4: switch on with the switch).
- Release the rotary knob immediately after the display shows.

The top line of the display (where the pointer scale normally appears) now shows: "Search AP ...". When the connection to the access point has been successfully established, the display shows: "AP:" followed by the name of the access point (only the first 9 characters are visible). In the access point, the WPS authentication is canceled and the device found is displayed in the list of logged-in stations. An "L" appears in the RSW3's display between the degree and the current display to indicate successful login. As a check, the power supply can be briefly interrupted and restored (without pressing the rotary knob!). After a short time, the "L" must appear on the display again and the device RSW3 or espressif must be shown as connected in the access point configuration software. Now the RSW3 automatically logs into this access point each time it is switched on (if accessible).



2. Logging into a suitably configured access point

If there is no possibility of connection using the WPS method, the RSW3 can only connect to access points that use a specific password. It is called: "1234567890". Such a password is of course not secure, if only because it is publicly displayed here. This method only makes sense if an access point is used that does not allow any connections other than those to the RSW3. An example are the receivers / transceivers of the "RDR" series (if equipped with firmware for remote control of the RSW3, such as the "sPocket"). An otherwise isolated PC (no connection to other devices) with a WiFi radio module can be configured accordingly and used with the RLFA_Vxx.EXE application to control the RLA4. **Not recommended due to high power consumption and strong EMC pollution of the environment!**

To log the RSW3 into an access point with password 1234567890, proceed as follows:

- Follow the steps as described for the WPS method (without starting the WPS on the router).
- After the "Search AP ..." message appears, turn the rotary knob **to the right** (min. approx. 90°).
- Press the knob again and release it immediately.
- The message "Scan APs ..." appears.
- The RSW3 now searches for all access points within radio range.
- After a while, the name of the first access point found appears.
- You can display the list of all the access points found by turning the rotary knob.
- Select the desired access point and briefly press the rotary knob.

If the access point allows the connection (authenticates the password 1234567890), the connection is established permanently and the "L" appears on the display of the RSW3 to indicate successful login.

If the control software (program RLFA_Vxx.EXE or user interface of the radio unit) has access (permanent connection, see above) to the RSW3, an "S" appears in the display instead of the "L". Remote control of the RSW3 is possible in this state. Control via the rotary knob is also always active, controls on the RSW3 are transferred to the display (antenna diagram) in the control software.

Instructions for successfully connecting the RSW3 to a WiFi router

The WPS push button method is standardized and should work with any router equipped with it. However, there are many different brands with many different setting options for the WLAN. Some of these can prevent a successful connection via WPS. Due to the large number of options, no general procedure for configuring the router can be given. There is also no guarantee that every device can be configured appropriately! But here are some tips on settings that should definitely be observed:

- WiFi radio channel: **MUST (!)** Be set to the 2.4 GHz band. "Auto" or similar is possible and should work. If a particular channel is to be used, identify a channel that is not used very often (there is often a graphic view of the channel assignment). A channel in the range of 8 to 13 is recommended.
- WiFi standard: 802.11 b. The "b" is important, combinations like "b+g+n" are also possible. "a" or "ac" or "a+c" usually do not work (but can be tried after successful login).
- Security / WPA encryption: WPA2 (CCMP). WPA (TKIP) or similar should also work. Stronger encryption such as "Enterprise" etc. do not work.
- WLAN access: "Allow all new WLAN devices" or similar setting. New devices must not be blocked (select "All devices may communicate with each other" or similar). Turn off the MAC filter. (Can be reactivated after successfully finding the RSW3 / espressif. Allow the MAC of the new device beforehand!)
- Activate WLAN coexistence if necessary.

Please note: After changes to the settings, a button "Apply" or "Save" or similar must often be pressed first so that these settings are not lost when changing the menu (call up WPS).

Firmware Update Version 3 (RSW3B_3.BIN)

Up to firmware version 2, the RSW3 keeps searching for a WiFi connection. If none is found, e.g. because it is not close enough to the configured access point or because no access point has been configured), this means a waste of energy (high current consumption during the search) and an unnecessary pollution of the WLAN frequency range.

The firmware update to version 3 limits the search time. An active search without a previously found connection is now shown with a "C" in the middle of the lower display line. As long as this C can be seen, the WLAN transmitter operates with full transmission power (approx. 100 mW).

If the configured access point is found, the RSW3 logs in (an "L" appears, or an "S" in the display when the control program is active) and the transmission power is reduced to a value that is just necessary to maintain the connection.

If no connection is found for approx. 10 s, the transceiver switches off completely (no more connection characters in the lower line). If you want to search for a connection repeatedly (e.g. because the access point should now be accessible), the search mode can be activated at any time by pressing the rotary knob. **To do this, the degree display must be set above 0°!** The search mode is of course also reactivated each time the power supply is switched on.

If the connection is interrupted during operation ("S" or "L" changes to "C"), the RSW3 switches to search mode for approx. 60 s. If the connection cannot be re-established within this time, the transceiver is switched off. A new connection can be established by pressing the button or switching the power supply off / on.

When the transceiver is switched off, the RSW3 tries to establish a new connection approx. every 3 minutes. For this, the search mode is activated for approx. 10 s. If no connection is found, the transceiver deactivates again for approx. 3 minutes. This behavior continues until a connection is found or the RSW3 is switched off.

Operator Manual RSW4

The RSW4 control unit largely corresponds to the RSW3. The operation is carried out according to the description of the RSW3. The following changes / extensions must be observed (firmware version 5):

- The RSW4 has an on / off switch for completely switching off the control unit including remote feeding of the antenna. When the device is switched off with this switch (**not** when disconnected from the power supply!), the current setting of the RSW4 is saved. When switched on again, the setting is set to the stored value(s).
Simply turning off the antenna by turning the button all the way to the left (setting "Off") is no longer necessary.
Caution!: If no display appears after switching on, the device must be disconnected from the power supply for a few seconds from the power supply.
- The adjustment knob is equipped with a high-resolution optical rotary encoder. It has no detent and allows quick and noiseless adjustment.
- The RSW4 is suitable for remote control of the ferrite antenna RFA1. To do this, a different firmware is loaded (version 6). This can be done ex works (ordered together with the RFA1 as "control unit for RFA"), or at any time by uploading the firmware via WiFi from a computer using the "RLFA_Vxx" software.
- The designation of the RSW4 in the network is "RSW34_xxxx" (xxxx = serial number with leading zeros). This designation is also introduced for the RSW3 from firmware version 5. The Reuter Pocket or sPocket receivers can control both RSW3 and RSW4 with updated software.

Firmware Update Version 6.0

In addition to the RLA4 control, the RSW4 can also be used for remote control of the RFA1. In this case, firmware version 6 (RSW4_RFA_V60.BIN) or higher is required.



The set values for the frequency "f" and the quality factor "Q" as well as the measured value for the antenna current are visible in the display. The frequency can be set in 1, 10 and 100 kHz steps with the rotary encoder. To do this, a cursor (line under a number) can be moved to the desired position with the rotary encoder pressed. If the cursor is moved under the last digit of the Q factor, this value can be changed.

The Windows program RLFA_Vxx has been expanded accordingly to control the RFA1 via WiFi. When connected to the control unit, it detects the firmware installed and adapts the user interface to control the RFA1.

Version 6 is also available for controlling the RLA4 loop antennas for both control units RSW3 and RSW4. It does not contain any additional functions with the exception to differentiate the RLA and RFA1 and small bug fixes.

Firmware Update Version 6.1 / RLFA_V03.EXE

The firmware V61 is available in 3 variants:

- RSW3_RLA4_V61.BIN: Firmware for RSW3 to control the RLA4 antennas
- RSW4_RLA4_V61.BIN: Firmware for RSW4 to control the RLA4 antennas
- RSW4_RFA1_V61.BIN: Firmware for RSW4 to control the RFA1 antennas

Depending on the device and application, the appropriate firmware must be loaded into the correct control unit. The RLFA_V03.EXE software must be used to connect to a Windows PC for remote control.

Caution! Never load this firmware into devices that have already been delivered with higher versions (from V7.0)!

RLA4 variants

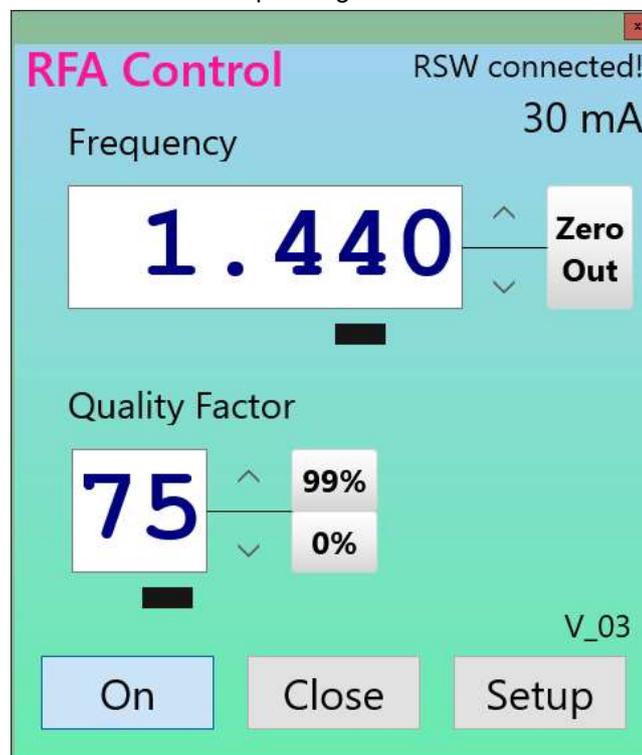
There are no changes to the control of the RLA4 compared to the previous versions, with the exception of an error correction: Switching the antennas on / off via the PC user interface is now always possible without restriction. There is a difference between RSW3 and RSW4:

- RSW3: If the antenna is switched off through the PC, it can be switched on again both on the PC and by turning the knob on the RSW3. When switching on using the "On / Off" button (now only labeled "On" or "Off" depending on the current status), the angle setting is retained. Turning the knob on the RSW3 starts with 0°.
- RSW4: If the antenna is switched off through the PC, it can only be switched on again on the PC, or by completely switching the control unit off / on using the switch on the RSW4. The current settings are saved and restored. If the RSW4 is switched off completely, the connection to the PC is lost and must be re-established after switching on in the Setup of the PC software. **Caution!** If the RSW4 is switched off with the switch while the antenna was previously switched off by the PC software, the minimum frequency of the RFA1 is saved! To save the current frequency, the antenna must be switched on.

Note: In all cases of shutdown through the PC, only the power supply to the antenna is interrupted. The RSWx remains fully active. For longer switch-off times, the control unit and also the PC (if possible) should be completely switched off (RSW3: Disconnect from the power supply).

RFA1 variant

The remote control of the RFA1 is principally only possible with the RSW4 device. The PC user interface has been expanded to include the necessary control elements. When connected to the control unit RSW4 and the firmware RSW4_RFA1_Vxx contained therein, the software recognizes the operation of the RFA1 instead of the RLA4 and switches to the corresponding interface.



User interface for remote control of the RFA1 antenna via the RSW4 control unit

The possible settings depending on the RSW4 or RFA1 are available in the user interface.

- Frequency: Tuning the antenna.

The frequency can be changed by tapping the up or down arrows. The position (digit) from which the setting is made is marked with a cursor (bar) under the digit, as on the antenna or the RSW4. The bar can be moved accordingly. "Zero Out" sets all digits from the selected position to the right to 0. The frequency can also be entered directly by tapping on the display field and entering it with a keyboard. As long as the direct entry is active, the display appears red. With "Enter" or tapping on another element of the surface, the entered value is sent to the antenna. Only numbers (thousands point is possible) may be entered in the tuning range of the antenna!

- Quality Factor: Q factor multiplier of the antenna.

The quality factor can be changed by tapping the up or down arrows. Tapping on "99%" or "0%" immediately sets the factor to these values. Direct entry is possible, as is the case with the frequency.

With all entries it should be noted that the displays always report back the current setting of the antenna. They also change simultaneously with the settings on the rotary knob of the RSW4. If an arrow key is pressed for longer than 1 s, there is a continuous change at 5 steps per second. Because the data transmission to the antenna takes some time, the display does not always immediately follow the possibly faster entry of new values.

The bars for defining the input point on the antenna, RSW4 and PC surface are independent. Each user interface has its own step size setting. The position of the bars in the PC interface is saved when the program is closed, the position in the antenna and RSW4 not when switched off (when switched on, always with the lowest digit).

Data protocol control RSW3/4

The RSW is controlled by data exchange via TCP or UDP data packets when correctly connected to an access point ("L" in display). Feedback messages from the RSW are always sent via TCP. The logical handling of the data is handled by corresponding sockets. They must be addressed as follows:

Host address: IP4 address assigned by the access point via DHCP.
Port: 55556.

The RSW contains an mDNS server. It defines an alphanumeric designation and transmits its currently assigned IP address to the network. This allows the sockets of the RSW to be addressed under this designation instead of the current IP address. The designation corresponds to the description of the setup of the RLA control program ("RSW34_xxxx" with xxxx = 4-digit serial number with possibly leading zeros). Depending on the development environment used to create your own control programs, this designation can be used immediately for programming (e.g. in components for network connections under Windows), or the IP4 address belonging to this name must be determined "manually" via corresponding mDNS queries and used for socket addressing.

Caution! The exchange of self-generated data via the WLAN connection of the RSW3/4 represents an unauthorized intervention in the operating principle of the device! Possible damage to hardware and software due to faulty / harmful data is not covered by warranty or guarantee!

UDP connection

Data exchange via UDP is only possible in one direction, from the access point (or other network nodes) to the RSW. The user data correspond to the data for TCP connection (see below). The advantage of UDP control is the often higher speed (lower latency), the disadvantage is the increased possibility of data loss.

TCP connection

The TCP connection is based on the server-client principle. For this purpose, the RSW provides a TCP server that permanently waits for connection requests from a TCP client from the network. As soon as a connection request with correct addressing (IP address and port) arrives, it is confirmed and the server is ready to transfer data. Only a single connection can be established. Further requests are ignored / rejected until the existing connection is disconnected again. An existing connection is indicated with "S" in the display.

As soon as a connection to a client has been established, the RSW sends a status data packet to the client approx. 2 times per second. Whenever a change is made to the device (operation of the rotary knob, overcurrent or interruption fault message), a packet is sent immediately. Likewise when the setting is changed by receiving a control data packet (immediate feedback on the successful processing of the control commands).

The status data packets differ according to whether the RSW is used to control an RLA loop antenna or an RFA ferrite antenna (it contains the corresponding firmware).

RLA:

| 1. Byte | 2. Byte | 3. Byte | 4. Byte | 5. Byte | 6. Byte |
|---------|---------|---------|---------|---------|----------|
| 0x0D | 0x08 | Current | 0x0D | 0x09 | Position |

Current: Current measured value in mA.

Position: Current direction setting in 232 steps. Level 0: Switched off, step 231: 180°.

Note: The current measurement is subject to large tolerances and is mainly used to detect a short circuit (current > approx. 120 mA) or an interruption (current = 0) of the antenna line.

Note: The directional adjustment of the RLA4 takes place in 232 steps within a rotation angle of 180°. The directional adjustment is subject to large tolerances and is non-linear in large parts of the rotation range.

RFA:

| | | | | | | | |
|---------|---------|---------|---------|---------|----------|-----------|---------|
| 1. Byte | 2. Byte | 3. Byte | 4. Byte | 5. Byte | 6. Byte | 7. Byte | 8. Byte |
| 0x0D | 0x08 | Current | 0x0D | 0x0A | Freq low | Freq high | Quality |

Current: Current measured value in mA.

Freq low + high: Low and high byte frequency (16 bit word) in 1 kHz resolution.

Quality: Quality in %.

Note: The current measurement is subject to large tolerances and is mainly used to detect a short circuit (current > approx. 120 mA) or an interruption (current = 0) of the antenna line.

Control data packets are always received by the RSW for both versions (RLA and RFA). Only data intended for the respective version is processed. All other data will be ignored.

Direction control RLA:

| | | |
|---------|---------|----------|
| 1. Byte | 2. Byte | 3. Byte |
| 0x0D | 0xB2 | Position |

Position: Direction control in 232 steps. Level 0: Switched off, step 231: 180°.

Note: The directional adjustment of the RLA4 takes place in 232 steps within a rotation angle of 180°. The directional adjustment is subject to large tolerances and is non-linear in large parts of the rotation range.

Quality setting RFA:

| | | |
|---------|---------|---------|
| 1. Byte | 2. Byte | 3. Byte |
| 0x0D | 0xB2 | Quality |

Quality: Quality in %.

Frequency setting RFA:

| | | | |
|---------|---------|----------|-----------|
| 1. Byte | 2. Byte | 3. Byte | 4. Byte |
| 0x0D | 0xB0 | Freq low | Freq high |

Freq low + high: Low and high byte frequency (16 bit word) in 1 kHz resolution.

Version request control unit firmware:

| | | |
|---------|---------|---------|
| 1. Byte | 2. Byte | 3. Byte |
| 0x0D | 0x12 | 0x00 |

The RSW responds to this message with a special data packet containing the version number and storage of the programmed firmware:

| | | |
|---------|---------|---------|
| 1. Byte | 2. Byte | 3. Byte |
| 0x0D | 0xFF | Version |

Version: Bit[6..0]: Version number, Bit[7] location: 0 = primary memory, 1 = secondary memory.

Note: After each successful reprogramming, the memory location is altered. This means that valid firmware is always available, even if errors occur during data transmission.

Firmware Update Version 8.0 / RLFA_V04.EXE

The firmware V80 is available in 3 variants:

- RSW3_RLA4_V80.BIN: Firmware for RSW3 to control the RLA4 antennas
- RSW4_RLA4_V80.BIN: Firmware for RSW4 to control the RLA4 antennas
- RSW4_RFA1_V80.BIN: Firmware for RSW4 to control the RFA1 antennas

Depending on the device and application, the appropriate firmware must be loaded into the correct control unit. The RLFA_V04.EXE software must be used to connect to a Windows PC for remote control.

Changes in version 80:

- Brightness setting of the display.

When turning the knob while pressed, the display brightness can be changed. This makes it possible to adapt to different ambient brightness levels.

Caution! The service life of the display decreases with increasing brightness! Set the brightness only as high as absolutely necessary for reading.

The setting is stored in non-volatile memory each time the button is released and is restored the next time the device is switched on.

Note: The primary press function of the button is to activate the connection to a WiFi access point. When pressed, an attempt is always made to establish a connection (if not already done, letter "L" or "S" visible). The letter "C" appears in the display and the WLAN transceiver operates at full power.

Caution! Pressing the button **while the device is being switched on** starts the WPS function to reconnect to an access point! During this, the access point must also be active in WPS mode. If you do not want to initiate a new connection, do not press the button until the normal display appears in the display (degree or frequency setting and indication of the current strength). Only from this moment on, the press function is used for brightness adjustment.

Firmware Update Version 9.0 / RLFA_V05.EXE

The V90 firmware is available in 3 variants:

- RSW3_RLA4_V90.BIN: Firmware for RSW3 to control the RLA4 antennas
- RSW4_RLA4_V90.BIN: Firmware for RSW4 to control the RLA4 antennas
- RSW4_RFA1_V90.BIN: Firmware for RSW4 to control the RFA1 antennas

Depending on the device and application, the appropriate firmware must be loaded into the correct control unit. The RLFA_V05.EXE software must be used to connect to a Windows PC for remote control.

Changes in version 90:

- Compatibility with the new PC software RLFA_V05 (contains control for preselector RAP1).