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Aziloop Antenna Processor

Model DF-72

User Guide

Revision 1.10.0 for Aziloop App 1.6.0

March 2025

Aziloop is designed and manufactured in the UK by QuietRadio

About This Document

This User Guide is intended to provide information sufficient to enable users to install, set up and use Aziloop DF-72 to best advantage.

Please get in touch if you think we have left anything out, made any mistakes, or could explain things in a better way.

We also welcome suggestions for new features or products.

Revision numbering: e.g. Version 1.10.0 means Version 1 of the product, 10th User Guide, zero corrections. Corrections / Edits with no new features would be 1.10.1, 1.10.2 and so on.

Document Navigation

There is a comprehensive Contents section at the start of this document. Click on any topic to select.

Your PDF viewer should have the facility to display the Table of Contents in a sidebar for easy navigation.

Click [Contents] in the footer of any page to return to Contents.

OPERATING AZILOOP SAFELY

Aziloop is a receive-only system. Failure to observe the following instructions could seriously damage Aziloop hardware or your receiver.

- Power supply: keep to 13.8 V DC (+/- 5%).
- Do not connect Aziloop to the output of a transceiver or transmitter.
- Do not connect your receiver to the LCU connector on the CIU.
- For locations with co-sited transmitters, place the loops as far away from hot antennas as possible and make sure you use Aziloop's built-in PTT muting function, especially if you run high power.

Copyright and Intellectual Property

Aziloop Hardware, Software, Firmware and Documentation is automatically protected by Copyright and Intellectual Property law.

You do not own the Aziloop app. You are licensed to use the Aziloop app for the sole purpose of controlling Aziloop hardware and attached devices or the simulation thereof in Demo mode.

Illegal use includes but is not limited to reverse engineering dis-assembling copying documenting or reselling the app or indeed the CIU/LCU firmware or the CIU/LCU circuit in whole or in part for profit or non-profit without documented consent from QuietRadio.

Trademarks

QuietRadio and Aziloop are registered trademarks. ‘Stepped Azimuth’ and ‘Reception. Reinvented’ are used as Trademarks.

Hardware Warranty

QuietRadio warrants the Aziloop hardware (CIU and LCU) and accessories against defects in materials and workmanship for one year from the date of original purchase. QuietRadio does not warrant against normal wear and tear, nor damage caused by accident or abuse including failure to heed warnings about use near transmitters without using the built-in mute facility and ‘acts of god’ such as lightning strikes.

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How this User Guide is organised

The green sections below are your reference for day-to-day use. As a once only operation, Installation (Section 6) is towards the end of the document.

Section 1 - Aziloop overview

Feature Summary, Description of component parts

Configuration hierarchy:

Section 2 - User Interface

How to operate Aziloop, function by function

Section 3 - Settings

Including Modes, Aux I/O and updates

Section 4 - Preferences

Including Antenna options, Omni-Rig, and Palette Editor

Section 5 – Remote Operation

Setting up and using Client and Server modes

Section 6 - Installation

Separate sections for Antenna, CIU, LCU and PC app.

Appendix 1 – Aziloop in practice

What you should expect

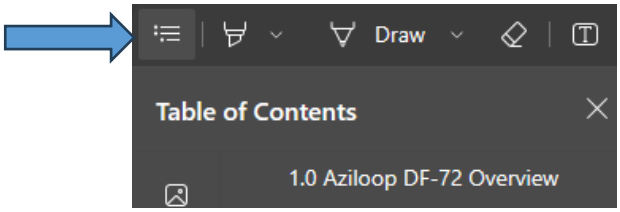
Appendix 2 – Understanding your Aziloop

Appreciating K9AY and Loop mode differences.

Contents

Viewing this User Guide.

Your PDF viewer should have the facility to display the Table of Contents (as above) in a navigation sidebar. For instance if you are using Microsoft Edge, press this:



1.0 OVERVIEW

Aziloop is a dual mode electronically rotatable HF receive antenna processor, with a primary frequency range of 20 kHz to 10 MHz, and coverage to 30 MHz at reduced directivity (determined ultimately by antenna size).

Product development was started in 2018 by Aziloop creator Dave GW4GTE. The original requirement was for a multi-purpose antenna that could be remotely controlled. Nothing suitable existed, and so Aziloop was born, originally as the DF-8 45-degree proof-of-concept model followed by the DF-24 with 15-degree steps.

In the DF-72 5-degree model, QuietRadio's Stepped-Azimuth™ technology offers up to 72 uni-directional headings and 36 bi-directional headings using a pair of orthogonal loops. This dual mode capability is enhanced by including features such as variable load resistance, signal level control, band filtering and auxiliary control ports as standard, all of which are managed via a user-friendly Windows app for local or remote use.

Who should consider Aziloop?

Aziloop will be of interest to shortwave listeners, radio amateurs, and professional users. Applications include general monitoring, co-channel station resolution, basic direction finding, atmospheric and electromagnetic interference reduction, and jamming mitigation. Plus of course just having fun learning about propagation and discovering what your previous antenna was keeping from you.

Product Positioning

Aziloop has capabilities that single loop antennas cannot offer. Occupying a different market sector, Aziloop is an intelligent first choice, or a rewarding upgrade for the discerning listener and serious DX-er.

Professional Users

Aziloop offers a feature-set that could meet your project requirements at a fraction of the expected cost, especially tactical or SIGINT deployments. Custom builds may also be possible. Please contact us to discuss your needs.

1.1 DF-72 Feature Summary

Dual Mode – Loop and K9AY

Aziloop is unique in offering two antenna modes in one product:

Best for DX: K9AY mode, where Aziloop operates as a K9AY terminated loop giving a uni-directional cardioid pattern.

Best for general listening and DF: Loop mode, producing the classic small loop figure-of-eight bi-directional pattern at low angles, and omni-directional pattern at higher angles.

Stepped-Azimuth™

In another first for this market, Aziloop DF-72 uses our Stepped-Azimuth™ technology to produce 72 x 5-degree uni-directional headings in K9AY mode or 36 bi-directional headings in Loop mode from a pair of orthogonal loops. The result is a choice of 108 heading/mode combinations. Changes take place in < 100 ms.

To be clear, the antenna does not move, azimuth rotation is achieved electronically.

Intuitive UI (User Interface)

The antenna is controlled from a software app. Nowadays serious listeners usually employ some sort of computer based SDR receiver. Where better to control your antenna than on-screen next to your receiver display? Note: at present only Microsoft Windows 10 and 11 is supported. PC CPU load is minimal so any PC will work fine. You just need a spare USB port.

Remote Operation

A remotely sited receive system is an increasingly popular pragmatic solution to local noise problems. Aziloop can be operated from anywhere there's an internet connection. Aziloop hardware is only required at the antenna (server) end.

No Control Cables

The antenna feeder also carries power and control signals to the LCU (Loop Control Unit). This makes antenna upgrades a snip if a coax feeder cable is already in place. There are other advantages too: separate control lines can be a source of unwanted noise pickup, and current loops can exist between feeder and control lines reducing antenna performance.

Designed for Outdoor Use

The LCU is housed in a high-quality purpose designed IP67 rated waterproof enclosure made from ASA (Acrylonitrile styrene acrylate) thermoplastic (as opposed

to ABS) for excellent weather and UV resistance, zero corrosion, and minimal condensation. The lid of the enclosure is secured with six stainless steel screws which clamp it firmly in place via a waterproofing gasket.

Cables are fed into the box via compression glands and are clamped using superior quality rising-cage type terminal blocks.

The enclosure includes integrated pole mounts allowing installation to be completed quickly and easily with just a couple of cable ties or jubilee clips. When you're out there fumbling about on a cold day, you'll be glad of that.

Full Control

The LCU has a switchable balanced preamplifier with a gain of nominally 18 dB, optimally placed at the antenna to maximise signal to noise ratio and swamp any external noise pickup on the feeder. Ahead of the preamp are three selectable 7-pole filters, two low-pass and one high-pass, to give your receiver (and our preamp) an easier life if needed. The high-pass filter and one low-pass filter overlap to produce a band-pass response as a fourth filter option.

The terminating resistor in K9AY mode is adjustable in 50 Ω increments from 250 Ω to 950 Ω.

The CIU (Common Interface Unit) has a 5-position attenuator: 0 dB, -6 dB, -12 dB, -18 dB and infinity (which isolates the receiver, terminating it in 50 Ω).

The combination of LCU preamp and CIU attenuator gives around 36 dB of level control allowing the user to achieve the best balance of signal to noise ratio versus dynamic range.

The CIU also has two auxiliary I/O lines that can be separately configured as inputs, or outputs. These can be operated remotely as well as locally. Uses include additional antenna switching, controlling other equipment, or in a remote scenario, mains-fail indication, intruder alarm, temperature alarm, remote fan control, equipment re-boot etc.

Mute Facility

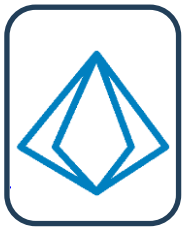
An auxiliary I/O channel can be set up as PTT sense line to quickly isolate a connected receiver and protect the LCU from high RF levels. The second channel can be configured as another PTT input or a PTT-out line with a selectable delay. There is also a mute (talk) timer with visual display within the app.

Omni-Rig 1.2 Support

For receiver syncing, PTT sensing, Aux I/O control and auto filter insertion.

1.2 Aziloop Components

1.2.1 The Antenna

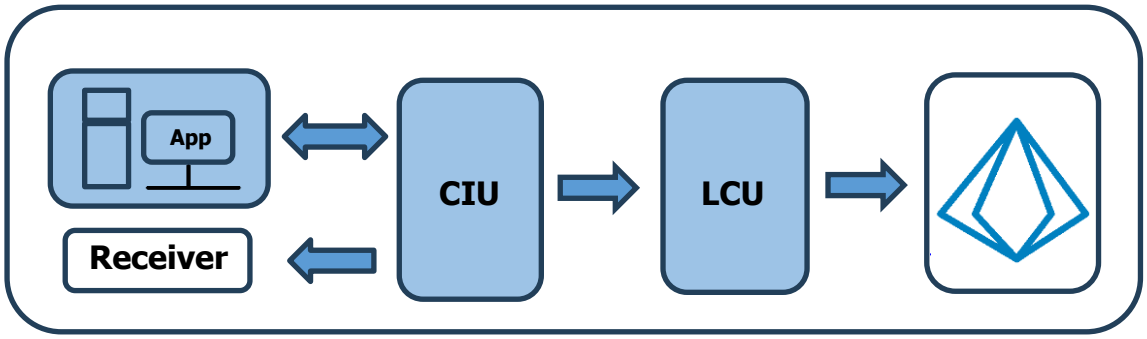


The antenna comprises two user supplied orthogonal loops identical in size sharing a common vertical axis, and four radials directly underneath forming a ground plane (or optionally an earth rod instead).

The antenna size and mounting method is a user decision therefore we don't currently offer an antenna kit, but equally we won't rule it out in future if there is sufficient demand for a complete package.

Antenna guidelines are set out in the Antenna Installation section below.

1.2.2 The Loop Controller Unit (LCU)



The LCU is powered and controlled via the signal coax. The connection is reverse polarity protected. Antenna wires and the feeder coax enter the LCU enclosure via compression glands. No coax plug is needed. The supplied pole mounting adapters make it easy to attach the LCU to a round pole.

Internal functions of the LCU

- **Stepped-Azimuth Phasing Circuit**

The Stepped-Azimuth phasing circuit processes the incoming antenna signals to electronically synthesize a single antenna producing a near instant 360-degree rotation capability in 5-degree steps.

- **Four band filters**

There are two low-pass filters and one high-pass filter. The upper low-pass filter and the high-pass filter overlap and can be enabled together to produce a band-pass filter, producing four filter options (plus of course no filter).

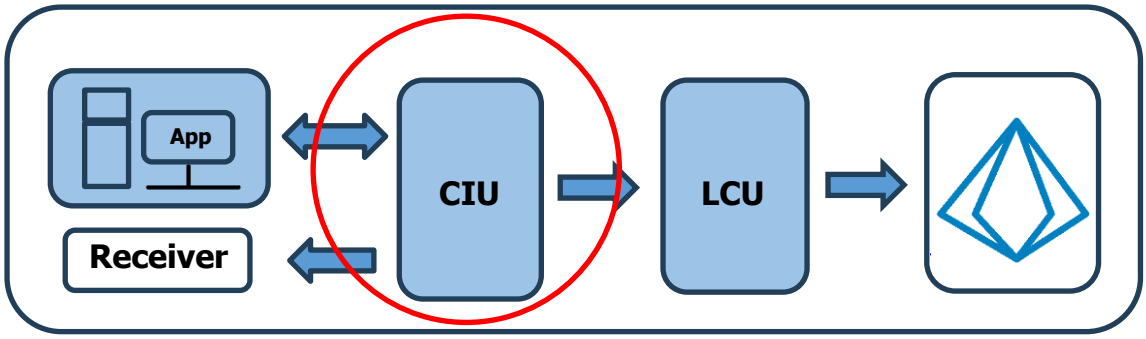
- **Switchable Preamplifier**

A (nominal) 18 dB gain preamplifier boosts signals to improve s/n ratio. Passive RF protection is built-in both before and after the preamp.

- **Variable K9AY Load**

The K9AY load resistor can be varied from 250Ω to 950Ω in 50Ω steps.

1.2.3 The Common Interface Unit (CIU)



The CIU circuitry is housed in a small, extruded aluminium box. Normally mounted indoors next to your PC and receiver, it plays a central role in the Aziloop system.

CIU Connectors

Power, USB, RJ45 and Aux I/O connectors are all located at one end of the enclosure along with a status LED. At the other end two SMA sockets connect to the LCU and the receiver.

Power Input (13.8 V nominal +/- 5%)

A nominal 13.8 V DC is applied via the 2.1 mm barrel connector. The controller will not operate without this voltage present. The connector is reverse polarity protected. Lower voltages may cause unreliable LCU operation on long feeder runs. Higher voltages may cause overheating of components. A low noise linear power supply is recommended.

Current Drain

This is around 250 mA in normal use depending on LCU functions selected. If you are using a current-limited supply, make sure you monitor the current limiting setting. Current drain is increased by about 170 mA when the CIU Server is powered.

Status LED

On applying 13.8 V, the red LED flashes 'R' in Morse code (dit-dah-dit) indicating the internal processor is running. Following that, the LED can assume several states:

LED Off	No power to LCU
LED On	Power to LCU
LED flashes 'R' in morse	DC applied and CIU processor has started
LED blinks momentarily	Data being sent to LCU
LED flashes rapidly	Bootloader mode

Auxiliary I/O ports – 3.5 mm socket

There are two uncommitted I/O ports presented as a 3.5 mm stereo jack socket that can each be used as an input or an output. They can be allocated to provide a PTT (Push to talk) mute function. See the Auxiliary I/O section for full details.

Mini USB socket

Local control of the CIU using the Aziloop app is via USB. This connection is not needed when using the CIU Server once it's configured. The USB interface is powered from the USB VSYS line and is optically isolated from the rest of the CIU.

RJ45 LAN connector marked 'LAN 10/100'

This is used to connect to the CIU's built-in Ethernet server. The standard RJ45 Ethernet connector will auto adjust to 10 Mbps or 100 Mbps. 10 Mbps is rarely seen these days but is more than adequate if encountered. Make sure your switch or router can rate adapt if it's 1 Gbps capable. Do not use screened RJ45 cable to avoid current loops and RF noise.

LCU Connector

The SMA female connector marked 'Antenna via LCU' feeds power and control signals to the LCU and receives RF from the LCU.

Receiver Connector

The receiver is connected to the SMA female connector marked 'Receiver'. Passive protection is built in. The port is also DC isolated.

Warning: Do not confuse with the LCU SMA connector which carries 13.8 V.

As a quick visual check, note the 13.8 V power input is on the same side of the CIU enclosure as the LCU connector carrying power.

The CIU control circuitry is powered from the 13.8 V supply. The USB interface is powered via the USB VBUS.

Internal functions of the CIU

The CIU sits where a 'bias-tee' would be located. In addition to acting as a bias-tee, the following features are included:

- **Soft Start**

Poorly designed bias-tees have a potential problem that could damage a connected receiver. When the DC is first applied, a situation can exist causing a voltage pulse

to be applied to the receiver as the isolation capacitor charges. The CIU contains soft start circuitry that avoids this and protects your receiver.

- **Opto-Isolation**

To keep unwanted RF noise to a minimum, the USB interface is opto-isolated from the rest of the circuitry.

- **Attenuator**

The CIU contains a four-stage attenuator (0 dB to -18 dB in -6 dB steps). Additionally, there is an isolation setting that disconnects the receiver and terminates it in 50 Ω.

- **Baseband filter**

A permanently in-line five-pole high pass filter greatly reduces feedthrough of baseband LCU control data to the receive port. The rollover frequency is around 20 kHz.

1.2.4 Modes of Operation

Aziloop is controlled by a dedicated program (app) running under a user supplied Windows 10 or 11 PC. The app is multi-mode.

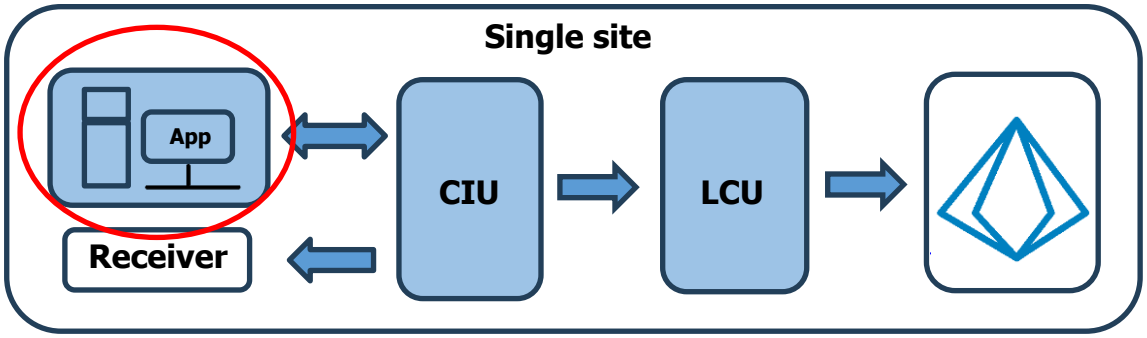
The available modes are:

		Mode	Use
1		Local	For single site operation
2		Local Demo	Simulates local hardware (CIU).
3		Client	The user end of a remote link
4		Server	The antenna end of a remote link
5		Server Demo	Simulates server operations

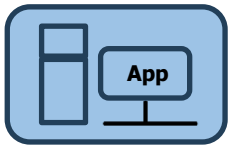
Additionally, there is in effect a sixth mode where the CIU server can operate stand-alone i.e. no local PC app needed once set up.

1. Local mode

This is the mode for single site operation.



2. Local Demo mode

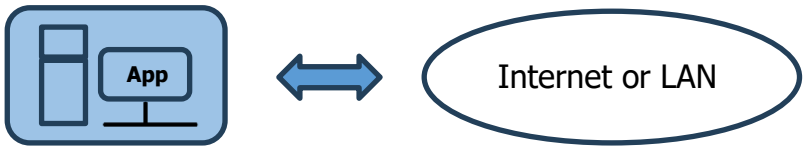


All functions are simulated within the app. No Aziloop hardware required.

Note: for all remote-control modes where the receiver is sited somewhere else, you will need to separately arrange for your receiver to also be remotely controlled, possibly using an app on the same PC the Aziloop server runs on.

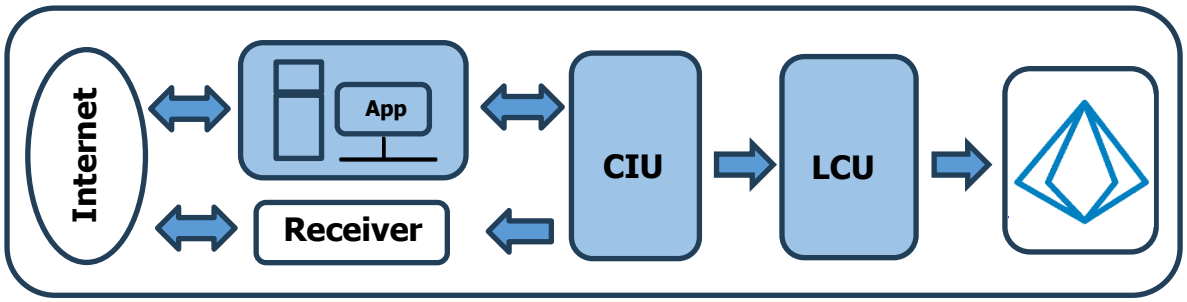
3. Client mode

The user end of a client server link. No hardware is required at the client end.

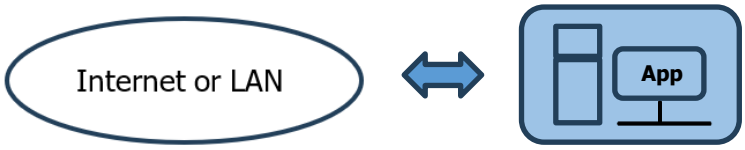


4. Server mode

App set to Server mode. The antenna end of a client server link.



5. Server Demo mode

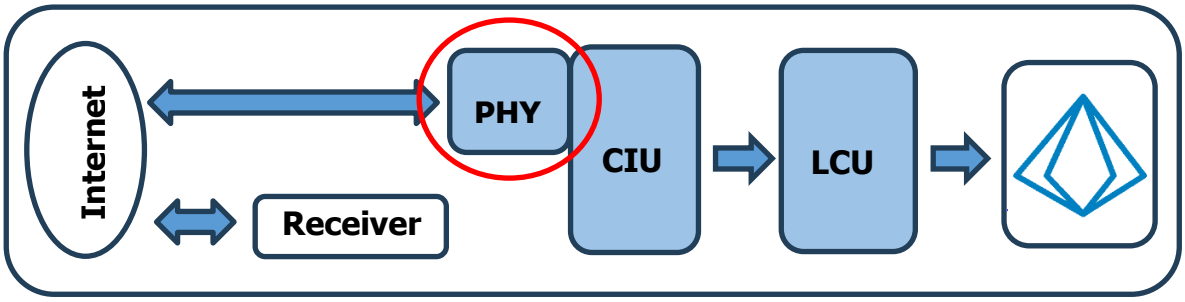


App in Server Demo mode. No Aziloop hardware required.

6. CIU Server config.

Stand-alone server using the CIU RJ45 Ethernet connection. Once set up the PC / app are not required at the server end.

The CIU, operating as a UDP Server, can be connected to a local or remote network using the Ethernet RJ45 socket.



Out-of-the-box settings

IP: 192.168.1.73, Port: 8022, DHCP: Off,

Mask: 255.255.255.0, Gateway: 192.168.1.1

The CIU Server is configured via the USB interface.

2.0 USER INTERFACE (UI)

From the outset, Aziloop was designed to be controlled from a computer screen, where features can be easily added that would be challenging to include later if a physical control box was used.

We have aimed to create an intuitive, clutter-free display, with a comprehensive range of settings and customisations just below the surface. You can use the ones that suit you and disregard the rest.

Navigation

The interface is designed for computer mouse control (or something that emulates it). Use is made of both right and left mouse buttons as well as the scroll wheel.

In this guide left click is written as 'click' in isolation or 'left click' if in the same paragraph as 'right click', to avoid ambiguity. Right click is always written as 'right click'.

The Complete UI (All panels visible)

The UI is divided into panels, the largest being the Compass panel. The Compass panel is the centre of operations and is always visible unless you minimise the app itself. All other panels can be hidden if preferred.

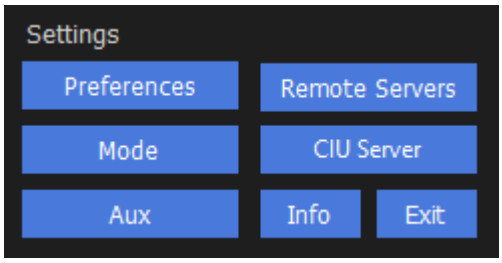
Title Bar – Standard Windows title bar with close 'X'.

Menu Bar

The Menu Bar contains the settings gear icon and is also used to display status messages e.g. "Powering Down", "Connected", "Memory 1 Loaded" etc.

The Gear Icon (Settings)

Everything that is user configurable is accessible from the Settings icon in the Menu Bar. Settings opens a selection panel thus:



Tip: Right click the gear icon to open the Preferences Panel directly, bypassing the above step.

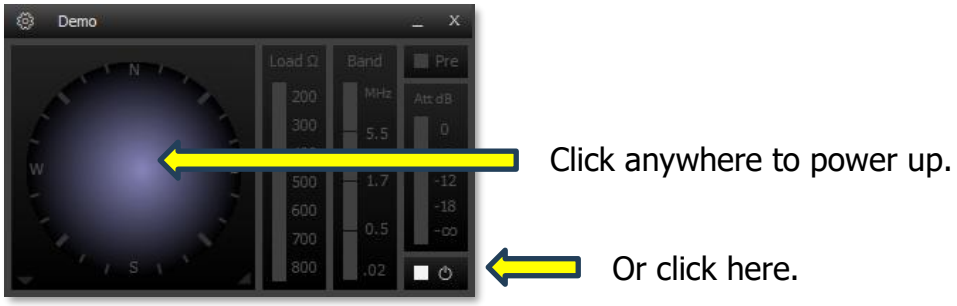
See the Section 3. Settings for a description of all the Settings options.

Starting the Aziloop app

Start the app like any other Windows program. Unless Autostart is enabled (Preferences > Pref 1 > Start > Auto), when the app loads it is in standby mode (i.e., available but not operating. No power is applied to the LCU).

LCU Power-Up

In Local mode or PC Server mode apply power to the LCU by clicking the Power icon (lower right) or click anywhere in the circle in the Compass panel. The UI then changes to enable all controls, and power is applied to the LCU.



Use the compass method above to start Aziloop when the levels panel (containing the Power icon) is hidden.

Aziloop can either restart centre-screen, or where you left off. See Section 4.1

LCU Power-Down (Standby)

Click the Power icon to place the app into standby and remove LCU power. In Client mode the icon disconnects the link to the server.

If only the compass panel is visible, choose the Standby option from the Compass panel options (shown below)

Closing the Aziloop app completely

Click the 'X' button on the Title bar or Menu bar.

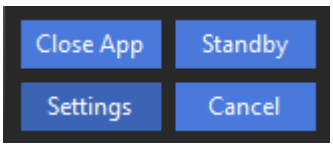
If only the compass panel is visible, you can expand the UI to show the levels panel and power off from there, or choose the Standby option from the Compass panel options (shown below)

Avoid closing down Aziloop from the Windows taskbar because if the LCU is powered it will stay powered after the app is closed, with the CIU LED remaining lit.

Compass Panel Options

When operating with just the Compass panel visible, you can close the app or to go standby without having to expand the UI to reveal other panels. Right click the Title / Menu bar selector to reveal the Options panel.

Title / Menu Selector



Options Panel

UI positioning

Drag the window using either the Title bar or the Menu bar.

Controlling Panel Visibility

Panel Selector Controls

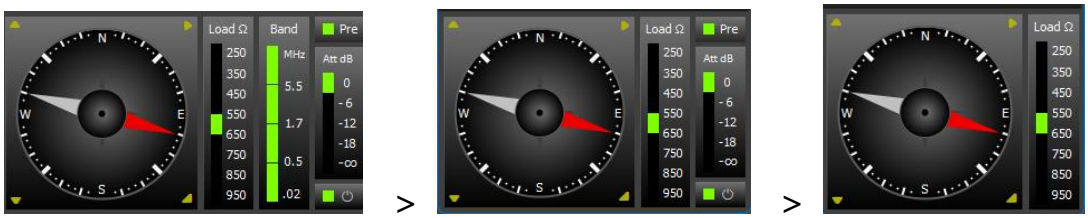
The arrows in the compass corners are panel selector controls. Except for the Compass panel itself, all panels in the UI can be hidden or revealed by clicking these controls.

Showing the Title and Menu Bars

The top left selector controls visibility of the Title and Menu bars. Successive presses change the display between three states: both bars visible, Menu bar only and neither visible.

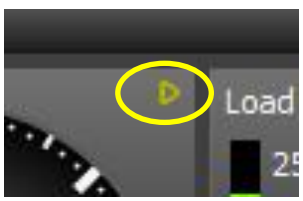
Showing the side panels

The top right selector controls the visibility of the three side panels. From a position of all side panels visible, successive clicks of the selector begin to collapse the side panels in a fixed sequence before finally displaying all panels once more in a round robin fashion. First the Band panel is hidden, then also the Levels panel – leaving just the Load panel, then finally all three are hidden again. Right click reverses the direction of the sequence.



Note: when the Aux panel is visible, the selector is hidden, as the full side width is needed for the Aux display

Note: When a filter segment is enabled and the Band panel is hidden, the selector becomes hollow to denote a filter is in circuit. This avoids confusing filtered signals with low band activity if you forget a filter is enabled.

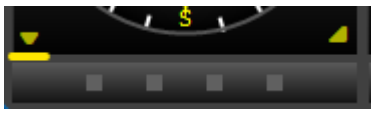


Hollow symbol indicates a filter is enabled.

Showing the Memory Panel

There are 4 memories that save all parameters for instant recall, with a toggle function for signal comparison. See the 'Memory Panel' section for full details.

Click the lower left arrow to toggle the Memory panel. Right click the arrow to also toggle the Aux I/O panel at the same time.

 left click.

right click.

Showing the AUX (Auxiliary I/O) Panel

The Auxiliary I/O panel is located underneath the main side panels and is only visible when you want it to be, by using the selection arrow (underlined in yellow in the above figure).

Two independent auxiliary I/O channels are provided.

The channels can be independently configured as inputs (Monitor), outputs (Control), or Mute in / Mute out ports.

Memory / AUX panels and UI symmetry

To preserve UI symmetry, panel placeholders will be visible even if the panel controls are not. For the same reason, when the Aux I/O panel is visible the three main side panels above it also become visible. Also, the side panel control arrow (top right in the compass panel) is hidden because you can't collapse the side panels with Aux I/O present.

If you had less than all three side panels visible before you enabled the Aux I/O panel, when you cancel the Aux I/O panel the display will revert to the previous state.

Right clicking either the Memory or the Aux I/O panel selectors closes both panels It's probably easier to deduce the operation yourself by experimenting with left and right mouse clicks.

2.1 Antenna Control - Compass Panel

The Compass panel is where you control the antenna heading (or azimuth) and select the antenna mode (K9AY or Loop). The compass needle represents the electrical heading of the antenna, not the physical position of the loops – they never move.

It is also the centre of operations in that the visibility of all other panels is controlled from the Compass panel.

We suggest you try out the functions in the actual app while reading this section.

Overview

Aziloop uses the position of the mouse pointer in the Compass panel to determine the action to take when the mouse is clicked. Use is made of left mouse click (i.e. a normal click), right click (both short and long press), and the mouse scroll wheel. For most operations the radial distance from the compass centre is key, and so the compass can be represented as a series of concentric zones as in 1-4 below

Note:

If 5, 6, 7, and 8 appear as dots you are probably running Windows 10 and haven't installed the TTF font as detailed in the installation notes.

The Settings cogwheel will also be a dot. See Section 6.1.

1. Loop mode selection zone
2. Null axis toggle zone (when enabled)
3. K9AY mode selection zone
4. K9AY mode selection zone with preview degrees (when enabled)
5. Menu Bar and Title bar panel selector
6. Memory panel selector
7. Side panel selector
8. Aux I/O panel selector

The rest of this section covers operation of the Compass panel in detail.

Heading pointer

There is a heading pointer that follows the mouse around the circumference of the compass rose. This can assist with alignment on a particular heading.

2.1.1 Changing Antenna Modes

Aziloop can operate in two antenna modes, K9AY mode and Loop mode, with the ability to switch rapidly between them.

In K9AY mode the antenna operates as a terminated loop to give a uni-directional cardioid pattern (at low angles) with a null to the rear. In Loop mode the antenna operates as a small loop with a bi-directional pattern at low angles (with a null at right angles to the loop axis), and an omni-directional pattern at high angles.

Changing Modes

Click anywhere outside the centre circle to select K9AY mode.

Click anywhere inside the centre circle to select Loop mode. The centre 'pivot pin' enlarges when you are in the Loop mode zone.

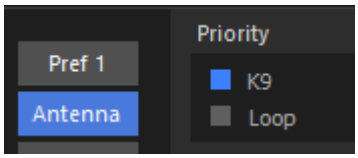
K9AY mode selected

Loop mode selected

Bi-directional Loop mode is indicated visually by both pointers becoming red (or whatever colour you have set from the Palette settings).

Mode Priority

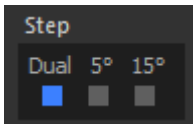
By default, the mode priority is K9AY mode (unless changed in Settings > Preferences > Antenna > Priority). For DF work in Loop mode, you can select Loop priority. You can click on a heading anywhere and the mode will stay in Loop mode.



Tip: You can force a temporary change back to K9AY mode by repeatedly clicking the centre circle area which puts the app into 3-way toggle mode (Loop, K9AY and reverse K9AY). Stop when K9AY mode appears then use the mouse wheel to rotate the heading. Clicking reverts to Loop mode.

2.1.2 Changing Headings

There are several ways to achieve this. Any method can be used according to preference. They are listed here in order of amenity.

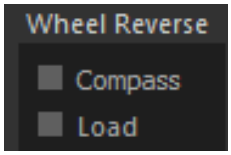


The step size is either 5 degrees or 15 degrees (or both) as set in Preferences>Antenna>Step

Method 1: Using the mouse scroll wheel

Move the mouse anywhere within the compass rose and use the scroll wheel to change direction clockwise or anticlockwise. The mode (Loop or K9AY) will be maintained. In Dual mode, mouse wheel rotation is speed sensitive – see below.

Scroll wheel direction



The direction can be reversed by enabling Preferences>Pref 1>Wheel Reverse.

Method 2: Using left and right mouse clicks

Click on a heading, then hold the mouse on that heading and right click. This puts the app into rotate mode, which, if you maintain mouse position, allows you to left click to rotate anticlockwise and right click to rotate clockwise. Clicking a different heading will cancel rotate mode until you re-trigger it by right clicking another heading.

Holding either mouse button down causes the app to go into auto-rotate mode until you release.

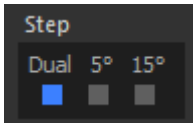
The mouse-click method defaults to 5-degree steps with Dual Step enabled allowing you to make small changes with a single click.

Method 3: Direct heading selection

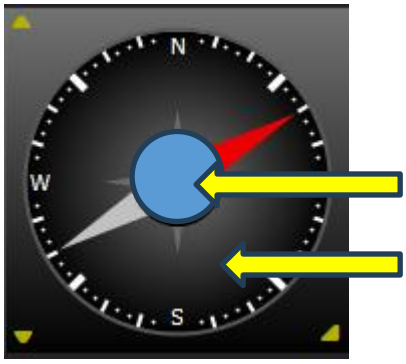
You can click anywhere outside the centre circle but for accurate selection move the mouse to the edge of the rose so that the heading assist marker appears.

You can't directly select a heading from the centre circle, so this method selects K9AY mode first. Then re-select the centre circle. Alternatively select the antenna priority to Loop. (Preferences>Antenna>Priority).

2.1.3 Mouse Wheel Scrolling with Dual Step



With Preferences>Antenna>Step set to Dual, the scroll rate changes depending on the mouse wheel scroll rate. Currently it is always 5-degrees in the centre circle. See below.



Always 5-degree scroll area

5-degree or 15-degree speed sensitive scroll area (mouse wheel).

The dual speed mouse wheel feature allows you to quickly rotate to a rough heading then fine tune to a precise heading without need to move the mouse position.

Dual is the default setting.

2.1.4 The two-way toggle (K9AY mode)

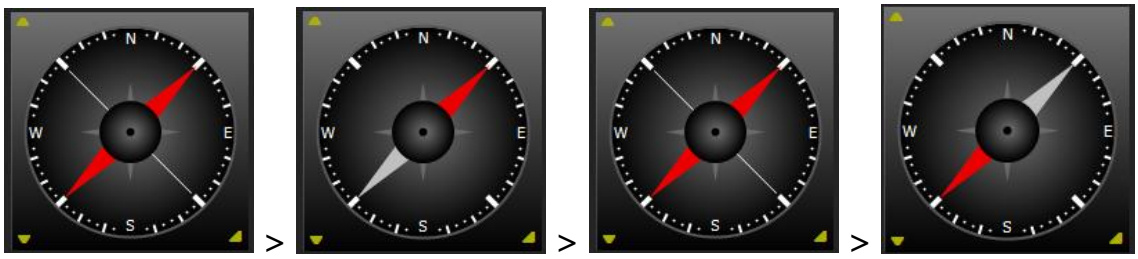
Click on a heading. Then click the same heading again. The compass needle now flips to point in the reciprocal direction. Click again to toggle back to the original heading and so on. This allows a quick comparison between front and back reception in K9AY Mode.

click again

Note: if the next click is a right click, you are enabling Quick-Step mode, and the antenna rotates to the next step clockwise. Rule: on a new heading, it's Left click to toggle, right click to rotate.

2.1.5 The three-way toggle (from Loop mode)

Click on the compass centre to select Loop mode then click the centre again until K9AY mode is selected on the same axis. Click again to go back to Loop Mode. Click yet again to return to K9AY mode but this time in the reciprocal direction. Continue clicking to sequence between the three states.



2.1.6 DF Assist Options

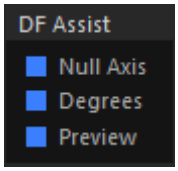
When attempting to locate a station by DF (Direction Finding) the preferred method is to use Loop mode, rotating the antenna for the best null. The station heading will then be along the null axis which is at right angles to the compass bearing.

Avoid K9AY mode for true DF

While K9AY mode can at time produce sharper nulls, the angle at which these occur cannot be relied upon for DF because at many elevation angles the polar diagram of the antenna produces two nulls, one either side of the rear lobe. See Appendix 2 for more antenna information.

Three DF Assist options are provided to make it easier to determine headings. They are located in the Antenna section of Preferences.

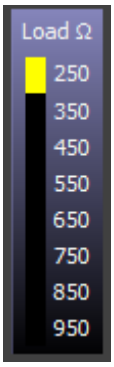
Settings > Preferences > Antenna



For a full description of DF assist please see Section 4.2

2.2 Load Panel

In K9AY mode the antenna operates as a terminated loop. The load value often quoted is 450 Ω, but a fixed value is not necessarily the optimum for your installation or use case and a range of values is more useful.



There are 15 termination values available from 250 Ω to 950 Ω, selectable in 50 Ω increments. The end values will rarely be used but offer the satisfaction of being able to 'tune through' the optimum value.

Hover the mouse anywhere in the load panel and use the scroll wheel to change value (recommended method).

Alternatively select a load value by clicking on it. Then, having selected a value, continue to left or right click the same position to scroll the value. You can also left or right click the Load Ω label.

If you hold the left or right mouse button down for > 500 ms the load value automatically increments or decrements. But it's far easier to just use the mouse scroll wheel.

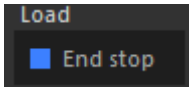
In Loop mode the Load value is not relevant and can't be changed.

Optimum value

When using Aziloop in K9AY mode for DX listening there will often be little to choose between adjacent load values when comparing front-to-back ratios. In any case the usual rapid fading on such signals makes optimisation a challenge. The most noticeable effect is when unwanted signals can be placed in the 'sweet spot', which is the notch between the forward and the rear lobes. See the K9AY party trick in Appendix 2 for more information.

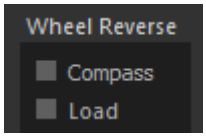
An appreciation of the K9AY lobe pattern will explain why the front-to-back ratio varies markedly depending on arrival angle and is poorer at higher angles.

Load end stop



Select Settings > Preferences >Pref 1 > End Stop to prevent the load value wrapping round again from the opposite end of the range.

Reverse



Select Settings>Pref 1>Wheel Reverse to alter the mouse wheel direction according to preference. Separately selectable for Compass and Load panels.

2.2.1 Compass panel Load

To minimise the UI footprint when required (e.g. to place on top of an SDR UI) you can hide all other panels to leave just the Compass panel visible. To maintain access to the Load control, a load adjustment windows now appears in the compass rose.

Adjustments can be made using mouse clicks or the mouse scroll wheel. Automatic increments also work when you keep a mouse button pressed.

To maintain the 3D illusion the compass needle passes over the load value and may obscure it, but mouse-over reveals the complete value.

Move the mouse pointer over the load window. The angle is now completely visible.

2.3 Band Panel

The Band panel, or pre-selection/roofing filter panel if you prefer, controls three selectable seven pole filters - two low pass, and one high pass. The 'upper' low pass filter overlaps with the high pass filter to create a band-pass filter when both are enabled. The filters themselves are housed in the LCU prior to the switchable preamp.

If you don't need the filters don't use them, but they are there for when you do. For instance, many listeners are unfortunate enough to live close to high power LW/MW broadcast stations that can play havoc with sensitive receiver frontends, and many shortwave broadcast stations can generate punishing signal levels in the early evening.

Note: The app now includes an Omni-Rig interface, with the ability to enable filter tracking with frequency.

Frequency visualisation

If a band sector is lit, you can hear things in that sector.

The bar is divided into four sectors. There are four filter options, with some lighting more than one section. When all sectors lit, no filters are in use. Response is then from 20 kHz to beyond 30 MHz. Move the mouse over the bars to preview the filters.

20 kHz to 500 kHz low pass filter

Click the .02 to 0.5 Sector to select the 500 kHz 7 pole low pass filter. This is useful for VLF listening and NDB DXing etc. to minimise overload from strong MW broadcast stations or elevated HF signals at night-time. The frequency was chosen to just include the 472 kHz amateur allocation as well.

20 kHz to 5.5 MHz low pass filter

Click the second sector up, marked 0.5 to 1.7 to select the 5.5 MHz low pass filter. In addition to the sector you clicked, the display shows all three sectors that are now open.

The 5.5 MHz edge was chosen to just include the 60 m amateur allocation. The 40 m amateur band didn't make the cut as the 7 MHz and 9 MHz broadcast bands are too close.

1.7 MHz to 5.5 MHz band pass filter

Click the 1.7 to 5.5 sector. In this case you will see just that sector lit, even though there is no actual band-pass filter for that sector. Aziloop is automatically selecting the 1.7 MHz high pass filter and the 5.5 MHz low pass filter together, creating a band-pass region where they overlap. For many amateur radio users this will be the filter of choice as it covers the 160 m, 80 m and 60 m bands.

1.7 MHz to 30 MHz high pass filter

Click the top sector. In this case you will see the top two sectors lit. This is a good option if you suffer from strong nearby LW and MW broadcasts and have no interest in listening below 1.7 MHz.

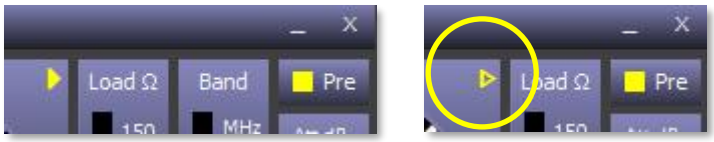
Bypassing the Filters

Click the selected filter a second time to bypass all filters. Repeated clicks toggle the filter in and out.

<**Tip**> the 'Band' label also acts as a bypass toggle button. Successive clicks toggle between the last filter selection and no filter.

"How do know a filter is in if the Band panel isn't visible?"

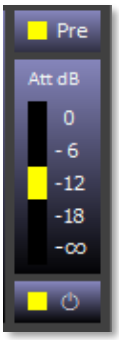
The 'panels' arrow becomes hollow if a filter is active and the Band panel is hidden.



Bear in mind you need to keep note of the filter state otherwise bands can seem strangely quiet!

2.4 Levels Panel

This comprises three sub-panels – preamp, attenuator and on/off.

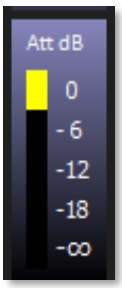


The Levels panel permits the user to achieve the best combination of signal level and sensitivity depending on receive conditions and the capability of the receiver. Once the best signal to noise ratio is achieved there is little point in increasing levels further. Some SDR receivers have a signal-to-noise meter which can be useful in determining the correct level.

Preamplifier

Clicking 'Pre' selects or de-selects the (nominally) 18 dB gain balanced preamplifier, located in the LCU after the band filters. A permanently in-line low pass filter kicks in above 30 MHz to reduce the chance of overload from local Band II broadcast or other VHF services (or indeed your own higher frequency transmissions.

Attenuator



The attenuator sub-panel controls the switched attenuator located in the CIU. Select 0 for no attenuation, or -6, -12 or -18 dB as preferred.

Together with the Preamplifier, you have around 36 dB of level control at your fingertips.

Click a level directly or left / right click to step through levels.

Receiver isolating – the infinity option

The infinity option disconnects the receiver from the Aziloop circuitry and terminates it in a 50 Ω (actually, 54 Ω) load. Handy for locating any noise sources, or manually isolating the receiver. This is also the attenuator state when PTT Mute is active unless silent mute is selected.

Start / Stop or Connect / Disconnect Button.

 Start/Stop  Connect/Disconnect

The action depends on the current mode of operation:

Local Mode

In Local mode the button controls power to the LCU.

Start button in Client mode

In Client mode the button icon changes to the link symbol. The button is used for managing the remote server connection.

Connection:

The button either initiates a server connection directly or opens the Client IP Manager panel for a server to be selected, depending on the 'Auto Connect on Start' setting in the Client panel. This is covered in more detail in the Client Server Operation section.

Disconnection:

Clicking while connected drops the connection to the remote server.

Start button in Server Mode

In Server Mode the button and starts or stops the app, applying or removing power to the LCU in the same way as Local mode.

Note: even with the app stopped (LCU off), an incoming Client connection will power-up the LCU.

In Server mode the UI can be operated locally as if it is in Local mode. When a connection from a client exists, any changes made at the server end are conveyed to the client end and the two UIs stay in sync.

2.5 Memory Panel

 Click to toggle the Memory panel.

The Memory panel is located underneath the Compass panel and is only visible when you want it to be, using the selection arrow. It allows you to essentially take a snapshot of the UI state for recall later. Each memory also stores the Aux I/O state which will be reproduced on memory recall.

Saving to a Memory

Right click one of the four Memory buttons and hold down for > 500 ms. The delayed action helps prevent inadvertent over-writing.

The memory name is displayed briefly in the Menu bar even if Preferences > Pref 1 > Memories > Names is disabled.

There are four independent memories. As with many Aziloop functions, use is made of left and right mouse buttons, in this case left click to recall a memory, right click for > 500 ms to save a memory.

Hover your mouse near one of the Memory buttons and it will light up to indicate it's now selectable. You will also see a name panel appear unless Preferences > Pref 1 > Names is de-selected.

Recalling a Memory

Click any one of the four Memory buttons. Aziloop parameters now change to the stored values. The button stays lit until a new command (heading, load etc.) is selected.

Memory Toggle

Click the same memory again to toggle back to the previous settings. The memory LED stays lit until it becomes invalid (when you alter something e.g., a new Load value).

Naming a memory

Assuming Preferences > Pref 1 > Memory > Names is enabled, when you save to a memory, a cyan text box with the memory name appears. Move the cursor with the keyboard arrow buttons or backspace and start over. Press Enter on your keyboard when done.

Aux I/O

Each memory also stores the Aux I/O state as long as the channel(s) are set to 'Control' in Settings>Aux.

The I/O state is recalled as long as Pref 1>Memories> AUX I/O is enabled, and the channels are set to 'Control'.

Why Memories?

Some examples:

- Off-Axis toggle:

  If co-channel stations can be separated but they are not on the same axis (so 2-way or 3-way toggle won't help) or not 90 degrees apart (so the null-toggle won't help), store the setting for one station in a memory then set the compass up for the other one. Press the memory repeatedly to toggle between the two.

- Set a reference:

  Store the settings for a known station as a reference or store the settings for your favourite frequency.

- Unattended operation – see Azi-Auto feature.

  This allows different headings etc to be automatically switched-in when trigger times are reached. Because the memories can also store the I/O channel state and reproduce it on recall, I/O lines could for instance be used to automatically select different antenna or different receiver.

  Azi-auto was an add-on suggested by Steve VK5SFA. He uses it to alter Aziloop headings overnight as propagation changes while he records LF DX happenings, to review next day.

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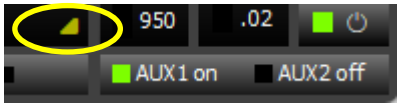
2.6 Aux I/O Panel

Two undedicated auxiliary I/O channels are included for use as inputs or outputs. They can also be enabled as PTT inputs and outputs to protect Aziloop (and your receiver) during transmit. See the Settings >Aux section for full details.

Showing the Aux I/O Panel

Click the lower right selector to toggle the Aux I/O panel, or right click to toggle the Memory panel at the same time. The main side panels become visible when the Aux panel is shown, to preserve UI shape. Side panels revert to their previous state when the Aux panel is removed.



The Aux 'LED' on / off colours can be changed in the Palette Manager.

The Aux panel setup information can be reached via Settings >Aux.

AUX settings shortcut

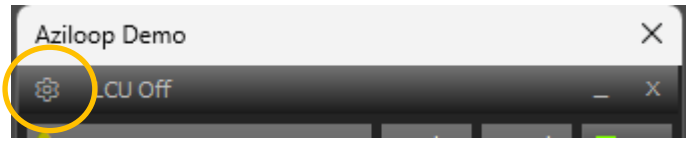
Right click either Aux I/O channel name label to directly open the AUX setup panel.

3.0 SETTINGS

If you remember nothing else:

All settings are reached via one place, here on the Menu bar:

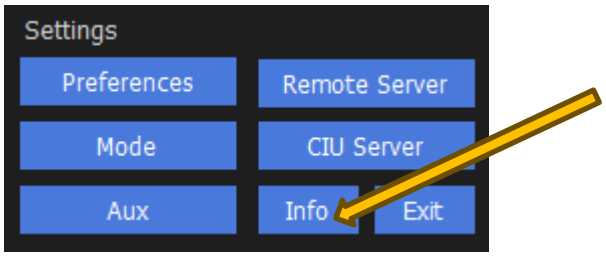
(If you see a dot instead of a cogwheel icon, you are probably running Windows 10 or earlier, and need to install the font supplied in the setup.zip package)



Click to open the Settings panel.

Click the icon again to hide the panel or press the 'Exit' button in the panel.

Settings Panel



Hover your mouse over Info to see the COMport in use.

Long press Info to restore settings to defaults.

Preferences shortcut

Right click the Settings icon to go straight to Preferences. One less click.

Reset Aziloop to default settings

Long press the Info button for > 2 seconds to restore defaults. Restart the app if it doesn't auto start

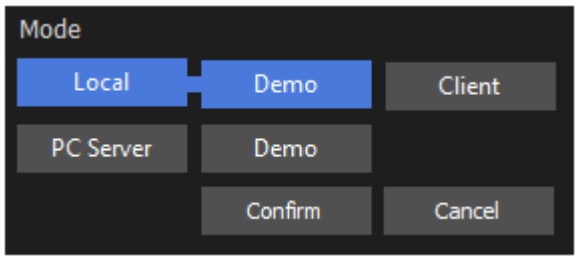
Which COMport?

Hover over Info to see the COMport in use.

Sections 3.1 to 3.6 below describe each Setting option in turn.

Sections 4.n describe the Preferences options.

3.1 Settings - Mode



This is a key setting as the mode defines the way the app operates. There are three main modes, Local, Client and PC Server. Local and Server modes also have a Demo option where no hardware is required. Client mode doesn't need a demo option as no hardware is needed at the client side anyway. Select the required mode then press 'Restart'.

CIU Server is an additional mode using the CIU's built-in UDP server. It is configured from the Settings panel, and once set up, runs separately (or alongside) the PC app.

On first installation the default mode is set to Local-Demo.

Local and Server modes need a valid USB port to communicate with the CIU, as does CIU Server during configuration. If no port has been defined you will be prompted to set one.

Local mode

For most users, Local mode will be set then never altered. This is the mode for single site operation with a direct USB link from PC to CIU. The other modes are used for client server (remote) operation, which is covered in detail in Section 5.

More than one CIU?

Right click Local (from any mode) to manually change the target COMport.

Client mode

When the operator is located at a remote location, assuming an internet link is possible, Client and Server modes are used (one PC at each end). Select Client mode at the operator end and Server mode at the antenna end. You'll also need to configure your router at each end for this to work (see Section 5.).

To just test the link, set the mode at the Server end to Server-Demo which runs without a CIU present.

Alternatively, the antenna end can use the CIU's built-in server if a PC is not otherwise required.

Server mode

Server mode is used at the antenna end of a client server link. You'll also need a PC at the Client end running Aziloop to make the connection. You'll need to configure your router at each end for this to work (see Client Server section).

Once Aziloop loads it is available to clients. You don't need to press 'On'. The link setup handshake manages LCU power-up.

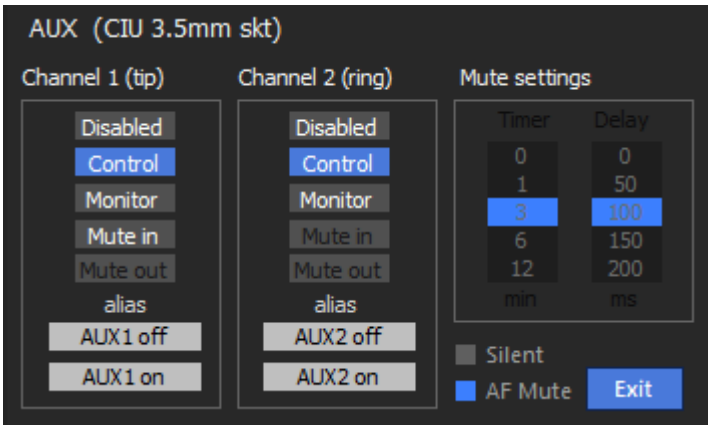
If you do elect to press 'On' then power is applied to the LCU when the Server is in standby (un-linked) mode, which may be preferable in cold conditions. At the Client end, the 'LCU off on dis-connect' option in Settings > Server Selector allows the client to control the LCU power when closing the link.

To test out a link, set the mode at the Server end to Server_Demo which simulates a CIU.

3.2 Settings – AUX

Shortcut: Right click a channel name in the main display to open AUX settings.

Two I/O channels are provided in the CIU. The Aux Configuration panel is used to set what the channels do. Until altered they initially present as 'Disabled' (in Demo mode they always simulate 'Control').



Channel 1 and 2 settings are identical but interact when mute is selected. I.e., you cannot select Mute out unless Mute in has been selected on the other channel first. Both channels can be set to Mute in.

Selecting Mute in (or also Mute out) enables the Mute settings panel – discussed separately below. Current mute panel settings are shown even when disabled.

Physical

The physical interface for the channels is the 3.5 mm socket on the CIU. The tip is Channel 1, the ring is Channel 2, with the sleeve as the common negative, which is the 13.8 V negative rail. The CIU case is also connected to 13.8 V negative.

Aux channel Options

Disabled: The default setting. No control or monitoring function. The I/O pins are still live with around 4.3 V present when floating.

Control: Allows the state of the I/O channel to be altered. If the state is altered externally this is also detected and displayed.

Monitor: External control inputs are detected. No control is possible.

Mute in/out, Silent, AF Mute: See Section 3.2.1 Mute Functions below.

Alias: The name of the channel can be altered for both On and Off. It is effective in Control and Monitor modes. It is preset in the other modes. There are two fields per channel. The upper field is shown when the channel is Off and the lower when the channel is On. To edit the name, click on the field and alter as required. The new name is saved on exit.

Action in Client mode

The I/O configuration cannot be changed from the Client side. When connected to a server, the Client I/O configuration inherits the settings defined by the server. Currently this does not include the channel alias.

Electrical

The tip and ring connections are combined inputs and open drain outputs. The sleeve connection goes to the negative rail of the 13.8 V feed. If you introduce circuitry powered from other sources pay attention to earthing to avoid current loops that may affect the receiver noise floor.

Aux channel as Input:

Applies to Control, Monitor, and Mute In modes.

Grounded = On. Unterminated = Off.

Standing voltage 4.3 V.

Short circuit current 4 mA.

On / Off thresholds:

- For reliable On: Shunt resistance < 100 Ω.
- For reliable Off: Shunt resistance > 1 kΩ.

A 1N4148 diode in series will still enable the On state. Useful when combining PTT lines.

Aux channel as Output:

Applies to Control and Mute Out modes.

Grounded = On. Open circuit = Off

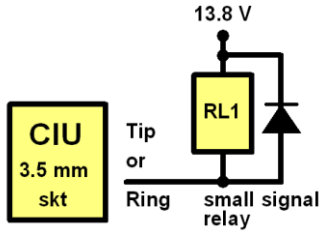
There is a standing voltage of 4.3 V present unless overridden by a higher external voltage. (internal diode isolation on 4.3 V)

Open drain operation. Max sink current 50 mA @ 13.8 V (abs max +24 V)

- Do not connect I/O lines directly across a power supply.
- Always use a relay driver board or external device for high power switching.
- Place a reverse diode across the coil of any directly connected signal relays.

Control (or Mute Out) example:

The channels will easily operate a 12 V low current signal relay with a typical coil resistance of 1 kΩ. Make sure you fit a suppression diode across directly connected relays. Do not sink more than 50 mA.



When switching circuits other than low current common earth circuits, the recommended solution is to use a relay driver board (example pictured below) that has a driver device included. These are readily available from many outlets.

Typical 2 channel relay board.

Monitor (or Mute in)

Unconnected, the channels present approximately 4.3 V at the tip and ring connections. This is the 'Off' state.

Pulling the channel to ground creates the 'On' state. Anything less than 100 Ω to ground will reliably produce the 'On' state.

The colours representing on and off can be changed using the Palette Editor.

<Tip> Right click on either channel name to go to AUX settings.

Note: When configured as Control, the Aux channels are also monitoring the channel and will show level changes caused by parallel connected external circuitry such as an external PTT line.

Can I be sure it's working?

The Aux channels function as combined inputs and outputs. So, when you activate a Control channel (and see the colour of the button change), that physical Aux channel itself is detecting the electrical change via its input circuitry, and it is this signal, fed back from the CIU, that changes the colour of the Aux button indicator, i.e., the Control channels effectively monitor themselves. This is also the case in Client Server operation, giving the remote operator confidence an action is successful.

Aux operation in Client Server mode

At the client end of a link there is no CIU, and the Aux I/O settings cannot be altered. However, when a link is active the Aux I/O settings of the server are conveyed to the client. Thus, if the server has both channels set to Control, the client end will be set similarly. Remote operation of the Aux I/O channels from the client end is therefore possible if permitted by the server Aux I/O settings.

Changing the Channel Name (Alias)

Each channel can be renamed in Control or Monitor Modes. Click the text boxes and edit as required. The names are pre-set in Mute in, Mute out and Disabled modes.

3.2.1 PTT Mute Functions

At transmit capable sites, to help protect Aziloop and any connected receiver from possible damage from excessive RF energy, the built-in muting facility should be used. Selecting 'Mute in' as the control mode allows an Aziloop Aux input to be placed across the PTT bus to detect a key-down. 'Mute out' allows Aziloop to 'regenerate' the PTT signal ensuring no further downstream actions can take place without Aziloop being muted first. There are also some extras built in by way of a Mute out delay and a Mute timer.

Note: During muting the loops cannot be disconnected entirely, though RF from the loops is reduced as much as possible, and the preamp is disconnected. Before that happens, the CIU isolates the receiver port, terminating it in 50 Ohms (this is the same as applying the 'infinity' attenuator setting).

Do not rely on muting alone. Your first line of defence is physical separation from the transmit antenna.

Mute In

When activated, Mute in isolates the receiver in less than 10ms, and the LCU enters Mute mode 35 ms later. Recovery times are similar.

Mute Out (Open drain)

When enabled, Mute out goes low immediately, or after a preset delay period following a Mute in signal.

The safest way of operating is to connect the Mute in to the line that would normally key the transmitter, and arrange for Mute out to key the transmitter instead, preferably with a delay if the transmit requirements can accept it.

In practice the best compromise may be to attach Mute in to the PTT out signal that most transceivers provide, and if you use an external linear, instead of keying that via the transceiver's PTT out, key it via the Aziloop PTT out instead. In this setup a PTT out delay may not be appropriate due to the risk of hot switching unless your transceiver has a transmit delay

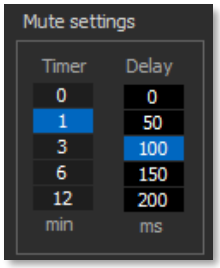
In any case, the first line of defence against RF overload should be the physical separation between the Aziloop antenna and the transmit antenna(s).

Mute Options - dependencies

Mute out per channel is not enabled unless Mute in is selected in the other channel. The Mute timer, Silent and Audio are not enabled unless Mute in is selected. Delay is not enabled unless Mute Out is enabled.

Both channels can operate as Mute in concurrently but clearly you can't have both channels as Mute out. If you only need one Mute in you can do something else with the other channel or disable it.

Mute Settings



The Mute Settings sub-panel exposes two additional settings as described below. Timer is only active when Mute in is selected, and Delay is only active when Mute out is selected.

Mute Clock or PTT 'talk timer'

Whenever Mute in is active a 'mute clock' appears in the Compass panel indicating the 'key down' time in minutes and seconds.

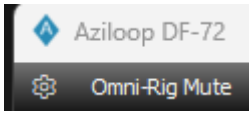
Mute Timer (or Talk Timer) progress ring

Any Timer setting other than '0' enables a time progress ring along with the Mute Clock.

The Compass perimeter becomes a time ring, with 360 degrees representing the complete time-period set. i.e., if Timer is set to 3 minutes, then the time ring completes a revolution in 3 minutes. The colour (red here) is taken from the Compass pointer colour setting.

After the timer completes one revolution the time ring then stays visible, and turns red if previously not red. The time digits carry on incrementing until Mute is released.

The PTT function can also be triggered via Omni-Rig.



This is displayed if the PTT was detected via Omni-Rig.

Mute Delay

This setting defines the time between Mute in being detected low, and Mute out being driven low. Set to Zero for no delay i.e., Mute out is co-incident with Mute in detection.

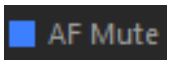
The Mute Delay panel is enabled when Mute out is selected on a channel.

Silent

Normally PTT Mute in sets the attenuator to infinity during transmit. When this is not required e.g. for a transceiver with a separate receive input, enable to remove audible CIU relay noise. LCU muting is not affected.

Use responsibly to avoid damage to connected receivers that are not otherwise isolated during transmit. Recommended for transceivers with separate RX input only.

AF Mute



This setting mutes the PC audio output when PTT is asserted.

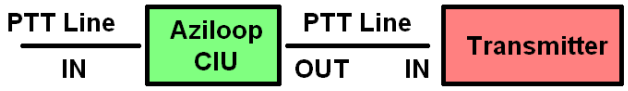
This is a simple AF toggle function. Un-mute the audio with normal PC audio controls if it gets out of step. Useful to prevent feedback when using online SDRs.

AF Mute Menu Bar display

With AF Mute enabled an icon appears on the Menu Bar. You can click this to manually initiate a mute toggle. If mute somehow gets out of step, right click to get back in step.

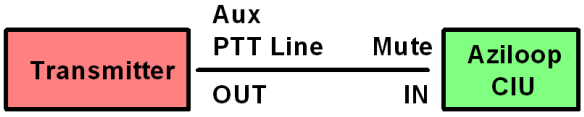
3.2.2 Dealing with PTT lines

Adding Aziloop's Mute in / Mute out lines to a PTT daisy chain can ensure that Aziloop mutes before any potentially damaging RF appears, especially if you add a delay to PTT out.

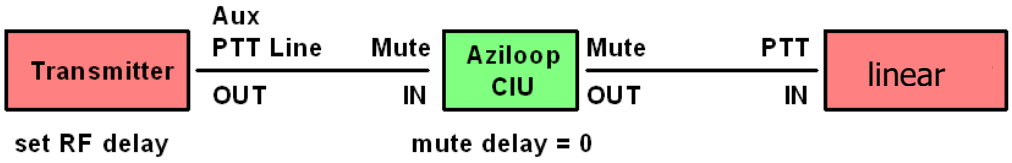


There are potential problems here with most amateur radio transceivers in that you cannot daisy chain the PTT line, it's internal when the front panel MOX or TUNE buttons are used, and even if you broke into the mic lead the MOX / TUNE issue remains.

The best option in practice may be to connect Aziloop's Mute in line to the PTT out pin of the Aux connector that is usually present on modern kit. A lot of equipment also has a settings option to delay transmit RF which could help with timing.



When a linear amplifier is in circuit in an amateur radio installation, the amount of RF present is likely to increase by at least 6 dB (which is double the RF voltage). We suggest the best option is to always key a linear via Aziloop's PTT out. This way you are certain the Aziloop has detected the PTT and acted on it.

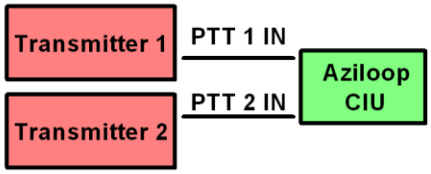


Set the RF hold-off delay on the transceiver to 50 ms if possible and set the Aziloop mute out delay to 0 ms **to avoid hot keying the linear**.

The further apart the transmit and receive antennas are the better of course.

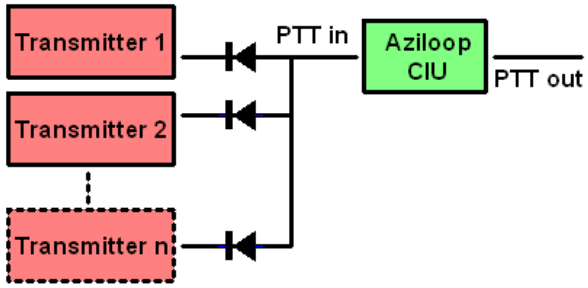
Two PTT lines

If you have two transmitters and can't mix the PTT lines, you can designate both I/O channels as Mute in so they operate logically as an OR gate.



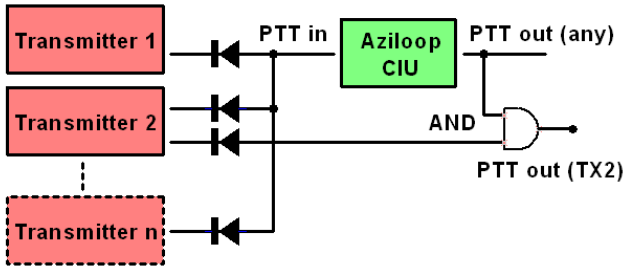
Multiple Transmitters

Alternatively, you can connect the PTT lines from many transmitters if you separate the key lines with diodes, which frees the other Aziloop I/O channel for use as PTT out, or anything else you wish.



Multiple Key Lines

Many configurations are possible, like this suggestion for transmitter specific PTT out lines each keying a separate linear amplifier but only after Aziloop mutes.



Shortcut: Right click either Aux I/O name label in the main UI to open the Aux setup

3.3 Settings - Info

Hover over User Guide for current revision number.

Issue number is the suffix

Note: You need to be online for the Info panel to work correctly

User Guide

Click **User Guide** to download the Aziloop User Guide (this document). It is a PDF viewable directly from your browser or you can download it. Best to always view online to be sure you're seeing the very latest info.

Azi-News

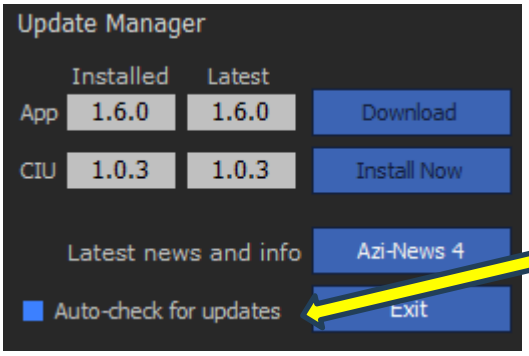
Online alerting method to inform users of app or firmware updates, or new products.

Website

Click to go to the Aziloop website.

3.3.1 Code Updates

Press Update Manager to open the panel. This allows you to download the latest app, or to update the CIU firmware if a newer version is available.

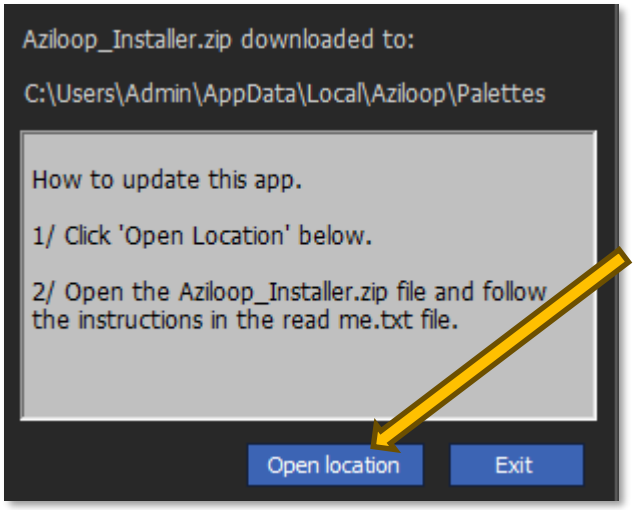


Keep Auto check for updates enabled to be alerted of new Azi-News issues.

See Sections 6.1.2 and 6.2.2 for more information about updates.

Updating the App

Click **Update** then follow the instructions:



Note: **You will need to uninstall the old version of the app first.**

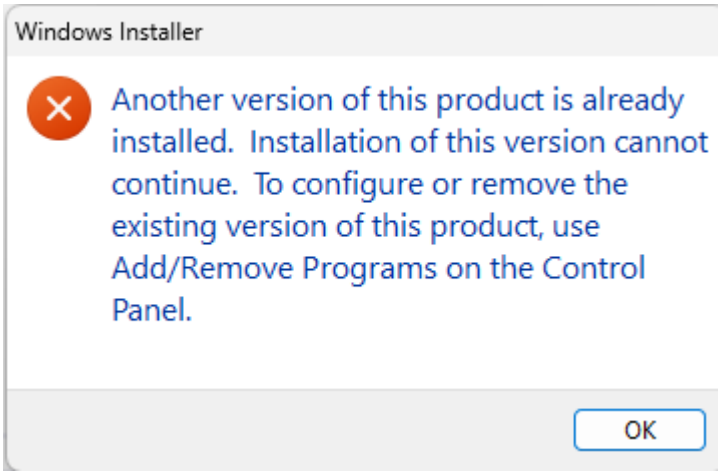
Click to go to the download location. You may need to remove any old .msi files before decompressing the new .zip (or you can open the new .msi from within the zip).

You can return to this folder by selecting Preferences > Palette > Path and copying the address path.

Uninstalling the previous app version

You will always need to uninstall any previous versions of the app before you install a new one, though as above, you can download the new file from the old app before you delete it.

If you try to install a new version without uninstalling the old one you will see this message (Windows 11):

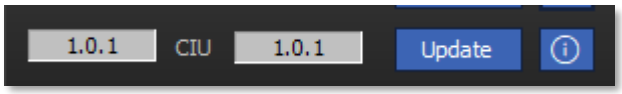


Updating the CIU Firmware

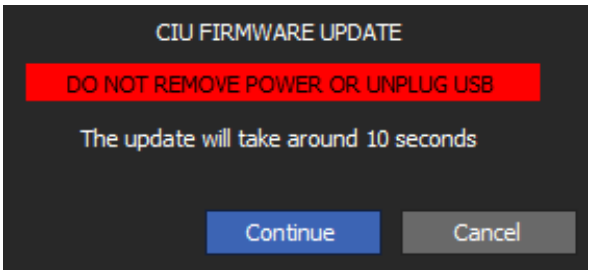
The CIU ships with firmware already installed, and updates are rare. However, the facility is there should the requirement arise.

Pre-requisites

The CIU Update button is only enabled when a newer version is available. Set the app to Local mode with USB connected (because comms to the CIU is required). Your PC must be connected to the internet (to get the updates), and the CIU 13.8 V supply must be present (to power the circuitry).



If enabled, click **Update**.



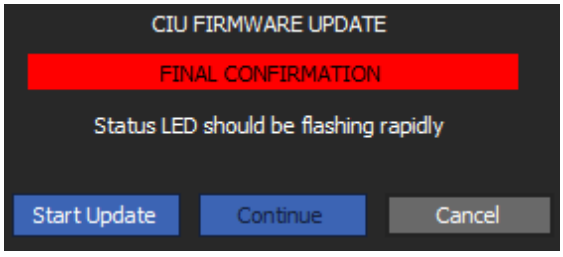
Two confirmation steps are required before the actual update begins. For the timid, there is a cancel button. For everyone else, press Continue.

If the CIU Server or LCU are active, they will be powered off once Continue is selected.

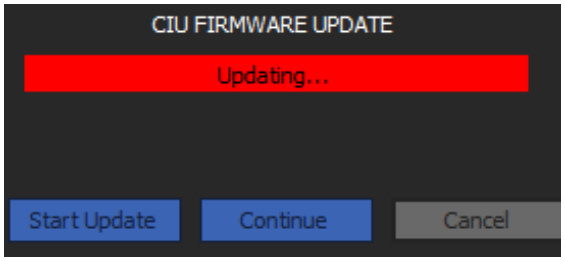
Caution:

You could 'brick' the CIU if you interrupt the update once in progress. Do not switch anything off or unplug the USB cable during the update - which only takes around 10 seconds. In practice updates have been 100% reliable. But there's always a first time hence our advice.

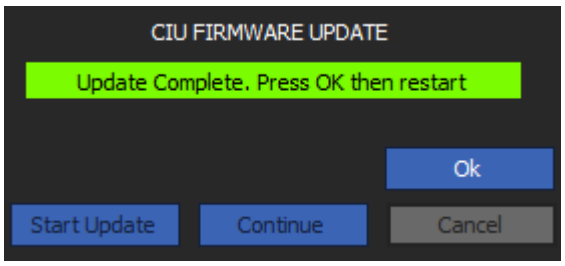
We use this method ourselves for programming the CIU during final commissioning, and we also ran a test of 1,500 consecutive updates overnight with no failures.



Ensure the Status LED on the CIU is flashing rapidly then press **Start Update**. The LED will flicker in a more random manner while the update takes place.



Update in progress.



Update complete. Press Ok.

The Status LED will flash the morse code 'R' on completion. After clicking Ok the app will close. Manually restart it.

You may wish to re-visit Settings > Info > Updates Manager to check the installed firmware version has now been updated to the latest version. The 'Installed' and 'Latest' values should now be the same.

3.4 Settings - Preferences

The Preferences panel is a Settings menu option.

Preferences are changes that in the main do not affect the basic operation of Aziloop. They are essentially customisations (such as changing colours) and enhancements such as Omni-Rig support.

- Click the Settings (gear) icon on the Menu bar then click Preferences.
- Preferences always opens on the last used sub-section.

Side-by-Side view

To display the Preferences panel alongside the main panel right click on any sub-section title. Alternatively, you can right click Preferences in the main settings panel.

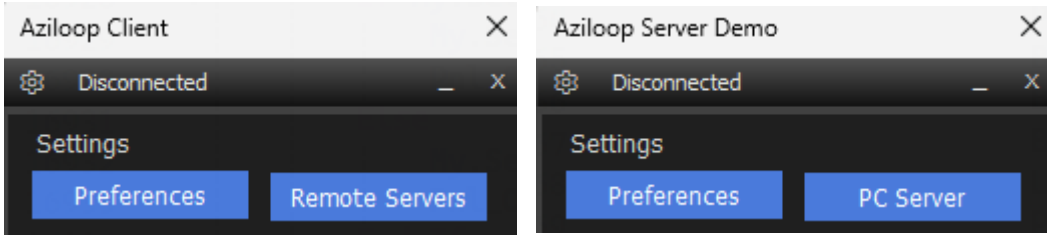
This allows changes to be tested as you make them, without needing to open the Preferences panel every time.

Section 4. below covers Preferences in detail:

Shortcut: Right click the gear icon to open Preferences directly.

3.5 Settings - Remote Server / PC Server

Labelling depends on the mode in use.



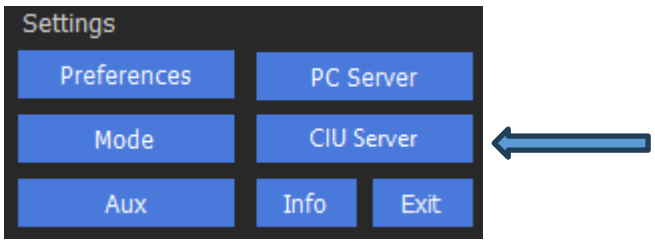
Client Mode

In Client mode. Remote Servers opens the Server Selector panel from which you can choose your target server, or add a new one etc.

Server or Server Demo Mode

In Server or Server Demo mode, PC Server opens the Server Setup panel.

3.6 Settings - CIU Server



CIU Server mode

This mode does not require use the PC app or USB connection once the CIU has been configured. The PC app can still be run alongside the CIU server with the USB connected – indeed putting the app into Client mode is a good way of testing the CIU server.

Limitations

Because of the way data is routed inside the CIU, when the CIU Server is powered, some paths are in parallel. To prevent the Client receiving replies from both the PC in Server mode and the CIU Server itself, the PC Server will not respond to polls from the client when the CIU Server is enabled. However, you can still connect to the PC Server when it's in Server Demo mode as there is no interaction with the CIU.

Local control is possible alongside an active CIU Server, though the local user and the remote Client will not be aware of each other's changes so can get out of step.

In summary, with CIU Server Enabled

Possible

Parallel operation with Local control (local UI and remote Client UI won't stay in step)

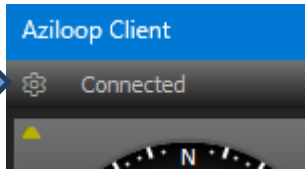
Not possible

Remote connection to PC Server. (Polls ignored)

CIU Server setup is discussed in detail here. (Section 5.2)

4.0 PREFERENCES

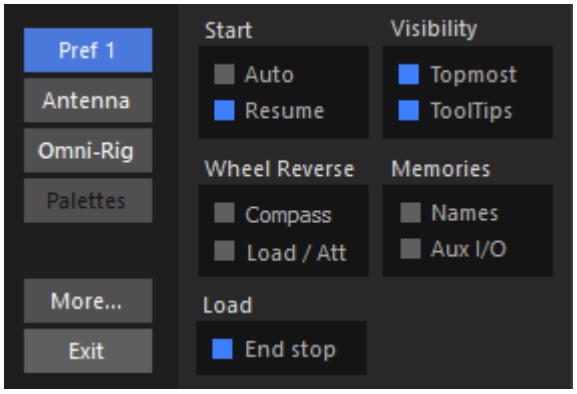
Preferences are a sub section of Settings.

Settings 

Shortcut: Right click to go direct to Preferences

Broadly, Settings are things that could potentially stop Aziloop working if wrongly configured. Preferences are user choices that customise the function of Aziloop or set up secondary functions.

4.1 Preferences - Pref 1



Preferences opens with the last selected sub section visible.

The menu option '…' opens a second set of more specialised preferences, discussed below.

Start

- **Auto**

  On app load, the 'On' button (or connect button in Client mode) is in effect automatically pressed for you. This is a handy time saver, but another use is in remote systems where Aziloop is required to automatically start, powering up the LCU after a reboot or power cycle. In Client mode, if 'Auto connect on start' is enabled in the Server Manager panel (only visible in Client Mode), enabling **Auto** means the app will attempt to connect to the target server. If the connection fails, the Server Manager panel will be displayed.

  Operational on app load, not mode changes as they are a manual operation.

- **Resume**

  Essentially, picks up where you left off in terms of the heading, Load, levels etc. When disabled, Aziloop starts in a default state.

Visibility

- **Topmost**

  Force the Aziloop app to stay uppermost in the Z-order to prevent other apps hiding the UI.

- **Tooltips**

  Most controls and panels have a mouse-hover tooltip associated. Cancel if not required or once you get to know your way around.

Wheel Reverse

- **Compass, Load / Att**

  Reverse the action of the mouse wheel according to your preference**.**

Memories

- **Names**

  Displays a user editable name for each of the four memories on memory mouseover.

- **Aux I/O**

  When a memory is stored, the state of the Aux I/O lines is also stored. On memory recall the I/O state is applied to the I/O ports.

  This is only active when the I/O channel is set to 'Control' in the AUX setup panel.

  Note you can choose to just use one I/O line this way and for instance still use the other as a PTT mute input.

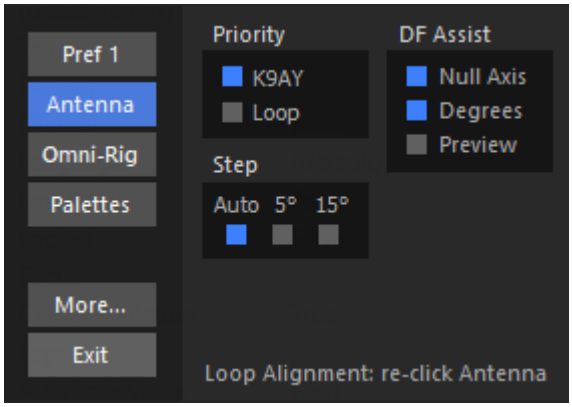
Load

- **End Stop**

  When enabled, Load values stop when each end of the load range is reached. Load values wrap around when End Stop is de-selected.

4.2 Preferences - Antenna

Antenna preferences change the way the antenna operates by altering mode priority, step size etc.



Loop Alignment not available in Client mode

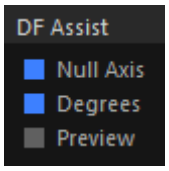
Priority

The default setting is K9. This allows you to click a heading in K9AY mode, dropping back to Loop mode when then the compass centre is clicked. If the main use is DF work, it may be preferable to set the priority to Loop, to stay in Loop mode when changing headings.

Even in Loop Priority you can force a change back to K9AY Priority by repeatedly clicking of the compass centre, until a K9AY heading appears. The next time the compass centre is clicked, Loop priority resumes.

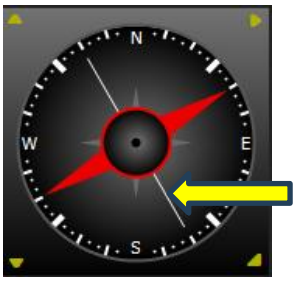
In Loop Priority the Compass panel load box is hidden. To gains access to load values, expand the UI to show the Load panel.

DF Assist



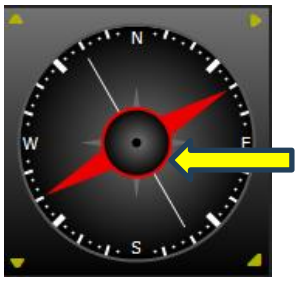
When attempting to locate a station by DF (Direction Finding) the preferred method is to use Loop mode, rotating the antenna for the best null. The station heading will then be along the null axis. To resolve the direction ambiguity, click one end of the null axis line to 'beam' along that axis, then use the three-way toggle method or click a heading to select K9AY mode then use the two-way toggle. Remember a loop is essentially omnidirectional when receiving high angle signals and K9AY mode will show very little front to back difference. Refer to the plots in the appendices.

Null Axis



With Null Axis enabled, when in Loop mode a thin line is shown at right angles to the plane of the loop. This indicates the null axis in the figure of eight pattern. It is more accurate to DF a station using a loop's null than to use the much broader main lobe to peak the signal. You can then use K9AY mode to resolve the heading ambiguity.

Null Toggle



With Null Axis enabled, you will also notice that a coloured ring appears when the mouse is in that position.

Keeping the mouse in this zone, repeatedly click to toggle between main and null axes.

Degrees

With Degrees enabled, a digital readout of the forward and reverse angles is displayed.

K9AY mode: The hemisphere containing the heading is shown in brighter text.
Loop mode: both readouts appear with equal brightness.

The upper digits display angles in the upper two quadrants.

When Null Axis and Degrees are both enabled

Enabling both Null Axis and Degrees changes the digital readout behaviour:

K9AY mode – As above (Degrees).

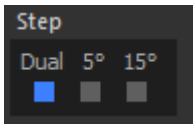
Loop mode – The digits now represent the null axis headings, differentiated by the underline font.

Preview

With Preview enabled, the location of the Heading Assist pointer is displayed in the compass centre in degrees.

Degrees and Preview are mutually exclusive (selecting one cancels the other).

Step



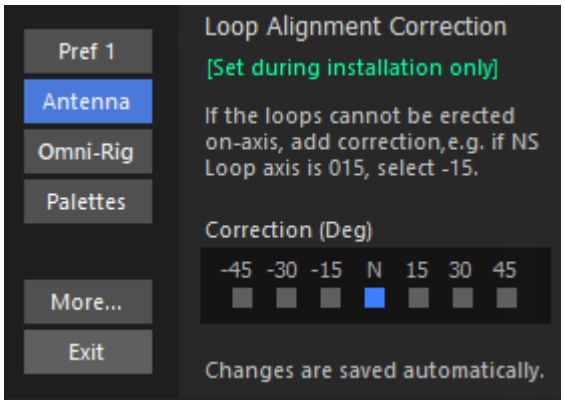
Fixed steps of 5 or 15 degrees can be selected. The default 'Dual' option auto-selects 5 or 15 degrees depending on mouse wheel scroll speed. Scrolling inside the centre circle is fixed at 5 degree increments.

Antenna Alignment – hidden option

If you happen to inadvertently click Antenna again, you will see the Loop Offset panel. This is described in the Installation section here. Click once more to return to the Antenna Preferences panel.

This is an adjustment that should only be made when the antenna itself is being installed. If you can't align the loops with the cardinal points, choose a 15-degree offset in the panel.

This adjustment is not available when in Client mode – any required compensation for the server antenna is defined at the server end.



4.3 Preferences – Omni-Rig

Aziloop is now Omni-Rig aware. Currently only version 1.2 from VE3NEA is supported. This section assumes you are already familiar with Omni-Rig.

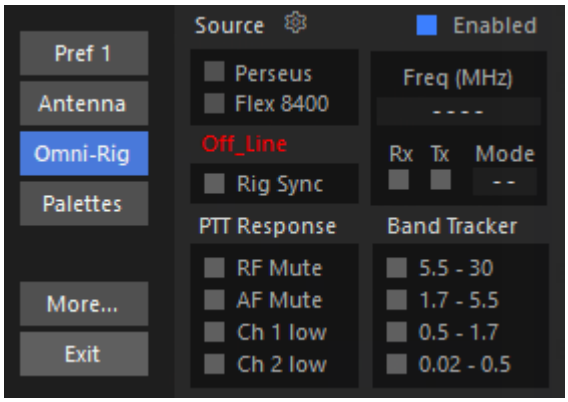
Overview

The Aziloop Omni-Rig feature allows you to choose what action to take depending on the transmit state and operating frequency of the target device. You can select Rig 1 or Rig 2 (as defined in the VE3NEA Omni-Rig app), have the active source mute Aziloop on transmit, and/or activate either or both Aux I/O lines. Also, using Band Tracker you can automatically activate one or more band filters when the selected Rig is on a frequency in that range. The sources can be re-named.

Transmit / receive status is reported along with the Mode. PTT actions are valid when the active rig source is detected as being in transmit.

Additionally, Rig Sync lets you lock the frequency and mode of two rigs.

Omni-Rig panel



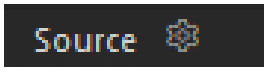
Source

The two source options correspond to the Rig 1 and Rig 2 sources in Omni-Rig's own setup panel. These can be re-named in Aziloop:

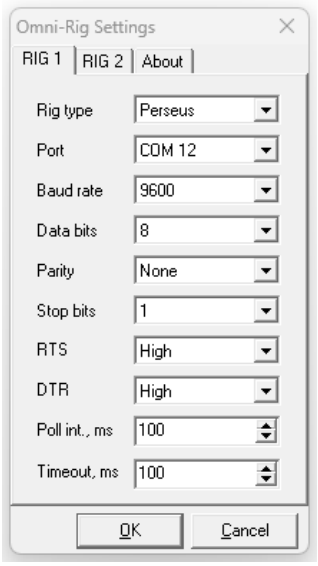
Re-naming the source

Right click the name and change as required then press 'Ok'.

Omni-Rig settings



Pressing the cogwheel brings up the standard VE3NEA Omni-Rig setup screen (which may appear on another screen in multi-screen setups).

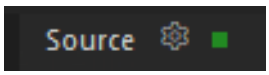


If you have a receiver or transceiver working with Omni-Rig already, Aziloop's Omni-Rig features should 'just work'. There is plenty of Omni-Rig setup help available including YouTube videos.

Note: make sure the Poll interval and the Timeout are set to the minimum of 100 ms.

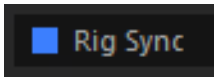
Omni-Rig Status messages

Activity Indicator



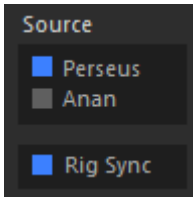
A small green activity indicator will momentarily appear each time Aziloop receives and makes use of incoming Omni-Rig data.

4.3.1 Rig Sync



Rig Sync keeps the frequency and mode of two rigs in track. This is particularly useful if you use a remote receiver and local transmitter, or a separate local receiver to your transmitter. Operation differs depending on what mode Aziloop is set to.

Rig Sync in Local / Local Demo mode



With Rig Sync active, the selected rig is in control. In this example a change in Perseus frequency or mode will be transferred to Anan. Anan changes won't be sent to Perseus.

Rig Sync in Server / Server Demo mode

Rig Sync is not available at the server end. Rig Sync is initiated by the client.

Operation in **CIU-Server** mode is not possible as the CIU cannot run Omni-Rig.

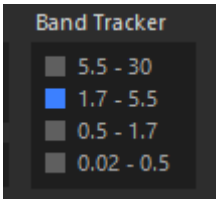
Rig Sync in Client Mode

Omni-Rig needs to be running on a PC at both ends of the link.

Remote Receiver Calibration

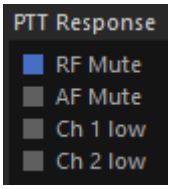
On some rigs, the RIT offset is detected by Omni-Rig and added to the main receive frequency. This means that using Rig Sync a client's transceiver RIT can in effect net the remote receiver's frequency. Note the RIT offset will stay constant unless re-adjusted, whereas any remote receiver frequency error will usually change with frequency so you may need to re-adjust the RIT again after a band change.

4.3.2 Band Tracker



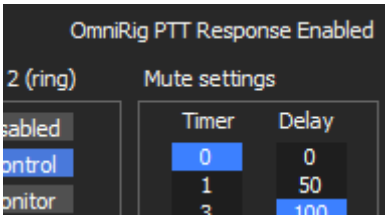
You can enable any combination of filters in the LCU. They are auto inserted when the receiver is within that band. The best filter fit is chosen for each selection.

4.3.3 PTT Response



When a PTT action is detected via Omni-Rig you can select RF Mute, AF Mute or choose to activate Channel 1* and/or Channel 2* in any combination.

* You must set the Main Aux I/O channel setting(s) to Control.



When any Omni-Rig PTT response is selected, this is also indicated in the Aux I/O setup panel

RF Mute

This has the same effect as triggering a normal Aziloop mute via the Aux I/O lines.

AF Mute

This is a simple AF toggle function that affects all audio fed through the PC's default audio out device. Un-mute the audio with normal PC audio controls if it gets out of step. Useful to prevent feedback when using online SDRs.

This operates in parallel with the AF Mute in the Aux I/O Settings panel i.e. although triggered by different events, each results in the same action of toggling the PC audio. Using both together is likely to put the toggle function out of step or cause the action to fail (PTT Aux mute may fire first then Omni-Rig un-mutes just after).

AF Mute Menu Bar display

With AF Mute enabled an icon appears on the Menu Bar. You can click this to manually initiate a mute toggle. If mute somehow gets out of step, right click to get back in step.

Ch 1 Low, Ch 2 Low

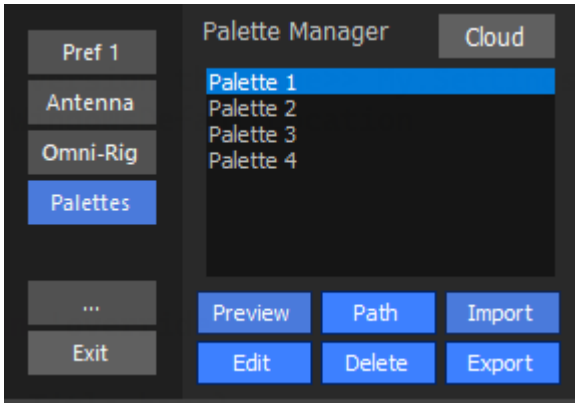
This pulls down the selected I/O channel on Omni-Rig PTT detection.

This does not operate in parallel with PTT mute out because Omni-Rig I/O control needs the Aux I/O mode for that channel to be set to Control (as opposed to Mute out) thus disabling the normal PTT function.

4.4 Preferences - Palettes

As well as providing a means to select a pre-existing palette from the dropdown list you can also edit an existing palette or create a new one by saving the changes under another name. You could for instance alter colours to match your preferred SDR receiver app.

Additionally, file management buttons provide full control over your palette list.



Note: The Palette option is not available while the app is in standby.

Cloud – display online palettes

These can be added to your local palette list (see 4.4.1 below).

Edit – Change the colours

This option opens the Palette Editor (see next section).

Import – add more palettes

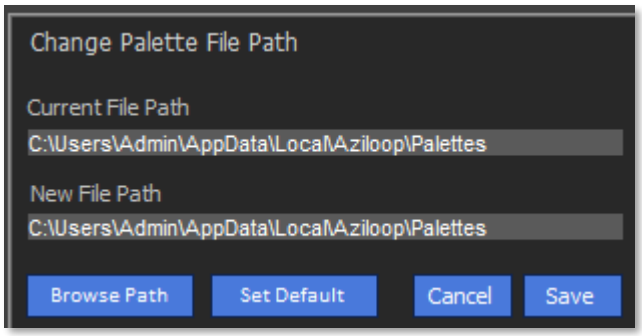
The main use for this option is to allow palettes to be added from a local folder (maybe a backup). Additionally, this is a way to share custom palettes between users. Press 'Import 'to bring up the standard Windows File Manager and select the file you wish to import.

Export – make copies of palettes

Exporting an .azi file allows you to make a backup copy of your latest creation or place a copy somewhere easy to find like your desktop to then send on to others.

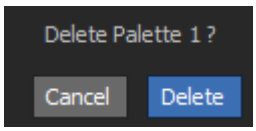
Path – change the palette file location

You can change the folder path used to store the .azi files. The default path on installation is shown below. A copy of all .azi files in the old folder will be copied to the new folder. Other file types that may exist in the old folder won't be copied. No files in the old folder are deleted. If you specify a new folder that doesn't exist, Aziloop will create it. Press browse to find another path or type in directly.



Set Default restores the path to the default created on first install, which is as shown here.

Delete a Palette.



Select 'Delete' to remove the highlighted palette file. A final confirmation prevents inadvertent removal. Delete means delete. Files do not go to the recycle bin.

If you inadvertently delete all the palette files from a folder, Aziloop will restart and put all the default ones back again.

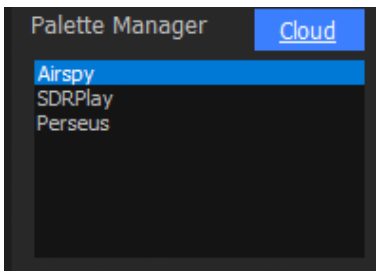
Note: If you update the app with a new version you need to uninstall the old app first. This leaves the palette files intact because the Windows Add/Remove Programs function doesn't know what palettes you created or where you put them. Should you wish to uninstall Aziloop completely you will need to manually remove the .azi files by deleting the …\Aziloop\Palettes folder or do a file search for *.azi.

4.4.1 Online palettes

Additional palettes are available online (you need an internet connection for this).

Listing the online Palettes

Press Cloud:



The Palettes available online are listed. Clicking Cloud again toggles between local and online palettes.

Click a name to see how it looks before downloading.

If Palette Manager was hiding the main UI, press Preview. Right clicking Palettes does the same thing.

Preview

Press Preview

Preview will temporarily apply the selected palette to the UI. Unless you download it, next time Aziloop is started it will revert to the previous palette.

Downloading the one you want

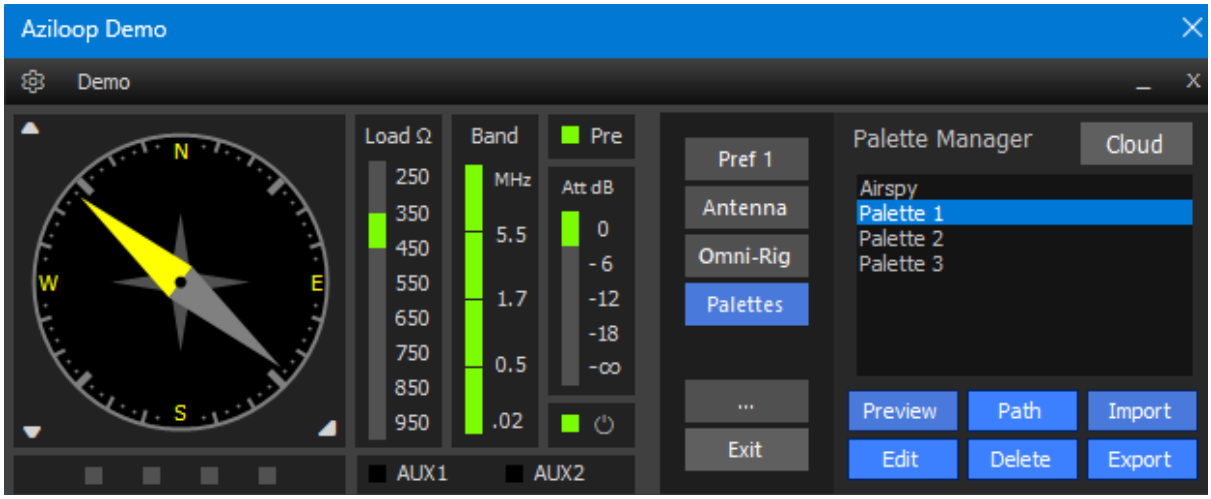
Press Import to add new palette to the local list.

4.4.2 Palette Editor

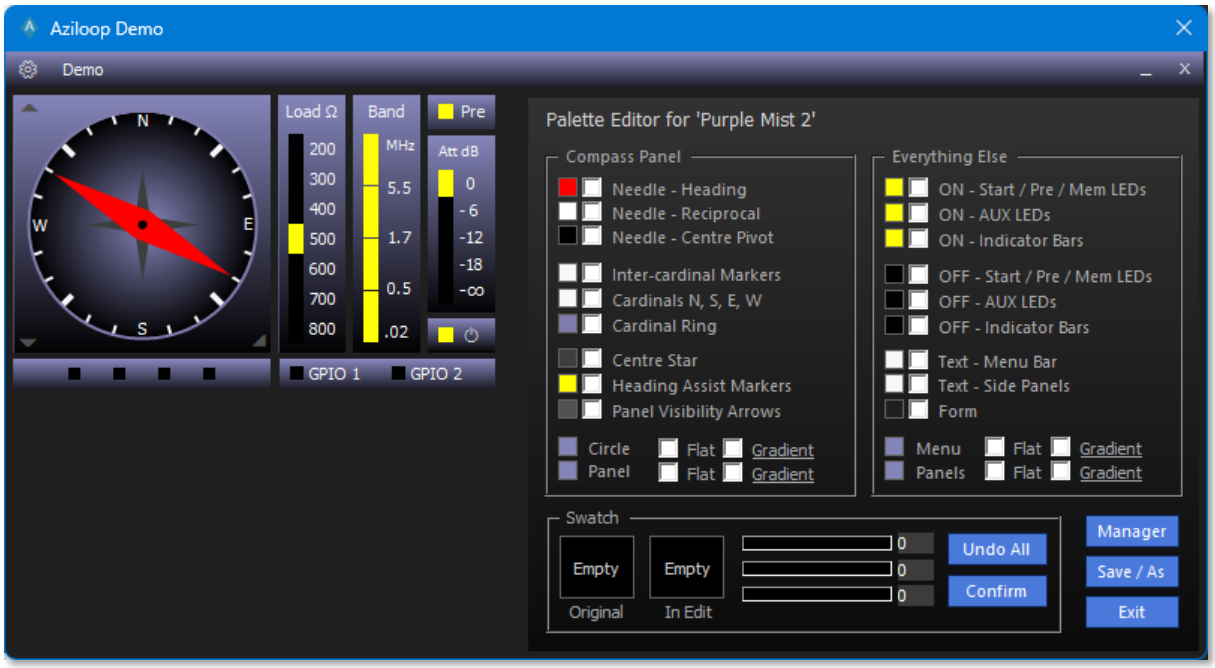
Aziloop comes with several palette choices pre-installed, and you can download more online, so Palette Editor is a feature you can ignore if you're happy with the palette colours available. But if you're feeling creative you can change the look of the app completely. Click through the other pre-installed palettes to see what we mean. Maybe you'd like to match Aziloop's colours to your favourite SDR app? You can even make panels and certain controls 'disappear' by matching foreground and background colours. If you just want to switch to a different colour palette from the list, click on the palette name then press Exit. As you select a new palette, the main app changes colour as a preview of what you've chosen.

Preview

Preview lets you visually check the palette file you selected is the one you want to use or to edit. Right clicking palettes does the same thing.



To open the Palette Editor, from Palette Manager select a palette (the active palette is highlighted in the palettes dropdown list) then press Edit. Select 'Purple Mist' which is a default palette added during installation.

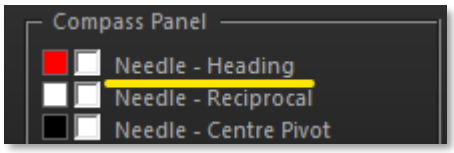


The Editor panel is not nearly as daunting as it first seems once you appreciate that the sub-panels marked 'Compass Panel and 'Everything Else' together offer the same option 18 times plus 4 options underneath for defining background colours as flat or gradient (shaded). The 'Swatch' panel shows the colour that you are currently working with.

How it works

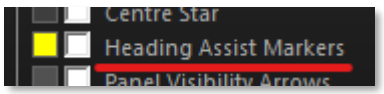
For each colour element available there is a mini-swatch showing the present colour, a tick box for selecting the element and a description e.g., 'Needle - Heading'.

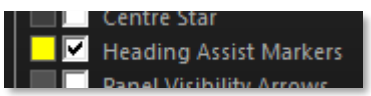
Worked example:



You can create a new colour or copy an existing one and use it unaltered or tweak it with the RGB sliders or numeric values. Let's say we want to change the needle heading colour from red to yellow.

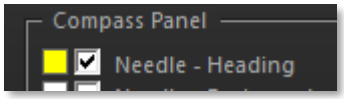
We want to use the same yellow as the Heading Assist Markers, so we click that element to select it as the donor colour thus:





Notice that the main swatch panel now shows the donor colour.

Now we've selected a donor colour we can apply it to one or more colour elements as we wish. Tick Needle-Heading:



You will notice the compass needle immediately changes to yellow to reflect the change. Tick one or more other elements to see what happens. Untick them to cancel the change.

To cancel everything and go back to the original press 'Undo All'. If you are happy with the changes press 'Confirm'. Confirm won't alter things for good - nothing is stored until you save the new palette. But pressing Confirm holds the new colour changes and 'clears the decks' so you can make other colour changes in the same session without messing up what you've just done.

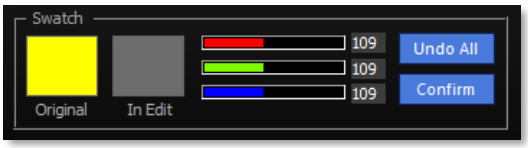
Create a new colour

If you alter the RGB sliders, you can vary the colour 'in Edit' and compare it to the original donor colour. Any ticked colour elements will vary accordingly. Press 'Confirm' to accept the change.

RGB Values

You can also directly enter RGB numeric values if you know the precise colour you want. Just click the numbers next to the sliders and change as required.

Greyscale



Right click and drag any of the three RGB sliders. All three colours adopt the same value and then change together to produce any greyscale shade required. (Left click and drag just changes the target slider alone)

The 'Flat' / 'Gradient' Option

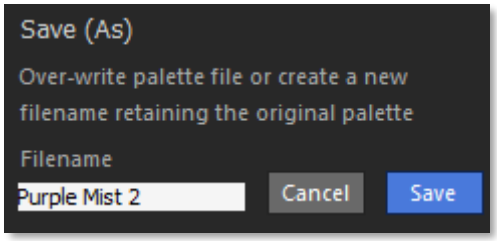
This option allows you to alter the background colours from flat to gradient (shaded). The underlined labels denote the current setting. As described above, select a donor shading and apply it to other elements or alter the colour with the RGB sliders. Note you can't apply shaded colours to smaller elements such as compass pointer.

In the example we are using, selecting 'Gradient' or 'Flat' for the 'Circle' element produces this:

The current setting, 'Gradient' is underlined.

Click 'Flat' and note the change.

Saving the new Palette



You don't need to press 'confirm' before saving a palette – the action of saving it implies confirmation. Press Save / As to open a panel that allows you to overwrite the existing 'donor' palette, or if you type in a new name, you can create a new file

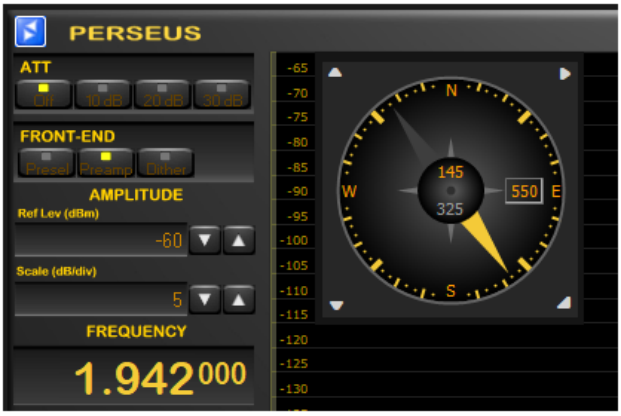
leaving the original unchanged. Palette files are small text files with the file-type extension *.azi. Press 'Path' in the Palette sub-menu to find out where they are.

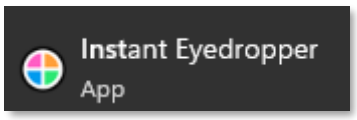
'Manager' takes you back to the Palette panel showing the list of palettes.

Press 'Exit' to abandon any changes and cancel all Palette operations.

Colour matching

To match Aziloop's colours to say your favourite SDR program, a colour picker can be especially useful. Many free colour pickers are available for download, for instance 'Instant Eyedropper'. They all let you hover over a colour anywhere on your screen and capture the RGB value.





Example of Aziloop colour matched to Perseus SDR and shown minimised to just the compass panel

4.5 Preferences – More…

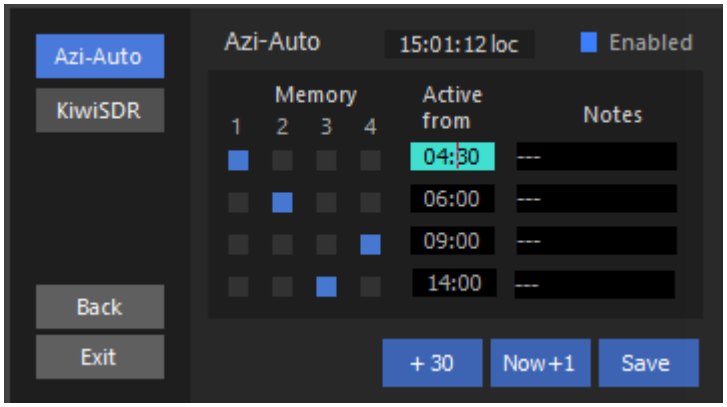
This opens a second set of Preference choices likely to be used less often. These have their own panel to reduce clutter in the main Preferences panel.

So far, these extra features have been developed in response to user requests and may not have happened otherwise. Please get in touch if there's a new feature you'd like to see, though we can't guarantee to act on every suggestion.

4.5.1 Azi-Auto

Purpose

Azi-Auto is a feature that allows automatic time-based switching of things like heading, filter state, preamp etc. There are up to 4 definable switch events. When the time reaches the 'Active From' time, the change occurs. Data is taken from the four memories of the memory panel (located below the Compass panel).



Memory

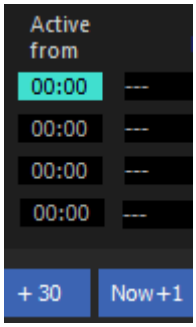
Each row can be set to recall the stored settings from any of the four memories, in any order, and repeatable if needed.

In the example above, row 1 will activate the state stored in Memory 1 at 04:30 local time, row 2 will activate Memory 2 at 06:00 and so on. The activation times do not have to be consecutive and can be as little as one minute apart, and memories can be re-used.

When enabled' a dot appears in the memory panel.

Active From

To set this time, click the text box, which changes colour, also enabling the +=30 and Now+1 buttons



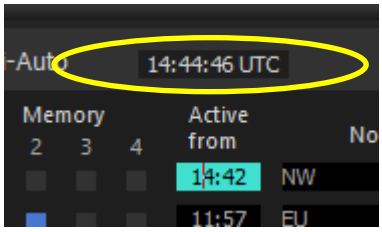
You can enter a time by direct entry, or by clicking the time insert buttons.

Now+1: Add 1 minute to the system time once only.

+30: Add 30 minutes to the system time per press.

Now+1 is a convenient way of selecting the earliest possible switch time, mainly for testing.

System Time



This can be displayed as UTC or local clock time. Change by clicking the text box.

Note: Decide on which time reference you wish to use before setting the trigger (Active from) times as they will not adjust themselves accordingly.

Notes

Freeform area for you to identify each change. This is not linked to the normal Memory names.

Save

All changes are saved on exit but to stay in the panel and move to another panel after a manual time entry, press Save.

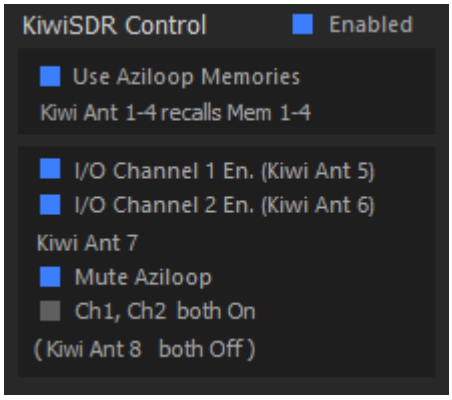
Aux I/O

The Aux I/O state stored in each memory can be used to trigger an I/O change.

Make sure Preferences>Pref 1>Memories: Aux I/O is enabled, and that the I/O channels to be used are set to 'Control'. You can set one channel to Control and the other to say PTT in and have dual use.

4.5.2 KiwiSDR Control

Kiwi Control works in conjunction with KiwiSDR (a stand-alone SDR receiver with a web interface see www.kiwisdr.com). Disclaimer: KiwiSDR is a third-party product that we have no control over, so we cannot guarantee future interoperability, though there is no suggestion of any imminent changes.



Preferences> More > KiwiSDR

Q: What does KiwiSDR Control give me?

- **Control of Aziloop heading etc.**

KiwiSDR Control allows you to select up to four different Aziloop antenna states directly from the KiwiSDR antenna switch extension, providing a limited yet convenient way to control Aziloop through the Kiwi web interface. This feature is particularly useful for KiwiSDR users with an Aziloop antenna who have a public setup and want to offer enhanced control options.

- **Switching of other antennas**

In addition to the four Aziloop antenna states, KiwiSDR Control can select other antennas. This is more in line with the original intention of the KiwiSDR antenna switch extension, which would normally be linked to a relay module, which can directly or indirectly switch antennas

Aziloop has two Aux I/O channels that can be configured in various ways (see section 3.2, Settings – Aux) and these lines can now be controlled from KiwiSDR. Using the I/O channels you can set up a system that can switch between Aziloop and up to three other antennas.

- **Mute Aziloop from the KiwiSDR app**

KiwiSDR Antenna 7 can be configured to do this.

Setting up

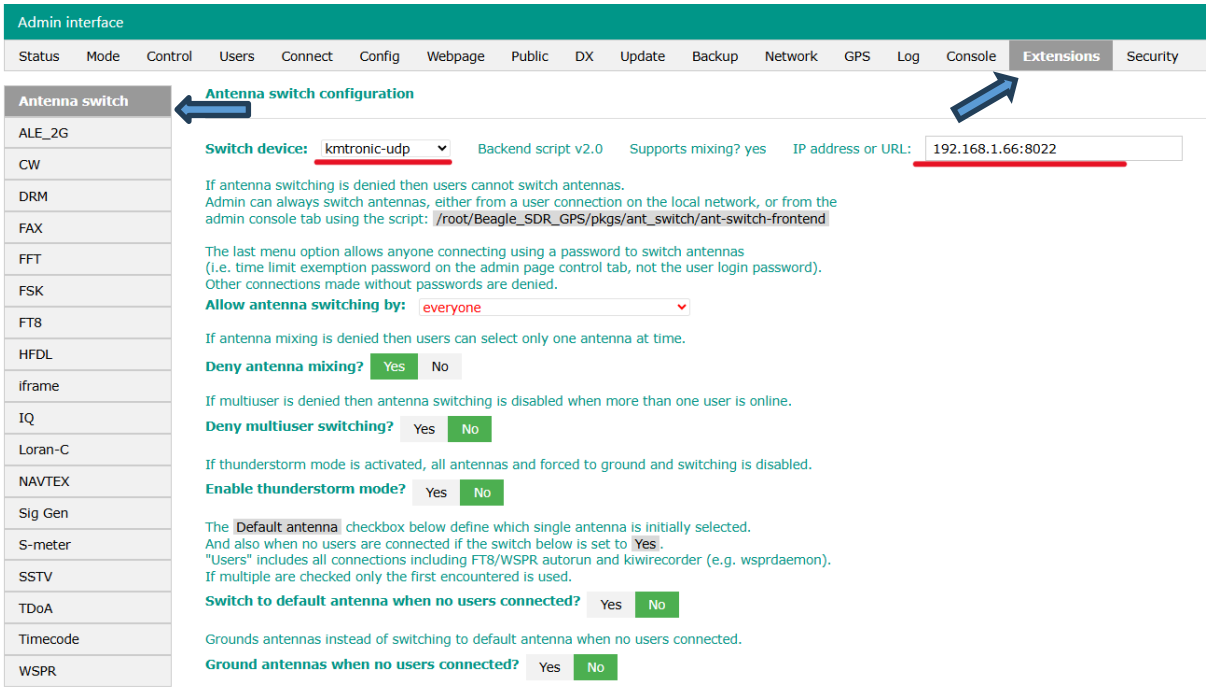
Two steps. You will need to configure both KiwiSDR (so that it knows how to contact Aziloop, and what format to use) and Aziloop (so that it reacts to control signals from KiwiSDR and performs the actions you want).

Step 1 : Configuring KiwiSDR

You'll require access to the KiwiSDR Admin interface page, usually reached via your web browser at something like 192.168.1.221:8073/admin. If you are using KiwiSDR you will know how to do this already.

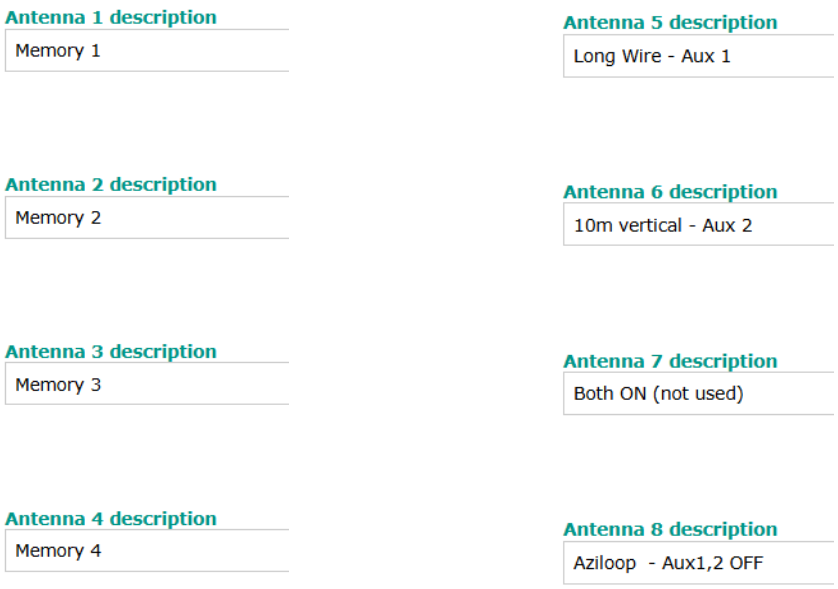
Select Extensions from the top menu bar, then Antenna switch from the options on the left.

The required KiwiSDR Admin settings are shown below:



1. Select kmtronic-udp (underlined in red) from the Switch device drop down.
2. Enter the IP address and port number (underlined in red) that your Aziloop PC server will listen on (this is the same address and port number an Aziloop Client would also use to connect to the server). Note currently CIU Server mode is not compatible with this feature, just PC Server.
3. Set up the Yes/No options as shown.

And finally, rename the Kiwi Antenna switch labels for the functions you want (remembering that Antenna 1-4 selects Aziloop antenna states, Antenna 5-8 selects the Aziloop Aux I/O). Example below:



Function Summary

You can change the KiwiSDR Antenna switch labels, but the functions always work as follows:

KiwiSDR Antenna	Aziloop function (if enabled)
1	Selects Aziloop Memory 1
2	Selects Aziloop Memory 2
3	Selects Aziloop Memory 3
4	Selects Aziloop Memory 4
5	Aux 1 On, Aux 2 Off
6	Aux 1 Off, Aux 2 On
7	Aux 1 On, Aux 2 On or mute Aziloop (see below)
8	Aux 1 Off, Aux 2 Off

Note: Regardless of the previous Aux I/O state set by 5-8, when you select Antenna 1-4 (to recall an Aziloop memory), both Aux channels are set to off.

This is to make sure that if the AUX lines are used for other antenna selection, whenever you select an Aziloop heading Aziloop is always the selected antenna.

In such a scenario you can select KiwiSDR Antenna 8 directly to change from another antenna to the existing Aziloop settings. i.e. without having to select an Aziloop memory (KiwiSDR antenna 1-4)

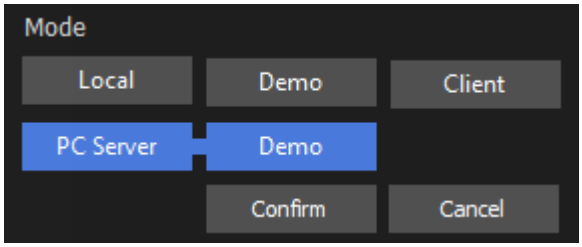
Step 2: Configuring Aziloop

Re-check these settings after a software update.

1. Set Aziloop to Server or Server Demo

KiwiSDR communicates with Aziloop over your LAN. Aziloop must therefore be set to either Server or Server Demo mode so that it is listening on the LAN.

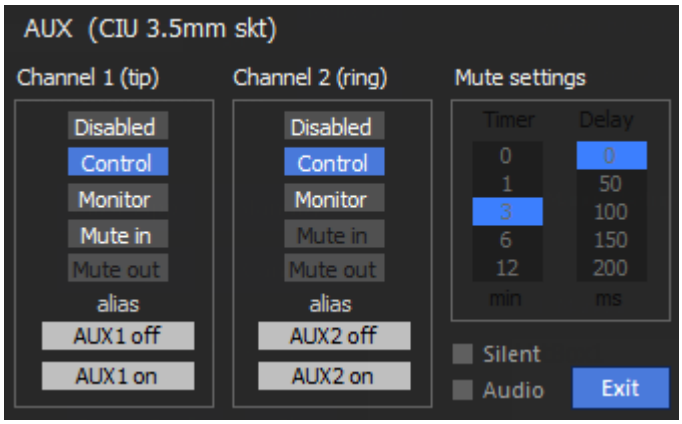
Settings > Mode:



2. Set Aux ports to Control (only needed if using I/O channels)

If you plan to use either or both Aux I/O channels, you need to check that those channels are configured as 'Control' in the main Aux setup panel.

Settings > Aux:

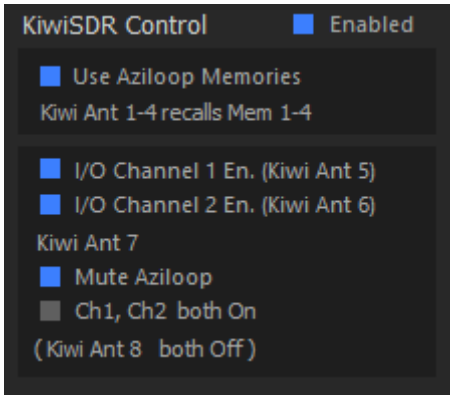


In this example above, both channels are set to Control. If for instance you had channel 1 set to Mute in you can still set channel 2 to Control and use that channel with KiwiSDR.

To operate KiwiSDR Antenna 7, set both channels to Control.

3. Finally, select the KiwiSDR Control options you require.

This is done via Settings > Preferences > More > KiwiSDR



Enabled

This is the Main enable control, without which no KiwiSDR features operate.

Use Aziloop Memories

Enable control of Aziloop memories 1-4 via KiwiSDR Antennas 1-4

I/O Channel 1

KiwiSDR Antenna 1 controls Aziloop Aux I/O 1

I/O Channel 2

KiwiSDR Antenna 2 controls Aziloop Aux I/O 2

Kiwi Ant 7

KiwiSDR Antenna 7 has two mutually exclusive control options

Mute Aziloop

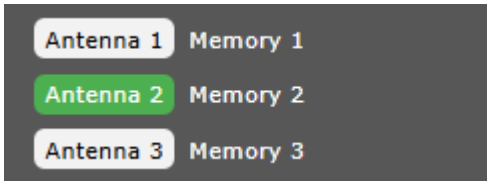
I/O Channels 1 and 2 do not need to be enabled.

Ch1, Ch2 both On

Activates Aux 1 and Aux 2 together. This operation will fail if I/O Channels 1 and 2 are not both enabled.

KiwiSDR Antenna 8 clears both Aux channels if they are active, as does selecting KiwiSDR Antennas 1-4**.**

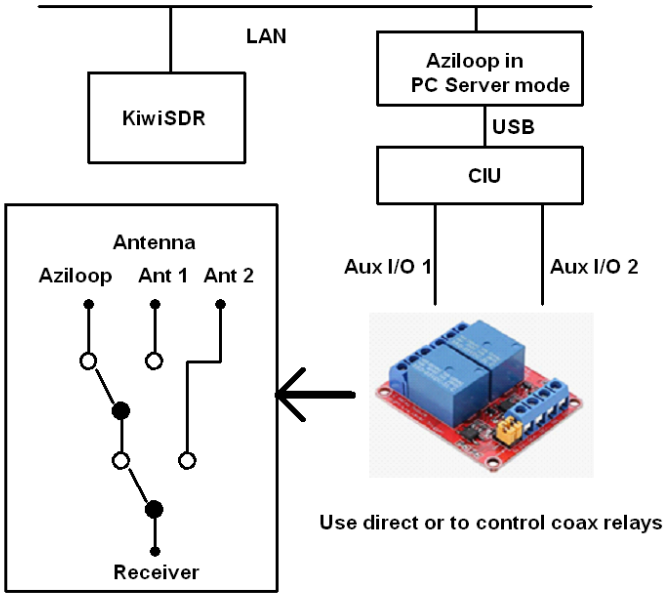
Has it worked?



If the selected Antenna doesn't turn green shortly after selecting, the action has failed. E.g. selecting an I/O channel when I/O isn't enabled in Aziloop.

Usage Examples

1. Using KiwiSDR / Aziloop as a three-way antenna switch:



Aziloop antenna selected when both relays are off, which is the case when Kiwi Antenna 1-4 is selected for Aziloop memories 1-4.

KiwiSDR Antenna 5 = Ant 1 (Aux I/O 1)

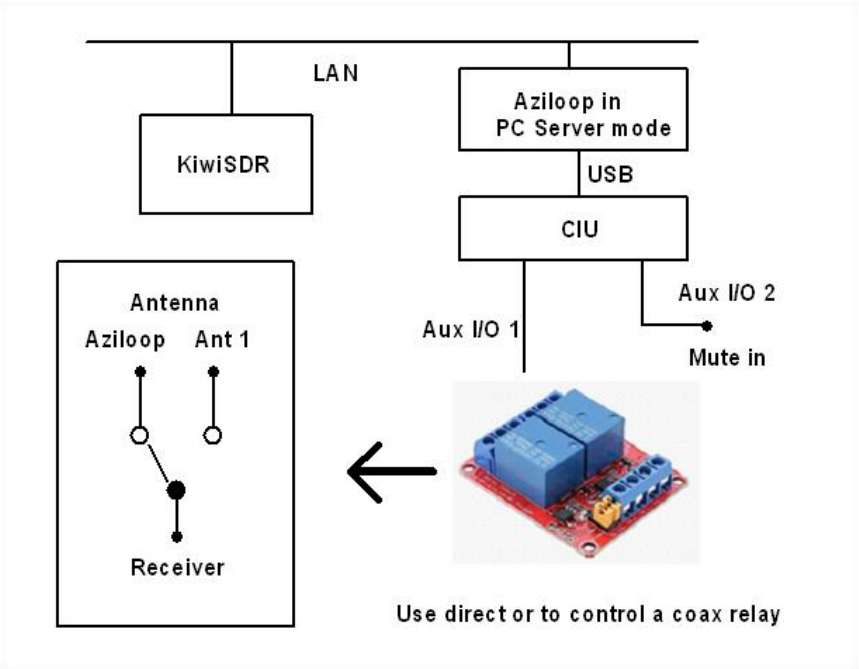
KiwiSDR Antenna 6 = Ant 2 (Aux I/O 2)

KiwiSDR Antenna 7 (both on) would also select Ant 2 in this example unless set to Mute Aziloop.

KiwiSDR Antenna 8 (both off) would select Aziloop in this example.

2. Using one channel for antenna switching:

Using a single I/O channel for switching reduces your options from four to two. However, it does free up the other I/O line for something else.



KiwiSDR Antenna 5 = Ant 1 (Aux I/O 1)

KiwiSDR Antenna 6,7 not used.

KiwiSDR Antenna 8 = Aziloop.

Questions

Will KiwiSDR Control work when the Aziloop PC server is in standby mode, or disconnected?

> Yes, you can switch antennas even if the Aziloop LCU is off, as long as the CIU has power and a USB link to a PC running Aziloop in Server mode.

Can I use normal PTT mute on one or both channels and still be able to mute Aziloop from KiwiSDR?

> Yes, except that when triggered from KiwiSDR, the main UI does not change, apart from indicating the new preamp and attenuator settings.

Finally – we suggest you leave Preferences > Pref 1 > Memories > AUX I/O disabled (default) to avoid the chance of a memory selection unexpectedly taking over the I/O channels.

5.0 REMOTE OPERATION

You can skip this section entirely for single site installations using a USB connection to the CIU.

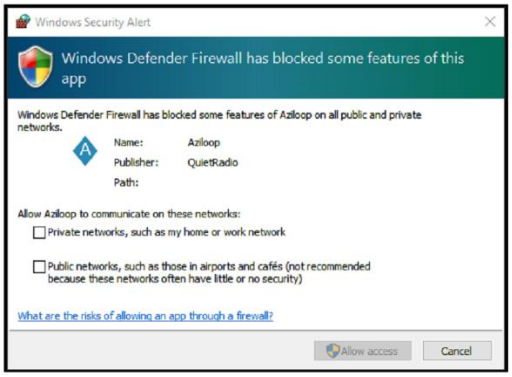
Introduction

The Aziloop app has built-in Client Server capability. The same app covers both modes along with local control. You will need a PC at both ends of the link, one to run an instance of Aziloop as a client, and one to run an instance of Aziloop as a server. All the Aziloop hardware (CIU, LCU, antenna) is installed at the server end. No hardware is required at the client end.

Additionally, the CIU has a built in Ethernet server so that you can operate Aziloop remotely without a PC at the antenna end, or you may choose to operate on your local LAN in the same way. This option is especially convenient if you sometimes operate locally and sometimes remotely where no further configuration is required when changing your location.

The PC server setup is very straightforward. There are only two things to adjust, and these can be left with their default settings. You will however need to add a port forwarding entry to your router so that client data can reach the server. The client setup requires just more step. As well as the same port forwarding requirement, you will need to know the IP address of the server. You can configure up to five remote servers and choose between them.

The following sections cover client server setup in detail.



Note: This popup may appear minimised, the only indication being an additional icon in the task bar (that may be flashing).

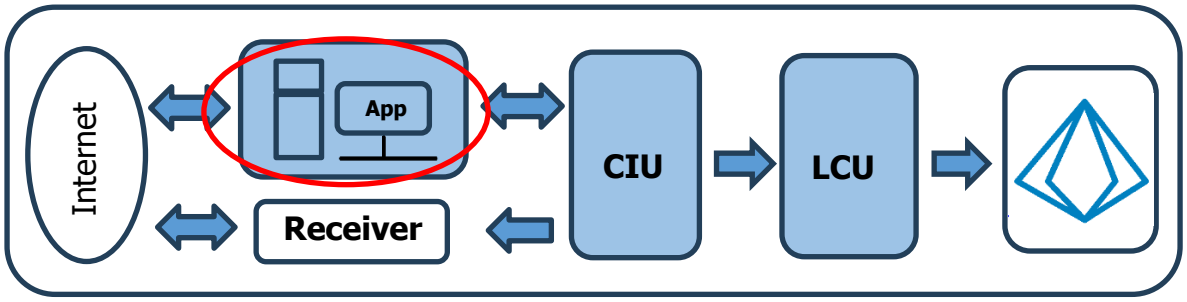
If Windows Defender is active on your PC, you will see a firewall exception appear the first time you run Client or Server mode. You need to allow access for the link to work.

If you are running more than one Ethernet adapter, see Server Setup Panel below.

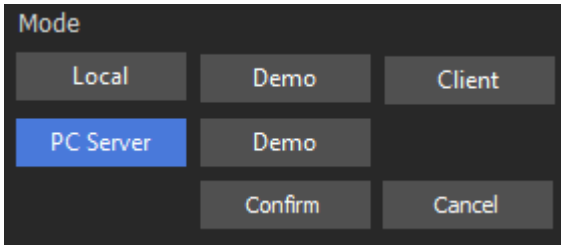
5.1 PC Server Mode

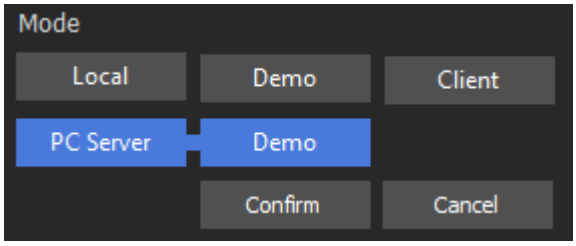
Configuring the app as a remote server with hardware connected, or in Demo mode (without hardware connected) is the same. However, in **Demo mode** the Aux setting is simulated as 'Control' on both channels because there is no CIU present.

To operate Aziloop remotely, the copy of the Aziloop app running on a PC at the antenna end needs to be set to Server mode, and the app running at the Client end (where you will be) needs to be set to Client mode.



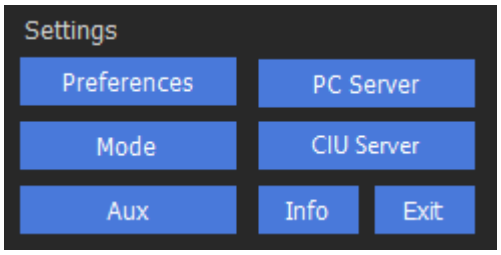
If the mode displayed on the Title bar isn't Server or Server Demo (where no hardware is required), select Settings > Mode then choose Server or Server Demo. Then press Confirm.





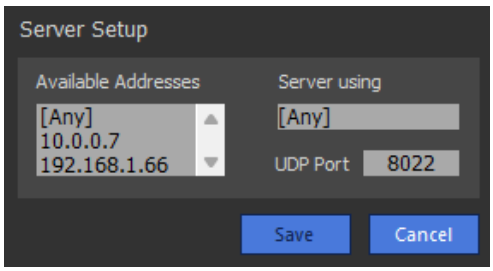
PC Server setup

Once in Server or Server Demo mode, the PC Server option becomes available in Settings.



Select PC Server

Server Setup Panel



Save is activated if changes are made.

Multiple Address Handling

This panel lists the available Ethernet adapters. In most cases only one will be listed unless you are also using a VPN (as illustrated above). Be aware if a destination has two routes, VPN and non-VPN, the VPN route may always take precedence depending on your VPN settings and Ethernet adapter metrics.

The IP addresses available are outside the control of the Aziloop app, but you'll need to know the one(s) in use for configuring the port forwarding on your router.

Server using

Select one from the list. The server will only respond to data on the 'Server using' address. **You cannot use [Any] when using KiwiSDR Control (Section 4.5.2).**

UDP Port

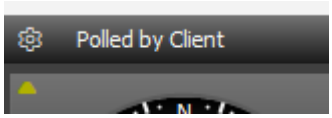
You can leave the port as 8022 unless there's a clash with something else, but use the same value at the client end, and enable port forwarding on both routers.

DHCP (Dynamic Host Configuration Protocol)

Generally, routers will dynamically allocate an IP address to a host with a particular MAC address then maintain that relationship. But this cannot be assumed, and it's better to change the server PC's IP address to a fixed value.

- On a Windows 11 machine, go to Settings > Network & Internet and select Ethernet, then press Edit next to the IP assignment row.
- Change to 'Manual' in 'Edit IP settings', enable the IP4 slider and fill in the fields as required.

Server Polled Indication



When a client sends a poll to the server (when the Server Selector is opened, or refreshed), at the Server end a 'Polled by Client' message pops up in the Menu bar.

5.2 CIU Server Mode

The DF-X CIU includes a built-in UDP server with an RJ45 socket. Many SDRs now have built-in servers, for instance the nRSP-ST from SDRPlay. Using CIU Server mode simplifies the requirement at a remote site if the server's IP address is reachable. Local LAN connections are of course also possible.

The Ethernet speeds available are 10 Mbps or 100 Mbps. If you use a router or switch capable of higher speeds, make sure it can rate-adapt accordingly. This is normally the case.

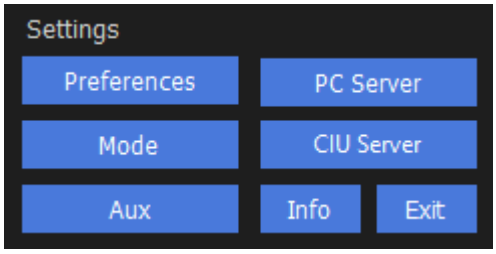
Once set up in CIU Server mode, the CIU runs on its own with just the 13.8 V supply and will auto-start when power is applied. The LEDs on the RJ45 socket will not light with the cable unplugged even if CIU is powered. The red status LED may not be lit.

Note: when the CIU Server is powered the CIU enclosure may become slightly warm after a while due to the extra current though the 5 V regulator.

CIU Server Setup Panel

The CIU Server settings are changed from the PC app via Settings:

- Make sure the USB cable is connected.
- Select CIU Server from the Settings panel. The text is underlined when the CIU Server is powered.

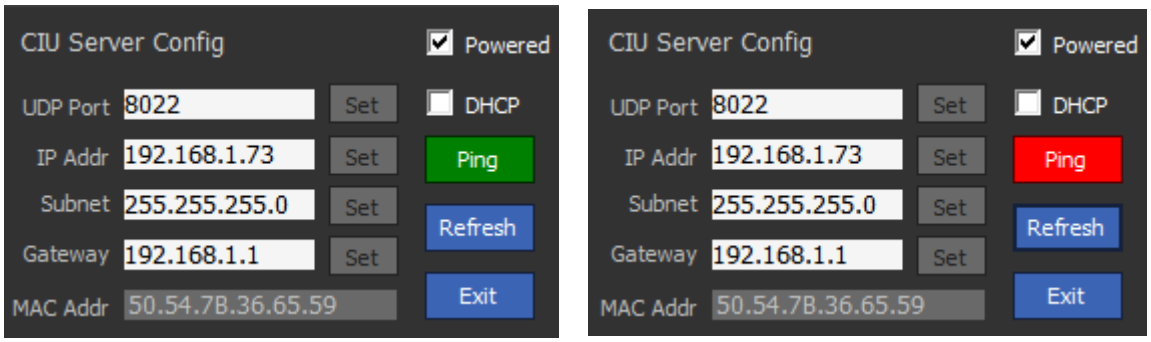


CIU Server can run alongside any mode running in the app itself. Once CIU Server is configured, the local PC can be disconnected.

The CIU Server operates in parallel with the PC app on a logical OR basis. Data from either is accepted by the CIU circuits. Note however that each is unaware of changes made by the other, so UI displays may become out-of-date if the other control method was the one last used.

Powering up the CIU Server

Press 'Powered', wait a few seconds then press Refresh. The RJ45 LEDs should now be lit.



Pinging the connection

With the CIU Server powered and the parameter boxes populated, press 'Ping' to check the IP address is reachable. Green indicates a successful test.

Changing the settings

Click inside a textbox and edit as required, then press the 'Set' button alongside, which becomes active when the textbox is clicked. Wait until the 'Ethernet port (as UDP Server)' title re-appears then you can press 'Refresh' to read-back the settings. Press 'Ping' to check the connection is working. You may need to unplug/wait a few seconds /re-attach the RJ45 depending on how your router handles the changes against the same MAC address.

UDP Port

The rule still stands that the client and server need to use the same UDP port for a connection to work, but the port used by the CIU Server can be different from that used by the PC server. This may be preferable to ease port forwarding setups. Note the Client app can only use one port number for all servers in its list.

DHCP (Dynamic Host Configuration Protocol)

We recommend using a fixed IP address though many routers will initially allocate a random IP address and lock it against the MAC address, but this cannot be relied upon.

If you want to use a fixed IP address that isn't in use, you could select DHCP to let the router allocate an address, then change to fixed IP using the same address.

Note: Currently the DHCP state is assumed from a stored setting in the app and is not updated from the CIU. If you are unsure, cycle the option to re-sync.

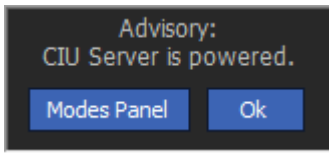
Once enabled, the CIU Server will run regardless of the app's operating mode and will auto-restart whenever the 13.8 V supply is present. It is a separate entity from the PC app and once set up, the USB cable can be unplugged (though you will of course need that connection to change any CIU Server settings).

Testing

Change the Aziloop app to Client mode, add your CIU Server details to the Remote Servers list in the Server Selector panel, and if CIU Server is powered it should be available for connection.

If you wish you can now unplug the USB cable as this isn't required by the app in Client mode.

CIU Server Powered Advisory



On first powerup, if the CIU Server is enabled, an advisory panel pops up as a reminder.

Omni-Rig not possible via CIU Server

There is no remote Omni-Rig capability when using CIU Server as Omni-Rig needs the Omni-Rig PC app.

KiwiSDR switching not possible via CIU Server mode

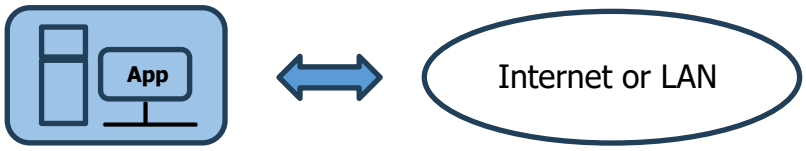
This is because the code for the switching runs in the PC app.

5.3 Configuring Client Mode

If you only intend to use Aziloop locally via USB, then this section can be ignored.

To operate Aziloop remotely, the app running at the server (receiver end) needs to be set up in Server mode, and the app running at the client end (where you will be) needs to be set up in Client mode.

At the client end, just a PC running the app, and an internet connection to the server is all that's needed.



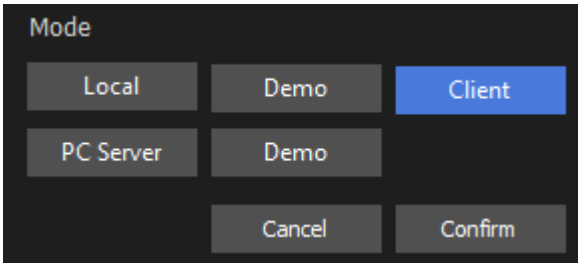
Client setup summary

If you leave the UDP port number as 8022 at both ends, and you know the IP address of the Server, then all you need do is create a new entry in the Client-side Server Selector panel (shown below). For normal IP addressing (non-VPN) you will also need to alter the port forwarding settings of your router to make sure data from the server is directed to your PC.

Make sure the app is running in Client mode, then open the Server Selector via Settings > Remote Server:

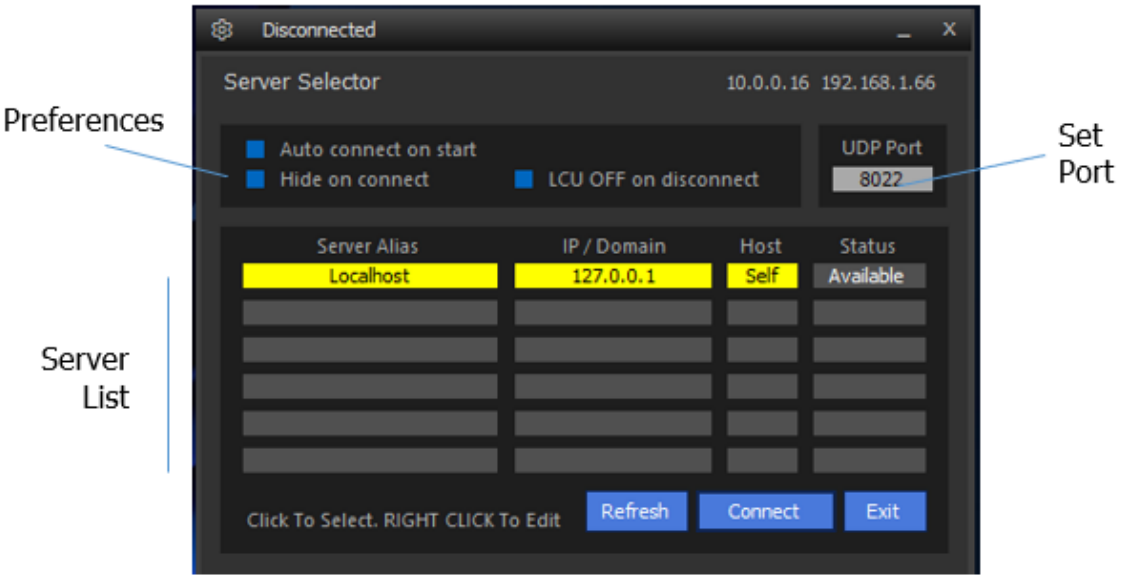
Selecting Client mode

If the mode displayed on the Title bar isn't Client, press Settings > Mode, select Client then Confirm.



5.3.1 Server Selector Panel

The Server Selector panel is where you add entries for each remote server, set the global port number the system uses throughout, and change any preferences.



At the top right is a list of IP addresses for the Ethernet adapters running on your PC. You'll use the addresses to set port forwarding in your router so that data from the Server is directed to your client PC (unless Client and Server are on the same LAN or you use a VPN). There are rows for up to 5 more servers in addition to the default 'local host' server on IP address 127.0.0.1 which is always present.

If a server is reachable via two addresses, only include one in the list. The server will only use the first address is receives a poll on. Try restarting the server if no response is received on a known good link.

Localhost entry on Row 1

This row serves as a confidence check and is not editable. The Status should always indicate 'Available'. You can connect to this server with no setup required, to familiarise yourself with Client operation. Note that Windows 'localhost' is not a check of the physical Ethernet cable and associated network – the loopback is handled internally in the PC and no data appears on the Ethernet cable, but it does confirm that the internal IP stack is functional.

Server Alias

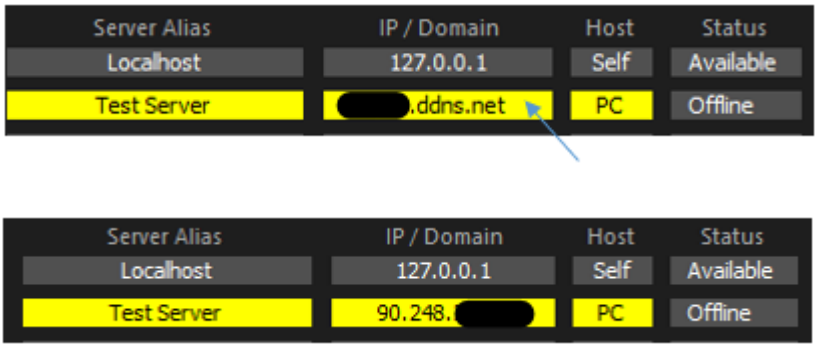
This is just a free-form field to enter a name that means something to you. It's not used by the app.

IP / Domain

Enter the server's IP address or domain name in this column. A Dynamic DNS service such as No-IP can be used for sites that don't have a fixed IP Address. Many routers have a built-in DDNS option with a choice of providers, otherwise you can run a background task on your PC that reports IP changes to the DDNS host of your choice. See your DDNS provider's website for details.

Finding a domain's IP address

If you use a domain name, you can find out the IP address it resolves to by hovering the mouse over the entry:



Host (PC or CIU)

This column indicates whether the server is a PC running the Aziloop app, or a CIU is using its own Ethernet server with no PC connection required (once configured). When the server responds as a CIU Server, the 'PC' text changes automatically to 'CIU'.

Status

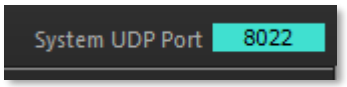
This is a read-only field. There are three states reported:

- **Available**: Server can be reached and has returned a poll response.
- **Connected**: Client is currently connected to that server.
- **Offline**: No poll response from the server. Domain names that do not resolve to a valid IP address are also reported as Offline.

Refresh button

If you've changed the network configuration outside of the app, press Refresh to re-poll the Servers. A refresh also happens automatically after any Server Selector edits, and when the panel is first opened.

Changing the UDP Port Number



Right click to Edit, make any changes, then right click again to Save.

Any number up to 65535 can be entered but avoid numbers already in use and make sure the server uses the same port. The port number is global (used in all server entries).

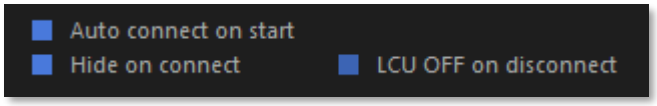
Deleting a server

Right click a row to enter Edit mode, then double (left) click the row to delete.

Leaving Edit mode

Right click again i.e. Right click toggles Edit mode.

Client preferences



Client preferences summary	
Auto connect on start	Attempt to auto-connect to default server when start button pressed
LCU OFF on disconnect	Remove power from remote LCU when link disconnected.
Hide on connect	Auto close the Server Selector panel after a successful connection to the target server.

Auto Connect on Start

A link to the default server is automatically attempted when the 'On' button is pressed. Without this option enabled the Server Selector panel appears first for you to manually choose a server. If you only use one server there is no need to select it every time.

LCU OFF on Disconnect

This option gives the Client a choice of whether to power down the Server LCU at the end of a session. The remote receiver is also isolated (CIU attenuator placed in 'infinity' mode, and of course power consumption is reduced. The purpose of the connection may be to adjust a setting then disconnect again, in which case retaining power is clearly the choice. In cold climates maintaining power may produce more reliable operation by keeping the circuitry warm, and similarly in very hot climates

long term reliability may be improved by removing power between sessions. We don't have any reports of climate related failures, these are just common-sense suggestions.

Note: When a new remote connection is made the LCU always powers up (or appears to if the remote server's mode is Server_Demo).

Hide on Connect

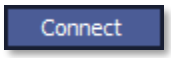
Once an available server is chosen and a successful connection established this setting automatically closes the Server Selector panel. If the connection fails, the panel stays in view.

Client Start Stop

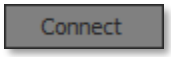
The power button on the Levels panel functions as the Connect button in Client mode. The power icon is replaced by a link icon. You can also disconnect from the Server Selector panel.

Click the button to close an existing connection. Clicking when disconnected causes the Server Selector panel to appear, or if Auto connect on start is enabled, the link is started automatically.

Connect / Disconnect button



The button is enabled when the selected server status is 'Available'.



If the target server is offline you can't attempt a connection.

After a successful connect, press to disconnect.

Exit button

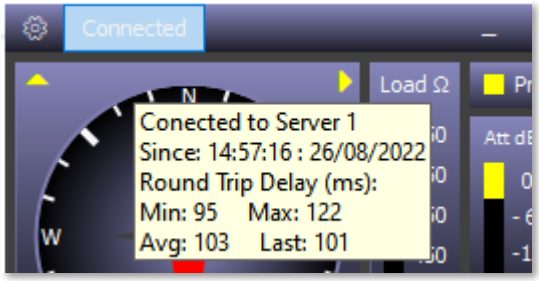
Closes the Client panel and returns control to the main app.

Am I connected?

As well as the Status field of the Server Selector, the Aziloop Menu Bar also shows the connection status

Shortcut: Click the status to open the Server Selector panel.

Link performance



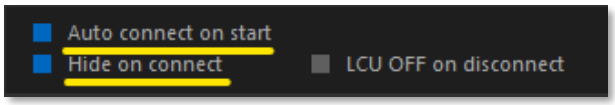
Hover the mouse over the 'Connected' label on the Menu bar. Round trip information is the total time for a Client command to travel from the Client PC to the Server PC and back again including local processing time at each end. It's not a 'ping' value.

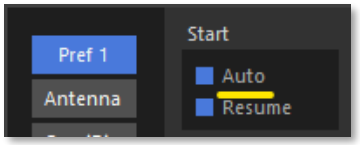
Note: The round-trip data only becomes valid after 10 commands have been sent and is not available when connected to Localhost. The app needs to have focus for hover to work.

Fully automating operation

If you have a single server or preferred server, you can automatically connect to it when the Aziloop app is loaded.

Make sure the target server is highlighted in yellow in the Server Selector panel then enable these options:

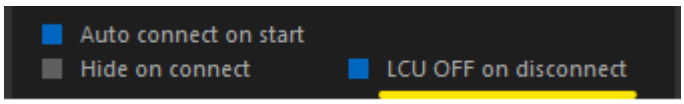




Additionally, make sure Auto is selected in the Pref 1 settings.

So, when the app starts it sees the Auto start setting in Pref 1, after which in Client mode the Server Selector would open. However as Auto connect on start is enabled, the app automatically attempts to connect to the default server (the server row highlighted in yellow). If the connection fails, the app falls back to showing the Server Selector panel for user intervention.

Remotely control LCU power



Options in Server Selector

This allows a client to decide whether the LCU at the server end stays powered up after a link disconnection.

6.0 INSTALLATION

What's shipped in the box?

The following items are supplied along with the CIU and LCU units:

- 2 x pole mount adapters for the LCU
- 4 x cable ties for attaching the LCU
- 1 x spare M2.5 LCU lid screw (when available)
- 2.1mm barrel to bare end cable for 13.8 V DC supply.
- USB mini to USB type A cable
- 3.5mm stereo plug to phono cable (for AUX I/O)
- 2 x SMA to BNC female adapters
- 4 x feet for attaching under CIU (pre-fitted ones are known to move in transit)

6.1 Installation - Software

Officially we support Windows 10 and Windows 11. CPU load is very small so any PC that can run under Windows 10 or 11 should work. Windows 7 has also been shown to work but we don't officially support it because Microsoft no longer do. **Note:** see dependencies below if you are using Windows 10 or older.

Note: If you are updating an installed version of Aziloop DF-72 you will need to uninstall it first. If you don't, the installer will prompt you anyway.

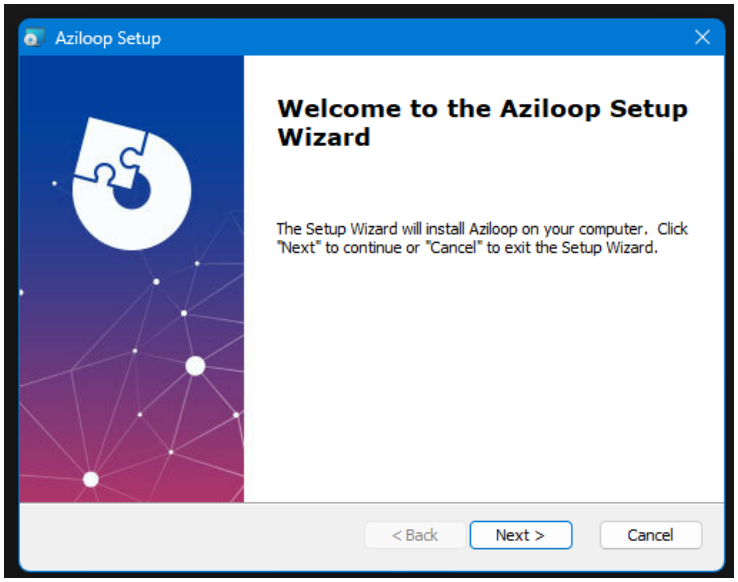
Finding the software

You may have been sent a link to the app as part of the ordering process. The link is also shown on the sheet in the shipping box. The same app works in all modes including at first, in Demo mode.

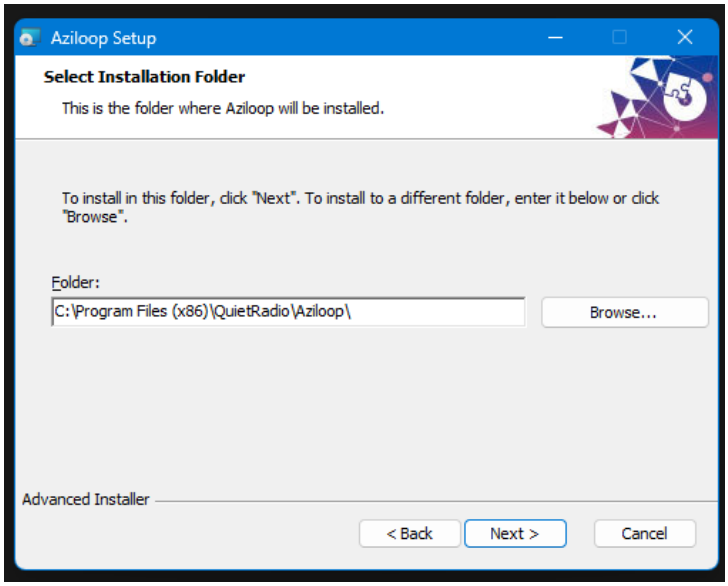
Some stages of the installation may take quite a few tens of seconds to complete so be patient. It depends on what system files you already have.

6.1.1 First Installation

Double click the .msi file in the Aziloop Installer.zip folder.

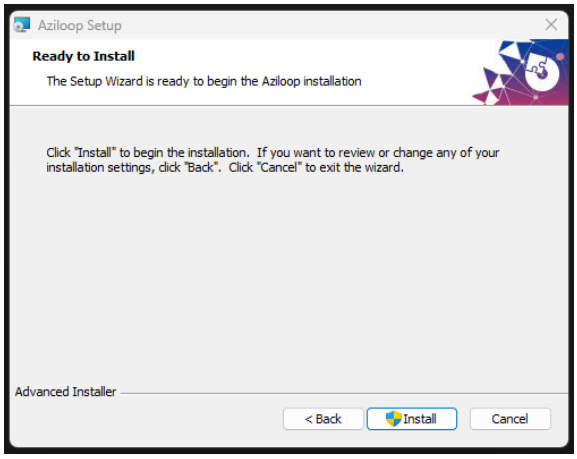


Press Next >

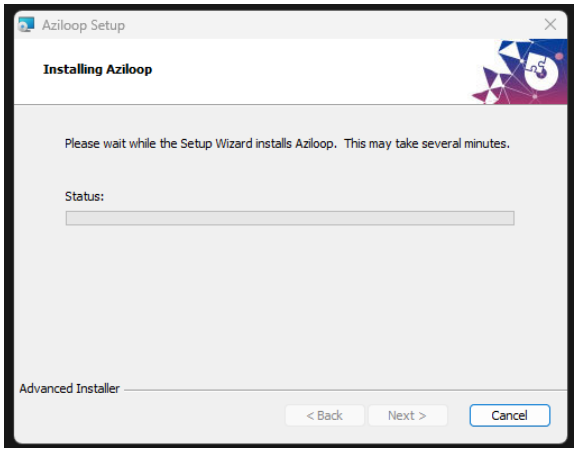


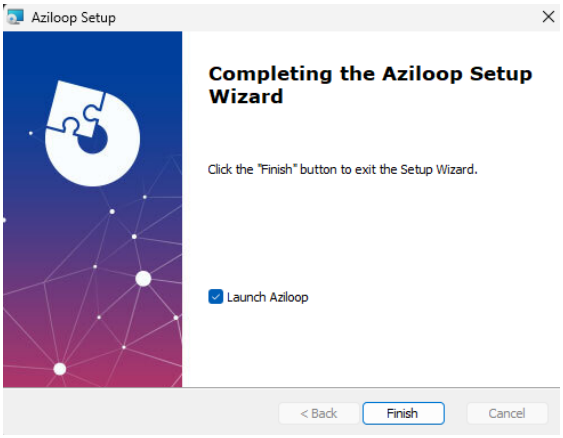
Press 'Browse…' if you want a different installation folder.

Press Next >

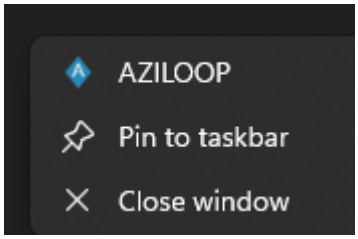


Press Install





Tick launch Aziloop, then press Finish



Once Aziloop starts you will see the Aziloop icon in the taskbar. Right click it then select Pin to taskbar for easy access.

You can check for updates with the Info button in the App's Settings panel. The Settings > Info section covers updates in detail.

Dependencies – Windows 10 Font

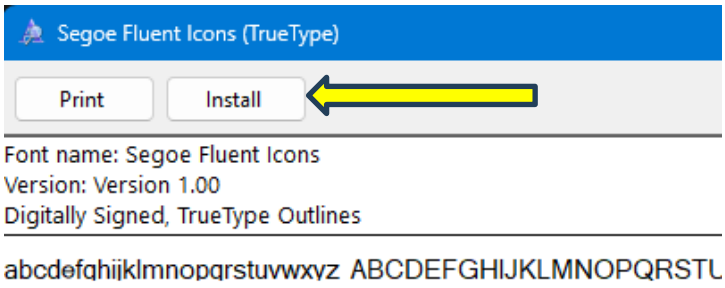
Aziloop uses a built-in Windows 11 TrueType font (TTF) called "Segoe Fluent Icons". This is absent in Windows 10 and older until you install it. You may have it installed already, and this can be checked in the Windows operating system, however it's probably easier to install the Aziloop software first, and if the cogwheel appears as a dot, then install the extra font as described below.

"What if I use Windows 10 and don't install the font?" Aziloop will still run but symbols such as the Settings cogwheel and panel selectors will appear as dots.

Adding the new font to Windows 10

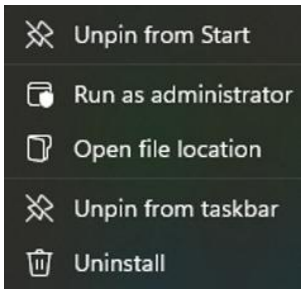
Fortunately, this is very quick one-time operation.

Included in the Aziloop_Installer.zip folder is a file called Segoe Fluent Icons.ttf. Double click it then select 'Install' from the top left of the window that appears. That's it – you're done.



Uninstalling the Aziloop App

Find the Aziloop app in the Start menu, right click, then select Uninstall.



Windows 10 options may be different.

To install a new version, double click the new .msi to launch the installer.

Complete removal

For a complete removal you need to manually remove the files Windows doesn't know about (as the app installs them itself).

Go to your Appdata > Local folder and delete any QuietRadio or Aziloop folders, as Windows leaves these in place.

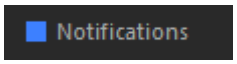
You can easily find this location from within Aziloop by examining the Path data in Preferences > Palette. It should start with C:\Users\ followed by your username (often Admin or default), then AppData\Local.

Note: Preferences > Palette is only enabled when Aziloop is active.

Note: If you have changed the Palette path you will still have .azi files in the original location as well unless you delete them.

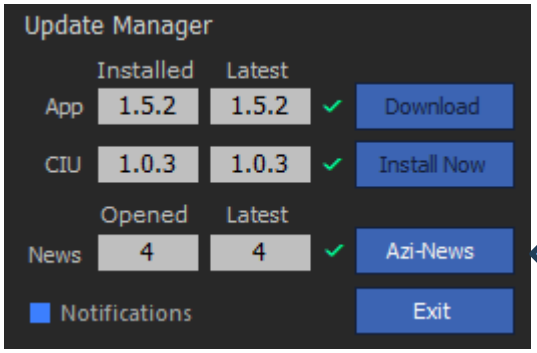
6.1.2 Checking for updates

To not miss updates, make sure Notifications is enabled in the Update Manager panel to auto-check on startup. Any update will be described in an accompanying copy of Azi-News. Open Azi-News first. Once you have opened Azi-News, the app assumes you have been made aware of the update and will not bother you further. It's up to you if/when you decide to implement the update.

Settings > Info > Update Manager 

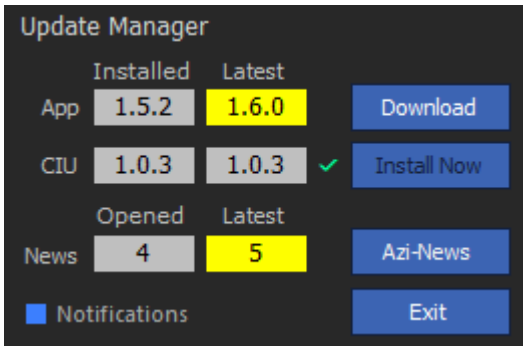
With Notifications enabled, when the app is loaded, a check is made (if there is an internet connection). If there are updates available the Update Manager panel will appear, indicating what's new.

An up-to-date system will look like this:



Azi-News is always available to re-read

If there are updates you will see something like this appear automatically on program load:



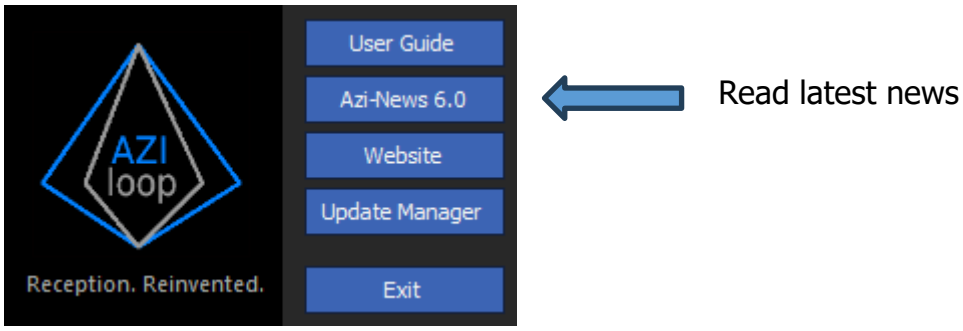
Open Azi-News first to learn what's new. Once opened you won't be nagged until there's another new one. So, if you defer an app update, don't forget about it.

In the above example there is a new app release and a new issue of Azi-News. There will always be a new Azi-News for each app or CIU update. Sometimes Azi-News may announce something else. When you click Azi-News, the app logs the fact you have opened it and won't nag you until another Azi-News is available.

Azi-News

Azi-News is an online pdf that can be accessed at any time from the Info panel or from the Update Manager panel.

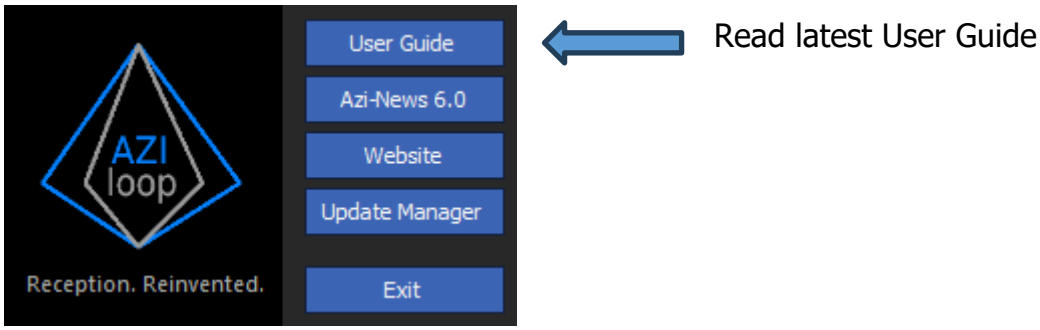
The primary role of Azi-News is to act as a method of notifying users of new features and bug fixes. Should any new products become available, they will also be announced here.



Click the Azi-News button. The latest Azi-News pdf will be downloaded and displayed in your browser. The numerical suffix (6.0 in the example above) is an incremental index indicating the latest online version.

User Guide

Settings > Info

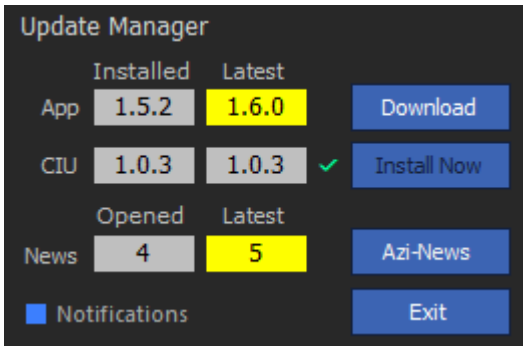


You can save the User Guide locally, but the User Guide button always downloads the latest version, so we recommend that method.

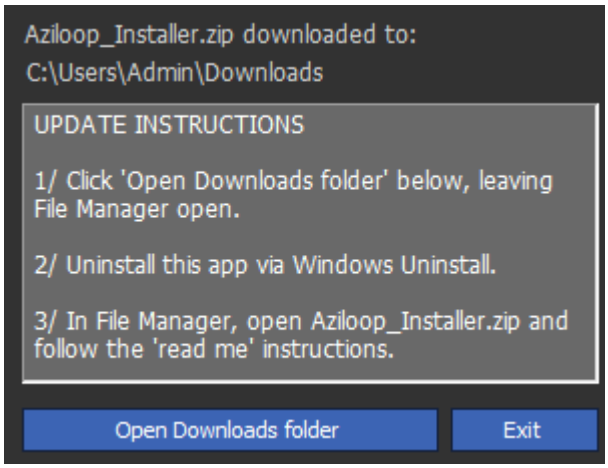
If a new app adds to or changes existing features, the User Guide will be updated at the same time.

6.1.3 Update Manager - App Updates

When a new app is available the Download button will be enabled.



Click Download to download the installer zip file.

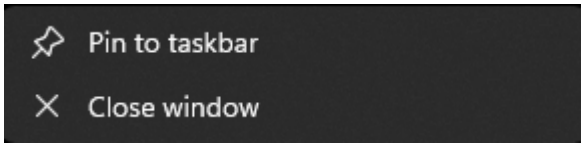


If you open the Downloads folder and keep it open in your PC, then once the current app is removed it's easy to find the file for the new one.

Perform the app update

After removing the currently installed app, open the .zip file you downloaded and double click the .msi file, following the instructions as for previous installations.

At the end of the installation process click the start Aziloop option. Once the app appears on the Taskbar you can choose to pin the app to the Taskbar for easy access (right click the icon).



6.2 Installation - CIU

If you haven't already installed the PC app, go to section 6.1.1 above first.

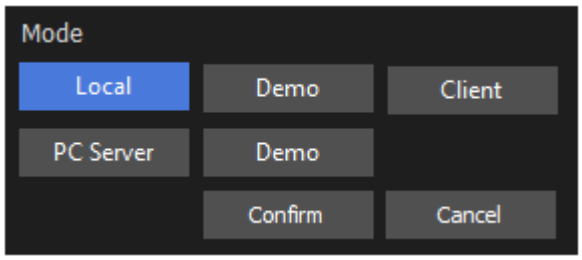
The app needs to connect to the CIU via the USB interface. Complete the steps below before moving on to check the LCU.

6.2.1 First Installation

Preparation

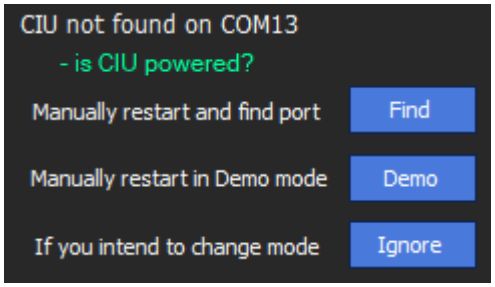
- Install the app and check it runs correctly in Demo mode – see above.
- Disconnect the USB cable from the CIU if you've already attached it.
- You can leave the SMA ports unconnected for now.
- Make sure the 13.8 V supply is connected to the 2.1 mm barrel jack (Centre pin is positive). Use a good quality low noise DC supply rated at >=1A. Linear power supplies are preferred over SMPSUs.
- Watch for the red Status LED to slowly flash 'R' in Morse code as the 13.8 V is applied.

In Settings > Mode, set the mode to Local (with Demo un-selected) then press Confirm.

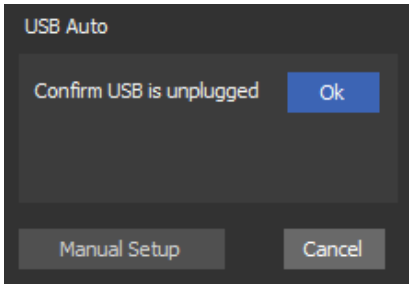


Automatic COMport setup

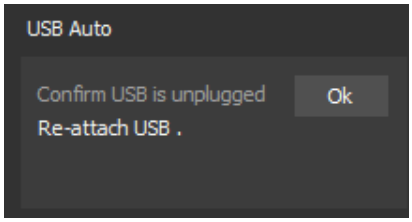
You will initially see this error message if the port is incorrect.



You can revert to Demo mode if you wish, otherwise select Find then follow the instructions below. Ignore is useful if you intend to change mode to one not requiring the COMport such as Client mode or realise you need to apply power.

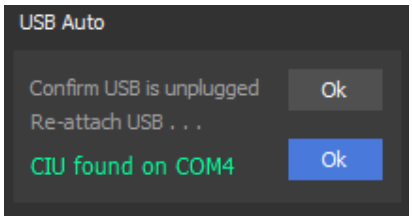


With the USB cable unplugged, press Ok.



Plug in the USB cable.

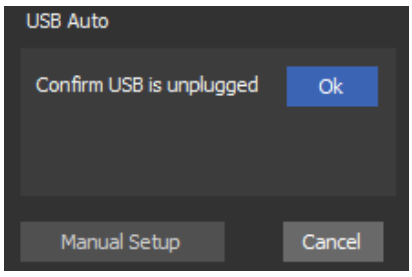
The first time you attach the CIU, Windows may need to download a USB driver. A pop-up message will appear on the bottom right Taskbar area of your screen. Pause a few seconds and watch for this before continuing.



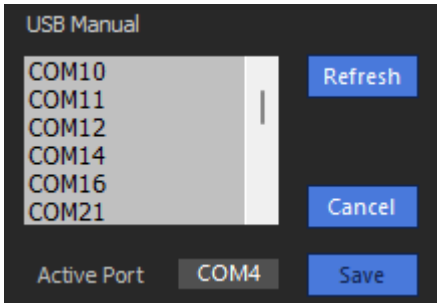
Aziloop should find the newly attached USB and report the port number. Press ok, and you're done. If you don't move USB cables around, you may never need to change this again.

Manual COMport Setup

Manual selection may be the easiest option if you only already know the port, or if the automatic process fails (rare but not impossible). If you have lots of ports in use and regularly 'swap things about' Windows can get a bit mixed up. If all else fails, try a different physical USB port.



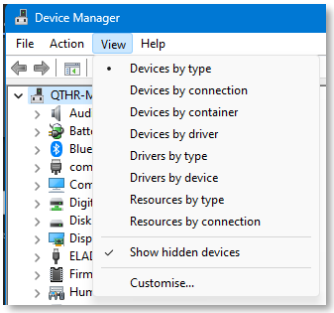
Follow the initial steps as above but this time Press Manual Setup.



- Note the ports in the list.
- Plug in the CIU USB Cable.
- Press 'Refresh' again and note the additional port that appears.
- Highlight the additional port then press 'Save'.

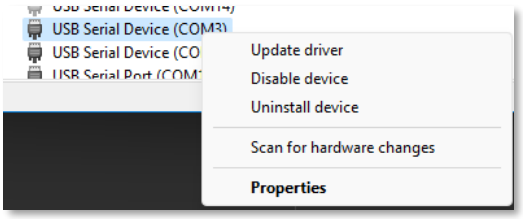
"Auto Mode fails, and in manual setup I see some ports listed twice. What's wrong?"

Windows USB handling is not fool-proof, and it's possible there are multiple entries for the same port, and inactive ones are normally hidden.

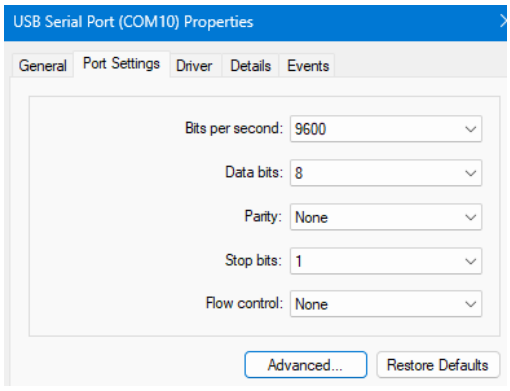


In Windows Device Manager, go to the Menu bar and select View. If 'Show Hidden Devices' isn't checked, click it.

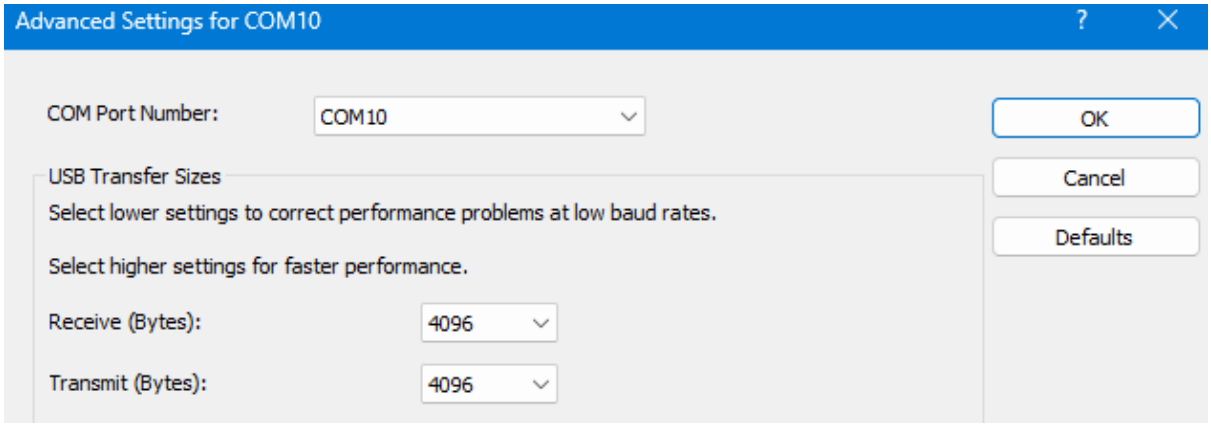
Delete all the hidden COMports, making sure there is only one listing for each port overall, then retry.



You can also go into the COMport properties in Device Manager and force a port to assume a different port number. Right click the port then select Properties > Port settings.



Click 'Advanced', change the port number then click 'OK'.



Third party COM port identifier

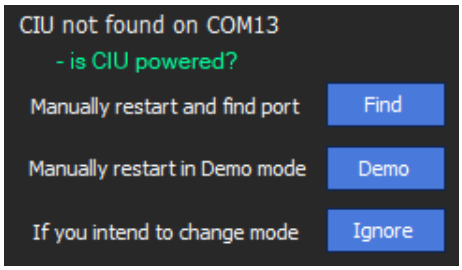
There is a third-party app (which we have no connection with) called Serial Port Notifier that we use extensively in the lab to immediately know what serial ports have been connected or disconnected. It's very handy to identify any USB change. At the time of writing, this link takes you to the app:

Serial Port Notifier

Once installed it runs as a background service. Whenever you plug or unplug a USB serial port a popup message appears identifying the port that's changed.

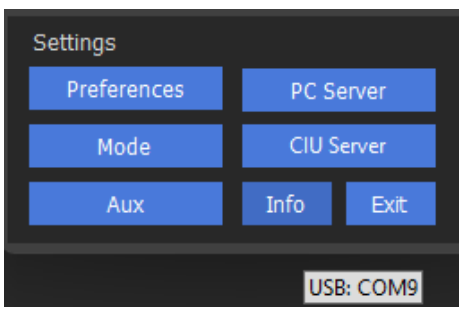
In-service USB port errors

If the CIU USB is inadvertently unplugged, the 'CIU not found panel' appears. If you realise what the problem is, press 'Ignore' and continue, otherwise re-do the port find process.



Normally, once you attach the CIU to a USB port, if you leave the cable in place Aziloop will continue to work without any issues.

What COMport is being used?



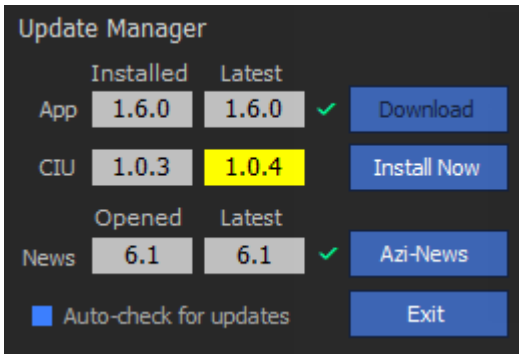
Hover your mouse over Info.

(Mode, Aux and PC Server also show config info on mouse hover.)

6.2.3 Update Manager – CIU Firmware

The CIU ships with firmware already installed, and updates are rare. However, the facility is there should the requirement arise.

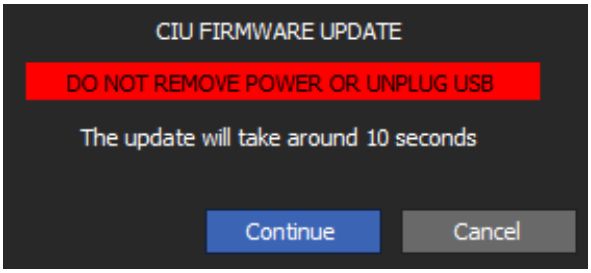
Updating the CIU Firmware



Checks only made in Local or Server modes.

The CIU Install Now button is only enabled when a newer version is available. The app needs to be in Local or Server mode with USB connected. Your PC must be connected to the internet.

Click Install Now…



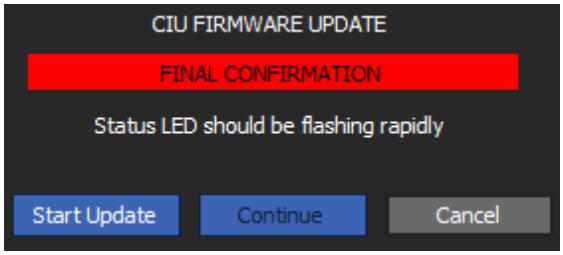
Two confirmation steps are required before the actual update begins. For the timid, there is a cancel button. For everyone else, press Continue.

If the CIU Server or LCU are active, they will be powered off once Continue is selected.

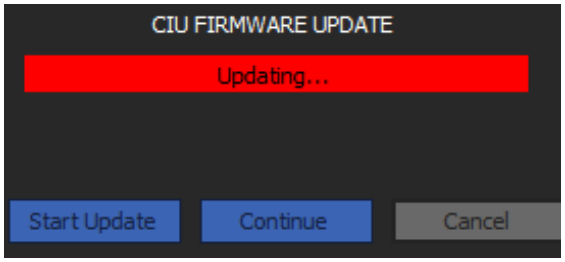
Caution:

You could 'brick' the CIU if you interrupt the update once in progress. Do not switch anything off or unplug the USB cable during the update - which only takes around 10 seconds. In practice updates have been 100% reliable. But there's always a first time hence our advice.

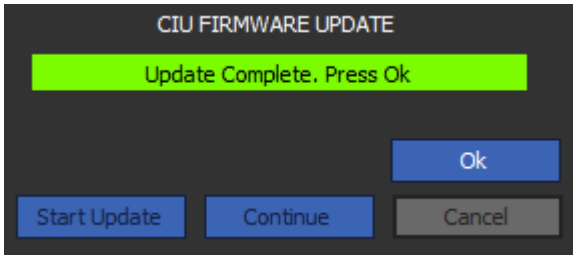
We use this method ourselves for programming the CIU during final commissioning, and we also ran a test of 1,500 consecutive updates overnight with no failures.



Ensure the Status LED on the CIU is flashing rapidly then press **Start Update**. The LED will flicker in a more random manner while the update takes place.



Update in progress.



Update complete. Press Ok.

Upon restart, you may wish to re-visit Settings > About > Updates to check the installed firmware version has now been updated to the latest version. The 'Installed' and 'Latest' values should now be the same, with a green tick alongside.

6.3 Installation - Antenna

The antenna and associated mounting hardware, feeder etc. are a user choice and not included in the Aziloop product.

Location, location, location

The loops should be placed in-the-clear as far as possible. Nearby large metallic objects can produce directional errors, degrade front to back performance and re-radiate local noise. You can only work with what you have of course, and compromises are inevitable, but if you can, 'give it room to breathe'.

Similarly, co-sited antennas, particularly resonant ones could affect performance by absorbing or re-radiating signals which can lead to azimuth errors or higher noise levels. If you use Aziloop for receive with a larger transmit antenna nearby, experiment with terminating the transmit antenna in different ways during reception. Try de-tuning a resonant antenna if you're receiving around the same frequency, shorting out the feeder or disconnecting it.

Generally, if you notice any interaction, then the antennas are too close, and the use of Aziloop's PTT mute option when transmitting is strongly advised.

PTT Mute reminder

Test the crosstalk by feeding a signal generator into the transmit antenna and measuring the Aziloop signal with its preamp off. Apply the loss figure to your maximum transmit power. If the result exceeds 5 mW you definitely need to mute Aziloop on transmit, and as a general rule you should always enable PTT mute anyway on transmit sites.

Design decisions

There are three key things to consider: antenna size, antenna shape and earth type (for K9AY mode).

Size

For a given frequency at a given site with a given noise floor (either natural or man-made) there is an antenna size that picks up enough antenna noise for that to be the dominating noise source in the receive system, meaning the system is 'external noise limited'. After that, increasing the antenna size merely degrades the receive system's dynamic range.

Double the size (area) and you'll double the output (+3 dB) but increasing the size lowers the maximum K9AY frequency for best lobe shape. This is not an Aziloop characteristic, just how untuned loops work

The K9AY cardioid lobe pattern is maintained right down to VLF, though the output level falls off at up to 12 dB per octave. In practice this is not as bad as it seems and a full size K9AY will still give useful results down to Aziloop's lower limit of around 20 kHz. If you can still hear noise from the antenna, ideally adding 8-10 dB then the system will be external noise limited and maximum s/n ratio achieved.

Without installing the antenna, you won't know the antenna noise level so a little trial and error may be needed. Bear in mind that the background noise level on the lower bands in the evening can increase by 10 dB or more, so do your checks at the right time. Test in both Loop mode and K9AY mode. Receive levels in Loop mode vary less with frequency than with K9AY mode. Depending on antenna size, levels are comparable in the 1.5 – 2 MHz region, above which K9AY mode wins, and below which Loop mode wins.

In summary, if you can hear the noise floor on your bands of interest at the time of day you listen, the loops are big enough.

Shape

A wide range of loop shapes are theoretically possible but in practice it boils down to just two: triangle or deltoid (kite shape); the difference being whether the lower leg is flat or shallow V shaped. They perform very similarly as will be shown, so it's down to personal choice.

Earth type

Loop mode doesn't utilise the earth connection whereas K9AY mode requires it to function. Essentially the 'earth' acts as a counterpoise to the E-field component of the loops. Ideally the phase and amplitude must match this loop component. You have three choices:

Earth Rod

Gary's Breed's original QST article from 1997 defines the earth connection as a ground rod. Counter-intuitively, this may be 'too good' and a series resistor may improve performance (See appendix 3)

Ground mounted radials

A ground rod may be impractical over rocky ground. Four radials, two along each loop axis under the loops may work better over dry / rocky terrain and provide a degree of adjustability.

Ground radials or an earth rod limit the loop height because the vertical wire connecting to the LCU increasingly affects the K9AY lobes at higher frequencies.

Elevated radials

The third option, and the one we recommend for Aziloop is elevated radials, for the following reasons:

- Lawnmower and animal friendly if mounted at an appropriate height.
- Results are much less affected by changes in ground conductivity – which can vary greatly with weather and the seasons.
- Improved signal to noise ratio if there are ground currents from electrical interference sources.

However, signal levels may be slightly down compared to a ground earth (2 dB or so) and the optimum load values tend to be higher (but still within the Aziloop load range). There are always trade-offs.

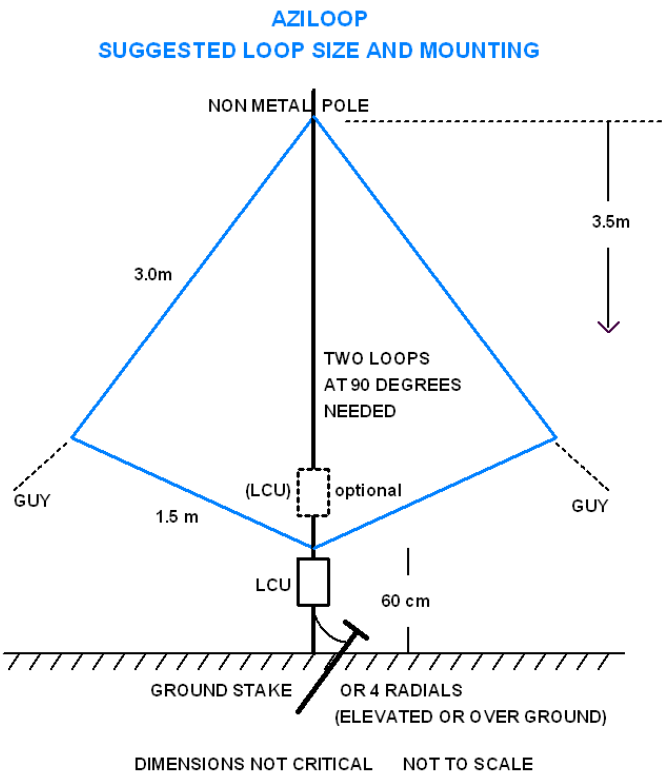
Suggested antenna designs to 7 MHz

For general use we suggest the following designs which have a small footprint and are easy to erect.

Small size antenna

The suggested dimensions for a small antenna as shown on the website and in previous user guides still stand, though further suggestions are added below:

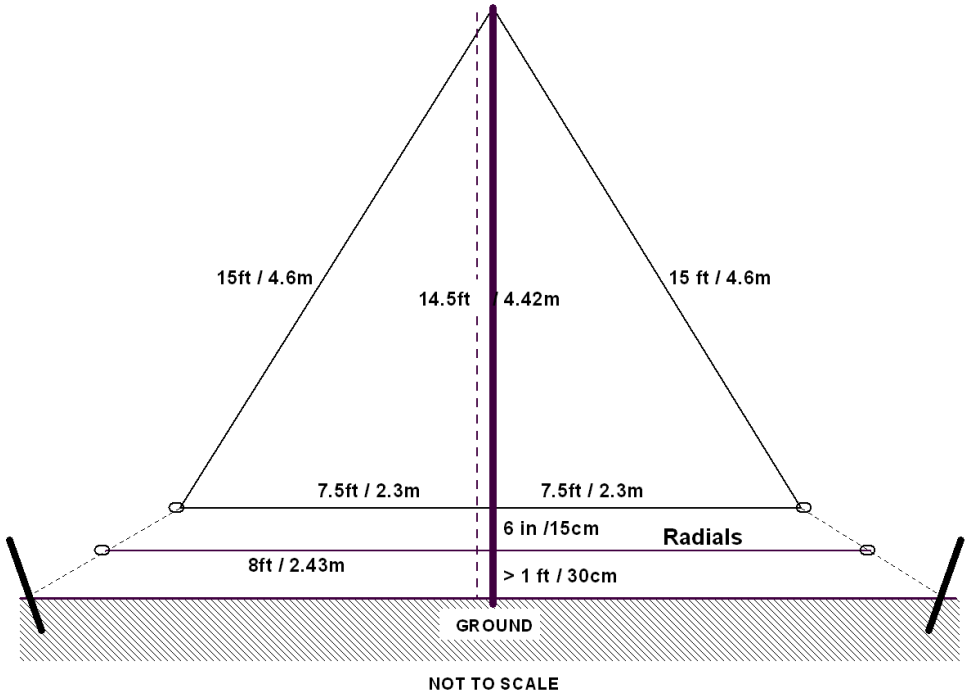
Original:



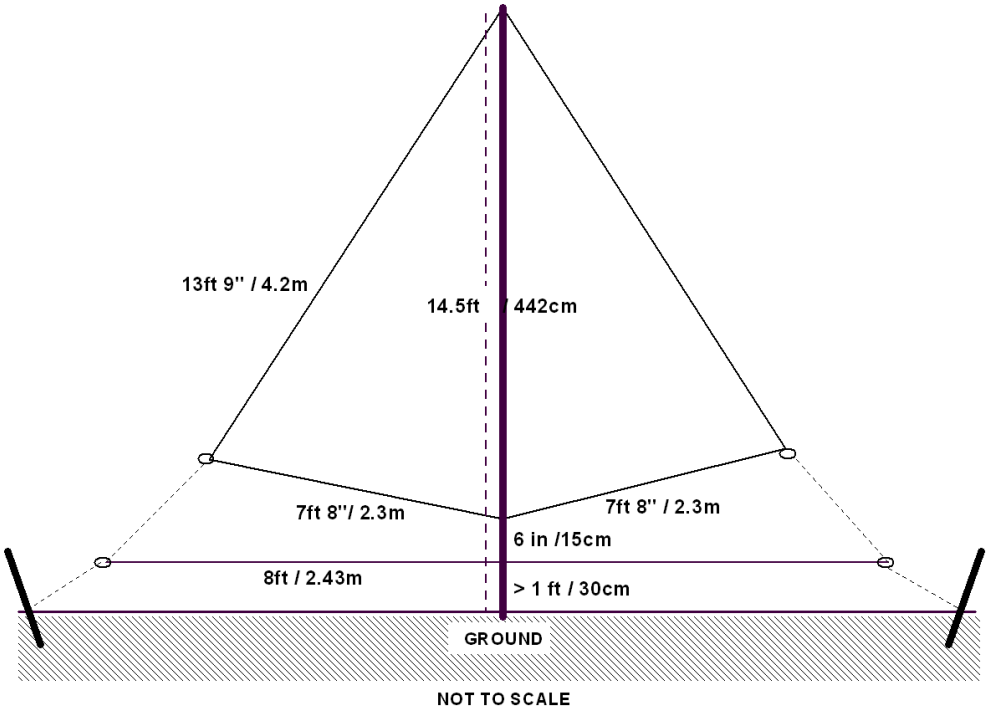
Medium size antenna. Two further suggestions:

These two have an almost identical modelled performance. Use the shape you prefer.

Option 1. Triangle



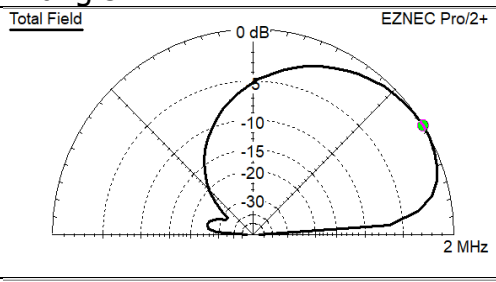
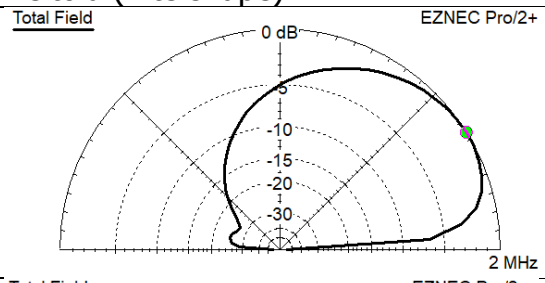
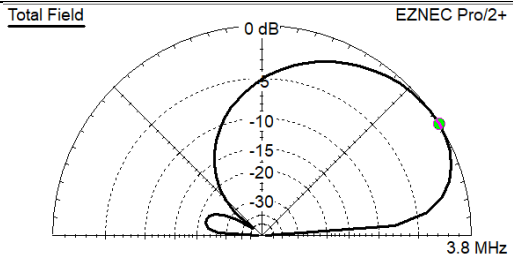
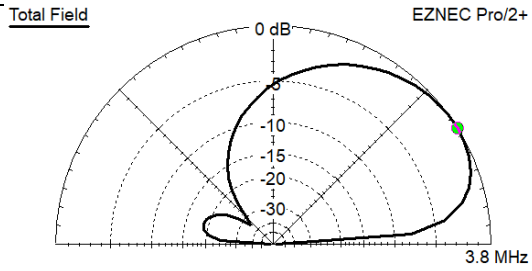
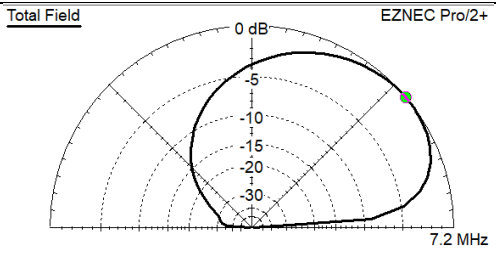
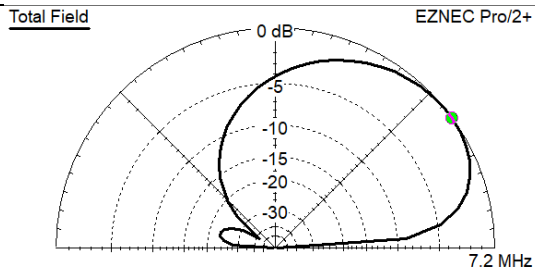
Option 2. Deltoid



K9AY Plot comparisons for the above antennas

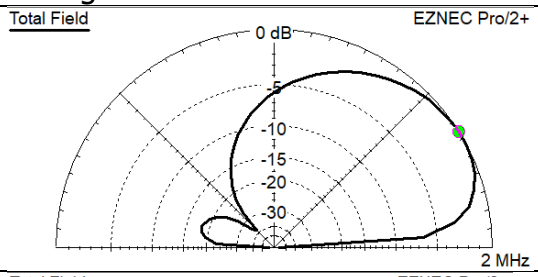
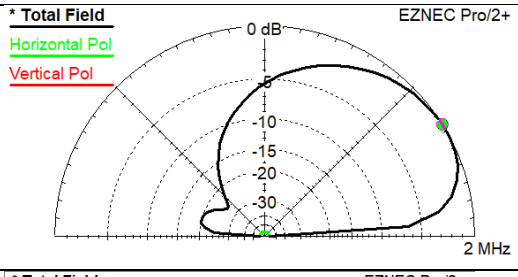
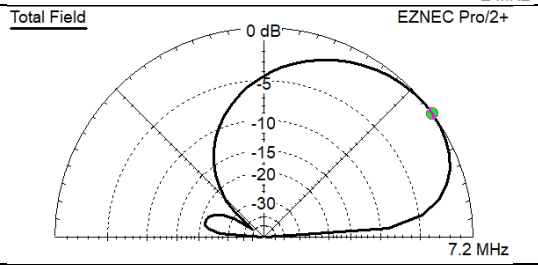
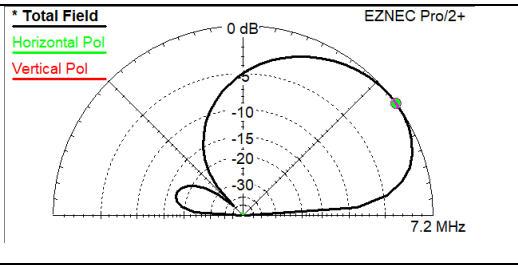
Using EZNEC Pro/2+ with ground conductivity 0.006 mS, dielectric constant 13.

In practice it would be hard to distinguish between the two loop shapes. Actual lobe patterns depend on the load value chosen, which in both cases increases towards 7 MHz in the range 650Ω – 850Ω. Remember these are just models, and each site will behave differently.

	Triangle	Deltoid (Kite shape)
160		
80		
40		

Comparison plots using a ground earth (below)

The plots below are with the same antennas but modelled with a ground earth. which look broadly similar, though it is apparent the rear lobe is less controlled. The optimum load values are more towards the lower end of the range (300Ω area). The shape is much more dependent on ground conditions, and as already mentioned, a close coupling to real ground also closely couples to any unwanted ground currents.

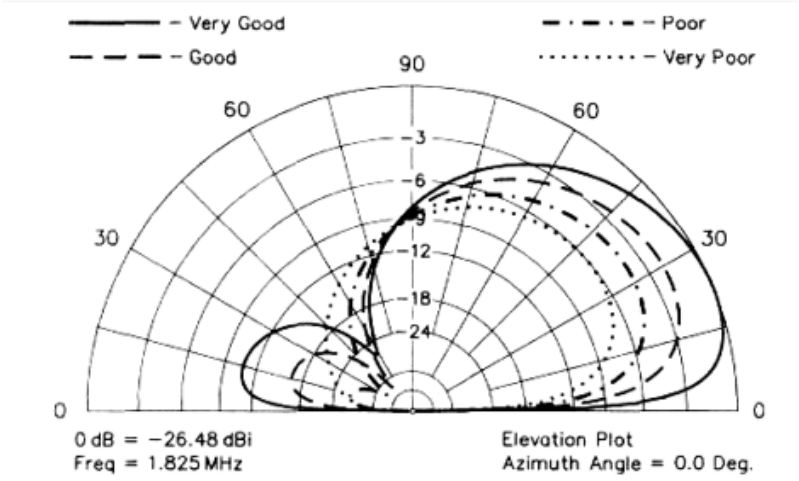
	Triangle	Deltoid
160		
40		

Too good an earth?

Several users have reported load values at the lower (250R) end of the scale when using ground radials or earth rod. Our advice has been to raise the radials off the ground, which raises the load values to give more control. This can happen if the ground conductivity is (counter-intuitively) too good.

If you prefer ground radials and see this effect, another possible solution could be to reduce the effective length of the radials (bend them back rather than cutting). But again, this will be affected by changes in ground conductivity. You could also add a 'Rooistor' to the earth lead (See Appendix 3)

Here below is a plot believed to be by (or reproduced by) Gary Breed, illustrating the effect of varying earth conductivity. The best front to back performance is with a poor earth. We assume they were taken with a fixed load value, but with Aziloop the lobes can be optimised by adjusting the load for best results. The change in output level is also apparent and is around 3 dB between good and poor earths.



What should you expect?

Loop mode – the larger the loop, the greater the output, otherwise all loop sizes and shapes perform to the standard loop reception pattern.

K9AY Mode

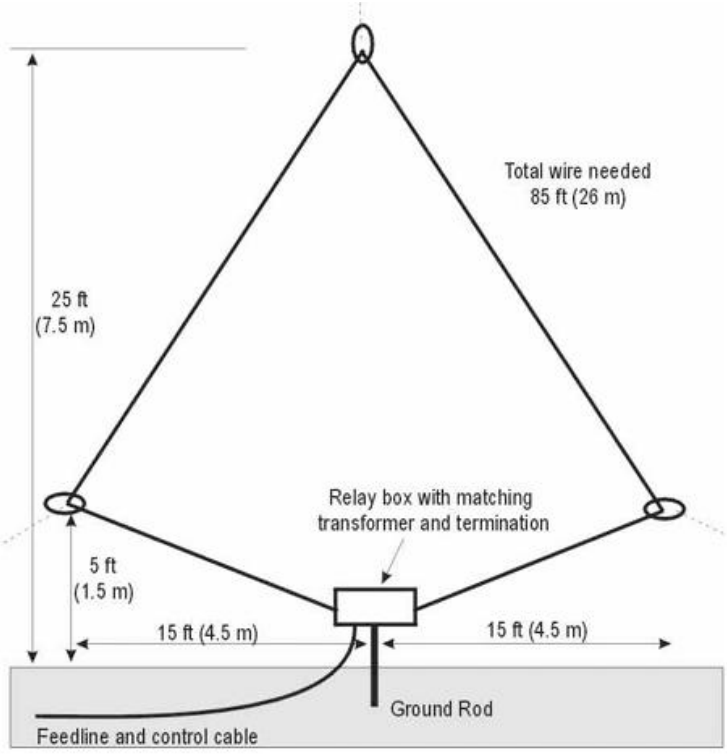
Compared to Loop mode there is less output at lower frequencies, and potentially greater output at higher frequencies due to the wider variation in output level with frequency with this type of antenna. Consideration should be given to how much output you actually need on your bands of interest (see previous comments regarding external noise limited reception).

Beyond 7 MHz

To extend coverage with good K9AY lobe shape up to and beyond 10 MHz you will need to reduce the size of the loops further or consider experimenting with the proposals in Appendix 3.

The 'Full Gary'

Full size loops (shown below, as defined by Gary K9AY himself) may be required at low noise sites to achieve external noise limiting but bear in mind 40m performance will suffer. If you are adapting a pre-existing full size K9AY setup, or prefer the larger antenna anyway, then check out Appendix 3 where we propose a new way of extending performance to include 40m.



Construction of a single K9AY Loop.

The importance of a variable load

To quote Gary:

"…The terminating resistor value will be between 390 to 560 Ω depending on your band preference. With average ground conductivity, a value of 390 Ω provides the optimum F/B at 160 meters, while 560 Ω optimizes the loops for 80 meters…"

We have found a far greater range of values is often needed for best results under varying conditions, but it is certainly the case that band-to-band adjustments are required.

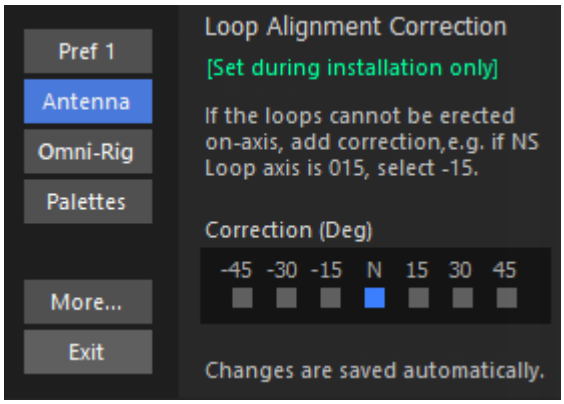
Loop Alignment

If you are unable to align the loops with the cardinal points, you can apply an offset during installation to compensate.

This is a set-once-per-installation choice reflecting the alignment of the north south loop with respect to actual north. Aziloop can compensate for other physical loop headings if the offset is a 15-degree multiple.

To show the setup panel, click Preferences > Antenna a second time. This extra step reduces the chance of inadvertent changes.

Offset is not adjustable in Client mode. If you have multiple sites, any site-specific offset is applied automatically at the server side.



For instance, if the actual NS loop heading was 030, then select the -30 option to cancel it.

The supporting Pole

This should be non-metallic. Other than that, use whatever is to hand but insulate metal poles from the ground. Bearing in mind this is a small structure that is normally held upright by the loop wires forming part of the guying system, a pole of lightweight construction is sufficient though it's a good idea for the pole to be able to support itself should a wire break or come loose.

A low-cost fibre glass fishing rod pole or 'roach pole' or telescope flag / windsock pole will do nicely (buy a longer one and use the thicker sections) but avoid carbon fibre versions. Even a wooden pole would do. For the ground support you could hammer a short length of metal rod into the ground or choose from the many types of parasol mount available from Amazon and elsewhere.

Engineering Composites Ltd near Chester UK have a good range of high-quality fibre glass poles with telescoping sizes and a free cutting service. They are used to dealing with radio amateurs and have already supplied poles for Aziloop installations. They advertise in Radcom.

The antenna wires

Don't be too precious about loop dimensions, just make both loops the same size. Theoretically thicker wire is better for VLF work but in practice 24/0.2 (24 strands of 0.2 mm) PVC covered equipment wire is fine for general use. It's low cost, plenty strong enough, and on a practical point, the wires will fit snugly through the compression gland, even if you also use four radial wires.

Radial wire suggestion

A stainless-steel earth bonding block may come in handy while experimenting with earth options but be aware of long-term weatherproofing issues. Spray with WD40 etc.

Route the wires directly into the LCU once you've settled on an earthing method.

Is your feeder good enough?

At HF unless the cable run is extremely long (> 100 metres) then 5 mm OD RG58 is adequate. The issue is purely the voltage drop due to the DC resistance of the feeder. RF losses at HF will be minimal.

Try to keep the DC loop resistance of the feeder below 5 Ω. Official Belden RG58 specifications show a loop resistance of 14.8 Ω per 1000 feet (or 304.8 metres), equating to approximately 5 Ω on a 100 m run. Existing feeders formerly on passive systems can deteriorate without you knowing – **check loop resistance first**.

Poor quality or deteriorated coax has been the only installation issue reported, - fixed when the coax is brought within specification.

For longer runs simply use thicker coax. DO NOT be tempted to increase the 13.8 V supply to compensate.

Avoid!

Avoid low quality adapters in your coax run such as BNC to terminal block converters. These are often poor from the outset and can have high resistance internal connections.

If you install your feeder over ground in open countryside, it's only a matter of time before it gets chewed by something unless you can tie it to a fence or enclose it in ducting. Serious installations should consider using good quality direct burial cable such as 5 mm OD Messi & Paoloni AIRBORNE .5/200" (Loop resistance 15.6 Ω per 1000 ').

Using tougher direct burial cable over-ground may sound like a good choice to combat rodent aggression but check your cable is UV resistant otherwise over time it may become brittle and crack when exposed to sunlight.

If all is working well and you still have the LCU lid off, make a note of the DC voltage at the LCU as a future reference. Failing that, a good alternative is to measure the current draw from your power supply.

Coax choices.

The system is designed to operate with 50 Ω coax and a 50 Ω receiver input impedance. However, if you happen to have a spare 75 Ω coax run pre-installed you can use it. If azimuth errors are observed insert the preamp to isolate the feeder.

The compression glands on the LCU are for cable diameters of 4mm – 8mm. They can be unscrewed to make a larger hole but take care to adequately weatherproof any 'custom' arrangements. A couple of users have removed the coax gland and fitted a coax socket instead. The glands are not glued in place – you can unscrew them. The thread is PG9.

Attaching the loops to the pole

Attaching the loops to the pole need be no more complicated than the use of a few cable ties.

The loop wires themselves form part of the guying system.

Note the pole mounts can be unscrewed if mounting on a flat surface such as a wooden post. (fixing screws under the flaps in the lid)

Or do it like the professionals – here using stainless steel wire:

Photo courtesy Steve VK5SFA

Apex suggestions

Many arrangements are possible depending on the pole material used and what clamping force it will tolerate.

There is also a plethora of accessories available online that seem tailor made for the job. Search for 'flagpole mounting rings'.

Note the two loops are kept electrically separate at the apex.

Photo courtesy Steve VK5SFA

Here's a great idea from one user, where a simple pulley arrangement can be fashioned out of a couple of eye bolts.

This reduces the chance of tangling wires as you can install one loop at a time. It also provides a quick and convenient way to experiment with different loop sizes should you wish.

Radial wire suggestion

A stainless-steel earth bonding block may come in handy while experimenting with earth options but be aware of long-term weatherproofing issues. Spray with WD40 etc.

Route the wires directly into the LCU once you've settled on an earthing method.

Tensioning the loops

Pretend it's a tent.

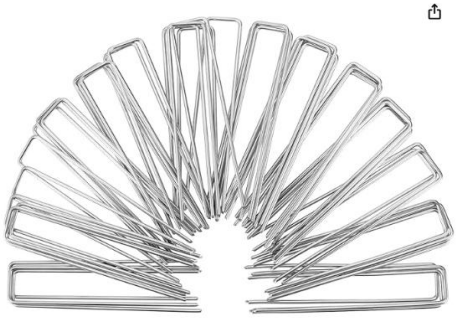
Remove before mowing. We use pitch marker spray to find the holes again.

Mower friendly. Loop cord around flat top pegs.

Side tensioning may need no more than this in a backyard location.

Below: using triangular loops with the bottom legs parallel to elevated radials.

Photo courtesy Steve VK5SFA

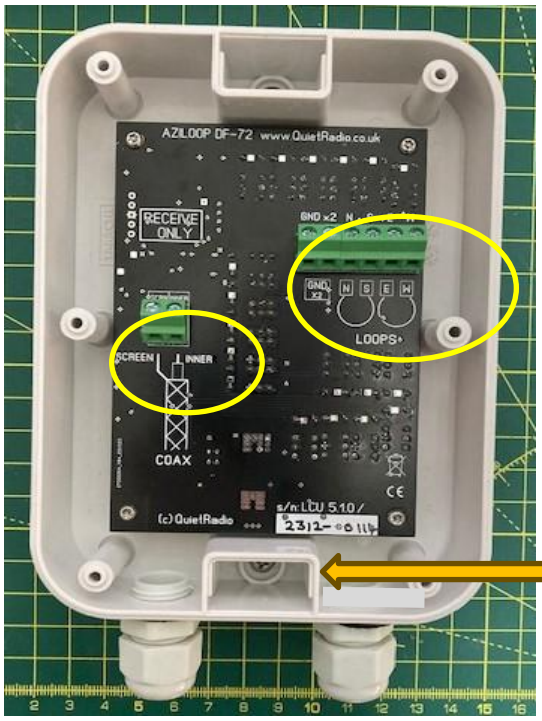


Galvanized steel 'garden pegs' are available cheaply online and are a good way to keep on-ground radial wires / coax in place until they 'grow-in'.

6.4 Installation - LCU

Step 1: Attaching the wires

All connections are made via terminal blocks inside the case. Glands are PG9 thread, 4-8mm cable hole. Simply unscrew to replace.



Two common earth terminals are provided. If you're using a radial system each terminal can easily accept two wires of the recommended size.

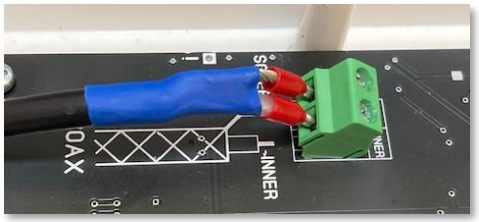
If you accidentally reverse the coax connections you won't blow anything up, the LCU just won't operate until you swap the wires.

Pole mounts can be omitted, e.g. when fixing to a flat wooden post.

Attaching the Coax.

The coax should be stripped back to form two bare wires.

We find plumber's PTFE tape useful for binding the coax 'Egyptian mummy' style to prevent frays. Ferrules and heat shrink even better.

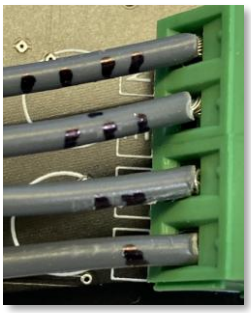


Attaching the antenna cables

The PG9 cable compression glands on the LCU enclosure will clamp cables of overall diameter between 4 mm and 8 mm. We find eight 24/0.2 wires fit snugly (four for loops, four for radials).

At a stretch you can remove the black inner sleeve inside the gland and gain a millimetre or so extra or even drill the dome out to 10mm if necessary. Broken glands can easily be unscrewed and replaced. The thread is PG9.

If you use much thicker cables, you will need an external junction box to reduce the thickness to something that fits the glands, but there's little point from a performance perspective.



Label the wires before you start, then make twisted pairs out of the two wires from each loop. Thread the wires through the compression gland first**,** then attach to the terminal blocks. Double check the wires go to the correct terminals.

There's less chance of the wires snagging if you strip the ends *after* passing through the compression gland.

Step 2: Attaching the lid.

Double check all the terminal block screws have been tightened. You don't need to overtighten the screws - we use rising cage terminals which firmly grip the wire without excessive force.

Recommendations

- Check the lid sealing gasket is correctly seated.
- if possible, screw down the lid before mounting on the pole – there's less chance of you dropping a screw into the grass (it'll be gone forever). **They are M 2.5 x 16 mm stainless screws if you need to obtain replacements.**
- Apply and lightly tighten the screws one by one. That way there's less chance of one being forgotten.
- Once all six screws are in place fully tighten. Do not overtighten – use your common sense.

Worried about losing screws during assembly?

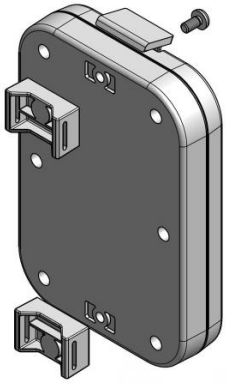
Tape them into the holes first then punch through with a thin shaft screwdriver. Also, you can easily see if you've missed one.

Replacements are M2.5 x 16mm stainless.

Feeder positioning

Sub-optimal feeder installation may lead to poor front to back ratios and azimuth errors. Arrange for the feeder to leave the LCU midway between the loops and bury it if possible. Keep the coax feeder away from the radials i.e., don't cable-tie a radial to the feeder! The ground plane is part of the antenna, and the feeder isn't.

Step 3: Attaching the LCU to the pole



Finally, use two cable ties to attach the LCU to the pole, top one first, mounting the LCU with the cable glands downwards. Take care to insert the ties through *both* slots in each pole adapter. For a more professional job use stainless steel jubilee clips instead, but remember the adapters are plastic – don't needlessly over-tighten. For testing you can hold the LCU in place with a tie on just the upper pole mount and let the LCU hang off the pole.

You can omit the pole mounts if you are attaching to a flat surface such as a wooden post.

It doesn't matter if you place the LCU inside the loop, though it's better to keep any vertical part of the K9AY earth connection as short as possible.

LCU enclosure orientation

Install with the thin sides facing the midday sun. The case is weatherproof and UV resistant so needs no further protection. DO NOT paint the box – the light colour helps keep it cool.

The preamp circuitry and relays generate heat. Heat energy only escapes from a sealed enclosure if the enclosure is cooler than the air inside, so if the case is heated by the sun the internal temperature will inevitably be that much greater. If you

happen to be in the middle of a desert, then it makes sense to also provide some additional shielding from direct sunlight. Correctly installed, Aziloop has survived a 40°C Australian Summer and worked perfectly throughout.

Static build-up prevention

To avoid static build-up the LCU includes 100k bleed resistors from the earth terminal and each loop to the coax outer, which should not be left floating at the shack end, especially if elevated radials are used. These resistors have no effect on the RF performance of the loops. There are also GDTs for more sudden static build up. An earth rod could be used with a series resistor as a static discharge path.

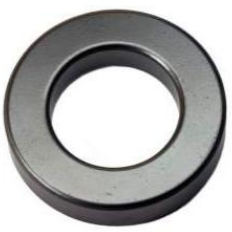
Do not connect the coax outer directly to the Aziloop K9AY earth at the antenna – this *will* adversely affect performance.

Ferrite is good

This is not essential, but some users have reported a worthwhile improvement in nulls and lower noise floor when type 31 ferrite cores are placed over the coax say 20 feet away from the LCU. We also recommend placing cores over the feeder at the CIU end. Of course, if there never was any noise to filter in the first place you won't see any improvement. Every site is different so some trial and error may be needed.

A deep null can be compromised when feeder re-radiation or direct injection fills it back in again. Ferrite chokes create a high impedance point on the outer of the feeder which sounds a good idea but it's possible for wrongly placed ferrites to do more harm than good. A high impedance point creates a low impedance point somewhere else. The best thing to do is experiment.

It's easy to slide or re-position clip-on chokes along the coax but you'll need a few to make any difference – at least four and preferably more. If you find a 'sweet spot' you can always replace them with a ferrite ring later or use multiple turns on fewer cores, coax diameter permitting.



FT240-31 rings (above left) can produce a higher impedance for a given size because you can thread more turns through

APPENDIX 1 Your Aziloop in Practice

Your signals may vary

The ionosphere is constantly changing, and arrival angles from the same station can change from season to season, day to day or even minute to minute, along with even more rapid changes in polarisation.

You will experience different effects on the same station, at times almost suggesting your antenna isn't working. The chances are the antenna is fine. For instance, local vertically polarised LF stations are received via ground wave in daylight. After dusk the ground wave signal can be joined by medium/high angle signals from first the E layer then the F layer. This explains why a few hours previously you could null a station out, but now, after dark, it's no longer possible. It is, as they say, how it is. See Appendix 2 below.

As a confidence check, we suggest you find one or two daylight reference stations on different headings, maybe a local NDB or MW broadcast station that will always be received by ground wave and take some readings for comparison.

Which antenna mode is best, K9AY or Loop? Which direction is best? If you were previously using a fixed-heading single loop, though you never realised it, a lot of the time your antenna was under-delivering. With Aziloop you have 108 choices, not just one (72 K9AY headings, 36 loop headings).

External noise limiting

Achieving the best receive performance is essentially all about achieving the best signal to noise ratio. It is most definitely not about achieving the highest S-meter reading per se. Once your system has achieved external noise limiting, by which we mean 'band noise' clearly swamps equipment noise, there is little more to be done equipment-wise.

The starting point is the receive equipment noise figure (how much your equipment degrades reception by adding circuit noise). Professional receiver comparison tests show how poor the noise figure of some equipment actually is. Most of the time it doesn't matter because noise picked up by the antenna will completely mask this. There comes a point though, where reducing the signal input level will cause system noise to become dominant, degrading the s/n. To see this, apply 6 dB attenuation and you may not notice a difference but add another 6 or 12 dB and you probably will.

Ideally, aim for a 8 to 10 dB uplift in receiver noise when the antenna is connected, at which point the receiver noise contribution is only a fraction of a dB. Any more signal merely degrades the system dynamic range unnecessarily.

Appreciation of this is a key factor in achieving the best results from lower output receive antennas i.e. small receive loops. With Aziloop you have around 36 dB of level control available by way of an 18 dB preamplifier and a 0-6-12-18 dB attenuator, allowing you to optimise signal levels. If you can't hear band noise with the preamplifier inline and 0dB selected, you are one of the privileged few who have a very quiet site. Try increasing the size of the loops to produce more signal, but bear in mind as you increase the loop size you decrease the frequency at which the K9AY lobes begin to deteriorate.

Once you have achieved external noise limiting, continuing to increase signal levels is just making an overload situation more likely. Most SDR receivers have an input overload warning which can be triggered by frequencies many MHz away from where you are listening. Many (but not all) SDR receivers have input filters that may help, and so does Aziloop. See Section 2.3 Band panel.

Compatible receivers

With the range of level control provided by Aziloop, just about any receiver should be compatible, be it SDR or classic (analogue). If you feel your receiver is 'deaf' on LW/MW compared to higher frequencies, check for a 'hidden' attenuator setting that kicks in automatically. You can usually override this – for instance in the Icom 7300 transceiver (but see the cautions below about using a transceiver).

In the lab we've tested Aziloop with the Colibri Nano, Airspy HF+, SDRplay RSP1, RSP2, RSPdx, and our firm favourite the Perseus from Microtelecom. Also IC-7300, IC-705, Flex 8400 and Anan 100D transceivers. The Airspy HF+ in particular is very sensitive, which can be an advantage if used with care. The downside of increased sensitivity is often an increased tendency to overload (if the levels aren't correctly controlled).

Bias-Tee: Some SDR receivers have a selectable bias-Tee voltage on the antenna input (e.g. some SDRplay models). This should be switched off to remove a possible noise source. If it's on by accident no damage should occur as Aziloop's Receiver port is DC isolated.

Transceivers – a warning

Most high-end transceivers have a dedicated receive-only input. Use this connector if you have one available (see Silent PTT). If you cannot contain yourself and as a first test you connect Aziloop directly to a transceiver's main antenna connector, be extremely careful. Remove the mic, turn the mic gain and RF to level to zero, avoid AM or FM, and make sure the rig isn't on VOX. Be aware also that some transceivers can emit a high-power spike on transmit even on low power.

One of our customers decided to test a transceiver with Aziloop and took most of the precautions but forgot about VOX. Luckily the burst of RF was very short lived and the protection diodes in Aziloop did their job. But you may not be so lucky!

Near field and far field

Most stations you want to listen to will be in the far field but local noise sources as well as all nearby objects, street wiring, house wiring etc. will be in the near field. The near field is generally defined as distances less than two wavelengths, with a transition zone from one wavelength. Only the far field represents properly formed electromagnetic radiation. The near field is much more complicated.

Near field signals decay at a faster rate than far field signals. Antennas don't work as you expect in the near field and a rotatable antenna will react to local noise in a different way to how it reacts to distant stations. Nonetheless, being able to rotate your antenna allows you to find the best signal to noise ratio. Remember, it's all about maximising signal to noise ratio, not signal strength per se.

Normal Aziloop behaviour

The following characteristics will go unnoticed by many, but we mention them here to clarify what constitutes 'normal' operation.

Amplitude ripple

You may notice a variation of a few dB as you change heading, particularly in K9AY mode. How much depends on the contribution from near field noise, and the arrival angle and polarisation of wanted signals, and it would be nigh impossible to compensate for factors outside Aziloop's control. The slight changes do not affect performance if you maintain external noise limiting.

Data noise and switching noise

Aziloop uses baseband signalling to convey control data to the LCU. There is a 20 kHz 5-pole high pass filter permanently in circuit in the CIU to remove this from the signal path. You may still hear traces of control data if you tune below 50 kHz.

At low frequencies relay switching noise may be apparent, caused by the inevitable momentary break in signal, and sometimes contact bounce. This is usually only apparent at frequencies below 200kHz.

Band filters

The 7-pole relay-switched band filters are very effective in reducing unwanted signals close-by due to the sharp cut off seven poles provides. However, capacitive coupling across the relay contacts ultimately limits performance at higher frequencies, e.g. with the 500 kHz low pass filter enabled, signals on 28 MHz, though greatly reduced, may still be noticeable.

A 1.1 Troubleshooting

Problems can be broken down into two types: Initial problems – there from the start, and in-service problems – where something has changed.

1. Initial problems

We suggest that before installing the LCU you connect it to the CIU / PC on the bench. You should hear relay noise for every adjustment you make (antenna, load, band, preamp, attenuator). The attenuator relays are in the CIU, everything else is in the LCU.

Antenna not responding at all, or intermittently.

This is very likely to be faulty coax that has gone high-resistance, often unnoticed if previously used in a passive receive situation. We recommend a coax loop resistance of under 5 Ohms.

Antenna responding consistently but wrongly.

Chances are the loop wires have been incorrectly attached to the LCU terminal block. Mark each wire with stripes using a marker pen (e.g. I, II, III, IIII for N,S,E,W) before attaching.

2. Problems in-service

Re-check the coax loop resistance if applicable and do the relay audio checks as above.

Check for loop wire damage. A common problem is local wildlife walking into the wires, and creatures with sharp teeth taking a liking to coax. Electrolytic corrosion when moisture forms the electrolyte is greatly accelerated when a DC voltage is present on the coax. Failure is usually preceded by loud crackles.

If you notice a drop in signal level but otherwise operating ok, check the preamp by switching in and out. There should be around 18 dB of gain at 2-4 MHz.

A good plan is to make a note of what constitutes normal operation – initially log the heading and signal level of a nearby broadcast station or NDB etc. then you have a reference.

If you have the slightest concern something may be amiss, please don't hesitate to contact us.

Note: The vast majority of issues we are aware of have been resolved by replacing faulty feeder and/or connectors. Doubt everything until checked.

A 1.2 RF Noise issues

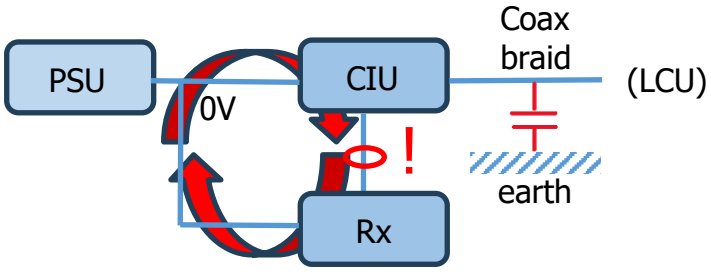
Unwanted noise can be present in any system and the information here applies not only to Aziloop, but to any setup where you are mixing multiple power sources and multiple earths. Noise problems can be there from the start or appear later. Noises that appear later are most likely to be external to your system, picked up by the antenna when some new electronic device gets plugged in.

Equipment noise

The USB connection to the CIU is opto-isolated, and the Ethernet RJ45 is galvanically isolated within the socket (but if you are using this, make sure you use unscreened Ethernet cable to avoid coupling the CIU 0 V to whatever is on the other end of the RJ45.) These connectors therefore shouldn't cause any problems.

If there's noise, there's current flow. And current only flows in a circuit. So, think about your setup and imagine if you were an electron, are there multiple paths you could take? Is there a chance that noisy power supply current is taking the same path as RF current?

Here's one possible scenario: Single power supply for CIU and receiver. Both the CIU and the receiver have two 0 V paths, and one is via the outer of the coax from the CIU to the Rx.



Also, the screen of the coax to the LCU is connected to the CIU 0V. This will capacitively couple to the real (soil) earth and potentially create another path if there is noise leakage to ground from the PSU. Our CIU USB port is optically isolated with its own 0V, but the chances are that a USB connector from the PC to a receiver won't be – definitely the case if the receiver is USB powered as many are. So, there's also a chance of coupling **PC noise** into the system.

This sort of issue usually only becomes apparent at low frequencies, where noise energy is greatest, and you may not have any problem at all. But if action is needed, ferrite is your friend. A nicely stocked bag of type 31 or 43 clip-on ferrites can work wonders.

As a test you could try replacing the supply feeding the CIU, the receiver, or both with a battery, and see what happens.

If you use a USB powered SDR dongle, try substituting with a conventionally powered receiver, or something like an IC-705 on battery as a test.
If you have the part to hand, try fitting an RF isolation transformer in the CIU to Receiver coax. Test at all frequencies to make sure that a fix in one band doesn't create a problem in another.

Using Aziloop to locate external RF noise

Discover noise contributors by noting any changes in noise level at each step.

1. Start with the 13.8 V to the CIU disconnected.
2. Plug the 13.8 V in but leave the LCU un-powered.
3. Power up the LCU with the attenuator on infinity.
4. Now set the attenuator to 0 dB in 6 dB steps.

If the noise tracks the attenuator setting then it could be coming down the coax, or picked up by the coax, or being injected into the 13.8 V supply and appearing on the DC to the LCU, back-feeding into the receiver.

Turning to the LCU:

5. Does the noise rise and fall with the preamp in and out?
6. Apply a band filter as far out of band as possible – does the noise drop or go away?

If the answer to either 5 or 6 is yes, then the chances are you are dealing with external noise picked up by the antenna itself. Change between K9AY and Loop modes, and rotate the antenna, looking for a null or definite peak somewhere. You may find it's far worse in K9AY mode and virtually absent in Loop mode, strongly suggesting a nearby external source. You may be left with the obvious choices – find and fix the external noise or move the antenna further away.

Some external noises are easy to identify, electric fences being one, with regular one second ticks. Often several can be heard with slightly different time intervals. By rotating the antenna to find a null, then using K9AY mode to resolve the direction along the null axis, one user was able to find a likely direction. Google Earth identified a farm and indeed they had several (badly) installed units. Switch mode PSUs have evenly spaced (circa 15- 30 kHz) harmonics all across the band. MPPT solar charging regulators can sound similar but the spikes 'hunt' in frequency.

Don't be quick to blame 'the neighbours' every time a new noise appears on the bands. We were puzzled by a regular pulsing noise across the spectrum that sometimes went away or changed signature. It turned out to be a new cordless mobile phone charging stand in our own lab!

APPENDIX 2. Understanding your Aziloop

Note: The plots and comments below apply to any K9AY and any small loop antenna, not just Aziloop.

Knowing how an antenna responds to different polarisations, and which are relevant is key to understanding what to expect. For instance, when receiving vertically polarised ground wave signals, an antenna's response to horizontal polarisation is immaterial – there is nothing to receive. However, if the signal's polarisation is random (like after ionospheric refraction), then the total field - which is a combination of horizontal and vertical polarisations, needs to be considered.

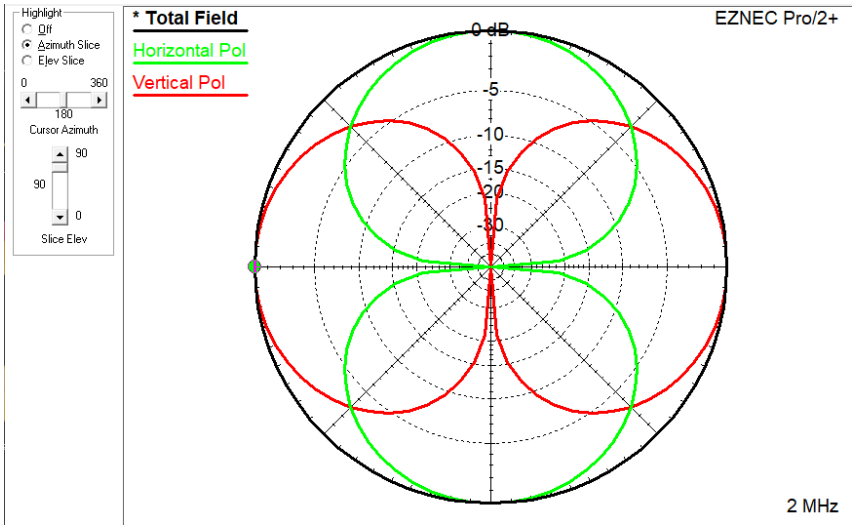
A 2.1 The Loop Antenna

Think of small receive loops (circumference less than 0.1 λ) and a 'figure of eight' reception pattern may spring to mind. Then again, the same loop is often described as 'omni-directional'. They can't both be correct, can they? Well, it depends...

Azimuth plots

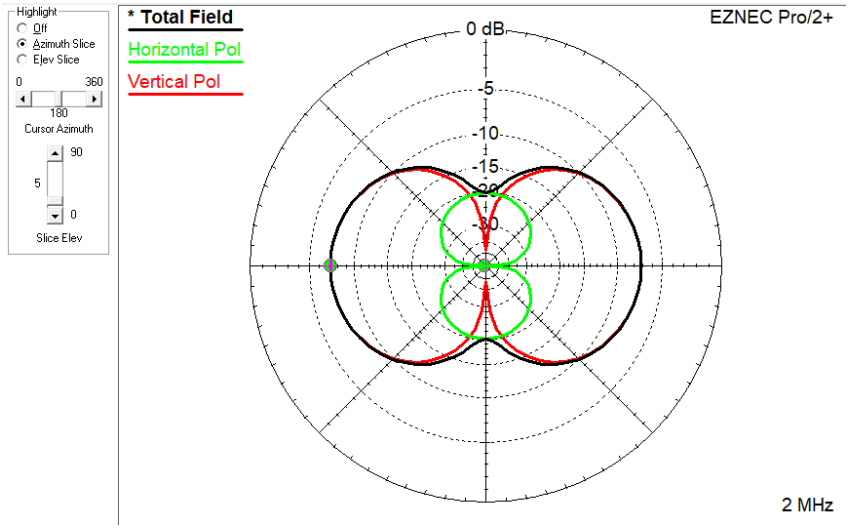
Here below are two different azimuth plots from the same small loop antenna. The plane of the loop is along the X axis.

Azimuth slice at 90 degrees elevation



Notice total field is circular, made up of horizontal and vertical responses combined.

Azimuth slice at 5 degrees elevation



The amplitude of all signals has decreased, but more so for horizontal signals.

The figure of eight pattern is starting to emerge for the total field.

Receive loops are very good at nulling ground wave signals because these are always vertically polarised and so only the red pattern is relevant.

At higher angles, ionospheric refraction scrambles the polarisation, and the loop becomes more and more omni-directional as the arrival angle approaches vertical.

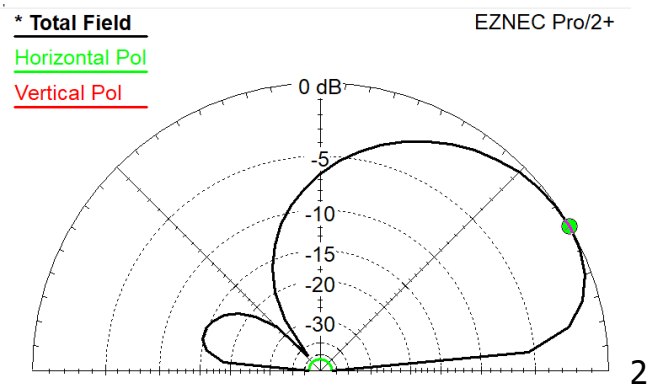
A 2.2 The K9AY Antenna

Renowned as a good DX antenna, the K9AY is another variant in the family of terminated loops, along with the Pennant, EWE and Flag antennas, all of which operate on the same basic principle. The DX capability comes from the low angle, cardioid shaped main lobe that responds to vertically polarised signals.
Many descriptions of the K9AY antenna are available online including from Gary Breed, K9AY himself.

For the K9AY to work properly, phase changes across the antenna should be kept to a minimum. Thus, for a given antenna size there is a maximum frequency above which the lobes begin to gradually deteriorate. At higher frequencies the antenna behaves more like a single vertical element, assuming an omnidirectional pattern. Thus, the low angle reception is still useful for DX work.

The cardioid pattern is maintained to very low frequencies, but the received signals fall off in strength as the antenna gets smaller. There is therefore a balance to be achieved between size, maximum frequency and minimum acceptable signal level.

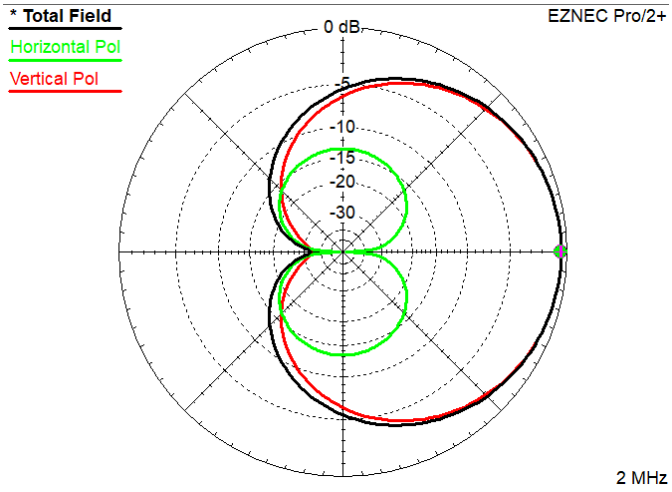
K9AY elevation plot on-axis



This is the classic on-axis elevation plot usually shown when describing the K9AY.

On axis, the total field is almost entirely vertical polarisation.

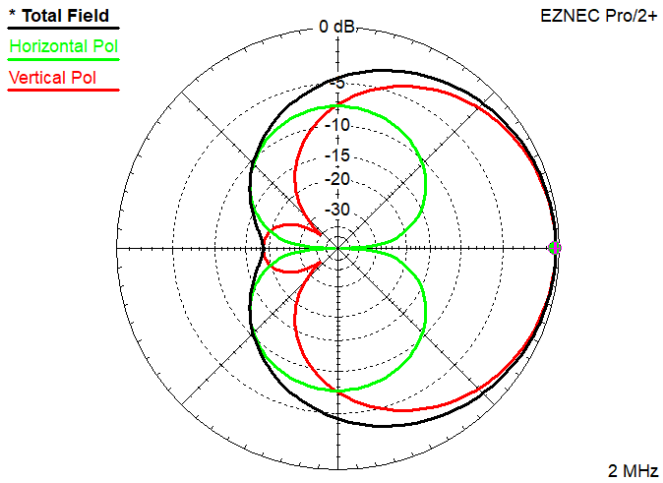
Azimuth plot



At 20 degrees elevation

Note the cardioid pattern is created in the vertical plane, and unlike the normal loop, the nulls in the horizontal plane line up, so the rear null is not 'filled in'.

The pattern is not constant however, as the rear vertical lobe changes in amplitude and shape with elevation.



Plot at 45 degrees elevation and the rear vertical lobe produces two nulls.

As the vertical rear lobe develops, the effect in the azimuth plane is to create two nulls, one either side of the axis. When signals are predominantly vertical, you may observe these two nulls. Thus, using K9AY mode for DF work is not an exact science.

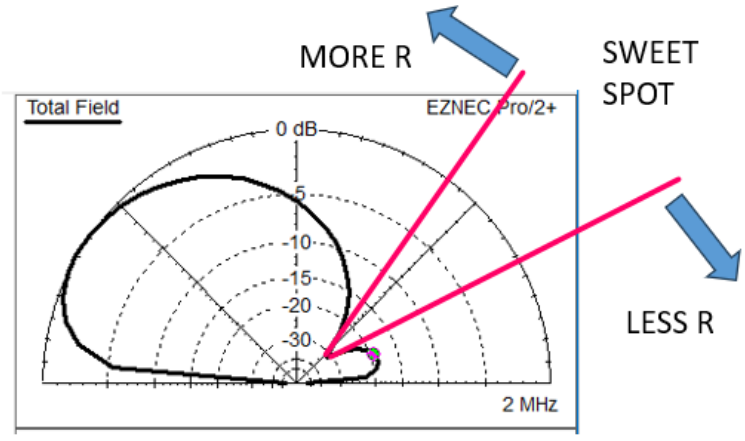
If the task is to minimise signals from the rear, as well as optimising the K9AY load value, it's often worthwhile adjusting the azimuth as well, repeating the process several times for the best result.

The K9AY 'party trick'

It can be an entertaining game to tune to a station and try for the best rear null. Under the right conditions nulls approaching 40 dB are sometimes achievable, 30 dB is often possible, and 20 dB is commonplace. Sharper nulls are always transitional and won't hold for long as ionospheric conditions are constantly changing. This 'game' relies on signals arriving exactly in that rear notch between the lobes. Bear in mind that trying this with very strong local stations is likely to be disappointing as every wire in your station will be picking up significant RF.

Changing the load value shifts the null angle slightly so if stations are the right distance away for the arrival angle to be in the zone, you can adjust the load value to maximise the null. Although not apparent from the theoretical plots, in practice the nulls for ground wave signals can be equally as impressive.

As a rule of thumb, increasing the load resistance increases the angle of the null with respect to the ground. During a daily cycle, towards evening as the E layer gives way to the F layer, arrival angles will change. You may find some stations can only be nulled at a particular time of day. Seasons will also affect this as the F layer height changes.

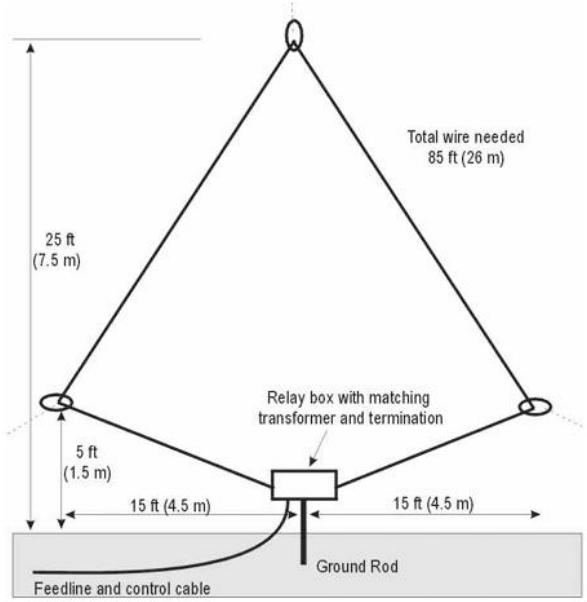


APPENDIX 3 Optimising Your Aziloop

A 3.1 Full size higher frequency

For LF work in very low noise locations, the greater output from the larger size may be preferred. But there are always trade-offs, and as Gary himself says, the antenna does not work well on 40m. "…In some installations, the antenna may retain some directivity above 5 MHz, but this should not be expected…"

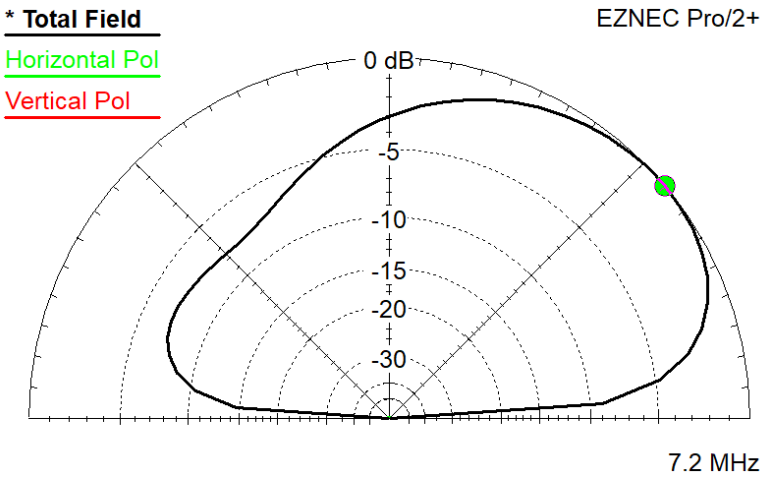
To supplement Section 6.3 above, which gives advice on antenna size and earth methods, we propose a novel way of extending coverage of a full size K9AY to include 40m.



Construction of a single K9AY Loop.

K9AY's original dimensions.

The above antenna on 40m (plotted with elevated radials):



Introducing the 'Rooistor' and the Azi-coil.

Firstly, we cannot stress enough that this requires more testing and is currently a proposal only though early tests are encouraging. Feedback would be much appreciated from anyone who tries this.

The 'Rooistor' (G3ROO resistor)

The Rooistor was (possibly re-) discovered by Ian G3ROO. He found it improved LF front to back ratios in real world tests as well as in modelling.

Normally a conventional K9AY with ground rod or buried radials over average to good earth has a significant backlobe and null in the region of 45 degrees (as shown in almost every K9AY elevation plot example). The null angle can be adjusted by varying the K9AY termination resistors (a trivial operation when using Aziloop), and some K9AY users have found this useful to null strong signals off the back from intermediate skywave angles, in contests etc.

For high conductivity soil, the groundwave f/b may only be in the region of 15dB. However, the Rooistor can be used to change the backlobe pattern of the K9AY or even eliminate the backlobe at low angles over a limited frequency range (e.g. MW BC to 2MHz).

The Rooistor appears to simulate the good f/b pattern of a conventional "poor earth" K9AY. Please note the rear 'party trick' null around 45 degrees is no longer there, the front lobe pattern is still determined by the ground conductivity, and adjustments only apply to 'on-axis' signals (underlining the advantage of an antenna that can be rapidly rotated as needed).

Groundwave f/b ratios of an amazing 30-40dB have been reported by Aziloop users when adjusting the value of resistor, in conjunction with the antenna termination (K9AY load), to achieve a minimum This applies to any type of counterpoise system, be it elevated radials, ground/buried radials or ground rod. The principle is the same.

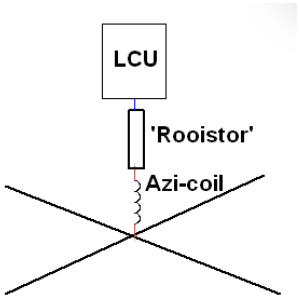
Different values of resistor are needed for different antenna heights and sizes, as well as different types of ground systems, but are usually in the region 100-600 ohms. 0-200 ohms for close elevated radials, and 470 ohms for a conventional earth system and K9AY loops 2-3ft agl.

These results are clearly shown on the antenna models but do not forget to deduct your estimated or measured value of earth resistance from the value shown, because in effect it is in series with the Rooistor. Bear in mind the earth resistance will change between wet weather and dry weather, and as the water table alters. Clearly fixed loads and fixed headings will not bring out the full potential of the K9AY antenna. Experimentation may be necessary to achieve the best results per site according to local conditions thus we cannot offer 'one size fits all' values.

The Azi-coil

Dave GW4GTE then added an inductor we named the 'Azi-coil', which improved 40m performance when using larger loops (e.g. the original K9AY sizes).

Using EZNEC, it appears that a Rooistor value of 180 Ω, and an Azi-coil of 6 uH considerably improves 40m f/b with little effect on lower bands. Those familiar with antenna modelling may wish to experiment further. If so, define a single loop and add four radials to your model not two, or use a ground earth and set to poor conductivity.

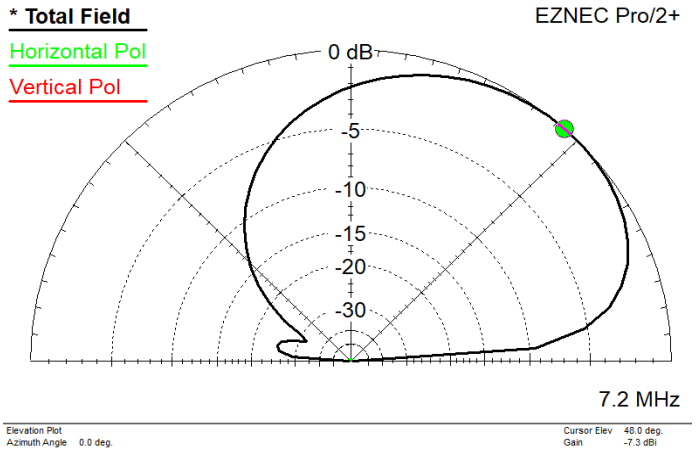


Insert 180 Ω, and 6 uH in series with the common K9AY earth line.

The values are critical and dependent upon the antenna size.

Dramatically improved 40m plot

(same antenna as plot above)

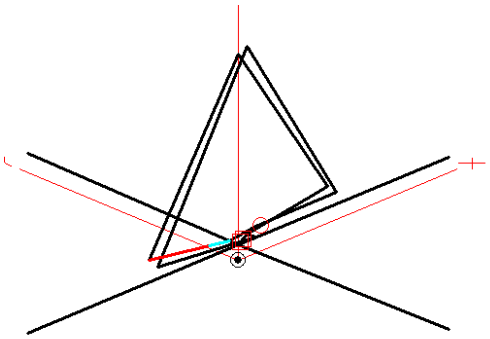


What the Azi-coil and Rooistor are doing is adding compensation to the E field level to maintain E and H field phase and amplitude balance at higher frequencies where normally the balance would be lost.

A 3.2 Smaller size, more signal

A second proposal that has only been modelled with EZNEC and not tried in practice, is a way of producing more signal from a smaller antenna.

It's well known that loop antennas with multiple turns produce more signal. But will it work when the antenna is a K9AY? Worth a try we thought …

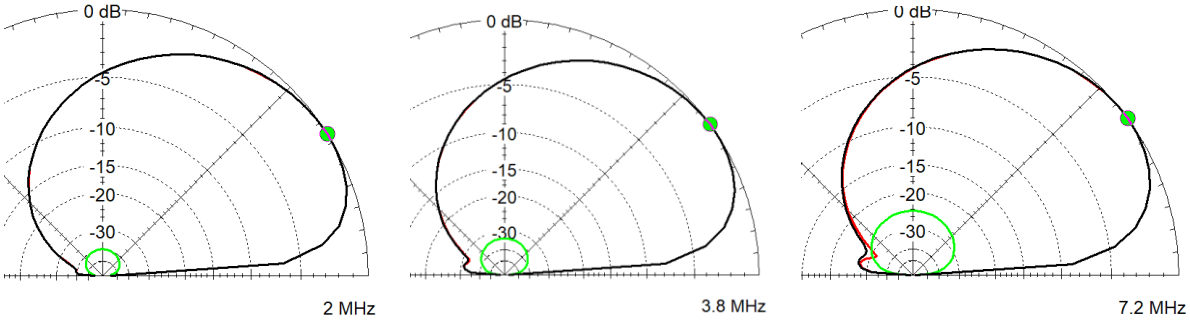


Loops:
Long leg 120"
Short leg 70"
Apex agl 114"
Turn Spacing 6" apart

Radials:
Length 150"

This model again requires a Rooistor and Azi-coil (100 Ω and 10 uH in this case). Dimensions are critically linked to those values. The radials ideally could be shorter with Rooistor and Azi-coil changes, but the above values gave the results below. The plots were all made with a fixed K9AY load of 750 Ω, showing a consistent performance.

Plots for two turn loops in K9AY mode



Comparison of (EZNEC) signal levels between one and two turns of the same dimension, showing around 4 dB extra output for two turns. Turns spaced 6".

SS

	Single turn K9AY (dBi)	Two turn K9AY (dBi)
2 MHz	-44	-40
3.8 MHz	-33.7	-28.5
7.2 MHz	-22.8	-18.5

Hopefully some users will be able to carry out tests and feedback.

www.quietradio.co.uk