

ED3X — IntelliSwitch

Remote control of relays, antennas and stacks

User Manual · by ED3X

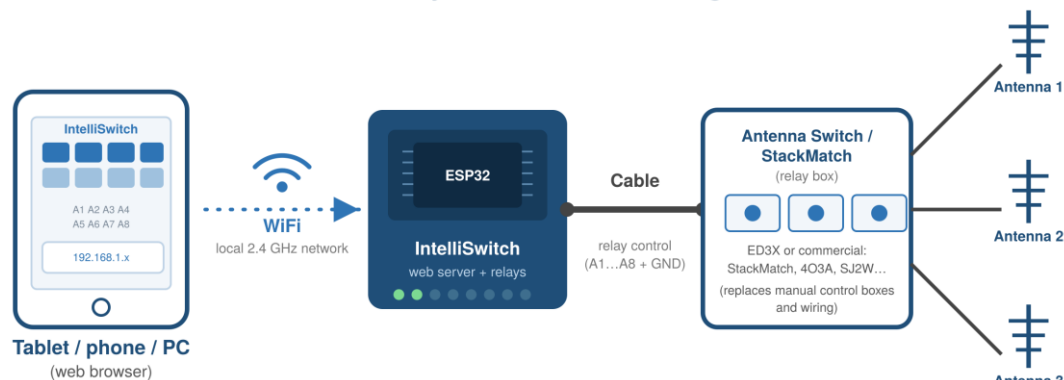
Introduction

- IntelliSwitch is a device designed to manage and control up to 8 relays.
- It is specifically designed as a smart antenna switch, allowing many different combinations: from a simple switch, to stack control, to matrix mode.
- The device has its own built-in web server and is managed through a browser from a computer, phone or tablet (Google Chrome, etc.), with no need to install any application.
- It can also be operated remotely via remote desktop access, Node-RED scripts or a Stream Deck (this requires additional Node-RED node programming and programming knowledge).
- It offers several operating modes, adapting to different control needs:
 - **Single:** only one relay is activated at a time; selecting an antenna switches the rest off (toggle).
 - **Multiple:** allows more than one relay/switch to be active at the same time. Useful when the relays control independent devices.
 - **Stackmatch:** manages the logic for combining several stacked antennas, using one of two switching logics: SJ2W or 4O3A.
 - **Matrix:** activates one or several relays (a combination of relays) depending on the button pressed.
- This project was born from the need to simplify operation inside a contest station when switching between antennas, and above all to adapt to any antenna switch, whether home-made or commercial (StackMatch, 4O3A, SJ2W, etc.). This way, control boxes and station cabling are replaced by direct control from a tablet or computer.
- This manual provides a guide for installing, configuring and operating IntelliSwitch.

General System Diagram

The figure below summarizes the whole setup: the operator controls IntelliSwitch over WiFi from a tablet, phone or computer (no cabling to the operating position), and IntelliSwitch in turn drives, over a cable, the antenna switch or StackMatch that physically switches the antennas.

General system connection diagram

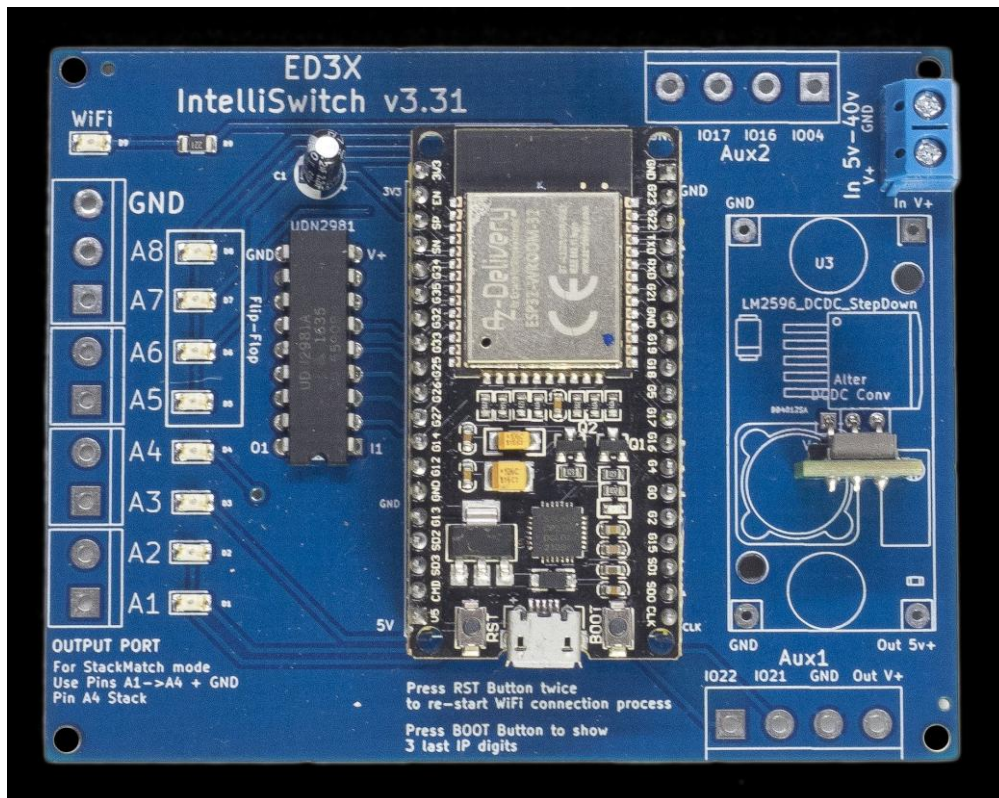


The operator controls the antenna switch / stack from any tablet, phone or computer on the same WiFi network, with no extra control boxes or cabling to the operating position.

Connection diagram: tablet/phone/PC — WiFi — IntelliSwitch (ESP32) — control cable — antenna switch / StackMatch — antennas.

IntelliSwitch: Technical Description and BOM

- Uses a 38-pin ESP32-WROOM-32 (important: versions with fewer pins and a different pinout exist) with a CP210x USB controller.
- The device accepts a supply voltage of 5 to 40 V DC, depending on the relays being switched.
- The ESP32 microcontroller itself is powered at 5 V, supplied by a voltage converter (LM2596 or an equivalent DC/DC converter).
- To power the ESP32 microcontroller and the relays, the device can be fed through:
 - A DC/DC buck converter: LM2596 DC-DC StepDown.
 - A 3-pin DC regulator, 5 V / 1–3 A (compatible with DC 5.5–32 V to 5 V, LM7805-type).
- Uses a UDN2981A power driver.
- Uses a capacitor between 1 μ F and 10 μ F / 50 V.
- Has a female pin-strip header socket for the UDN2981 (18 pins).
- Includes connection headers for power and relay control (outputs A1 to A8).
- All components are easy to source, inexpensive, and mostly pre-assembled (ESP32 module, DC/DC converter), which greatly simplifies final assembly.
- Firmware version described in this manual: v30.29.



IntelliSwitch v3.31 board: ESP32-WROOM-32 module, UDN2981A driver, LM2596 DC/DC converter and relay outputs A1–A8.

Installation and Wiring

- The board ships with all indicator LEDs and control resistors already pre-installed.
- Solder the socket for the UDN2981A driver (optional, if not already mounted).
- Solder the pin strip that will hold the ESP32 module.
- If desired, connect and solder the power and relay-control connection headers.
- Solder the capacitor, observing polarity.
- Connect and solder the chosen DC/DC converter.
- Do not fit the ESP32 module yet.
- **Important:** if using the LM2596 DC/DC converter, its output voltage must be adjusted to 5 V before fitting the ESP32.

- Proceed to load the software onto the ESP32 microcontroller (see next section).

Operating IntelliSwitch

Power and wiring

- First make sure IntelliSwitch is correctly powered and that the DC/DC converter output is set to 5 V. Perform this check with the ESP32 module NOT plugged into the board.
- Connect the relays to outputs A1...A8 and to the common ground (GND).
- In Stack mode:
 - Stack relay boxes (StackMatch, SJ2W, etc.) use 4 wires + GND.
 - Connect the wires to pins 1 to 3 according to the antenna being activated.
 - Pin 4 is connected to the wire that activates the stack.
 - The Aux1 and Aux2 outputs are reserved for future software versions.

Loading the software and getting started

- Load the software onto the ESP32 microcontroller (*see “How to Load the IntelliSwitch Software onto the Microcontroller”*).
- Connect IntelliSwitch to your own WiFi network (*see “How to Connect IntelliSwitch to the WiFi Network”*).
- Find out the IP address assigned to IntelliSwitch (*see “How to Find the IP Address Assigned to IntelliSwitch”*).
- Configure IntelliSwitch for the desired operating mode (*see “Configuring IntelliSwitch”*).

How to Load the IntelliSwitch Software onto the Microcontroller

- Connect IntelliSwitch to the computer using a USB cable.
- Once connected, a COM port is created (COM4 in this example).
- Download the **Flash Download Tool** from the Espressif website (espressif.com, Support → Download → Other Tools).
- Unzip the file and run the executable.
- Select Chip Type: ESP32.
- Work Mode: Develop. Press OK.
- On the SPIDownload screen:
 - Select the firmware file downloaded from the ED3X website (in this case, IS_v30_29.ino.bin).
 - Set the start address: 0x10000.
 - SPI Speed: 40 MHz.
 - SPI Mode: DIO.
 - DoNotChgBin: checked.
 - Com Port: select the COM port where IntelliSwitch was created (COM4 in this example).
 - Baud: 921600.
 - Press Start.
- Once the firmware upload finishes (FINISH message in the blue info panel), you can close the program and disconnect IntelliSwitch.

How to Access IntelliSwitch

The IP address assigned to IntelliSwitch is an address within your router's DHCP range. To find it:

- You can check it by logging into the router and looking at the assigned DHCP addresses.
- Once connected to the network, press the ESP32 board's BOOT button once (see “How to Find the IP Address Assigned to IntelliSwitch”).
- You can also use the IntelliBeacon application, which locates the device on the network automatically (see “IntelliBeacon” section).

Once known, simply enter the IP address in your browser's address bar.

Configuring IntelliSwitch

Access IntelliSwitch by entering its IP address in your browser's address bar (Google Chrome, etc.). From any screen, tap the device's current configuration area to open the configuration page.

The screenshot displays the IntelliSwitch web configuration interface. It is divided into four main sections:

- Device:** Contains a 'Device name' field with the value 'Intelliswitchv3028'. Below it, it shows 'Used as hostname on the network', 'FIRMWARE v30.26 ESP32 - Jun/26', 'IP ADDRESS 192.168.1.130', and 'STATUS Online'.
- Switch mode:** Features four selectable modes: 'Single' (One switch active at a time; rest deactivate automatically), 'Multiple' (Several switches can be active simultaneously), 'Stackmatch' (Stackmatch combiner logic (SJ2W or 4O3A)), and 'Matrix' (Each button activates the relays defined in the matrix). The 'Stackmatch' mode is selected, and its logic is set to 'SJ2W'.
- Antenna / switch names:** A grid of 8 input fields for naming switches. The first four are labeled 'Antena 1a' through 'Antena 4a', and the next four are 'Antena 5a' through 'Antena 8a'.
- Behaviour:** Includes a 'Flip-flop mode' toggle switch, which is currently turned off. Below it, a text box explains how flip-flop mode works, noting that two relays are linked and activated in alternating mode. It lists two modes: 'Single mode' (relay pairs 1-5, 2-6, 3-7, 4-8 activate in flip-flop — max 4 switches available) and 'Stackmatch mode' (relay pairs 1-5, 2-6, 3-7 activate in flip-flop).

At the bottom of the screen, a footer reads 'ED3X IntelliSwitch v10.26 ESP32 - Jun/26'.

IntelliSwitch web configuration screen: device name, switch mode, antenna/switch names and Flip-Flop mode.

- **Device name:** lets you customize the device name (also used as the network host name, and the one IntelliBeacon uses to identify the unit).
- **Switch mode:** defines IntelliSwitch's behavior. Only one option can be selected:
 - **Single:** activates a single relay; selecting an antenna disconnects the rest.
 - **Multiple:** allows multiple selection; useful when the relays control independent devices.
 - **Stackmatch:** manages a stack of up to 3 antennas, using one of two logic types:
 - **SJ2W:** the most common (compatible with StackMatch and SJ2W).
 - **4O3A:** for the 4O3A stack.
 - **Matrix:** IntelliSwitch activates different relays/antennas depending on the button pressed; for each button (B1 to B8) you select the relays (1 to 8) that will be activated.
- **Antenna / switch names:** lets you customize the switch names (Switch 1 to Switch 8). If Stackmatch mode is selected, only 3 buttons are shown.
- **Flip-flop mode:** two relays are linked and activated in alternating mode, to switch between the main relay and an auxiliary one (for example, to connect a 50 Ω dummy load when no antenna is selected). In Single mode it activates up to 4 relay pairs (1-5, 2-6, 3-7, 4-8); in Stackmatch mode, up to 3 pairs (1-5, 2-6, 3-7).
- **Save button:** saves the changes made.

How to Connect IntelliSwitch to the WiFi Network

IntelliSwitch always tries to reconnect to the last configured network. If this is the first connection, or you want to switch networks, follow these steps:

- Press the board's RST button twice in a row; this starts the WiFi connection setup process.
- IntelliSwitch creates its own configuration network, called “Intelliswitch Configuration”.
- Connect to the WiFi network created by IntelliSwitch from your phone, tablet or computer. It will show up as an available network in the device's WiFi settings, and will be remembered for future connections (“My Networks”):

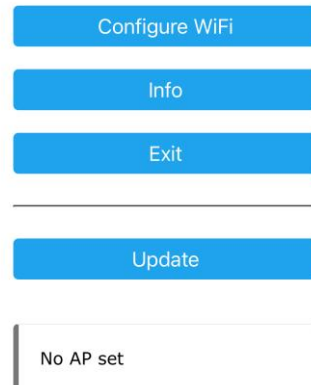


The “Intelliswitch Configuration” network appears in the phone's WiFi settings, alongside the author's home network (anonymized here as “MyHomeWiFi”). Phone menu shown as captured, in Spanish.



WiFiManager

Intelliswitch Configuration



On connecting, the WiFiManager captive portal opens automatically. Select “Configure WiFi”.

- When connecting to the IntelliSwitch network, the device (phone, tablet or computer) will usually open the WiFiManager configuration portal automatically; if it doesn't, open a browser and go to 192.168.4.1.
- On the WiFiManager screen, select “Configure WiFi”.
- From the list, select the station's actual WiFi network (not the configuration network) and enter its password.
- Press Save.
- IntelliSwitch connects to the defined WiFi network and restarts its network module.
- If the connection is successful, the WiFi LED blinks a “C” in Morse code.
- To find out which IP address was assigned, see “How to Find the IP Address Assigned to IntelliSwitch”, or use IntelliBeacon (next section).

How to Find the IP Address Assigned to IntelliSwitch

Once connected to the network, pressing the ESP32 board's BOOT button once lights up the relay LEDs one after another, and then lights up the LEDs corresponding to the last 3 digits of the assigned IP address.

- For example, if the assigned address is 192.168.1.145:
 - START: all LEDs light up in sequence.
 - The LEDs then light up in turn: for 1 → A1; for 4 → A4; for 5 → A5.
 - END: all LEDs light up in sequence.
- Another example, if the assigned address is 192.168.1.092:
 - START: all LEDs light up in sequence.

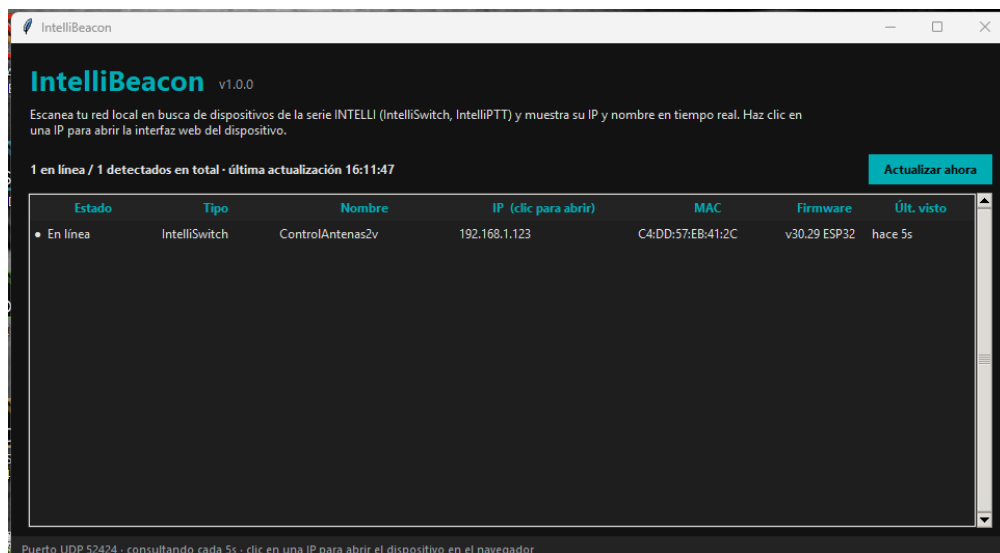
- The LEDs then light up in turn: for 0 → A1 and A8 simultaneously; for 9 → the WiFi LED; for 2 → A2.
- END: all LEDs light up in sequence.

The assigned IP address is the one used to access IntelliSwitch from a web browser (Google Chrome, etc.), or the faster alternative: using IntelliBeacon, described next.

IntelliBeacon: Locating Intelli Devices on the Network

In stations with several Intelli-family devices connected at once — typically multi-tower or multi-operator contest stations, with several IntelliSwitch and IntelliPTT units on the same network — finding each unit's IP address by reading LED blink codes or digging through the router's DHCP table is impractical. IntelliBeacon solves this.

- **What it is:** a small desktop application (Windows) that scans the local network for devices in the INTELLI series (IntelliSwitch, IntelliPTT) and shows their IP address and name in real time.
- **How it works:** it performs discovery via UDP broadcast on port 52424, polling the network every 5 seconds; Intelli devices respond by announcing their name, IP address, MAC address, firmware version and status.
- **Direct access:** just click a device's IP address in the list to open its web configuration interface directly in your default browser, with no need to type the address manually.
- **Usefulness in contests:** with several antennas, stacks and PTT switches spread across different towers or shacks, IntelliBeacon lets you see at a glance which units are online, their firmware version and their IP, speeding up station maintenance and setup before and during the contest.



IntelliBeacon detecting an IntelliSwitch on the local network (name, IP, MAC, firmware and last activity); clicking the IP opens its web interface.

Status	Type	Name	IP	MAC	Firmware	Last seen
Online	IntelliSwitch	ControlAntenas2v	192.168.1.123	C4:DD:57:EB:41:2C	v30.29	5s ago

IntelliBeacon is a complementary tool, not required for IntelliSwitch to work: the methods described in the previous section (LEDs, router) remain valid. It is available for download from the ED3X website together with the device firmware.

Technical Specifications

Parameter	Value
Microcontroller	ESP32-WROOM-32, 38 pins
USB controller	CP210x
Power supply	5 – 40 V DC (depending on relays connected)
ESP32 power supply	5 V, via LM2596 converter (DC/DC buck) or 3-pin 5 V regulator
Power driver	UDN2981A
Relay outputs	8 (A1 – A8) + Aux1 / Aux2 (reserved for future versions)
Connectivity	2.4 GHz WiFi, built-in web server
Operating modes	Single, Multiple, Stackmatch (SJ2W / 4O3A), Matrix

Parameter	Value
Network discovery	IP-indicating LEDs (BOOT button) or the IntelliBeacon application
Reference firmware	v30.29

Additional Information

- Firmware updates: available on the ED3X website, together with the upload instructions described in this manual.
- Complementary tools in the Intelli family: IntelliBeacon (network device discovery) and IntelliPTT (remote PTT control), both designed to integrate into the same station ecosystem.
- Licensing: information pending publication; will be updated in future revisions of this manual.