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D-0023
Levil Joy
Installation and Pilot's Guide

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AMENDMENT RECORD

This procedure is reviewed to ensure its continuing relevance to the systems and processes that it describes. A record of contextual additions or mission is given below:

Revision No.	Date	Responsable Person	Description of Change
1			Initial release

Warranty

Levil Aviation warrants this product to the original purchaser to be free from defects in material and workmanship for a period of one year from the date of the original purchase. The following are not covered: software, damage resulting from accident, neglect, misuse, fire, or flood, improper voltage supply, or failure to follow operational guidelines supplied with this product. An extended warranty is available for purchase on our website.

IN NO EVENT SHALL LEVIL AVIATION BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THE PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.
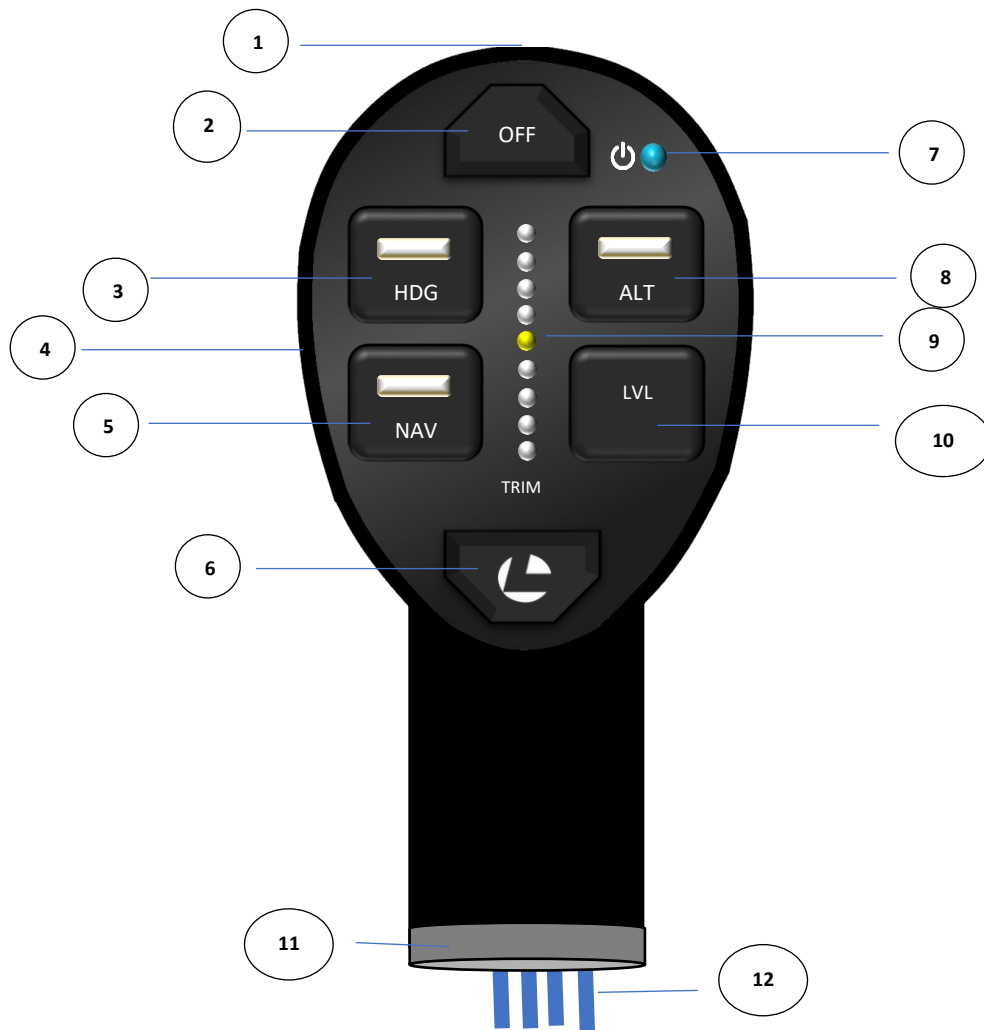
1. Introduction

The Levil Joy is an aircraft grip designed with a wireless or wired autopilot control interface and "Push to Talk" interface for experimental aircraft. The Levil Joy is intended to be used in combination with the iLevil Autopilot or compatible autopilot's such as SuperEco from Aircraft Automation.

2. Installation

2.1 Overview

Feature	Name	Description
1	AP I/O Button	Provides a wired connection to iLevil AP for Autopilot OFF override and LEVEL functions.
2	AP OFF Button	Autopilot Disengage button
3	HDG Button	Heading Control and Status button
4	Scroll Wheel	Use for trimming functionality and Heading and Altitude bug selection
5	NAV Button	Engage autopilot in Navigation mode to follow a flight plan
6	Push to Talk Button	Connect to radio from COM functionality
7	Status LED	Status of the Joy
8	ALT Button	Altitude Control and Status button
9	TRIM LED bar	Shows Pitch Trim Position
10	LEVEL button	Press to engage AP at current HDG and ALT
11	Adapter	Joy adapter to fit different size of rods
12	Wiring	POWER, PPT, RX, TX,GND, AP GPIO

2.2 Wiring

Color	Name	Description
Black	GND	Ground Wire
Orange	PPT	Push to Talk – connect to radio, this pin is grounded when PPT button is pressed.
Gray	RX	RS- 232 receive, connect to iLevil AP Pin 2 (TX) (Optional)
Green	TX	RS-232 transmit, connect to iLevil AP Pin 3 (RX) (Optional)
Blue	AP /IO*	Autopilot disengage, this pin is grounded when AP IO button is pressed, connect to iLevil AP Pin 7 (Autopilot OFF). (Optional)
Red	Power	Connect to 9-40V, 1A fuse recommended

Note: For Autopilot functionality, only GND and POWER are required. RX and TX are optional, and only used when wired connection is desired to the iLevil AP, otherwise, the Joy will connect via Wi-Fi to the iLevil AP's access point. (see section 3.2 pairing via Wi-Fi)
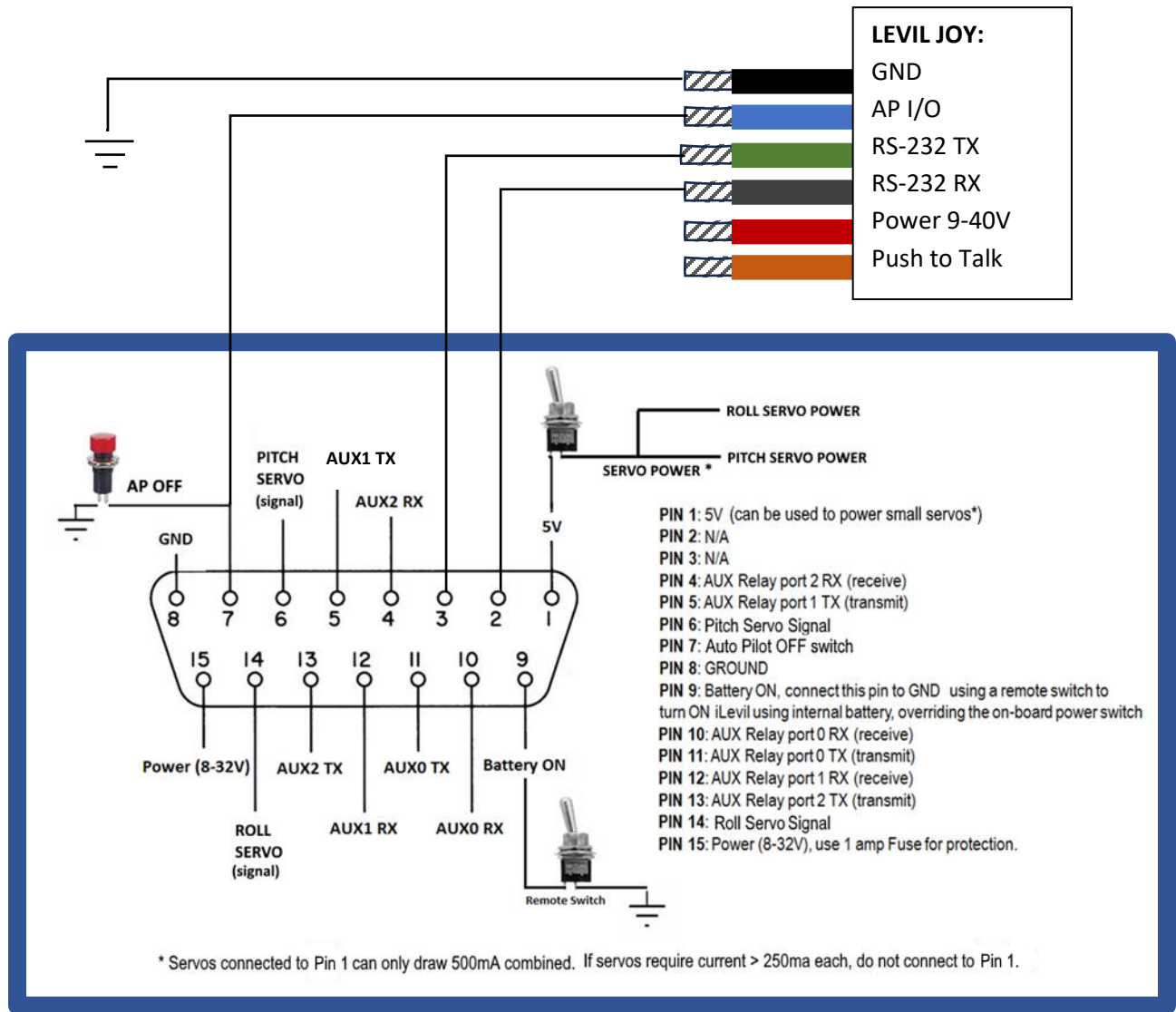
AP I/O is also optional. This button is meant to override the RED push button that comes with the iLevil AP harness for Autopilot OFF and LEVEL features. It is recommended to at least connect one or the other. Both inputs can also be connected simultaneously and wired to the same pin 7 on iLevil AP.

* When LONG pressing the AP I/O (>3 sec), the autopilot will temporarily disengage and will perform an automatic LEVEL command when the button is released. This function is useful

when attempting to avoid an obstacle without having to disengage the autopilot completely. To have this feature, the blue wire needs to be connected to iLevil AP pin 7.

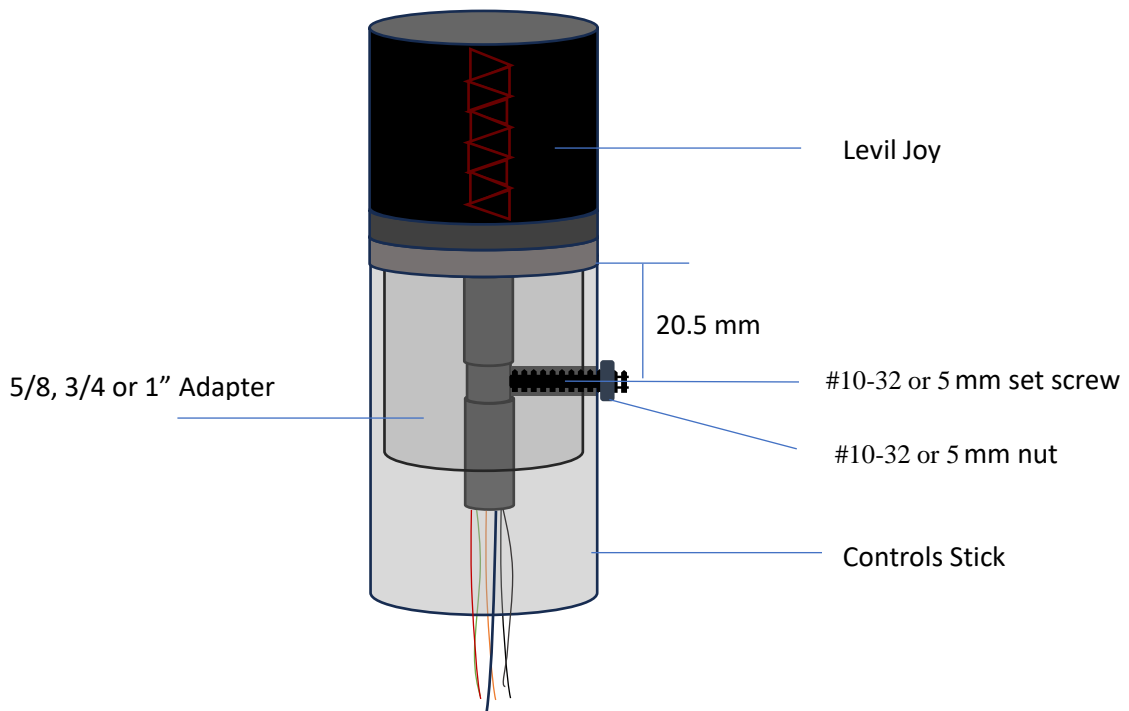**Common Installation Diagram for Wired communication:**

LEVIL JOY:
GND
AP I/O
RS-232 TX
RS-232 RX
Power 9-40V
Push to Talk

ROLL SERVO POWER

PITCH SERVO POWER

SERVO POWER *

PIN 1: 5V (can be used to power small servos*)
PIN 2: N/A
PIN 3: N/A
PIN 4: AUX Relay port 2 RX (receive)
PIN 5: AUX Relay port 1 TX (transmit)
PIN 6: Pitch Servo Signal
PIN 7: Auto Pilot OFF switch
PIN 8: GROUND
PIN 9: Battery ON, connect this pin to GND using a remote switch to turn ON iLevil using internal battery, overriding the on-board power switch
PIN 10: AUX Relay port 0 RX (receive)
PIN 11: AUX Relay port 0 TX (transmit)
PIN 12: AUX Relay port 1 RX (receive)
PIN 13: AUX Relay port 2 TX (transmit)
PIN 14: Roll Servo Signal
PIN 15: Power (8-32V), use 1 amp Fuse for protection.

AP OFF
GND
PITCH SERVO (signal)
AUX1 TX
AUX2 RX
5V

8 7 6 5 4 3 2 1
15 14 13 12 11 10 9

Power (8-32V) AUX2 TX AUX0 TX Battery ON
ROLL SERVO (signal) AUX1 RX AUX0 RX
Remote Switch

* Servos connected to Pin 1 can only draw 500mA combined. If servos require current > 250ma each, do not connect to Pin 1.

ILEVIL AP DB15 DIAGRAM

2.3 Mounting

Measure the inside diameter of the aircraft rod where the Joy will be installed. You will need to purchase or manufacture an adapter that fits the inside diameter. Different adapter sizes are available on the website, as well as drawings for 3D printed versions. After selecting the appropriate adapter size, verify that it fits tightly inside the shaft.

Using a Xinch (6 mm) drill bit, open a hole on the shaft centered at Xin (20.5 mm) from the top. This hole will be used to secure the Levil Joy in place as follows:

Levil Joy

20.5 mm

5/8, 3/4 or 1" Adapter

#10-32 or 5 mm set screw

#10-32 or 5 mm nut

Controls Stick

# 3. Operation

3.1 Status LED

The status LED on to the top right corner of the Joy will illuminate upon supplying power. This LED will blink according to the following table:

LED Status	Description
OFF	Power OFF
Solid Red	No Connection to iLevil AP found
Solid Green	Valid connection to iLevil AP
Flashing Green	Network found but no valid data is present

3.2 Pairing via Wi-Fi

When pairing for the first time to an iLevil AP, or pairing to a new device, Long Press Both HDG and ALT button simultaneously for >8 seconds. The Trim LED bar will start flashing up and down indicating the Levil Joy is in "Configuration mode".

Once in Configuration mode, connect to the Levil Joy's network on your phone or tablet. Look up "Joy-Autopilot xxxxxx" network under Wi-Fi, and connect to it using Password: 12345678
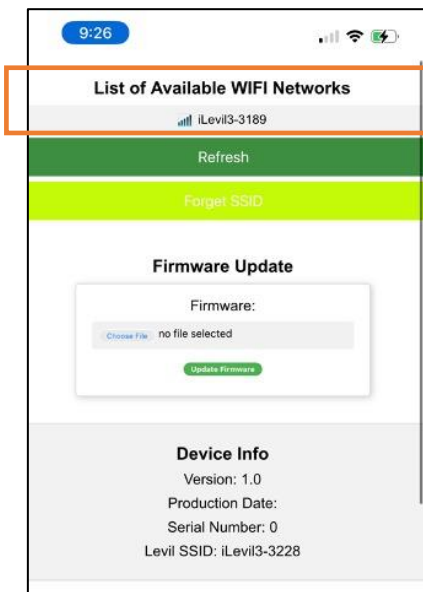
Go to your browser and navigate to the following address on the browser: http://192.168.4.1

On the configuration page, you will see a list of available networks to connect to. Find the network of the iLevil AP and select it. The Joy will attempt to connect to the iLevil AP and the LED Status will change to solid green.

This configuration is then saved to memory. Next time the Levil Joy is powered on, it will attempt to find the iLevil AP's network and connect to it automatically.

3.3 User interface

3.3.1 HEADING MODE

To enable/disable Heading Mode, LONG PRESS the HDG button (> 3 sec), when the Autopilot is engaged in Heading mode the HDG LED will be ON solid. When Autopilot is not engaged in Heading mode, the HDG LED will be off.

3.3.2 HEADING BUG CHANGE

To adjust the Heading Bug, SHORT PRESS the HDG button. When the HDG LED starts blinking, the scroll-wheel on the back is enabled for heading bug adjustment. Simply rotate the scroll-wheel to achieve the desired Heading. After two seconds of no scroll wheel movement, the Levil Joy will command the iLevil AP to engage the new Heading. If Heading Mode is ON, the autopilot will follow the new heading, otherwise, the new heading will be set and ready for future use.

3.3.3 ALTITUDE MODE

To enable/disable Altitude Mode, LONG PRESS the ALT button (> 3 sec), when the Autopilot is engaged in Altitude mode the ALT LED will be ON solid. When Autopilot is not engaged in Altitude mode, the ALT LED will be off.

Note: Before using Altitude mode, be sure to set the altimeter setting either on the Levil Aviation App or compatible display. Otherwise, the autopilot will engage in Altitude with an incorrect reference.

3.3.4 ALTITUDE BUG CHANGE

To adjust the Altitude Bug, SHORT PRESS the ALT button. When the ALT LED starts blinking, the scroll-wheel on the back is enabled for altitude bug adjustment. Simply rotate the scroll-wheel to achieve the desired Altitude. After two seconds of no scroll wheel movement, the Levil Joy will command the iLevil AP to engage the new Altitude. If Altitude Mode is ON, the autopilot will climb/descend to the new altitude, otherwise, the new altitude will be set and ready for future use.

3.3.5 NAV MODE

Whenever the iLevil AP is receiving a valid flight plan from a navigation source, the autopilot can be engaged in flight following by using a SHORT PRESS on the NAV button. The NAV LED will remain ON solid when NAV MODE is engaged.

If no flight plan is being received by the iLevil AP, a NAV Mode command from the Joy will be ignored.

3.3.6 LEVEL MODE

A SHORT PRESS on the LVL button will engage the autopilot in both heading and altitude mode at the current heading and current altitude of the aircraft.

Note: Before using LEVEL mode, be sure to set the altimeter setting either on the Levil Aviation App or compatible display. Otherwise, the autopilot will engage in Altitude with an incorrect reference.

3.3.7 AUTOPILOT OFF

A SHORT PRESS on the OFF button will disengage the autopilot completely.

This will enable TRIM MODE and the Trim LEDs will be illuminated according to trim position.

A LONG PRESS will reset the WiFi in case of any communication issues between Joy and iLevil.

3.3.7 TRIM MODE

When autopilot is not engaged in Altitude mode, the pitch trim function is enabled. Adjusting the scroll-wheel on the back of the Levil Joy, will trim up and down the aircraft in pitch. The LED bar in the center of the Levil Joy will indicate the position of the pitch trim tab. When the pitch trim tab is fully deflected (trim up = 100%), the top 5 LEDs will be illuminated. Inversely, when the pitch trim tab is fully deflected (trim down = 100%), the bottom 5 LEDs will be illuminated. When the trim tab is in neutral position, the middle LED will be illuminated.

3.3.8 AP I/O

When wiring the AP GPIO button directly to the iLevil AP (pin 7), the autopilot can be controlled in two ways:

a. **Autopilot OFF:**
A SHORT PRESS on this button will disengage autopilot functionality, same as the OFF button. This hardwire connection is recommended in case the wireless connectivity is lost, it provides a means to disconnect the AP manually.

b. **Autopilot Stand-by:**
A LONG PRESS (>3 sec) on this button will disengage the autopilot temporarily until the button is released. This feature is helpful when avoiding obstacles or performing a small heading change. While the button is pressed, the servo power for pitch and roll trim tabs will be disconnected allowing the pilot to maneuver the aircraft where needed. When this button is released, a LEVEL command will be executed, thus both HDG and ALT mode will be engaged at the current heading and altitude.

3.3.9 PUSH TO TALK

The PPT button has a Levil logo engraved and is centered at the bottom of the Levil Joy. Pressing this button will activate radio communications. The orange wire must be connected to the PPT line on the radio and a common ground must exist between radio and Joy. Pressing this button will ground the line connected to the radio.

4.0 Firmware Update

You can download firmware files from the website at:

Search for the Joy.bin file and download to a known location on your computer/phone.

Long Press Both HDG and ALT button simultaneously for >8 seconds. The Trim LED bar will start flashing up and down indicating the Levil Joy is in "Configuration mode".

Once in Configuration mode, connect to the Levil Joy's network on your phone or tablet. Look up "Joy-xxx" network under Wi-Fi, and wait until the connection is established.

Go to your browser and navigate to the following address on the browser: http://192.168.4.1

On the configuration page, you will see an option to select the BIN file to be uploaded. Browse for the location where the .bin file was saved.

Click on update and wait until the Levil Joy reboots with the new firmware.