User & Installation Manual

PWS-I/O32 - turn your switches and levers into simulator controls.

Your panel. Your controls.

Start with one pushbutton. Connect two wires, watch it respond on screen, and assign it to a simulator command. Then add the rest of your panel at your own pace.

32 switch inputs

6 rotary encoders

6 potentiometer inputs: AX02-AX07

2 load-cell inputs

Includes labeled connection pictures, actual Configurator screen examples, calibration instructions and help when something does not work.

Find what you need

New to the board? Start with safety, then follow the first-button example from wiring through testing.

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Three words used in this guide: **input** means a connected control; **button number** means the numbered joystick button Windows receives; **assignment** means the simulator command you choose for that button or lever.

Screen examples show the actual Configurator layout. Connect your board to see live readings and enable device read/write buttons.

Connect safely

Your board arrives with firmware installed. You do not need to install firmware to begin.

IMPORTANT - SWITCHES CONNECT TO GROUND ONLY

Connect a switch between a terminal labeled SW and a terminal labeled GND. Do not connect 3.3V, 5V, lamp power or another power supply to a SW terminal.

IMPORTANT - POTENTIOMETERS USE 3.3V

Use the board terminals labeled 3.3V, AX and GND for potentiometers. Do not use 5V. Keep the middle signal wire on the potentiometer wiper.

1. Unplug the USB cable before adding or moving any wire. Keep loose screws, stripped wire ends and metal panel parts away from the underside of the board.

2. Place the board on a nonconductive surface for testing. Secure it before normal use. Do not let the underside touch a metal panel.

3. Use a USB data cable that fits your board. A charging-only cable may supply power without letting Windows detect the controller.

4. Extract the complete Configurator ZIP into a folder. Open PWS_Configurator.exe in that folder and keep its other files alongside it.

5. For your first setup, connect only the board you intend to configure. Add one control, test it, then add another.

An illuminated switch may have separate lamp connections. Use only its switch contacts for the SW/GND connection. Obtain the switch wiring diagram before attaching any lamp supply.

Find the connections

Hold the board with the USB socket at the top and the green screw terminals facing you.

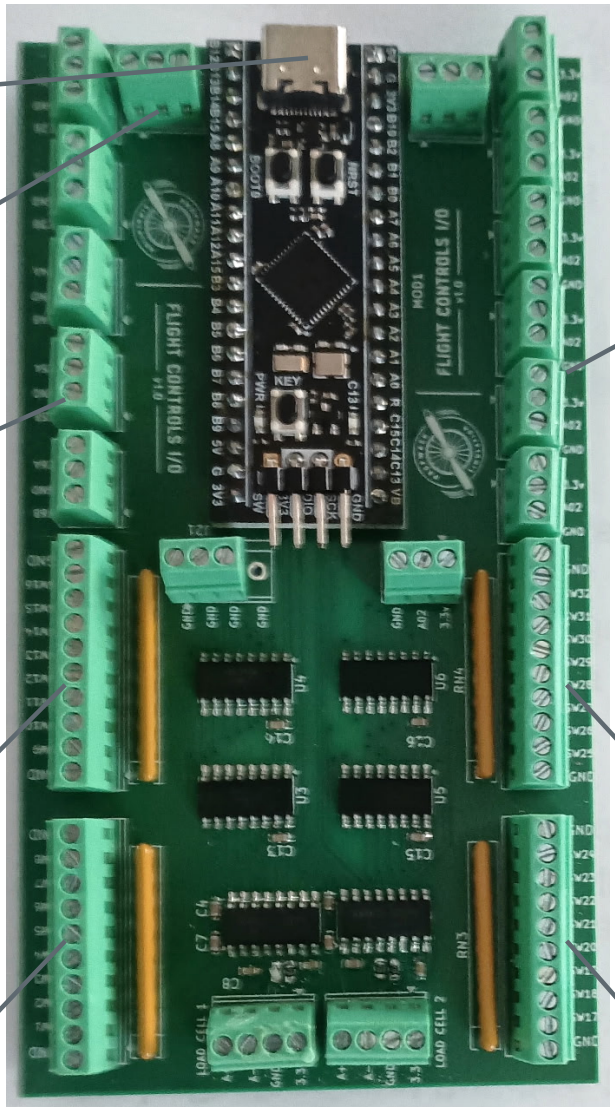
USB
Connect to your PC

ENC1
Top inside connector

ENC2-ENC6
Five left-edge blocks

SW9-SW16
Upper left long block

SW1-SW8
Lower left long block



AX07-AX02
Six right-edge blocks

SW25-SW32
Upper right long block

SW17-SW24
Lower right long block

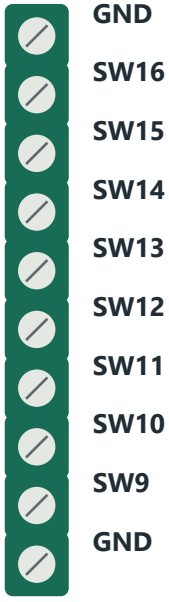
Bottom edge: Load Cell 1 is on the left; Load Cell 2 is on the right. The extra inside GND connector is for ground connections. Leave AX01 and AX08 unused.

The four long switch blocks each have ten screw positions. There are two long blocks on each lower side. Use the close-up diagrams on the next pages to find each wire position.

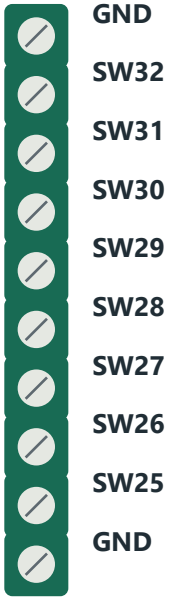
Switch labels, as you see them

USB at the top. These enlarged blocks show the terminal order from top to bottom. Use the SW and GND labels when wiring.

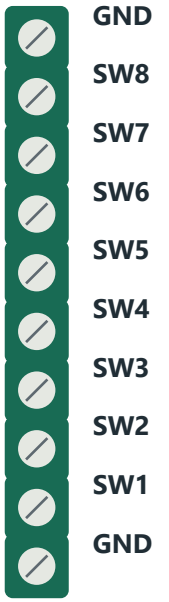
UPPER LEFT



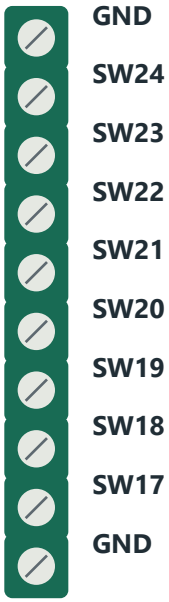
UPPER RIGHT



LOWER LEFT



LOWER RIGHT

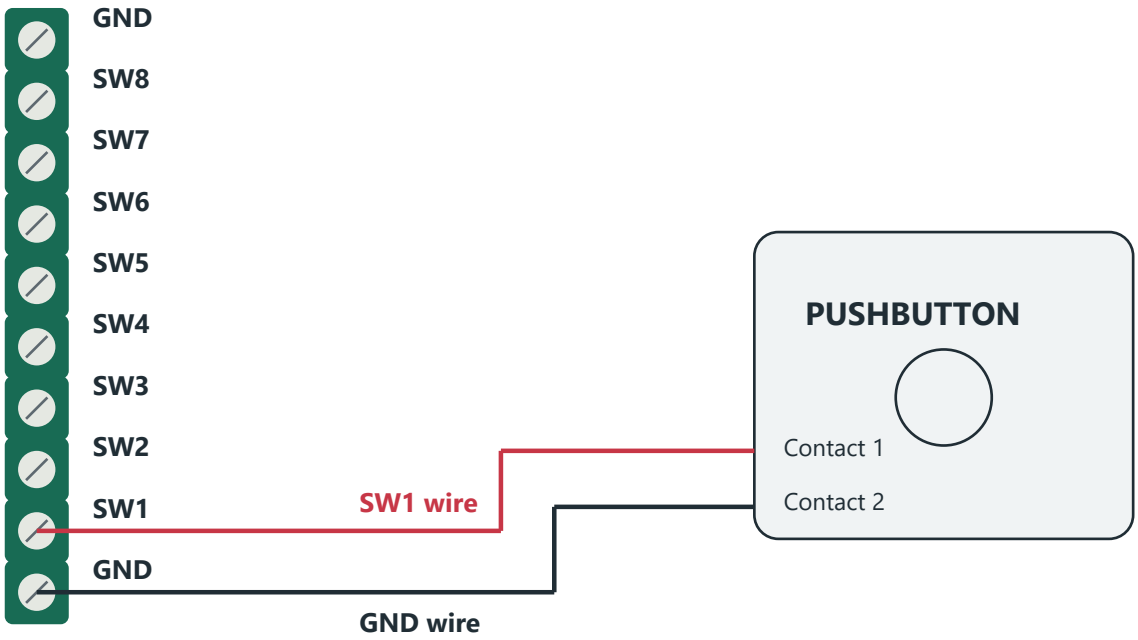


GND means ground: the return connection shared by your passive switches.

Wire your first pushbutton

Use a simple pushbutton that is open when released and closes when pressed. Start with SW1 on the lower left switch block.

LOWER LEFT SWITCH BLOCK



1. Unplug USB. Loosen the screw for SW1, insert one stripped wire end into that terminal opening and tighten to hold it. Check that the wire cannot pull out.

2. Connect the other end of that wire to one pushbutton contact.

3. Connect the second pushbutton contact to the GND terminal directly below SW1. The two switch wires do not need power.

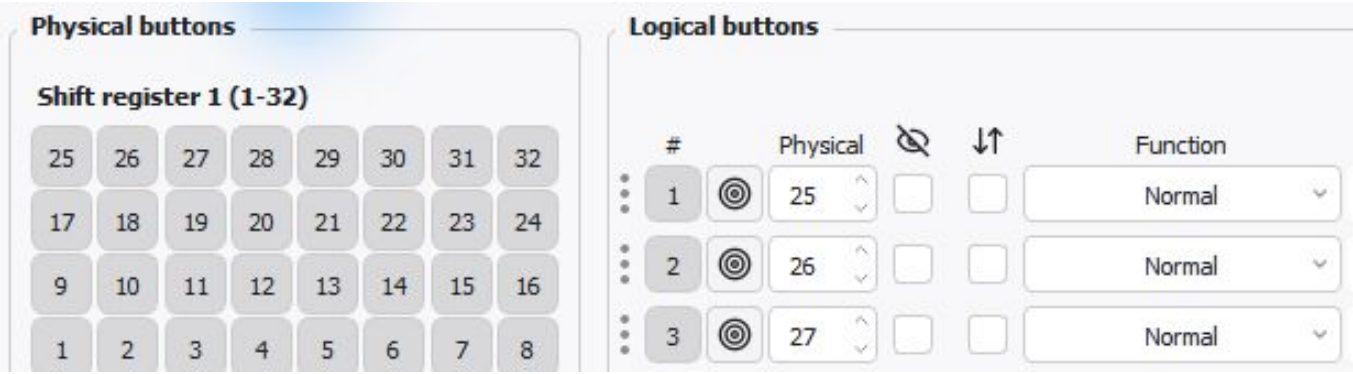
4. Check for loose strands touching adjacent terminals, then reconnect USB. Continue with the screen steps on the next page.

DO NOT APPLY VOLTAGE TO SW1

The pushbutton closes a connection from SW1 to GND. Do not connect SW1 to 3.3V or 5V.

See your button on screen

The Button Config page connects your real switch to a numbered joystick button.



Button Config: the left panel shows input activity; the right panel shows the numbered buttons sent to Windows.

1. Select your connected board in the Device box at the upper left of the app. Click **Read config from Device** to load its settings.

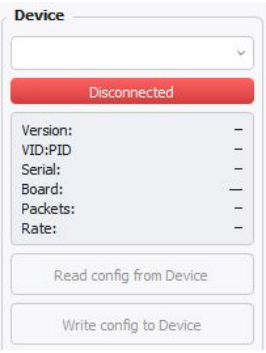
2. Click the **Button Config** tab. Press and release your pushbutton. Watch which square in **Physical buttons** changes. That square identifies the input from your switch.

3. Find the row on the right that uses that input in the **Physical** column. The number in the **#** column is the joystick button number. Write that number down. Keep an existing working assignment.

4. If no row uses the changing input, choose an unused row and set its Physical value to that input number. Choose **Normal** in Function. Leave the other settings unchanged.

5. Press and release again. The result should follow the pushbutton. Click **Write config to Device** to store your settings on the board.

If the screen shows Disconnected, the read/write buttons stay grey. Check the USB data cable and selected device before changing settings. The example input numbers on screen may differ from your saved setup.



Device panel: select your board in the top box. Read loads its settings; Write stores your changes. These buttons become available when connected.

Test in Windows, then assign it

Finish the first-button test here before wiring the rest of the panel.

Test the button in Windows

1. Hold the Windows key and press R on your keyboard. Type **joy.cpl** in the Run box, then press Enter.

2. In the Game Controllers window, select the Propwash controller and open **Properties**. Open the test display if there is more than one tab.

3. Press your pushbutton. One numbered button indicator should light while held and go out when released. Note the number. If it does not, return to Button Config and check the assignment and Write action.

Assign the button in your simulator

1. Open the simulator control settings and select the Propwash controller. Choose or create a controller profile.

2. Choose a simple command you can easily check, such as a cockpit light. Use the simulator input-detection option, then press your pushbutton.

3. Save the assignment. Enter the cockpit and press the button to check the result. Menu names and available commands vary by simulator and aircraft.

What a successful test tells you

If Windows sees the button, your wiring and controller assignment are working. If the cockpit does not respond, check the simulator command, aircraft support and duplicate assignments. Do not rewire a working button to fix a simulator assignment.

Keep the board configuration file and the simulator control profile. They store different settings.

Connect toggles and selectors

A toggle stays in position; a pushbutton returns when released. Wire the contacts first, then choose a matching simulator command.

ON/OFF toggle - one input

Wire from	Wire to
One toggle contact	SW2 on the lower left switch block
Other toggle contact	GND on that block

With USB unplugged, make these two connections. Reconnect and use Button Config exactly as for the first pushbutton: watch the changing input, find or assign its button row, keep Function Normal and write. The button stays pressed in one toggle position.

In the simulator, use an explicit ON/OFF or set-state command when offered. A generic toggle command can leave the cockpit and physical switch out of step. Check both switch positions after loading a flight.

ON-OFF-ON switch - two inputs

Switch contact	Board label
Common contact	GND
First switched contact	SW3
Second switched contact	SW4

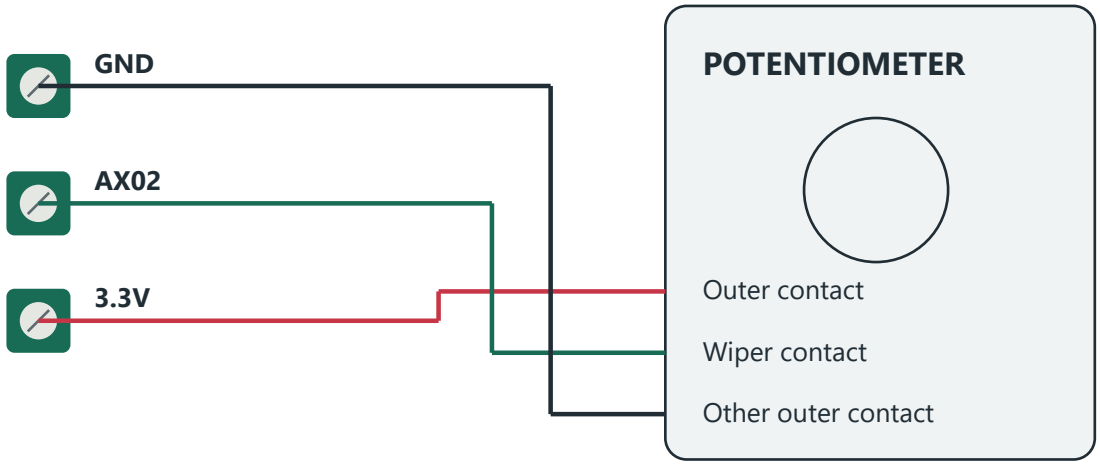
Use the switch maker diagram to identify common and the two contacts. In center, neither input should be pressed; each end position should press a different input. Map and test those two inputs separately. A center command may need simulator-side handling.

A contact rotary selector can use one SW input for each contact position and GND for common. An encoder uses A/B signals instead; see pages 13-14.

Wire a potentiometer

Example: a throttle lever on AX02. Use the bottom one of the six active three-screw blocks along the right edge.

AX02 BLOCK - TOP TO BOTTOM



1. Unplug USB. Identify the potentiometer wiper and its two outer contacts from its maker diagram. The wiper is the moving signal contact.

2. Connect 3.3V to an outer contact, AX02 to the wiper and GND to the other outer contact, as shown.

3. Reconnect USB and follow page 11 to turn on this axis output and calibrate its travel.

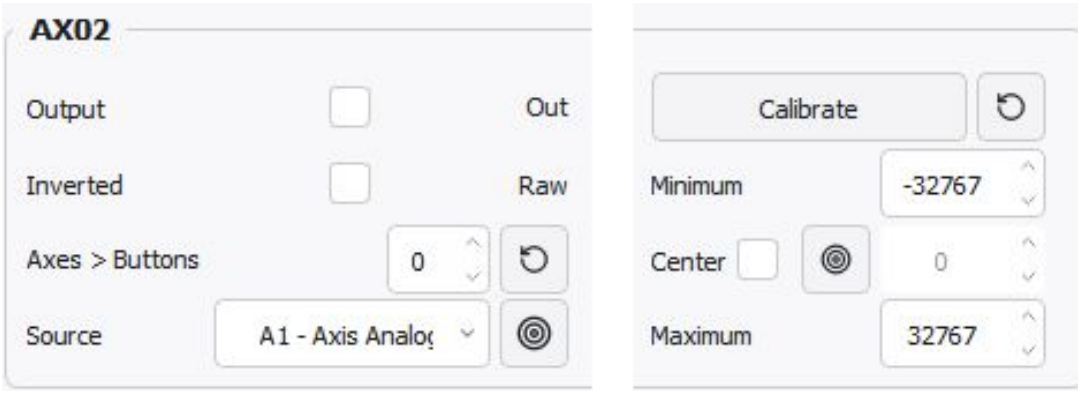
Use the same three-wire pattern for AX03, AX04, AX05, AX06 and AX07. Along the right edge, from top to bottom, the six blocks are AX07, AX06, AX05, AX04, AX03, AX02. Leave AX01 and AX08 unused.

USE 3.3V - NEVER 5V

Use the supply terminal on the same AX block. If travel is reversed, use Inverted in the app, or exchange only the two outer potentiometer wires with USB unplugged. Keep the wiper on AX02.

Calibrate the potentiometer

Calibration teaches the board the usable movement of your lever. Do this before changing curves or sensitivity.



Axes Config close-ups: Output and Source on the left; calibration controls on the right.

1. Read the connected board and click **Axes Config**. Find **AX02**. Move your lever and watch the **Raw** bar. Raw shows the sensor input before calibration.

2. Tick **Output** for AX02. This lets the board send that axis to Windows. Unused axes can remain unticked.

3. Click **Calibrate**. Move the lever slowly through all its safe travel several times, including both ends. Click the calibration button again to stop. Minimum and Maximum now reflect that travel.

4. For an end-to-end throttle, leave Center at its normal midpoint. For a spring-return control, place it at neutral, tick the Center option and click the target button beside Center to capture neutral.

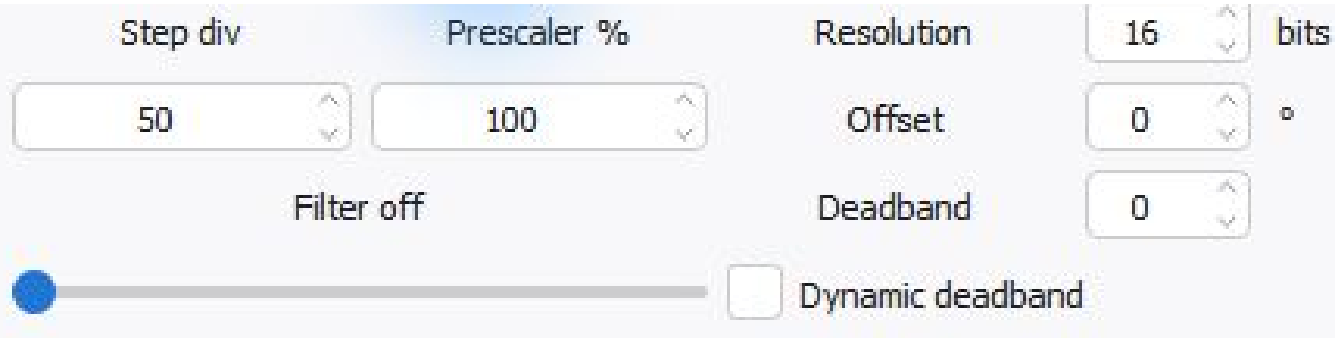
5. Move through the full range. If direction is backwards, tick **Inverted**. Click **Write config to Device**.

6. Open the Windows game-controller test using joy.cpl as on page 8. Move the lever: its axis indicator should move smoothly to both ends. Then assign it to a throttle axis in your simulator.

Each board axis starts with Output off in the factory settings. If Raw moves but Windows does not, check Output, write the settings and test again. Repeat the steps for every used AX03-AX07 input.

Make an axis stable and smooth

Use only enough filtering or deadband to solve the problem you can see. Too much makes the control feel slow or insensitive.



Extended Settings close-up: Filter is the slider; Deadband is the value at the right.

Stop a resting lever from twitching

1. Hold the lever still and watch Raw. If it jumps badly, unplug USB and check the wiper and ground connections before adjusting the software.

2. In Axes Config, open **Extended Settings** for the intended axis. Move the Filter slider one small step above off. Write and test again.

3. Increase only if needed. Stop when the resting output is stable and deliberate movements still respond promptly. Higher filter levels smooth more but respond more slowly.

Ignore a small amount of unwanted movement

Deadband is an area where a little movement is ignored. For a centered control, add a small amount if it will not hold neutral. After every change, write and test movement just outside neutral and at both ends. Too much deadband wastes usable travel.

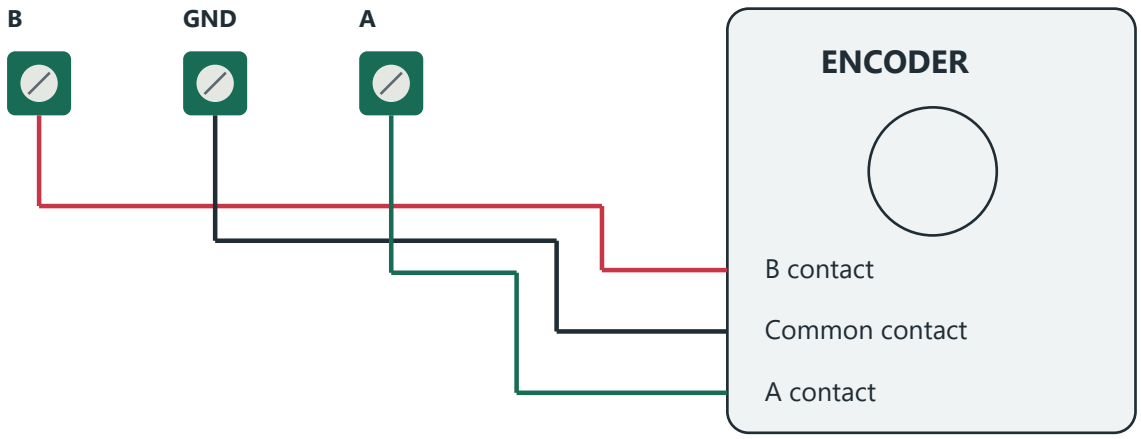
Leave Dynamic deadband, Prescaler, Resolution, Offset and Function at their normal settings while you get the basic axis working. Page 20 explains why you might use the advanced controls later.

If the simulator also has a curve, filter or deadzone, check it before adding more here. Two sets of adjustments can make a good axis feel unresponsive.

Wire a rotary encoder

An encoder knob produces steps as it turns. It has two signal contacts, A and B, plus a common contact.

ENC1 - TOP INSIDE LEFT CONNECTOR



1. Unplug USB. Find A, B and common from the encoder maker diagram. Do not assume the physical pin order.

2. Connect B to the ENC1 B terminal, common to GND, and A to the ENC1 A terminal. The top inside ENC1 block reads B, GND, A from left to right.

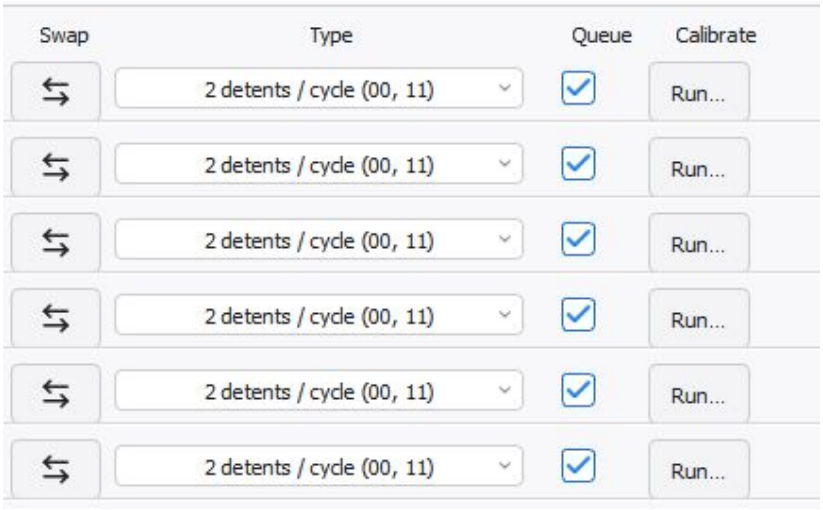
3. For ENC2-ENC6 down the left edge, the three terminals read A, GND, B from top to bottom. Use the block for the encoder you are adding.

4. A knob push switch is a separate pair of contacts. Connect those between an unused SW label and GND, just like the first pushbutton.

These instructions are for compatible passive incremental encoders. A powered encoder module or absolute-position sensor needs its own confirmed wiring instructions.

Configure the encoder knob

Use the Slow encoders section for the six normal encoder connections. Keep the existing Pin A and Pin B choices for your board.



Right-hand controls of the six rows: Swap, Type, Queue and Run. Keep the existing Pin A/B choices.

1. Read the board and click **Encoders**. Use the row for your encoder. ENC1 is the first configured normal row; the next five are ENC2-ENC6.

2. Turn one detent slowly each way. Check that the corresponding direction responds. If the two directions are reversed, use the row **Swap** control, then test again.

3. If one detent gives the wrong number of steps, use **Run...** in the Calibrate column and follow its measurement prompts. Select the recommended Type, then retest slowly.

4. Leave **Queue** ticked when quick turns need their steps preserved. Some pulses can continue briefly after a fast turn.

5. On **Button Config**, watch the inputs while turning each way. Find or assign two separate button rows, one per direction. Write the configuration.

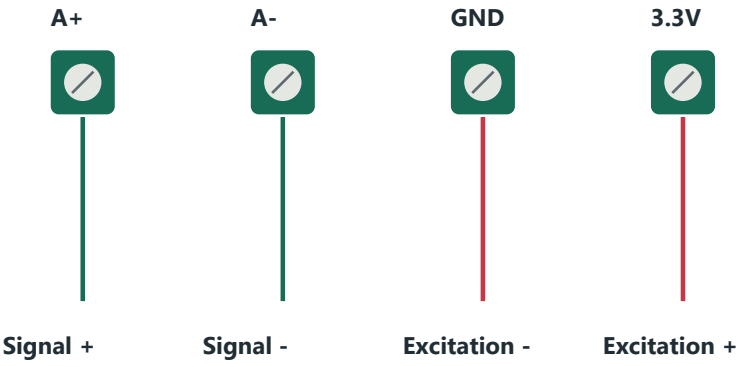
6. In the simulator, assign those buttons to increase/decrease commands. Test slow and rapid turns. Configure a knob push switch separately.

Do not change unrelated Pin Config settings to fix a reversed knob. Check wiring, Swap and Type first.

Wire a load cell

A load cell measures force, such as brake pressure. Use a compatible four-wire bridge sensor and its manufacturer wiring diagram.

BOTTOM EDGE - LOAD CELL 1 LEFT, LOAD CELL 2 RIGHT



FOUR-WIRE LOAD CELL / FORCE SENSOR

1. Mount the load cell in its final mechanism. Keep within the sensor and mechanism force ratings.

2. Unplug USB. Identify excitation positive/negative and signal positive/negative from the sensor maker diagram. Wire colours are not universal.

3. On the chosen bottom connector, connect signal positive to A+, signal negative to A-, excitation negative to GND and excitation positive to 3.3V.

4. Check the four wires, then reconnect. Load Cell 1 is the left bottom connector; Load Cell 2 is the right bottom connector. Calibrate the corresponding channel on the next page.

The board already contains the load-cell amplifier. Do not connect another amplifier to these four sensor terminals. If your sensor has extra sense wires, a shield or a different arrangement, obtain its connection instructions before wiring it.

CALIBRATE IN THE FINAL MECHANISM

The operating force you apply during Set Maximum becomes full simulator output. Do not exceed the rated load to try to obtain a larger reading.

Calibrate load-cell force

Remove force to set zero. Apply your chosen full operating force to set maximum. Do this separately for each load cell.



Load Cell close-ups: Output and direction on the left; zero and maximum on the right.

1. Read the board, click **Axes Config** and scroll down to the correct Load Cell row. Tick **Output**. Begin with a straight/default curve and normal extended settings.

2. Remove operating force from the mechanism. Click the small target button beside **Zero / Tare**. This records the unloaded starting point.

3. Apply a small force in the direction you will use. Watch **Force**. If it stays zero, change **Invert Direction** and try again. Force in the other direction is ignored.

4. Apply the force you want for full simulator output. Hold it steady and click **Set Maximum**. Check that **Maximum Force** is greater than zero.

5. Click **Write config to Device**. Test no force, part force and full force in Windows and then in the simulator. Output should rise as you apply more force.

6. Repeat for the other load cell if fitted. Save a backup after both are working.

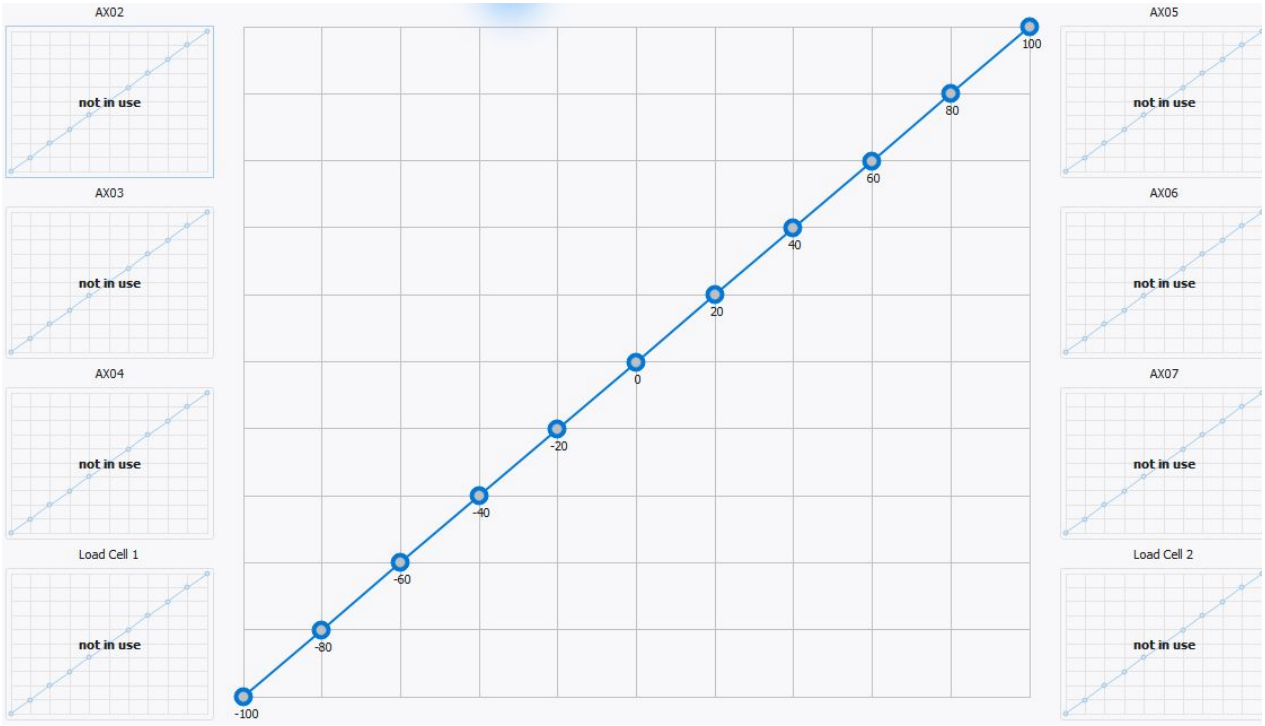
AFTER EVERY NEW ZERO / TARE, SET MAXIMUM AGAIN

Setting zero clears the previous maximum. Apply the desired full force, click Set Maximum and write the configuration again.

Force numbers are sensor counts, not pounds or kilograms. A signed minimum in a Windows axis display can be normal: it means no force. The Configurator Force bar starts at zero.

Adjust an axis response curve

A curve changes how much simulator movement you get for each amount of lever movement or force. Calibrate first.



Axes Curves: choose the small axis graph, then edit its response in the large graph.

1. Read the board and click **Axes Curves**. Select the small graph for the axis you want, such as AX02.

2. Begin with a straight line. To soften response near center, make a small adjustment to the points near the middle. Keep the ends and keep the line increasing through the range.

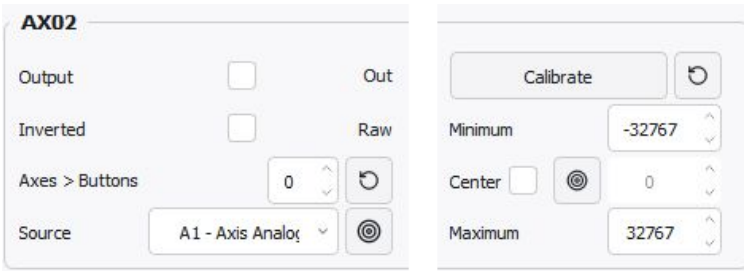
3. Write the configuration. Test small, medium and full movements in the simulator. If the result jumps, reverses or feels wrong, restore the straight/default curve.

4. Use a curve profile to reuse a preferred shape. Also save the full configuration file so the rest of your panel settings are backed up.

The screen can say not in use for axes whose Output is off. Enable and calibrate a used axis before judging its curve. Avoid applying strong curves both here and in the simulator unless you intend their combined effect.

Make lever positions act as buttons

Optional example: use different parts of a calibrated lever travel to select different simulator commands.



Axes > Buttons is the number of travel zones. It starts at 0, meaning no extra buttons.

1. First calibrate the lever and confirm its normal axis works. Save a backup before adding zones.

2. In its Axes Config row, increase **Axes > Buttons** from 0 to the number of positions you want. Start with a small number, such as three.

3. Adjust the zone boundaries on that row so each covers the intended part of travel. Move the lever slowly through every zone.

4. Open **Button Config** and watch which physical button source responds in each zone. Find or assign those sources to unused button rows.

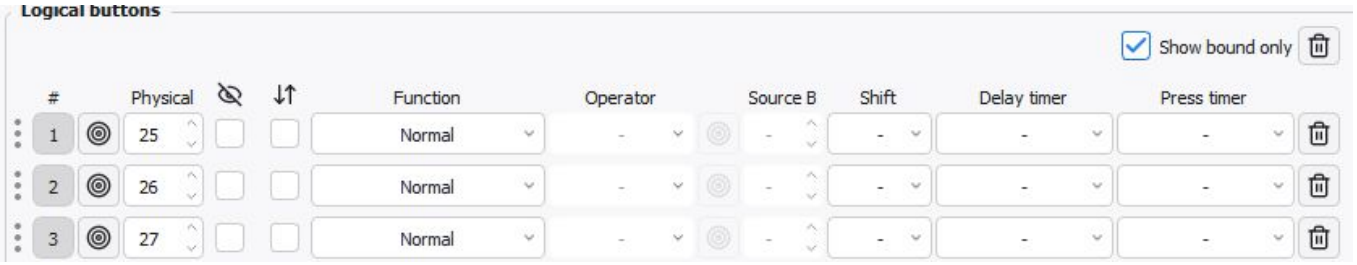
5. Write the configuration. Assign the resulting button numbers in the simulator and test every zone and boundary.

A zone remains active while the lever is in that area. If a command flickers at a boundary, first check that the lever signal is stable. Adjust the boundary or use modest filtering rather than allowing a tiny resting movement to cross it repeatedly.

This feature creates buttons in software; it does not require another wire. Keep it at 0 if you only want a normal throttle or other continuous axis.

Understand the button row

Most simple controls need only an input, a button number and Function Normal. Leave additional choices unchanged until you need them.



The # column is the joystick button number; Physical selects the input from your control.

On screen	What it means
#	Button number sent to Windows and later assigned in your simulator.
Physical	The input you saw change when operating the switch.
Function: Normal	Ordinary pressed/released behavior. Good starting point.
Invert input	Reverses pressed and released. Use only if the result is backwards.
Show bound only	Shows assigned rows and helps you review a large panel.
Trash / clear	Removes a button assignment. Does not change the wiring.
Operator / Source B	Optional combination of two inputs.
Shift / timers	Extra behavior. Not needed for the basic examples; leave unset.

Optional logic example: where AND is offered, set the first input, Source B and AND. Test neither, either one and both. Only both should press the result. Keep your backup so you can restore ordinary behavior if needed.

Settings you can leave alone

The board is already set up for its terminals. You do not need to configure its internal wiring to add a switch, potentiometer or encoder.

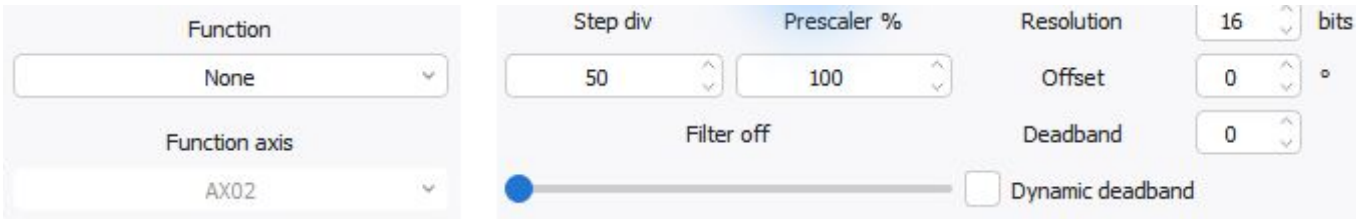
Pin Config and Shift Registers

These pages describe the internal connections used to read your controls. Leave the supplied settings in place. Use Button Config to choose what a switch does, and Axes Config to calibrate a lever. Changing internal assignments can make a whole group of controls stop responding.

Shifts & Timers and LED/PWM

These pages are not used on this IO32 board and are disabled when the board is recognized. A grey tab is expected. Do not try to enable a different hardware profile to make it available.

Extended axis settings



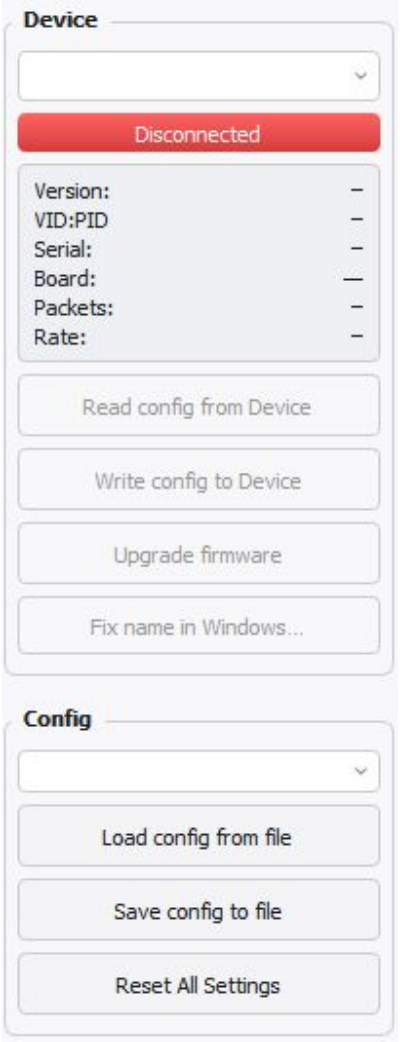
Normal starting point: Function None, Filter off or low, and the supplied scaling values.

Setting	When it helps
Function / Function axis	Special combinations of two axis inputs. Keep None for a normal lever or load cell.
Prescaler	Changes the amount of output movement. Keep the supplied value during calibration.
Resolution	Changes output detail. The supplied value suits normal setup.
Offset	Shifts the output position. Leave unchanged for first setup.
Button 1 / 2 / 3	Lets buttons affect a special axis function. Not needed for the standard wiring examples.

If you want an advanced combination, save first, change one setting, then check rest and full travel before using it in a flight.

Save and restore your panel

Changing a setting on screen does not store it on the board. Use Write config to Device when your change is ready.



Read config from Device
Board -> screen. Use before editing an existing panel.

Write config to Device
Screen -> board. Stores your changes on the selected board.

Save config to file
Screen -> PC file. Creates a backup without changing the board.

Load config from file
PC file -> screen. Write is still required to apply it to the board.

Back up a working setup

1. Read the intended board. Save config to file and choose a name with your panel name and date.

2. To restore, load the saved file, review its axis Output boxes and button assignments, then write to the intended board.

3. Read back and test several controls. If restoring an older load-cell setup, set zero and maximum again with the matching software.

Reset, reconnect and maintain

Keep a known-good backup so you can return to a working panel.

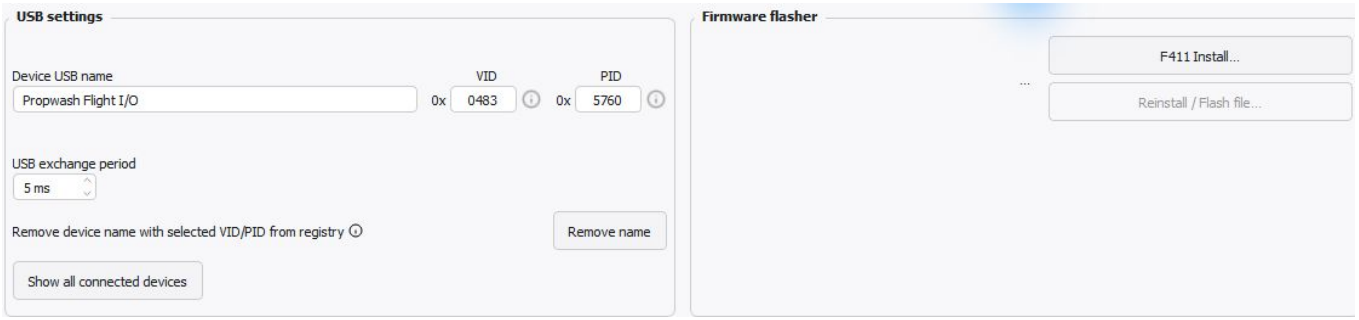
Reset All Settings

This loads the factory settings into the app. The board is not reset until you click Write config to Device. Save first. After applying factory settings, enable Output for used axes and calibrate again. AX01 and AX08 remain unused.

More than one board

Check the selected device and serial before writing. Each board has its own configuration. If you cannot tell which one you selected, disconnect the others while you set it up.

App preferences and updates



Advanced Settings includes USB identity and firmware maintenance controls. Leave USB identifiers and timing at their supplied values.

Language and Font size are available in the app preferences. Choose a convenient Default save directory so you can find your backups.

Your board ships with firmware installed. For an update, first save your configuration and use the matching Propwash-approved firmware and Configurator. Follow the supplier update instructions. F411 Install is a recovery/installation tool, not part of ordinary control setup.

Do not change VID/PID to fix a missing control. If Windows sees an old controller name, use the supplied name-fix function only after checking the intended board is selected.

Help with switches and encoders

Start at the real control and work toward the simulator. Change one thing at a time.

What you see	What to do
Board not detected	Use a known USB data cable and another port. Check the selected device. Unplug before removing field wiring, then test USB alone.
One switch does nothing	Unplug. Check the SW wire, GND wire and switch contacts. Reconnect and watch the input squares on Button Config.
Several switches fail together	Check their shared GND connection. Confirm the correct long block from the labeled board picture.
Input square changes, button does not	Find or assign its Physical number in a button row. Start with Normal and no extra logic/timers.
App works, Windows does not	Write config to Device, then test the correct controller in joy.cpl. Read back if you are unsure what was stored.
Windows works, cockpit does not	Check selected simulator controller, command type, aircraft support and duplicate assignments.
Encoder turns backwards	Check A/B/common. Use Swap on the encoder row, or exchange A/B with USB unplugged.
Encoder skips or doubles	Turn slowly and check Type/Run calibration. Test Queue for rapid turns. Test in Windows separately from the simulator.
Several commands fire at once	Look for duplicate assignments in Button Config and in the simulator.

Keep a note of the board label, changing input square and joystick button number. Those three details make a support request much easier to diagnose.

Help with axes and load cells

Raw or Force shows the sensor input. Out shows the resulting control output. Check both before changing simulator settings.

What you see	What to do
Potentiometer Raw does not move	Unplug. Check 3.3V, AX wiper and GND. Use AX02-AX07, not AX01 or AX08.
Raw moves but Windows axis does not	Enable Output, complete calibration and write to the board. Check the correct Windows controller.
Axis jitters at rest	Check loose wiper/ground and the mechanism. Add only a small filter after wiring is sound.
Axis does not reach both ends	Repeat full safe-travel calibration. Check deadband, curves and simulator adjustments.
Two output axes move together	Check that the intended Source is selected for each. Leave special Function None for ordinary independent controls.
Load-cell Force stays zero	Check bridge lead functions, correct Load Cell row, Zero / Tare, Invert Direction and a nonzero Maximum Force.
Load cell reaches full too early	Set Maximum again at your intended full operating force, within the sensor rating.
Load cell stops after a new tare	Tare cleared the maximum. Apply full force, Set Maximum and write again.
Windows load axis rests at a signed minimum	This can be normal: the minimum endpoint means no force. Test that output rises with force.
Settings seem lost after reconnect	Read the selected board. Loading or saving a PC file is not the same as writing to the board.

If you need help, keep your saved configuration, board identity, wiring photographs and a description of which Raw/Force/Out display changes.

Check the finished panel

Use this checklist before enclosing the board, after restoring a file, or after a change that affects control behavior.

1. With USB unplugged, inspect mounting, retained wires and loose strands. Confirm switch wires go only between SW and GND.

2. Reconnect and read the intended board. Test each switch in both states, then confirm its Windows button and simulator command.

3. Test every encoder both directions slowly and quickly. Test any separate knob pushbutton.

4. For every used potentiometer, confirm Output is on, full travel is calibrated, direction is correct and endpoints are reached.

5. For each load cell, test unloaded, part force and intended full force. After any new tare, set maximum and write again.

6. Save the final board configuration and simulator profile. Disconnect/reconnect, read back and test a few controls before closing the panel.

Keep with your panel	Your record
Panel name / board identity	_____
Configuration backup filename	_____
Simulator profile / aircraft	_____
Axis calibration date	_____
Load-cell operating force / notes	_____

You are ready when every physical control produces the intended Windows input and simulator action, and you have a backup that restores the working setup.