Caterpillar full dome controller

User manual



caterpillar

made in the Milky Way

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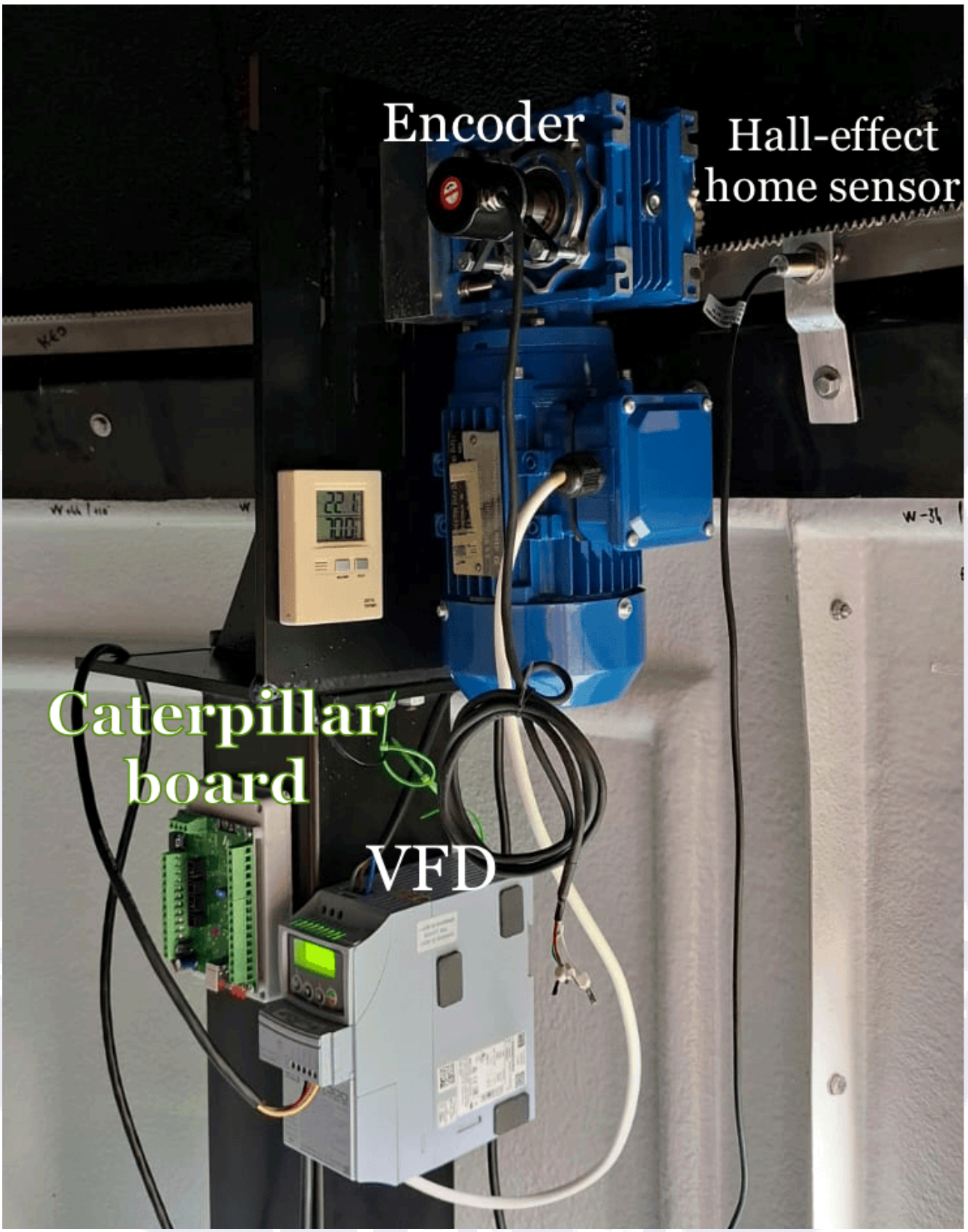
1. Setup

1.1. Overview

To get your dome fully up and running with the Caterpillar, you will need to perform a few tasks:

- ★ Connect all the elements to the Caterpillar boards: external drivers, motor, encoder, etc. Details in the following section
- ★ Download the Caterpillar ASCOM driver and software
- ★ Perform an initial setup with the "Initial motor configuration and setup" tool, as indicated below.
- ★ Use your ASCOM or INDILib driver to calibrate the rotation (full calibration), and optionally the shutter.
- ★ You are ready to go!

1.2. Example installations



Example rotator installation (no shutter)

Have got a Caterpillar? We'd really appreciate it if you sent us a picture of your setup so we can feature it here to assist other users.

2. Hardware

2.1. Hardware overview

The Caterpillar Dome FC is the "full" model, with separate boards to control the rotation and the shutter. For a standard dome, the system is comprised of two elements:

- ★ The **rotation element** is made up of the Caterpillar board, connected to a motor (any of 3-phase, DC, or stepper), a rotary encoder, and a home switch.
- ★ The **shutter element** depends on whether it has one or two parts.
    - The **opening** always has a motor—any type, wired and configured just like the rotation motor—plus two limit switches, with an optional (recommended) encoder.
    - If the shutter also has **flaps**, they are driven by a DC motor through the shutter board's dedicated flap connector, always with two more limit switches and no encoder option. See Shutter hardware for details.

Both boards communicate via an internal Wi-Fi link. The power input accepts from 12 up to 51 V DC; the board provides a regulated +5 V output for powering sensors. If the shutter board is installed in the rotating section of the dome, provisions must be made for it to be powered independently—a battery (charging at the park position) or conductor rails (busbar system) are two common options.

What you'll need

There are sections for each element below further ahead in the document. For now, this table gives an overview of the main elements required depending on your setup.

Element	Notes	Amount required
Rotation board	Required for controlling the dome rotation	1 per installation
Shutter board	Optional—for automated shutter and/or flap control	1 per installation if controlling shutter/flaps

Rotation motor	Any type—DC, stepper (with external driver), 3-phase (via VFD, e.g. CFW300), or relay/contactor	1 for rotation 1 for shutter 1 for flaps
Home sensor	**Required for rotation**—establishes azimuth reference (mechanical or hall-effect). Not used on the shutter, which relies on limit switches instead.	1 per installation (for rotation)
Encoder	**Required for rotation**—rotary encoder for position feedback. Optional on the shutter's opening (recommended); flaps never take an encoder.	1 for rotation 1 recommended for shutter
Power supply	+12 to +51 V DC	1 or 2 per installation (1 can be shared by 2 boards)
Limit switches	Required if using shutter board—2 per element (open/close), 4 total with flaps	2 for shutter 2 for flaps

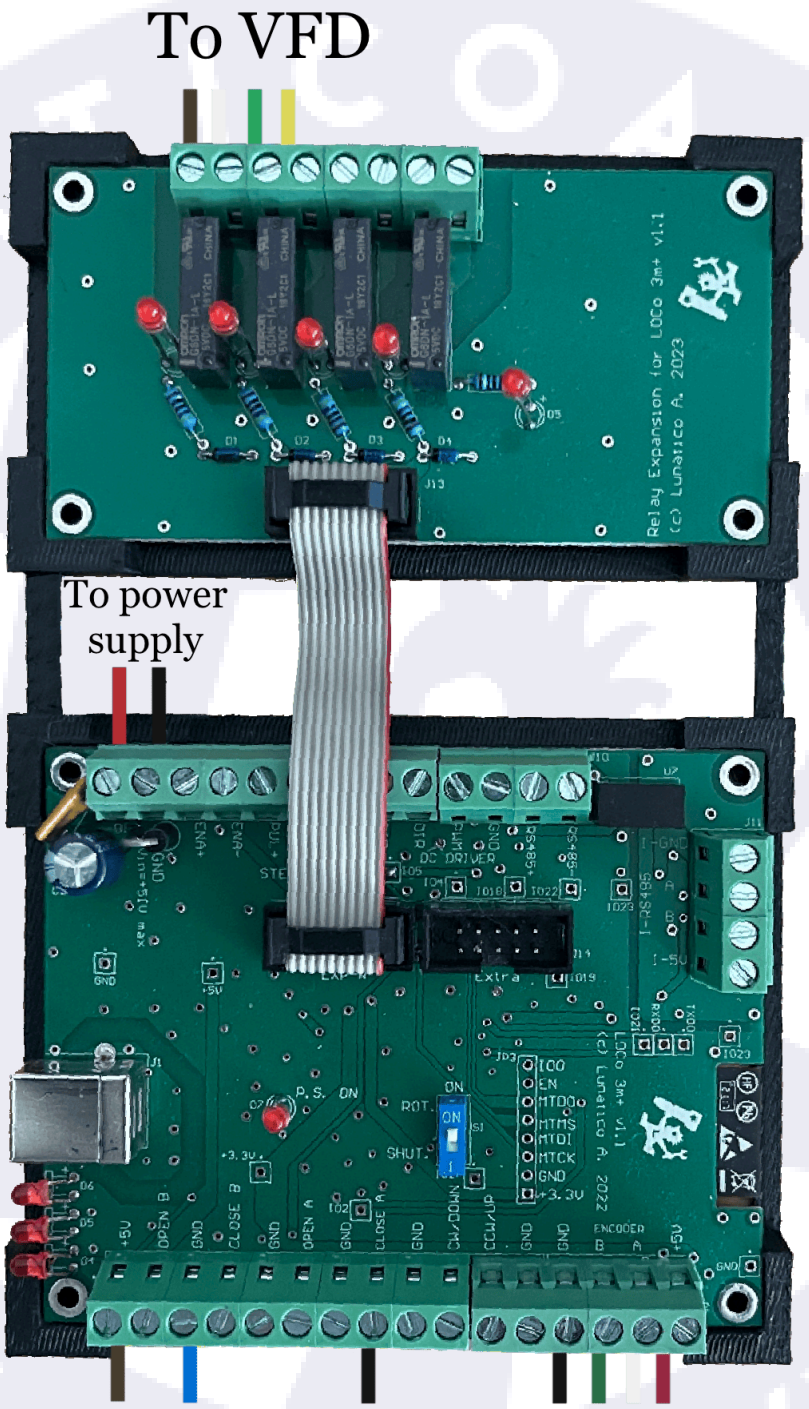
The following table refers to other elements dependent on the setup. They also have their own sections further into the document.

Element	Notes
External driver for stepper motor	The Caterpillar board doesn't drive stepper or DC motors directly, so a driver is required
External driver for DC motor	
Variable-frequency drive (VFD)	The Caterpillar uses a VFD to control 3-phase motors, paired with the relay expansion board (below)
Relay expansion board	A relay expansion board can be used to automate control of motors or drives that are normally operated through simple on/off switches or contactors

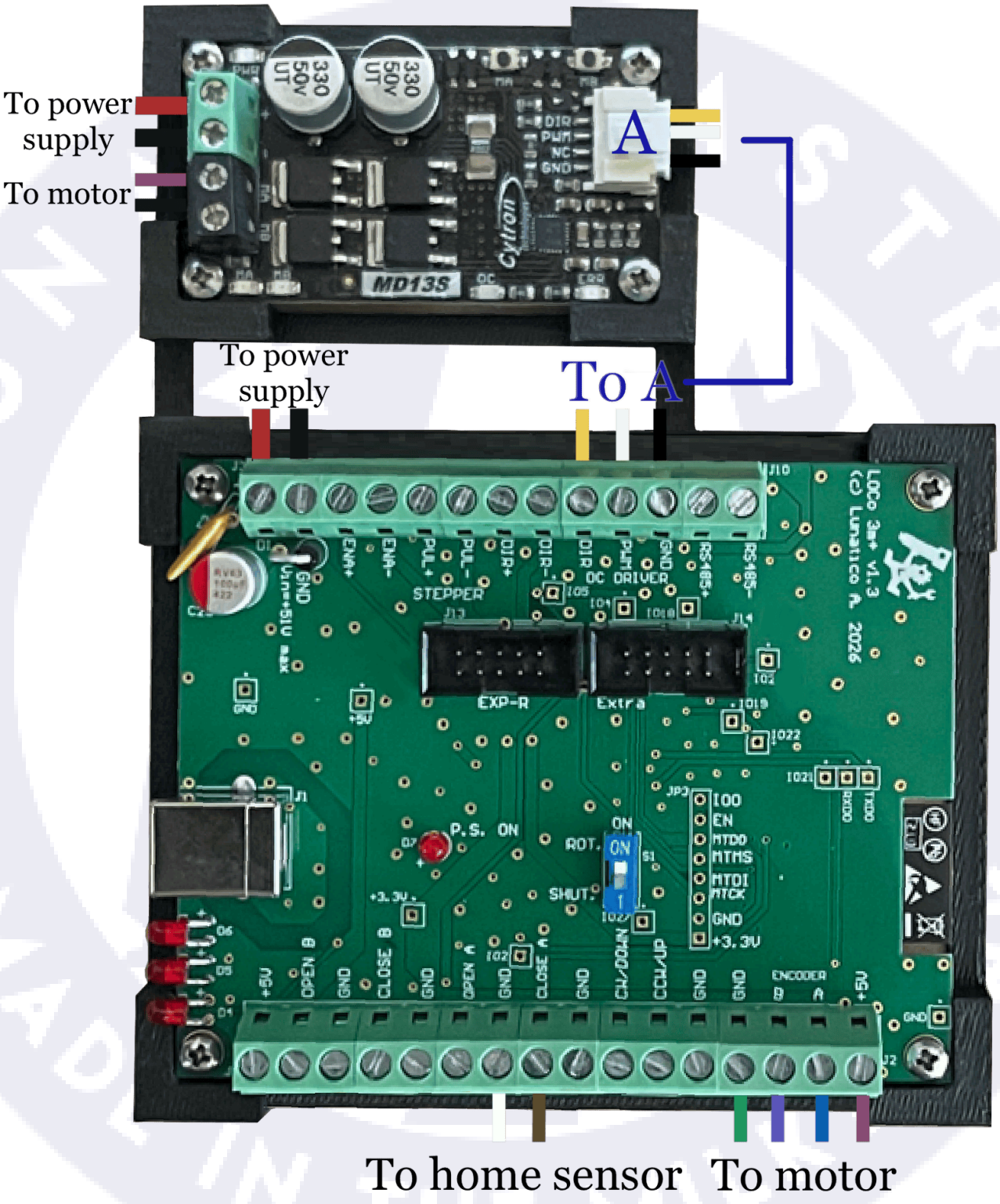
3D printed parts

Find 3D printing designs, including board holders, here: [3D files repository].

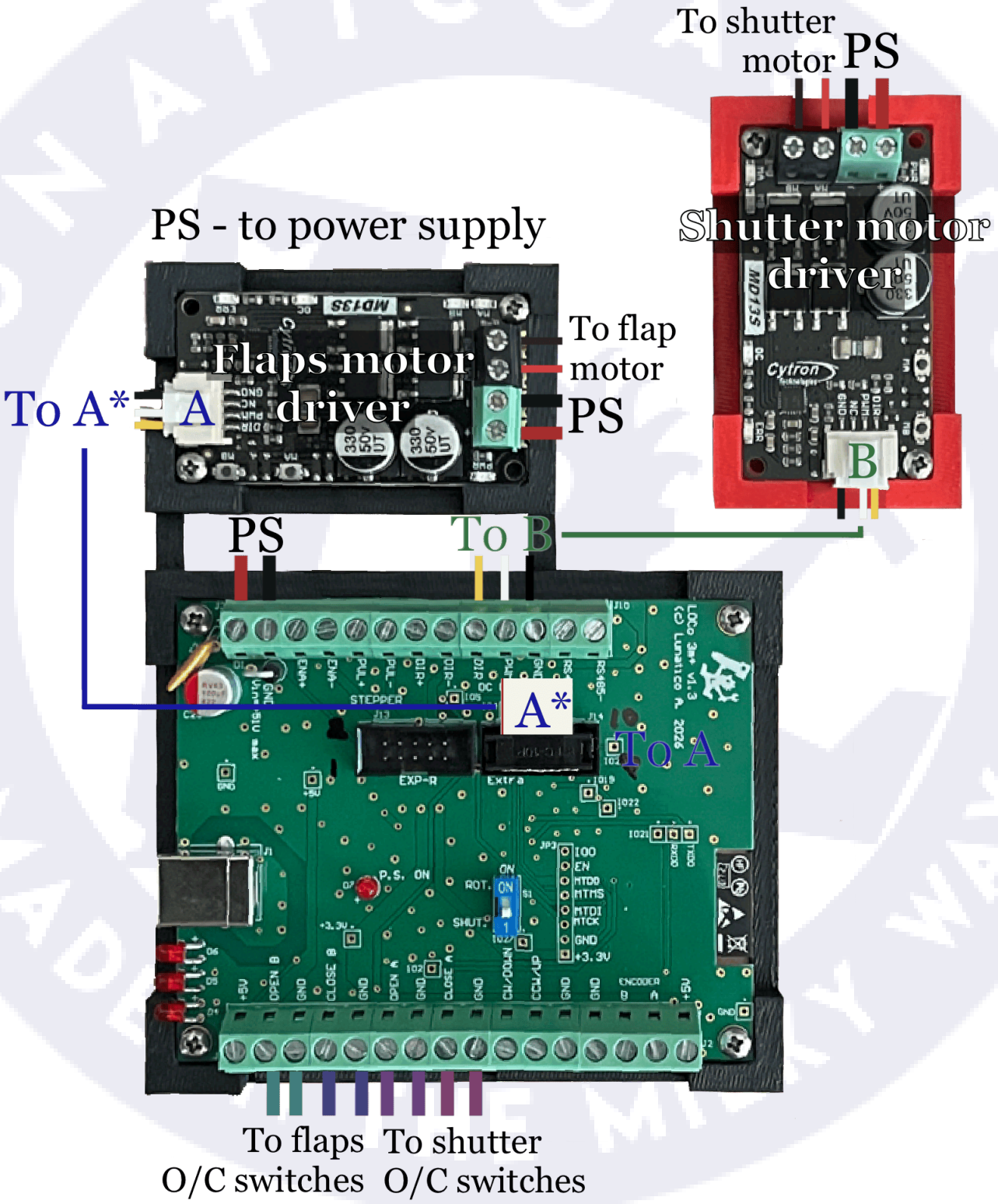
Example board connections



Rotation board with relay expansion board



Rotation board with DC motor driver



Shutter board with DC drivers for shutter and flaps

2.2. Home sensor

The rotation unit needs a home sensor. Both a mechanical or a hall-effect sensor (usually preferred) can be used. They are wired to the same connector on the board, which provides +5 V required for the hall-effect one.

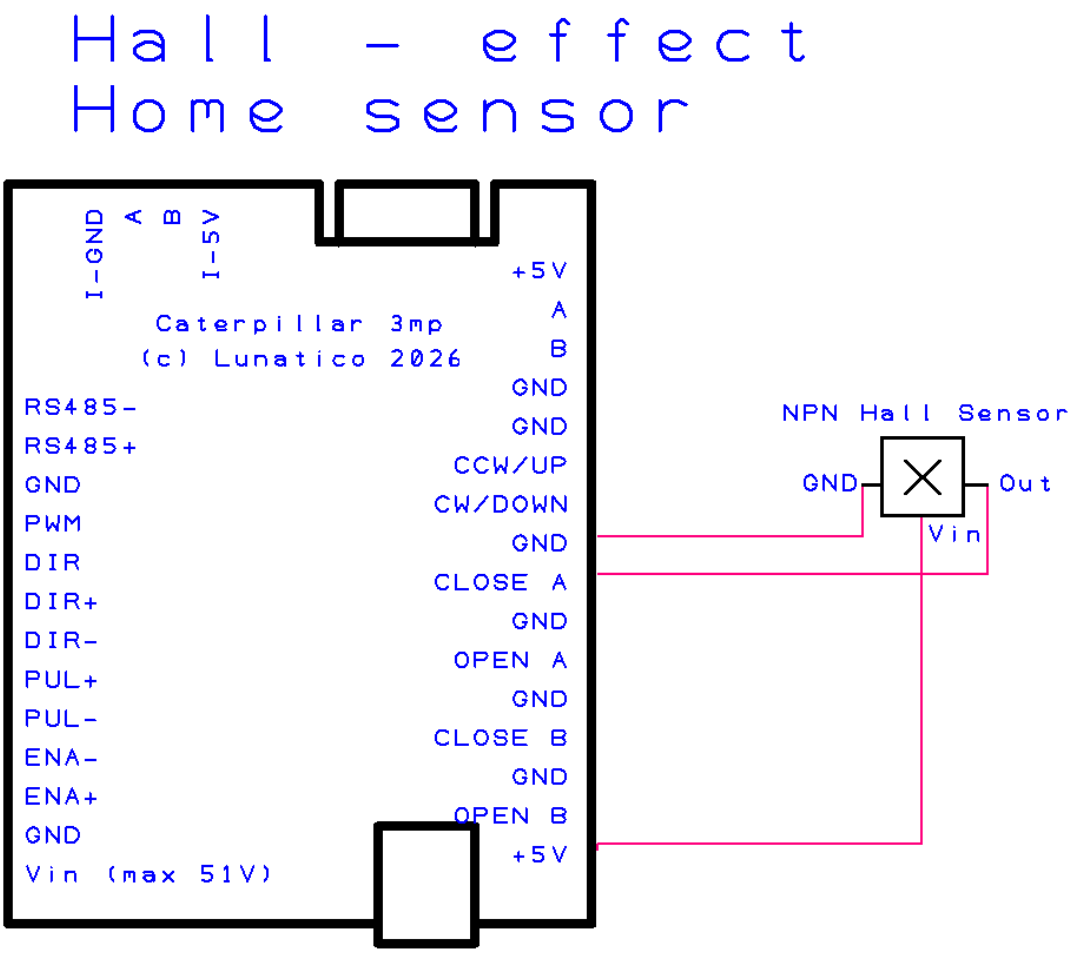
Note: this applies to **rotation only**; the shutter has no home sensor—its open and close positions come from limit switches instead.

In normal operation, should the home sensor not be found after a complete revolution, the system will stop and issue a warning.

Hall-effect sensor (preferred)

Popular NPN hall-effect sensors include an LED that will light when the sensor is active, which is very convenient to test the system during installation.





Hall-effect (NPN) sensor wiring

Tested Hall-effect sensors

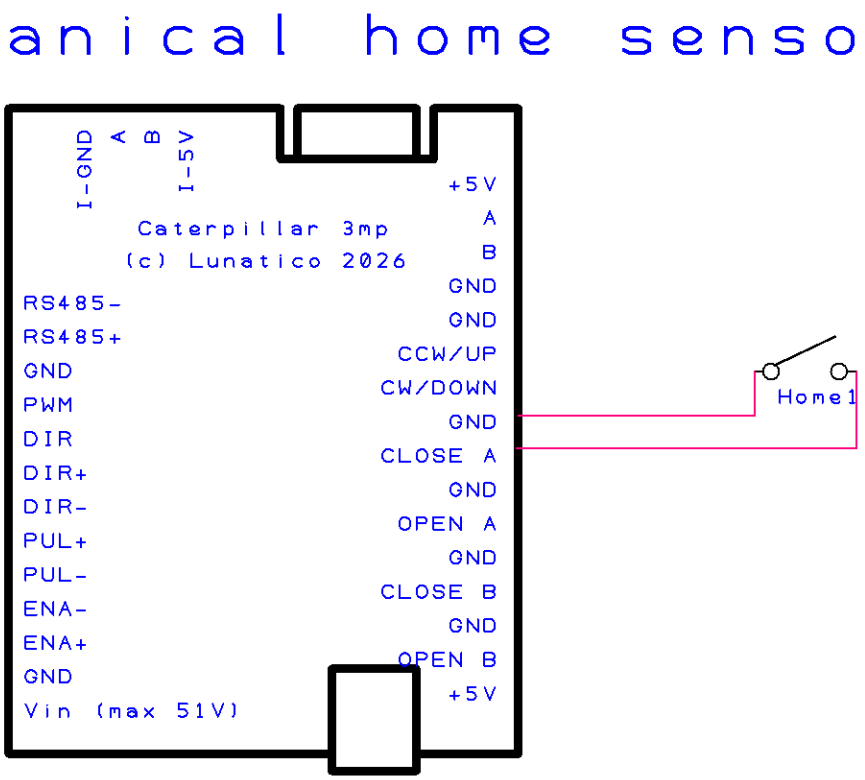
One sensor we have tested to work with the +5 V from the Caterpillar board is the NJK 5002C.

Mechanical limit switch

A mechanical push-button or lever switch can also be used. For switches with two closed positions (i.e. the lever can be pressed from either side), precautions must be taken so it is only triggered at one point per revolution. A good approach is placing the sensor horizontally, so the dome lowers the switch when reaching the home position, rather than pushing it sideways—this way only one consistent trigger point is possible.



This Omron sensor is an example of mechanical sensor with 2 closed positions; horizontal mounting avoids double-triggering



Mechanical limit switch wiring

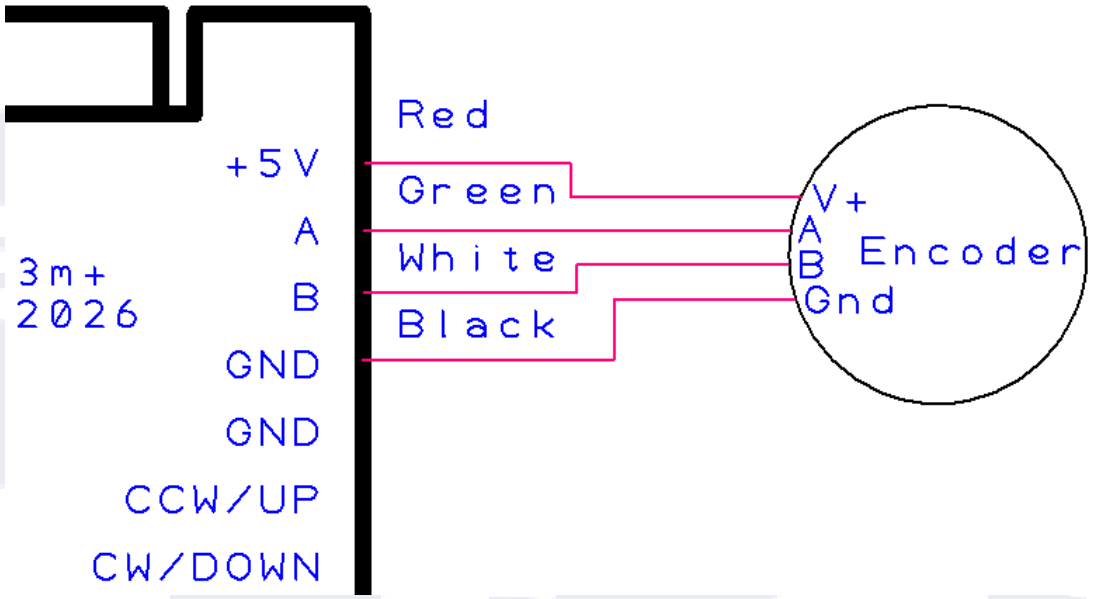
2.3. Encoder

Rotation of the dome is measured by a rotary encoder, and the home position is confirmed by the home sensor. The combination of these allows for very precise positioning of the dome.

The encoder is **required**, except for stepper motors; without it, the system cannot track dome position accurately. If the encoder does not detect motion when the dome is running, the system will stop and issue a warning.

The encoder can be coupled either to the motor axle—downstream of any reduction gearing—or directly to the dome rack, using a dedicated coupling. A non-friction coupling is preferable in either case, to avoid slippage.

Note: on the shutter's opening, the encoder is optional—open and close positions come from the limit switches—but we recommend fitting one anyway: it lets the system catch a stalled or slipping motor as an extra safety check. Flaps never take an encoder.



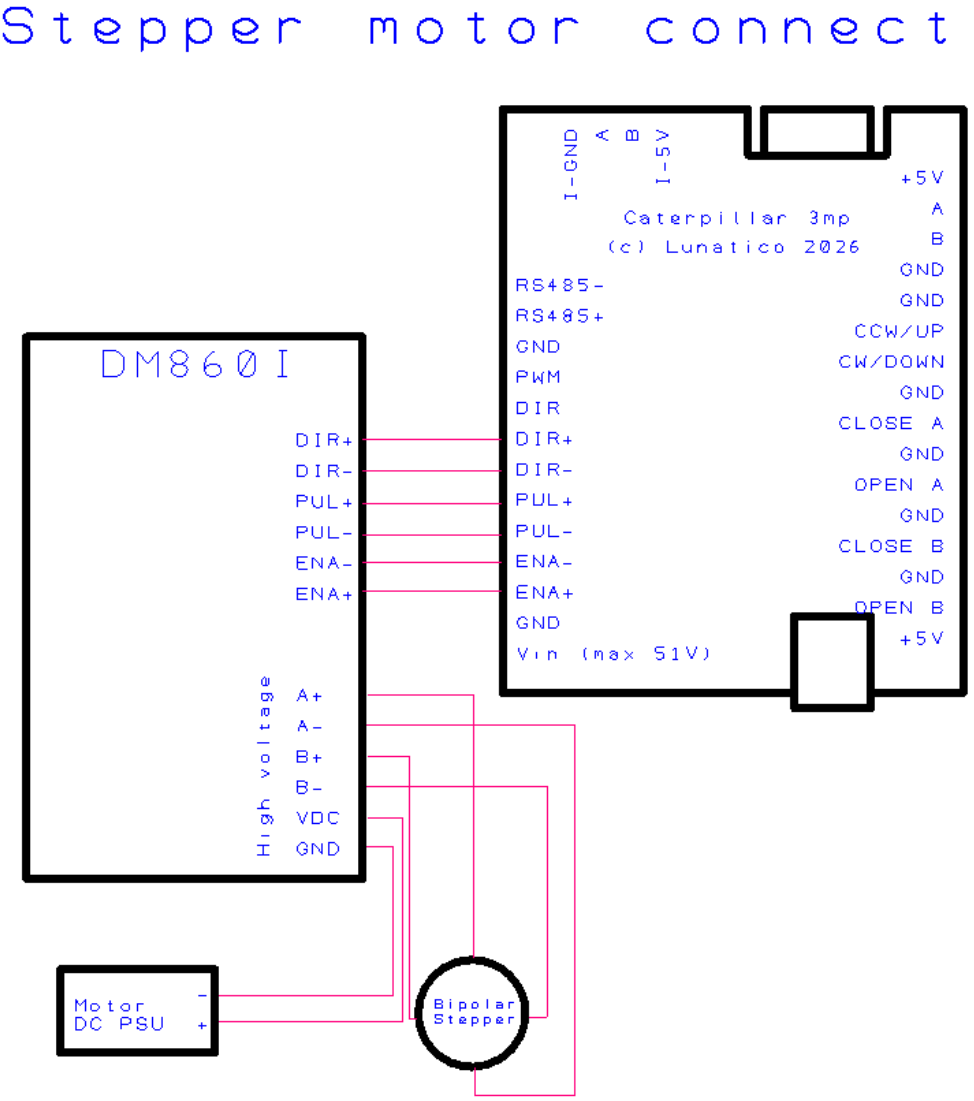
Encoder wiring

Encoder specs

NPN, 5V DC quadrature encoder required. The system will track up to 2 KHz step pulses, which is clearly overkill. Anything above a few counts per degree will provide ample resolution for dome tracking.

2.4. Stepper motor—external driver

For stepper motors, the Caterpillar board does not drive the motor directly. Instead, it outputs 5 V control signals to an external stepper driver (such as a DM860I or TB6600), which handles the high-current motor supply. Many stepper drivers accept opto-isolated ENA+/ENA-, PUL+/PUL-, and DIR+/DIR- inputs referenced to 5V as supplied by the Caterpillar.



External stepper driver wiring

Tested drivers

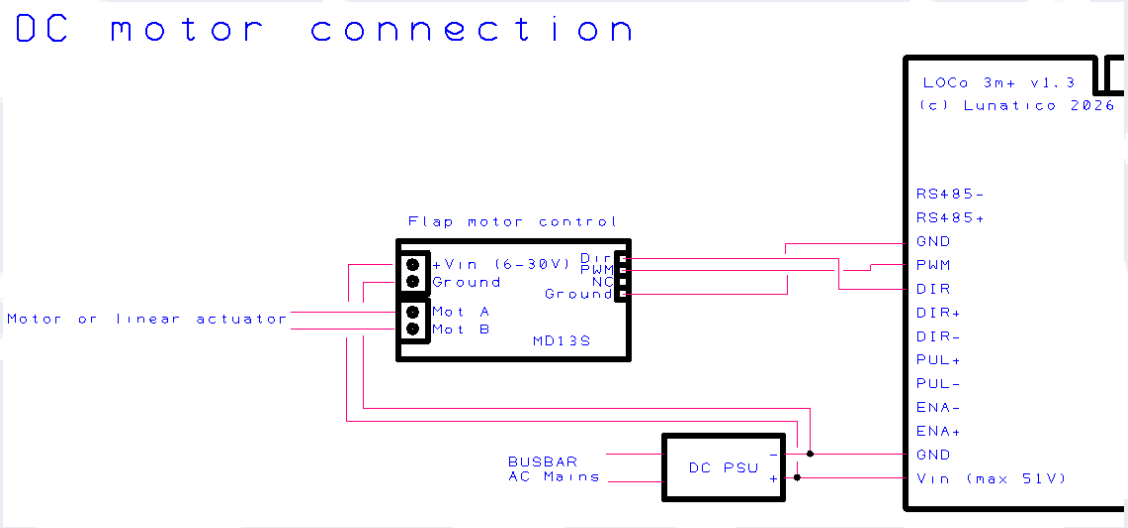
- ★ **DM860I**—up to 7.2 A, suitable for larger NEMA 34 motors
- ★ **TB6600**—up to 4.5 A, common choice for NEMA 23 motors

2.5. DC motor—external driver

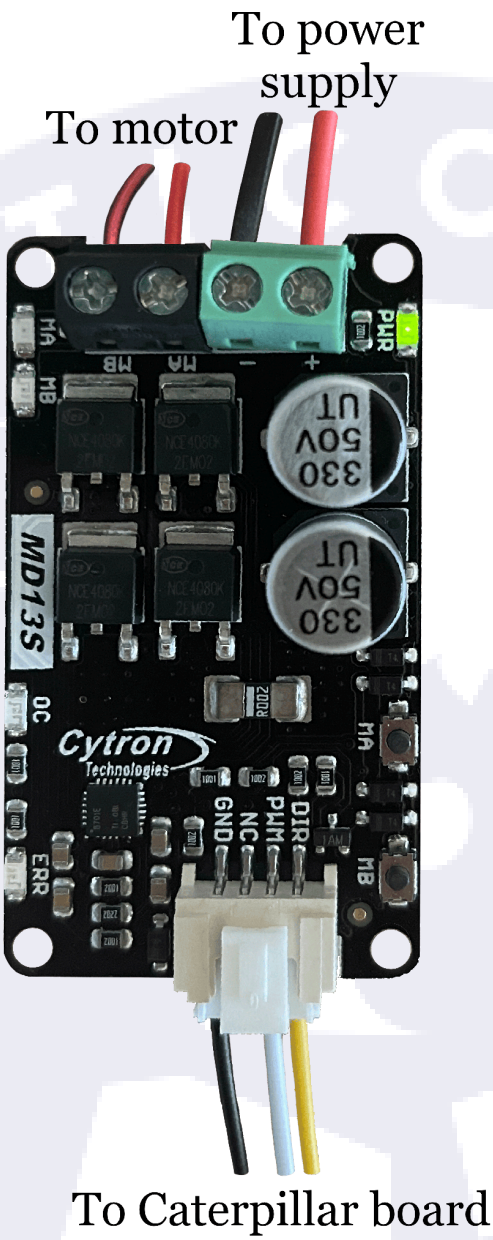
For DC motors, the Caterpillar board does not drive the motor directly either. Instead, it outputs a PWM speed signal and a direction (DIR) signal to an external DC motor driver (H-bridge), which handles the higher current the motor needs. Any DC driver that accepts PWM + DIR control at 3.3 V logic is compatible.

Tested driver

★ **Cytron MD13S**—13 A continuous (30 A peak for up to 10 s), 6–30 V motor supply, PWM (up to 20 kHz) + DIR control, 3.3 V/5 V logic; built-in overcurrent, undervoltage, and thermal protection.



DC motor · MD13S driver



Cytron board connections

2.6. Variable-frequency drive (VFD)

For 3-phase motors, the Caterpillar controls a variable-frequency drive (VFD) through its digital inputs (DIx), driven by the relays on our relay expansion board—a convenient way to get run/stop and direction control without any serial link. Any VFD that lets you assign run/stop and forward/reverse commands to digital inputs can be used this way; the parameter names and numbers below are given for the **WEG CFW300** as a concrete example—consult your VFD's manual for the equivalent digital-input parameters if you are using a different model.

For the VFD to read its digital inputs the way the Caterpillar's relays expect, a few parameters have to be adjusted. On a CFW300, these are:

Param	Description	Value	Meaning
P220	LOC/REM Selection Source	4	DIx (0 always LOC, 1 always REM)
P223	LOC FWD/REV Selection	4	DIx
P224	LOC Run/Stop Selection	1	DIx
P263	DI1 Input Function	9	LOC/REM
P265	DI3 Input Function	4	Forward Run
P266	DI4 Input Function	5	Reverse Run

After this configuration, the VFD will obey the run/stop and direction relays wired from the expansion board's outputs to its digital inputs, and will also be capable of manual operation with the flip of a switch.

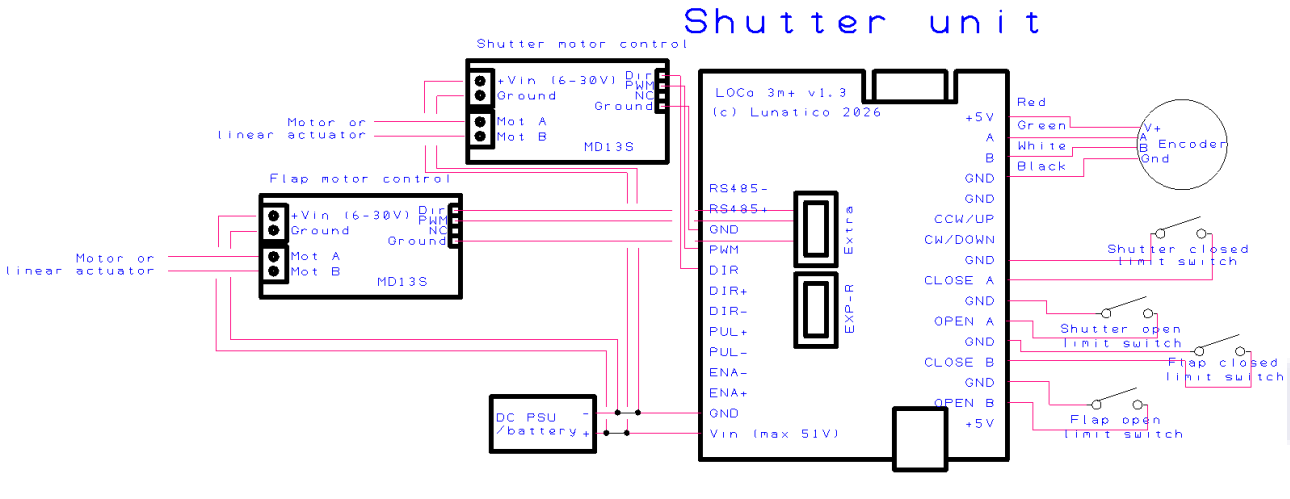
2.7. Relay expansion board

For motors or drives that are normally operated through simple on/off switches or contactors, the Caterpillar can automate that control using our relay expansion board. Rather than wiring to the motor or drive electronics directly, the board's relay outputs connect to whatever would otherwise be flipped by hand—a contactor coil, a VFD's digital inputs (see above), or any other **low current** switch-operated control point.

This makes it a convenient, driver-agnostic option: as long as a motor or drive can be commanded through dry-contact switch closures, it can be automated this way, without needing a dedicated speed/direction interface like PWM+DIR or a serial connection.

2.8. Shutter hardware

The shutter board controls up to two independent elements: the opening and, if fitted, the **flaps** (AKA lower shutters). Each element has its own motor/driver and its own pair of limit switches.

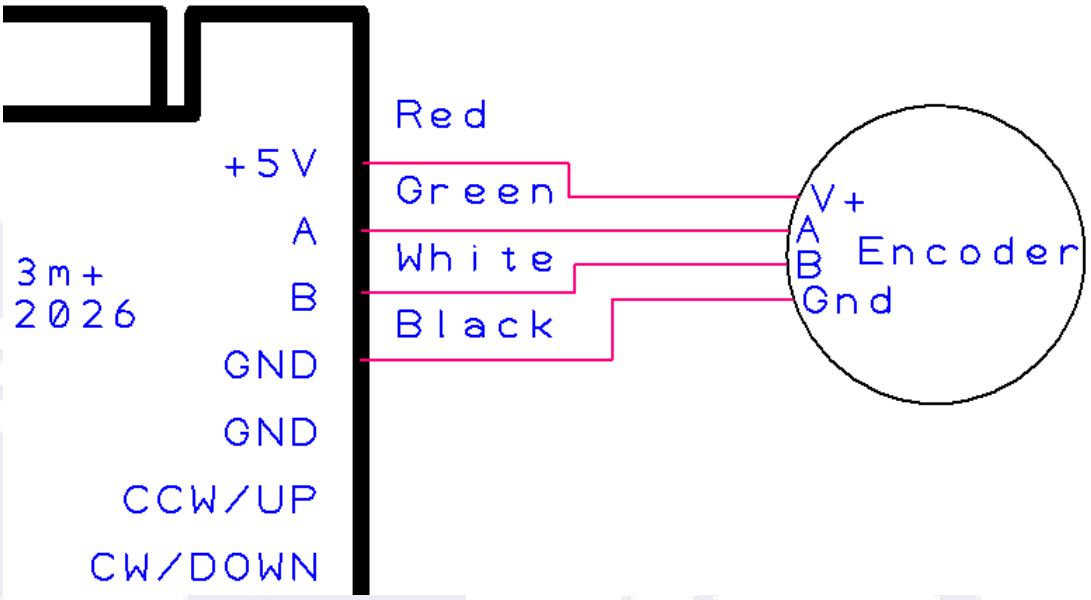


Shutter unit full wiring: opening (DC) + flaps + encoder + limit switches + PSU.

Opening

The opening motor can be any type—DC, stepper, 3-phase (via VFD), or relay/contactor—wired and configured exactly like the rotation motor; see the DC motor, Stepper motor, VFD, and relay expansion board sections for wiring details.

Two limit switches (open and close), normally open, are required. There is no home sensor for the opening—the limit switches themselves define the open and close positions—and a rotary encoder is optional, though recommended as an extra safety check (see Encoder).



Encoder (optional on the opening)

Opening motor	Any type—DC, stepper (external driver), 3-phase (via VFD), or relay/contactor
Opening limit switches	2 (NO, open/close), **required**
Opening encoder	Optional, recommended as an extra safety check

Flaps (lower shutters)

If your shutter has two elements—a main opening and flaps (AKA lower shutters)—the flaps are **always driven by a DC motor or a linear actuator (or 2)** through a dedicated connector on the shutter board, separate from the opening's motor connector. The flap driver has no encoder input; instead, two limit switches (open and close) are always required to track its position.

Note that even if the flaps use 2 linear actuators, these can be controlled by the same driver; alternatively 2 drivers can be wired in parallel if the power requirements demand it.

Flap driver	DC only, via a dedicated connector on the shutter board
Flap limit switches	2 (NO, open/close), required

Flap encoder	Not supported

Note: flaps are enabled in Initial motor configuration and settings by checking **Has flaps?** in the Shutter panel—see Enabling the shutter.

3. Software and configuration

3.1. Software overview

The Caterpillar can be controlled from any operating system, but it's important to note that the first first configuration has to be done with the *Initial motor configuration and settings* application, which runs on Windows. The Caterpillar's USB Windows drivers can be found here: CP210x_Universal_Windows_Driver.zip.

The Caterpillar's software package includes:

- ★ The *Initial motor configuration and settings*, which as mentioned, is an application used usually just once, to set everything up according to your specific dome characteristics
- ★ The ASCOM dome driver and ASCOM safety monitor driver

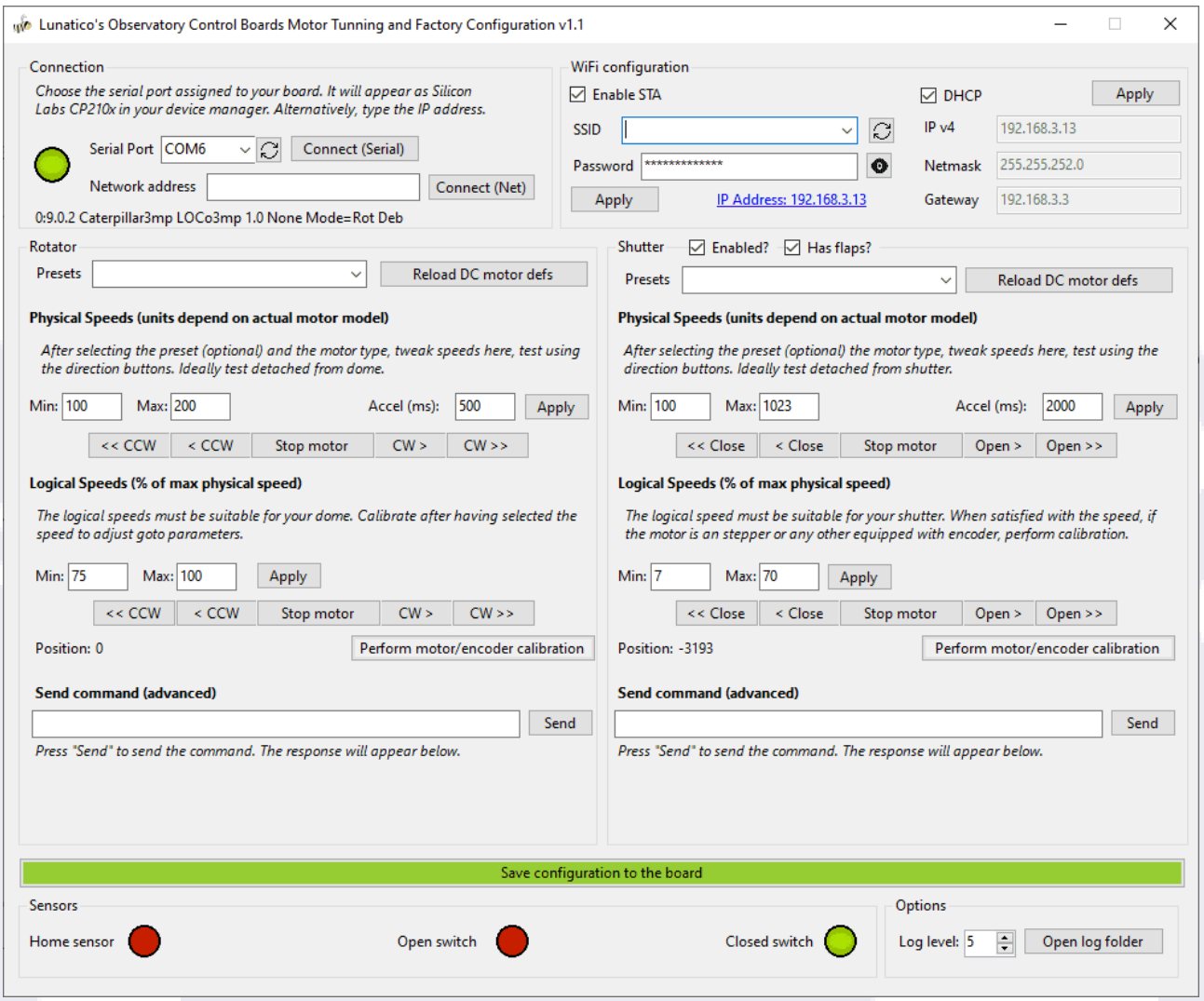
There is an INDI driver available as well. Refer to its section for more information.

3.2. Initial motor configuration and settings

The *Initial motor configuration and settings* application is a small Windows application used to fine-tune the Caterpillar's settings. You will use it to:

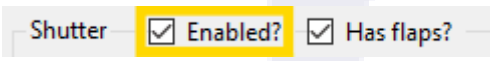
- ★ Select the correct motor preset for your drive system
- ★ Set physical and logical speed parameters
- ★ Configure the WiFi so the board can be reached over your observatory network
- ★ Run motor and encoder calibration
- ★ Save all settings to the board's internal flash storage

Once your observatory is up and running, you will rarely need this tool again; day-to-day operation goes through your ASCOM or INDI driver and automation software.



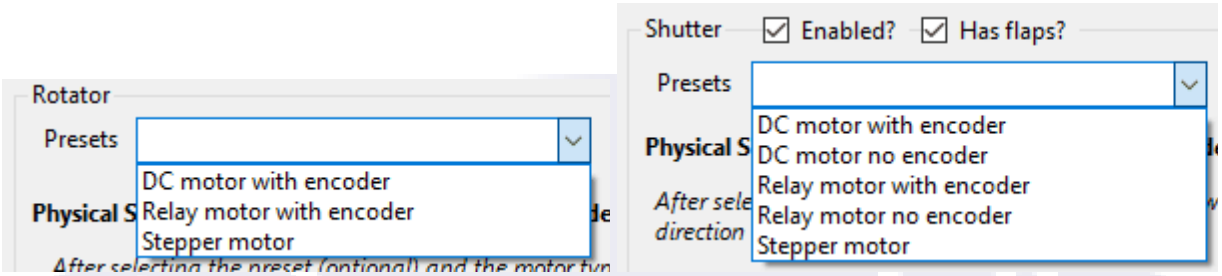
Initial motor configuration and settings application

The window is split into two mirrored halves, Rotator (left) and Shutter (right). **The shutter half only becomes active once you check its *Enabled?* box**.



Both halves share the same layout:

★ A preset dropdown and a "Reload ... motor defs" button. See Selecting a motor preset.



- ★ Physical Speeds and Logical Speeds, each with jog buttons (<< < Stop motor > >>) to test movement directly from the app. See Configuring speeds.
- ★ A live Position readout and a Perform motor/encoder calibration button. See Motor and encoder calibration.
- ★ A Send command (advanced) box to send raw commands straight to the board. This is only needed for low-level diagnostics or support requests.

At the bottom, Sensors shows live indicators for the home sensor and, on the shutter side, the open/closed limit switches. This is handy for checking wiring without leaving the app. The green Save configuration to the board bar writes everything to flash (see Saving settings to the board). Options lets you raise the log level and open the log folder if you need to troubleshoot or file a support request.

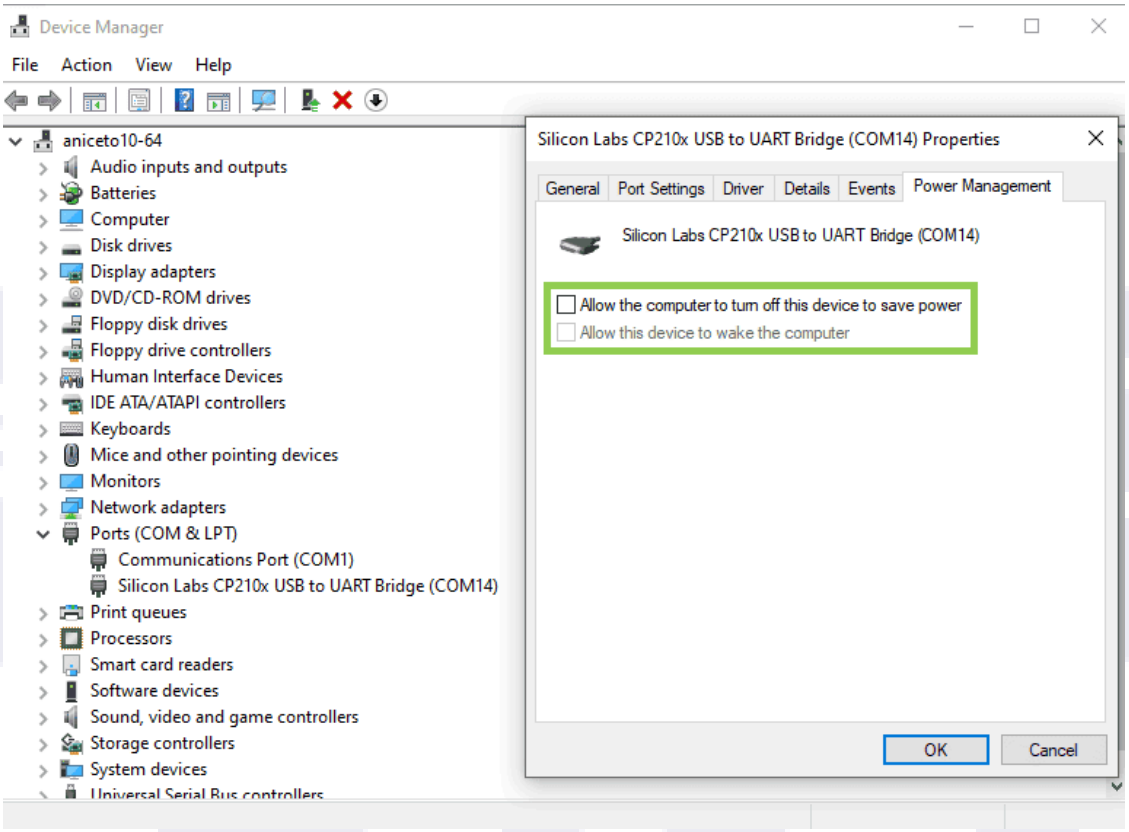
Step 1: connecting

Connecting via USB

Connect your computer to the board with a USB cable, and turn the Caterpillar on. Windows will detect a new device and may install the drivers automatically. If it does not, install the CP210x driver manually: CP210x_Universal_Windows_Driver.zip.

In order to find out which COM port has been assigned to your Caterpillar, use the Windows Device Manager. This number will always be the same for your device, and will be required to configure the connection.

You should also disable the power saving feature of the USB port: in Device Manager, find the CP210x device under Ports (COM & LPT), open its Properties → Power Management, and uncheck "Allow the computer to turn off this device to save power".



Device Manager; the Caterpillar appears as a CP210x USB to UART Bridge

Open *Initial motor configuration and settings*. The Port dropdown will list all available serial ports. If the board does not appear, click Reload Ports. Select the correct port and click Connect.

The status bar will show the board's firmware version string once connected (e.g. Caterpillar3mp LOCo3mp 1.2.0 None Mode=Rot|Shut).

Note: if you have a separate shutter board, *Initial motor configuration and settings* will connect to the rotator board first, then wait up to 30 seconds for the shutter board to respond. A "Waiting for shutter..." message will appear in the meantime—make sure both boards are powered on.

Configuring board WiFi

You can use *Initial motor configuration and settings* to configure WiFi so the board can be reached over your observatory network. To do so, follow these steps:

1. Connect via USB first, as WiFi configuration requires an existing connection.
2. In the **WiFi** section, enable **Station mode** by checking the STA checkbox.

3. Click **Scan** to discover nearby networks, or type your SSID directly.
4. Enter the WiFi password.
5. Choose **DHCP** (default), or enter a static IP, subnet mask, and gateway if you prefer a fixed address.
6. Click **Apply WiFi**. The board will apply the settings and disconnect—this is normal. If connected via USB, *Initial motor configuration and settings* will attempt to reconnect automatically.

Important note: applying new WiFi settings over a WiFi connection will disconnect you. You will need to reconnect manually once the board has joined the network using the new settings.

After reconnecting, the current IP address is shown in the WiFi section; note it down, as you will need it to connect without USB in future sessions.

Connecting via WiFi

Once the board has been configured with your WiFi credentials (see Configuring board WiFi), you can connect to it over the network instead of USB.

In the **Network address** field, enter the board's IP address—you can find this in your router's DHCP lease table, or from the address shown in *Initial motor configuration and settings* after a USB connection. The default port is 10000, so entering just the IP address is enough; to use a different port, enter 192.168.x.x:port. Press Enter or click **Connect**.

Tip: assigning a static IP to the board—either via a DHCP reservation on your router, or using the Static IP settings in *Initial motor configuration and settings*—means the address will not change between sessions.

Step 2: selecting a motor preset

Motor presets load a complete set of factory default parameters tuned for a specific motor and drive combination. This is the first thing you should do after connecting to a freshly installed board.

The rotator and shutter each have their own preset dropdown. Select the preset that matches your motor.

Warning: selecting a preset resets all parameters (speeds, acceleration, calibration) to factory defaults for that motor type—any custom values you have set will be overwritten. The board will reboot automatically; *Initial motor configuration and settings* will reconnect after a few seconds.

Preset	Motor/drive type	Encoder
Stepper	Stepper motor via external driver	Not needed—position comes from steps
DC motor with encoder	DC motor via external driver (e.g. Cytron MD13S)	Yes
DC motor no encoder	DC motor via external driver	No
Relay motor with encoder	Relay-driven motor or contactor, including a VFD driven through the relay expansion board	Yes
Relay motor no encoder	Relay-driven motor or contactor, including a VFD driven through the relay expansion board	No

The "no encoder" presets are only offered in the **Shutter** preset dropdown—on the rotator, an encoder is always required except with the Stepper preset, which tracks position by step count instead (see Encoder).

Step 3: Configuring speeds

Speed configuration uses two layers, and the split is intentional: **physical speeds** describe what the motor and driver can do, while **logical speeds** describe what your specific dome needs given its mechanics (gearing, dome diameter, friction, desired real-world rotation speed, etc.).

Keeping them separate pays off in two situations:

- ★ If you install the same motor/driver combination on more than one dome, you only need to re-tune the logical range for each one—the physical range stays the same.
- ★ After a mechanical repair or adjustment to the dome, you typically only need to revisit the logical range too, since the motor and driver themselves have not changed.

Physical speeds

Physical speeds are the raw parameters the motor driver works with. Their units depend on the motor type (e.g. steps/s for a stepper or a PWM-related value for a DC driver). They should be set once per motor/driver combination and left alone afterward—they do not depend on the specific dome the motor is installed on:

- ★ **Min**—the slowest speed the motor can turn without stalling. Below this, the motor may not move reliably.
- ★ **Max**—the fastest safe speed for your drive system.
- ★ **Accel**—how quickly the motor ramps up from min to max, in ms.

Your preset loads sensible defaults, only adjust these if you know your motor's characteristics and are seeing stalling or noise.

Each side has its own jog buttons (<< < Stop motor > >>) next to both the physical and logical speed fields, so you can test a speed immediately after applying it. **Test with the motor disconnected** from the dome or shutter mechanism first, so a wrong setting cannot drive it into a limit or cause damage.

Logical speeds

Logical speeds are what your ASCOM driver and automation software see, expressed as percentages of the physical range. This is the layer you tune to match the concrete mechanical installation: setting logical min to 20% and max to 80%, for example, limits the software-accessible range to the middle portion of the motor's capability, which is useful if extreme speeds cause vibration or inaccuracy on that particular dome. Expect to revisit this range whenever the dome's mechanics change (after a repair, a gear or belt adjustment, added friction, and so on) even though the physical range underneath stays the same.

Note: *Initial motor configuration and settings* will warn if logical min > logical max, or if the derived step value at logical min falls below the physical min. **Always apply physical speeds before adjusting logical speeds**.

If your motor type is Relays (CaterpillarR), speed controls are not available so the fields are disabled. This is expected: relay-based drives run at whatever speed the existing motor system provides.

Click **Apply** in each speed section to send the values to the board, then **Save configuration to the board** to persist them.

Step 4: enabling the shutter

If your dome has a shutter or flap controlled by a separate Caterpillar board, enable it in the Shutter section of *Initial motor configuration and settings*.

1. Check **Enabled?**. The shutter controls will become active.
2. Select the shutter motor preset from the Shutter preset dropdown.
3. If your shutter has two elements—a main opening and flaps (AKA lower shutters)—check **Has flaps?**. Note that the flap motor must be DC (motor or linear actuator), and flaps require their own open and close limit switches. There is currently nothing to configure for flaps.
4. Click **Save configuration to the board**.

On power on, both boards connect to each other over a private, internal Wi-Fi link—this is automatic and requires no configuration from you. **The observatory computer must be connected to the rotation board**, which can be done via USB or your own Wi-Fi network. The rotation board controls the shutter board; you do not need to address the shutter board separately from ASCOM. Similarly, the rotation board will automatically update the firmware of the shutter one when required.

Step 5: check motor directions

Use the jog buttons to move the rotator, and the shutter (if applicable). Look at whether

or not they're moving in the direction the jog buttons indicate, if not, you'll need to swap the motor wirings.



Note: you won't need to swap the encoder wiring, if it's reading the wrong direction, this'll be corrected automatically.

Step 6: motor and encoder calibration

Calibration matches the encoder response to motor motion. Run it after initial setup, and after changing a motor or encoder.

1. Make sure the dome is clear to move through its full range of travel.
2. Click **Perform motor/encoder calibration**.
3. The dome will exercise the motor, both in CW and CCW direction, stopping, moving again, until the system measures every parameter it needs for accurate operation. **Do not interrupt this process** unless necessary.
4. On success, a confirmation dialog appears. Click **Save configuration to the board** immediately to preserve the calibration data.

If calibration fails

Check that the encoder is properly connected and that the board can detect movement. Try reducing the physical max speed and re-running. If the issue persists, check wiring and ensure the motor is turning in the correct direction.

Step 7: saving settings to the board

The green **Save configuration to the board** bar writes all current settings—speeds, WiFi configuration, calibration data, and motor parameters—to the board's internal flash (non-volatile) storage.

Important note: until you click Save configuration to the board, your settings exist only in the board's RAM and will be lost when it reboots or loses power. **Always save after completing configuration**.

A confirmation dialog appears once the save completes. You can then close the application and proceed to ASCOM driver setup.

3.3. ASCOM dome driver

The Caterpillar's software includes the ASCOM dome driver and is available from this link. It has two components: the dome driver and a safety monitor driver for the optional weather input (a CloudWatcher can be used for this purpose).

The ASCOM Platform must be installed before running the Caterpillar installer. The software and drivers are the same for both the Caterpillar and the CaterpillarR.

Selecting the driver

In your astronomy software's dome chooser, select **Caterpillar Dome** from the list. Open the driver's Setup dialog to configure the connection before connecting for the first time.



Caterpillar ASCOM driver setup

Connect

Enter the board's IP address (for WiFi) or select the COM port (for USB); the board communicates on UDP port 10000. The dialog also shows the connected board's firmware version (FW v.), and Firmware update lets you flash a new one without leaving the driver.

Open log folder and Trace on are diagnostic aids—enable tracing and reproduce an issue to be able to send the logs for support. Configuration / Hide configuration toggles the extended panel described below, and **Factory reset** resets the driver's own settings back to defaults.

Homing and calibration

These buttons perform the same kind of homing/calibration work as Motor and encoder calibration in Initial motor configuration and settings, but from the driver itself, without needing to reconnect with that tool:

Find home	drives the dome until it locates the physical home sensor.
Measure home	finds the home sensor, then sweeps back and forth across it to precisely measure its trigger point from both directions.
Measure all	measures the full circumference together with the home sensor; the complete calibration.
Tune Rot Motor	matches the motor to the encoder, the same operation Initial motor configuration and settings performs, but for a different board revision; on the Caterpillar it is normally disabled.
Calibrate shutter	measures the distance between the shutter's open and close limit switches.

The first time you visit the driver, run Measure all. You can also run Calibrate shutter.

Options

Use status window	shows a small floating status window.
Status window always visible	keeps that window on top at all times, instead of only when relevant.
Enable shutter control	activates the shutter commands/buttons when a shutter board is present.

Safety settings

Full rotation max time (secs)	the longest a full rotation should take; if exceeded, the driver treats the dome as stuck and faults instead of spinning indefinitely.
Shutter bat min voltage	if the shutter's independent battery drops below this voltage, the shutter closes automatically.
Ignore weather safety devices	lets the shutter open, and keeps it from auto-closing, even while the Safety Monitor reports unsafe weather. Use at your own discretion.

Note: the **Ignore weather safety devices** option bypasses a safety feature meant to protect your equipment from weather—only enable it if you understand the risk (e.g. bench testing indoors, or taking sky flats under conditions the safety monitor would otherwise flag as unsafe).

Rotator parameters

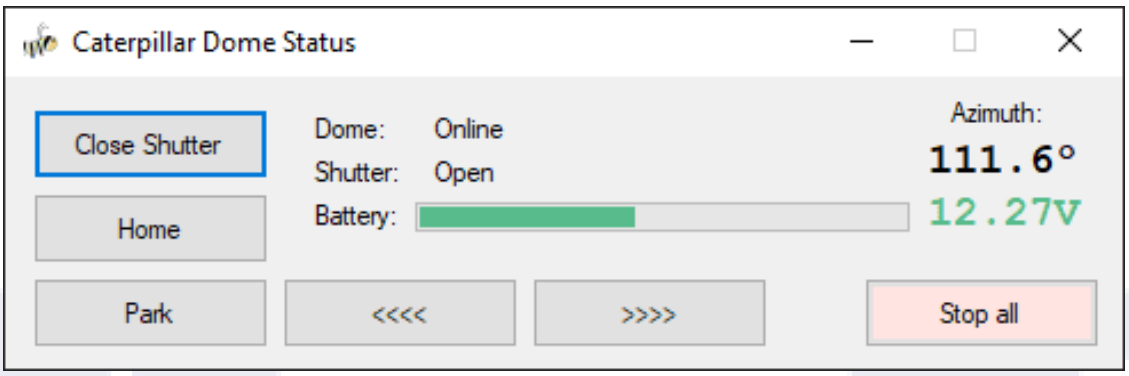
Home azimuth is the real-world azimuth, in degrees, that corresponds to the home sensor position; Park azimuth is where the dome should move to when parking.

Note that there is no separate "save" step—settings take effect as soon as you click Apply values.

Reload last config discards any unapplied changes and reloads the last saved values instead.

Status window

Checking **Use status window** opens a small floating window with live status and quick manual controls—handy for keeping an eye on the dome without opening your full automation software.



Status window—live status and manual controls

Dome / **Shutter**	connection and open/close state at a glance.
Battery	the shutter's independent battery voltage (see **Shutter bat min voltage** above).
Azimuth	the dome's current azimuth.
Close Shutter (toggles to *Open Shutter*)	opens or closes the shutter.
Home / **Park**	send the dome to its home or park position.
<<<< / >>>>	rotate the dome manually, one direction each.
Stop all	immediately stops all motion, rotation and shutter alike.

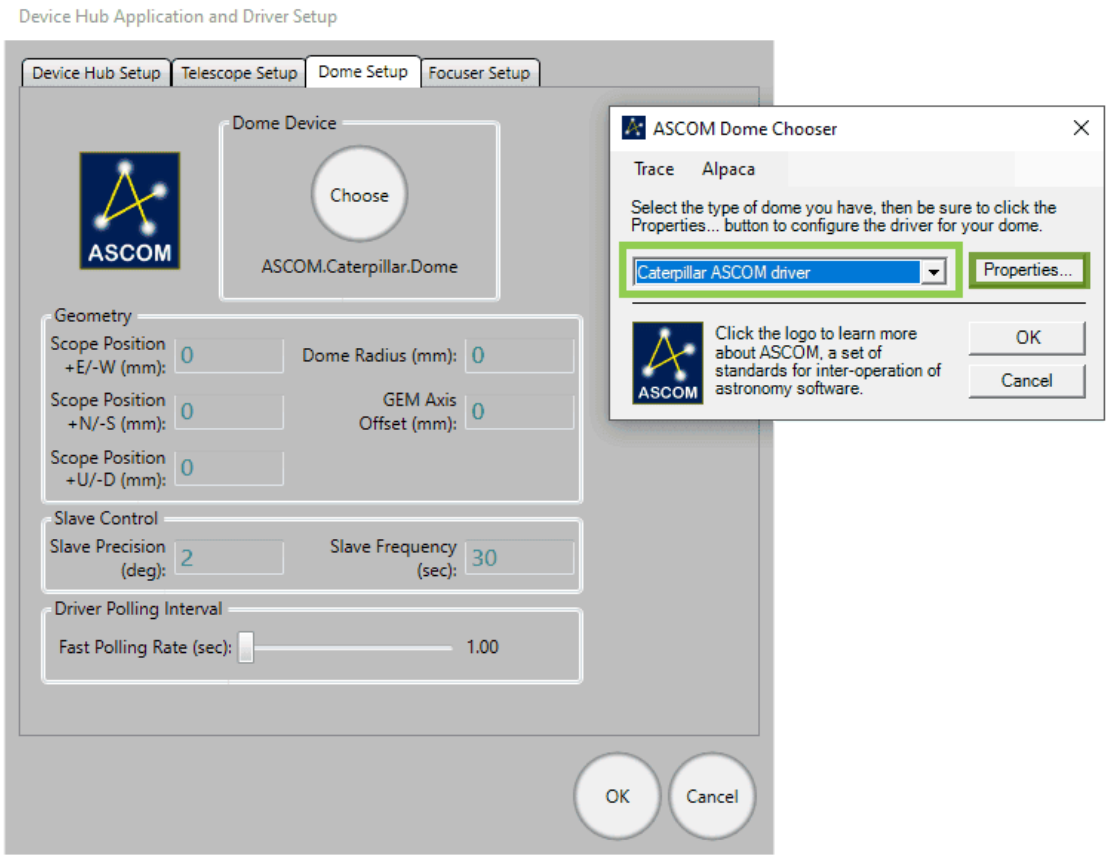
ASCOM Device Hub setup

ASCOM Device Hub lets multiple astronomy applications share a single dome driver connection, and handles telescope-dome slaving so the dome follows the telescope automatically.

Note: some programs—such as Voyager, Sequence Generator Pro, or N.I.N.A.—include their own dome to telescope slaving. It is up to you to choose the software to synchronise both elements. The ASCOM Device Hub is used here for reference.

Connecting the dome driver

1. Open ASCOM Device Hub.
2. Go to **Tools → Setup → Dome Setup**.
3. Click **Choose** and select the **Caterpillar ASCOM driver**.
4. Click **Connect**.

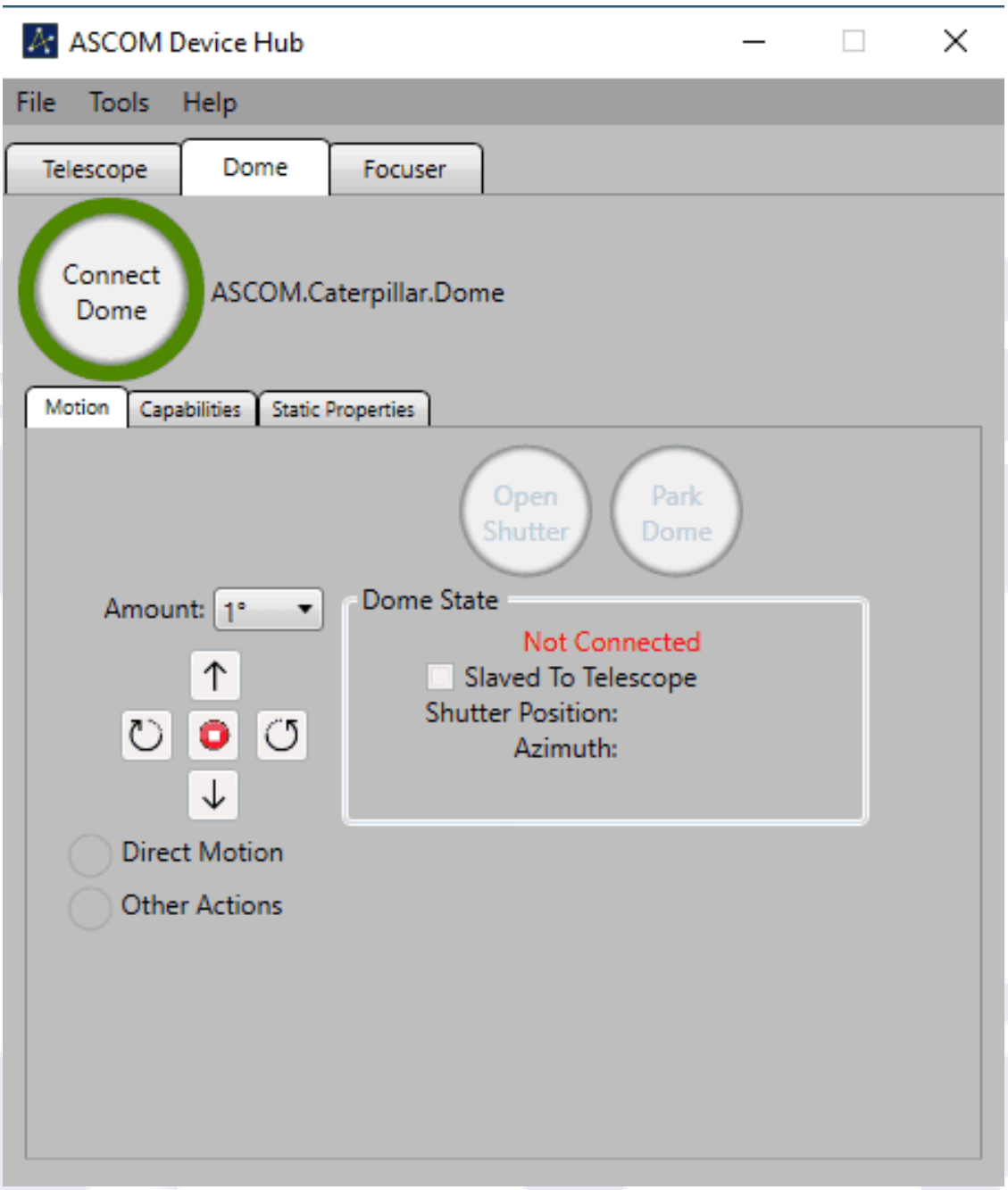


ASCOM Device Hub — Dome Setup

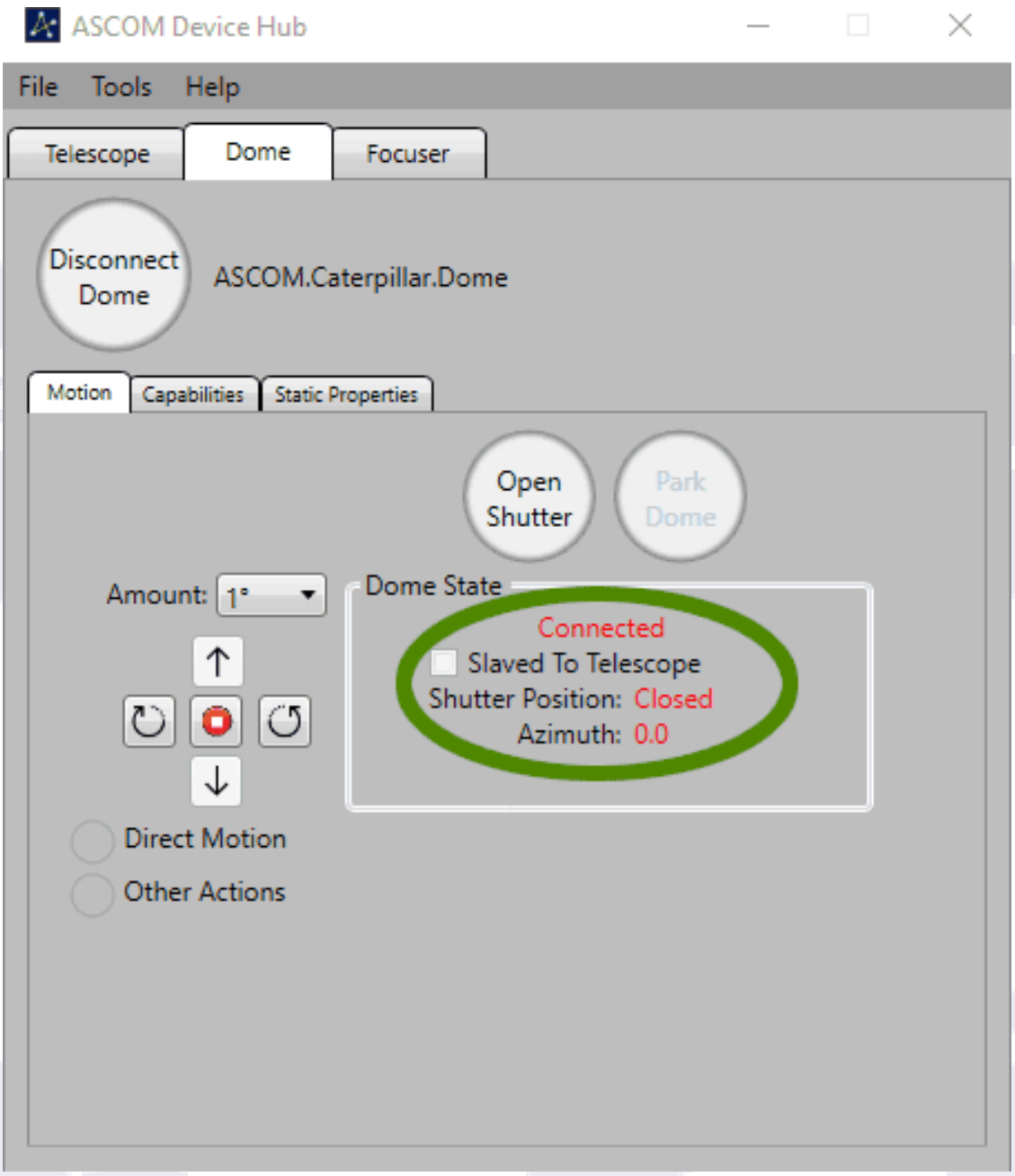
Telescope slaving

Configure the Telescope tab to connect to your mount's ASCOM driver, then enable slaving. Recommended parameters:

Slave precision	2°
Slave frequency	Every 5 seconds
Driver polling	Every 2 seconds



ASCOM Device Hub — Dome tab



ASCOM Device Hub — Telescope tab

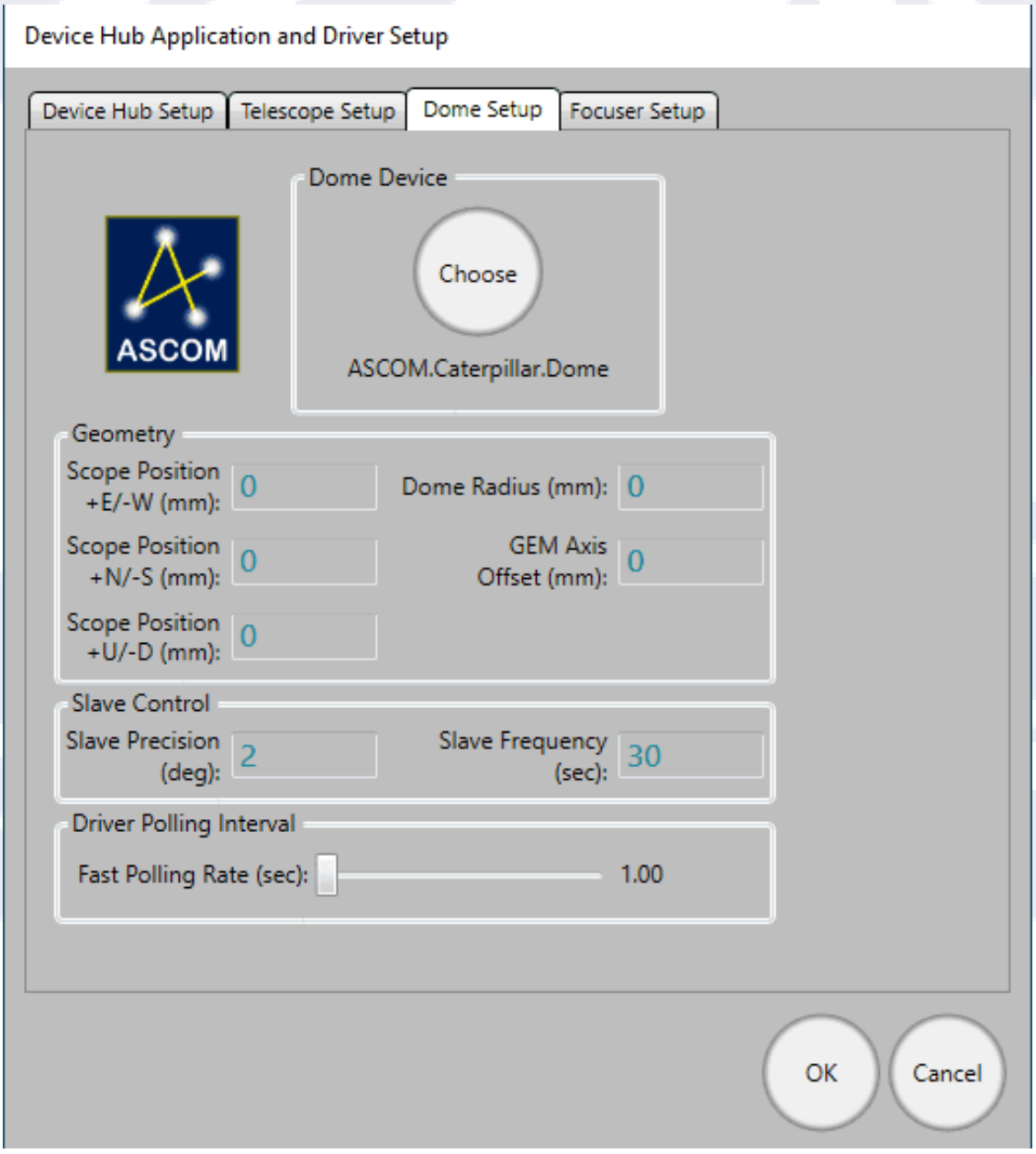
Dome geometry

For accurate slaving, you need to tell Device Hub the physical geometry of your dome and mount. Open **Dome Setup → Geometry** and enter:

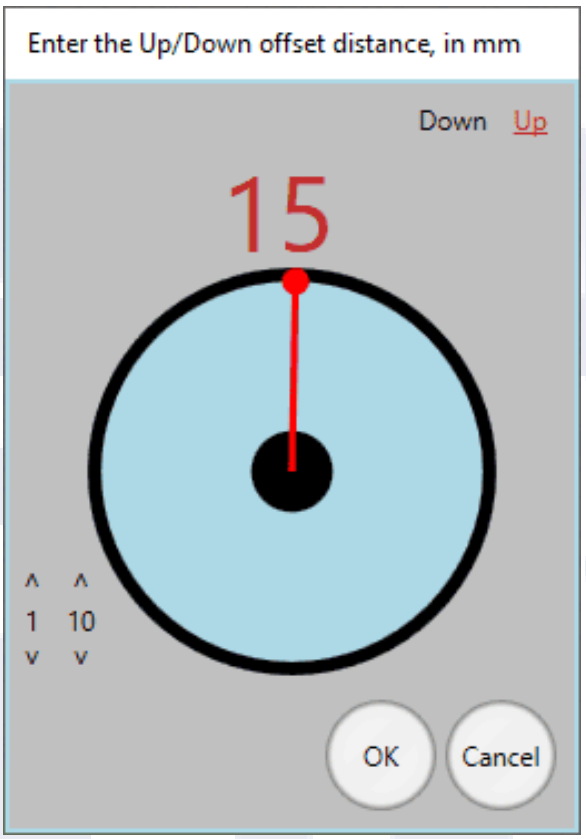
Dome Radius	The inside radius of the dome
GEM Axis Offset	Distance from the GEM pier to the dome's geometric centre

E/W Offset	East–West offset of the mount's intersection point from dome centre
N/S Offset	North–South offset
Up/Down Offset	Vertical offset

The N/S, E/W, and Up/Down parameters describe by how much the mount's optical axis intersection point is offset from the centre of rotation of the dome. The best way to measure these is often by taking differences—position the telescope at different azimuths, note the dome positions required, and back-calculate the offsets.



Dome geometry configuration



Geometry values

ASCOM Safety Monitor

The safety monitor driver is included in the same installer as the dome driver (Caterpillar-Install.exe), and allows your automation software to close the observatory automatically when unsafe conditions are detected. It is fully compatible with the Lunaticoastro CloudWatcher and other monitors such as Hydreon's rain gauges.

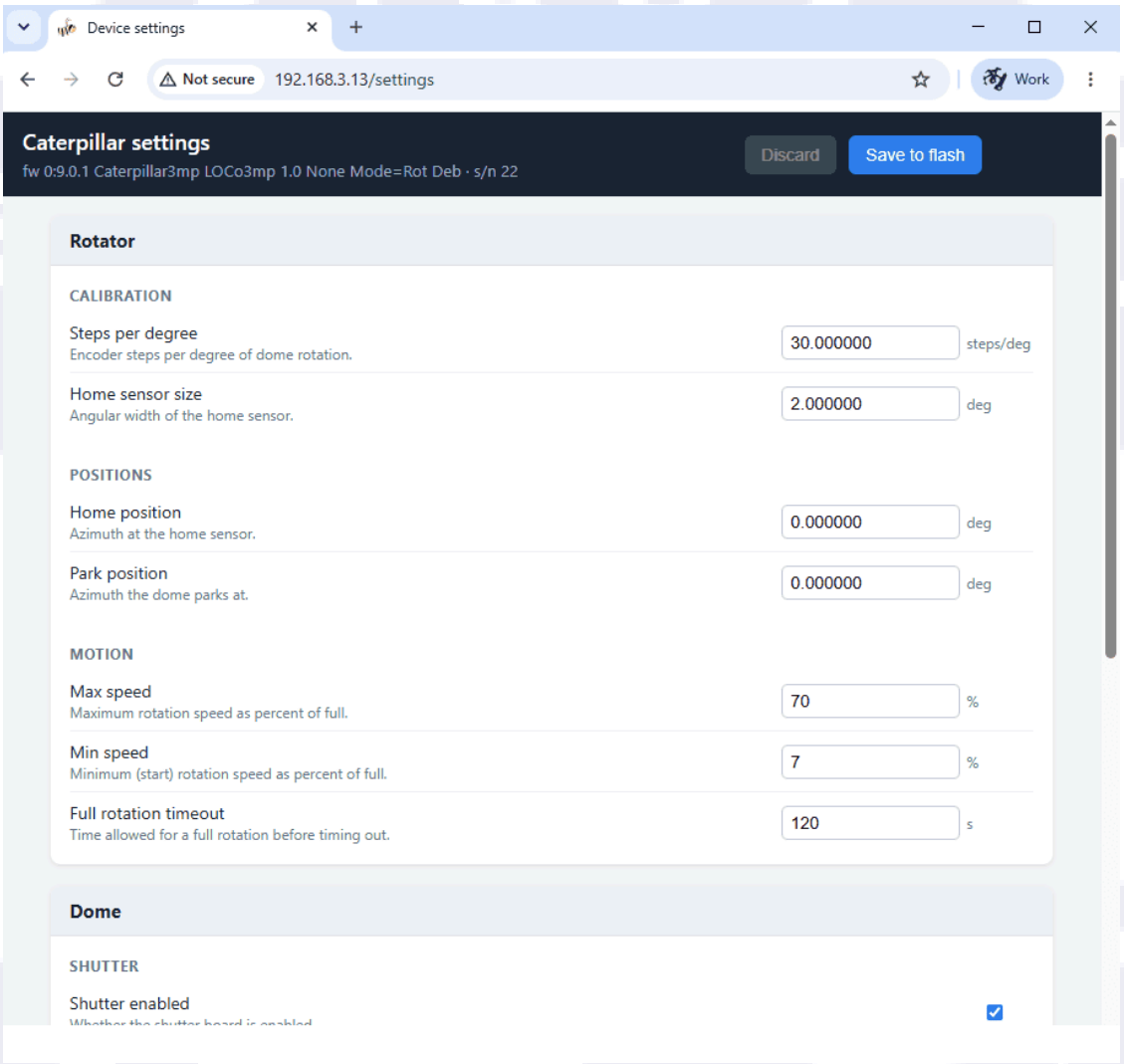
3.4. INDI driver

A dedicated INDI driver is coming soon. In the meantime, **the Caterpillar is fully compatible with the Nexdome Beaver INDI driver**, which is included with the default drivers, and that one can be used.

If you encounter issues with INDI support, please get in touch with us at support@lunaticoastro.com.

3.5. Configuration via internal webserver

Some settings of the Caterpillar can also be configured from its own internal webserver, accessed via its IP address, as in the screenshot below.



Configuration via internal webserver

4. Troubleshooting

4.1. Connection issues

Board not appearing as a COM port

Install the CP210x driver: CP210x_Universal_Windows_Driver.zip. Try a different USB cable (some cables are charge-only and carry no data), and try a different USB port on your computer.

Connection drops unexpectedly

You should disable the power saving feature of the USB port. In Device Manager, find the CP210x device under *Ports (COM & LPT)*, open its Properties → Power Management, and uncheck "**Allow the computer to turn off this device to save power**".

Cannot connect over WiFi

- ★ Verify the IP address; check your router's DHCP table, or reconnect via USB to see the current address shown in Initial motor configuration and settings.
- ★ Make sure the board and the PC are on the same network.
- ★ Check that no firewall is blocking UDP port 10000.
- ★ Confirm that Station mode is enabled and the board has successfully joined your network.

Shutter board not connecting

- ★ The rotator↔shutter link is a private, internal Wi-Fi connection that pairs automatically—no network settings to check here. If it is not coming up, power-cycle both boards.
- ★ Make sure both boards are powered and within range of each other.
- ★ Initial motor configuration and settings waits up to 30 seconds for the shutter, be patient after connecting the rotator.

4.2. Unexpected stops

System stops with a warning during homing

Should the home sensor not be found after a complete revolution, the system will stop and issue a warning. Check:

- ★ Home sensor wiring and connector.
- ★ That the sensor is positioned to trigger as the dome passes. Test manually by activating the sensor while watching its indicator in the Sensors panel of Initial motor configuration and settings.
- ★ For hall-effect sensors: confirm the magnet is close enough and correctly oriented.
- ★ For mechanical sensors: check the plunger is not obstructed.

System stops with a warning during rotation

If the encoder does not detect motion when the dome is running, the system will stop. Check encoder wiring and connections, and verify the encoder is spinning when the dome moves.

4.3. Other issues

Calibration fails or aborts unexpectedly

- ★ Check encoder wiring, a loose connection will cause no position feedback.
- ★ Reduce the physical max speed in Initial motor configuration and settings and retry; the motor may be losing steps under load at high speed.
- ★ Make sure the dome can complete a full unobstructed cycle during calibration.

Dome position drifts over time

- ★ Re-run calibration, the encoder mapping may be stale after a motor or dome modification.
- ★ Check that calibration data was saved to flash after the last successful calibration.

Dome not reaching target azimuth

- ★ Check the logical speed range, if logical min is set too low, the derived motor speed may fall below physical min and the motor will not turn.
- ★ If the motor runs but the dome barely moves, check the mechanical coupling.

5. Setups not covered here

If you believe your setup wasn't covered by this manual, it's still possible that the Caterpillar, whether it be this version or another one (check the Caterpillar's page on our website), is the right controller for you. Just flick us an email at support@lunaticoastro.com with the details of your observatory and we'll be happy to discuss automation with the Caterpillar or point you in the right direction.

Likewise, if you encounter any issues, we're always here to help.
