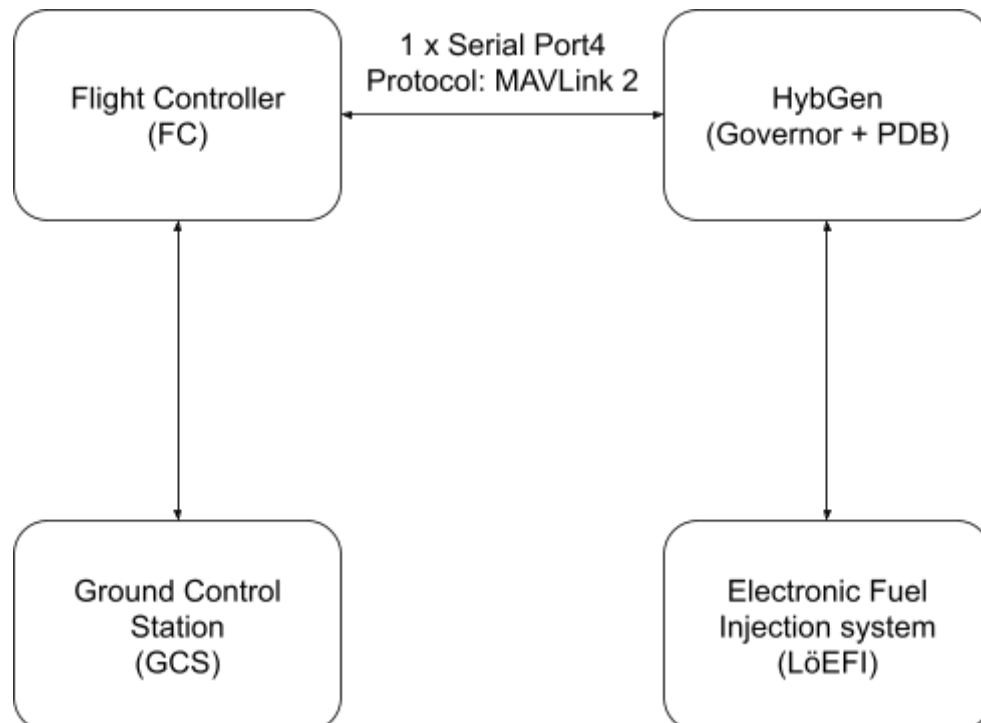


ArduPilot Support for the Löweheiser HybGen Range Extender

Although Löweheiser provides precompiled firmware for the most popular flight controllers, this document explains how to build the firmware using the ArduPilot Custom Firmware Builder. This tool allows you to create firmware with customized options and is likely to become the preferred approach as ArduPilot continues to add more and more features.

This document explains how to compile any supported ArduPilot version with Löweheiser HybGen generator support for operation through a UART telemetry port. A single serial port is used for both generator control and telemetry. Through this port, the flight controller receives telemetry from the generator controller (voltages, currents, throttle target, etc.) as well as telemetry from the engine's electronic fuel injection ECU (engine temperature, TPS, RPM, etc.). The data flow is shown in the following diagram:

Communications Diagram



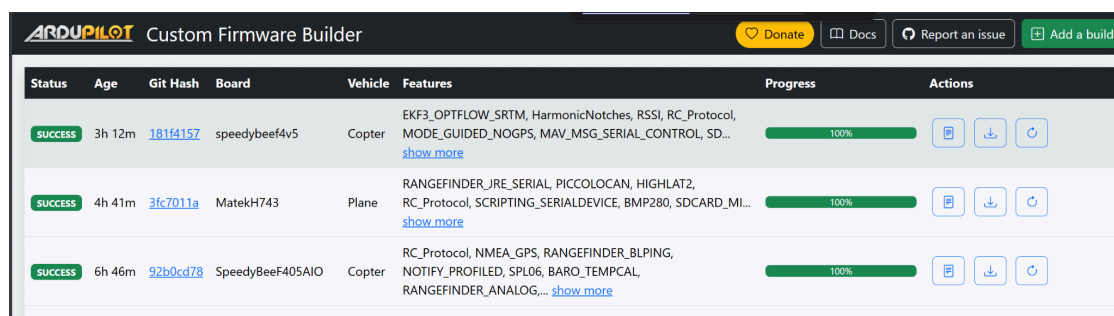
ArduPilot Firmware with Loweheiser Support

Two options are available: compile your own firmware using the ArduPilot Custom Firmware Builder, or download precompiled firmware with standard options and Löweheiser support enabled from the Löweheiser website.

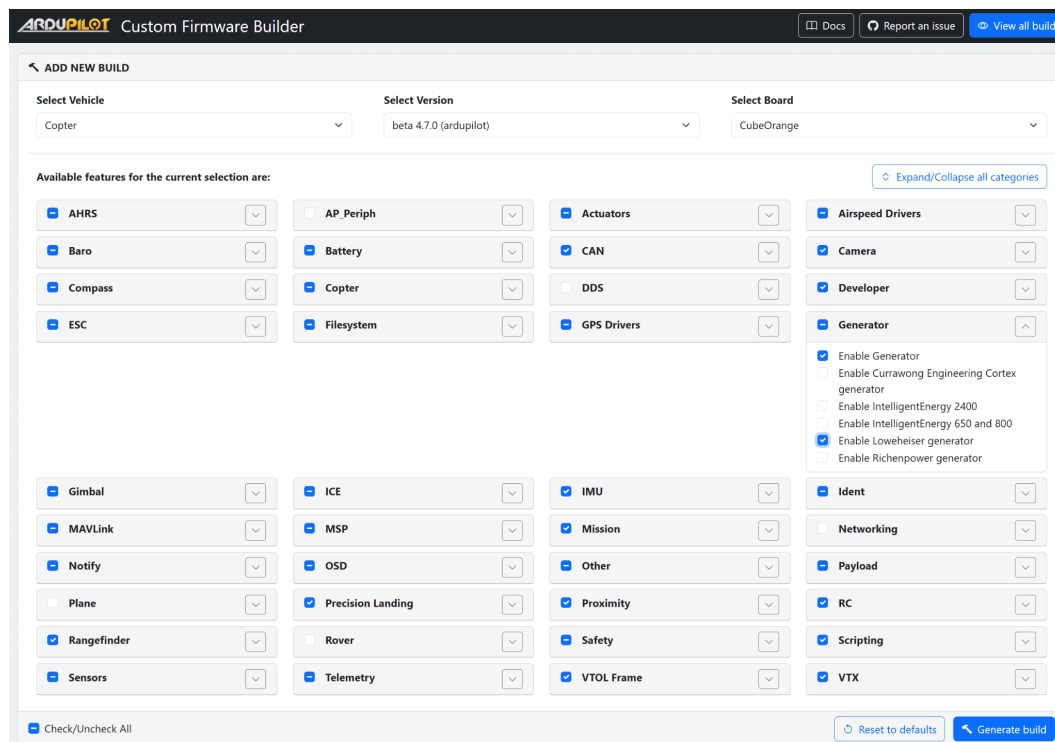
Option 1: Compile Your Own Firmware

Go to: <https://custom.ardupilot.org/>

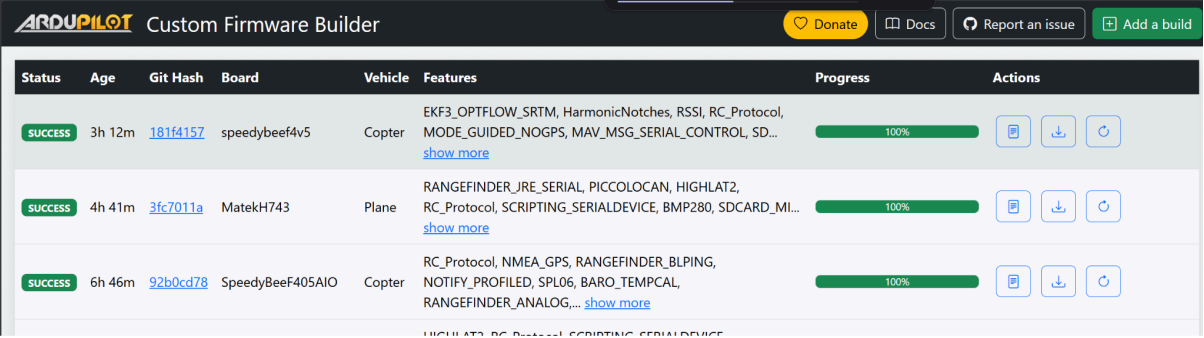
Step 1: Click “Add a build” (green button in the upper-right corner).



Step 2: Select the ArduPilot version. Löweheiser support is available from ArduPilot 4.7 onward. Select your flight controller (FC), enable “Loweheiser generator”, and then click “Generate Build” in the bottom-right corner.



Step 3: Return to the first window and wait for the build to complete. Once it is ready, click “Download” on the right-hand side of your build.



The screenshot shows the ArduPilot Custom Firmware Builder web interface. At the top, there's a header with the ArduPilot logo, the title 'Custom Firmware Builder', and buttons for 'Donate', 'Docs', 'Report an issue', and 'Add a build'. Below the header is a table with columns: Status, Age, Git Hash, Board, Vehicle, Features, Progress, and Actions. Three builds are listed, all with a 'SUCCESS' status and 100% progress. Each build row has a 'show more' link and three action buttons (document, download, refresh).

Status	Age	Git Hash	Board	Vehicle	Features	Progress	Actions
SUCCESS	3h 12m	181f4157	speedybeef4v5	Copter	EKF3, OPTFLOW, SRTM, HarmonicNotches, RSSI, RC_Protocol, MODE_GUIDED, NOGPS, MAV_MSG_SERIAL_CONTROL, SD...	100%	show more [document] [download] [refresh]
SUCCESS	4h 41m	3fc7011a	MatekH743	Plane	RANGEFINDER_JRE_SERIAL, PICCOLOCAN, HIGHLAT2, RC_Protocol, SCRIPTING_SERIALDEVICE, BMP280, SDCARD_ML...	100%	[document] [download] [refresh]
SUCCESS	6h 46m	92b0cd78	SpeedyBeeF405AIO	Copter	RC_Protocol, NMEA_GPS, RANGEFINDER_BLPING, NOTIFY_PROFILED, SPL06, BARO_TEMPICAL, RANGEFINDER_ANALOG,...	100%	[document] [download] [refresh]

Option 2: Download Precompiled Firmware

Löweheiser provides precompiled firmware for the most popular flight controllers. Go to the bottom of this page, where you can download the firmware:

<https://www.loweheiser.com/hybrid-drone-generators/>

Uploading Custom Firmware with Mission Planner

Firmware generated using the **ArduPilot Custom Firmware Builder** can be uploaded to the flight controller directly from Mission Planner.

1. Download the completed build from the ArduPilot Custom Firmware Builder and extract the downloaded package.
2. Inside the extracted folder, locate the firmware file with the **.apj** extension. This is the file that should be uploaded using Mission Planner.
3. Connect the flight controller directly to the computer using a USB cable.
4. Open **Mission Planner** and select the correct COM port in the upper-right corner. Do **not** connect to the flight controller yet.
5. Go to:
SETUP → Install Firmware
6. Click **Load custom firmware** and select the **.apj** file.
7. Mission Planner will detect the flight controller and begin uploading the firmware. Follow any instructions shown on screen, including disconnecting and reconnecting the USB cable if requested.
8. Wait until the upload process is complete. Mission Planner should display:
Erase → Program → Verify → Upload Done
9. Once completed, allow the flight controller to reboot and then connect normally with Mission Planner.

Configuring the Flight Controller

Parameter Setup

Once the firmware has been successfully uploaded, the flight controller must be configured with the required Löweheiser HybGen parameters.

Configure the serial port used by **HybGen**, and then enable the **generator, EFI, RC controls, and battery monitors** as required. **[x]** represents the selected serial port; **SERIAL4** is used in this reference configuration. Legacy values are shown only for older installations.

In **Mission Planner**, open the **Full Parameter List** and configure all the parameters shown below.

If any of the required parameters do not appear in the list, the parameter list may not have been refreshed after the firmware update. **Reboot the flight controller, reconnect Mission Planner, and try again.**

After loading and saving all the parameters, **completely power-cycle the flight controller**. Disconnect **all power** from the Pixhawk, wait a few seconds, and then reconnect it.

Once the system restarts and communication is correctly established, the **status LED on the Löweheiser Governor board should turn green.**

Green Governor LED = communication established and the system is ready to operate.

Parameter	Value	Function
SERIAL[x]_PROTOCOL	2	MAVLink communication protocol
SERIAL[x]_BAUD	115	Baud rate: 115200
GEN_TYPE	4	Löweheiser generator
EFI_TYPE	4	Löweheiser EFI
RC8_OPTION	111	Electric starter: press = ON, release = OFF
RC9_OPTION	85	Generator state: STOP / IDLE / RUNNING
RC10_OPTION	218	Manual throttle in IDLE, 0-100%

Generator Setup

ArduPilot HybGen parameters for the different operating states:

Parameter	Value	Description
BATT2_MONITOR	17	
BATT3_MONITOR	18	
BATT3_CAPACITY	10000	
BATT2_MONITOR	18	
BATT2_CAPACITY	10000	
BATT3_MONITOR	17	
GEN_IDLE_TEMP	110	Temperature threshold for switching from RUN to IDLE.
GEN_IDLE_TH	0	Minimum throttle in IDLE. Set to 0 for initial tests.
GEN_IDLE_TH_H	15	Minimum throttle in RUNNING. The source document also notes setting this to 0 for initial tests.
GEN_MNT_TIME		
GEN_OVER_TEMP	205	Maximum generator operating temperature. Exceeding this value generates an alarm.
GEN_RUN_TEMP	60	Threshold for switching from IDLE to RUN. Set to 0 for immediate transition without waiting for engine warm-up.
GEN_RUNTIME	0	Future feature; not yet implemented.

Verify the MAVLink Communication

Once the **Governor status LED is green**, you can verify that telemetry is being correctly received by the flight controller.

In **Mission Planner**, press **Ctrl + F** and open the **MAVLink Inspector**.

Check that the **Löweheiser generator and EFI MAVLink messages** are present and that their values are updating.

If the messages are visible and updating, communication between the **HybGen Governor and the flight controller is working correctly**.

RC Transmitter Setup

The Löweheiser HybGen can be controlled directly from the RC transmitter using three channels. In this reference configuration, **CH8**, **CH9**, and **CH10** are assigned to the starter, generator operating mode, and manual throttle.

CH8 — Electric Starter

CH8 controls the remote **electric starter**.

We recommend assigning this function to a **momentary push button** on the RC transmitter:

- **Button pressed:** Starter ON
- **Button released:** Starter OFF

CH9 — Generator Mode: STOP / IDLE / RUN

CH9 selects the generator operating mode. We recommend assigning this channel to a **3-position switch**:

- **1000 μ s — STOP:** Generator stopped.
- **1500 μ s — IDLE:** Engine running at idle. Manual throttle control through CH10 is available.
- **2000 μ s — RUN:** Generator operating normally under automatic governor control.

CH10 — Manual Throttle in IDLE

CH10 provides manual throttle control while the generator is in **IDLE** mode. This is useful during start-up, testing and diagnostics, allowing the operator to manually increase or decrease the engine throttle.

We typically assign the **RC transmitter throttle stick** directly to CH10. This allows the throttle stick to control the engine throttle while the generator is on the ground in **IDLE** mode.

Once CH9 is switched to **RUN**, manual throttle control is automatically disabled and the generator takes control of the throttle through its governor. The RC throttle stick can then be used normally to control the multicopter.

In summary:

CH8 → **Starter**

CH9 → **STOP / IDLE / RUN**

CH10 → **Manual throttle (IDLE only)**