

MachineDriver Operator Manual

How to connect the real paper machine (STEC/Multiverse) to the automap4 controller

1. What MachineDriver is

MachineDriver is the bridge between the real paper machine and the automap4 controller. It runs on the PC that can reach both the machine's STEC/Multiverse server and the automap4 ZeroMQ controller.

It has two independent communication links and passes data between them:

- STEC/Multiverse (machine side) — reads actuator positions, scanner profile, sheet edges, machine speed, and scanner direction; writes actuator setpoints and mapped profiles back to the machine.
- ZeroMQ (controller side) — sends scan_data messages to automap4 and receives setpoints, zone-in-manual flags, control/identification status, and mapped databoxes.

MachineDriver never invents data. Every profile, actuator position, and setpoint is forwarded from one side to the other. The machine's own edge detector, scanner direction, and profile are respected, but you can override how they are interpreted (for example reversing the profile or recomputing the edges from the raw profile).

2. Starting MachineDriver

Open a terminal and run one of the following commands:

```
python -m automap.machinedrivers.machinedriver
```

or, if the package is installed:

```
machinedriver
```

Optional command-line arguments are only used the first time, or when the saved VSettings do not yet have a value. All settings are persisted and restored on the next run.

- `-m/--modelhost` — automap4 controller hostname/IP (default 127.0.0.1).
- `-p/--port` — automap4 ZeroMQ port (default 5555).
- `--stechost` — STEC Multiverse server hostname/IP (default 127.0.0.1).
- `--stechport` — STEC Multiverse service port (default 4897).

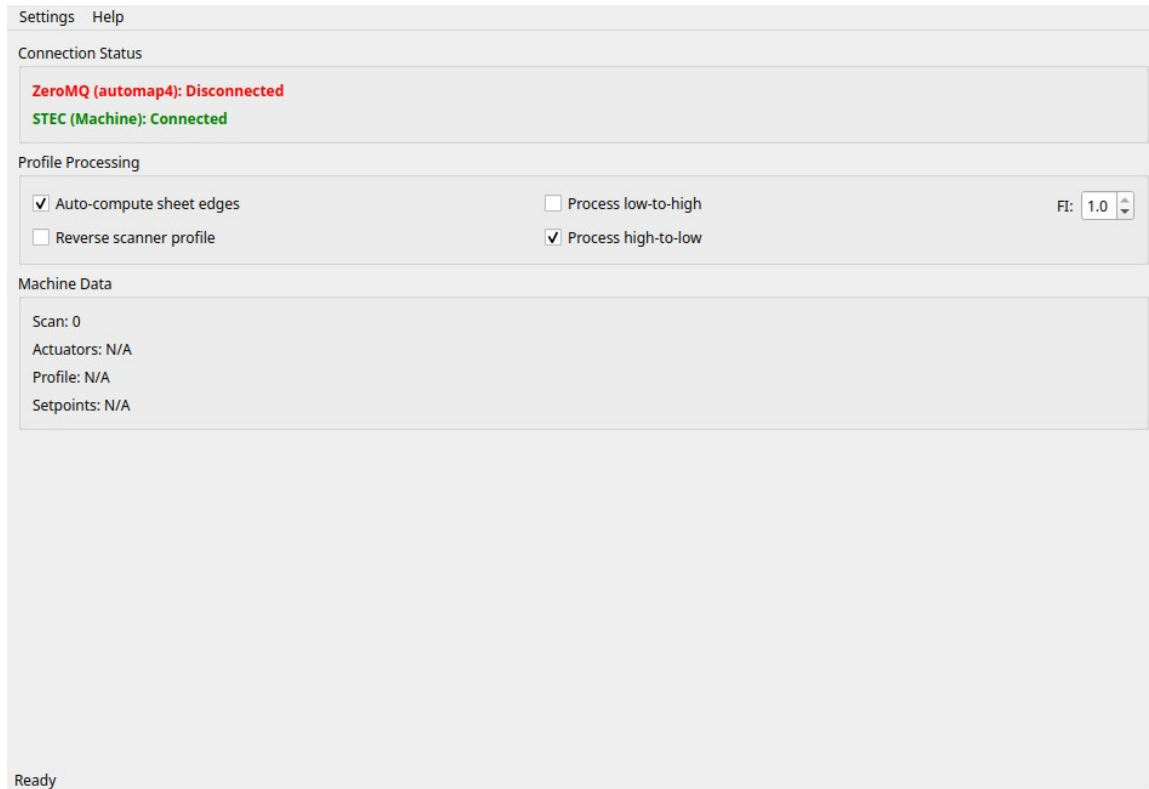


Figure 1: MachineDriver main window at startup.

3. Main window screen items

The window is divided into Connection Status, Profile Processing, Machine Data, and a Subscription Mapping table.

Connection Status

Two coloured labels at the top show whether the two required links are alive:

- ZeroMQ (automap4) — green when a REQ/REP connection to the automap4 controller is active.
- STEC (Machine) — green when the Multiverse TCP connection is established.

Both links are required for closed-loop control. MachineDriver reconnects automatically if either connection drops.

Profile Processing

This group controls how the raw scanner profile is transformed before it is sent to automap4.

- Auto-compute sheet edges — when checked, MachineDriver calculates `left_edge` and `right_edge` from the first and last non-zero databoxes of the profile. The computed edges are also written back to STEC so the operator HMI sees the same edges as automap4.

- Reverse scanner profile — when checked, the profile array is reversed before it is forwarded. Use this when the machine's databox 0 is on the opposite side from actuator 0.
- Process low-to-high / Process high-to-low — choose which scanner sweep directions are forwarded. Most sites keep only one direction so that turnaround shift does not create a double image.
- FI — exponential profile-filter blending factor. FI = 1.0 means no filtering (the raw profile is used). Lower values smooth the profile more by blending in the previous scan. The office uses FI ≈ 0.2 to match the United QCS 2σ reading.

Profile Processing

☒ Auto-compute sheet edges ☐ Process low-to-high FI: 1.0

☐ Reverse scanner profile ☒ Process high-to-low

Figure 2: Profile Processing group with auto-compute edges, direction filter, and FI.

Machine Data

A read-only summary of the last data received from the machine and from automap4:

- Scan — scan counter forwarded to automap4 in scan_data messages.
- Actuators — number of actuator position values read from STEC.
- Profile — number of databoxes in the last scanner profile.
- Setpoints — number of actuator setpoints last received from automap4.

Subscription Mapping (STEC → automap4)

This table tells MachineDriver which STEC/Multiverse subscription name belongs to each automap4 data field. It has five columns:

- automap4 Field — the fixed internal field name (for example actuator_positions, profile).
- STEC Subscription — the exact Multiverse subscription name. You can type it, paste it, or drag it from the Subscription Names list.
- Owner — check this when the machine owns the data (the value comes from STEC and goes to automap4).
- Direction — to_zmq for machine-owned data; from_zmq for data owned by automap4.
- Description — required when Owner is checked.

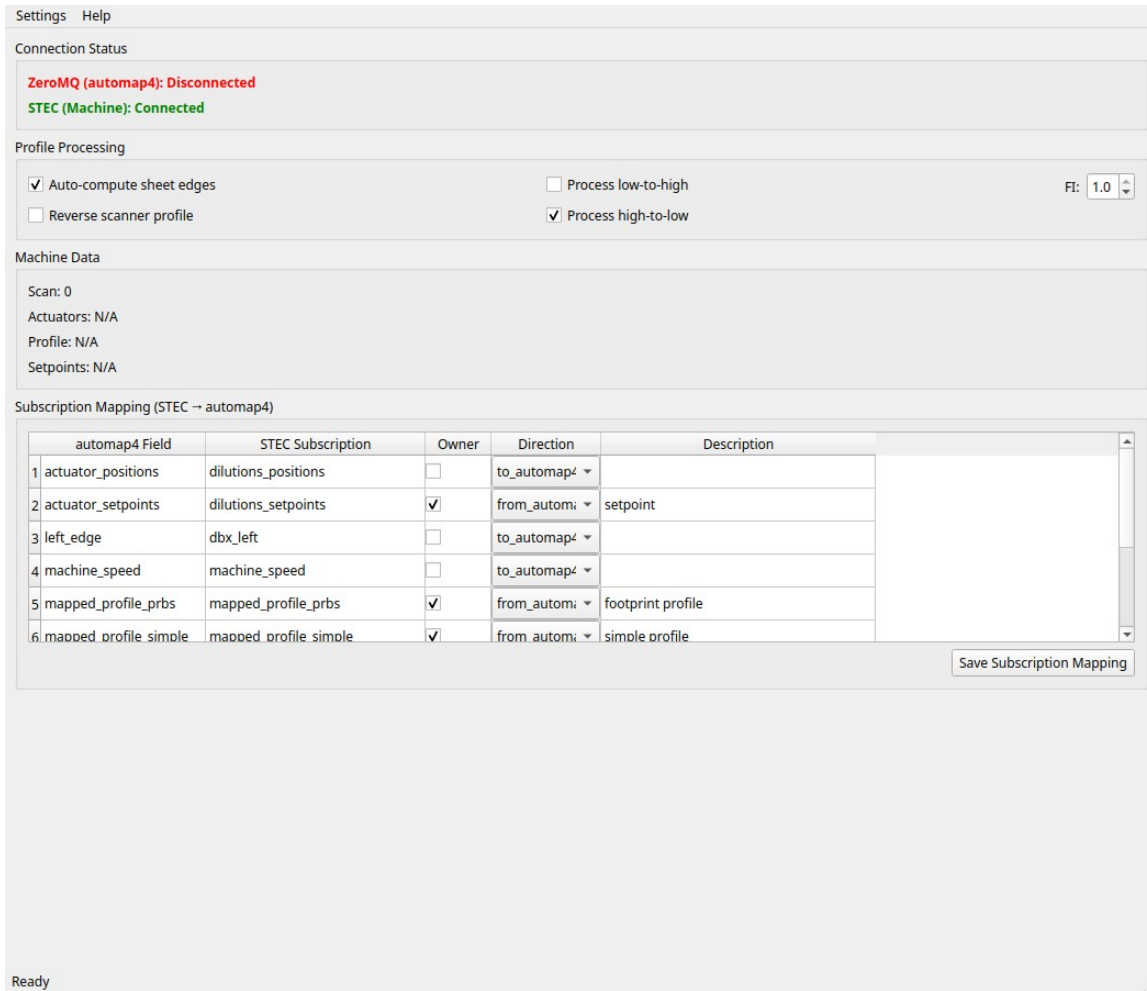


Figure 3: Main window with the Subscription Mapping table visible.

4. The Settings menu

The Settings menu contains the dialogs and panels used to configure the bridge.

Connection Settings

Open: Settings – Connection Settings...

The dialog has two independent groups. Change the host or port and click OK. MachineDriver will reconnect automatically.

- ZeroMQ (Controller - automap4) — host and port of the automap4 ZeroMQ REP socket.
- STEC (Machine - stecQSocket) — host and port of the Multiverse server.

The image shows a 'Connection Settings' dialog box with two sections. The first section is titled 'ZeroMQ (Controller - automap4)' and contains two input fields: 'Host' with the value '127.0.0.1' and 'Port' with the value '5560'. The second section is titled 'STEC (Machine - stecQSocket)' and also contains two input fields: 'Host' with the value '127.0.0.1' and 'Port' with the value '4897'. At the bottom right of the dialog are two buttons: 'OK' and 'Cancel'.

Section	Host	Port
ZeroMQ (Controller - automap4)	127.0.0.1	5560
STEC (Machine - stecQSocket)	127.0.0.1	4897

Figure 4: Connection Settings dialog.

Show Subscription Mapping

This menu item toggles the Subscription Mapping table in the main window. You normally leave it open while configuring the bridge, then hide it once data is flowing.

Show Subscription Names

Open: Settings — Show Subscription Names. This modeless dialog lists every subscription name that Multiverse has announced so far. You can copy a name from the list, or drag it directly onto the STEC Subscription cell in the mapping table.

Click a name to copy. Right-click for Copy. Drag a name to the STEC Subscription cell in the mapping table.

Actuator.Pos[0]

Actuator.Setpoint

BWT.Profile

Left.Edge

Machine.Speed

Right.Edge

Scanner.Direction

Figure 5: Subscription Names dialog with example Multiverse names.

Show STEC Debug / Show ZeroMQ Debug

These panels show a rolling log of the data flowing through each side of the bridge. They are useful when a subscription is not updating, when scan_data messages are not reaching automap4, or when setpoints are not being written back to the machine.

The screenshot shows a software interface with several panels. At the top, there are 'Settings' and 'Help' menus. Below them is a 'Connection Status' section showing 'ZeroMQ (automap4): Disconnected' in red and 'STEC (Machine): Connected' in green. The 'Profile Processing' section has checkboxes for 'Auto-compute sheet edges' (checked), 'Reverse scanner profile' (unchecked), 'Process low-to-high' (unchecked), and 'Process high-to-low' (checked), along with a 'Fit: 1.0' dropdown. The 'Machine Data' section shows 'Scan: 0', 'Actuators: N/A', 'Profile: N/A', and 'Setpoints: N/A'. The 'Subscription Mapping (STEC → automap4)' section contains a table with 6 rows mapping STEC subscriptions to automap4 fields. A 'Save Subscription Mapping' button is at the bottom right of this section. Below the table are two debug panels: 'STEC Data Flow Debug' showing a log of messages and 'ZeroMQ Data Flow Debug' which is currently empty. The status bar at the bottom says 'Ready'.

	automap4 Field	STEC Subscription	Owner	Direction	Description
1	actuator_positions	dilutions_positions	☐	to_automap4	
2	actuator_setpoints	dilutions_setpoints	☒	from_automap4	setpoint
3	left_edge	dbx_left	☐	to_automap4	
4	machine_speed	machine_speed	☐	to_automap4	
5	mapped_profile_prbs	mapped_profile_prbs	☒	from_automap4	footprint profile
6	mapped profile simple	mapped profile simple	☒	from_automap4	simple profile

```
[12:59:00.857] ~ STEC right_edge: len=1
[12:59:00.857] ~ STEC scanner_direction: len=1
[12:59:00.861] ~ STEC actuator_positions: len=96
[12:59:00.861] ~ STEC left_edge: len=1
[12:59:00.861] ~ STEC machine_speed: len=1
[12:59:00.861] ~ STEC profile: len=500
[12:59:00.861] ~ STEC right_edge: len=1
[12:59:00.862] ~ STEC scanner_direction: len=1
```

Figure 6: Main window with Subscription Mapping, STEC Debug, and ZeroMQ Debug panels open.

5. How to configure the subscription mapping

The mapping is the most important part of the setup. Each row links one automap4 field to one Multiverse subscription name.

MachineDriver knows these automap4 fields:

- `actuator_positions` — current actuator positions from the machine.
- `actuator_setpoints` — setpoints from automap4 that must be written to the machine.
- `left_edge` — first databox that carries paper.
- `right_edge` — last databox that carries paper.
- `machine_speed` — machine speed in m/min.
- `mapped_profile_prbs` — footprint-mapped profile in actuator space, written back to STEC for external controllers.
- `mapped_profile_simple` — window-mean mapped profile in actuator space, also written back to STEC.
- `profile` — raw scanner profile in databox space.
- `scanner_direction` — +1 for low-to-high sweep, -1 for high-to-low sweep.

For each row you must set the Direction correctly. Direction only affects the ZeroMQ data flow, not the STEC subscription itself:

- `to_zmq` — MachineDriver owns this value. The data is read from STEC and sent to automap4.
- `from_zmq` — automap4 owns this value. The data is received from automap4 and written to STEC.

Validation rules: every row that has an STEC Subscription name must also have a Direction. Rows with Owner checked must also have a Description. Click Save Subscription Mapping when you are done. MachineDriver rebuilds the STEC subscribers immediately and data starts flowing.

6. Typical site workflow

A typical commissioning session looks like this:

1. Start MachineDriver on the PC that can reach both Multiverse and automap4.
2. Open Settings → Connection Settings and enter the Multiverse host/port and the automap4 host/port.
3. Open Settings → Show Subscription Names and check that the expected names appear. If the list is empty, verify the STEC connection.
4. Open Settings → Show Subscription Mapping and fill in the STEC Subscription column for every field the site uses. Drag names from the names list if needed.
5. Click Save Subscription Mapping. Watch the Connection Status labels turn green.
6. Open the STEC Debug panel and confirm that profile, actuator_positions, scanner_direction, and edges are updating.
7. Open the ZeroMQ Debug panel and confirm that scan_data is being sent and status replies are returning.
8. Start automap4, run S-curve discovery or PRBS identification, and finally close the control loop.

7. Notes and caveats

- The Direction column is the source of truth for data ownership. Make sure to_zmq rows correspond to data that comes from the machine, and from_zmq rows correspond to data that comes from automap4.
- Auto-compute sheet edges ignores the left_edge and right_edge subscriptions. This is the normal mode for the edge-free frame: edges are derived from the physical profile every scan.
- Reverse scanner profile changes the databox order before the profile is sent to automap4. It does not reverse actuator setpoints, because actuator index is fixed to the headbox.
- The scanner direction is sent by the machine immediately before the profile. MachineDriver uses it together with the Process low-to-high / Process high-to-low checkboxes to decide whether a profile is forwarded.
- If the ZeroMQ indicator stays red, check that automap4 is running and that the port matches. If the STEC indicator stays red, check the Multiverse host, port, and firewall.
- The Help → Setup Guide menu item reopens the built-in setup guide shown in Figure 7. Help → About shows the Vremsoft LLC 2026 copyright notice.

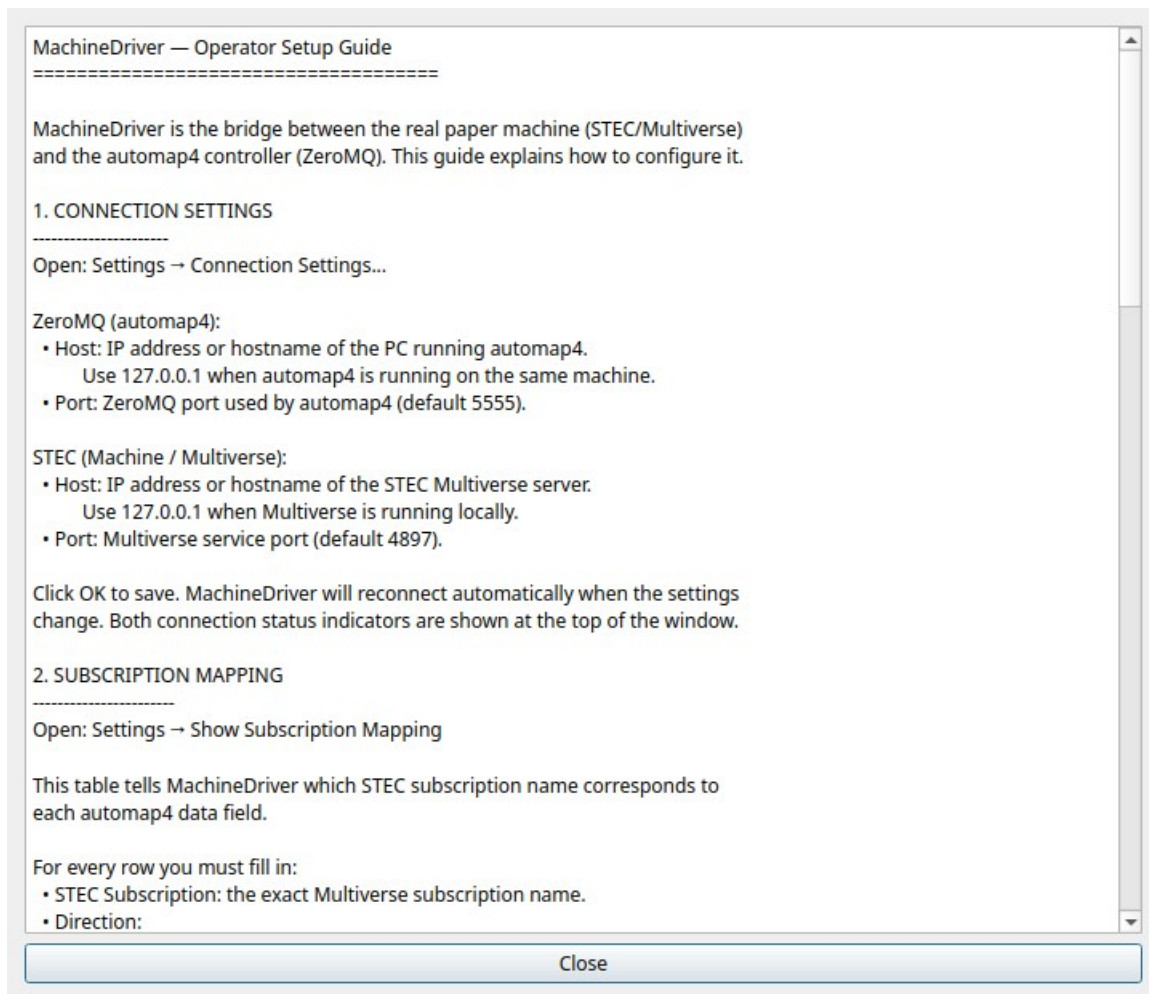


Figure 7: Built-in MachineDriver Setup Guide dialog.