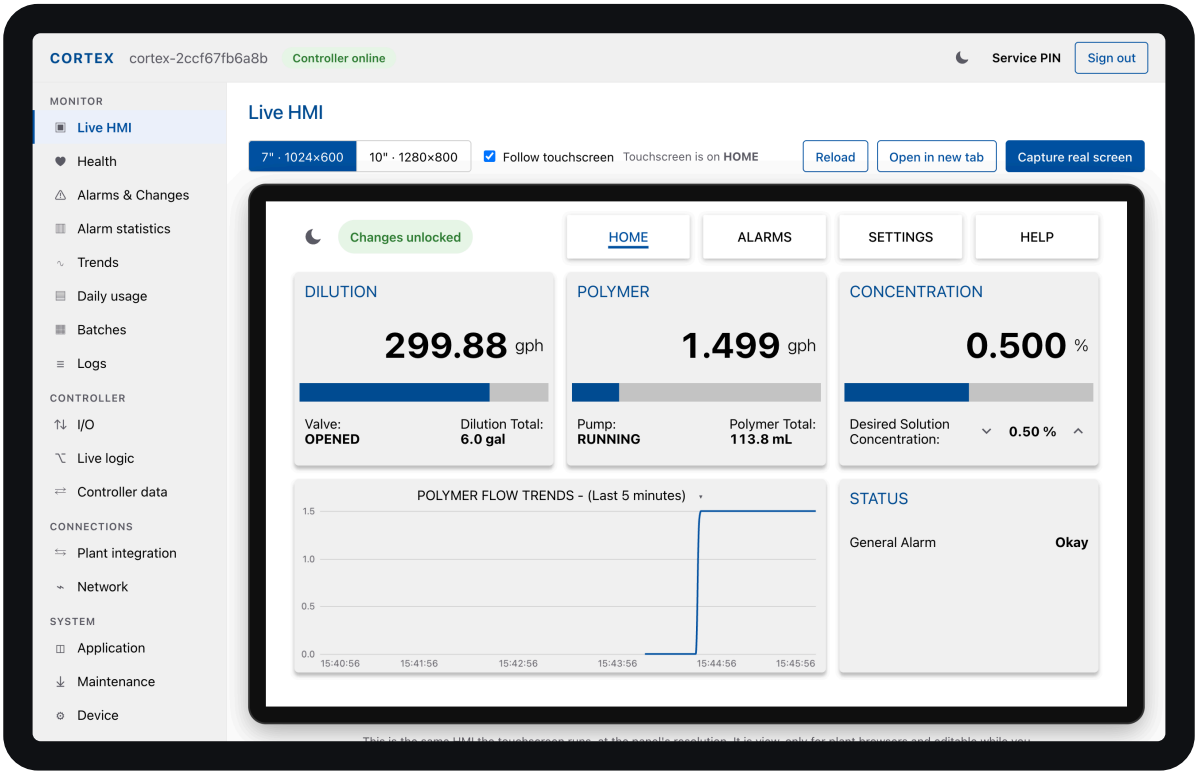
EXCELL FEEDERS

Cortex 7 Controller

Console Manual

Setup and troubleshooting from a browser



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1 About this manual

This manual is for the people who set up, connect and troubleshoot a Cortex 7 from a computer: service technicians, plant integrators and IT staff. It covers the Cortex Console, the desktop view served by the panel, for any machine the Cortex 7 runs. Operating the touchscreen is in the Cortex 7 HMI Manual; what a machine's settings and alarms do is in that machine's O&M manual.

> **!** CAUTION
>
> Changes made in a browser go straight to the controller and can start, stop or change the speed of the machine's pumps and motors. Make sure it is safe before changing anything from a distance.

Getting help

Excell Feeders support: support@excellfeeders.com, 732.828.8655. When you call, have the panel's host name and software versions ready (page Device). Chapter 8 covers remote support, and section 9.2 the service snapshot.

2 Connecting

The panel has one Ethernet port for the plant network. Out of the box it gets its address from DHCP; a fixed address can be set on the page Network. The address is shown on the touchscreen under HELP → RESOURCES.

Service	Port	Default
Web HMI and Cortex Console	80 (HTTP), 443 (HTTPS)	On
Modbus TCP (SCADA)	502	Off, paid option
EtherNet/IP adapter (PLCs)	44818 TCP/UDP, 2222 UDP	Off, paid option

IIoT MQTT connects out from the panel to the plant's broker; nothing connects in.

2.1 The web HMI

Open a browser at **http://<panel address>**. It shows the same screens as the touchscreen. A browser is view only until you click **View only · Unlock** at the top and enter the service PIN; changes are then allowed until the service login ends.

2.2 Signing in to the console

Open **http://<panel address>/console** (or HELP → **Cortex Console**). Sign in with a named account (chapter 12) or the service PIN; the form opens on the way last used in this browser.

A sign-in ends by itself after 15 minutes without a change. The console then returns to the sign-in form, which says why; signing in again opens the page you were on. The browser's tab is named after the page and the panel, to tell several panels apart.

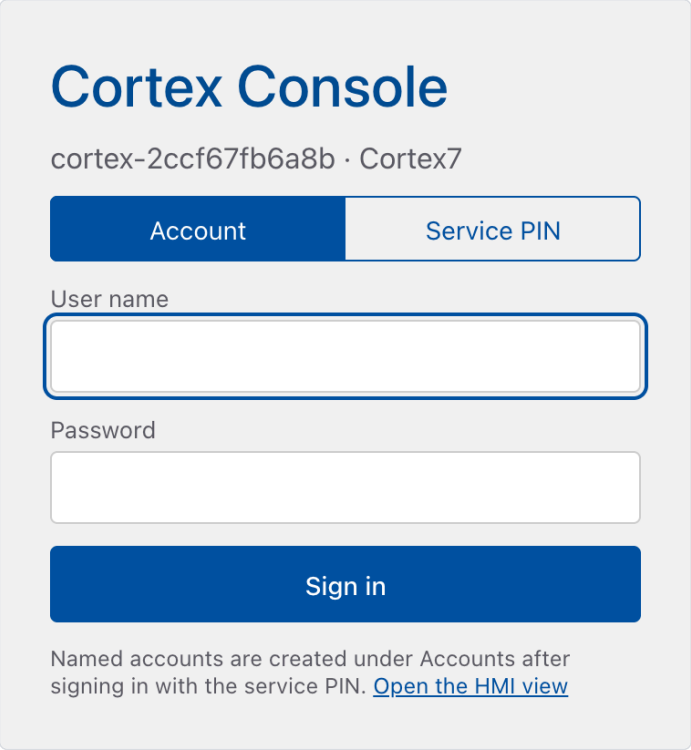

Figure 1 · Signing in

2.3 The pages

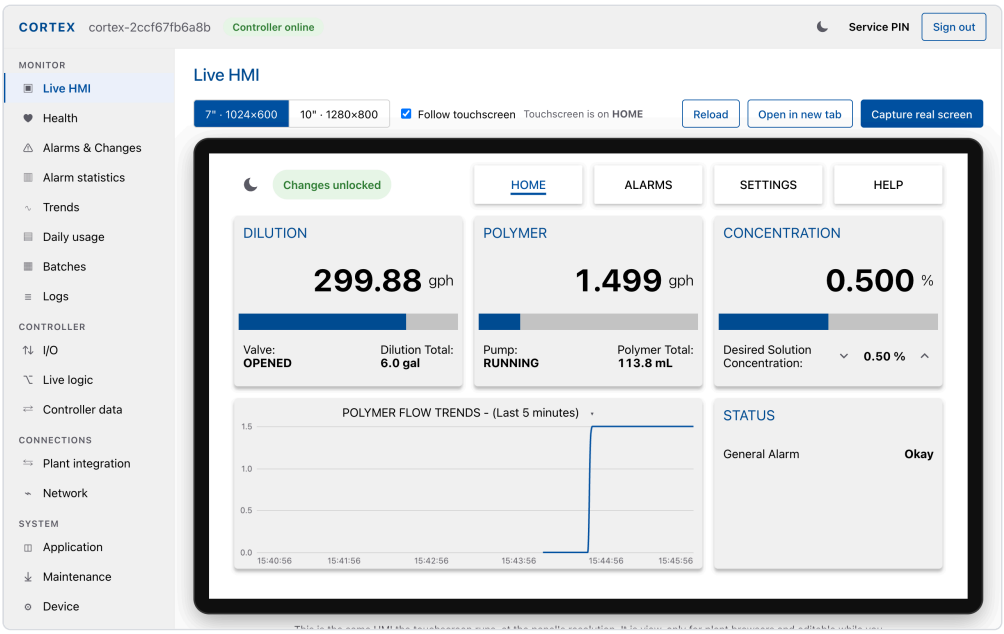

Figure 2 · Cortex Console

Page	What it is for	Chapter
Live HMI	The touchscreen in a frame; “Follow touchscreen” shows the screen the panel is on.	—
Health	The panel, its services and the controller.	3
Alarms & Changes	The ALARMS screen, with CSV download.	HMI Manual
Alarm statistics	How often each alarm came on, for how long, and when.	3
Trends	90 days of values, with totals and alarm markers.	3
Daily usage	Each day’s use of the application’s totals and the relays’ run time, with CSV download.	3
Batches	Each batch the panel recorded: per day, the list, and one batch’s steps, holds, alarms and changes, with CSV download.	3
Logs	System logs by source and severity.	3
I/O	Every input and output live; analog input calibration.	4
Controller data	The controller’s messages, live.	4
Live logic	The running application as a diagram, every block’s value live.	4
Application	What the controller runs: installing, models, every setting and terminal against its factory default; factory reset.	5
Plant integration	Modbus TCP, EtherNet/IP and IIoT MQTT.	6
Network	Network settings, checks, LTE and remote support.	7, 8
Maintenance	Software updates, backups, date and time, alarm history, service snapshot.	9
Device	Model, versions, storage wear, boot history; paid options.	10

Page	What it is for	Chapter
Status report	What the unit is and how it stands on one page, to print or save.	11
Accounts	Named accounts and the service PIN.	12

2.4 The strip over the page

What every page needs to say is in a strip over it, on whichever page is open:

- **No connection to the panel.** The console lost the panel (its restart, an update, the network, a cable). The page stays, greyed, with the last values it received, and nothing can be changed. The console keeps trying and carries on where it was, still signed in, when the panel answers; if the panel restarted meanwhile, it asks to sign in again and says so.
- **The controller is not answering.** The panel is reachable but its controller is not (no power, restarting, its cable): the values on every page are the last it sent. In update mode with no firmware running, the strip says so and where to install it.
- **An install.** From the moment it is asked for (Starting the install…) through its progress to its result, which stays until closed: finished, or failed with the reason and what runs now. If the panel does not start an install within 20 seconds the strip says that nothing was changed.

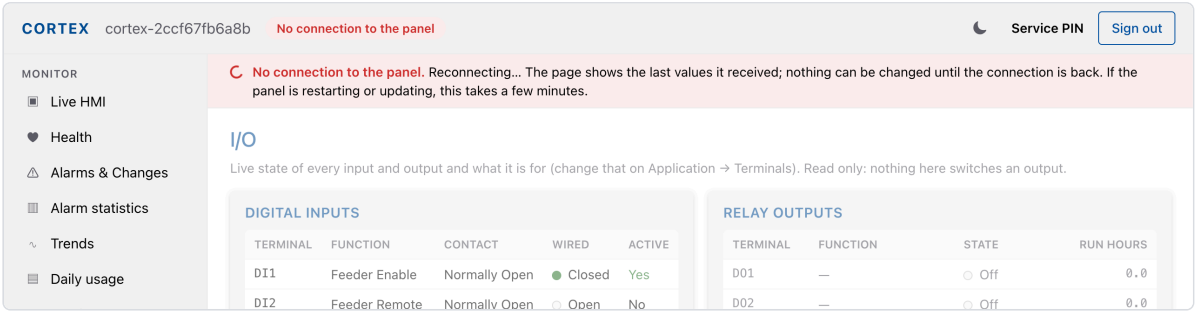

Figure 3 · The strip: no connection to the panel

3 Monitoring

3.1 Health

Panel temperature, power supply (under-voltage), memory and disks, and the services with their automatic restarts: a rising count means a crash loop. **Restart** restarts a service and **Reboot HMI** the panel; the controller and the machine keep running through both.

The CONTROLLER card shows the controller's own diagnostics: its firmware, memory, restarts and faults, its timing and CPU load, its devices (the analog input converters, the settings memory, the analog outputs) with their failures, and its tasks. **Copy diagnostics** copies all of it for support.

- **Timing**: the logic runs every millisecond. **Tick lateness** and **Ticks ≥ 1 ms late** show how often something held it up; a few milliseconds each application cycle is normal.
- **Tasks**: each of the controller's tasks with its share of the CPU and its longest run, the busiest first. A run of 1 ms or more is flagged: it holds up the logic.

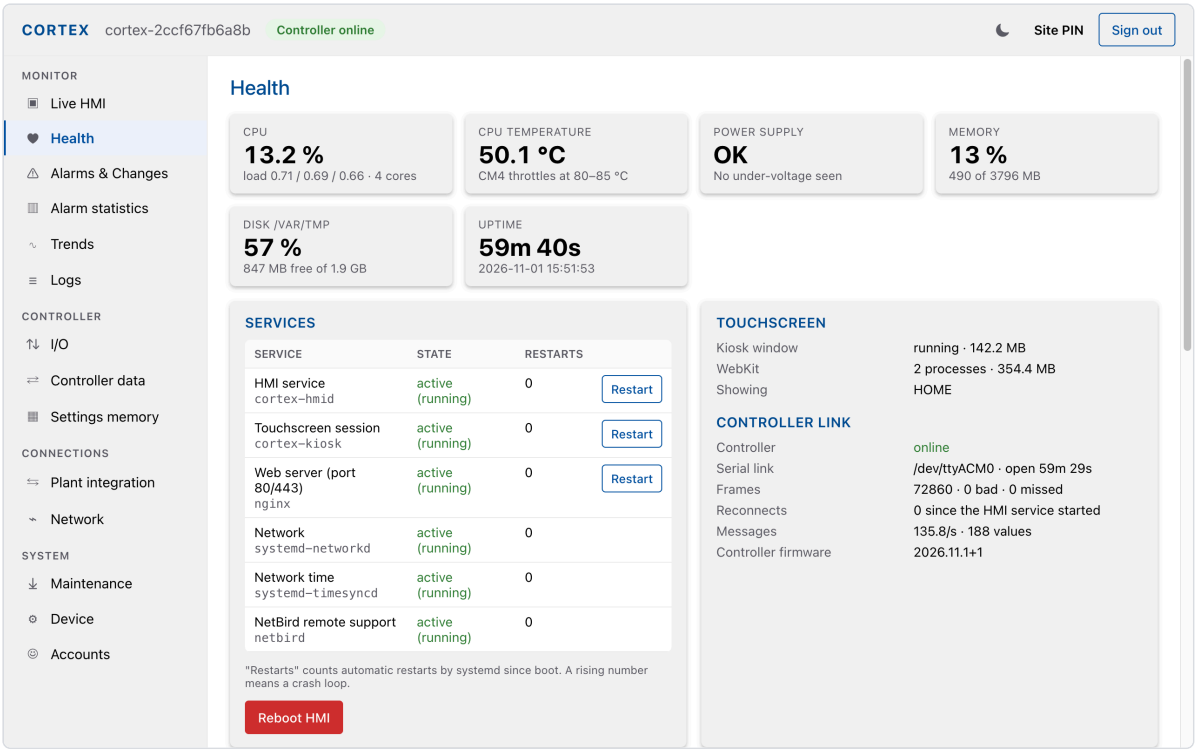

Figure 4 · Health

3.2 Alarm statistics

From the alarm history: how often each alarm came on, how long it stayed on, and by day and hour when, so a nuisance alarm or a pattern (every morning, every shift change) shows without reading the history line by line. Click an alarm to show only it in the charts.

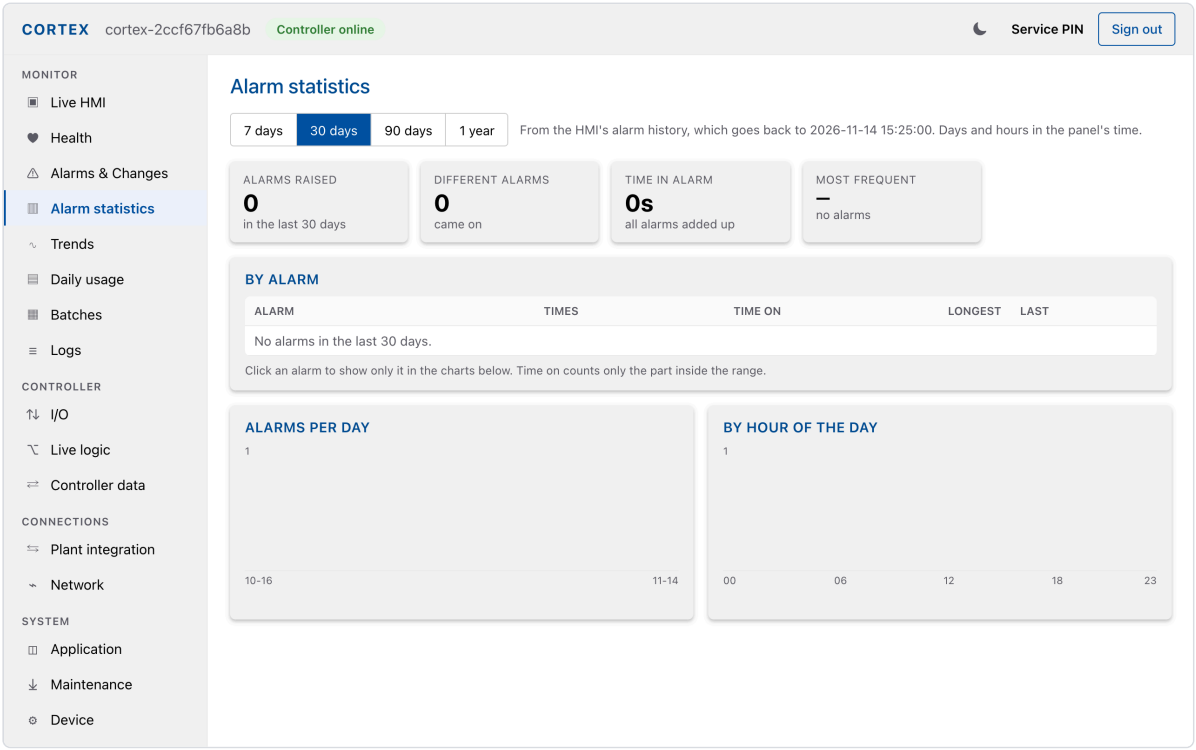

Figure 5 · Alarm statistics

3.3 Trends

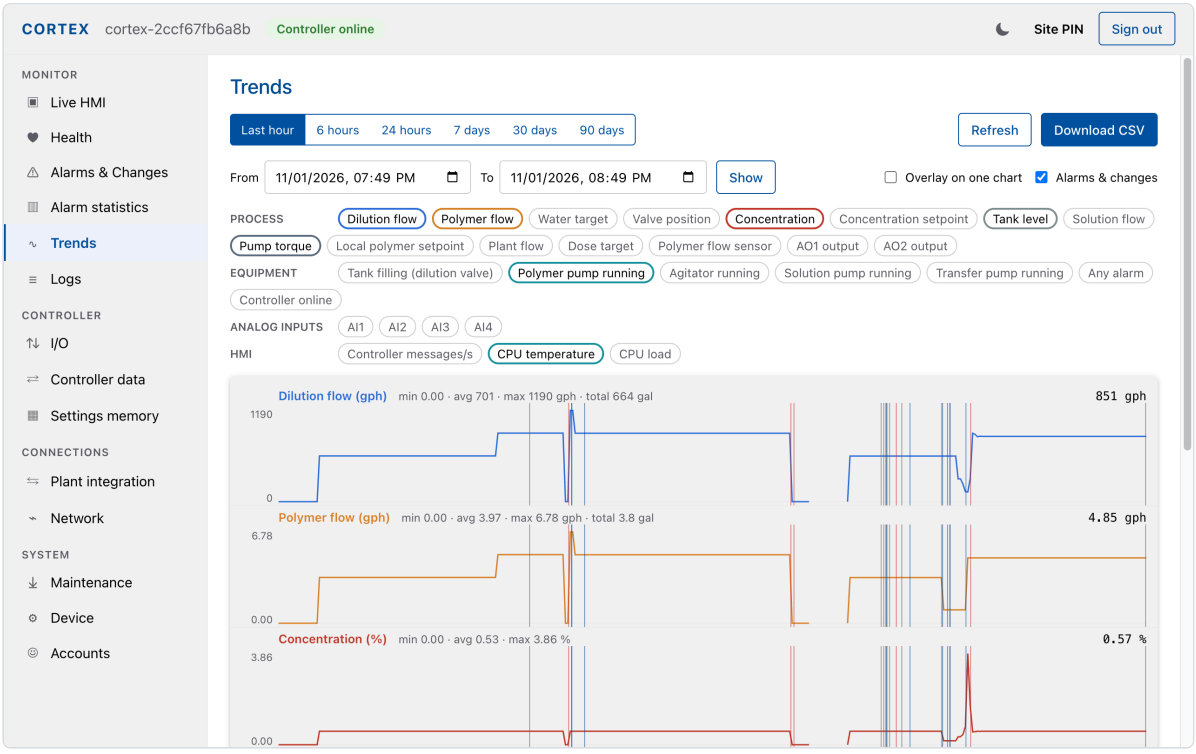

Figure 6 · Trends

Trends keeps 90 days of samples, every second for the last 7 days and every 10 seconds before: the application's values (its flows, levels and setpoints) and its equipment on/off, the four analog inputs and two analog outputs in mA, any alarm, controller online, and the panel itself. Pick the values to show by group. Each chart shows its minimum, average and maximum over the period; flows also show the total in gallons, and on/off values how long they were on.

Drag across a chart to zoom in (**Zoom out** goes back), or pick a start and end date. **Overlay on one chart** draws the chosen values together, each on its own scale. With **Alarms & changes** on, alarms (red), setting changes (blue) and events (grey) are marked on the charts; hover a marker to see what it was.

3.4 Daily usage

What each of the application's totals (its polymer, water, run hours, …) and each relay's run time counted on each day of the last 90, for monthly reports; **Download CSV** saves them, oldest day first. Days are the panel's local days, in its time zone (a day the clocks change is 23 or 25 hours). A day marked partial is one the panel did not see whole, because it was off or the controller offline; what was counted meanwhile is still in it, or, when the stop began the day before, in the day it ended (its note says so). A total that was reset counts nothing for the moment it went back, and the day notes it; a relay that never ran in the 90 days isn't shown. The report is the running application's: after another application is installed, the totals of the one before are left out (they are kept, and return if it is installed again).

3.5 Batches

The page is in the menu when the application has a batch sequence (a dry feeder; not a 6PSevo). Each run of the application's batch sequence, from leaving Idle until back at Idle, is a numbered record on the panel: the number is the controller's count of batches started, so it goes on from where it was on a replaced panel. The tiles and **Per day** give how many batches, how long they took on average, what each used on average (the polymer and water per batch on a dry feeder) and how many ended early; the list has every batch, newest first. Pick 7, 30 or 90 days or all of them; **Download CSV** saves them for a spreadsheet.

Type a batch's number and press **Open** (or click it in the list) to see that batch: its steps along its time, the holds (hatched) with the alarms active as each began, time past a step's timeout, its water, polymer and what it needed as it ended, and the alarms and setting changes during it. A batch whose start the panel did not see (it was restarting) is marked, and so is one it did not see to the end. In Alarms & Changes, an entry made during a batch carries its number, a link to it.

When an operator reports that a batch went wrong, its number is on the BATCH card while it runs and here afterwards. For the logic itself over that batch (why a step waited, what held it), save a service snapshot and send it to Excell Feeders support: Cortex Studio opens the batch by its number and replays it.

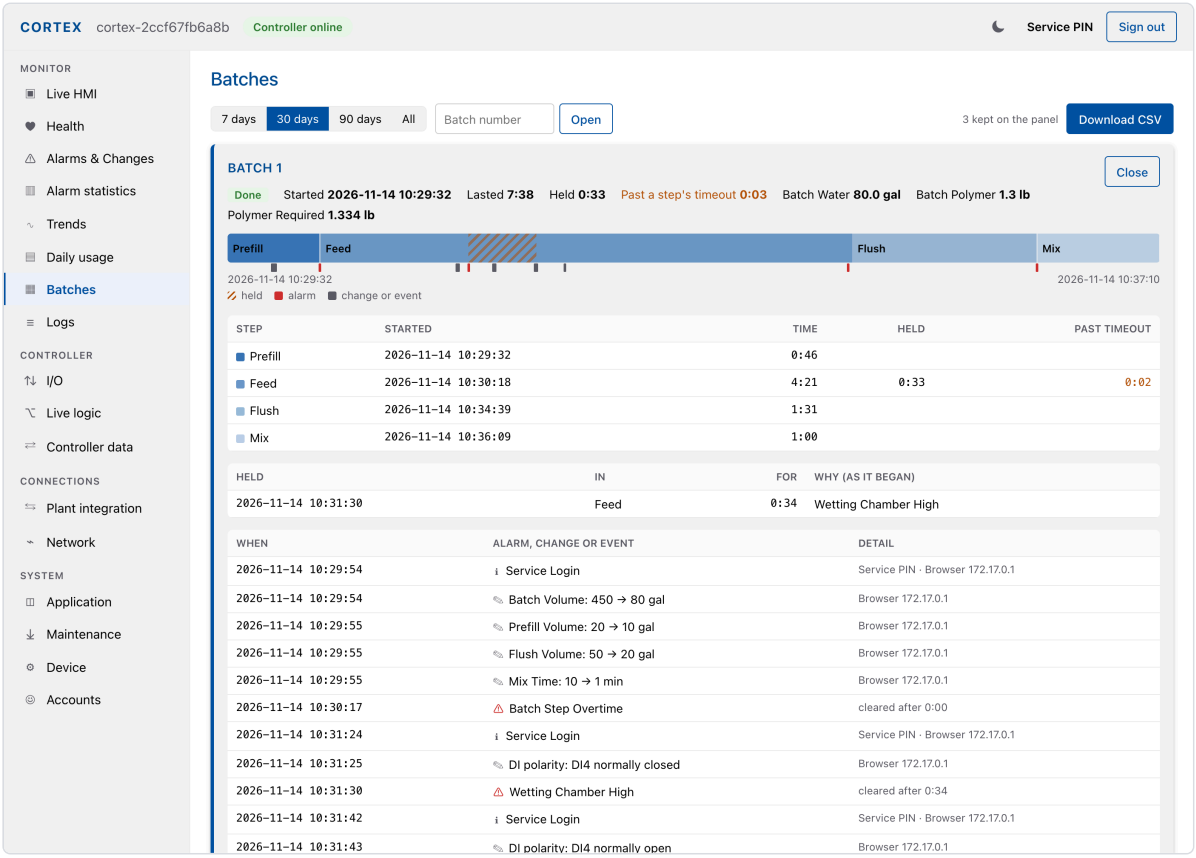

Figure 7 · Batches, one batch opened

The panel keeps the last 5000 batches; they are in every service snapshot. Each record is its application's: with another batch application installed on the same panel, the page, the BATCH card and the CSV start again with that application's batches, numbered on their own. The earlier application's records stay on the panel and in a service snapshot, and are listed again if it is put back.

3.6 Logs

The panel's system logs: pick a source, severity and boot, follow them live or search. **Download** saves them as a file.

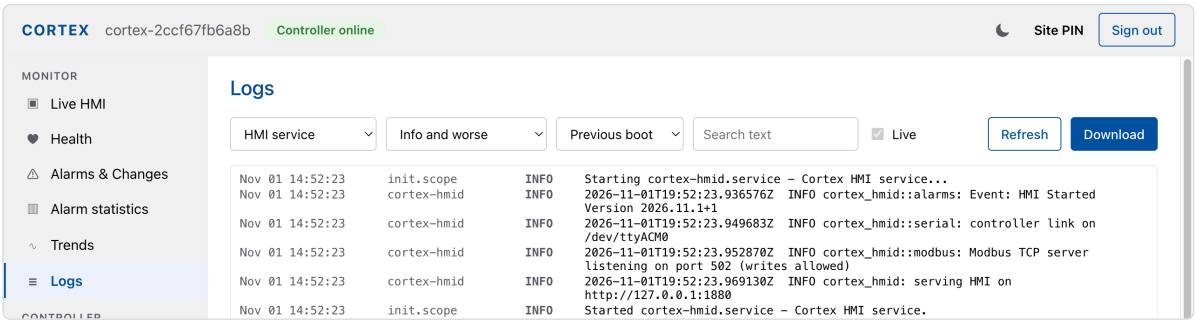

Figure 8 · Logs

4 The controller

4.1 I/O

The live state of every input and output and the function it is set to: digital inputs (as wired, and active after the contact setting), relays, MOSFET outputs, analog inputs and outputs and the motor connectors. It is read only: nothing here switches an output. Functions are set on the HMI's SETTINGS → Inputs and Outputs, or on the page Application (chapter 5).

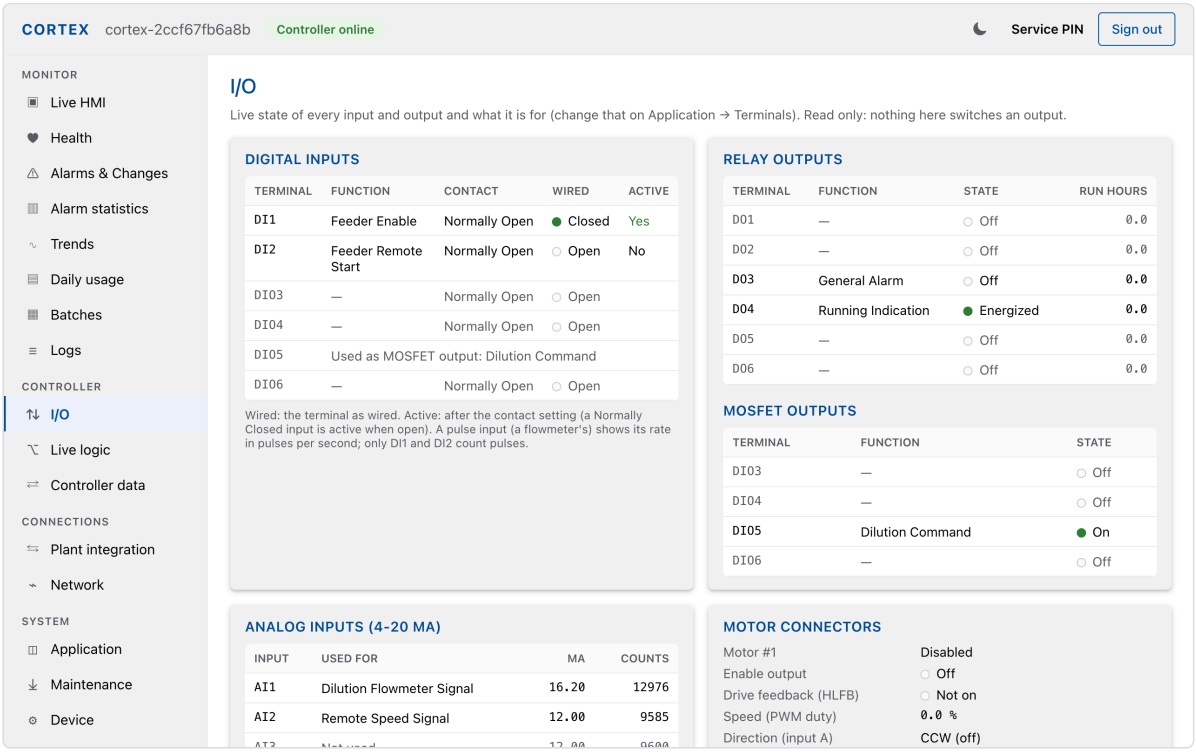

Figure 9 · I/O

4.2 Analog input calibration

Each analog input can be calibrated against a 4–20 mA calibrator when its reading is off. The calibration is stored in the controller.

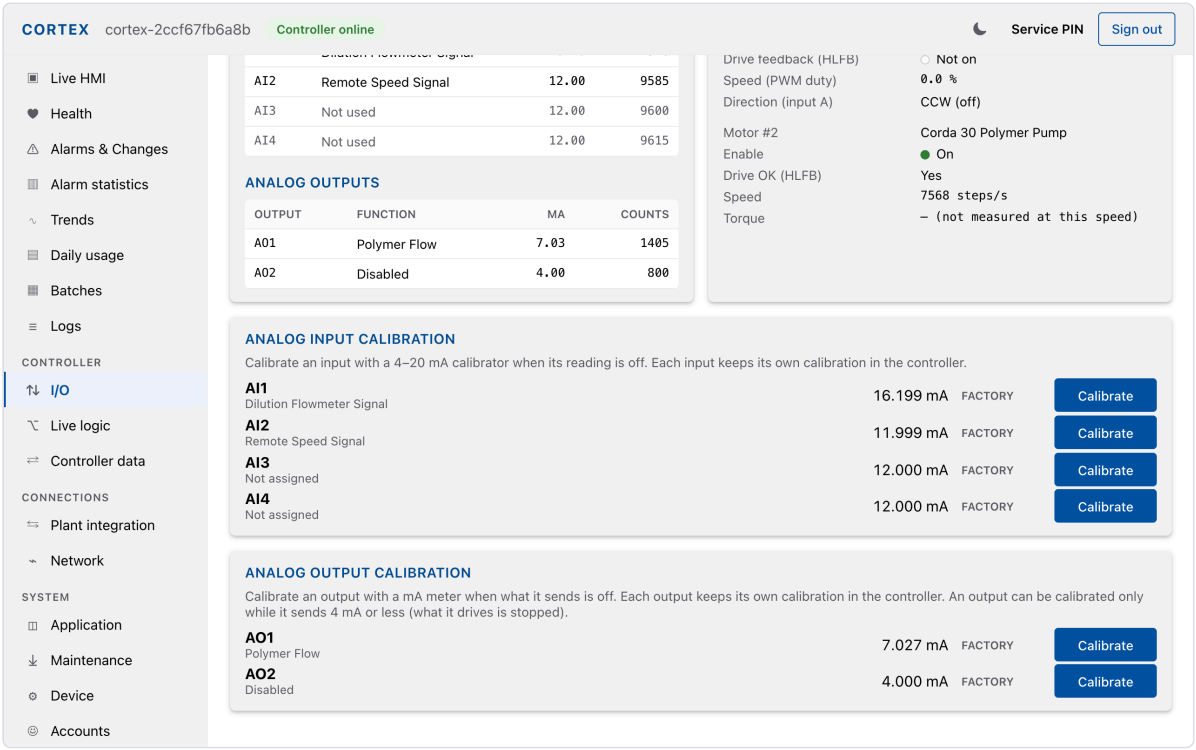

Figure 10 · Analog input calibration

1. Stop the machine, or put what the input controls in a local mode: while you calibrate, the controller reads the calibrator, not the field signal.
2. Disconnect the field device from the input and connect the calibrator in its place.
3. On the page I/O, click **Calibrate** next to the input, then **Start**.
4. Set the calibrator to 4.000 mA and capture it (**Capture 4 mA**). The panel reads the input for 3 seconds.
5. Set the calibrator to 20.000 mA and capture it (**Capture 20 mA**).
6. Check the values and the reading with the new calibration, then **Save**.
7. Disconnect the calibrator and reconnect the field device.

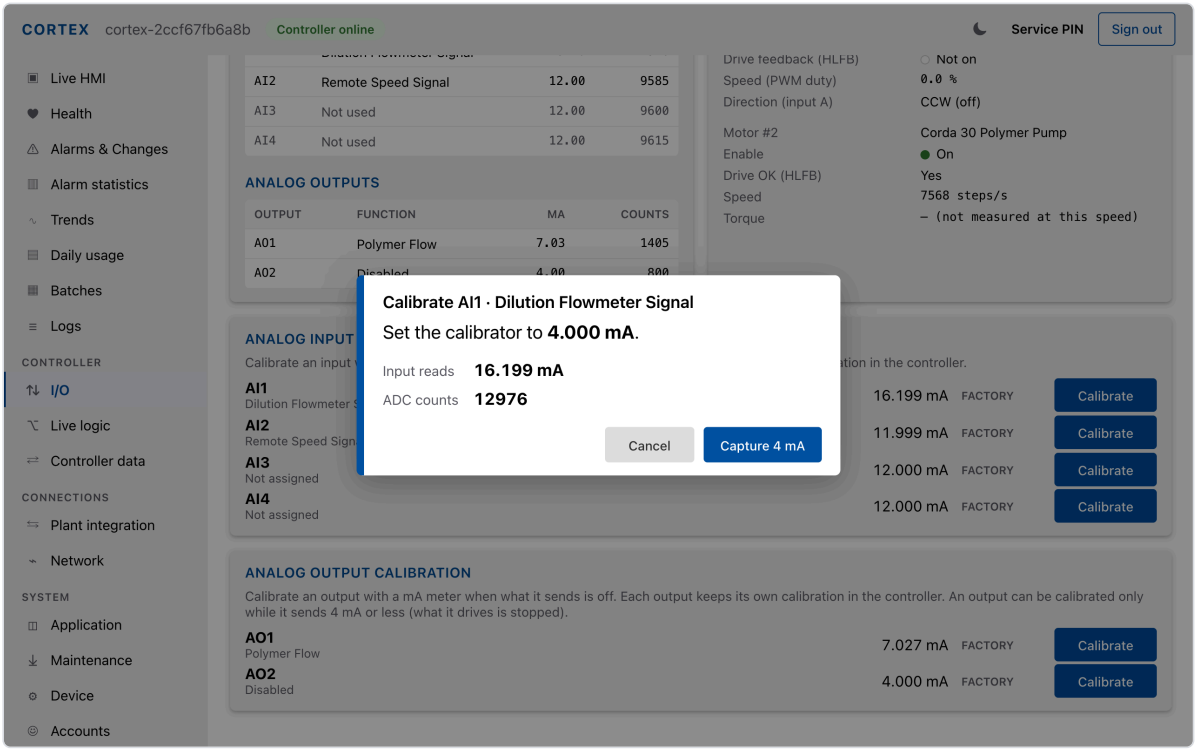

Figure 11 · Capturing the 4 mA point

If a reading is unsteady or far from what 4 mA or 20 mA should read, the panel says so and asks you to check the calibrator and wiring. **Factory** returns an input to its factory calibration.

4.3 Analog output calibration

Each analog output can be calibrated against a mA meter when what it sends is off. The calibration is stored in the controller. It needs the controller's platform firmware (an application installed, or none).

The output changes while you calibrate: whatever it is wired to sees about 4 mA, then about 20 mA, its full scale. An output can be calibrated only while it sends 4 mA or less, so stop what it drives first (or take its channel off the output on the I/O page). If its function needs the output during the calibration, the controller hands it back at once and the panel says so; it also hands it back after 15 minutes.

1. Stop what the output drives.
2. Put a mA meter in series with the output, or disconnect the field device and connect the meter in its place.
3. On the page I/O, click **Calibrate** next to the output, then **Start**. The output is driven at about 4 mA.
4. Read the meter once it is steady and enter its reading (**Enter reading**). The output is driven at about 20 mA.
5. Enter the meter's reading again, check both, then **Save**. The output is driven at 20 mA with the new calibration: the meter should read 20.000 mA. **Check 4 mA** drives 4 mA.
6. **Close** hands the output back to its function. Disconnect the meter and put the wiring back.

A reading far from 4 mA or 20 mA, or one that would need a calibration far from the factory's, is refused with a message. Every drive and the calibration are recorded under ALARMS → Changes. **Factory** returns an output to its factory calibration.

4.4 Controller data

Every value the controller reports, by topic, and a live stream of its messages for troubleshooting (**Start live stream**, **Pause**).

4.5 Live logic

The running application as a diagram: one block, terminal, setting or alarm in focus, what feeds it on the left and what it drives on the right. Click a box to follow it, or find one by name. Every value is the controller's own, refreshed four times a second while the page is open: on/offs read **On** or **Off** and their boxes are lit while on, a box flashes when its value changes, the wires a block uses are bright, and the inputs a selection passes over are dimmed, so the path to a value can be followed while the machine runs. The marker above the diagram says how fresh the values are (**Live**, **Stale**, or why there are none); **Pause** holds them still.

A sequence (a batch) shows where it is along the top: its steps, the one it is in with how long it has been there, and whether it is held. With a sequence in focus, **Steps** draws it as a chart: what starts, holds and ends it, and for each step what it turns on, what it waits for and its timeout. The step it is in says what it is waiting for, and why that hasn't happened yet (or what holds it). **Wiring** shows its connections as for any other box.

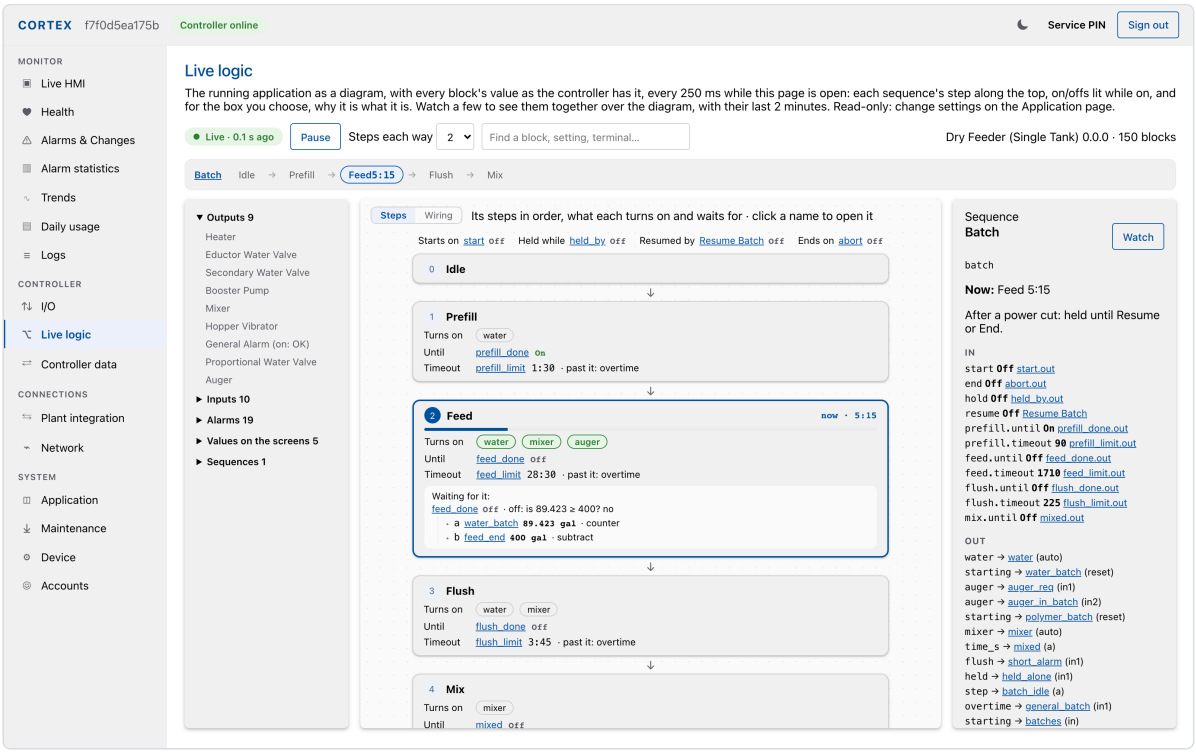

Figure 12 · Live logic: a batch in its Feed step

Beside the diagram, **Why it is ...** follows the box in focus back through the logic to what decides it: an AND that is off by those of its inputs that are off, an OR that is on by those that are on, a timer by how far it has run, a comparison by its two numbers. On/offs are followed all the way back; what a number is made of is folded, a click away. Each name opens it on the diagram.

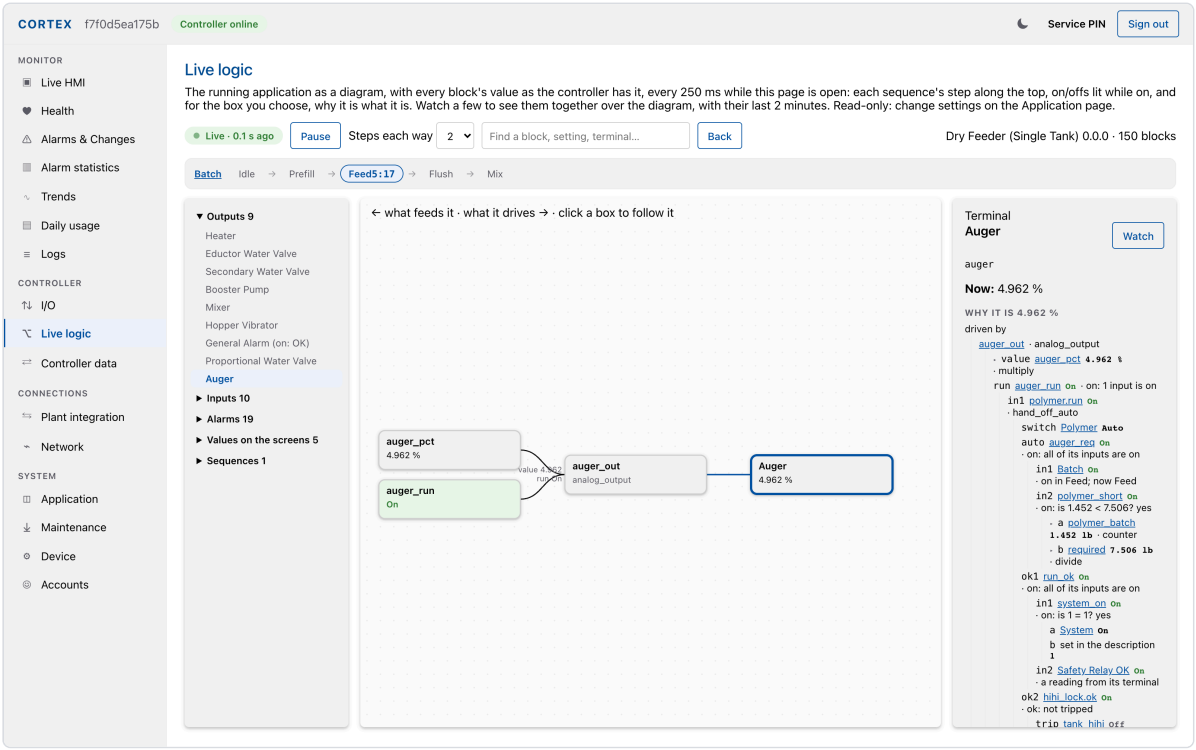

Figure 13 · Why the auger runs

Watch keeps a box's value in a strip over the diagram, with its last 2 minutes, whichever box is in focus: a few watched together show what changes with what. The strip is kept per application in this browser.

The page only shows: settings are changed on the page Application. It stops when the console's sign-in ends.

5 Application

The page Application shows what the controller runs, and every setting of it.

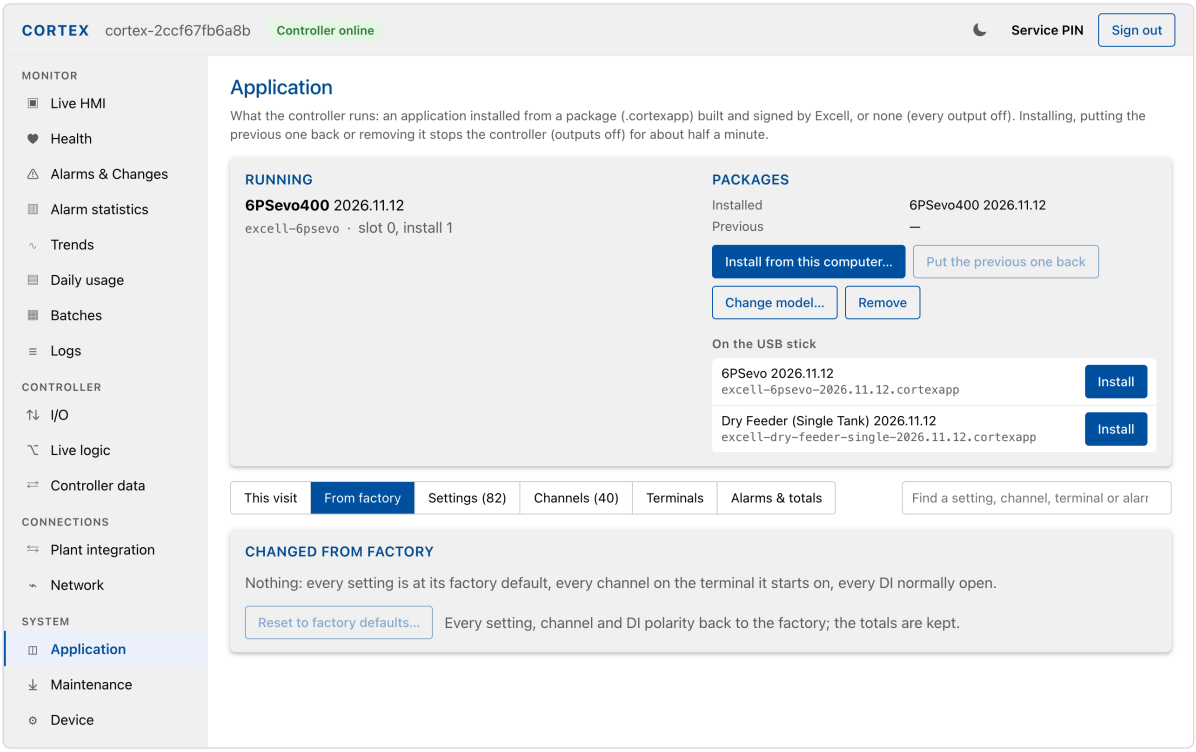

Figure 14 · Application

Running and packages

Running names the application, its model and version, or why none runs. **Packages** installs and changes it:

- **Install from this computer...** installs an application package (**<id>-<version>.cortexapp**); one on a USB stick in the panel is listed under **On the USB stick**. An update of the same machine keeps its model and settings. A package for a machine with more than one model asks which one this controller is before it installs, unless the controller already runs one of them.
- **Change model...** changes this controller to another model of its machine: settings still at the old model's factory values take the new model's.
- **Put the previous one back** reinstalls the version before.
- **Remove** leaves the controller with no application, every output off. Its package is kept, to put back.

> **!** CAUTION
>
> The machine stops while an application is installed, changed or removed: every output is off for about half a minute.

Settings, terminals and the factory reset

This visit lists what is not as it was when you signed in: each setting, terminal and contact type with its value now and its value then, whoever changed it (this console, the touchscreen or the plant's network). **Put back** returns one to how it was; **Put every setting back...** does so for all the settings at once (terminals and contact types go back by

their own buttons, after a confirmation, because what the unit does changes at once). The list is kept while you stay signed in, also through a reload of the page; signing out starts a new visit.

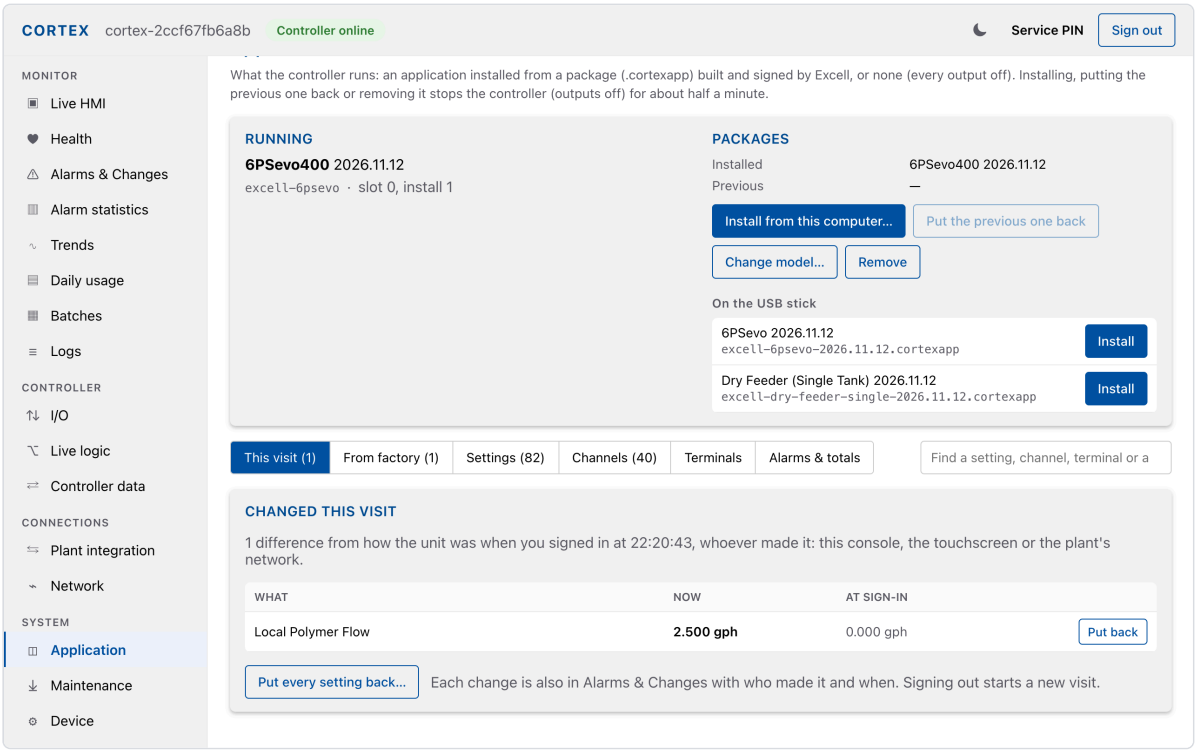

Figure 15 · What changed since signing in, each with Put back

From factory lists what differs from a new controller: settings, the terminal each function is on, and the inputs' contact types. Below it every setting is listed by section, with its value, factory value and range; a changed value is in bold. **Channels**, **Terminals**, **Alarms** and **Totals** show the rest of the application live; terminals and contact types can be changed here.

Finding a setting

The box beside the tabs finds by name: a setting (also by its section or card), a channel (also by its kind or terminal), a terminal, an alarm or a total. Every tab then shows only what matches and how many do; when the open tab has none, the page says which tabs have. The tab and what is looked for are in the page's address, so a link or a bookmark opens the same view. On **Settings**, **Download CSV** saves the settings shown, each with its value, factory value and range, as a record of how the unit was left.

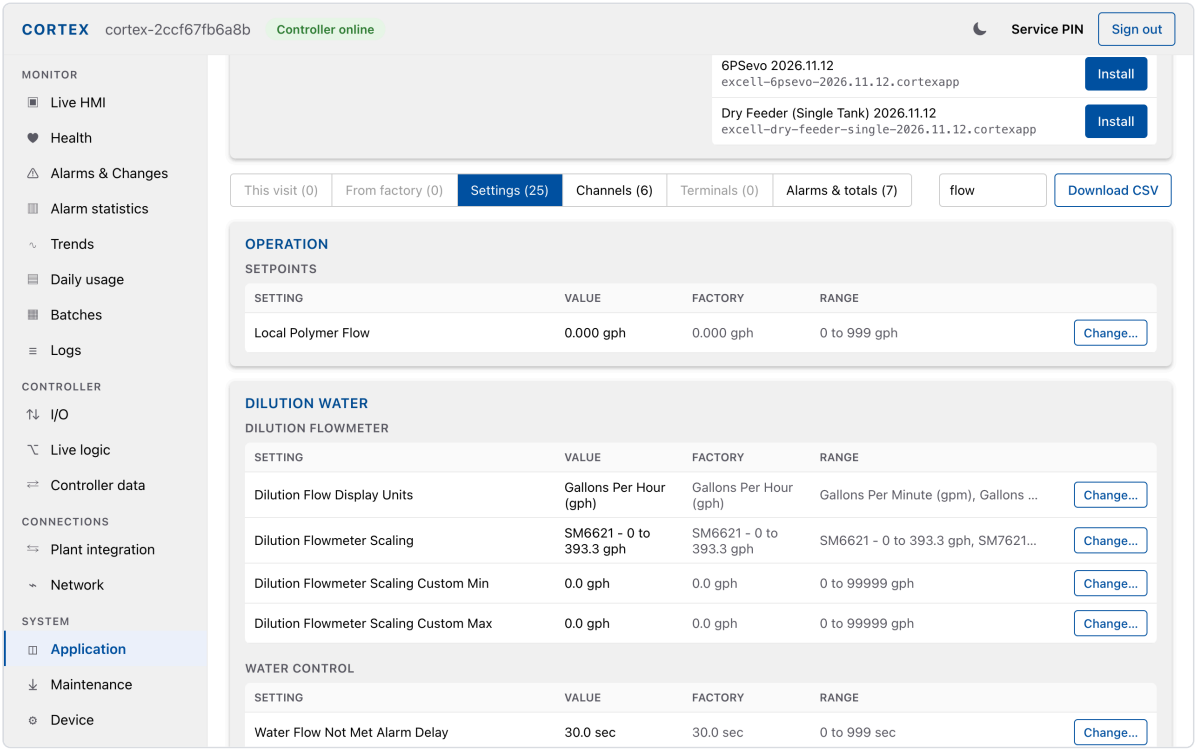

Figure 16 · Finding the settings about flow

Reset to factory defaults… puts the application back as on a new controller: every setting at its default, every function on the terminal it starts on, every input normally open. The analog input calibration and the totals are kept. The panel saves a settings backup by itself first (section 9.2): restore it to go back. The controller refuses the reset while an output is running (a pump, a valve, a motor): stop the machine first. The reset is only in the console, not on the touchscreen, and it is recorded under Alarms & Changes.

6 Plant integration

How the plant's SCADA, PLCs and IIoT systems read the machine and, if allowed, change its setpoints and modes. All three are paid options (chapter 10) and off by default. Each can be switched on in **Read only** or **Allow writes** mode; writes are checked the same way as on the touchscreen and recorded under ALARMS → Changes.

Only one plant-network protocol can allow writes at a time, so two plant systems cannot fight over the same setpoints. Choosing **Allow writes** on one makes the others **Read only**, and the change is recorded under ALARMS → Changes. All can still be on for reading.

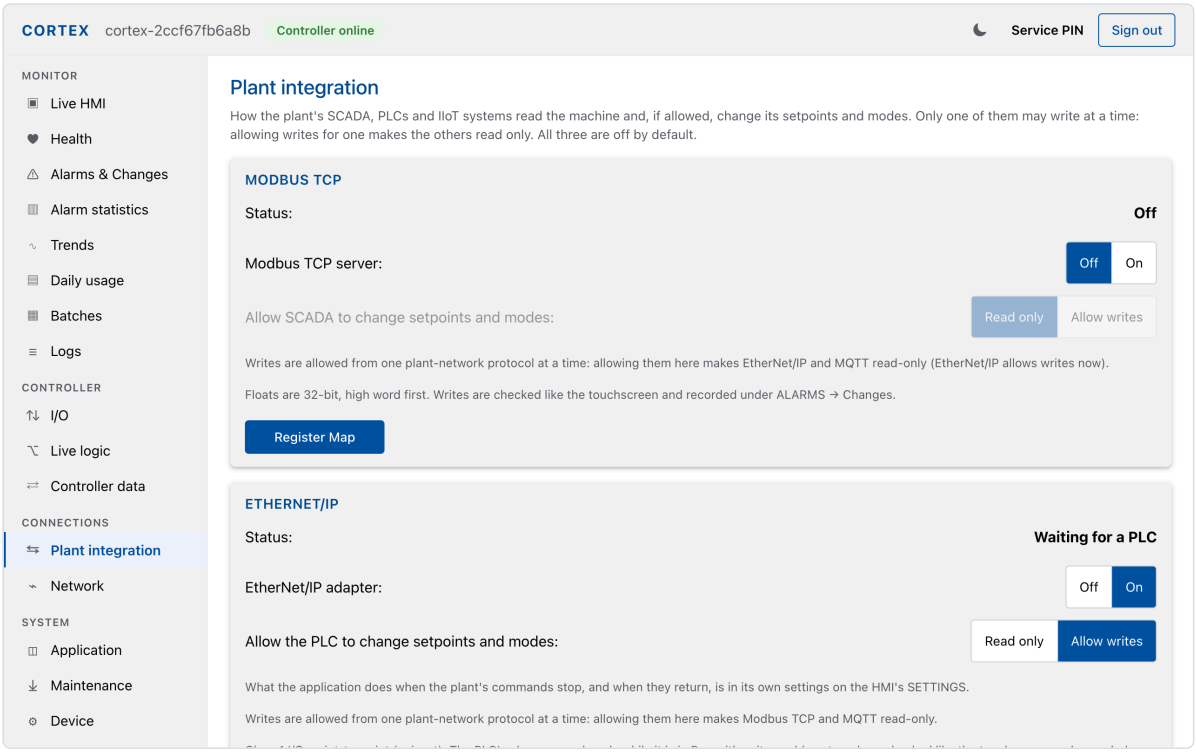

Figure 17 · Plant integration

Every map starts with the controller's own block, the same for every application: the link, the application running and the terminals. The application's values, settings and alarms follow; its O&M manual lists them.

- **Modbus TCP**, port 502: **Register Map** lists the registers: the platform block from 0, the application's from 100.
- **EtherNet/IP** (Rockwell Logix, CODESYS, Keyence and other scanners): **I/O Layout** lists the assemblies and **Download EDS** saves the EDS file. Input assembly 100 and output assembly 150 start with the platform block (64 and 8 bytes), the application's after it.
- **IIoT MQTT**: the panel connects out to the plant's broker (**Broker…**) and publishes the controller's values and alarms there, for IIoT platforms, historians and dashboards. **Topics** lists them. With **Allow writes** it also takes setpoints and modes from there.

7 Network

Shows and changes the panel's address, gateway and DNS servers (DHCP or fixed). When the address changes, browsers connected to the panel must reconnect at the new address. Ping, DNS and TCP port checks run from the panel, to test its path to a server or PLC. The page also shows the link to the controller: "controller port not found" means the controller is not answering (no power, restarting, or in update mode).

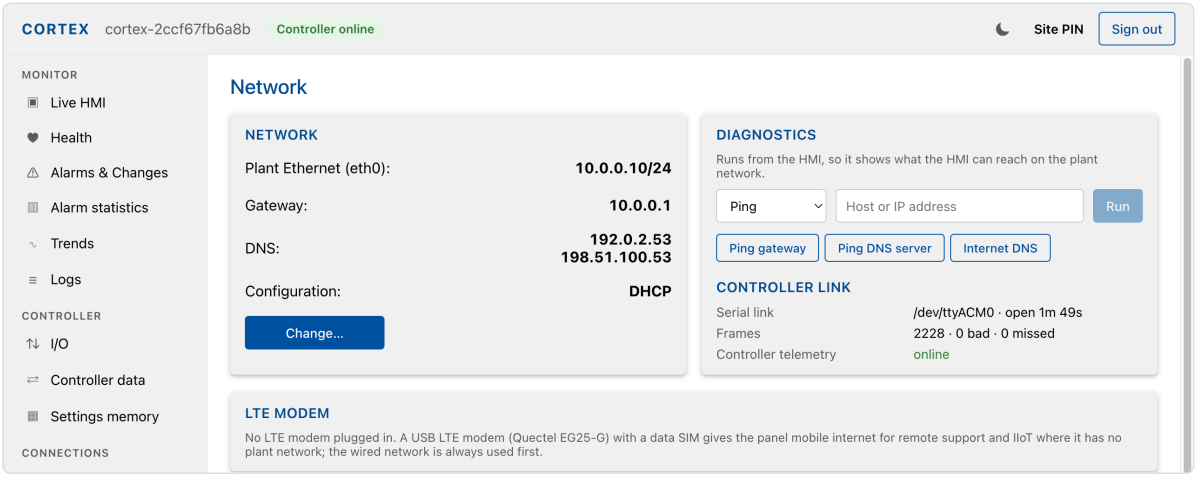

Figure 18 · Network

LTE

LTE is a paid option (chapter 10). A USB LTE modem (Quectel EG25-G) with a data SIM gives the panel mobile internet for remote support and IIoT where it has no plant network; the wired network is always used first. The APN comes from the SIM provider (blank works for most). Mobile data costs money, so over LTE keep the IIoT interval long.

8 Remote support

Excell Feeders support can connect to the panel over the internet, with your permission, to help with setup and troubleshooting. Remote support is off until someone switches it on at the panel, and it can be switched off at any time.

8.1 Connecting

1. Open the page Network, card **Remote support**.
2. Click **Connect**. A login link appears.
3. Send the link to Excell Feeders support (by phone or e-mail). Support approves the connection; the link is valid for about 15 minutes.
4. The state changes to Connected.

If support has given you a one-time setup key, enter it before clicking Connect; the panel then connects straight away.

8.2 Disconnecting

Click **Disconnect**. The panel leaves the support network and stays disconnected, also after restarts, until someone connects it again. Connections and disconnections are recorded under ALARMS → Changes.

> **NOTE**
>
> The panel needs outgoing internet access for remote support. It does not change the panel's network settings, and support can reach only the panel, not the rest of your network.

9 Maintenance

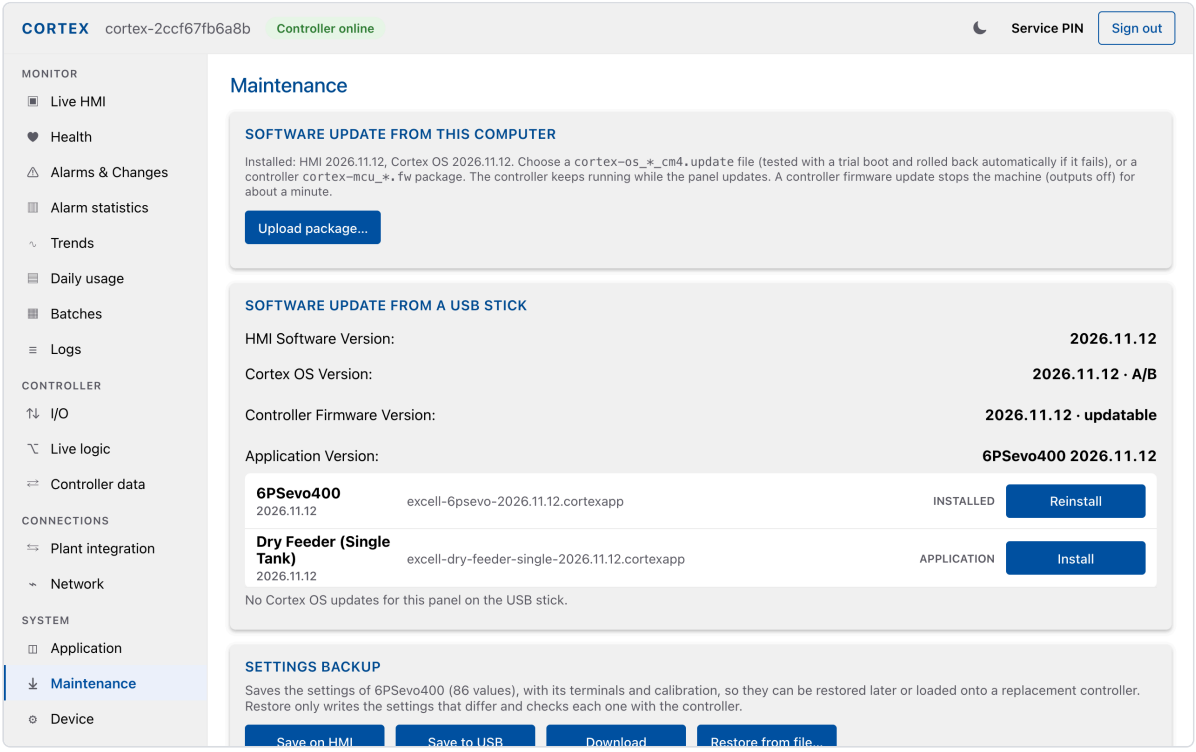

Figure 19 · Maintenance

9.1 Software update from this computer

Upload package... installs a **cortex-os_<version>_cm4.update** file (the panel) or a **cortex-mcu_<version>_1101_pcb_15.fw** file (the controller firmware). The console asks before it sends the file, saying what stops while it is installed. Applications are installed on the page Application (chapter 5). The card below it, **Software update from a USB stick**, installs the same files from a stick in the panel.

- **Cortex OS:** the panel writes the update, restarts into it and checks that everything runs; if not, it returns to the previous version by itself. The controller and the machine keep running. Settings, PIN, accounts, alarm history, trends and the panel's applications are kept.
- **Controller firmware:** takes about a minute. If the new firmware does not start correctly, the panel puts the previous firmware back.

> **NOTE**
>
> The panel installs only software signed by Excell Feeders. A file that is not signed, or has been changed, is refused with a message and nothing is installed.

> **CAUTION**
>
> The machine stops while the controller firmware is updated: all outputs are off for about a minute. Update when the machine can be stopped.

9.2 Backups and the service snapshot

- **Settings backup** saves the application's settings, with the terminals and contact types, to restore later or load onto a replacement controller: on the panel (the last 30 are kept), on a USB stick, or as a file. Restoring shows what will change, writes only the settings that differ and checks each one. The analog input calibration is restored only onto the same controller board.
- **Automatic backups:** the panel saves a settings backup by itself before the settings are replaced: before a restore, before an application or controller firmware is installed, put back or removed, and before a reset to factory defaults. They show in the list on the panel as **Automatic before …** (the last 10 are kept, apart from the ones you save). To go back, restore that one.
- **Device backup** (**Download device backup**) is one file with everything needed to set up a replacement panel: controller settings, service PIN, named accounts, the plant network (Modbus TCP, EtherNet/IP and MQTT), time zone, network and LTE settings, and the application. Keep it safe: it contains account and PIN information and the MQTT broker's password.
- **Service snapshot** is one file for Excell Feeders support with everything needed to see what the unit did: its settings and application, the alarm and change history, the batch records, the trends and system logs over 7, 30 or 90 days, the versions and the panel's health. Passwords and the PIN are left out. **Download snapshot** saves it to this computer; **Save to USB in the HMI** writes it to the stick in the panel (cortex-snapshots folder).

9.3 Date and time

Shows the panel's date, time, time zone and whether network time is synchronized. Set them by hand, choose the time zone, or copy the computer's time. Alarm and change times use this clock.

10 Device and paid options

Device shows the model, serial number, Cortex OS release and versions, storage wear and the boot history. Boots without a clean shutdown usually mean the panel lost power; frequent ones point at the supply or wiring.

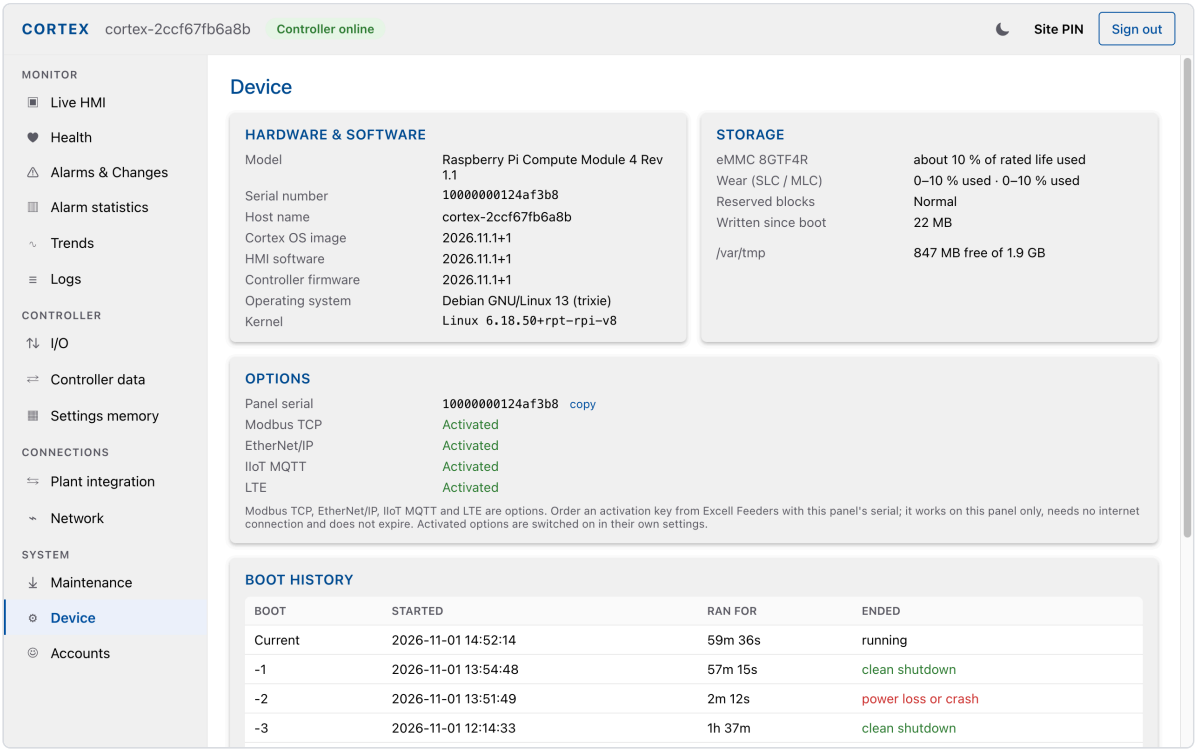

Figure 20 · Device

Paid options

Modbus TCP, EtherNet/IP, IIoT MQTT and LTE are options. Each stays off until an activation key from Excell Feeders turns it on. A key works on one panel only, needs no internet connection and does not expire. Several keys add up.

1. Copy the panel's serial number from Device → Options and order the key from Excell Feeders with it.
2. Paste the key and click **Activate**, or use **From a key file…**. With a USB stick in the panel holding the key file (**cortex-activation-<serial>.txt**), the file is listed there too.
3. Switch the option on in its own settings. The activation is recorded under Alarms & Changes.

11 Status report

The page Status report says what the unit is and how it stands, on one page: the application, firmware and software versions, the panel's serial number, network and paid options; the state now, with the active alarms; what differs from the factory; every terminal with its function, how it is set and its state; the totals; and the latest changes with who made them. **Include every setting** adds all the settings by section. The notes typed at its top (the site, the work done, what to follow up) go with it.

Print… prints it (or saves a PDF, from the browser's print dialog) and **Save as a file** saves it as one file that opens in any browser. Leave one with the unit's papers after commissioning or a service call, and send one when asking Excell Feeders for help. The report is made in the browser from what the console shows: nothing is changed, nothing is sent anywhere, and no network is needed beyond the one to the panel. It shows a moment (**Refresh** takes it again); for the unit's history, save a service snapshot (section 9.2).

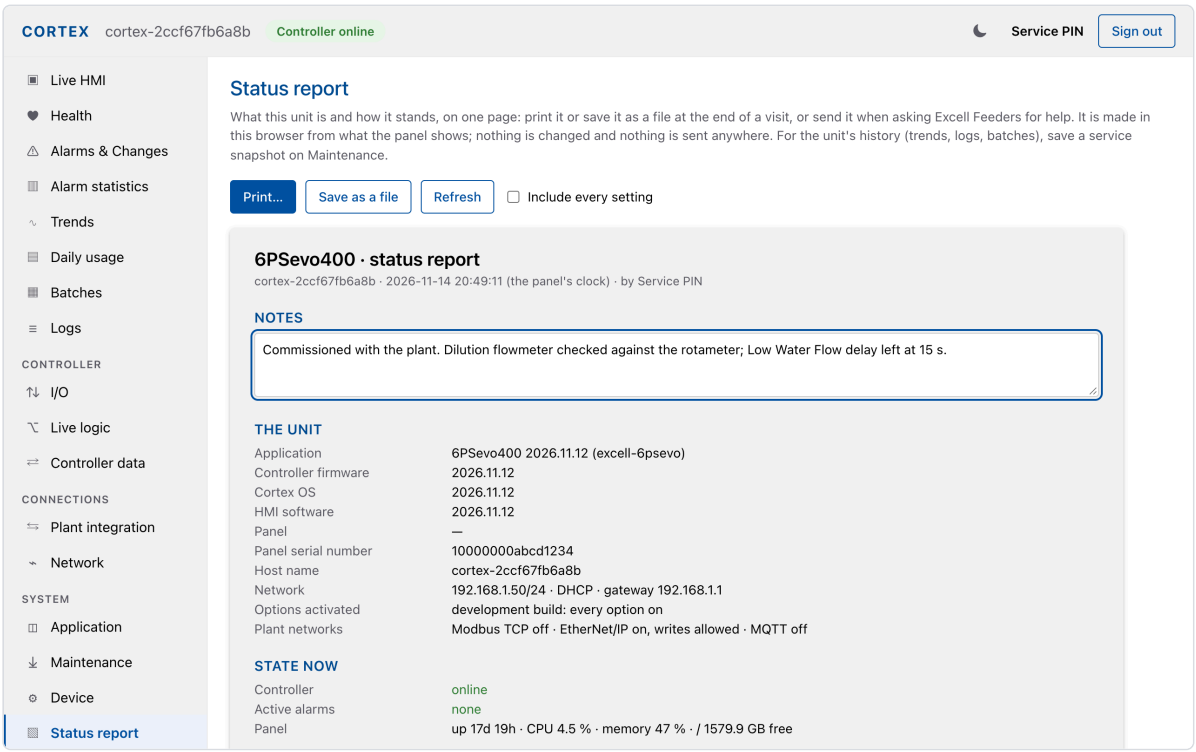

Figure 21 · Status report

12 Accounts

Instead of sharing the service PIN, create an account for each person (full name, user name, password of at least 8 characters). Changes are then recorded with the person's name. Until there are accounts, sign in with the service PIN.

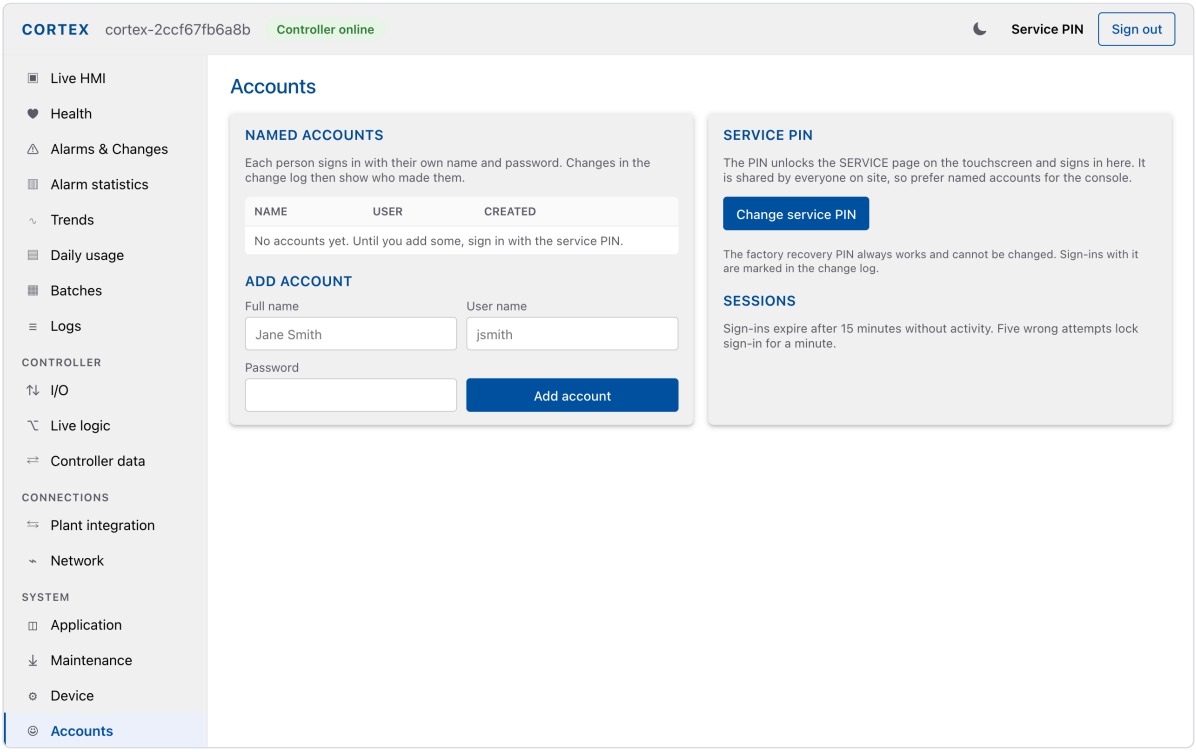

Figure 22 · Accounts

Change service PIN changes the PIN that unlocks the SERVICE page on the touchscreen and signs in here. The factory recovery PIN always works and cannot be changed; sign-ins with it are marked in the change log.

13 Troubleshooting

Symptom	What to do
The page does not load	Check the address on HELP ⟶ RESOURCES, and that the computer can reach it (a firewall between them?).
The console is back at the sign-in form	The sign-in ended after 15 minutes without a change (the form says so). Sign in again.
Values in a browser cannot be changed	The browser is view only: click **View only · Unlock** and enter the service PIN.
"No connection to the panel" over the page	The console lost the panel: it reconnects by itself (section 2.4). If it stays, check the panel's power and the network between it and the computer.
"controller port not found"	The controller is not answering: no power, restarting, or in update mode. See the alarms; the HMI Manual covers installing firmware from a USB stick.
No application runs	The page Application says why. Install the application (from this computer, a USB stick or the touchscreen).
High CPU load or late ticks on Health	Look at the Tasks table for the busiest task, then copy the diagnostics for support.
A plant system's writes are refused	Another protocol has **Allow writes** (chapter 6), or this one is **Read only**.
A service keeps restarting	The count rises on Health. Save a service snapshot and contact support.
Panel returned to the previous version after an update	The strip over the page says so while the console is open; Alarms & Changes gives the reason afterwards. Save a service snapshot and contact support.
Frequent boots without a clean shutdown	Check the panel's supply and wiring (Device ⟶ Boot history).