AI-04734 Sunpower Monitoring via HAOS

DIY SunPower Monitoring System

Deployment Setup Manual

PVS5 → Home LAN → Hyper-V → Home Assistant OS → HACS → Enhanced SunPower → Solar Sentinel

Version 1.0 | September 18, 2026

This manual reconstructs the working deployment developed during the September 18, 2026 troubleshooting session. It is written as a repeatable field manual rather than a generic Home Assistant tutorial. The final design uses Home Assistant OS directly in a Hyper-V virtual machine; the earlier Docker/PVS Watch path is treated as an alternative, not the primary deployment.

1. Final Working Architecture

The successful architecture is intentionally simple: the SunPower PVS5 remains on the normal home LAN, Home Assistant OS runs as a Generation-2 Hyper-V VM, Enhanced SunPower talks directly to the PVS5's local API, and Solar Sentinel reads the per-inverter data already exposed through Home Assistant's Energy Dashboard.

SunPower panels / microinverters (23)

↓

SunPower PVS5 Supervisor

↓ local LAN / Wi-Fi WAN

192.168.1.124

↓

Windows PC → Hyper-V External Virtual Switch

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Home Assistant OS VM

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HACS → Enhanced SunPower (smcneece/ha-esunpower)

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Home Assistant Energy Dashboard

↓

Solar Sentinel

2. Deployment Record — Known Working System

PVS model	SunPower PVS5
PVS LAN IP	192.168.1.124
PVS firmware	0.0.25.5412 / BUILD 5412
PVS serial	ZT161185000441C1140

Microinverters	23
HA host	Windows + Hyper-V
HA installation	Home Assistant OS (HAOS) VHDX
HAOS image used	haos_ova-18.3
VM generation	Generation 2
VM CPU	2 vCPU
VM memory	4 GB RAM
VM storage	32 GB target used in the deployment
VM network	External Hyper-V virtual switch
Secure Boot	Disabled
SunPower integration	Enhanced SunPower / smcneece/ha-esunpower
PVS polling	300 seconds recommended
Per-panel dashboard	Solar Sentinel

3. Important Design Decisions

· Use the PVS5 Wi-Fi WAN/local-LAN path. Do not use the PVS5 installer LAN2 interface for this deployment; that interface has its own 172.27.153.1 network and requires isolation.

· Do not put Docker in the final HA monitoring path. Docker/PVS Watch was evaluated as an alternative, but the completed system uses HAOS because it provides Home Assistant Supervisor/Apps and a clean all-in-one deployment.

· Use Enhanced SunPower rather than the older integration for this PVS5 firmware. The current project documents PVS5 BUILD 5408+ as supported by the new varserver API; BUILD 5412 therefore meets that requirement.

· Use a conservative 300-second polling interval. Faster polling does not make the PVS5's inverter data update faster and can create unnecessary load.

· Add the inverter Lifetime Power sensors to the Home Assistant Energy Dashboard. Solar Sentinel then discovers the individual inverters automatically from that Energy Dashboard configuration.

4. Phase 0 — Confirm the PVS5 Before Building Anything

Goal: prove that the PVS5 is reachable from a computer on the same LAN before troubleshooting Home Assistant.

From a browser on the same LAN, verify:

http://192.168.1.124/vars?name=/sys/info/sw_rev

http://192.168.1.124/vars?name=/sys/info/model,/sys/info/serialnum

The first request returned firmware 0.0.25.5412. The second identifies the PVS model and serial. Keep these values in the deployment record because they are useful when diagnosing firmware/API compatibility.

A common trap: the older local endpoint can return HTTP 403 on newer firmware. Do not conclude that the PVS is unusable just because the old /cgi-bin/dl_cgi/devices/list endpoint is blocked. Enhanced SunPower uses the newer authenticated varserver path for supported firmware.

5. Phase 1 — Prepare Hyper-V

1. On the Windows machine, open Hyper-V Manager.

2. Make sure virtualization is enabled in the PC firmware/UEFI and Hyper-V is installed.

3. Create or select an External Virtual Switch. Bind it to the physical Ethernet/Wi-Fi adapter that can reach 192.168.1.124.

4. The important requirement is LAN reachability: the HAOS VM must be able to reach the PVS5 on the same home network.

6. Phase 2 — Create the HAOS Hyper-V VM

Download the Hyper-V VHDX from Home Assistant's Windows installation page. The deployment used the haos_ova-18.3 image.

1. Extract the HAOS archive so the .vhdx file is available.

2. In Hyper-V Manager select New → Virtual Machine.

3. Name the VM something obvious, such as HAOS-SunPower.

4. Select Generation 2.

5. Assign 4 GB RAM. Dynamic Memory is not required for this simple deployment.

6. Connect the VM to the External Virtual Switch.

7. Select Use an existing virtual hard disk and choose haos_ova-18.3.vhdx.

8. Finish the VM creation wizard.

9. Open VM Settings → Security and disable Secure Boot.

10. Open the firmware/boot settings and make sure the virtual hard drive is a boot device.

11. Confirm the network adapter is attached to the External Switch.

12. Start the VM and watch the console until HAOS finishes booting.

Home Assistant's current Windows documentation specifically calls for a Generation-2 VM, a bridged/External virtual switch, an existing VHDX, and Secure Boot disabled for the Hyper-V HAOS VM. Minimum resources are 2 GB RAM and 2 vCPUs; the 4 GB/2-vCPU configuration used here gives additional headroom.

7. Phase 3 — First Home Assistant Startup

1. From the Windows host, open **http://homeassistant.local:8123**.

2. If name resolution fails, find the HAOS VM's IP address from the router or Hyper-V/network tools and use http://<HA-IP>:8123.

3. Complete the Home Assistant onboarding wizard.

4. Set the location to the actual installation location in Round Rock, Texas. Correct latitude/longitude matters because Solar Sentinel uses HA's location for the solar arc and historical solar times.

5. Set the correct Central Time timezone.

6. Let Home Assistant complete its initial updates.

7. Create a full backup before installing custom components.

8. Phase 4 — Install HACS

HACS (Home Assistant Community Store) is the community repository manager used here to install Enhanced SunPower. HACS is a custom/community component rather than part of the core Home Assistant project.

1. Install HACS using the current official HACS installation procedure.
2. Restart Home Assistant when the installation requests it.
3. Open HACS from the HA sidebar.
4. If prompted, authenticate/link HACS with GitHub.
5. Confirm that HACS can browse integrations.

Do not confuse HACS with the Home Assistant Apps/Add-ons store. Enhanced SunPower is a HACS integration; Solar Sentinel is installed as a Home Assistant App/Add-on.

9. Phase 5 — Install Enhanced SunPower

Repository: smcneece/ha-esunpower

1. Open HACS → Integrations.
2. Search for Enhanced SunPower.
3. Open the repository by smcneece.
4. Click Download and install the current compatible release.
5. Restart Home Assistant.
6. Go to Settings → Devices & Services → Add Integration.
7. Search for Enhanced SunPower.
8. Enter the PVS5 IP address: 192.168.1.124.
9. Allow the integration to auto-detect firmware, serial number, and PVS password.
10. Use the recommended 300-second polling interval.
11. Finish the setup wizard.
12. Open the resulting PV Supervisor device and verify that the PVS5 and its inverter entities appear.

The current Enhanced SunPower documentation states that PVS5 BUILD 5408 or higher is supported by the new varserver API. This installation is BUILD 5412. The integration also states that PVS5 does not support the PVS6 WebSocket live-data option; therefore do not look for a 1-second WebSocket option on this PVS5.

10. Phase 6 — Configure the Home Assistant Energy Dashboard

This is the critical bridge between Enhanced SunPower and Solar Sentinel.

1. Open Energy in the Home Assistant sidebar.
2. Click the pencil/edit control to configure the Energy Dashboard.
3. Under Grid consumption/import, select KWh To Home from the consumption (...c) power-meter device.
4. Under Grid return/export, select KWh To Grid from the same ...c meter.
5. Do not use the ...p meter for the bidirectional grid setup when the ...c sensors are available.
6. Under Solar production, add the Lifetime Power energy sensor for each individual inverter.

7. Add all 23 inverter Lifetime Power sensors individually.

8. Leave the Solar production power field blank unless your particular HA configuration requires a separate system power sensor.

9. Save the Energy Dashboard.

Statistics may take a few hours to populate. That does not mean the sensors are incorrectly configured. The important immediate test is that the correct entities exist and are reporting sensible values.

11. Phase 7 — Install Solar Sentinel

Solar Sentinel is the visual per-inverter dashboard used in the finished system. It reads the solar sources already configured in the HA Energy Dashboard; it does not need a second direct connection to the PVS5.

1. In Home Assistant go to Settings → Apps.

2. Open the Apps Store menu → Repositories.

3. Add the Solar Sentinel repository: **https://github.com/smcneece/solar-sentinel**

4. Find Solar Sentinel in the App Store.

5. Install it.

6. Enable Start on boot and Auto-update.

7. Enable Show in sidebar.

8. Start the app.

9. Open Solar Sentinel from the sidebar.

10. Allow it to discover the 23 inverters from the Energy Dashboard.

12. Phase 8 — Configure Solar Sentinel

1. Set the refresh interval to match the SunPower integration's 300-second polling cadence.

2. Set Peak panel output to the actual rated wattage of the installed modules if known. This controls the color scale; it is not a measurement of actual panel capacity.

3. Use Layout Editor to arrange the 23 inverter cards to match the physical roof layout.

4. Drag each discovered inverter into its physical position.

5. Rotate cards when necessary to match the roof/panel orientation.

6. Add section labels if the roof has logical groups such as Garage, House, South Roof, etc.

7. Save the layout.

The screenshot from the completed deployment showed Solar Sentinel reporting 23/23 online and an array output of about 3.11 kW. That is a useful acceptance-test snapshot: all 23 inverter entities were being discovered and were actively reporting.

13. Acceptance Test — System Is Successfully Deployed When…

☐ HAOS boots automatically after a Windows/Hyper-V restart.

☐ Home Assistant is reachable at its normal IP/hostname.

☐ The Enhanced SunPower integration reports the PVS5 as available.

☐ PVS firmware shows BUILD 5412 / 0.0.25.5412.

☐ All 23 inverter devices/entities exist.

☐ Individual inverter power values change during daylight.

☐ Lifetime energy values increase over time.

☐ KWh To Home and KWh To Grid are available for the grid configuration.

☐ The Energy Dashboard accepts all 23 inverter Lifetime Power sensors.

☐ Solar Sentinel discovers all 23 inverters.

☐ Solar Sentinel shows 23/23 online during normal daylight operation.

☐ Solar Sentinel's production total is reasonably consistent with the aggregate inverter readings.

14. Troubleshooting Playbook

HAOS VM will not boot: Verify Generation 2, existing VHDX, Secure Boot disabled, and the VHDX placed as the boot disk. Confirm the VM is connected to the External Virtual Switch.

HA opens but cannot reach the PVS5: Confirm the HAOS VM received a LAN IP. From another LAN machine verify 192.168.1.124 is reachable. Check that the Hyper-V adapter is using the External Switch rather than an isolated/default switch.

Old PVS endpoint returns 403: This can be expected with newer PVS firmware. Do not use the old /cgi-bin/dl_cgi/devices/list result as the sole compatibility test. Enhanced SunPower uses the newer varserver API for supported firmware.

Enhanced SunPower cannot connect: Verify 192.168.1.124, confirm the PVS is powered and on the same LAN, and check the integration's device/log diagnostics. Keep polling at 300 seconds while diagnosing.

All inverter entities are missing: Wait for one or more polling cycles. Confirm the PVS is reachable and the integration is using the correct firmware/API path.

Energy Dashboard has no useful history yet: New statistics need time to accumulate. Verify the entity configuration first; historical charts do not populate instantly.

Solar Sentinel does not show all 23 panels: Confirm all 23 Lifetime Power entities were added as individual solar-production sources in the Energy Dashboard. Then use Solar Sentinel → Settings → Re-discover.

Panels appear offline immediately after HA restart: Give the integration time to reconnect and poll the PVS. Solar Sentinel can temporarily show panels offline during the HA/integration reconnection window.

PVS5 data stops being collected: Check HA logs for SunPower/pypvs errors and confirm the PVS5 is still reachable. A community-reported PVS5 issue has involved pypvs returning zero inverters during daylight; this is an integration/library issue rather than proof that the solar hardware has failed.

15. PVS5 Polling and Reliability Rules

· Keep the Enhanced SunPower polling interval at 300 seconds unless there is a specific reason to change it.

· Do not aggressively poll the PVS5 every few seconds merely to obtain a faster dashboard. The inverter data itself is not necessarily refreshed faster.

· If data collection becomes intermittent, inspect HA logs before assuming the solar array or microinverters have failed.

· Record PVS firmware BUILD whenever troubleshooting. Firmware changes can alter the available local API.

· Keep a DHCP reservation for 192.168.1.124 so the PVS address does not unexpectedly change.

16. Backup and Recovery

1. After the system is working, create a full Home Assistant backup.

2. Keep a copy of the backup outside the HA VM.

3. Record the PVS IP, model, firmware, and the integration/repository names in this manual.

4. Export the Solar Sentinel panel layout when changing or rebuilding the installation if desired.

5. If the Hyper-V host is replaced, recreate the Generation-2 VM, attach the HAOS VHDX/restore the HA backup, reconnect the External Switch, and restore the HA configuration.

17. Optional Remote Access

Tailscale was explored during the build for secure remote access. It should be treated as an access layer, not as part of the PVS5-to-HA data path. The core monitoring path remains local: PVS5 → LAN → HAOS. If remote access is added later, avoid exposing Home Assistant directly to the public Internet.

18. What Was NOT Used in the Final Deployment

- Standalone Docker/PVS Watch as the primary dashboard.
- The PVS5 LAN2/installer network at 172.27.153.1.
- A separate Raspberry Pi.
- A second Home Assistant installation.
- Direct Internet/cloud dependency for the basic monitoring path.
- PVS6 WebSocket live-data features.

19. Reference URLs

- **Home Assistant — Windows / Hyper-V installation:** https://www.home-assistant.io/installation/windows/
- **Home Assistant — installation overview:** https://www.home-assistant.io/installation
- **HACS:** https://hacs.xyz/
- **Enhanced SunPower:** https://github.com/smcneece/ha-esunpower
- **Solar Sentinel:** https://github.com/smcneece/solar-sentinel
- **PVS Watch — alternative Docker monitor:** https://github.com/timkatz/pvswatch

20. Final Deployment Summary

The completed system is a local-first SunPower monitoring stack. The PVS5 supplies the data over the home LAN; Home Assistant OS provides the operating environment and Energy Dashboard; Enhanced SunPower handles the PVS5-specific local API; and Solar Sentinel turns the per-inverter data into an operational visual dashboard. The key lesson from the deployment is to solve the system in layers: first prove PVS5 network/API access, then prove HAOS networking, then install the integration, then configure Energy Dashboard, and only then add the visualization layer.

END OF MANUAL — DIY SunPower Monitoring System v1.0

My Hyper-V deployment is in a notebook pc. If I build another notebook similar to the Sunpower Monitoring/Solar Sentinel capable pc and go to another house and deploy it, what are the changes needed? List all. Don't go into details, I just need a task list.

Yes. If you build a **second notebook appliance** and deploy it at another SunPower house, the architecture stays essentially the same. The main work is **site-specific configuration**.

Multi-Site Deployment Task List

1. Prepare the notebook

- Verify CPU virtualization support
- Install Windows
- Install Hyper-V
- Create External Virtual Switch
- Verify Ethernet/Wi-Fi networking
- Install/replace battery and power supply as needed
- Set Windows power behavior for 24/7 operation
- Disable sleep/hibernate
- Configure automatic startup after power failure
- Give notebook a unique hostname

2. Deploy HAOS

- Obtain HAOS VHDX
- Create Generation-2 Hyper-V VM
- Assign CPU/RAM/storage
- Attach External Virtual Switch
- Disable Secure Boot
- Boot HAOS
- Complete HA onboarding
- Set **new home's location**
- Set **new home's timezone**
- Set appropriate units/currency
- Create HA backup

3. Configure the new home's network

- Determine customer's LAN subnet
- Determine router/gateway
- Connect notebook to customer's LAN
- Assign/reserve HAOS IP
- Determine PVS5 IP address
- Verify HAOS → PVS5 connectivity
- Verify Internet access
- Verify DNS

- Record network information

4. Configure the customer's PVS5

- Identify PVS5 model
- Record PVS5 serial number
- Record PVS5 firmware/build
- Verify PVS5 local API
- Verify PVS5 network connection
- Verify PVS5 Wi-Fi if applicable
- Determine number of microinverters
- Record inverter serial numbers
- Identify any SunVault/battery equipment
- Verify inverter data is being reported

5. Install Home Assistant components

- Install HACS
- Install Enhanced SunPower
- Configure customer's PVS5 IP
- Verify PVS5 discovery
- Verify all inverters appear
- Set appropriate polling interval
- Restart HA
- Verify data survives restart

6. Configure Energy Dashboard

- Identify customer's grid import sensor
- Identify customer's grid export sensor
- Identify customer's solar production sensors
- Add each inverter's Lifetime Power sensor
- Configure grid consumption
- Configure grid return
- Configure solar production
- Verify energy statistics
- Verify daily/monthly/yearly production

7. Install Solar Sentinel

- Install Solar Sentinel
- Enable automatic startup
- Enable automatic updates if desired
- Discover customer's inverters
- Verify inverter count
- Configure panel/inverter layout
- Map physical panel positions
- Configure panel rating/scale
- Verify aggregate production
- Verify individual inverter production

8. Configure Tailscale

- Install/configure Tailscale
- Authenticate appliance
- Give appliance a unique Tailscale hostname
- Verify remote HA access
- Verify remote Solar Sentinel access
- Configure appropriate access permissions
- Document customer/device association
- Test remote access from outside the customer's LAN

9. Configure remote management

- Assign unique site name
- Assign unique appliance name
- Assign unique Tailscale identity
- Configure remote support access
- Configure HA notifications
- Configure inverter-offline alerts
- Configure production anomaly alerts
- Verify notification delivery

10. Site-specific Solar Sentinel configuration

- Number of panels
- Number of microinverters
- Panel/inverter serial mapping
- Roof layout
- Panel orientation
- Panel grouping
- Panel wattage
- Inverter naming
- Physical location labels

11. Customer-specific documentation

- Record PVS5 IP
- Record PVS5 serial
- Record firmware
- Record inverter count
- Record inverter mapping
- Record HA IP
- Record Tailscale hostname
- Record appliance serial/asset number
- Record installation date
- Record hardware configuration
- Create site-specific backup

12. Reliability configuration

- Configure automatic boot after power failure
- Configure HA automatic startup

- Verify Hyper-V VM automatic start
- Configure Windows updates appropriately
- Configure HA backups
- Verify available disk space
- Verify notebook temperature
- Verify network stability
- Test reboot recovery
- Test power-loss recovery

13. Final commissioning

- Verify PVS5 reachable
- Verify HAOS reachable
- Verify Enhanced SunPower
- Verify every inverter
- Verify Energy Dashboard
- Verify Solar Sentinel
- Verify Tailscale
- Verify remote access
- Verify notifications
- Verify backup
- Reboot entire appliance
- Confirm everything automatically returns
- Perform final production comparison against PVS5
- Photograph/document final installation

14. Appliance standardization for future units

For every new appliance, keep these **identical**:

- Windows/Hyper-V baseline
- HAOS version
- VM configuration
- HACS
- Enhanced SunPower
- Solar Sentinel
- Tailscale
- Backup strategy
- Monitoring strategy
- Troubleshooting procedure

Make these **unique per house**:

- PVS5 IP
- PVS5 credentials/API information
- PVS5 serial
- Firmware
- Number of inverters
- Inverter serial numbers
- Energy entities

- Panel layout
- Panel wattage
- House location
- Timezone
- LAN configuration
- HA IP
- Tailscale identity
- Site name
- Customer information

The key idea

Your **golden appliance** becomes:

Notebook → Hyper-V → HAOS → HACS → Enhanced SunPower → Solar Sentinel → Tailscale

Then each deployment becomes:

Clone/prepare → Site configuration → PVS5 pairing → Inverter mapping → Energy configuration → Sentinel layout → Tailscale → Commissioning

That's the point where your one-off Frankenstein lab starts becoming a **repeatable appliance deployment process**.