

SMA Zero Export with ennexOS Data Manager M and Elkor WattsOn Mark II

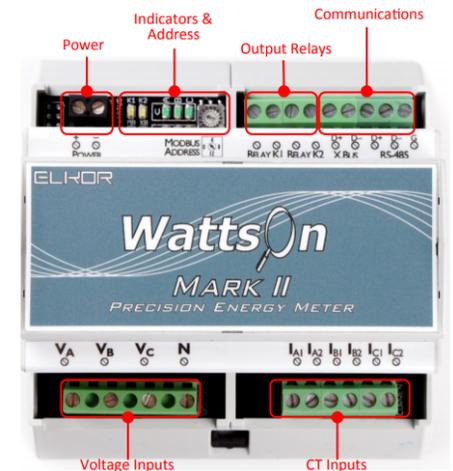
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10/25/2018

Installation and configuration of Elkor meter

- These instructions are for **W2-E3-mA-DL** Elkor meter
- Install meter on DIN rail in an enclosure
- Connect 24Vdc power supply
- Connect L1/L2/(L3)/N/PE on AC breaker for Grid voltage measurements (usually near the CT's)
- Connect CT's on all necessary phases (L1/L2 for Sunny Boys, L1/L2/L3 for STP/CORE1)
- Connect Ethernet cable to LAN (must be on same LAN as EDMM)
 - Notice image to the top right has RS485, this is version 'W2-M1-mA'. M1 is not compatible with EDMM
 - Bottom right image of 'W2-E3-mA-DL' has RJ45 Ethernet port on the top right, E3 model
- Elkor webpage should appear with IP address in browser once powered up. IP address can be viewed on display



Elkor webUI interface

- If configured properly, local AC data will now be reporting on Elkor's IP address

ELKOR Technologies Inc. Precision. Innovation. Engineered.

ETnet-W2 WattsOn-Mark II Gateway Firmware 1.6.9

CONNECTED DEVICE

- Monitor
- View config
- Web posting
- Modbus setup

GATEWAY

- Information
- Diagnostics
- Filesystem
- Network
- System
- Web Interface

READING TIMESTAMP

9:55:23 AM 10/31/2018 (UTC-7) Polling Freq: 1 sec

REAL-TIME PARAMETERS

	V (L-N)	A	kW	kVAR	kVA	PF
Phase A	120.8	10.227	1.110	0.496	1.238	0.899
Phase B	121.3	10.141	1.112	0.505	1.245	0.901
Phase C	0.0	0.000	0.000	0.000	0.000	1.000
Average / Total	80.7	6.789	2.221	1.001	2.482	0.900
Frequency				60.01		

ENERGY

	kWh Import	kWh Export	Net kWh
Phase A	405.822	336.194	69.628
Phase B	416.608	184.879	231.728
Phase C	0.000	0.000	0.000
Total	822.430	521.073	301.357

	kVA Import	kVA Export	Net kVA
Phase A	443.377	390.851	52.526
Phase B	468.531	239.764	228.767
Phase C	0.000	0.000	0.000
Total	911.908	630.614	281.293

	Q1 kVAR	Q2 kVAR	Q3 kVAR	Q4 kVAR
Phase A	88.939	148.086	0.059	16.733
Phase B	109.212	109.243	0.015	15.641
Phase C	0.000	0.000	0.000	0.000
Total	198.150	257.329	0.073	32.374

CONNECTION STATUS

The ETnet is currently connected to the following device:

WattsOn-Mark II (SN#14409)
Firmware 11.12

The ETnet is connecting through the following device:

Integrated Serial Port
Address 1

POSTING STATUS

The ETnet's most recent web post was at the following time:

Web posting is currently disabled.

Elkor webUI interface

- Find 'Network settings' (IP address issued by router)
- These values will be helpful for configuring Elkor in the EDMM
- Static IP values are configured in this example
- Elkor is set default DHCP, if router reboots it's possible the Elkor IP will have a re-assigned Ip address to something different. If the Elkor has different IP address, EDMM might not be able to communicate.
- Static IP assignment is recommended

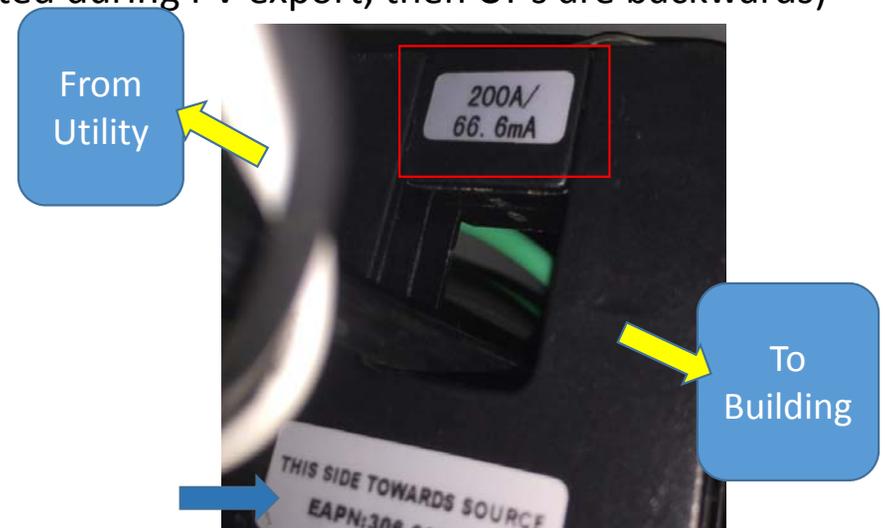
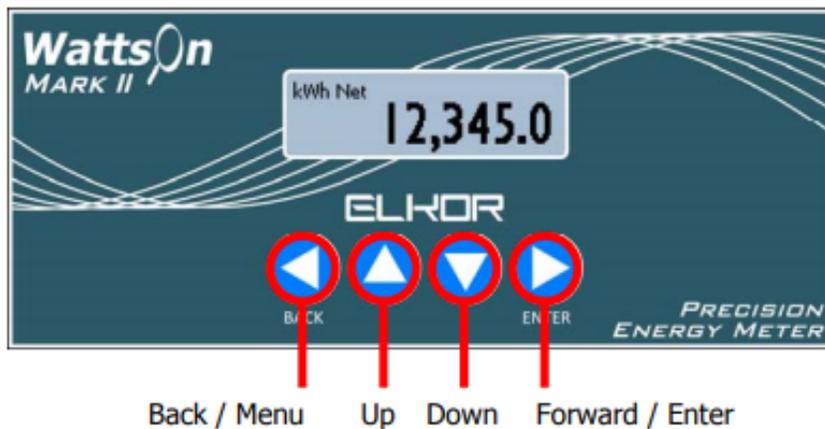
The screenshot displays the Elkor Technologies Inc. webUI interface. The header includes the company logo and tagline "Precision. Innovation. Engineered." along with device information: "ETnet-W2", "WattsOn-Mark II Gateway", and "Firmware 1.6.9".

The interface is divided into several sections:

- CONNECTED DEVICE:** Includes options for Monitor, View config, Web posting, and Modbus setup.
- GATEWAY:** Includes options for Information, Diagnostics, Filesystem, Network (highlighted with a red box), System, and Web Interface.
- NETWORK CONFIGURATION:** Contains fields for Hostname and Domain, Time Sync settings (Enable NTP Time Sync:) and IP Configuration (Automatic Configuration: DHCP, BOOTP, Static (Set Manually)). The **Manual IP Settings** section is highlighted with a red box and includes fields for IP Address (192.168.0.127), Subnet Mask (255.255.255.0), Default Gateway (192.168.0.1), Primary DNS (75.75.75.75), and Secondary DNS, with a Submit button.
- CONNECTION STATUS:** Shows the ETnet is currently connected to the WattsOn-Mark II (SN#14409) with Firmware 11.12, and is connecting through the Integrated Serial Port Address 1.
- POSTING STATUS:** Indicates that web posting is currently disabled.

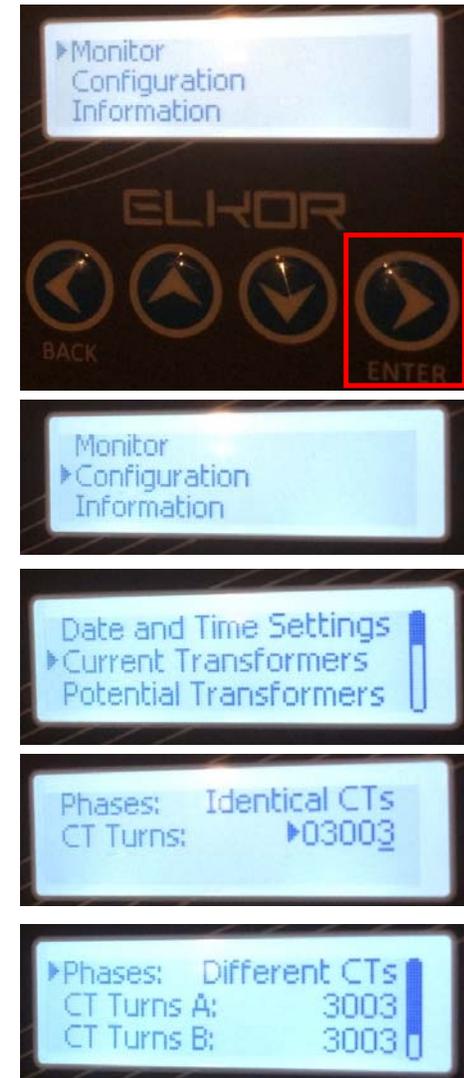
Configuring the CT ratios for mA Elkor meter

- Enter CT ratios into the display of meter (this is only available with the –DL version)
 - Follow on screen steps for display configuration
 - For example, a CT with spec's "200A/66.6mA" has a ratio of $200 / .0666 = 3003$ (a 3,033:1 ratio). We must enter 3003 into the Configuration menu
 - Ensure the CT's are orientated correct, such as 'This side towards source' (Source usually means Grid, if negative power/current values are reported during PV export, then CT's are backwards)



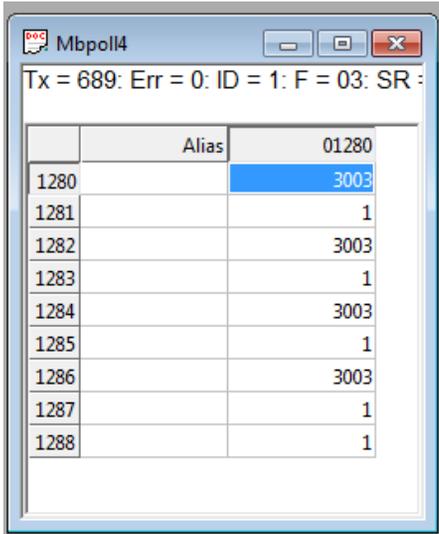
Elkor Manual CT configuration

- For Meters with the onboard LCD Display
- Push Enter to bring up Menu options, then down to select 'Configuration', push Enter
- Press down to select 'Current Transformer', push Enter
- For 'Identical CTs' enter the CT Turns or ratio (we're using 3003 ratio)
- For different CT's, press Enter on 'Identical CTs', then each CT can be manually configured, enter values unique to individual CT spec's if using different CTs.



Elkor CT configuration through Modbus TCP

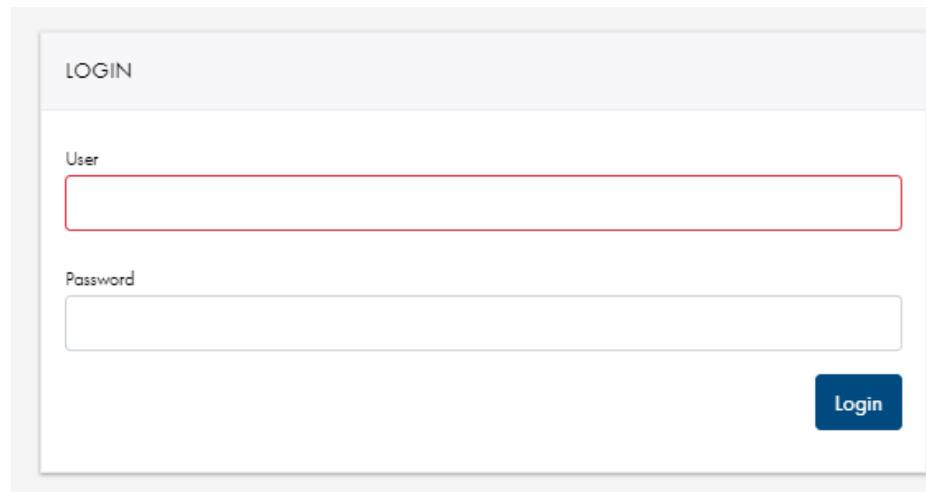
- Connect Modbus Master software to Elkor, must be on same LAN
- Default Modbus Slave ID is 1, port 502, IP address is DHCP by default (same as webUI IP address).
 - Consult router DHCP list for Elkor's IP assignment
 - WebUI can be used for defining static IP configuration on LAN
- Modbus registers 41281 S16 can be used to define all connected CT's ratios (same as Identical CTs setting in display)
- Elkor Modbus Map is zero-indexed, so we must subtract '-1' on all registers
- Elkor also has the '4'xxxx scrubbed or removed, so you must use '1280' (in order to read or write **41281**)
- Modbus Master should be configured to Function Code 03, write '1280' (with S16) the unique CT ratio which is being used, this applies ratios to all CT's.
- 3003 is used for this example
- Independent CT ratios can also be configured uniquely if desired, follow map to do so (CT#1 = 1282, CT#2 = 1284, CT#3 = 1286)



	Alias	01280
1280		3003
1281		1
1282		3003
1283		1
1284		3003
1285		1
1286		3003
1287		1
1288		1

Registering the Elkor in the EDMM webUI

- Log in to EDMM (NOT into the ennexOS Sunny Portal, although they look like very similar interfaces)
- Login credentials are user created during commissioning of EDMM



A screenshot of the EDMM webUI login form. The form is titled "LOGIN" and contains two input fields: "User" and "Password". The "User" field is highlighted with a red border. A blue "Login" button is located at the bottom right of the form.

LOGIN

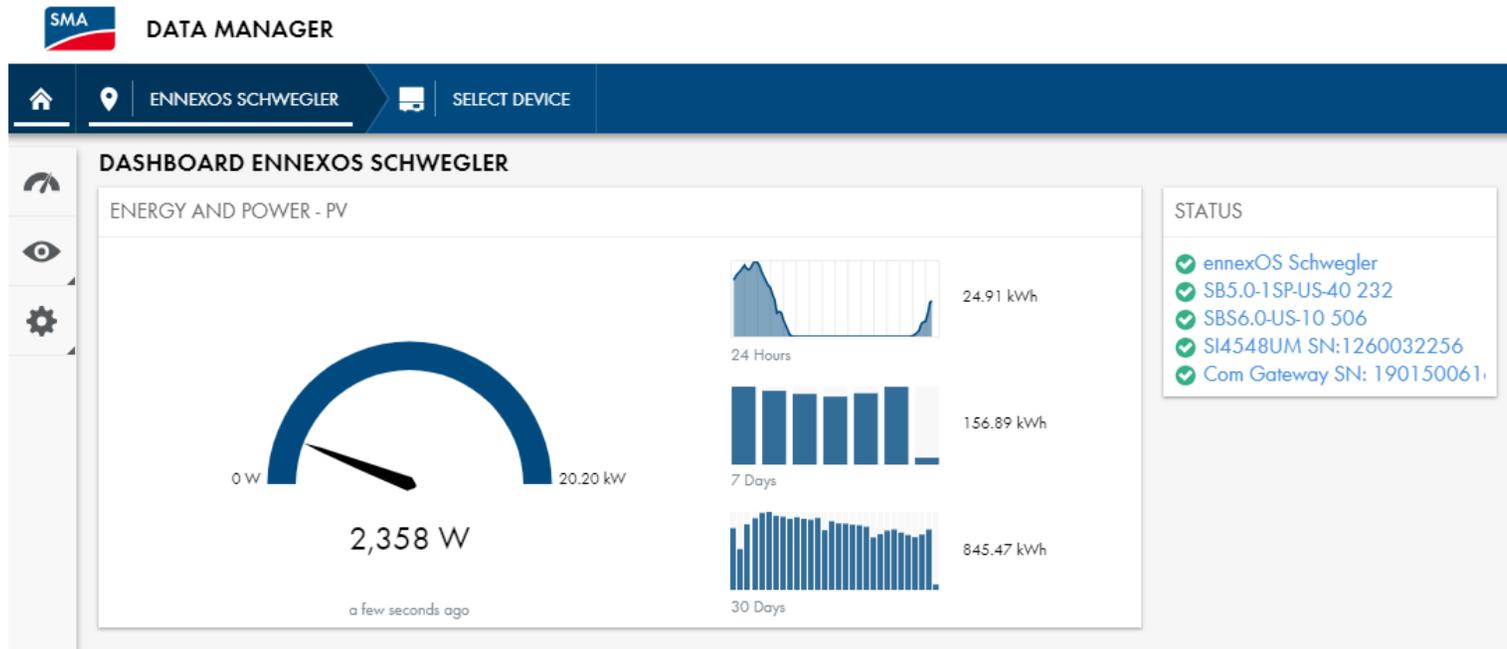
User

Password

Login

EDMM webUI home screen Dashboard

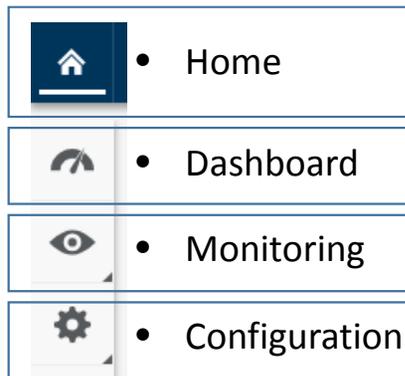
- The default Dashboard shows information from PV system at a quick glance
- If no data is present, Inverters and Modbus devices must be detected and configured



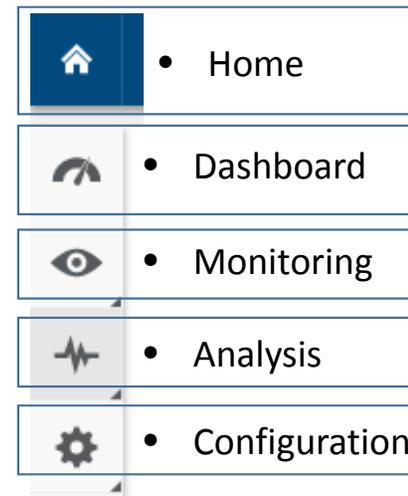
Differences between ennexOS Sunny Portal and EDMM webUI (navigation key terms)

- Here are the new interface icon names (located on left side of the screen):
- Some configuration menus are only possible in the EDMM webUI (such as configuring zero export)

EDMM web interface:

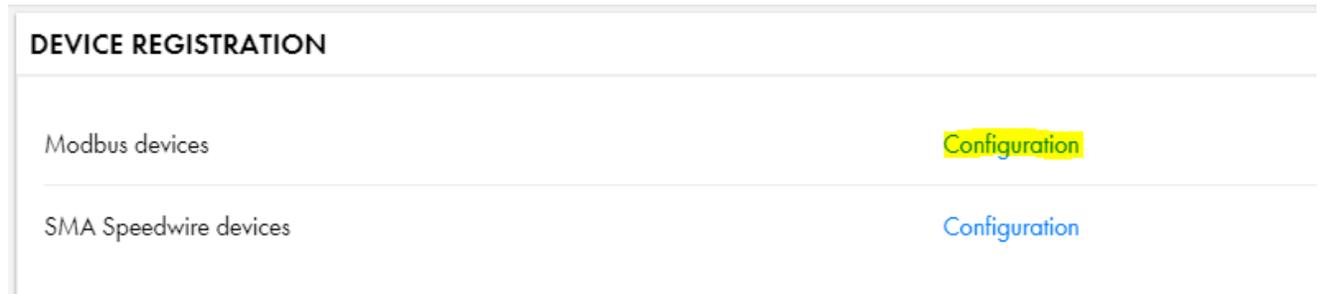
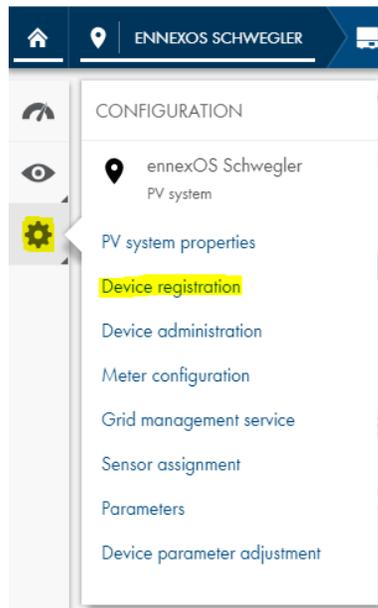


ennexOS Sunny Portal web interface:



Detecting Elkor meter in EDMM webUI

- Select Configuration, then Device registration
- Select Modbus devices 'Configuration'



Configuring Elkor meter in EDMM webUI

- Click the (+) icon on the top right of menu
- Name the device in the description field
 - Change 'ModbusDevice-0' to 'Elkor Meter' for example
- Enter IP address in field (preferably IP is set to static)
- Enter port (502 is default)
- Enter Unit ID (1 is default, which conveniently is also Elkor default Slave ID)
- Select "Elkor WattsOn Mark II" for the preconfigured Modbus profile

DEVICE REGISTRATION MODBUS

Device name	IP address	Port	Unit ID	Modbus profile	
ModbusDevice-0	IP address	502	1	Elkor WattsOn Mark II	

Managing your own Modbus profiles

Cancel Save

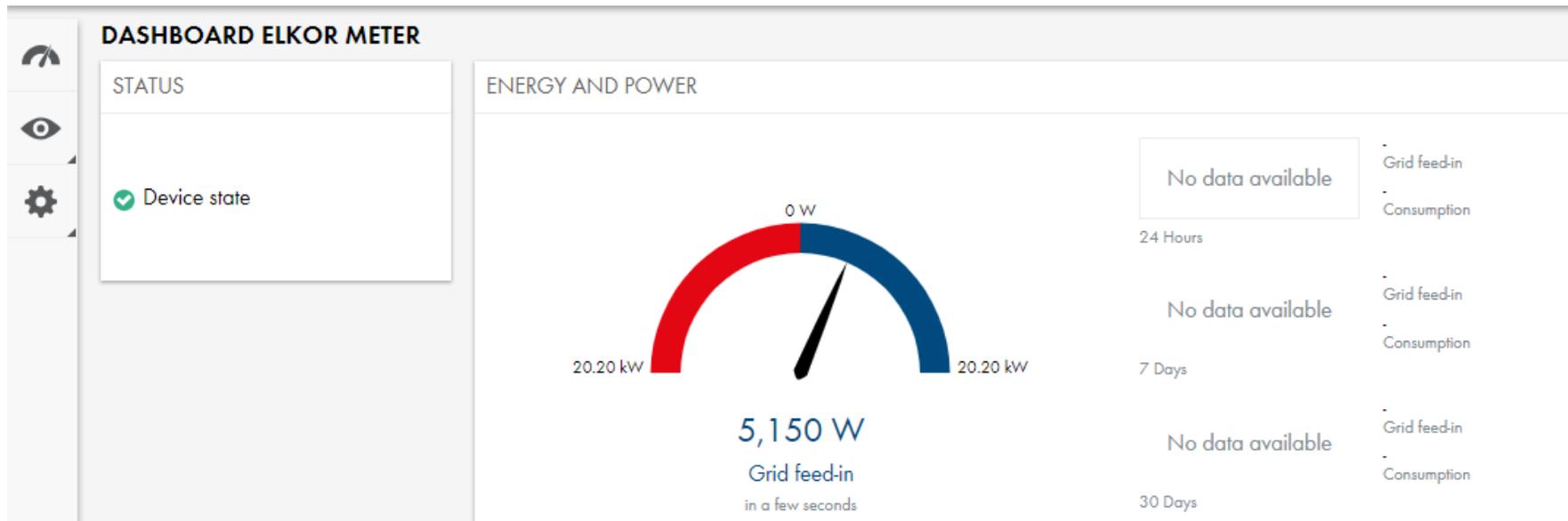
Finding new Device

- Click Home button, then 'Select Device'
- Verify that Elkor Meter is now available in device tree with a green check mark
- Click on 'Elkor Meter' to pull up dashboard



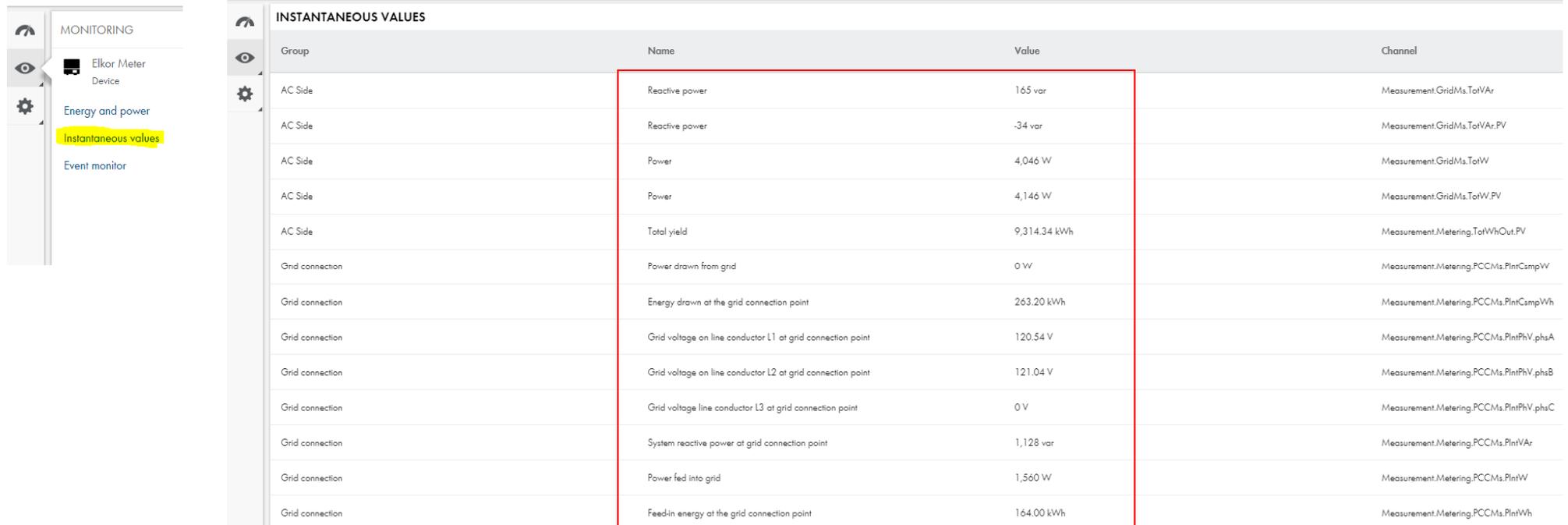
SELECT DEVICE							
Status	Device name ↑	Serial number	Current PV power [W]	Yield 10/31/2018 [Wh]	Yield 10/30/2018 [Wh]	Spec. yield 10/31/2018 [Wh/Wp]	Spec. yield 10/30/2018 [Wh/Wp]
✓	Com Gateway SN: 1901500616	1901500616	-	-	-	-	-
✓	Elkor Meter		-	-	-	-	-
✓	ennexOS Schwegler	3001354652	-	-	-	-	-
✓	SB5.0-1SP-US-40 232	1990003232	273.00	0.00	15,590.03	0.00	3.12
✓	SBS6.0-US-10 506	3002771506	-	-	-	-	-
✓	SI4548UM SN:1260032256	1260032256	-	-	-	-	-
✓	SN: 1913000071	1913000071	92.00	0.00	6,243.91	0.00	1.25
✓	SN: 1913130069	1913130069	34.00	0.00	2,269.92	0.00	0.57

Dashboard for the Elkor Meter



Elkor Meter – Instantaneous values

- Click 'Monitoring, Instantaneous values'
- Each spot value of measurement can be viewed, refresh is about 5 seconds



The screenshot displays the 'MONITORING' section of the Elkor Meter interface. On the left, a sidebar menu includes 'Elkor Meter Device', 'Energy and power', 'Instantaneous values' (highlighted in yellow), and 'Event monitor'. The main area shows a table titled 'INSTANTANEOUS VALUES' with columns for Group, Name, Value, and Channel. A red box highlights a subset of rows in the table.

Group	Name	Value	Channel
AC Side	Reactive power	165 var	Measurement.GridMs.ToVAr
AC Side	Reactive power	-34 var	Measurement.GridMs.ToVAr.PV
AC Side	Power	4,046 W	Measurement.GridMs.ToW
AC Side	Power	4,146 W	Measurement.GridMs.ToW.PV
AC Side	Total yield	9,314.34 kWh	Measurement.Metering.ToWhOut.PV
Grid connection	Power drawn from grid	0 W	Measurement.Metering.PCCMs.PInCampW
Grid connection	Energy drawn at the grid connection point	263.20 kWh	Measurement.Metering.PCCMs.PInCampWh
Grid connection	Grid voltage on line conductor L1 at grid connection point	120.54 V	Measurement.Metering.PCCMs.PInPhV.phsA
Grid connection	Grid voltage on line conductor L2 at grid connection point	121.04 V	Measurement.Metering.PCCMs.PInPhV.phsB
Grid connection	Grid voltage line conductor L3 at grid connection point	0 V	Measurement.Metering.PCCMs.PInPhV.phsC
Grid connection	System reactive power at grid connection point	1,128 var	Measurement.Metering.PCCMs.PInVAr
Grid connection	Power fed into grid	1,560 W	Measurement.Metering.PCCMs.PInW
Grid connection	Feed-in energy at the grid connection point	164.00 kWh	Measurement.Metering.PCCMs.PInWh

Configuring SMA inverters for Active Power Control in EDMM webUI

- During regular inverter commissioning, using 'Start the installation assistant', step Grid Management Service section, by default 'Act. power lim. via PV system ctrl' should be selected. **If so, no change is needed.** If not, follow instructions on how to activate:

1. Click Select Device, choose an inverter
2. Click Configuration, Parameters
3. Enter 'feed-in' search term into Filter section
4. Select Drop Down menu option 'Act. power lim. via PV system ctrl'
5. Click Save

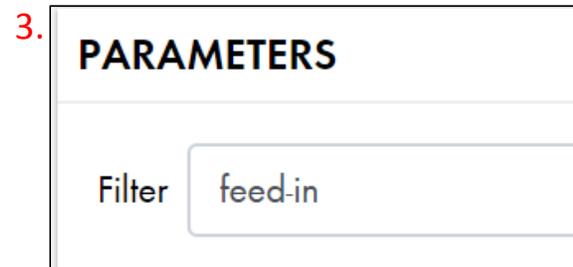
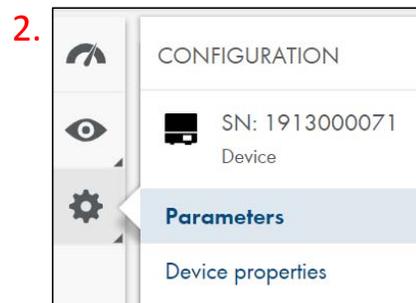
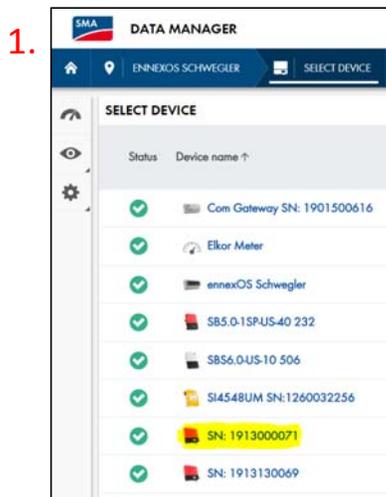
(During setup installation assistant)

System control and power limitation

On Off

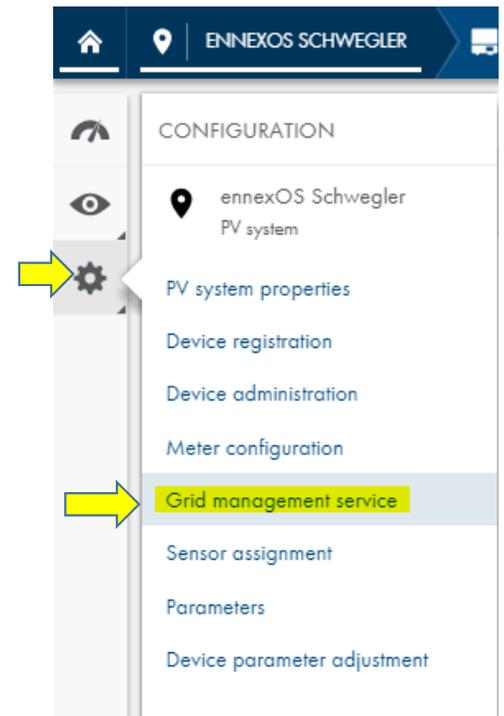
Operating mode Active power

Act. power lim. via PV system ctrl



Configuring Zero Export in EDMM

- Click Configuration > Grid Management service
- Grid Management Service screen pops up, click 'Configuration & activation'
- Zero Export will occur at CT measurement location, which must be at the buildings Main Point of Interconnection (POI)!



GRID MANAGEMENT SERVICE	
Active power	Configuration & activation
Reactive power	Configuration & activation

Configuring Zero Export in EDMM

Follow steps:

Step 1: Select 'Closed loop control' >> then click 'Next'

i GRID MANAGEMENT SERVICE

1. STEP 2. STEP 3. STEP 4. STEP 5. STEP

SELECTING THE OPERATING MODE

Operating mode

Open loop control

Closed loop control

To configure Q(v) you have to setup the counter configuration .

Cancel Next

Configuring Zero Export in EDMM

Step 2: Select 'Manual control' >> then click 'Next'

GRID MANAGEMENT SERVICE

1. STEP **2. STEP** 3. STEP 4. STEP 5. STEP

SELECTING THE SIGNAL SOURCES FOR THE SETPOINT

Signal sources

- Digital inputs
- Modbus
- Manual control

If your plant participate on the direct marketing, you can active the required interfaces here.

Direct Marketing Interface:

[Back](#) [Cancel](#) [Next](#)

Configuring Zero Export in EDMM

Step 3: Manual Control > Constant Setpoint > Active power setpoint >> click 'Next'

For a zero export systems:

Under 'Active power setpoint' > enter '0'

For 'limited export systems' you can enter a percentage here,

- For example 1MW system which can only export 300kW maximum, enter '30%'

The screenshot shows the 'GRID MANAGEMENT SERVICE' interface. At the top, there is a progress bar with five steps: 1. STEP, 2. STEP, 3. STEP (highlighted), 4. STEP, and 5. STEP. Below the progress bar is the title 'SETTING OF THE SIGNAL SOURCES'. Underneath, there is a section for 'MANUAL CONTROL' which contains a 'CONSTANT SETPOINT' section. In this section, there is a label 'Active power setpoint' followed by a text input field containing the value '0' and a '%' symbol to its right. A yellow arrow points to the input field. At the bottom of the interface, there are three buttons: 'Back', 'Cancel', and 'Next'. A yellow arrow points to the 'Next' button.

Configuring Zero Export in EDMM

Step 4:

- Define the speed in which the EDMM must control the PV. For most 'Zero export' systems, 1 second and 100% active power gradient is OK
- Click '**Active**' >
- Configuration time, enter **1.0 s**
- Active power gradient, enter **100%**
- Click 'Next'

**If the active power gradient is too slow, depending on PV production and how fast loads turn on/off, there is the risk of exporting PV power back to the grid if the controls are not fast enough*

Consult with Utility to determine allowed export limits (if any)

The screenshot shows the 'GRID MANAGEMENT SERVICE' configuration interface. At the top, there is a progress bar with five steps: 1. STEP, 2. STEP, 3. STEP, 4. STEP (highlighted), and 5. STEP. Below the progress bar is a section titled 'MODIFICATION SPEED OF THE SETPOINT'. This section contains three configuration items:

- Active:** A toggle switch is shown in the 'on' position, indicated by a yellow arrow pointing to it.
- Configuration time:** A text input field contains the value '1.0' with a unit 's' to its right. A yellow arrow points to the input field.
- Active power gradient:** A text input field contains the value '100' with a unit '%' to its right. A yellow arrow points to the input field.

At the bottom of the interface, there are three buttons: 'Back' on the left, 'Cancel' in the middle, and 'Next' on the right. A yellow arrow points to the 'Next' button.

Configuring Zero Export in EDMM

Step 5:

- Define the 'Timeout for communication fault indication'
- Total system power, enter Watts summation of all PV inverters
- Click Save

GRID MANAGEMENT SERVICE

1. STEP 2. STEP 3. STEP 4. STEP 5. STEP

FREQUENCY OF REPETITION OF THE SETPOINT

Timeout for communication fault indication 30 s

PLANT CONFIGURATION

Total system power 14,000 W

Back Cancel Save

Configuring Energy Meter

- EDMM **must** be configured to 'use' the Elkor measurements for Purchased or Feed-in electricity/kW values
- Click Configuration >> Click Meter configuration
- Under Device > Select Elkor Meter
 - Under Channel > Select 'Grid reference counter' or 'Grid feed-in counter' respectively

The screenshot displays the 'CONFIGURATION ENERGY METER' interface. On the left, a sidebar contains the following menu items: CONFIGURATION, ennexOS Schwegler PV system, PV system properties, Device registration, Device administration, **Meter configuration** (highlighted with a yellow arrow), Grid management service, Sensor assignment, Parameters, and Device parameter adjustment. The main configuration area is titled 'CONFIGURATION ENERGY METER' and features an 'Electrical' section with a table. The table has three columns: Position, Device, and Channel. The 'Purchased electricity' row shows 'Elkor Meter' selected in the Device column and 'Grid reference counter' in the Channel column. The 'Grid feed-in' row shows 'Elkor Meter' in the Device column and 'Grid feed-in counter' in the Channel column. The 'PV generation' row shows 'All PV inverters' in the Device column and 'PV generation' in the Channel column. Yellow arrows point to the 'Elkor Meter' and 'Grid reference counter' selections in the table.

Position	Device	Channel
Purchased electricity	Elkor Meter	Grid reference counter
Grid feed-in	Elkor Meter	Grid feed-in counter
PV generation	All PV inverters	PV generation

Visualizing the EDMM target setpoint

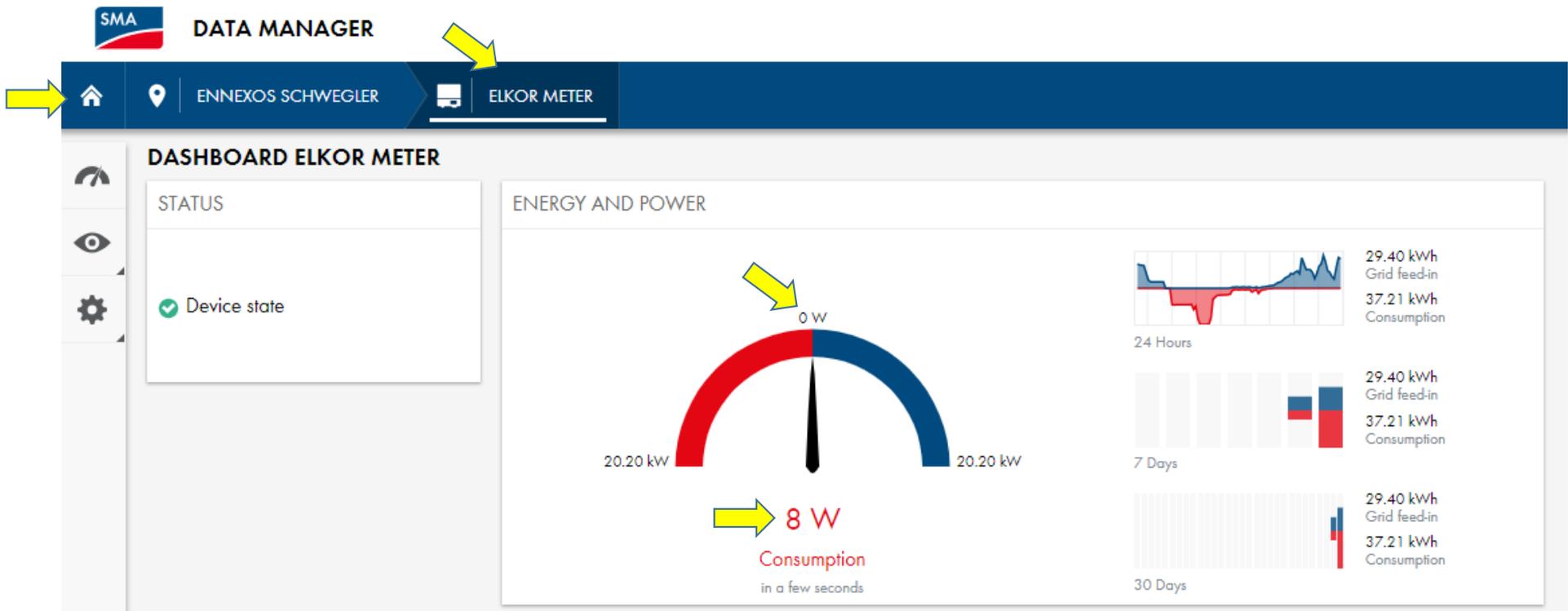
- Click Home, Monitoring, Instantaneous Values
- Scroll to the bottom 'Active power limitation set value' shows the real time target for the PV plant (1.391% of 14kW = ~194Watts PV target set value, which is the total amount of loads)

The screenshot shows the EnnexOS Schwegler monitoring interface. The top navigation bar includes a home icon, a location pin, and the text 'ENNEXOS SCHWEGLER'. Below this is a 'MONITORING' section with a sun icon. The main content area shows the 'ennexOS Schwegler PV system' with a location pin icon. The left sidebar contains several menu items: 'Energy and power - PV', 'Instantaneous values' (highlighted with a yellow arrow), and 'Event monitor'. The main content area displays a table with the following data:

System and device control	Active power limitation set value	1.391 %	Measurement.Inverter.Cur WCfINom
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Yellow arrows point to the home icon, the eye icon in the sidebar, the 'Instantaneous values' menu item, and the '1.391 %' value in the table.

EDMM with small loads and throttling PV to close to 0%



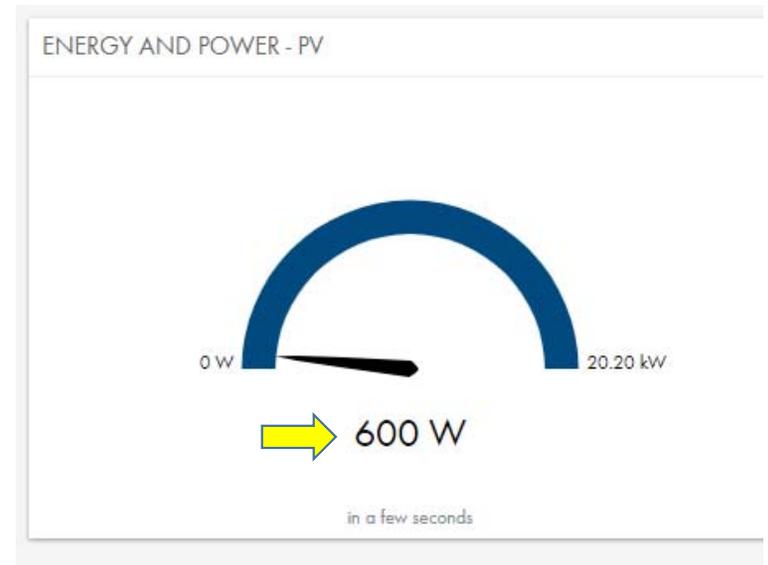
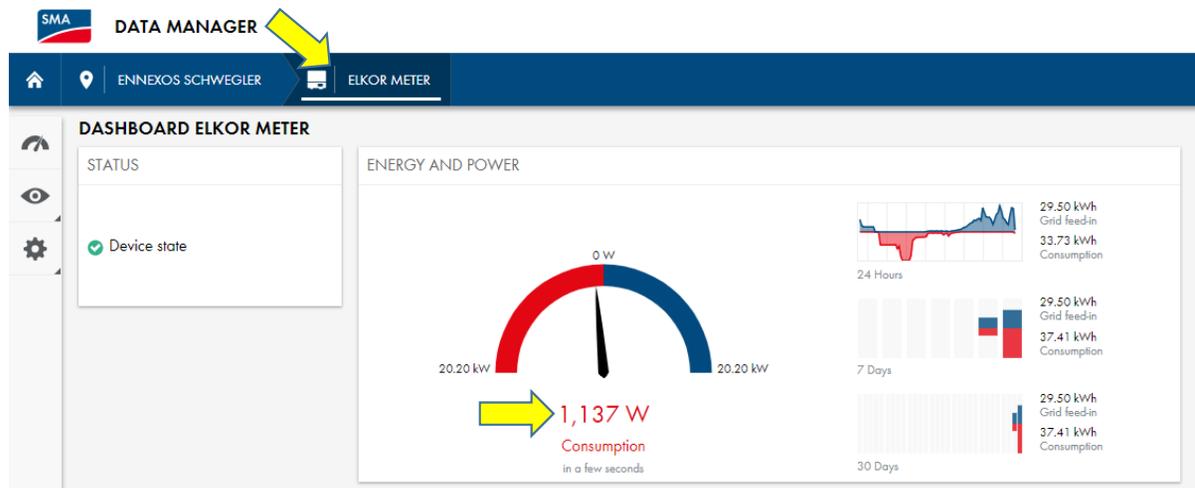
Viewing inverters curtailed power output

- Click 'Select Device' for list of inverters in PV plant
- Visually verify that each inverter is responding to curtailment commands
- Measurements are constantly changing, but these values are very close to previous measurement of 1.391%/194W (41+49+18 =108W)

Status	Device name ↑	Serial number	Current PV power [W]
✓	Com Gateway SN: 1901500616	1901500616	-
✓	Elkor Meter		-
✓	ennexOS Schwegler	3001354652	-
✓	SB5.0-1SP-US-40 232	1990003232	41.00
✓	SBS6.0-US-10 506	3002771506	-
✓	SI4548UM SN:1260032256	1260032256	-
✓	SN: 1913000071	1913000071	49.00
✓	SN: 1913130069	1913130069	18.00

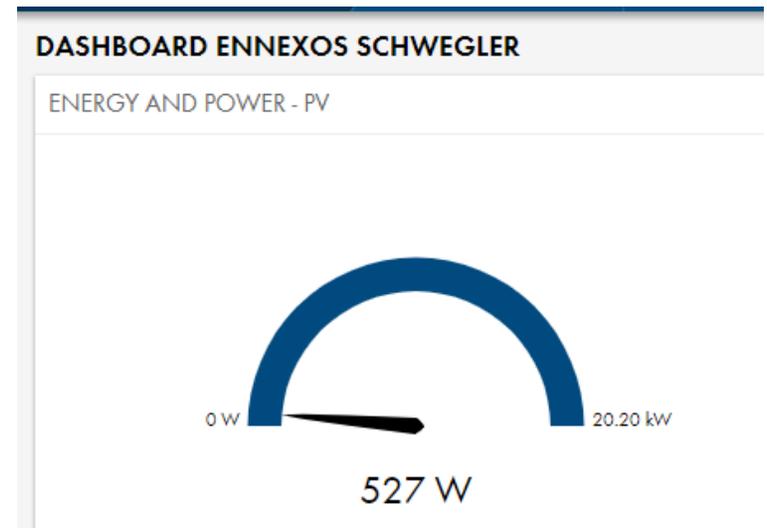
Comparing PV production to Elkor CT measurements

- Select Device, click Elkor Meter
- Elkor Dashboard shows net energy flow at CT measurements
- Loads are greater than PV production (1,137W from grid + 600W from PV = 1737W total Loads)
- Next slide will show reducing the loads to below 600W, and PV's response



Now PV production is making exactly as much to meet the loads

- Loads reduced to about 550Watts
- PV production is 527W, 23W coming from Grid

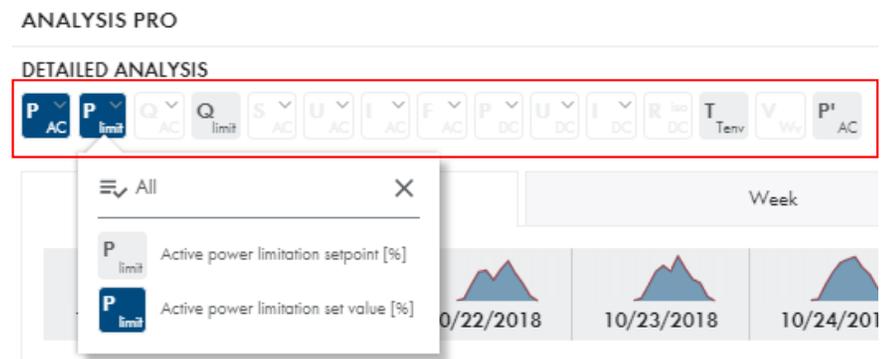
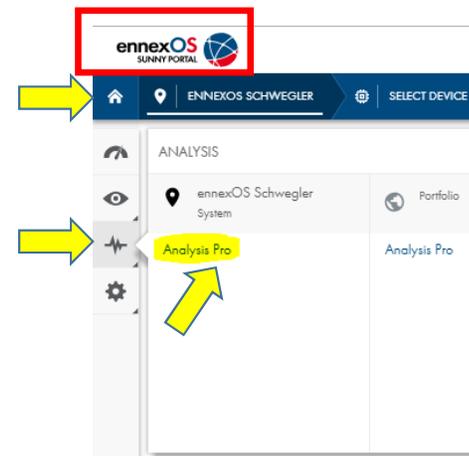


- Elkor webUI shows 43W power at CT's, essentially no power flow in/out so PV is meeting all building loads
- Again measurements change too fast to screen capture all values simultaneously

REAL-TIME PARAMETERS						
	V (L-N)	A	kW	kVAR	kVA	PF
Phase A	121.1	2.708	0.016	0.295	0.321	-0.010
Phase B	121.8	2.997	0.027	0.300	0.324	0.021
Phase C	0.0	0.000	0.000	0.000	0.000	1.000
Average / Total	81.0	1.902	0.043	0.595	0.645	0.006
Frequency				59.96		

ennexOS Sunny Portal Analysis view

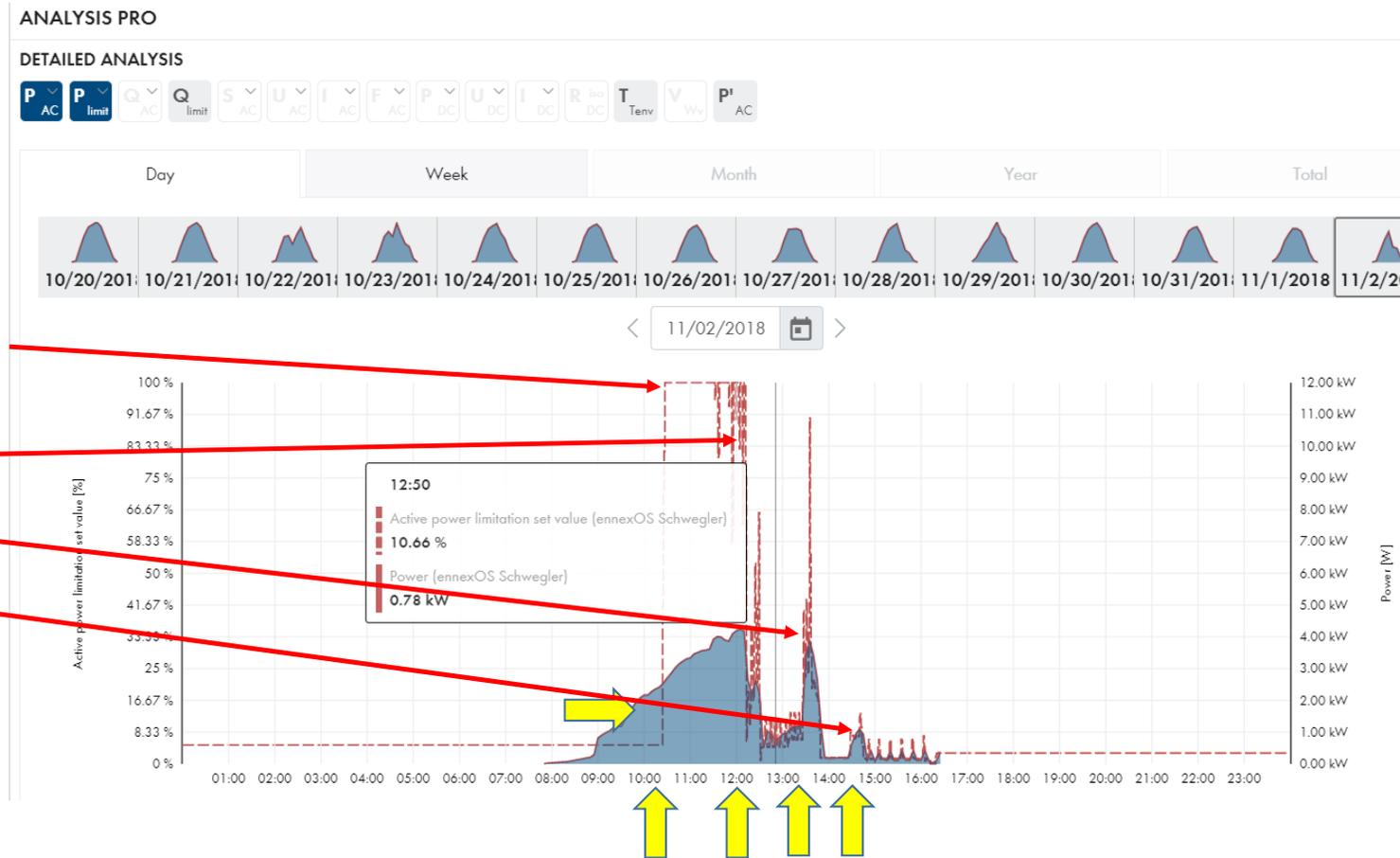
- Log into <https://ennexOS.sunnyportal.com>
 - Notice the ennexOS Sunny Portal logo in the top left, this is different than Data Manager interface, but the layouts are similar
- Click Analysis, Analysis Pro
- Under 'Detailed Analysis' section atop the graphs, click on desired channels/data button to show the information on the daily graph
 - (P_{AC}) Total plant PV Power is selected by default
 - (P_{limit}) Active power limitation set value [%] shows target % during the day
 - This will change with loads and needs
- See next page for Graphics



Summary: In ennexOS Sunny Portal (with EDMM, Elkor and CTs) – Shows home with SolarPV and Zero Export functions setup

When PV power exceeds Home's electric loads, EDMM 'throttles' down the PV inverters.

- **Blue** Area is PV production,
- **Red** dashed line is the Elkor/EDMM target set value (zero export settings were configured about 10:30am)
- Target varies throughout the day with changing loads
- Between 9 and 12, morning loads were greater than PV production, so EDMM was not limiting PV (hence 100% target)
- At 12:00pm, loads dropped drastically, so did Target and PV production
- At 1:30pm, a few large loads (~3kW) were turned
- At 2:45pm, a 1kW load was turned on, and the EDMM allowed the inverter to 'power up' to meet load, then 'power down' after load was removed



Thank you for choosing SMA!