TKS CONNECT
MANUAL V5.2

TKS Solar Engineering

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Contents

Introduction

1. TKS Connect

TKS Connect is an advanced Energy Management Software (EMS) designed to streamline energy monitoring, control, and optimization for businesses and energy facilities. With a focus on efficiency and sustainability, TKS Connect integrates seamlessly with PCS and BMS systems to provide a comprehensive solution for energy management needs.

2. What is an Energy Management Software (EMS)?

An Energy Management Software (EMS) is a digital tool designed to monitor, analyse, and optimize energy usage across systems or facilities. It acts as the central platform for managing energy flow, ensuring that resources are utilized efficiently while minimizing waste and operational costs.
An EMS collects real-time data from energy-producing and energy-consuming devices, processes it, and provides actionable insights to decision-makers. Modern EMS solutions also include predictive analytics, automation, and remote control capabilities to enhance energy reliability and sustainability.

3. What Does an EMS Do?

3.1 Real-Time Monitoring
EMS software constantly monitors energy flow across systems and devices. It provides live data on energy production, consumption, and storage, allowing users to track usage patterns and identify inefficiencies instantly.

3.2 Data Analytics
By analysing historical and real-time data, an EMS identifies trends, predicts future energy needs, and detects anomalies such as equipment faults or unexpected energy surges. This helps in making data-driven decisions to optimize performance.

3.3 Energy Optimization
An EMS suggests or implements strategies to improve energy efficiency. For example, it can schedule energy-intensive tasks during off-peak hours or switch between power sources based on demand and cost.

3.4 Load Management
It ensures that the energy load is balanced across all devices, avoiding overloads and ensuring system reliability. This is especially important in facilities with variable energy demands or renewable energy sources.

3.5 Integration with Renewable Energy
Many EMS platforms, including TKS Connect, integrate renewable energy sources like solar panels, wind turbines, and battery storage systems. This helps maximize the use of clean energy and reduce dependency on fossil fuels.

3.6 Cost Savings
By minimizing waste and optimizing energy use, an EMS reduces energy costs significantly. It also provides insights into utility billing structures, helping users take advantage of peak and off-peak rates.

3.7 Remote Management and Control
EMS platforms often include remote access capabilities, enabling users to monitor and control systems from anywhere. This is particularly useful for managing distributed energy resources or multi-location facilities.

3.8 Compliance and Reporting
Many EMS systems help organizations meet energy compliance standards by tracking carbon footprints, generating reports, and providing recommendations for sustainability initiatives.

4. How TKS Connect EMS Stands Out

TKS Connect EMS takes these core features to the next level by offering:

- Seamless Integration: Compatible with Sinexcel PCS and SYL & Pylontech BMS systems, ensuring smooth communication between hardware and software.
- User-Friendly Interface: An intuitive dashboard that simplifies complex energy management processes.
- Advanced Analytics: Includes machine learning algorithms for more accurate predictions and optimizations.
- Scalability: Suitable for small setups to large, multi-location facilities.
- Reliability: High uptime and robust performance, even in demanding industrial environments.
- Customizability: Tailored solutions to meet specific operational needs and energy goals.

5. Conclusion

An Energy Management Software like TKS Connect is an indispensable tool for modern businesses aiming to enhance energy efficiency, reduce costs, and support sustainability. By providing deep insights and automating energy-related decisions, TKS Connect EMS empowers users to take control of their energy systems and achieve optimal performance.

Initial Setup

To setup the environment for TKS Connect EMS.

1. Download TKS Connect EMS

1. Download the TKS Connect EMS Software:
   - www.tksenergy.co.za
   - Downloads Page
2. The EMS software should be downloaded to the computers Download folder as a ZIP folder.
3. Extract the ZIP folder to a desired location.
   - (Documents folder recommended).
4. Delete the ZIP folder.

2. Download TKS Connect WatchDog

1. Download the TKS Connect WatchDog Software:
   - www.tksenergy.co.za
   - Downloads Page
2. The WatchDog software should be downloaded to the computers Downloads folder as a ZIP folder.
3. Extract the ZIP folder to a desired location.
   - (Documents folder recommended).
4. Delete the ZIP folder.

3. General navigation to EXE

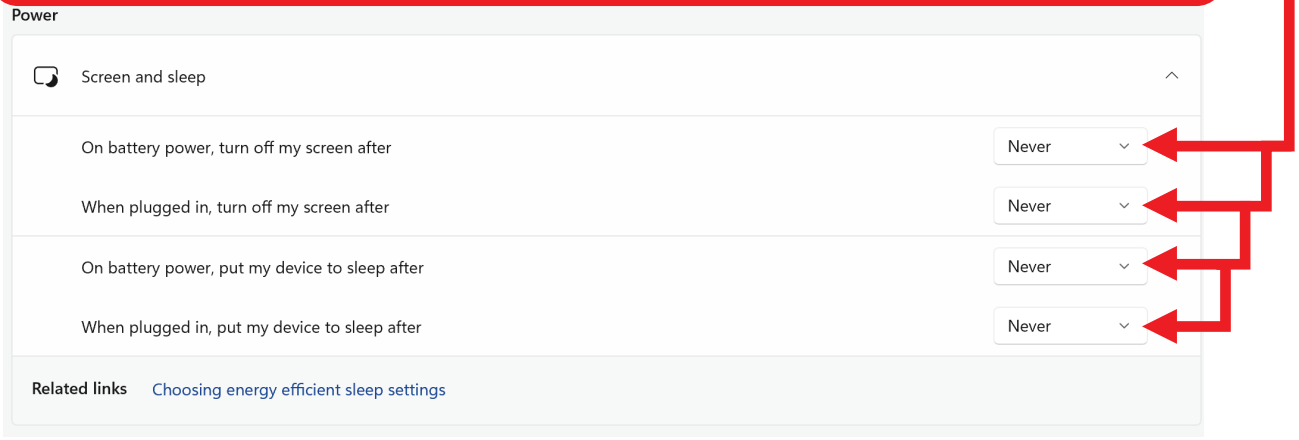
1. Open the folder of the software.
2. Once opened, open the folder again that holds the same name.
3. Open the next folder that shares a TKS name.
4. Open the “Bin” folder.
5. Open the “Debug” folder.
6. Navigate down the page until you find the application with an .exe extension.

4. Set the environmental variables

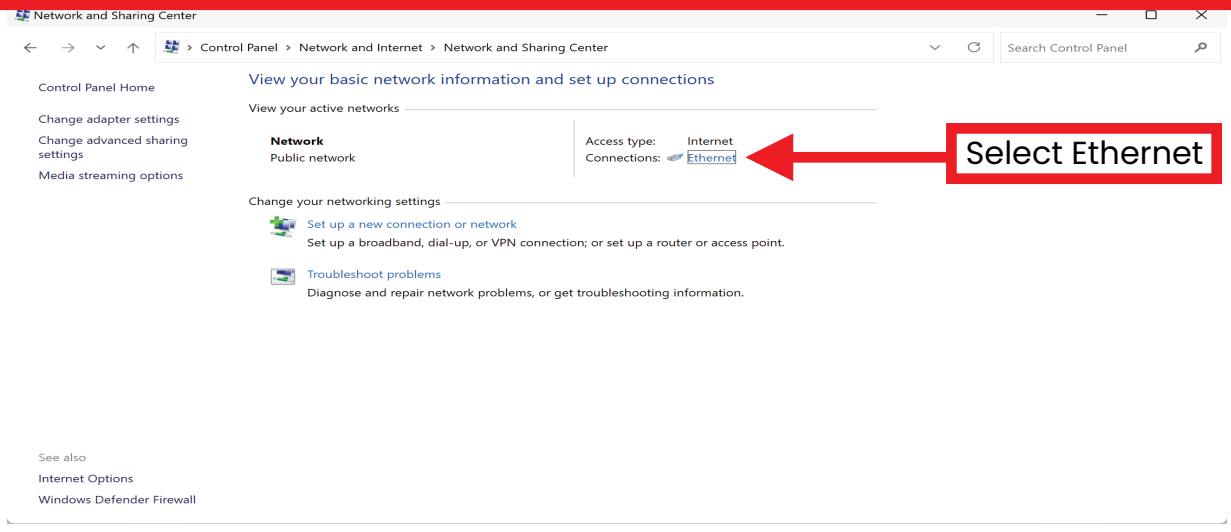
1. Remove notifications and updates from the computer
2. Set sleep timer to “Never” & “Best Performance”.
3. Set the static IP address of the computer and the gateway.
   a. (If possible, use the site current network for easier integration or use a double network)
   b. A double network will be set the same, with different IP addresses and gateways.
4. Turn Off Updates.

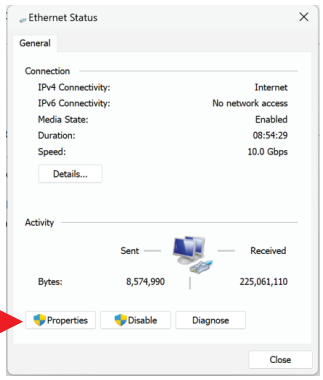
Settings -> System -> Notifications -> Notifications Off

Settings -> System -> Power & Battery -> Screen & Sleep

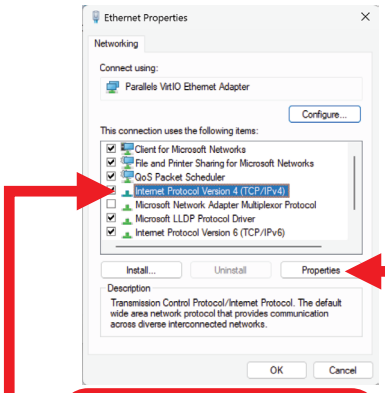


Control Panel -> Network & Internet -> Network & Sharing Center -> Ethernet



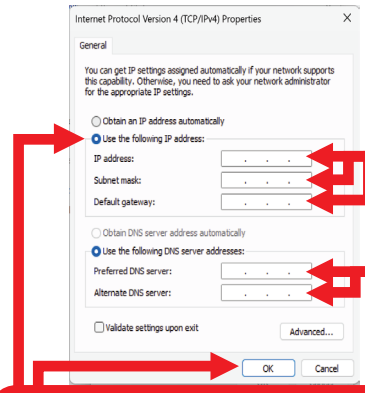


Select the Properties Tab



Click on Internet Protocol Version 4 (TCP/IPv4)

Click on Properties Tab

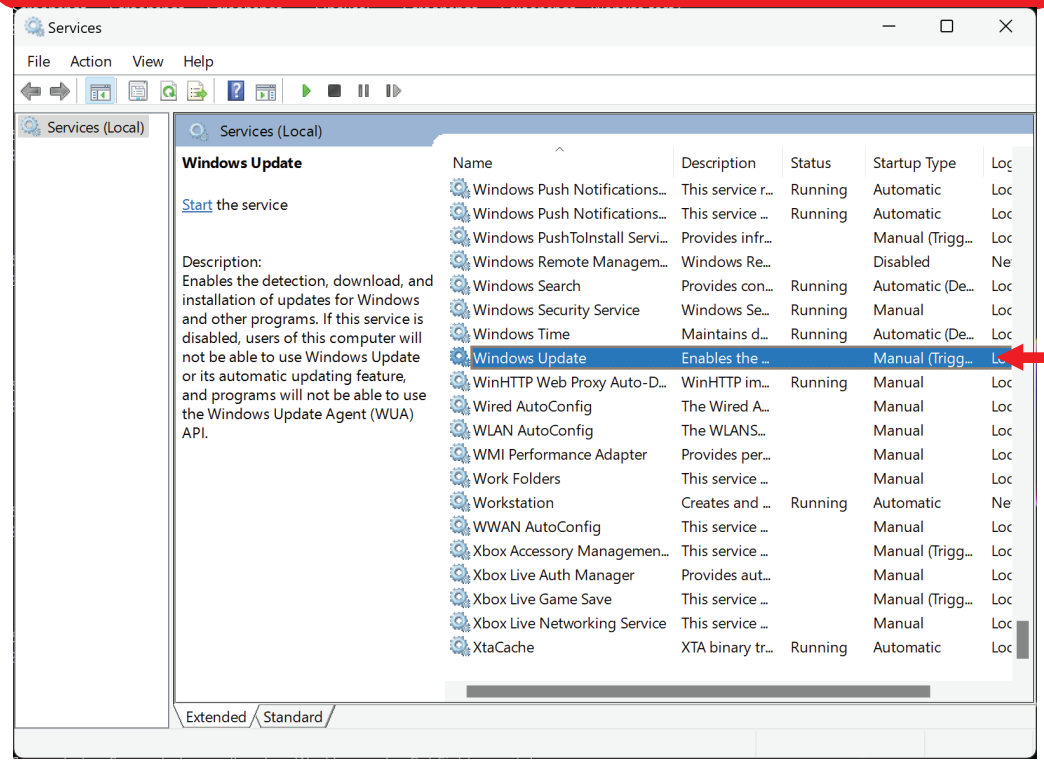


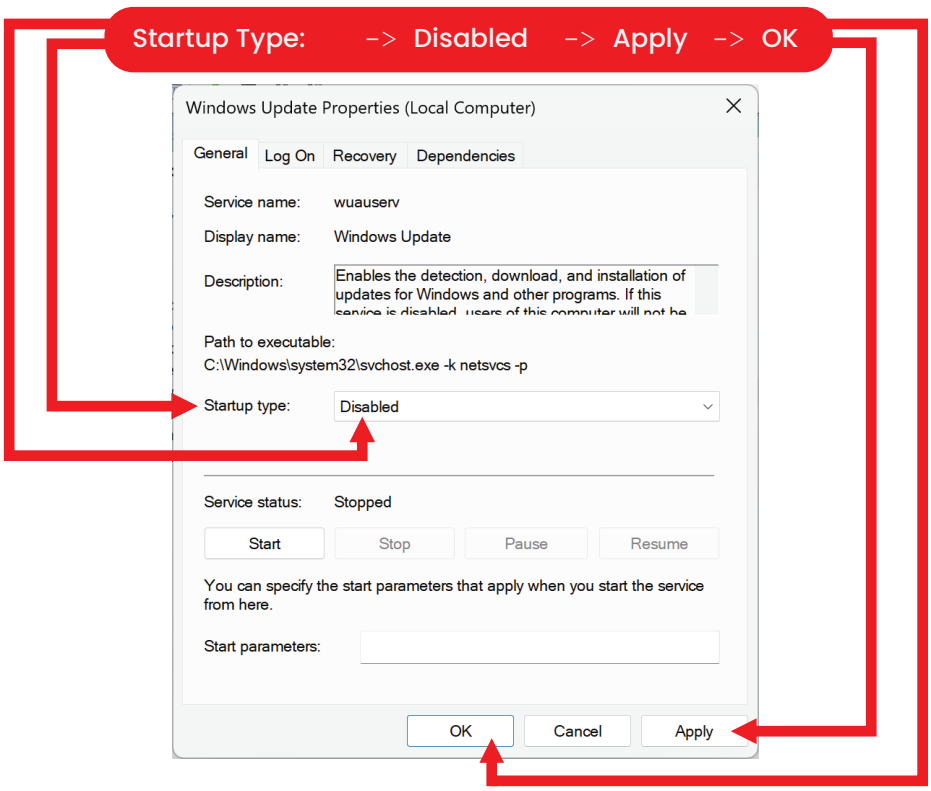
Choose:
Use the following IP address:

Specify the required IP address, Subnet mask, Default Gateway and DNS

Press OK after completed.

Services -> Windows Update -> Properties





WatchDog

After the Environmental Variables have been set, the software can be launched. TKS Connect EMS should be setup and launched first before starting TKS Connect Watchdog!

TKS Connect Watchdog is a light-weight application that monitors the performance and health of the EMS. If the EMS were to have any performance issues or health decreased, the WatchDog application will assist the EMS and keep it running at optimal levels.

After TKS Connect EMS has been launched and setup completed, TKS Connect WatchDog can be launched.
TKS Connect WatchDog requires a single setup.

1. Create a shortcut of TKS Connect EMS and store the shortcut in a safe location.
2. Open TKS Connect WatchDog.
3. Click on the “Browse” button.
4. Navigate the directories to that shortcut created and select it.
5. After about 30 seconds, the WatchDog should start displaying information about the EMS running.
6. You are done and WatchDog will take it from there.

Initial Start-up

With the first-time start-up of the TKS Connect EMS, it must be verified by the TKS Connect Control Room.
This ensures the integrity and legitimacy of the EMS.

The initial start-up of the EMS requires an active internet connection for verification. Once verification is complete, an active internet connection will no longer be necessary for the EMS setup.

On the verification page:

1. Provide your name.
2. Enter the site name where the EMS will be active.
3. Provide a contact number to receive the verification code.
4. After entering the required information, press the “Request Verification” option.

A verification request will be sent to the Control Room, where it will be validated. The verification code will then be received from the EMS and shared with the applicable user who requested the code.

Once the code is received, enter it in the “Verification Code” field.

Click the “Verify” option.

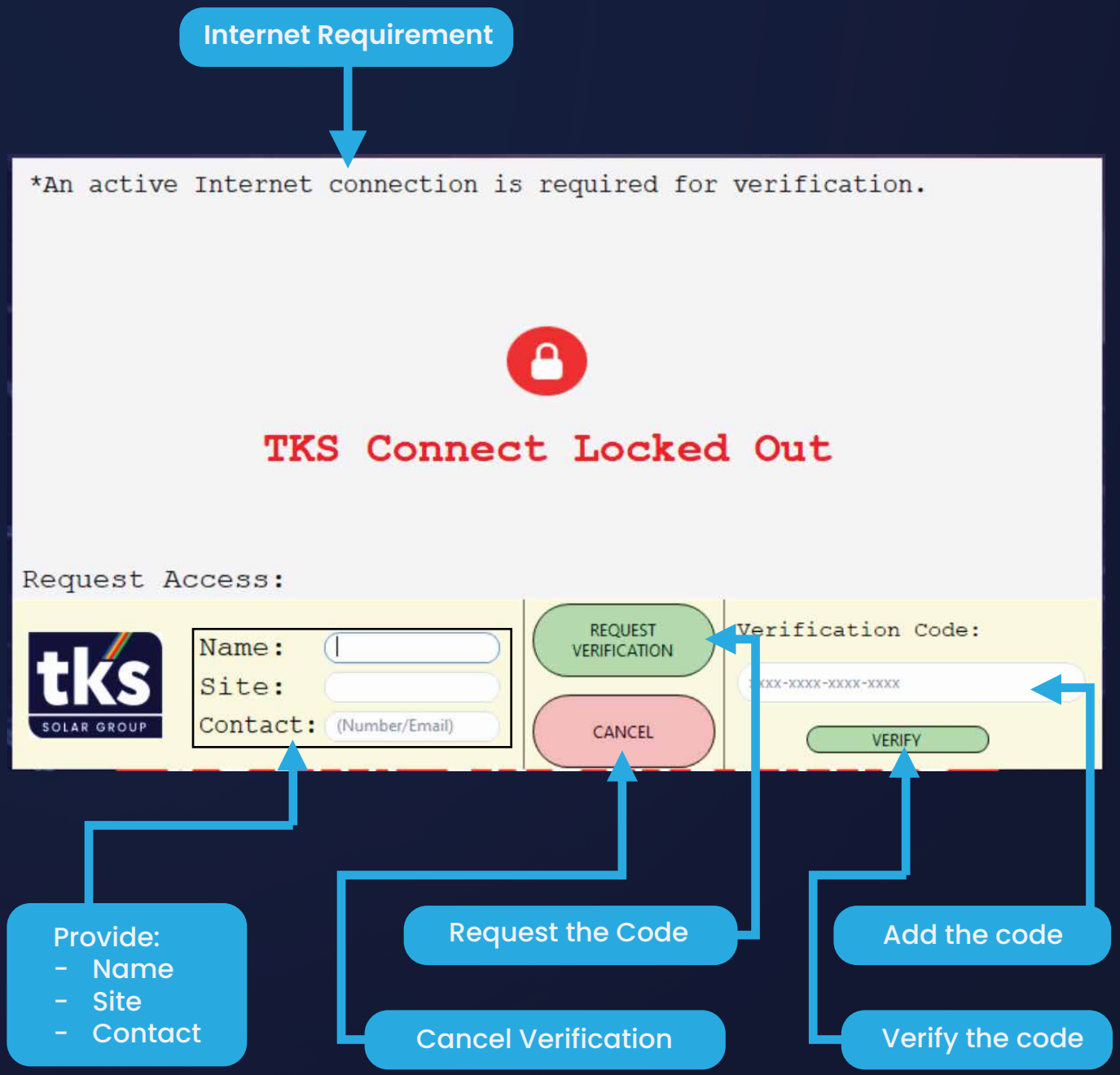
If the code is valid, the TKS Connect EMS will reboot and start.

After the EMS has booted, it will prompt the user to “Bind” the EMS.

The EMS must be bound to an allocated space on the system to function correctly:

1. Log in to the EMS and go to the Settings page.
2. In the “Basic” settings tab, there will be an option on the right-hand side: “Bind TKS Connect.”
3. Click on “Bind TKS Connect.”
4. The TKS Connect EMS will now be bound and will no longer request any verifications.

Verification Page :



TKS Connect Dashboard

1.1 Displays
The dashboard serves as the landing page of the EMS, displaying basic necessary information and errors.

1.2 Grid
The grid usage is shown in kW and kVA as real-time readings. This reading represents the facility's current usage from the mains.

1.3 Load
The load usage is shown in kW as a real-time reading. The load is the total power usage of the facility. The load will mostly remain stable as it is not affected by incoming PV power or outgoing PV power, whereas the grid usage will be affected. As PV power increases, grid usage will decrease, but the load usage will remain the same, as the facility's total usage has not changed. The difference between grid usage and load usage represents the facility's savings amount.

1.4 Solar
The solar usage is shown in kW as a real-time reading. This reading indicates the output power from the PV Grid-Tie inverters.

1.5 PCS
The PCS usage is shown in kW as a real-time reading. The PCS reading provides information on the usage of the PCS and its current activity.

- If the reading displays 0 kW, the PCS is on standby and is not using or providing power.
- If the reading displays a positive value greater than 0 (e.g. 20 kW), it means the PCS is currently using power received either from the grid or PV. This indicates that the PCS is charging with 20 kW of power.
- If the reading displays a negative value less than 0 (e.g. -20 kW), it means the PCS is discharging power from the batteries and providing power from the PCS system to the facility.

1.6 BMS
The BMS reading, shown as SOC (State of Charge), displays the current battery percentage. For example:

- 100%: Batteries are full.
- 10%: Batteries are low and need to be charged.

1.7 Generator
The dashboard displays the generator usage in real-time. If a diesel generator is integrated with the system, it will show the generator's output power in kW.

The status of the generator is displayed below the kW reading:

- Gen Disconnected: No generator is integrated into the system.
- Gen Connected: The generator is integrated into the system.
- Gen On: The generator is currently running.
- Gen Off: The generator is currently off.

1.8 Power Flow
The power flow lines between all components are displayed in either red or green, connecting all components to the central load. The colors indicate the status of the connected component:

- Red: The component is inactive or on standby.
- Green: The component is active and contributing to the central load.

Example:

- If the PCS is on standby and not performing any task (e.g., 0 kW output power), the power flow line connected to the PCS will turn red, indicating that the PCS is not currently contributing to the central load.
- If the PCS is performing a task (e.g., 20 kW or -20 kW for charging or discharging), the connected power flow line will turn green, indicating that the PCS is actively contributing to the central load.

1.9 Monitoring
As part of the EMS setup, a monitoring profile will be created for remote monitoring of the system. The monitoring status is indicated as follows:

- If the monitoring profile is not logged in, "TKS Connect" will appear at the top of the central load icon.
- If the monitoring profile is logged in, the facility name will appear at the top of the central load icon, displaying your personalized facility name.

1.10 Errors
If the EMS encounters any errors, they will be displayed at the bottom of the EMS dashboard.

Error codes include:

1.10.1 Power Meter Error
A Power Meter Error occurs if there is a communication problem with the external power meters that measure the Grid, Load, Gen, or PV usage.

1.10.2 SyncNode Controller not Connected
The SyncNode Controller is only applicable to BESS (Battery Storage) sites. It is an ATS (Automatic Transfer Switch) designed and manufactured by TKS, which integrates with the EMS for automatic transfer between the main supply (Grid-Tied) and off-grid modes with the PCS.

This error indicates that the SyncNode Controller is not connected or that a connection error with the EMS has occurred, preventing the use of the SyncNode Controller's functionality.

1.10.3 No PCS Type Specified

This error is also only applicable to BESS (Battery Storage) sites. The error indicates that a PCS model has not been configured within the EMS, which will hinder the EMS from communicating with the PCS. The PCS model must be selected from the list of available PCS models.

1.11 EMS Operations

The EMS displays operations at the top of the dashboard.

1.11.1 PCS Status

Applicable to BESS (Battery Storage) sites, the EMS will show the status of the PCS at the top left of the dashboard.

- PCS ON: The PCS is running.
- PCS OFF: The PCS is not running.

1.11.2 System Run

The System Run displays whether the system is running or has a fault:

- System Run: The system is running without faults.
- System Fault: There are errors in the system, and the system will be turned off until the errors are resolved.

1.11.3 System Mode

The System Mode displays which mode the system is running in.

- Grid-Tied: The system is currently in Grid-Tied mode, meaning the system uses the mains supply as the primary power source.
- Off-Grid: The system is currently in Off-Grid mode, meaning the system does not use the mains supply and instead uses PV and batteries as the primary power source.

1.12 Dashboard Navigation

The dashboard navigation panel can be found at the top centre of the dashboard, and is used to navigate between the different viewing dashboards.

Options:

- Dashboard
- Status
- Throttle
- PCS
- BMS
- Power Meters

You can select any of these options to display its given contents and information.

1.12.1 Dashboard
Displays the main dashboard.

1.12.2 Status
Displays the status page of the system.

The status page includes additional information about the system that is not displayed on the dashboard. This information mainly provides more insight into the system's running status and operations.

1.12.3 Throttle
Displays the throttle page of the system.

The throttle page provides insight into how much of the PV power is being throttled to avoid PV grid export. This page can assist in analyzing system performance regarding throttling and can be used to optimize the system to achieve the most efficient output power from the PV generated.

Please see the Throttle section for detailed explanations and uses of throttling.

1.12.4 PCS
Displays the PCS page information, offering more insight into the PCS readings and values.

1.12.5 BMS
Displays the BMS page information, providing more insight into the BMS readings and values.

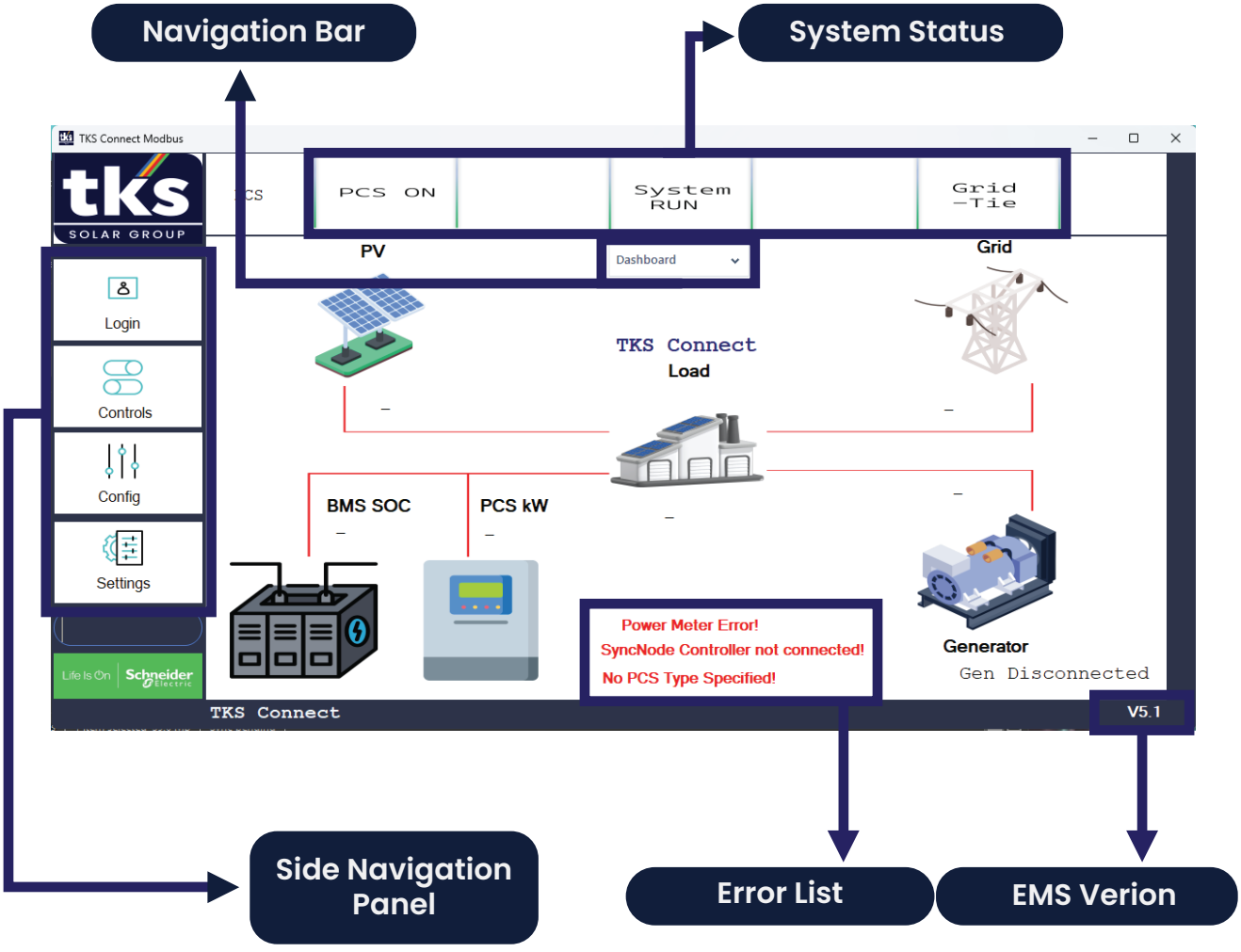
1.12.6 Power Meter
Displays the Power Meter page information, offering more insight into the external connected meters for the Grid, Load, Generator, and PV usage.

1.12.7 LoRa Network
Displays the LoRa Network and LoRa controls if the network has been enabled in settings. Once enabled, it will show the total LoRa load on the EMS dashboard.

1.12.8 TKS Hydrogen
TKS is proud to announce our new hydrogen integration with our BESS sites. TKS Hydrogen will be available soon!

1.12.9 Data Export
The Data Export page can be used to retrieve offline data compiled by the EMS. You can export data from the EMS for a more in-depth data analysis. This page only allows for data export and not for data viewing. The exported file will include all requested information.

1.13 The Dashboard



EMS Login :

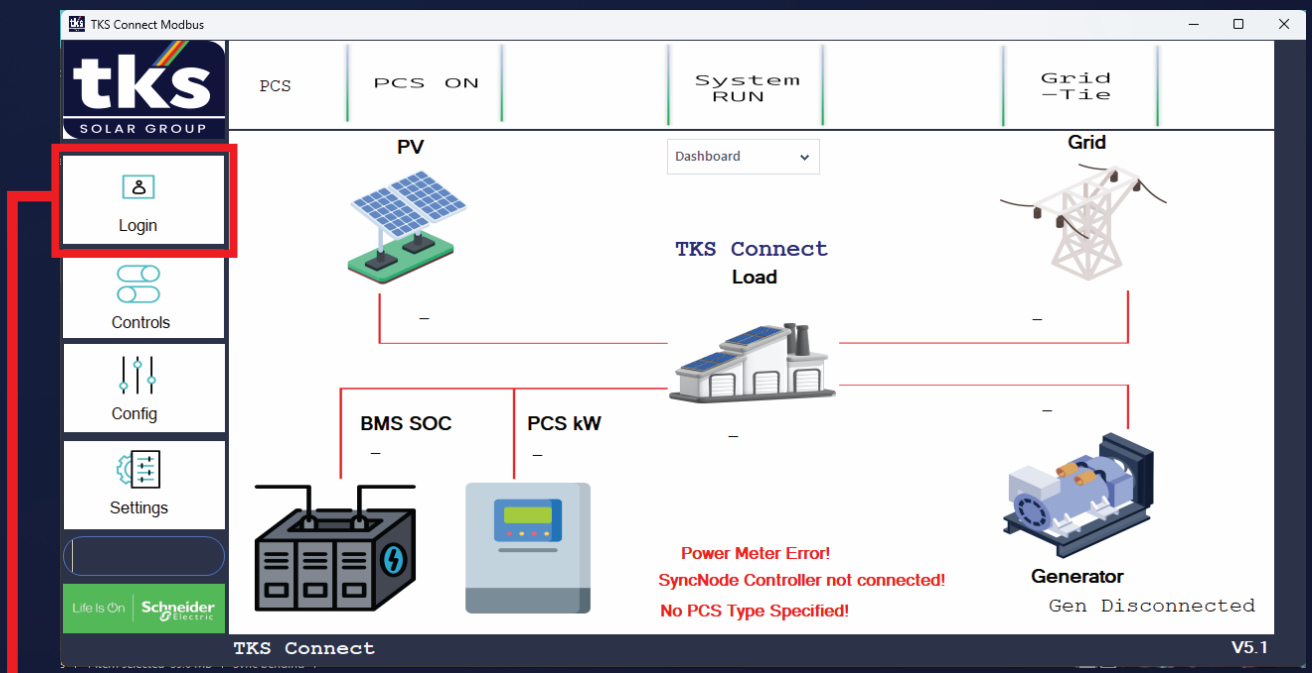
1. Login Functionality

At the top left of the side panel, below the TKS Logo, you will see an option for “Login”.

Once clicked, you will be greeted by a login page with credentials:

Password: 1123

When logged into the system, you will have access to various settings and configurations to optimise your system for the best possible power efficiency.



Select Login form the side panel.

EMS Controls

1. Controls of System

In the side panel, you will see the option “Controls.”

The Controls page allows you to take manual control of basic system functions, such as:

- PCS Start
- PCS Stop
- Grid-Tied
- Off-Grid
- BMS Start
- BMS Stop
- Remote
- Local Manual
- Grid ON
- Grid OFF

1.1 PCS Start

PCS Start will turn on the PCS. This will not start charging or discharging the PCS, it will only turn it on. For the PCS to follow instructions, these need to be provided after it has been turned on.

1.2 PCS Stop

PCS Stop will turn off the PCS, and all instructions to the PCS (whether to charge or discharge) will also stop.

1.3 Grid-Tied

Grid-Tied will change the PCS mode to Grid-Tied, meaning it will rely on a mains supply to function and receive instructions. This does not change the ATS state to Grid-Tied; it only affects the PCS.

1.4 Off-Grid

Off-Grid will change the PCS mode to Off-Grid, meaning it will no longer rely on a mains supply, and will instead rely solely on batteries and PV to function. This does not change the ATS state to Off-Grid; it only affects the PCS.

1.5 BMS Start

BMS Start will turn on the BMS (Battery Management System) – High Voltage Box, which will activate all batteries to supply or receive power.

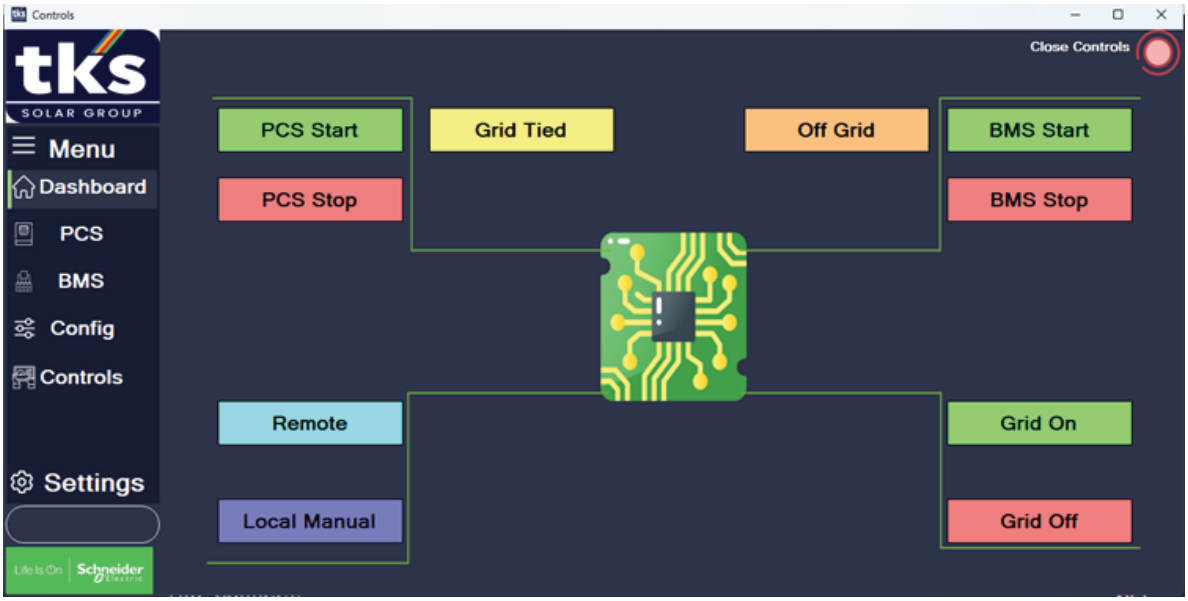
1.6 BMS Stop
BMS Stop will turn off the BMS, which will stop all incoming and outgoing power from the batteries.

1.7 Remote
Remote will set the EMS to Auto mode, allowing the EMS to manage the entire energy system automatically.

1.8 Local Manual
Local Manual will set the EMS to Manual mode, disabling the Auto functionality. The EMS will no longer be able to control the energy system, and all operations must be performed manually by the user.

1.9 Grid ON
Grid ON sets the ATS to Grid-Tied mode, allowing the Mains Supply to provide output power.

1.10 Grid OFF
Grid OFF sets the ATS to Off-Grid mode, turning off the Mains Supply. This means the facility will no longer receive power from the Mains Supply and will rely on the PCS system to provide power from the Batteries and PV. The PCS must be in Off-Grid mode and turned on to supply power when the ATS is set to Off-Grid.



Config

Config Introduction:

In the middle of the side panel, you will find the option for "Config."

This page requires authentication to access its contents.

The Config page is used to change certain parameters and operations of the EMS to optimize its functionality for the best possible energy outcomes and savings.

Within the Config page, you will find the following options in the left-side panel:

- Tactics
- Charging
- Throttling
- Dispatching

1. Tactics

The Tactics page is used to set the system to perform specific actions at designated times in order to achieve savings and optimize the use of the energy system through the EMS.

1.1 Enable Tactics

The Enable Tactics toggle switch is used to activate the Tactics feature. This option pairs with the “Set Tactics” option at the top left of the page.

1.2 Enable on Weekends

The Enable on Weekends toggle switch allows tactics to run on weekends. When this feature is off, tactics will only run during the weekdays (Monday to Friday). This option pairs with the “Set Tactics” option at the top left of the page.

1.3 Off-Grid Mode Enable

The Off-Grid Mode Enable toggle switch enables the off-grid mode feature. This feature allows you to schedule certain times during the day for the system to run off-grid, turning off the Mains Supply and using Batteries and PV as the primary energy sources.
This option is paired with the Off-Grid Mode tab at the bottom right of the page.

1.4 Immediate Off-Grid

The Immediate Off-Grid toggle switch enables the system to enter Off-Grid mode immediately, turning off the Mains Supply and prioritizing the use of Batteries and PV. The system will remain in the Off-Grid state until the user disables this feature or until the batteries are depleted and require charging from either a diesel generator or the Mains Supply.

2. Set Tactics

The Set Tactics option at the top right of the page allows the user to select times when the system should perform charging or discharging tasks.
The tactics allows for four different time slots.

Example:

Tactics Timer 1:

This is the first timer to set the desired system outcome.

- Enable Tactics:
  - Click the toggle switch "Enable Tactics" to its on position.
- Weekends Enable:
  - Click the toggle switch "Weekends Enable" if the tactics should run during weekends.
- Start Time:
  - Enter the start time in format: 07:00
- End Time:
  - Enter the end time in format: 15:00
- Rate:
  - Enter the rate in kW in format: 20
  - OR:
  - Enter the rate in kW in format: -20
- Save Tactics:
  - Click on the button with the option "Save Tactics"
- Reboot:
  - Click on the red "Reboot" at the bottom right of the page for all changes to take effect.

After completion of the above steps, the system will perform one tactic during the time 07:00 until 15:00. The system will charge at 20kW if the rate was set to 20, or the system will discharge at 20kW if the rate was set to -20 until 15:00.

More tactics can be added, maximum four tactics, and should be set in an ascending order.
Example:

Tactics 1: 07:00 till 11:00
Tactics 2: 12:15 till 13:15
Tactics 3: 13:15 till 16:00
Tactics 4: 20:00 till 23:00

3. Off-Grid Mode

The Off-Grid Mode option, located at the bottom left of the page, allows you to set the system to an off-grid state for a specified time every day.

Off-Grid Mode Enable
Click the toggle button for "Off-Grid Mode Enable" to turn it on.

In the Off-Grid Mode panel:

- Start Time:
  Enter the start time in the format: 06:00.

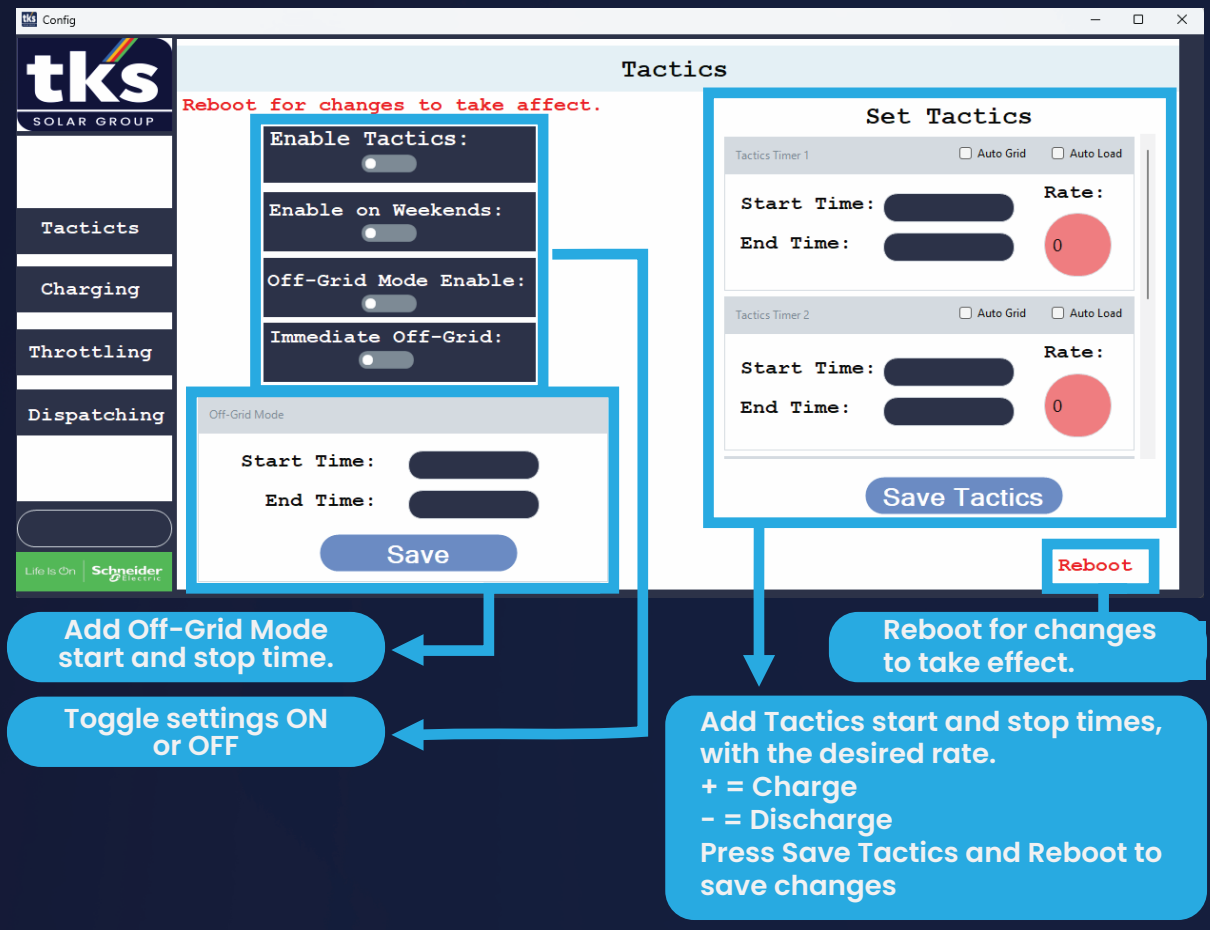
- Stop Time:
  Enter the stop time in the format: 18:00.

- Save:
  Click the “Save” button at the bottom.

- Reboot:
  Click the red "Reboot" option at the bottom right for changes to take effect.

The system will now automatically switch the ATS and PCS to Off-Grid mode every day from 06:00 until 18:00. During this time, the system will run in Off-Grid mode, turning off the Mains Supply and prioritizing the Batteries and PV as the main power sources. After the end time (18:00), or if the batteries are depleted and require charging, the system will revert to Grid-Tied mode and use the Mains Supply.

4. Tactics Demonstration



Charging

Charge Configurations

The charging configurations can be set to optimise the charging of the batteries to ensure a safe charge rate for both the system as well as the Mains Supply.

With the charging optimised, it will allow the system to be utilised to ensure charging is used in such a manner to ensure energy savings.

1. **Auto Charge Enable**
   Enable this setting, to have the system to always be in a charging state if the batteries SOC (%) levels are not full.

2. **Bulk Charge Rate**
   Set the rate (kW) of the charge speed. Ensure that the charge rate does not exceed that of the system or the Mains Supply, or the system, Mains Supply will trip.

   *The higher the rate, the faster the batteries will charge, but will also shorten the lifespan of the batteries. It is advisable to have a medium charge rate to ensure the longevity of the batteries lifespan.

3. **EOC (%)**
   This setting can be set to change to stop the charging at a given SOC %. If set to 80, the system will stop charging at 80% battery capacity.

4. **Force Charge (%)**
   The Force Charge setting will set the system to start with a force charge once it reaches the force charge SOC % parameter. If set to 10, the system will initiate a force charge at 10%. Force charging is there to ensure the system does not trip due to batteries that are fully depleted. Once batteries are fully depleted, it will require a manual reset on site to recover the batteries.

5. **Force Charge Rate (kW)**
   This will set the rate at which the system will charge during the force charge period. A lower rate is advisable to ensure the system will recover from force charge and low SOC % successfully.

6. **Float Charge %**
   Set when the float charging should start at the given SOC % of the batteries.
   Example:
   Float Charge %: 90
   Float charging will start at 90% and bulk charge will stop.

7. Float Rate

Set the rate (kW) for the float charge.
Example:

Float Charge %: 90
Float Rate: 5
The system will enter float charge mode at 90% with a charge rate of 5 kW.

8. Grid Protection

Grid Protection is used to stop the system from charging if the grid output reaches a certain kW level, ensuring that grid peaks do not exceed safe limits.

To enable this feature, click the toggle button to turn it ON.

8.1 Grid Threshold

Set the grid threshold to define the peak at which the system should stop charging.

Example:

Grid Threshold: 80
Output:
Once the grid output reaches 80 kW, the system will stop charging.

8.2 Grid Recovery

Set the grid recovery value to allow the system to resume charging.

Example:

Grid Threshold: 80
Grid Recovery: 40
Output:
If the grid output reaches 80 kW, the system will stop charging.
Once the grid output drops to 40 kW or below, the system will begin its charging sequence and continue charging while staying below the Grid Threshold value.

9. Load Protection

Load Protection functions similarly to Grid Protection but uses the load output instead of the grid output.

Follow the same configuration steps as for Grid Protection.

It is not advisable to use both Grid and Load Protection simultaneously, as this may hinder the system's ability to charge effectively.

10. Peak Shaving

Peak Shaving assists the mains supply when high loads are reached. If the load output exceeds a specified value, Peak Shaving will activate, reducing a portion of the mains power, assisted by the PCS system.

This feature helps manage peak demands.

To enable the feature, click the toggle switch to turn it ON.

10.1 Peak Shaving Start

Enter the value for when peak shaving should start, based on the load output.

Example:

Peak Shaving Start: 200
Output:
Peak Shaving will begin once the load output reaches 200 kW.

10.2 Peak Shaving Stop

Peak Shaving will stop either when the load output decreases or when the battery's State of Charge (SOC) reaches a predefined level.

Example:

If the load output reaches 180 kW, Peak Shaving will stop.
Peak Shaving Stop: 50
Peak Shaving will stop once the SOC reaches 50%.

10.3 Peak Shaving Target

The main purpose of Peak Shaving is to assist with peak demand, not to manage the entire load.
The Peak Shaving Target is set as a percentage of how much the system should assist with the load during peak times.

Example:

Peak Shaving Target: 30
Output:
If the load reaches 100 kW, Peak Shaving will assist by 30%, meaning the output power of the PCS will be in discharge mode at -30 kW.

11. PV Charging

PV Charging allows the system to charge only when there is available PV output power. If no PV output is available, the system will not enter a charging state. This feature helps optimize energy savings by utilizing PV energy for charging.

To enable this feature, turn the toggle button ON.

11.1 Minimum PV

Minimum PV defines the minimum output power that the PV system must have before charging will commence.

Example:

Minimum PV: 60
Output:
Charging will begin once the PV output reaches 60 kW or higher.

12. Gen Size

The Gen Size is set to the size of the generator in kVA if a generator has been integrated.

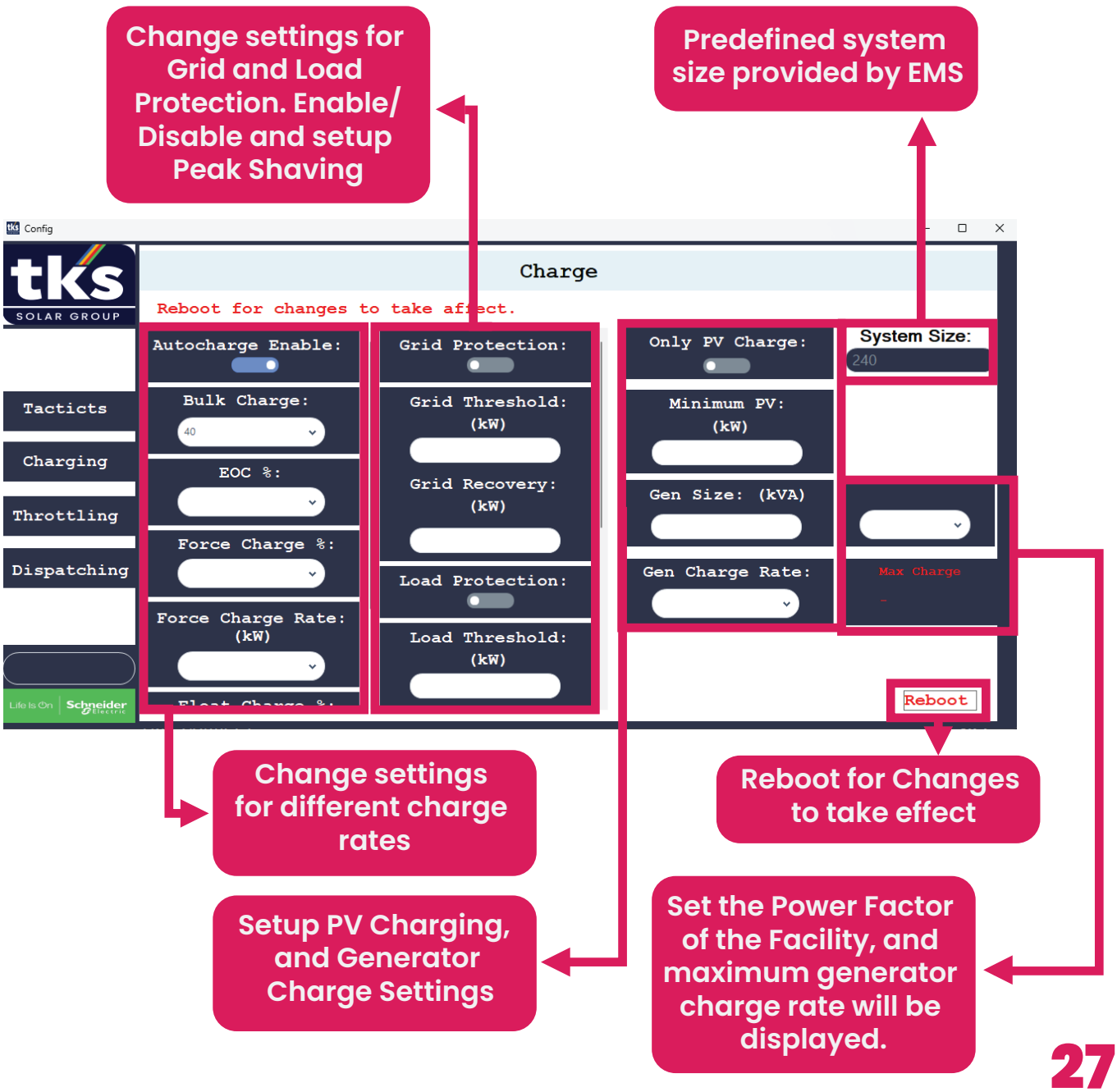
12.1 Gen PF

You have to set the power factor ratio received on the facility to ensure that the generator charge rate will be calculated effectively and safely.

12.2 Gen Charge Rate

After all values for the generator has been added, the system will provide you with the maximum charge rate allowed for the generator. You can then set the necessary charge rate accordingly.

13. Charge Demonstration



Throttling

Why use Throttling?

The throttle feature has two states:

xlvii. Grid-Tied Throttling
xlviii. Off-Grid Throttling

Throttling
Throttling ensures that the PV system does not export too much power to the Mains Supply, which could lead to potential fines from your local Mains Municipality.

However, throttling is carefully configured to avoid underutilizing the PV, ensuring maximum energy savings. It is designed to match the PV output with the facility's load usage.

Example:

Load = 100 kW
PV = +- 95 kW / 105 kW
Grid = +- 5 kW / -5 kW
This configuration allows for optimal savings with a small safety margin, preventing excessive grid export.

Off-Grid Throttling
When off-grid, the Mains Supply is inactive. In this mode, throttling is used to prevent the batteries from overcharging. For example, if the SOC (State of Charge) of the batteries reaches 90%, the PV output will be reduced to allow the batteries to discharge. Once the SOC reaches 85%, the PV output will increase to resume charging the batteries. These SOC parameters can be adjusted within the throttle settings.

Throttle Config
To configure throttling, go to the Config tab and select the Throttle option. Here, you can set up and optimize the throttling parameters.

1. **Enable/Disable**
   Toggle this setting to either enable or disable the throttling feature.

2. **Allow Grid Export**
   If enabled, this setting allows the system to export excess PV power to the Mains Supply. (Not recommended)

3. **Predictive Throttle**
Enable or disable the predictive throttle feature. This feature utilizes an AI algorithm to dynamically adjust the throttle output, closely matching the load and aiming to keep grid output as close as possible to 0 kW. (Experimental Feature)

   3.1 **Increments**
   Add increments of 0 – 1100 (0% - 110%) to determine how quickly the predictive throttling should react. A higher value results in a larger increase in PV output power. A default value of 500 (50%) is typically the most stable setting.

4. **Calibration**
Calibration should be set as a reference between the system size and the average load usage for throttling in kW.

Example:

System: 2 x 50 kW Grid-Tied Inverters
Size = 100 kW
Average daytime load: 60 kW
Calibration range: 80 – 100
Calibration = 90

5. **System Size**
This setting is pre-configured by the system and is used for verification purposes only.

6. **PV Inverter Amount**
Specify the number of Grid-Tied Inverters installed at the site.

Example:

Site capacity = 200 kW (50 kW Inverters)
Number of Inverters = 4 (4 x 50 kW = 200 kW).

7. **PV CAP**
This setting controls the power output of the Inverters, ranging from 0 to 1100.

0 = Minimum power (Inverter won't supply power)
1100 = Maximum power, allowing the Inverter to supply up to 50 kW per installed inverter (if sunlight allows).

8. **Low Load**
Applicable to Off-Grid throttling, this setting defines the fixed PV output power once a certain load threshold is reached.

Example:

Set Low Load = 20
If the load is 20 kW or lower, the PV will output a fixed amount of power.

9. **Low Load Amount**
Use this setting paired with Low Load, to set the output power of the PV. 0 – 1100

The 0 – 1100 can be seen as percentages % example:
0 = 0%
500 = 50%
1100 = 110%

If:

Low Load = 20
Low Load Amount = 500

The outcome will be:
Once the load reaches 20kW or lower, the PV will only output 50% of its power.

This setting can be used for slower charging while off-grid or ensure system safety from trips if the PV size is larger than the size of the PCS or Batteries.

10. **Throttle Start %**
This setting is used to start the throttle process while off-grid to lower the PV output power, to ensure the system does not overcharge while off-grid.

Example:

Set Throttle Start %: 95

The PV output power will start to decrease once the battery SOC % reaches 95% and the PCS will start with discharging.

11. **Throttle Stop %**
This setting is used to end throttling while off-grid to increase the power output from the PV and utilise the PV again.

Example:

Set Throttle Stop %: 92

Therefore:

Throttle Start % = 95
Throttle Stop % = 92

Output:

Once the SOC % reaches 95% the PV output lowers allowing the PCS to start discharging, and once the SOC % reaches 92% the PV output will increase and provide PV power and the charging will commence. This process keeps on repeating ensuring that the system won't overcharge.

Generator Throttling

Note: Throttling should be done with caution.

For example, if you have a 200 kVA generator, it should not receive more than 50 kW of PV power to ensure the safety of the generator.

The TKS Connect EMS settings will help you configure the generator and its throttling. It is important to follow the recommended settings provided by TKS Connect EMS to ensure the generator operates safely.

How Does Generator Throttling Work?
When the generator is active, the EMS will switch to generator throttling mode. The EMS knows the size of the generator and will automatically remove excess PV inverters, only activating those needed. The active inverters will provide a fixed output rate directed to the generator, assisting in reducing the generator's load.

Example:

If the generator's load is 100 kW, the PV will provide 50 kW to help lower the load of the generator to 50 kW, thus saving on diesel consumption.
Setup of Generator Throttling
For generator throttling to work, a generator power meter must be integrated into the system. The power meter should be connected to the output load of the generator to enable proper throttling.

1. **Gen Meter**
   If a generator power meter is active within the system, click the setting "Gen Meter" to ON.

2. **Active Amount PV Inverters**
   Set the amount of PV inverter to be active while the generator is running.

3. **PV Throttle Amount**
   Set the output power of the PV inverters active when generator is running. (0-1100)

Finish Throttle Settings

After making all necessary adjustments on the Throttle page, scroll down to the bottom of the page.

1. Click the green "Save Settings" button.
   - The system will validate and save the current configurations.

2. Once the settings have been saved, click the red "Reboot" button below the "Save Settings" button for the changes to take effect.

Once these steps are completed, all throttle settings should be active. The Throttle Page within the Dashboard will begin to populate with insight data, reflecting the new configurations.

Display Throttle Performance

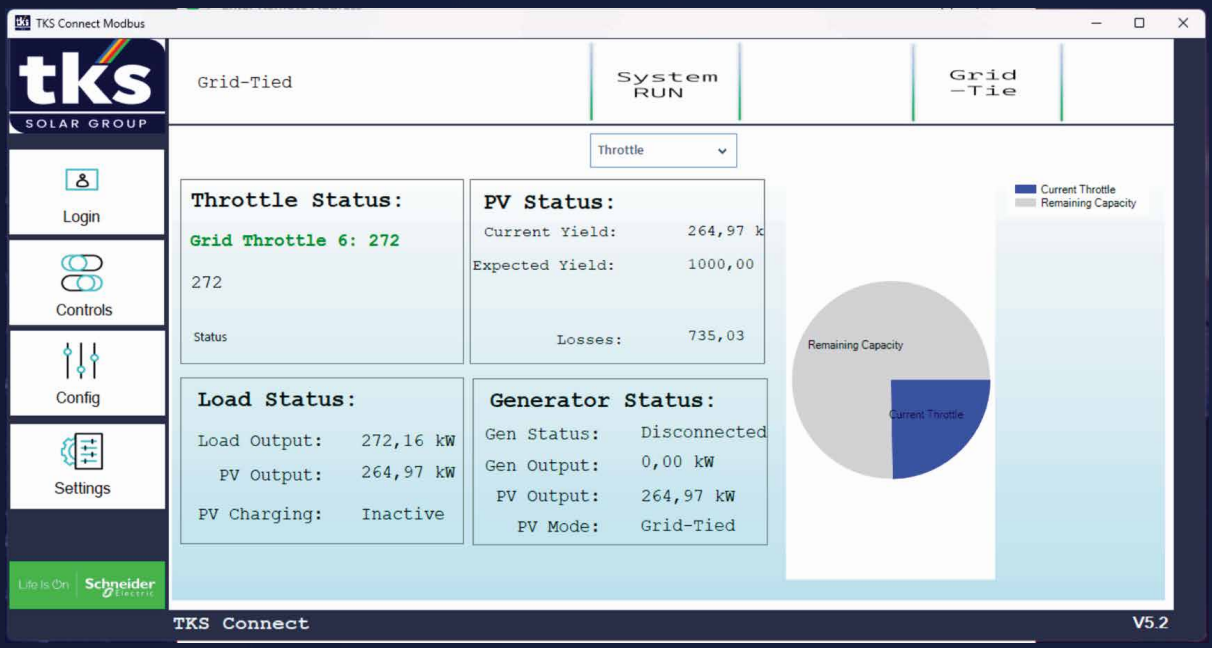
The Throttle page within the navigation bar on the dashboard will show the throttle performance, that will display various features including:

xlix. **The status**
1. What throttle mode is currently active

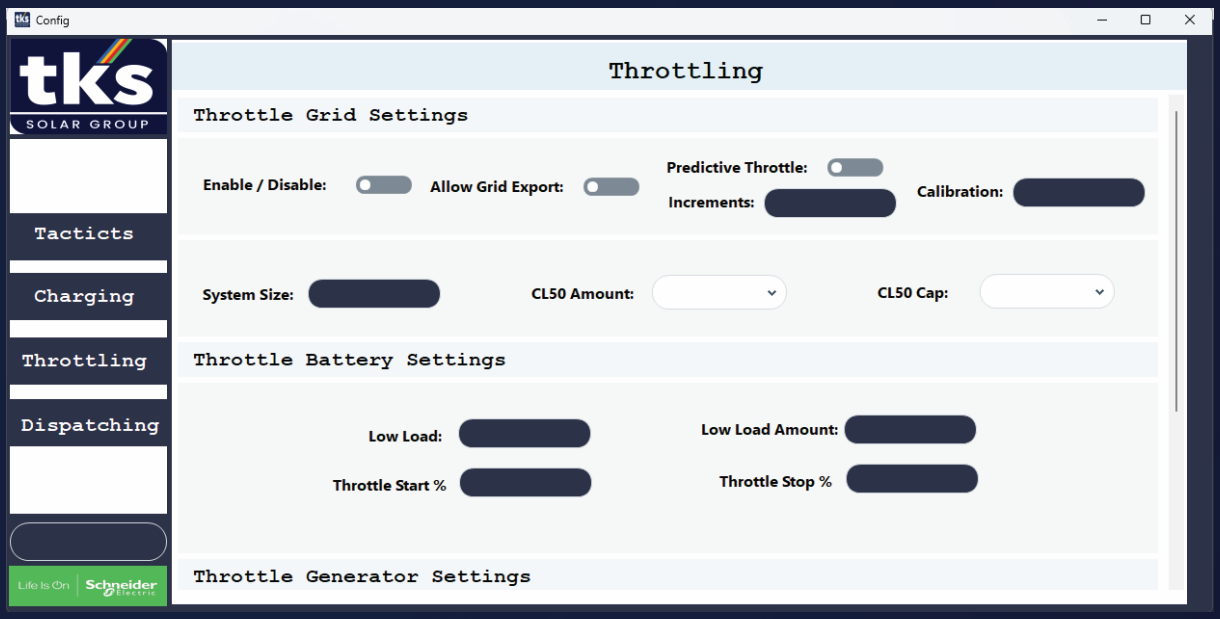
I. **PV Status**
1. Shows the Expected yield from the PV that could've been delivered under the perfect circumstances.
2. Current yield shows what yield is currently being achieved from the PV output.

II. **Load Status**
1. Shows the various loads paired to the PV performance. With perfect conditions the PV output power should be able to match that of the Load output.

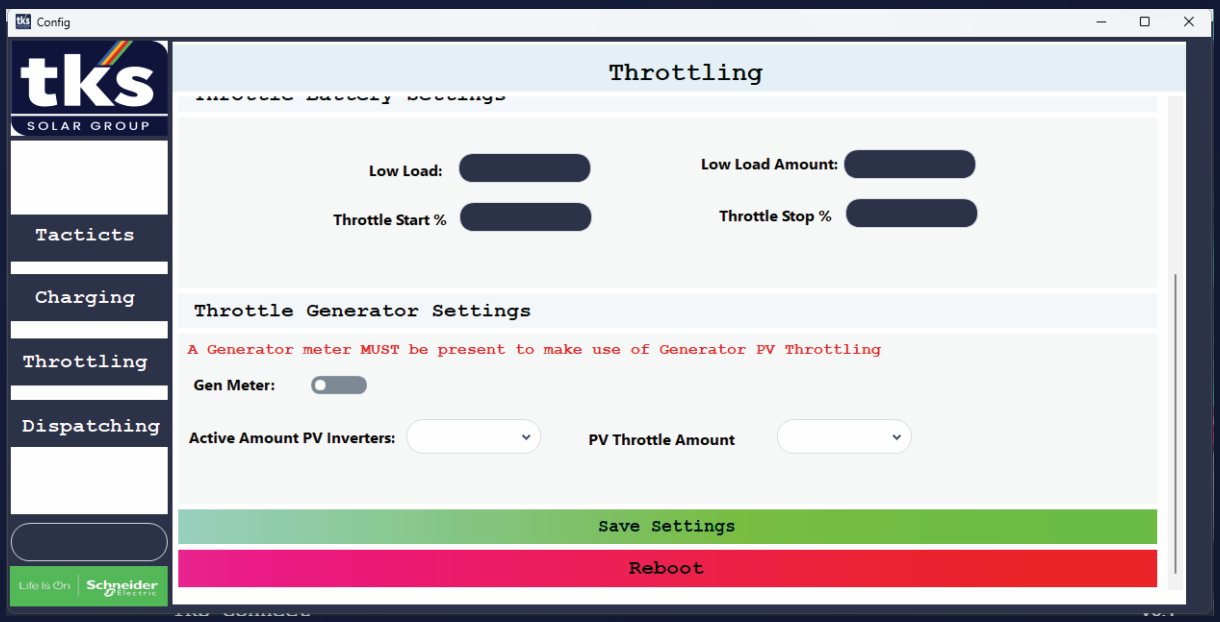
III. **Generator Status**
1. This will provide information on the generator throttling status. If the generator is running, display the ratio between the generator and the PV output.
2. The PV should not exceed more than 30% of the Generator capacity to ensure generator safety!



Display Throttle Settings



The Throttle settings should be done with high understanding of the throttle concept. Please contact the TKS Control Room to assist with these settings, to ensure safe and effective throttle configurations.

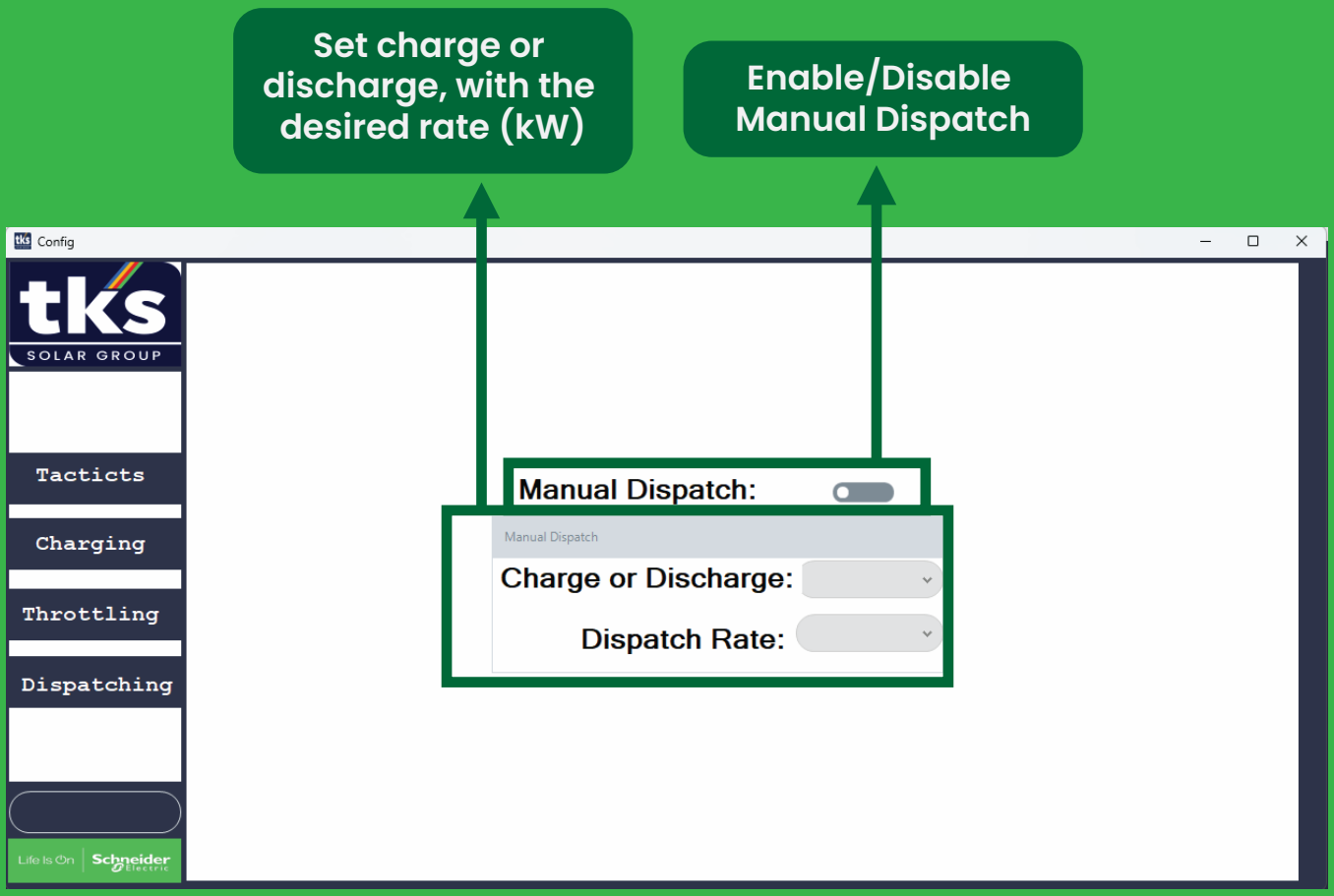


Dispatching

The Dispatch config is used to manually charge or discharge the system.

1. Turn off Auto Charge in the Charge settings.
2. Turn On Manual Dispatch.
3. Charge or Discharge:
a. Choose whether you want to charge or discharge.
4. Dispatch Rate:
a. Choose a rate you want to charge or discharge with.

Note!
This is a manual operation, do not charge or discharge at high rates as you might trip the system or Mains Supply!



Settings Page

Within the settings page, core functionality of the EMS can be set here. These settings should be changed with caution, as the EMS heavily relies on these settings and will not function correctly if these settings are set incorrectly.

1. Basic Setup

This page is used for the basic core functionality of the EMS.

1.1 PCS Select

Select the PCS model, 30P or 500K model. If the 500K model is selected, the amount of 500K cabinets should be specified.

1.2 Meters and Addresses

Select whether to use a Physical load meter of a Virtual load meter. (Virtual Load meter is recommended)
If Physical load meter is selected, ensure that a load meter is added to the site.

liii. Grid Meter Addr.
1. Enter the address of the grid meter.
liv. Load Meter Addr.
1. Enter the address of the load meter.
2. (If Physical load meter is selected)
lv. PV Meter Addr.
1. Enter the address of the PV meter.

The address added to the EMS should be the same as on the power meters. Please follow the information box with the given communication parameters:

Defaults:
1. Set Addresses
2. Baud Rate = 9600
3. Parity = None
4. Stop Bits = 1
5. Encoding = UTF-8

1.3 System Size
Set the size of the PCS system in kW.
Example:

3 x 30kW PCS = 90kW
System Size = 90

Click the Save Button below.

1.3 System Size

Set the size of the PCS system in kW.
Example:

3 x 30kW PCS = 90kW
System Size = 90

Click the Save Button below.

1.4 COM Port

Set the COM Port of each device that is connected.

The COM Ports can be retrieved by two ways:

1. CMD:

1.1 Open CMD on the computer
1.2 Once opened, type: mode
1.3 Press enter
1.4 The list of connected COM Ports will appear.

2. Device Manager

2.1 Open Device Manager on the computer
2.2 Look for the option “Ports” and expand it.
2.3 The list of COM Ports will appear.

SyncNode Port:

Set the SyncNode Port if applicable.
Example:

SyncNode Port: COM3
(Ensure that the SyncNode is COM3 in Device Manager or in CMD)

Power Meter Port:

This setting has all of the external power meters connected in daisy chain.
Specify their port the same as with the SyncNode, and retrieve its COM port from Device Manager or CMD.

Throttle Port:

The Throttle Port will be connected to the PV Inverters.
COM Port also retrieved from Device Manager or CMD.

Understand COM Ports

Each COM port will be different from each other.
The connection of the COM ports is done via a RS485 to USB cable.
The meters:
Will have the RS485 to USB cable from the PC to the first power meter, and daisy chains to the rest of the meters.
The PV will have the same connection with its own USB to RS485 cable.

The SyncNode has its own cable from the PC to the controller.

1.5 Generator Support

This setting is used to integrate the generator.

Click on the Generator Enable button to enable the setting.

Gen Start %:

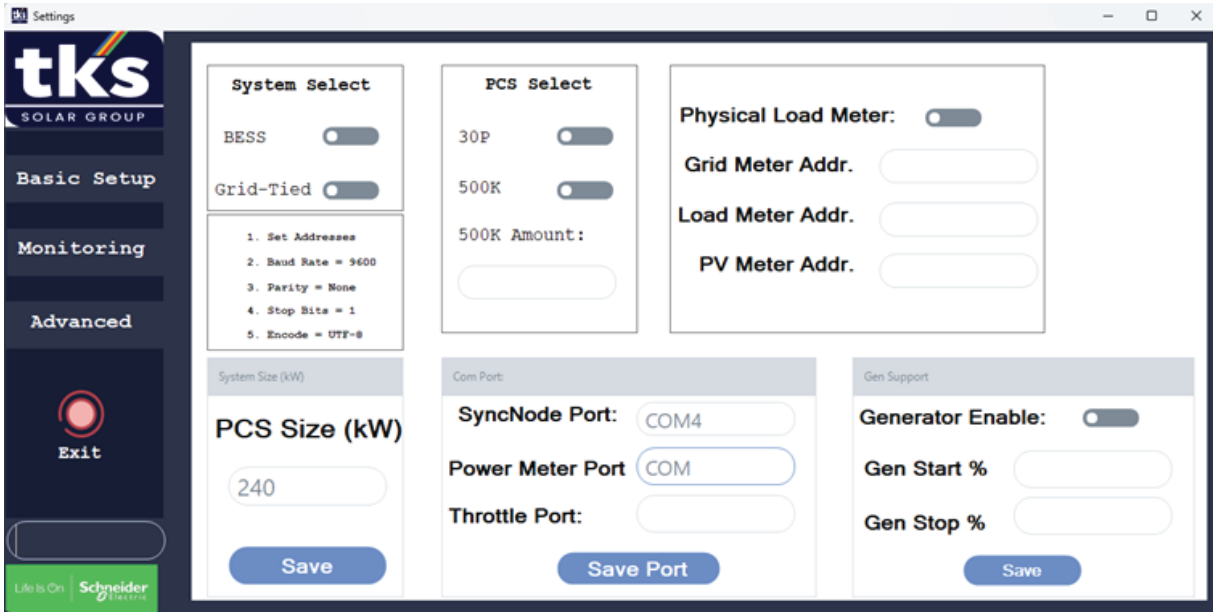
Set this to when the generator should start according to the SOC % of the batteries while off-grid.

Gen Stop %:

Set this to when the generator should stop according to the SOC % of the batteries while off-grid.

Click the Save button, and the generator should be integrated to the EMS.

*Remember that this only integrates the generator towards the EMS, and all generator setups should be done as mentioned in the manual.



2. Monitoring

The Monitoring page is used to setup the monitoring of the system, both offline monitoring and remote cloud monitoring.

1. Enable Coms Debugging

If the cloud monitoring has been activated and does not work correctly, enable this setting to see the error output of why the monitoring is not working. Once it has been resolved, please turn off the setting.

2. Enable Notifications

This is the SMS Notifications that the EMS can send to the user regarding system operations.

Click on the Enable Notifications toggle button to enable the notifications.

Add the mobile number to where the SMS should be sent in format:

+27823334444

Once the number has been entered into the box, click on the button “Add Number”

The number should be added, to confirm, you can click on the button, “Show Numbers”. The numbers selected to receive the SMS will be displayed in the Show Numbers large box.

If a number should be removed from receiving SMS, add the number once more in the “Add Number” box in the same format.

Click on the button “Remove”

That number should be removed. The same confirmation can be done.

Notification Parameters:

The Notification Parameters box at the bottom, allows to send an SMS once the DC Amps of the Batteries goes too high that could lead to a system trip.
DC A- Warning: Add the Amps amount example: 140
If the DC Amps of the batteries reaches 140A, an SMS will be sent to inform that Amps are too high and that the system might trip.

3. Create Portal

The Portal is the information for the Cloud Login to remotely monitor the system

The Portal Credentials will be created by a TKS Member and be sent to the client.

The credentials are then added to the Create Portal section.

Site Name: (The Name of the site to be displayed in the dashboard of the EMS)

Password: (The Password created for the portal login)

Username: (The Username created for the portal login)

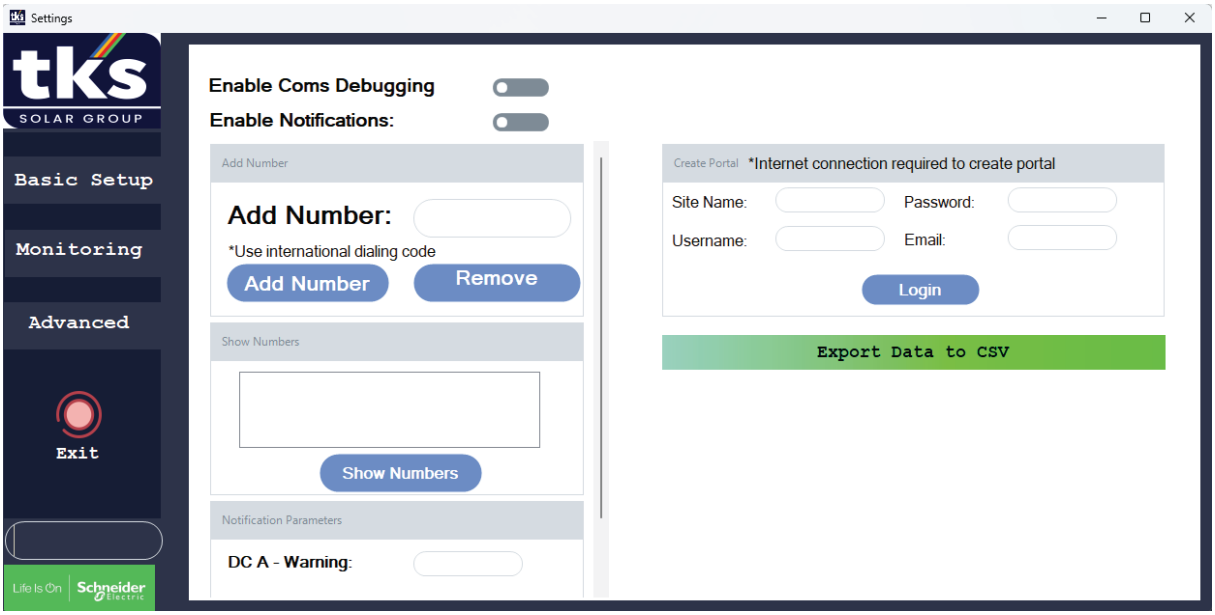
Email: (The Email of the user to receive confirmation of portal creation)

To access your portal for remote monitoring after creation and login, visit:

www.tksenergy.co.za

Click on Client Login
Enter your Credentials
Your Site will be visible

4. Monitoring Page



To ensure effective and stable communications, please contact TKS Control Room to assist with these settings.

*For clients that has a maintenance contract with TKS Solar Engineering will receive a monthly report per year section from the TKS Control Room with detailed analytics from the system performance.

*Clients with a maintenance contract with TKS Solar Engineering will receive access to the SMS system, receiving regular SMS from the EMS that will provide system information.

3. Advanced Settings

The advanced settings tab allows to add more flexibility to the EMS. The System does not rely on these settings, but could provide more insight and functionality to the EMS.

1. Add Additional Meters

Additional meters can be added dynamically to measure different loads outside the scope of the EMS base metering.

1. *Enable the setting.*
   a. Once enabled, on the Dashboard navigation a new navigation will appear "Custom Metering" with a new page allowing to see the custom meters.

2. *Amount of meters*
   a. Define the amount of meters that are added.
   b. Current support with a maximum of 5 meters.
   c. Format: Amount of meters: 3

3. *Starting Address*
   a. Add the starting Modbus address of the first power meter in the chain.
   b. If you set that value to 10, the address of the first meter should be 10.
   c. If you have 3 meters connected to the chain, their addresses should then be 10, 11, 12

4. *Meter Usage*
   a. Define the usage of the meters
   b. Options:
      i. PV Metering
      ii. Load Metering
      iii. Custom Metering
   c. The PV Metering is used to add extra meters to the current PV meters, and will join their output values to the main PV output value on the Dashboard
   d. The Load metering is used the same as that of PV Metering, but incorporates it to the main load on the Dashboard.
   e. Custom Metering is completely separate from the current meters, and are displayed exclusively on the custom metering page.

5. *Meter names*
   a. Add names for each meter added to easily identify all meters.
   b. If 3 meters were added, only provide to three of the meters names that will be displayed in the custom metering page.

2. TCP/IP Site

This feature is used if the site is not connected via RS485 to USB cables and are fully connected via TCP modules. If the site layout uses the TCP modules, please enable this setting and reboot.
This setting is off by default.

If TCP Communication has been enabled, please specify the IP address of the N540 (485) device, and connected ports.
The N540 should also be setup first. Please find the N540 in-depth manual on www.tksenergy.co.za.

3. Meter Speeds

This feature allows you to set the speed of communication with external power meters, optimizing either for faster reading speeds or a more stable connection.Defaults:

- Baud Rate: 9600
- Read Speed: 100 (milliseconds)

4. ATS Mode

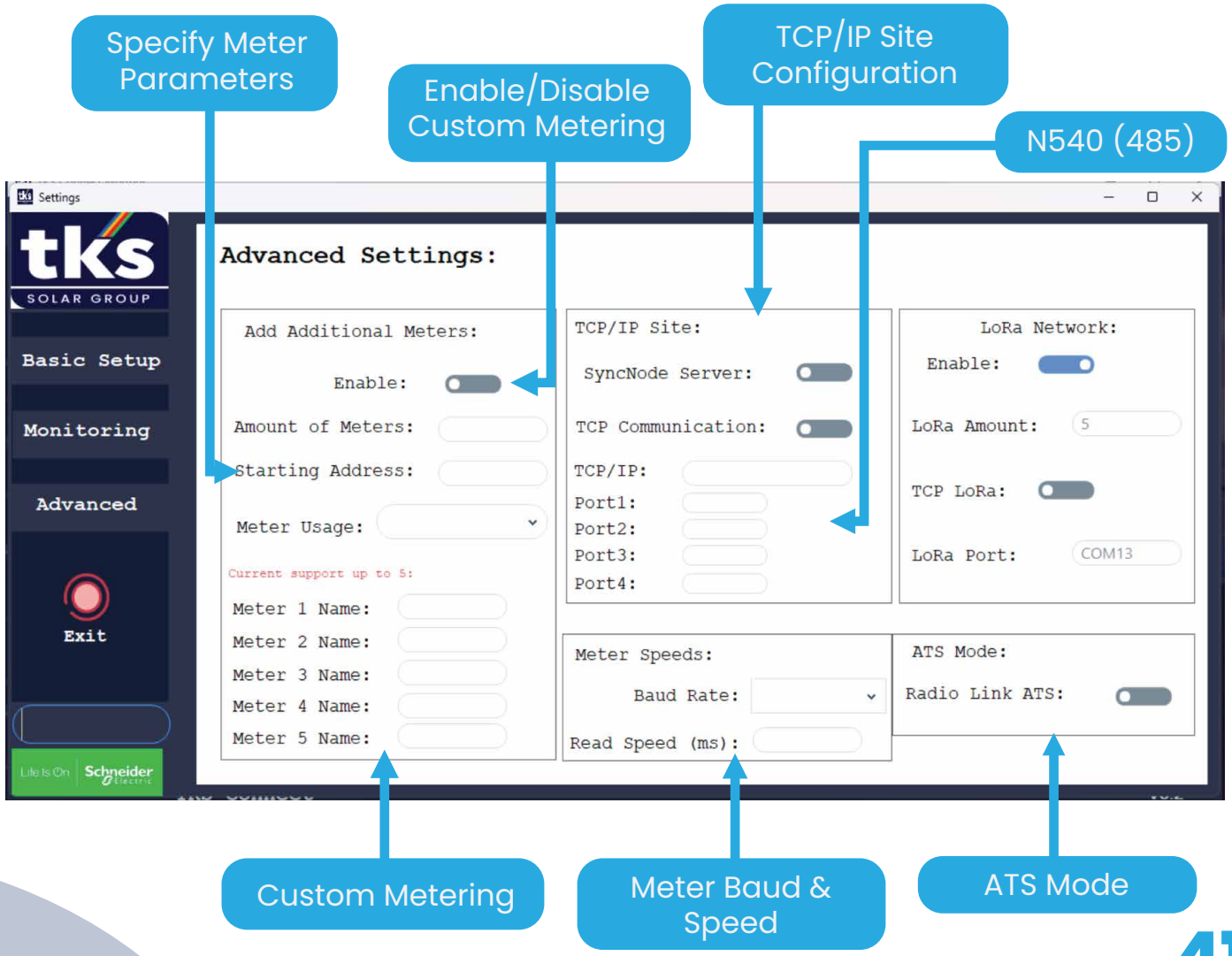
If the connected ATS is linked via TCP, enable this feature to utilize TCP-based changeovers.
Default:

- OFF
- Changeover via Microcontroller.

5. LoRa Network

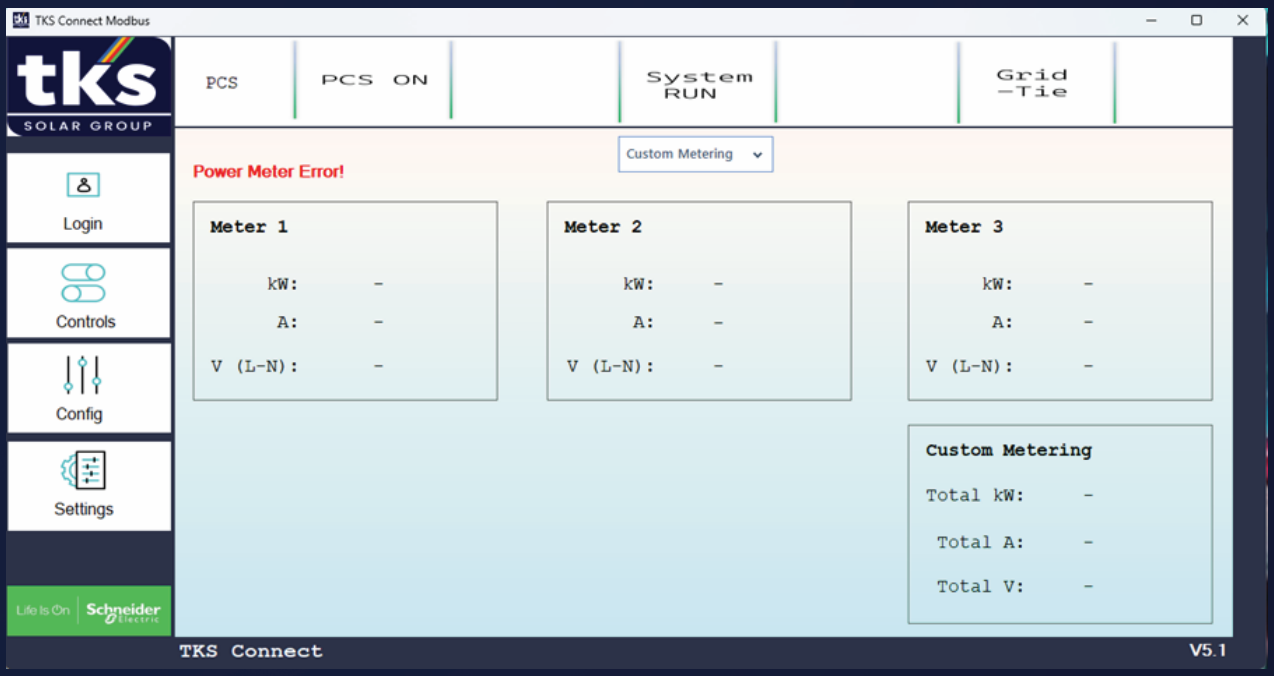
If there is a connected LoRa network for measuring and controlling remote points and changeovers, enable this setting.

- Specify the number of connected LoRa points.
- Toggle whether the master LoRa device communicates via TCP or RS485 (default: RS485).
- If the master is connected via RS485, specify the applicable connected COM port for the master device.



Custom Power Meter

1. Enable the additional meters
2. Specify the amount of custom meters.
3. Specify the stating address. (Modbus Address of first connected meter)
4. Select the meter usage. (In this example we will choose Custom Metering)
5. Provide names to the amount of meters selected.
6. Only provide names to the amount of meters connected. Leave the other options blank if not applicable.
7. Reboot the EMS for changes to take effect.



On the Dashboard, in the navigation bar a new option will appear “Custom Metering”.

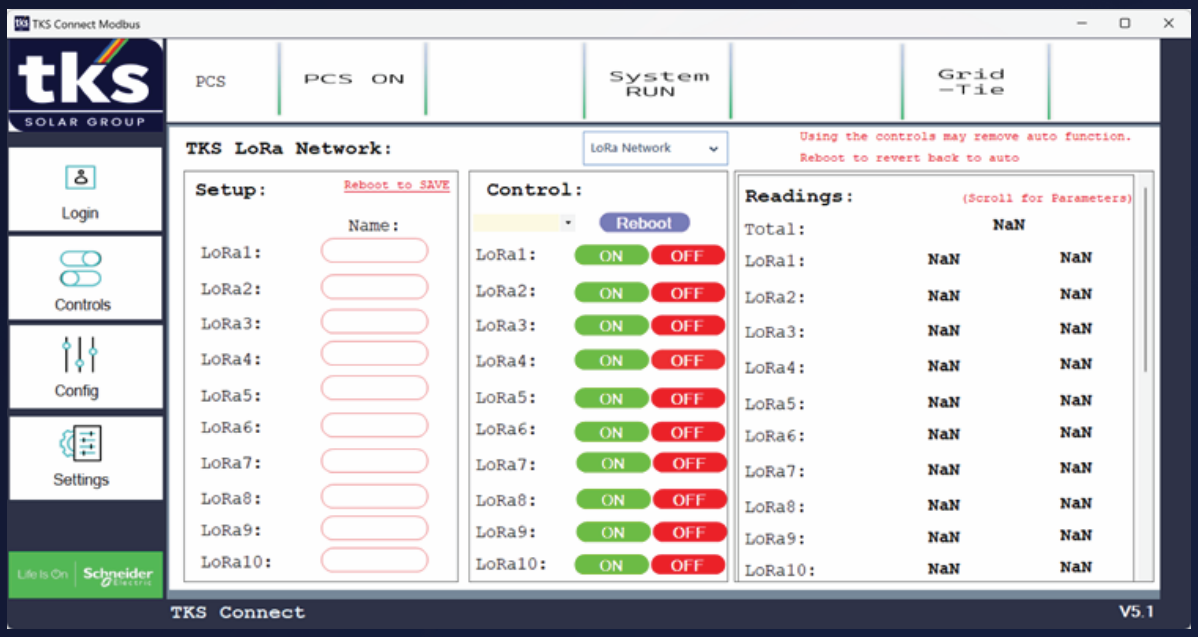
This page will dynamically show the new meters connected to the EMS and provide their data individually and all of the data combined.

As more meters (maximum 5) are connected, will appear in this page.

LoRa Network

Once the LoRa network is enabled in the advanced settings and the parameters are configured, it can be customized to meet the specific site requirements.

To access the LoRa network settings, use the main navigation bar in the EMS and navigate to “LoRa Network”.



Setup (Left Pane)

In the “Setup” section, you can assign a name to each connected LoRa point for easy identification.

Control (Middle Pane)

The “Control” section allows the user to manually control the LoRa points. You can toggle the LoRa points between the “ON” and “OFF” positions. This feature can be utilized for various purposes based on the site’s needs, such as:

- Changeovers
- Pumps
- Load controlling
- Irrigation
- And more

You can select a specific LoRa point in the yellow box below “Control” and reboot it if necessary. The reboot option is only available if the master device has communication with the slave device.

Readings

The “Readings” tab displays the total kW output of all the LoRa points combined. Additionally, each individual LoRa point’s kW readings will be shown.
If NaN (Not a Number) appears, it indicates either a communication failure with the LoRa point or that the line is inactive.

Auto Parameters for LoRa Control

You can scroll down on the Readings page to access the setup for Auto Parameters. These parameters enable automatic switching functionality, similar to the “ON” and “OFF” controls in the “Control” section. The Auto Parameters use the Grid output (kW) as a reference for switching.

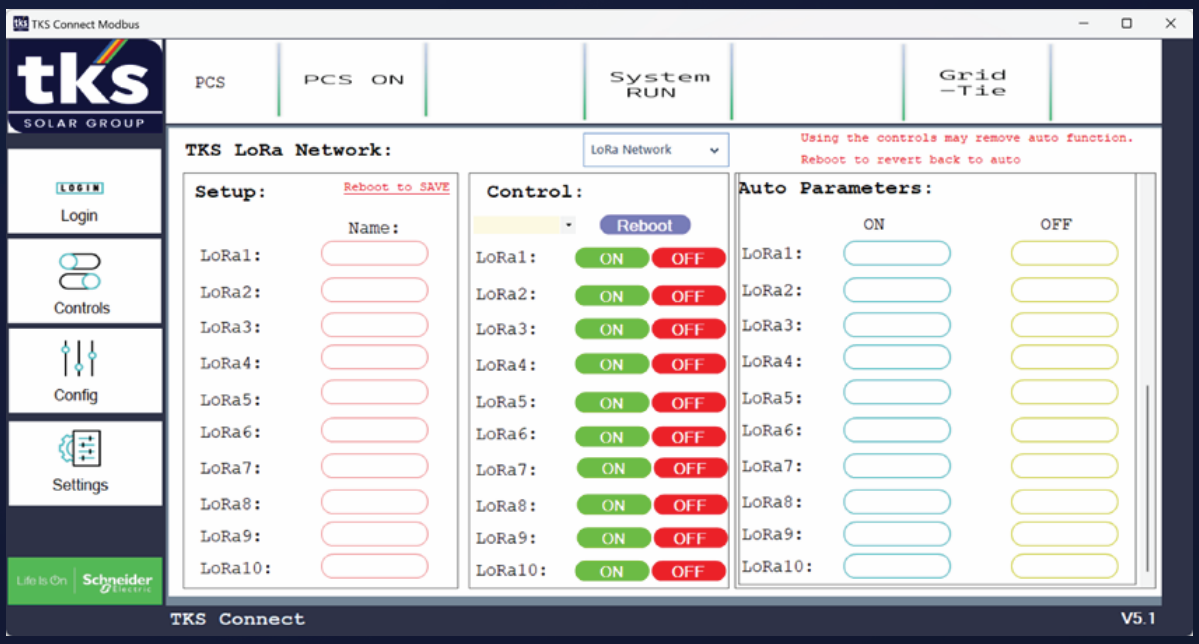
Example:

- ON Parameter:
  - Set = 50 kW
- OFF Parameter:
  - Set = 200 kW

Functionality:

- ON Position: If the grid output drops below 50 kW, the specified slave will automatically switch to its “ON” position.
- OFF Position: The slave will remain in its “ON” position until the grid output exceeds 200 kW. Once the grid output goes beyond 200 kW, the slave will automatically switch to its “OFF” position.

The current position of the slave will be displayed on the right side of the Readings page.



Data Exporting

TKS Connect EMS uploads data to the TKS Connect Cloud where the system can be monitored remotely and all data analysis is being processed.

TKS Connect EMS offers offline data as well, where the raw data is being captured by the EMS in real time. The offline data provides more in depth data due to the data being captured in real time.

If data were to be lost on the remote portal, the offline data can still be captured.

Due to the offline data being raw data, it will be exported as a CSV file that is Excel compatible and will be formulated into columns and rows.
This will allow the user to process the data and add their own graphs and system analysis.

When the data has been exported, it will be in a zip data file. Extract the zip file to find the individual data files for each requested date. These files will all be encrypted as HEX files to ensure data integrity. Please use TKS Connect Utilities application to decrypt the files into readable CSV files. TKS Connect Utilities can be found under Downloads on www.tksenergy.co.za with its manual.

How to export data

On the dashboard, use the navigation tab and choose the option “Data Export”

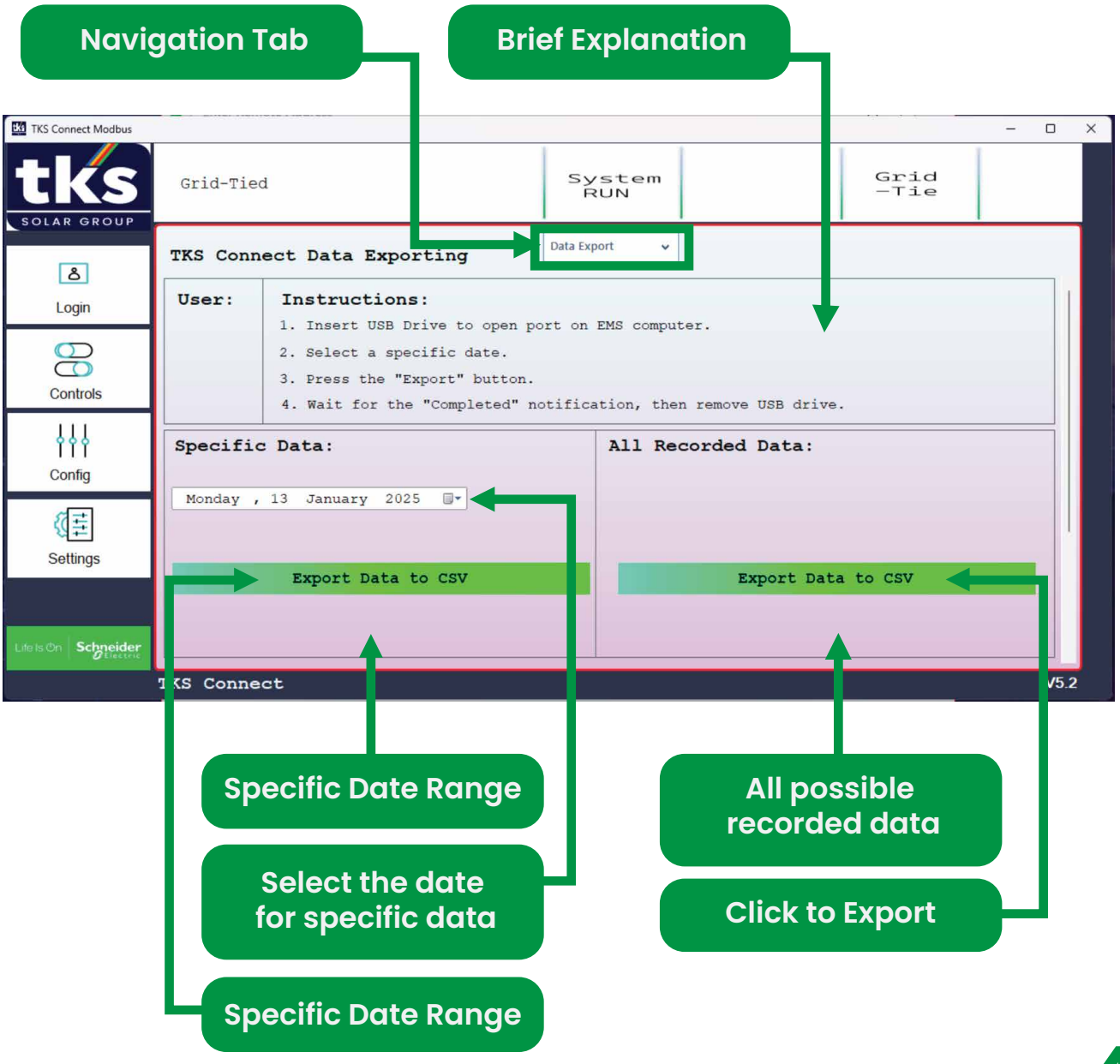
On this page, there will also be a short explanation on how to retrieve offline data.

1. Insert your USB Drive into the PC running the EMS.
   The USB Drive must be inserted into an open USB Port.
   DO NOT UNPLUG ANY OTHER USB CABLES ON THE PC AS THE EMS MAKES USE OF THE CONNECTED USB CABLES!
2. You will have two options for data export.
   On the left side, select a specific date for data to be exported. Once a date has been selected, below the date, click on the “Export” button.
   On the right side, you won’t be able to select a date.
   This option is to receive all possible data recorded from the EMS.
   Click on the “Export” button, and all the possible recorded data will be exported.
3. After you have selected one of the two options and the “Export” button has been clicked, please wait until you receive a popup notification that will notify you whether the data has been exported successfully.
4. After the notification has appeared, and export has finished, you may remove the USB Drive.
5. Plug the USB Drive into your own computer and open the USB Drive directory.

6. Look for the ZIP TKS Data folder.
7. Right Click on the folder, and choose the “Extract” option.
8. The ZIP folder will be extracted into a normal folder which can then be opened.
9. All of the encrypted HEX files will appear. Use TKS Connect Utility to decrypt the HEX files into CSV files.
10. After the HEX files has been decrypted, the CSV file will automatically open in Excel with the recorded data from the EMS.

NOTE:

A USB Drive must be connected to export the data, otherwise the export will fail.
Once USB Drive has been inserted, only follow the above steps, do not try to open the USB directory.
Do not use the Control Room Export, as it will not return any data to the user.



Metering Guide

TKS Connect EMS V5 offers a wide range of metering options:

1. Basic Metering
2. Custom Metering
3. Radio Metering
4. Basic Remote Metering

These metering options are all modular allowing to measure different points and receiving separate or combined data.

a. Basic Metering

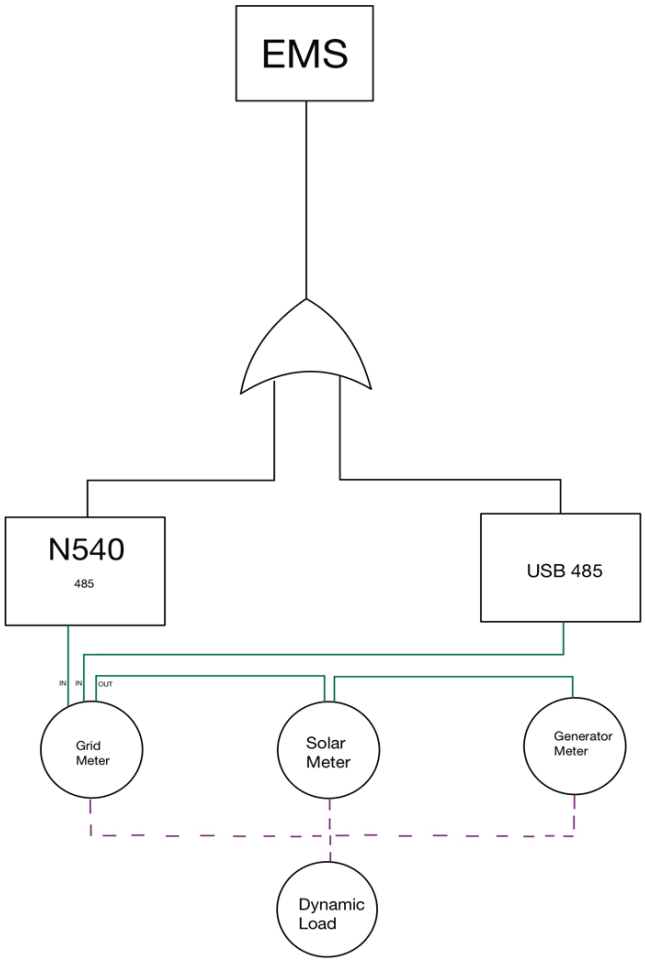
Basic Metering is the standard practice for the EMS, and won't function without the basic metering. The basic metering includes three physical power meters:

lx. Grid Meter
lxi. Solar Meter
lxii. Generator Meter (Optional)

These meters are connected in a logical order:

EMS -> Grid Meter -> Solar Meter -> Generator Meter

Please see the Basic Metering sketch:



b. Custom Metering

Custom Metering offers modularity, in creating a custom measuring tree.

The custom metering consists of three parts:

1. Custom Load
2. Custom Solar
3. Custom Metering

- Custom Load can be used to add more load to the main EMS load measurement. If there are undefined loads on a site that is not included with the main dynamic load of the EMS, it can be included via the Custom Load Metering option.

- Custom Solar has the same feature as custom load. If there are PV points on other lines, and feeds towards the same common point, custom solar metering can be used to measure the other PV points that aren't directly connected to the EMS. These values will be added to the main solar reading on the EMS.

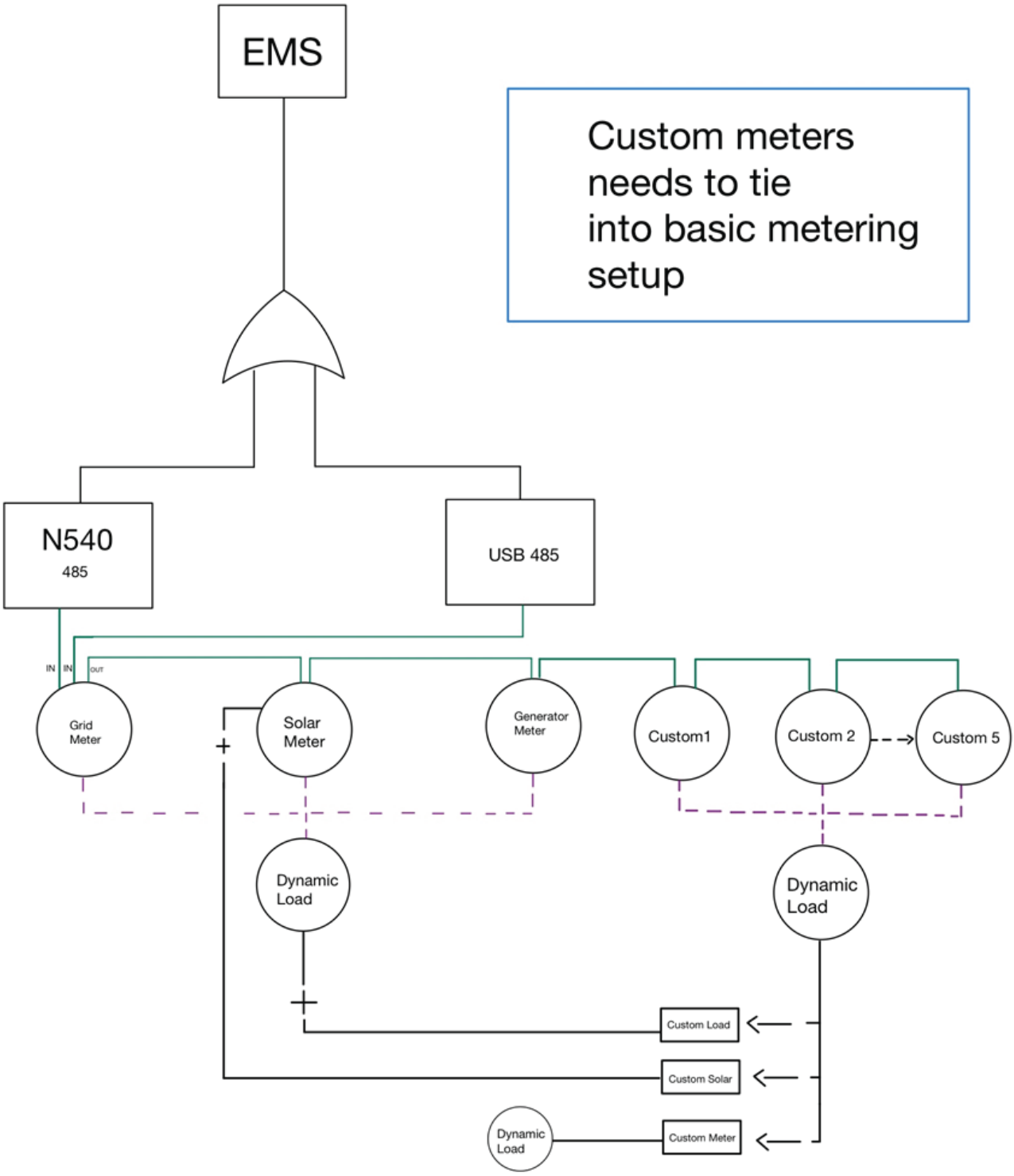
- Custom metering can be used independently, and measure any points of interest on a site, without affecting any readings on the main side of the EMS. It will measure kW, V, and A. It will provide a total of all points measured as custom metering.

Note!
Custom Metering allows for only one option. The user should choose between Load metering, Solar Metering or Custom Metering as only one option will function at a time!

Connection as follows:

EMS-> Custom1 -> Custom2 -> Custom3 -> Custom4 -> Custom5

Please see the Custom Metering sketch


EMS
Custom meters needs to tie into basic metering setup
N540
485
USB 485
IN
IN
OUT
Grid Meter
Solar Meter
Generator Meter
Custom1
Custom 2
Custom 5
Dynamic Load
Dynamic Load
Custom Load
Custom Solar
Dynamic Load
Custom Meter

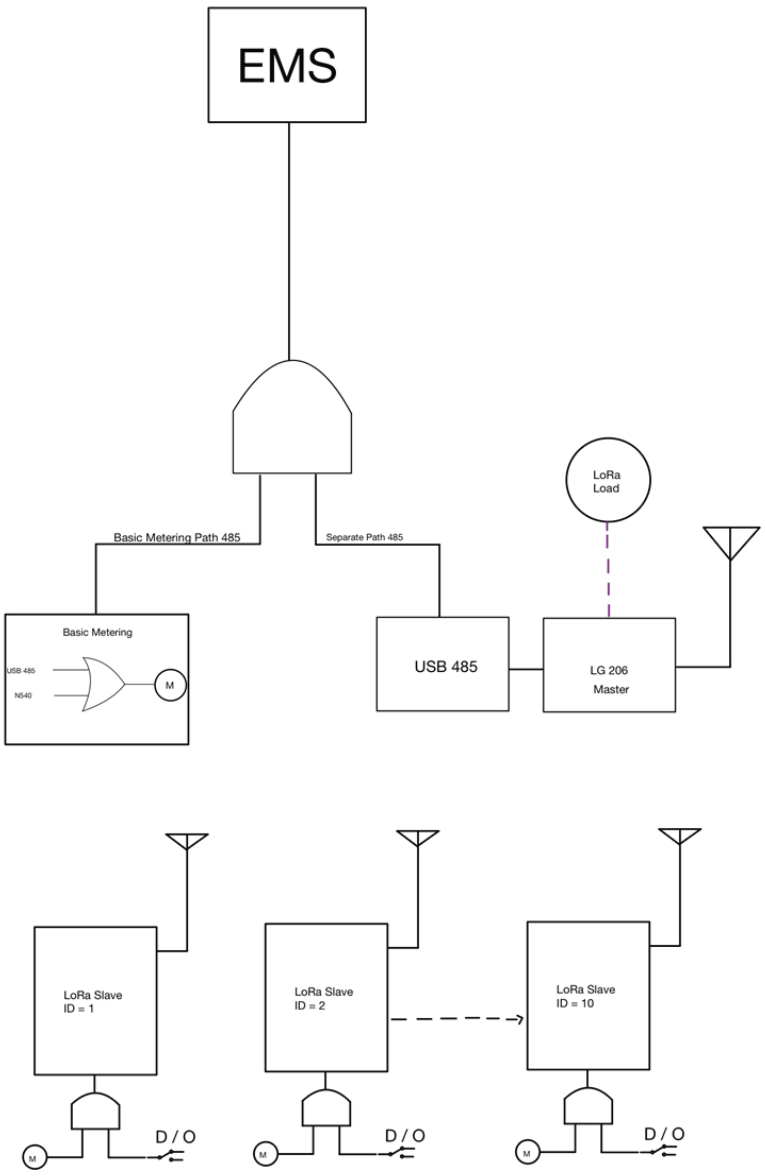
c. LoRa Metering

LoRa Metering allows the EMS to receive metering information from remote points up to 3.5km.
TKS Connect EMS allows for up to 10 LoRa points.

The EMS is connected to a Master Lora, that will then connect to the 10 slave LoRa boxes installed at the various points. The LoRa slave boxes can be connected to a physical power meter and send the readings to the EMS. The slaves are also equipped with D/I and D/O allowing for remote control and switching from the EMS, via manual trigger from the EMS or Automated trigger from the EMS with a set value from the Grid usage.

Each slave should be given an ID via its dip switch, and then connected to the power meter and/or DI/DO.
Each slave can be defined from the EMS.

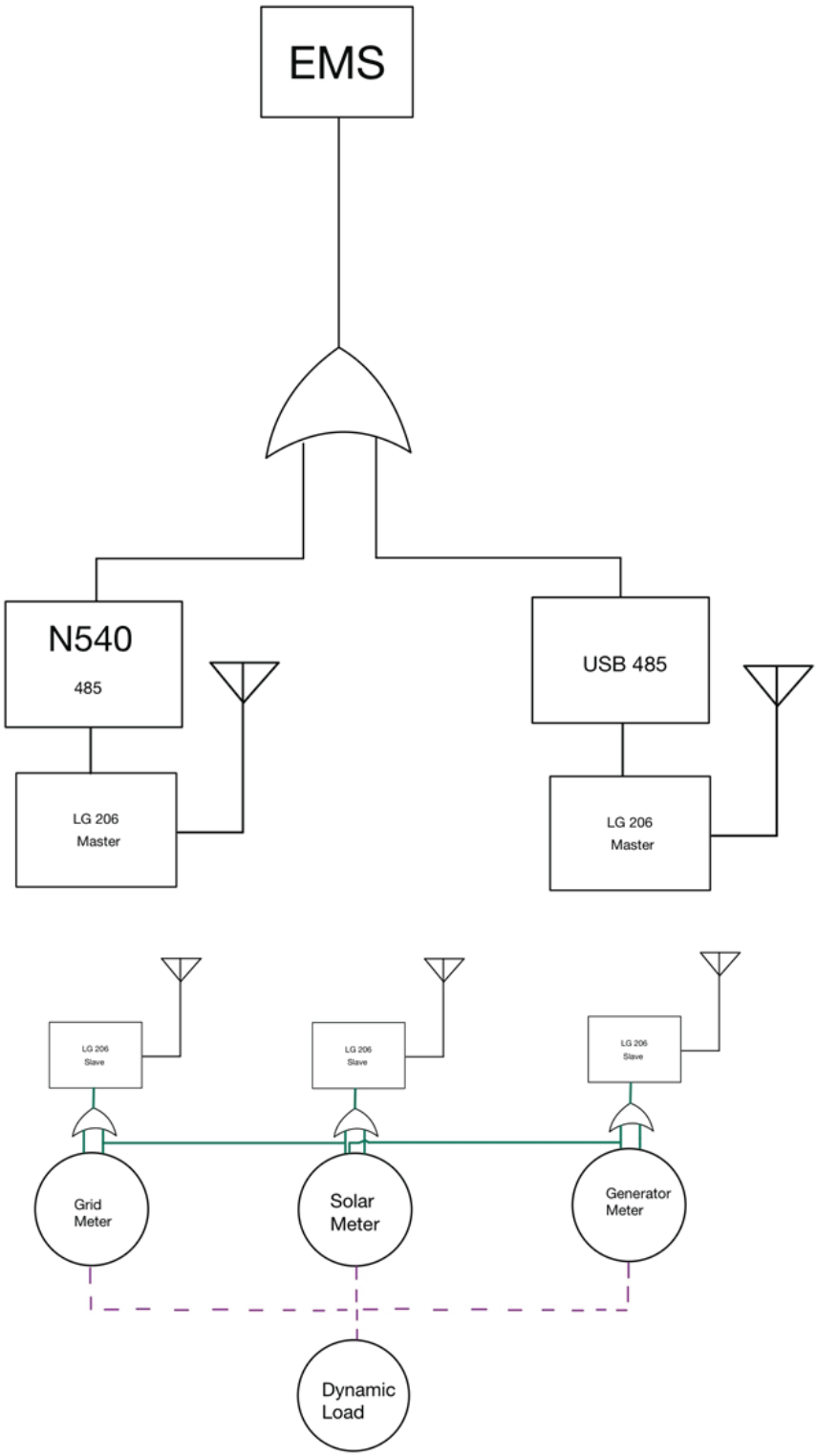
Please see the Custom Metering sketch:



d. Basic Remote Metering

Basic Remote Monitoring has the same functionality as the Basic Monitoring, except instead of having a direct cable connected from the EMS to the meter, a LoRa can be used. This scenario is useful when the basic metering setup locations are either far or has difficult cable routes.

Please see the Custom Metering sketch:



Contact Us

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Disclaimer:

This document provides information on TKS Connect EMS, powered by the TKS Connect group. All information in this document is intended as a guideline for site setups, and different configurations may apply to different applications.

Important Notes:

- Configuration settings should only be performed by TKS members or validated by them.
- TKS will not be held responsible for any incorrect settings made without TKS consent or assistance.
- TKS Connect EMS V5.2 serves as the TKS Generic EMS.
- If your site has any custom requests outside the scope of the EMS, there may be delays in EMS upgrades and remote monitoring for that specific site.

Update Log:

This document is applicable to TKS Connect EMS version 5.2.

- Please validate your TKS Connect EMS version.
- If you have an outdated version, please contact the TKS Control Room.

Notes on :

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