Eaton® EnergyAware™ Controller

HMI Screen User's Guide

Powering Business Worldwide

Revision 1

Eaton EnergyAware Controller - HMI Screen User's Guide

Introduction

This document is applicable to the human-machine interface (HMI) screens of the Eaton EnergyAware Controller (EAC) [if installed on an uninterruptible power supply (UPS)].

This document describes how to use the EnergyAware UPS HMI screens that are Web hosted by the EAC. There are two types of HMI screens:

- **Display HMIs**: Screens used for display purposes
- **Configuration HMIs**: Screens used for configuration purposes.

Display HMIs may be shared by different energy services. For example, the Summary Dashboard display screen is shared by all of the energy services. Most of the configuration HMIs are used to support specific energy services offered by the EnergyAware UPS solution.

The display HMI parameters inform the user of the configuration process (including testing). The configuration HMI parameters can be set by the user.

The following is a comprehensive list of the EnergyAware HMI screens:

Display HMIs

- Summary Dashboard Display
- About Software Display

Battery Related Configuration HMIs

- Battery Setup Configuration
- Battery State of Charge (SOC) Configuration

Energy Services Configuration HMIs

- Real Time Pricing (RTP) Demand Response (DR) Configuration
- Time-of-Use (TOU) Demand Charge Management (DCM) Configuration

Dynamic Capability

The screen parameters can be updated remotely if the **Enable Dynamic Capability** checkbox is enabled (checked) on the applicable parameter. Limiting dynamic capability is recommended for settings that do not require remote access or active management (such as system startup or commissioning parameters).

The following sections cover the EnergyAware HMI screens and include provide user tips denoted by the symbol .

EnergyAware HMI Screens

Summary Dashboard Display

The Summary Dashboard Display screen utilizes a one-line diagram to summarize the system (see Figure 1).

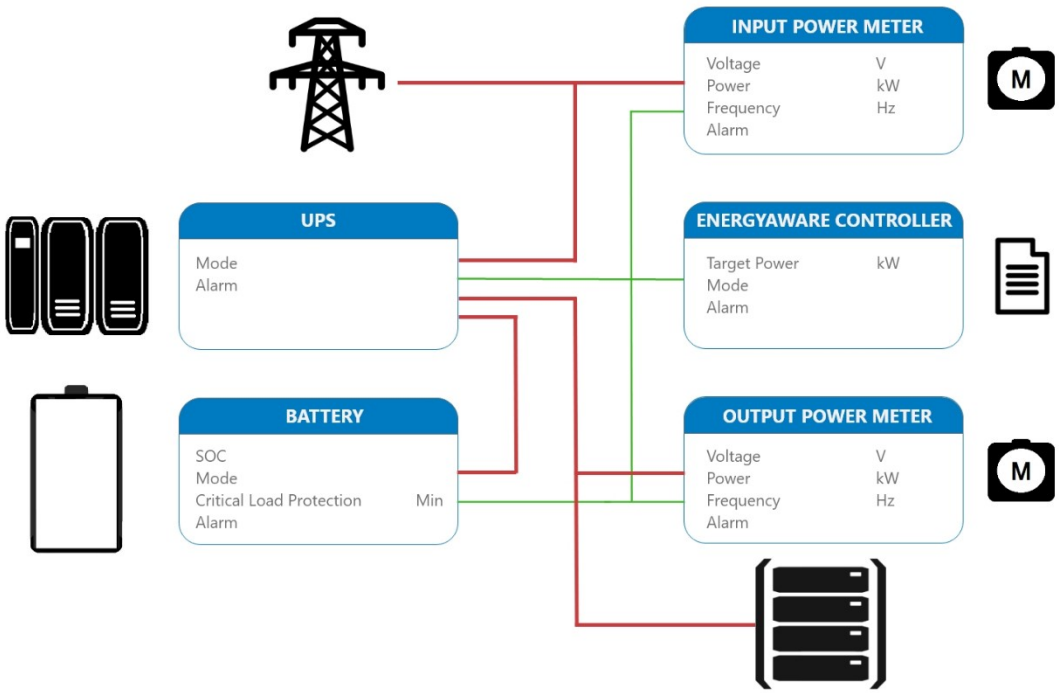
This screen shows the following key components of the EnergyAware UPS system:

- Input Power Meter
- UPS
- EnergyAware Controller

- Battery
- Output Power Meter

The battery icon will change according to the battery state of charge. The green section is the battery capacity allocated and available to support energy services. The yellow section is the battery capacity allocated to support the critical load and is referred to as critical reserve capacity.

Figure 1. Summary Dashboard Display



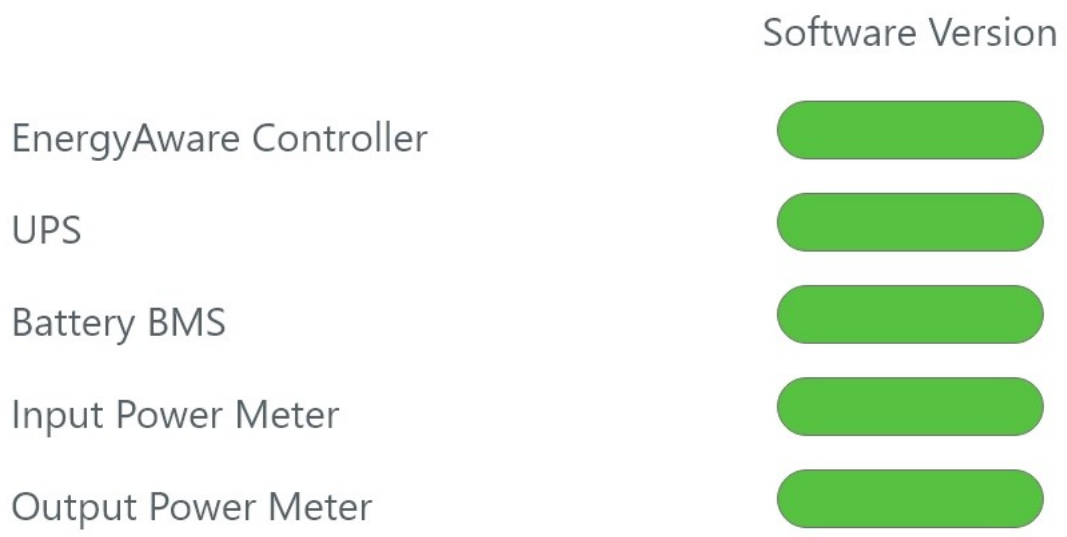
Each component on the Summary Dashboard Display has a summary alarm that can assist in isolating the source of a system alarm condition.

When there is an alarm condition, the user can also investigate the EnergyAware components individually to obtain more information.

About Software Display

This screen displays the software revision levels for each component in the EnergyAware UPS system.

Figure 2. About Software Display



Battery Setup Configuration

Use the Battery Setup Configuration screen to set key EnergyAware UPS battery parameters. These parameters include the battery chemistry, setting the battery max and min SOC ratings, and identifying the battery manufacturer (see Figure 3).

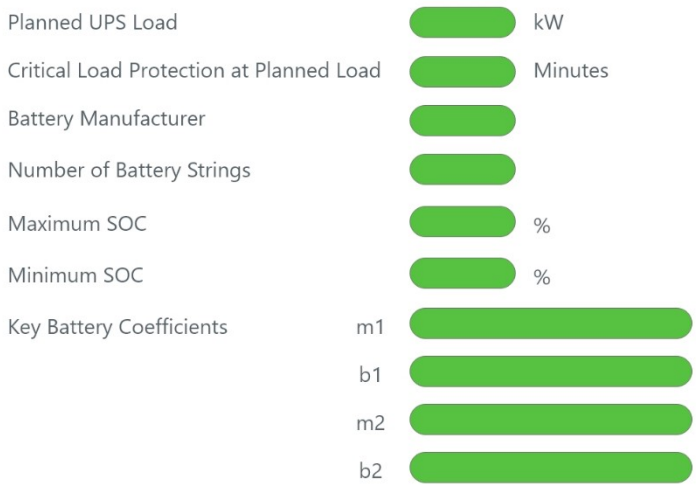
Planned UPS Load and Critical Load Protection at Planned Load are parameters displayed on this screen and are derived from the Battery SOC Configuration (see Figure 4). These parameters display information that is used to set the amount of capacity reserved to protect the critical load in case of a utility outage.

Information specific to the battery configuration is entered by the user. The battery manufacturer name and the number of battery strings are directly associated with the battery configuration.

Maximum SOC is the greatest state-of-charge that can be obtained with the specified float voltage. Maximum SOC is defined by the battery manufacturer. The user input for Maximum SOC should not be greater than the Maximum SOC specified by the battery manufacturer. Minimum SOC is the lowest state-of-charge that is reached at the specified cut-off voltage. Minimum SOC is defined by the battery manufacturer. The user input for Minimum SOC should not be less than the Minimum SOC specified by the battery manufacturer. Eaton PQ Engineering will provide guidance regarding these ratings.

The Key Battery Coefficients are special parameters that relate to the battery's discharge profile and chemistry. Eaton PQ Engineering will provide the Key Battery Coefficients. Battery installations vary from site to site, so it is important that the user visually compare these settings to physical batteries being installed or commissioned.

Figure 3. Battery Setup Configuration



Battery SOC Configuration

Maximum Active SOC is the highest operational state-of-charge that the system utilizes for the ancillary service. Maximum Active SOC sets an upper boundary for ancillary services (see Figure 4).

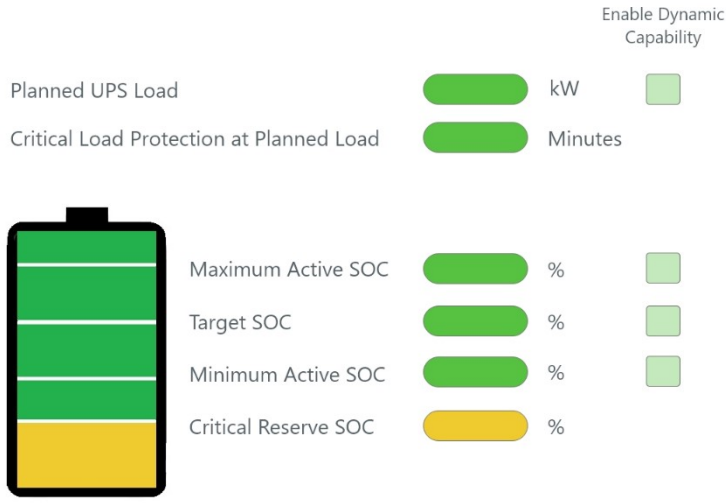
Target SOC is the nominal operational state-of-charge that the battery returns for the specific ancillary service. The UPS charges and discharges the battery as required to obtain the Target SOC.

Minimum Active SOC is the lowest operational state-of-charge that the system utilizes for the specific ancillary service. Minimum Active SOC sets a lower boundary for ancillary services.

The Critical Reserve SOC parameter is a calculated value. Critical Reserve SOC is a function of the Planned UPS Load and the Critical Load Protection at Planned Load. Planned UPS Load (kW) is set by the customer before the start of the energy ancillary service and cannot be changed during the service; this includes Planned UPS Load with Dynamic Capability checked. In cases where an energy service is underway, the operator should either stop the energy service or allow the service to finish before adjusting the Planned UPS Load. The Critical Load Protection at Planned Load is a user-set value determining the duration to protect the critical load.

The battery shown in Figure 4 is a static icon (colors and levels do not change in operation). The purpose of this visual aid is to help the user understand key battery SOC levels and their respective regions of operation. Maximum Active, Target, and Minimum Active SOC represent the battery regions of operation that support energy ancillary services. Critical Reserve SOC represents the battery critical load protection region.

Figure 4. Battery SOC Configuration

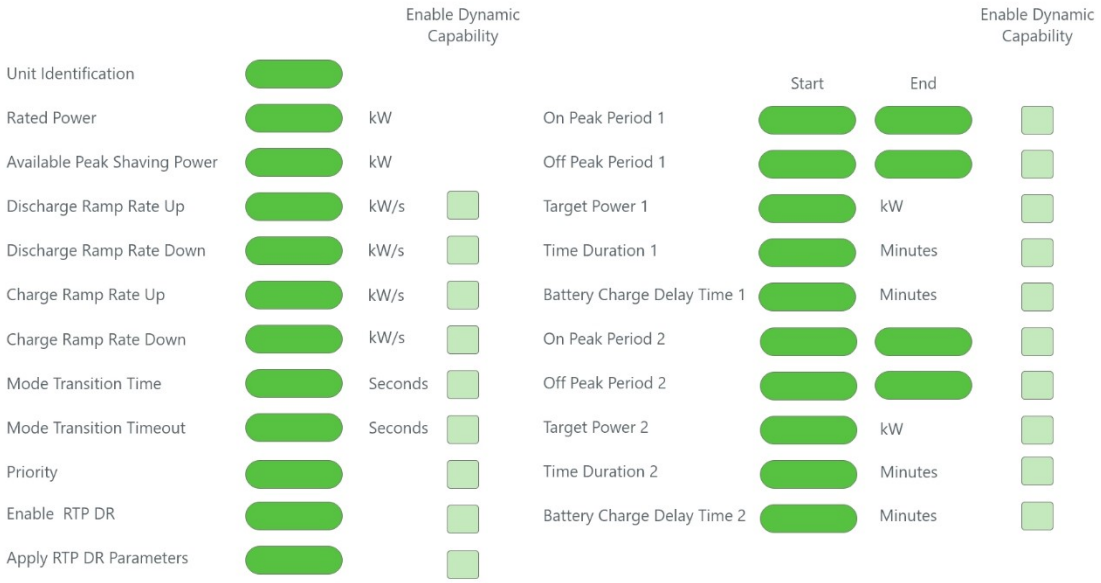


Real Time Pricing Demand Response Configuration

RTP DR is an energy service that can help customers participate in wholesale energy market real-time pricing programs. The service affords the customer the ability to respond to energy markets that change in real-time; for example, it provides the ability to quickly and frequently respond to wholesale market price volatility. The underlying energy service function is peak shaving; the customer can peak shave on command when their energy and demand charges are high due to the hour-by-hour energy market conditions.

The real-time nature of this energy service can be applied to other cases like the management or avoidance of coincident peaks. It can be used in conjunction with higher level software to control many EnergyAware UPSs as one coordinated group. This is generally referred to as distributed energy resource (DER) aggregation.

Figure 5. RTP DR Configuration



Unit Identification

This parameter is the designation used to identify the UPS and/or the UPS input feeder bus. This is an alpha-numeric value entered by the user at the time of UPS and startup.

Rated Power

The output rating of the UPS that is entered by the user at the time of installation.

Available Peak Shaving Power

This value is a displayed parameter that is calculated by the EAC as a function of the UPS load condition. The value is displayed to inform the user during RTP DR configuration process.

Discharge Ramp Rate Up

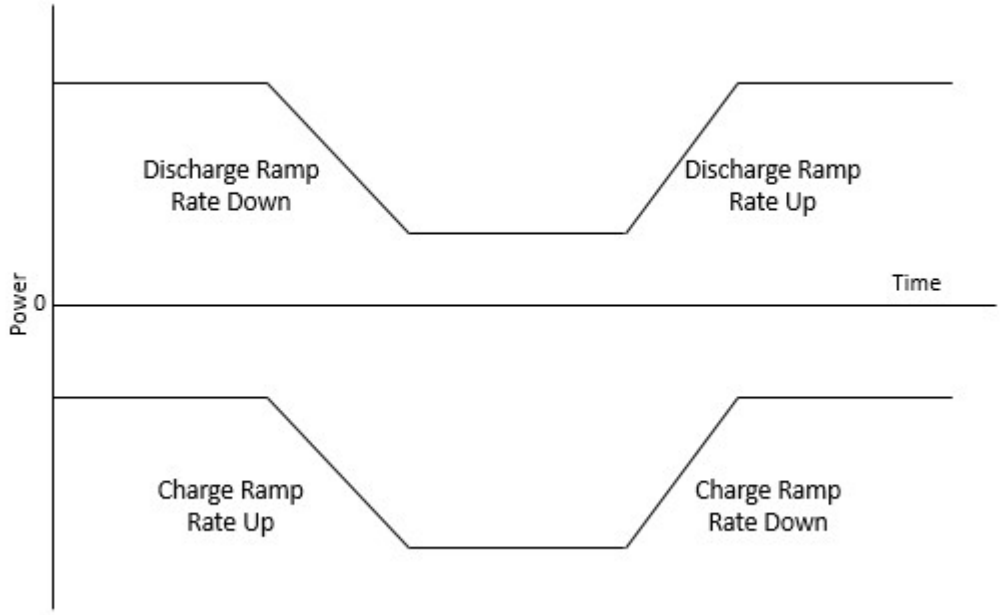
The allowed maximum rate of change of the required discharge power (kW/s) when moving from one power level to another. Discharge represents the generation or export of power. Up represents an increase in power level when comparing final to initial power (see Figure 6).

Discharge Ramp Rate Up, Discharge Ramp Rate Down, Charge Ramp Rate Up, Charge Ramp Rate Down, Mode Transition Time, and Priority are MESA/SunSpec Alliance parameters important to the EnergyAware UPS system's future roadmap, but are not currently available. Values entered in these fields are currently ignored by the EAC software.

Discharge Ramp Rate Down

The allowed maximum rate of change of the required discharge power (kW/s) when moving from one power level to another. Discharge represents the generation or export of power. Down represents an decrease in power level when comparing final to initial power (see Figure 6).

Figure 6. Power Discharge and Charge Ramp Rate Diagram



Charge Ramp Rate Up

The allowed maximum rate of change of the required recharge power (kW/s) when moving from one power level to another. Charge represents the consumption or import of power. Up represents an increase in power level when comparing final to initial power (see Figure 6).

This parameter can be related to the batteries recharging to restore energy lost during peak shaving, but only to the extent that the battery recharge power level may need to be increased

Charge Ramp Rate Down

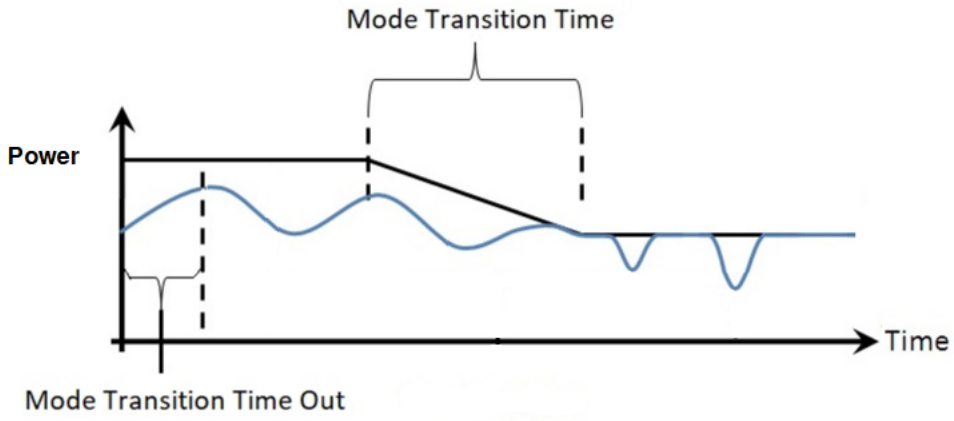
The allowed maximum rate of change of the required recharge power (kW/s) when moving from one power level to another. Charge represents the consumption or import of power. Down represents a decrease in power level when comparing final to initial power (see Figure 6).

This parameter can be related to the batteries recharging to restore energy lost during peak shaving, but only to the extent that the battery recharge power level may need to be increased.

Mode Transition Time

The time allocated to move from the current operational mode setting to a new operational mode setting as described in Figure 7:

Figure 7. Mode Transition Time Diagram



Mode Transition Time Out

The time-out period of the energy service in the absence of any command or additional action.

Priority

This parameter determines the priority of one energy service over another. A value of 1 represents the highest priority.

Priority is an important parameter when working with stacked energy services. Stacked energy services occur when two or more energy services are enabled simultaneously (or are effectively ready to go). The Priority value assigned to each of the services can represent the comparative economic opportunity of one service over another at a point in time.

Priority can also be used to avoid conflicts between mutually exclusive services.

Enable RTP DR

This is a binary value (ON or OFF) that starts or stops the energy service.

Apply RTP DR Parameters

This is a binary value (ON or OFF) that selects the energy service to be executed and applies all the settings entered on the RTP DR Configuration screen.

The ability to run more than one energy service at the same time is not currently available. This feature will be implemented in conjunction with the Priority parameter.

On Peak Period 1 and 2

The on-peak energy period when energy and demand rates are highest. This parameter is defined by the customer or the local utility energy provider. This value is entered by the user in 24-hour time, hh:mm.

Off Peak Period 1 and 2

The off-peak energy period when energy and demand rates are lowest. This parameter is defined by the customer or the local utility energy provider. This value is entered by the user in 24 hour time, hh:mm.

The RTP DR Configuration screen is organized to support two on-peak and off-peak operational periods of interest, shown as Period 1 and Period 2. The user can think or organize these two periods in many regards. For

example, one scenario could be to allocate the two periods as morning and afternoon operational peak periods. Another example would be facility first shift and second shift operational periods. The supporting parameters like Target Power, Time Duration, and Battery Charge Delay Time are also designated in terms of the Period 1 and Period 2.

If the user does not wish to subdivide the on-peak and off-peak periods, then simply use the first period, Period 1, and enter zeros into the fields associated with Period 2.

When entering times for on-peak and off-peak periods, users must convert their local time to UTC time.

Target Power 1 and 2

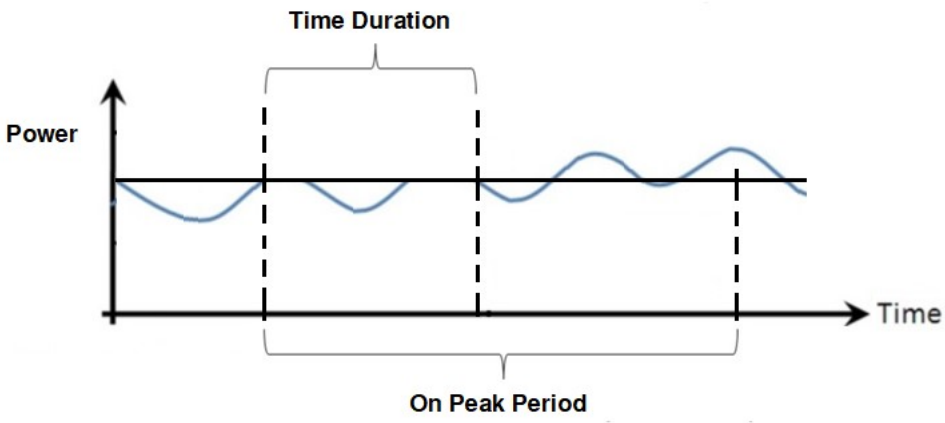
The input power limit level above which peak shaving is started.

Time Duration 1 and 2

Time Duration is the time during the on-peak period that peak shaving is available. This value is entered by the user in minutes (see Figure 8).

If the user desires to allow peak shaving over the entire peak period, then set this parameter equal to the entire on-peak period.

Figure 8. Time Duration Diagram



Battery Charge Delay 1 and 2

The desired time delay before the charging of batteries after peak shaving is done, whether reaching the Time Duration parameter limit or the Minimum Active SOC limit. This value is entered by the user in minutes. If no delay is required, then enter 0.

If charging is not allowed during the peak period, then extend this delay to a point in time after the on-peak period has ended.

Time-of-Use Demand Charge Management Configuration

TOU DCM applies to customers who participate in TOU energy markets and tariffs. This energy service is used to reduce demand charges found in the customers' monthly utility bills. DCM is accomplished by peak shaving during on peak periods to avoid high demand charges.

TOU contains seasonal parameters to account for energy rates being different in summer and winter months.

Figure 9. Time-of-Use Demand Charge Management (TOU DCM) Configuration

Unit Identification

This is the designation used to identify the UPS and/or the UPS input feeder bus. This is an alpha-numeric value entered by the user at the time of UPS installation.

Rated Power

The output rating of the UPS. This is entered by the user at the time of installation.

Available Peak Shaving Power

This value is a displayed parameter that is calculated by the EAC as a function of the UPS load condition. The value is displayed to inform the user during the TOU DCM configuration process.

Discharge Ramp Rate Up

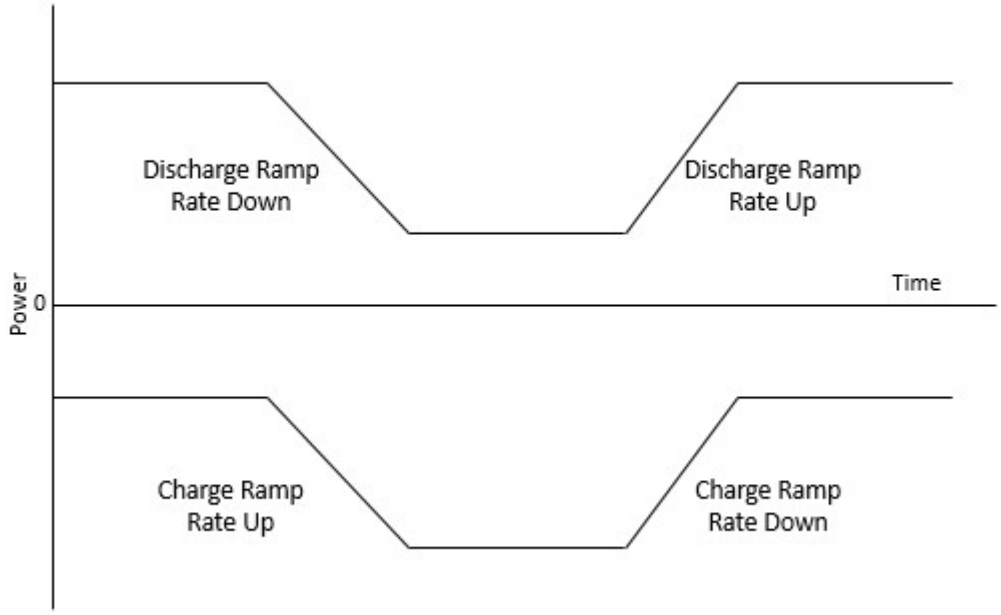
The allowed maximum rate of change of the required discharge power (kW/s) when moving from one power level to another. Discharge represents the generation or export of power. Up represents an increase in power level when comparing final to initial power (see Figure 10).

Discharge Ramp Rate Up, Discharge Ramp Rate Down, Charge Ramp Rate Up, Charge Ramp Rate Down, Mode Transition Time, and Priority are MESA/SunSpec Alliance parameters important to the EnergyAware UPS system's future roadmap, but are not currently available. Values entered in these fields are currently ignored by the EAC software.

Discharge Ramp Rate Down

The allowed maximum rate of change of the required discharge power (kW/s) when moving from one power level to another. Discharge represents the generation or export of power. Down represents a decrease in power level when comparing final to initial power (see Figure 10).

Figure 10. Discharge and Charge Ramp Rate Diagram



Charge Ramp Rate Up

The allowed maximum rate of change of the required recharge power (kW/s) when moving from one power level to another. Charge represents the consumption or import of power. Up represents an increase in power level when comparing final to initial power (see Figure 10).

This parameter can relate to the recharge of the batteries to restore energy lost during peak shaving. And only to the extent that the battery recharge power level may need to be increased.

Charge Ramp Rate Down

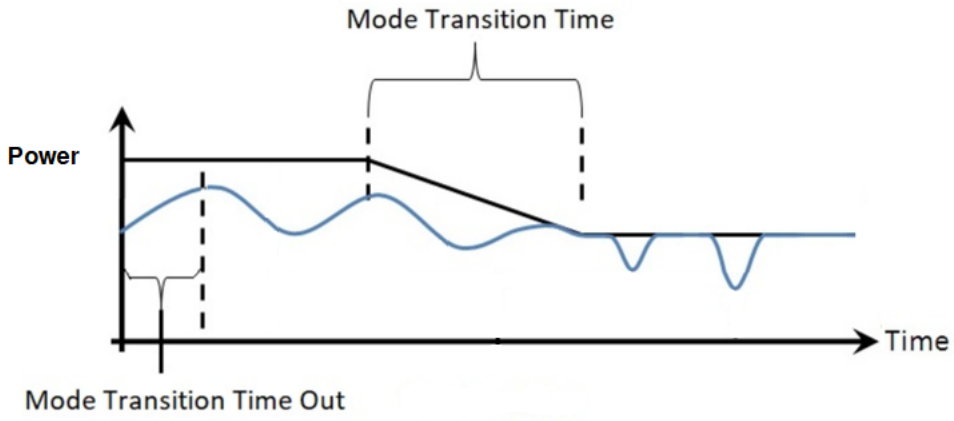
The allowed maximum rate of change of the required recharge power (kW/s) when moving from one power level to another. Charge is representative of the consumption or import of power. Down represents a decrease in power level when comparing final to initial power (see Figure 10).

This parameter can be related to batteries recharging to restore energy lost during peak shaving, but only to the extent that the battery recharge power level may need to be increased.

Mode Transition Time

The time allocated to move from the current operational mode setting to a new operational mode setting. See figure Figure 11.

Figure 11. Mode Transition Time Diagram



Mode Transition Time Out

Time out period to suspend the energy service in the absence of any command or additional action.

Priority

Priority is a potentially important parameter when working with stacked energy services. Stacked energy services occurs when two or more energy services are enabled simultaneously (or are effectively ready to go). The Priority value assigned to each of the services can represent the comparative economic opportunity of one service over another at a point in time; the service that offers of high economic value is assigned the higher priority number and will be executed first.

Priority can also be used to avoid conflicts between mutually exclusive services.

Enable TOU DCM

This is a binary value (ON or OFF) that starts or stops the energy service. A value of 1 starts the energy service and a value of 0 stops the service.

Apply TOU DCM Parameters

This is a binary value (ON or OFF) that selects the energy service to be executed and applies all the settings entered on the TOU DCM Configuration screen.

The ability to run more than one energy service at the same time is not currently available. This feature will be implemented in conjunction with the Priority parameter.

Season 1 and 2

This is where the user enters start and end dates that define each season.

This screen supports two seasons, 1 and 2, which can represent the winter and summer seasons.

On Peak Period for S1 and S2

The on-peak energy period when energy and demand rates are highest. This parameter is defined by the customer or the local utility energy provider. This value is entered by the user in 24-hour time, hh:mm.

Off Peak Period for S1 and S2

The off-peak energy period when energy and demand rates are lowest. This parameter is defined by the customer or the local utility energy provider. This value is entered by the user in 24 hour time, hh:mm.

- The on-peak and off-peak periods can be a function of the given season (or time of the year) as represented by the S1 and S2 designation.
- On-peak and off-peak periods must add up to 24 hours, otherwise a scheduling alarm occurs.
- When entering times for on-peak and off-peak periods, users must convert their local time to UTC time.

Target Power 1 and 2

The input power limit level above which peak shaving is started.

S1/S2 Energy Charges and S1/S2 Demand Charges

Energy and demand charges are entered in these fields. These parameters should equal those found in the customer's latest monthly utility bill or other document that describe the customer's TOU energy rate structure.

- The TOU energy and demand charges can be a function of the given season (or time of year) as represented by the S1 and S2 designation.

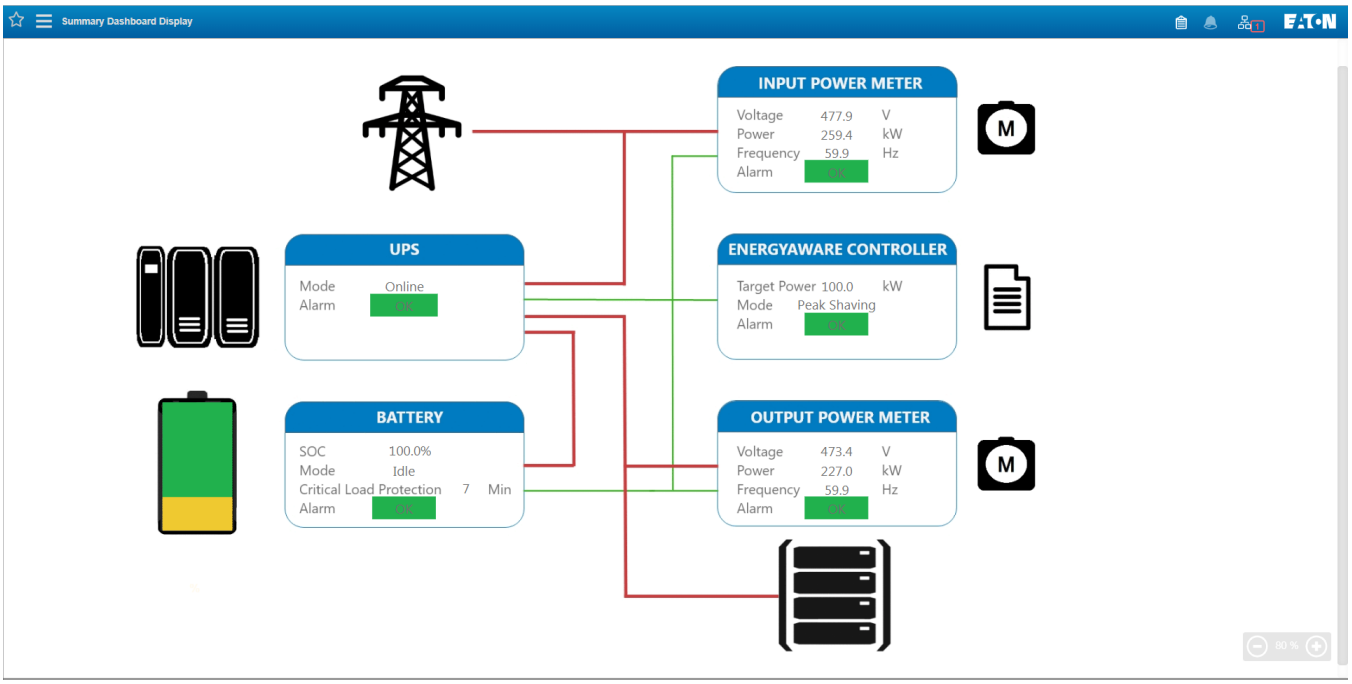
On-peak and off-peak periods must add up to 24 hours, otherwise a scheduling alarm occurs. On-peak and off-peak periods must add up to 24 hours, otherwise a scheduling alarm occurs.

Appendix A: Human-Machine Interface (HMI) Screens During Operation

This section shows each of the HMI screens with sample values that would be seen during operation of the EnergyAware Controller.

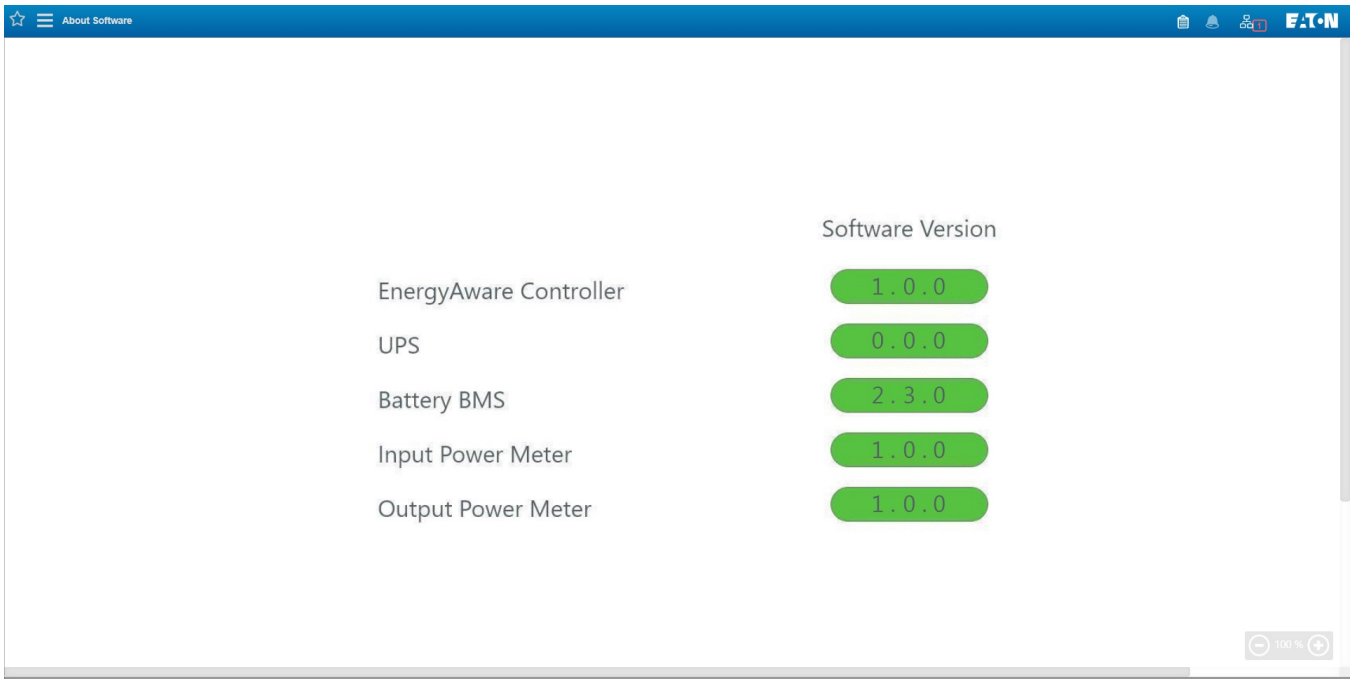
Summary Dashboard Display

Figure 12. Summary Dashboard Display Operational HMI Example



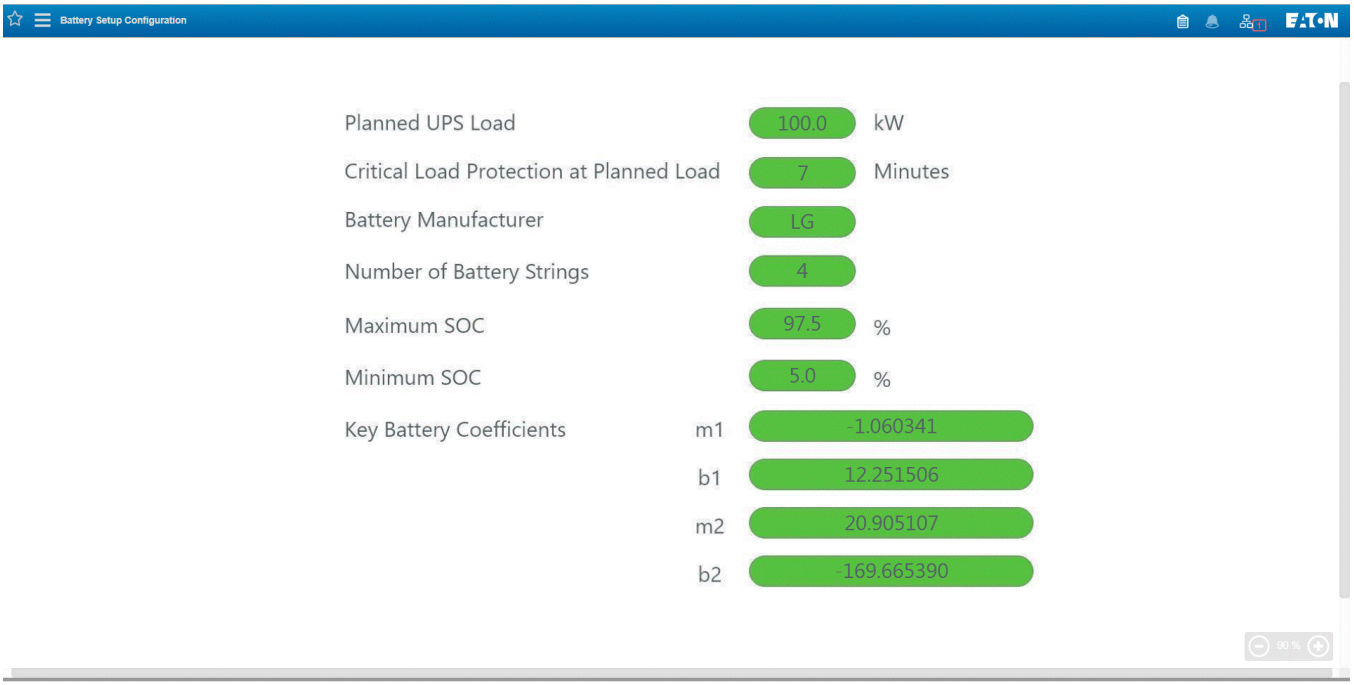
About Software Display

Figure 13. About Software Display Operational HMI Example



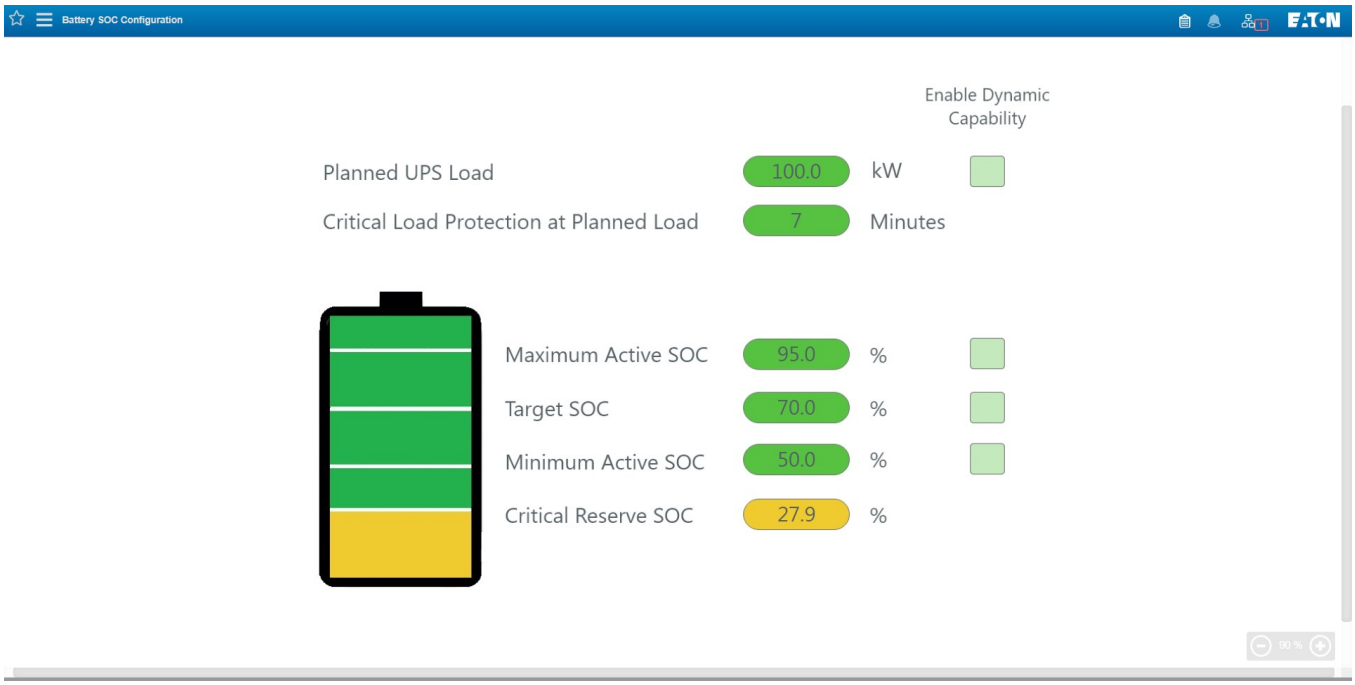
Battery Setup Configuration

Figure 14. Battery Setup Configuration Operational HMI Example



Battery SOC Configuration

Figure 15. Battery SOC Configuration Operational HMI Example



Real-Time Pricing Demand Response Configuration

Figure 16. RTP DR Configuration Operational HMI Example

Time-of-Use Demand Charge Management Configuration

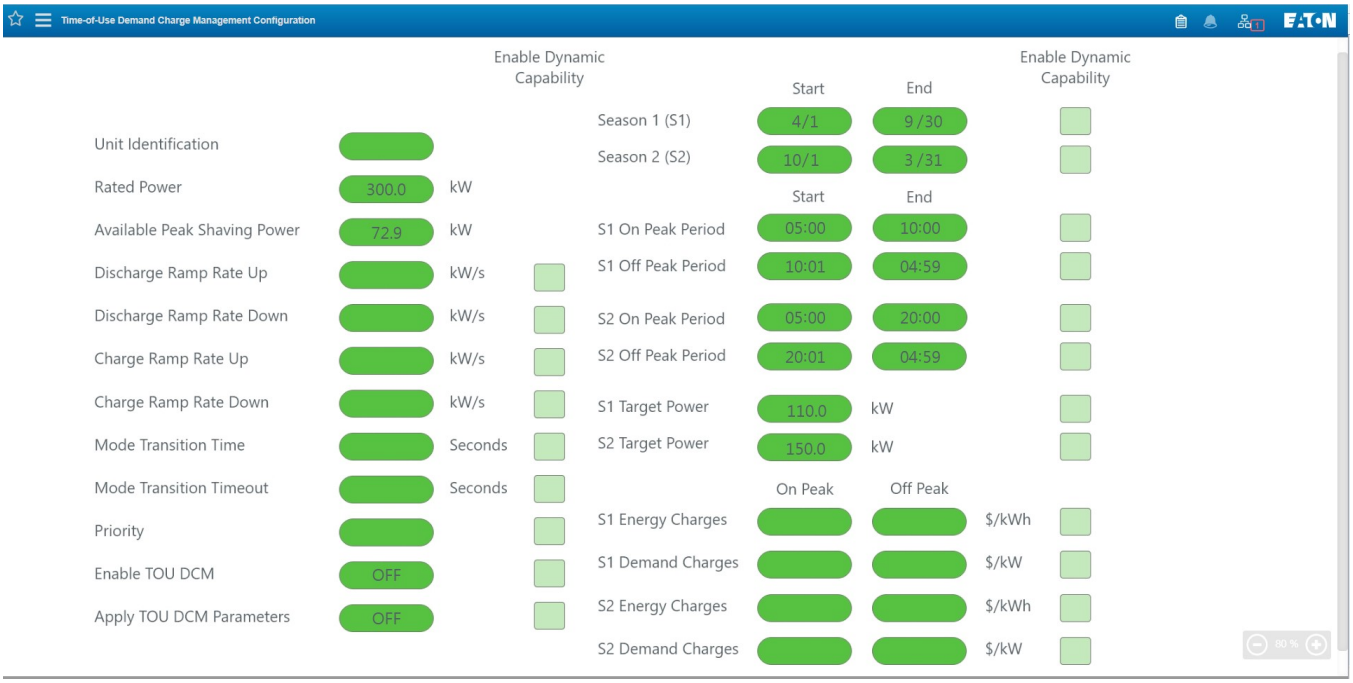



Figure 17. TOU DCM Configuration Operational HMI Example