ASCO® 5850 Load Management Unit+

TABLE OF CONTENTS

ASCO Power Technologies®
Florham Park, NJ 07932-1591
Call 1 800 800-2726 (ASCO) for sales or service

381333-466

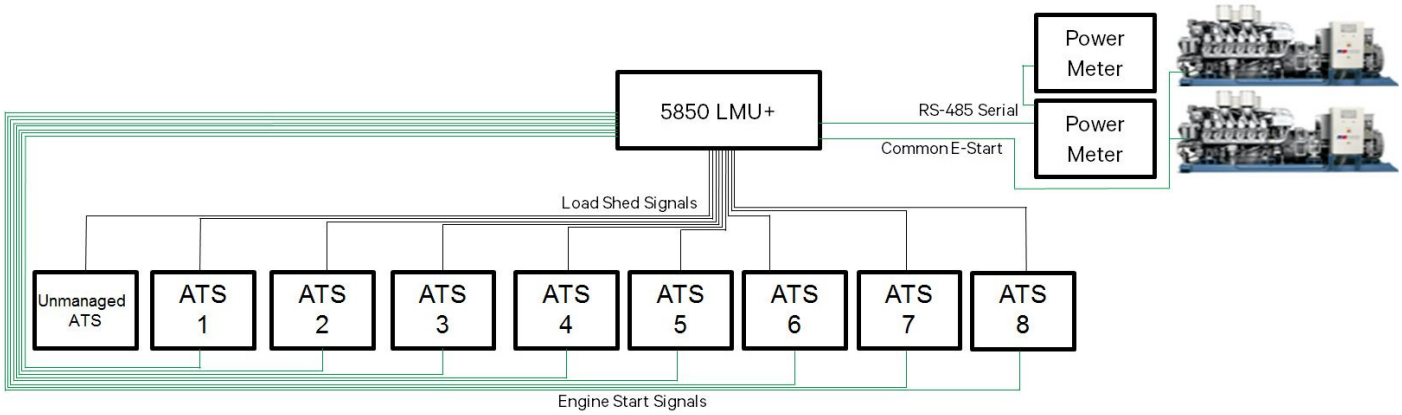
General Information

The ASCO 5850 Load Management Unit+ (5850 LMU+) is a system designed to control the transfer of ASCO Automatic Transfer Switches (ATS) to emergency generation systems that have limited capacity relative to the full loading of all the connected switches.

The 5850 LMU+ uses an ASCO Power Meter placed at the generator(s) to collect generator loading information. Based upon the real time loading of the generator(s) the system will regulate the transfer of the switches, in order of the priority, to the emergency source: allowing them to connect when there is sufficient capacity or shedding them from the emergency source when there is insufficient capacity.

The 5850 LMU+ can be used to manage up to eight transfer switches (priorities) which are connected to either a single generator system or a two generator paralleled system. This system operates using a proactive load management concept which compares a pre-programmed expected ATS load to the available capacity (headroom) on the generator prior to allowing a transfer to the emergency source.

System Architecture



System Components

- **5850 Load Management Unit+**
  - Receives individual ATS engine start signals and issues a master engine start signal to the generators.
  - Serially reads real-time electrical parameters of generator via ASCO Meter.
  - Issues load shed/adds commands to transfer switches based upon generator loading.
- **5210 Digital Power Meter(s) – supplied separately**
  - Meters generator electrical parameters using voltage sensing lines and CTs (CTs provided by others).
  - Communicates real-time data back to LMU+ using 4-wire serial RS-485 connection.
  - One meter is required per generator.
  - Provided as loose meter for customer integration (5210 DPM) or enclosed/mounted meter (5211/5212 PMU).
- **ASCO Automatic Transfer Switches – supplied separately**
  - ASCO switches require load shed option that sheds load from emergency upon removal of 24Vdc (ex. Acc. 30B3 or 30BA3)
  - Switch will supply close to start engine signal to 5850 LMU+.
  - Delayed transition switches are recommended to allow shed to center off position. Open transition switches acceptable to allow shed to normal source.
  - 5210 Power Meters recommended on Transfer Switches to provide users with Max KW Demand information for use in system configuration.

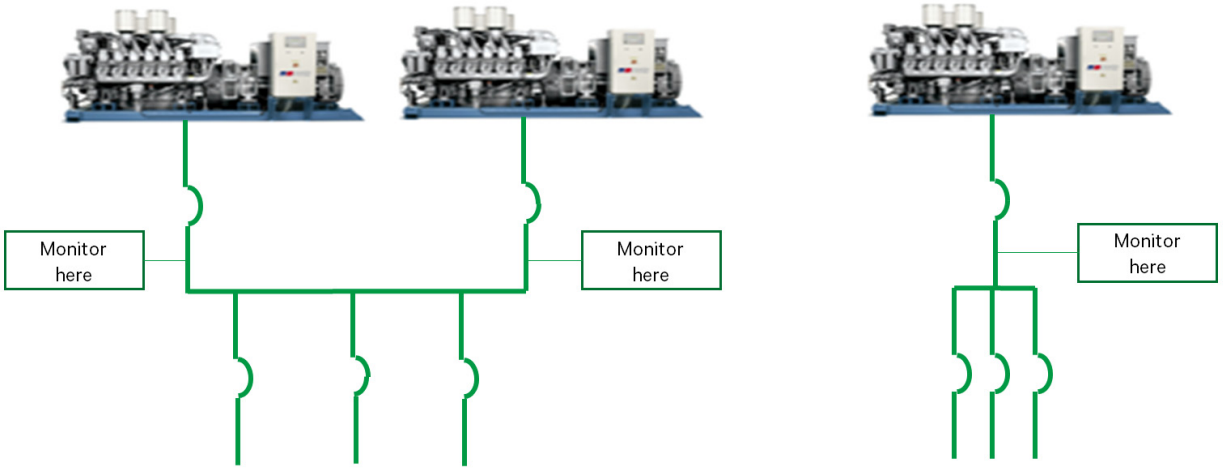
System Requirements

Generator Monitoring Requirements

An ASCO 5210 Digital Power Meter must be used to monitor each generator in the system. This meter is responsible for monitoring the electrical parameters of the generator, especially power and frequency, and communicating them back to the 5850 LMU+ via its on board 4-Wire RS-485 serial connection . These parameters are then used by the 5850 LMU+ to make its control decisions.

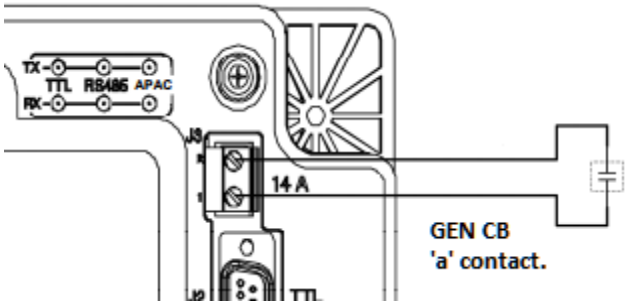
The ASCO 5210 Digital Power Meter can be provided either loose for installation/integration into other equipment or it can be provided within a Type 1 enclosure (ASCO 5211/5212 PMUs) that can be wall mounted within a facility.

The meter must be installed downstream of the main generator or paralleling breaker to ensure that the full load on the generator is captured and to ensure that the voltage read from the generator is 0 if the breaker is open (despite the generator running).



The following items must be wired to the meter for proper operation with the 5850 LMU+.

- Voltage Sensing Lines
- Current Sensing Lines (from externally supplied CTs)
- RS-485 4-Wire Connections
- Breaker Closed Contact
- Control Power



For single generator systems, if no GEN CB aux contact is available, this terminal can be shorted. For dual parallel gens, these breaker contacts MUST be wired to the meters since they will determine how many generators are connected to the bus and thus the total available capacity.

Additional details on mounting, wiring, and operation of the ASCO 5210 Digital Power Meter (or enclosed models) can be found in Operator's Manual 381333-368 or with its associated drawings.

LMU Connection Requirements

The Load Management Units must be properly wired to the metering device, generator, and ATSs for it to operate correctly.

The LMU requires 24Vdc or 120Vac control power. Either is sufficient for the system to operate; For added redundancy both may be wired. The system should be fed from a reliable location so that it may be powered from the primary or alternate source of power. Without control power the unit will be unable to properly manage the transfer of ATSs during an outage. The LMU does have several seconds of ride-through power; which is intended to maintain communications integrity rather than full operability

The LMU must have the engine start (close to start) signal from each managed transfer switch wired to its corresponding terminal block. Optionally, although they are unmanaged, life safety/unmanaged ATSs may also route their engine start signals through the LMU, although this is not required. These will determine which switches require or are requesting permission to transfer to emergency. These engine starts will be commoned (logical OR) together and the LMU will then provide a master engine start signal to the generator. The master engine start signal can be provided either as an open to start or closed to start signal. This common engine start signal is designed with a fail-safe so that if control power or controller failure occurs the engines will be signaled to start.

The meter placed at the generator(s) must also be wired back to the LMU using RS-485 4-wire serial cable. This connection will be used by the LMU to poll and monitor the electrical parameters and output of the generator which will drive the logic of the LMU.

Lastly the LMU must have its Load Add/Shed connections wired to each of the ATS(s). This connection serves as the control signal that manages the transfers of the ATSs. When the system allows a transfer to the Emergency source these outputs will energize with 24Vdc signaling the equipment that it is “OK” to proceed with transfer. Should the system require load to be removed or restricted from transferring to the Emergency source this signal will remain off. The fail-safe of this design is set to restrict all transfers should the system or wiring runs become compromised and prevent transfers to the Emergency Source. This prioritizes protection of the generator from overload as well as ensures sufficient capacity for life safety loads to transfer over.

Note the engine start and load management signal for each ATS must work in sets meaning that both signals must be matched when physically wired. (Ex…Engine Start 3 = Load Shed 3 = ATS 3)
Details on wiring points can be located in the wiring diagram.

ATS Requirements

As previously mentioned the closed to start signal from each ATS must be wired to the LMU.

ATSs must also be properly equipped to accept and act upon load management signals. ATSs must have the ability to accept a 24Vdc load add signal and shed when no voltage is present. For ASCO ATSs this can be accomplished by equipping accessory 30B3 for open transition switches or 30BA3 for delayed/closed transition switches.

NOTICE

Delayed transition switches are recommended to allow shed to center off (disconnected) positions during load shed situations. Open transition switches are acceptable to allow shed to the normal source; however, this will expose the ATS loads to a potentially unacceptable power source.

Sequence of Operations

1. All loads are shed
2. Generator starts
3. Loads brought on one at a time based on pre-set rating if capacity allows.
4. When next load exceeds capacity it is left off

*If time sequencing is on remaining loads are brought on one at a time for preset time.

Description of Operation

Upon failure of the normal source at any ATS and after a normal failure time delay (set in the ATS controller), the engine start signal from the ATS will start the generator. The start signals from all controlled ATS will be routed through the Load Management cabinet to start the generator. Engine start from any ATS will be referred to as "Emergency Mode". Once the generator is at rated speed and voltage, the system will be ready to add loads on to the generator. If an ATS is not equipped with load shed, those ATS will transfer to the emergency source on its own and cannot be shed by the load management controls. The rest of the loads will be added by the load management controller onto the generator source.

For bus optimization, each load should be wired to the correct output that is assigned the priority value desired. Output 1 is priority 1, output 2 is priority 2, and up to output 8 is priority 8.

Load Bus Optimization is provided to re-add shed loads one at a time based on predetermined (operator entered setting) kW loading values up 95% (adjustable via OIT) of the capacity of the on-line power. This percentage value is referred to as the Bus Optimization KW de-rating value.

With loads requiring emergency power and after an activation time delay (adjustable via the OIT, default 5 seconds), the load management feature is activated and a load management status indicator turns on. The Load Management indicator flashes through the duration of the activation time delay. At this time, the Bus Optimization loading control will determine if there is enough room to add the next load by checking the pre-set Load Value (field adjustable, accessible via the OIT) assigned to the highest priority block that is shed and compare it to the excess generator bus capacity (also known as Headroom).

If it is determined that the load can be added without exceeding the Bus Optimization KW de-rating value, the load is signaled to add. The real time kW output of the generator bus is constantly measured and the next sub-priority load is evaluated. Loads are evaluated at a preset time interval defined via the OIT (Bus Opt Step Time). When the bus has been loaded to a level such that the next load would exceed the de-rating value, the Next Load Exceeds Headroom indicator will activate and load adding will pause. The system will continuously monitor the generator load and evaluate if the next load step can fit on the bus. If building load decreases and the next load can fit (for the duration of the step time delay), the system will add it and continue the evaluation process until as many loads as possible are added to the bus.
If the load is not calling for an engine start (load still fed from normal power), it will be skipped.

If at any time, the online load exceeds 105% (overload value, adjustable via OIT) of available rated capacity, the system will remove the last load that was added. If the online load does not decrease to less than 105% (overload value, adjustable via OIT) of rated capacity, loads will be shed one at a time, every second in reverse order until the overload is corrected or the system only has loads online that cannot be shed (loads do not have load shed capability). The Bus Overload indicator will show that the bus is overloaded and will automatically reset as the overload is corrected. In this event, the system will begin a 30 second overload stabilization delay time (adjustable via OIT, default 2700 seconds) before evaluating adding additional load to the bus.

In the event of a bus Under-frequency, all controlled loads will be shed (priorities 1 through 8). The "Bus Under Frequency" indication will show this condition.

No loads can be manually added while a bus under frequency alarm indication is active. By default, the system will go through the stabilization time delay before attempting to add loads again. The system settings may be changed to require the operator to acknowledge the alarm by pressing the Alarm Reset pushbutton (provided bus under frequency is still not active) before adding loads again. After the operator acknowledges the alarm, the system will again be allowed to load management again.

Features

Hand off Auto (HOA) – Manual Load Control

The system is provided with (H-O-A controls) of the load priorities through the OIT. After logging in to the OIT, the operator can select the priority to be brought online and place it in the HAND position via the pushbutton on the OIT touch screen. When placed in the HAND position, the load shed signal is removed and the load priority is allowed to transfer to emergency power.

When the load priority is placed back into the AUTO position, the system will be allowed to control the load priority normally for adding and shed controls. Any load priority in the HAND position will be returned to AUTO at the end of Emergency Mode.

If a load priority is placed in the OFF position, it will **NEVER be allowed to transfer to emergency**. Any load priority left in the OFF position **will NOT** automatically return to AUTO at the start of emergency mode. If the system is running in emergency mode, placing a load priority in the OFF position will immediately shed it from the emergency source. During any bus under frequency, any load priorities placed in HAND will be set back to AUTO and will shed.

Generator Load Monitoring

The generator metering information is monitored via an ASCO 5212 digital power meter for each generator. This meter must be connected to CTs and PTs. These CTs and PTs are not part of the ASCO Load Management cabinet and must be provided by others as part of the generator setup. The OIT communicates via RS-485 Modbus to the ASCO 5210/ 5212 digital power meter.

Priority Swap Mode

Some systems may not have enough generator power for everything and no load is really more important than the next. During an extended utility outage, emergency power may be available, but not for everyone. Bus optimization will functionally normally until the system reaches “next load exceeds bus headroom”, then the Swap Mode Start time delay (adjustable via OIT) will start counting up to activate Swap Mode. This mode is designed to give power for a defined time (Swap Mode Step Time Delay, adjustable via OIT) to selected loads where the system does not the capacity to handle all selected loads; the chosen loads (enabled for swapping via OIT) will cycle on and off sharing time as defined by the swap mode step time delay. The loads not designated for swapping will stay on if they were previously on or will remain off if they were previously off. Load sets will be evaluated and compared to bus headroom before the current load set will be swapped for the next. Load swap mode will not progress if the next load set does not fit within the bus capacity (headroom).

Configuration

Generator Metering Configuration

The meter(s) on the generator(s) must be configured as per the manual included with the meter to ensure the electrical parameters are being accurately measured. The following items are key configuration items that must be set:

1. PT ratio
2. CT ratio
3. System Type (Electrical Configuration)

Additionally the following communication settings must be set on the meter for proper communications with the LMU.

1. 485 Protocol = Modbus
2. 485 Address = 1 (for gen 1 or single gen systems) OR 485 Address = 2 (for gen 2 on dual gen systems)
3. 485 Baud rate = 19200

LMU Configuration

Once wired the LMU must be properly configured to ensure operation as expected and for optimization to your specific site.

First the rating of the generator(s) must be entered from the Generator Settings Menu. This rating will be used by the LMU as the capacity of the system and will drive all load add and shed decisions. For single generator models ensure that "Generator 2 Capacity" is set to "0" (Note: if a single gen system was purchased even if this parameter is set it will not function as a dual gen system).

Second set the expected KW for each load under the Load Settings Menu. These settings are used by the LMU to calculate if adding this load will likely overload the system when relative to available capacity. The KW values used for this setting may be derived by metering the demand of the load over time or estimation can be made based upon the understanding of the served loads. Having accurate near the max demand potential of the load are important, underestimating may result in the load being added and causing an overload condition while overestimating may prevent the load from being added despite their being sufficient capacity for its true operating power level.

Additional settings, features, and delays are described in the below tables and sequence of operation and may be adjusted or enabled based upon the sites specific needs or preferences.

ATS Configuration

ASCO ATSs shipped with the proper load shed accessories will already have the proper configurations set. Please contact ASCO if the system is intended for use with other ATS systems or if there are any ATS configurations since the necessary settings are factory configurable only.

Settings

The operation of this Load Management System must be adjusted as described in the Configuration section for the system to operate properly. Additional settings may be adjusted to better suit the needs of a specific site or application.
To view these settings on the LMU one must a use the LCD touchscreen. The settings can be reached by selecting the "Menu" option (or pressing the F1 button) on any screen and then selecting "View Settings". Once at the settings menu you may then select a category and use the on screen touch controls to navigate through them.

To change the settings one must first Login to the unit. The login screen can be reached by selecting the "Menu" option (or pressing the F1 button) on any screen and then selecting "Login/Logout". Alternatively pressing the "F4" button will take you directly to the Login/Logout screen. Once on this screen select the "Enter Password" box. Use this screen to enter the **default password "2726"** then press enter. On the resulting screen select the login button and you will see the status changed to "Logged In". At this time you will have the option to change the password from this same screen or navigating to the settings menu and change any of the configuration options.

Once logged in, you will have to the following options from the "menu" screen which were previously described.

- Configure Settings
- Load HOA (manual overrides)

Remember to return to the "login/logout" screen and logout when changes are completed.

NOTICE

System settings (reached by pushing the settings button) are factory only settings that should not be adjusted in the field. Changes to these settings could jeopardize the operation of the system.

Generator Settings

Setting Name	Description	Range
Generator 1 Capacity	KW Standby Rating of Generator 1	0-32000 KW
Generator 2 Capacity	KW Standby Rating of Generator 2	0-32000 KW (SET TO "0" FOR SINGLE GEN SYSTEMS)

Load Settings

Setting Name	Description	Range
Pri 1 KW	Expected KW of Priority 1 Load	0-9999 KW
Pri 2 KW	Expected KW of Priority 2 Load	0-9999 KW
Pri3 KW	Expected KW of Priority 3 Load	0-9999 KW
Pri4 KW	Expected KW of Priority 4 Load	0-9999 KW
Pri5 KW	Expected KW of Priority 5 Load	0-9999 KW
Pri6 KW	Expected KW of Priority 6 Load	0-9999 KW
Pri7 KW	Expected KW of Priority 7 Load	0-9999 KW
Pri8 KW	Expected KW of Priority 8 Load	0-9999 KW
Pri1 Swap Enb?	Is Priority Load Swapping allowed for Load 1?	0=Off / 1=On
Pri2 Swap Enb?	Is Priority Load Swapping allowed for Load 2?	0=Off / 1=On
Pri3 Swap Enb?	Is Priority Load Swapping allowed for Load 3?	0=Off / 1=On
Pri4 Swap Enb?	Is Priority Load Swapping allowed for Load 4?	0=Off / 1=On
Pri5 Swap Enb?	Is Priority Load Swapping allowed for Load 5?	0=Off / 1=On
Pri6 Swap Enb?	Is Priority Load Swapping allowed for Load 6?	0=Off / 1=On
Pri7 Swap Enb?	Is Priority Load Swapping allowed for Load 7?	0=Off / 1=On
Pri8 Swap Enb?	Is Priority Load Swapping allowed for Load 8?	0=Off / 1=On
Pri 1 Always On	Keep priority 1 loads always on when generator power is available or allow bus optimization to add/shed priority 1 loads.	0=Off / 1=On

General Settings

Setting Name	Description	Range
Load Strt TD	Time delay before load addtion/management after the generator is available.	0-3276.7 sec
Load Step TD	Time delay between load management adding load steps.	0-3276.7 sec
Der. Bus Cap	Load Management will continue to add loads up to this % of the rated generator KW value.	0-100 %
Stable TD	Stabilization time delay required before adding more loads after hitting bus overload and shedding load.	0-3276.7 secs
Overload %	Percent load which overload is triggered. Overload will step shed loads in reverse priority order every second until the overload is relieved.	90-150%
Bus UF Mon.	Frequency at which below the under frequency time delay will be triggered.	0-65.00 Hz
Bus UF TD.	Time delay after which a bus under frequency alarm will occur with bus UF monitor under frequency.	0-10.0 sec
Bus UF Enb	Enable or disable under frequency monitoring function.	0=Off / 1=On
Ack UF Req	Alarm reset push button must be pressed on the screen to clear the under frequency alarm before loading will occur again. This can be enabled or disabled.	0=Off / 1=On
Ext. Modbus	Modbus RTU output from the OIT screen. Enable/Disable. Enabling this will disable ASCO programming ability of the OIT screen. This must be disabled before programming can occur again.	0=Off / 1=On
LoadSwapMode	Enable or Disable swap mode	0=Off / 1=On
LoadSwapStrtTD	Time Delay for starting Swap Mode after system reaches next load exceeds bus headroom and a load online is enabled for swapping and loads shed are enabled for swapping.	0-32767 seconds
LoadSwapCycTD	Time Delay for each load set to operate before swapping to a different load set.	0-32767 seconds

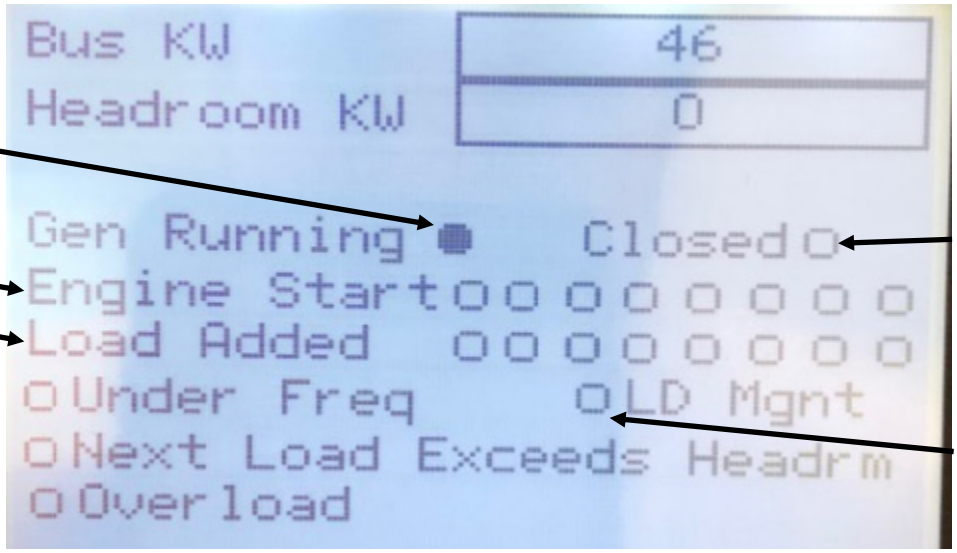
Navigation

Operation and monitoring of the LMU is accomplished using the front touchscreen. From this screen the various status/operational screens can be accessed as well as the settings menus. In addition, quick navigation buttons are also provided on the front of the unit:

System = ASCO Factory Settings (do not edit)
F1 = Main Menu
F2 = System Status (default home screen)
F3 = Meter Data
F4 = Login/Logout Screen

NOTICE

On the system status screen a filled in circle (●) is used to annunciate a specific condition is true.



Optional Communications

Ethernet

The LMU can support Modbus communications via Ethernet by using an included serial to Ethernet converter. The converter is a Moxa Mgate MB3170i. This converter must be configured on site to meet the needs of the customer/site. The manual for this device is included with the LMU when shipped or can be obtained from Moxa's website.

Serial

If required the LMU can be easily modified to support serial RS-485 communications. To perform this change please contact ASCO.

Modbus Map

Modbus Default ID: 1
Note: bits described as 1-16
Data Type: INT 16 bit

Parameter	Modbus Address
Emergency Mode (ON/OFF)	40001.01
Bus Optimization Active (ON/OFF)	40001.02
Next Load Exceeds Headroom (ON/OFF)	40001.03
Priority 1 loads added (ON/OFF)	40001.06
Priority 2 loads added (ON/OFF)	40001.07
Priority 3 loads added (ON/OFF)	40001.08
Priority 4 loads added (ON/OFF)	40001.09
Priority 5 loads added (ON/OFF)	40001.10
Priority 6 loads added (ON/OFF)	40001.11
Priority 7 loads added (ON/OFF)	40001.12
Priority 8 loads added (ON/OFF)	40001.13
Bus Under Frequency Alarm Active (latched condition) (ON/OFF)	40001.14
Bus Overload (ON/OFF)	40001.15
Operator Logged In to OIT (ON/OFF)	40001.16
Priority 1 Load Shed (ON/OFF)	40002.01
Priority 2 Load Shed (ON/OFF)	40002.02
Priority 3 Load Shed (ON/OFF)	40002.03
Priority 4 Load Shed (ON/OFF)	40002.04
Priority 5 Load Shed (ON/OFF)	40002.05
Priority 6 Load Shed (ON/OFF)	40002.06
Priority 7 Load Shed (ON/OFF)	40002.07
Priority 8 Load Shed (ON/OFF)	40002.08
Priority 1 HAND (Active/Not Active)	40002.09
Priority 2 HAND (Active/Not Active)	40002.10
Priority 3 HAND (Active/Not Active)	40002.11
Priority 4 HAND (Active/Not Active)	40002.12
Priority 5 HAND (Active/Not Active)	40002.13
Priority 6 HAND (Active/Not Active)	40002.14
Priority 7 HAND (Active/Not Active)	40002.15
Priority 8 HAND (Active/Not Active)	40002.16
Priority 1 OFF (Active/Not Active)	40003.01
Priority 2 OFF (Active/Not Active)	40003.02
Priority 3 OFF (Active/Not Active)	40003.03
Priority 4 OFF (Active/Not Active)	40003.04
Priority 5 OFF (Active/Not Active)	40003.05
Priority 6 OFF (Active/Not Active)	40003.06
Priority 7 OFF (Active/Not Active)	40003.07
Priority 8 OFF (Active/Not Active)	40003.08

Modbus Map (continued)

Parameter	Modbus Address
Priority 1 AUTO (Active/Not Active)	40003.09
Priority 2 AUTO (Active/Not Active)	40003.10
Priority 3 AUTO (Active/Not Active)	40003.11
Priority 4 AUTO (Active/Not Active)	40003.12
Priority 5 AUTO (Active/Not Active)	40003.13
Priority 6 AUTO (Active/Not Active)	40003.14
Priority 7 AUTO (Active/Not Active)	40003.15
Priority 8 AUTO (Active/Not Active)	40003.16
Generator 1 Running (ON/OFF)	40004.01
Generator 2 Running (ON/OFF)	40004.02
Generator 1 Online (ON/OFF)	40004.03
Generator 2 Online (ON/OFF)	40004.04
Basic Version (ON=Basic/OFF=Advanced)	40004.05
Swap Mode Switch (ON/OFF)	40004.06
Swap Mode Active (Active/Not Active)	40004.07
Priority 1 Load Enabled for Swap (ON=Enabled, Off=No Swap)	40004.08
Priority 2 Load Enabled for Swap (ON=Enabled, Off=No Swap)	40004.09
Priority 3 Load Enabled for Swap (ON=Enabled, Off=No Swap)	40004.10
Priority 4 Load Enabled for Swap (ON=Enabled, Off=No Swap)	40004.11
Priority 5 Load Enabled for Swap (ON=Enabled, Off=No Swap)	40004.12
Priority 6 Load Enabled for Swap (ON=Enabled, Off=No Swap)	40004.13
Priority 7 Load Enabled for Swap (ON=Enabled, Off=No Swap)	40004.14
Priority 8 Load Enabled for Swap (ON=Enabled, Off=No Swap)	40004.15
Priority 1 Engine Start (ON/OFF)	40005.01
Priority 2 Engine Start (ON/OFF)	40005.02
Priority 3 Engine Start (ON/OFF)	40005.03
Priority 4 Engine Start (ON/OFF)	40005.04
Priority 5 Engine Start (ON/OFF)	40005.05
Priority 6 Engine Start (ON/OFF)	40005.06
Priority 7 Engine Start (ON/OFF)	40005.07
Priority 8 Engine Start (ON/OFF)	40005.08
Gen 1 Capacity KW	40010
Gen 2 Capacity KW	40011
Bus Headroom KW	40012
Bus Optimization Active Time Delay (ON/OFF)	40013
Bus Optimization Active Time Delay Accumulator (ON/OFF)	40014
Bus Optimization Step Time Delay (ON/OFF)	40015
Bus Optimization Step Time Delay Accumulator (ON/OFF)	40016
Derated Bus KW	40017
Derated Bus KW Percent	40018
Bus Under Frequency Set Point	40019

Modbus Map (continued)

Parameter	Modbus Address
Bus Stabilization Time Delay	40020
Bus Stabilization Time Delay Accumulator	40021
KW Overload Percentage	40022
Bus KW	40023
Swap Mode Start Time Delay	40024
Swap Mode Swap Time Delay	40025
Swap Time Delay Remaining	40026

SETUP CHECKLIST

Metering Device

- ☐ Validate wiring (control power, voltage sensing, current sensing, breaker status input, and communications)
- ☐ Confirm system type, PT, and CT ratios
- ☐ Confirm communication settings
- ☐ Start generator and confirm readings

Transfer Switch

- ☐ Validate wiring (engine start signal and load shed signal)

Load Management Unit

- ☐ Validate wiring (engine start inputs, master engine start output, load control signals, control power, and communications)
- ☐ Validate primary settings (Gen KW rating, Priority KW ratings, and delays)

INDEX