PRODUCT MANUAL

Galaxy Millennium® SC Controller

J2011002

Product Manual
Ordering code: 850015641

Notice:

The information, specifications, and procedures in this manual are subject to change without notice. OmniOn assumes no responsibility for any errors that may appear in this document.

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Introduction

The Galaxy Millennium® SC controller (MSC) brings next generation features of the controller to plants with legacy rectifiers. It provides integrated control and monitoring of plants with a mixture of rectifier technologies by interfacing with parallel rectifiers (legacy, non-serial rectifiers) as well as all Galaxy Protocol (GP) serial rectifiers and converters. It provides control, monitoring, and alarm monitoring functions over a multi-drop serial interface that interconnects Galaxy Protocol (GP) rectifiers, GP converters, Bay Interface Cards (BICs), and other serial devices. Galaxy Protocol communication is via robust RS-485 serial buses. MSC has a plethora of I/O and monitoring options. It can monitor and control battery plants containing up to 72 GP serial rectifiers, up to 16 serial converters, up to 32 BICs, and up to 16 parallel rectifiers. A maximum combination of 90 GP nodes can be directly managed on the rectifier serial bus. MSC performs many functions described more thoroughly in following sections.

Feature Summary

- Alarm Detection, Identification, and Reporting
- System and Component Status
- System and Feature Configuration
- System Alarm Thresholds
- Battery Management (Slope Thermal Compensation/Recharge Current Limit)
- Battery discharge testing
- Reserve Time Prediction
- Selective high/low voltage shutdown
- Float/Boost Mode Control
- Low Voltage Disconnect Management
- Remote Access Control And Multiple Level Password Security
- Control and Operation
- Plant
- Rectifiers
  - Parallel - Legacy OmniOn and non-OmniOn Ferro, SCR, and OmniOn ECS Switch Mode
  - Serial GP Protocol - OmniOn Switch Mode
- History
- Statistics

Abbreviations

- MSC - Galaxy Millennium® SC controller
- SC - Galaxy® SC controller
- M2 - Galaxy Millennium® II controller
- GP - Galaxy Protocol (RS-485)

This controller directly replaces existing rear access versions of the Galaxy® SC controller (SC), including its application as replacement for other legacy controllers, e.g. MCS, CCS, etc. The MSC is easier to use and adds additional functionality to the comprehensive feature set provided by the existing SC. The separate Independent (Basic), Intelligent, and network interface circuit cards of the existing SC have been updated and integrated into the standard M2, which is the intelligent core of the MSC. This eliminates the need to manage multiple cards for features as well as plant voltage. Standard communications features now include remote 10/100 Base-T network access to display power system operating status and available information via the world wide web (internet) or your enterprise network (intranet) using standard browsers.

Upgrading to the MSC is easy. Software features include and expand on those of the SC. Rectifier interfaces continue to support legacy rectifiers with the same Remote Interface Modules (RIMs) as the SC. MSC is physically backwards compatible with SC for ease of field upgrade.

Upgrading to the MSC adds newer and more available technologies to the power system. MSC chassis, Figure 1, replaces the SC chassis.

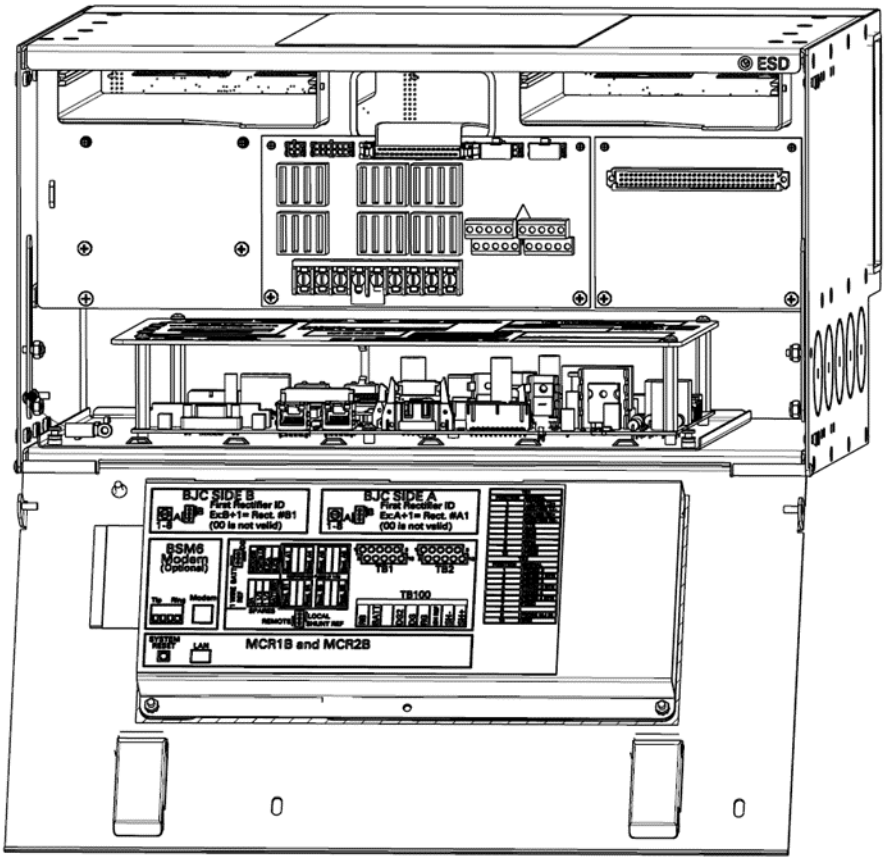
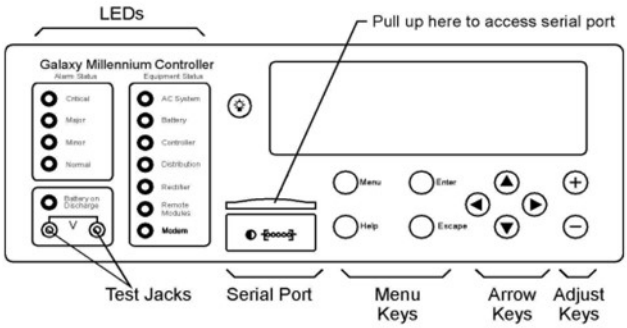


Figure 1 MSC Chassis

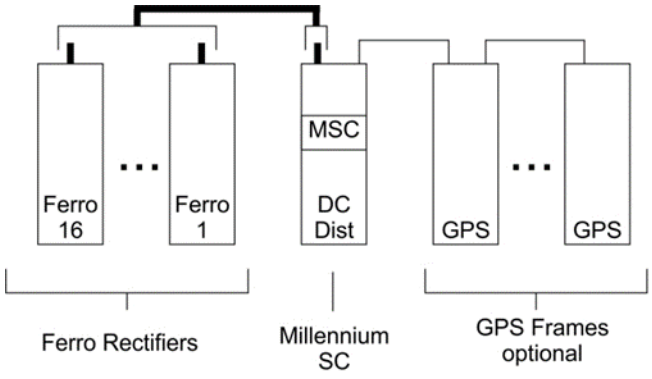
Product Description

Overview

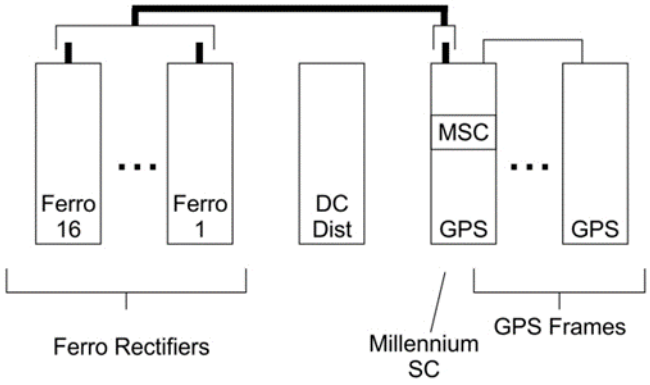
Galaxy Millennium® SC (MSC)	
 **MSC** **(with Onboard M2)**  **MSC** **without M2**  **Front Panel**	MSC combines the features of the industry benchmark M2 controller with the parallel (Ferro / SCR / ECS) rectifier control capability of Galaxy SC controller. MSC replaces MCS, CCS, and Galaxy SC controllers as well as controllers of other manufacturers. MSC can control up to 16 parallel (Ferro / SCR / ECS) rectifiers and up to 72 switch mode rectifiers. MSC uses the same rectifier cables as the Galaxy SC controller. MSC can be supplied with an onboard M2 controller or utilize an M2 controller mounted in a GPS plant or in a relay rack. The front panel provides a backlit LCD display with an easy-to-use, push-button, and menu-driven interface. The panel can be used to operate and program basic functions and access real-time date, history, statistics, and measured values.

Controller arrangements are shown in Figure 3.

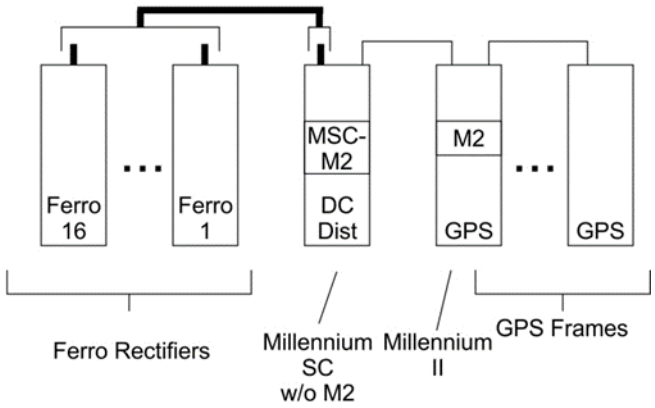
MSC may be installed in new power systems or in operating power systems currently being managed by installed controllers. OmniOn SC, MCS, and CCS controllers and controllers made by others are suitable for upgrade to MSC.



MSC in Existing DC Distribution Frame



MSC in GPS Frame

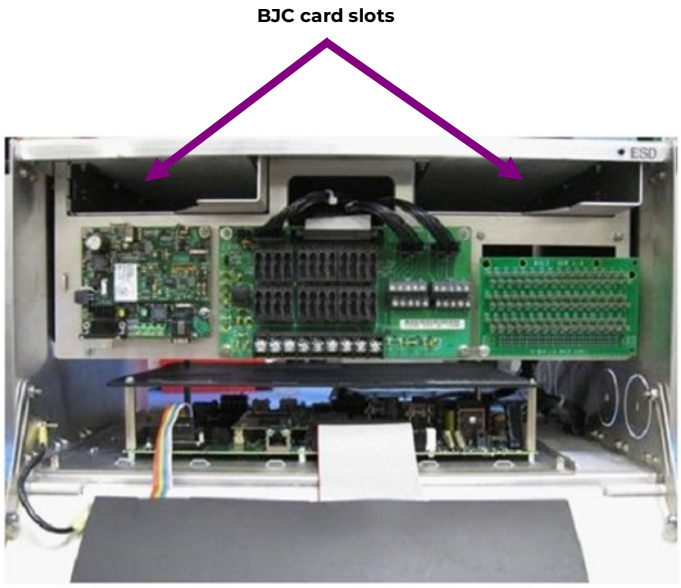


M2 in GPS Frame

Figure 3 Controller Arrangements[1]

[1]MSC-M2 = MSC without M2

MSC Controller With On Board M2



Front View with Onboard M2 Controller

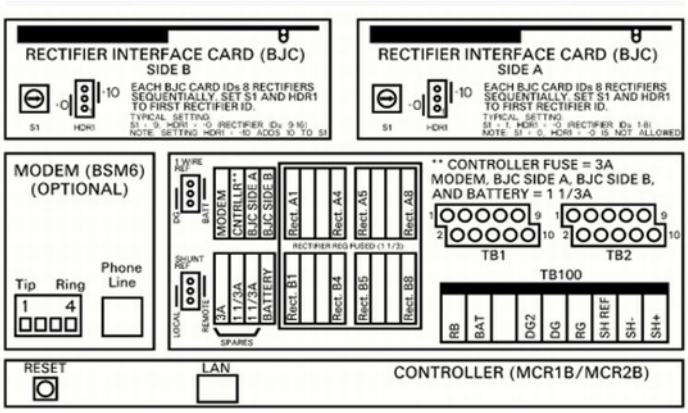


Figure 4 BJC Card Slots

MSC has slots for (2)
BJC Rectifier Interface cards for legacy (parallel) rectifiers.

Feature Summary

MSC adds support for parallel rectifiers (legacy, non-serial rectifiers) to the functionality of the M2 controller platform. This controller supports ABB's most extensive controller feature set.

Standard System Features

Table 1 MSC Standard System Features	
Monitoring and control of parallel rectifiers	• Maximum of 16 parallel rectifiers (legacy, non-serial rectifiers), OmniOn or commercial, including ECS SR 364 series
Monitoring and control of up to 90 RS-485 serial connected GP devices	• Maximum of 2 BJCn_MSC cards (within the Controller) • Maximum of 90 serial switch mode rectifiers. Supported rectifier families: 570, 595, 596, NP, CPS6000, QS, AC, and NE • Maximum of 32 Bay Interface Cards (BICs) • Maximum of 72 serial converters • Maximum of 8 ringers • Maximum of 6 LVD distribution cards • Maximum of 8 VIM1s
Alarms	• Standard and custom User Defined system alarms • Alarm test • Alarm cut-off • Multiple-level alarm severity: Critical, Major, Minor, Warning, and Record-Only
Rectifiers	• Automatic rectifier restart • Reserve engine transfer • High Voltage Shutdown • Energy management • Remote rectifier (on/off) control • Automatic rectifier sequence control • N + X redundancy check • Digital voltage regulation and rectifier load share
Contactor/Disconnect Control	• Low Voltage Load • Low Voltage Battery
Interfaces	• Enhanced Front Panel Display • Local PC Port • Modem • LAN (Gateway) • X.25/TL1

Table 1 MSC Standard System Features	
Monitoring and Control	• Up to 512 monitoring / relay channels via optional RPMs • Up to 18 mid string voltages via optional ES771A, 1-Wire®, Mid-string Voltage modules - 3 voltages per module • Up to 18 battery temperatures via optional 1-Wire® QS873A modules • On board external voltage channel • On board 4-20mA transducer channel
Maintenance Tools	• User Programmable Alarms • History • Statistics • Diagnostics • Derived Channels • Inventory Management • Configuration Backup/Restore
Memory	• Non-Volatile • Battery Backed • Remote and Local Software Upgrade

Front Panel User Interface

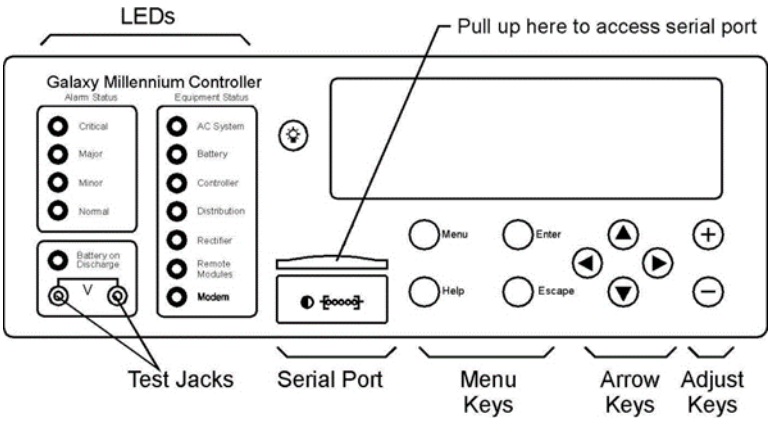


Figure 5 Front Panel

Table 2 Front Panel User Interface	
LCD	• 8-line by 40-character (240 x 64) backlit display with digital contrast adjust
Menu Driven User Interface	• Re-designed user friendly menu driven LCD with similar push-button membrane switch interface • Menu structure similar to other OmniOn controllers
Audible Alarm Buzzer	• Integrated on display assembly • May be Enabled/Disabled
LEDs	• 12 individual user configurable status LEDs: Critical, Major, Minor, Normal, AC System, Battery, Controller, Distribution, Rectifier, Remote Modules, Modem, and Battery On Discharge
Test Jacks	• Used to verify displayed system bus voltage
Local Port[2]	• DB-9 RS-232 system port for local terminal access or event log printing • ANSI T1.317 serial access • EasyView Windows-based software for configuration and reporting • Ground referenced
Compatibility	• Backwards compatible to existing Galaxy SC

[2]Connection to the Local Port disables modem communication.

Local Serial Access

Local Port - see Front Panel User Interface section above

Ethernet Port - Browser Interface - standard and custom web pages for browsers (HTTP)

Remote Access

Integrated 10/100Base-T Ethernet Network capability	• Supports TCP/IP Version 5, SNMP Version 2c, SMTP, TL1, DHCP, Telnet, FTP • Browser Interface - standard and custom web pages for browsers (HTTP) • Compatible with Galaxy Manager® • Standard shielded RJ-45 interface referenced to chassis • DHCP Client, Server, and Static addressing modes
Optional Modem[3]	• Remote access via internal BSM6 Modem option (33.6k bps Modem) • Remote access capability via external Modem • Callback security
TL1	• Configurable RS-232/485 port for remote via TL1/X.25
Easy View PC User Interface	• Windows-based software, for configuration and reporting through local terminal or • Modem connections
Security	• Multiple password-protected security levels • DIP Switches • Enhanced Security Features enable or disable many controller features

[3]Connection to the Local Port disables modem communication.

Battery Management

Slope Thermal Compensation (STC)	• High temperature compensation • Low temperature compensation • Step temperature • STC Enable/Disable • Low temperature Enable/Disable • mV/°C adjustments
Recharge Current Limit	• Control recharge rate for batteries
Reserve Time Prediction	• Supports a variety of batteries • Use configurable Low Reserve Time Alarm • Integrated “At Rate Calculator” for estimation purposes
Battery Discharge Testing	• Manual • Periodic • Plant Battery Test (PBT) input driven • Battery Discharge trace data
Float/Boost Mode Control	• Manual Timed Boost- Locally T1.317 and remotely initiated • External Timed Boost • Battery Thermal Protect module Boost (BTP) • Auto Boost terminated by time or current • Manual front panel Boost
Temperature Disconnect	• Programmable high temperature
Emergency Power Off	• User programmable

Integrated Monitoring Inputs

System	• Voltage and Current monitoring
System Shunts	• Maximum of 2 (more with BICs and RPMs) • Battery or Load • Battery or Return Side
4-20 mA	• Single channel Input
External Voltage Input	• Single Channel Input • External resistors for: 5, 30 and 60 Vdc ranges
Temperature Probe	• 4 Channels • 1 – 10/30k Thermal Probe Inputs • 3 – 10k Thermal Probe Inputs
Binary Inputs	• 22 Inputs • Engine signal inputs • Battery test inputs • External Float/Boost control • 2 User programmable
Remote Peripheral Monitoring	• Integrated serial bus • Maximum 300 meter serial bus • 512 channels maximum • Transducer interface • Battery, Shunt, Voltage, Temperature, and Binary monitoring • Control Relays • Channels can be programmed for custom alarms
1-Wire® Monitoring	• Integrated serial bus • 6 ES771 Mid-string Voltage modules maximum 1 voltage per module • 18 QS873A Temperatures probes maximum 1 temperature per probe

Integrated Outputs

Traditional Office Alarms	• 19 Form C alarm outputs • 2 User programmable relay outputs
Alarm Battery Supply	• 1.3A Fused

Chassis

MSC mounts in frames – 19, 23, and 25 inch. See Figure 6. It is designed to be physically backwards compatible with existing Galaxy SC rear access controllers for field replacements or upgrades.

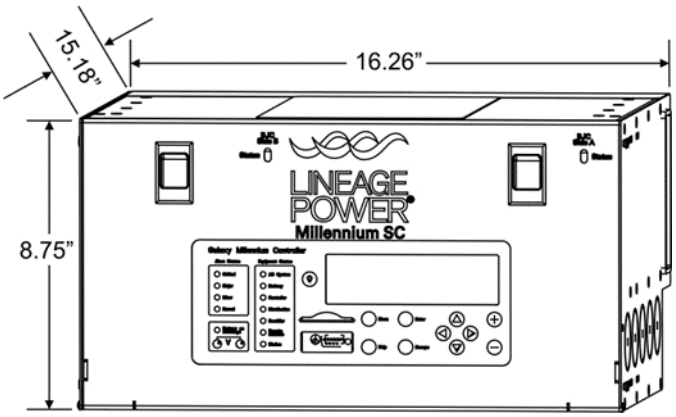
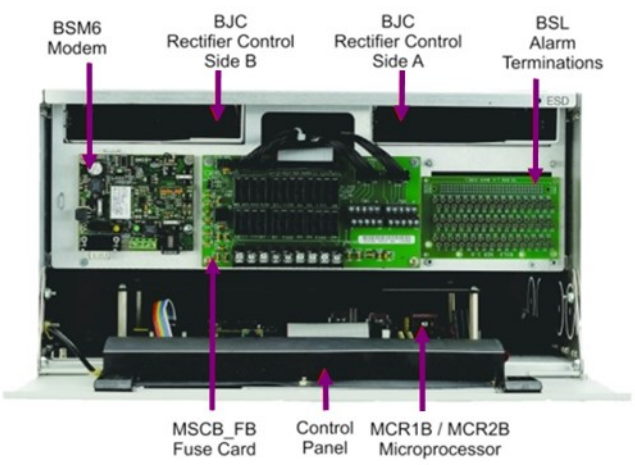


Figure 6 Controller Dimensions

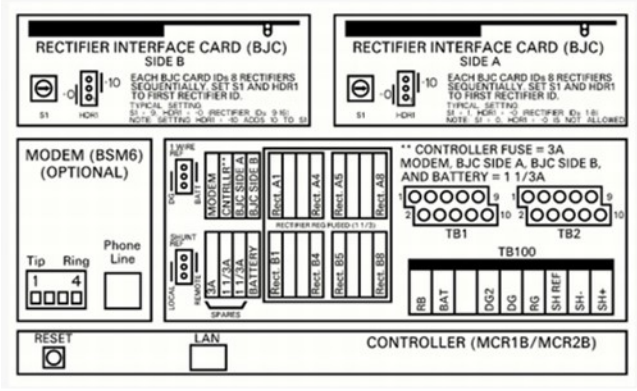
Controller Cards

Card Locations - With On Board M2



Front View with Onboard M2 Controller

Backplane



Circuit Card Layout

Figure 7 Card Locations

MSC without On Board M2 does not include:

- MCR1B / 2B Microprocessor
- Front Panel
- BSL Alarm Terminations
- BSM6 Modem

Microprocessor Cards - MCR1B and MCR2B

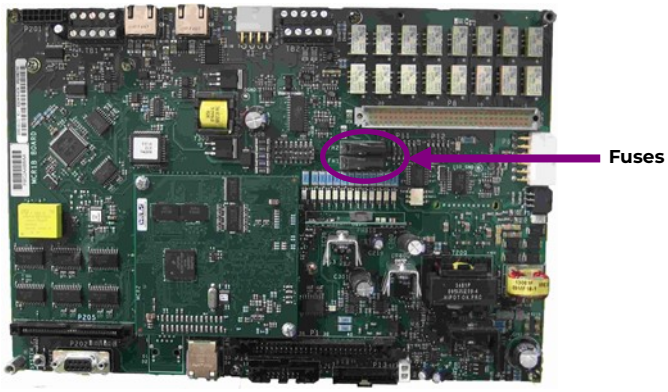


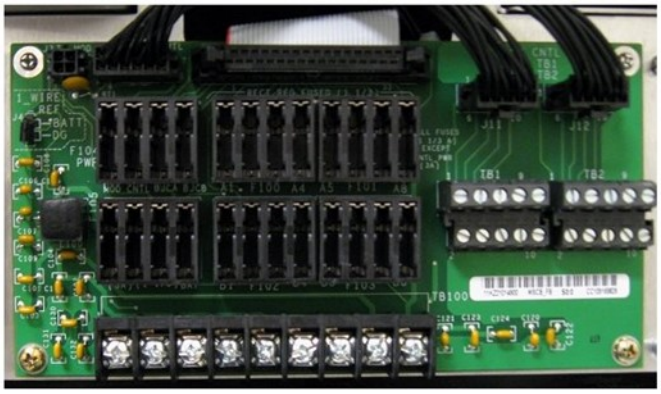
Figure 8 MCR1B/2B Circuit Card

Same cards used in M2 controller

Fuse	Description	Fuse Size
F1	Controller Input Power	3A
F2	Alarm Battery Supply (ABS)	1.3A

The core MSC is the matched pair of M2 circuit cards mounted on a drawer - MCR1B and MCR2B. The MCR1 is the larger of the two cards and contains all the external input/output interfaces, local and remote user interface circuitry, measurement circuits, real time clock, wide input range power converter, and connections for the MCR2B. The MCR2B contains the main microprocessor with of Flash memory and RAM. It also contains the hardware for the Ethernet control. Factory calibration values for the analog circuits located on the MCR1B are stored in memory on the MCR2B.

Fuse Card - MSCB_FB



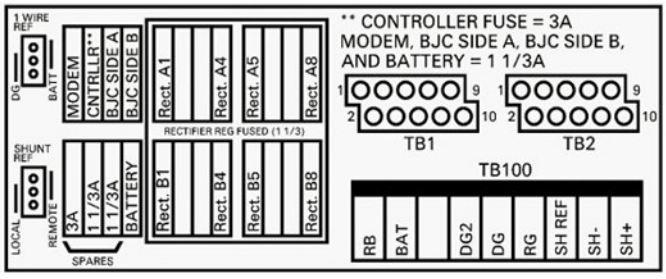


Figure 9 MSCB_FB Fuse Card

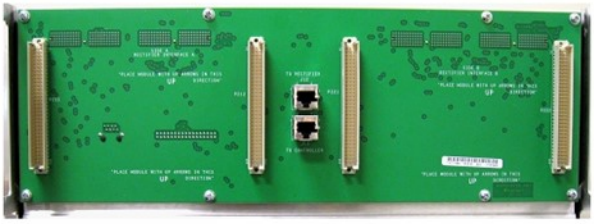
Fuses for

- Controller cards
- Parallel rectifier
  - remote sense (reg)
  - Ferro rectifier EQ, HV, and TR relays
  - SM rectifier CH, EQ, HV, and OTR circuits

Terminal block connections for

- Aux Port - RS-232/RS-485
- Remote Peripheral Module (RPM) bus
- 10k/30k thermistors
- Controller Power and Ground
- Plant Voltage and Shunt sense inputs

Backplane



Backplane Connections

RS-485 GP Serial Connection

Figure 10 Backplane

Up to two Remote Interface Modules may be installed on the backplane. Each module is associated with the Rectifier Interface Card on the same side of the chassis.

RS-485 GP Serial Connections

- "To Rectifiers"
  To all GP devices except M2
- "To Controller"
  To M2
  For MSC without On-Board M2

Modem Option - BSM6

Figure 11 Modem BSM6

Optional BSM6 Modem card provides dial up access at 33.6k bps.

Alarm Terminations Card - BSL3_MSC & BSL4_MSC

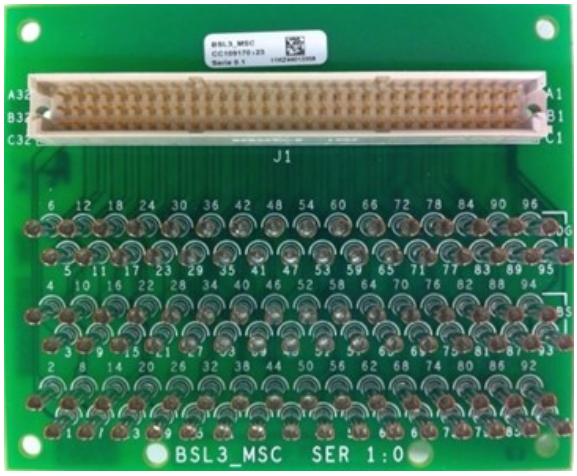


Figure 12 Alarm Termination Card BSL3_MSC

There are 2 options for alarm terminations:

- BSL3_MSC punch down block (standard)
- BSL4_MSC Wire wrap block (option)

Rectifier Interface Cards (RIC) - BJC1_MSC and BJC2_MSC

Figure 13 Rectifier Interface Card

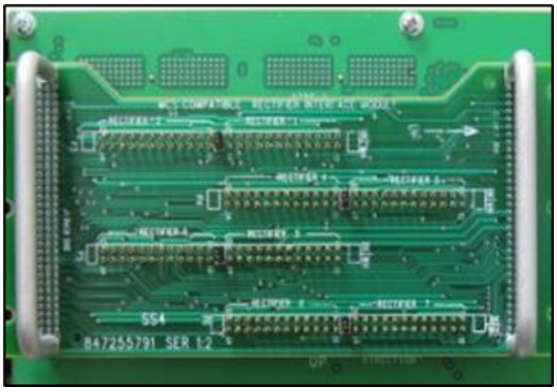
One or two of these cards will always be present in the MSC.

BJC1_MSC	Control 8 OmniOn Ferros
BJC2_MSC	Control 8 ECS Rectifiers OR
	8 third party parallel rectifiers

MSC can control a total of up to 16 parallel rectifiers.

Remote Interface Modules are also required.

See Table 40 Rectifier Cables.

Remote Interface Modules (RIM)	
 **Figure 14 Remote Interface Module (RIM)**	One or two of these modules will always be installed on the backplane. Each module routes the signals between the rectifier cable and the rectifier interface board (BJC) installed on the same side of the chassis. See Table 40 Rectifier Cables.

J2011002 Remote Interface Modules (RIM) - up to 8 rectifiers each	
108028671 J85501F1L31	OmniOn Ferros without enhanced communications
108028697 J85501F1L32	OmniOn Ferros with enhanced communications
108208689 J85501F1L34	Third party parallel (Ferro / SCR) rectifiers
108572660 J85501F1L35	OmniOn ECS 364 Rectifiers

Supporting Documents

Table 3 Supporting Documents

Name	Number
Millennium SC Controller Ordering Guide	J2011002
Galaxy SC Product Manual	850015641
Millennium Controller Product Manual	108324765

Front Panel

Default Display

The default display shown in Figure 15 provides basic system status. The controller returns to this display after approximately three minutes after the last time a key is pressed.

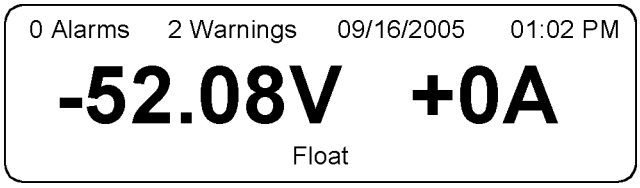


Figure 15 Default Display

The first line shows:

# of Alarms	# of Warnings	Date	Time

Plant Voltage	Plant Load (Current)

The larger text in the middle of the screen shows:

An Hourglass may appear in the lower left hand corner of the screen. This indicates that a configuration change is being saved to non-volatile memory. **CAUTION:** Do not power down the controller while this icon is present.
Audible Alarm Cutoff State(Toggle) (Only shown if an alarm is active)
Plant Mode (Default Float)

The bottom line(s) show:

Screen information is updated approximately every two seconds. The front panel display offers a series of menus that allow the user to:

- Configure
- Control
- View Status
- View History
- View Statistics
- Perform Diagnostics

These menu operations are accomplished by navigating through different screens.

LCD

The primary local interface for MSC is an eight-line LCD assembly mounted to the front of controller. This user interface is a panel that includes a backlit LCD module, two sections of status LEDs, system voltage test jacks, and an array of simple push-button controls.

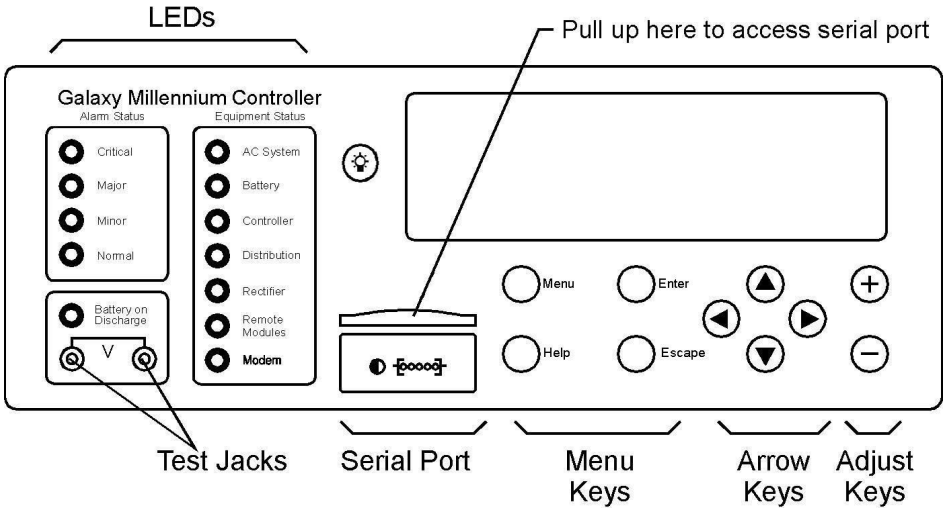


Figure 16 Front Panel

LEDs

Depending on the LCD option utilized, the LCD assemblies contain two rows of LEDs at the right side of the interface card or two columns of LEDs at the left side of the interface card as seen in Figure 16. The segregated sections of LEDs provide an indication of the alarm source (rectifier, battery, distribution, communication, controller, remote modules) and the severity (Critical, Major, Minor, Nominal) of the various alarms. Operation of the status LEDs can be reconfigured via the local or remote controller interfaces.

Push-Button Keys

A group of keys (push-buttons) identified in Table 4, provides the primary method of locally interacting with the MSC. These keys are used singly or in combination to navigate through the menus and follow industry standard functionality. Following is the general description of all the keys.

Table 4 Push-Button Key Functionality

Key	Function
Up arrow	Use to navigate the menu; press the key to move the cursor up one line.
Down arrow	Use to navigate the menu; press the key to move the cursor down one line.
Left arrow	Use to navigate the menu; press the key to move the cursor left one field.
Right arrow	Use to navigate the menu; press the key to move the cursor right one field.
ADJUST Plus (+)	Use to adjust (increase) the value of a field. Adjust contrast - press and hold.
ADJUST Minus (-)	Use to adjust (decrease) the value of a field. Adjust contrast - press and hold.
MENU	Press this key any time to bring the MAIN menu on line.
HELP	Press this key to display limited on-line help information.
ENTER	Use this key to save a value that has been changed, or to select a menu item.
ESCAPE	Use this key to abort a change, or to go back to the immediate higher level menu.
Lamp Test	Use this key to test the display and LEDs

Test Jacks

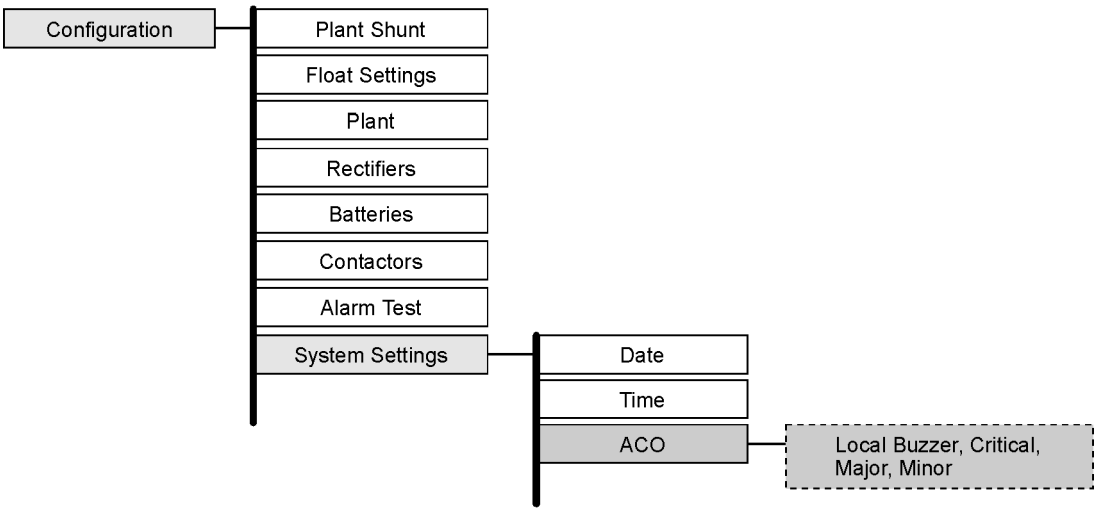
The LCD panel assemblies also provide test jacks to provide the ability of using an external meter to monitor the Plant Voltage as seen in. Voltages to the front panel test jacks are current limited and ESD protected. The controller measures this voltage to regulate the system bus voltage as well as display it as the battery plant bus voltage. The value of this voltage is used for many other controller related features. Red is battery, black is ground.

Serial (PC) Port

A ground referenced RS-232 local port is provided at the front of the display to allow easy connection to a personal computer or terminal using ANSI T1.317 object oriented command language. ABB's EasyView is also available to provide a user friendly system interface locally or remotely. See Figure 16.

Alarm Buzzer

The audible alarm buzzer is located on the front panel display assembly. It can be programmed from the front panel display to operate as follows:



Disabled for ALL Alarms
Audible on PCR
Audible on PMJ
Audible on PMN

Contrast Adjust

Press the **+** or **-** key to change the display contrast. Repeat or hold the button until the desired contrast is reached.

Configuration Menus

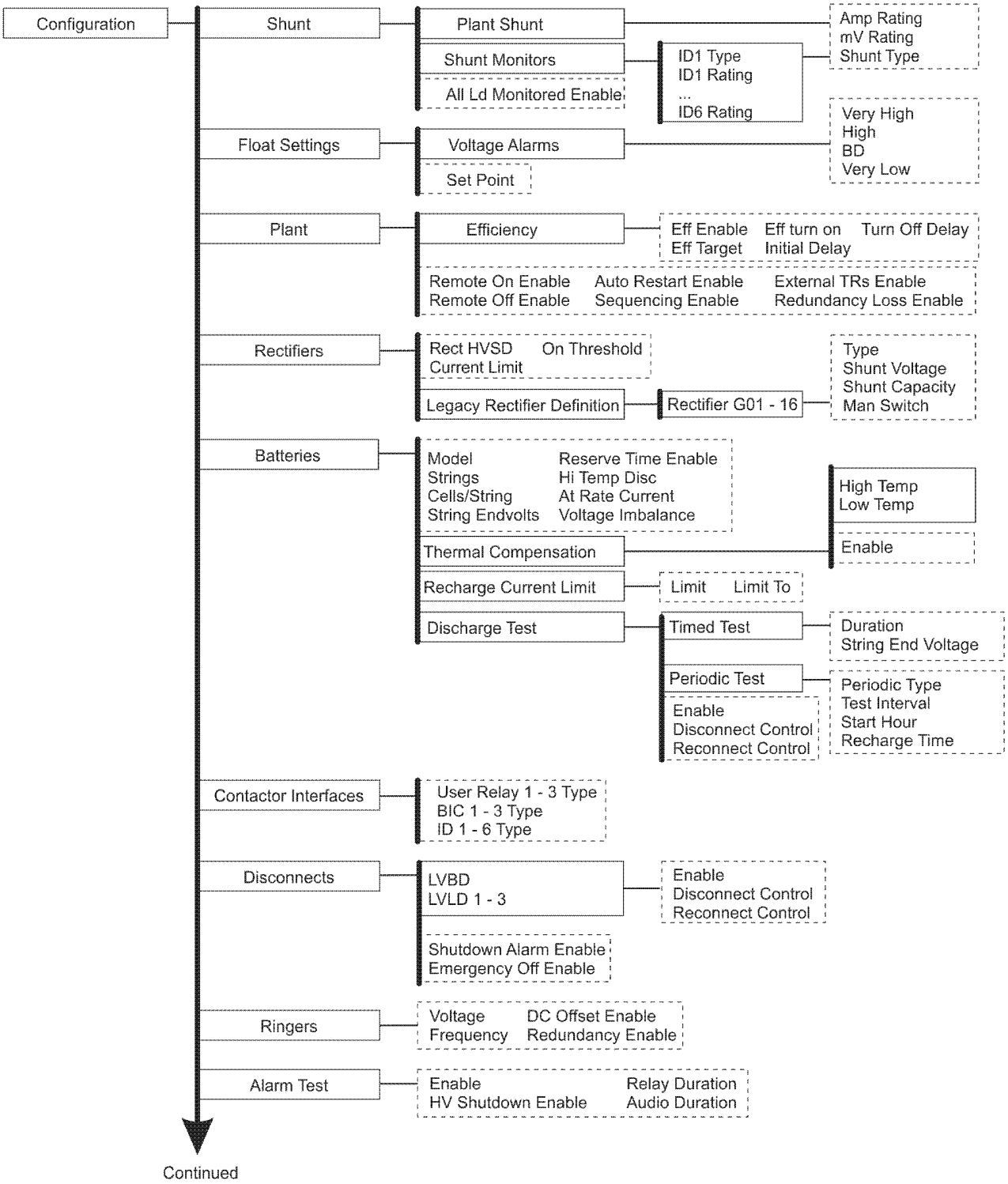


Figure 17 Configuration Menus 1 of 2

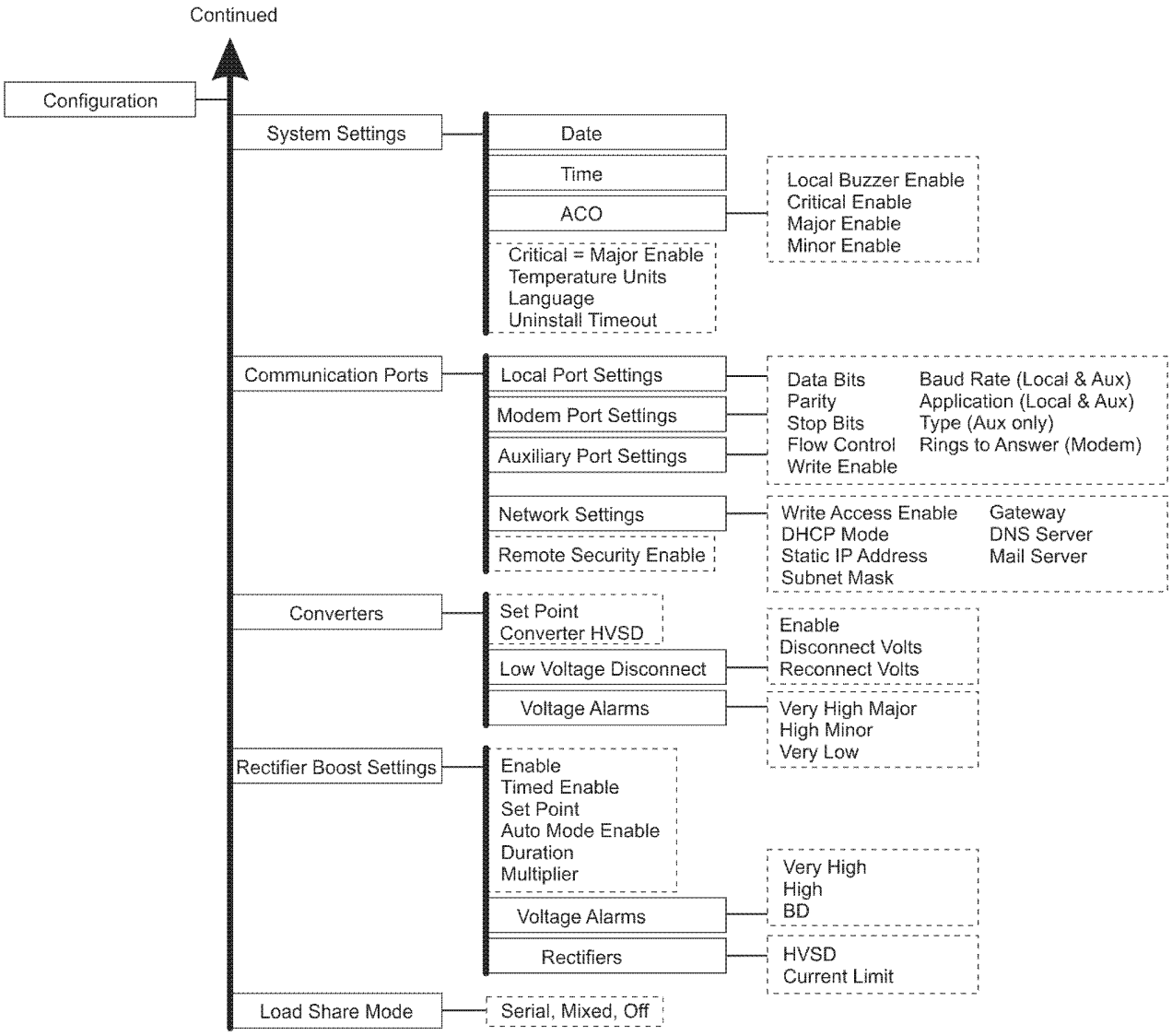


Figure 18 Configuration Menus 2 of 2

Control and Operations Menus

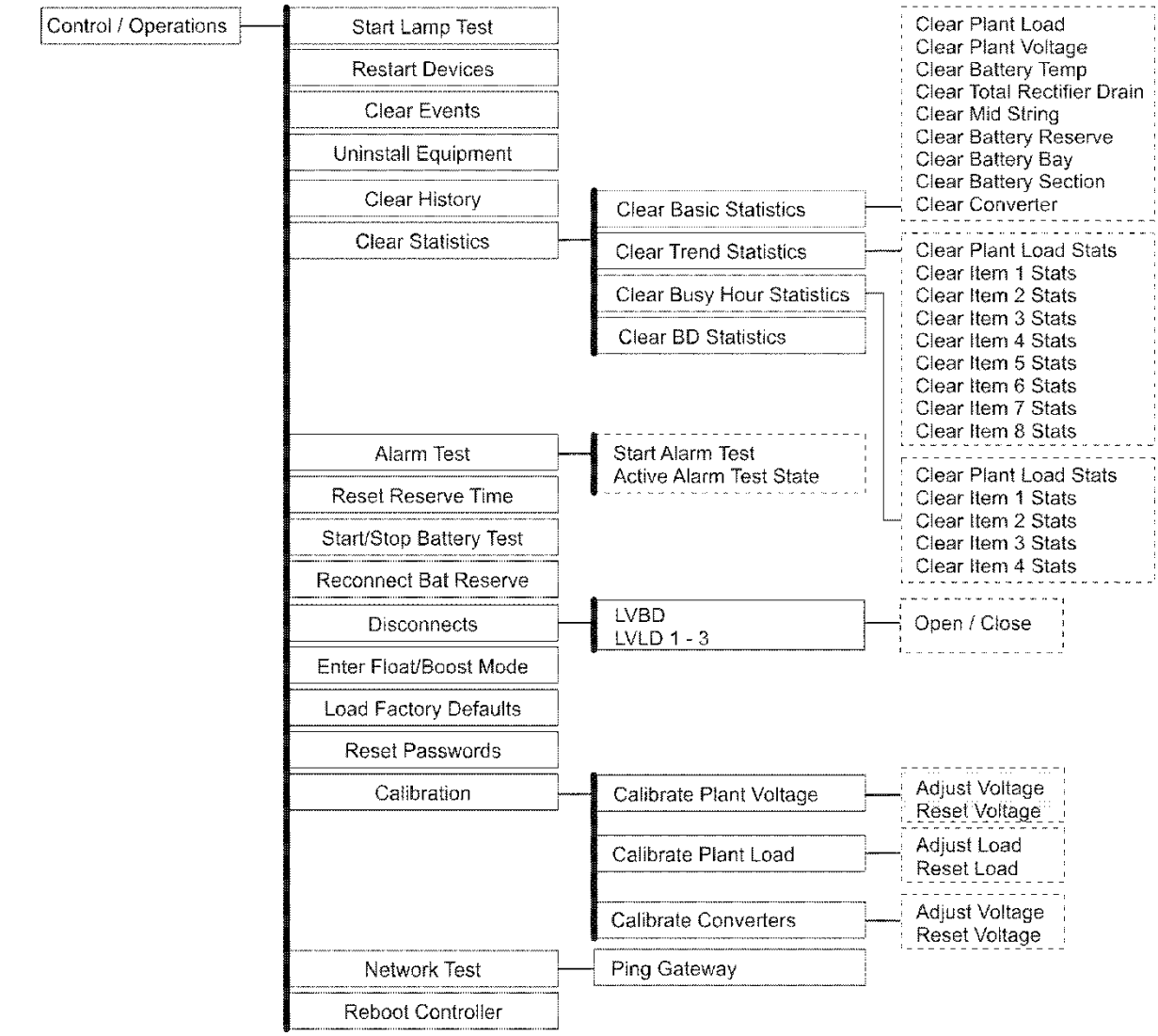


Figure 19 Control and Operations Menus

History Menus

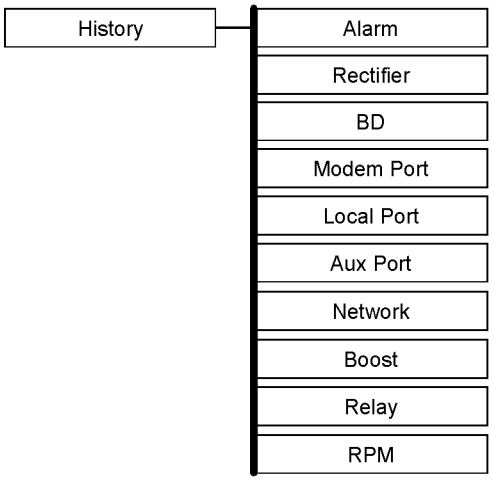


Figure 20 History Menus

Statistics Menus

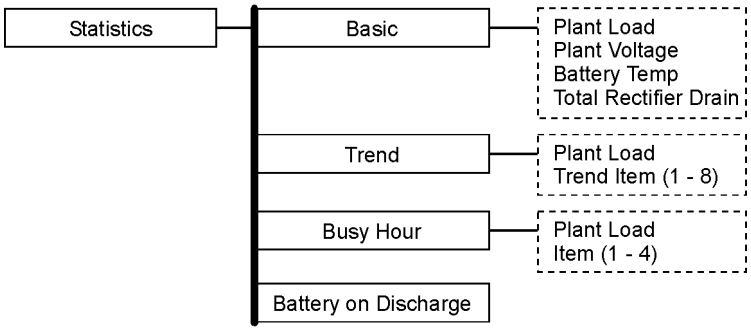


Figure 21 Statistics Menus

Status Menus

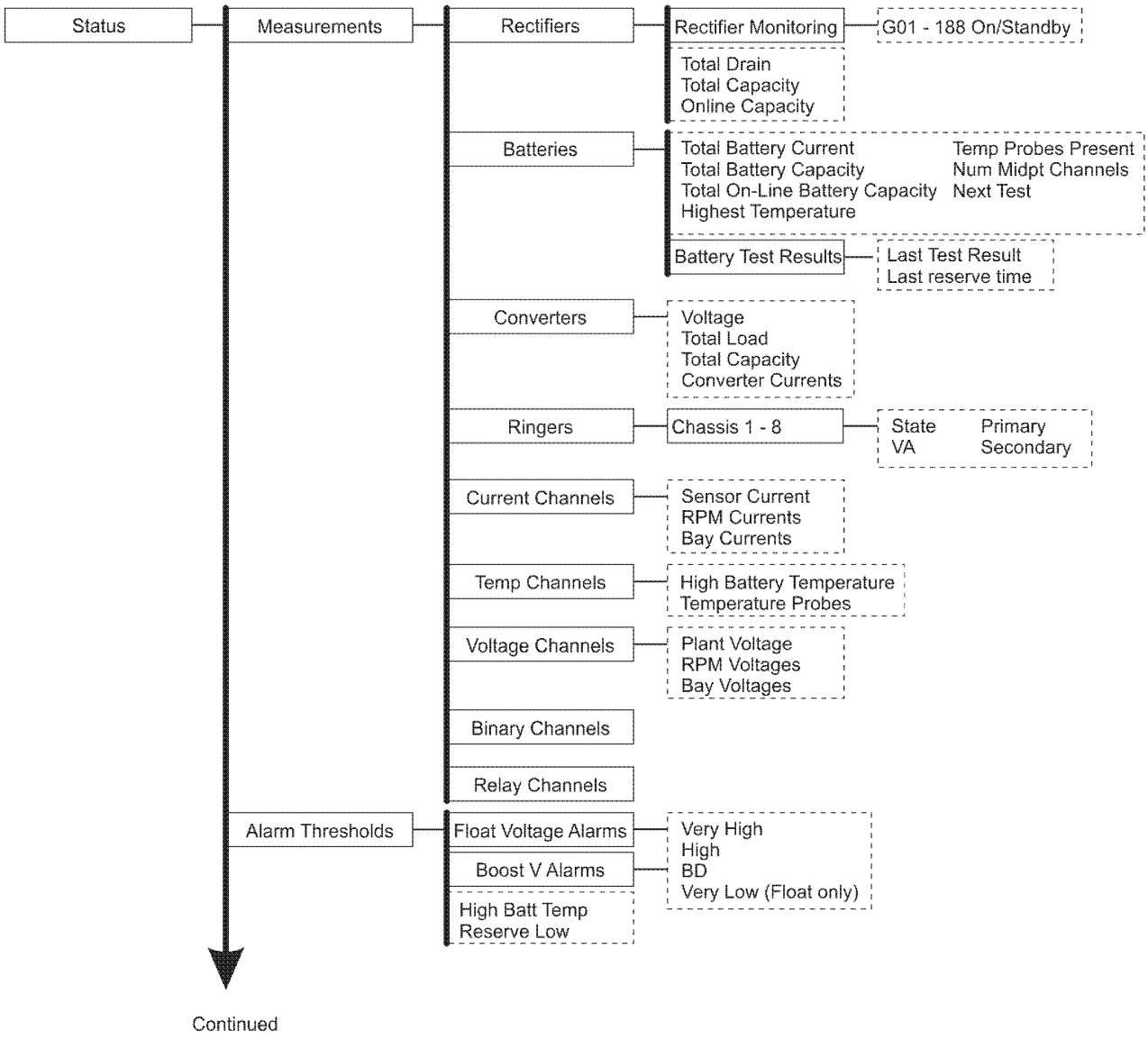


Figure 22 Status Menus 1 of 2

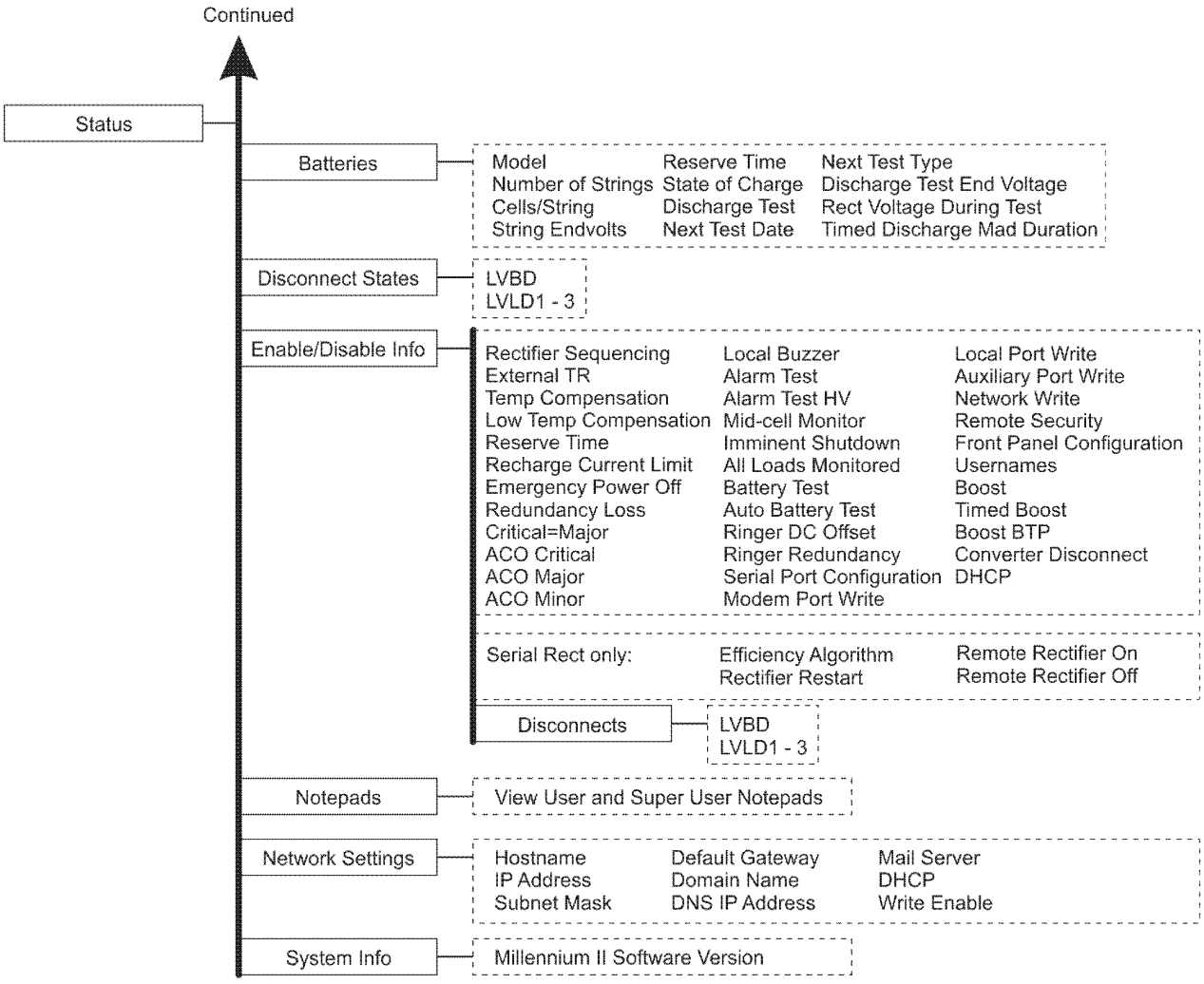


Figure 23 Status Menus 2 of 2

Installation

MSC is factory configured with industry standard defaults for thresholds and feature operability in typical applications. In addition, customer specific default controller settings may be available upon request.

Preparation

Safety and Precautions

Safety Action	Verified
Review the Safety section. Always consider personal safety before beginning any procedure.	
Be aware of the presence of unfused battery potential in the vicinity of the controller.	
Use only insulated tools.	
Make sure the system is properly grounded per the National Electrical Code and local building codes.	
Remove all metal jewelry before beginning the installation.	
Observe ESD protection while installing circuit cards.	
Wear grounded antistatic wrist straps when handling all circuit cards. The wrist strap must contact the skin and is not to be worn over clothing.	
Never hand a circuit card from a grounded to a non-grounded person or vice-versa.	

Installation Materials

Installation Materials	Verified
Wire cutters and strippers	
18 to 22 AWG wire	
Jewelers screwdriver (Flat and Phillips)	
Small needle nose pliers	
Digital meter, +/- 0.02%	
Screw Drivers (flat-blade and Phillips)	
Wrenches or sockets SAE and Metric	
ESD wrist strap	
Wire-wrap tool or AMP punch-down tool 552714 (408-6553)	
Flameproof insulating matting or equivalent	

Plan Rectifier Interface Cards First ID Settings

Rectifier interface Cards (BJC cards or BJCs) determine the Rectifier IDs of their rectifier positions. The switch and jumper that set rectifier IDs are accessible only when the BJC card is not installed.

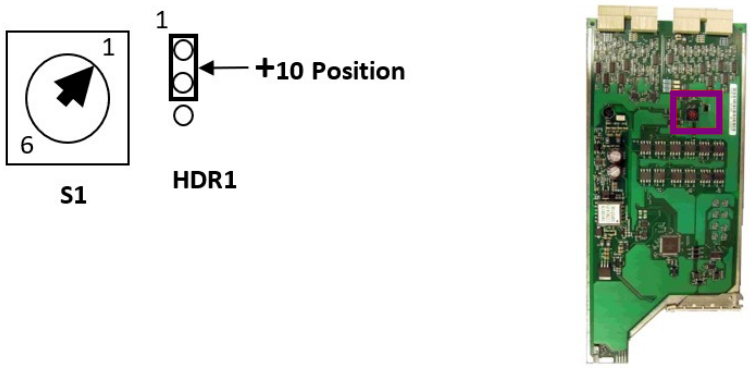


Figure 24 RIC ID Setting

- Separate BJC types control different rectifier types
  - BJC1_MSC CC109167771 for ABB(AT&T) type rectifiers
  - BJC2_MSC CC109167788 for non-ABB(AT&T) type rectifiers
- A MSC or MSC without M2 each accepts up to 2 BJC cards
- 1 or 2 BJCs may be installed
- Each BJC assigns a rectifier ID to each of its 8 rectifier positions.
- The first Rectifier IDs of a BJC is set with a rotary switch and a jumper on the BJC.
  - The rotary switch may be set from 0 to 9.
  - Jumper position “0” or “10” adds 0 or 10 to the rotary switch setting.
  - 1 is the lowest valid rectifier ID (0 is an invalid rectifier ID)

Single BJC Type Systems

Plants with only ABB(AT&T) type rectifiers or with only non-OmniOn (AT&T) type rectifiers will use a single type of BJCs - either all BJC1_MSCs or all BJC2_MSCs.

In this case, set BJC First Rectifier IDs so that they are consecutive.

Usual First IDs in Single BJC Type Systems		
BJC	**First ID**	**Rectifier IDs**
1st	1	1 - 8
2nd	9	9 - 16

Example:

12 rectifiers are numbered 1 through 12

First IDs for BJCs:

1st BJC (position A): 1 (rotary switch = 1, jumper = 0.
Positions 1 through 8 connect to rectifiers 1 through 8.

2nd BJC (position B): 9 (rotary switch = 9, jumper = 0.
Positions 1 through 4 connect rectifiers 9 through 12.
Positions 5 through 8 (IDs 13 - 16) are available for future use.

Multiple BJC Type Systems

Plants with a combination of ABB(AT&T) type rectifiers and non-ABB(AT&T) type rectifiers will use both BJC1_MSCs and BJC2_MSCs.

In this case, set BJC First Rectifier IDs may be set so that they allow consecutive rectifier numbers. IDs of unused positions on a BJC may overlap IDs of used positions on another BJC without conflict.

Example:

3 non-ABB(AT&T) type rectifiers are numbered 1 through 3

7 ABB(AT&T) type rectifiers are numbered 4 through 10

First IDs for BJCs:

1st BJC2_MSC (position A): 1 (rotary switch = 1, jumper = 0.)
Positions 1 through 3 connect to non-ABB(AT&T) rectifiers 1 through 3.

Positions 4 through 8 are not usable.

2nd BJC1_MSC (position B): 4 (rotary switch = 4, jumper = 0.)
Positions 1 through 7 connect to ABB(AT&T) rectifiers 4 through 10.

Position 8 is available for future use.

Step	Action to Plan Rectifier Interface Cards First ID Settings	
1	The First ID Setting for the Side A Rectifier Interface Card is the lowest rectifier number of existing rectifiers. This card type must match the rectifier type (see above). Write it in Table 5 below.	
2	**Are all BJC cards of the same type, either all BJC1_MSC or all BJC2_MSC?**	
	Yes – The First ID Setting for the Side B Rectifier Interface Card is the eight (8) higher than the First ID Setting for the first Rectifier Interface Card determined in Step 1.	No – The First ID Setting for the Side B Rectifier Interface Card is the lowest rectifier number of the second type of rectifiers.
3	Write the First ID Setting for the Side B Rectifier Interface Card in Table 5 below.	
	Plan is completed.	

Table 5 Rectifier Interface Cards First ID Settings	
Rectifier Interface Card	First ID Settings
Side A	
Side B	

Plan Wiring Transfer from Existing Controller

If not replacing an existing controller continue to the Install Controller section.

Plan the transfer of alarm and control wiring before installing an MSC as a replacement for an existing controller

Step	Action to Plan Wiring Transfer from Existing Controller	
1	Is the controller being replaced a Galaxy SC, MCS, CCS, or ECS-12U?	
	Yes – Proceed to Step 4	No – Proceed
2	Alarm and Control Wiring - Other Controller Fill in Table 82 Wiring Transfer Plan - Other Controller. Use the following to plan alarm and control wiring transfer: • the existing controller documentation • plant documentation • Table 35 Alarm and Control - Signal Names and BSL Pins • Table 36 Alarm - Descriptions, BLS Pins, and Signal Names • Table 37 Alarm and Control Inputs - Descriptions, BLS Pins, and Signal Names • Alarm and Control Signals section	
3	Rectifier Wiring Fill in Table 41 Commercial Rectifier Wiring (H285-226 G62). Use the following to determine rectifier cable wiring: • the existing rectifier documentation • the existing controller documentation • plant documentation	
	Plan is completed.	
4	Alarm and Control Wiring - Galaxy SC, MCS, CCS, or ECS-12U Fill in one of the following to plan and record alarm and control wiring transfer: • Table 79 Galaxy SC Wiring Plan & Cross Reference • Table 80 MCS/CCS Wiring Plan & Cross Reference • Table 81 ECS - 12U Wiring Plan & Cross Reference • plant documentation The following may also be useful reference information for planning. • Table 35 Alarm and Control - Signal Names and BSL Pins • Table 36 Alarm - Descriptions, BLS Pins, and Signal Names • Alarm and Control Signals section	
	Plan is completed.	

Prepare Galaxy SC Configuration File for MSC Use

If not replacing an existing Galaxy SC controller continue to the Record Customer Specified Minimum Configuration section.

Some of the Galaxy SC configuration settings may be transferred to the MSC using the configuration backup and restore features of the controllers.

The configuration file from the Galaxy SC must be edited before transfer to the MSC because not all of the settings are compatible.

Backup the configuration file from Galaxy SC for MSC use before removing the existing Galaxy SC Controller.

Step	Action to Prepare Galaxy SC Configuration File
1	Backup Galaxy SC Configuration to a File. Use one of the procedures detailed in the Backup and Restore section. (Browser Interface is not supported by Galaxy SC.) For example - Using Easy View: File → Backup
2	Edit Galaxy SC Configuration File a. Copy the file saved in step 1 for reference. b. Open the backup file in text editor such as Notepad (not in Word). c. At the start of the file insert lines to ADD each Ferro rectifier that will be present in the system. For each rectifier the line will be: ADD Gxx (where xx is the rectifier number) d. Remove the battery type definitions (incompatible with the MSC). Delete all lines starting with: CHA BTxx (where xx is 01 - 12) e. Remove converter configuration. Delete all lines starting with: CHA Cxx (where xx is 01 - 16) f. Remove the modem initialization string; it is not compatible with the MSC modem. Delete the line starting with: CHA MP1,INS g. Check the float and boost setpoints. Ferros did not use these attributes, so they may not be set correctly: GM1,FSP and GM1,BSP h. Check the float and boost shutdown voltages: GM1,FSD and GM1,BSD i. Check that energy management is disabled: DC1,EME=0 j. Save the file.
3	Save the file.

Record Customer Specified Minimum Configuration

Step	Action to Plan Record Customer Specified Minimum Configuration
1	Record customer specified configuration in Table 30 Minimum Configuration and Table 32 Network Settings Configuration.

Remove Existing Controller

If not replacing an existing controller continue to the Install Controller section.

Before installing an MSC Controller as a replacement for an existing controller several steps must be completed. These steps assure uninterrupted power delivery to the loads and maximize compatible configuration of the new controller.

- Place the system in Float Mode
- Turn all available rectifiers ON
- Record the DIP Switch Positions that enable/disable features in hardware
- Record the Alarm Threshold Settings and Rectifier Setpoints
- Place any battery/load contactors in an independent, safe state
- Disconnect Rectifier Control Cables & Adjust Rectifiers back to Float Voltage
- Power Down the controller
- Remove the controller

Proceed to the appropriate Controller Removal Section:

- Galaxy SC Controller Removal
- MCS Controller Removal
- Other Controller Removal

Galaxy SC Controller Removal

This section provides a method for preparing a Galaxy SC rear access controller for removal.

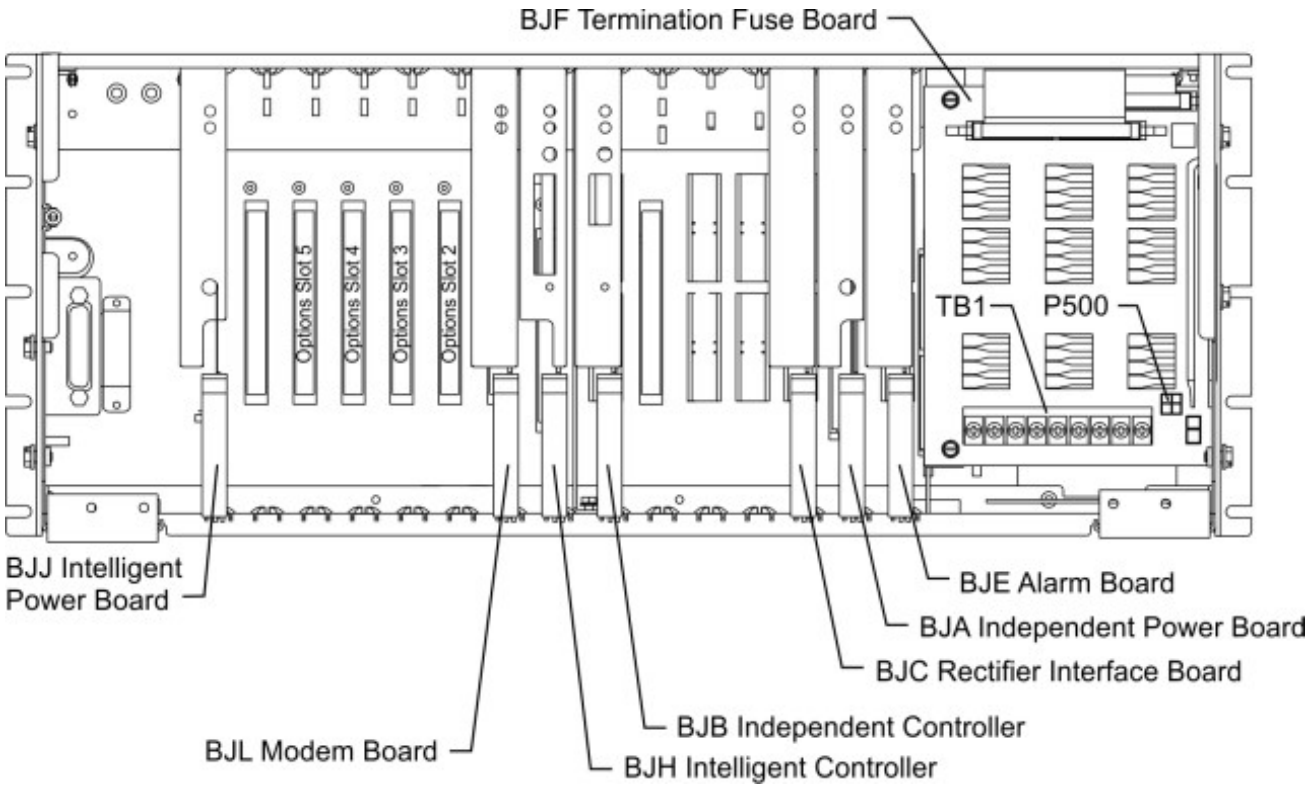


Figure 25 Galaxy SC Controller - Front

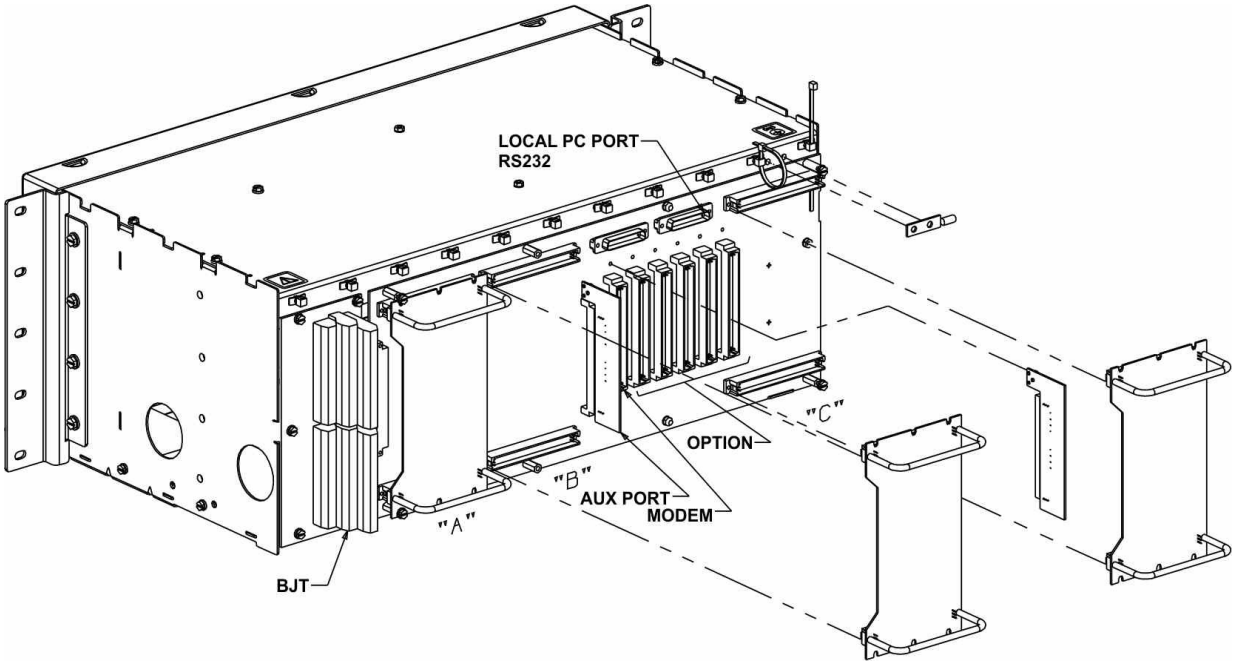


Figure 26 Galaxy SC Controller - Rear

Prepare the Galaxy SC Controller for Removal

Step	Action to Prepare the SC Controller for Removal	
NOTE	Verify that the Alarm center has been notified of potential alarms being generated.	
1	Is the system in FLOAT mode? From the Default Display of the controller, note the system mode of operation.	
	Yes – Proceed	No – 1. Place the system into FLOAT mode. 2. Proceed
2	Disable the Efficiency Feature Assure that the Efficiency feature is disabled. Using the front panel, go to MENU → CONFIG → RECT MNGR → RECT CTR → EFFICIENCY → DISABLE.	
3	Turn all Available Rectifiers On Turn ON any rectifiers manually turned OFF. Verify that all rectifiers are on and sharing load.	
4	Record the DIP Switch Settings DIP Switch settings determine if some controller features are enabled or disabled. If the MSC controller is to have the same configurations, the settings on the Galaxy SC controller SW201, SW202, SW203, and SW204 must be recorded. All of these DIP switches (except SW201-2, auxiliary portRS-232/485), work in coordination with software settings. Galaxy SC features must be enabled in both hardware and software. A feature is disabled if either its DIP switch its software setting is set to disabled.	
	Record the Switch Positions for future reference	

Table 6 Galaxy SC Basic Controller (BJA) HVSD DIP Switch Settings

Switch Position	Description	Value from Table
SW200-201	BJA High Voltage Shutdown. Convert Switch Settings to Voltage using Table 14 Galaxy SC High Voltage Shutdown Setting -48V. or Table 15 Galaxy SC High Voltage Shutdown Setting +/-24V.	V

Step	Action to Prepare the SC Controller for Removal

Table 7 Galaxy SC Basic Controller (BJB) DIP Switch Settings

Switch Position	Description	Switch Setting (1 or 0) (Closed = 1 = Enabled)
SW202-8	Front Panel Configuration	
SW202-7	Auto Rectifier Restarts	
SW202-6	Critical = Major Relays	
SW202-5	Alarm Test	
SW202-4	HVSD during Alarm Test	
SW202-3	Boost Mode	
SW202-2	External Timed Boost	
SW202-1	Password Reset for Indep Modem	

Table 8 Galaxy SC Intelligent Controller (BJH) DIP Switch Settings

Switch Position	Description	Switch Setting (1 or 0) (Closed = 1 = Enabled)
SW203-8	Remote rectifier in standby	
SW203-7	Remote rectifier turn on	
SW203-6	Full access through local port[4]	
SW203-5	Full access through auxiliary port	
SW203-4	Full access through modem port	
SW203-3	Configure via Modem/aux/local port	
SW203-2	Local port: Event Log or Terminal. (1 = Event Log, 0 = Terminal	
SW203-1	Auxiliary port: RS-232 or RS-485. (1 = RS-232, 0 = RS-485	
SW204-4-8	Not used	
SW204-3	Enhanced remote security	
SW204-2	Remote alarm test	
SW204-1	Rectifier efficiency algorithm	

[4]Disabled = User Only access

<table>
<tr><th>Step</th><th>Action to Prepare the SC Controller for Removal</th></tr>
<tr><td>5</td><td>
Alarm Threshold Settings
Alarm thresholds are designed to generate low/high voltage alarms.
Record the Float Alarm Thresholds by selecting the following menus from the front panel display:
MENU → CONFIG → ALARM THRESHOLDS
<table>
<tr><th colspan="3">Table 9 Galaxy SC Alarm Threshold Settings</th></tr>
<tr><th>Alarm</th><th>Float</th><th>Boost (optional)</th></tr>
<tr><td>High Voltage</td><td></td><td></td></tr>
<tr><td>High Float Voltage</td><td></td><td></td></tr>
<tr><td>Battery on Discharge</td><td></td><td></td></tr>
<tr><td>Rectifier On</td><td></td><td></td></tr>
<tr><td>Very Low Voltage</td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>6</td><td>
Plant Shunt Settings
Record shunt information, so that it can be programmed when the new controller has been installed.
Record this information by selecting the following menus from the front panel display:
MENU → CONFIG → PLANT
<table>
<tr><th colspan="2">Table 10 Galaxy SC Plant Shunt Settings</th></tr>
<tr><td>Shunt I</td><td></td></tr>
<tr><td>Shunt mV</td><td></td></tr>
<tr><td>Shunt Type</td><td></td></tr>
</table>
</td></tr>
</table>

Step	Action to Prepare the SC Controller for Removal
7	**Low Voltage Disconnects Settings** Record low voltage disconnect information, if installed in the system, so that it can be programmed when the new controller has been installed. Record this information by selecting the following menus from the front panel display: MENU → CONFIG → LVD Note: Contactor State cannot be changed by the user.

Table 11 Galaxy SC Low Voltage Disconnects Settings

Contactor 1	
Type	
Disconnect Volt	
Reconnect Volt	
Contactor 2	
Type	
Disconnect Volt	
Reconnect Volt	
Contactor 3	
Type	
Disconnect Volt	
Reconnect Volt	

8	**Slope Thermal Compensation Settings** Record slope thermal compensation information, if implemented in the system, so that it can be programmed when the new controller has been installed. Record this information by selecting the following menus from the front panel display: MENU → CONFIG → STC

Table 12 Galaxy SC Slope Thermal Compensation Settings

STC Enabled/Disabled	
Nominal Temperature	
Step Temperature	
Disconnect Temperature	
Low Temperature	
Upper Temperature	
Raise Voltage Enable	
Temperature Units	

Step	Action to Prepare the SC Controller for Removal
9	**Rectifier Float Setpoints** Rectifier float setpoint determines the system voltage. Record the float setpoint by selecting the following menus from the front panel display: MENU → CONFIG → RECT MNGR

Table 13 Galaxy SC Rectifier Setpoints

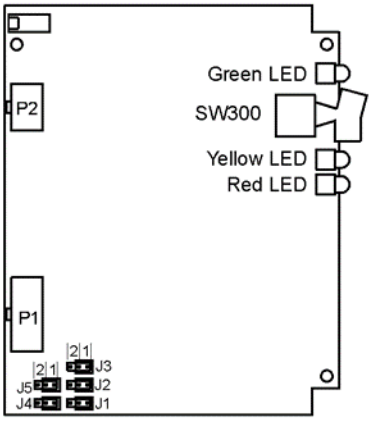
	Float	Boost
Plant V		
I limit		
SHVSD		
Load Share (EN or DIS)		

10 — Secure Contactors

Configure Battery and Load contactors, if present in the system, so that they do not OPEN during the controller replacement. To ensure that these contactors do not open, force all LVLD and LVBD contactors closed.

NOTE: These contactors may have already been forced closed per customer requirements. If so, then proceed to the next step.
To force LVLD contactors closed, place SW300 in the up position as shown in Figure 27 and Figure 28.

EBV Low Voltage Load Disconnect
(LVLD) Contactor Control Board



Manual Contactor Control Switch

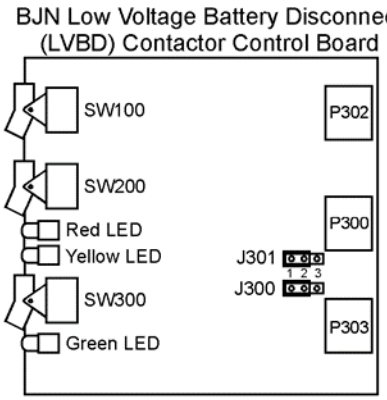
SW300	Contactor State
Down	Under controller control (normal position, shown)
Up	Contactor forced closed

Note Board Orientation.

This switch is not meant to be used to permanently override the LVLD function. It is only to be used temporarily while servicing or testing the equipment.

When powering up the system from an ac failure, SW300 must be in the down position.

Step	Action to Prepare the SC Controller for Removal



Manual Contactor Control Switch

SW100*	SW200*	SW300	Contactor State
Up	Up	Up	Under controller control (normal position, shown)
x	x	Down	Contactor forced closed
Down	Down	Up	Contactor forced open

x - Switch position doesn't matter

*SW100 and SW200 are redundant switches. If either switch is up, the controller will determine the contactor state. If both switches are not in the up position however, the green LED will not be lit.

Note Board Orientation.

These switches are not meant to be used to permanently override the LVBD function. They are only to be used temporarily while servicing or testing the equipment.

When powering up the system from an ac failure, switches must be in the up position.

Figure 28 LVBD Contactor Control BJN Card SW300

Contactor Type	Control Card and Switch	To Force Closed, Change to
Load	EBV – SW300	UP
Battery	BJN – SW300	UP for ½ height cabinets Down for full height cabinets

Table 14 Galaxy SC High Voltage Shutdown Setting -48V								
Voltage	SW201 Bottom				SW200 Top			
	#1	#2	#3	#4	#1	#2	#3	#4
50.00	0	0	1	0	1	0	1	1
.10	0	0	1	0	1	1	0	1
.20	0	0	1	0	1	1	1	1
.30	0	0	1	1	0	0	0	0
.40	0	0	1	1	0	0	1	0
50.50	0	0	1	1	0	0	1	1
.60	0	0	1	1	0	1	0	1
.70	0	0	1	1	0	1	1	1
.80	0	0	1	1	1	0	0	0
.90	0	0	1	1	1	0	1	0
51.00	0	0	1	1	1	1	0	0
.10	0	0	1	1	1	1	0	1
.20	0	0	1	1	1	1	1	1
.30	0	1	0	0	0	0	0	0
.40	0	1	0	0	0	0	1	0
51.50	0	1	0	0	0	1	0	0
.60	0	1	0	0	0	1	0	1
.70	0	1	0	0	0	1	1	1
.80	0	1	0	0	1	0	0	1
.90	0	1	0	0	1	0	1	0
52.00	0	1	0	0	1	1	0	01
.10	0	1	0	0	1	1	0	1
.20	0	1	0	0	1	1	1	1
.30	0	1	0	1	0	0	0	1
.40	0	1	0	1	0	0	1	0
52.50	0	1	0	1	0	1	0	0
.60	0	1	0	1	0	1	1	0
.70	0	1	0	1	0	1	1	1
.80	0	1	0	1	1	0	0	1
.90	0	1	0	1	1	0	1	0
53.00	0	1	0	1	1	1	0	0
.10	0	1	0	1	1	1	1	0
.20	0	1	0	1	1	1	1	1
.30	0	1	1	0	0	0	0	1
.40	0	1	1	0	0	0	1	0
53.50	0	1	1	0	0	1	0	0
.*.60 (default)	0	1	1	0	0	1	1	0
.70	0	1	1	0	0	1	1	1
.80	0	1	1	0	1	0	0	1
.90	0	1	1	0	1	0	1	1
54.00	0	1	1	0	1	1	0	0
.10	0	1	1	0	1	1	1	0
.20	0	1	1	0	1	1	1	1
.30	0	1	1	1	0	0	0	1
.40	0	1	1	1	0	0	1	1
54.50	0	1	1	1	0	1	0	0
.60	0	1	1	1	0	1	1	0
.70	0	1	1	1	1	0	0	0
.80	0	1	1	1	1	0	0	1
.90	0	1	1	1	1	0	1	1

Table 14 Galaxy SC High Voltage Shutdown Setting -48V								
Voltage	SW201 Bottom				SW200 Top			
	#1	#2	#3	#4	#1	#2	#3	#4
55.00	0	1	1	1	1	1	0	0
.10	0	1	1	1	1	1	1	0
.20	1	0	0	0	0	0	0	0
.30	1	0	0	0	0	0	0	1
.40	1	0	0	0	0	0	1	1
55.50	1	0	0	0	0	1	0	1
.60	1	0	0	0	0	1	1	0
.70	1	0	0	0	1	0	0	0
.80	1	0	0	0	1	0	0	1
.90	1	0	0	0	1	0	1	1
56.00	1	0	0	0	1	1	0	1
.10	1	0	0	0	1	1	1	0
.20	1	0	0	1	0	0	0	0
.30	1	0	0	1	0	0	1	0
.40	1	0	0	1	0	0	1	1
56.50	1	0	0	1	0	1	0	1
.10	1	0	0	1	0	1	1	0
.20	1	0	0	1	1	0	0	0
.30	1	0	0	1	1	0	1	0
.40	1	0	0	1	1	0	1	1
57.00	1	0	0	1	1	1	0	1
.10	1	0	0	1	1	1	1	1
.20	1	0	0	0	0	0	0	0
.30	1	0	1	0	0	0	1	0
.40	1	0	1	0	0	0	1	1
57.50	1	0	1	0	0	1	0	1
.60	1	0	1	0	0	1	1	1
.70	1	0	1	0	1	0	0	0
.80	1	0	1	0	1	0	1	0
.90	1	0	1	0	1	1	0	0
58.00	1	0	1	0	1	1	0	1
.10	1	0	1	0	1	1	1	1
.20	1	0	1	1	0	0	0	0
.30	1	0	1	1	0	0	1	0
.40	1	0	1	1	0	1	0	0
58.50	1	0	1	1	0	1	0	1
.60	1	0	1	1	0	1	1	1
.70	1	0	1	1	1	0	0	1
.80	1	0	1	1	1	0	1	0
.90	1	0	1	1	1	1	0	0
59.00	1	0	1	1	1	1	0	1
.10	1	0	1	1	1	1	1	1
.20	1	1	0	0	0	0	0	1
.30	1	1	0	0	0	0	1	0
.40	1	1	0	0	0	1	0	0
59.50	1	1	0	0	0	1	0	1
.60	1	1	0	0	0	1	1	1
.70	1	1	0	0	1	0	0	1
.80	1	1	0	0	1	0	1	0
.90	1	1	0	0	1	1	0	0
.60.00	1	1	0	0	1	1	1	0
*Default setting = 53.60		1 = closed		0 = open				

Table 15 Galaxy SC High Voltage Shutdown Setting -+/-24V								
Voltage	SW201 Bottom				SW200 Top			
	#1	#2	#3	#4	#1	#2	#3	#4
24.80	0	0	0	1	1	1	0	1
.85	0	0	0	1	1	1	1	1
.90	0	0	1	0	0	0	0	1
.95	0	0	1	0	0	0	1	0
25.00	0	0	1	0	0	1	0	0
.05	0	0	1	0	0	1	0	1
.10	0	0	1	0	0	1	1	1
.15	0	0	1	1	1	0	0	1
.20	0	0	1	1	1	0	1	0
25.25	0	0	1	0	1	1	0	0
.30	0	0	1	0	1	1	0	1
.35	0	0	1	0	1	1	1	1
.40	0	0	1	1	0	0	0	1
.45	0	0	1	1	0	0	1	0
25.50	0	0	1	1	0	1	0	0
.55	0	0	1	1	0	1	0	1
.60	0	0	1	1	0	1	1	1
.65	0	0	1	1	1	0	0	1
.70	0	0	1	1	1	0	1	0
25.75	0	0	1	1	1	1	0	0
.80	0	0	1	1	1	1	0	1
.85	0	0	1	1	1	1	1	1
.90	0	1	0	0	0	0	0	1
.95	0	1	0	0	0	0	1	0
26.00	0	1	0	0	0	1	0	0
.05	0	1	0	0	0	1	0	1
.10	0	1	0	0	0	1	1	1
.15	0	1	0	0	1	0	0	1
.20	0	1	0	0	1	0	1	0
26.25	0	1	0	0	1	1	0	0
.30	0	1	0	0	1	1	1	0
.35	0	1	0	0	1	1	1	1
.40	0	1	0	1	0	0	0	1
.45	0	1	0	1	0	0	1	0
26.50	0	1	0	1	0	1	0	0
.55	0	1	0	1	0	1	1	0
.60	0	1	0	1	0	1	1	1
.65	0	1	0	1	1	0	0	1
.70	0	1	0	1	1	0	1	0
26.75	0	1	0	1	1	1	0	0
.*.80 (default)	0	1	0	1	1	1	1	0
.85	0	1	0	1	1	1	1	1
.90	0	1	1	0	0	0	1	0
.95	0	1	1	0	0	0	1	0
27.00	0	1	1	0	0	1	0	0
.05	0	1	1	0	0	1	1	0
.10	0	1	1	0	0	1	1	1
.15	0	1	1	0	1	0	0	1
.20	0	1	1	0	1	0	1	0

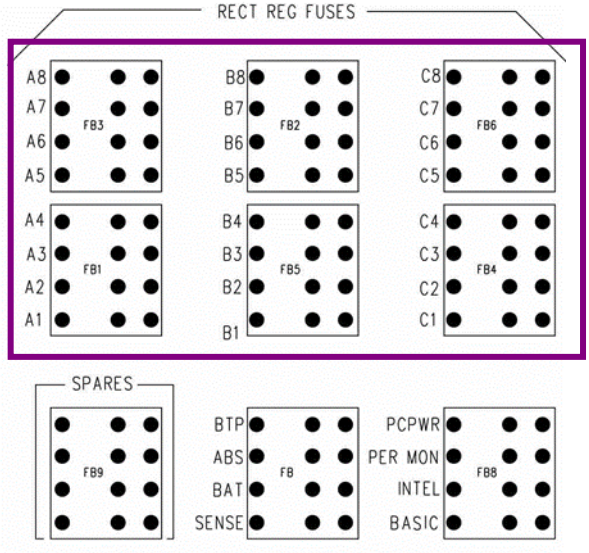
Table 15 Galaxy SC High Voltage Shutdown Setting -+/-24V								
Voltage	SW201 Bottom				SW200 Top			
	#1	#2	#3	#4	#1	#2	#3	#4
27.25	0	1	1	0	1	1	0	0
.30	0	1	1	0	1	1	1	0
.35	0	1	1	0	1	1	1	1
.40	0	1	1	1	0	0	0	1
.45	0	1	1	1	0	0	1	1
27.50	0	1	1	1	0	1	0	0
.55	0	1	1	1	0	1	1	0
.60	0	1	1	1	0	1	1	1
.65	0	1	1	1	1	0	0	1
.70	0	1	1	1	1	0	1	1
27.75	0	1	1	1	1	1	0	0
.80	0	1	1	1	1	1	1	0
.85	0	1	1	1	1	1	1	1
.90	1	0	0	0	0	0	0	1
.95	1	0	0	0	0	0	1	1
28.00	1	0	0	0	0	1	0	0
.05	1	0	0	0	0	1	1	0
.10	1	0	0	0	0	1	1	1
.15	1	0	0	0	1	0	0	1
.20	1	0	0	0	1	0	1	1
28.25	1	0	0	0	1	1	0	0
.30	1	0	0	0	1	1	1	0
.35	1	0	0	0	1	1	1	1
.40	1	0	0	1	0	0	0	1
.45	1	0	0	1	0	0	1	1
28.50	1	0	0	1	0	1	0	0
.55	1	0	0	1	0	1	1	0
.60	1	0	0	1	0	1	1	1
.65	1	0	0	1	1	0	1	1
.70	1	0	0	1	1	0	1	1
28.75	1	0	0	1	1	1	0	0
.80	1	0	0	1	1	1	1	0
.85	1	0	1	0	0	0	0	0
.90	1	0	1	0	0	0	0	1
.95	1	0	1	0	0	0	1	1
29.00	1	0	1	0	0	1	0	0
.05	1	0	1	0	0	1	1	0
.10	1	0	1	0	1	0	0	0
.15	1	0	1	0	1	0	0	1
.20	1	0	1	0	1	0	1	1
29.25	1	0	1	0	1	1	0	1
.30	1	0	1	0	1	1	1	0
.35	1	0	1	1	0	0	0	0
.40	1	0	1	1	0	0	0	1
.45	1	0	1	1	0	0	1	1

Table 15 Galaxy SC High Voltage Shutdown Setting -+/-24V								
Voltage	SW201 Bottom				SW200 Top			
	#1	#2	#3	#4	#1	#2	#3	#4
29.50	1	0	1	1	0	1	0	0
.55	1	0	1	1	0	1	1	0
.60	1	0	1	1	0	1	0	0
.65	1	0	1	1	1	0	0	1
.70	1	0	1	1	1	0	1	1
29.75	1	0	1	1	1	1	0	0
.80	1	0	1	1	1	1	1	0
.85	1	1	0	0	0	0	0	0
.90	1	1	0	0	0	0	0	1
.95	1	1	0	0	0	0	1	1
30.00	1	1	0	0	0	1	0	1
.05	1	1	0	0	0	1	1	0
.10	1	1	0	0	1	0	0	0
.15	1	1	0	0	1	0	0	1
.20	1	1	0	0	1	0	1	1
30.25	1	1	0	0	1	1	0	1
.30	1	1	0	0	1	1	1	0
.35	1	1	0	1	0	0	0	0
.40	1	1	0	1	0	0	0	1
.45	1	1	0	1	0	0	1	1
30.50	1	1	0	1	0	1	0	1
.55	1	1	0	1	0	1	1	0
.60	1	1	0	1	1	0	0	0
.65	1	1	0	1	0	0	1	0
.70	1	1	0	1	1	0	1	1
30.75	1	1	0	1	1	1	0	1
.80	1	1	0	1	1	1	1	0
.85	1	1	1	0	0	0	0	0
.90	1	1	1	0	0	0	0	1
.95	1	1	1	0	0	0	1	1
31.00	1	1	1	0	0	1	0	1
.05	1	1	1	0	0	1	1	0
.10	1	1	1	0	1	0	0	0
.15	1	1	1	0	1	0	0	1
*Default setting = 26.80		1 = closed		0 = open				

Disconnect Rectifiers

CAUTION	**Disconnect Parallel Rectifier**
	When parallel rectifier regulation fuses are pulled, the following will occur:
	• The rectifier will switch to internal regulation.
	  • OmniOn rectifiers automatically switch to internal regulation.
	  • Non-OmniOn rectifiers must be manually configured for internal regulation.
	• Consult the rectifier manual for method of configuration for internal regulation.
	• The system voltage will increase.

NOTE	This requires a readjustment of the rectifier output volts adjust potentiometer as detailed in the following steps.

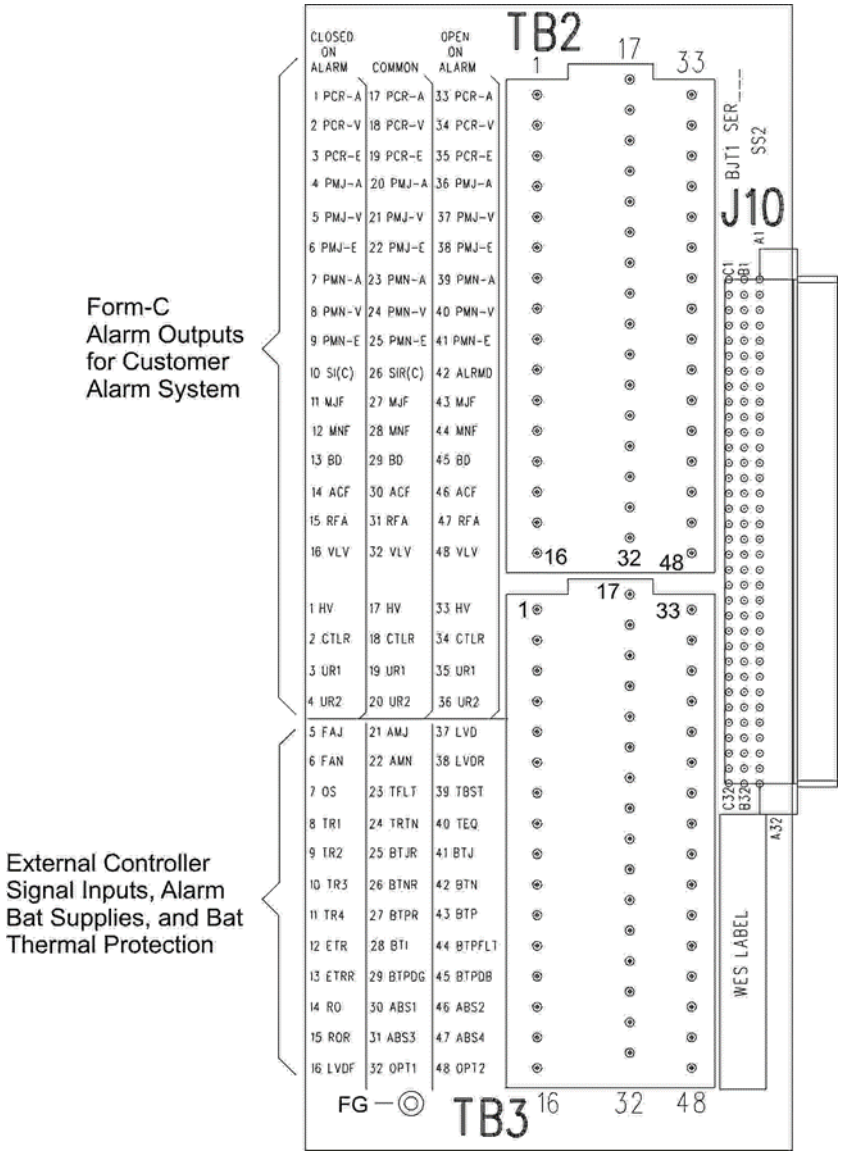
Step	Action to Disconnect Parallel Rectifiers from Galaxy SC	
1	Observe and record the output current of each rectifier.	
2	Turn the rectifier power switch OFF, regardless of whether a readjustment is necessary.	
3	Is the rectifier a OmniOn rectifier with automatic internal voltage sense?	
	Yes – Proceed to Step 6.	No – Proceed.
4	Mark, Tag, and Disconnect external voltage sense leads at the rectifier. Leave the wires in place for later reconnection.	
5	Convert the rectifier to internal sense. Consult the rectifier manual for details.	
6	Remove the associated rectifier regulation fuse (A1 to A8, B1 to B8, and C1 to C8) from the BJF Termination Fuse Board.	 **Figure 29 Galaxy SC Rectifier Fuses**
7	Turn the rectifier Power switch ON.	
8	• Adjust the rectifier output voltage potentiometer to obtain the same current observed in Step 1, readjustment.	
9	Are all rectifiers operating on local sense?	
	Yes – 1. Verify that the system charge bus is within tolerance. 2. Make final adjustments, if necessary.	No – 1. Verify that the system charge bus is within tolerance. 2. Repeat from Step 1 for the next rectifier.
10	• Remove all remaining rectifier regulation fuses.	
11	Are all rectifiers operating at or near the currents recorded in Step 1?	
	Yes – Proceed	No – Re-install fuses removed in Step 11. Repeat Steps 1 through 11 for each rectifier not operating at or near the current recorded in step 1.

Step	Action to Disconnect Parallel Rectifiers from Galaxy SC
12	Note: Do not remove rectifier cables from the Rectifier Interface Modules. Mark, Tag, Disconnect, and Insulate Rectifier Interface Modules from the backplane of the Galaxy SC controller.

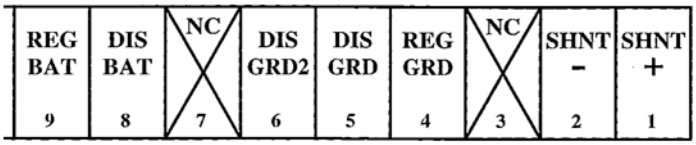
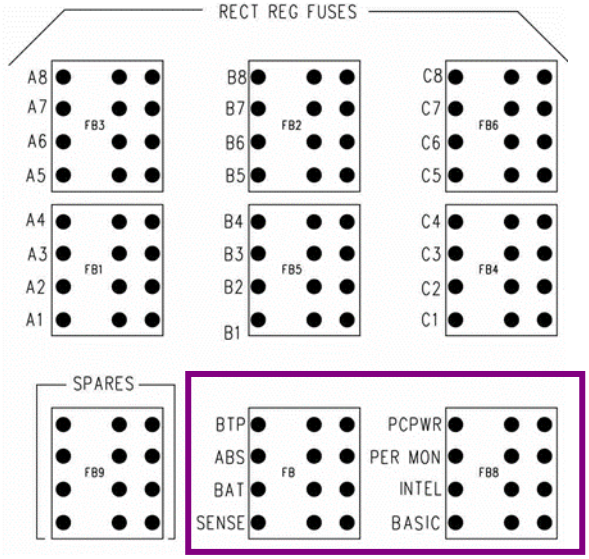
Step	Action to Disconnect Serial GP Rectifiers from Galaxy SC
	The serial rectifier interface cable is terminated (RJ-45 connector) to the J85501F-1 L-36 serial rectifier interface module mounted to backplane on the rear of the Galaxy SC controller.
1	Mark, Tag, Disconnect, and Insulate the serial rectifier interface cable.

Disconnect Other Galaxy SC Connections

Step	Action to Remove Modem Connections	
1	Is there a phone cable attached to the Modem Port Interface Card installed on the rear of the Galaxy SC controller at Connector P101 (see Figure 26)?	
	Yes – 1. Mark, Tag, and Remove, and Insulate the cable. 2. Proceed	No – proceed

Step	Action to Remove Alarm and Control Wiring
	TB2 and TB3 are located on the rear of the Galaxy SC controller (see Figure 26)  **Figure 30 Galaxy SC TB2 and TB3**
NOTE	STOP! Before proceeding with this step, verify that ABS supply (pins 30, 31, 46, and 47) is not connected to anything. If there are connections to ABS perform proper transitioning procedures and move these connections to another source.
1	Mark, Tag, Remove, and Insulate all connections terminating on TB2 and TB3. You may need to reference a controller product manual for labeling the connections.

Step	Action to Remove Other Option Wiring
1	Remove, Mark, Tag, and Insulate any external wires terminated on the optional side of the backplane. See Figure 26 Galaxy SC Controller - Rear. Examples: • Telephone lines • Remote interface cables Make sure that office records are present. Refer to Table 79 Galaxy SC Wiring Plan & Cross Reference and the Galaxy SC Product Manual.

Step	Action to Power-Down Galaxy SC
	Controller Power Down  **Figure 31 Galaxy SC TB1 Plant Connections**  **Figure 32 Galaxy SC Controller Fuses**
1	Remove all 8 controller fuses using a fuse puller (see Figure 32 Galaxy SC Controller Fuses)
2	Mark, Tag, Insulate, and Remove all wires from TB1 on the front of the Galaxy SC.
3	Remove these wires from the controller chassis.

Remove the Galaxy SC Controller

Step	Action to Remove Galaxy SC Controller
1	Mark, Tag, Insulate and Remove all remaining wires and cables are connected to the controller
2	Remove all connectors and wires from the controller chassis.
3	Cut all remaining tie-straps that inhibit removal of the MCS controller.
4	Fully insulate the area around the MCS using a flameproof matting or equivalent. Make sure that these are insulated: • Bus bars • Battery leads • Ground leads
5	Remove all 6 nuts (3 on left side and 3 on right side), using a 6-32 hex nut driver. Slide the Galaxy SC out of the bay, using a second person for support. **CAUTION:** Use two people, one supporting the controller. The SC weighs about 35 pounds.
	Controller removal is complete.

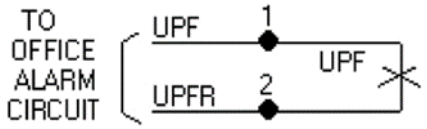
MCS Controller Removal

This section provides a method for preparing an AT&T MCS J85501A2 controller for removal.

Note that if this procedure is adapted for retrofits of other types of controllers such as CCS Galaxy compatible rectifier control cables and possibly different rectifier circuit cards will be necessary. Refer to Table 40 Rectifier Cables.

Prepare the MCS Controller for Removal

NOTE	Some circuit cards in the left side of the MCS (optional side) controller may lose their configurations. Discuss this with the responsible party and note agreements with name and date.

Step	Action to Prepare for MCS Removal	
1	Are alarms present in the controller and rectifiers?	
	Yes – Clear Alarms	No – Proceed
2	Operate all alarms to be sure all alarms are operating properly. For example, put a wire jumper between the terminal block 1, terminal 1 and 2.  **Figure 33 MCS Alarm Circuit**	
3	Open the door of the MCS controller by pulling down on the top side.	
4	Record older vintages of feeder drain or universal shunt monitoring boards. The configuration will be lost when the controller is powered down.	
5	Locate the ED-83009 series circuit card in the right hand side of the controller.	
6	Toggle the EFF/DIS switch upward to the Disabled position. The following LEDs will activate the MCS: • System EFF Status • System Alarm	
7	Are alarms present in the controller and rectifiers?	
	Yes – proceed	No – stop and correct the problem. Refer to the rectifier product manual.
8	Identify the power converter card (ED-83011 series or ED83010 series) in the left most position of the right-hand card cage.	
9	Pull down on the lock lever of the converter to power down the converter. Repeat this step for all converters.	

Disconnect Rectifiers

CAUTION	Disconnect Parallel Rectifier
	When parallel rectifier regulation fuses are pulled, the following will occur:
	• The rectifier will switch to internal regulation.
	  • ABB rectifiers automatically switch to internal regulation.
	  • Non-ABB rectifiers must be manually configured for internal regulation. Consult the rectifier manual for method of configuration for internal regulation.
	• The system voltage will decrease.

NOTE	This requires a readjustment of the rectifier output volts adjust potentiometer as detailed in the following steps.

Step	Action to Disconnect Rectifiers from MCS	
1	Observe and record the current on the rectifiers if an adjustment is necessary.	
2	Turn the rectifier power switch OFF, regardless of whether a readjustment is necessary.	
3	Is the rectifier a OmniOn rectifier with automatic internal voltage sense?	
	Yes – Proceed to Step 6.	No – Proceed.
4	Mark, Tag, and Disconnect external voltage sense leads at the rectifier. Leave the wires in place for later reconnection.	
5	Convert the rectifier to internal sense. Consult the rectifier manual for details.	
6	Remove the associated rectifier regulation fuse (F1 to F16) from the controller.	
7	Remove the rectifier control cable from the controller backplane.	
8	Turn the rectifier Power Switch ON.	
9	Adjust the rectifier output voltage potentiometer to obtain the same current observed in Step 1, readjustment.	
10	Are all rectifiers operating on local sense?	
	Yes – 3. Verify that the system charge bus is within tolerance. 4. Make final adjustments, if necessary. 5. Proceed	No – 1. Verify that the system charge bus is within tolerance. 2. Repeat from Step 1 for the next rectifier.
11	Remove all remaining rectifier regulation fuses.	
12	Are all rectifiers operating at or near the currents recorded in Step 1?	
	Yes – Proceed	No – Re-install fuses removed in Step 11. Repeat Steps 1 through 11 for each rectifier not operating at or near the current recorded in step 1.
13	Mark, Tag, Disconnect, and Insulate rectifier cables from the backplane of the MCS controller. Do not remove connectors from the controller end of the cables.	

Disconnect Other MCS Connections

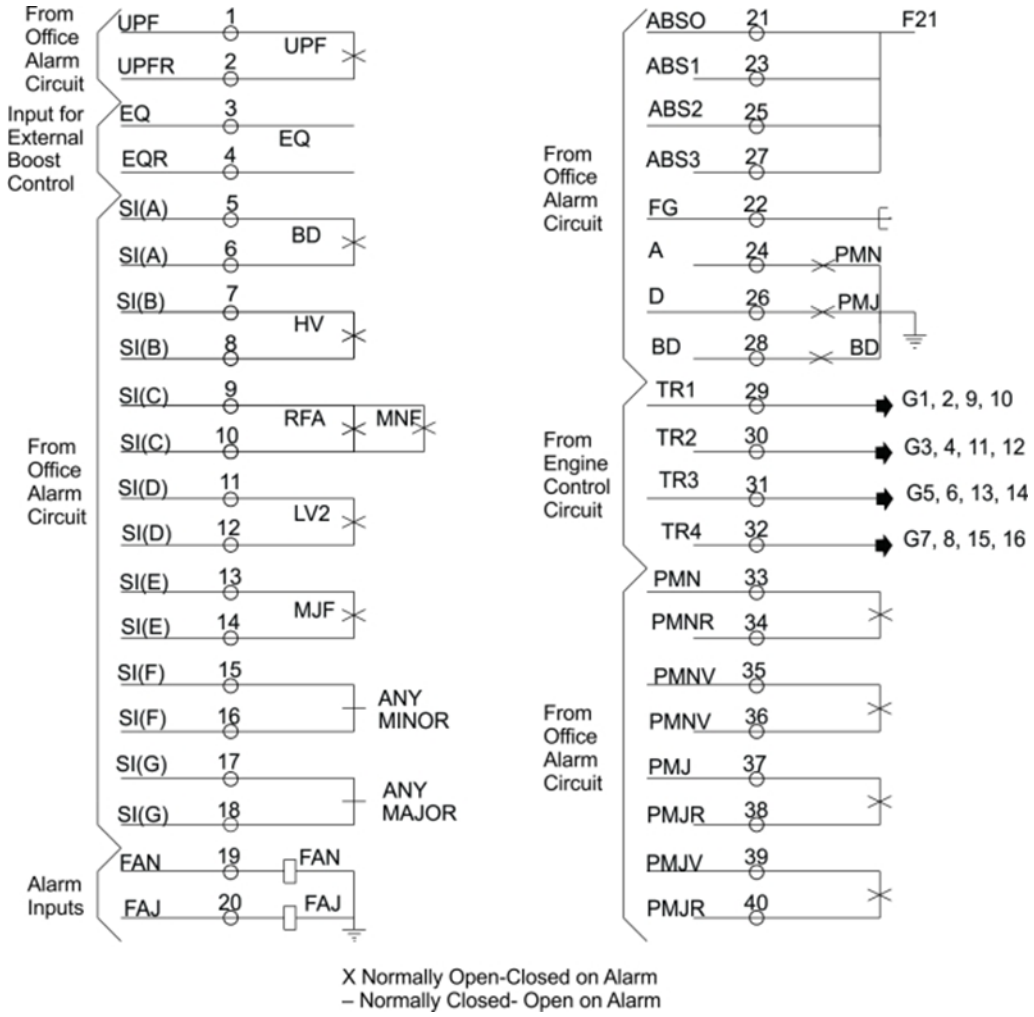


Figure 34 MCS TB1 Alarm Connections

Step	Action to Disconnect Other MCS Connections	
1	Is more than 1 wire connected to TB2 pin 1 or pin 2?	
	Yes – Proceed	No – Proceed to Step 3.
NOTE	Systems equipped with ED83018-31 group 17 low-voltage disconnect panels can operate and disconnect an office load.	
WARNING	Additional wires on these terminals could be sense leads for ED83018-31 group 17 low voltage disconnect panels. If the sense leads are removed from these panels, the contactor can operate and disconnect critical office loads. Therefore, it is necessary to determine what they feed and their function.	
2	Are wires connected to TB2 pin 1 or Pin 2 used as sense leads for ED83018-31 group 17 low voltage disconnect panels?	
	Yes – 1. Place jumpers on the wires before disconnecting them from TB2. 2. Proceed	No – Proceed.
3	Record wire colors of all wires to be removed in Table 80 MCS/CCS Wiring Plan & Cross Reference.	
4	Twist together the normally closed alarm leads after disconnecting the existing alarm leads from the MCS terminal block TB1. See Figure 34 MCS TB1 Alarm Connections. Disconnecting will prevent continuous office alarms during controller transition. For example, twist together wires from positions 39 and 40 (PMJV and PMJVR).	
5	Remove, Mark And Insulate all external wires (office alarms) terminated on TB1.	
6	Cut the existing MCS alarm connections at TB1 on the MCS controller. Leave adequate length for reconnection to MSC. Alarm connections on MSC do not require crimped connections.	
7	Remove fuses F17 to F22 from the controller.	
8	Disconnect from the energy source, insulate, and label these leads: • Regulation battery (RB) • Discharge battery (DB) • SH+ • SH –	
9	Disconnect from MCS TB2, insulate, and label these leads: • Regulation battery (RB) • Discharge battery (DB) • Discharge ground (DG) • Regulation ground (RG) • SH+ • SH –	
10	Is the controller equipped with a shunt isolator circuit card?	
	Yes – Isolate or Disconnect the shunt isolator circuit card. This is located behind the blank panel below the controller.	No – Continue.
11	Verify that no voltage exists on MCS TB2. Disconnect and label all remaining wires terminated on TB2.	
12	Remove, Mark and Insulate any external wires terminated on the optional side of the backplane. Examples follow: • Telephone lines • Remote interface cables Make sure that office records are present. Refer to Table 80 MCS/CCS Wiring Plan & Cross Reference.	

Record MCS DIP Switch Settings

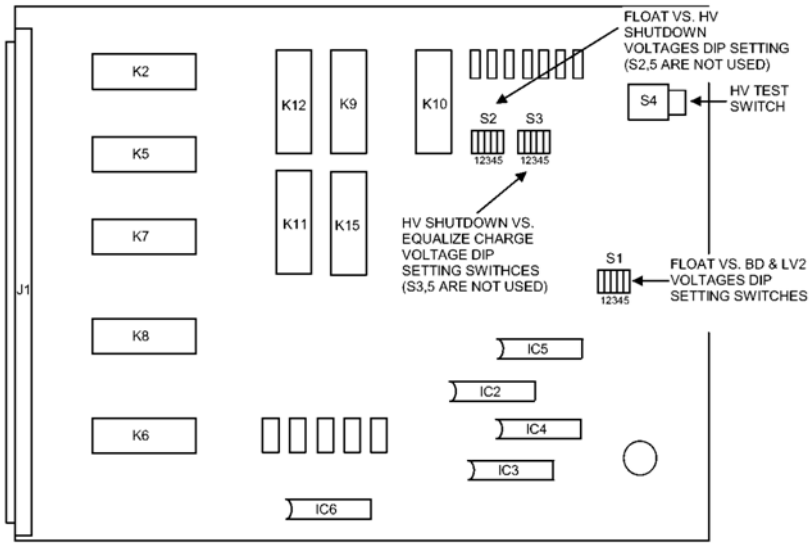
Step	Action to Record MCS DIP Switch Settings
	 **Figure 35 MCS Auxiliary Board (CP2)**
1	Remove the ED83006 (auxiliary circuit card) from the MCS.
2	Is the ED83006 equipped with DIP switches S1, S2, and S3?
	Yes – Proceed. / No – Nothing to record. Proceed to Remove the MCS Controller.
3	Record the setting values of DIP switches S1, S2, and S3 in Table 16. • Float/BD/L2 setting from S1 • HV/float shutdown settings from S2 • HV/equalize settings from S3

Table 16 MCS DIP Switch Settings

DIP Switch	Default	Use Table	Threshold	Value
S1 BD	51.25 /25.50	Table 17	Battery on Discharge	
S2 HV	53.00 / 26.00	Table 18	High Voltage - Float	
S3 HV	55.00 / 28.50	Table 19	High Voltage - Equalize	

Table 17 MCS-BD and LV2 Alarm Settings – S1								
24 Volt		48 Volt		Switch Settings				
BD Level	LV2 Level	BD Level	LV2 Level	O = Open X = Closed				
± 0.25 Volts	± 0.25 Volts	± 0.50 Volts	± 0.50 Volts	S1.1	S1.2	S1.3	S1.4	S1.5
		56.00	53.00	O	O	O	O	O
29.70	28.20	55.60	52.60	X	O	O	O	O
29.60	28.10	55.50	52.50	O	X	O	O	O
29.10	27.60	55.00	52.00	X	X	O	O	O
29.50	28.00	55.40	52.40	O	O	X	O	O
29.00	27.50	54.90	51.90	X	O	X	O	O
28.90	27.40	54.80	51.80	O	X	X	O	O
28.50	27.00	54.40	51.40	X	X	X	O	O
29.20	27.70	55.10	52.10	O	O	O	X	O
28.70	27.20	54.60	51.60	X	O	O	X	O
28.60	27.10	54.50	51.50	O	X	O	X	O
28.10	26.60	54.00	51.00	X	X	O	X	O
28.50	27.00	54.50	51.50	O	O	X	X	O
28.00	26.50	54.90	51.90	X	O	X	X	O
27.90	26.40	54.00	51.00	O	X	X	X	O
27.40	25.90	53.40	50.40	X	X	X	X	O
28.20	26.70	54.00	51.00	O	O	O	O	X
27.70	26.20	53.60	50.80	X	O	O	O	X
27.60	26.10	53.50	50.50	O	X	O	O	X
27.10	25.80	53.00	50.00	X	X	O	O	X
27.50	26.00	53.40	50.40	O	O	X	O	X
27.00	25.50	52.90	49.90	O	X	X	O	X
26.50	25.00	52.90	49.90	X	X	X	O	X
27.20	25.70	53.00	50.00	O	O	O	X	X
26.60	25.10	52.60	49.80	X	O	O	X	X
26.60	25.10	52.50	49.50	O	X	O	X	X
26.10	24.60	52.00	49.00	X	X	O	X	X
26.00	24.50	51.90	48.90	X	O	X	X	X
25.90	24.40	51.40	48.40	O	X	X	X	X
25.50	24.00	51.25	48.25	X	X	X	X	X

Table 18 MCS High Voltage Shutdown / Float – S2					
24 Volt HV Level	**48 Volt HV Level**	**Switch Settings[5] O = Open X = Closed**			
± 0.25 Volts	**± 0.50 Volts**	**S2.1**	**S2.2**	**S2.3**	**S2.4**
	57.00	O	O	O	O
	56.50	X	O	O	O
	56.50	O	X	O	O
29.80	56.00	X	X	O	O
29.75	56.00	O	O	X	O
29.30	55.50	X	O	X	O
29.25	55.50	O	X	X	O
28.80	55.00	X	X	X	O
28.75	55.00	O	O	O	X
28.30	54.50	X	O	O	X
28.25	54.50	O	X	O	X
27.80	54.00	X	X	O	X
27.75	54.00	O	O	X	X
27.30	53.50	X	O	X	X
27.25	53.50	O	X	X	X
26.75	53.00	X	X	X	X

[5]Switch S2.5 will be open for 48 volt system and closed for a 24 volt system.

Table 19 MCS High Voltage Shutdown / Equalize – S3					
24 Volt HV Level	48 Volt HV/Equalize Level	Switch Settings[6] O = Open X = Closed			
± 0.25 Volts	± 0.50 Volts	S3.1	S3.2	S3.3	S3.4
	59.00	O	O	O	O
	58.50	X	O	O	O
	58.50	O	X	O	O
	58.00	X	X	O	O
	57.50	X	O	X	O
	57.50	O	X	X	O
	57.00	X	X	X	O
	57.00	O	O	O	X
	56.50	X	O	O	X
	56.50	O	X	O	X
	56.00	X	X	O	X
29.75	56.00	O	O	X	X
29.30	55.50	X	O	X	X
29.25	55.50	O	X	X	X
29.75	55.00	X	X	X	X

[6]Switch S3.5 will be open for 48 volt system and closed for a 24 volt system.

Remove the MCS Controller

Step	Action to Remove the MCS Controller
1	Cut all remaining tie-straps that inhibit removal of the MCS controller.
2	Fully insulate the area around the MCS using a flameproof matting or equivalent. Make sure that these are insulated: • Bus bars • Battery leads • Ground leads
3	Remove the mounting bolts on both sides of the MCS. Slide the MCS out of the bay, using the second person for support. **CAUTION:** Use two people, one supporting the controller. The MCS weighs about 35 pounds.
	Controller removal is complete.

Other Controller Removal

This section provides a method for replacing controllers other than Galaxy SC or AT&T MCS with the MSC.

NOTE	Consult Engineering for details of the specific installation and specific controller being replaced. The steps in this section are intended to be a guide and are representative of an existing controller. The specific existing controller may have different features and connections from those included in this section. Consult the Product Manual for the existing controller for settings and control information.

Prepare the Controller for Removal

Step	Action to Prepare the Controller for Removal
Note	Verify that the Alarm center has been notified of potential alarms being generated.
1	Place System in Float Mode From the Default Display of the controller, note the system mode of operation: If the mode is FLOAT, go to Step 2. If the mode is something other than Float (ex. – BOOST), place the system in FLOAT mode before going to Step 2.
2	Turn all Available Rectifiers On • If rectifiers have been manually turned off, turn them back on. • If rectifiers have been placed in standby because of the Energy Management feature of the controller, then disable Energy Management. • If all rectifiers are not sharing load adjust them.
3	Record the DIP Switch Settings Consult the manual for the controller being replaced for DIP Switch location and function. **Record** for each DIP Switch: Switch ID, Switch Function, Function Setting (Enable / Disable, ON / OFF, etc.)

Table 20 Other Controller DIP Switch Settings

Switch ID. (SW-#)	Switch Function	Function Setting. (Enable / Disable)

<table>
<tr><th>Step</th><th>Action to Prepare the Controller for Removal</th></tr>
<tr><td>4</td><td>Record Alarm Threshold Settings
Consult the manual for the controller being replaced for Alarm Threshold Settings method and location.

<table>
<tr><th colspan="3">Table 21 Other Controller Alarm Threshold Settings</th></tr>
<tr><th>Alarm</th><th>Float</th><th>Boost (optional)</th></tr>
<tr><td>High Voltage</td><td></td><td></td></tr>
<tr><td>High Float Voltage</td><td></td><td></td></tr>
<tr><td>Battery on Discharge</td><td></td><td></td></tr>
<tr><td>Rectifier On</td><td></td><td></td></tr>
<tr><td>Very Low Voltage</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>5</td><td>Record Plant Shunt Configuration
Consult the manual for the controller being replaced for Plant Shunt Configuration method and location.
Record Plant Shunt configuration

<table>
<tr><th colspan="2">Table 22 Other Controller Plant Shunt Settings</th></tr>
<tr><td>Shunt I</td><td></td></tr>
<tr><td>Shunt mV</td><td></td></tr>
<tr><td>Shunt Type – Load, Battery, none, etc.</td><td></td></tr>
</table></td></tr>
<tr><td>6</td><td>Low Voltage Disconnects Configuration
Consult the manual for the controller being replaced for Low Voltage Disconnects Configuration method and location.

<table>
<tr><th colspan="2">Table 23 Other Controller Low Voltage Disconnect Settings</th></tr>
<tr><td>Contactor 1</td><td></td></tr>
<tr><td>Type – Battery, Load</td><td></td></tr>
<tr><td>Disconnect Threshold</td><td></td></tr>
<tr><td>Reconnect Threshold</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Contactor 2</td><td></td></tr>
<tr><td>Type – Battery, Load</td><td></td></tr>
<tr><td>Disconnect Threshold</td><td></td></tr>
<tr><td>Reconnect Threshold</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Contactor 3</td><td></td></tr>
<tr><td>Type – Battery, Load</td><td></td></tr>
<tr><td>Disconnect Threshold</td><td></td></tr>
<tr><td>Reconnect Threshold</td><td></td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Step</th><th>Action to Prepare the Controller for Removal</th></tr>
<tr><td>7</td><td>Slope Thermal Compensation Configuration
Consult the manual for the controller being replaced for Slope Thermal Compensation Configuration method and location.
Record the actual setting names from the controller being replaced. If the controller has different setting names than in this table,

<table><tr><th colspan="2">Table 24 Other Controller Slope Thermal Compensation Settings</th></tr><tr><td>STC Enabled/Disabled</td><td></td></tr><tr><td>Nominal Temperature</td><td></td></tr><tr><td>Step Temperature</td><td></td></tr><tr><td>Disconnect Temperature</td><td></td></tr><tr><td>Low Temperature</td><td></td></tr><tr><td>Upper Temperature</td><td></td></tr><tr><td>Raise Voltage Enable</td><td></td></tr><tr><td>Temperature Units</td><td></td></tr></table></td></tr>
<tr><td>8</td><td>Rectifier Float Setpoints
Consult the manual for the controller being replaced for Rectifier Float Configuration method and location.
Record the float setpoints

<table><tr><th colspan="2">Table 25 Other Controller Rectifier Float Setpoints</th></tr><tr><td>Plant V</td><td></td></tr><tr><td>I limit</td><td></td></tr><tr><td>High Voltage Shut Down (SHVSD)</td><td></td></tr></table></td></tr>
<tr><td>9</td><td>Secure Contactors
Configure Battery and Load contactors, if present in the system, so that they do not OPEN during the controller replacement. To ensure that these contactors do not open, force all LVLD and LVBD contactors closed.
NOTE: These contactors may have already been forced to remain closed independently of the controller per customer requirements. If so, then proceed to the next step.
Consult the manual for the controller being replaced and associated plant equipment for contactor control method and location.</td></tr>
</table>

<table>
<tr><th>Step</th><th>Action to Prepare the Controller for Removal</th></tr>
<tr><td>10</td><td>Disconnect Alarm Bias and Return from Old Controller
Consult the manual for the controller being replaced for Alarm Bias (ABS), Alarm Return connection method and location.

<table><tr><th>Step</th><th>Action</th></tr><tr><td>b</td><td>Locate Alarm Bias (ABS), Alarm Return connections.</td></tr><tr><td>b</td><td>Mark, Tag and Insulate the Alarm Bias (ABS), Alarm Return connections cables.</td></tr><tr><td>c</td><td>Remove these connections from the controller housing.</td></tr><tr><td>d</td><td>Perform proper transitioning procedures and move these connections to another source.</td></tr></table></td></tr>
<tr><td>11</td><td>Controller Power Down
Consult the manual for the controller being replaced for Power Fuse location.

<table><tr><th>Step</th><th>Action</th></tr><tr><td>a</td><td>Remove all controller power fuses using a fuse puller.</td></tr><tr><td>b</td><td>Locate Input Power, Shunt, and Regulation inputs to the controller.</td></tr><tr><td>c</td><td>Mark, Tag, and Insulate these leads.</td></tr><tr><td>d</td><td>Remove these leads from the controller housing.</td></tr></table></td></tr>
</table>

Disconnect Rectifiers

<table>
<tr><td>NOTE</td><td>Disconnect Parallel Rectifier
Consult the manuals for the existing controller, plant, and rectifiers for details regarding disconnecting rectifiers.
The steps in this section are intended to be a guide and are representative of existing rectifiers. The specific existing rectifiers may have different features and connections from those included in this section.</td></tr>
<tr><td>CAUTION</td><td>When parallel rectifier regulation fuses are pulled, the following will occur:
The rectifier will switch to internal regulation.
OmniOn rectifiers automatically switch to internal regulation.
Non-OmniOn rectifiers must be manually configured for internal regulation.
Consult the rectifier manual for method of configuration for internal regulation.
The system voltage will decrease.</td></tr>
<tr><td>NOTE</td><td>This requires a readjustment of the rectifier output volts adjust potentiometer as detailed in the following steps.</td></tr>
</table>

Step	Action to Disconnect Rectifiers from Controller	
1	Observe and Record the current on the rectifiers if an adjustment is necessary.	
2	Turn the rectifier power switch OFF, regardless of whether a readjustment is necessary.	
3	Is the rectifier a OmniOn rectifier with automatic internal voltage sense?	
	Yes – Proceed to Step 6.	No – Proceed.
4	Mark, Tag, and Disconnect external voltage sense leads at the rectifier. Leave the wires in place for later reconnection.	
5	Connect internal sense leads. Consult the rectifier manual for details.	
6	Remove the associated rectifier regulation fuse, if present.	
7	Remove the rectifier control cable from the controller.	
8	Turn the rectifier Power Switch ON.	
9	Adjust the rectifier output voltage potentiometer to obtain the same current observed in Step 1, readjustment.	
10	Are all rectifiers operating on local sense?	
	Yes – 1. Verify that the system charge bus is within tolerance. 2. Make final adjustments, if necessary.	No – 1. Verify that the system charge bus is within tolerance. 2. Repeat from Step 1 for the next rectifier.
11	Remove all remaining rectifier regulation fuses.	
12	Are all rectifiers operating at or near the currents recorded in Step 1?	
	Yes – Proceed	No – Re-install fuses removed in Step 11. Repeat Steps 1 through 11 for each rectifier not operating at or near the current recorded in step 1.
13	Mark, Tag, Disconnect, and Insulate rectifier cables from the backplane of the MCS controller. Do not remove connectors from the controller end of the cables.	
14	Mark, Tag, Disconnect, and Insulate rectifier cables from each rectifier.	

Disconnect the Other Connections

Step	Action to Disconnect Other Connections from Other Controller	
1	Disconnect Shunt from Old Controller Consult the manual for the controller being replaced for Shunt connection method and location.	
	Step	**Action to Disconnect Shunt from Old Controller**
	1a	Locate Shunt connections.
	1b	Mark, Tag and Insulate the Shunt connections cables.
	1c	Remove these connections from the controller housing.
2	Disconnect Regulation Sense from Old Controller Consult the manual for the controller being replaced for Shunt connection method and location.	
	Step	**Action to Disconnect Regulation Sense from Old Controller**
	2a	Locate Regulation Sense connections.
	2b	Mark, Tag and Insulate the Regulation Sense connections cables.
	2c	Remove these connections from the controller housing.
3	Remove Alarm Wiring from Old Controller Consult the manual for the controller being replaced for Shunt connection method and location.	
	Step	**Action to Remove Alarm Wiring from Old Controller**
	3a	Locate Alarm wiring connections.
	3b	Mark, Tag and Insulate the Alarm wiring connections cables.
	3c	Remove these connections from the controller housing.
4	Remove Thermal Probe(s) from Old Controller Consult the manual for the controller being replaced for Thermal Probe(s) method and location.	
	Step	**Action to Remove Thermal Probe(s) from Old Controller**
	4a	Locate Thermal Probe(s) connections.
	4b	Mark, Tag and Insulate the Thermal Probe(s) connections cables.
	4c	Remove these connections from the controller housing.
5	Remove Modem Connections from Old Controller Consult the manual for the controller being replaced Modem Connections method and location.	
	Step	**Action to Remove Modem Connections from Old Controller**
	5a	Locate Modem connections.
	5b	Mark, Tag and Insulate the Modem connections cables.
	5c	Remove these connections from the controller housing.

Step	Action to Disconnect Other Connections from Other Controller
6	Remove PC Serial Port from Old Controller Consult the manual for the controller being replaced for PC Serial Port method and location.

Step	Action to Remove PC Serial Port from Old Controller
6a	Locate PC Serial Port Cables connections.
6b	Mark, Tag and Insulate the PC Serial Port connections cables.
6c	Remove these connections from the controller housing.

7	Remove Aux Port from Old Controller Consult the manual for the controller being replaced for Aux Port connection method and location.

Step	Action to Remove Aux Port from Old Controller
7a	Locate Aux Port Cables connections.
7b	Mark, Tag and Insulate the Aux Port connections cables.
7c	Remove these connections from the controller housing.

8	Verify that All Connections have been Removed • Do not proceed until all connections have been removed from existing controller. • Consult Engineering for details of the specific installation and specific controller being replaced.

Remove the Existing Controller

Step	Action to Remove the Existing Controller
1	Cut all remaining tie-straps that inhibit removal of the controller.
2	Fully insulate the area around the controller using a flameproof matting or equivalent. Make sure that these are insulated: • Bus bars • Battery leads • Ground leads
3	Remove the mounting bolts on both sides of the controller. Slide the controller out of the bay, using the second person for support. **CAUTION:** Use two people, one supporting the controller. Controllers may be heavy.
	Controller removal is complete.

Install Controller

Figure 36 MSC

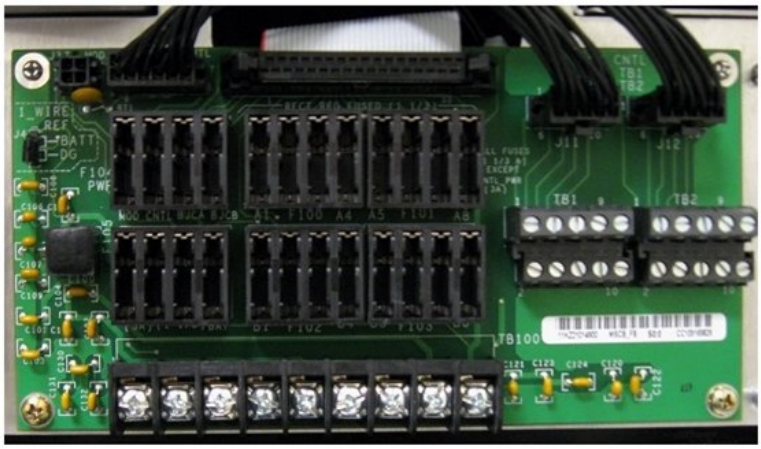
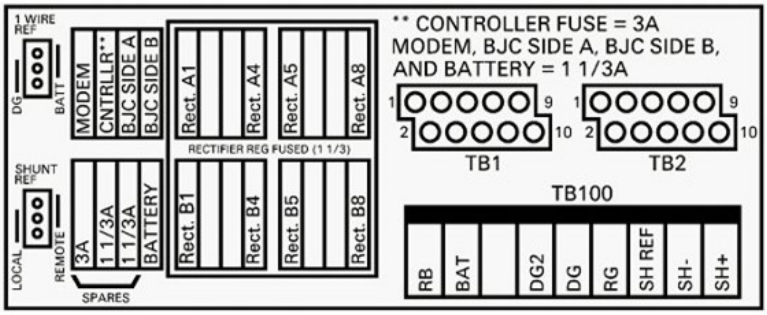
MSC is factory configured with industry standard defaults for thresholds and features. In addition, customer specific default controller settings may be available upon request. This section provides:

- Procedures for the proper addition of optional cards
- Input and output wiring to the controller and the installation and wiring of optional features

Mount the MSC

<table>
<tr><th>Step</th><th>Action to Mount MSC</th></tr>
<tr><td>1</td><td>Mount the MSC
<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1a</td><td>Position the mounting brackets for desired controller front panel set back in the frame, usually closest to the front of the controller.</td></tr>
<tr><td>1b</td><td>Attach the mounting brackets appropriate to the target frame or cabinet to the controller chassis using 4 screws on each bracket.</td></tr>
<tr><td>1c</td><td>Protect any energized bus bars in the area from accidental contact with insulating material.</td></tr>
<tr><td>1d</td><td>Position the MSC housing in the frame or cabinet as desired. Secure the controller to the frame with 3 screws on each side.
CAUTION: Use two people, one supporting the controller. The controller is heavy.</td></tr>
</table></td></tr>
</table>

Remove Controller Fuses

Step	Action to Remove Controller Power Fuses
	 
1	Remove and set aside all controller power and rectifier fuses: MODEM, CNTRLLR, BJCA, and BJCB, Rect A1 - Rect A8, and Rect B1 - Rect B8.

Install Circuit Cards

NOTE: Installation or replacement of cards can be done “hot”; power removal is not necessary, except as noted.

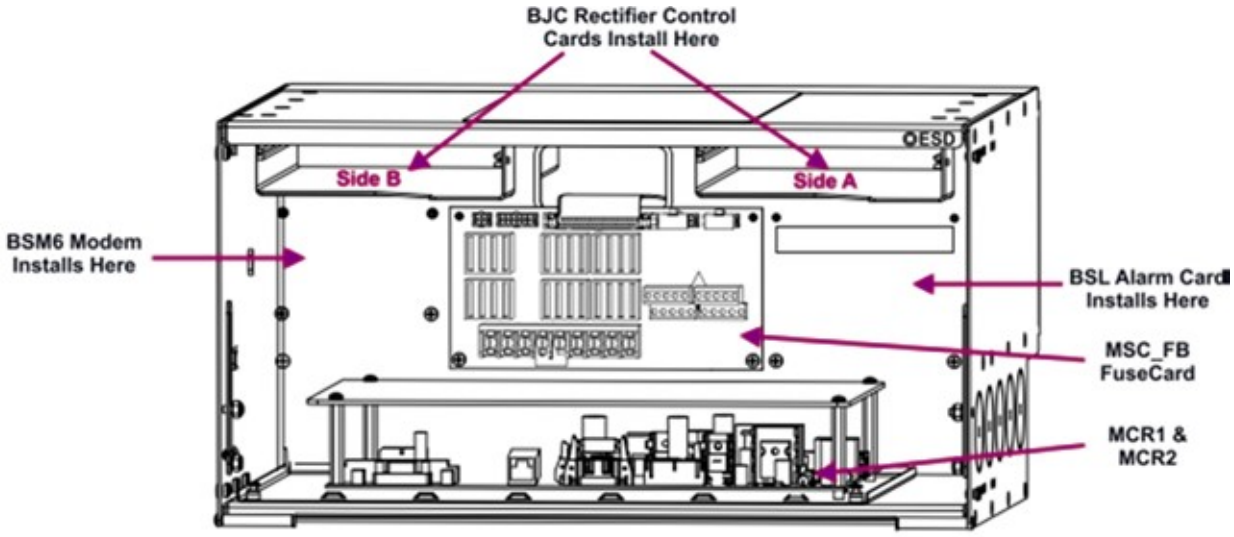


Figure 38 Cards Front

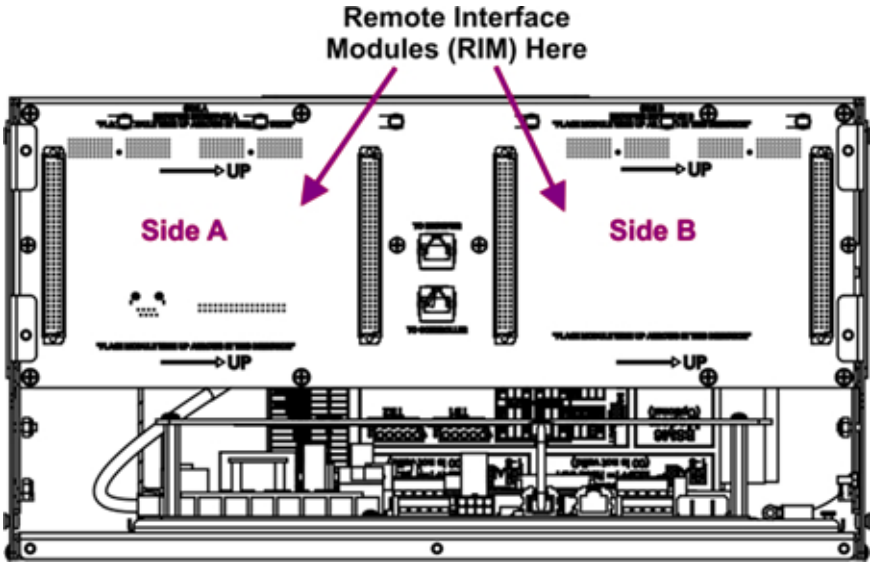


Figure 39 Cards Rear

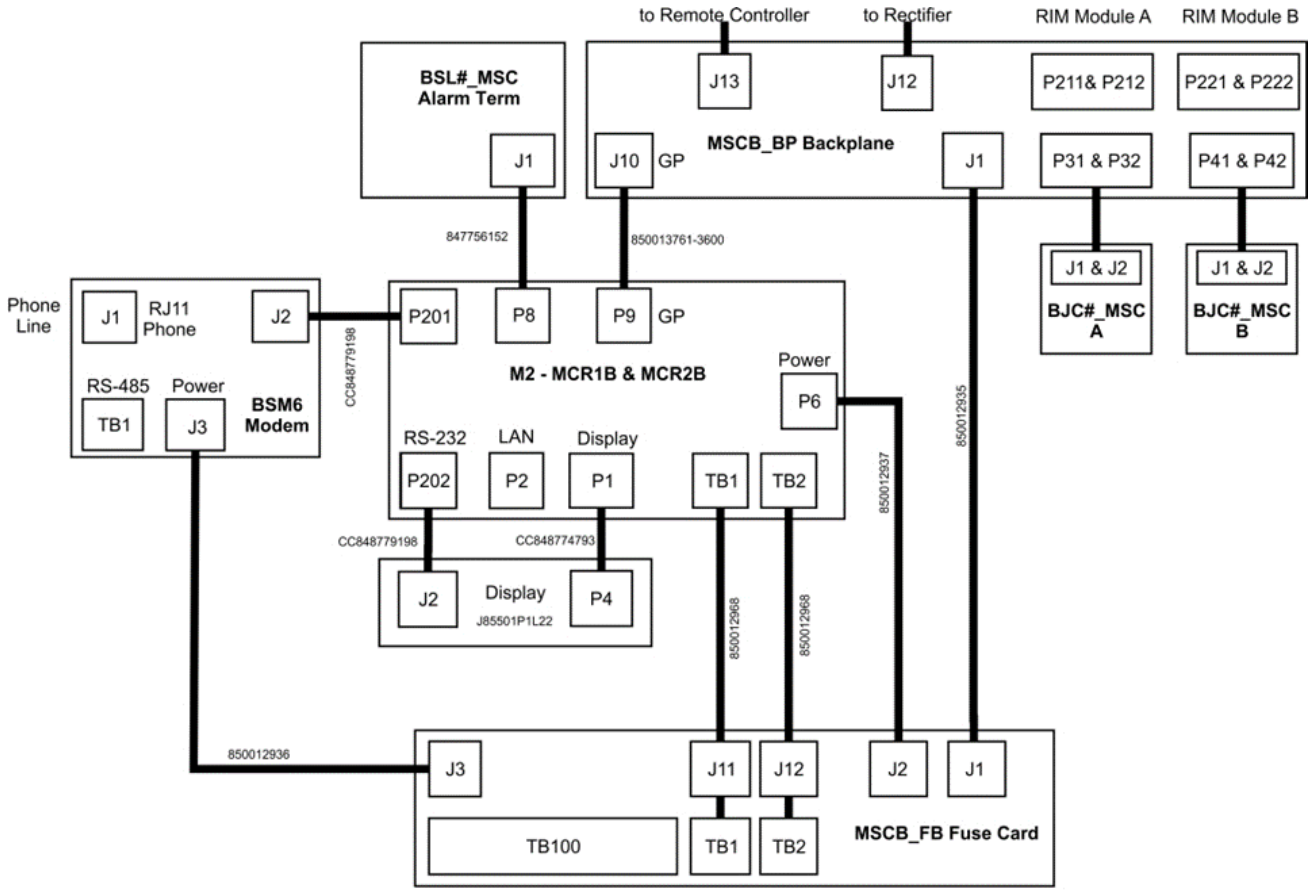


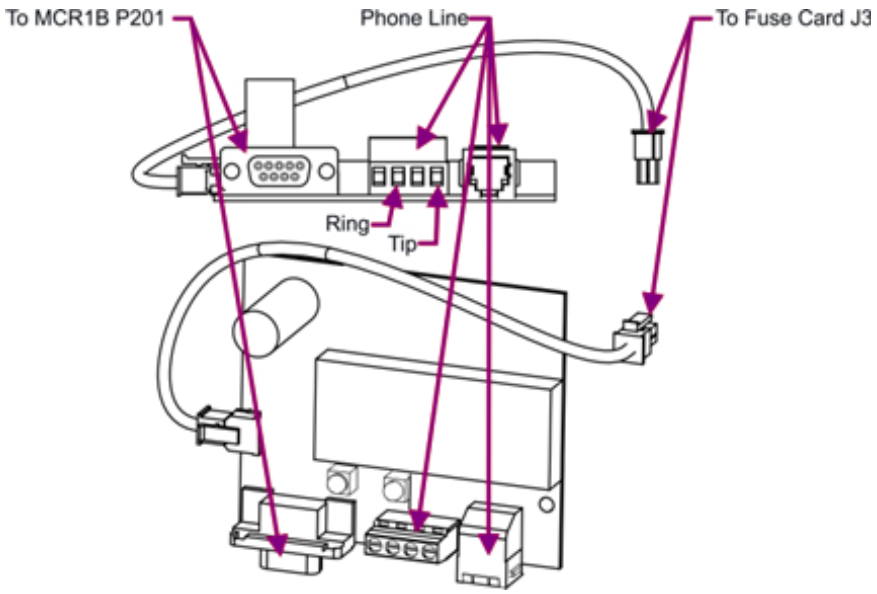
Figure 40 Card Connections

Rectifier Interface Cards - BJC

Step	Action to Install Rectifier Interface Cards
1	Select the appropriate BJC card for Side A BJC1_MSC CC109167771 for OmniOn Power (AT&T) type rectifiers BJC2_MSC CC109167788 for non-OmniOn Power (AT&T) type rectifiers **NOTE:** For existing Galaxy SC replacement • Select BJC_MSC cards of the same type as the replaced BJC cards. BJC1_MSC replaced BJC1, etc. • Install the BJC cards in the same left or right positions as on the Galaxy SC to make RIM insertion more convenient. **NOTE**: Rectifier Interface Card options provide for compatibility with a variety of rectifier cable connections. Remote Interface Module associated with a Rectifier Interface Card must also match the application for proper operation.

2	Set First Rectifier ID per the plan recorded in Table 5 Rectifier Interface Cards First ID Settings. Set S1 and HDR1 for first Rectifier ID according to the plan prepared above on each BJC card. 1. Set S1 2. Set the HDR1 jumper as necessary to add 0 or 10 to the S1 setting.  **Figure 41 RIC ID Setting**
3	Position the card latch / ejector to the unlatched position
4	With components side down 1. Position the card in the card guides on Side A position - Right hand side. See Figure 38 Cards Front. 2. Slide the card firmly into position.
5	Position the latch / ejector to secure the card.
6	Repeat from step 1 for a Side B BJC card if present.

Modem Card - BSM6 - Option

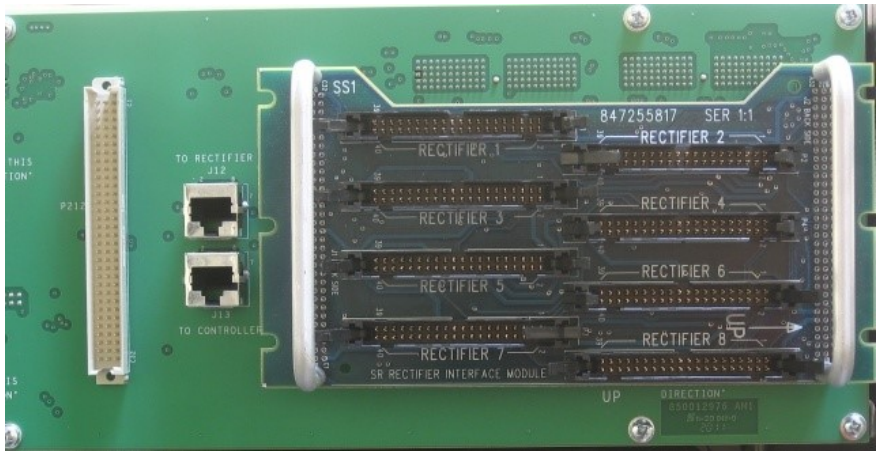
Step	Action to Install Modem Card
	 **Figure 42 Modem Card Wiring**
1	Install the BSM on the 4 standoffs using four 845143866 screws. See Figure 38 Cards Front.
2	Connect the 848779198 cable assembly between the BSM J2 plug and P201 on the rear of the MCR1 card.
3	Connect the 850012936 cable assembly between the BSM J3 plug and J3 on the adjacent Fuse Card.
4	If the controller was powered during installation • Operate the reset switch on the MCR1 card in the front left corner of the MCR1 card.
5	Configure the Modem per the Configure Modem Settings section. NOTE: Modem Settings may be set improperly by restoring a Galaxy SC configuration from file. See the Prepare Galaxy SC Configuration File for MSC Use section.

Alarm Termination Card - BSL

Alarm Termination card options provide for wire wrapped or insulation displacement (punch down) terminations. Field installation may be required.

Step	Action to Install Alarm Termination Card
1	Position the 847756152 cable from P8 on the MCR1B card so that it does not obstruct the mounting for the BSL card. See Figure 38 Cards Front.
2	Mount the BSL card to chassis 1. Snap the card onto the two top standoffs 2. Secure the card to the bottom two standoffs with two 845143866 screws
3	Connect the 847756152 cable to the BSL card

Remote Interface Modules (RIM)

Step	Action to Install Remote Interface Modules (RIM)
	 **Figure 43 Remote Interface Module (RIM) - Side B**
1	Select the appropriate Remote Interface Module OmniOn Power (AT&T) type rectifiers 108028671 Ferro rectifiers without Enhanced Communications 108028697 Ferro rectifiers with Enhanced Communications 108572660 ECS 364 Rectifiers Non-OmniOn Power (AT&T) type rectifiers 108028689 all **NOTE**: Remote Interface Module and the associated Rectifier Interface Card must match the rectifier for proper operation.
2	Mount the Remote Interface Module to the rear of the controller 1. Position the module as shown on Side A or Side B See Figure 39 Cards Rear. 2. Orient the card with the “UP” arrows aligned with those on the controller. 3. Align the module to its mating connectors 4. Firmly seat the module to its mating connectors

Install Cabling

CAUTION: All ports of the controller except the BSM6 Modem phone port are Intra-building ports. Connect only per Connections - Ports in the General Specifications section – Inputs/Outputs.

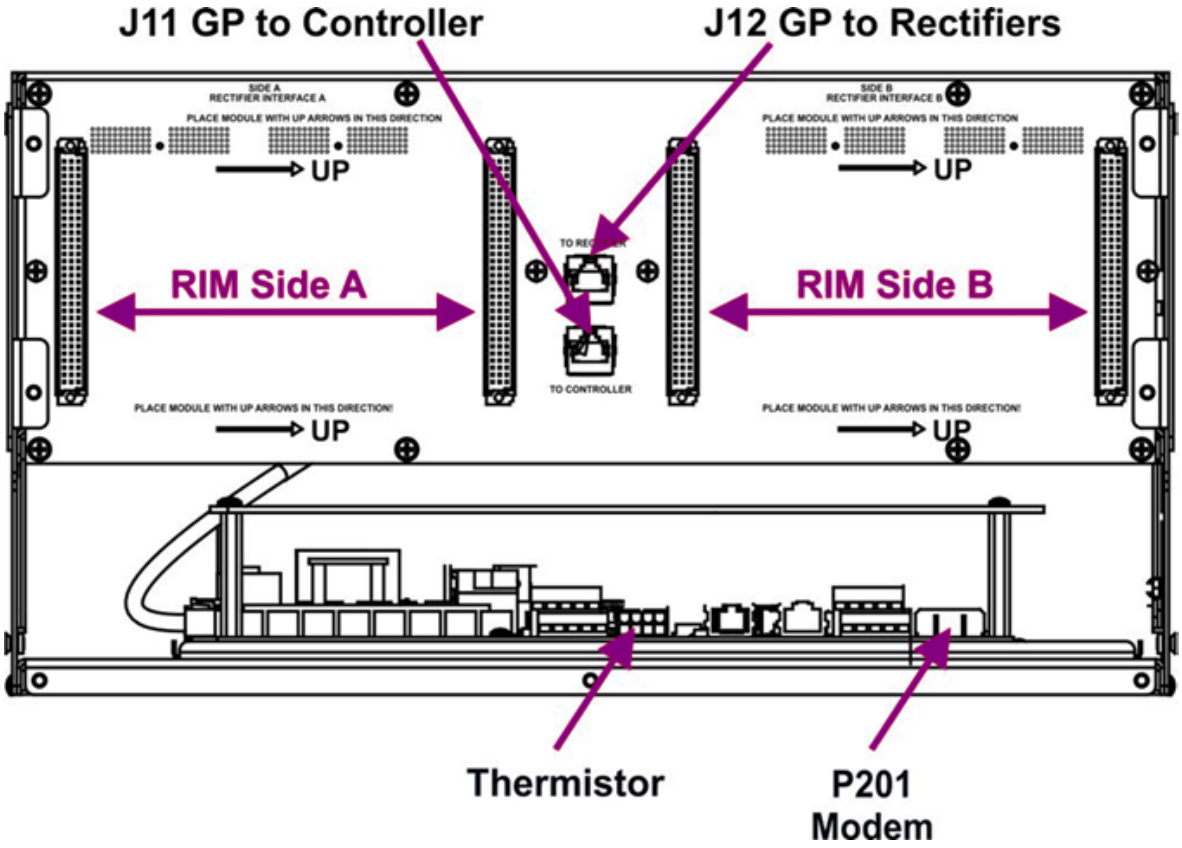


Figure 44 Controller Connections Rear

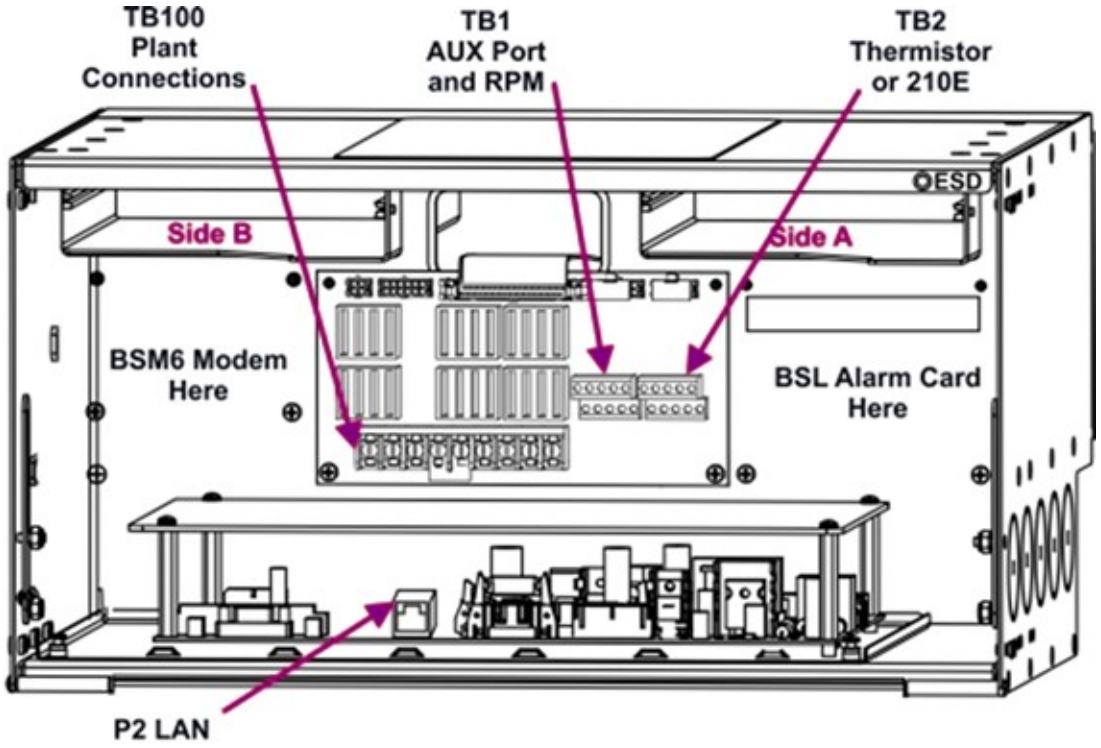


Figure 45 Controller Connections Front

Table 26 MSC Interface Reference	
Interface Reference	**Description**
BSL Card	Alarm Outputs; Alarm and Control Inputs
P1	Controller to front panel assembly
P2	LAN 10/100 Base-T Ethernet - RJ-45
P3	10K/30K thermistor probe options
P7	Auxiliary RS-485 circuit and 1-Wire® voltage / temperature monitoring devices - RJ45, ground referenced
P201	Controller to Modem
TB1	RS-232/RS-485 Auxiliary port and Remote Peripheral Module (RPM)
TB2	10K thermistor probe connection options - three additional
TB100	Plant connections: Power, Ground, Voltage Sense, Shunt Sense
J1	BSM6 Modem - RJ11 phone line
J2	BSM6 Modem - to controller P201
J13	GP to Controller - use only to connect MSC without M2 to M2 controller
J12	GP to Rectifiers, etc. Serial Protocol - isolated RS-485 system component monitoring and control of rectifiers, converters, low voltage disconnect contactors, and bay level alarm inputs (GP Serial Rectifier bus) - RJ45

Alarm and Control Signals - Alarm Termination Card - BSL

BSL Alarm Termination card options provide for wire wrapped or insulation displacement (punch down) terminations.

Alarm terminations may be wired to customer external office alarms at their destination.

Refer to Table 35 Alarm and Control - Signal Names and BSL Pins and Table 36 Alarm - Descriptions, BLS Pins, and Signal Names for leads terminating on the BSL alarm interface card.

Step	Action to Install Alarm and Control Wiring - BSL

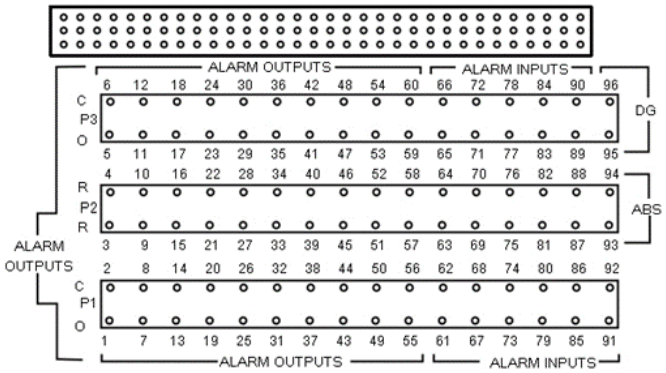


Figure 46 BSL4_MSC Alarm Terminations

NOTE: Wire Wrap

- Use 24 to 30 AWG wire.
- Strip approximately 1 inch of insulation from wire.
- Use a standard wire wrap tool to connect each wire to its terminal.

Punch Down

- Use 18 to 22 AWG
  (if less than 18AWG, use multi-conductor cable for mechanical integrity).
- Secure wires to terminals using a punch down tool or
  Phillips #1 or #2 screwdriver inserted into a punch down insulating cap[7].
- Install punch insulating down caps[7] on each termination - optional

	Is an existing controller being replaced?	
	Yes – Proceed.	No – Proceed to Step 3.
1	Run alarm and control signal wires to the controller. Extending the wires removed from the existing controller as necessary. Follow one of these tables. • Table 79 Galaxy SC Wiring Plan & Cross Reference • Table 80 MCS/CCS Wiring Plan & Cross Reference • Table 81 ECS - 12U Wiring Plan & Cross Reference • Table 82 Wiring Transfer Plan - Other Controller	
2	Terminate the wires by punch down or wire wrap, as provided.	
	Wiring is done.	
3	Run alarm and control signal wires to the controller Follow the alarm and control wiring plan provided for the installation.	
4	Terminate the wires by punch down or wire wrap, as provided.	
	Alarm and Control Wiring is done.	

[7] Punch down insulating caps () are furnished with the controller.

Thermal Probes

Without thermal probes, many of the controller's battery management features will not function, or produce erroneous results. Some features requiring thermal inputs are:

- Slope Thermal Compensation
- Reserve Time Prediction
- High Temperature Alarm
- Ambient High and Low Temperature Alarms
- High Temperature Disconnect

NOTE	• There are several controller thermal probe inputs. • There are several types of thermal probes. • The type of probe used determines where it is connected on the controller. • Any temperature channel may be configured as Battery Temperature. See the Battery Temperature Measurement section in Features Reference.

Table 27 Thermal Probe Types

Type of Probe	Controller Connection Location	
10/30K Thermal Probe aka UBT (Universal Battery Temperature Probe	P3	
1-Wire® Voltage / Temperature Devices	P7	
10K Thermal Probe additional Terminal Block Interface (also known as Controller Temperature Channels)	**TB2 Pin**	**Description**
	1	Probe 2
	2	Probe 2 RTN
	3	Probe 3
	4	Probe 3 RTN
	5	Probe 4
	6	Probe 4 RTN
10K Thermal Probe	BIC cards in GPS bays (J12 GP to Rectifiers)	
100K RPM Temperature Probes	RPM modules (TB1 RPM serial bus)	

Table 28 P3 Compatible Temperature Probe Cables

Cable Assembly	Used with
848152997	KS20472 round cell thermistor
848152989	ring or paddle type thermistor

Step	Action to Install Thermal Probes	
1	Determine temperature probe type and connection from Table 27 Thermal Probe Types and Table 28 P3 Compatible Temperature Probe Cables	
2	Mount Thermal Probe.	
3	Run and terminate a thermal probe wire from probe to connection per Table 27 Thermal Probe Types.	
4	Is there another thermal probe to be wired?	
	Yes – Repeat from Step1	No – Proceed
	Thermal Probe Wiring is done.	

Alarm Battery Supply - BSL 93-96

This is a fused alternate plant voltage source for user alarm systems. This power is fused with a 1-1/3 ampere ABS fuse.

Table 29 ABS Pin Numbers

Signal Name	BSL Pin No.	Description
ABS	93	Alarm Battery Supply
ABS	94	Alarm Battery Supply
DG	95	Discharge Ground[8]
DG	96	Discharge Ground

Rectifier Cabling - Parallel Rectifiers

Step	Action to Connect Parallel Rectifiers	
NOTE	Remote Interface Module (RIM) and the associated Rectifier Interface Card must match the rectifier for proper operation.	
	Is the rectifier cable present and equipped with a connector matching the receptacle on the RIM?	
	Yes – Proceed to Step3	No – Proceed
1	Run the appropriate cable from the rectifier to the controller.	
2	Terminate the cable wires at the rectifier end per Table 41 Commercial Rectifier Wiring (H285-226 G62).	
3	Are all rectifier cables run to the controller?	
	Yes – Proceed	No – Repeat from step 1 for each rectifier.
4	Carefully align each rectifier cable connector to its intended receptacle on the RIM.	
5	Firmly seat each rectifier cable connector on its intended receptacle on the RIM.	

[8] Plant ground/return source for user alarm systems.

Rectifier Cabling - GP Serial Rectifiers and Frames

Step	Action to Connect GP Serial Rectifiers
NOTE	For connector integrity, verify that the cable is installed and connected properly.
1	Verify that the rectifier cable is connected to J12 (Rectifier) on the rear of the controller, NOT J13 (Controller) cable connector.
2	Verify that the cable connector is properly seated into J12, and that it is not loose.
3	Verify that the rectifier cable terminating on the BIC/BLJ card is connected to J12 and also not loose.

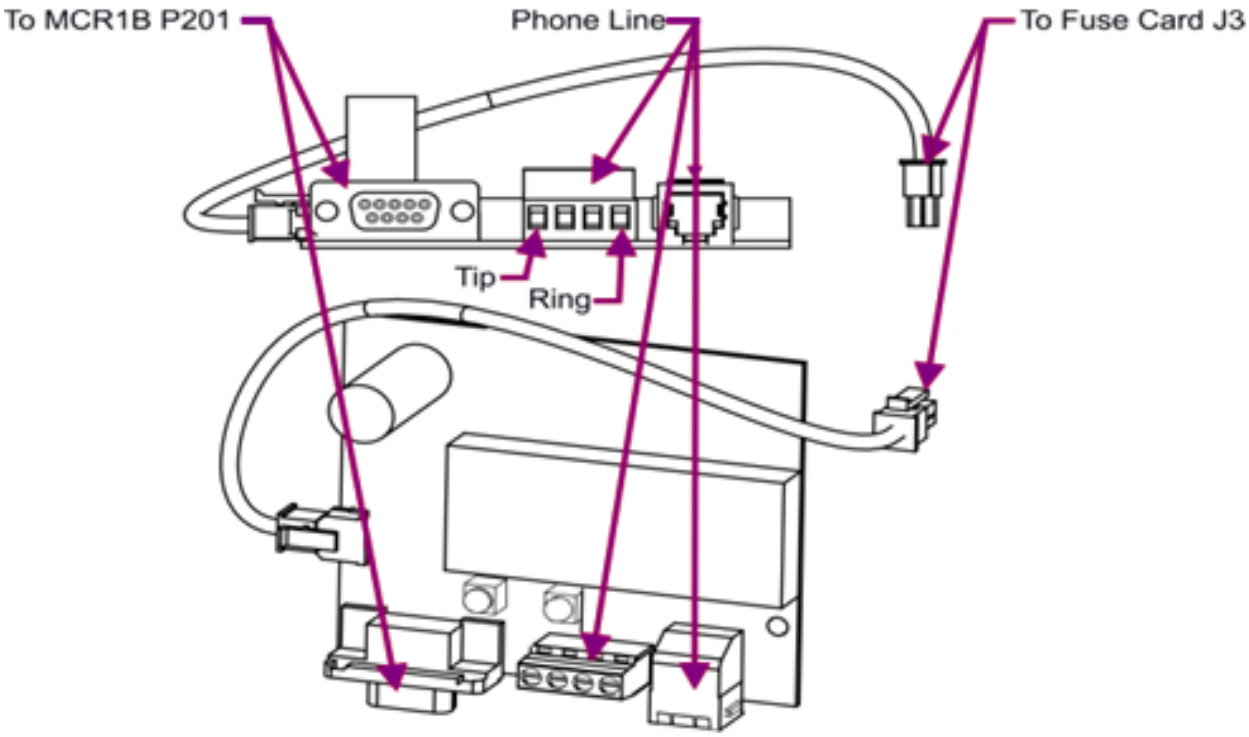
LAN Connections

Step	Action to Connect LAN
NOTE	The LAN interface is IEEE 802.3 compliant 10Base-T. Since the cable length required to connect to the network is variable, this cable must be supplied by the user.
1	Connect one end of the network interface cable to P2 at the controller. This connector is located at the bottom center of the MCR1 card, and immediately below the MCR2B card.
2	Connect the other end to an IEEE 802.3 compatible network. Configuration will be performed after power up.

Auxiliary Port - RS-232 or RS-485

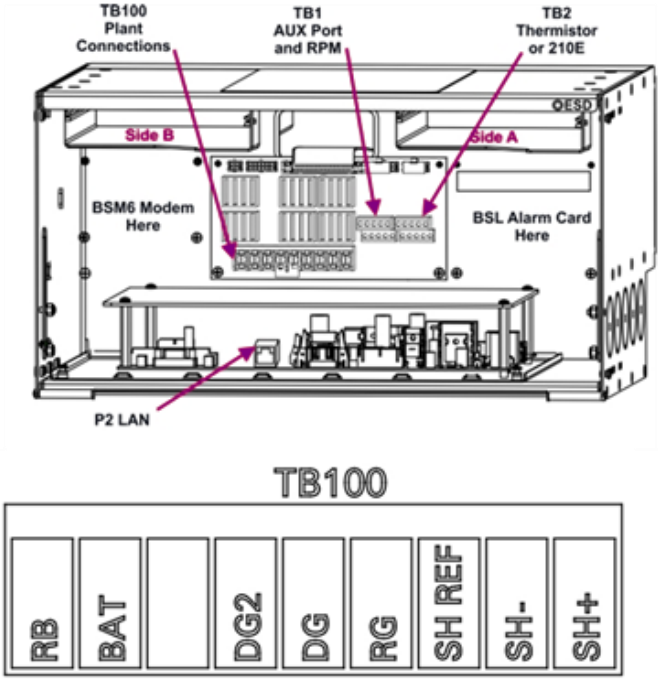
<table>
<tr><th>Step</th><th>Action to Connect Auxiliary Port - RS-232 or RS-485</th></tr>
<tr><td>NOTE</td><td>The Auxiliary port is RS-232 or RS-485 compliant. It is used to communicate with an external device or network.
SW202-5 must be set to select either RS-232 or RS-485 connection.
Note: an RS-232 to USB adapter (dongle) may be used to connect the RS-232 port to the USB port of a PC. Adapters may require a specific manually set baud rate to operate properly. See Figure 17 Configuration Menus.
CAUTION: Ground / Bond the power before connecting to RS-232 and USB ports.
See the Auxiliary Port - TB1 section in Specifications.</td></tr>
<tr><td>1</td><td>Set SW202-5 for RS-232 or RS-485. CLOSED = RS-232, OPEN = RS-485.
See Table 73 MSC DIP Switch Settings.</td></tr>
<tr><td>2</td><td>Terminate the RS-232 or RS-485 cable to TB1 on the controller:
<table>
<tr><th>TB-1 Pin</th><th>RS-232 Descriptions</th><th>RS-485 Descriptions</th></tr>
<tr><td>1</td><td>TX</td><td>TX+</td></tr>
<tr><td>2</td><td>RTS</td><td>TX-</td></tr>
<tr><td>3</td><td>RX</td><td>RX+</td></tr>
<tr><td>4</td><td>DSR</td><td>RX-</td></tr>
<tr><td>5</td><td>CTS</td><td></td></tr>
<tr><td>7</td><td>GND</td><td></td></tr>
<tr><td>9 or 10</td><td>FGND
(to cable shield)</td><td>FGND
(to cable shield)</td></tr>
</table></td></tr>
</table>

Modem Card - BSM6

Step	Action to Connect Modem Card - BSM6
	 **Figure 47 Modem Connections**
NOTE	Modem Connection may be performed at a later time.
1	• Connect the phone cable RJ11 connector to the RJ11 connector on the Modem OR • Connect phone cable Tip/Ring conductors to TB1 NOTE: Tip is TB1 pin 1 (Pin closest to the RJ11 connector) and Ring is Pin 4. Pins 2 and 3 are not used.

Plant Connections - TB100

TB100 provides terminations for plant connections: power, ground, plant voltage, and plant shunt.

Step	Action to Connect Plant Connections - TB100
	 **Figure 48 TB100**
NOTE 1	The shunt input may be connected to a shunt in the battery or ground side of the plant.
NOTE 2	The EMI bead on the plant connections cable from an existing Galaxy SC controller may be removed or left in place.
NOTE 3	SH REF (Shunt Reference) - Shunt Negative Reference and J5 Jumper. The isolated shunt measurement circuit must be referenced to the negative side of the shunt for proper operation. Local Reference - J5 Shunt Reference Jumper position 2-3 - DEFAULT In most cases, a local reference connection, via the J5 jumper, results in noise free shunt monitoring. J5 position 2-3 connects the SH REF to SH- on the Fuse Card - MSCB_FB and no connection to SH REF is required. Remote Reference - J5 Shunt Reference Jumper position 1-2 If the displayed current is noisy or unstable when local referenced, use Remote Reference rather than Local. Place J5 in position 1-2 and run an external wire from SH REF to the negative side of the shunt.

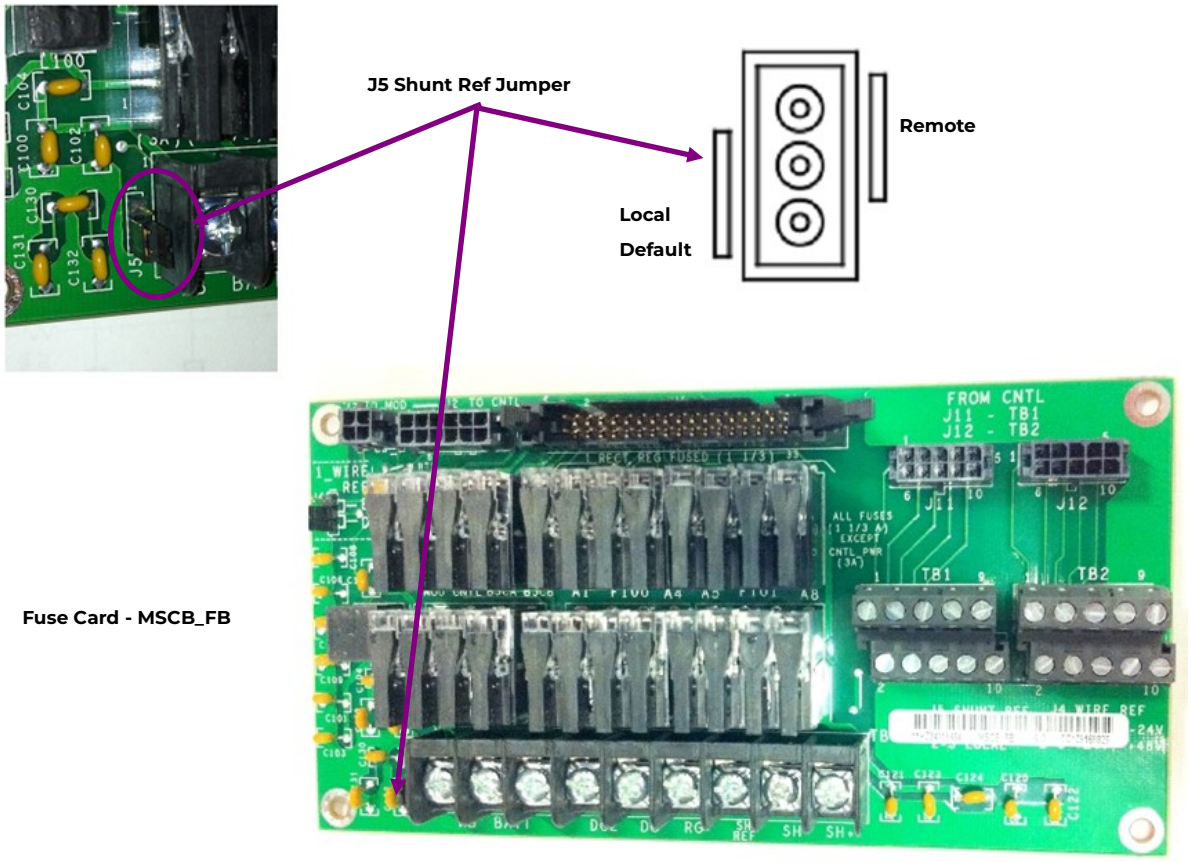
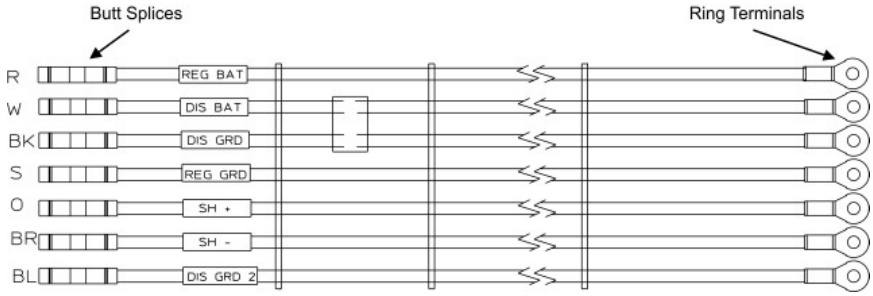
<table>
<tr><th>Step</th><th colspan="2">Action to Connect Plant Connections - TB100</th></tr>
<tr><td>1</td><td colspan="2">Set J5 Shunt Ref jumper.
 

Figure 49 Shunt Reference Jumper - J5</td></tr>
<tr><td></td><td colspan="2">Is a remote shunt reference being wired?</td></tr>
<tr><td></td><td>Yes –
1. Place the J5 Shunt Ref jumper into the REMOTE position.
2. Proceed.</td><td>No –
1. Place the J5 Shunt Ref jumper into the LOCAL position.
2. Proceed to Step 3.</td></tr>
<tr><td>2</td><td colspan="2">Run and secure the Shunt Reference wire from the negative side of the shunt to the SH REF terminal on TB100 on the Fuse Card.
• SH REF (Shunt Reference) - Shunt Negative Reference</td></tr>
<tr><td>3</td><td colspan="2">Is an existing controller being replaced?</td></tr>
<tr><td></td><td>Yes – Proceed</td><td>No – Proceed to Step 5</td></tr>
</table>

Step	Action to Connect Plant Connections - TB100
4	Run plant connection wires to TB100 on the Fuse Card. New Installations - Follow the alarm and control wiring plan provided for the installation. Replacing an Existing Controller - Follow the one of these tables. • Table 79 Galaxy SC Wiring Plan & Cross Reference • Table 80 MCS/CCS Wiring Plan & Cross Reference • Table 81 ECS - 12U Wiring Plan & Cross Reference • Table 82 Wiring Transfer Plan - Other Controller
5	Run and secure six wires to the terminals on TB100 on the Fuse Card. Butt splice pigtail wire set (ordering code 847411824) is provided (loose) to ease dressing and securing these leads.  **Figure 50 Plant Connections Wire-set - 847411824** • RB (Regulation Battery) - Plant (Battery) Voltage Sense • BAT (Battery) - Power Input • DG2 (Discharge Ground 2)[9] • DG (Discharge Ground)[9] • RG (Regulation Ground) - Plant (Battery) Voltage Sense Ground • SH- (Shunt Negative)[10] • SH+ (Shunt Positive)[10]

Controller to Controller Connections - MSC without Embedded M2 Controller

Step	Action to Connect MSC without Embedded M2 Controller to M2 Controller
NOTE	For connection integrity, verify that the cable is installed and connected properly.
1	Verify that the controller cable is connected to J13 on the MSC backplane, and NOT J12 (Rectifier) cable connector.
2	Verify that the cable connector is properly seated into J13, and that it is not loose.
3	Verify that the cable terminating on the associated M2 P9 and that it is not loose.

[9] The controller is factory configured with a jumper between DG and DG2 terminals. Wire DG and DG2 discharge grounds separately and remove the jumper to provide best meter accuracy. If this is not possible, leave the jumper in place.

[10] Shunt wiring required only with Millennium SC (with Embedded M2 Controller) and single external load shunt.

Remote Peripheral Monitoring (RPM)

Remote Peripheral Monitoring (RPM) provides data acquisition capability far beyond that normally available in a power system controller. Monitoring modules available consist of:

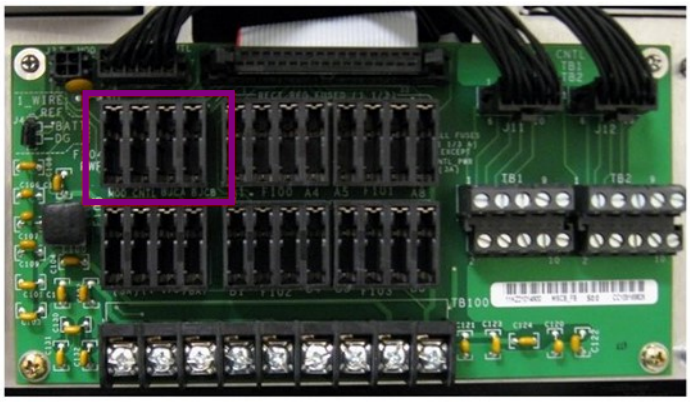
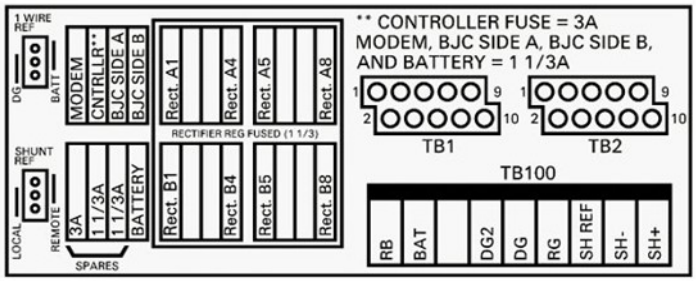
- Shunt monitors (6 channels + 1 temperature channel)
- 0-100mV dc Voltage monitors (6 channels + 1 temperature channel)
- 0-3V dc Voltage monitors (6 channels + 1 temperature channel)
- 0-16V dc Voltage monitors (6 channels + 1 temperature channel)
- 0-200V dc Voltage monitors (6 channels + 1 temperature channel)
- Temperature monitor (7 Channels)
- Control Relay module (3 sets of programmable form C relay outputs)

The user may connect a maximum of 95 of any combination of these modules serially.

<table>
<tr><th>Step</th><th>Action to Connect Remote Peripheral Monitoring (RPM)</th></tr>
<tr><td>NOTE</td><td>The Remote Peripheral Monitoring (RPM) feature has been designed into the MCR1B card and requires no additional circuit cards. Monitoring and control modules ARE required, based on the application.</td></tr>
<tr><td>NOTE</td><td>This section only describes a single module connection to the controller. Modules MUST BE PROGRAMMED after they have been installed or they may not function properly.</td></tr>
<tr><td>1</td><td>Wrap the RPM bus cable (ordering code 407377704) through the EMI inductor bead twice Place the bead approximately 3 inches from the end of the cable.</td></tr>
<tr><td>2</td><td>Terminate the RPM bus cable end with the EMI bead to TB1 on the controller:
<table>
<tr><th>TB-1 Pin</th><th>TB-1 Pin Descriptions</th><th>RPM Conductor Color</th><th>RPM Conductor Description</th></tr>
<tr><td>6</td><td>*RPM</td><td>Blue or White</td><td>Power/Communications</td></tr>
<tr><td>8</td><td>*RPM</td><td>Blue or White</td><td>Power/Communications</td></tr>
<tr><td>9 or 10</td><td>FGND</td><td>Bare wire</td><td>Shield</td></tr>
</table>
*connections of the bus wire are NOT polarity sensitive.</td></tr>
<tr><td>3</td><td>Run the RPM bus cable to the first RPM mounting location.</td></tr>
<tr><td>4</td><td>Mount the RPM module connection unit (base).</td></tr>
<tr><td>5</td><td>Route the wires through the open-faced bottom of the RPM connection unit (base).</td></tr>
<tr><td>6</td><td>Terminate the wires on TB2 on the RPM connection unit (base):
<table>
<tr><th>RPM TB-2 Pin</th><th>RPM Conductor Color</th><th>RPM Conductor Description</th></tr>
<tr><td>IN</td><td>Blue or White</td><td>Power/Communications</td></tr>
<tr><td>OUT</td><td>Blue or White</td><td>Power/Communications</td></tr>
<tr><td>SHIELD</td><td>Bare wire</td><td>Shield</td></tr>
</table>
• Connections of the bus wire are NOT polarity sensitive.
• There are 2 IN, and 2 OUT connections. Either one may be used.</td></tr>
</table>

Step	Action to Connect Remote Peripheral Monitoring (RPM)	
7	Is this RPM to be at the end of the RPM wiring?	
	Yes – 1. Remove the terminating resistor (405298308) across the IN and OUT positions of any other RPMS in this wiring run. 2. Install a terminating resistor (405298308) across the unused IN and OUT positions. 3. Proceed.	No – Proceed.
8	Locate the RPM control unit. This is the half with circuitry on it.	
9	Set the RPM address to the desired address. Set the two rotary switches: SW-1 (HI) and SW-2 (LO) in the lower right hand side of the RPM control unit (inside). Each RPM modules must have a unique, non 00 address.	
10	Carefully attach the RPM control unit to the RPM connection unit (base) using the ribbon connector. NOTE: This connector/cable is not keyed, so be careful to line up the pins properly.	
11	Secure the RPM control unit to the base with the spring clips.	
NOTE	After approximately 1 minute, the green LED on the front of the module will blink once approximately every 5 seconds.	

Power-Up the Controller

Step	Action to Power Up the Controller
	 **Fuse Card** 
1	Install the four controller fuses: • MODEM (1 1/3 A) • CNTRLLR (3 A) • BJCA and BJCB (1 1/3 A).

Configure Settings

MSC is factory pre-configured with industry standard defaults for thresholds and feature operability in typical applications. In addition, customer specific default controller settings may be available upon request.

MSC must be configured to operate and generate alarms per customer specifications.

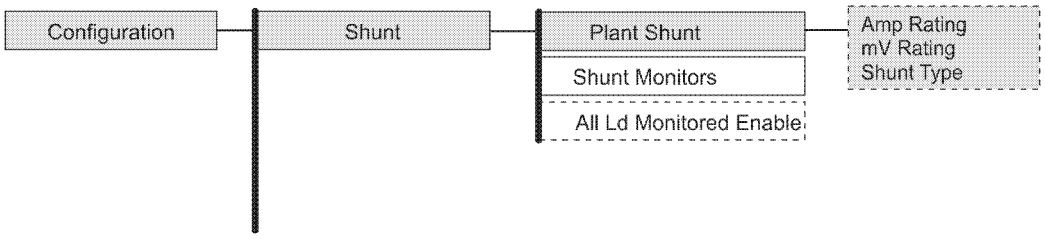
Step	Action to Configure MSC	
	Is an existing controller being replaced?	
	• Yes – Proceed to one of the following: • Configure the MSC from Galaxy SC • Configure MSC from MCS • Configure MSC from Other Controller	No – Proceed to Minimum Configuration.

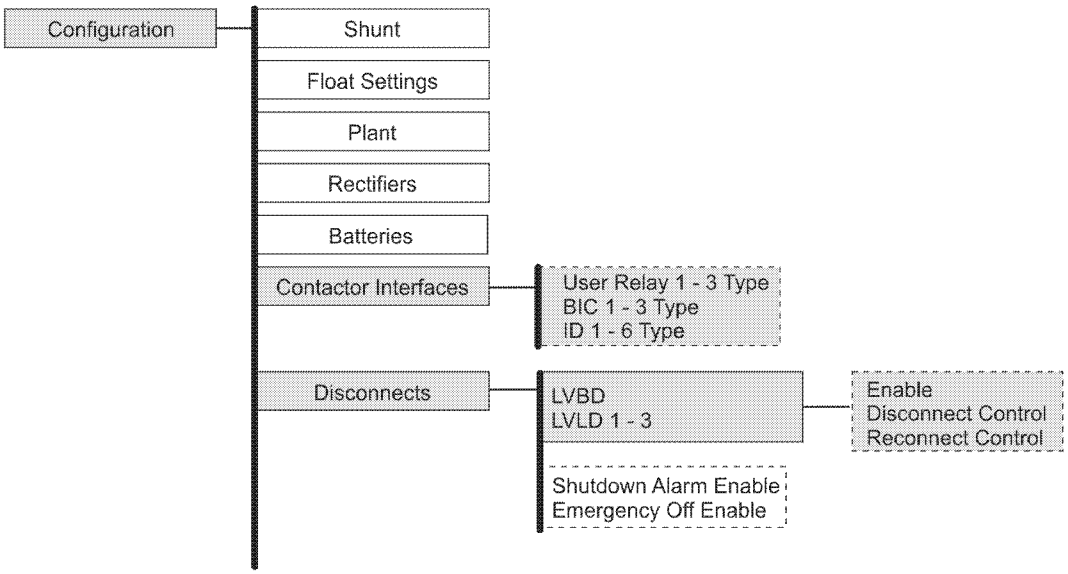
Configure the MSC from Galaxy SC

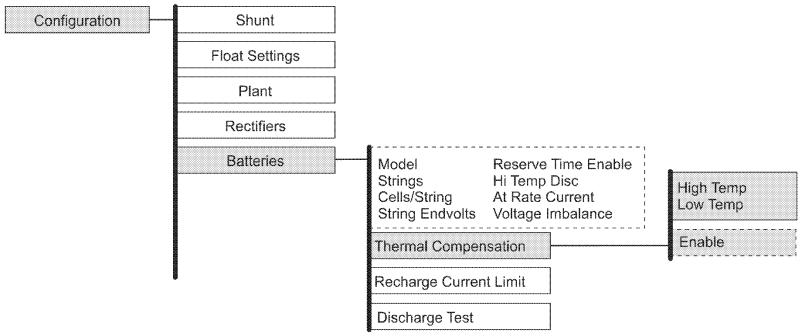
Refer to the following tables for settings recorded from the Galaxy SC:

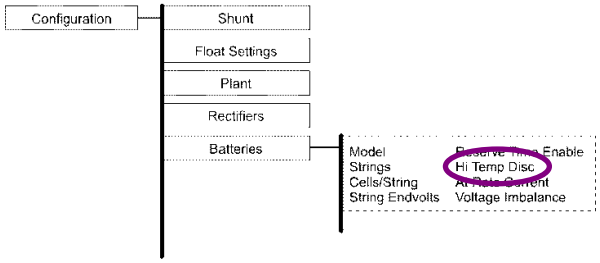
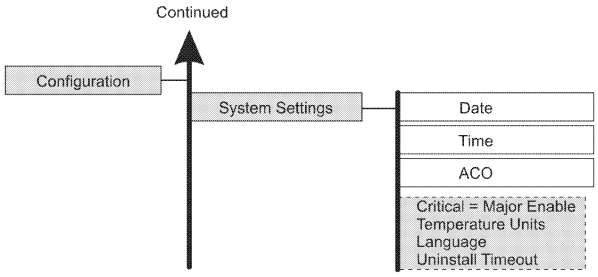
- Table 6 Galaxy SC Basic Controller (BJA) HVSD DIP Switch Settings
- Table 7 Galaxy SC Basic Controller (BJB) DIP Switch Settings
- Table 8 Galaxy SC Intelligent Controller (BJH) DIP Switch Settings
- Table 9 Galaxy SC Alarm Threshold Settings
- Table 10 Galaxy SC Plant Shunt Settings
- Table 11 Galaxy SC Low Voltage Disconnects Settings
- Table 12 Galaxy SC Slope Thermal Compensation Settings
- Table 13 Galaxy SC Rectifier Setpoints
- Table 14 Galaxy SC High Voltage Shutdown Setting -48V
- Table 15 Galaxy SC High Voltage Shutdown Setting -+/-24V

<table>
<tr><th>Step</th><th colspan="4">Action to Configure MSC from Galaxy SC</th></tr>
<tr><td>NOTE</td><td colspan="4">Closed = 1 = Enabled for both Galaxy SC and MSC DIP switches.</td></tr>
<tr><td>NOTE</td><td colspan="4">Some Galaxy SC features configured via DIP switches are configured via software in MSC.</td></tr>
<tr><td>1</td><td colspan="4">Restore edited Galaxy SC Configuration from a File.
Use one of the procedures detailed in the Backup and Restore section.
For example - Using Easy View: File → Restore ...
NOTE: Restore only the edited Galaxy SC Configuration file prepared in the Prepare Galaxy SC Configuration File for MSC Use section.</td></tr>
<tr><td rowspan="4">2</td><td colspan="4">Action to Configure Software from Galaxy SC SW202</td></tr>
<tr><td colspan="4">See Table 7 Galaxy SC Basic Controller (BJB) DIP Switch Settings.</td></tr>
<tr><td>Step</td><td>Galaxy SC Switch Position</td><td>Description</td><td>MSC Setting</td></tr>
<tr><td>2a</td><td>SW202-7</td><td>Auto Rectifier Restarts</td><td>Using the front panel, go to
Menu→Config→Plant.
Config Auto Restart to:
Enabled if Galaxy SC was 1
Disabled if Galaxy SC was 0</td></tr>
<tr><td>2b</td><td>SW202-6</td><td>Critical = Major Relays</td><td>Using the front panel, go to
Menu→Config→System Settings.
Config Crit=Major to:
Enabled if Galaxy SC was 1
Disabled if Galaxy SC was 0</td></tr>
</table>

Step			Action to Configure MSC from Galaxy SC	
	2c	SW202-5	Alarm Test	Using the front panel, go to Menu→Config→Alarm Test. Config Test to: Enabled if Galaxy SC was 1 Disabled if Galaxy SC was 0
	2d	SW202-4	HVSD during Alarm Test	Using the front panel, go to Menu→Config→Alarm Test. Config HV Shutdown to Enabled if Galaxy SC was 1 Disabled if Galaxy SC was 0
	2e	SW202-3	Boost Mode	Using the front panel, go to Menu→Config→Rect Boost. Config Enable to Enabled if Galaxy SC was 1 Disabled if Galaxy SC was 0
	2f	SW202-2	External Timed Boost	Using the front panel, go to Menu→Config→Rect Boost. Config Timed to: Enabled if Galaxy SC was 1 Disabled if Galaxy SC was 0
	2g	SW202-1	Password Reset for Indep Modem	Not Applicable for MSC
3	Plant Shunt See Table 10 Galaxy SC Plant Shunt Settings. Enter this information, recorded earlier, by selecting the following menus from the front panel display:  			

Step	Action to Configure MSC from Galaxy SC
4	Low Voltage Disconnects See Table 11 Galaxy SC Low Voltage Disconnects Settings. Enter the Low Voltage Disconnect information recorded earlier by selecting the following menus from the front panel display: 

Step	Action to Configure MSC from Galaxy SC
5	Slope Thermal Compensation See Table 12 Galaxy SC Slope Thermal Compensation Settings. Enter the STC information recorded earlier by selecting the following menus from the front panel display: 

Configuration Item	
Galaxy SC Controller	**MSC**
STC Enabled/Disabled	Enabled
Nominal Temperature	Nominal (Under High Temp Comp)
Step Temperature	Volt Step Down (Under High Temp Comp)
Disconnect	
Low Temperature	Low Comp Limit (Under Low Temp Comp)
Upper Temperature	High Comp Limit (Under High Temp Comp)
Raise Voltage Enable	Low T Comp (Under Low Temp Comp)
Temperature Units	
N/A	Decrease (Under High Temp Comp)
N/A	Increase (Under Low Temp Comp)

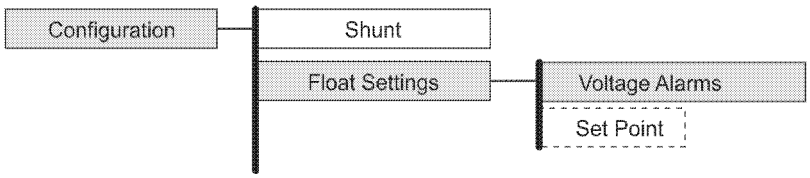
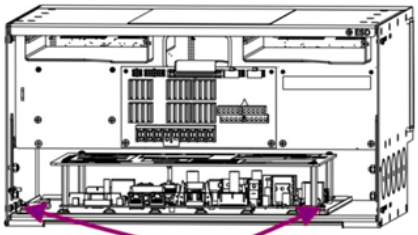
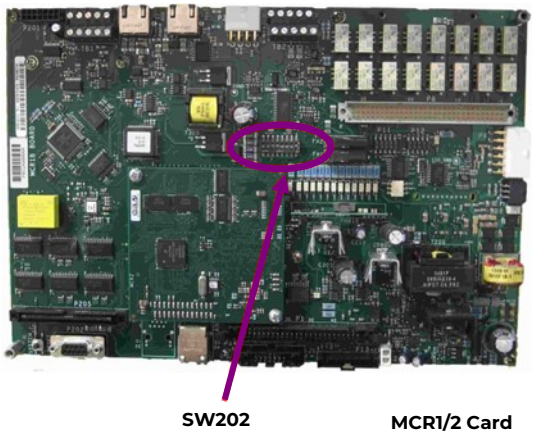
<table>
<tr><th>Step</th><th>Action to Configure MSC from Galaxy SC</th></tr>
<tr><td>6</td><td>Alarm Threshold Settings
See Table 9 Galaxy SC Alarm Threshold Settings.
Enter the Float Alarm Thresholds recorded earlier in by selecting the following menus from the front panel display:
 
</td></tr>
<tr><td>7</td><td>Removing the Forced Contactor Conditions
If Battery and Load contactors are in the system, contactor control cards should have been configured so that they did not OPEN during the controller replacement.
NOTE: Contactors may have always been in the FORCED state per customer requirements. If no changes were made to the Contactor States in the “Securing Contactors” section, then DO NOT change the switch positions.
To return contactors to their normal state, place SW300 in the position as shown
In Figure 27 LVLD Contactor EBV Card SW300 and Figure 28 LVBD Contactor Control BJN Card SW300.
<table>
<tr><th>Contactor Type</th><th>Control Card and Switch</th><th>Under MSC Control</th></tr>
<tr><td>Load</td><td>EBV – SW300</td><td>DOWN</td></tr>
<tr><td>Battery</td><td>BJN – SW300</td><td>DOWN for ½ height cabinets
UP for full height cabinets</td></tr>
</table></td></tr>
<tr><td>8</td><td>Action to Configure DIP Switch from a Galaxy SC
See Table 7 Galaxy SC Basic Controller (BJB) DIP Switch Settings.
<table>
<tr><th colspan="3">Step</th></tr>
<tr><td>8a</td><td>Loosen the two screws securing the controller drawer.</td><td> 

Figure 52 Controller Drawer</td></tr>
<tr><td>8b</td><td>Slide the controller drawer out.</td><td></td></tr>
<tr><td>8c</td><td>Remove the controller cover
1. Remove screws in each corner (four).
2. Remove the cover</td><td></td></tr>
</table></td></tr>
</table>

Step	Action to Configure MSC from Galaxy SC



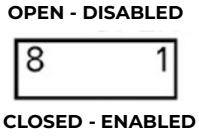
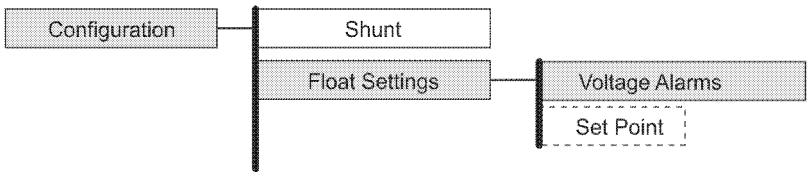


Figure 53 MSC Controller SW2

Action to Configure DIP Switch from a Galaxy SC SW202			
See Table 7 Galaxy SC Basic Controller (BJB) DIP Switch Settings.			
Step	**Galaxy SC Switch Position**	**Description**	**MSC SW202 Setting**
8d	SW202-8	Front Panel Configuration	Set SW202-8 to: Enabled if Galaxy SC was 1 Disabled if Galaxy SC was 0
8e	Replace the controller cover with 4 screws in its corners.		
8f	Secure the controller 1. Slide the controller drawer back into the chassis. 2. Align the drawer screws with the threaded inserts in the chassis. 3. Secure the drawer screws.		

9	Configure remaining MSC features per office documentation. Proceed to Minimum Configuration.

Configure MSC from MCS

Step	Action to Configure the MSC from MCS
	Set the alarm threshold settings recorded in Table 16 MCS DIP Switch Settings via the front panel. 
1	Set Battery on Discharge alarm threshold from value in Table 16 MCS DIP Switch Settings.
2	Set Float High Voltage alarm threshold from value in Table 16 MCS DIP Switch Settings.
3	Configure remaining MSC features per office documentation. Proceed to Minimum Configuration.

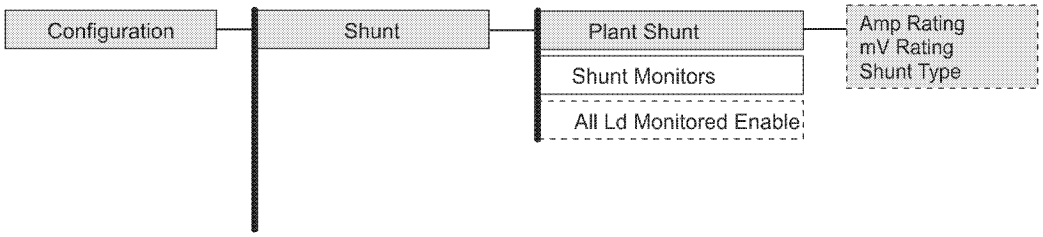
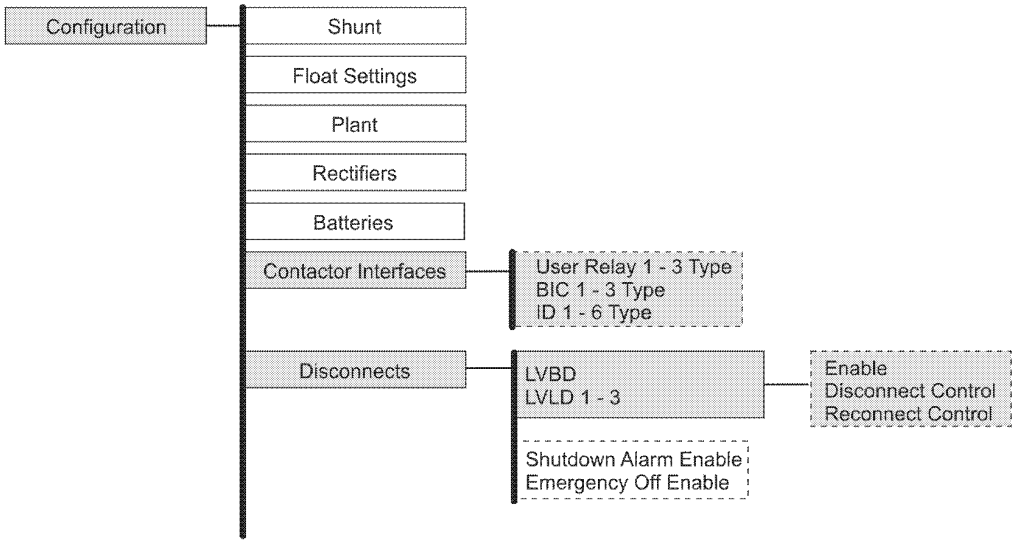
Configure MSC from Other Controller

NOTE	Consult Engineering for details of the specific installation and specific controller being replaced. The steps in this section are intended to be a guide and are representative of an existing controller. The specific existing controller may have different features and connections from those included in this section. Consult the Product Manual for the existing controller for settings and control information. Some Other Controller features configured via DIP switches are configured via software in MSC.

Refer to the following tables for settings recorded from the previously removed other controller:

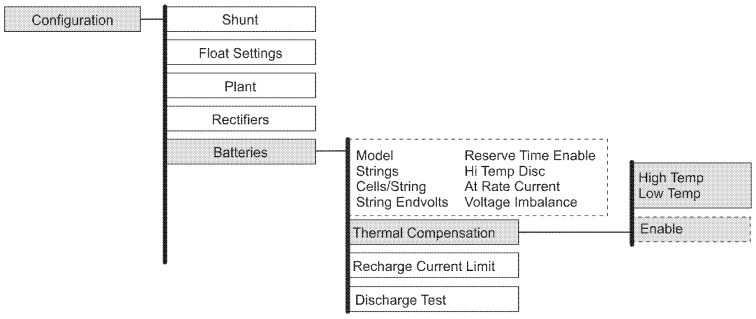
- Table 20 Other Controller DIP Switch Settings
- Table 21 Other Controller Alarm Threshold Settings
- Table 22 Other Controller Plant Shunt Settings
- Table 23 Other Controller Low Voltage Disconnect Settings
- Table 24 Other Controller Slope Thermal Compensation Settings
- Table 25 Other Controller Rectifier Float Setpoints

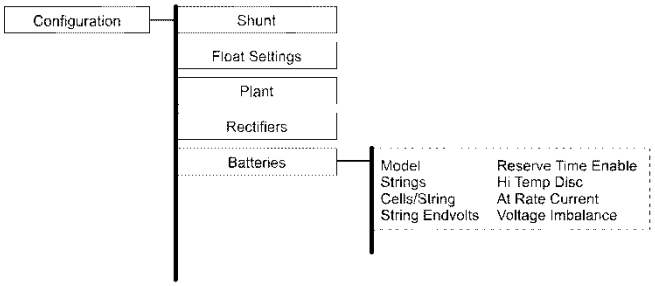
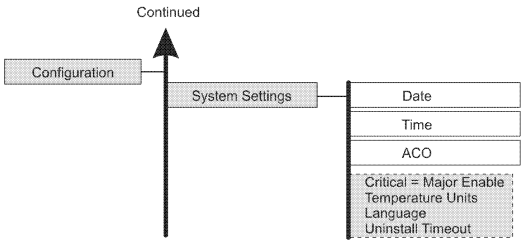
Action to Configure Software from Other Controller			
See Other Controller Settings tables and documentation.			
Step	**Step**	**Description**	**MSC Setting**
1	1a	Auto Rectifier Restarts	Using the front panel, go to Menu→Config→Plant. Config Auto Restart to: Enabled if Galaxy SC was 1 Disabled if Galaxy SC was 0
	1b	Critical = Major Relays	Using the front panel, go to Menu→Config→System Settings. Config Crit=Major to: Enabled if Galaxy SC was 1 Disabled if Galaxy SC was 0
	1c	Alarm Test	Using the front panel, go to Menu→Config→Alarm Test. Config Test to: Enabled if Galaxy SC was 1 Disabled if Galaxy SC was 0
	1d	HVSD during Alarm Test	Using the front panel, go to Menu→Config→Alarm Test. Config HV Shutdown to: Enabled if Galaxy SC was 1 Disabled if Galaxy SC was 0

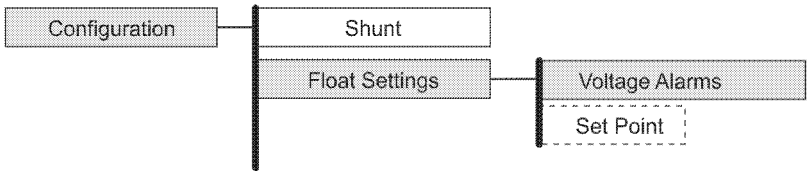
<table>
<tr><td rowspan="3"></td><td>1e</td><td>SW202-3
Boost Mode</td><td>Using the front panel, go to
Menu→Config→Rect Boost.
Config Enable to:
<table><tr><td>Enabled if Galaxy SC was 1</td></tr><tr><td>Disabled if Galaxy SC was 0</td></tr></table></td></tr>
<tr><td>1f</td><td>SW202-2
External Timed Boost</td><td>Using the front panel, go to
Menu→Config→Rect Boost.
Config Timed to:
<table><tr><td>Enabled if Galaxy SC was 1</td></tr><tr><td>Disabled if Galaxy SC was 0</td></tr></table></td></tr>
<tr><td>1g</td><td>SW202-1
Password Reset for Indep Modem</td><td>Not Applicable for MSC</td></tr>
<tr><td>2</td><td colspan="3">Plant Shunt
See Table 10 Galaxy SC Plant Shunt Settings.
Enter this information, recorded earlier, by selecting the following menus from the front panel display:
 
</td></tr>
<tr><td>3</td><td colspan="3">Low Voltage Disconnects
See Table 11 Galaxy SC Low Voltage Disconnects Settings.
Enter the Low Voltage Disconnect information recorded earlier, by selecting the following menus from the front panel display:
 
</td></tr>
</table>

4

Slope Thermal Compensation
See Table 12 Galaxy SC Slope Thermal Compensation Settings.
Enter the STC information recorded earlier by selecting the following menus from the front panel display:



Configuration Item	
Galaxy SC Controller	**MSC**
STC Enabled/Disabled	Enabled
Nominal Temperature	Nominal (Under High Temp Comp)
Step Temperature	Volt Step Down (Under High Temp Comp)
Disconnect	
Low Temperature	Low Comp Limit (Under Low Temp Comp)
Upper Temperature	High Comp Limit (Under High Temp Comp)
Raise Voltage Enable	Low T Comp (Under Low Temp Comp)
Temperature Units	
N/A	Decrease (Under High Temp Comp)
N/A	Increase (Under Low Temp Comp)

<table>
<tr><td>5</td><td>Alarm Threshold Settings
See Table 21 Other Controller Alarm Threshold Settings.
Enter the Float Alarm Thresholds recorded earlier by selecting the following menus from the front panel display:
 
</td></tr>
<tr><td>6</td><td>Removing the Forced Contactor Conditions
If Battery and Load contactors are in the system, contactor control cards should have been configured so that they did not OPEN during the controller replacement.
NOTE: Contactors may have always been in the FORCED state per customer requirements. If no changes were made to the Contactor States in the “Securing Contactors” section, then DO NOT change the switch positions.
To return contactors to their normal state, place SW300 in the position as shown
In Figure 27 LVLD Contactor EBV Card SW300 and Figure 28 LVBD Contactor Control BJN Card SW300.
<table>
<tr><th>Contactor Type</th><th>Control Card and Switch</th><th>Under MSC Control</th></tr>
<tr><td>Load</td><td>EBV – SW300</td><td>DOWN</td></tr>
<tr><td>Battery</td><td>BJN – SW300</td><td>DOWN for ½ height cabinets
UP for full height cabinets</td></tr>
</table></td></tr>
<tr><td>7</td><td>Configure remaining MSC features per office documentation.
Proceed to Minimum Configuration.</td></tr>
</table>

Minimum Configuration

Some of these settings may duplicate those of the preceding sections if replacing an existing controller.

Set the following configuration items from the front panel as specified by the customer. SW202-8 must be set to ENABLED for changes to be made from the front panel. This section covers only the basic operations that must be performed so that the controller is minimally configured.

Table 30 Minimum Configuration
Action to Configure the Minimum Configuration

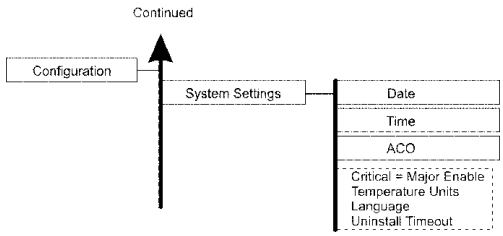
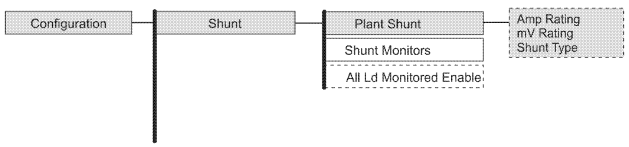
Step	Configuration Attribute to Change	Front Panel Menu Path/Action	Customer Value
	DATE/TIME		
1	Format	Set the date format: MM/DD/YY, DD/MM/YY, YY/MM/DD, MM/DD/YYYY, DD/MM/YYYY, YYYY/MM/DD.	
2	Month	Set the current month (1 - 12).	
3	Day	Set the current day (1 - 31).	
4	Year	Set the current year.	
NOTE	Please note that the system will validate the entries before the system date is modified.		
	TIME		
5	Format	Set time format: 12 or 24 hour.	
6	Time	Set the current time.	
7	Daylight	Enables or Disables Daylight Savings.	
	SYSTEM SHUNT		
8	Type See Shunt Type	Set the shunt type: LOAD, BATTERY, or NONE.	
9	mV	Set the shunt mV rating (25, 50, 60, 100, 150 mV).	
10	I	Set the shunt rated current (0-99999).	

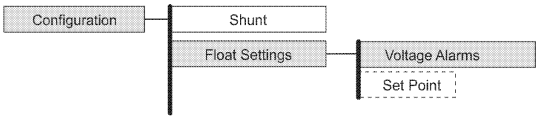
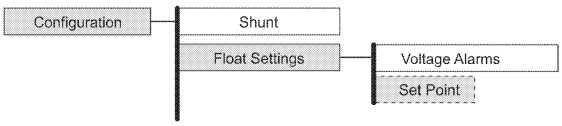
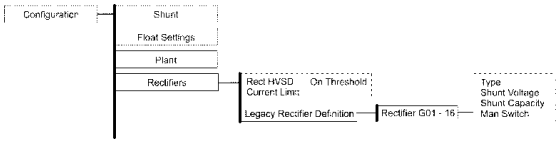
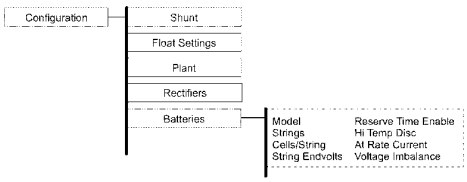
Table 30 Minimum Configuration Action to Configure the Minimum Configuration			
Step	**Configuration Attribute to Change**	**Front Panel Menu Path/Action**	**Customer Value**
	ALARM THRESHOLDS		
11	High Voltage	Set the High Voltage alarm threshold.	
12	High Voltage Float	Set the High Float Voltage Alarm (HFV) threshold.	
13	Battery on Discharge	Set the Battery Discharge alarm threshold.	
14	Very Low Voltage	Set the Very Low Voltage alarm threshold.	
	Rectifiers		
15	Setpoint	Set the desired battery voltage. This value sets the system voltage for all GP serial rectifiers.	
			
16	HVSD	Set the HVSD threshold. This setting is transferred to GP serial rectifiers. GP serial rectifiers will act on this threshold when communication with the MSC controller is lost.	
	Batteries		
17	Model	Select the installed battery model from the list of available models. This is used in reserve time prediction and enhanced battery test features.	
18	Strings	Set the number of installed battery strings. This is used in reserve time prediction and enhanced battery test features.	
19	Cells/String	Set the number of battery cells per string. This is used in reserve time prediction and enhanced battery test features.	

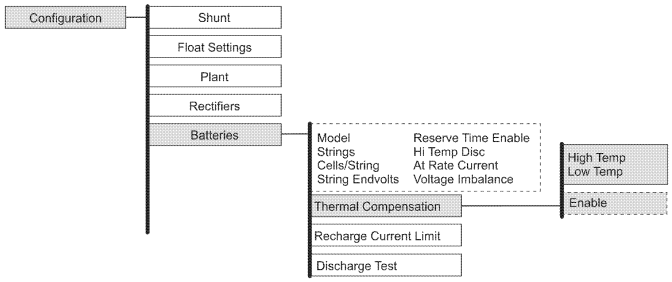
Table 30 Minimum Configuration Action to Configure the Minimum Configuration			
Step	**Configuration Attribute to Change**	**Front Panel Menu Path/Action**	**Customer Value**
20	Type	Set the battery type - Flooded or Valve Regulated (sealed). This is used in reserve time prediction and enhanced battery test features.	
	Thermal Comp	 This feature allows dynamic control of sealed cell battery voltage as a function of temperature.	
21	Enabled	Enable or Disable Thermal Compensation.	
	High Temp Comp	Compensates for high temperatures.	
22	Volt Step Down	Set Battery step temperature 113-185F. At this temperature, the system voltage is reduced by 0.17V X # of cells/string.	
23	High Comp Limit	Set Battery High Comp Limit. This is the maximum temperature for which thermal compensation is active.	
24	Decrease	Set slope (mV/°C) for high temperature compensation.	
25	Nominal Temp	Set Nominal temperature. The temperature at which no compensation is required. The system voltage is at the float mode setpoint.	
	Low Temp Comp	Compensates for low temperatures.	
26	Low T Comp	Enable or Disable low temperature compensation.	
27	Low Comp Limit	Set the minimum temperature for which thermal compensation is active.	
28	Increase	Sets the slope (mV/°C) for low temperature compensation.	

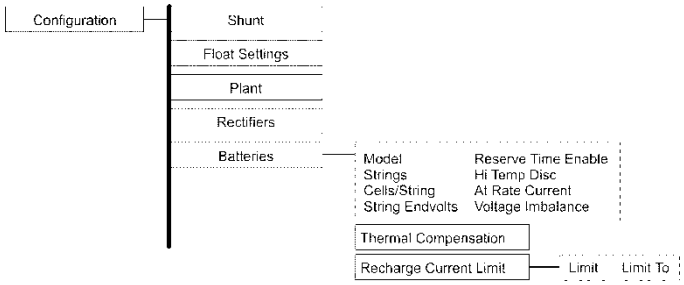
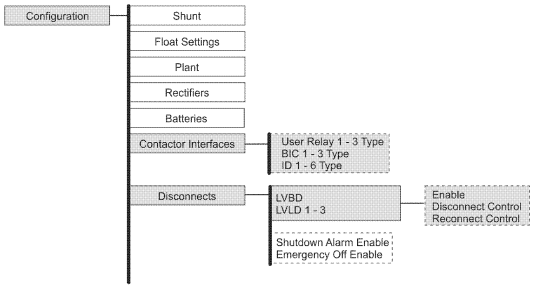
Table 30 Minimum Configuration Action to Configure the Minimum Configuration			
Step	**Configuration Attribute to Change**	**Front Panel Menu Path/Action**	**Customer Value**
	Recharge Current Limit	This feature sets the total amount of current that will be allowed to recharge the batteries. 	
29	Limit	Enable or Disable Recharge Current Limit	
30	Limit to	Set the maximum recharge current (in Amps) to be allowed for recharging the batteries. The range is from 10 – 1000A.	
	Contactors	Up to three optional LVD devices can be connected to a MSC and configured from this screen. 	
	Contactor 1		
31	Type	Set contactor Type - BATTERY, LOAD or NONE. This setting identifies the type of contactor, BATTERY, LOAD or NONE that has been installed in the plant. Be sure that the wiring for the contactor being configured matches the type chosen here. For standard GPS configurations using BIC cards, Contactor 1 is wired to and controls all BATTERY contactors in the plant. Contactors 2 and 3 are wired to and control only LOAD contactors.	
32	Disconnect	Set contactor disconnect threshold. This setting configures the plant voltage at which the contactor will disconnect from the bus.	

Table 30 Minimum Configuration Action to Configure the Minimum Configuration			
Step	**Configuration Attribute to Change**	**Front Panel Menu Path/Action**	**Customer Value**
33	Reconnect	Set contactor reconnect threshold. This setting configures the plant voltage at which the contactor will reconnect to the bus. To prevent the contactor from re-operating when battery voltage increases due to load removal, a voltage several volts higher than the disconnect voltage is recommended.	
	Contactor 2		
34	Type	Set contactor Type - BATTERY, LOAD or NONE.	
35	Disconnect	Set contactor disconnect threshold.	
36	Reconnect	Set contactor reconnect threshold.	
	Contactor 3		
37	Type	Set contactor Type - BATTERY, LOAD or NONE.	
38	Disconnect	Set contactor disconnect threshold.	
39	Reconnect	Set contactor reconnect threshold.	

Configure Modem Settings

Configure if BSM6 modem is installed.

Table 31 Modem Settings Configuration Action to Configure Modem Settings			
Step	**Configuration Attribute to Change**	**Action**	**Customer Value**
1	Initialization String[11]	Set the Initialization String to AT&FEV.	
2	Rings Before Answering[12]	Set Rings Before Answering as instructed by the customer.	
3	Handshaking[12]	Set Handshaking as instructed by the customer.	
4	Data Bits[12]	Set Data Bits as instructed by the customer.	
5	Parity[12]	Set Parity as instructed by the customer.	
6	Stop Bits[12]	Set Stop Bits as instructed by the customer.	
7	Time-out[12]	Set Time-out as instructed by the customer.	
8	Write Enable[12]	Set Write Enable as instructed by the customer.	

[11] Local/Remote Access (Settings > Communication > Modem)
[12] Front Panel (Configure> Communication Ports > Modem) or
Local/Remote Access (Settings > Communication > Modem)

Configure Network Settings

See the Network Access - LAN (Gateway) section in Features Reference.

Table 32 Network Settings Configuration
Action to Configure Network Settings

Step	Configuration Attribute to Change	Action	Customer Value
1	Write Access[13]	Set Write Access Enable as instructed by the customer's network administrator.	
2	DHCP[13]	Set the DHCP mode to Client, Server, or Static as instructed by the customer's network administrator.	
3	IP Address[13]	Set the IP Address as instructed by the customer's network administrator.	
4	Subnet Mask[13]	Set the Subnet Mask as instructed by the customer's network administrator.	
5	Gateway[13]	Set the Gateway as instructed by the customer's network administrator.	
6	DNS Server[13]	Set the DNS Server as instructed by the customer's network administrator.	
7	Mail Server[13]	Set the Mail Server as instructed by the customer's network administrator.	
8	Host Name[14]	Set the Host Name as instructed by the customer's network administrator.	
9	Domain Name[14]	Set the Domain Name as instructed by the customer's network administrator.	

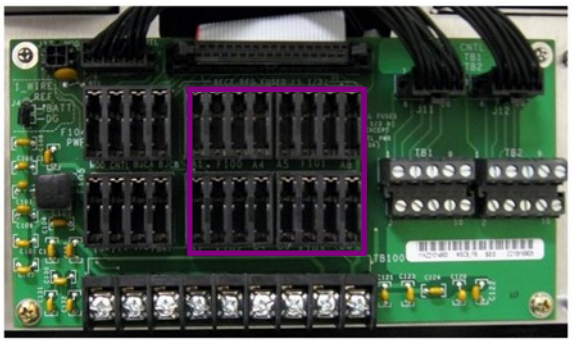
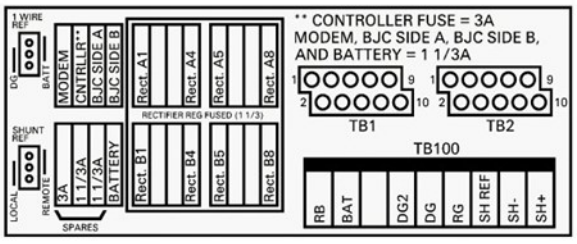
[13]Front Panel (Configure> Communication Ports > Network Settings) or Local/Remote Access (Network)
[14]Local/Remote Access (Settings > Communication > Network)

Configure Continued

Configure other features as directed by the customer.

Install Parallel Rectifiers Regulation Fuses

CAUTION	**Disconnect Parallel Rectifier** When parallel rectifier regulation fuses are pulled, the following will occur: • The rectifier will switch to internal regulation. • OmniOn rectifiers automatically switch to internal regulation. • Non-OmniOn rectifiers must be manually configured for internal regulation. • Consult the rectifier manual for method of configuration for internal regulation. • The system voltage will decrease.
NOTE	This requires a readjustment of the rectifier output volts adjust potentiometer as detailed in the following steps.

Step	Action to Install Parallel Rectifiers Regulation Fuses	
1	Observe and record the output current of each rectifier.	
2	Turn the rectifier power switch OFF, regardless of whether a readjustment is necessary.	
3	Is the rectifier a OmniOn rectifier with automatic internal voltage sense?	
	Yes – Proceed to Step 6.	No – Proceed.
4	Convert the rectifier to external voltage sense. Consult the rectifier manual for details.	
5	Connect external voltage sense leads at the rectifier. These leads were disconnected earlier.	
6	Install the associated rectifier regulation fuse on the Fuse Card Rect A1 to Rect A8, or Rect B1 to Rect B8	 **Fuse Card**  **Figure 54 Rectifier Regulation Fuse**

Step	Action to Install Parallel Rectifiers Regulation Fuses	
7	Turn the rectifier Power switch ON.	
8	Adjust the rectifier output voltage potentiometer to obtain the same current observed in Step 1, readjustment.	
9	Are all rectifiers Connected?	
	Yes – 1. Verify that the system charge bus is within tolerance. 2. Make final adjustments, if necessary.	No – 1. Verify that the system charge bus is within tolerance. 2. Repeat from Step 1 for the next rectifier.
10	Install all remaining rectifier regulation fuses.	
11	Are all rectifiers operating at or near the currents recorded in Step 1?	
	Yes – Proceed	No – Readjust each rectifier to obtain the same current recorded in step 1.

Acceptance Test

Introduction

MSC is tested before it leaves the factory, but many users wish to add some test procedures as part of installation and turn-up. The tests described here will simulate various alarm conditions and verify that the controller functions properly. Follow the steps listed below in the order they are given.

Tools and Test Equipment

Tools and Test Equipment Required for Acceptance Testing
Digital Voltmeter (DVM) with dc accuracy of at least 0.05%
Short length of wire or clip lead for jumper
Jeweler's screwdriver

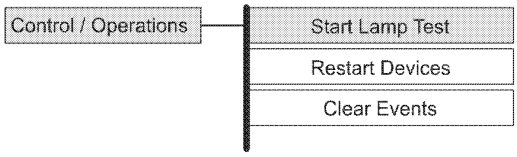
Test Precautions

Follow these steps to test plant alarms when installing an MSC in a new plant. In a new installation, begin the sequence with the rectifiers running with a dummy load on the plant bus bar.
For these tests, it is assumed that:
• All rectifiers are functioning properly.
• Plant batteries have received their original charges and are ready to support a load.
If you are testing a controller in a live plant:
• Some tests will cause a battery discharge. Insure that plant batteries are capable of supporting the load.
• Alarms will be generated. Notify the appropriate alarm monitoring personnel.

Test Sequences

Lamp Test

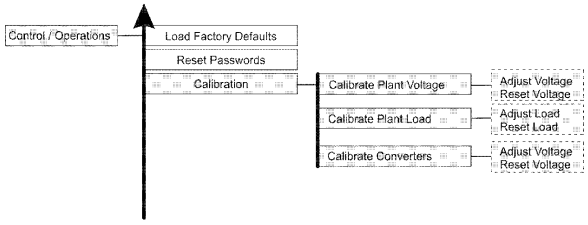
This test verifies that All of the LEDs on the front panel of the controller are functioning properly. No alarms are generated from this test.



Step	Action to Perform Lamp Test
1	Press the Menu button for the Main Menu (from the Default Screen).
2	Scroll to Control/Operations and press Enter. Use the Up/Down Arrows.
3	Select Start Lamp Test, and press Enter.
4	Press Enter again to start the test, or Escape to return to the menus.
5	Observe: 1. LCD Refreshes 2. Front Panel LEDs ALL turn on momentarily and return to normal 3. NO alarms are generated from this test

Front Panel Display Meter Calibration

Using a calibrated digital voltmeter, measure the plant voltage from the front panel test jacks. Follow these steps to calibrate the front panel meter display for Voltage and Current readings:



Step	Action to Calibrate Voltage
1	Reset the plant voltage reading by selecting RESET VOLTAGE. Use the Meter Calibration Menus. Press the Enter key to reset the voltage. This will remove any pre-existing user calibrated values if they exist.
2	Wait at least 5 seconds and press the ESCAPE key.
3	Select CALIBRATE VOLTAGE. Use the Arrows, and UP/DOWN keys to calibrate the system voltage. Press ENTER to save. NOTE: The controller will not allow changes greater than +/- 0.5V of the displayed voltage.
4	Press the <ESCAPE> key until the default screen is displayed. Verify that the plant voltage reading now agrees with the calibrated DVM. NOTE: The DVM reading will be the one to change since Rectifier Manager will adjust rectifier outputs as necessary per the calibration performed.

Step	Action to Calibrate Current
NOTE	The following procedure is applicable only in plants with Load shunts in a plant configured for "Centralized Architecture."
1	Measure the plant load from the sense connection points on the plant shunt(s). Use a calibrated DVM.
2	Calculate the plant load, in amperes, as measured by the DVM. a) Divide the mV DVM reading by the rated shunt mV value b) Multiply this result by the shunt ampere rating This value is the plant load measured by the DVM, in amperes.
3	Reset the Plant Current reading by selecting RESET LOAD. Use the Meter Calibration Menus. Press the Enter key to reset the Load. This will remove any pre-existing user calibrated values if they exist.
4	Wait at least 5 seconds and press the ESCAPE key.
5	Select CALIBRATE LOAD. Use the Arrows, and UP/DOWN keys to calibrate the system Load. Press ENTER to save. NOTE: The maximum total change is +/-10% of the current load value.
6	Press the <ESCAPE> key until the default screen is displayed. Verify that the plant current reading has been changed. NOTE: This operation is performed and verified ONLY if plant load is constant during the calibration procedure.
7	Observation: • Displayed System load changes to new value.

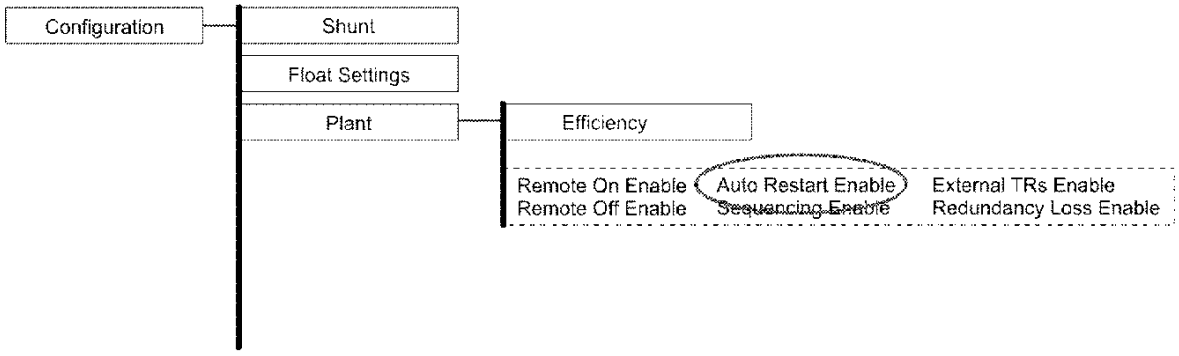
High Float Voltage Alarm – New Installations

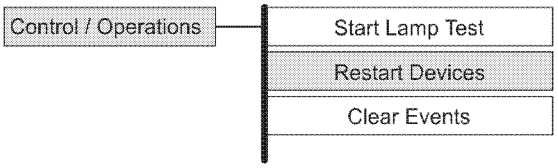
Step	Action to Test the High Float Voltage Alarm New Installations
NOTE	Clear all controller alarms for this test.
NOTE	The high voltage alarm test is completed by raising the plant voltage above the threshold set for HFV (High Float Voltage).
NOTE	Raising the plant voltage on a working system is left to the discretion of the user. • This test could disrupt power to working equipment. • If the test is performed, verify that the plant is in FLOAT mode • Rectifier voltage has been set to the normal level after completing the test.
1	Record the High Float Alarm threshold value here _____ V. Use the Voltage Alarms Menu Screens.
2	Record the value here _____V. Use the Float Settings Menu Screens, select Set Point and Use the Voltage Alarms Menu Screens.
NOTE	The next step WILL RAISE the system voltage.

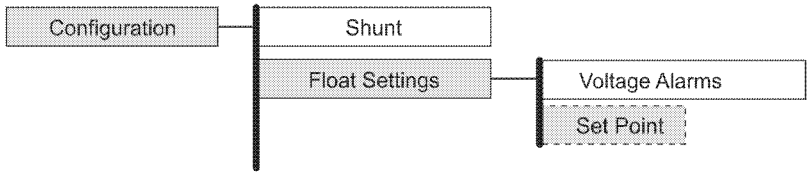
Step	Action to Test the High Float Voltage Alarm New Installations
3	Change the system float voltage setpoint to 0.1V above the High Float Alarm Threshold. Use the Arrows, and UP/DOWN keys. Press ENTER to save.
4	Observe: 1. The plant voltage increases to the set voltage 2. Power Minor alarm (PMN) is generated 3. RECT and MIN LEDs are illuminated
5	Select Set Point. Use the Float Settings Menu Screens.
6	Change the system float voltage setpoint to its original value. Use the Arrows, and UP/DOWN keys. Press ENTER to save.
7	Observe: 1. The plant voltage decreases to the original set voltage 2. Power Minor alarm (PMN) retires 3. RECT and MIN LEDs are extinguished

High Float Voltage Alarm – Systems with Actual Loads

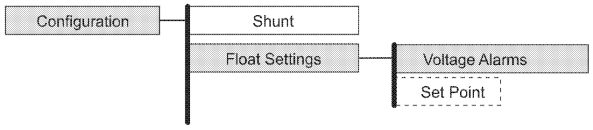
Step	Action to Test the High Float Voltage Alarm Systems with Actual Loads
NOTE	Clear all controller alarms for this test.
NOTE	The System Voltage WILL NOT change.
NOTE	The high float voltage alarm test is completed by changing the threshold for this condition below the system voltage to make it active.
1	Record the Set point value here _____V. Use the Float Settings Menu Screens, Select Set Point.
2	Record the High Float Alarm threshold value here _____V. Use the Voltage Alarms Menu Screens.
3	Change the High Float Alarm Threshold to 0.1V below the System Voltage. Use the Arrows, and UP/DOWN keys. Press ENTER to save.
4	Observe: 1. Power Minor alarm (PMN) is generated 2. RECT and MIN LEDs are illuminated
5	Change the High Float Alarm threshold value to its original value. Use the Voltage Alarms Menu Screens. Press ENTER to save.
6	Observe: 1. Power Minor alarm (PMN) retires 2. RECT and MIN LEDs are extinguished

STEP	Action to Test High Voltage Shutdown Alarm New Installations Only
NOTE	The High Voltage Shutdown Test is recommended only for new installations where a dummy load is available prior to the application of office load, and batteries are connected.
NOTE	There are three requirements for a serial rectifier to shut down upon a controller initiated High Voltage Alarm. 1. The plant voltage must be above the level set for the High Voltage alarm at the VOLTAGE ALARMS menu screen: MENU → CONFIGURE → FLOAT SETTINGS → VOLTAGE ALARMS 2. The rectifier must be delivering a current of at least 10% of its capacity. 3. The rectifier's current output must be unbalanced by more than 10% from the average output currents of the other rectifiers. Because item 3 is difficult to achieve in a simulation test of properly functioning serial rectifiers, (even with load share disabled), rectifiers are tested one at a time, rather than as a group. Slightly different test procedures are used for special applications in batteryless plants. Serial rectifiers have their own internal restart circuits which will function 3 times before the rectifier locks itself out and initiates a High Output Rectifier Fail Alarm to the controller. If there is a sufficient interval between restart and a subsequent shutdown the rectifier resets its restart counter. The controller initiates a restart signal a few seconds after the first RFA (HO) alarm is received. After the second RFA (HO) is received, the controller waits 5 minutes before sending one additional restart signal.
1	Verify the Auto Restart is enabled from the front panel menus: 
2	Turn off all rectifiers except the rectifier under test by operating their power switches to STBY.
3	Adjust the dummy load to provide 10 to 30% of the rectifier's output capacity.
4	Record High Voltage Alarm threshold value here _____V. Use the Voltage Alarms Menu Screens.

STEP	Action to Test High Voltage Shutdown Alarm New Installations Only
5	Record the Set Point value here _____V. Use the Float Settings Menu Screens, select Set Point.
NOTE	The next step WILL RAISE the system voltage.
6	Change the system float voltage setpoint to 0.1V above the High Voltage Alarm Threshold. Use the Arrows, and UP/DOWN keys. Press ENTER to save.
7	Controller Observations: 1. The plant voltage increases 2. Power Major alarm (PMJ) is generated 3. RECT and MAJ LEDs are illuminated Rectifier Observations: 1. When the voltage increases to the HV (FLOAT) level the rectifier shuts down. 2. The Green ON LED on the rectifier blinks, the ALM LED on the rectifier is not lit. 3. After 5-6 seconds the rectifier initiates its own restart signal again raising the plant voltage. 4. The rectifier will shutdown and restart two additional times. 5. Upon the third shutdown, the rectifier's ALM LED lights and the rectifier's display indicates "HO". 6. The controller receives the RFA signal from the rectifier and initiates a restart signal 5-6 seconds later. 7. The rectifier restarts again raising plant voltage. 8. The rectifier shuts down and restarts 3 additional times. 9. During these shutdowns the Green ON LED on the rectifier blinks and the ALM LED on the rectifier is not lit. 10. Upon the fourth shutdown, the rectifiers ALM LED lights and the rectifier's display indicates "HO". 11. Any external RFA office alarm has occurred. 12. The controller will wait 5-6 minutes and issue one final restart signal initiating the final sequence of shutdown and restart events before the rectifier locks out, requiring personnel intervention. • Prior to this occurring, change the value of the system voltage to its original value. Press ENTER to save the change. • Restart the rectifier from the front panel by using the menus: 

STEP	Action to Test High Voltage Shutdown Alarm New Installations Only
8	Select Set Point Use the Float Settings Menu Screens. 
9	Change the system float voltage setpoint to its original value. This value must be at least 0.5V below the HV alarm threshold setting. Use the Arrows, and UP/DOWN keys. Press ENTER to save.
10	Controller Observations: 1. The plant voltage returns to its original value 2. Power Major alarm (PMJ) retires 3. RECT and MAJ LEDs are extinguished Rectifier Observations: 1. Rectifier is operating normally

Battery on Discharge Alarm

STEP	Action to Test the Battery on Discharge Alarm
NOTE	If the BD alarm was observed during the High Voltage Shutdown test this test can be disregarded.
1	Follow the path (Voltage Alarms). Use the front panel. 
2	Record the setting of the Battery on Discharge Threshold here _____V.
3	Attach a dummy load to the plant.
4	Operate all rectifiers to STBY until the plant voltage drops below the BD (FLOAT) threshold.
5	Controller Observations: 1. PMJ Alarm is active 2. BD and MAJ LEDs are illuminated
6	Turn on all rectifiers
7	Controller Observations: 3. PMJ Alarm retires 4. BD and MAJ LEDs are extinguished 5. System Voltage is normal
8	Remove the dummy load from the plant.

Rectifier Fail Alarm

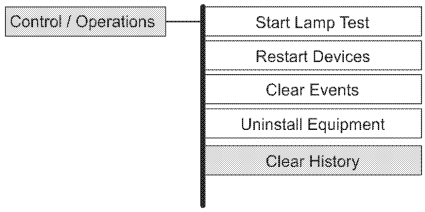
The RFA alarm was observed during the High Voltage Shutdown Test so no separate test is required.

Major Fuse Alarm

Major Fuse Alarm may be tested by placing a blown fuse in the alarm fuse position of any distribution fuse position in the plant or by inserting a paper clip into the alarm indicating hole of its fuse holder.
For distribution circuit breakers, temporarily connect the pins 8 and 9 of any KS22010 or KS22012 style circuit breakers together. This is accomplished on the ED83143-30 circuit breaker panels by shorting the (-) panel bus to pin 1 on the P4 connector of its BNL1 alarm card.
Observation: • The DIST and MAJ LEDs and Power Major and MJF alarm relays will be active. • Remove alarm condition and verify that DIST, MAJ LEDs and MJF relay retire.
Test Alarms in each distribution bay of the plant to verify the integrity of the alarm bus throughout the plant.
If the distribution bays are equipped with “Bay Fuse Alarm” indicating LEDs, also verify that this LED activates during these tests for the bay in which the alarm originates (and not in any other).

Clear History

This feature is useful when there is a need to remove unnecessary historical data from the controller. An example might be after installation and testing and the controller is ready for operation. There may be history that is of no use to the customer. Also, since the history log has a finite number of entries, user can save the history using a PC, and then clear the logs.



Step	Action
1	Press the Menu button for the Main Menu. Start at the Default Screen.
2	Select to Control/Operations and press Enter. Use the Up/Down Arrows.
3	Select Clear History, and press Enter. Use the Up/Down Arrows.
4	Press Enter again to clear the History Log, or Press Escape to return to the menus.

Troubleshooting

Controller Circuit card

After power up, or after a reset, the multicolor LED (Located to the right of the MCR2 card) will be RED while self-diagnostics are in progress (which will take about 10 seconds). If all diagnostics pass, the red LED will change to green. If failures are detected during diagnostics the LED will change to Amber. If a terminal is attached to the local port during diagnostics, the diagnostic messages will show which test failed. During normal operation if a failure occurs, the green LED will change to amber. When a failure occurs, perform the following steps.

Step	Action
1	Press the reset switch (System Reset, located to the right of the serial port connector at the bottom of the MCR1 card). If all diagnostics pass, it is possible that some type of “one time” abnormality occurred to cause the failure, such as hot-insertion of option cards, shorting backplane pins when installing optional equipment, etc. If the diagnostics did not pass, or if the problem reoccurs, go to the next step.
2	Remove all optional circuit cards then again press the reset switch on the MCR1 card. If the problem is not resolved, proceed to the next step. If all diagnostics pass, install optional cards one at a time, verifying operation after each.
3	Replace the MCR1/MCR2 cards and verify the failure is resolved before installing and connecting any optional circuit cards.

Modem

The Modem health LED illuminated Green. If the LED is not Green first verify cable connections in Modem Card - BSM6 - Option. If connections are correct, replace the modem card.

Controller Alarm Descriptions

Table 33 Controller Alarm Descriptions	
Alarm Description	**Explanation**
ACO Active	Alarm Cut-Off has been initiated to silence local audible alarms. Any subsequent Power Critical, Power Major, or Power Minor alarm disables ACO. A programmable ACO time-out period for each alarm severity resets silenced alarms.
Alarm Battery Supply	Operated ABS fuse (F2) on MCR1 card.
AC Fail	A rectifier is reporting an ACF to the controller.
Auxiliary Major	A resistive battery potential is present on the AMJ alarm input BSL-64, indicating a major alarm is active in the external equipment connected to this point.
Auxiliary Minor	A resistive battery potential is present on the AMN alarm input BSL-66, indicating a minor alarm is active in the external equipment connected to this point.
Alarm Test Active	Alarm Test is currently active. Any real alarm with a severity of Critical, Major or Minor, other than RFA or HV, aborts an active Alarm Test.
Alarm Test Aborted	Alarm Test has been aborted by an alarm. This is a latched event, remaining active until cleared by a user.
Memory Backup Battery Low	The controller memory battery requires replacement.
Battery Type Conflict	The DC Plant – Battery Type and Battery Management – Battery Test Class attributes (sealed vs. flooded) do not match.
Battery On Discharge	The plant voltage is below the threshold set for BD in the present plant mode, FLOAT or BOOST/BTP. This alarm will not retire immediately upon rectifier restoration after an extended discharge. Plant voltage will not fully recover until depleted battery energy has been replaced. Do NOT adjust the rectifier voltage adjustments if they are at or near rated output currents.
Battery Test Failed	A Battery Test was aborted before a reserve time could be established. This is a latched event, remaining active until cleared by a user.
Bay Interface ID Conflict	The ID for a BIC (Bay Interface Card) connected to the controller's serial bus is the same as that of a previously installed BIC.
Battery Test Active	A Battery Test session has been initiated. (Available only in plants with all serial rectifiers. Rectifier voltage has been lowered and the batteries are discharging.) The BD LED and BD relays are active and both the BD and VLV alarm thresholds along with STC (Slope Thermal Compensation) are inhibited while the Battery Test is active.

Table 33 Controller Alarm Descriptions	
Alarm Description	**Explanation**
Configuration Changed	A change has been made to a configuration setting. This is a latched event, remaining active until cleared by a user.
Converter Distribution Fuse	A converter distribution module connected to the controller's serial bus is reporting an operated fuse in its output distribution.
Converter ID Conflict	The ID for a converter connected to the controller's serial bus is the same as that of a previously installed converter.
Converter Fail	A converter connected to the serial bus has failed.
Converter Fan Major	More than 1 converter fan has failed.
Converter Fan Minor	A single converter fan has failed.
Clock Changed	A change has been made to the Time or Date setting. This is a latched event, remaining active until cleared by a user.
Rectifier Current Limit	The rectifiers connected to the controller's serial bus have reached their current limit setting. Plant voltage may, therefore, be lower than that requested in Rectifier Manager.
Minor Comm Fail Alarm	The controller has lost communication with a device that it had previously recognized on its rectifier/converter/BIC serial bus. If one of these devices is to be permanently removed, it is necessary to issue an UNINSTALL DEVICES command to clear the alarm.
Multiple Converter Fail	Multiple converters connected to the controller's serial bus have failed. This threshold is programmable.
Contactor 1 Failed	A contactor controlled by the controller's LVD settings (usually used with all LVBD contactors of a plant) is in the opposite state of that it has been instructed to be in (open if instructed to be closed, closed if instructed to be open).
Contactor 2 Failed	A contactor controlled by the controller's LVD settings (usually used with all LVBD contactors of a plant) is in the opposite state of that it has been instructed to be in (open if instructed to be closed, closed if instructed to be open).
Contactor 3 Failed	A contactor controlled by the controller's LVD settings (sometimes used with some of the LVLD contactors of a plant) is in the opposite state of that it has been instructed to be in (open if instructed to be closed, closed if instructed to be open).
Contactor 1 Open	The contactors controlled by the controller's LVD settings (usually used with all LVBD contactors of a plant) are open (disconnected).
Contactor 2 Open	The contactors controlled by the controller's LVD settings (usually used with some or all LVLD contactors of a plant) are open (disconnected).

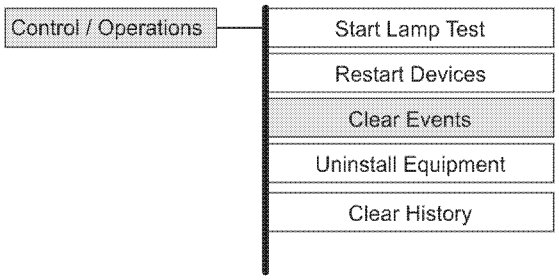
Table 33 Controller Alarm Descriptions	
Alarm Description	**Explanation**
Contactor 3 Open	The contactors controlled by the controller's LVD settings (sometimes used with some of the LVLD contactors of a plant) are open (disconnected).
Queue Overflow	The 256 event call-out on alarm memory queue filled, causing events occurring while full to be dropped from the call-out queue. This is a latched event, remaining active until cleared by a user. Usually indicates that programmed phone numbers are not responding.
Number Did Not Respond	Active when both a primary and alternate call-out phone number failed to connect at least 3 times in a row. This is a latched event, remaining active until cleared by a user.
ID Conflict	The ID for a rectifier connected to the controller's serial bus is the same as that of a previously installed rectifier.
Energy Management Disabled	The Energy Management feature has been disabled in software, or due to an active BD alarm, Boost mode, or attached rectifiers that are unconfigured or have an invalid load reading.
Excess Plant Drain	Plant load has been reported at greater than the plant shunt size. This is a latched event, remaining active until cleared by a user.
External Password Reset	The administrator password has been reset to its default (ADMINISTRATOR) by use of the password reset switch on the front of the MCR1 card. This is a latched event, remaining active until cleared by a user. This event is logged into history each time it occurs, regardless of whether it has been cleared previously or not.
Excess Rectifier Drain	A connected rectifier load has been reported at greater than the programmable threshold for this event. This is a latched event, remaining active until cleared by a user.
External Transfer Shutdown	A rectifier shutdown is active through external signals into TR1 to TR4 on MSC BSL-73, 79, 85, 80.
Excessive Login Attempts	A user has failed 6 times at entering a correct password at login or 3 times when changing security levels. This is a latched event, remaining active until cleared by a user. This event is logged into history each time it occurs, regardless of whether it has been cleared previously or not.
External Fuse Major	A resistive battery potential is present on the FAJ alarm input at MSC BSL-63, indicating a major fuse or CB alarm is active in the plant distribution circuit connected to this point.
External Fuse Minor	A resistive battery potential is present on the FAN alarm input at MSC BSL-65, indicating a minor fuse alarm is active in the plant circuit connected to this point. Typically only the capacitor charge circuit fuse alarm is wired here as a minor fuse alarm

Table 33 Controller Alarm Descriptions	
Alarm Description	**Explanation**
History Cleared	A user has cleared the event history record of one of MSC history reports. This is a latched event, remaining active until cleared by a user.
High Float Voltage	Plant voltage is above the programmed threshold for this alarm. Set the HFV threshold lower than the HV threshold which causes a HVSD signal to be issued to plant rectifiers.
High Voltage	Plant voltage is above the programmed threshold for this alarm. The HV alarm causes a HVSD signal to be issued to plant rectifiers.
Low Current	A connected rectifier has load share enabled, but its present output load is less than a predefined threshold for that rectifier type. (Usually 3% or less of capacity.)
Limited Recharge	The plant load has exceeded the programmed percentage of the total rectifier capacity set for this alarm. Rectifier capacity may be inadequate for recharging batteries in an acceptable period of time following an extended battery discharge. This is a latched event, remaining active until cleared by a user.
Low Voltage Disconnect	An externally controlled LVD is open, providing a closure signal to MSC BSL-61/-62 for alarm purposes.
Low Voltage Disconnect Fail	The monitoring circuit of an external LVD has failed, providing a resistive battery potential signal into MSC BSL-84.
Manual Off	A connected rectifier has been manually turned off or has lost AC input power.
Major Comm Fail Alarm	The controller has lost communication with two or more devices that it had previously recognized on its rectifier/converter/BIC serial bus. Typically indicates that the serial bus is physically interrupted. If any of these devices is being permanently removed from service, it is necessary to issue UNINSTALL DEVICES command to clear this alarm.
Module Failure	RPM system alarm. A module connected to the RPM serial bus has failed or has been disconnected.
Multiple AC Fail	The controller has detected more than one AC failure from connected rectifiers. This is a programmable threshold.
Multiple MAN Alarm	The controller has detected that more than one rectifier has manually been placed in standby. This is a programmable threshold.
Multiple Rectifier Fail	The number of rectifiers currently processing a RFA alarm has exceeded the programmable threshold for this alarm.
Measurement Out of Range	RPM system alarm. A channel measurement on a RPM is outside the DC voltage range designed for that RPM type. Often indicates reversed polarity for measurement leads on a unipolar module type.

Table 33 Controller Alarm Descriptions	
Alarm Description	**Explanation**
Module Type Conflict	RPM system alarm. A module has been connected and given the address used previously by a module of a different type, without unlocking the previous module's configuration.
Number Not Configured	A call-out number has been assigned as the notification destination for an alarm, which does not have the phone number field defined.
Open String	A battery disconnect circuit is providing a resistive battery potential signal into MSC BSL-72, indicating that a battery string is presently off line.
Password At Default	One or more of the log-in passwords is at its default value. All passwords must be set to something other than their default before this event will clear.
Program Line Invalid	The program line for a derived channel, user defined event channel, or RPM control relay channel contains an invalid operand. Typically occurs when a RPM channel value or state is used in a program line and that RPM is disconnected or otherwise goes into a failure mode.
Processor Halt	The controller stopped processing, usually due to a reset or reboot.
Number Did Not Respond	Active when the periodic status call-out phone number failed to connect 4 times in a row. This is a latched event, remaining active until cleared by a user.
Rectifier Fail	A connected rectifier is reporting a failure condition to MSC.
Rect/Plant Inconsistency	The plant load has exceeded the total rectifier drain by more than the factor programmed for this alarm, without causing plant voltage to fall. This is a latched event, remaining active until cleared by a user. Either the plant load reading or the total rectifier drain value is in error.
Redundancy Loss	The programmed number of redundant rectifiers in the system is not sufficient. System load has exceeded the redundancy limit.
Emergency Power Off	Emergency Power off input closure to ground.
Reserve Time Low	The predicted battery reserve time has fallen below the programmed threshold.
Shunt Not Configured	The shunt has been configured for either battery or load type and the value programmed for shunt Amps is invalid.
Self Test Failed	During initial boot, one or more of the tests performed on the controller failed. This is a latched event, remaining active until cleared by a user.
Thermal Probe Failure	A temperature probe used for the Reserve Time Prediction or Slope Thermal Compensation features is returning a temperature outside of an acceptable range.
User Relay Conflict	Battery management contactor LVD CN1, CN2, or CN3 has been configured for a type other than NONE and associated user relay UR1, UR2, or UR3 has also been assigned to report an alarm condition. This attribute is only applicable in plants not using BIC cards.
Very Low Voltage	The plant voltage is below the threshold set for VLV. This is a critical alarm, indicating that load failures are imminent.
ID Not Configured	A device on the rectifier/converter serial bus has been recognized without an assigned ID.

Clear Events

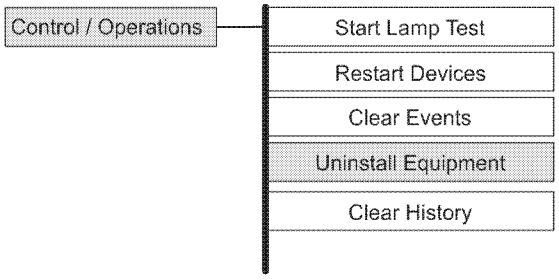
Events that have generated an Alarm and retired, but the Alarm remains active, may be cleared using this feature. Alarms that remain, even though the condition has gone away, are referred to as Latched Events.



Step	Action
1	Press the Menu button for the Main Menu. Start at the Default Screen.
2	Select Control/Operations and press Enter. Use the Up/Down Arrows.
3	Select Clear Events, and press Enter.
4	Press Enter again to clear the latched events, or Press Escape to return to the menus.
NOTE	If the Alarm is a Latched Event and does not retire after performing this operation, the alarm condition most likely still exists.

Uninstall Devices

This feature is used to logically remove serial bus devices that have been physically removed and an alarm generated to indicate this removal. Rectifiers, converters, and BICs are the most common devices that require this feature.



Step	Action
NOTE	This feature uninstalls ALL devices that have been physically removed.
1	Press the Menu button for the Main Menu. Start at the Default Screen.
2	Select Control/Operations and press Enter. Use the Up/Down Arrows.
3	Select Uninstall Devices, and press Enter.
4	Press Enter again to Uninstall Devices, or Press Escape to return to the menus.

Specifications

General

Basic MSC specifications are summarized in Table 34. Consult service center for other details.

Table 34 MSC Specifications - General

Parameter	Specification
General	
Input Voltage Range	±24 Vdc, -48 Vdc (Range: 18-60V)
Input Power	36W depending upon options
Dimensions and Weight	8.75 in x 16.26 in x 15.18 in (H x W x D) 20 lb (9.07 Kg)
Mounting	Frame mounted 19”, 23”, & 25” frames
Bonding Network	Suitable for installation as part of both • Common Bonding Network (CBN) • an Isolated Bonding Network (IBN)
Facilities	Suitable for installation in • Network Telecommunication Facilities • Locations where the NEC applies
DC Return	Either Isolated DC Return (DC-I) or Common DC Return (DC-C)
Front Panel User Interface	• 8-line by 40-character backlit LCD • 12 individual user configurable status LEDs: Critical, Major, Minor, Normal, AC System, Battery, Controller, Distribution, Rectifier, Remote Modules, Modem, and Battery On Discharge • Voltage test jacks • Tem Push Buttons
System Configuration Methods	• Front panel LCD display and menu keys • 10/100 Base-T port • DB9 for RS232 port: T1.317 or EasyView; • Phone line – MODEM option

Table 34 MSC Specifications - General	
Parameter	**Specification**
Maximum Power Units	• 16 parallel rectifiers (legacy, non-serial rectifiers), including ECS SR 364 series • 72 serial switchmode rectifiers. Supported rectifier families: 570, 595, 596, NP, CPS6000, QS, AC, and NE • 32 Bay Interface Cards (BICs) • 16 serial converters
Low-Voltage Disconnects	Load - LVLD • Up to 3 configurable LVLD Groups (threshold settings) • Up to 9 contactors, each assignable to a LVLD Group Battery - LVBD • 1 contactor with configurable LVBD thresholds
Voltage Monitoring	• ES771 1-Wire® mid string voltage modules – up to 6 modules 18 voltages (3 per module) • RPM modules - 6 voltage channels per module • External Voltage Input – 1 (on-board)
Temperature Monitoring	• External Thermistor Input - up to 4 Thermistor Probes (on-board) • 1-Wire® QS873A Temperature Probes - up to 18 (1 per probe) • Bay Interface Card - up to 32 Thermistor Probes - 1 per BIC • RPM modules - 7 temperature channels per temperature module 1 temperature channel per other module
Binary Monitoring	• RPM modules - 6 binary channels per module
Transducer Interface	• 4-20mA Input Monitor – 1 (on-board)
Relay Control	• RPM modules - 3 control relay channels per module
Inputs/Outputs	
SELV	All input and output connections comply with SELV requirements.
Connections - Ports	**CAUTION** Intra-building ports of the equipment or subassembly • Are suitable for connection only to shielded intra-building or unexposed wiring or cabling grounded at both ends. • MUST NOT be metallically connected to interfaces which connect to the Outside Plant (OSP) or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 5) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection. All controller ports are intra-building except the phone port of the BSM6 Modem.
Alarm and Control Inputs	See Specifications Alarm and Control Signals section.
Alarm Contact Outputs	See Specifications Alarm and Control Signals section.
Form C Alarm Output Contact Ratings	60VDC at 0.5A

Table 34 MSC Specifications - General	
Parameter	**Specification**
Plant Voltage Measurement Accuracy	0 to 50°C (±.05% of full scale + 1 count) 48V Systems: ±40 mV 24V Systems: ±25 mV 48V Systems: ±70 mV 24V Systems: ±40 mV
Resolution	0.01V
Plant Current Measurement (Up to 2 shunts) Accuracy Resolution	0 to +50°C : ±0.5% of full scale -40 to +75 °C: ±1.25% of full scale 1A
Temperature Measurement Thermistor Accuracy 1-Wire® Probe Accuracy Resolution	-5 to +55°C: ±2°C -40 to +75 °C: ±3°C -5 to +55 °C: ±1°C -40 to +75 °C: ±3°C 0.1°C
4-20mA Input Monitor Accuracy Resolution	±100µA ±10.0µA
External Voltage Input (EXT-V) Polarity Return Reference Accuracy Resolution Scaling (Range)	EXT-V - Positive voltage with respect to EXT-VR input EXT-VR - Referenced to Discharge Ground (DG) or Floating[15] with 1% 100ppm/°C external resistors ±1.0% of full scale 0.01VDC 0 to 5Vdc, 0 to 30Vdc, or 0 to 60 Vdc via external resistors
Environmental	
Operating Temperature	-40 to 75 °C (-40 to 167 °F)
Storage Temperature	-40 to 85 °C (-40 to 185 °F)
Altitude	-200 to 13,000 feet (-61 to 3962 meters)
Humidity	10% to 95% non-condensing
Audible Noise	< 60 dBA
Earthquake Rating	See Safety and Standards below
Controlled Environment	Store and operate this equipment in a controlled environment, an area where the humidity is maintained at levels that cannot cause condensation on the equipment, the contaminating dust is controlled, and the steady-state ambient temperature is within the range specified.
Operation Without Batteries	
Suitability without Batteries	Suitable for use in power plants with or without batteries.
Loss of AC Power without Batteries	Loss of ac power causes • Controller DC power is lost • Controller alarm relays are activated (unpowered)
Recovery from Loss of AC Power without Batteries	Restoration of AC power causes • Rectifiers return to their configured voltage set point • Controller DC power is restored • Controller automatically return to its last configuration Alarm relays reflect actual alarm states

[15]Floating means EXT-V and EXT-VR are isolated from all other circuits.
[16]For altitudes above 5000 feet (1524 meters), derate the temperature by 3.6 °F per 1000 feet (0.656 °C per 100 meters).

Table 34 MSC Specifications - General	
Parameter	**Specification**
Installation Area	
Item	**Specification**
Installation Area Limitations	Install only in restricted access areas (dedicated equipment rooms, equipment closets, or the like) in accordance with articles 110-26, 110-27, and 110-18 of the U.S. National Electric Code (NEC-2011), ANSI/NFPA No. 70, and pursuant to applicable local codes.
Safety and Standards	
Safety Agency Approvals	UL Listed
NEBS	NEBS Level 3 Tested and Complaint
Electromagnetic Immunity	Meets Telcordia GR-1089-CORE ISSUE 6 [IEC801-2 level 2,4,5
Radiated and Conducted Emissions	FCC Part 15, Class A EN55022 (CISPR22), Class A
Radiated Emissions	FCC Class A, EN55022 (CISPR22) level A
Electrostatic Discharge	EN61000-4-2 Level 1-4
RF Immunity	IEC61000-4-3 Level 3, 10 V/m
Conducted Immunity	IEC 61000-4-6 Level 3 Input Power Ports GR1089 ISSUE 6 IEC 61000-4-6 Level 2 Telecom Ports GR1089 ISSUE 6
Earthquake & Office Vibration	NEBS Zone 4 level 3
Voltage Dips, Interruptions, and Variations	• IEC 61000-4-11, EN55024 (CISPR24) • GR1089 Section 10: DC Power Port Telecommunication load equipment

MSC is suitable for use in power plants with or without batteries. In battery less plants, the loss of ac power causes an immediate loss of dc power to the controller and the activation of all office alarm relays. When ac power is restored, plant rectifiers will return to their last specified voltage set point, and the controller will automatically return to its last configuration.

Alarm and Control Signals

In a standard Galaxy Power System (GPS) configuration, plant level alarms are sent to the controller via the Bay Interface Card through serial data communication. The following alarm inputs are provided for discretionary use in other applications.

Table 35 Alarm and Control - Signal Names and BSL Pins					
Pin Number	**Signal Name**	**Pin Number**	**Signal Name**	**Pin Number**	**Signal Name**
1	PCRAO	33	MJFR	65	FAN
2	PCRAC	34	MNFR	66	AMN
3	PCRAR	35	MNFC	67	TFLT
4	PCRVR	36	MNFO	68	TBST
5	PCRVC	37	BDO	69	TRTN
6	PCRVO	38	BDC	70	PBTR
7	PCREO	39	BDR	71	PBT
8	PCREC	40	ACFR	72	OS

Table 35 Alarm and Control - Signal Names and BSL Pins					
Pin Number	**Signal Name**	**Pin Number**	**Signal Name**	**Pin Number**	**Signal Name**
9	PCRER	41	ACFC	73	TR1
10	PMJAR	42	ACFO	74	TEQ
11	PMJAC	43	RFAO	75	IN-5
12	PMJAO	44	RFAC	76	IN5-R
13	PMJEO	45	RFAR	77	RO
14	PMJEC	46	HVR	78	ROR
15	PMJER	47	HVC	79	TR2
16	PMJVR	48	HVO	80	TR4
17	PMJVC	49	UR1O	81	RBRPO
18	PMJVO	50	UR1C	82	IN-1
19	PMNAO	51	UR1R	83	IN-2 / BTP
20	PMNAC	52	CTLRR	84	LVD1
21	PMNAR	53	CTLRC	85	TR3
22	PMNVR	54	CTLRO	86	-
23	PMNVC	55	UR2O	87	4-20mA
24	PMNVO	56	UR2C	88	4-20mA-R
25	5V	57	UR2R	89	IN-3/ BTPFLT
26	-	58	UR3R Now VLVR	90	LVD3/ BTMJ
27	-	59	UR3C Now VLVC	91	EXT-V
28	PMNER	60	UR3O Now VLVO	92	EXT-VR
29	PMNEC	61	LVD2	93	ABS
30	PMNEO	62	LVD2R	94	ABS
31	MJFO	63	FAJ	95	DG
32	MJFC	64	AMJ	96	DG

Table 36 Alarm - Descriptions, BLS Pins, and Signal Names		
Description	**BSL Pin Number**	**Signal Name**
Critical-Audio	1	PCRAO
	2	PCRAC
	3	PCRAR
Critical-Visual	4	PCRVR
	5	PCRVC
	6	PCRVO
Critical-External	7	PCREO
	8	PCREC
	9	PCRER
Power Major-Audio	10	PMJAR
	11	PMJAC
	12	PMJAO

Table 36 Alarm - Descriptions, BLS Pins, and Signal Names		
Description	**BSL Pin Number**	**Signal Name**
Power Major – External	13	PMJEO
	14	PMJEC
	15	PMJER
Power Major – Visual	16	PMJVR
	17	PMJVC
	18	PMJVO
Power Minor-Audio	19	PMNAO
	20	PMNAC
	21	PMNAR
Power Minor – Visual	22	PMNVR
	23	PMNVC
	24	PMNVO
Power Minor – External	28	PMNER
	29	PMNEC
	30	PMNEO
Major Fuse	31	MJFO
	32	MJFC
	33	MJFR
Minor Fuse	34	MNFR
	35	MNFC
	36	MNFO
Battery On Discharge	37	BDO
	38	BDC
	39	BDR
AC Fail	40	ACFR
	41	ACFC
	42	ACFO
Rectifier Fail	43	RFAO
	44	RFAC
	45	RFAR
High Voltage	46	HVR
	47	HVC
	48	HVO
User Relay 1	49	UR1O
	50	UR1C
	51	UR1R
Controller Fail	52	CTLRR
	53	CTLRC
	54	CTLRO
User Relay 2	55	UR2O
	56	UR2C
	57	UR2R
Very Low Voltage	58	VLVR
	59	VLVC
	60	VLVO

Table 37 Alarm and Control Inputs - Descriptions, BLS Pins, and Signal Names		
Alarm	**BSL Pin Number**	**Signal Name**
Low Voltage 2 Disconnect State Detect	61	LVD2
Fuse Alarm Major	63	FAJ
Fuse Alarm Minor	65	FAN
Auxiliary Alarm Major	64	AMJ
Auxiliary Alarm Minor	66	AMN
Timer Float Control	67	TFLT
Timer Boost Control	68	TBST
Plant Battery Test	71	PBT
Open String Detect	72	OS
Transfer Rectifier 1	73	TR1
General Purpose Input 4 Previously TEQ	74	IN-4 Previously TEQ
General Purpose Input -5 Previously Engine Transfer	75	IN-5 Previously ETR
General Purpose Input -5 RTN Previously Engine Transfer Return	76	IN-5R Previously ETRR
Reserve Operation	77	RO
Reserve Operation RTN	78	ROR
Transfer Rectifier 2	79	TR2
Transfer Rectifier 4	80	TR4
Reserve Battery-Emergency Power Off	81	RBRPO
General Purpose Input 1	82	IN-1
BTP or General Purpose Input 2	83	IN-2/BTP
Low Voltage 1 Disconnect State Detect	84	LVD1
Transfer Rectifier 3	85	TR3
General Purpose 4-20mA Measuring Circuit	87	4-20mA
General Purpose 4-20mA Measuring Circuit-RTN	88	4-20mAR
BTPFLT or Generic Input 3	89	IN-3/ BTPFLT
Low Voltage 3 Disconnect State Detect Also Battery Thermal Protect Major	90	LVD3/ BTMJ
External Voltage Input	91	EXT-V
External Voltage Input -RTN	92	EXT-VR

Fuse Alarm Major (FAJ) - BSL-63

A battery potential input is required, which must use an external 1K ohm 2W current limiting resistor at the source. A Fuse Alarm Major is generated when battery potential is received.

Fuse Alarm Minor (FAN) - BSL-65

A battery potential input is required, which must use an external 1K ohm, 2W current limiting resistor at the source. A Fuse Alarm Minor is generated when battery potential is received.

Open String Alarm (OS) - BSL-72

A battery potential input is required, which must use an external 1K ohm 2W current limiting resistor at the source. This circuit is used to signal the controller that a battery string protective device or switch is in the open position. An Open String Alarm is generated when battery potential is received.

Aux Major (AMJ) - BSL-64

A battery potential input is required, which must use an external 1K ohm, 2W current limiting resistor at the source. This circuit is used to allow the controller to monitor another power device and provide alarms for it. An Aux Major Alarm is generated when battery potential is received.

Aux Minor (AMN) - BSL-66

A battery potential input is required, which must use an external 1K ohm, 2W current limiting resistor at the source. This circuit is used to allow the controller to monitor another power device and provide alarms for it. An Aux Minor Alarm is generated when battery potential is received.

Low Voltage Disconnect Active (LVD1) - BSL-84

A battery potential input is required, which must use an external 1K ohm, 2W current limiting resistor at the source if not using standard OmniOn Power LVD circuit cards or controller. This circuit is used to inform the controller that the monitoring circuit of a Low Voltage Disconnect device has failed. In standard Galaxy Power Systems, the Bay Interface card monitors these alarms and informs the Controller through the serial interface connection.

Low Voltage Disconnect Active (LVD2/LVD2R) - BSL-61/62

A closure between these points or a ground signal into LVD2/ BSL-61 is used to inform the controller that a Low Voltage Disconnect device has opened. In standard Galaxy Power Systems, the Bay Interface card monitors these alarms and informs the Controller through the serial interface connection.

External Boost Option (TFLT/TBST/PBT) - BSL-67-69

A variety of external devices may be used to initiate boost in the controller. Wiring is required from positions 67/68/69 on the BSL card for operation of this feature. Providing a contact closure between TBST and TRTN initiates the boost feature. A contact closure between TFLT and TRTN returns the plant to float.

Rectifier Hold OFF on Engine Option (RO/ROR) - BSL-77-78

The controller accept a contact closure between RO/ROR (BSL-77-78) to hold OFF rectifiers configured as “Remote Group Standby”

These controller inputs hold OFF individual rectifiers or groups of rectifiers under external control.

Internal Sequencing - The controller is capable of holding OFF individual rectifiers when AC is being provided by emergency generator. Internal Rectifier Sequencing requires external wiring to RO/ROR on BSL pin numbers 77/78, in order to function.

Rectifier External Sequence Option (TR1-TR4) - BSL-73/79/85/80

The controller accepts ground signals on TR1 to TR4 (BSL 73/79/ 85/80) from an external device to control the sequencing of plant rectifiers by holding them OFF in groups as follows:

Table 38 TR Leads and Associated Rectifiers

TR Signal	Rectifiers Held OFF by TR Signal
TR1	G01, G02, G09, G10, G17, G18, G25, G26, G33, G34, G41, G42, G49, G50, G57, G58
TR2	G03, G04, G11, G12, G19, G20, G27, G28, G35, G36, G43, G44, G51, G52, G59, G60
TR3	G05, G06, G13, G14, G21, G22, G29, G30, G37, G38, G45, G46, G53, G54, G61, G62
TR4	G07, G08, G15, G16, G23, G24, G31, G32, G39, G40, G47, G48, G55, G56, G63, G64

Auxiliary Port - TB1

The Auxiliary port is RS-232 or RS-485 compliant. It is used to communicate with an external device or network.

SW202-5 must be set to select either RS-232 or RS-485 connection.
See Table 73 MSC DIP Switch Settings.

Table 39 Auxiliary Port - TB1

TB-1 Pin	RS-232 Descriptions	RS-485 Descriptions
1	TX	TX+
2	RTS	TX-
3	RX	RX+
4	DSR	RX-
5	CTS	
7	GND	
9 or 10	FGND (to cable shield)	FGND (to cable shield)

Note: An RS-232 to USB adapter (dongle) may be used to connect the RS-232 port to the USB port of a PC. Adapters may require a specific manually set baud rate to operate properly. See Figure 17 Configuration Menus.

NOTE: Before connecting the USB or RS-232 port to your PC, be sure that the power system and its output are properly grounded. Discharge Ground (DG) bus must be bonded (connected) to earth ground.

CAUTION: Damage to the controller may occur if the USB or RS-232 port is connected to a PC when Discharge Ground (DG) bus is not bonded (connected) to earth ground.

Rectifier Interface

Table 40 Rectifier Cables			
Rectifier	**Drawing**	**Length**	**Ordering code**
Used with BJC1_MSC RIC and J85501F-1 L-31[17] MCS-Compatible RIM			
J8550x -48V Ferro or J85702H -48V PXS with GCM Interface	H285-226 G5	15 ft.	108967175
		25 ft.	108967183
		35 ft.	108967191
		45 ft.	108967209
		60 ft.	108967217
		100 ft.	108969460
J8550x +24V Ferro or J85702H +24V PXS w/GCM Interface	H285226 G8	40 ft.	108967225
J87437 or J87439 -48V Ferro with SP7 Interface	H285-224 G8	40 ft.	108967456
Used with BJC1_MSC RIC and J85501F-1 L-32 Enhanced Ferro RIM			
J85503B-2 or J85503C-3 -48V Ferro (with enhanced features) or Any Other J8550x -48V Ferro (without enhanced features used) or J85702H -48V PXS with GCM Interface	H285-226 G60	15 ft.	108967233
		25 ft.	108967241
		35 ft.	108967258
		45 ft.	108967266
		60 ft.	108967274
		100 ft.	108969478
J85503B-2 +24V Ferro (with enhanced features) or other J8550x +24V Ferro (without enhanced features used) or J85702H +24V PXS with GCM Interface	H285-226 G64	40 ft.	108967282
Used with BJC2_MSC RIB and J85501F-1 L-33 Switchmode[18] or L-35 SMR with Shunt RIM			
J85702B-2 L-5 -48V SMR Shelf with 364A (50A SMR)	H285-226 G61	40 ft.	108967316
J85702E-1 -48V 150A SMR	H285-226 G63	40 ft.	108967308
Used with BJC2MSC RIC and J85501F-1 L-34 Commercial RIM			
Commercial Rectifier (voltage regulated, parallel interface) (See Table 41 Commercial Rectifier Wiring (H285-226 G62) for available signals).	H285-226 G62	60 ft.	108967290
		100 ft.	108969486
J87437 or J87439 -48V Ferro with SP1 Interface	H285-226 G67	40 ft.	108967464
		100 ft.	108969494
Used with GP Protocol Rectifiers (no RIC or RIM required)			
595 or 596 Serial Rectifier Located in H569-43x GPS Cabinet	T83314-30	25 ft.	847865425[19]
J85702H PXS without GCM Interface	T82493-30		

[17]The modification of control cables for rectifier identification (cutting TP leads) is not necessary for use with the Galaxy SC.
[18]The use of rectifiers or rectifier interfaces that do not provide for a load reading disables the Energy Management features of the Galaxy Controller.
[19]847865425 comes with a coupler and can extend the serial bus to 200 feet maximum.

Table 41 Commercial Rectifier Wiring (H285-226 G62)			
Signal Name	**Wire Color**	**Rectifier Termination TB/P/J - pin**	**Signal Description**
R+	(W-BL)		Positive voltage polarity from point of regulation
R-	(BL-W)		Negative voltage polarity from point of regulation
RS	(W-O)		Restart - When used in conjunction with RSR, provides an isolated contact closure from the Galaxy SC to the rectifier in attempt to restart the rectifier after RFAO shutdown.
RSR	(O-W)		Restart Return - When used in conjunction with RS, provides an isolated contact closure from the Galaxy SC to the rectifier in attempt to restart the rectifier after RFAO shutdown
BAT	(W-G)		Battery Plant Voltage: Signal sent from the Galaxy SC to the rectifier (if necessary) to operate alarm and control relays (HV, TR, and EQ)
TR	(G-W)		A contact closure to HVR sent from the Galaxy SC to the rectifier which is to be turned off.
BOOST	(W-BR)		A contact closure to HVR sent from the Galaxy SC to the rectifier which is to be placed in boost mode.
HV	(BR-W)		A contact closure to HVR sent from the Galaxy SC to the rectifier during a high voltage condition.
HVR	(W-S)		Return signal for alarms HV, TR, BOOST.
TRH	(S-W)		TR Handshake. A contact closure from the rectifier to the Galaxy SC in response to a TR signal sent from the controller to the rectifier.
RFA	(BL-R)		Rectifier Failure Alarm. A closure to rectifier ground provided by the rectifier to the Galaxy SC upon rectifier failure.
MAN	(R-BL)		Manual. An open or closed contact to rectifier ground provided by the rectifier upon being turned off manually.
ACF	(O-R)		AC Input Failure. A closure to rectifier ground provided by the rectifier upon loss of AC input voltage.

Table 41 Commercial Rectifier Wiring (H285-226 G62)			
Signal Name	**Wire Color**	**Rectifier Termination TB/P/J - pin**	**Signal Description**
SH+	(R-O)		Positive potential shunt voltage. Signal from the rectifier, used in conjunction with SH-, to provide a differential shunt voltage with the range of (0mVDC to 150mVDC) to the Galaxy SC. Both SH+ and SH- signals must be current limited at the rectifier shunt source with 100kΩ resistors. Common-mode input voltage between any two shunt channels on individual BJC2 circuit cards must not exceed 2.5V. Furthermore, the common-mode voltage must not exceed 160VDC.
SH-	(R-G)		Negative potential shunt voltage. Signal from the rectifier, used in conjunction with SH+, to provide a differential shunt voltage with the range of (0mVDC to 150mVDC) to the Galaxy SC. Both SH+ and SH- signals must be current limited at the rectifier shunt source with 100kΩ resistors. Common-mode input voltage between any two shunt channels on individual BJC2 circuit cards must not exceed 2.5V. Furthermore, the common-mode voltage must not exceed 160VDC.
RTN1	(G-R)		Return signal for ACF, RFA, TRH, and MAN. This signal is the Galaxy SC reference ground.

Features Reference

Shunt Type

Shunt type informs the controller what current the shunt connected to TB100 SH+ and SH- measures. This determines how the controller will calculate plant (load) and battery currents.

The TB100 connected shunt may be connected to measure total LOAD current or to measure total BATTERY current or may not be present (NONE). In the case of NONE, the controller measures multiple battery shunts, not connected to TB100, to calculate plant and battery currents.

Distributed architecture plants (shunt type NONE) provide a battery shunt in each system bay. The controller measures up to 32 shunts connected to the Bay Interface Cards in the system bays. The controller reads the shunt currents over the GP serial data connection.

NONE shunt type means that no shunt is connected to TB100 SH+ and SH-. Each distributed architecture bay provides a battery current measurement to the controller. The load current displayed is derived from the total of battery currents and the total of rectifier currents.

Centralized architecture plants (shunt type LOAD or BATTERY) provide either LOAD or BATTERY shunt connected to TB100 SH+ and SH-.

LOAD shunt type means that the shunt connected to TB100 SH+ and SH- measures total load current only. The load current displayed on the front panel is the sum of the two shunt currents.

BATTERY shunt type means that the shunt connected to TB100 SH+ and SH- measures total battery current only. The load current displayed on the front panel is derived from the total battery current and the total rectifier output current.

NOTE Selecting an incorrect shunt type for the plant configuration will result in incorrect measured and reported currents for Plant / Load and Battery. All features and user configured events using these current measurements will also using be incorrect current values.

Threshold Alarms

Table 42 Threshold Alarms

Alarm	Actions

High Voltage	When the plant voltage exceeds this threshold
	• High Voltage Alarm (HVA) is turned ON
	  • Major (MJ) LED is turned ON
	  • PMJ relay is OPERATED
	  (assuming there is no alarm with CRITICAL severity level active).
	• The controller sends a signal to the rectifiers to shut down in an orderly and timely fashion.
	This alarm prevents damaging high voltage due to rectifier failure to regulate voltage.

High Voltage Float	When the plant voltage exceeds this threshold
	• High Float Voltage Alarm (HFV) is turned ON
	  • Minor LED is Turned ON
	  • PMN relay is OPERATED
	  (assuming there is no alarm with CRITICAL or MAJOR severity level active).
	This alarm indicates that the plant voltage is high probably due to an adjustment in the plant rather than due to a failure. This alarm allows the High Voltage (HV) shutdown threshold to be set slightly higher, thus reducing the number of nuisance shutdowns without decreasing the plant reliability.

Battery on Discharge	When the plant voltage is less than this threshold
	• Battery on Discharge Alarm (BD) is turned ON
	  • MAJ and BD LEDs are turned ON
	  (assuming there is no alarm with CRITICAL severity level active).
	  • PMJ and BD relays are OPERATED
	  (assuming there is no alarm with CRITICAL severity level active).

Very Low Voltage	When the plant voltage is less than this threshold
	• Very Low Voltage (VLV) is turned ON
	  • CRIT BD LED is turned ON
	  • CRIT relay is OPERATED
	This alarm indicates that the system voltage is very low, and that the batteries have discharged to a dangerously low depth.

Battery Temperature Measurement

Temperature measurements are required for many of the controller's battery management features. Some features requiring thermal inputs are:

- Slope Thermal Compensation
- Reserve Time Prediction
- High Temperature Alarm
- Ambient High and Low Temperature Alarms
- High Temperature Disconnect

These features all consider the highest temperatures measured by a number of battery temperature sources. The various sources are linked to battery temperature in priority order. Some of are linked by physical connection and some by configuration options.

Configure all RPM, BIC, and Controller battery temperature channels as Priority 1 sources to assure that they are considered by the Battery High Temperature alarm.

EasyView Windows based configuration Settings → Battery Section[20]

Table 43 Battery Temperature Source Priority

Priority[21]	Temperature Source	Configured by
1	P3 connected Temperature Probe	Physical Connection
1	1-Wire® Temperature Probes	Physical Connection
1	RPM Temperature Channels	Settings → Battery Section
1	Bay (BIC) Temperature Channels	Settings → Battery Section[20]
1	Controller Temperature Channel - TB2 Probe 2, 3, 4	Settings → Battery Section[20]
2[21]	RPM Temperature Channels	Settings → Monitoring Channels or Settings → Battery Management
2[21]	Bay (BIC) Temperature Channels	Settings → Monitoring Channels or Settings → Battery Management
2[21]	Controller Temperature Channel - TB2 Probe 2, 3, 4	Settings → Monitoring Channels or Settings → Battery Management

Load Share

MSC provides load share among of serial rectifiers and between the group of serial rectifiers and the group of non-serial rectifiers.

Non-serial rectifiers may load share via an analog load share bus wired between rectifiers. Some non-serial rectifiers do not load share and do not have a load share bus. Load share performance is diminished when non-serial and serial rectifiers are both present.

Three load share modes are provided: Mixed, Serial, and None.

Table 44 Load Share Modes

Load Share Mode	Plant Voltage Regulated by	Load Share Between Serial and Non-serial Rectifiers	Load Share Among Serial Rectifiers
Mixed	Non-Serial Rectifiers	Yes	Yes
Serial	All Rectifiers[22]	No	Yes
None	All Rectifiers[22]	No	No

[20]The presence of any Battery Section, even if unconfigured, establishes a Priority 1 Battery Temperature source presence causing Priority 2 sources to not be considered.
[21]Priority 2 temperature sources are only included in determining Battery High Temperature when no Priority 1 sources are present.
[22]Serial and non-serial rectifiers both attempt to regulate plant voltage.

Mixed Load Share Mode

Mixed load share mode enables the controller to manage load share among serial rectifiers and between the group of serial rectifiers and the group of monitored[23] non-serial rectifiers by adjusting serial rectifiers. Non-serial rectifier load share is not managed by the controller.

- Serial rectifiers are managed to load share among themselves
- Serial rectifiers are managed to share load as a group with the group of non-serial rectifiers
- Non-serial rectifiers regulate plant voltage.
  Serial rectifiers not are managed to regulate plant voltage to the configured plant voltage set point.

The controller accomplishes mixed load share in two steps:

1. Balance load between the group of serial rectifiers and the group of non-serial rectifiers.
   Controller adjusts serial rectifier set point to equalize serial and non-serial groups to the same aggregate percent of rated capacity.
2. Load share among serial rectifiers.
   Controller adjusts serial rectifiers individually to load share.

Note Load share within the group of non-serial rectifiers is not managed by the controller.

Note Plant voltage is determined by non-serial rectifier voltage. Controller rectifier set point is only the initial setting for serial rectifiers and does not determine plant voltage.

Example:

2,000A aggregate rated capacity of ON serial rectifiers
4,000A aggregate rated capacity of ON non-serial rectifiers
4,000A load

Load =67% of ON rectifiers
1,333A aggregate load of ON serial rectifiers (67% x 2,000A capacity)
2,667A aggregate load of ON non-serial rectifiers (67% x 4,000A capacity)

Serial rectifiers initially operate at the plant voltage set-point.

The controller then shifts the serial rectifier voltage set point up or down as necessary to increase or decrease their share of total plant load until the load shared between serial and non-serial rectifier groups based on capacity of ON rectifiers.

Changes in total rectifier load and capacity of ON rectifiers in both groups are tracked and the serial rectifier set-point is readjusted as necessary.

Serial rectifier adjustment limits accommodate issues such as rectifiers that are significantly out of adjustment, incorrectly configured non-serial rectifier shunts, etc.

- Set point adjustments are limited to Float Voltage Set-Point ± 0.5%.
- Adjustments to serial rectifier set point occur when balance between serial and non-serial groups is not within 10%.

[23]Monitored rectifiers are those with shunts configured in the controller.

Serial Load Share Mode

Serial load share mode enables the controller to actively manage sharing load between all attached serial rectifiers and to use the configured plant voltage set-point to regulate serial rectifier output voltage.

- Serial rectifiers are managed to load share among themselves
- Serial rectifiers are managed to regulate plant voltage to the configured plant voltage set point.

Note Load share within the group of non-serial rectifiers is not managed by the controller.

Note Plant voltage is determined by non-serial rectifier voltage, configured plant voltage set point, and various performance characteristics of the serial and non-serial rectifiers.

Note Rectifier current sharing between the serial and non-serial groups of rectifiers may be very poor and may change with load and with changes in ON rectifier capacity in the two groups.

None Load Share Mode

None load share mode disables the load share between serial rectifiers attached to the system.

- Serial rectifiers are not managed to load share
- Serial rectifiers are managed to regulate plant voltage to the configured plant voltage set point.

Configuring Load Share Mode

Load share mode may be configured via EasyView, Gateway web pages, or on front panel at

MENU → CONFIG → LOAD SHARE MODE

Network Access - LAN (Gateway)

Local and remote network access is provided in three DHCP modes: Client, Static, and Server.

CAUTION Do not operate in DHCP Server mode when connected to a network. Severe network problems may result.

DHCP Mode - Dynamic Host Configuration Protocol

Client Mode Controller network parameters are dynamic. They are provided and managed by DHCP server (manager) external to the controller. The controller IP address may be different each time the controller connects to the network.

Static Mode Controller network parameters are manually configured and static (unchanging).

Server Mode Controller acts as the DHCP server, providing IP addresses to other devices on the network. Server mode is suitable only for connection to a local PC.
This mode is not compatible with networks with other DHCP servers attached.

Network Parameters

IP Address The complete Host Identifier of an internet device, e.g. 192.168.2.1.

The host identifier may be interpreted as single number or logically divided into two fields: subnet number and host identifier.

Subnet Mask A decimal representation of a binary mask that defines the division of an IP Address into subnet number and host identifier. It identifies how many of the most significant bits of the IP Address are subnet number (the remaining bits are the host identifier), e.g. 255.255.255.0 identifies that the most significant 24 bits of the IP address are a subnet number and the least significant 8 bits are the host identifier on the subnetwork.

Gateway Address The IP Address of the gateway (router) providing network access to a device (host), e.g. 192.168.2.1.

Host Name A label assigned to a device, e.g. plant1

Domain Name Name of the domain to which the controller is connected (e.g. ge.com).

Together, the Host Name and Domain name form the familiar URL format, e.g. plant1@ABB.com.

Network Parameters				
Parameter			Value	Default
DHCP Mode			Client/Static/Server	Client
Network Parameters by DHCP Mode				
	DHCP Mode			
Parameter	**Client**	**Static**	**Server**	**Value**
IP Address		User Assigned	192.168.2.1	n.n.n.n
Subnet Mask		User Assigned		n.n.n.n
Gateway Address		User Assigned		n.n.n.n
Host Name	User Assigned	User Assigned		name
Domain Name		User Assigned		.name

Slope Thermal Compensation

This feature is available only on plants without non-serial rectifiers.

Slope thermal compensation continuous adjusts battery float voltage (plant voltage) based on battery temperature to optimize the life and performance of valve regulated lead acid (VRLA) batteries.

The maximum continuous adjustment is 0.1V times the configured number of cells per battery string. The adjustment to plant voltage per degree change in temperature, (PV/°C), is equal to the total adjustment voltage divided by the difference between the start (NOM TEMP) and stop (LOW TEMP or UPPER TEMP) temperatures.

Example:

NOM temp = 25°C

HIGH TEMP = 58°C

24 cell per string

Results in PV/°C = 72 mV/°C = (24 x 0.1V) / (58°C - 25°C)

72 mV/°C is compatible with many VRLA batteries. Divide PV/°C by the number of cells to obtain the per cell change voltage change per degree change in temperature, (CV/°C).

Additionally a high temperature threshold may be set that will further reduce plant voltage in one step to a total voltage reduction of 0.17 volts times the number of cells in the battery plant.

The slope thermal compensation feature uses the highest battery temperature measured. See the Battery Temperature Measurement section for details.

STC	Enables/Disables the Slope Thermal Compensation feature.
LOW TEMP	Temperature at which the plant voltage will have raised 0.1 volts x the number of cells. Valid range is 23° to 68° F or -5° to 20°C
NOM TEMP	Temperature at which the plant voltage is set to its nominal value. Compensation begins at temperatures above or below this point. Valid range is 59° to 86°F or 15° to 30°C.
UPPER TEMP	Temperature at which the plant voltage will have decreased 0.1 volts x the number of cells. Valid range is 86° to 131° F or 30° to 55°C.
STEP TEMP	Temperature at which the plant voltage will further decrease to a total voltage reduction of 0.17 volts x the number of cells. 113° to 185° F or 45° to 85°C
RAISE VOLTS	Enables or Disables the raising of plant voltage due to decreasing temperature.

Battery Recharge Current Limit

This feature is available only on plants without non-serial rectifiers.

Battery Recharge Current Limit continuous adjusts plant voltage to limit total battery charge current to not exceed the configured maximum value (amperes).

External Voltage Input (EXT-V)

The External Voltage Input (EXT-V / EXT-VR) is a user configurable analog voltage measurement input. Configuration via external resistors and software configuration parameters allows a wide range of input signals to be displayed and reported in the scale and units desired.

Limitations:

EXT-V must be positive with respect to EXT-VR.
EXT-VR may be either floating or referenced to Discharge Ground (DG).

Parameters

Parameters are set via EasyView PC interface or TL1 command line.

- Range: +5Vdc, +30Vdc, +60Vdc
  Set via external resistors and input as parameter
  CAUTION: Appropriate external resistors must be installed to avoid damage to the controller.
- Scale Factor: positive or negative decimal value
  Multiplier of measured voltage to displayed voltage
  Set as a parameter.
- Units: displayed after scaled numeric value
  Set as a text parameter.
- Offset: positive or negative offset to scaled numeric value

Displayed Value

Displayed Value = Measured Voltage x Scale Factor + Offset (followed by Units text)

Measured Voltage is the value determined by the input voltage, external resistors, and the Range parameter.

Example:

For	Range	+30Vdc (external resistors and parameter)
	Scale Factor	25 (parameter)
	Offset	-50
	Units	PSI
	Input	+16V
	Display: 350 PSI	= 16 x 25 - 50

External Resistors

- External resistors must be installed in series with both EXT-V and EXT-VR inputs.
- 1/8 W minimum
- 1% tolerance, 100ppm/°C is required to meet specified measurement accuracy

Table 45 External Voltage Input Resistors

Range	Resistors (2 required) 1/8W, 1%, 100ppm/°C	Resistor Kit[24]
+5Vdc	10.98kΩ	150022227
+30Vdc	115.2kΩ	150022228
+60Vdc	242kΩ	150022229

[24]Resistor Kits include 2 resistor assemblies with pig-tail and butt splice attached.

Backup and Restore Configuration

Backup and Restore provide configuration save, restore, and change via file transfer. Configuration files are ASCII files, consisting of a series of T1.317 commands. Files are typically transferred between a controller and a PC.

Controller configuration does not actually reside in a file within the controller.

Backup - The controller sends its configuration as a file. The file may be edited before restoring it. The file is created by the controller on the fly during the backup operation.

Restore - The controller receives a configuration file and executes the commands within the file to perform configuration changes. The file does not replace the pre-restore configuration in its entirety.

Backup and restore may be performed via several alternate means.

Browser Interface

Software Tab: → Save Config. or → Restore Config.

EasyView 2

Software Tab: → Save Config. or → Restore Config.

EasyView

File: → Backup or → Restore

ftp

Backup Procedure from a PC (requires a network card in the Galaxy SC)

1. Open a Command window (DOS window)
2. Change Directory (CD) to the directory to receive the configuration file to be restored
3. Connect an ftp program to the controller, e.g. ftp 172.16.11.5
4. Login to Galaxy SC as a super-user
5. Change Directory (CD) to config: cd config
6. GET the file config.gal: get config.gal target.gal
   "target.gal" is the name of the file to be saved on the PC
7. The ftp transfer terminates with a message indicating success or not.
8. Disconnect from the controller: type bye

Restore Procedure from a PC (requires a network card in the Galaxy SC)

1. Open a Command window (DOS window)
2. Change Directory (CD) to the directory to containing the configuration file
3. Connect an ftp program to the controller, e.g. ftp 172.16.11.5
4. Login to Galaxy SC as a super-user
5. Change Directory (CD) to config: cd config
6. PUT the file source.gal: put source.gal config.gal
   "source.gal" is the name of the file to be restored from the PC
7. The ftp transfer terminates with a message indicating success or not.
8. Disconnect from the controller: type bye

T1.317

Backup Procedure

1. Login as a super-user.
2. Enter the BACKUP command.
3. Select either Xmodem or ASCII transfer.
4. Start your terminal Xmodem or ASCII download program.
5. During an ASCII transfer, hit any key to indicate that you are ready for the data.

The backup session terminates automatically with a message indicating that the backup was completed or not.

Restore Procedure:

1. Login as a super-user.
2. Enter the RESTORE command.
3. Select either Xmodem or ASCII transfer.
4. Start your terminal upload program.

The restore session terminates automatically with a message indicating that the configuration restore completed or not.

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T1.317 Objects and Attributes

This appendix contains tables of all objects supported by the T1.317 interface. The objects are listed in categories with each object being described in terms of its attributes. Each attribute is identified by a description, mnemonic, type, related commands, and a range of values. The mnemonic is used to identify the attribute and the type indicates what type of value the attribute is.

For example, the system object identified as PS1 has an attribute called system time that is identified by the mnemonic TIM. Its value is of type time. This attribute may be modified using the CHA command and its value will be reported by the CON command. However, it is not included in a backup.

As another example, the system object has an attribute identified by the mnemonic TUN which stands for temperature units. This attribute is of type text, for example “C” or “F”. This attribute may be modified using the CHA command, its value will be reported using the CON command, and it will be included in a backup.

Note that the value of any attribute may be acquired by using the STA commands.

Unless otherwise noted, default values are in bold type.

For ranges of numeric values 1 - 80:8 indicates a valid range or 1 to 80 and the default = 8.

Values with separate ranges for 24V and 48V plants:

[24V plant range and default or 48V plant range and default], e.g. 19.5 - 27:24 or 39 - 55:48 (V)

Units:

Implied units are in parentheses, e.g. “number (A)”.

Displayed or transmitted are not in parentheses, e.g. “number A”.

Maximum Characters for Attributes:

MNEM	Attribute	Maximum Characters
DES	Descriptions	30
PRG	Program Line	60
PWD	Password	15
USR	User Name	15
BTY	Battery Type	14
PHN, PGR	Phone Number	25
MSG	Pager Message	25
ADR	Email Address	40
CS	SNMP Community String	20
CL	Periodic Dial-Out Command Line	40
CL	Notepad Comment Line	60
INS	Modem Initialization String	40
UNI	Unit	5
CDS	TL1 Condition Description	60
AID	TL1 AID	20
CND	TL1 Condition Type	20
TXT	Reminder Test	60
CID	Connected Equipment ID	6
SID	Site ID	20
SDE	Site Description	55
SYS	System Description	55

Table 46 System Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
System		PSM						
Identifier	IDE	text						PS1
Description	DES	text	X			X	X	Millennium II
Site Id	SID	text	X			X	X	"1"
Site Description	SDE	text	X			X	X	""
System Description	SYS	text	X			X	X	""
Software Versions	SWV	text						
Web pages version	VERW	text						
Boot block version	VERB	text						
Defaults version	DFLT	text						
Board code	BRC	text						MCR1B-MCR2B
Serial number	SN	text						XXXXXXYYLLddddddddd or YYLLddddddddd
Controller type	CTY	number						1:SC, 2:M1, 3:M2
Day of Week	DOW	text						Sunday, Monday, Tuesday, ...
System Date	DAT	date	X			X		per DTF
Controller Year	YRS	number	X					2000 - 2100
Controller Month	MON	number	X					1 - 12
Controller Day	DAY	number	X					1 - 31
Date Format	DTF	text	X			X	X	mm/dd/yy dd/mm/yy yy/mm/dd mm-dd-yy dd-mm-yy yy-mm-dd mm/dd/yyyy dd/mm/yyyy yyyy/mm/dd mm-dd-yyyy dd-mm-yyyy yyyy-mm-dd
System Time	TIM	time	X			X		hh:mm
Controller Hour	HRS	number	X					0 - 23
Controller Minute	MIN	number	X					0 - 59
Controller Second	SEC	number	X					0 - 59
Time Format	TMF	number	X			X	X	12 or 24
Day Light Savings	DLS	number	X			X	X	0:off 1:on
Language	LNG	text	X	X		X	X	from LNGL list (ENGLISH, ...)
Language list	LNGL	text						Comma separated list of available languages
Temperature Units	TUN	text	X			X	X	C or F
Critical Equals Major	CEM	number	X			X	X	0:no 1:yes (HW,SW)
Front Panel Configuration	FPC	number	X			X	X	0:disable 1:enable (HW,SW)
Serial Port Configuration	SPC	number	X			X	X	0:disable 1:enable (HW,SW)

Attribute	MNEM	Type	CHA	OPE	MET	CON	BU	Value
Remote Rectifier On	RRN	number	X			X	X	0:disable 1:enable (HW,SW)
Remote Rectifier Off	RRF	number	X			X	X	0:disable 1:enable (HW,SW)
Remote security	LMA	number	X			X	X	0:disable 1:enable
Power off enable	POE	number	X			X	X	0:disable 1:enable
Uninstall missing equipment	USL	number		X				1 = do install
Username enable	USR	number	X			X	X	0:disable 1:enable
Display contrast	DCT	number	X			X		0 – 100 %
Shutdown reset (cancel)	POR	number		X				1 = cancel shutdown
Communication port type	PTT	text						“LOCAL”,”MODEM”
Factory defaults	FST	text	X	X		X	X	See ps1,fstl
Factory defaults list	FSTL	text						Comma delimited list of defaults
Reset Passwords	RAP	number		X		X		1 = do reset passwords
Front Panel Pin enable	FPE	text	X			X	X	0:disable 1:enable
Front Panel Pin Time-out	FPT	number	X			X	X	1 - 120 (minutes)
Front Panel PIN	FPP	text	X			X		4 digit PIN (only viewable as admin)
Restart all	RSS	number		X		X		1 = do restart rectifiers and ringers
Lamp test	LTT	number		X		X		1 = do lamp test
System alarm state	AST	text						NORM, RO, WRN, MIN, MAJ, CRIT
Port security level (Access level of this session)	SLV	text						USER, SUPER-USER, ADMINISTRATOR
Daylight saving start	DSS	text	X			X	X	mon:wk:dow:min mon:-1:dom:min
Daylight saving end	DSE	text	X			X	X	mon:wk:dow:min mon:-1:dom:min
Uninstall Timeout	UET	number	X			X	X	0 - 60 (seconds)
Alarm Sub-Objects								
Intelligent Controller Fail	CRA	attrl						CRA1
Intelligent Control Fuse	CRF	attrl						CRF1
Circuit Pack Fail	CPA	attrl						CPA1
Remote Peripheral Fuse	RPF	attrl						RPF1
Regulation Battery Fuse	RBF	attrl						RBF1
Battery Power Fuse	BPF	attrl						BPF1
External Password Reset	EPR	attrl						EPR1
Passwords At Defaults	PFD	attrl						PFD1
Excessive Login Attempts	EXL	attrl						EXL1
Memory Backup Battery Low	BBL	attrl						BBL1
Processor Halt	PHT	attrl						PHT1
Clock Changed	CLC	attrl						CLC1

Attribute	MNEM	Type	CHA	OPE	MET	CON	BU	Value
Self Test Failed	STF	attrl						STF1
Program Line Invalid	PGI	attrl						PGI1
Configuration Changed	CCH	attrl						CCH1
History Cleared	HCL	attrl						HCL1
Measurement Out Of Range	MOR	attrl						MOR1
Module Type Conflict	MTC	attrl						MTC1
Module Failure	MDF	attrl						MDF1
Other Sub-Objects								
System Alarm Test	ATS	attrl						AT1
Ambient Temperature Low	AMTL	attrl						AMTL1
Ambient Temperature High	AMTH	attrl						AMTH1
Auxiliary Alarm Input	AXn (1 - 6)	attrl						AUXn (1 - 6)
Maintenance Reminders	MRM	attrl						MRnn (01 - 12)
Local Display		FPL						
Identifier	IDE	text						FP1
Description	DES	text	X			X	X	Local Display 1

Table 47 DC Distribution Objects and Attributes

Related Commands

Attribute	MNEM	Type	CHA	OPE	MET	CON	BU	Value
DC Distribution Feeder		FEE						
Identifier	IDE	text						LDA
Description	DES	text	X			X	X	DC Distribution Feeder
Distribution Fuse	DFA	attrl						

Table 48 AC Distribution Objects and Attributes

Related Commands

Attribute	MNEM	Type	CHA	OPE	MET	CON	BU	Value
AC Distribution		ACD						
Identifier	IDE	text						ACD1
Description	DES	text	X			X	X	AC Distribution
Phase R Voltage	PRV	attrl						
Phase S Voltage	PSV	attrl						
Phase T Voltage	PTV	attrl						
Voltage Between RS	RSV	attrl						
Voltage Between ST	STV	attrl						
Voltage Between TR	TRV	attrl						
Phase R Current	PRA	attrl						
Phase S Current	PSA	attrl						
Phase T Current	PTA	attrl						
Phase R Fail Alarm	PRF	attrl						
Phase S Alarm	PSF	attrl						
Phase T Fail Alarm	PTF	attrl						
Master Switch Alarm	MSA	attrl						

Table 49 Alarm Test Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Alarm Test		ATS						
Identifier	IDE	text						AT1
Description	DES	text	X			X	X	Alarm Test 1
Alarm Test State	STT	number		X		X		0:inactive 1:active
Alarm Test Stage	STG	text						"", HVSD, RFAT, PCR, PMJ, PMN, MJF, MNF, BD, ACF, RFA, VLV, HV, CTLR, UR1, UR2
Rectifier Test Failure	RTF	text						list of rectifiers not passing alarm test
Alarm Test Enable	LTE	number	X			X	X	0:disable 1:enable (HW,SW)
HV Shutdown	HVS	number	X			X	X	0:disable 1:enable (HW,SW)
Duration	DUR	number	X			X	X	5 - 300:60 (seconds)
Test Power Critical	PCR	number	X			X	X	0:no 1:yes
Test Power Major	PMJ	number	X			X	X	0:no 1:yes
Test Power Minor	PMN	number	X			X	X	0:no 1:yes
Test Major Fuse	MJF	number	X			X	X	0:no 1:yes
Test Minor Fuse	MNF	number	X			X	X	0:no 1:yes
Test Battery on Discharge	BD	number	X			X	X	0:no 1:yes
Test AC Fail	ACF	number	X			X	X	0:no 1:yes
Test Rectifier Fail Alarm	RFA	number	X			X	X	0:no 1:yes
Test High Voltage	HV	number	X			X	X	0:no 1:yes
Test Controller	CTLR	number	X			X	X	0:no 1:yes
Test User Relay 1	UR1	number	X			X	X	0:no 1:yes
Test User Relay 2	UR2	number	X			X	X	0:no 1:yes
Test User Relay 3	UR3	number	X			X	X	0:no 1:yes
Email Test	ETS	number		X		X		1 = do test (sets and clears ATA1)
Email Results	EMS	text						
Individual Relay Test State	IRT	text		X		X		""=Stop Test, HVSD, RFAT, PCR, PMJ, PMN, MJF, MNF, BD, ACF, RFA, HV, CTLR, UR1, UR2, UR3
SNMP Test	SNT	number		X		X		1 = do test
Audio Test State	BZT	text		X		X		""=Stop Test, Local=local buzzer
Audio Test Duration	BZI	number	X			X	X	5 - 300 (seconds)
Alarm Test Active	ATA	attrl						ATA1
Alarm Test Failed	ATF	attrl						ATF1
Alarm Test Aborted	ATB	attrl						ATB1

Table 50 Plant Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
DC Plant		DCP						
Identifier	IDE	text						DC1
Description	DES	text	X			X	X	DC Plant 1
Plant Type	TYP	number	X	X		X	X	48V or 24V
Voltage	VDC	number		X	X			number V
Current	ADC	number		X	X			number A
Capacity	CAP	number						number A
On-line Rectifier Capacity	OLCAP	number						number A
Total Rectifier Drain	TRD	number			X			number A
Shunt Type	SHT	text	X			X	X	LOAD, BATTERY, NONE
Shunt Current	SHA	number	X			X	X	number (A)
Shunt Voltage	SHV	number	X			X	X	1 - 150 (mV)
Monitor Load Shunts	MLS	number	X			X	X	0:disable 1:enable

Table 50 Plant Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Status	STT	text		X		X		FLOAT, BOOST, BTP, FLOAT-COMPENSATED, BATTERY ON DISCHARGE, BATTERY TEST ACTIVE, BATTERY RECHARGE LIMIT, BOOST-COMPENSATED OPE: FLOAT, BOOST (if BTP=0), BTP (if BTP=1)
Battery On Discharge	BOD	OTHER						0:no BD 1:BD active
Time on BD	BDT	OTHER						HH:MM:SS
Energy Management State	EMS	number						0:off 1:on
Energy Management Enable	EME	number	X			X	X	0:disable 1:enable (HW,SW)
Efficiency target	EMT	number	X			X	X	20 - 95 (%)
Efficiency turn on rectifier threshold	EMO	number	X			X	X	25 - 100 (%)
Efficiency delay	EMW	number	X			X	X	1 - 30 (minutes)
Efficiency initial delay	EMI	number	X			X	X	1 - 30 (minutes)
Restart State	RSS	number		X		X		0:off 1:on
Restart Enable	RSE	number	X			X	X	0:disable 1:enable (HW, SW)
Rectifier Sequencing	RSQ	number	X			X	X	0:disable 1:enable
External ETR	ETE	number	X			X	X	0:disable 1:enable
Rectifier Remote Group Transfer (Standby)	RON	number		X		X		STA0 = not Transferred 1 = Manually Transferred 2 = HW Transferred 3 = 1 & 2 OPE 0 = end Manual Transfer 1 = start Manual Transfer
All Rectifier On Threshold	ROT	number	X			X	X	20 - 25:22 or 40 - 50:44 (V)
Rectifier On Delay	ROD	number	X			X	X	0 - 60:10 (minutes)
Transfer (Standby)	TRF	number						0:inactive 1:active,...,0:inactive 1:active
Initial Engine Transfer Delay	ITD	number	X			X	X	1 - 600:1 (seconds)
Transfer Sequence Interval	TSI	number	X			X	X	0.1 - 600:1.0 (seconds)
Universal Battery Temperature	UBT	text						Temperature Channel (default: linked to CT1)
Universal Temp Probe Present	TPP	number						0:no 1:yes
Number of Strings	NST	number	X			X	X	1 - 70:2
Number of Cells per String	CPS	number	X			X	X	1 - 75:12 (24V plant) or 24 (48V plant)
Plant Battery Type	BTY	text	X	X		X	X	from defined Battery Types (BTD) default: ""
Reserve Time	RTM	time						hh:mm or LOW CURRENT OR HIGH CURRENT, DISABLED, UNCONFIGURED
Imminent shutdown enable	ISD		X			X	X	0:disable 1:enable
Battery charge percentage	POC	number			X			0 - 100% (with percent character)
String capacity	SCAP	number						number (Ah)
Alarm Sub-Objects								
Battery Thermal Major	BTJ	attrl						BTJ1
Auxiliary Fuse Major	AMJ	attrl						AMJ1
Auxiliary Fuse Minor	AMN	attrl						AMN1
External Fuse Major	FAJ	attrl						FAJ1
External Fuse Minor	FAN	attrl						FAN1
Alarm Battery Supply	ABS	attrl						ABS1
Sense/control Fuse	VSF	attrl						VSF1
Low Voltage Disconnect Fail	LVDA	attrl						LVDA1
Low Voltage Disconnect	LVD	attrl						LVD1
Open String	OSA	attrl						OSA1

Table 50 Plant Object and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Energy Management Disabled	EMD	attrl						EMD1
Excess Plant Drain	EPD	attrl						EPD1
Shunt Not Configured	SNC	attrl						SNC1
User Relay Conflict	URC	attrl						URC1
ID Not Configured	ZID	attrl						ZID1
Thermal Probe Failure	TPA	attrl						TPA1
Voltage Channel Failure	VMF	attrl						VFM1
Minor Comm Fail Alarm	CMA	attrl						CMA1
Major Comm Fail Alarm	MCM	attrl						MCM1
Emergency Power Off	EPO	attrl						EPO1
Incompatible Rectifier	ICR	attrl						ICR1
External Fuse Major 2	FAJ2	attrl						FAJ2
Bay Interface ID Conflict	BID	attrl						BID1
Rectifier Fail	RFA	attrl						RFA1
AC Fail	ACF	attrl						ACF1
Phase or Low Output	PHA	attrl						PHA1
Low Current	LCA	attrl						LCA1
Load Share Fuse	LSF	attrl						LSF1
Manual Off	MAN	attrl						MAN1
External Transfer Shutdown	ETS	attrl						ETS1
Rectifier Incomplete Config	RIC	attrl						RIC1
Half Power	HPA	attrl						HPA1
ID Conflict	DID	attrl						DID1
Rectifier Current Limit	CLM	attrl						CLM1
Very Low Voltage (VLV)	VLA	attrl						VLA1
Mult Rectifier Fail(MRFA)	MFA	attrl						MFA1
Limited Recharge	LMR	attrl						LMR1
Excess Rectifier Drain	ERD	attrl						ERD1
Engine Transfer Timeout	ETO	attrl						ETO1
Rectifier/Plant Inconsistency	RPI	attrl						RPI1
Reserve Time Low	RTL	attrl						RTL1
Real-time reserve low	RRTL	attrl						RRTL1
Redundancy Loss	RLS	attrl						RLS1
Multiple Manual Off	MMAN	attrl						MMAN1
Multiple AC Fail	MACF	attrl						MACF1
Battery On Discharge (BD)	BDA	attrl						BDA1
High Voltage (HV)	HVA	attrl						HVA1
High Float Voltage	HFV	attrl						HFV1
Other Sub-Objects								
Boost	BST	attrl						BS1
Rectifier	REC	attrl						Gnn (01 - 64)
Bay Interface Card	BIC	attrl						BICn (1 - 32)

Table 51 Bay Interface Card (BIC) Objects and Attributes								
			Related Commands					
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Bay Interface Card		BIC						
Identifier	IDE	text						BICnn (01 - 32)
Description	DES	text	X			X	X	Bay Interface n (1 - 32)
Status	STT	text		X		X		PRESENT,MISSING,VACANT OPE: VACANT
Serial Number	SN	text						YYLLddddddddd or XXXXXXYYLLddddddddd
Bay Interface ID Conflict	BID	number						0=no 1=yes
Communication fail	BCF	number						0=no 1=yes
Bay Current Monitor		BCM						
Identifier	IDE	text						BCMccbb (cc = 01 - 04 , bb = 01 - 32)
Description	DES	text	X			X	X	Current c Bay b
Bay Current	VAL	number			X			number A
Shunt A	SHA	number	X			X	X	number (A)
Shunt mV	SHV	number	X			X	X	1 - 150 (mV)
Shunt Type	SHT	text	X			X	X	LOAD, BATTERY ??
Bay Voltage Monitor		BVM						
Identifier	IDE	text						BVMvvbb (vv = 01 - 04 , bb = 01 - 32)
Description	DES	text	X			X	X	Voltage v Bay b
Bay Voltage	VAL	number			X			number V
Bay Temperature Monitor		BTM						
Identifier	IDE	text						BTMttbb (tt = 01, bb = 01 - 32)
Description	DES	text	X			X	X	Temperature t Bay b
Bay Temperature	VAL	number			X			number C or F
Is Battery Temperature	IBT	number	X			X	X	0:not battery temperature 1:is battery temperature

Table 52 Boost Objects and Attributes								
			Related Commands					
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Boost Control		BST						
Identifier	IDE	text						BS1
Description	DES	text	X			X	X	Boost Control 1
Status	STT	text						QRCT, MANUAL, BTP, TIMED AUTO, OFF
Boost Enable	BSE	number	X			X	X	0:disable 1:enable (HW,SW)
External Timer Boost Enable	TBE	number	X			X	X	0:disable 1:enable (HW,SW)
Battery Therm. Protect Enable	BTP	number	X			X	X	0:disable 1:enable
Auto Mode	ATM	text	X			X	X	DISABLED, OFF,QRCT,TIMED
Timed Manual Duration	TMD	number	X			X	X	1 - 80:8 (hours)
Auto Multiplication Factor	AMF	number	X			X	X	1 - 9:5
Current Term Current Thresh	CTA	number	X			X	X	>= 0:50 (A)
Alarm Sub-Objects								
Boost State Alarm	BSA	attrl						

Table 53 Rectifier Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Rectifier Manager		RMN						
Identifier	IDE	text						GM1
Description	DES	text	X			X	X	Rectifier Manager 1
Load Share Enable	LSE	number	X			X	X	0:disable 1:serial 2:mixed
Redundancy monitor enable	RME	number	X			X	X	0:disable 1:enable
Float High Voltage Shutdown	FSD	number	X			X	X	25 - 30:27.75 or 50 - 60:55.50 (V)
Boost High Voltage Shutdown	BSD	number	X			X	X	26 - 30:27.75 or 52 - 60:55.50 (V)
Float Set-Point	FSP	number	X			X	X	22 - 28:26.04 or 44 - 56:52.08 (V)
Boost Set-Point	BSP	number	X			X	X	22 - 30:26.04 or 44 - 60:52.08 (V)
Float Current Limit	FCL	number	X			X	X	30 - 110 (%)
Boost Current Limit	BCL	number	X			X	X	30 - 110 (%)
Slope Thermal Compensation		STC						
Identifier	IDE	text						SC1
Description	DES	text	X			X	X	Slope Thermal Comp
Status	STT	number	X			X	X	0:disable 1:enable
Raise Voltage Enable	RVE	number	X			X	X	0:disable 1:enable
Lower Temperature Threshold	LTT	number	X			X	X	-5 - 20 (°C) or 23 - 68 (°F)
Nominal Temperature Threshold	NTT	number	X			X	X	15 - 30 (°C) or 59 - 86 (°F)
Upper Temperature Threshold	UTT	number	X			X	X	30 - 55 (°C) or 86 - 131 (°F)
Step Temperature	SPT	number	X			X	X	45 - 85 (°C) or 113 - 185 (°F)
Low temperature slope	LSP	number	X			X	X	1 - 10 (mV/°C per cell)
Upper temperature slope	USP	number	X			X	X	1 - 10 (mV/°C per cell)
Rectifier Interface Card (Bridge)		BRD						
Identifier	IDE	text						FBn (1-3)
Description	DES	text	X			X	X	Bridge board n
Status	STT	text						PRESENT, MISSING
Serial Number	SN	text						XXXXXXYYLLddddddddd
Type	TYP	text						BJCn (1 - 2)
Rectifier Bay		RBY						
Identifier	IDE	text						RBnn (01-o 32)
Description	DESZZ	text	X			X	X	Rectifier Bay n (1 - 32)

Table 53 Rectifier Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Rectifier		REC						
Identifier	IDE	text						Gnn (01 - 99) or Gnnn (100 – 188)
Description	DES	text	X			X	X	Rectifier nn (1 - 100) or nnn (100 188)
Rectifier Type	TYP	text	X			X	X	12 char from list (default: UNCONFIGURED)
Serial Number	SN	text						XXXXXXYYLLddddddddd or YYLLddddddddd
DC Current (VI, VIR)	ADC	number			X			number A
DC Voltage	VDC	number			X			number V
Status	STT	text		X		X		ON[25], OFF, STANDBY[25], VACANT[25]
Shunt Voltage Rating	SHV	number	X			X	X	number:50 (mV)
Shunt Amp Rating	SHA	number	X			X	X	number:0 (A)
Capacity	CAP	number						number A
AC Input Voltage	VAC	number			X			number V
AC Input Voltage Phase 1	VAC1	number			X			number V
AC Input Voltage Phase 2	VAC2	number			X			number V
AC Input Voltage Phase 3	VAC3	number			X			number V
AC Input Current	AAC	number			X			number A
AC Input Current Phase 1	AAC1	number			X			number A
AC Input Current Phase 2	AAC2	number			X			number A
AC Input Current Phase 3	AAC3	number			X			number A
Temperature	TMP	number			X			number F or C
MAN Type	MNT	text	X			X	X	CC, CO, NONE
Use In Sequence Enable	SEQ	number	X			X	X	0:no 1:yes
Output Breaker State	OCB	text						CLOSED, OPEN
Rectifier Fail	RFA	number						0:inactive 1:active
AC Fail	ACF	number						0:inactive 1:active
Phase or Limited Output	PHA	number						0:inactive 1:active
Low Current	LCA	number						0:inactive 1:active
Load Share Fuse	LSF	number						0:inactive 1:active
Standby or Manual Off	MAN	number						0:inactive 1:active
Excess Rectifier Drain	ERD	number						0:inactive 1:active
External Transfer Shutdown	ETS	number						0:inactive 1:active
Rectifier Incomplete Config	RIC	number						0:inactive 1:active
Half Power	HPA	number						0:inactive 1:active
ID Conflict	DID	number						0:inactive 1:active
Rectifier Current Limit	CLM	number						0:inactive 1:active
Communication Failure	RCF	number						0:inactive 1:active
Rectifier Fan Fail	RFN	number						0:inactive 1:active

Table 54 Converter Objects and Attributes								
			Related Commands					
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Converter Plant		CON						
Identifier	IDE	text						CP1
Description	DES	text	X			X	X	Converter Plant 1
Converter output type	TYP	text	X			X	X	24V or 48V
DC Voltage	VDC	number		X	X			number in volts
DC Current	ADC	number			X			number in amps
Capacity	CAP	number						number in amps
On-line Converter Capacity	OLCAP	number						number in amps
Voltage Set-Point	VSP	number	X			X	X	48 - 52:50, 23 - 27.2:24 (V)
Internal high voltage shutdown	VSD	number	X			X	X	50 - 60:50, 25-30:24 (V)
Current Limit	CLM	number	X			X	X	30% - 100%
Low Voltage Discon Threshold	DTH	number	X			X	X	20 - 25:23 (V)
Low Voltage Recon Threshold	RTH	number	X			X	X	22 - 27:25 (V)
Low Voltage Disconnect Enable	LVD	number	X			X	X	0:disable 1:enable
Remote standby enable	ROF	number	X			X	X	0:disable 1:enable
Redundancy monitor enable	RME	number	X			X	X	0:disable 1:enable
Converter restart	RSS	number		X		X		1 = do restart
Alarm Sub-Objects								
Converter Fail Alarm	CFA	attrl						CFA1
Converter Fan Minor	CFN	attrl						CFN1
Converter Fan Major	CFJ	attrl						CFJ1
Distribution Fuse Alarm	DFA	attrl						CDFA1
Id Conflict	DID	attrl						CDID1
Incompatible Converter	ICC	attrl						ICC1
Multiple Convert Fail Alarm	MFA	attrl						CMFA1
High Voltage Alarm	HVA	attrl						CHVA1
High Float Voltage Alarm	HFV	attrl						CHFV1
Low Output Voltage Alarm	VLA	attrl						CVLA1
Converter redundancy loss	RL	attrl						CRL1
Converter		DCC						
Identifier	IDE	text						Csr (01 - 188)[26]
Description	DES	text	X			X	X	DC Converter sr (01 - 188)[26]
Type	TYP	text						as found (10 chars)
DC Current	ADC	number			X			number A
Capacity	CAP	number						number (A)
Status	STT	text		X		X		ON, OFF, STANDBY[27], VACANT[27]
Converter Fail	CFA	number						0:inactive 1:active
Distribution Fuse Alarm	DFA	number						0:inactive 1:active
ID Conflict	DID	number						0:inactive 1:active

[25] The user may only set the state to ON, STANDBY, or VACANT
[26] s is the shelf or carrier number (0 or 1) or shelf number (0 - 18)
r is the converter number within the shelf or carrier (1 - 6)
[27] The user may only set the state to ON, STANDBY, or VACANT

Table 55 Ringer Objects and Attributes								
			Related Commands					
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Ringer Plant		RIN						
Identifier	IDE	text						RIN1
Description	DES	text	X			X	X	Ringer Plant 1
Frequency	FRQ	number	X			X	X	15 - 50 (Hz)
Voltage Set-Point	VSP	number		X	X			65 - 100 (V)
Ringer offset enable	OFE	number			X			0:disable 1:enable
Redundancy monitor enable	RME	number						0:disable 1:enable
Ringer restart	RSS	number		X		X		1 = do restart
Alarm Sub-Objects								
Ringer Fail	RF	attrl						RF1
Ringer Fan Fail	RPFF	attrl						RPFF1
Ringer Major External Fault	RRL	attrl						RRL1
Ringer Minor External Fault	RPFJ	attrl						RPFJ1
Ringer Redundancy Loss	RPXJ	attrl						RPXJ1
Ringer Fail Major	RPXN	attrl						RPXN1
Ringer ID Conflict	RCDP	attrl						RCDP1
Ringer Chassis		RCH						
Identifier	IDE	text						RCn (1 - 8)
Description	DES	text	X			X	X	Ringer Chassis n
Status	STT	number		X		X		ON, STANDBY, VACANT, OFF, MISSING (with reasons), FAIL, TA. EXT, RF, EXT, FAN, REDUN, DUP
Volt Amps Output	VA	number			X			number VA
Primary ringer	PRI	number						sp[28]
Secondary ringer	SEC	number						sp[28]
Ringer Fail	RF	number						0:inactive 1:active
Ringer Fan Fail	RPFF	number						0:inactive 1:active
Ringer Major External Fault	RPXJ	number						0:inactive 1:active
Ringer Minor External Fault	RPXN	number						0:inactive 1:active
Ringer Redundancy Loss	RPRL	number						0:inactive 1:active
Ringer Fail Major	RPFJ	number						0:inactive 1:active
Ringer ID Conflict	RCDP	number						0:inactive 1:active

[28] s is the shelf number
p is the ringer position
1 = first primary ringer
2 = first secondary ringer
3 = second primary ringer
4 = second secondary ringer
First ringers are in the odd shelf slot.
Second ringers are in the even shelf slot.

Table 56 Battery Objects and Attributes								
			Related Commands					
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Battery Reserve		BAR						
Identifier	IDE	text						BR1
Description	DES	text	X			X	X	Battery Reserve 1
Total battery current	ADC	number			X			number A (+ for discharge, - for charge)
Highest battery temperature	HBT	number			X			number C or F
Installed battery capacity	CAP	number			X			number Ah
On-line battery capacity	OLCAP	number			X			number Ah
Discharge test results	BTR	text		X	X			result, reserve, load[29]
High Temperature Threshold	TTH	number	X			X	X	30-90:75(C) or 86-194:167(F)
Current Limit Enable	CLE	number	X			X	X	0:disable 1:enable
Current Limit Threshold	CLT	number	X			X	X	10 - 1000 (A)
End Volts Per String	CEV	number	X			X	X	19.25 - 25.35 or 40.25 - 48.75 (V)
Enhanced Prediction Enable	EPE	number	X			X	X	0:disable 1:enable
Battery Test State	BTS	text		X		X		0:inactive 1:active
Battery Test Enable	BTE	number	X			X	X	0:disable 1:enable
Manual test type	MTT	text	X			X	X	DISABLED, 20%, TIMED
Manual test alarm voltage	TEV	number	X			X	X	21 - 27V or 36 - 48 (V)
Manual test duration	TMD	time	X			X	X	00:00:00 - 23:59:59 (hh:mm:ss)
Battery test rectifier voltage	BTV	number	X			X	X	21 - 26 or 42 - 52 (V)
Auto test start hour	ATH	number	X			X	X	0 - 23
Auto test interval	TIN	number	X			X	X	1 - 18 (months)
Auto test min hours after BD	ATW	number	X			X	X	0 - 240 (hours)
Auto test date	ATD	date	X			X	X	Date (in PSM,DTF format)
AT reserve current	ATC	number	X			X	X	number (A)
AT reserve time	ATR	time						(hh:mm)
Number of mid-cell V present	NVM	number			X			Number (0- 21)
Number of temperatures present	NTM	number			X			Number (0 - 18)
Battery voltage imbalance detection enable	SCD	number						0:disable 1:enable (Automatically enabled when mid cell V monitor present)
Battery imbalance threshold	SCV	number	X			X	X	1.5 - 3.0 (V)

[29] result is one of the following:

COMPLETED
CHECK BATTERY
INTERRUPTED
ACTIVE
NOT RUN

reserve is hours calculate by last complete test
load is load at beginning of test

Table 56 Battery Objects and Attributes								
			Related Commands					
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Alarm Sub-Objects								
Battery Test Active	BTA	attrl						BTA1
Battery Test Failed	BFA	attrl						BFA1
Shorted Cell Detected	SCDA	attrl						SCD1
Imminent Low V Shutdown	ISDA	attrl						ISD1
Voltage Duplicate ID	MDP	attrl						MDP1
Voltage ID Not Configured	MZD	attrl						MZD1
Battery Temperature High Alarm	BTHA	attrl						BTHA1
Battery Bay		BBY						
Identifier	IDE	text						BBnn (01 - 32)
Description	DES	text	X			X	X	Battery Bay n (1 - 32)
Battery Section		BAT						
Identifier	IDE	text						Bnn (01 to 70)
Description	DES	text	X			X	X	Battery Section n
Contactor	CON	text	X			X	X	CN1 or CN2 (default: “”)
Status	STT	text						DISCON,CONNECT, UNKNOWN
Number of Strings	NST	number	X			X	X	1 - 70
Section Battery Type	BTY	text	X			X	X	From list of defined types
Section Nominal Capacity	CAP	number						number (Ah)
Reserve Time	RTM	time						hh:mm
DC Current	ADC	number			X			number A
Install Date	DAT	date	X			X	X	date
Battery Type Definition		BTD						
Identifier	IDE	text						BTnn (01 to 34)
Description	DES	text	X			X	X	Default: Battery Type n
Battery Type	BTY	text	X			X	X	up to 14 characters
Battery Class	BTC	text	X			X	X	FLOODED, SEALED, NICAD, LI-LMP, LI-ELITE, VALVE-REGULATED, (List in web: FLOODED, VALVE-REG , NICAD, LI-ELITE, LI-LMP)
Capacity	CAP	number	X			X	X	number Ah
Data Parameter nn (01 to 17)	Dnn	number	X			X	X	number

Table 57 Disconnect Contactor Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Contactor Interface Card		DCN						
Identifier	IDE	text						DCNnn (01-12)
Description	DES	text	X			X	X	Contactor Interface n
Serial Number	SN	text						Serial number
Board Code	BRC	text						Board code
Status	STT	text		X				NONE, MISSING, OPEN, CLOSED
Contactor Interface Type	TYP	text	X			X	X	NONE, CN1, CN2, CN3, or CN4[30]
Contactor		CNT						
Identifier	IDE	text						CNn (1 - 4)
Description	DES	text	X			X	X	Defaults: CN1:LVBD, CN2:LVLD1, CN3:LVLD2, CN4:LVLD3
Status	STT	text		X[31]				NONE, DISCON, CONNECT, FAILED
Enable	ENA	number	X			X	X	0:disable 1:enable
Disconnect Threshold	DTH	number	X			X	X	20 - 25:22 or 40 - 50:44 (V)
Disconnect delay	DDY	number	X			X	X	0 - 300 minutes
Disconnect automode	DAM	number	X			X	X	0:NONE 1:VOLTAGE 2:VOLTAGE+TIME
Disconnect remaining time	DTM	number						>0 means going to disconnect
Reconnect Threshold	RTH	number	X			X	X	19.5 - 27:24 or 39 - 55:48 (V)
Reconnect delay	RDY	number	X			X	X	0 - 300 minutes
Reconnect automode	RAM	number	X			X	X	0:NONE 1:VOLTAGE 2:VOLTAGE+TIME
Reconnect remaining time	RTM	number	X		X	X	X	>0 means going to disconnect
Alarm Sub-Objects								
Contactor Open Alarm	CNO	attrl						CNOn (1 - 4)
Contactor Failed Alarm	CNF	attrl						CNFn (1 - 4)

[30] Default contactor interface type: DCN01 = CN1, DCN02 = CN2, DCN03 = CN3, DCN04-DCN08 = CN4

[31] A contactor configured as a LOAD type cannot be disconnected via a software command. A contactor configured as a BATTERY type may be disconnected via a software command only if another contactor is also configured as a BATTERY type.

Table 58 Standard Alarm Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Standard Alarm		SDA						
Identifier	IDE	text						see list below
Description	DES	text	X			X	X	see list below
Alarm State	AST	number						0:inactive 1:active
Severity	SEV	text	X			X	X	CRIT MAJ, MIN, WRN, RO
LED	LED	text	X			X	X	BATT, BD, DIST, RECT, AC, RM, or CTLR
Contact Closure	ACC	text	X			X	X	ACF, MJF, MNF, RFA, VLV, HV, BD, CTLR, UR1, or UR2
Notify Delay	DLY	number	X			X	X	0 - 540 (seconds)
Notify On Occur	NOO	number	X			X	X	0:no 1:yes
Notify On Retire	NOR	number	X			X	X	0:no 1:yes
NAG On Occur	NAG	number	X			X	X	0:no 1:yes
Notify Destination	DST	text	X			X	X	"", P1, P2, P3, P4

IDE	DEFAULT DESCRIPTION	IDE	DEFAULT DESCRIPTION	IDE	DEFAULT DESCRIPTION
CRA1	Controller Fail	MDF1	Module Failure	OSA1	Open String
CRF1	Controller Fuse	AUXn	Auxiliary n (1-6)	EMD1	Energy Management Disabled
CPA1	Circuit Pack Fail	BTJ1	Battery Thermal Major	EPD1*	Excess Plant Drain
EPR1*	External Password Reset	AMJ1	Auxiliary Major	SNC1	Shunt Not Configured
PFD1	Password At Default	AMN1	Auxiliary Minor	URC1	User Relay Conflict
EXL1*	Excessive Login Attempts	FAJ1	External Fuse Major	ZID1	ID Not Configured
BBL1	Memory Backup Battery Low	FAJ2	External Fuse Major	TPA1	Thermal Probe Failure
PHT1	Processor Halt	FAN1	External Fuse Minor	VMF1	Voltage Channel Failure
CLC1*	Clock Changed	RBF1	Regulation Battery Fuse	CMA1	Minor Communication Fail Alarm
STF1*	Self Test Failed	BPF1	Battery Power Fuse	MCM1	Major Communication Fail Alarm
PGI1	Program Line Invalid	BJT1	Battery Thermal Major	EPO1	Emergency Power Off
CCH1*	Configuration Changed	ABS1	Alarm Battery Supply	ICR1	Incompatible Rectifier
HCL1*	History Cleared	VSF1	Sense/Control Fuse	BID1	Bay Interface ID Conflict
MOR1	Measurement Out Of Range	LVDA1	Low Voltage Disconnect Fail	RFA1	Rectifier Fail
MTC1	Module Type Conflict	LVD1	Low Voltage Disconnect	ACF1	AC Fail

Table 58 Standard Alarm Objects and Attributes					
IDE	**DEFAULT DESCRIPTION**	**IDE**	**DEFAULT DESCRIPTION**	**IDE**	**DEFAULT DESCRIPTION**
PHA1	Phase Or Low Output	ICC1	Incompatible Converter	RF1	Ringer Fail
LCA1	Low Current	COF1*	Queue Overflow	RPFF1	Ringer Fan Fail
LSF1	Load Share Fuse	COR1*	No Call-Out Response	RPRL1	Ringer Redundancy Loss
MAN1	Manual Off	NNC1	Unconfigured Alarm Destination	RPFJ1	Ringer Fail Major
ETS1	External Transfer Shutdown	POR1*	No Dial-Out Response	RPXJ1	Ringer Major External Fault
RIC1	Rectifier Incomplete Config	AAC1	ACO Active	RPXN1	Ringer Minor External Fault
HPA1	Half Power	ATA1	Alarm Test Active	RCDP1	Ringer ID Conflict
DID1	ID Conflict	ATF1*	Alarm Test Failed	CNO1	Contactor 1 Open
CLM1	Rectifier Current Limit	ATB1*	Alarm Test Aborted	CNO2	Contactor 2 Open
RFN1	Rectifier Fan Fail	BTA1	Battery Test Active	CNO3	Contactor 3 Open
CFA1	Converter Fail	BFA1	Battery Test Failed	CNO4	Contactor 4 Open
CFN1	Converter Fan Minor	SCD1	Shorted Cell Detected	CNF1	Contactor 1 Failed
CFJ1	Converter Fan Major	ISD1	Imminent Low Voltage Shutdown	CNF2	Contactor 2 Failed
CDFA 1	Converter Distribution Fuse	MDP1	Voltage Duplicate ID	CNF3	Contactor 3 Failed
CDID1	Converter ID Conflict	MZD1	Voltage ID Not Configured	CNF4	Contactor 4 Failed

*These alarms can be cleared using the CLE command.

Table 59 Single Threshold Alarm Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Threshold Alarm		THA						
Identifier	IDE	text						see list below
Description	DES	text	X			X	X	see below
Alarm State	AST	number	X					0:inactive 1:active
Severity	SEV	text	X			X	X	CRIT, MAJ, MIN, WRN, RO
Threshold	THR	text	X			X	X	number (no unit, see table below)
LED	LED	text	X			X	X	BATT, BD, DIST, RECT, AC, RM, or CTLR
Contact Closure	ACC	text	X			X	X	ACF,MJF,MNF,RFA,VLV,HV, BD,CTLR,UR1, or UR2
Notify Delay	DLY	number	X			X	X	0 - 540 seconds
Notify On Occur	NOO	number	X			X	X	0:no 1:yes
Notify On Retire	NOR	number	X			X	X	0:no 1:yes
NAG On Occur	NAG	number	X			X	X	0:no 1:yes
Notify Destination	DST	text	X			X	X	“”, P1, P2, P3, P4

IDE	Default Description	Threshold (THR) Value Range
VLA1	Very Low Voltage	20 - 25.5:23 or 40 - 51:46 (V)
MFA1	Multiple Rectifier Fail	2 - 24:2
LMR1*	Limited Recharge	0.5 - 1.0:0.8
ERD1*	Excess Rectifier Drain	1.0 - 2.0:1.18
ETO1	Engine Transfer Timeout	0 - 60:30 (minutes)
RPI1*	Rectifier/Plant Inconsistency	1.0 - 2.0:1.05
RTL1	Reserve Time Low	0 - 99:59 :2 (hours)
RRTL1	Real-Time Reserve Low	0 - 99:59 :2 (hours)
RLS1	Redundancy Loss Alarm	1 - 187:1
MMAN1	Multiple Manual Off	2 - 188:2
MACF1	Multiple AC Fail	2 - 188:2
BTHA1	High Battery Temperature	30 - 85 : 55 C
CMFA1	Multiple Converter Fail	2 - 188:2
CHVA1	Converter High Voltage Major	25.0 - 30.0 :28.5 / 50.0 - 60.0 :56.0 (V)
CHFV1	Converter High Voltage Minor	24.0 - 30 :27.0 / 48.0 - 60.0 :54.0 (V)
CVLA1	Converter Very Low Voltage	20.0 - 27.0 :23 / 40.0 - 54.0 :46 (V)
CRL1	Converter Redundancy Loss	1 - 188:1
AMTL1	Low Ambient Temperature	-40 - 10 : -40 - 50 (C)
AMTH1	High Ambient Temperature	20 - 75 :75 (C)

*These alarms can be cleared using the CLE command.

Table 60 Dual Threshold Alarm Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Dual Threshold Alarm		DTA						
Identifier	IDE	text						see list below
Description	DES	text	X			X	X	see below
Alarm State	AST	number						0:inactive 1:active
Severity	SEV	text	X			X	X	CRIT, MAJ, MIN, WRN, RO
Float Threshold	FTH	number	X			X	X	number
Boost Threshold	BTH	number	X			X	X	number
LED	LED	text	X			X	X	BATT, BD, DIST, RECT, AC, RM, or CTLR
Contact Closure	ACC	text	X			X	X	ACF, MJF, MNF, RFA, VLV, HV, BD, CTLR, UR1, or UR2
Notify Delay	DLY	number	X			X	X	0 - 540 seconds
Notify On Occur	NOO	number	X			X	X	0:no 1:yes
Notify On Retire	NOR	number	X			X	X	0:no 1:yes
NAG On Occur	NAG	number	X			X	X	0:no 1:yes
Notify Destination	DST	text	X			X	X	“”, P1, P2, P3, P4

		Threshold Voltage Ranges	
IDE	**Default Description**	**Float**	**Boost**
BDA1	Battery On Discharge	23-28:25V or 46-55:51V	23 - 28:25 or 46 - 55:51 (V)
HVA1	High Voltage	24.75-29.75:26.8V or 50-60:53.6V	25.75 - 31.75:26.8 or 52 - 60:53.6 (V)
HFV1	High Float Voltage	24.75-29.75:26.5V or 50-60:53V	25.75 - 31.75:26.5 or 52 - 60:53 (V)

Table 61 Events Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
User Defined Event		UDE						
Identifier	IDE	text						Unnnn (0001-1500)
Description	DES	text	X			X	X	30 char
Alarm State	AST	number	X					0:inactive 1:active
Severity	SEV	text	X			X	X	CRIT, MAJ, MIN, WRN, RO
Program Line	PRG	text	X			X	X	"" (60 characters)
Minimum Duration	DUR	number	X			X	X	number (seconds)
Latched	LAT	number	X			X	X	0:no 1:yes
LED	LED	text	X			X	X	"",BATT, BD, DIST, RECT, AC, RM, or CTLR
Contact Closure	ACC	text	X			X	X	"", ACF, MJF, MNF, RFA, VLV, HV, BD, CTLR, UR1, or UR2
Notify Delay	DLY	number	X			X	X	0 - 540 (seconds)
Notify On Occur	NOO	number	X			X	X	0:no 1:yes
Notify On Retire	NOR	number	X			X	X	0:no 1:yes
NAG On Occur	NAG	number	X			X	X	0:no 1:yes
Notify Destination	DST	text	X			X	X	"", P1, P2, P3, P4
Time Event		TME						
Identifier	IDE	text						Tnn (01-32)
Description	DES	text	X			X	X	Timer Event n
Status	STT	number						0:inactive 1:active
Date	DAT	date	X			X	X	date
Time	TIM	time	X			X	X	time (default: 11:59am)
Duration	DUR	number	X			X	X	1 - 1440 (minutes)
Maintenance Reminder		MRM						
Identifier	IDE	text						MRnn (nn=1 - 12)
Description	DES	text	X			X	X	Maintenance Reminder n
Alarm State	AST	text						0=not active 1=active
Severity	SEV	text						WRN
Notify On Occur	NOO	number	X			X	X	0:no 1:yes
Notify On Retire	NOR	number	X			X	X	0:no 1:yes
NAG On Occur	NAG	number	X			X	X	0:no 1:yes
Notify Destination	DST	text	X			X	X	"", P1, P2, P3, P4
Notification Date	DAT	date	X			X	X	01/01/1992
Notification time	TIM	time	X			X	X	12:00AM
Text	TXT	text	X			X	X	""
Connected Equipment Alarm		CEA						
Identifier	IDE	text						CEAn (1 - 6)
Description	DES	text	X			X	X	Connected Equip Alarm n
Alarm State	AST	number	X					0:inactive 1:active
Severity	SEV	text	X			X	X	CRIT, MAJ, MIN, WRN, RO
Notify Delay	DLY	number	X			X	X	0 - 540 seconds
Notify On Occur	NOO	number	X			X	X	0:no 1:yes
Notify On Retire	NOR	number	X			X	X	0:no 1:yes
NAG On Occur	NAG	number	X			X	X	0:no 1:yes
Notify Destination	DST	text	X			X	X	"", P1, P2, P3, P4

Table 62 Alarm Input Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Alarm Input		INP						
Identifier	IDE	text						INmnn[32]
Description	DES	text	X			X	X	Defaults: see list below
Board Code	BRC	text						(board code of input source)
Serial Number	SN	text						XXXXXXYYLLddddddddd or YYLLddddddddd
Status	STT	number			X			0=normal 1=alarm
Input Alarm Type	TYP	text	X			X	X	"", FAN1, FAJ1, OSA1, AUX1, AUX2, AUX3, AUX4, AUX5, AUX6, REMLVD
Input Alarming State	POL	text	X			X	X	CLOSED, OPEN

Built-in Controller Plant Inputs	
Object	**Default Description**
In001	General Input 1
In002	LBF Input
In003	RBRPO Input
In004	PBT Input
In005	TFLT Input
In006	TBST Input
In007	General Input 4
In008	LVD1/General Input 2
In009	LVD2 Input
In010	LVD3/General Input 3
IN011	General Input 5
IN012	RO Input
IN013	TR1 Input
IN014	TR2 Input
IN015	TR3 Input
IN016	TR4 Input
IN017	MNF Input
IN018	MJF Input
IN019	AMN Input
IN020	AMJ Input
IN021	OS Input
IN022	FAJ2 Input
IN023	General Input 2
IN024	General Input 3

[32] m is the distribution interface module ID from 1 to 4 (0 for the controller)
nn is the input number from 01 to the number of inputs supported by the distribution interface module

Table 63 Data Switch Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Data Switch		DSW						
Identifier	IDE	text						DSn (1 - 6)
Description	DES	text	X			X	X	Data Switch n
Connected Equipment ID	CID	text	X			X	X	GALAXY, OMNI, ECS, MCS, XCS, RAS, ...
Status	STT	text		X		X		IDLE, REPORTING, PASS-THRU
Reporting Enable	REN	number	X			X	X	0:disable 1:enable
Connect Baudrate	BDR	text	X			X	X	300, 1200, 2400, 4800, 9600, 19200
Data Bits	DBT	number	X			X	X	7, 8
Parity	PRY	text	X			X	X	O, E, N
Stop Bits	SBT	number	X			X	X	1, 2
Handshake	HSH	text	X			X	X	NO, SW, HW
Monitor DSR Signal	DSR	number	X			X	X	0:no 1:yes
Alarm Header Length	HDR	number	X			X	X	0 - 100 (lines)
Attention Prompt	APR	text	X			X	X	12 char (default: \r\,\r)
Password	PWD	text	X			X	X	20 char (default: ABB\r)
Alarms Command	ACM	text	X			X	X	30 char (default: ALMS\r)
Hang-up Command	HUC	text	X			X	X	20 char (default: BYE\r)
Connected Equip Alarm	CEA	attrl						CEAn (1 - 6)

Table 64 Remote Peripheral Monitor Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Remote Peripheral Monitor		RPM						
Identifier	IDE	text						Mhh (h = 0-9, A-F, i.e.. hh = 01-o FF)
Description	DES	text	X			X	X	typ Module Addr hh
Serial Number	SER	number						'M'YYMMLLddddddddd or 'R'YYMMLLddddddddd
Status	STT	text						ATTACHED, DETACHED, FAIL, TYPE CONFLICT
Module Type	TYP	text						SHM, VTM, TPM, CRM, BIM
Type Lock	TLK	number	X			X	X	0:not locked 1:locked
Measurement Out Of Range	MOR	number						0=no 1=yes
Module Failure	MDF	number						0:inactive 1:active
Type Conflict	MTC	number						0:inactive 1:active
Voltage Monitor		**VTM**						
Identifier	IDE	text						Cchh (c = 1 - 6, h = 0-9, A-F)
Description	DES	text	X			X	X	Voltage Chan c Addr hh
Status	STT	text						ATTACHED, DETACHED, FAIL, TYPE CONFLICT
Channel Type	TYP	text						VTM
Range	RNG	text						text
Value	VAL	number			X			number[33] UNI
Unit	UNI	text	X			X	X	5 chars (default: V)
Offset	OFS	number	X			X	X	-99999 - 99999:0
Scale Factor	SCF	number	X			X	X	-99999 - -99999:1
Measurement Out Of Range	MOR	number						0=no 1=yes
Shunt Monitor		SHM						
Identifier	IDE	text						Cchh (c = 1 - 6, h = 0-9, A-F)
Description	DES	text	X			X	X	Shunt Chan c Addr hh
Status	STT	text						ATTACHED, DETACHED, FAIL, TYPE CONFLICT
Channel Type	TYP	text						SHM
Range	RNG	text						Text
Value	VAL	number			X			number A
Shunt Current	SHA	number	X			X	X	number (A)
Shunt Voltage	SHV	number	X			X	X	number (mV) (not 0)
Measurement Out Of Range	MOR	number						0=no 1=yes
Temperature Monitor		TPM						
Identifier	IDE	text						Cchh (c = 1 - 7, h = 0-9, A-F)
Description	DES	text	X			X	X	Temperature Chan c Addr hh
Is Battery Temperature	IBT	number	X			X	X	0:disable 1:enable
Status	STT	text						ATTACHED,DETACHED,FAIL,TYPE CONFLICT
Channel Type	TYP	text						TPM
Value	VAL	number			X			number (C or F)
Measurement Out Of Range	MOR	number						0:inactive 1:active

[33] Value = InputVoltage x ScaleFactor + Offset

Table 64 Remote Peripheral Monitor Objects and Attributes								
			Related Commands					
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Control Relay		**CRM**						
Identifier	IDE	text						Cchh (c = 1 - 3, h = 0-9, A-F)
Description	DES	text	X			X	X	Relay Chan c Addr hh
Status	STT	text						OFF, ON
Channel Type	TYP	text						CRM
Value	VAL	text						OFF, ON
Program Line	PRG	text	X			X	X	60 char (default: “”)
Measurement Out Of Range	MOR	number						0=no 1=yes
Binary Monitor		**BIM**						
Identifier	IDE	text						Cchh (c = 1 - 6, h = 0-9, A-F)
Description	DES	text	X			X	X	Binary Chan c Module hh
Status	STT	text						ATTACHED, DETACHED, FAIL, TYPE CONFLICT
Channel Type	TYP	text						BIM
Value	VAL	text			X			CLOSED, OPEN
Measurement Out Of Range	MOR	number						0=no 1=yes

Table 65 Distribution Current Objects and Attributes								
			Related Commands					
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Distribution Current		DCM						
Identifier	IDE	text						DCMC1 is the plant shunt DCMnn (01 - 06)
Description	DES	text	X			X	X	DCMC1: Plant Current DCMn: Distribution Current n
Board Code	BRC	text						(board code of input source)
Serial Number	SN	text						
Status	STT	text						NONE, MISSING, PRESENT
Shunt Type	TYP	text	X			X	X	NONE, LOAD, BATTERY[34]
Shunt Rated Current	SHA	number	X			X	X	number (A)
Shunt Rated Voltage	SHV	number	X			X	X	number (mV)
Value	VAL	number			X			number A

[34] Shunt Type defaults:
DCMC1 = LOAD
DCM01 = BATTERY
DCM02-DCM06 = LOAD

Table 66 Controller Analog Input Objects and Attributes								
			Related Commands					
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
0 - 20 mA Input (Controller Current Input)		CCC						
Identifier	IDE	text						CC1
Description	DES	text	X			X	X	Sensor Current Channel 1
Value	VAL	number			X			number[35] UNI
Unit	UNI	text	X			X	X	5 charts (default: mA)
Offset	OFS	number	X			X	X	-99999 - 99999:0
Scale Factor	SCF	number	X			X	X	-99999 - 99999:1
External Voltage Input (Controller Voltage Channel)		CVC						
Identifier	IDE	text						CV1
Description	DES	text	X			X	X	Voltage Channel 1
Range	RNG	number						1 - 5, 1 - 30, 1 - 60
Value	VAL	number			X			number[36] UNI
Unit	UNI	text	X			X	X	5 charts (default: V_{dc})
Offset	OFS	number	X			X	X	-99999 - 99999:0
Scale Factor	SCF	number	X			X	X	-99999 - 99999:1
Temperature Monitor (Controller Temperature Channel)		CTC						
Identifier	IDE	text						CTn (1 - 4)
Description	DES	text	X			X	X	Temperature Chan n
IS Battery Temperature	IBT	number	X			X	X	0:not battery temperature 1:is battery temperature
Value	VAL	number			X			number C or F

[35] Value = InputVoltage x ScaleFactor + Offset
[36] Value = InputVoltage x ScaleFactor + Offset

Table 67 Other Measurement Objects and Attributes								
			Related Commands					
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Mid-String Voltage (1-Wire® Modules)		MSV						
Identifier	IDE	text						MSmc (m = 1 - 18, c = 1 - 3)[37]
Description	DES	text	X			X	X	String n Midpoint
Status	STT	text		X		X		NONE, MISSING, PRESENT, AVAILABLE
Value	VAL	number			X			number V
ID Conflict	DID	number						0:inactive 1:active
Derived Channels		DRC						
Identifier	IDE	text						DRnn (nn=01 to 32)
Description	DES	text	X			X	X	Derived Chan n
Value	VAL	number			X			number UNI
Program Line	PRG	text	X			X	X	“”
Unit	UNI	text	X			X	X	“”

[37] m is One-Wire module number, c is the channel number in the module

Table 68 Reporting Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Call Out Manager		COM						
Identifier	IDE	text						CM1
Description	DES	text	X			X	X	Call-Out Manager
NAG Interval	NGI	number	X			X	X	15 - 60 (minutes)
Alarm Sub-Objects								
Queue Overflow	COF	attrl						COF1
Number Did Not Respond	COR	attrl						COR1
Number Not Configured	NNC	attrl						NNC1
Phone Numbers	COP	attrl						P1, P2, P3, P4, A1
Call Out Phone Number		COP						
Identifier	IDE	text						P1, P2, P3, P4, A1
Description	DES	text	X			X	X	Call-Out Number n or Alternate
Type	TYP	text	X			X	X	DATA, PAGER
Phone Number	PHN	text	X			X	X	digit ( ) * # - , up to 25 characters (default: “”)
Connect Baudrate	BDR	number	X			X	X	300, 1200, 2400, 4800, 9600, 19200
Data Bits	DBT	number	X			X	X	7, 8
Parity	PRY	text	X			X	X	O, E, N
Stop Bits	SBT	number	X			X	X	1, 2
Pager Id Delay	DLY	number	X			X	X	0 - 9 (seconds)
Pager ID (Pin #)	PGR	text	X			X	X	digit ( ) * # - , up to 25 characters (default: “”)
Pager Message	MSG	text	X			X	X	“”
Email Address		COE						
Identifier	IDE	text						En (1 - 4)
Description	DES	text	X			X	X	Email Address n
Email Address	ADR	text	X			X	X	“”
Type	TYP	text	X			X	X	NORMAL, PAGER
Periodic Call-Out		PSO						
Identifier	IDE	text						PO1
Description	DES	text	X			X	X	Periodic Call-Out 1
Phone Number	PHN	text	X			X	X	digit ( ) * # - , up to 25 characters (default: “”)
Connect Baudrate	BDR	number	X			X	X	300, 1200, 2400, 4800, 9600, 19200
Data Bits	DBT	number	X			X	X	7, 8
Parity	PRY	text	X			X	X	O, E, N
Stop Bits	SBT	number	X			X	X	1, 2
Interval	INT	text	X			X	X	Sunday...Saturday, Daily, Monthly, Quarterly, Never
Time	TIM	time	X			X	X	hh:mm:ss (default: 06:00:00)
Command Line 1-10	CL01-10	text	X			X	X	“”
Alarm Sub-Objects								
Number Did Not Respond	POR	attrl						POR1

Table 69 Remote Communication Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Network		NET						
Identifier	IDE	text						NET1
Description	DES	text	X			X	X	Network Settings
Ethernet (MAC) Address	EAD	number						hh:hh:hh:hh:hh:hh
DHCP	DHCP	number	X	X[38]		X	X	0:static IP, 1:DHCP Client, 2:DHCP Server
Static IP address	IP	text (IP)	X			X	X	xxx.xxx.xxx.xxx[39]
Static Subnet Mask	SUB	text (IP)	X			X	X	xxx.xxx.xxx.xxx[39]
Static Gateway (Router) IP	GTWY	text (IP)	X			X	X	xxx.xxx.xxx.xxx[39]
Hostname	HOST	text (IP)	X			X	X	
Working IP address	WIP	number						xxx.xxx.xxx.xxx[40]
Static Domain Name	DOM	text	X			X	X	(not used if DHCP enabled)
Static DNS IP	DNS	text (IP)	X			X	X	xxx.xxx.xxx.xxx[39]
Write Enable	WRE	number	X			X	X	0:disabled 1:enabled
Session Timeout	TMO	number	X			X	X	number (minutes)
Mailhost IP	MSRV	text (IP)	X			X	X	xxx.xxx.xxx.xxx[41]
Modem		MDM						
Identifier	IDE	text						MP1
Description	DES	text	X			X	X	Modem Port 1
Status	STT	text						USER, SUPER-USER, ADMINISTRATOR, TL1, LOGOUT
Data Bits	DBT	number	X			X	X	7, 8
Parity	PRY	text	X			X	X	O, E, N
Stop Bits	SBT	number	X			X	X	1, 2
Time-Out	TMO	number	X			X	X	0(disabled) - 45:5 (minutes)
Handshaking	HSH	text	X			X	X	NO, SW
Number of Rings Before Answer	NRG	number	X			X	X	2 - 15
Write Enable	WRE	number	X			X	X	0:disable 1:enable (HW,SW)
Modem Initialization String	INS	text	X			X	X	up to 40 characters “” assigns the default string
SNMP Destination		SND						
Identifier	IDE	text						Sn (1 - 4)
Description	DES	text	X			X	X	SNMP Trap Destination n (1-4)
IP Address	IP	text (IP)	X			X	X	xxx.xxx.xxx.xxx
Community string	CS	text	X			X	X	public
SNMP Community Sting		CS						
Identifier	IDE	text						CSn (1 - 3)
Description	DES	text	X			X	X	SNMP Community String n
Community string	STR	text	X			X	X	CS1 - public CS2 - public-write CS3 - “”
IP address to match	IP	text (IP)	X			X	X	xxx.xxx.xxx.xxx (0.0.0.0 = no match required)
IP address mask	IPM	text (IP)	X			X	X	xxx.xxx.xxx.xxx (255.255.255.255 = match entire IP address)
Write enable	WRE	number	X			X	X	0:disable 1:enable SETs

[38] OPE causes system reboot

[39] not used if DHCP enabled

[40] shows DHCP assigned or static IP address

[41] 0.0.0.0 will force a DNS lookup of “mailhost”

Table 69 Remote Communication Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Local RS-232 Port		LPT						
Identifier	IDE	text						LP1
Description	DES	text	X			X	X	Local Port 1
Status	STT	text						USER, SUPER-USER, ADMINISTRATOR, TL1, LOGOUT
Baudrate	BDR	text	X			X	X	AUTO, 300, 1200, 2400, 4800,9600,19200
Data Bits	DBT	number	X			X	X	7, 8
Parity	PRY	text	X			X	X	O, E, N
Stop Bits	SBT	number	X			X	X	1, 2
Time-Out	TMO	number	X			X	X	0 (disabled) - 45:5 (minutes)
Handshaking	HSH	text	X			X	X	NO, HW, SW
Application	APP	text	X			X	X	TERMINAL, EVENT LOG(HW,SW)
Write Enable	WRE	number	X			X	X	0:disable 1:enable (HW,SW)
Auxiliary Port		AUX						
Identifier	IDE	text						AU1
Description	DES	text	X			X	X	Auxiliary Port 1
Status	STT	text						USER, SUPER-USER, ADMINISTRATOR, TL1, LOGOUT
Baudrate	BDR	text	X			X	X	AUTO, 300, 1200, 2400, 4800,9600,19200
Data Bits	DBT	number	X			X	X	7, 8
Parity	PRY	text	X			X	X	O, E, N
Stop Bits	SBT	number	X			X	X	1, 2
Time-Out	TMO	number	X			X	X	0 (disabled) - 45 (minutes)
Handshaking	HSH	text	X			X	X	NO, SW, HW
Application	APP	text	X			X	X	TERMINAL, TL1, EVENT LOG
Write Enable	WRE	number	X			X	X	0:disable 1:enable (HW,SW)
Port Type	PTT	text	X			X	X	RS232, RS485

Table 70 Configurable Statistics Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
Trend		TRS						
Identifier	IDE	text						DCT1, TRn (1 - 8)
Description	DES	text	X			X	X	DC1 Trend Statistics Trend Statistics n
Source	SRC	text	X			X	X	Any MET attribute path (default: “”)
Busy Hour Statistics		BHS						
Identifier	IDE	text						DCBH1, BHn (1 - 4)
Description	DES	text	X			X	X	DC1 Busy Hour Stats Busy Hour Stats n (1 -4)
Source	SRC	text	X			X	X	Any MET attribute path
Start Date	SDT	date	X			X	X	
Start Hour	SHR	number	X			X	X	0 - 23

Table 71 TL1 Management Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
TL1 Manager		TLM						
Identifier	IDE	text						TLM1
Description	DES	text	X			X	X	TL1 Manager
Activate-User Enable	AUE	number	X			X	X	0:disable 1:enable
CTS Connect Detection	CTS	number	X			X	X	0:disable 1:enable
DSR Connect Detection	DSR	number	X			X	X	0:disable 1:enable
Port	PRT	number	X			X	X	2020
Timeout	TMO	number	X			X	X	0 - 60 (minutes)
TL1 Object		TL1						
Identifier	IDE	text						TLnnn (001 to 256)
Description	DES	text	X			X	X	TL1n
Condition Description	CDS	text	X			X	X	Condition Description
Aid	AID	text	X			X	X	AID1
Condition Type	CND	text	X			X	X	Condition Type
Service Affecting	SAF	number	X			X	X	0:no 1:yes
Reporting	RPT	text	X			X	X	EQUIPMENT, ENVIRONMENT, PRESENCE

Table 72 System Objects and Attributes								
Related Commands								
Attribute	**MNEM**	**Type**	**CHA**	**OPE**	**MET**	**CON**	**BU**	**Value**
User		USR						
Identifier	IDE	text						USRn (01 - 14), ADM1
Description	DES	text	X			X	X	User Account n (1 - 14) Administrator Account
Password	PWD	text	X			X		“” ADM1 - “ADMINISTRATOR”
User name	USR	text	X			X		“” ADM1 - “admin”
Security level	LVL	text	X			X		“”, USER, SUPER-USER, ADMINISTRATOR ADM1 - ADMINISTRATOR
Call Back Security		CBS						
Identifier	IDE	text						CB1
Description	DES	text	X			X	X	Call-Back Security 1
Status	STT	number	X			X	X	0:off 1:on
Call-Back Phone Number	PHn (1-5)	text	X			X	X	digit ( ) * # - , space (default: “”)
Connect Baudrate	BRn (1-5)	number	X			X	X	300, 1200, 2400, 4800, 9600, 19200
Notepad		NPD						
Identifier	IDE	text						UNP, SNP, ENP
Description	DES	text	X			X	X	User Notepad Super-User Notepad Easy View Notepad
Notify State	STT	number	X			X	X	0:don’t notify 1:notify
Comment Line	CLnn (01-15)	text	X			X	X	“”
Alarm Cut Off		ACO						
Identifier	IDE	text						ACO1
Description	DES	text	X			X	X	Alarm Cut-off
Status	STT	number		X		X		0:disable 1:enable
Critical ACO State	CST	number						0:inactive 1:active
Critical ACO Enable	CAE	number	X			X	X	0:disable 1:enable
Critical ACO Timeout	CTO	number	X			X	X	1 - 4 (hours)
Major ACO State	JST	number						0:inactive 1:active
Major ACO Enable	JAE	number	X			X	X	0:disable 1:enable
Major ACO Timeout	JTO	number	X			X	X	1 - 4 (hours)
Minor ACO State	NST	number						0:inactive 1:active
Minor ACO Enable	NAE	number	X			X	X	0:disable 1:enable
Minor ACO Timeout	NTO	number	X			X	X	1 - 72:8 (hours)
Local Buzzer Enable	LBE	number	X			X	X	0:disable 1:enable
Alarm Sub-Objects								
ACO Active	AAC	attrl						AAC1
User Defined Object		UDO						
Identifier	IDE	text						Onnn (1-100)
Description	DES	text	X			X	X	User Object n

User Defined Object Build example

Users “build” their user defined objects by following the example below:

Command	Comment
ADD UDO,CELL1	- Add a user defined object called CELL1 to the system
ADD CELL1,TEMP	- Add the attribute TEMP to CELL1
LIN CELL1 TEMP,C701	- Link a temperature monitor channel to CELL1 TEMP

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Factory Defaults

Network Settings

See the Network Access - LAN (Gateway) section in Features Reference.

DHCP mode	Client
IP Address	
DHCP Client mode	(automatically assigned by the network)
DHCP Server mode	192.168.2.1
DHCP Static mode	0.0.0.0 must be configured as instructed by the customer's network administrator for operation in DHCP Static mode.
Gateway IP Address	0.0.0.0 must be configured as instructed by the customer's network administrator for operation in DHCP Static and Client modes.
Subnet Mask	255.255.255.0 must be configured as instructed by the customer's network administrator for operation in DHCP Static and Client modes.
Host Name	blank
Domain Name	blank

DIP Switch Settings

MSC has 8 DIP switch positions (SW202) that may be changed. SW202 is located on the MCR1B card. (See Figure 55)

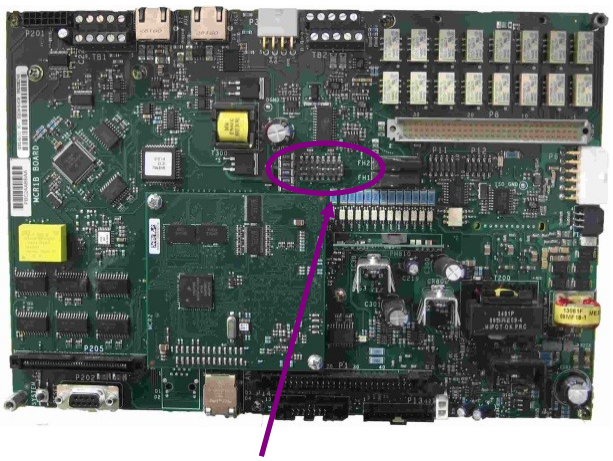

Figure 55 DIP Switches

Table 73 MSC DIP Switch Settings				
Switch Position	**Default**	**Description**	**Closed (1)**	**Open (0)**
SW202-8	1	Front Panel Configuration	ENABLED	DISABLED
SW202-7	0	Modem/Aux/Local/Gateway/USB/IRDA Port Setting Configuration (Remote Access)	ENABLED	DISABLED
SW202-6	0	Enhanced Security Mode (See table 4-H, for features affected)	ENABLED	DISABLED
SW202-5	1	Auxiliary Port Configuration	RS-232	RS-485
SW202-4	1	Remote Rectifier in Standby	ENABLED	DISABLED
SW202-3	1	Boost Mode	ENABLED	DISABLED
SW202-2	1	Reserved for Future Use	ENABLED	DISABLED
SW202-1	1	Reserved for Future Use	ENABLED	DISABLED

Table 74 Enhanced Remote Security Features
The modem and auxiliary ports can be configured for full access and read-only using DIP switch 202-7. Restricted access is also available. This prevents changes in the modem and auxiliary ports that will affect the state of the plant, even when logged in as a Super-User or Administrator. This enhanced remote security is enabled and disabled with DIP switch SW202-6. The functions and parameters restricted with the enhanced remote security feature are listed in this table.
Enable or disable Rectifier Restart feature
Change All Rectifier On Threshold
Change Timed Manual Boost Duration
Change Boost Current Threshold
Change Rectifier Status to “Standby”/ “Vacant” status is prohibited. The change to “On” status is allowed.
Change Rectifier Shunt Voltage configuration
Change Rectifier Float High Voltage Shutdown Threshold
Change Rectifier Boost High Voltage Shutdown Threshold
Change Rectifier Float Set Point
Change Rectifier Boost Set Point
Change Rectifier Boost Current Limit
Change Converter Voltage Set-Point
Change Converter Low Voltage Disconnect Threshold
Change Converter Low Voltage Reconnect Threshold
Enable or disable Converter Low Voltage Disconnect feature
Change Converter Status to “Standby”/ “Vacant” status is prohibited. The change to “On “status is allowed.
Change Battery High Temperature Threshold
Enable or disable Battery Current Limit
Change Battery Limit Threshold
Change Battery Contactor Status to “Open” status is prohibited. The change to “Close” status is allowed.

Table 74 Enhanced Remote Security Features
Change Battery Disconnect Threshold
Change Battery Reconnect Threshold
Change Very Low Voltage Alarm Threshold and Severity
Change Multiple Rectifier Fail Alarm Threshold and Severity
Change Limited Recharge Current Alarm Threshold and Severity
Change Excess Rectifier Drain Alarm Threshold and Severity
Change Engine Transfer Timeout Alarm Threshold and Severity
Change Reserve Time Low Alarm Threshold and Severity
Change Multiple Converter Fail Alarm Threshold and Severity
Change Battery On Discharge Alarm Threshold and Severity

Voltage Threshold Ranges and Default Values

Table 75 Voltage Threshold Ranges and Default Values			
Threshold	**Low**	**High**	**Default**
Very Low Voltage (VLV)			
24V	20.00	25.50	23.00
48V	40.00	51.00	46.00
Battery on Discharge (BD)			
24V Float	23.00	28.00	25.00
24V Boost	23.00	28.00	25.00
48V Float	46.00	55.00	51.00
48V Boost	46.00	55.00	51.00
High Float Voltage (HFV)			
24V Float	24.75	29.75	26.50
24V Boost	25.75	31.75	26.50
48V Float	50.00	60.00	53.00
48V Boost	52.00	60.00	53.00
High Voltage Shutdown Alarm (HV)			
24V Float	24.75	29.75	26.8
24V Boost	25.75	31.75	26.8
48V Float	50.00	60.00	53.6
48V Boost	52.00	60.00	53.6
Rectifier On Threshold (ROT)			
24V	20.00	25.00	22.00
48V	40.00	51.00	44.00

Controller Alarm Severity, LED and Relay Default Values

Table 76 Controller Alarm Severity, LED and Relay Default Values				
Symbol	**Default Designation**	**Default Severity**	**Default LED**	**Default Relay**
AAC	ACO Active	RO	None	None
ABS	Alarm Battery Supply Fuse	Major	CTLR	CTLR
AMJ	Auxiliary Major	Major	None	None
AMN	Auxiliary Minor	Minor	None	None
ATA	Alarm Test Active	RO	None	None
ATB	Alarm Test Aborted	RO	None	None
ATF	Alarm Test Failed	Warning	None	None
BBL	Memory Backup Battery Low	Warning	None	None
BCA	Battery Type Conflict	Warning	None	None
BDA	Battery on Discharge	Major	BD	BD
BFA	Battery Test Failed	Minor	BAT	None
BID	Bay Interface ID Conflict	Major	CTLR	CTLR
BTA	Battery Test Active	RO	BD	BD
BTJ	Battery Thermal Major	Major	BAT	None
BTN	Battery Thermal Minor	Minor	BAT	None
CCH	Configuration Changed	RO	None	None
CDFA	Converter Distribution Fuse	Major	RECT	MJF
CDID	Converter ID Conflict	Major	RECT	None
CFA	Converter Fail	Minor	RECT	None
CLC	Clock Changed	RO	None	None
CMA	Minor Communications Failure	Minor	CTLR	None
CMFA	Multiple Converter Fail	Major	RECT	None
CNF1	Contactor 1 Failed	Major	BAT	None
CNF2	Contactor 2 Failed	Major	BAT	None
CNF3	Contactor 3 Failed	Major	BAT	None
CNO1	Contactor 1 Open	Major	BAT	None
CNO2	Contactor 2 Open	Major	BAT	None
CNO3	Contactor 3 Open	Major	BAT	None
COF	Queue Overflow	Warning	None	None
COR	Number Did Not Respond	Warning	None	None
CPA	Circuit Pack Fail	Major	CTLR	CTLR
CRA	Controller Fail	Major	CTLR	CTLR
DID	Rectifier ID Conflict	Major	RECT	None
EMD	Energy Management Disabled	Warning	None	None

Table 76 Controller Alarm Severity, LED and Relay Default Values				
Symbol	**Default Designation**	**Default Severity**	**Default LED**	**Default Relay**
EPD	Excess Plant Drain	Minor	RECT	None
EPO	Emergency Power Off	Critical	BATT	None
EPR	External Password Reset	Warning	None	None
ETO	Engine Transfer Timeout	Minor	AC	None
EXL	Excessive Login Attempts	Warning	None	None
FAJ	External Fuse Major	Major	DIST	MJF
FAN	External Fuse Minor	Minor	DIST	MNF
HCL	History Cleared	RO	None	None
HFV	High Float Voltage	Minor	RECT	None
HVA	High Voltage	Major	RECT	HV
LMR	Limited Recharge	Minor	RECT	None
LVD	Low Voltage Disconnect	Minor	BAT	None
LVDA	Low Voltage Disconnect Fail	Minor	BAT	None
MCM	Major Communication Fail	Minor	CTLR	None
MDF	Module Failure	Minor	RM	None
MOR	Measurement Out Of Range	Minor	RM	None
MTC	Module Type Conflict	Warning	None	None
NNC	Number Not Configured	Warning	None	None
OSA	Open String	Minor	BAT	None
PFD	Password At Default	Warning	None	None
PGI	Program Line Invalid	Major	None	None
PHT	Processor Halt	RO	None	None
POR	Number Did Not Respond	Warning	None	None
RLS1	Redundancy Loss	Minor	RECT	None
RPI	Rectifier/Plant Inconsistency	Warning	None	None
RTL	Reserve Time Low	Minor	BAT	None
SNC	Shunt Not Configured	Warning	None	None
STF	Self Test Failed	Minor	CTLR	CTLR
TPA	Thermal Probe Failure	Minor	CTLR	CTLR
URC	User Relay Conflict	Warning	None	None
VLA	Very Low Voltage	Critical	BAT	UR3
VSF	Sense/Control Fuse	Major	CTLR	CTLR
ZID	ID Not Configured	Major	RECT	None

Table 77 Rectifier Alarm Defaults				
Symbol	**Default Designation**	**Default Severity**	**Default LED**	**Default Relay**
ACF	AC Fail	Minor	AC	ACF
CLM	Rectifier Current Limit	RO	None	None
ERD	Excess Rectifier Drain	Minor	RECT	None
ETS	External Transfer Shutdown	Minor	RECT	None
HPA	Half Power	Minor	RECT	None
LCA	Low Current Alarm	Minor	RECT	None
LSF	Load Share Fuse	Minor	RECT	None
MACF	Multiple AC Fail	Major	AC	ACF
MAN	Manual Off	Minor	RECT	None
MFA	Multiple Rectifier Fail	Major	RECT	RFA
MMAN	Multiple MAN Alarm	Major	RECT	None
PHA	Phase Or Low Output	Minor	AC	None
RIC	Rectifier Incomplete Config	Warning	None	None
RFA	Rectifier Fail	Minor	RECT	RFA

Spare and Replacement Parts

Use only replacement parts listed in this manual and on the equipment drawings.
The following table lists the spare parts available for the MSC Model J2011002.

Table 78 MSC Spare and Replacement Parts	
Ordering code	**Part Description**
CC109130630	MCR1B/MCR2B Cards (May not be ordered separately)
CC109170123	BSL-3_MSC Alarm Card
CC109170131	BSL-4_MSC Alarm Card
CC109112257	BSM6 Modem Card
CC109169826	MSCB_FB Fuse Board
download	Easy View Software Package
406530725	1-1/3 A fuse (GMT)
406204230	3 A fuse (GMT)
405298308	Terminating Resistor for RPM
406712968	406712968 Inductor Bead for RPM
107330946	Galaxy SC Controller Product Manual (Old Controller)
J85501P1L22	Display assembly for MSC
230707-1	Punch down terminal insulating caps

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Alarm and Control Signals Cross Reference

These tables provide cross references to alarm and control signals on existing Galaxy SC, MCS, CCS, or ECS-12U controllers.

When replacing an existing controller these tables assist in determining how to transfer alarm and control signal wiring from the existing controller to the MSC.

Table 35 Alarm and Control - Signal Names and BSL Pins

Table 36 Alarm - Descriptions, BLS Pins, and Signal Names

Table 37 Alarm and Control Inputs

Table 38 TR Leads and Associated Rectifiers

Table 79 Galaxy SC Wiring Plan & Cross Reference

Table 80 MCS/CCS Wiring Plan & Cross Reference

Table 81 ECS - 12U Wiring Plan & Cross Reference

Table 79 Galaxy SC Wiring Plan & Cross Reference				
Galaxy SC Controller J85501F1			MSC Controller	
TB - Pin	**Wire Color**	**Signal Name[42]**	**TB - Pin**	**Signal Name[43]**
TB2 - 1		PCR - AC	BSL - 2	PCRAC
TB2 - 2		PCR - VC	BSL - 5	PCRVC
TB2 - 3		PCR - EC	BSL - 8	PCREC
TB2 - 4		PMJ - AC	BSL - 11	PMJAC
TB2 - 5		PMJ - VC	BSL - 17	PMJVC
TB2 - 6		PMJ - EC	BSL - 14	PMJEC
TB2 - 7		PMN - AC	BSL - 20	PMNAC
TB2 - 8		PMN - VC	BSL - 23	PMNVC
TB2 - 9		PMN - EC	BSL - 29	PMNEC
TB2 - 10		SI(C)C		none
TB2 - 11		MNFC	BSL - 35	MNFC
TB2 - 12		MJFC	BSL - 32	MJFC
TB2 - 13		BDC	BSL - 38	BDC
TB2 - 14		ACFC	BSL - 41	ACFC
TB2 - 15		RFAC	BSL - 44	RFAC
TB2 - 16		VLVC	BSL - 59	VLVC
TB2 - 17		PCR - AR	BSL - 3	PCRAR
TB2 - 18		PCR - VR	BSL - 4	PCRVR
TB2 - 19		PCR - ER	BSL - 9	PCRER
TB2 - 20		PMJ - AR	BSL - 10	PMJAR
TB2 - 21		PMJ - VR	BSL - 16	PMJVR
TB2 - 22		PMJ - ER	BSL - 15	PMJER
TB2 - 23		PMN - AR	BSL - 21	PMNAR
TB2 - 24		PMN - VR	BSL - 22	PMNVR
TB2 - 25		PMN - ER	BSL - 28	PMNER
TB2 - 26		SI(R)C		none
TB2 - 27		MNFR	BSL - 34	MNFR
TB2 - 28		MJFR	BSL - 33	MJFR
TB2 - 29		BDR	BSL - 39	BDR
TB2 - 30		ACFR	BSL - 40	ACFR
TB2 - 31		RFAR	BSL - 45	RFAR
TB2 - 32		VLVR	BSL - 58	VLVR
TB2 - 33		PCR - AO	BSL - 1	PCRAO
TB2 - 34		PCR - VO	BSL - 6	PCRVO
TB2 - 35		PCR - EO	BSL - 7	PCREO
TB2 - 36		PMJ - AO	BSL - 12	PMJAO
TB2 - 37		PMJ - VO	BSL - 18	PMJVO

[42] Galaxy SC “Closed on Alarm”, “Return”, and “Open on Alarm” signals are named here as ...C”, “...R”, and “...O” respectively.

[43] Note: BSL3_MSC has an “E” prefix before each pin number in (). The BSL4_MSC does not.

Table 79 Galaxy SC Wiring Plan & Cross Reference				
Galaxy SC Controller J85501F1			MSC Controller	
TB - Pin	**Wire Color**	**Signal Name[42]**	**TB - Pin**	**Signal Name[43]**
TB2 - 38		PMJ - EO	BSL - 13	PMJEO
TB2 - 39		PMN - AO	BSL - 19	PMNAO
TB2 - 40		PMN - VO	BSL - 24	PMNVO
TB2 - 41		PMN - EO	BSL - 30	PMNEO
TB2 - 42		ALRMD		none
TB2 - 43		MNFO	BSL - 36	MNFO
TB2 - 44		MJFO	BSL - 31	MJFO
TB2 - 45		BDO	BSL - 37	BDO
TB2 - 46		ACFO	BSL - 42	ACFO
TB2 - 47		RFAO	BSL - 43	RFAO
TB2 - 48		VLVO	BSL - 60	VLVO
TB3 - 1		HVC	BSL - 47	HVC
TB3 - 2		CTLRC	BSL - 53	CTLRC
TB3 - 3		UR1C	BSL - 50	UR1C
TB3 - 4		UR2C	BSL - 56	UR2C
TB3 - 5		FAJ	BSL - 63	FAJ
TB3 - 6		FAN	BSL - 65	FAN
TB3 - 7		OS	BSL - 72	OS
TB3 - 8		TR1	BSL - 73	TR1
TB3 - 9		TR2	BSL - 79	TR2
TB3 - 10		TR3	BSL - 85	TR3
TB3 - 11		TR4	BSL - 80	TR4
TB3 - 12		ETR	Not used[44]	Not used[44]
TB3 - 13		ETRR	Not used[44]	Not used[44]
TB3 - 14		RO	BSL - 77	RO
TB3 - 15		ROR	BSL - 78	ROR
TB3 - 16		LVDF	BSL - 84	LVD1
TB3 - 17		HVR	BSL - 46	HVR
TB3 - 18		CTLRR	BSL - 52	CTLRR
TB3 - 19		UR1R	BSL - 51	UR1R
TB3 - 20		UR2R	BSL - 57	UR2R
TB3 - 21		AMJ	BSL - 64	AMJ
TB3 - 22		AMN	BSL - 66	AMN
TB3 - 23		TFLT	BSL - 67	TFLT
TB3 - 24		TRTN	BSL - 69	TRTN
TB3 - 25		BTJR		none
TB3 - 26		BRNR		none
TB3 - 27		BTPR		none
TB3 - 28		BT1		none

[44] RO / ROR is the only signal used by MSC for internal rectifier signaling. ERT / ETRR is no longer required.

Table 79 Galaxy SC Wiring Plan & Cross Reference				
Galaxy SC Controller J85501F1			MSC Controller	
TB - Pin	**Wire Color**	**Signal Name[42]**	**TB - Pin**	**Signal Name[43]**
TB3 - 29		BTPDG		Use DG
TB3 - 30		ABS1	BSL - 93	ABS
TB3 - 31		ABS3	BSL - 93	ABS
TB3 - 32		OPT1		none
TB3 - 33		HVO	BSL - 48	HVO
TB3 - 34		CTLRO	BSL - 54	CTLRO
TB3 - 35		UR1O	BSL - 49	UR1O
TB3 - 36		UR2O	BSL - 55	UR2O
TB3 - 37		LVD	BSL - 84	LVD1
TB3 - 38		LVDR		LVDR
TB3 - 39		TBST	BSL - 68	TBST
TB3 - 40		TEQ		none
TB3 - 41		BTJ		none
TB3 - 42		BTN		none
TB3 - 43		BTP	BSL - 83	IN - 2 (BTP)
TB3 - 44		BTPFLT	BSL - 89	IN - 3 (BTPFLT)
TB3 - 45		BTPDB		none
TB3 - 46		ABS2	BSL - 94	ABS
TB3 - 47		ABS4	BSL - 94	ABS
TB3 - 48		OPT2		None
			BSL - 95	DG
			BSL - 96	DG
P500 - 1		THERMA	TB2 - 4	THERMINA
P500 - 2		THERMB	TB2 - 5	THERMINB
P500 - 3		RCPP	TB2 - 3	RCPP
P500 - 4		RCPPR	TB2 - 6	RCPP2

Table 80 MCS/CCS Wiring Plan & Cross Reference				
MCS/CCS J85501A - 1, 2, 3			MSC	
TB - Pin	**Wire Color**	**Signal Name**	**TB - Pin**	**Signal Name**
TB1 - 1		UPF	BSL - 53	CTRLC
TB1 - 2		UPF A	BSL - 52	CTLRR
TB1 - 3		EQ	BSL - 74	TEQ
TB1 - 4		EQR	BSL - 69	TRTN
TB1 - 5		SI (A)[45]	BSL - 38	BDC[45]
TB1 - 6		SIR (A)	BSL - 39	BDR
TB1 - 7		SI (B)	BSL - 47	HVC
TB1 - 8		SIR (B)	BSL - 46	HVR
TB1 - 9		SI (C)	none	none
TB1 - 10		SIR (C)	none	none
TB1 - 11		SI (D)	BSL - 59	VLVC
TB1 - 12		SIR (D)	BSL - 58	VLVR
TB1 - 13		SI (E)	BSL - 32	MJFC
TB1 - 14		SIR (E)	BSL - 33	MJFR
TB1 - 15		SI (F)	BSL - 30	PMNEO
TB1 - 16		SIR (F)	BSL - 28	PMNER
TB1 - 17		SI (G)	BSL - 13	PMJEO
TB1 - 18		SIR (G)	BSL - 15	PMJER
TB1 - 19		FAN	BSL - 65	FAN
TB1 - 20		FAJ	BSL - 63	FAJ
TB1 - 21		ABS0	BSL - 93	ABS
TB1 - 22		FG	Chassis Lug or FG	Chassis Lug or FG
TB1 - 23		ABS1	BSL - 94	ABS
TB1 - 24		A	none	none
TB1 - 25		ABS2	BSL - 93	ABS
TB1 - 26		D	none	none
TB1 - 27		ABS3	BSL - 94	ABS
TB1 - 28		BD[45]	BSL - 38 BSL - 39 BDR must be grounded	BDC[45]
TB1 - 29		TR1	BSL - 73	TR1
TB1 - 30		TR2	BSL - 79	TR2
TB1 - 31		TR3	BSL - 85	TR3
TB1 - 32		TR4	BSL - 80	TR4
TB1 - 33		PMN	BSL - 20	PMNAC
TB1 - 34		PMNR	BSL - 21	PMNAR
TB1 - 35		PMNV	BSL - 23	PMNVC
TB1 - 36		PMNVR	BSL - 22	PMNVR

[45] MCS/CCS alarms “SI (A)” and “BD” are mutually exclusive when mapped to the Millennium SC controller. Only one may be connected.

Table 80 MCS/CCS Wiring Plan & Cross Reference				
	MCS/CCS J85501A - 1, 2, 3		MSC	
TB - Pin	**Wire Color**	**Signal Name**	**TB - Pin**	**Signal Name**
TB1 - 37		PMJ	BSL - 11	PMJAC
TB1 - 38		PMJR	BSL - 10	PMJAR
TB1 - 39		PMJV	BSL - 17	PMJVC
TB1 - 40		PMJVR	BSL - 16	PMJVR
TB2 - RB		RB	TB100 - RB	RB
TB2 - DB		DB	TB100 - BAT	BAT
TB2 - DG		DG	TB100 - DG & TB100 - DG2	DG & DG2[46]
TB2 - RG		RG	TB100 - RG	RG
TB2 - SH+		SH+	TB100 - SH+	SH+
TB2 - SH-		SH-	TB100 - SH-	SH-

[46] Wire DG and DG2 discharge grounds separately to provide maximum meter accuracy. If this is not possible, install a jumper between DG and DG2 terminals.

Table 81 ECS - 12U Wiring Plan & Cross Reference				
	ECS - 12U J85501E 2		MSC	
TB - Pin	Wire Color	Signal Name[47]	BSL Pin	Signal Name
TB101 - 1				
TB101 - 2		TF / ER	69	TRTN
TB101 - 3		OS	72	OS
TB101 - 4		RMN	66	AMN
TB101 - 5		RMJ	64	AMJ
TB101 - 6		TEQ	74	IN-4 (TEQ)
TB101 - 7		TFL	67	TFLT
TB101 - 8		ABS	93, 94	ABS
TB101 - 9		TR1	73	TR1
TB101 - 10		TR2	79	TR2
TB101 - 11		TR3	85	TR3
TB101 - 12		TR4	80	TR4
TB102 - 1		BDEC	38	BDC
TB102 - 2		BDER	39	BDR
TB102 - 3		BDEO	37	BDO
TB102 - 4		HVEC	47	HVC
TB102 - 5		HVER	46	HVR
TB102 - 6		HVEO	48	HVO
TB102 - 7		ACFC	41	ACFC
TB102 - 8		ACFR	40	ACFR
TB102 - 9		ACFO	42	ACFO
TB103 - 1		PMNAC	20	PMNAC
TB103 - 2		PMNAR	21	PMNAR
TB103 - 3		PMNAO	19	PMNAO
TB103 - 4		PMNEC	29	PMNEC
TB103 - 5		PMNER	28	PMNER
TB103 - 6		PMNEO	30	PMNEO
TB103 - 7		MNFEC	35	MNFC
TB103 - 8		MNFER	34	MNFR
TB103 - 9		MNFEO	36	MNFO
TB103 - 10		PMNVC	23	PMNVC
TB103 - 11		PMNVR	22	PMNVR
TB103 - 12		PMNVO	24	PMNVO
TB103 - 13		PMJAC	11	PMJAC
TB104 - 1		PMJAR	10	PMJAR
TB104 - 2		PMJAO	12	PMJAO
TB104 - 3		PMJEC	14	PMJEC
TB104 - 4		PMJER	15	PMJER
TB104 - 5		PMJEO	13	PMJEO
TB104 - 6		PMJVC	17	PMJVC
TB104 - 7		PMJVR	16	PMJVR
TB104 - 8		PMJVO	18	PMJVO
TB104 - 9		MJFEC	32	MJFC
TB104 - 10		MJFER	33	MJFR
TB104 - 11		MJFEO	31	MJFO

[47] Galaxy SC “Closed on Alarm”, “Return”, and “Open on Alarm” signals are named here as ...C”, “...R”, and “...O” respectively.

Table 82 Wiring Transfer Plan - Other Controller				
Controller being Replaced			MSC	
TB - Pin	Wire Color	Signal Name[48]	TB Pin	Signal Name
			BSL - 1	PCRAO
			BSL - 2	PCRAC
			BSL - 3	PCRAR
			BSL - 4	PCRVR
			BSL - 5	PCRVC
			BSL - 6	PCRVO
			BSL - 7	PCREO
			BSL - 8	PCREC
			BSL - 9	PCRER
			BSL - 10	PMJAR
			BSL - 11	PMJAC
			BSL - 12	PMJAO
			BSL - 13	PMJEO
			BSL - 14	PMJEC
			BSL - 15	PMJER
			BSL - 16	PMJVR
			BSL - 17	PMJVC
			BSL - 18	PMJVO
			BSL - 19	PMNAO
			BSL - 20	PMNAC
			BSL - 21	PMNAR
			BSL - 22	PMNVR
			BSL - 23	PMNVC
			BSL - 24	PMNVO
			BSL - 25	5V
			BSL - 26	none
			BSL - 27	none
			BSL - 28	PMNER
			BSL - 29	PMNEC
			BSL - 30	PMNEO
			BSL - 31	MJFO
			BSL - 32	MJFC
			BSL - 33	MJFR
			BSL - 34	MNFR
			BSL - 35	MNFC
			BSL - 36	MNFO
			BSL - 37	BDO
			BSL - 38	BDC
			BSL - 39	BDR
			BSL - 40	ACFR
			BSL - 41	ACFC
			BSL - 42	ACFO

[48] Galaxy SC “Closed on Alarm”, “Return”, and “Open on Alarm” signals are named here as ...C”, “...R”, and “...O” respectively.

Table 82 Wiring Transfer Plan - Other Controller				
Controller being Replaced			MSC	
TB - Pin	Wire Color	Signal Name[48]	TB Pin	Signal Name
			BSL - 43	RFAO
			BSL - 44	RFAC
			BSL - 45	RFAR
			BSL - 46	HVR
			BSL - 47	HVC
			BSL - 48	HVO
			BSL - 49	UR1O
			BSL - 50	UR1C
			BSL - 51	UR1R
			BSL - 52	CTLRR
			BSL - 53	CTLRC
			BSL - 54	CTLRO
			BSL - 55	UR2O
			BSL - 56	UR2C
			BSL - 57	UR2R
			BSL - 58	VLVR (UR3R)
			BSL - 59	VLVC (UR3O)
			BSL - 60	VLVO (UR3O)
			BSL - 61	LVD2
			BSL - 62	LVD2R
			BSL - 63	FAJ
			BSL - 64	AMJ
			BSL - 65	FAN
			BSL - 66	AMN
			BSL - 67	TFLT
			BSL - 68	TBST
			BSL - 69	TRTN
			BSL - 70	PBTR
			BSL - 71	PBT
			BSL - 72	OS
			BSL - 73	TR1
			BSL - 74	TEQ
			BSL - 75	IN-5
			BSL - 76	IN-5R
			BSL - 77	RO
			BSL - 78	ROR
			BSL - 79	TR2
			BSL - 80	TR4
			BSL - 81	RBRPO
			BSL - 82	I/O-1
			BSL - 83	IN-2 (BTP)
			BSL - 84	LVD1
			BSL - 85	TR3
			BSL - 86	-
			BSL - 87	4-20mA

Table 82 Wiring Transfer Plan - Other Controller				
Controller being Replaced			MSC	
TB - Pin	**Wire Color**	**Signal Name[48]**	**TB Pin**	**Signal Name**
			BSL - 88	4-20mA-R
			BSL - 89	IN-3 (BTPFLT)
			BSL - 90	USE3DETECT/BTMJ
			BSL - 91	EXT-V
			BSL - 92	EXT-VR
			BSL - 93	ABS
			BSL - 94	ABS
			BSL - 95	DG
			BSL - 96	DG
		RB	TB100 - RB	RB
		DB	TB100 - BAT	BAT
		DG	TB100 - DG & TB100 - DG2	DG & DG2[49]
		RG	TB100 - RG	RG
		SH+	TB100 - SH+	SH+
		SH-	TB100 - SH -	SH-

[49] Wire DG and DG2 discharge grounds separately to provide maximum meter accuracy. If this is not possible, install a jumper between DG and DG2 terminals.

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Safety

Safety Statements

Read and follow all safety instructions and warnings before installing, maintaining, or repairing the equipment. Refer to individual equipment product manuals for additional safety statements specific to equipment being installed, removed, or replaced.

See the Specifications section for equipment specific

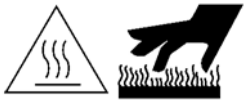
- Safety Compliance information
- Installation Area Limitations
- Environmental Limitations

- Do not install this equipment over combustible surfaces.
- For installations in the U. S. or Canada, use Listed/Certified compression connectors to terminate Listed/Certified field-wire conductors where required. For all installations, apply the appropriate connector to the correct size conductor as specified by the connector manufacturer, using only the connector manufacturer's recommended or approved tooling for that connector.
- If the proper connector for the country of installation is not provided, obtain appropriate connectors and follow manufacturer's requirements and all local requirements for proper connections.
- Follow all national and local rules and regulations when making field connections.
- Torque electrical connections to the values specified on labels or in the product documentation.
- DC output cables must be dressed to avoid damage to the conductors (caused by routing around sharp edges or routing in areas where wires could get pinched) and undue stress on the connectors.
- External protectors (fuses or circuit breakers) must be sized as required by the National Electric Code (NEC) and/or local codes. Refer to the equipment ratings to assure current does not exceed:
  Continuous Load (List 1) - 64% of protector rating

  Maximum Load (List 2 - typically end of discharge) - 80% of protector rating.
- Insulation on field-wired conductors must be rated no less than 90°C. Size conductors based on listed recommendations. Wiring internal to enclosed equipment cabinets must be rated at 105°C (minimum).
- Provide an accessible AC disconnect/protection device to remove AC power from the equipment in the event of an emergency. This device must open all poles and be connected together.
- Alarm contacts are not fused within the equipment. Current limiting protection for these contacts must be provided by external circuits. Exceeding these maximum ratings could result in fire or damage to the unit. See the Specifications section for alarm contacts ratings.
- In enclosed equipment cabinets, the equipment chassis must be connected directly to the cabinet ac service ground bus. For applications in huts, vaults, and central offices, the equipment chassis must be connected to the system bonding network.
- Use only GMT fuses provided with safety caps.

Warning Statements and Safety Symbols

The symbols may sometimes be accompanied by some type of statement; e.g., “Hazardous voltage/energy inside, or Risk of injury. This unit must be accessed only by qualified personnel.” Signal words as described below may also be used to indicate the level of hazard.

DANGER	Indicates the presence of a hazard that will cause death or severe personal injury if the hazard is not avoided.
WARNING	Indicates the presence of a hazard that can cause death or severe personal injury if the hazard is not avoided.
CAUTION	Indicates the presence of a hazard that will or can cause minor personal injury or property damage if the hazard is not avoided.
	This symbol identifies the need to refer to the equipment instructions for important information.
	These symbols (or equivalent) are used to identify the presence of hazardous ac mains voltage.
	This symbol is used to identify the presence of hazardous ac or dc voltages. It may also be used to warn of hazardous energy levels.
	One of these two symbols (or equivalent) may be used to identify the presence of rectifier and battery voltages. The symbol may sometimes be accompanied by some type of statement, for example: “Battery voltage present. Risk of injury due to high current. Avoid contacting conductors with uninsulated metal objects. Follow safety precautions.”
	One of these two symbols may be used to identify the presence of a hot surface. It may also be accompanied by a statement explaining the hazard. A symbol like this with a lightning bolt through the hand also means that the part is or could be at hazardous voltage levels.
	This symbol is used to identify the protective safety earth ground for the equipment.
	This symbol is used to identify other bonding points within the equipment.
	This symbol is used to identify the need for safety glasses and may sometimes be accompanied by some type of statement, for example: “Fuses can cause arcing and sparks. Risk of eye injury. Always wear safety glasses.”

Precautions

Precautions and proper methods for handling related equipment is in their manuals.

The following precautions apply when working on or using this type of equipment:

- This unit must be installed, serviced, and operated only by skilled and qualified personnel who have the necessary knowledge and practical experience with electrical equipment and who understand the hazards that can arise when working on this type of equipment.
- The equipment could be powered by multiple ac inputs. Ensure that the appropriate circuit protection device for each ac input being serviced is disconnected before servicing the equipment. Do not disconnect permanent bonding provisions unless all ac inputs are disconnected.
- Batteries may be connected in parallel with the output of the rectifiers. Turning off the rectifiers will not necessarily remove power from the bus. Make sure the battery power is also disconnected and/or follow safety procedures while working on any equipment that contains hazardous energy/voltage.
- Hazardous energy and voltages are present in the unit and on the interface cables that can shock or cause serious injury. Follow all safety warnings and practices when servicing this equipment. When equipped with ringer modules, hazardous voltages will be present on the ringer output connectors.
- In addition to proper job training and safety procedures, the following are some basic precautions that must always be used:
    - Use only properly insulated tools.
    - Remove all metallic objects (key chains, glasses, rings, watches, or other jewelry).
    - Wear safety glasses.
    - Test circuits before touching.
    - Lock out and tag circuit breakers/fuses when possible to prevent accidental turn on.
    - Be aware of potential hazards before servicing equipment.
    - Identify exposed hazardous electrical potentials on connectors, wiring, etc. (note the condition of these circuits, especially wiring).
    - Use care when removing or replacing covers; avoid contacting circuits.
    - Use a personal ESD strap when accessing or removing electronic components.
- Electricity produces magnetic fields that can affect implanted medical electronic devices, such as pacemakers. The strength of the magnetic field depends on the amount of current in the circuit, as well as other conditions (such as number of conductors, placement, and distance from the conductor). DC power and distribution systems, including batteries, which are typically used in telecommunications utility rooms, can operate at high current levels. Personnel with electronic medical devices need to be aware of their restrictions when working around electricity.

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Contacts and Warranty

Customer Service Contacts

Customer Service, Customer Training, Technical Support, Product Repair and Return, and Warranty Service

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, please dial +1 877 546 3243 (877 OmniOn) or for all other countries, please call +1 972 244 9288. This number is staffed from 7:00 am to 5:00 pm USA Central Time Zone (GMT -6), Monday through Friday, on normal business days. At other times, this number is still available, but for emergencies only. Services provided include initiating the spare parts procurement process, ordering documents, product warranty administration, and providing other product and service information.

For other customers worldwide the 800 number may be accessed after first dialing the AT&T Direct country code for the country where the call is originating, or you may contact your local field support center or your sales representative to discuss your specific needs.

On-Line Power Systems Product Manuals and Software

Power Systems on-line product manuals and software are available on-line. Software includes Easy View and SNMP MIB.

Product Warranty

A. Seller warrants to Customer only, that:

1. As of the date title to Products passes, Seller will have the right to sell, transfer, and assign such Products and the title conveyed by Seller shall be good;
2. During the warranty period stated in Sub-Article B below, Seller's Manufactured Products (products manufactured by Seller), which have been paid for by Customer, will conform to industry standards and Seller's specifications and shall be free from material defects;
3. With respect to Vendor items (items not manufactured by Seller), Seller warrants that such Vendor items, which have been paid for by Customer, will be free from material defects for a period of sixty (60) days commencing from the date of shipment from Seller's facility.

B. The Warranty Period listed below is applicable to Seller's Manufactured Products furnished pursuant to this Agreement, commencing from date of shipment from Seller's facility, unless otherwise agreed to in writing:

Warranty Period		
Product Type	**New Product**	**Repaired Product***
Central Office Power Equipment**	24 Months	6 Months

* The Warranty Period for a repaired Product or part thereof is six (6) months or, the remainder of the unexpired term of the new Product Warranty Period, whichever is longer.

C. If, under normal and proper use during the applicable Warranty Period, a defect or nonconformity is identified in a Product and Customer notifies Seller in writing of such defect or nonconformity promptly after Customer discovers such defect or nonconformity, and follows Seller's instructions regarding return of defective or nonconforming Products, Seller shall, at its option attempt first to

repair or replace such Product without charge at its facility or, if not feasible, provide a refund or credit based on the original purchase price and installation charges if installed by Seller. Where Seller has elected to repair a Seller's Manufactured Product (other than Cable and Wire Products) which has been installed by Seller and Seller ascertains that the Product is not readily returnable for repair, Seller will repair the Product at Customer's site.

With respect to Cable and Wire Products manufactured by Seller which Seller elects to repair but which are not readily returnable for repair, whether or not installed by Seller, Seller at its option, may repair the cable and Wire Products at Customer's site.

D. If Seller has elected to repair or replace a defective Product, Customer shall have the option of removing and reinstalling or having Seller remove and reinstall the defective or nonconforming Product. The cost of the removal and the reinstallation shall be borne by Customer. With respect to Cable and Wire Products, Customer has the further responsibility, at its expense, to make the Cable and Wire Products accessible for repair or replacement and to restore the site. Products returned for repair or replacement will be accepted by Seller only in accordance with its instructions and procedures for such returns. The transportation expense associated with returning such Product to Seller shall be borne by Customer. Seller shall pay the cost of transportation of the repaired or replacing Product to the destination designated by Customer.

E. Except for batteries, the defective or nonconforming Products or parts which are replaced shall become Seller's property. Customer shall be solely responsible for the disposition of any batteries.

F. If Seller determines that a Product for which warranty service is claimed is not defective or nonconforming, Customer shall pay Seller all costs of handling, inspecting, testing, and transportation and, if applicable, traveling and related expenses.

G. Seller makes no warranty with respect to defective conditions or nonconformities resulting from actions of anyone other than Seller or its subcontractors, caused by any of the following: modifications, misuse, neglect, accident, or abuse; improper wiring, repairing, splicing, alteration, installation, storage, or maintenance; use in a manner not in accordance with Seller's or Vendor's specifications or operating instructions, or failure of Customer to apply previously applicable Seller modifications and corrections. In addition, Seller makes no warranty with respect to Products which have had their serial numbers or month and year of manufacture removed, altered, or experimental products or prototypes or with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like. Seller's warranty does not extend to any system into which the Product is incorporated. This warranty applies to Customer only and may not be assigned or extended by Customer to any of its customers or other users of the Product.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S SOLE AND EXCLUSIVE REMEDY SHALL BE SELLER'S OBLIGATION TO REPAIR, REPLACE, CREDIT, OR REFUND AS SET FORTH ABOVE IN THIS WARRANTY.

Revision

Doc Rev.	Description	Date Dept./Init
1.0	Initial release	April 2012
2.0	Updated as per OmniOn template	05/25/2023
2.1	Updated as per OmniOn template	11/29/2023

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