LINEAGE POWER

Galaxy Rack-Mounted Vector Controller J85501M-1

Product Manual
Select Code 167-792-117
Comcode 108993564
Issue 2
January 2008

Product Manual
Select Code 167-792-117
Comcode 108993564
Issue 2
January 2008

Rack-Mounted Vector Controller
J85501M-1

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

Table of Contents

1 Introduction

2 Product Description

3 Operation

4 Installation and Configuration

5 Troubleshooting

6 Product Warranty

Appendix A Communications

Appendix B T1.317 Objects and Attributes

List of Figures

List of Tables

1 Introduction

General Information

This product manual describes the Lineage Power Galaxy Rack-Mounted Vector Controller, J85501M-1. This controller is an integral part of various Lineage Power FMS (H569-462) (Frame-Mounted System). It can also be integrated into other standard frame applications utilizing various PXS and FMS system components. The controller provides control and alarm monitoring functions over an RS-485 interface that interconnects system rectifiers, converters and other devices. Control includes the setting of converter output voltage, rectifier output voltage, current limit, high voltage shutdown, rectifier restart, sequencing and boost mode. Versions of the J85501M-1 Vector Controller are available for both +24Vdc and -48Vdc systems for standard 23 and 26-inch frames.

The following Lineage Power rectifiers can interface with the Galaxy Vector Controller:

Model	Vdc	Current
570A	-48V	100A
595A, 595B, 595C	-48V	200A
596A / 596D	-48V	50A / 100A
596B	+24V	100A / 125A
596F	+24V	100A
NP	+24V / -48V	24-50A
AC3000	-48V	60A

In addition to rectifier and converter control, the J85501M-1 Vector Controller provides:

- Front panel alarm and plant status
- Form C or transfer type alarm contacts
- Modem or network remote access
- Low voltage disconnect
- Local RS-232 access

This manual describes the basic features, operation, installation and configuration, acceptance testing, troubleshooting, and repair of the J85501M-1 Galaxy Vector Controller.

Customer Service Contacts

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

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-THE-1PWR (1-800-843-1797). This number is staffed from 7:00 am to 5:00 pm Central Time (zone 6), Monday through Friday, on normal business days. At other times this number is still available, but for emergencies only. Services provided through this contact 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.

Customer Training

Lineage Power offers customer training on many Power Systems products. For information call 1-972-284-2163. This number is answered from 8:00 a.m. until 4:30 p.m., Central Time Zone (Zone 6), Monday through Friday.

Downloads and Software

To download the latest product information, product software and software upgrades, visit our web site at http://www.lineagepower.com

2 Product Description

Overview

The J85501M-1 Vector Controller (Figure 2-1) is a 1U rack-mounted controller designed for standard 23 and 26-inch frames. 19-inch versions are also in development. All I/O connections and operations can be accessed and performed from the front of the unit. List 1 and List 2 are full-feature display controllers. List 3 and List 4 have LED status displays. All units are front accessible and available in both +24V and -48V versions. Consult customer service for -24V applications. Remote access using a modem or network card is available. Basic controller specifications are summarized in the following table.

Table 2-A: J85501M-1 Galaxy Vector Controller Specifications

	List2, List 4 GCM2	List 1, List 3 GCM3
Input voltage range	19 - 30V	36 - 60V
Maximum input power	4.5W	
Form C Alarm contact ratings	60V at 0.3A	
Plant voltage measurement accuracy (±.05% of full scale + 1 count)	±30mV	±40mV
Plant voltage measurement resolution	.01V	
Plant current measurement accuracy	±1% of full scale	
Plant current measurement resolution	1A	
Thermistor temperature measurement accuracy	• ±3°C for battery temperatures from -5°C to +55°C • ±5°C for battery temperatures from -10°C to -5°C • ±5°C for battery temperatures from +55°C to +85°C+	
Operating temperature range	-40°C to +85°C	

Batteryless Operation

The J85501M-1 Controller is suitable for use in power plants with or without batteries. In batteryless 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.

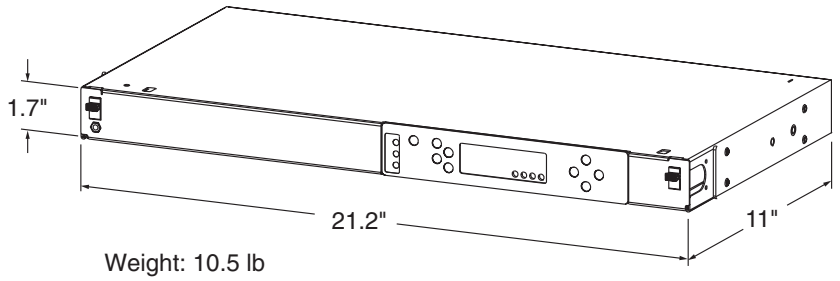


Figure 2-1: J85501M-1 Galaxy Vector Controller

GCM2 or GCM3 Control Board

J85501M-1 Controller uses the GCM2 (24V) or GCM3 (48V) controller boards available in Lineage Power GPS and FMS systems. This board consists of an embedded microcontroller, A/D converters, timers, memory, and input/output alarm and control circuitry with connections to the terminal connection boards. Software is updated by replacing the controller board. It is possible to upgrade the software by replacing the memory IC (IC27), but this method is not recommended. Replacing the board eliminates directly handling, and possibly causing damage to the memory IC. There are no hardware user-configurable items on the GCM boards.

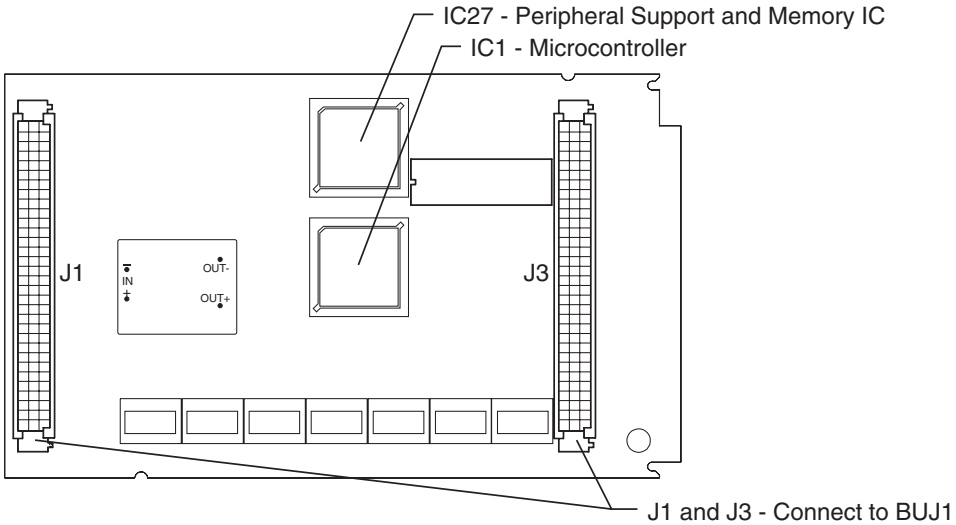


Figure 2-2: J85501M-1 Vector Controller GCM2 or GCM3

User Interface Control Panel

Figure 2-3 shows a view of the 848733907 user interface control panel used with the J85501M-1 List 1 and List 2. This assembly interfaces with the BUJ1 connection board via a 14 pin cable attached to J9, and a 12 pin flex-cable (keypad) to J6. The 848733907 provides a comprehensive user interface to the controller. It is used to view plant voltage and load, configure thresholds and other system parameters, view active alarms and to initiate system operations. This interface consists of a 4 line x 20 alphanumeric character LCD, a nine key keypad, and three status LEDs. A contrast control potentiometer is located just behind the display on the BUJ1 board.

J4 (Local Port)

A standard DB9 connector (J4) is provided on the BUJ board for local terminal access. This local port is referenced to the battery side of the power system. **Connecting non-isolated (earth ground referenced) terminal may cause damage.** Laptop computers running on battery can typically be connected to the local port. AC line powered terminals, as well as some AC/DC supplies for computers and laptops are referenced to earth ground. For these applications isolation is required between the terminal device and the controller's local port. For cases requiring isolation a commercially available external port isolation device, connected through J4 (local port), is required, or a Lineage Power BSM4 can be purchased and connected through J5.

J5 (Option Port)

A 14 pin connector (J5) provides RS-232 connection to option boards which provide remote access. These are: optional network interface card EBW1 Gateway or a BSM3 modem board. It should be noted that the BSM3 modem board also provides an isolated RS-232 port.

See Appendix A for more specific details about connecting to these ports.

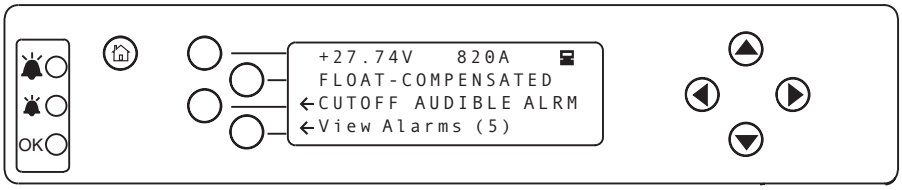


Figure 2-3: 848733907 1U Full-Feature Control Panel

Four softkeys are located directly to the left of the display. The labels and functions of these buttons change dynamically as you

make selections and perform system operations. Softkey labels appear in the display window and are preceded by a "←".

Four navigation keys (up, down, left, and right arrow keys) are located to the right of the display. These keys are used to navigate through the controller menus.

 The home key, located directly to the left of the four softkeys, brings you:

- to the main menu from the default screen or any sub-menu
- to the default screen from the main menu

The following table lists the user interface control panel keys and functions.

Table 2-B: Control Panel Keys and Functions

Key	Function
Softkeys	Move through the various features and menu structure of the controller
Left and Right Arrow Keys	Move through digits in edit screens
Up and Down Arrow Keys	Scroll or select a configuration option or value in an edit screen
Home Key	Return to top level of menu structure or default screen

Three alarm status LEDs give a visual indication of system status. The Major and Minor alarm LEDs indicate when alarms are present, and then the actual alarm descriptions can be displayed on the LCD by pressing the Alarms softkey. LED indications are described in the following table. The J85501M-1 List 3 and List 4 controllers utilize only the LED status indicators. Using this display option requires local terminal access for obtaining plant details and troubleshooting problems.See Figure 2-4.

Table 2-C: Control Panel LEDs and Functions

LED	Indication
MAJOR (red) 	A Major alarm is active. If the MAJOR LED is lit, MINOR and OK LEDs will not be lit.
MINOR (amber) 	A Minor alarm is active. If the MINOR LED is lit, there are no Major alarms active and the MAJOR and OK LEDs will not be lit.
OK (green)	No alarms are active. If the OK LED is lit, MAJOR and MINOR LEDs will not be lit.

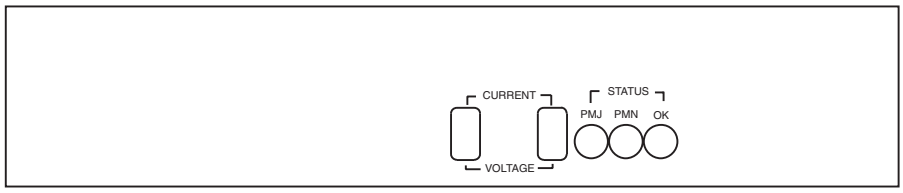


Figure 2-4: 848575841 List 3 / List 4 Display Panel

On the full-feature display, the default screen shows system voltage and current, system mode (FLOAT or BOOST and other system conditions), and any active alarms. The display will return to the default screen from any menu whenever there has been no user initiated activity for three minutes.

All power system attributes are characterized into three main categories by the Vector Controller:

Status *Information Only*
View system voltage, system load, alarms, etc.

Control/Operations *Perform System Functions*
Put the system into float or boost mode, perform plant battery test, etc.

Configuration Set System Parameters
Set float/boost voltage, enable/disable system features, etc.

Figure 2-5 shows a menu map of the controller software. In the Configuration section, there are two types of edit screens: numeric and scroll lists. Numeric edit screens are those on which you modify numbers by changing the individual digits in the number. An example is the Float Set Point screen. Scroll list edit screens are modified by pressing the UP and DOWN buttons to scroll through a list of possible settings. These lists may include numeric values or text. Selecting a Shunt Type is an example of a scroll list edit.

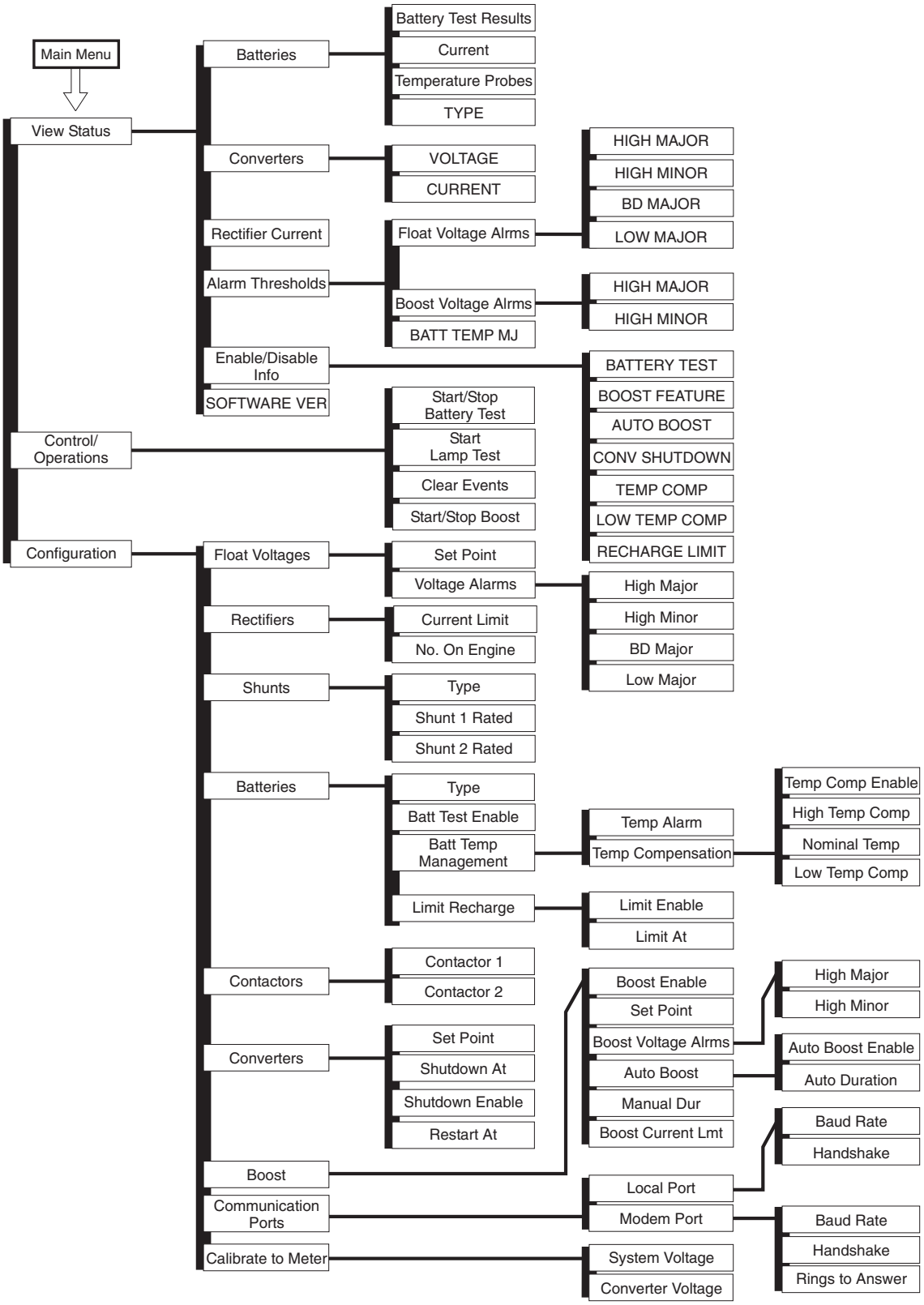


Figure 2-5: J85501M-1 Vector Controller Display Menu Flow

BUJ Terminal Connection Board

Figure 2-6 shows the BUJ Terminal Connection Board. The following pages describe the required connections. Note: To make connections to the 1U_ALM Board terminal blocks, pull the front of the insulating cover off of the mounting posts.

S1.1: Front Panel Configuration
0 - Enabled (shown)
1 - Disabled

S1.2: Software Mode[1,2]
0 - Standard (shown)
1 - Custom Default Configuration Parameters[3]

S1.3: Option Card Availability
0 - Modem
1 - Galaxy Gateway Card (Internet)

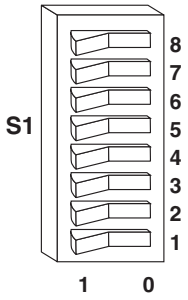
S1.4: Rectifier Class
0 - Standard GPS Rectifiers
1 - NP/AC3000 Rectifiers

S1.5: Alarm Contact Select[1]
0 - Standard HV, High Voltage
1 - VLV, Very Low Voltage

S1.6: - Set to 0

S1.7: Plant Battery Test
0 - Disabled (shown)
1 - Active

S1.8: - Display Reset[4]
0 - Normal (shown)
1 - Reset Display



1. Setting both SW1.2 and SW1.5 to "1" will result in activating the HV alarm cont act.
2. SW1.2 setting will only be read by the software when the GCM is powered up.
3. HV alarm contacts used for 2ACF alarm instead of HV alarm.
4. Cycling from "0" to "1" and back to "0" will reset the display.

S1 DIP Switch Settings

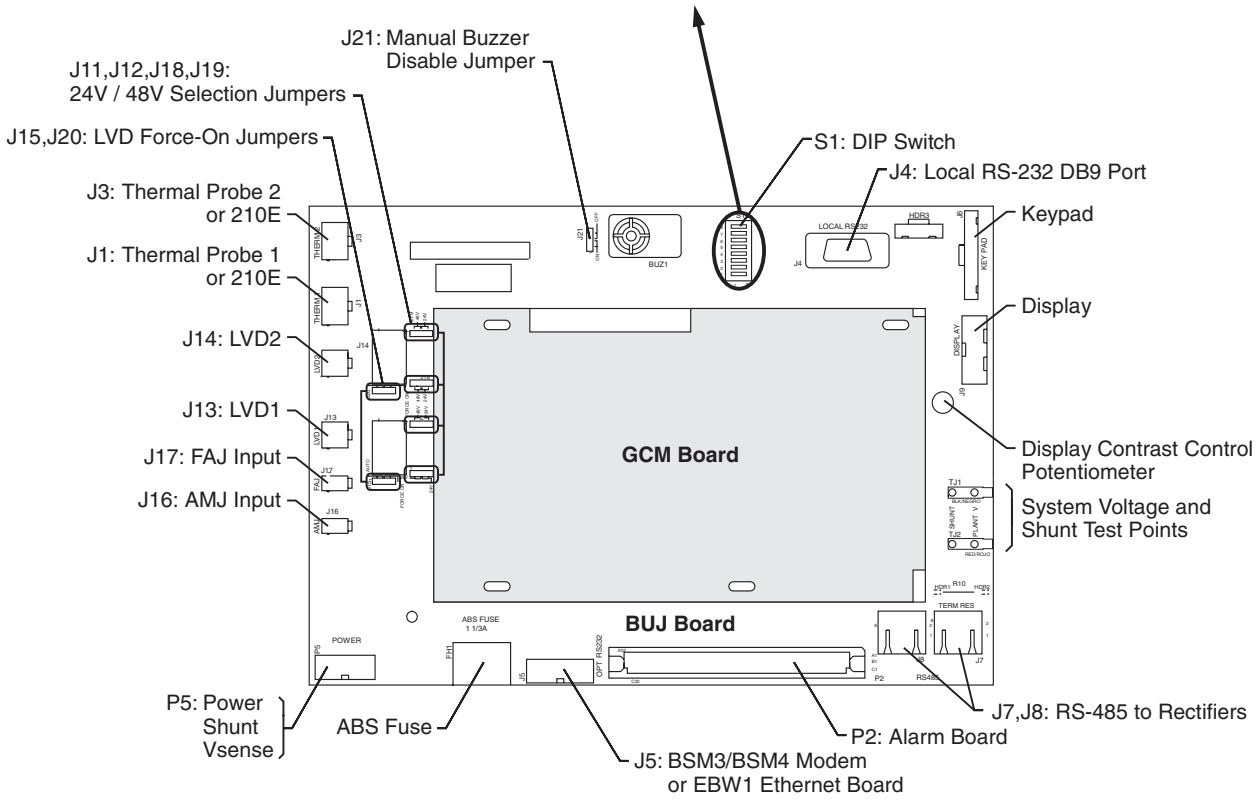


Figure 2-6: J85501M-1 Vector Controller / BUJ Terminal Connection Board

BUJ1 Power, Sense and Shunt Connections

Power and other primary signal connections from the system (factory wired in FMS). BUJ/Vector Controller power input connections are not polarity sensitive, so the BUJ and controller boards will operate regardless of BAT and DG polarity. However, the operation of alarms and Vsense inputs are affected, and the following guidelines should be used.

.

Table 2-D: Power / Main Signal Connections

Input	Wire Color	BUJ	Alarm Board	Plant Termination
BAT	Yellow	P5.7		Charge Bus (Rectifier bus)
DG	White	P5.1		Discharge Return Bus
		P5.2, P5.3		no connection
Shunt2+	Brown	P5.4	TB1.8	
Vsense-	Red	P5.5	TB1.4	Negative remote regulation battery sense point
Shunt1+	Green	P5.6	TB1.11	Most positive side of shunt while on discharge
FAJ	Violet	P5.8, J17.1	TB4.6	Distribution fuse alarm (see Alarm Inputs)
CG	Orange	P5.9		Bus on which shunts are mounted
Shunt2-	Blue	P5.10	TB1.9	Most negative side of second shunt while on discharge
Vsense+ [2]	Slate (Gray)	P5.11	TB1.2	Positive remote regulation battery sense point
Shunt1-	Black	P5.12	TB1.12	Negative side of shunt while on discharge

BAT: Connection to the battery discharge bus for controller power, and fused through on-board F1. It is +24V for the GCM2, and -48V for the GCM3. BAT input is typically the bus in which circuit breakers and fuses are installed for distribution, and therefore the alarm input potential. It is the ungrounded side of the dc bus. For applications where this connection is made outside of the frame/bay, this lead should be fused with a 3 to 5 amp fuse.

DG: Connection to battery return (discharge ground) bus. DG provides the return for BAT (controller power) and ABS loads. Connections are available on TB2 pins 11 and 12 on the alarm board, and P5 pin 1 on the BUJ. DG input to the BUJ must be the bus voltage opposite to the alarm inputs (BAT) bus. It is connected to the grounded side of the dc bus.

SHUNT1+, SHUNT1-, SHUNT2+, SHUNT2-: Shunts must be rated for 50mv full scale. The BUJ1 does not require series impedance in these leads for circuit measurements. However, the leads should be fused protected (1A or less) at the shunt prior to sending the signal to the J85501M-1. The circuit can handle the standard Lineage Power 100K 1% resistors in series with the shunt which can also be used to limit the current.Shunt

connections are available on both the alarm board and the BUJ board.

Vsense: Typically connected to the battery bus. Vsense+ is connected to the positive dc potential, and Vsense- to the negative. The GCM recognizes plant voltage sense inputs on the BUJ board. Polarity of sense inputs must be observed. Incorrect polarity will display incorrect plant voltage. Vsense leads should be fused with a 1A or smaller fuse at the source. These signals are available on both the alarm board and the BUJ board.

CG: (Controller Ground) determines the controller ground reference. The controller ground reference is connected according to the location of the plant shunts being monitored. If the shunts are located in the battery side of the DC bus, then (CG) should be connected to the battery side of the DC bus. If the shunts are located in the Discharge Ground (DG) side of the dc bus, then CG must be connected to the Discharge Ground (DG) side of the DC bus. Note: All shunts installed must be in the same side of the DC bus. Either side of the shunt can be used as the reference, but best practice is to connect the reference to the more negative side of the shunt. For shunts in the hot side, this lead should be protected with a 1A to 4A fuse.

Alarm Inputs Basic office and contactor state alarm inputs. These inputs are closures to BAT or provided ABS input with the exception of the PBT signal that requires a closure to CG. All connections can be made with the provided 1U-ALM terminal block termination board 848711933.

Table 2-E: BUJ Alarm Input Terminals

Name	Description	Alarm Board	BUJ1	Alarm Asserted
AMJ	Auxiliary major alarm input	TB4.2	J16.1	Closure to Batt
FAJ	Fuse major alarm input	TB4.6	P5.8/J17.1	Closure to Batt
LVD1O	Low voltage disconnect contactor 1 open status input	TB3.4	J13.2	Closure to Batt
LVD2O	Low voltage disconnect contactor 2 open status input	TB3.9	J14.2	Closure to Batt
MAINT	Maintenance (open connector)	TB4.10	-	Open to Batt

LVD1, LVD2 Relay contact outputs for LVD contactor control. Contacts are rated for 10 amps. Power must be provided externally to the contactor coil. The contactor coil should have battery permanently attached. The LVD1 and LVD2 contacts should complete the circuit to DG. This power is switched by the LVD control contact closure provided.

Table 2-F: LVD Drive Terminals

Contactor	Name	Alarm Board	Description
LVD1	LVD1-CON1 LVD1-CON2	TB3.6 TB3.7	Dry closure provided. External power required.
LVD2	LVD2-CON1 LVD2-CON2	TB3.11 TB3.12	

Office Alarm Relay Outputs All alarm output relays are isolated Form C or transfer type contacts, consisting of Open (O) and Closed (C) contacts, with a common Return (R(C)) contact. The de-energized state of the controller forces these contacts to the alarm state. An alarm condition results in a closure of the Closed contact to the Return contact, and an open between the Open and Return contacts.

Table 2-G: BLJ3 Office Alarm Relay Output Terminals

Alarm	**Alarm Description**	**C**[1]	**R(C)**[1]	**O**[1]
ACF	Single AC Fail	TB8.1	TB8.2	TB8.3
BD	Battery on Discharge	TB8.9	TB8.10	TB8.11
HV/2ACF/VLV[2]	High Voltage / Multiple AC Fail / Very Low Voltage	TB8.5	TB8.6	TB8.7
MJF	Major Fuse	TB7.9	TB7.10	TB7.11
PMJ	Power Major	TB7.1	TB7.2	TB7.3
PMN	Power Minor	TB7.5	TB7.6	TB7.7

1. **C:** Open contacts. Closed to R(C) when alarm condition exists.
   R(C): Return (common)
   O: Closed contacts. Open to R(C) when alarm condition exists.
2. Relay assignment is determined by the settings of S1.2 and S1.5:
   HV alarm S1.2-0, S1.5=0
   2ACF alarm S1.2=1, S1.5=0
   VLV alarm S1.2=0, S1.5=1
   Setting both switches to 1 results in activating HV. The S1.2 setting is only read during GCM power up.

Auxiliary Battery Supply (ABS) Auxiliary Battery Supply (ABS) is connected to the battery discharge bus and fused through F1 (1-1/3A) for user application on TB4 pins 1, 3, 5, 9, and 11, and TB5 pin 1. F1 is field replaceable.

Control Signal Inputs

Table 2-H: BUJ1 Control Signal Inputs

Signal	Description	Alarm Board	Alarm Asserted
PBT	Plant Battery Test	TB4.8	Closure to PBT_RTN (TB4.7)
RO	Reserve Operation	TB4.4	Closure to Batt

See Section 3 for details on the Plant Battery Test and Reserve Operation features.

Thermal Probe Connections

Four thermistor or 210E module inputs are provided on the alarm termination board, and two thermal probe inputs are provided at J1 and J3 on the BUJ1. These connectors will accept standard Lineage Power thermal cables or 210E cables. J1 and J3 provide cable access to RTH1 and RTH2 thermal probes, respectively. If connections are made at J1 and J3 then they should not be made at the terminal blocks and vice versa. Access to all four thermistors is available at the terminal block. Each thermistor is connected to the RTH#+ and RTN#, where # = 1 through 4. A strap is required across RTH#+ and EN#+ for each thermistor input used. The strap is not required when using 210E modules.

RTH ALM, RTH ALMR: Thermistor alarm input and return from 210E module. See Section 4 for 210E module connections.

Table 2-I: RTH ALM, RTH ALMR Terminals

Signal	Terminal
RTH1_EN	TB6.7
RTH1_RTN	TB6.8
RTH1+	TB6.9
RTH2_EN	TB6.3
TRH2.RTN	TB6.4
RTH2+	TB6.5
RTH3_EN	TB5.10

	Terminal
RTH3_RTN	TB5.11
RTH3+	TB5.12
RTH4_EN	TB5.6
RTH4_RTN	TB5.7
RTH4+	TB5.8
RTH_ALM	TB6.11
RTH_ALMR	TB6.12

Rectifier Connections

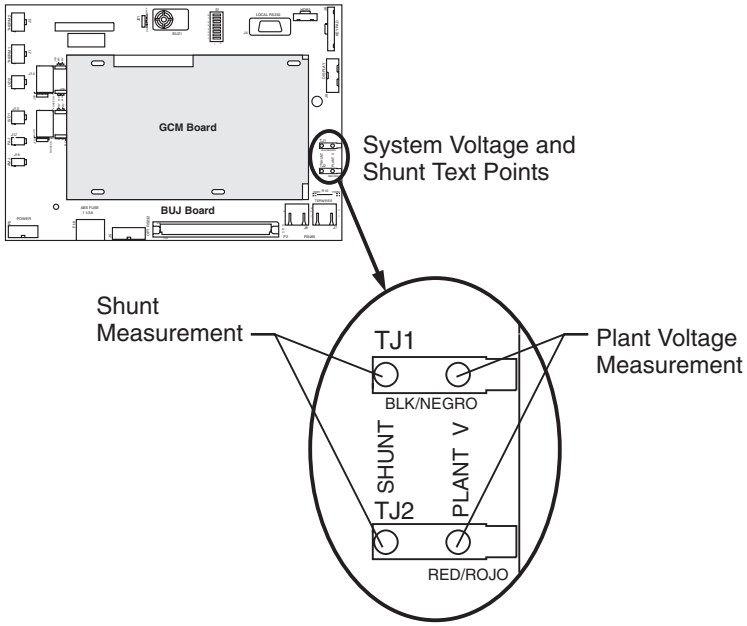
J7, J8: RJ45 connectors for the serial RS-485 rectifier and equipment interface. These are parallel connectors and can be used interchangeably.

Communication Port

J5: RS-232 serial communication port used with the optional BSM3 modem boards or EBW1 Gateway board (see Appendix A).

Miscellaneous

TPT1, TPT2: Thermistor protected test points for access to system voltage available on the front panels of systems without display. They can also be accessed on models with display by opening the controller unit and probing the "Plant VI" and "Shunt" PWB pads.



J9: 14-pin connector to the LCD display.

J6: 12-pin connector to the Membrane (Keypad) panel.

P1, P3: GCM board mounting connectors.

J21: For List 3 and List 4, this jumper may be used for temporarily disabling the audible alarm. Placement of the jumper is identified by silkscreen on the BUJ board.

1U_ALM Board Terminal Blocks

P2 on the BUJ board interfaces with the 1U_ALM terminal block board. Signals found on the 1U have been previously described. Figure 2-7 shows the 1U_ALM Board terminal blocks and their signal designations.

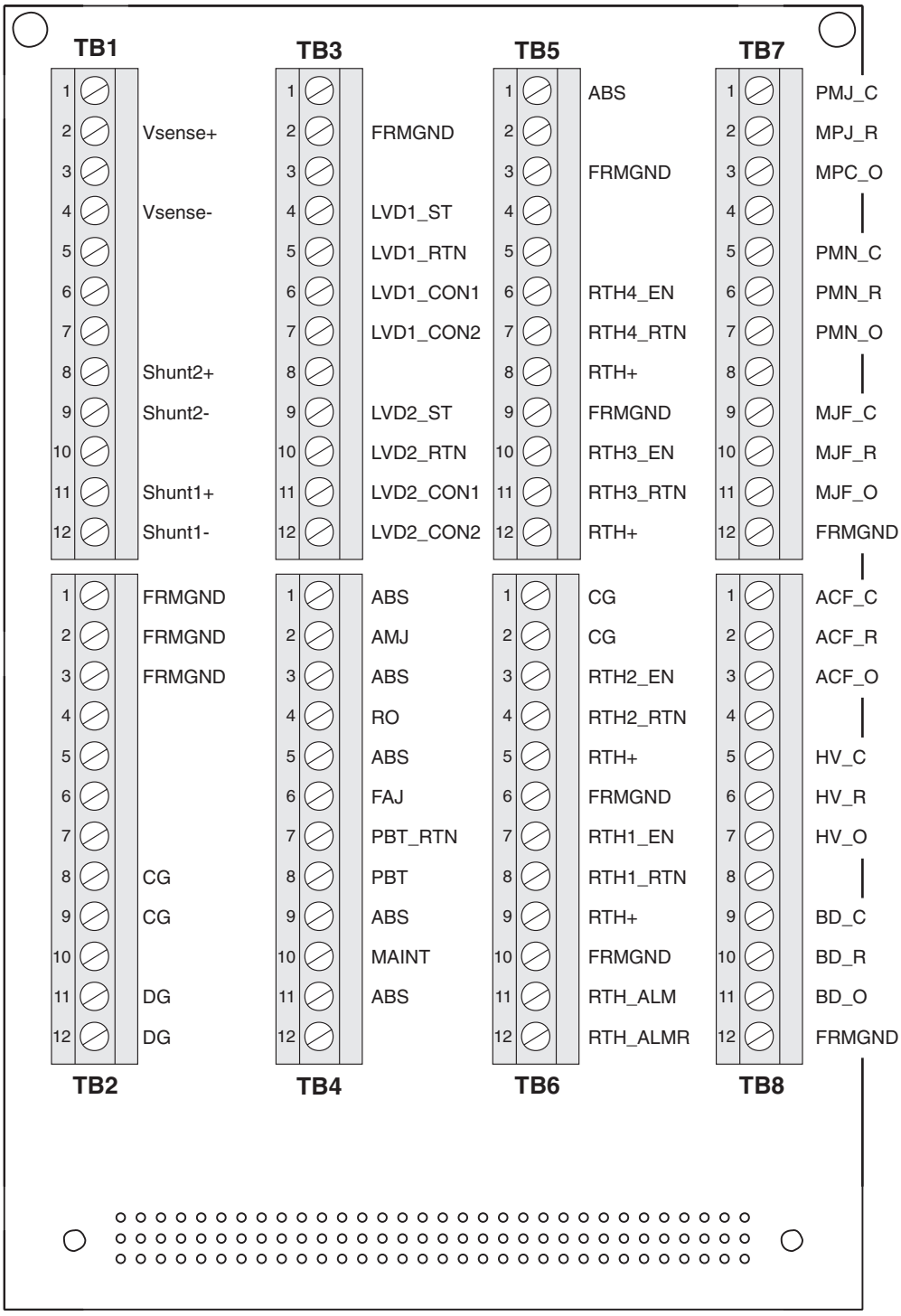
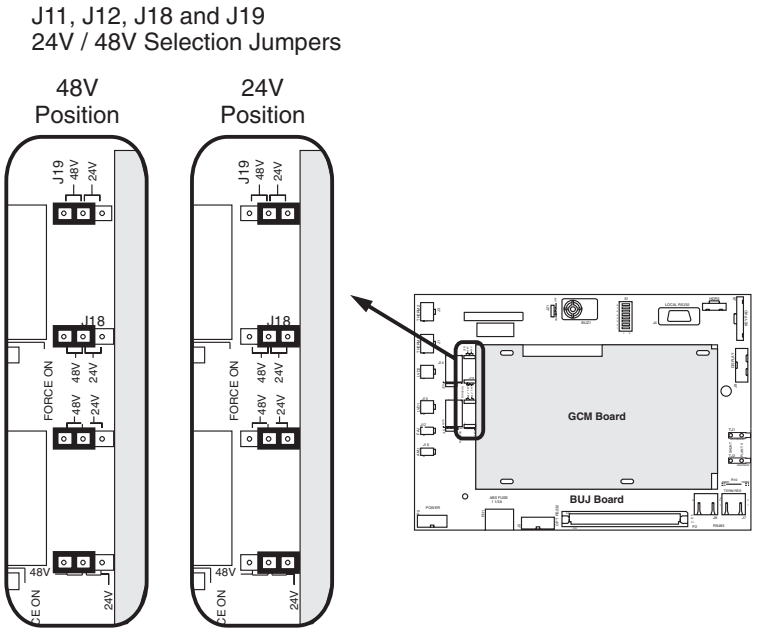
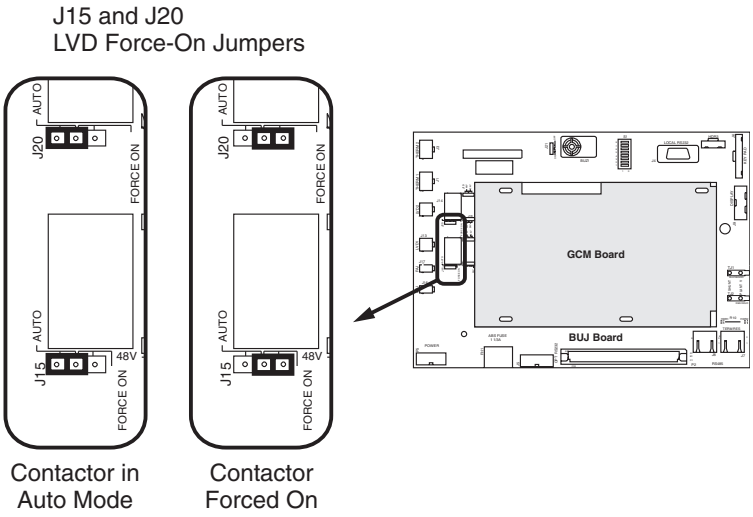


Figure 2-7: 1U_ALM Board Terminal Blocks

J11, J12, J18, J19: Select between 24V and 48V systems. All jumpers must be set.



J15, J20: Used to force the LVD contactor closed.



3 Operation

Office Alarm Contacts

The J85501M-1 Vector Controller issues PMJ, PMN, MJF, BD, ACF and HV/2ACF/VLV office alarms from the BUJ board. Refer to Table 2-G for a description of their output terminals. Refer to Table 3-A for a listing of the various available alarms. Refer to Table 3-B for a listing of alarm relays and their associated front panel LEDs.

Alarm Descriptions

To see active alarms, press the Active Alarm softkey, then use the ∧ or ∨ keys to page through alarms. See Tables 3-A and 3-B. The alarms are listed in order of severity. Some abbreviations are required to fit the LCD screen.

Very Low Voltage Alarms and Battery on Discharge

When system voltage drops below the battery voltage, the batteries start providing current to the load. Any time that the plant voltage is below the threshold selected for BD, the Battery on Discharge alarm activates. If the plant voltage continues to drop, a second, lower threshold can be reached, activating a Very Low Voltage alarm. These thresholds can be changed in the configuration menu. S1.5 set to “1” will allow the relay dedicated for HV/ACF/VLV to be asserted for the VLV condition.

Note that a BD alarm does not necessarily mean that the batteries are discharging, only that the present voltage is lower than the set point for this alarm. This alarm may be activated by an incorrectly set BD threshold or plant voltage set point. Following the restoration of ac power after a battery discharge of significant depth, this alarm remains active for some time during the recharge period, until the batteries have recharged to a level which allows the plant voltage to rise above the BD threshold.

BD threshold default is set at 25.54V standard in 24V systems, and 51.1V in 48V systems with slope thermal compensation disabled. In systems with slope thermal compensation, the BD threshold should be 0.5V below the slope upper temperature voltage for 24V systems, and 1.0V below the slope upper temperature voltage for 48V systems. The slope upper temperature equals:

Float Set Point - (number of cells) · E · (F-D)
See Figure 3-1 for system settings E, F, and D

These levels generally avoid nuisance alarms from transient conditions yet provide alarm indications early in a true BD event, so that sufficient time is provided for maintenance personnel to respond before battery reserve is exhausted. VLV should be activated towards the end of the battery reserve voltage to indicate a critical service condition.

Table 3-A: Alarm Identification Standard Assignments

	Alarm Status	Front Panel LED	GCM Relay
No active alarms present	Norm	Green	None
Very low voltage	Major	Red	None
Battery on discharge	Major	Red	BD
High float voltage	Minor	Yellow	None
Very high voltage	Major	Red	HV
Voltage sense fuse alarm	Major	Red	None
AC fail	Minor	Yellow	ACF
Multiple AC fail	Major	Red	ACF
Rectifier fail	Minor	Yellow	None
Multiple rectifier fail	Major	Red	None
Rectifier ID conflict	Major	Red	None
Rectifier manual off alarm	Minor	Yellow	None
Rectifier AC phase alarm	Minor	Yellow	None
Converter fail	Minor	Yellow	None
Multiple converter fail	Major	Red	None
Converter ID conflict	Minor	Yellow	None
Converter distribution alarm	Major	Red	MJF
Converter fan fail minor	Minor	Yellow	None
Converter fan fail major	Major	Red	None
Fuse alarm major	Major	Red	MJF
Auxiliary input major	Major	Red	None
Load Share imbalance	Minor	Yellow	None
Contactor 1 open	Major	Red	None
Contactor 1 failed	Major	Red	None
Contactor 2 open	Major	Red	None
Contactor 2 failed	Major	Red	None
High battery temperature	Major	Red	None
Temperature probe failure	Minor	Yellow	None
Maintenance open alarm	Major	Red	None

Table 3-B: Office Alarm Relay and Front Panel LED Standard Assignments

	Alarm Relays	Front Panel LEDs
Very high voltage [HV]	PMJE, (HV or none)	MAJ (red)
High float voltage [HFV]	PMNE	MIN (yellow)
Battery on discharge [BD]	PMJE, BD	MAJ (red)
Very low voltage [VLV]	PMJE, (VLV or none)	MAJ (red)
Single ac fail [ACF]	PMNE, ACF	MIN (yellow)
Multiple ac fail [MACF]	PMJE, (2ACF or none)	MAJ (red)
Single rectifier fail [RFA]	PMNE	MIN (yellow)
Multiple rectifier fail [MRFA]	PMJE	MAJ (red)
Single converter fail [CFA]	PMNE	MIN (yellow)
Multiple converter fail [MCFA]	PMJE	MAJ (red)
Major fuse (Controller, FAJ input) [MJF]	PMJE, MJF	MAJ (red)
Low voltage battery disconnect [LVBD]	PMJE	MAJ (red)
Low voltage load disconnect [LVLD]	PMJE	MAJ (red)
LVD1 fail [LVDA]	PMJE	MAJ (red)
LVD2 fail [LVDA]	PMJE	MAJ (red)
Controller fail [CTLR]	PMJE	MAJ (red)
Slope thermal compensation active		LCD
Defective battery temperature probe [TPA]	PMNE	MIN (yellow)
Voltage sense fuse alarm	PMJE	MAJ (red)
Rectifier manual off alarm	PMNE	MIN (yellow)
Rectifier phase alarm	PMNE	MIN (yellow)
Rectifier half power alarm	PMNE	MIN (yellow)
Auxiliary major alarm	PMJE	MAJ (red)
Battery thermal alarm	PMJE	MAJ (red)
Controller unpowered	PMJE, PMNE, MJF, BD, ACF, HV	
Connector open	PMJE, PMNE	MAJ (red)
Alarm cut off		LCD
Display volts		LCD
Display amps		LCD

High Float Voltage Minor Alarm and Very High Voltage Major Alarm and Shutdown

Because of the importance of protecting the batteries and load from overvoltage conditions, three high voltage thresholds are provided. Two are controlled by the Vector and one backup threshold is hard-wired internally in Lineage Power rectifiers. The two lowest thresholds are preset at the factory but can be adjusted through the Vector control panel or remotely. The third threshold (ISHVSD) is generated by the controller by adding 1.50V to the very high voltage threshold. This value is then transmitted to the rectifier and stored. Each rectifier compares its own output voltage to this threshold value and initiates internal shutdown if the value is exceeded. “Very High Voltage” and “High Float Voltage” are set in the Vector in the Configuration mode. See Section 4, Installation, Configuration and Operation.

The Vector is equipped to detect a high voltage condition on the system bus. Such a high voltage condition may typically be caused by lightning-induced transients on the commercial ac or a rectifier failure may cause an individual rectifier to go high. To prevent a high voltage condition from damaging the connected load, the Vector also sends a signal for the rectifiers to shut down if the plant voltage goes above a second threshold.

When the system voltage increases above the threshold for "High Float Voltage," it issues the High Float Voltage minor alarm. If the voltage continues to rise and reaches the threshold for "Very High Voltage," that alarm is issued as a major alarm and a shutdown signal is issued simultaneously to the plant rectifiers. Any rectifier which is producing at least 10% of its rated capacity and is 10% over the average of all rectifier outputs in the plant, responds to this shutdown signal by shutting down with a RFA or ALM condition active and reports back to the Vector. A restart attempt initiated by the controller occurs 4 seconds after the controller receives the RFA signal from the rectifier. The rectifier then attempts to restart three times. During the restart sequence, the rectifier, recognizing that its output current exceeds the average rectifier current, shuts down and tries again up to three times.

For plants with the battery thermal lower temperature compensation disabled, the High Float Voltage threshold is usually set approximately 0.75V above float for a 48V plant and 0.5V above float for a 24V plant. High Voltage shutdown threshold is then usually set approximately 2.5V above float for a 48V plant and 1.0V above float for a 24V plant. In plants with battery thermal lower temperature compensation enabled, the High Float Voltage threshold is usually set approximately 0.8V above the maximum voltage due to low temperature in a 48V plant and 0.5V in a 24V plant.

Very High Voltage shutdown is usually 0.5V above the High Float Voltage threshold for 48V plants and 0.25V above the High Float Voltage threshold in 24V plants. Like the BD and VLV thresholds, these are set in the Galaxy VC in the configuration mode as described in the Installation, Configuration and Operation section of this manual (Section 4). S1.2 set to "0" will assign the HV/2ACF/VLV alarm contact to the standard default of HV for the Very High Voltage shutdown condition.

Voltage Sense Fuse Alarms

A lack of voltage or reversed voltage on the Vsense +/- pair to the Vector Controller as a result of a broken connection or a blown fuse while the Vector is still powered results in a Voltage Sense Fuse alarm. A voltage of 16.xx / -34.xx volts is displayed.

Sanity Fail in the Vector microprocessor or loss of power to the Vector result in operation of the PMJ alarm. This PMJ defaults to the alarm state if the controller is removed from the BUJ1.

AC Fail and Multiple AC Fail Alarms

If the proper ac input voltage is not available to any system rectifier which is connected to the serial rectifier bus, an AC Fail alarm (ACF) activates as a PMN. More than one ACF results in a Multiple AC Fail alarm, changing this alarm status to a PMJ. Note: S1.2 set to "1" will allow the HV/2ACF/VLV alarm contact to be assigned to the Multiple AC Fail condition. However, this will also cause the custom default configuration values to be used any time the GCM is rebooted at power up.

Rectifier Failure and Multiple Rectifier Failure Alarms

Various rectifier failure modes cause a rectifier failure signal to be issued to the controller, such as high voltage, temperature over threshold, fan failure, and rectifier circuit breaker/fuse open. Additionally, when rectifiers are removed or fail to communicate with the Vector, a RFA alarm is generated. This RFA alarm is cleared by updating the serial line in the Operations and Control menu (see Configuration, Section 4).The RFA signal results in a RFA and Power Minor alarm being issued by the Vector. More than one RFA at any time results in a Multiple Rectifier Failure alarm and Power Major. The Vector does not attempt restarts for RFAs caused by TA (Thermal Alarm), CB/fuse trip, or Fan Failure.

Rectifier ID Conflict Alarm

This alarm occurs when rectifier ID numbers are duplicated or are zero. Refer to the rectifier manuals for setting and viewing the rectifier ID numbers.

Rectifier Manual Off Alarm

Whenever the rectifier is manually turned to standby, this alarm occurs. A switch on the front panel for each rectifier allows the user to manually turn the rectifier on or standby. When the switch is in standby position, the alarm is active.

Rectifier Phase Alarm

This alarm is for multiphase rectifier. When AC is lost in one or more phase but not all phases, this alarm occurs.

Converter Failure and Multiple Converter Failure Alarm

Converter failure alarms are generated for various reasons. These include failure in the converter, the converter is removed, the converter interface board is removed, or communication is lost with the converter interface board. The removed CFA is cleared by updating the serial line in the Operations and Control menu (see Configuration, Section 4).

Converter ID Alarm

This alarm occurs when converter ID numbers are other than 1 through 8, or are duplicated. Refer to the converter section of the plant manual for setting and viewing ID numbers.

Converter Distribution Alarm

Any fuse or breaker open at the converter output side (-48v distribution) causes this alarm.

Converter Fan Fail Minor and Converter Fan Fail Major

The converter carrier 597B has two fans. If one fan in a carrier fails, the controller reports a Converter Fan Minor alarm. If both fans fail, the controller reports a Converter Fan Major alarm.

Major and Auxiliary Major Alarms

FAJ and AMJ are the controller primary alarm inputs. FAJ is available at P-8 and J17-1 on the BUJ and TB4-6 on the alarm terminal board. AMJ is available at J16-1 on the BUJ1 and TB4-2 on the alarm terminal board. To create these alarms, the respective alarm inputs must be connected to Bat or battery voltage. This battery voltage typically has a series 1K ohm resistor between Bat and the alarm input.

The operation of an output distribution fuse or circuit breaker places battery voltage onto the FAJ input of the BUJ1 board, activating the Major Fuse alarm.

Auxiliary Major on the BUJ1 board can be user-assigned for any supplemental alarm monitoring for which a battery voltage signal (through 1K ohms) can be obtained, which is asserted by a signal to the AMJ terminal on the BUJ1 board.

Load Share Imbalance Alarm

This alarm is generated when the current share function is enabled and the rectifiers do not share the current equally or within the current share boundaries. The controller monitors the current (I_{rect}) delivered by each of the rectifiers and determines the total current delivered by the plant as the sum of all rectifier currents. The average rectifier current (I_{avg}) is calculated by dividing the total current by the number of active rectifiers in the plant. If, for any rectifier, actual rectifier current I_{rect} is different from the average rectifier current I_{avg} by 10A or more for 5 minutes, then the controller issues a Rectifier Current Imbalance Alarm. This alarm retires when the difference between the I_{rect} and I_{avg} drops below 10A.

Contactor 1 Open, Contactor 2 Open, Contactor 1 Failure, Contactor 2 Failure Alarm

A Contactor Open alarm is reported whenever the Vector senses that a contactor is open. This alarm is processed as a PMJ.

A Contactor Fail alarm is reported whenever the Vector senses that a contactor that should be open or closed is in the opposite state (closed or open). This alarm is also processed as a PMJ.

High Battery Temperature Alarms Temperature Probe Failure

See Figure 3-1. The Vector reports a High Battery Temperature Alarm when the temperature rises above the configured set point. See Section 4, "Installation, Configuration and Operation," for information on battery thermal compensation settings. It reports a Thermal Probe Alarm when thermal compensation is enabled and a temperature probe is disconnected or returns a grossly inaccurate reading to the Thermal Compensation circuit.

Open Maintenance Alarm

Input Number 4 (MAINT) of the BUJ1 terminal connection board should be connected to battery voltage during normal operating conditions. This connection may be looped through one or more circuit packs so that if the connection path is interrupted, the Open Maintenance Alarm is activated.

System Features

Load and Battery Contactor Features and Alarms

The Vector has two distinct circuits for controlling the state of external Load and Battery Disconnect Contactors via the LVD1 and LVD2 terminals on the BUJ1 board. External contactor driver circuits are not required.

Each contactor can be configured as none, load, or battery.

When configured as a battery contactor:

- The contactor is open when the plant voltage is less than the respective low voltage battery disconnect threshold.
- The contactor is closed when the plant voltage is greater than the respective low voltage battery reconnect threshold. At power up, the contactor is closed and there is an 18 second delay before the controller determines the correct state of the contactor.

When configured as a load contactor:

- The contactor is open when the plant voltage is less than the respective low voltage load disconnect threshold.
- The contactor is closed when the plant voltage is greater than the respective low voltage load reconnect threshold. Additionally, there must be no active ac failure and rectifier phase alarms, since the load would immediately disconnect after reconnecting. At power up, there is an 18-second delay before the load is reconnected to allow the rectifiers to walk in.

Refer to the Alarm Descriptions section for alarms associated with these two contactors (Contactor Open and Contactor Fail).

Refer to the associated plant documentation for information on connecting these Load and Battery Disconnect driver circuits to the BUJ1 terminal connection board. Figure 4-1 provides general connection information.

Thermal Compensation Features and Alarms

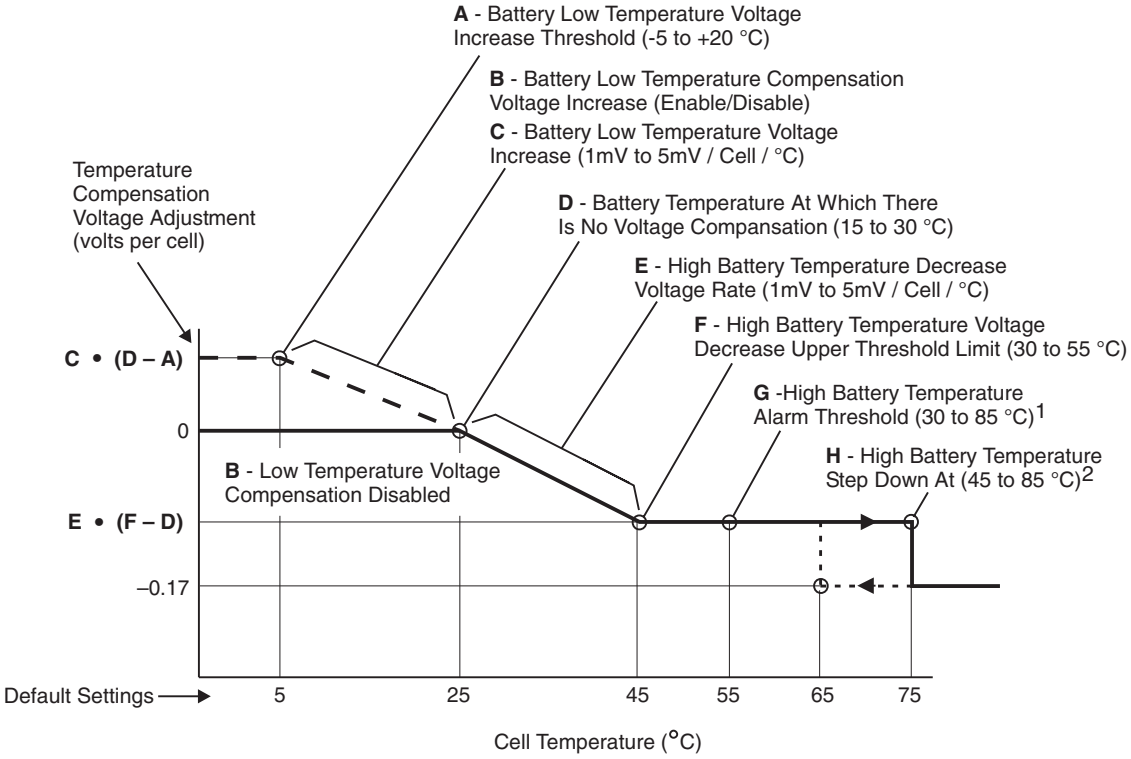
The Vector has a flexible Thermal Compensation feature which provides voltage compensation from that level established by the Plant Float Set-Point (FSP), dependent on the highest temperature monitored by thermistors located at the plant batteries. Thermal Compensation should only be enabled when the controller is used in a plant containing “sealed” or valve regulated “maintenance free” batteries. This feature requires the

use of external thermistors at the plant batteries to monitor cell temperatures. Refer to the Installation section for more details on wiring and configuring this feature.

Thermal Compensation lowers plant voltage from the FSP for monitored battery temperatures which are above the ideal temperature established during configuration as the Battery Thermal Slope Nominal Temperature. Lowering the plant voltage helps to keep the batteries at their optimum state of charge while protecting them from thermal runaway. Thermal runaway is a complex sealed battery phenomenon where, for a number of reasons, one or more cells in a string are unable to dissipate the internal heat generated by their charging current and experience an increase in internal temperature. By lowering the float voltage as cell temperature increases, the float current is lowered to a point where this destructive behavior can be avoided. If a cell failure is imminent and the cell temperature continues to rise above the threshold configured for Battery Thermal Step Temperature, the plant voltage drops in a single step to a level which helps keep from overcharging and damaging the remaining cells in the string. Refer to Figure 3-1 for a graphical view of Battery Thermal Compensation and the relationship of its various set points.

Refer to the Alarm Descriptions section for the Battery Thermal Alarm and Temperature Probe Failure Alarm.

The Vector can also increase plant voltage above the FSP for colder environments. Again, this seeks to keep batteries in such an environment at their optimum charge state. Since this feature results in an increase in plant voltage, it is activated through a second enable switch during configuration. Again, refer to Figure 3-1.



1. The Battery High Temperature Alarm occurs when the temperature rises above the High Battery Temperature Alarm Threshold (**G**) set point. It retires when the temperature decreases to 10 °C below this set point set point (45 °C default).

2. Plant voltage decreases 0.17 volts per cell when the temperature increases above the High Temperature Voltage Step Down At (**H**) set point. It is increased 0.17 volts per cell when the temperature decreases to 10 °C below this set point, as indicated by the dashed line (65 °C default).

Figure 3-1: Battery Thermal Compensation Set Points

Note: Any time that Battery Thermal Compensation is actively changing the plant voltage above or below that set by the FSP parameter during configuration, the LCD indicates the mode by displaying the message “Float - Compensated”. This is not an alarm condition, only an indication to the user that plant voltage is different than that set by the FSP parameter.

Rectifier Sequencing

Rectifier Sequencing is a feature which allows the Vector to bring the plant rectifiers back on line one at a time following an ac power interruption. This serves to minimize their impact on

the ac service, especially useful in avoiding loading down an emergency generator with an inrush surge.

The Reserve Operation (RO) engine signal (closure, available only on the BUJ1 board) notifies the Vector that a backup engine is supplying stable ac power to the rectifiers. A certain number of rectifiers are then started in sequence. The number of rectifiers which should be on when the engine is in use is configurable. Refer to Section 4 for details. The number of ON rectifiers is usually determined by the capacity of the engine.

When a rectifier reports an ACF to the Vector, it places that rectifier into standby. As rectifiers report good ac, they are turned on at 1 second intervals. When the controller senses the RO signal, it pauses 10 seconds and starts the configured number of rectifiers at 1 second intervals.

While RO is active, the Vector maintains the configured number of rectifiers on. When RO retires, the Vector turns the remaining rectifiers on at 1 second interval.

Shunt Types and Sizes

The Vector provides three separate methods and up to two separate shunt signals for use in determining the plant current to display. The access connections to the two shunt signals are Shunt1+/- and Shunt2+/- as shown in Figure 2-5. These signals shall be a maximum of 50 mV signals that can represent a range of 0-9999 amps. Refer to the configuration section of this manual for additional details.

Float Mode Controls and Thresholds

Float mode is the default mode of operation and is active if the Boost mode is not active. Plant voltage, while in Float mode, is determined by the configuration parameter System Float Set Point (FSP), and may be adjusted by the Battery Thermal Compensation feature, if it is enabled. There is no individual adjustment of plant rectifiers in this digital serial bus interface arrangement. Load share among plant rectifiers is automatic in all system modes and takes effect within several seconds of a new rectifier being added to the bus and turned on.

The FSP chosen should correspond to the battery type used and the battery manufacturer's recommendations. For example, Lineage Power KS20472 Round Cell (flooded) battery floats at 2.17 volts per cell (VPC). A 12 cell, 24V plant would therefore have a FSP of 2.17 x 12 = 26.04V. The Lineage Power KS23619

Enhanced VR (Valve regulated) battery floats at 2.27 VPC, if Battery Thermal Compensation is enabled or 2.25 VPC if used without Battery Thermal Compensation. A 12 cell, 24V plant using this battery would have a desired FSP of 2.27 x 12 = 27.24V with or 2.25 x 12 = 27.00V without Battery Thermal compensation.

Rectifier Current Limit in Float mode (FCL) is an adjustable configuration parameter from 30% to 110% of rectifier capacity. This parameter can be important in limiting the recharge current available following a deep discharge in a plant using a "sealed" or valve-regulated battery type to a level which is safe for that battery and not cause unnecessary internal pressure buildup and venting. Typically, this maximum safe recharge rate for "sealed" or valve-regulated battery types in the industry is in the range of 1/10 of the 8 or 10 hour rating. Refer to your specific battery manufacturer for recommendations regarding the battery type used. The following typical example shows the use of the FCL feature to maintain the maximum recharge rate decided upon.

Consider a plant with three strings of 2VR375E Lineage Power KS23619 Enhanced VR Series batteries, four 100A rectifiers and a 200 amp typical load. When ac power returns following a significant discharge, 200 amps are available for recharging these batteries, a rate of 67A per string (200A / 3 strings). Recharge should be limited to approximately 40A per string (1/10 of 375) however, reducing the possibility of venting and life depreciation of the batteries. Calculate current limit for limiting recharge to 40A per string as follows:

CL = [Plant Load + (Max Recharge per String × # Strings) / (Rect Cap × # Rect)] × 100

CL = [200 + (40 × 3) / (100 × 4)] × 100

CL = [(200 + 120) / 400] × 100

CL = (320 / 400) × 100 = 80%

Check for N + 1 redundancy with this CL value with the following statement:

Plant Load < [Rect Cap × (# Rect - 1) × CL] / 100

200 < [100 × (4 -1) × 80] / 100

$200 < [(100 \times 3) \times 80)] / 100$

$200 < (300 \times 80) / 100$

$200 < 240$

Float mode adjustments are also available for High Float Voltage Float Threshold which activates the High Float Voltage (alarm only) minor when exceeded and the High Voltage Float threshold which activates the High Voltage major alarm and rectifier shutdown. Battery on Discharge Float Threshold and Very Low Voltage Threshold are additional Float mode configuration parameters. Refer to the Alarm Descriptions section for additional information regarding these alarms.

Battery Recharge Current limit

The battery recharge current limit feature enables the Vector Controller to limit the recharge current flowing into a battery section during the charge cycle. This feature is available only in plants that have at least one battery shunt to monitor the battery current. It can be enabled or disabled using the front panel display or EasyView® Interface. The recharge current flowing into the battery section can be limited to any value between 10 and 1000A.

The Vector Controller can monitor up to two shunts connected to two battery sections, each battery section can contain one or more battery strings. The controller limits the current flowing through the shunts thereby limiting the charging current into the batteries. This feature has no impact on the discharge current flowing from the battery. The controller maintains the recharge current within 10% of the set level.

Battery Discharge Test

The purpose of the test is to verify the battery capacity connected to the plant. The reserve time can be predicted after the test and stored in the memory for future retrieval. By discharging about 20% of the battery capacity, the controller can predict the total reserve time if 100% battery capacity is discharged at the same load condition.

This function can be enabled in the configuration process by enabling the battery test in the appropriate configuration menu. Refer to Section 4 for detail. If the function is enabled, this test can be activated by accessing the operations menus and manually pressing the Battery Test Start softkey. The battery test can be stopped in the same manner, by pressing the Battery Test Start softkey again during the test.

Note: The battery type should be configured before starting. The Vector assumes one type of battery per system. The battery type may be configured as either valve regulated or flooded.

During the test, rectifiers are set at a lower voltage. The set voltage is the maximum of {LVD1 threshold +ΔV, the LVD2 threshold +ΔV, or EDV}, where EDV (the end voltage) = 22V for 24V plant and 44V for 48V plant, ΔV = 0.6V for 24V plant and 1.2V for 48 plant. The plant mode is returned to float mode automatically if this set voltage is reached during the test.

The test stops automatically whether it is successful or not. Refer to the configuration process in Section 4. During the test, the default screen of the LED indicates a battery test is active. Any alarm occurring during the test aborts the test, and causes the system to return to float mode.

The last test results, battery reserve time, and load current are stored in memory. The user can retrieve them under the operations menu. Refer to the configuration process in Section 4.

Boost Mode Controls and Thresholds

Boost mode is a feature of the Vector which allows the user to temporarily raise the system voltage to a higher, predetermined level for a specified period of time. This feature may be useful in systems using a flooded battery type where the batteries are displaying symptoms of an undercharged state such as differing cell voltages or in the case of the Lineage Power KS20472 Round Cell, lead-sulfate crystals visible on the vertical positive plate columns. Boost mode may also be used to accelerate the recharge of discharged strings to their full charge condition.

Plant voltage, while in Boost mode, is determined by the configuration parameter Plant Boost Set- Point. Refer to “Plant Boost Mode Settings” in Section 4. Like Float mode, there is no individual adjustment of plant rectifiers. Load share among plant rectifiers is automatic.

Boost voltage is determined from the battery manufacturer’s recommendations, but must also be less than the maximum voltage rating of all connected loads since Boost Mode raises the entire system bus voltage. Typical boost levels and durations used might include 2.25 VPC for 96 hours, 2.27 VPC (volts per cell) for 72 hours, or 2.30 VPC for 48 hours. **Do not exceed the maximum voltage rating of any connected load.**

Boost is typically not used with “sealed” or valve regulated battery types. If it is used, it is generally completed at significantly lower levels than that of flooded battery design to avoid the build up of pressure and venting noted under the Float mode section on Float Current Limit. When Boost mode is disabled in the configuration menu, the feature cannot be initiated.

Once enabled, Boost mode is entered by accessing the operations menu and pressing the Boost softkey. The default LCD screen shows that the system is in Boost mode of operation. The present Boost duration is also displayed in hours. This Boost duration can be edited with 0 and 24 hour minimum and maximum values (0 = forever). Pressing the Step Boost mode softkey returns the system to the Float mode. If a High Voltage, High Float Voltage or RFA alarm occurs while in Boost mode, the plant returns immediately to Float mode. AC Fail and Phase Fail alarms does not affect Boost mode.

Boost mode has its own configuration parameters for Rectifier Boost Current Limit, High Float Voltage Boost Threshold, and High Voltage Boost Threshold, all of which control these respective features and alarms whenever Boost mode is active.

Auto Timed Boost

The plant goes into Boost mode automatically if the following conditions occur:

- Auto Boost is enabled
- Autoboost factor is configured from 1 to 9.
- A battery on discharge alarm occurs with AC Failure alarms, or rectifier phase alarms occur for at least four minutes.

When all rectifier phase and AC Failure alarms retire, the plant automatically goes into boost mode.

The duration of the boost period is BD and AC Failure or Phase alarm duration multiplied by the autoboost factor. The maximum boost duration is limited to 24 hours.

If AC Failure alarms and Phase alarms are asserted while the plant is in autoboost mode, the plant re-enters float mode, retaining the remaining boost duration. If the Battery on Discharge (BD) alarm asserts while the AC Failure or phase alarm is active, the new multiplied time is be added to the boost

duration. When the AC Failure and Phase alarms retire, the plant re-enters the boost mode for the remaining boost duration.

During autoboost, if the plant has a High Voltage, High Float Voltage, or RFA alarm, the plant returns to float mode and the remaining autoboost time is cancelled.

Plant Battery/Generator Test (PBT)

Plant Battery Test is a simple battery test feature available with the Vector controller. When the controller receives a PBT signal (either via an external input signal or via setting S1-7 to position 1), all the rectifier output voltages are reset to 22V/44V so that the batteries are placed on discharge. The plant voltage will drop to only 22V/44V minimum, but remain at this voltage until the PBT signal is released.

Vector does not reset the output voltage to 22V/44V, even if the PBT signal is asserted, if there are any active major alarms or if the serial communication alarm is active. If any major alarm occurs during the test, the plant recovers to float mode and sets all rectifiers back to the previous float setting.

Remote Access and Monitoring

The Vector controller offers local and remote (modem or Gateway) access capability to communicate and configure a limited set of features using personal computers. It is possible to communicate with the Vector controller by two means:

- By using any ANSI (American National Standards Institute) character-based terminal including terminal emulators into either local or modem ports or by using a PC Telnet communication session via a TCP/IP LAN connection and a Gateway card. The T1.317 command language is the human to machine interface used for this communication. Refer to Appendix-A for modem and Gateway details.
- By using Galaxy EasyView, which combines both a communications package and a user friendly Microsoft Windows interface (local or modem ports only).

The Vector controller provides one remote access port. This port is split to two RS232 ports on the BUJ1 through digital switches. These two ports are J4 (DB9) for local terminal access, and J5 for modem or TCP/IP access to the Vector controller. This local port is referenced to the battery side of the power system. **Connecting non-isolated (earth ground referenced) terminal equipment may cause damage.** Laptop computers running on battery can typically be connected to the local port. AC line powered terminals as well as some AC/DC supplies for

computers and laptops are referenced to earth ground. For these applications isolation is required between the terminal device and the controller's local port.

J4 connection takes precedence over J5. When a terminal is connected to J4 communication to/from J5 will be disconnected. Only when the terminal is disconnected from J4 will communication to/from J5 resume. J5 connection interfaces with either the BSM3 (which provides modem and RS-232 Access), or the BSM4 (which provides isolated RS-232 interface to the Vector), or with the Gateway card (EBW1) for TCP/IP access. See Appendix A.

Once logged into the controller, users type in commands to access measurements, configuration and control parameters in the system. The command line interface used for incoming connections is a version of T1.317 adapted for low end controllers. Two levels of security, User and Super-user, are provided to protect incoming access and to prevent any unauthorized access.

The controller can be configured to dial out on alarm and dial out when all alarms are cleared using the internal modem. The port settings, configuration and command language used for remote access as well as the error messages is described in the Appendices A and B.

Remote Rectifier Standby

The rectifiers can be placed in standby after accessing them through the local port or through a modem. Once the rectifier is placed in standby, it automatically recovers from this state when the plant voltage drops below the BD threshold level, when the active rectifiers cannot supply the plant demand.

Dial-out On Alarm

This function requires an optional BSM3 modem card. See Appendix A for description. By default, the controller is configured not to dial-out at all. It can be configured to dial-out to a primary phone number or an alternate phone number, used if the controller fails connect to the primary phone number. The controller attempts to dial-out when an alarm occurs that it has not reported yet and when all alarms clear.

Phone numbers may be up to 25 characters long and may contain any of the following characters: 0123456789,( )#* or space. Configuring the phone numbers enables the controller to dial-out. The phone number must be the number of a modem. After the controller connects to the remote modem it sends an alarm

report. The alarm report is the same report generated by the T1.317 “ala” command with addition of the site id at the beginning of the report.

When attempting to dial-out, the controller first attempts to dial the primary phone number. It makes up to three attempts, at 1-minute intervals, to connect to the primary phone number. If unsuccessful, the controller makes up to three attempts, at 1-minute intervals, to connect to the alternate phone number. If still unsuccessful, the controller waits for 15 minutes and then repeats this cycle. The controller attempts the cycle 6 times before giving up completely. If the controller successfully contacts either the primary or alternate phone number it sends the alarm report and then disconnects.

Whether or not the controller successfully connects with the primary or alternate phone number, it makes a new attempt to dial-out when a new alarm occurs or all active alarms clear.

The alarm report includes the site ID followed by all active alarms in the system or the message NO ALARMS if no alarms are active in the system.

4 Installation and Configuration

This section covers the installation and configuration procedures specific to the J85501M-1 Galaxy Vector controller. This controller is typically factory wired and assembled in an FMS series battery plant equipped with serialized RS-485 bus communication rectifiers. It is also available stand-alone for use with J85702H-1 PXS shelves, NP shelves, etc. Follow the installation instructions of the appropriate plant, rectifier, converter and battery products to complete all external wiring related to those components of the system.

Wiring

Refer to Section 2 for a summary of all input/output connections associated with the J85501M-1 Vector. The digital serial bus connection must be established from the BUJ1 board port to the rectifiers.

Internal cabinet monitoring is factory wired to the appropriate alarm input terminations. They are also available for connection in the field.

PMJ, PMN, BD, HV/2ACF/VLV, ACF, and MJF alarm output connections are provided on the 848725383 alarm terminal board attached to the BUJ board, as described in Section 2 of this manual. Refer to Figure 2-7 and Table 2-J for additional details.

If use of the available Low Voltage Disconnect (LVD) circuits is required, the wiring from the LVD1/LVD2 terminals on the BUJ board or alarm terminal board to the associated driver circuit, and associated wiring from this driver circuit to the Low Voltage Battery Disconnect or Low Voltage Load Disconnect must be completed. A contactor driver circuit is not necessary when driving less than three contactors from and LVD control

output. For these applications the contactor may be wired directly to the control output of the BUJ board. The installation of this circuitry is covered in the appropriate plant product manual. These connections are typically factory wired. If the controller is to be wired in the field, the following connections should be made to the external LVD contactor from the alarm terminal board.

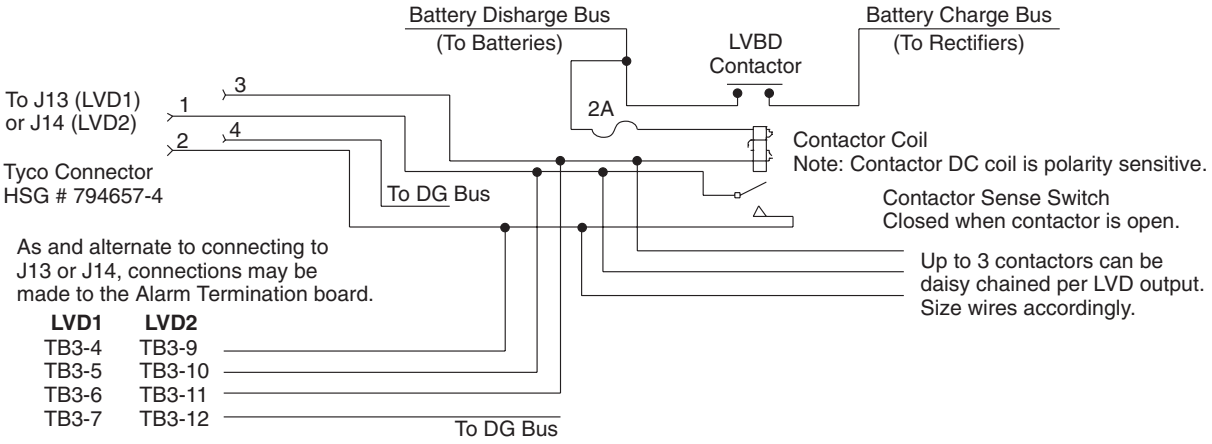


Figure 4-1: Typical Wiring for LVD Contactors (LVBD Shown)

Signal	Alarm Board	6-Pin Connector	Description
LVD1_ST(ate)	TB3.4	J13-2	A closure between this signal and LVD1_RTN or bat, signals the Vector controller the Contactor is OPEN.
LVD1_RTN	TB3.5	J13-1	Return for LVD1_ST
LVD1_CON1	TB3.6	J13-3	Provides on side of a contact closure for contactor coil operation
LVD1_CON2	TB3.7	J13-4	Provides second side of a contact closure for contactor coil operation
LVD2_ST(ate)	TB3.9	J14-2	A closure between this signal and LVD1_RTN or bat, signals the Vector controller the Contactor is OPEN.
LVD2_RTN	TB3.10	J14-1	Return for LVD1_ST
LVD2_CON1	TB3.11	J14-3	Provides on side of a contact closure for contactor coil operation
LVD2_CON2	TB3.12	J14-4	Provides second side of a contact closure for contactor coil operation

If the plant batteries are the “sealed” or maintenance free valve-regulated type, Battery Thermal Compensation may be used. This feature requires 10K ohm thermistor devices. The Vector controller can monitor up to four temperatures. If more than four devices are needed, a 210E thermistor multiplexer may be used. The 210E is then wired into the BUJ1 temperature ports as shown in Figure 2-5. The installation of this equipment is

covered in its respective product manual. These connections may be factory or field wired.

Thermistor input and alarm connections for the 210E thermistor multiplexer unit are shown in Figure 4-2.

The Vector performs rectifier sequencing based on the state of the ACF alarms from the rectifiers and Rectifier RO (Reserve Operation) engine signal terminated at the BUJ1 RO terminal. If this feature is to be used, complete this wiring as described in Section 3.

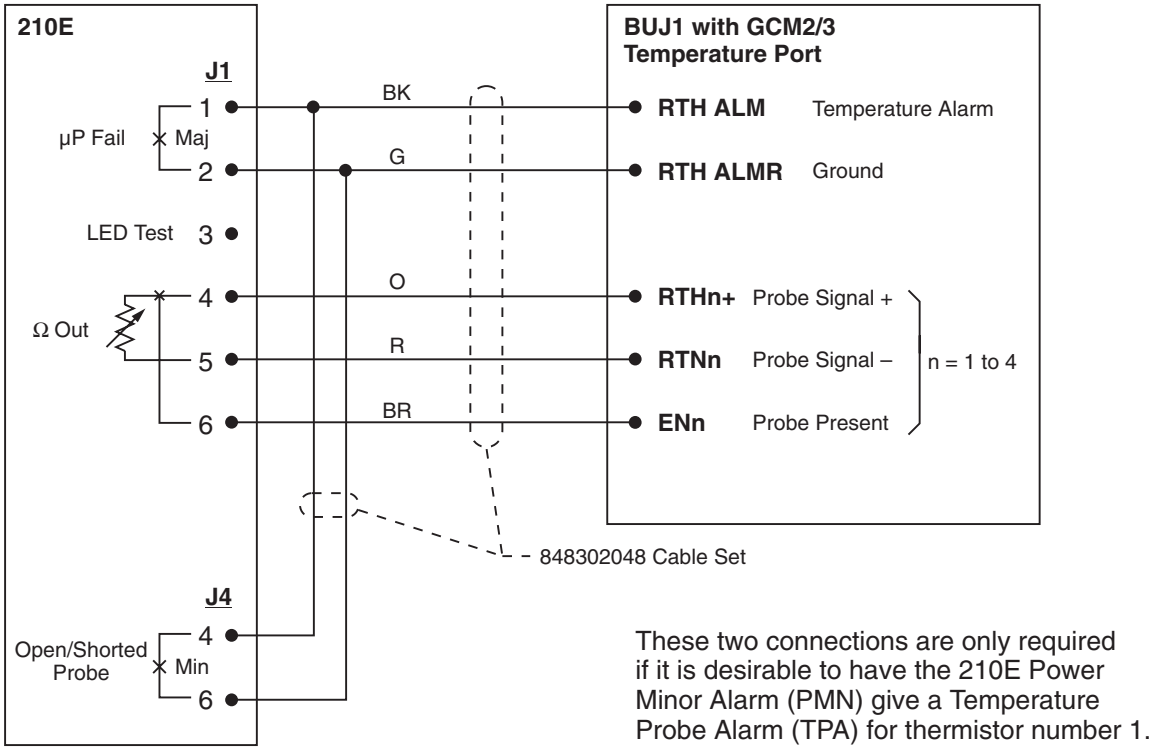


Figure 4-2: 210E Thermistor Multiplexer Connections to BUJ1

Front Panel Operation

Default Front Panel Menu

The J85501M-1 Galaxy Vector Controller with its LCD display presents a default front panel screen displaying the system bus voltage and load current. Regardless of the active display mode, if no key is pressed for approximately 3 minutes, the Vector returns to its default menu. The present operating state of the system is also displayed on the default menu.

View Active Alarms Mode

If alarms are active in the system, the last two rows of the screen will provide additional softkey information. The third row will provide a softkey that allows a user to deactivate all audible alarms. This is performed by using the "ACO" feature. The fourth row on the display will provide immediate access to the system alarms. This mode is entered by pressing the View Active Alarms softkey. While in this mode, alarms are listed in order of severity. All major alarms will be listed first, followed by minor alarms. If four or more alarms are present, use the up or down arrows to scroll through the alarms. When no alarms are present, the default screen will display No Active Alarms. To exit View Active Alarms mode, press "Done" the Home key. If no key is pressed for 3 minutes, the Vector returns to the default screen automatically.

Configuration

All rectifiers must be numbered uniquely. Valid numbers for rectifiers are 1 through 24. Refer to the appropriate sections of the plant manuals for setting ID numbers. NP rectifier numbering is managed through configuration in the shelf. For additional information, consult the appropriate NP documentation.

SW1 and Softkey Display Navigation in Configuration Mode

SW1-1 of the BUJ1 board is a hardware enable switch for Configuration mode of the J85501M-1. If Configuration is not enabled, the user is only permitted to access and view the configuration parameters, but may not change any of them. To allow configuration changes, move SW1-1 to position 0. Once configuration has been completed, it is a good practice to disable (position 1) SW1-1 to prohibit someone from mistakenly changing these parameters.

Configuration mode is entered by pressing the Home key to display the menu selections. Press the appropriate softkey to enter the Configuration mode. The first parameter of the configuration menu will be displayed. Refer to Table 4-A for a description of the parameters of the configuration menu. Note that two columns of default values are shown, for standard and custom applications. The defaults are determined by SW1-2. SW1-2 = 0 is standard, SW1-2 = 1 is custom. SW1-2 is recognized only upon power-up of the GCM.

In addition, the other remaining switches on SW1 (see Figure 2-5) are used to configure the installed option card, the installed rectifier class, and alarm setting for alarm contacts

HV/2ACF/VLV. If no option card is installed, set S1-3 to the factory default of "0". This will allow local terminal access. The GPS rectifier class includes all 596 and 595 series of serial controlled rectifiers (S1-4=0). NP rectifiers include NP2500, NP1500, NP1200, and NP1300 with installed NPC1 GP serial communication option cards (S1-4=1). The alarm select switch, S1-5, can be changed and recognized while the GCM is powered. Similarly, S1-7 can be recognized while the GCM is powered and setting this switch to "1" will manually force a PBT session. S1-6 is used to initiate the front panel display when the display assembly has been removed and re-installed. S1-8 is used to initiate the front panel display when the display assembly has been removed and re-installed.

Once in configuration mode, use the ∧ and ∨ keys to select the heading that contains the item you want to edit See Figure 4-x for assistance. Press the appropriate softkey on the left to access the item to be edited. Then use the appropriate arrow keys to change the default values of the parameters being edited. Generally the ∧ and ∨ arrows are used to scroll through a selection of items or used to change a digit in a numerical value. The < and > arrows are used to move left and right in a configuration field. Items displayed in brackets identify the user's place in the menu structure. For instance, [config 1/3] means screen 1 of 3 in the Configuration menu.

Once a change is made, two actions are available. The first is to press the softkey designated "Save." The new value for the parameter is saved and will be used from then on. The second choice is to press the softkey designated "Quit." The new parameter is not saved. The previous value is restored as the system value. Pressing the Menu hardkey has the same effect as "Quit." Both of these choices remove the user from the parameters edit screen.

If an attempt is made to set a parameter higher than allowable, the maximum value will be displayed. Likewise, an attempt to set a parameter lower than allowed results in display of the minimum value.

To save changes made to a parameter value and return to the configure menu, press the Save softkey. To return to the configure menu without saving any changes to a parameter, press the Quit softkey. To exit configuration mode and return to

the default screen, press MENU twice. If no key is pressed for approximately three minutes, the display will return to the default front panel screen.

Refer to Table 4-A as each of the Configuration Parameters is explained in the following sections. Each section also explains how to access the data available from these features.

Table 4-A: Configuration Parameters

Main Menu Heading	Parameter Description	Range (24V, 48V Systems)	Default (24V, 48V Systems)	
			Standard	Custom
Float Voltage	System float voltage set point	22-28V, 44-56V	27.24V, 54.48V	27.24V, 54.48V
	High float voltage major alarm	25-30V, 50-60V	28.24V, 57V	28.5V, 57.0V
	High float voltage minor alarm	25-30V, 50-60V	27.74V, 56V	27.74, 56.0V
	Battery discharge major alarm	23-27.5V, 46-55V	25.54V, 51.1V	25.0V, 51.1V
	Very low voltage major alarm	20-25.5V, 40-51V	23.00V, 46.00V	23.0V, 46.0V
Rectifiers	Rectifier output float current limit	30-110%	100%	110%
	Number of rectifiers on line	1-24	24, 1	24
Shunts	System shunt type	Battery, load, none	Battery	Battery
	Shunt 1 current rating	0-9999A	800A	1000A
	Shunt 2 current rating	0-9999A	0A	0A

Table 4-A: Configuration Parameters (Continued)

Main Menu Heading	Parameter Description	Range (24V, 48V Systems)	Default (24V, 48V Systems)	
			Standard	Custom
Batteries	Type	Valve-regulated, flooded	Valve-regulated	Valve-regulated
	Battery discharge test enable	Enabled/Disabled	Disabled	Disabled
	High battery temperature major alarm	30° to 85°C	55°C	75°C
	Battery temperature compensation enable	Enabled/Disabled	Disabled	Enabled
	High battery temperature stepdown voltage	45° to 85°C	75°C	75°C
	High battery temperature voltage decrease stop (upper slope limit)	30° to 55°C	45°C	53°C
	High battery temperature voltage decrease rate (upper slope per cell)	1 to 5mV/°C	3mV	3mV
	Nominal temperature (no voltage compensation)	15° to 30°C	25°C	25°C
	Battery low temperature compensation voltage increase enable	Enabled/Disabled	Disabled	Disabled
	Low battery temperature voltage decrease stop (lower slope limit)	-5° to 20°C	0°C	-5°C
	Low battery temperature voltage decrease rate (lower slope per cell)	1 to 5mV/°C	3mV	3mV
	Battery recharge current limit enable	Enabled/Disabled	Disabled	Disabled
	Battery recharge current limit threshold	10-1000A	1000A	1000A

Table 4-A: Configuration Parameters (Continued)

Main Menu Heading	Parameter Description	Range (24V, 48V Systems)	Default (24V, 48V Systems)	
			Standard	Custom
Contactors	Contactor 1 type	Battery/Load/None	None	Battery
	Disconnect voltage, contactor 1	20-26V, 40-52V	21V, 43.2V	N/A, 43.2V
	Reconnect voltage, contactor 1	20-26V, 40-52V	22.2V, 44.4V	N/A, 44.4V
	Contactor 2 type	Battery/Load/None	None	N/A, 43.2V
	Disconnect voltage, contactor 2	20-26V, 40-52V	21V, 43.2V	N/A, 44.4V
	Reconnect voltage, contactor 2	20-26V, 40-52V	22.2V, 44.4V	N/A, 43.2V
Converters	Converter set point voltage	46-57V	50V	N/A
	Converter shutdown voltage (disconnect threshold)	20-26V	21V	N/A
	Converter shutdown voltage enable (low voltage disconnect)	Enable/Disable	Disable	N/A
	Converter restart voltage (reconnect threshold)	20-26V	22.2V	N/A
Boost	Boost feature enable	Enable/Disable	Disable	Disable
	Boost set point system voltage	24-30V, 48-60V	27.24V, 55.2V	N/A, 55.2V
	High boost voltage major alarm threshold	26-30V, 52-60V	28.24V, 57V	N/A, 57.0V
	High boost voltage minor alarm threshold	25-30V, 50-60V	27.74V, 56.2V	N/A, 56.2V
	Auto boost feature enable	Enable/Disable	Disable	Disable
	Auto boost duration (_ × BD duration)	1 to 9	1	N/A, 1
	Manual boost duration	1-250 hours	8	N/A, 8
	Boost current limit (rectifier limit during boost)	30%-110%	100%	N/A, 100%

Table 4-A: Configuration Parameters (Continued)

Main Menu Heading	Parameter Description	Range (24V, 48V Systems)	Default (24V, 48V Systems)	
			Standard	Custom
Communication ports	Local port baud rate setting	Auto/1200 to 19,200	Auto	Auto
	Local port flow control setting	None/SW/HW	None	None
	Modem port baud rate setting	Auto/1200 to 19,200	2400	2400
	Modem port flow control setting	None/SW/HW	None	None
	Number of rings before modem answers	1 to 9	1	1
Calibrate to meter	Calibrate system voltage to a new value	22-28V, 44-56V	System voltage	N/A
	Calibrate converter voltage to a new value	46-57V	Converter voltage	N/A

Battery Discharge Test Results

After initiating a Battery Discharge Test through the Operations menu, the user obtains the data or results from a battery discharge test through the View Status menus. Selecting Batteries > Battery Test Result displays the result of the last battery test. The Vector stores the result of the last completed test. This is the recorded data (not manually changeable) for the battery test result. Refer to the battery discharge test operation for detail test procedure and results.

Pressing the Battery Test Result softkey displays an indication of the last battery test performed. The display indicates either that the test was completed or not completed. In addition, the last completed battery test results are saved and can be accessed by pressing the "< View Completed" softkey. This allows the user to observe the reserve time and load current during the test. If for some reason the test was completed and results were unsatisfactory, the message "Check Battery" is displayed. If the last test was interrupted, the message "Not Available" is displayed. If a test was stopped before completion, the phrase "Previous Test Was Interrupted" will also appear when the Battery Test softkey is pressed.

When a test has been completed, the battery reserve time is displayed in the form of hours and tenths of hours (hh.h).

Load current is displayed in the form of Amps without decimal point (dddd). The load current is the current observed during the test.

Battery Discharge Test Enable

Two settings are available, Enable or Disable. Selecting Enable allows the battery discharge test to be performed and selecting Disable prevents the battery discharge test from being performed. Press the < Save softkey to save one of the two settings. When the test is enabled, the battery test softkey will be enabled. Otherwise, the battery test softkey is disabled.

Shunt Type/Size

The J85501M-1 Vector provides two separate shunt signals for use in determining the system current to display: SH1+/- and SH2+/- on the BUJ1 board as shown in Figure 2-5. The shunts must be rated for 50 mV and have a current rating of 0-9999 amps.

The method used by the Vector to determine the system load value is determined by the configuration of the Shunt Type. The three choices for this parameter are “None”, “Load”, and “Battery”.

None: Select “None” if there is no central load shunt used in the system or connected to the BUJ1 board. Selecting “None” results in displaying the system load current as the sum of the individual rectifier loads. This may not be the true “load” current in systems with battery backup since it includes the portion of the rectifier loads which is floating or recharging the batteries. Zero amps will be shown when the rectifiers are off and the batteries are carrying the system load. Typically, this shunt type would be used only in batteryless systems, where this is an accurate depiction of system load.

Load: Selecting “Load” as the shunt type assumes that the system provides at least of the two shunt signals to the BUJ1 board. When the shunts are configured for “Load,” the displayed system load is the sum of all active shunt values. Battery float or charge current can be determined by subtracting the displayed system load current from the sum of the individual rectifier outputs. The use of two separate shunt signals allows loads to

two distribution bays to be monitored separately. If the current is displayed as "Err," the system may contain a battery shunt or may be improperly wired.

Battery: Placing one or both shunts in the charge/discharge path of the system batteries and configuring the shunts as Battery shunts results in a system load current that is the calculated difference of the sum of the individual rectifier currents and the sum of the battery charge currents obtained from the shunt measurements. This is the typical configuration used with most distributed architecture systems. It is accurate regardless of whether system batteries are charging or discharging.

Shunt Size

The shunts are assumed to have a voltage rating of 50mV. The full scale load ratings are user configurable. Each shunt can have a current rating configured from 1 to 9999 amps. A value of 0000 disables that shunt reading.

System Float Mode Settings

The following parameters are settings which are active anytime the plant is in Float mode.

System Float Voltage Set-Point: This is the output voltage that all system rectifiers will be set to while in Float mode. If Battery Thermal Compensation is enabled and active, the actual system voltage will be adjusted from Float Set Point based on the highest battery temperature monitored by the Vector.

Rectifier Float Current Limit: Rectifier current limit can be adjusted from 30 to 110% of rectifier capacity. This is the current limit while the system is in Float mode.

High Float Voltage Major Alarm Threshold: System voltage monitored above this threshold results in a High Voltage major alarm and possible rectifier shutdown while in Float mode.

High Float Voltage Float Minor Alarm Threshold: System voltage monitored above this threshold results in a High Float Voltage minor alarm (no rectifier shutdown) while in Float mode.

Battery on Discharge Float Major Alarm Threshold: System voltage monitored below this threshold results in a Battery Discharge major alarm while in Float or Boost mode.

Very Low Voltage Threshold

Very Low Voltage Major Alarm Threshold: In any system mode, system voltage monitored below this threshold results in a Very Low Voltage major alarm.

Battery Recharge Current Limit Settings

Battery Recharge Current Limit: The maximum current flowing into a monitored battery string during a recharge period is adjustable to any value between 10A and 1000A. At least one battery string must be present to have this function.

Battery Recharge Current Limit Enable: To activate the battery recharge current limit feature, the function must be enabled in the appropriate configuration menu. The user must select "enabled;" the default setting is "disabled."

Battery Thermal Compensation Settings

Refer to Figure 3-1 (standard) or Figure 3-2 (custom) for a graphical representation of the various Battery Thermal Compensation settings.

High Battery Temperature Alarm Threshold (G): A monitored battery temperature above this threshold results in a Battery Temperature major alarm. This threshold can be set from 30°C to 85°C. The default temperature is 45°C.

High Battery Temperature Step Down Temperature (H): A monitored battery temperature above this threshold results in a "step" decrease in plant voltage to a level corresponding to 0.17 volts per cell (VPC) below the Plant Float Voltage Set-Point (FSP). This threshold can be set from 45°C to 85°C. The default temperature is 65°C.

Battery Temperature Slope Upper Temperature (F): This is the upper temperature where Battery Temperature Compensation will have reduced system voltage to a level corresponding to F*(F-D)*cells-per-string below the FSP. System voltage will be reduced proportionally at any temperature between this point and the No Voltage Compensation Temperature (D).

Battery No Voltage Compensation Temperature (Nominal Temperature) (D): This is the zero compensation temperature point. Temperatures monitored between this point and the High Battery Temperature Voltage Decrease Upper Threshold (F) will result in a proportional decrease of plant voltage to a level corresponding to F*(F-D)*cells-per-string below the limit. If the

Low Battery Temperature Compensation is enabled, temperatures monitored between this point and the Battery Low Temperature Voltage Increase Threshold (A) will result in a proportional increase of plant voltage to a level corresponding to C*(D-A)*cells-per-string above the limit.

Battery Low Temperature Voltage Increase Threshold (A): This is the lower temperature where, if Battery Low Temperature Compensation is enabled, the temperature compensating feature will have increased system voltage to a level corresponding to C*(D-A)*cells-per-string above the FSP. System voltage will be increased proportionally at any temperature between this point and the Nominal Battery Temperature (D) Slope.

Battery High Temperature Voltage Decrease Rate (Slope) Per Cell (E): This is the slope rate for the voltage decrease per cell when the battery temperature is above the Nominal Battery Temperature (D) Slope.

Battery Low Temperature Voltage Increase Rate (Slope) Per Cell (C): This is the slope rate for the voltage increase per cell when the battery temperature is below the temperature at which there is no voltage compensation (Nominal Temperature, D).

Battery Low Temperature Voltage Compensation Increase Enable: This feature must be enabled in the appropriate configuration menu in order to compensate at the lower temperatures. This feature increases plant voltage rather than decreasing it based on temperature. The capability to enable this feature separately from high temperature compensation is provided so that equipment loads sensitive to high voltages can be protected.

Battery Temperature Compensation Enable: Battery Temperature Compensation (slope thermal compensation) must be configured to “enabled” in order for the feature to be active.

Low Voltage Disconnect Contactor 1 and 2 Settings

Contactor 1 and 2 Low Voltage Disconnect jumpers: Six jumpers are associated with the LVD circuitry on the BUJ board: three of these jumpers J11, J12 and J15 are for LVD1 circuitry and three jumpers J18, J19, and J20 are for LVD2 circuitry. J11, J12, J18, and J19 are factory set, but should the BUJ need to be replaced, these jumper positions should be verified as being set to the appropriate plant voltage as marked on the PWB (24 or 48V). J15 for LVD1 and J20 for LVD2 are manual LVD force-on jumpers used when it is required that the contactors remain closed during service. Return to the Auto position for normal operation.

Contactor 1 and 2 Low Voltage Disconnect Threshold: The low voltage at which a signal will be sent to the respective contactor driver circuit, causing it to open, disconnecting either the load or the batteries, depending on the contactor's location in the circuit.

Contactor 1 and 2 Reconnect Voltage Threshold: This is the voltage at which a signal will be sent to the respective contactor driver circuit, to force the contactor to reconnect or close. This can be used to reconnect either loads or batteries, depending on the contactor's configuration within the system.

Contactor 1 and 2 Type: The contactor type defines how the contactor is used in the system. The type can be set to one of these three choices:

None	no contactor available
Load	contactor used for connecting a load
Battery	contactor used to connect/disconnect battery strings

Plant Boost Mode Settings

The following configuration parameters are settings which are active anytime the plant is in Boost mode.

System Boost Set-Point: This is the voltage that all system rectifiers will be set to when the Boost mode is entered.

Rectifier Boost Current Limit: This is the current limit of the rectifiers while in Boost mode. This current limit is adjustable from 30% to 110% of rectifier capacity.

High Voltage Boost Threshold: System voltage monitored above this threshold results in a High Voltage major alarm. The controller attempts to shutdown the offending rectifiers.

High Float Voltage Boost Threshold: A voltage monitored above this threshold results in a High Boost Voltage alarm. No rectifier shutdown attempts are made.

Boost Auto Enable: This function enables and disables the auto boost feature. The parameter must be configured to "enabled" for this feature to be available.

Boost Enable: This function enables and disables the manual timed Boost feature. The parameter must be configured to "enabled" for this feature to be available.

Boost Auto Mode Factor: This factor sets the duration of the boost. A value from 1 to 9 sets the factor that determines how long the plant is in boost mode after a discharge. The time is determined by multiplying the BD duration by this factor. The Boost Enable parameter must be enabled for this feature to be available.

Converter Settings

The following configuration parameters are settings which affect the operation of any converters that may be connected to the system and communication on the serial bus.

Converter Voltage Set-Point: This is the output voltage that all converters will be set to by Vector.

Converter Low Voltage Disconnect Enable: This feature allows the converter LVD to be operational. Select "Enabled" in the configuration menu to enact the function.

Converter Low Voltage Disconnect Threshold: This is the value at which the converters are placed into standby.

Converter Low Voltage Reconnect Threshold: This is the value at which the converters are retired from standby and their outputs returned to the set-point.

Converter Front Panel Voltage Calibration: The voltage displayed on the front panel is the uncalibrated converter output voltage as seen by the controller. If necessary, this voltage can be calibrated to match a meter. Adjust the displayed voltage until it matches the voltage displayed on a calibrated voltmeter that is measuring the voltage across the converter's output.

Voltage Calibration

Controller's displayed system voltage may be adjusted or calibrated to a known, calibrated meter.

Caution:
This calibration affects all controller functions using plant voltage and/or current values. These functions include the float and boost set points. Generally, this feature is not necessary.

Front Panel Voltage Calibration: The displayed value of voltage can be adjusted by going through the configuration menu. Under "Calibrate to meter," the "System Voltage" softkey can be used to adjust the system of the system voltage. Adjust the displayed voltage until it matches the voltage displayed on a calibrated voltmeter measuring the plant or converter output voltage.

Reserve Operation Engine

Number of Rectifiers On With Backup Engine (Reserve Operation Engine): When a backup engine is running to supply ac power to the rectifiers, a certain number of rectifiers in the system are allowed to be turned on. This number should be based on the engine capacity. The number can be selected between 1 and 24. The default number is 24 (maximum rectifiers on).

Serial Bus Updating and Clearing

The user can perform several operations under the Control/Operations softkey in the Main Menu. These operations include Start Battery Test, Star Lamp Test, Updating the Serial Link, and Starting Boost. Brief descriptions of these items follow:

The Vector remembers any rectifier or converter connected to the system's digital serial bus. A Rectifier Fail Alarm (RFA) will be active if any one of these components is removed from the system or if communication is lost between the component and the controller. If the controller is indicating Rectifier or Converter Fail Alarm (RFA) and no alarm is indicated by the LEDs of the rectifiers or converters, it may be necessary to clear the Galaxy VC rectifier memory. Operating the Clear Events (CLE) resets the Vector rectifier memory and tells the controller to recognize all devices on the bus. The alarm may be cleared.

Note: A few moments after executing Clear Vents, the controller alarms should clear and each rectifier should display no alarms. If alarms continue to be displayed, see Section 5, Troubleshooting. USL will not restart the rectifiers or converters at any time.

Software Release Information

A report of the present software release active in the control board microprocessor may be obtained via the View Status -> Software Version menu path.

5 Troubleshooting

Replacing Circuit Packs

Table 5-A lists the circuit packs available as replacements in the Vector Controller.

Table 5-A: Replacement Circuit Packs and Temperature Modules

Designation	Description	Comcode
210E	Thermal Probe Multiplexer	107789513
BSM3	Modem Board	108415647
BSM4	Local Port Isolation Board	848501037
EBW1	Gateway Network Card	848733898
-	EBW Power Cable	848575841
GCM2	24V Vector Control Board	108890088
GCM3	48V Vector Control Board	108890096
--	LCD Display / Keypad Assembly	848733907
--	Alarm Board Header	406790188
1U-ALM	Alarm Termination Board	848711933
--	P5 Power Cable	848722096

Checking the Highest Battery Temperature

If temperature probes are connected to the controller and thermal compensation is enabled, the highest battery temperature can be calculated based on the plant voltage. Temperatures between the battery thermal lower temperature and the battery thermal nominal temperature can be calculated if the raising of system voltage is also enabled.

Calculate the temperature as follows:

$$\text{voltage difference} = \frac{(\text{system set point} - \text{system voltage reading})}{\text{cells per string}}$$

where cells per string is the number of 2-volt cells per string.

If voltage difference ≥ 0.17, the highest battery temperature is at least as high as the battery thermal step temperature hysteresis value, which is the battery thermal step temperature – 10°C.

If voltage difference = 0.1, the highest battery temperature is between the battery thermal upper temperature and the battery thermal step hysteresis value.

If voltage difference > 0 and voltage difference < 0.10, temperature = thermal nominal temp + voltage difference × (thermal upper temp – thermal nominal temp)

Note: This will be a temperature in the range of the battery thermal nominal temperature setting and the battery thermal upper temperature setting.

If voltage difference ≤ -0.10, the highest battery temperature is at or lower than the battery thermal lower temperature setting.

If voltage difference < 0 and voltage difference > -0.10, temperature = thermal lower temp – voltage difference × (thermal nominal temp – thermal lower temp)

Note: this will be a temperature in the range of the battery thermal lower temperature setting and the battery thermal nominal temperature setting.

Inaccurate Plant Voltage Readings

If the default menu of the LCD indicates that the system is in "compensation mode," this indicates that the plant voltage has been altered to raise or lower based on the highest battery temperature. Temporarily disabling the Battery Thermal Compensation feature through the configuration menu returns the system voltage to the set point.

The system voltage may differ slightly from an external meter reading. This difference could be attributed to the calibration or accuracy of the external voltmeter. A meter adjustment may be attempted by using the "Calibrate to meter" function in the Configuration menu. See to the plant voltage configuration section.

If the voltage sense wires are open or reversed, the display will be +16 or -35 depending on the GCM type.

Temperature Probe Alarm is present

The Temperature Probe Fail alarm indicates that either there is something wrong with the temperature connections, or that there is a problem with one of the external temperature processing units. An additional possibility is that the alarm is indicating that the thermal compensation feature is enabled, and that no temperature probes are present. If there are no temperature probes connected to the Vector, then disable the Battery Thermal Compensation Enable setting.

Unexplained Rectifier Failure Alarm and Multiple Rectifier Failure Alarm

A rectifier that is removed from the plant will generate a Rectifier Fail Minor alarm. If more than one rectifier is missing, a Multiple Rectifier Fail Major alarm is generated. To clear these alarm conditions, go to the Operation Menu and assert the Clear Events (CLE) command.

Note: A few minutes after executing the Clear Events function to clear alarms, the controller RFA alarm should clear and no rectifier should display any alarms. If alarms continue to be displayed, continue investigating the system for possible rectifier problems.

Unexplained Converter Failure Alarm and Multiple Converter Failure Alarm

A converter that is removed from the plant will generate a Converter Fail Minor alarm. If more than one converter is missing, a Multiple Converter Fail Major alarm is generated. To clear these alarm conditions, go to the Operation Menu and assert the Clear Events (CLE) command.

Note: A few minutes after executing the Clear Events function to clear alarms, the controller CFA alarm should clear and no rectifier should display any alarms. If alarms continue to be displayed, continue investigating the system for possible converter problems.

Rectifier Id conflict alarm is asserted

This alarm indicates that a rectifier Id has not been set or is duplicated in the system. Verify all rectifiers are numbered uniquely between 1 and 24. Refer to numbering procedure in rectifier manual.

Converter Id (Cid)

This alarm indicates that a converter Id has not been set or is duplicated in the system. Verify all converters are numbered uniquely between 1 and 8. Refer to numbering procedure in bay manual.

6 *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.

Appendix A Communications

BSM3 Modem

Port Settings This section describes the communication port settings for the BSM3 internal modem, external modem, and RS-232 terminal. Figure A-1 shows the BSM3 modem board. In addition, set SW1-3 to "0" for the MODEM option. Figure A-2 shows a block diagram of connections from the Modem kit to the BUJ board.

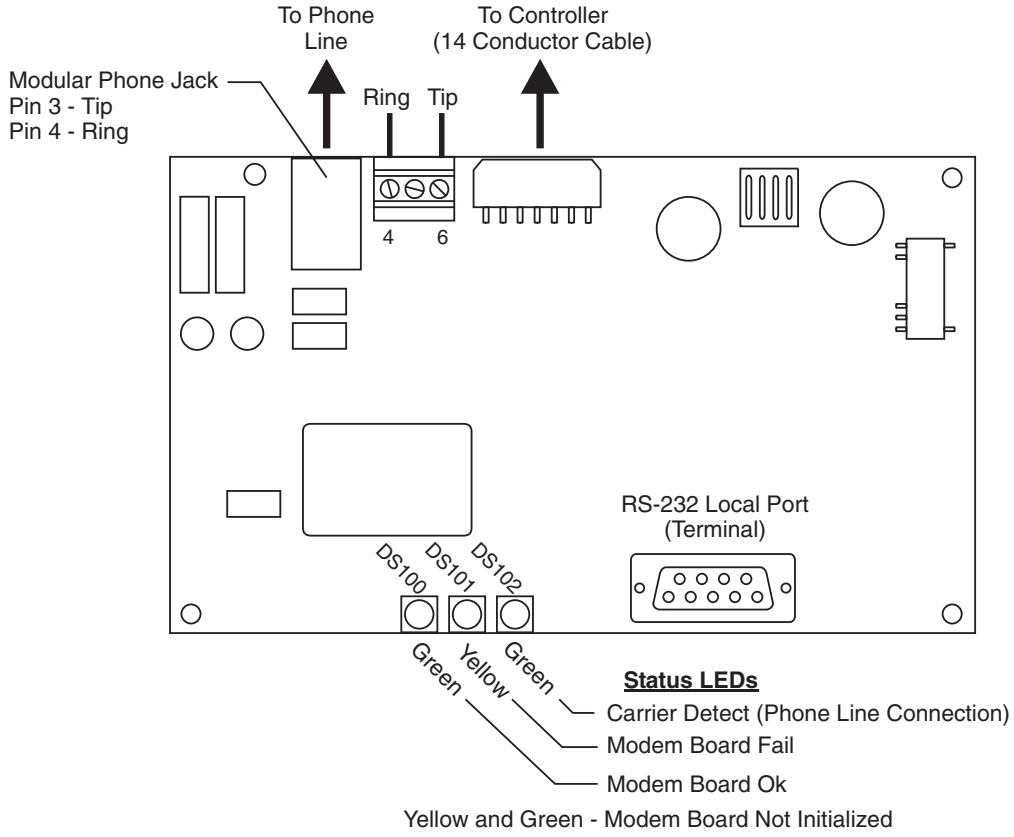


Figure A-1: BSM3 Modem Board

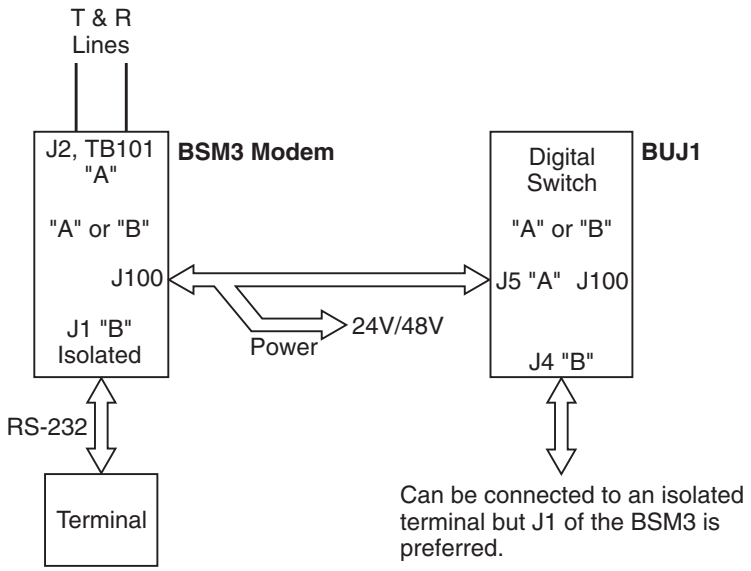


Figure A-2: BSM3 Modem Connections Block Diagram

The controller communicates with the BSM3 internal modem and an external modem at the same communication settings. These settings are as follows:

baud rate:	2400
data bits:	8
stop bits:	1
parity:	none

The controller communicates over the RS-232 terminal interface using the following settings:

baud rate:	9600 default, auto baud from 1200 to 19200
data bits:	8
stop bits:	1
parity:	none

Logging in This section describes how to log into the system. The first step to logging in is to get to an "ENTER PASSWORD: " prompt. From a modem, dial into the controller and wait for the modem to connect. After the modem connects you will be presented with the log-in prompt. If you don't see the log-in prompt after the modem connects, you may have to press the ENTER key in order to see the prompt.

From a terminal connected to the RS-232 port, simply press ENTER until you are presented with the log-in prompt. The number of ENTER keys required will depend on the baud rate you are trying to connect at. The controller will adjust its baud rate automatically until it recognizes the carriage return character (ASCII 13) sent by pressing ENTER.

At the "ENTER PASSWORD" prompt type the user or super-user password. The default password for each level of security is listed below.

lineage	default user password
super-user	default super-user password

In general, the user and super-user may view any measurement, configuration, or control parameter. The super-user can also set configuration and control parameters as well as change system passwords.

After receiving the correct password, the controller will respond with one of the following command line prompts:

*	user command line prompt
**	super-user command line prompt

When these prompts appear the controller is ready to accept commands. If the port is idle for 15 minutes then the session will terminated.

BSM4 Isolation Board

The BSM4 Isolation Board isolates the RS-232 communication port of the BUJ from battery voltage. Figure A-3 shows a block diagram of connections from the BSM4 kit to the BUJ board.

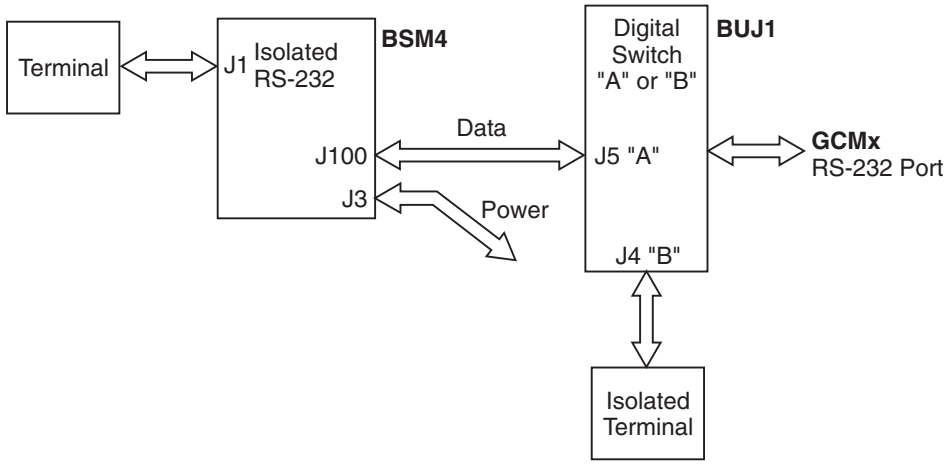


Figure A-3: BSM4 RS-232 Isolation Board Connections Block Diagram

Galaxy Gateway

Figure A-2 shows the Galaxy Gateway installation and cabling procedures required in a J85501M-1 Vector controller, including computer and Galaxy Gateway configuration. Note that only one mounting position is available for a remote option; either a Gateway (EBW) or modem (BSM) board.

Operational Note

If J5 is connected to an option board (EBV1, BSM3 or BSM4), then a terminal is connected to DB9 connector J4, the J4 RS-232 connection takes precedence. This will stop the RS-232 communication through J5 until the connection to J4 is removed.

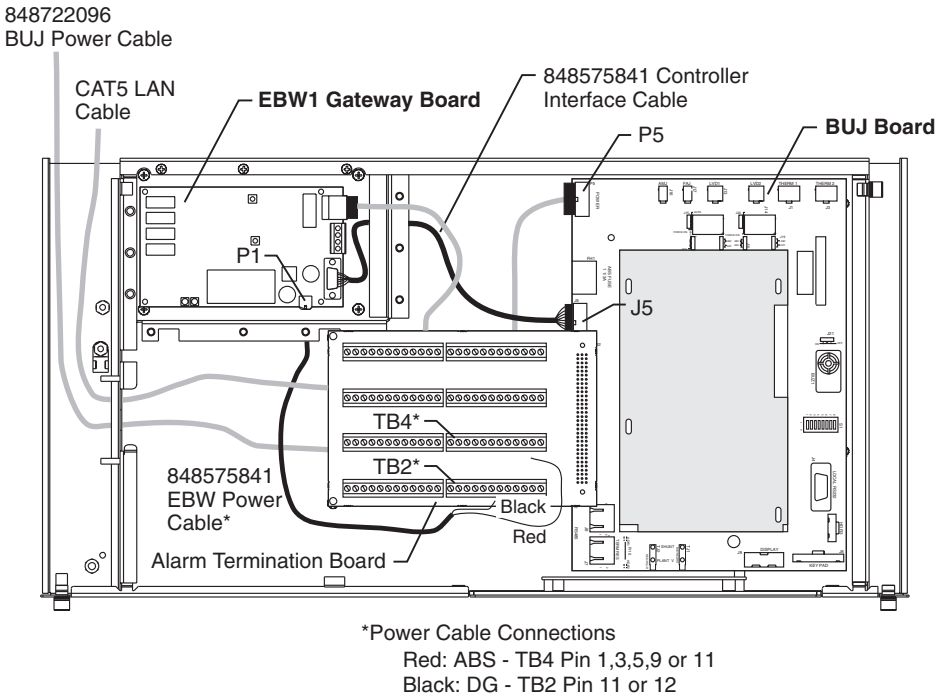


Figure A-4: Installing the Gateway

Preparation

The following Network Configuration Parameters must be obtained from your Network Administrator before starting:

- IP address
- Subnet mask
- Host name
- Gateway IP address

Note: Host and Gateway are optional.

Precautions

Note: Before starting, make sure proper ESD precautions are observed. The ESD grounding termination point is located on the left front of the unit.

- Wear grounded antistatic wrist straps when handling all circuit packs. The wrist strap must be in contact with the skin and is not to be worn over clothing.
- Always consider personal safety. Be aware of the presence of battery potential in the vicinity of the controller.
- Use only insulated tools.

Verify that no controller related alarms are active on the LCD display panel. If a controller alarm is active, review the product manual troubleshooting section or contact Lineage Power technical support.

Tools/Equipment Required

Before installing and configuring the Galaxy Gateway, the following tools/equipment are required:

- Flat jeweler's screwdriver (controller DIP switch setting)
- Small #2 Phillips head screwdriver
- PC with terminal emulation program (example: HyperTerminal)
- 9 pin male serial interface cable (DB-9 male) to connect to Galaxy Gateway
- Network interface cable (CAT 5 UTP)

Unpacking the Galaxy Gateway

The 848733898 Galaxy Gateway Kit has been inspected, tested and carefully packed. Examine the shipping carton and all components for any sign of shipping damage.

1. Check for external damage to the shipping cartons.
2. Remove all parts from shipping cartons.
3. Check the following table and verify that all components are present.

Item	Qty	Comcode	Description
1	1	108340100	Galaxy Gateway circuit pack
2	1	848281945	Black insulator (not used)
3	1	848364865	Millennium Controller interface cable (not used)
4	2	408456465	Nylon mounting posts (HMSP-TM-10)
5	1	402244081	Cable tie
6	2	407882141	Metal standoff (9740-SS-0632)
7	2	845143866	Screw, PPHM 6-32 x 5/16"
8	1	848589859	Black insulator
9	1	848575841	Vector Controller interface cable
10	4	408450955	Metal standoff (AL-5171-16)
11	8	901377366	Screw, PPHM M3 x 6mm
12	4	901351239	Nut, hex 6-32
13	1	848649943	Mounting bracket

If damage is found and/or components are missing, file a claim with the carrier if applicable, and notify Lineage Power Customer Service (See Section 1).

Vector Controller Configuration

The physical interface for the Vector controller to the Galaxy Gateway is through P4 connector on the BUJ1 connection board, close DIP switch S1.3 (set to 1) to allow communication between Gateway and the Vector Controller.

Gateway Installation for the J85501M-1 Vector Controller

Use the following procedure and Figures A-4 and A-5 to install a new or replacement Galaxy Gateway.

1. Place 848718276 black insulator under the Galaxy Gateway and position over the mounting standoffs. J1 (RJ-45 connection) should be pointing toward the middle of the unit.

2. Install four 845143874 6-32 screws to the lower mounting standoffs (torque to 3 in·lbs).

3. Install two 407882141 metal standoffs to the upper mounting standoffs (torque to 10 in·lbs).

4. Wrap insulator around the Gateway board and snap onto nylon posts. Using two 845143866 screws, secure top of insulator to metal standoffs (torque to 10 in·lbs).

5. Locate 848575841 controller interface cable provided in the kit.

6. Identify the end with a black, 14 position connector. Connect this end to P4 on the BUJ terminal connector board.

7. The red and black leads should be connected to posts marked ABS and DG of the BUJ1. The ABS connection is protected by a 1-1/3 ampere fuse on the BUJ1 terminal board. The maximum current required by the Gateway is 600mA. Verify that the current required by all equipment connected to these ABS connections does not exceed the capacity of the fuse. Connect the black 4-position connector of the cable to the P1 power connector on the Galaxy Gateway. Power will be applied to the Galaxy Gateway when this cable is plugged into P1. The DB-9 male (9 pin) connector will not be connected until after the Gateway is configured.

8. After the connection to P1, wait approximately 45 seconds. The Yellow status LED should blink, indicating that the Gateway is ready to be configured.

9. Install 848711305 cover with twelve 901301275 6-32 counter-sink screws.

10. Close drawer.

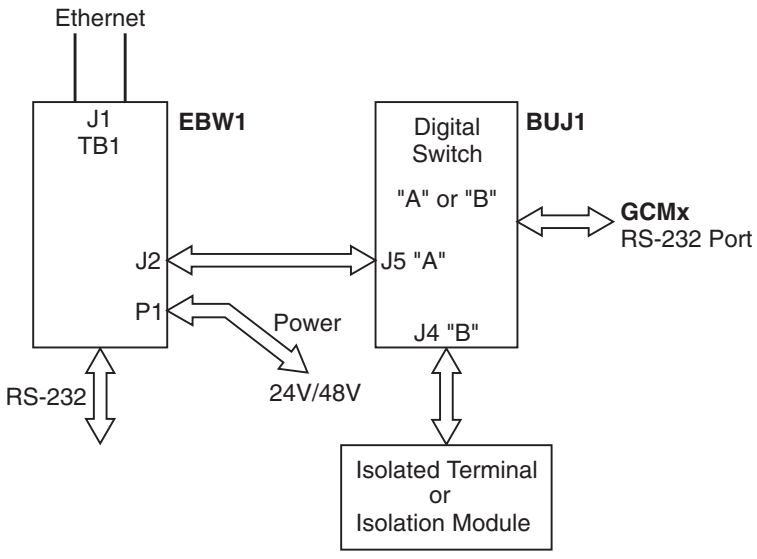


Figure A-5: Gateway Connection to J85501M-1 BUJ1 Board.

10Base-T Network

The Galaxy Gateway has an IEEE 802.3 compliant 10Base-T network interface. Since the cable length required to connect the Galaxy Gateway to the network is variable, this cable must be supplied by the user. Connect the network interface cable from the IEEE 802.3 compatible network to J1 (RJ-45) connector on the Galaxy Gateway as shown in Figure A-3.

1. Connect one end of the network interface cable to J1 (RJ-45 Network Interface Connector), usually located at the bottom right on the Galaxy Gateway. (Other configurations are possible with the hardware shown in Figure A-3.)

2. Connect the other end to an IEEE 802.3 compatible network.

Configuring Network Communications

The Galaxy Gateway uses Transmission Control Protocol/ Internet Protocol (TCP/IP) to communicate with the host computer on a local area network. TCP/IP is a widely used protocol that provides communication across networks of diverse computers and devices. This protocol forms the basis for the Internet. Each device or host on a TCP/IP network has its own IP address. The IP address is a 32-bit number, usually written in dot notation (e.g., 127.9.235.48). Another 32-bit number, called subnet mask (or *address mask*, *netmask*, e.g., 255.255.0.0) is used to identify the network portion and subnet portion of the IP address.

1. Connect a PC to the local port (9-pin female connector) of the Galaxy Gateway.

2. Using the built-in configuration utility, enter network configuration information. This information may have to be provided by the network administrator. The following equipment is required:

   - PC with terminal emulation program

   - Serial interface cable (DB-9 Male) for connection to the Galaxy Gateway

   To configure the Galaxy Gateway for your network, the following information is required for the Galaxy Gateway and your network:

- IP address
- Subnet mask

In addition, the following optional information may be entered:

- Host name
- Default Gateway IP address

Logging In to the Galaxy Gateway

To login to the Galaxy Gateway, follow these steps:

1. Start-up the PC terminal program (Windows Terminal, Procomm, etc.) using the following communication parameters:

   Baud : 9600
   Data : 8
   Parity : none
   Stop : 1
   Handshaking: none
   Flow Control: none

2. Connect the PC to the Galaxy Gateway card's local port (RS-232) connector J2 (if it isn't already connected).

3. Press reset (SW1 – uP reset; see Figure A-3) on the Galaxy Gateway card.

4. Wait for any diagnostic messages to pass.

5. Wait for the "ENTER PASSWORD:" command line prompt.

6. Type the Network Administrator password (default*:* *networkadm*).

7. Wait for the "$" prompt.

Configuring Static Network Parameters

After a valid password entry, a login header with the following format will be displayed:

```
Board Code           EBW1 1:3 or BJD1 1:2
```

```
Serial Number        02DJ09112345

Boot Block           version 1.0
Application Code     version 3.0
Default Web Pages    version 3.0
Custom Web Pages     not found

Ethernet Address     00-60-1D-00-5C-07
IP Address           not configured
Subnet Mask          not configured
Default Gateway      not configured
Host Name            not configured

For assistance type help

$
```

Typing HELP at the "$" will show all available network administration commands and command line formats.

**note: 1) commands are not case sensitive*
2) for the commands that follow, ddd is a number from 0 - 255

- To set the IP Address, type:
  CHA NET1,IP=*ddd.ddd.ddd.ddd*
  Verify by typing:
  STA NET1,IP

- To set the Subnet mask, type:
  CHA NET1,SUB=*ddd.ddd.ddd.ddd*
  Verify by typing:
  STA NET1,SUB

- Optional:
  To set the Default Gateway Address, type:
  CHA NET1,GTWY=*ddd.ddd.ddd.ddd*
  Verify by typing:
  STA NET1,GTWY

- Optional:
  To set the Host Name, type:
  CHA NET1,HOST=*host name*
  Verify by typing:
  STA NET1,HOST

Logging Out of the Galaxy Gateway

To terminate the configuration session, enter the "bye" command. The Galaxy Gateway will notify the user if configuration is not complete. This message will have the following format:

```
NOTICE:
Default gateway may be required for network
access.
Host Name may be required for network access.

Logging off...
```

Messages referencing the Gateway and Host Name are acceptable, since these parameters are optional.

Note: If the IP address or Subnet mask messages appear, for example:

```
IP Address is required for network access.
Subnet mask is required for network access.
```

then the configuration procedure must be repeated.

Post Installation Procedures

Once configuration has been completed

1. Disconnect the serial cable from the Galaxy Gateway (J2 connector).

2. Connect the 9-pin male end of the auxiliary port cable assembly to the J2 connector on the Galaxy Gateway.

3. Press SW1 (uP reset) on the Galaxy Gateway.

4. After approximately one minute, observe the LEDs on the Galaxy Gateway.

   - Yellow STATUS LED: OFF
   - Green STATUS LED: ON
   - Link LED: ON
   - XMIT/RCV: May be blinking

   The Galaxy Gateway should be communicating over the network.

5. Secure the cable to the lance on the mounting bracket using the cable tie provided.

Appendix B T1.317 Objects and Attributes

The command language is based on the T1.317 standard. The T1.317 standard has been adapted to the needs of a low-end controller. This section describes the commands, objects and attributes used to access measurements, configuration, and control parameters in the controller.

Objects and Attributes

The T1.317 standard organizes system parameters called attributes into groups called objects. The tables below lists the objects supported for remote access.

An object-attribute pair uniquely identifies a measurement, configuration, or control parameter. For example, the object-attribute pair "dc1,vdc" identifies the plant voltage while the object-attribute pair "dc1,adc" identifies the plant load current. In each of these examples "dc1" identifies the plant object and "vdc" and "adc" identify DC voltage and DC current respectively. The table below summarizes the object-attribute pairs in the system along with the commands that can be used with the pair and the valid range that the attribute may have. Commands are defined in detail in the following section.

Table B-1: Power System

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
ps1,des	Power system description	√			text	"Tyco Vector Controller"
ps1,sid	Site ID	√	√		text	Up to 15 characters:""
ps1,swv	Software version	√			text	Vector software version
ps1,usl	Update serial link & clear alarms	√		√	number	1

Table B-2: DC Plant

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
dc1,stt	Plant state	√		√	text	"FLOAT", "BOOST"
dc1,vdc	Plant voltage	√			number	*dd.dd* V
dc1,adc	Plant load current	√			number	*dddd* A
dc1,sht	Plant shunt type	√	√		text	"NONE","LOAD","**BATTERY**"
dc1,sha1	Plant shunt 1 size	√	√		Number	0-9999:**800** 0 means none
dc1,sha2	Plant shunt 2 size	√	√		Number	**0**-9999 0 means none
dc1,trd	Plant Total Rectifier Drain	√			number	*dddd* A

Table B-3: Alarm Thresholds

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
hva1,fth	Very High Float Voltage Major	√	√		number	25-30:**28.24V** or 50-60:**57V**
hva1,bth	Very High Boost Voltage Major	√	√		number	26-30:**28.24V** or 52-60:**57V**
hfv1,fth	High Float Voltage Minor	√	√		number	25-30:**27.74V** or 50-60:**56V**
hfv1,bth	High Boost Voltage Minor	√	√		number	25-30:**27.74V** or 50-60:**56.20V**
bda1,thr	Battery on Discharge	√	√		number	23-27.50:**25.54V** or 46-55:**51.10V**
vla1,thr	Very Low Voltage	√	√		number	20-25.5:**23V** or 40-51:**46V**
bta1,thr	Battery Thermal Alarm	√	√		number	30:85:**55°C**

Table B-4: Rectifier Management

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
gm1,fsp	Rectifier float set-point	√	√		number	22-28.5:**27.24V** or 44-56:**54.48V**
gm1,bsp	Rectifier boost set-point	√	√		number	24-30:**27.24V** or 48-60:**55.20V**
gm1,fcl	Rectifier float current limit	√	√		number	30-110:**100%**
gm1,bcl	Rectifier boost current limit	√	√		number	30-110:**100%**
gm1,rone	Rectifiers on while on engine	√	√		number	1-**24**

Table B-5: Rectifiers (*xx* is 01 to 24)

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
gxx,stt	Individual rectifier state	√		√	text	"ON","OFF","STANDBY", "VACANT"
gxx,adc	Individual rectifier current	√			number	*ddd*

Table B-6: Battery Reserve Management

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
br1,cle	Batt recharge current limit enable	√	√		number	**0:disable** 1:enable
br1,clt	Battery recharge current limit	√	√		number	10-**1000 A**
br1,btc	Battery test class	√	√		text	"FLOODED","**VALVE-REG**"
br1,bte	Battery test enable	√	√		number	**0:disable** 1:enable
br1,btr	Battery test results	√			mixed	*result, reserve, load* *code:* ok, aborted, failed, not run, interrupted *reserve: dd.d* (hours) load: *dddd* (amps)
br1,bts	Battery test state	√		√	number	0:inactive 1:active

Table B-7: Battery Sections

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
b01,adc	Battery section 1 current	√				*dddd* A
b02,adc	Battery section 2 current	√				*dddd* A

Table B-8: Controller Battery Temperature Channels

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
ct1,val	Controller battery temp chan 1	√				*dd* °C
ct2,val	Controller battery temp chan 2	√				*dd* °C
ct3,val	Controller battery temp chan 3	√				*dd* °C
ct4,val	Controller battery temp chan 4	√				*dd* °C

Table B-9: Converter Plant

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
cp1,vdc	Converter output voltage	√			number	dd.d V
cp1,adc	Converter load current	√			number	dd.d A
cp1,vsp	Converter float set-point	√	√		number	46-57:**50V**
cp1,dth	Converter disconnect threshold	√	√		number	20-26:**21.00V**
cp1,rth	Converter reconnect threshold	√	√		number	22-26:**22.20V**
cp1,lvd	Converter low voltage disconnect	√	√		number	**0:disable** 1:enable

Table B-10: Boost Management

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
bs1,bse	Boost enable	√	√		number	**0:disable** 1:enable
bs1,abe	Auto boost enable	√	√		number	**0:disable** 1:enable
bs1,amf	Auto Boost multiplication factor	√	√		number	**1**-9
bs1,tmd	Manual boost duration	√	√		number	1-250:**8 hours**

Table B-11: Battery/Load Contactor

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
cn1,typ	Contactor 1 type	√	√		text	"**NONE**","LOAD","BATTERY"
cn1,dth	Low voltage disconnect threshold	√	√		number	20-26:**21V** or 40-52:**43.20V**
cn1,rth	Low voltage reconnect threshold	√	√		number	20-26:**22.20V** or 40-52:**44.40V**
cn2,typ	Contactor 2 type	√	√		text	"**NONE**","LOAD","BATTERY"
cn2,dth	Low voltage disconnect threshold	√	√		number	20-26:**21V** or 40-52:**43.20V**
cn2,rth	Low voltage reconnect threshold	√	√		number	20-26:**22.20V** or 40-52:**44.40V**

Table B-12: Slope Thermal Compensation

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
sc1,stt	State	√	√		number	**0:disable** 1:enable
sc1,rve	Raise voltage enable	√	√		number	**0:disable** 1:enable
sc1,ltt	Lower temperature	√	√		number	-5-20:**0°C**
sc1,ntt	Nominal temperature	√	√		number	15-30:**25°C**
sc1,utt	Upper temperature	√	√		number	30-55:**45°C**
sc1,spt	Step temperature threshold	√	√		number	45-85:**75°C**
sc1,lsp	Lower temperature slope per cell	√	√		number	1-5:**3mV/°C**
sc1,usp	Upper temperature slope per cell	√	√		number	1-5:**3mV/°C**

Table B-13: Call-Out

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
p1,phn	Primary phone number	√	√		text	Up to 25 characters:“”
a1,phn	Alternate phone number	√	√		text	Up to 25 characters:“”

Table B-14: Serial Ports

		Related Commands				
OBJ,ATTR	**DESCRIPTION**	**STA**	**CHA**	**OPE**	**TYPE**	**RANGE OF VALUES**
mp1,bdr	Modem baud rate	√	√		number	1200,**2400**,4800,9600, and 19200
mp1,ins	Modem initialization string	√	√		text	Up to 25 characters: “**at&fev&c1h0**”
mp1,hsh	Modem handshaking	√	√		text	**“NO”: none** “SW”: xon and xoff
mp1,nrg	Modem number of rings before answering	√	√		number	1 - 9 rings
lp1,bdr	Local RS-232 baud rate	√	√		number	**“AUTO”**,1200,2400,4800,9600, and 19200
lp1,hsh	Local RS-232 handshaking	√	√		text	**“NO”: none** "SW": xon and xoff "HW": cts and rts

Commands

This section describes each of the remote access commands supported by this controller.

ala Report Active Alarms

Syntax ala

Description:
This command reports all the active alarm conditions in the plant. One alarm message is listed per line in the report. The table below lists the alarm messages.

Table B-15: Alarm Messages

MAJ,Multiple Rectifier
MAJ,Multiple AC Fail
MAJ,Rectifier ID Conflict
MAJ,Very Low Voltage
MAJ,Battery On Discharge
MAJ,High Voltage
MAJ,Sense Fuse
MAJ,Multiple Converter Fail
MAJ,Converter Distribution Fuse
MAJ,Converter Fan Major
MAJ,Fuse Major
MAJ,Auxiliary Major
MAJ,Contactor 1 Open
MAJ,Contactor 1 Failed
MAJ,Contactor 2 Open
MAJ,Contactor 2 Failed
MAJ,Battery High Temp
MAJ,Open Connection
MIN,Rectifier Fail
MIN,AC Fail
MIN,Phase Fail
MIN,Manual Off
MIN,High Float Voltage
MIN,Converter Fail
MIN,Converter ID Conflict
MIN,Converter Fan Minor
MIN,Load Share Imbalance
MIN,Thermal Probe Failure

If no alarms are active "NO ACTIVE ALARMS" is reported.

bye Log-off

Syntax bye

Description:
This command is used to terminate remote access session. If the user is connected via a modem, the controller will command the modem to hang-up the line.

cha Change Value

Syntax cha *obj,attr=value*
where: *obj,attr* is an object-attribute pair. For example, ps1,sid.

Description:
This command is used to change system configuration parameters. A couple of examples are listed below to illustrate how this command works.

```
cha ps1,sid="My Plant"    - change the site id to My Plant
cha p1,phn="123456789"- change the primary phone number to 123456789
```

You must be logged in as a super-user to use this command.

login Login

Syntax login "*password*"
where: *password* is either the user or super-user password

Description:
This command is used to log-in as a user or super-user. For example, if you are currently logged into the controller as a user but would like to change the site id you must first use this command to log-in as a super-user.

ope Operate a Control

Syntax ope *obj,attr=value*
where: *obj,attr* is an object-attribute pair. For example, dc1,pbt.

Description:
This command is used to operate a system control parameter. A couple examples are listed below to illustrate how this command works.

```
ope dc1,pbt=1             start a plant battery test
ope dc1,stt="boost"       place plant into boost mode
```

You must be logged in as a super-user to use this command.

pas Change Passwords

Syntax pas *t,"password", "password"*
where: *t* is u to change the user password or s to change the super-user password
password is the new password

Description:
This command changes either the user or super-user password. You must be logged in as a super-user to use this command. The password is sent twice in order to avoid mistakes. The password must have at least 6 characters but no more than 15 characters.

sta Report Status

Syntax sta *obj,att*
where: *obj,attr* is an object-attribute pair. For example, ps1,sid.

Description:

This command reports the value of the measurement, configuration, or control parameters in the system. A couple of examples are listed below to illustrate how this command works.

```
sta dc1,vdc        - report plant voltage
sta dc1,adc        - report plant load current
```

The command line would respond as follows for first command listed above.

```
* sta dc1,vdc
:DC1
VDC=-52.48
.
* _
```

The "*" in the example above is the user command line prompt. The line ":DC1" indicates that the information that follows is for the plant object. The line starting with "VDC" identifies the DC voltage. The "." line is the end-of-command identifier.

Error Messages

While logging into the vector controller or while entering commands you may encounter one or more of the following error messages:

Table B-16: Error Messages

Error Message	Description
!-112,SYNTAX ERROR	Unrecognizable command was entered.
!-220,SECURITY	Super-user command was entered by a mere user.
!-221,EXCESSIVE LOGIN ATTEMPTS	Too many attempts were made to login with an unrecognized password.
!-223,INVALID PASSWORD	New password contains an illegal character.
!-224,NEW PASSWORD MISMATCH	First and second copy of new passwords don't match
!-304,INVALID PARAMETER	An attempt was made to change a parameter to an illegal value.
!-319,INVALID ATTRIBUTE	An invalid object id was specified in the command or, a command referred to an attribute that doesn't support it.
!-320,INVALID OBJECT	An invalid object id was specified in the command