Lucent Technologies
Bell Labs Innovations

Remote Peripheral Monitoring (RPM) System J85501G-1

Product Manual
Select Code 167-790-063
Comcode 107570517
Issue 6
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Lucent Technologies Remote Peripheral Monitoring (RPM) System

Notice:
Every effort was made to ensure that the information in this document was complete and accurate at the time of printing. However, information is subject to change.

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1 Introduction

RPM System and Components

Functions of the RPM Modules

The RPM modules provide data acquisition and control functions for power applications. The user can program various alarm and control functions with the modules when they are used with a Galaxy controller. The modules, which communicate back to the controller, are physically connected in a daisy-chain bus configuration. System capacity is added in a modular fashion with measurement and control modules.

Types of RPM Modules

There are several types of RPM modules available:

- Voltage
- Shunt
- Transducer
- Binary
- Temperature
- Control Relay

Customer Assistance Contacts

Customer Training

Lucent Technologies 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.

Customer Service

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-THE-1PWR (1-800-843-1797). Services provided through this contact include initiating the spare parts procurement process for out of service emergencies, ordering Lucent Technologies documents, and providing other product and service information.

For other customers worldwide, call 001-972-840-0382. This number is answered from 8:00 a.m. until 4:30 p.m., Central Time Zone (Zone 6), Monday through Friday.

Technical Support

Technical support for Lucent Technologies customers is available around the world during the normal product warranty period and also while specific contractual agreements extend this service.

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-CAL-RTAC (1-800-225-7822) to contact a product specialist to answer your technical questions and assist in troubleshooting problems.

For other customers worldwide, contact your local field support center or your sales representative to discuss your specific needs.

Product Repair and Return

Repair and return service is provided for Lucent Technologies customers around the world.

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-255-1402 for information on returning of products for repair.

For other customers worldwide, contact your sales representative to discuss your particular circumstances.

Customer Assistance Contacts, continued

Warranty Service For domestic warranty service, contact your Warranty Service Manager (WSM). For international warranty service, contact your sales representative.

2 Product Description

Overview

Types of Modules

There are several types of Remote Peripheral Monitoring (RPM) Modules:

- Voltage
- Shunt
- Transducer
- Binary
- Temperature
- Control Relay

The ranges and accuracies of each module are listed in Table 2-A.

Voltage Modules

A Voltage Module measures dc voltage. Each module has six different voltage input channels that are used as inputs to measure external voltage, based on the range of the module in use. Each module also has one channel that measures external temperature using a thermistor.

Each channel has positive and negative terminals. Polarity of channels is critical for voltage measurements.

There are four different Voltage Modules: 221A, 221B, 221C, and 221D.

Overview, continued

Shunt Module

The 221F Shunt Module measures dc current. The measuring channels measure shunt voltage within the range of -50 to +150mV, and use the shunt size to derive the current. The module has six measuring channels and one external temperature channel.

Each channel has positive and negative terminals. Polarity of channels is critical for voltage measurements.

Transducer Module

The 221J Transducer Module can monitor up to six transducers with millivolt outputs ranging from 0 to 100 millivolts. The module has one external temperature channel.

Note: Transducers for use with the 221J Transducer Module must be provided separately. See Appendix B for more information about available transducers.

Binary Module

The 222A Binary Module is designed to measure six differential binary channels and one temperature channel.

The six binary channels are polarity sensitive. All externally powered points measured by a Binary Module must be of the same polarity.

For monitoring of contacts without a voltage potential (dry contacts), the Binary Module provides a +5Vdc biasing voltage. The +5Vdc bias is isolated from the bus. If there is voltage on both positive and negative potentials of the points to be monitored, e.g., lamps, coils, etc., multiple Binary Modules must be used.

Temperature Module

The 223T Temperature Module has seven channels to measure the temperature of seven different points in the system. Each channel must be connected to a 100K thermistor or ring-type probe, which must be ordered separately.

The cable length should be limited to 120 ohms per wire.

The Temperature Module can measure temperatures within the range of -40°C to +70°C with a tolerance of ±1°C. Polarity of channels is not critical for temperature measurements.

Overview, continued

Control Relay Module

The 214A Control Relay Module contains three separate Form-C relay contacts for controlling external equipment. The controller's configuration of the ON and OFF modes determines the state of the three relays' normally closed (NC), normally open (NO), and COM contacts.

- The ON mode:
  - disconnects NC from COM
  - connects NO to COM
- The OFF mode:
  - disconnects NO from COM
  - connects NC to COM
- During module power-up and power-down, all three relays are placed in the controller OFF mode.

Module Specifications

Available RPM Modules

Table 2-A gives the specifications for the available RPM modules.

Table 2-A: Remote Peripheral Monitoring Modules

Type of Module	Module No.	Input Voltage Range*	Measurement Accuracy**
Voltage	221A	0 - 3 Vdc	± 5 mVdc
	221B	0 - 16 Vdc	± 25 mVdc
	221C	0 - 70 Vdc	± 50 mVdc
	221D	0 - 200 Vdc	± 150 mVdc
Shunt	221F	-50 to +150 mVdc†	±0.55 mVdc
Transducer	221J	0 - 100 mVdc	±0.55 mVdc
Binary	222A	5 - 200 Vdc	±1.5 Vdc
Type of Module	**Module No.**	**Input Temperature Range**	**Measurement Accuracy****
Temperature	223T	-40°C to +70°C	±1°C
Type of Module	**Module No.**	**Input Voltage Range‡**	**Input Current Range‡**
Control Relay	214A	0 - 110 Vdc	±0 - 0.3 Adc

*****All measurement modules are calibrated with respect to positive voltages. To measure a negative voltage, the connection to the measurement point should be reversed and the reading should be multiplied by -1. The dc voltage between any two input terminals must not exceed 200 Vdc.

******All measurement accuracies are valid in the temperature range of 0 °C to +40°C. Measurement accuracies will degrade for 221A/B/C/D in the extended temperature range of -40°C to +70°C.

†Although the bipolar shunt module is able to measure an input voltage as low as -100 mVdc, the Galaxy controller software will raise an alarm indicating measurement out of range. This alarm may be ignored as long as the input voltage is within the range of -100 mVdc to +150 mVdc.

‡The input voltage and current ranges for the 214A Control Relay module are valid in the temperature range of -40°C to +70°C.

Module Specifications, continued

210 through 212 Series

Table 2-B lists the specifications for the 210 through 212 series of RPM modules, which were replaced by the 221 through 222 series. For additional information on the older modules described in Table 2-B, call Lucent's Technical Hotline, 1-800-CAL-RTAC (1-800-225-7822).

Table 2-B: 210-212 Series RPM Modules

Module	Input Voltage Range	Measurement Accuracy
210D Voltage Module	0 - 200 Vdc	± 150 mVdc
210F Shunt Module	0 - 110 mVdc	± 0.55 mVdc
210J Transducer Module	0 - 100 mVdc	± 0.55 mVdc
211A Voltage Module	0 - 3 Vdc	± 5 mVdc
211B Voltage Module	0 -16 Vdc	± 25 mVdc
211C Voltage Module	0 - 70 Vdc	± 50 mVdc
211F Bipolar Module	-50 - +150 mVdc	± 0.55 mVdc
212A Binary Module	0 - 200 Vdc	± 1.5 Vdc

Module Kits

Introduction

Modules consist of two sections, the actual measurement/control unit (top) and a connection unit (base).

The RPM modules are ordered by list number from the J85501G-1 drawing, and are delivered as kits. In addition to the monitoring unit and connection unit of the module itself, the kits contain other items, which are listed below.

Voltage Modules (L22, L24, L25, L26)

- Six (6) 100K current limiting resistor assemblies (847540424)
- One (1) temperature thermistor (407209808)
- Twenty-four (24) butt splices
- Two (2) cable ties
- One (1) velcro loop

Shunt Module (L21)

- Six (6) 100K current limiting resistor assemblies (847568920)
- One (1) temperature thermistor (407209808)
- Two (2) cable ties
- One (1) velcro loop

Transducer Module (L23)

- Six (6) 100K current limiting resistor assemblies (847540424)
- One (1) temperature thermistor (407209808)
- Twenty-four (24) butt splices
- Two (2) cable ties
- One (1) velcro loop

Note: Transducers for use with the 221J Transducer Module must be provided separately. See Appendix B for more information about available transducers (AC Interface Units).

Binary Module (L27)

- Six (6) 100K current limiting resistor assemblies (847540424)
- One (1) temperature thermistor (407209808)
- Twenty-four (24) butt splices
- Two (2) cable ties
- One (1) velcro loop

Module Kits, continued

Temperature Module (L28)

- Two (2) cable ties
- One (1) velcro loop

Note: Order thermal probe (407209808) or ring-type probe and connection cable assembly (847917879/847307410) separately for use with the Temperature Module.

Control Relay Module (L9)

- Two (2) cable ties
- One (1) velcro loop

Connection Units

What Is a Connection Unit?

A module consists of two parts: the measuring device itself and the base (connection unit).

Types of Connection Units

There are two types of connection units available for various module types. Table 2-C shows the module types and the corresponding connection units.

Table 2-C: Connection Units

Module Type(s)	Module Code(s)	Connection Unit Comcode
Voltage	221A/B/C/D	847635851
Shunt	221F	
Transducer	221J	
Binary	222A	
Temperature	223T	
Control Relay*	214A	847629342
*For the 214A Control Relay Module, the maximum relay contact voltage is 110Vdc and maximum current is 0.3Adc. Wiring depends on the voltage, current, local building codes, and various other characteristics of the controlled point.		

Current Limiting Resistors

Introduction

Current limiting resistors provide short circuit protection for wiring between the measuring points and the RPM modules. The resistors are required at the power source for the circuit to meet NEC Class 2 circuit requirements.

Control Relay Module

Current limiting resistors **are not required** for the Control Relay Module. Refer to the specific controller manual for the programming and implementation of the Control Relay Module.

Temperature Module

Current limiting resistors **are not required** for the Temperature Module.

Voltage, Binary, Transducer, and Shunt Modules

Current limiting resistors (100K ohms) **are required** for the measurement inputs of the Voltage, Binary, Transducer, and Shunt Modules.

- Comcode 847540424 current limiting resistor assemblies are used (one per measurement channel) with the Voltage, Binary, and Transducer Modules. Each assembly contains two 100K-ohm resistors terminated in butt splices on both ends.

- Comcode 847568920 current limiting resistor assemblies are used (one per measurement channel) with the Shunt Module. Each assembly contains two 100K-ohm resistors terminated in a butt splice on one end and terminals for connection to KS-22012 circuit breakers on the other end.

GPS Cabinet Shunts

All shunts (load and battery) and some voltage points that are provided with the GPS cabinets already have current limiting resistors; check the T-83314-30 drawing for resistor presence.

Mounting Panels

Introduction The RPM modules can be mounted in a variety of mounting panels.

Panel Descriptions Table 2-D describes the panels used for mounting the RPM modules.

Table 2-D: Mounting Panels

J85501G-1 List No.	Description of Panel
K1	Panel for mounting 7 modules in a 26-inch/66cm frame with 22.4-inch/56.9cm mounting centers horizontally, and 1-inch/2.54cm centers vertically (6-inch/15.24cm height)
K2	Mounting bracket for one module on a frame with 1-inch/2.54cm mounting centers (4-inch/10.16cm height)
K3	Mounting bracket for one module on a frame with 1-inch/2.54cm mounting centers (6-inch/15.24cm height)
Comcode	**Description of Panel**
848285854	Panel for mounting 6 modules on the top of a GPS cabinet (23.6 inch/59.9cm wide)

Replacement Modules

Ordering Information

Table 2-E lists the comcodes for ordering replacement RPM modules.

Table 2-E: Replacement RPM Modules

Module	Comcode
Voltage (221A)	108040890
Voltage (221B)	108040908
Voltage (221C)	108040916
Voltage (221D)	108040924
Shunt (221F)	108040932
Transducer (221J)	108040940
Binary (222A)	108040957
Temperature (223T)	108274242
Control Relay (214A)	107307555

3 Engineering an RPM System

Planning the RPM System Installation

Overview

The number of RPM modules that can be installed in a system depends on two things:

- which Galaxy controller is used to monitor and control the system
- current consumed on the communication bus

Galaxy Controller Support

Each of the Galaxy controllers supports a different number of RPM modules:

- A Galaxy SC controller can support one, two, or three buses of RPM modules. Up to 95 RPM modules can be installed on any one bus, but the total number of modules installed on all three buses cannot exceed a total of 255. Each bus can have a maximum reach of 300 meters. Figure 3-1 illustrates the relationship of distance to number of modules.

  Note: There is no need to use more than one bus unless more modules need to be installed than a given bus length can support. However, multiple buses can be used for convenience or to simplify installation of modules when monitoring points are located in different directions. Modules should be evenly distributed along the length of the bus when possible.

- A Millennium controller can support only one bus of RPM modules with a maximum of 95 modules on the bus. The bus has a maximum reach of 300 meters.

- The Galaxy Vector Controller does not support RPM modules.

Planning the RPM System Installation, continued

Current Consumption

Current consumption on the communication bus depends on the following factors that contribute to the various voltage levels available to each module on the bus:

- total bus length
- distance of the modules from the controller
- the quantity and type of modules

Configuration Guideline

Although it is difficult to characterize every network bus configuration, Figure 3-1 offers a general guideline. Consult with Lucent Technologies Engineering regarding system installations that differ from this general guideline.

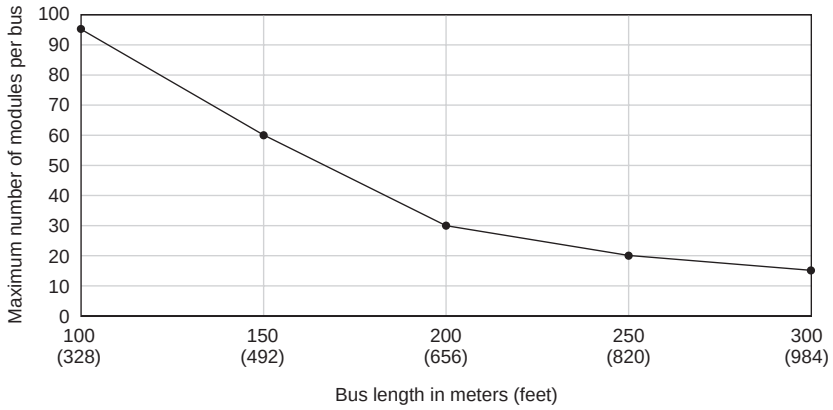


Figure 3-1: Maximum Number of Modules Per Bus Versus Bus Length

Application Specific Configurations

Application-specific configurations of RPM modules are described in the appropriate controller manual.

Galaxy SC Controller	167-790-060
Galaxy Millennium Controller	167-792-180

Note: The Galaxy Vector Controller does not support RPM modules.

4 Safety

Safety Statements

The Remote Peripheral Monitoring System modules were evaluated to the requirements of Underwriters Laboratories Inc. UL Subject 1801 and IEC 60950 as peripheral devices for use with Lucent Technologies controllers for DC Power Distribution Centers for Communications Equipment.

Please read and follow all safety instructions and warnings before installing, maintaining, or repairing the Remote Peripheral Monitoring System.

- Install only in restricted access areas, e.g., dedicated equipment rooms and equipment closets, in accordance with articles 110-16, 110-17, and 110-18 of the U.S. National Electric Code (NEC), ANSI/NFPA No. 70, and pursuant to applicable local codes.

- This equipment is to be used in controlled environments (an area where the humidity is maintained at levels that cannot cause condensation on the equipment, the contaminating dust is controlled, and the steady-state ambient temperature is within the range specified).

- This equipment has been evaluated for use in a continuous ambient temperature of up to 70° Celsius.

- Input power supplied to the modules on TB102 must be current limited Class 2 levels that are rated 30 Vac maximum and capable of delivering approximately 5mA to each module, such as supplied from a Galaxy controller.

Safety Statements, continued

- For electrical connections requiring crimp-on lugs, make sure the proper crimping tools and dies are used (information for these connections are provided in the product documentation). Torque electrical connections to the values specified on labels or on the T-83275-30 drawing.

- Alarm contacts on the Control Relay Module are not fused within the module. Therefore, current limiting protection for these contacts must be provided by external circuits. Maximum ratings for alarm connections are 110Vdc and 0.3A. Exceeding these maximum ratings could result in fire or damage to the unit.

- Termination kits may not be provided with the equipment. Refer to the J85501G-1 and T-83275-30 drawings for the proper hardware. Use only the parts specified in the equipment documentation.

- The maximum cable sizes or required cable assemblies for the input/output wiring are noted on the T-83275-30 drawing.

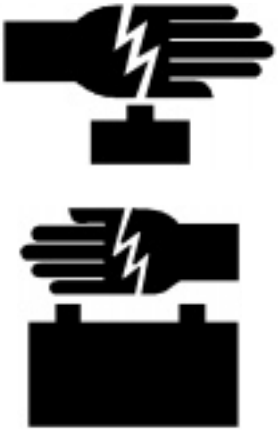
- The CLR (current limiting resistor) assembly is required to protect the wiring and internal circuits from the hazardous energy levels (resistors provided for each of the two wires). It also limits the current on high voltage measurements to reduce the possibility of electrical shock. The module provides NEC Class 2 levels on the output side to the controller with an input voltage of up to a maximum of 150Vdc. It provides a limited current circuit (less than 2mA) per UL1950/IEC950 with a maximum input voltage of up to 200Vdc. This CLR assembly must be used with the modules as shown on the T-83275-30 drawing. All shunts (load and battery) and some voltage points that are provided with the GPS cabinets already have current limiting resistors; check the T-83314-30 drawing for resistor presence.

- The Control Relay Module provides at least basic insulation (per UL 1950/IEC 60950) between the contacts and the coil. There is also a minimum of basic isolation between the different relay inputs.

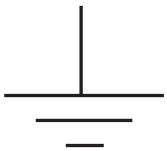
- If the peripheral monitoring/measurement modules are equipped with thermal probes, make sure the thermal probes are not connected directly to any uninsulated hazardous voltage circuits.

Warning Statements and Safety Symbols

The symbols may sometimes be accompanied by some type of statement; e.g., “Hazardous voltage/energy inside. Risk of injury. This unit must be accessed only by qualified personnel.”

	This symbol identifies the need to refer to the equipment instructions for important information.
	These symbols (or equivalent) are used to identify the presence of hazardous ac mains voltage.
	This symbol is used to identify the presence of hazardous ac or dc voltages. It may also be used to warn of hazardous energy levels.
	One of these two symbols (or equivalent) may be used to identify the presence of rectifier and battery voltages. The symbol may sometimes be accompanied by some type of statement, for example: “Battery voltage present. Risk of injury due to high current. Avoid contacting conductors with uninsulated metal objects. Follow safety precautions.”

Warning Statements and Safety Symbols, continued

	This symbol is used to identify the presence of a hot surface. It may also be accompanied by a statement explaining the hazard. A symbol like this with a lightning bolt through the hand also means that the part is or could be at hazardous voltage levels.
	This symbol may also be used to identify the presence of a hot surface. The marked item should not be touched without taking care.
	This symbol is used to identify the protective safety earth ground for the equipment.
	This symbol is used to identify other bonding points within the equipment.
	This symbol is used to identify the need for safety glasses and may sometimes be accompanied by some type of statement, for example: “Fuses can cause arcing and sparks. Risk of eye injury. Always wear safety glasses.”

Precautions

Note the following precautions when working on or using this type of equipment:

- This unit must be installed, serviced, and operated only by skilled and qualified personnel who have the necessary knowledge and practical experience with electrical equipment and who understand the hazards that can arise when working on this type of equipment.

- Hazardous voltages may be present in the modules and on the interface cables that can shock or cause serious injury. Follow all safety warnings and practices when servicing this equipment.

- Use caution when connecting the measurement modules (CLR assemblies) to battery circuits. All batteries are at hazardous energy levels and some systems may also be at hazardous voltage levels.

- In addition to proper job training and safety procedures, the following are some basic precautions that should always be used:

  – Use **only** properly insulated tools.

  – Remove all metallic objects (key chains, glasses, rings, watches, or other jewelry).

  – Wear safety glasses.

  – Test circuits before touching.

  – Lock out and tag any circuit breakers/fuses when possible to prevent accidental turn-on.

  – Be aware of potential hazards in the area you are working before entering the equipment.

  – Identify exposed hazardous electrical potentials on connectors, wiring, etc. (note the condition of these circuits, especially any wiring).

  – Use care when removing or replacing any covers. Avoid contacting any circuits.

5 Installation

Installation Preparations

Installation Materials

- 1 set of standard installer's tools (standard size screwdrivers)
- Universal digital multimeter (Fluke 8060A or equivalent)
- Jeweler's screwdriver
- Crimp tool (22-16 gauge)
- Ballpoint pen

Safety

- When working in a powered plant, USE EXTREME CARE to avoid contacting exposed terminals and bus bars.
- Make sure the plant is properly grounded according to local building codes before proceeding.
- Label all cables associated with the change before beginning installation.
- Read the Safety section of this product manual carefully before installing the RPM modules. Follow all safety instructions and warnings during the installation process.
- Observe antistatic precautions during the installation procedure.
- Remove all metal jewelry.

DANGER

Powered circuits may be connected to the RPM modules. Use extreme caution!

Replacements or Additions to an RPM System

Monitoring/ Control Units

If necessary, monitoring/control units may be disconnected from the connection unit while it is powered. As long as the communications bus wires are not disconnected or short-circuited, the controller will continue to monitor the other modules on the bus.

Note that all data collection (statistics, history, trend, etc.) associated with a disconnected module is stopped. After the module is reconnected and initialization is complete, the module is capable of providing monitoring information.

Connection Units or Bus

When replacing a connection unit or rearranging a bus, the power may be temporarily interrupted to all or part of the Remote Peripheral Monitoring System. When communications are restored, some or all modules on the communications bus will require time to re-initialize.

New Module Added to End of a Bus

If a new module is being added to the end of a bus, follow the procedures for the controller power-down sequence. Connect the new connection unit as shown in Figure 5-5. Remove the terminating resistor from the previously last connection unit and place it in the newly added connection unit. Before attaching the new RPM module, set its address to a non-used number. Attach the module to the connection unit. Follow instructions for the Controller power-up sequence.

Mounting the Modules

Location

Individual RPM modules can be secured to virtually any location near the equipment to be monitored. The connection unit allows front access to all termination points.

Note: Make sure the mounting location allows easy viewing of the green status LED on the module.

Optional Panel or Brackets

RPMs can be installed on a mounting panel or bracket. The J85501G-1 Lists K1, K2, and K3 panel and brackets, and the GPS panel (comcode 848285854) are illustrated in Figure 5-1. Refer to Section 2 for more information.

Mounting the Modules	
Step	**Action**
1	Mount the panel or bracket using the screws that have been provided. Refer to Figure 5-1.
2	Attach the module base to the panel, bracket, or other location.

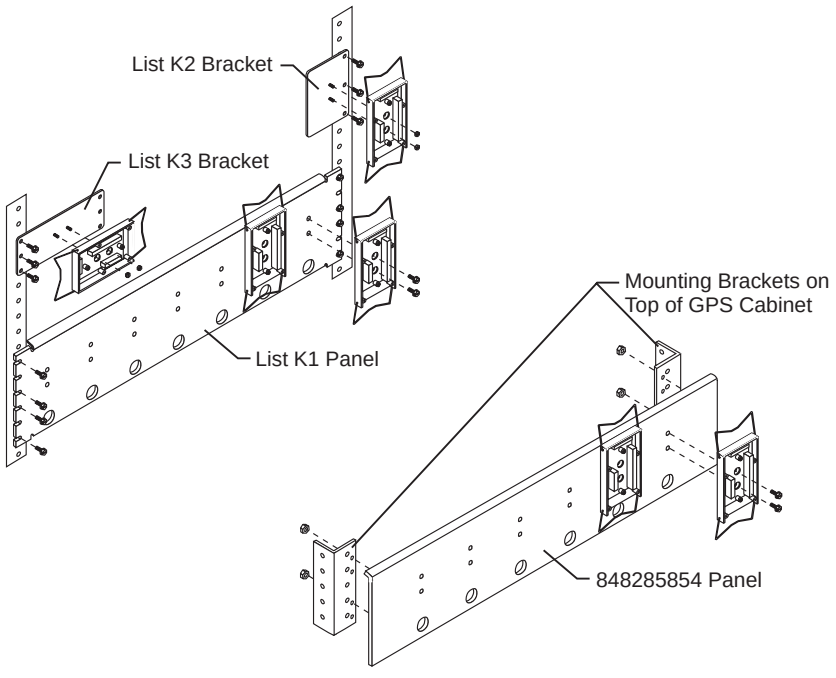


Figure 5-1: Mounting Panel and Brackets

Making TB101 and TB102 Connections

TB101

The connection for the monitoring/control signals is made between terminal block TB101 on the RPM module and the equipment being monitored.

The connection units are wired as follows:

- For Voltage, Shunt, Binary, and Transducer Modules, use TB101 to connect the six voltage channel inputs and one temperature channel input.
- For the Temperature Module, use TB101 to connect up to seven thermistors or thermal probes to different measuring points.
- For the Control Relay Module, use TB101 to connect up to three control points. The maximum relay contact voltage is 110 Vdc and maximum current is 0.3 Adc. Wiring to TB101 depends on the voltage, current, local building codes, and various other characteristics of the controlled point.

TB102

The connection for communications input/output is made between terminal block TB102 on the RPM module and the controller interface circuit pack.

Making TB101 and TB102 Connections, continued

Making TB101 and TB102 Connections	
Step	**Action**
1	Connect wiring from monitored equipment to TB101 on the RPM module connection unit, as shown in Figures 5-2, 5-3, and 5-4. Note: Except for the temperature input, maintain correct polarity.
2	Using shielded twisted pair cable (comcode 407377704), wire the input/output communications bus from TB102 to the bus controller circuit pack. If connecting more than one RPM, daisy chain the modules, as shown in Figure 5-5. Note: Polarity is not essential for the input/output communications bus wiring (except for shield).
3	Using the circuit pack installation guide corresponding to the Galaxy controller, install the RPM bus controller circuit pack.
4	Before terminating the bus wire at the controller, run the wire three times through one of the supplied inductor beads (406712968). See Figure 5-5. Note: Use one inductor bead for each bus.
5	Route the wires connected to the module through the open-faced bottom of the connection unit. Place a cable tie or waxed cord through the opening at the bottom of the connection unit and around the connected wires for strain relief.
	Continued on next page.

Making TB101 and TB102 Connections, continued

Making TB101 and TB102 Connections, continued

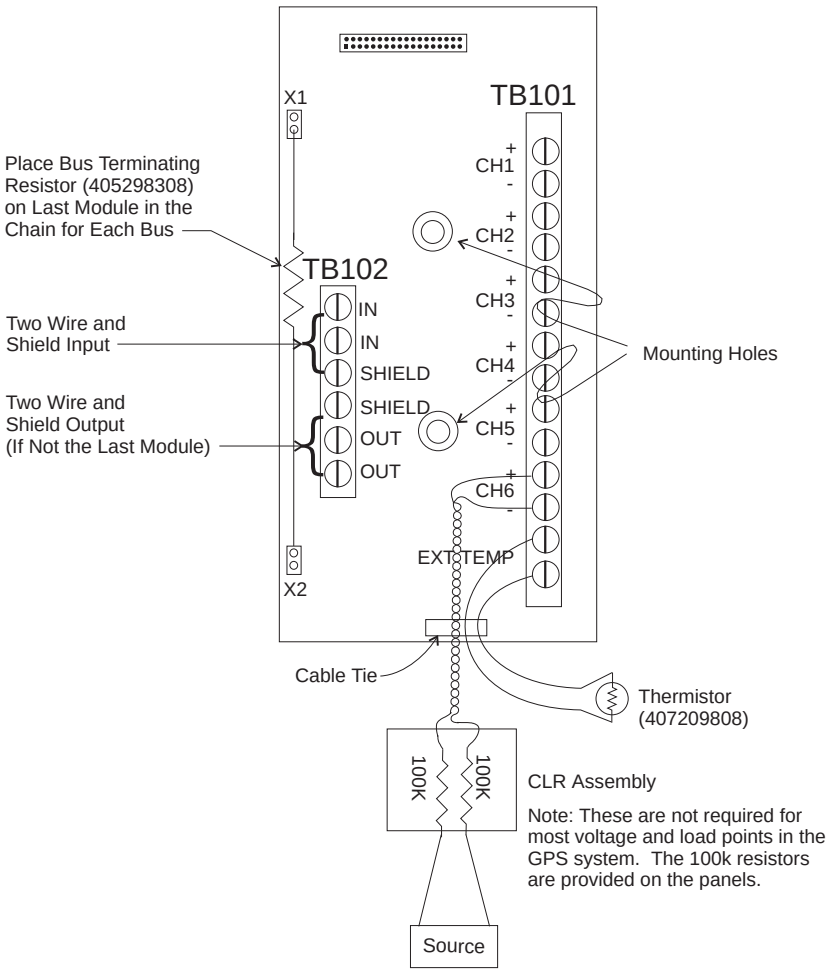


Figure 5-2: Connection Unit for Voltage, Shunt, Transducer, and Binary Modules

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Making TB101 and TB102 Connections, continued

Making TB101 and TB102 Connections, continued

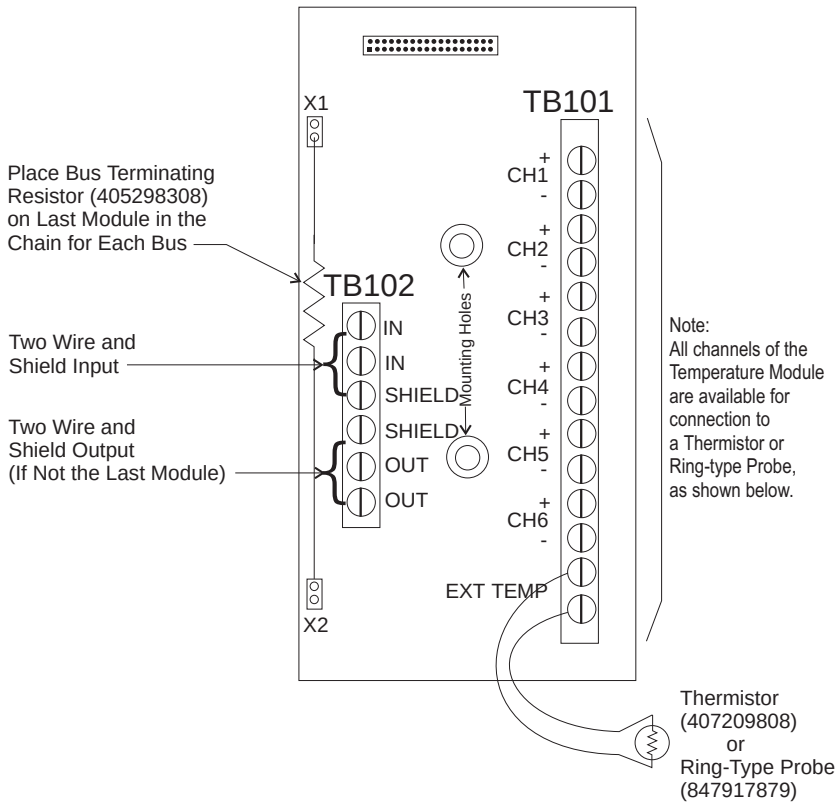

Figure 5-3: Connection Unit for Temperature Module Only

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Making TB101 and TB102 Connections, continued

Making TB101 and TB102 Connections, continued

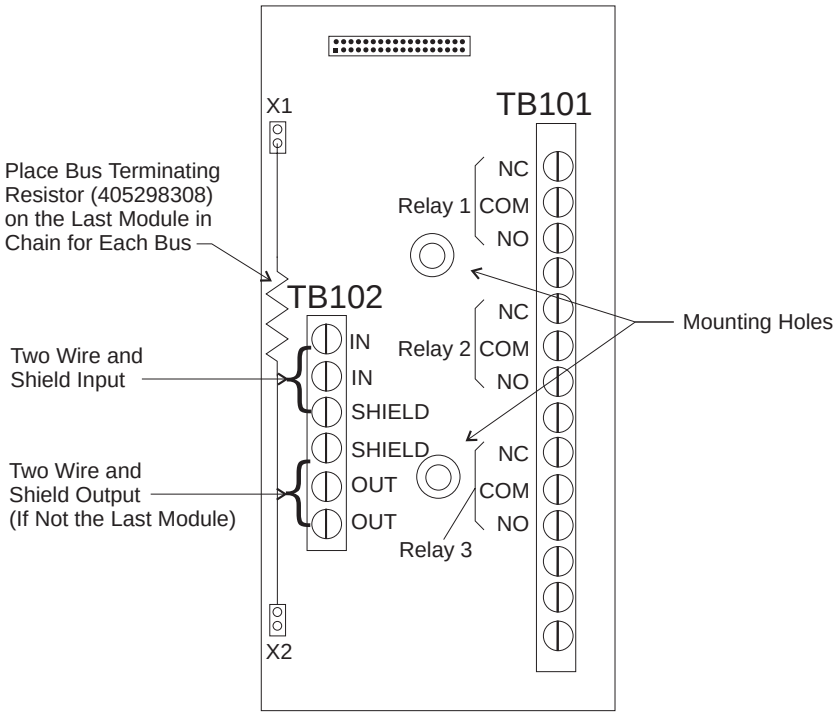

Figure 5-4: Connection Unit for Control Relay Module Only

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Making TB101 and TB102 Connections, continued

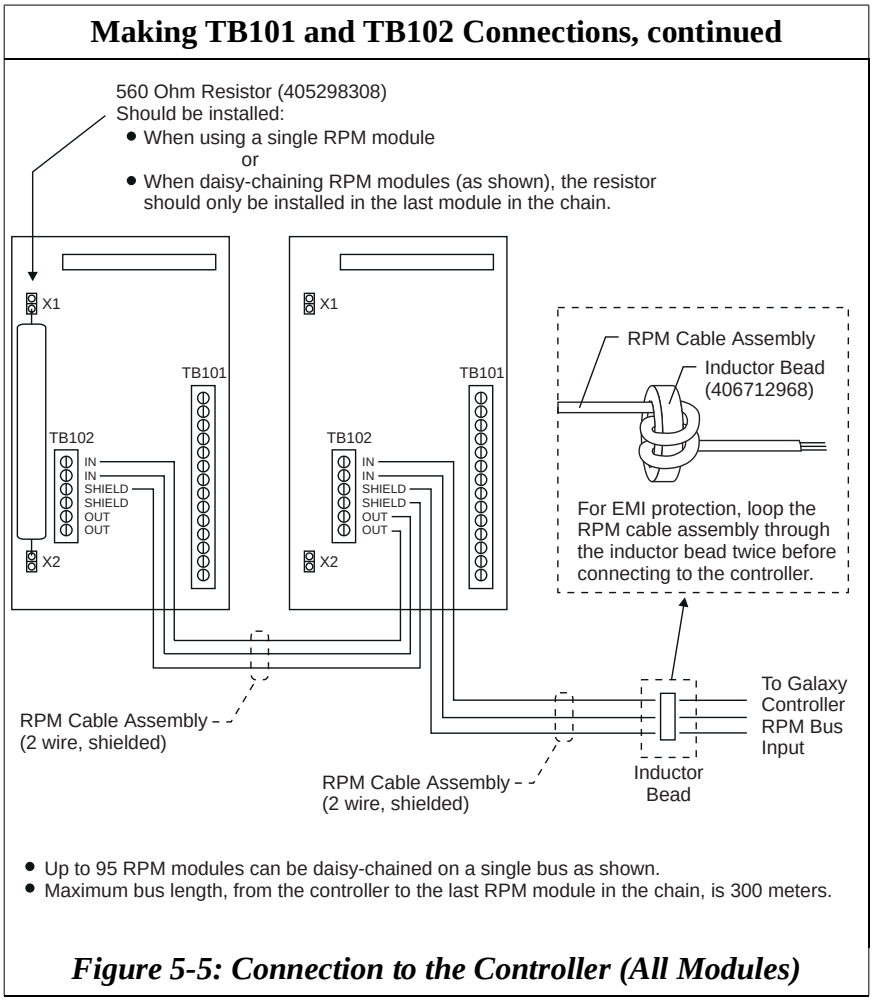


Figure 5-5: Connection to the Controller (All Modules)

Terminating the Final Module

Terminating the Final Module	
Step	**Action**
1	Place a terminating resistor (560 ohm, 10 watt; comcode 405298308) in the socket of the final bus module for each of the three buses. See Figure 5-5. Note: If a bus is not used, install a terminating resistor on the controller interface for the unused bus.
2	To verify that no shorts exist between the two cable connections (blue or white) on the final bus module, measure the resistance across the blue and white wires of the module containing the terminating resistor. The resistance measurement should be in the range of 560-600 ohms. If the resistance measurement *is* in the range of 560-600 ohms, proceed to "Assigning Module Addresses." If the resistance measurement *is not* in the range of 560-600 ohms, verify that the 560 ohm, 10 watt resistor has been installed in the last module. If not, install it now and repeat the measurement. If the measurement is not in the 560-600 ohm range, proceed to Step 3.
3	a. Check for cracks in the 560 ohm, 10 watt resistor. If cracks exist, replace the resistor. Repeat Step 2. b. Check for loose connections of the white and blue wires at each module and the controller. If necessary, tighten connections. Repeat Step 2.

Assigning Module Addresses

Using Unique Addresses

Each module requires a unique address for proper communication between the module and controller. All addresses are valid except 00. **The Galaxy controller will not recognize a module with a 00 address.**

SW1 and SW2

The unique address is set with two switches (SW1 - Hi and SW2 - Low) located on the Remote Peripheral Monitoring module. See Figure 5-6.

Hexadecimal Numbers and Letters

The switch display numbers/letters are in hexadecimal.

For example: SW1 - Hi = D
SW2 - Low = 8
The HEX address is D8.

Note: Appendix A provides a decimal-to-hexadecimal conversion table.

Assigning Module Addresses	
Step	**Action**
1	Using a jeweler's screwdriver, set the address on each module. (See Figure 5-6.)

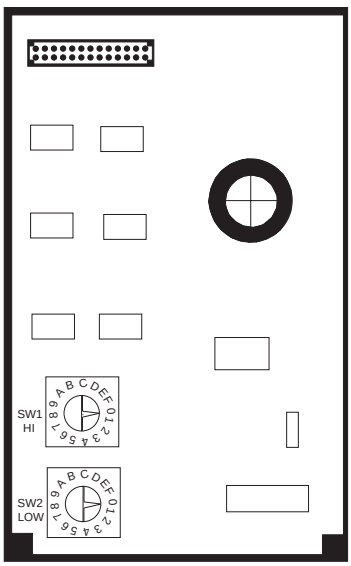


Figure 5-6: Switches for Setting Hexadecimal Addresses

Installing Current Limiting Resistors

Voltage, Shunt, and Transducer Modules

Installing Current Limiting Resistors for Voltage, Transducer, and Shunt Modules

Step	Action
1	Place a 100K-ohm current limiting resistor (CLR) assembly near the monitoring point. Refer to Figures 5-7 and 5-8 for wiring examples. Note: Use CLR Comcode 847540424 for Voltage and Transducer Modules and CLR Comcode 847568920 for the Shunt Module.

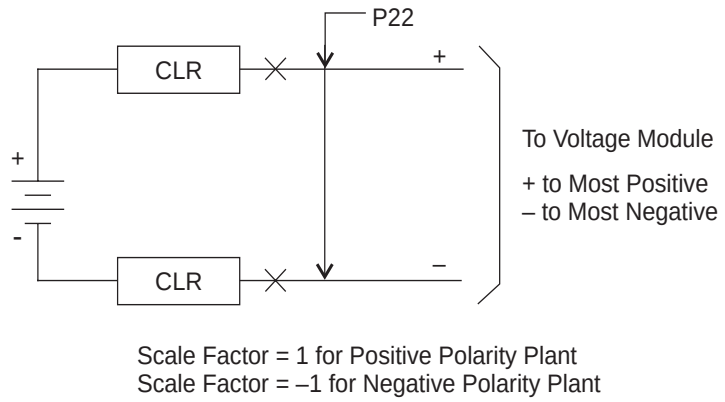


Figure 5-7: DC Plant Voltage Monitoring

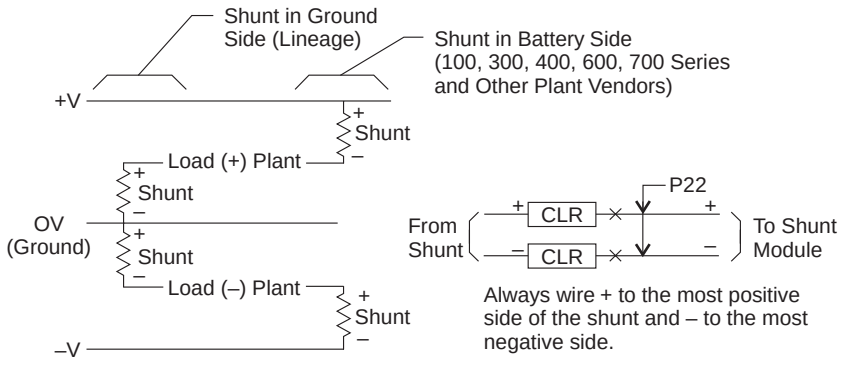


Figure 5-8: DC Plant Load Monitoring

Installing Current Limiting Resistors, continued

Binary Module

Installing Current Limiting Resistors for a Binary Module	
Step	**Action**
1	Place a 100K-ohm current limiting resistor assembly (Comcode 847540424) near the monitoring point. Refer to Figures 5-9 through 5-15 for wiring examples.

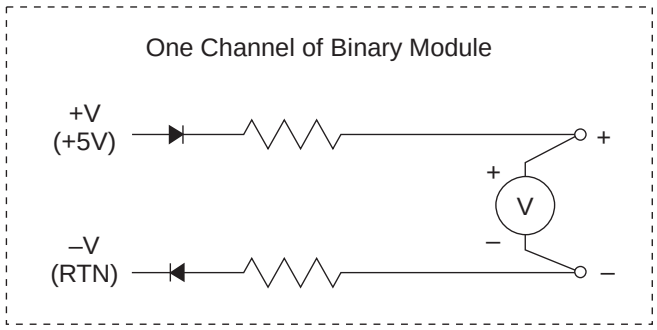
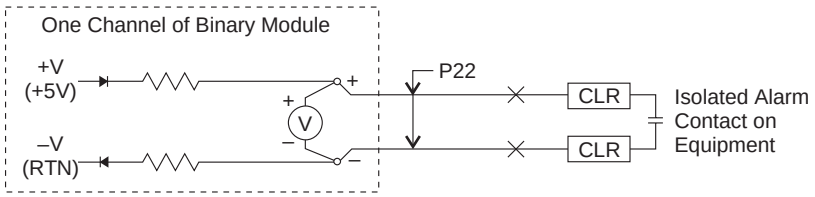


Figure 5-9: Functional Schematic for One Channel of a 222A Binary Module



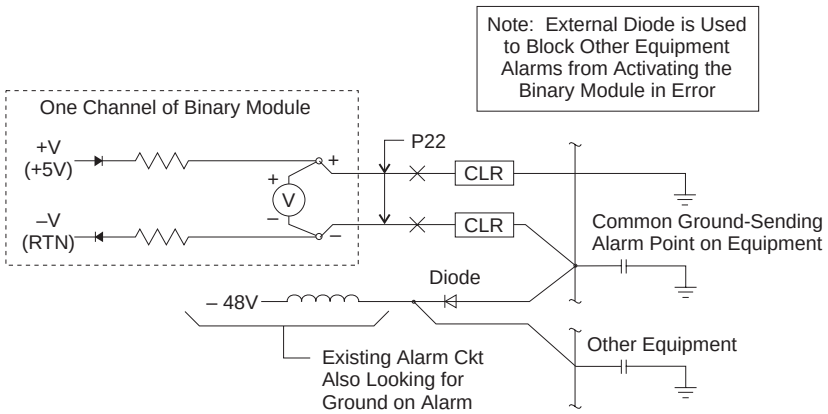
If the equipment alarm contact closes for an alarm condition, set the associated User-Defined Channel program line to activate when:	If the equipment alarm contact opens for an alarm condition, set the associated User-Defined Channel program line to activate when:
BinCh = 0 or BinCh = Closed or Not BinCh	BinCh = 1 or BinCh = Open or BinCh

Figure 5-10: Isolated Alarm Contact Monitoring Using a 222A Binary Module

Continued on next page.

Installing Current Limiting Resistors, continued

Installing Current Limiting Resistors for a Binary Module, continued



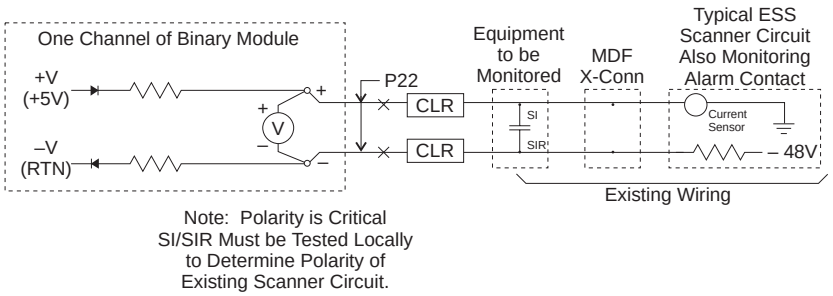
If the equipment alarm sends ground for an alarm condition, and the existing alarm circuit voltage (-48V) is monitored when no alarm is active, set the associated User-Defined Channel program line to activate when: BinCh = 0 or BinCh = Closed or Not BinCh	If the equipment alarm contact opens for an alarm condition, and the existing alarm circuit voltage (-48V) is monitored when an alarm is active, set the associated User-Defined Channel program line to activate when: BinCh = 1 or BinCh = Open or BinCh

Figure 5-11: Monitoring a Ground-sending Alarm Point Shared with Another Alarm System Using a 222A Binary Module

Continued on next page.

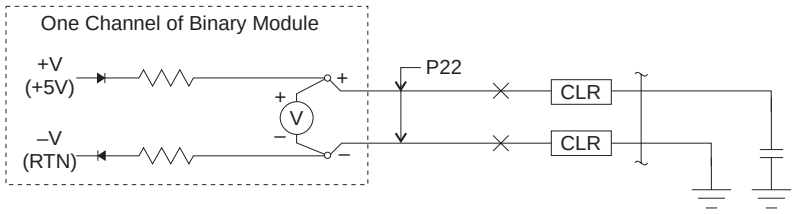
Installing Current Limiting Resistors, continued

Installing Current Limiting Resistors for a Binary Module, continued



If the equipment alarm contact closes for an alarm condition, and the existing alarm circuit voltage (-48V) is monitored when no alarm is active, set the associated User-Defined Channel program line to activate when:	If the equipment alarm contact opens for an alarm condition, and the existing alarm circuit voltage (-48V) is monitored when an alarm is active, set the associated User-Defined Channel program line to activate when:
BinCh = 0 or BinCh = Closed or Not BinCh	BinCh = 1 or BinCh = Open or BinCh

Figure 5-12: Sharing a Loop-closure Alarm with Another Alarm System (222A Binary Module)



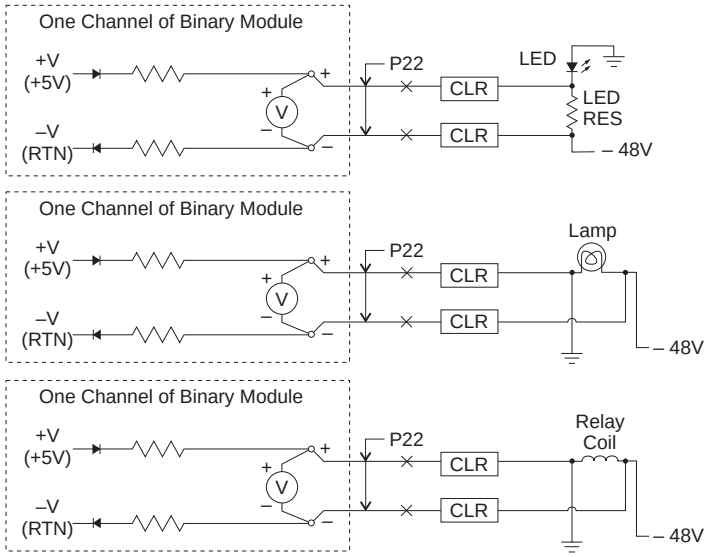
If the equipment alarm contact closes for an alarm condition, set the associated User-Defined Channel program line to activate when:	If the equipment alarm contact opens for an alarm condition, set the associated User-Defined Channel program line to activate when:
BinCh = 0 or BinCh = Closed or Not BinCh	BinCh = 1 or BinCh = Open or BinCh

Figure 5-13: Monitoring an Isolated Ground-sending Alarm Contact Using a 222A Binary Module

Continued on next page.

Installing Current Limiting Resistors, continued

Installing Current Limiting Resistors for a Binary Module, continued



NOTE: Polarity is Critical
and Must be Tested Locally

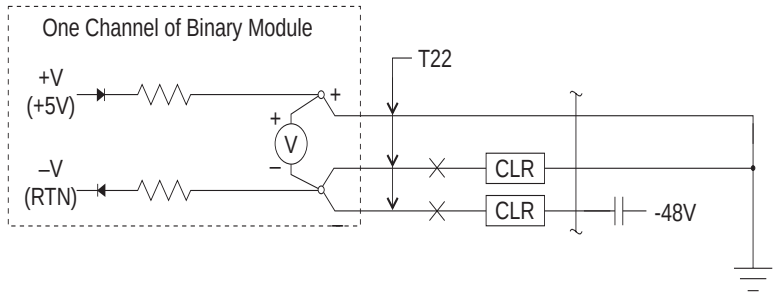
If the equipment lamp, LED or relay coil is off for an alarm condition, set the associated User-Defined Channel program line to activate when:	If the equipment lamp, LED or relay coil is active for an alarm condition, set the associated User-Defined Channel program line to activate when:
BinCh = 0 or BinCh = Closed or Not BinCh	BinCh = 1 or BinCh = Open or BinCh

Figure 5-14: Monitoring the Presence or Absence of Voltage on a Resistor, Lamp or Relay Coil Using a 222A Binary Module

Continued on next page.

Installing Current Limiting Resistors, continued

Installing Current Limiting Resistors for a Binary Module, continued



If the equipment alarm contact opens or -48V is taken away for an alarm condition, set the associated User-Defined Channel program line to activate when:	If the equipment alarm contact closes or -48V is present for an alarm condition, set the associated User-Defined Channel program line to activate when:
BinCh = 0 or BinCh = Closed or Not BinCh	BinCh = 1 or BinCh = Open or BinCh

Figure 5-15: Monitoring an Isolated -48V Fuse Alarm or Other -48V-sending Alarm Contact Using a 222A Binary Module

Making the Controller Interface

Making the Controller Interface	
1	Secure each module to the connection unit with the two clips provided. Refer to Figure 5-16.

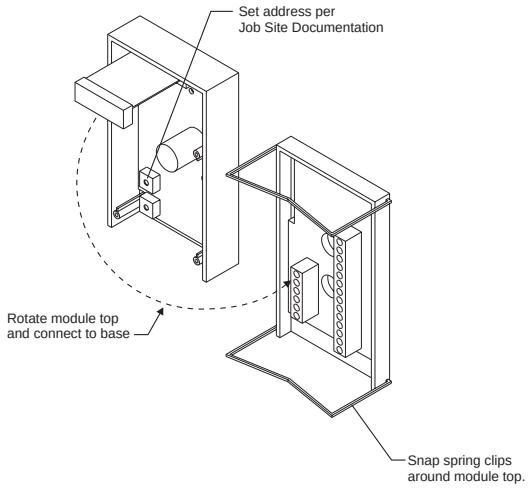


Figure 5-16: RPM Module Top and Base

2	Write the connected equipment description and module address on the label on the front of the module.

Initialization Sequence

Rapid Cycling of the Green LED

Upon connection to a controller, the RPM modules will begin the initialization sequence. This is characterized by a rapid cycling of the Green LED (approximately four cycles per second) on the front of the module.

Continuous Illumination of the Green LED

The process of module initialization may require various time periods depending on the total number of modules on the communications bus. Once initialization has been completed, the Green LED should stay continuously illuminated except for short periods when the module is communicating with the controller.

Slow Cycling of the Green LED

A slow cycling of the Green LED (approximately one cycle per second) will occur if the address switches of the module are set to 00 (invalid address) because the controller will not recognize this address. If the module address is set to 00, remove the module from the bus, change its address, and re-attach it to the bus.

Warning

Before changing the address, the module must be electrically disconnected from the bus. The module should not be re-attached for at least five seconds following an address change. This allows the storage capacitors in the module to discharge.

6 *Troubleshooting*

Table 6-A: Troubleshooting

Symptom	Possible Cause(s)	Recommended Procedure(s)
Green LED flashes steady (approx. 1 second pulse)	Invalid Address - module is not initialized	Verify module has unique address. Module cannot use address 00.
Green LED stays on continuously (never flashes)	Module Failure - component failure on module base or module cover	1. Run diagnostics on controller. 2. Replace module.
		1. Create a user-defined event for each installed module to identify which module is failing. 2. Replace module that failed.
Green LED stays off	Module not connected to bus Module failure	1. Verify wiring to interconnect module. 2. Replace module.
Measurement out of range	Excessive or reverse voltage polarity to channel input	Verify that input voltage is less than the maximum measurement voltage. Verify channel input polarity.
Module type conflict	Module type does not match controller software configuration	Replace module with correct type or unlock and change software configuration (see controller manual).

7 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. Upon shipment, Seller's Manufactured Products will be free from defects in material and workmanship, and will conform to Seller's specifications or any other agreed-upon specification referenced in the order for such Product;
3. With respect to Vendor items, Seller, to the extent permitted, does hereby assign to Customer the warranties given to Seller by its Vendor of such Vendor Items, such assignment to be effective upon Customer's acceptance of such Vendor Items. With respect to Vendor items recommended by Seller in its specifications for which the Vendor's warranty cannot be assigned to Customer, or if assigned, less than Sixty (60) days remain of the Vendor's warranty or warranty period when the Vendor's items are shipped to Customer or when Seller submits its notice of completion of installation if installed by Seller, Seller warrants that such Vendor's items will be free from defects in material and workmanship on the date of shipment to Customer. In such an event, the applicable Warranty Period will be sixty (60) days.

B. The Warranty Period listed below is applicable to Seller's Manufactured Products furnished pursuant to this Agreement, unless otherwise stated:

Warranty Period

Product Type	New Product	Repaired Product or Part*
Central Office Power Equipment	24 Months	6 Months
*The Warranty Period for a repaired Product or part thereof is as listed or, in the case of Products under Warranty, is the period listed or the unexpired term of the new Product Warranty Period, whichever is longer. **The Warranty Period for Products ordered for Use in Systems or equipment Manufactured by and furnished by Seller is that of the initial Systems or equipment.		

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 repair or replacing

Product to the destination designated by Customer within the Territory.

E. The defective or nonconforming Products or parts which are replaced shall become Seller's property.

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 with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like.

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 Decimal/Hexadecimal Conversion Table

Table A-1: Decimal/Hexadecimal Conversion

Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal
Invalid	00	1	01	2	02
3	03	4	04	5	05
6	06	7	07	8	08
9	09	10	0A	11	0B
12	0C	13	0D	14	0E
15	0F	16	10	17	11
18	12	19	13	20	14
21	15	22	16	23	17
24	18	25	19	26	1A
27	1B	28	1C	29	1D
30	1E	31	1F	32	20
33	21	34	22	35	23
36	24	37	25	38	26
39	27	40	28	41	29
42	2A	43	2B	44	2C
45	2D	46	2E	47	2F
48	30	49	31	50	32
51	33	52	34	53	35

Table A-1: Decimal/Hexadecimal Conversion

Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal
54	36	55	37	56	38
57	39	58	3A	59	3B
60	3C	61	3D	62	3E
63	3F	64	40	65	41
66	42	67	43	68	44
69	45	70	46	71	47
72	48	73	49	74	4A
75	4B	76	4C	77	4D
78	4E	79	4F	80	50
81	51	82	52	83	53
84	54	85	55	86	56
87	57	88	5	89	59
90	5A	91	5B	92	5C
93	5D	94	5E	95	5F
96	60	97	61	98	62
99	63	100	64	101	65
102	66	103	67	104	68
105	69	106	6A	107	6B
108	6C	109	6D	110	6E
111	6F	112	70	113	71
114	72	115	73	116	74
117	75	118	76	119	77
120	78	121	79	122	7A
123	7B	124	7C	125	7D
126	7E	127	7F	128	80
129	81	130	82	131	83
132	84	133	85	134	86

Table A-1: Decimal/Hexadecimal Conversion

Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal
135	87	136	88	137	89
138	8A	139	8B	140	8C
141	8D	142	8E	143	8F
144	90	145	91	146	92
147	93	148	94	149	95
150	96	151	97	152	98
153	99	154	9A	155	9B
156	9C	157	9D	158	9E
159	9F	160	A0	161	A1
162	A2	163	A3	164	A4
165	A5	166	A6	167	A7
168	A8	169	A9	170	AA
171	AB	172	AC	173	AD
174	AE	175	AF	176	B0
177	B1	178	B2	179	B3
180	B4	181	B5	182	B6
183	B7	184	B8	185	B9
186	BA	187	BB	188	BC
189	BD	190	BE	191	BF
192	C0	193	C1	194	C2
195	C3	196	C4	197	C5
198	C6	199	C7	200	C8
201	C9	202	CA	203	CB
204	CC	205	CD	206	CE
207	CF	208	D0	209	D1
210	D2	211	D3	212	D4
213	D5	214	D6	215	D7

Table A-1: Decimal/Hexadecimal Conversion

Decimal	Hexadecimal	Decimal	Hexadecimal	Decimal	Hexadecimal
216	D8	217	D9	218	DA
219	DB	220	DC	221	DD
222	DE	223	DF	224	E0
225	E1	226	E2	227	E3
228	E4	229	E5	230	E6
231	E7	232	E8	233	E9
234	EA	235	EB	236	EC
237	ED	238	EE	239	EF
240	F0	241	F1	242	F2
243	F3	244	F4	245	F5
246	F6	247	F7	248	F8
249	F9	250	FA	251	FB
252	FC	253	FD	254	FE
255	FF				

Appendix B AC Interface Units

Applications

Functions of the Units

AC interface units are available to enable the Galaxy controller to perform a variety of ac monitoring applications. These ac interface units convert ac signals to low voltage dc outputs that can be transmitted to monitoring systems. These interface units provide accurate monitoring of ac voltage, current, and frequency of:

- Commercial ac load circuits
- Engine/generator outputs
- UPS outputs
- Inverter outputs
- Other ac monitoring

Programming Examples

The Galaxy controller can be programmed to provide accurate ac reporting. Examples are:

- UPS output voltage too high/low
- Inverter output voltage too high/low
- Commercial ac failure
- Transfer to engine/generator
- Engine/generator voltage too high/low
- Monitor engine/generator frequency
- High/low ac current alarms
- Output frequency too high/low

Available Units

Overview

AC interface units are available to monitor ac voltage, ac current, or ac frequency. Each unit may be ordered separately, or a combination of one voltage and one current unit may be ordered as a cost-effective voltage-current unit in a single metal housing.

The Voltage Interface Unit, Current Interface Unit, and Frequency Interface Unit are designed to provide a simple-to-install, pre-packaged solution for ac monitoring applications.

The Voltage and Current Interface Unit is designed to provide a flexible solution for applications that require a combination of voltage and current monitoring.

Voltage Interface Unit

The Voltage Interface Unit provides accurate single or three phase line-line (delta configuration) or line-neutral (wye configuration) RMS ac voltage measurements.

Refer to the AC Voltage Interface Unit for Galaxy Controller product manual, Select Code 167-792-104, for more information.

Current Interface Unit

The Current Interface Unit provides accurate ac current measurements for up to three circuits. The current transformers selected determine the range for accurate current measurement. These ranges may be 30-300A, 60-600A, or 200-2000A. Solid-core or split-core transformers may be used. Use of a split-core transformer allows installation around the current carrying conductor without interrupting the circuit. Solid-core transformers are a less expensive solution, but may require higher installation costs, and require interruption of the circuit for installation. Solid-core transformers are ideal for new ac circuit installations and are more accurate than split-core.

Refer to the AC Current Interface Unit for Galaxy Controller product manual, Select Code 167-792-103, for more information.

Available Units, continued

Frequency Interface Unit

The Frequency Interface Unit provides accurate frequency monitoring for 50, 60, and 400 Hz center frequencies.

Refer to the AC Frequency Interface Unit for Galaxy Controller product manual, Select Code 167-792-102, for more information.

Voltage/Current Interface Unit

The Voltage/current Interface Unit provides accurate three phase (line-line or line-neutral) voltage and three phase current monitoring in a single enclosure.

Refer to the AC Voltage/Current Interface Unit for Galaxy Controller product manual, Select Code 167-792-105, for more information.

Installation

Introduction

Complete instructions for installing, operatin,g and maintaining the modules are packed with the units themselves. This section provides guidelines to help prepare for installation.

Required Components

The following components are required for ac measurements with the Galaxy controller:

- Independent (Basic) Controller
- Intelligent Option Card
- Remote Peripheral Monitoring Option Card
- 0-3V Remote Peripheral Module(s)

Mounting

The units can be wall mounted on any flat, smooth surface using the mounting holes provided in the rear of the units. Suitable fasteners should be used when mounting on masonry or drywall.

Wiring

Electrical knockouts are provided on the top and bottom of the ac units for conduit connections. The units have separate high and low voltage terminal block connectors for connecting the units to the measurement point(s) and to the remote monitoring module channel inputs. Wiring from the units to the measurement point(s) should be fused (capable of being disconnected when performing maintenance on the units) at the measurement point.

Ordering Information

Ordering the Units Please refer to your Product Guide or contact your Lucent Technologies Account Representative. Marketing and Sales customer service is available at 1-800-526-7819.

Receiving the Units The units are delivered with the measurement modules and current limiting resistors factory mounted and pre-wired, which greatly simplifies the installation process. Before you begin, read and review all safety rules and procedures.