



**USER'S GUIDE**

# **ECHELON<sup>®</sup> CONFIGURATION HANDBOOK**

**OCTOBER 2007 (REVISED JUNE 2014)**

**DOCUMENT NO. COM-00-07-09  
VERSION A.1**

Siemens Industry, Inc. Rail Automation  
9568 Archibald Ave., Suite 100  
Rancho Cucamonga, California 91730  
1-800-793-7233

Copyright © 2008 - 2014 Siemens Industry, Inc.  
All rights reserved

**PRINTED IN U.S.A.**

## PROPRIETARY INFORMATION

Siemens Industry, Inc. has a proprietary interest in the information contained herein and, in some instances, has patent rights in the systems and components described. It is requested that you distribute this information only to those responsible people within your organization who have an official interest.

This document or the information disclosed herein, shall not be reproduced or transferred to other documents or used or disclosed for manufacturing or for any other purpose except as specifically authorized in writing by **Siemens Industry, Inc.**

## TRANSLATIONS

The manuals and product information of Siemens Industry, Inc. are intended to be produced and read in English. Any translation of the manuals and product information are unofficial and can be imprecise and inaccurate in whole or in part. Siemens Industry, Inc. does not warrant the accuracy, reliability, or timeliness of any information contained in any translation of manual or product information from its original official released version in English and shall not be liable for any losses caused by such reliance on the accuracy, reliability, or timeliness of such information. Any person or entity that relies on translated information does so at his or her own risk.

## WARRANTY INFORMATION

Siemens Industry, Inc. warranty policy is as stated in the current Terms and Conditions of Sale document. Warranty adjustments will not be allowed for products or components which have been subjected to abuse, alteration, improper handling or installation, or which have not been operated in accordance with Seller's instructions. Alteration or removal of any serial number or identification mark voids the warranty.

## SALES AND SERVICE LOCATIONS

Technical assistance and sales information on **Siemens Industry, Inc.** products may be obtained at the following locations:

SIEMENS INDUSTRY, INC. RAIL AUTOMATION  
2400 NELSON MILLER PARKWAY  
LOUISVILLE, KENTUCKY 40223  
TELEPHONE: (502) 618-8800  
FAX: (502) 618-8810  
SALES & SERVICE: (800) 626-2710  
WEB SITE: <http://www.rail-automation.com/>

SIEMENS INDUSTRY, INC. RAIL AUTOMATION  
939 S. MAIN STREET  
MARION, KENTUCKY 42064  
TELEPHONE: (270) 918-7800  
CUSTOMER SERVICE: (800) 626-2710  
TECHNICAL SUPPORT: (800) 793-7233  
FAX: (270) 918-7830

## FCC RULES COMPLIANCE

The equipment covered in this manual has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

## DOCUMENT HISTORY

Version	Release Date	Sections Changed	Details of Change
A	Nov 2008	- - - - -	Initial Release
A.1	June 2014	ALL	Convert to Siemens Format

## Table of Contents

Section	Title	Page
	PROPRIETARY INFORMATION .....	ii
	TRANSLATIONS.....	ii
	WARRANTY INFORMATION .....	ii
	SALES AND SERVICE LOCATIONS .....	ii
	FCC RULES COMPLIANCE .....	ii
	DOCUMENT HISTORY .....	iii
	NOTES, CAUTIONS, AND WARNINGS.....	v
	ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS.....	vi
1.0	INTRODUCTION.....	1
2.0	APPLICABLE SIEMENS EQUIPMENT.....	2
3.0	ECHELON® LAN SPECIFICATIONS .....	3
4.0	ECHELON® TERMINATION UNIT (ETU) .....	4
5.0	ECHELON® BUS WIRING .....	5
5.1	BASIC CABLE CONNECTIONS .....	5
5.2	THE” 8-IN-16” RULE.....	5
5.2.1	The 8-in-16 Rule – Examples .....	6
5.3	SUMMARY OF NODE CONNECTION RULES .....	7
6.0	TROUBLESHOOTING TIPS .....	8
6.1	IMPROPERLY CONFIGURED ECHELON® NODES.....	8
6.2	IMPROPER ECHELON® CONNECTION .....	8
6.3	BROKEN OR NON-TERMINATED WIRES.....	8
APPENDIX A	GCP 3000 ECHELON® INTERFACE/TERMINATION ASSEMBLY .....	9
APPENDIX B	ILOD SPECIAL CONSIDERATIONS.....	11

## NOTES, CAUTIONS, AND WARNINGS

Throughout this manual, notes, cautions, and warnings are frequently used to direct the reader's attention to specific information. Use of the three terms is defined as follows:

### **WARNING**

**WARNING**  
INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY. WARNINGS ALWAYS TAKE PRECEDENCE OVER NOTES, CAUTIONS, AND ALL OTHER INFORMATION.

### **CAUTION**

**CAUTION**  
REFERS TO PROPER PROCEDURES OR PRACTICES WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN A POTENTIALLY HAZARDOUS SITUATION AND/OR POSSIBLE DAMAGE TO EQUIPMENT. CAUTIONS TAKE PRECEDENCE OVER NOTES AND ALL OTHER INFORMATION, EXCEPT WARNINGS.

### **NOTE**

**NOTE**  
Generally used to highlight certain information relating to the topic under discussion.

If there are any questions, contact Siemens Industry, Inc. Rail Automation Application Engineering.

## **ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS**

Static electricity can damage electronic circuitry, particularly low voltage components such as the integrated circuits commonly used throughout the electronics industry. Therefore, procedures have been adopted industry-wide which make it possible to avoid the sometimes invisible damage caused by electrostatic discharge (ESD) during the handling, shipping, and storage of electronic modules and components. Siemens Industry, Inc., Rail Automation has instituted these practices at its manufacturing facility and encourages its customers to adopt them as well to lessen the likelihood of equipment damage in the field due to ESD. Some of the basic protective practices include the following:

- Ground yourself before touching card cages, assemblies, modules, or components.
- Remove power from card cages and assemblies before removing or installing modules.
- Remove circuit boards (modules) from card cages by the ejector lever only. If an ejector lever is not provided, grasp the edge of the circuit board but avoid touching circuit traces or components.
- Handle circuit boards by the edges only.
- Never physically touch circuit board or connector contact fingers or allow these fingers to come in contact with an insulator (e.g., plastic, rubber, etc.).
- When not in use, place circuit boards in approved static-shielding bags, contact fingers first. Remove circuit boards from static-shielding bags by grasping the ejector lever or the edge of the board only. Each bag should include a caution label on the outside indicating static-sensitive contents.
- Cover workbench surfaces used for repair of electronic equipment with static dissipative workbench matting.
- Use integrated circuit extractor/insertion tools designed to remove and install electrostatic-sensitive integrated circuit devices such as PROM's (OK Industries, Inc., Model EX-2 Extractor and Model MOS-40 Insertion (or equivalent) are highly recommended).
- Utilize only anti-static cushioning material in equipment shipping and storage containers.

For information concerning ESD material applications, please contact the Technical Support Staff at 1-800-793-7233. ESD Awareness Classes and additional ESD product information are also available through the Technical Support Staff.

## 1.0 INTRODUCTION

The primary purpose of this document is to provide an installation guideline for the interconnection of Echelon<sup>®</sup> LonTalk<sup>®</sup> LAN cabling in a *new* Siemens Rail Automation system environment.

This manual may also be used as a guide for troublesome systems where the Echelon LAN is suspected to be at fault.

The information contained in this manual supersedes all similar Echelon LAN information in prior Siemens equipment manuals. However, Echelon LAN installations based on previous manuals that are working satisfactorily do NOT need to be modified.

Echelon LAN installations based on previous manuals that are not working satisfactorily should be modified in accordance with the recommendations contained in this manual.

**⚠ CAUTION**

**CAUTION**

BECAUSE THE EHELON<sup>®</sup> INTERFACE IS NOT SURGE PROTECTED, THE NETWORK CONNECTIONS MUST BE RESTRICTED TO EQUIPMENT CONTAINED INSIDE A PROTECTED ENCLOSURE.

**⚠ CAUTION**

**CAUTION**

UNTWISTED WIRES, OR CABLES CONTAINING FLAT OR PARALLEL UNTWISTED CONDUCTORS, MUST NOT BE USED ON AN EHELON<sup>®</sup> LONWORKS<sup>®</sup> TWISTED PAIR CHANNEL. THE USE OF THESE WIRES/CABLES MAY RESULT IN IMPROPER NETWORK OPERATION AND COULD, UNDER CERTAIN CIRCUMSTANCES, RESULT IN DAMAGE TO NODES CONNECTED TO SUCH A CHANNEL.

## 2.0 APPLICABLE SIEMENS EQUIPMENT

Siemens Rail Automation equipment that employs the Echelon® LAN currently includes:

- 4-Input Analog Unit A80261 \*
- AB Switch A53434 \*
- ARGUS Event Recorder
- BCM (Base Communications Module) A53444
- Bipolar I/O Module A53101 \*
- Digit I/O and Analog Input Module A80258 (counts as two nodes) \*
- GCP 3000
- GCP 4000 (GCP 4000 with SEAR Ili counts as two nodes)
- GEO
- HD
- iLOD (intelligent Light Out Detector) \*
- MCM (Mobile Communications Module) CPU A53105
- Relay Output Module A53103 \*
- SDIM (Scalable Digital Input Module) A80293 \*
- SEAR I Event Recorder
- SEAR II Event Recorder
- SSCC (Solid State Crossing Controller) IIIA, III Plus, and IV
- SSR 2020 and Site ID Module 53419
- ULCP (Universal Local Control Panel) A50692 \*
- Unipolar I/O Module A53102 \*
- VHF Communicator \*
- VSLIC (Vital Siemens Logic I/O Controller) A80510
- WAG (Wayside Access Gateway) A53457
- WCC/FPD (Wayside Communications Controller/Field Protocol Device) A53401
- WCM (Wayside Communications Module) A53447

\* Unit must be installed via Echelon Service button located on the unit.



### 3.0 ECHELON® LAN SPECIFICATIONS

Data Transfer Rate: 1.25 Mbps

Transmission Medium: Level 4 (NEMA) cable, twisted pair (shielded or unshielded), wire size #22 AWG (0.65 mm) or #24 AWG (0.5 mm) Category 5 cable.

Echelon Corporation recommends the following characteristics:

Specification	Level IV	CAT 5
<b>D-C Resistance</b> (Ohms/1000 feet at 20°C (68°F)) Maximum for a single copper conductor regardless of whether it is solid or stranded, and is or is not metal-coated.	18.0	28.6
<b>D-C Resistance Unbalance</b> (percent) max	5%	5%
<b>Mutual Capacitance of a Pair</b> (pF/foot) max	17	17
<b>Pair-to-Ground Capacitance Unbalance</b> (pF/1000 feet) max	1000	1000
<b>Characteristic Impedance</b> (Ohms) (1.0 – 20.0 MHz)	100 ± 15%	100 ± 15%
<b>Attenuation</b> (dB/1000 feet at 20°C (68°F)) max (1.0 MHz)	5.5 dB	6.5 dB

Topology: Bus (direct daisychain), no stubs or Routers.

Number of Nodes:

Number of Nodes	Environmental Temperature
16	-40 to +85° C (-40 to +185° F)
32	-20 to +85° C (-4 to +185° F)
64	0 to +70° C (32 to +160° F)

Maximum of 8 nodes in any 16 meter (53 foot) length of transmission cable (the “8-in-16” Rule. See section 5.0 ECHELON BUS WIRING).

**NOTE**

**NOTE**

For most site installations, Siemens Rail Automation recommends a maximum of 16 nodes on the Echelon bus, which will provide the widest environmental operating temperature range.

**NOTE**

**NOTE**

The SEAR, SEAR II, SEAR Ili and Argus Event Recorders can monitor up to 16 nodes.

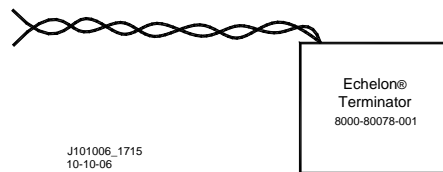
**Termination:** Echelon cable runs and/or connection to several modules requires special (non-polarized) termination at both LAN endpoints (refer to section 4.0 ECHELON TERMINATION UNIT (ETU)), or contact Siemens Industry, Inc., Rail Automation, Applications Engineering, for details.

**Network Length:** 430 feet (130m) maximum network length.

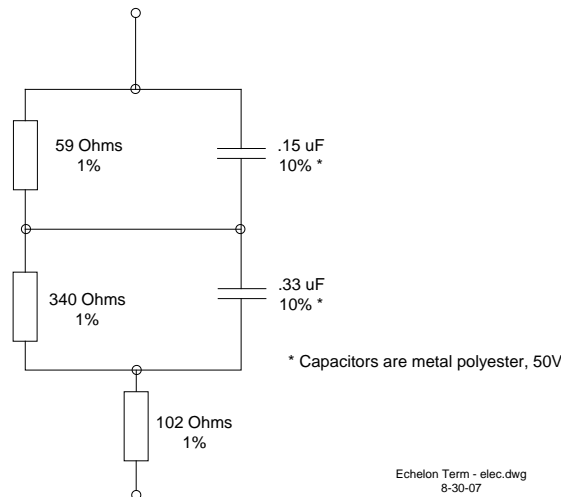
#### 4.0 ECHELON® TERMINATION UNIT (ETU)

In general, the Echelon network requires a terminator (often referred to as Echelon Termination Unit or ETU) at each endpoint of the bus for proper data transmission and performance.

The terminator is not polarity sensitive and can be attached in either direction across the two Echelon pins on the bus end connectors.



#### Echelon Termination Unit (ETU)

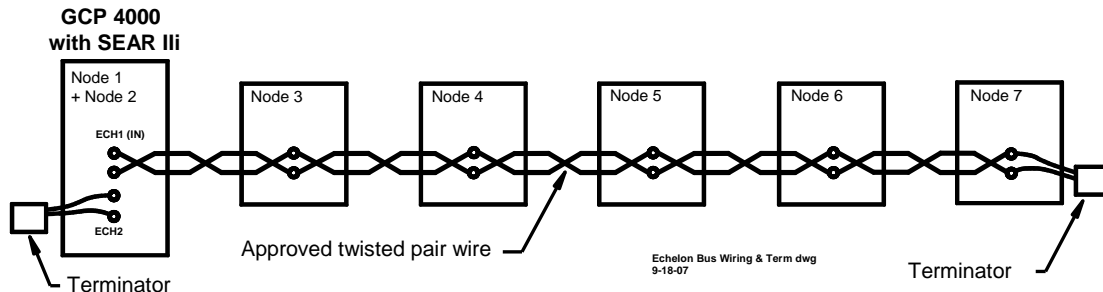


#### ETU Circuit Diagram

To obtain Echelon Termination Units, order Siemens Rail Automation part number 8000-80078-001.

## 5.0 ECHELON® BUS WIRING

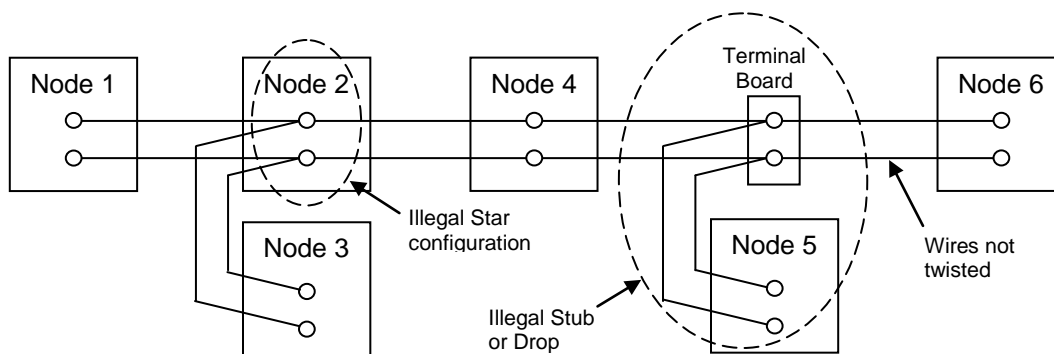
### 5.1 BASIC CABLE CONNECTIONS



### CORRECT BUS WIRING

#### NOTE

**NOTE**  
A GCP 4000 with a SEAR Ili installed counts as two nodes. Also, the A80258 Digital I/O and Analog Input module counts as two nodes.



### EXAMPLES OF INCORRECT WIRING

### 5.2 THE "8-IN-16" RULE

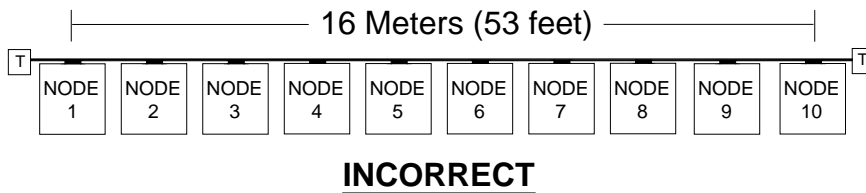
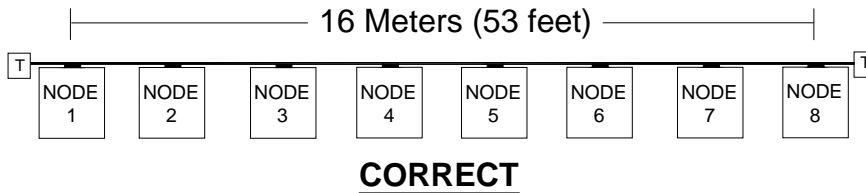
Due to transmission characteristics of the Echelon channel, communication failures may result from reflections of the Echelon transceiver's 1.25 Mbps transmitted signal under conditions of concentrated node loading. These communication failures are eliminated when nodes are used in a simple distributed configuration known as the "8-in-16" topology rule.

The 8-in-16 rule requires that no more than 8 nodes be located within any 16 meter (53 foot) length of bus cable. In other words, no matter where along the bus the 16 meter measurement is taken, there should be no more than 8 nodes. See following examples.

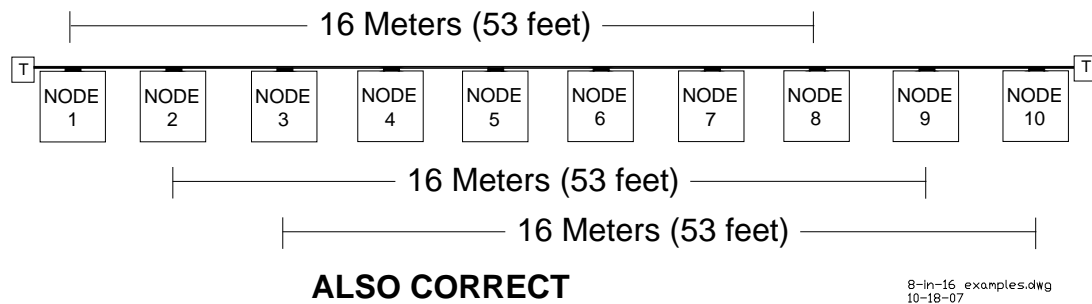
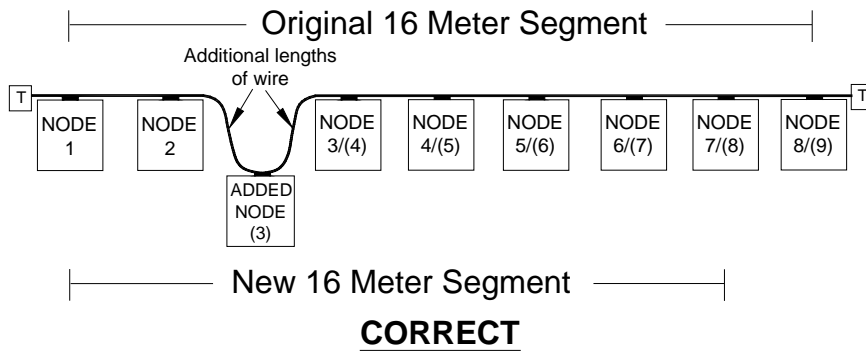
**NOTE**

**NOTE**  
 To standardize wiring procedures, it is recommended that at least nine feet of wire be installed between nodes to satisfy the "8-in-16" rule.

**5.2.1 The 8-in-16 Rule – Examples**



**IMPORTANT:** If adding a node within an existing 16 meter segment (due to mounting limitations, for example) be sure to add enough additional cable to expand the new segment to conform to the 8-in-16 rule, as shown below.



8-in-16\_examples.dwg  
 10-18-07

### 5.3 SUMMARY OF NODE CONNECTION RULES

- Number of possible nodes is dependent on the installation environmental temperature range. See Specifications page.
- Siemens Rail Automation recommends that in configurations where a GCP 3000 or GCP 4000 is used, that the GCP is the first device on the Echelon bus. If the network also contains iLODs, then the iLODs should be grouped together at the opposite end of the bus. (See APPENDIX B - ILOD SPECIAL CONSIDERATIONS).
- Because the Echelon interface is not surge protected, network connections must be restricted to the equipment contained inside a signal case or bungalow.
- Never use wire other than Level IV #22 AWG (0.65 mm) twisted pair or Category 5 (Cat 5) #24 AWG (0.5 mm) twisted pair for the main bus cable.
- Category IV (Cat 4) cable should never be used in place of Level IV cable.
- For new installations, an Echelon Termination Unit (ETU) is required at each endpoint of the Echelon bus.
- Echelon Termination Units (ETUs) are not counted as nodes.
- Stubs and Routers are not allowed in Siemens Echelon bus configurations.
- The SEAR, SEAR II, SEAR Ili and Argus Event Recorders can monitor up to 16 nodes. Also, the A80258 Digital I/O and Analog Input module counts as two nodes.
- There is no minimum number of nodes required within a 16 meter cable segment (e.g. 1 – 7 additional nodes can be connected within a 16 meter cable segment).
- There can be no more than 8 nodes connected within any 16 meter (53 foot) length (segment) of bus cable. (See sections titled “The 8-in-16 Rule” and “The 8-in-16 Rule – Examples”).
- If adding a node within an existing 16 meter segment of cable with 8 nodes already connected, then additional cable must be added within the original segment in order to conform to “8-in-16” rule. (See section titled “The 8-in-16 Rule – Examples”).
- There is no restriction on the distance between 16 meter cable segments containing nodes, as long as the overall cable length does not exceed 130 meters (430 feet).
- When connecting two wires into a cage-clamp connector on the bus use ferrules to ensure solid connection.
- iLODs connected to the Echelon bus require additional connection configuration. See APPENDIX B - ILOD SPECIAL CONSIDERATIONS.

**NOTE****NOTE**

For additional information concerning the Echelon LAN, contact Siemens Industry, Inc., Rail Automation, Technical Services Group.

## **6.0 TROUBLESHOOTING TIPS**

In the event that lost communication sessions or other strange behavior is reported at a site, it is advisable to first verify that all equipment has been properly configured. Additionally, other items should be checked to ensure proper performance. Some of these issues are:

### **6.1 IMPROPERLY CONFIGURED ECHELON<sup>®</sup> NODES**

Check that all Echelon devices are properly installed on the network. This will include verification of proper slot assignment, Echelon node assignment, ATCS address (if applicable), and so on. Verification should be performed through the SEAR II device monitor.

### **6.2 IMPROPER ECHELON<sup>®</sup> CONNECTION**

While in theory the connecting of two wires into a single wire input on a cage-clamp terminal should not pose a problem, there is a possibility that one or both wires do not make a continuous connection to the connecting pin. In the event that this occurs, ferrules can be used to ensure solid connection.

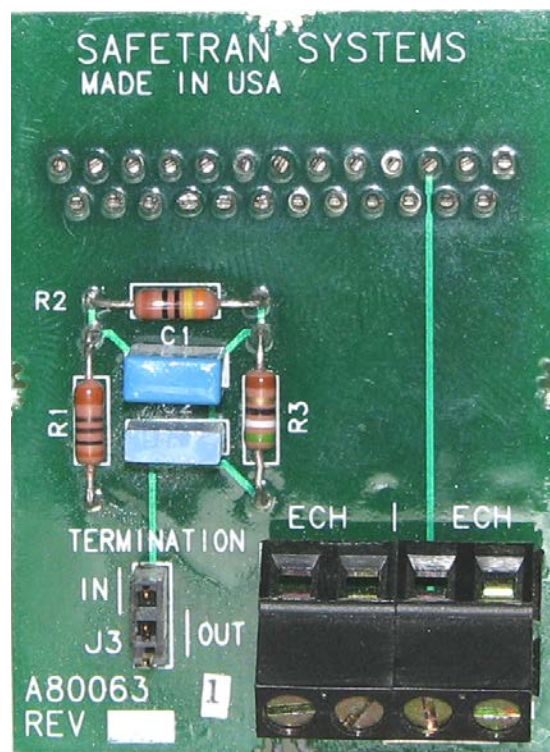
### **6.3 BROKEN OR NON-TERMINATED WIRES**

Occasionally, a device like a VHF Communicator might be removed from the Echelon network. In such cases, the wires might be disconnected from the unit, but inadvertently left dangling from the Echelon network. This allows the loose wires to act as an antenna, possibly introducing noise into the system. If a device must be removed from the network, be sure that all unused Echelon wiring for that device has been removed as well.

## APPENDIX A GCP 3000 ECHELON® INTERFACE/TERMINATION ASSEMBLY

If a GCP 3000 is equipped or retrofitted with a Recorder Interface Module (A80255 or A80265), a Network Interface Plug Assembly (A80063) must be plugged into the DB-25 Recorder connector (J1) located on the front of the GCP 3000 case. The network interface plug assembly contains a 4-wire cage-clamp connector for the Echelon cable and the Echelon termination circuitry.

If the GCP 3000 is connected at the beginning (or end) of the Echelon bus, the termination circuit for that unit must be enabled by setting the Termination jumper block (J3) to the **IN** position. If the GCP 3000 is connected anywhere else on the Echelon bus the termination circuit must be disabled by setting the Termination jumper block to the **OUT** position.



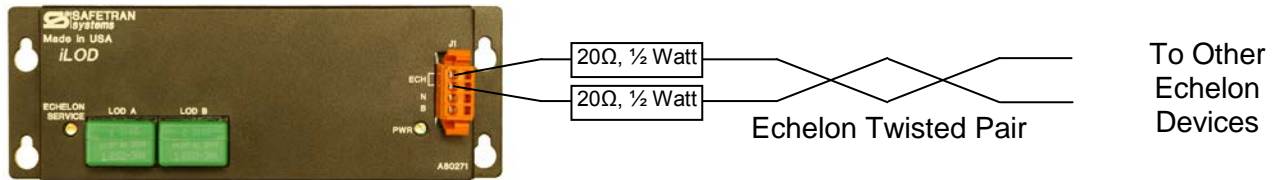
**GCP 3000 Network Interface Plug Assembly A80063**

This page intentionally left blank



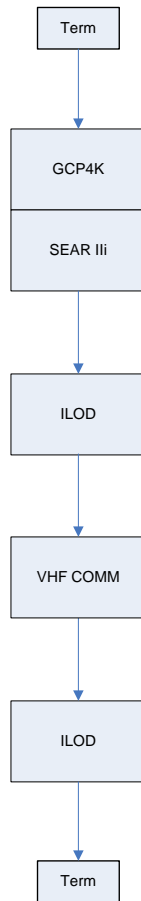
## APPENDIX B ILOD SPECIAL CONSIDERATIONS

Special consideration is necessary when iLOD devices are connected with other devices on the Echelon LAN. In this situation ALL iLODs should be placed at one end of the network. Additionally, two 20 ohm ½ Watt resistors are required to separate the iLODs from the other nodes on the network. These resistors must be installed at the Echelon connection to the FIRST iLOD, as shown below. See following paragraphs for examples on how to connect the resistors.

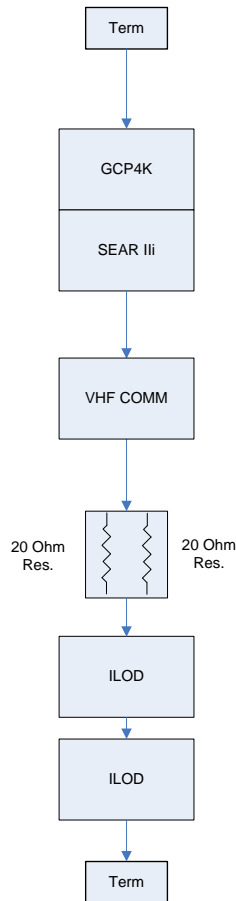


First iLOD on Echelon Network

### Incorrect



### Correct



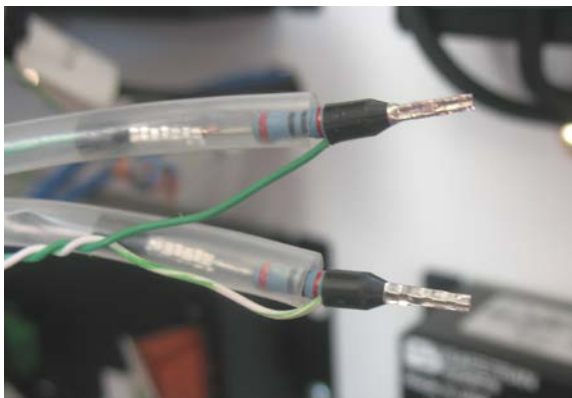
## Connecting Resistors to the First iLOD Using Ferrules

One method of securely fastening the iLOD resistors to the Echelon cable is by using ferrules. The resistors are first soldered or crimp-connected to the cable wires and covered with insulating sleeves. Next the loose ends of the resistors and the continuing Echelon cable wires (if any) are inserted into the ferrules and crimped. It then becomes a simple matter of inserting the ferrules into the cage-clamp connector. See illustrations below.

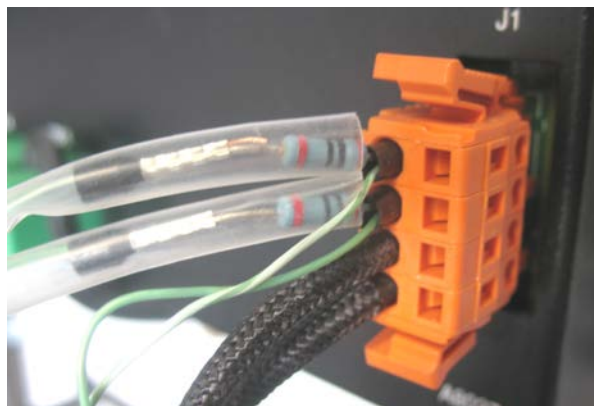
### NOTE

### NOTE

If this is the only iLOD (and the last node) on the cable bus then an Echelon Termination Unit (ETU) must be attached at the ferrule connection in lieu of continuing the Echelon cable.



Resistors And Bus Wires Attached to Ferrules



Ferrules Inserted Into Connector

## Connecting Resistors to the First iLOD Using Spare AREMA Terminals

In situations where there are unused AREMA terminals, the iLOD resistors can be attached between the unused terminals. The incoming Echelon cable wires can then be attached to the terminals on one side of the resistors and the outgoing wires (going to the first iLOD) can be attached to the terminals on the opposite side of the resistors and routed to the first iLOD.

**NOTES**

# SIEMENS

**Siemens Industry, Inc., Rail Automation**

2400 Nelson Miller Parkway  
Louisville, Kentucky 40223  
(502) 618-8800

**Siemens Industry, Inc., Rail Automation**

California R&D Division  
9568 Archibald Ave., Suite 100  
Rancho Cucamonga, California 91730  
(909) 532-5300