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PowerCommand™

Network Installation and Operation Manual

TP-78 [redacted]

Power Generation

The Power of One™

Printed U.S.A. 900–0366 5-2002

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⚠WARNING

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Safety Precautions

The PowerCommand Network can be used to remotely operate power transfer equipment (e.g., transfer switches, paralleling systems) and start and stop generator sets. All of the safety precautions for that equipment must observed. Refer to the Operator's Manual for the equipment that is being monitored and controlled by the network for important safety precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

⚠ DANGER ***This symbol warns of immediate hazards which will result in severe personal injury or death.***

⚠WARNING ***This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.***

⚠ CAUTION ***This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.***

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Keep your hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect battery charger from its AC source, then disconnect starting batteries, negative (-) cable first. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry in the vicinity of moving parts, or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag and lock open switches to avoid accidental closure.
- Jewelry is a good conductor of electricity and should be removed before working on electrical equipment.

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MEDIUM VOLTAGE GENERATOR SETS (601V to 15kV)

- Medium voltage acts differently than low voltage. Special equipment and training is required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Due to the nature of medium voltage electrical equipment, induced voltage can remain even after the equipment is disconnected from the power source. Plan the time for maintenance with authorized personnel so that the equipment can be de-energized and safely grounded.

TRANSFER SWITCHES

- AC and DC voltages in the transfer switch components present serious shock hazards that can result in severe personal injury or death. Read and follow these instructions.
- Keep the transfer switch cabinet closed and locked. Make sure only authorized personnel have cabinet and operational keys.
- Due to the serious shock hazard from medium voltages within the cabinet, all service and adjustments to the transfer switch must be performed only by an electrician or authorized service representative.
- If the cabinet must be opened for any reason:

1. Move the operation selector switch on the generator set to Stop.
2. Disconnect battery charger from its AC source. Disconnect the starting batteries of the generator set. (Remove the negative [–] lead first to prevent arcing from igniting explosive battery gas.)
3. Remove AC power to the automatic transfer switch. If the instructions require otherwise, use extreme caution due to the danger of shock hazard.

GENERAL SAFETY PRECAUTIONS

- The PowerCommand Network allows remote operation of equipment. PowerCommand Software for Windows can remotely start and stop a genset or exercise a transfer switch. Network modules can independently control other network modules and operate other electrical devices such as fans or pumps etc. Make certain that all appropriate personnel are notified before remotely operating equipment and make them aware of any equipment that can be energized automatically.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.
- Use only the latest physical and logical connection diagrams for installing and maintaining the PowerCommand Network. If changes are made to the physical or logical network connections, make sure the site connection diagrams are updated. Create a new CSV file if the number or type of modules changes or if the bindings change.

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1. Introduction

ABOUT THIS MANUAL

This manual covers the PowerCommand™ Network installation, setup, and service information. The PowerCommand Network is an Echelon® *LonWorks*® based local operating control network. This manual is intended for use by trained network installers.

Sections 1 and 2 provide an overview of this manual, the expected technical background of the installer, the required hardware and software tools, and some basic network concepts.

Section 3 describes procedures for the *logical* installation and connection of the various modules on the network using *LonMaker*™ software. This section also describes network testing and service procedures using *LonMaker*.

Much of the material in Section 3 is derived from the Echelon *LonMaker Installation Tool Users Guide.* The Echelon manual is included with the LonMaker software, and should be considered a reference companion to this manual.

Section 4 covers procedures for using the PowerCommand Configuration Tool. This software is used to complete the network installation by performing several functions including setting up the dial out phone number and creating a .CSV file for use by PowerCommand Software for Windows.

Sections 5 thru 12 cover individual modules on the PowerCommand Network and provide procedures for locating, mounting and wiring these modules (*physical* installation). These sections also list the network variables associated with each module. As new modules are made available they will be added to this manual. A glossary of network terms, forms and additional installation aids will be found in the Appendices at the back of this manual.

Use normal and necessary safety precautions before starting any service procedures. Identify all hazards by referring to the Safety Precautions section and observe all warnings and cautions within the manual. When you are troubleshooting, remember that the PowerCommand Network, generator set, transfer switch, and utility power source are all interdependent.

Keep this manual where it will be readily available to the network installer and operator.

REQUIRED BACKGROUND

To use this manual, you need:

- Experience and familiarity with generator set installation and service.
- A basic understanding of control networks.
- Experience and familiarity with personal computers and using a mouse.
- Experience and familiarity with DOS, and Windows-type graphical user interfaces.
- Experience and familiarity with the organization of disk drives, directories, subdirectories, files, and path names.

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⚠ WARNING

THE GENSET, TRANSFER SWITCH AND OTHER EQUIPMENT ASSOCIATED WITH THE POWERCOMMAND NETWORK WILL NOT FUNCTION PROPERLY, OR WILL NOT BE SUBJECT TO PROPER MONITORING AND SERVICE UNLESS THE INSTRUCTIONS IN THIS MANUAL ARE FOLLOWED IN DETAIL. IMPROPER FUNCTIONING CAN RESULT IN SEVERE PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST HAVE THE REQUIRED INSTALLATION TOOLS AND BE QUALIFIED TO PERFORM NETWORK INSTALLATIONS INCLUDING USE OF INSTALLATION SOFTWARE AND BE ABLE TO PERFORM ELECTRICAL AND MECHANICAL SERVICE. READ THIS ENTIRE MANUAL BEFORE STARTING.

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REQUIRED INSTALLATION TOOLS

In additional to conventional tools and all system components and cabling, you need the following tools and manuals to install a PowerCommand Network:

- Network Module Library software.
- Echelon LonMaker software.
- PowerCommand Configuration Tool software.
- IBM PC-compatible computer, with an 80486SX or better processor, running at 25 MHz, minimum.
- VGA monitor (color or gray scale) and video card.
- Windows 3.1 or Windows 95.
- 640 KB of conventional RAM, with at least 580 KB available for LonMaker.
- To free 580 KB of conventional memory for LonMaker, you may have to use DOS (Memmaker) or a memory management utility that lets you store DOS and device drivers in high memory (640 to 1024 KB).
- 8 MB of memory.
- 6.7 MB of available hard disk storage as follows:
  1.2 MB for LonMaker software
  500 KB for the Network Module Library.
  5 MB for PowerCommand Configuration Tool
- Floppy disk drive: 3 1/2”, 1.44 MB.
- Serial port, Network Installation Gateway and driver software.
- Microsoft-compatible mouse and mouse driver software.
- Installation gateway cables and connectors (included with the Network Installation Gateway Kit).
- The *LonMaker Installation Tool Users Guide (provided with LonMaker)*.

To test the PowerCommand Network before leaving the site, the following tools will be needed:

- PowerCommand Software for Windows (PCW).
- A Network Gateway Module.

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SYSTEM OVERVIEW

Figure 1-1 shows a block diagram using each of the network modules described in this manual. The network and network modules are covered in detail in the following sections.

The **PowerCommand Control** (PCC) communicates through the Genset Communications Module with other modules, such as a Digital I/O Module, or Network Gateway Module.

The **Genset Communications Module** (GCM), is mounted in the PCC, and is required for connecting the PCC to the network.

The **Digital I/O Module** (DIM) provides a group of relay contact outputs and discrete inputs for interfacing the PowerCommand system to alarm or status outputs and to equipment that does not have compatible communications capability.

The **Network Annunciator Module** (NAM) allows remote annunciation via the PowerCommand Network of a genset or transfer switch etc.

The **Network Gateway Module** (NGM) provides a network interface to a PC or modem.

The **Controls Communications Module** (CCM) allows interfacing the network to a non–PCC generator set or transfer switch.

The network **Router** (RTR) connects two communications channels and routes messages between them. (Refer to the Router Section for a typical installation diagram).

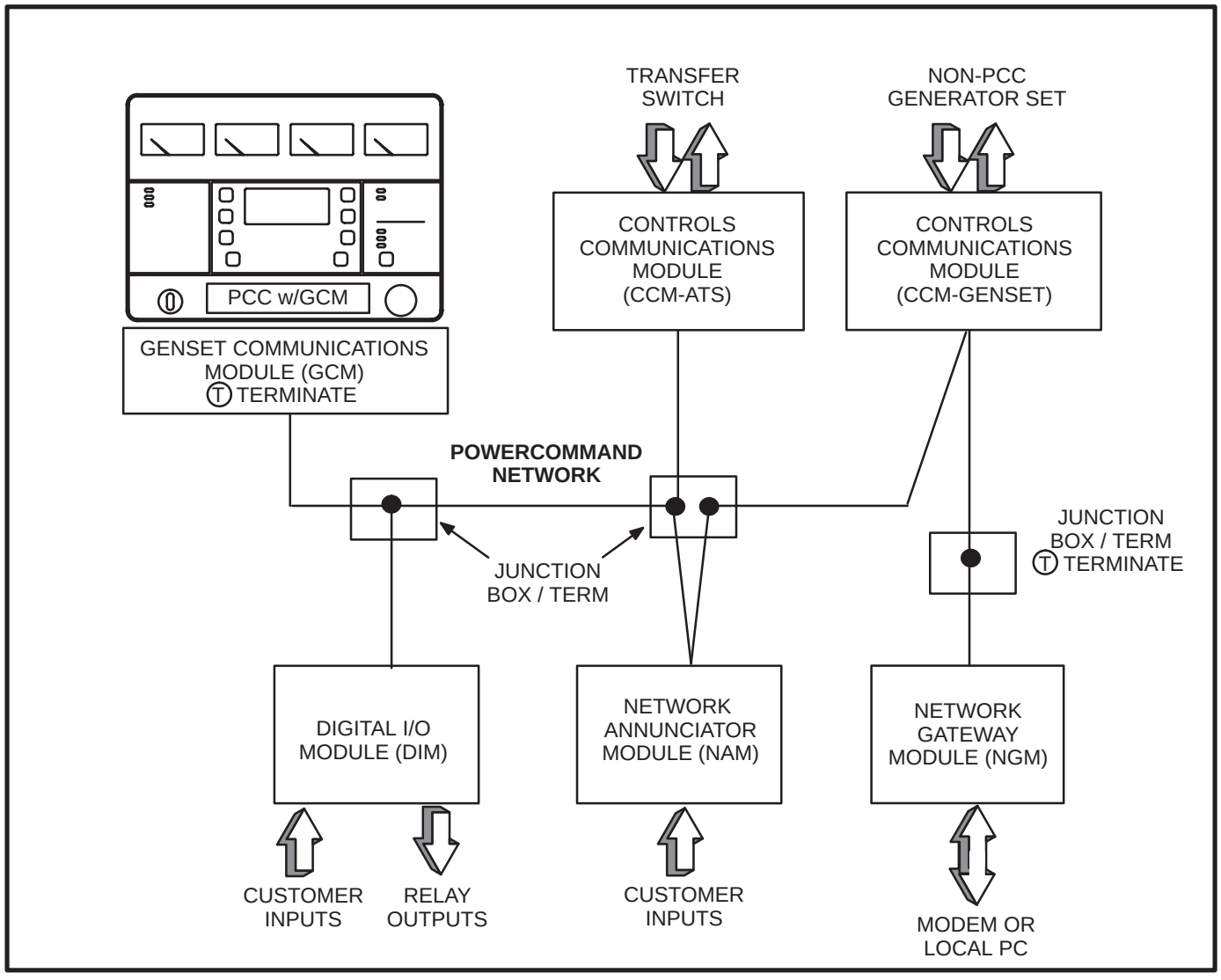

FIGURE 1-1. BLOCK DIAGRAM OF NETWORK MODULES

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2. Network Hardware and Wiring

OVERVIEW

This section describes the network communications protocol and the individual modules used in the PowerCommand network. This section also describes network media, network power supply, and physical connection requirements. For a definition of the terms used in a PowerCommand network, refer to the Glossary in Appendix A.

NETWORK CONFIGURATION

The PowerCommand network uses a multidrop bus topology (Figure 2-2). The network is made up of individual modules that are connected by twisted-pair communications cable for the transmission of network data. Network power is transmitted over a second pair of wires.

Figure 2-1 shows a typical network with several modules. Refer to Figures E-1 thru E-3 in Appendix E for a more detailed network example.

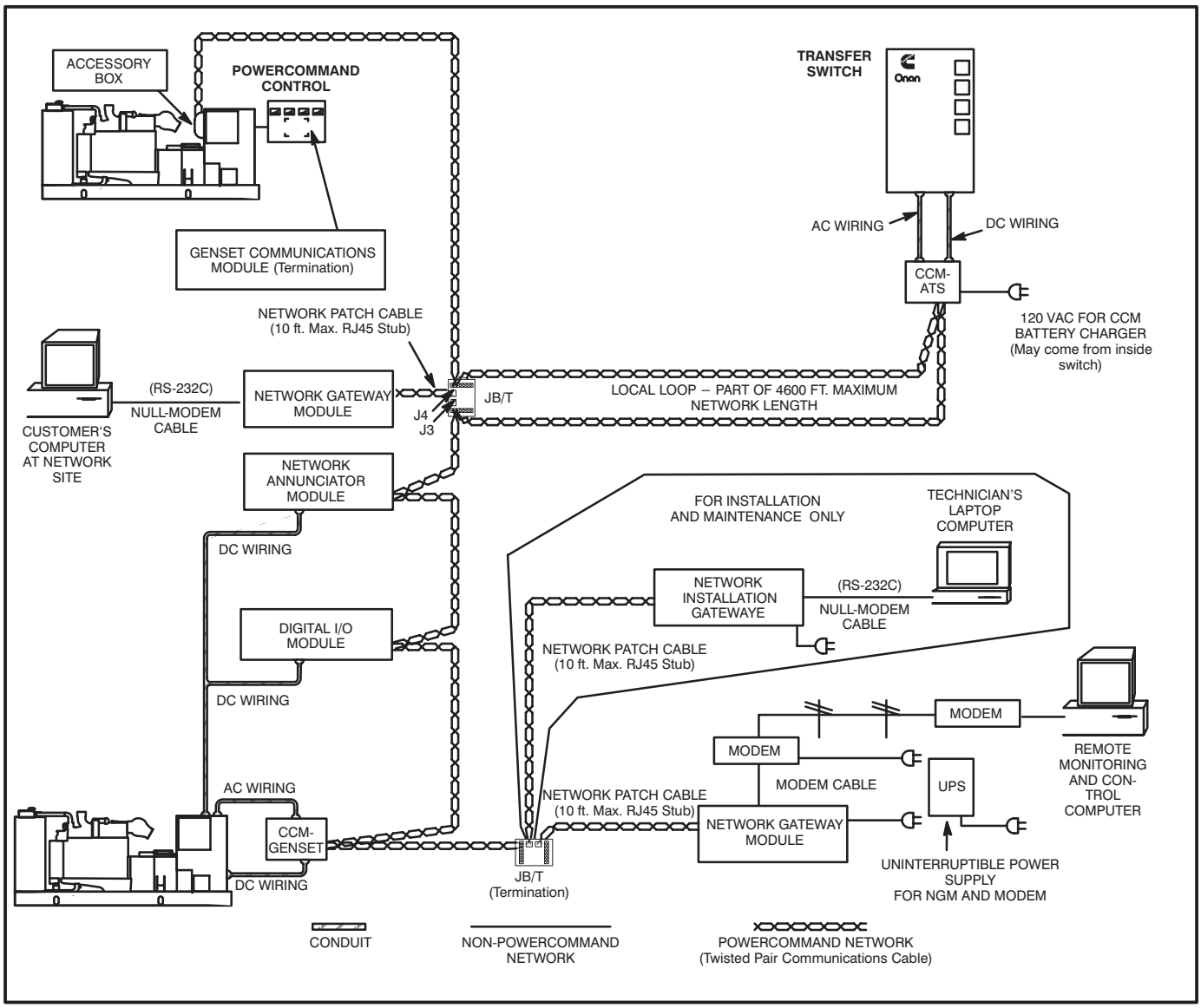

FIGURE 2-1. TYPICAL NETWORK CONFIGURATION

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SYSTEM DESCRIPTION

The PowerCommand Network is a distributed control network. Echelon LonWorks technology provides the communications protocol via Echelon's Neuron® Chip and firmware. The network consists of nodes (for example: PCCs with Genset Communications Modules, Digital I/O Modules, Controls Communication Modules, and Network Gateway Modules) wired together on a common network data bus.

The control of the system does not reside in a central device, but rather is distributed at the system component level. That is, each node has its own intelligence—intelligence needed at that location to perform functions for that particular component.

The nodes communicate control and monitoring information to one another over the network data bus.

The nodes, their connections to one another, and the modules/devices they control/monitor collectively form the distributed control system. A distributed control system is a more robust control scheme than a conventional central control system. Single points of failure in the distributed control system do not necessarily render the whole system inoperative.

Communications Protocol

A distributed control network operates on a peer-to-peer communication protocol, whereby any device on the communication channel can communicate with any other device at any time.

Messages can be prioritized so that critical control messages have first access to the network. Reliability of transmission is provided through use of acknowledged or repeated message service levels. Accuracy of the message is checked by cyclical redundancy checking.

The application is defined by naming the inputs and outputs for each device as network variables.

Nodes that do not have a local source of uninterrupted power are supplied by the network power lines.

Neuron Chip

Each node contains a Neuron Chip. The primary function of the Neuron Chip is to serve as a communications link between the system component located at that node and other system components on the network. The Neuron Chip also provides the node with some local processing power to read switch positions, drive outputs, read analog data, etc. The Neuron Chip communicates by directly transmitting and receiving through a transformer-coupled transceiver.

SYSTEM MODULES

PowerCommand Control

The PowerCommand Control is a microprocessor-based control for Onan generator sets. It provides fuel control and engine speed governing, main alternator voltage output regulation, and complete generator set control and monitoring.

The operating software provides control of the generator set and its performance characteristics, and displays operating information on a digital and analog display panel.

The PowerCommand Control (PCC) communicates through the GenSet Communications Module with other modules, such as a Network Annunciator Module or Network Gateway Module.

The PowerCommand Control is covered in your generator set Installation, Operator's, and Service manuals.

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GenSet Communications Module (GCM)

The GenSet Communications (GCM) is mounted inside the PCC, and is required for connection of the PCC to the network.

The GCM provides an interface for data between the PowerCommand Control and other modules on the network. It communicates with the PCC through the PCC's serial port, as well as by monitoring various PCC inputs to determine the operating state of the control. For example, the GCM monitors PCC data such as voltage, current, engine speed, and oil temp; and then stores it for the network.

The GCM also provides some direct local control and monitoring of the PCC. Outputs from the GCM allow it to "wake up" the PCC when needed, or to cause an emergency shutdown on command. It monitors Not-In-Auto mode and battery voltage (when the PCC is asleep).

The GCM is installed piggyback on the analog board within the PCC. Description of the GCM is covered in Section 5.

Digital I/O Module

The Digital I/O Module (DIM) provides a group of relay contact outputs and discrete inputs for interfacing the PowerCommand System to alarm or status outputs and to equipment that does not have compatible communications capability.

The Digital I/O Module provides sixteen 5A, 250VAC/30 VDC Form-C dry contact relay outputs, which are driven by data from the network. The contacts are connected to pluggable terminal blocks for field wiring. Each relay can be programmed to operate from any Boolean variable on the network. The module also includes four digital inputs to couple user inputs to the network for use elsewhere in control or monitoring.

Description and installation of the Digital I/O Module is covered in Section 6.

Network Gateway Module

The Network Gateway Module (NGM) provides a network interface to a PC either directly or through a modem. It translates network protocol into a protocol that can be understood by a PC.

The NGM connects to network data wire through an RJ45 jack. Connecting to the network requires a 24 AWG communications cable (cables are included with NGM kit) . The NGM receives its power from AC wall power, and should be backed up by a standby uninterruptable power supply (UPS).

The NGM allows software running on a PC to access, and control all modules on a network. The PowerCommand Software uses this module to access the network.

⚠ CAUTION ***An NGM that is used for monitor and control of a site cannot be used to install a site. Failure to use a separate installation NGM will cause the NV data stored in the site monitoring NGM to be destroyed. If this occurs, do a Repair/Replace in LonMaker on the Site NGM.***

LonMaker and PowerCommand Configuration Tool software require a unique network gateway module referred to as the "Network Installation Gateway" for installing and servicing a network (shown in Figure 2-1).

Description of the NGM is covered in Section 7.

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Junction Box/Terminator

A Junction Box/Terminator (JBT) provides connection points for network power and data wire. Junction Boxes may be used throughout a network for connecting in Pass Thru, Local Loop and Stub configurations. The JBT is a potted assembly.

The JBT is required when connecting an NGM to the network.

A junction box provides two 6-position pluggable connector for data and power, two RJ45 jacks for 24AWG stub connections (e.g. NGM), a switch to connect the data lines to a terminator circuit, and a switch to select either a Pass Thru or a Local Loop connection between the data lines on the two connectors.

Description of the JBT is covered in Section 8.

Network Annunciator Module

The Network Annunciator Module (NAM) combines a hardwired PowerCommand System Annunciator with a Digital I/O Module. The NAM is connected to the network by twisted pair communication wire.

The NAM has 20 LEDs to annunciate alarms. In NFPA 110 applications the network directly controls 16 of the LEDs and indirectly controls one LED (DS3). The remaining three LEDs can be hardwired. In non-NFPA 110 applications the network controls 16 of the LEDs and four can be hardwired. This module has its own Operator's manual (900-0282).

The NAM is covered in Section 9 of this manual.

Controls Communications Module for Generator Set and Transfer Switch Monitoring

The Controls Communications Module (CCM) allows interfacing the network to conventional non-PCC generator sets, transfer switches, system or breakers.

These modules monitor discrete inputs, AC and DC analog inputs, and communicate data to the PowerCommand Network.

The CCM has 32 discrete inputs and 7 analog inputs.

The module also includes two Form-C output relays and two Form-A output relays to provide control of the monitored equipment from the network. For example, these outputs can be used to initiate a test within a transfer switch, or to remotely start a generator set.

Description of the CCM for genset applications is covered in Section 10, and the transfer switch applications are covered in Section 11.

Network Router

The Network Router (RTR) connects two communications channels by passing messages between the two channels. The PowerCommand Network Router is configured to connect two twisted pair/ transformer isolated 78kb (TP/XF-78) channels.

The Router can be used within a PowerCommand Network to extend the physical length of the network beyond 4600 feet (1402 m) and/or increase the maximum number of nodes to more than 44 nodes. Refer to the Section 12 for application information on the Network Router.

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DATA TRANSMISSION MEDIA

The modules communicate at 78 kbps over a bus of 22 AWG UL Level IV (or EIA Category 4) twisted pair communications wire. The network data signal is coupled to the twisted pair wire by transformer-coupled transceivers in each node. Nodes are isolated by transformer from the data lines, which makes the data wiring polarity insensitive. A high degree of noise immunity is achieved with this medium.

Wiring and connection of data transmission media is covered in the individual module sections.

NETWORK TOPOLOGY

The wiring topology is a multidrop bus topology. This topology requires that there be only two ends to the network. Stubs off the network bus can be no longer than 10 feet (3 m). The maximum bus length of a single channel is 4600 feet (1402 m).

A Local Loop must be used when branching off for more than 10 feet (3 m). The Local Loop lets you wire "out and back" to a module. Add the length of the local loop in both directions to the overall bus length.

Both ends of the network data bus must be terminated with a terminator circuit. Proper termination of the network is important for reliable communications. All Onan nodes have the terminator circuit built in except the NGM and Router. Termination is activated by a slide switch.

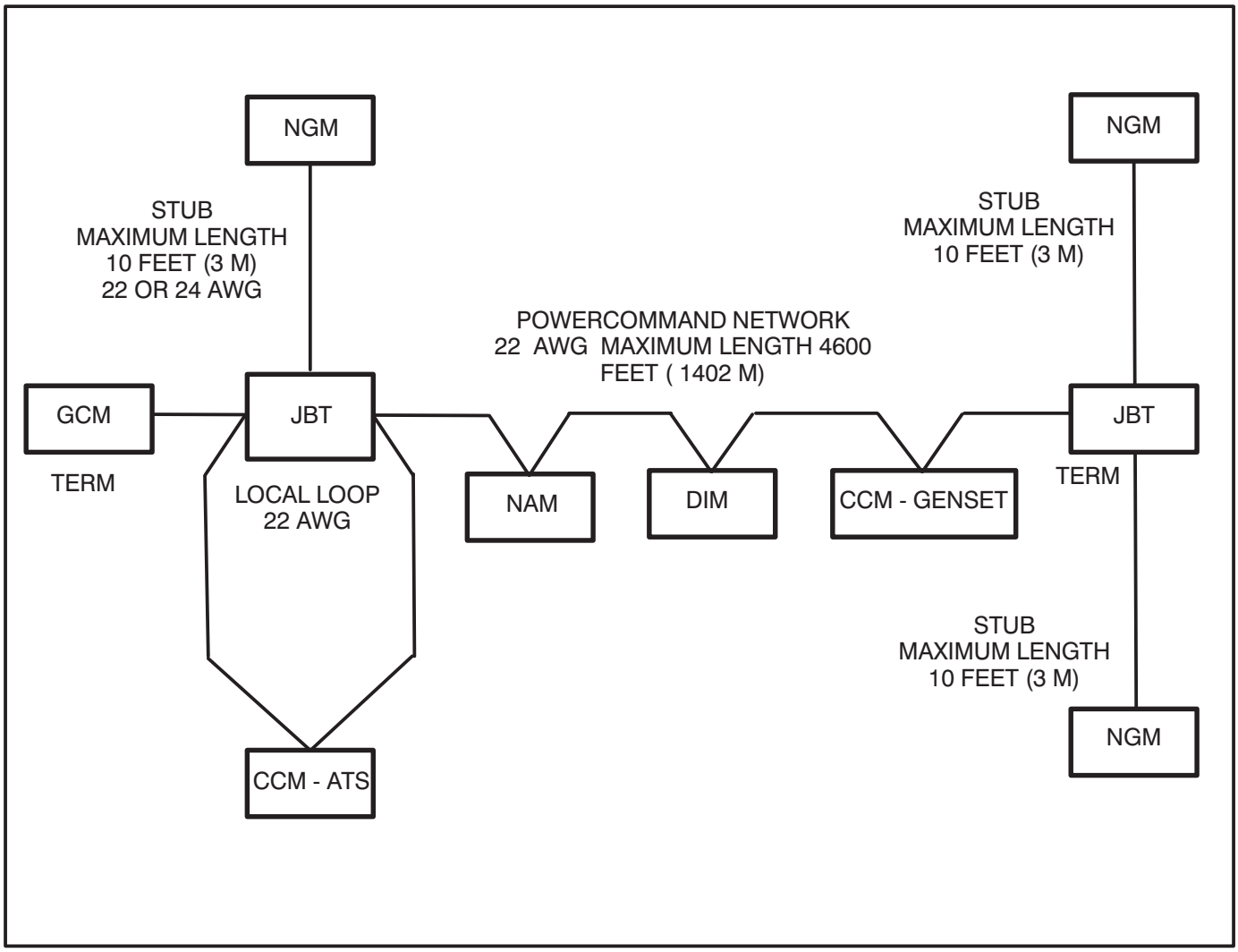

FIGURE 2-2. TYPICAL MULTIDROP BUS NETWORK

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TABLE 2-1. NETWORK DATA SPECIFICATION

Data Communications Type:	Transformer coupled, Differential Manchester encoding	
Media:	Twisted pair communications wire	
Bit Rate:	78k bits/sec	
Wiring Topology:	Multidrop Bus	
Polarity:	Polarity insensitive	
Max Bus Length:	4600 feet	
Max Stub Length:	10 feet	
Termination:	Terminators required at both ends of the bus	
Wire Type Required:	Bus –	Unshielded 22 AWG UL Level IV or EIA Cat. 4 Twisted Pair Communication Wire
	Stubs –	same as Bus or may be 24 AWG instead of 22 AWG
Maximum number of nodes per channel:	44	
Maximum no. of channels:	20	
Wire Color Codes:	Blue and White/Blue – primary wire pair for data Orange and White/Orange – secondary wire pair for Local Loops with 2 pair cable	
Connector:	Onan nodes – 6 position pluggable screw terminal block Onan Junction Box/Terminator – pluggable screw terminal blocks & RJ45s NGM node — RJ45	

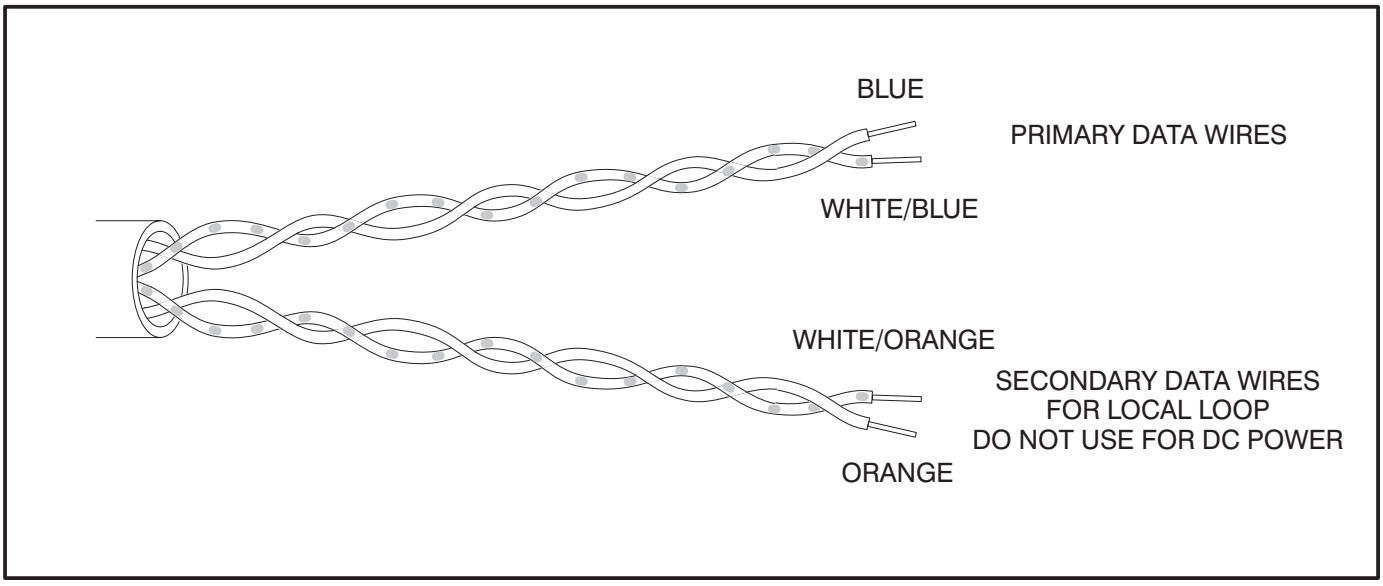

FIGURE 2-3. TWO TWISTED PAIR COMMUNICATIONS WIRE

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CONNECTORS AND WIRE COLOR CODES

All Onan nodes, except the GCM, have a black, 6-position pluggable screw terminal block for connection to network data and network power. The GCM uses four positions on the DIN rail customer connection terminals.

The Junction Box/Terminator module has two 6-position pluggable terminal blocks, as well as two RJ45 connectors.

The NGM has an RJ45 connector for network data stub connections.

Connector positions and wire color codes are listed in Tables 2-2 and 2-3.

TABLE 2-2. 6-POSITION PLUGGABLE TERMINAL BLOCK

Position	Signal	Wire Color Code	Comments
1	Net Data1	white/blue	if 2pr cable – white/orange for Local Loop
2	Net Data2	blue	if 2pr cable – orange for Local Loop
3	Net Power+		
4	Net Power+		
5	Net Power–		
6	Net Power–		

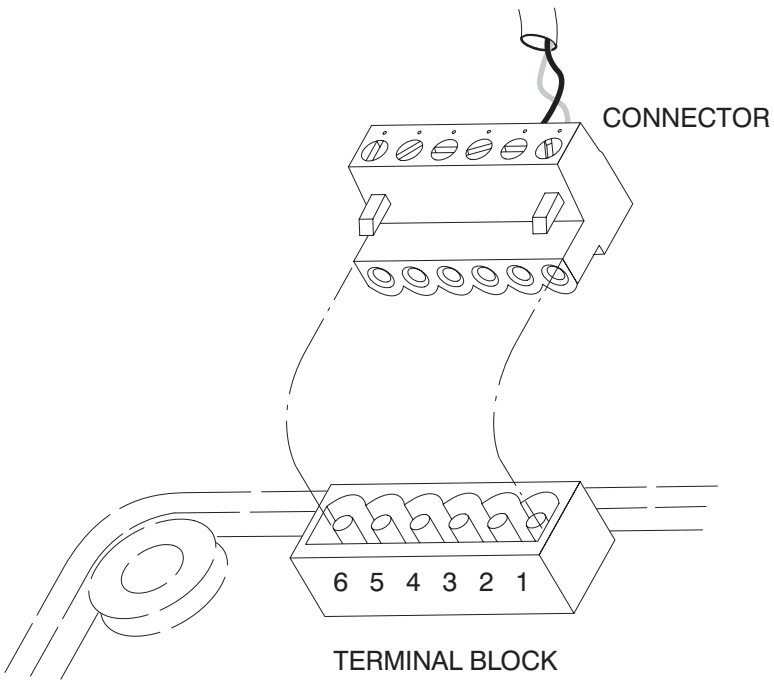

FIGURE 2-4. 6-POSITION PLUGGABLE CONNECTOR

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TABLE 2-3. RJ45 CONNECTOR

Position	Signal	Wire Color Code	Comments
1	Net Data1	white/blue	24AWG only
2	Net Data2	blue	24AWG only
3	not used		
4	not used		
5	not used		
6	not used		
7	not used		
8	not used		

Note: Position numbering goes from left to right when looking into the jack with the pins at the top and the latching notch at the bottom.

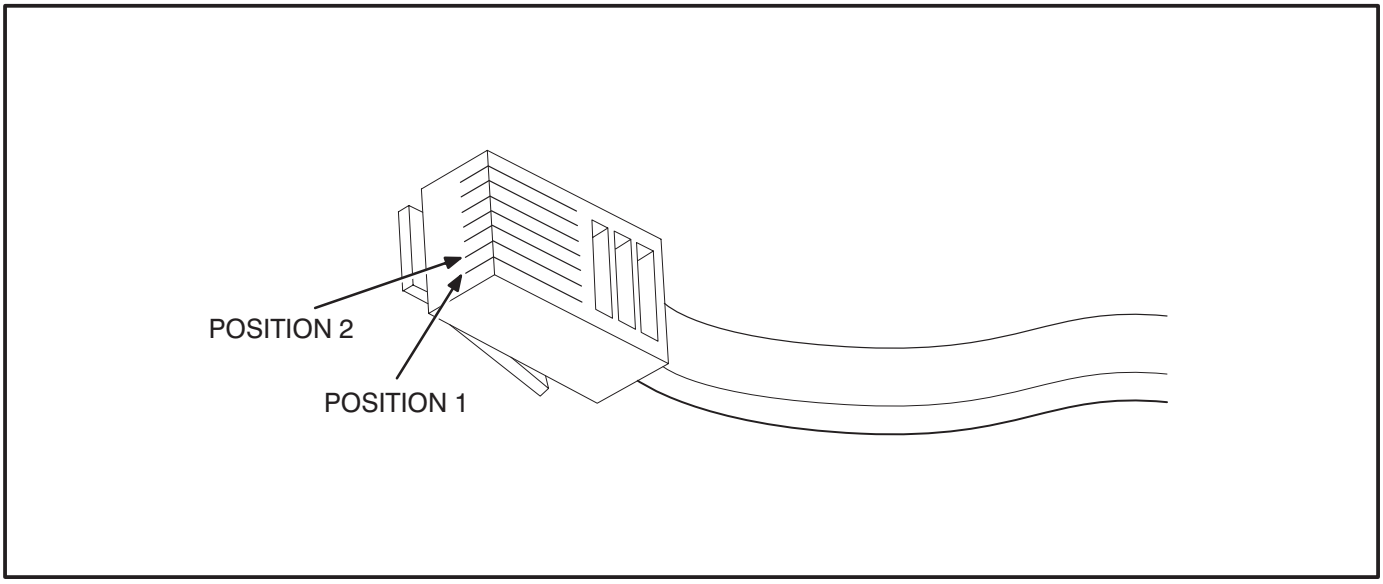

FIGURE 2-5. RJ45 CONNECTOR

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WIRING GUIDELINES

Communication over unshielded twisted pair (UTP) could be distorted by external sources of electromagnetic interference (EMI), especially if the conductors are physically degraded in any way. To avoid or minimize this interference, observe the following guidelines.*

⚠ CAUTION ***Electromagnetic interference (EMI) can cause communication signal distortion, which can cause network failure and unintended equipment operation. Read and follow these wiring guidelines.***

Observe all local wiring codes. Refer to the NEC (NFPA70) section on *Wiring Methods and Materials* for general wiring methods and procedures.

Routing: Whenever possible, cabling should be installed over corridor areas or along lines that are parallel to the contours of buildings. All deviations from straight runs should be made at right angles. Keep wire away from sharp, abrasive, and hot surfaces.

Separation from sources of EMI: All cabling should be installed in such a way as to comply with the minimum separations from AC power sources, as listed in Table 2-4.

In general, communications wiring should not be located in spaces that are shared with electrical panels, transformers, or other high voltage equipment.

Tension: All cabling should be free from tension at both ends, as well as over the length of each run.

Twisted pairs: All terminations should be made in such a way as to **minimize the extent to which each twisted pair is unraveled at the point of its physical termination**. Allow no more than 0.5 inch (13 mm) of exposed untwisted pairs.

UTP cable bends: UTP cable bends, or radii, should be no less than eight times the cable diameter.

Harsh, hazardous, or corrosive environments: Communications wiring should not be installed where vapors, fumes, corrosives, dusts, or other industrial byproducts are present without taking appropriate precautions to protect the cables. Installers and cabling manufacturers of the materials involved must be consulted in all such cases.

Grounding and bonding: Although the use of UTP does not involve the use of shielded cables in horizontal station runs, the use of shielding in high-pair-count UTP riser cables as well as cables of all types used in outdoor conditions is not uncommon. In some cases, qualified installers or manufacturers will make related recommendations in the interest of human safety or mechanical protection of installed cables (e.g., shielding against rodents).

When shielded cables are used, all applicable regulations for grounding and bonding as defined by local building codes for electrical materials must be strictly adhered to.

TABLE 2-4. MINIMUM SEPARATION DISTANCES OF UTP FROM SOURCES OF EMI

Condition	<2 kVA	2–5 kVA	>5 kVA
Unshielded power lines or electrical equipment in proximity to open or nonmetal pathways	5 in. (127 mm)	12 in. (305 mm)	24 in. (610 mm)
Unshielded power lines or electrical equipment in proximity to a grounded metal pathway	2.5 in. (64 mm)	6 in. (152 mm)	12 in. (305 mm)
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal pathway		3 in. (76 mm)	6 in. (152 mm)

*These guidelines are derived from “The Do’s and Don’ts of UTP Cabling,” by Mark W. McElroy, in EC&M, June 1994.

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NETWORK POWER

This section describes the methods of supplying power (referred to as network power) to those network modules that require an external power source. Observe all local wiring codes and regulations when designing and installing network power wiring.

The modules that require DC network power are:

- Digital I/O Module (DIM)
- Network Annunciator Module (NAM)
- Controls Communications Module – GenSet Applications (CCM–GenSet)
- Controls Communications Module – Automatic Transfer Switch Applications (CCM–ATS)

The DIM, NAM and CCM-Genset modules can be powered by a 24V genset battery. The 24V genset battery can supply one or more of these modules within specific distance limitations.

The CCM–Genset module can also be powered by a 12V genset battery power supply. The distance is very limited and no other types of modules can be powered off the same network power circuit. Refer to Table 2-6 for distance and wire gauge requirements. (When powering CCM modules only from a 24V genset battery, refer to Table 2-7.)

The CCM–ATS network power will be supplied by a 12VDC battery that is included along with a battery charger in the CCM–ATS kit.

A 12V genset battery will not provide an adequate power supply for DIM's and NAM's. In cases where the genset is powered by a 12V battery, a separate power supply must be used.

Locate the CCM as close to the device being monitored as possible. Do not mount the CCM on a genset or vibration damage can result.

If current transformers will be monitored, the distance limitations between the current transformers and the CCM will generally be more restrictive than the network power distance limitations. Refer to the appropriate CCM section for current transformer distance charts.

24V GenSet Battery Power Supply

The genset batteries cannot deliver network power over a long distance due to the voltage drop during cranking. The genset batteries require a battery charger that can supply the network load and maintain the batteries.

Refer to the genset wiring diagram for fused B+ connection points. (On PCC gensets: Use the TB1 terminal in the customer connection box. TB1–12 [+] and TB1–13 [–] is fused at 10 amps, and are the preferred connection points. If voltage is not available at these points, use TB1–1 [+] and TB3/4 [–], fused at 20 amps. Make sure that the total circuit load [load factor] does not exceed the fuse rating.)

SELECTING NETWORK POWER CONFIGURATION AND WIRE SIZE

The following section describes the procedures for selecting the copper wire gauge needed to supply network power. The wire gauge selected will be a function of the type and number of modules used, the type of power supply selected, and the distance between the power source and the farthest module in the power supply circuit. Do not use twisted pair data wire for DC power.

Use this procedure for developing network power circuits for DIM, NAM and CCM-Genset modules only. (CCM-ATS modules are not included because they are equipped with their own power supply.)

Refer to Figure 2-6 for illustrations of typical circuit configurations and notes.

1. Determine the number and type of load modules (DIM, NAM and CCM-Genset modules).

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2. Calculate the Total Load Factor by adding up the individual load factors for each DIM, NAM, and CCM-Genset in each circuit.

   Each CCM-GenSet has a load factor of: 2.40
   Each DIM has a load factor of: 0.10
   Each NAM has a load factor of: 1.20

3. Determine the distance between the power source and the farthest load device (DIM, NAM or CCM-GenSet module) in the circuit.
4. Look up the required minimum copper wire gauge. Refer to Table 2-5 for 24V genset battery power supply.

Example:

Application: The network plans call for one CCM-Genset at 40 feet (12 m), one DIM at 50 feet (15.2 m) and one NAM at 300 feet (91.4 m). The farthest module from the network power source is the NAM. The top drawing in Figure 2-6 shows each of these modules being supplied in one circuit.

Calculation: The total load factor =
(1 X 2.40) + (1 X 0.10) + (1 X 1.20) = **3.70**

Wire Size Required: Look up the total load factor (3.70) in the first column of Table 2-5. Then look across the table to find a distance equal to or greater than the distance to the farthest load device (300 feet). Table 2-5 indicates that the maximum distance obtainable is only 201 feet, this power supply is not adequate to supply all of these modules in one circuit.

The circuit can be redesigned so the CCM-GenSet module is supplied by a second circuit off the same source (center diagram in Figure 2-6). Be careful not to exceed the current rating of the circuit. (The load factor equals the maximum current draw.)

–OR–

The circuit can be supplied by more than one genset power supply if available (bottom diagram in Figure 2-6). Do not connect separate network power sources in parallel or damage to the batteries will result from overcharging.

Using either of the redesigned circuits, recalculate the wire gauge based on steps 1 thru 4. The CCM–GenSet with a load factor of 2.40 can be supplied using 18 gauge wire. The DIM and NAM with a total load factor of 1.30 can be supplied using 14 gauge wire.

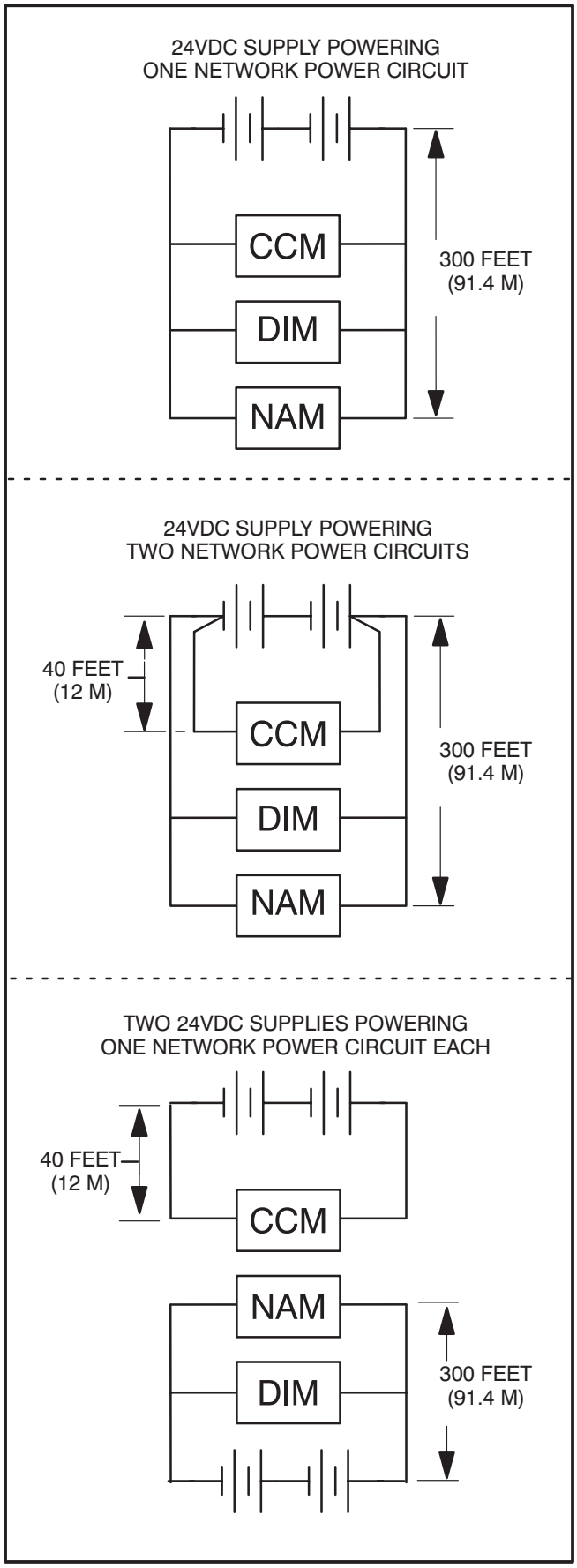

FIGURE 2-6. NETWORK POWER DIAGRAMS

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TABLE 2-5. 24V GENSET BATTERY POWER SUPPLY

WIRE AWG	18 (0.50 mm^2)		16 (0.50 mm^2)		14 (0.75 mm^2)		12 (1.25 mm^2)	
TOTAL LOAD FACTOR	MAXIMUM DISTANCE BETWEEN THE NETWORK POWER SOURCE AND THE FARTHEST LOAD DEVICE IN FEET OR METERS							
	FEET	METERS	FEET	METERS	FEET	METERS	FEET	METERS
0.10	1887	575.1	2995	912.9	4754	1449.1	7547	2300.3
0.20	943	287.5	1498	456.4	2377	724.6	3774	1150.2
0.30	629	191.7	998	304.3	1585	483.0	2516	766.8
0.40	472	143.8	749	228.2	1189	362.3	1887	575.1
0.50	377	115.0	599	182.6	951	289.8	1509	460.1
0.75	252	76.7	399	121.7	634	193.2	1006	306.7
1.00	189	57.5	300	91.3	475	144.9	755	230.0
1.25	151	46.0	240	73.0	380	115.9	604	184.0
1.50	126	38.3	200	60.9	317	96.6	503	153.4
1.75	108	32.9	171	52.2	272	82.8	431	131.4
2.00	94	28.8	150	45.6	238	72.5	377	115.0
2.25	84	25.6	133	40.6	211	64.4	335	102.2
2.50	75	23.0	120	36.5	190	58.0	302	92.0
2.75	69	20.9	109	33.2	173	52.7	274	83.6
3.00	63	19.2	100	30.4	158	48.3	252	76.7
3.25	58	17.7	92	28.1	146	44.6	232	70.8
3.50	54	16.4	86	26.1	136	41.4	216	65.7
3.75	50	15.3	80	24.3	127	38.6	201	61.3
4.00	47	14.4	75	22.8	119	36.2	189	57.5
4.25	44	13.5	70	21.5	112	34.1	178	54.1
4.50	42	12.8	67	20.3	106	32.2	168	51.1
4.75	40	12.1	63	19.2	100	30.5	159	48.4
5.00	38	11.5	60	18.3	95	29.0	151	46.0
5.25	36	11.0	57	17.4	91	27.6	144	43.8
5.50	34	10.5	54	16.6	86	26.3	137	41.8
5.75	33	10.0	52	15.9	83	25.2	131	40.0
6.00	31	9.6	50	15.2	79	24.2	126	38.3
6.25	30	9.2	48	14.6	76	23.2	121	36.8
6.50	29	8.8	46	14.0	73	22.3	116	35.4
6.75	28	8.5	44	13.5	70	21.5	112	34.1
7.00	27	8.2	43	13.0	68	20.7	108	32.9
7.25	26	7.9	41	12.6	66	20.0	104	31.7
7.50	25	7.7	40	12.2	63	19.3	101	30.7

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TABLE 2-5. 24V GENSET BATTERY POWER SUPPLY (Continued)

WIRE AWG	18 (0.50 mm^2)		16 (0.50 mm^2)		14 (0.75 mm^2)		12 (1.25 mm^2)	
TOTAL LOAD FACTOR	MAXIMUM DISTANCE BETWEEN THE NETWORK POWER SOURCE AND THE FARTHEST LOAD DEVICE IN FEET OR METERS							
	FEET	METERS	FEET	METERS	FEET	METERS	FEET	METERS
7.75	24	7.4	39	11.8	61	18.7	97	29.7
8.00	24	7.2	37	11.4	59	18.1	94	28.8
8.25	23	7.0	36	11.1	58	17.6	91	27.9
8.50	22	6.8	35	10.7	56	17.0	89	27.1
8.75	22	6.6	34	10.4	54	16.6	86	26.3
9.00	21	6.4	33	10.1	53	16.1	84	25.6
9.25	20	6.2	32	9.9	51	15.7	82	24.9
9.50	20	6.1	32	9.6	50	15.3	79	24.2
9.75	19	5.9	31	9.4	49	14.9	77	23.6
10.00	19	5.8	30	9.1	48	14.5	75	23.0
11.00	17	5.2	27	8.3	43	13.2	69	20.9
12.00	16	4.8	25	7.6	40	12.1	63	19.2
13.00	15	4.4	23	7.0	37	11.1	58	17.7
14.00	13	4.1	21	6.5	34	10.4	54	16.4
15.00	13	3.8	20	6.1	32	9.7	50	15.3
16.00	12	3.6	19	5.7	30	9.1	47	14.4
17.00	11	3.4	18	5.4	28	8.5	44	13.5
18.00	10	3.2	17	5.1	26	8.1	42	12.8
19.00	10	3.0	16	4.8	25	7.6	40	12.1
20.00	9	2.9	15	4.6	24	7.2	38	11.5

NOTES

1. This table is for copper wire at 50°C (122°F). Derate the distances by 0.4% per °C over 50°C
2. Minimum wire gauge for NEC compliance is AWG 14
3. Network power wiring must be run in a conduit separate from the utility/genset power cables
4. Wire sizes given in mm^2 are for the nearest standard metric wire size.
5. DIM's and NAM's have a minimum operation voltage of 8 VDC. This Table is for use with DIM's, NAM's or DIM's NAM's and CCM's in combination. For network power supplies with CCM's only refer to Tables 2-6 and 2-7.

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TABLE 2-6. 12V GENSET BATTERY POWER SUPPLY FOR CCM'S ONLY

WIRE AWG	18 (0.50 mm^2)		16 (0.50 mm^2)		14 (0.75 mm^2)		12 (1.25 mm^2)	
TOTAL LOAD FACTOR	MAXIMUM DISTANCE BETWEEN THE NETWORK POWER SOURCE AND THE FARTHEST LOAD DEVICE IN FEET OR METERS							
	FEET	METERS	FEET	METERS	FEET	METERS	FEET	METERS
2.40	26	7.9	42	12.8	66	20.1	105	32.0
4.80	13	3.9	21	6.4	33	10.0	52	15.8
7.20	9	2.7	14	4.2	22	6.7	35	10.6
9.60	7	2.1	10	3.0	17	5.1	26	7.9
12.00	5	1.5	8	2.4	13	3.9	21	6.4
14.40	4	1.2	7	2.1	11	3.3	17	5.1
16.80	4	1.2	6	1.8	9	2.7	15	4.5
19.20	3	.9	5	1.5	8	2.4	13	3.9
21.60	3	.9	5	1.5	7	2.1	12	3.6
24.00	3	.9	4	1.2	7	2.1	10	3.0
26.40	2	.6	4	1.2	6	1.8	10	3.0

NOTES

1. This table is for copper wire at 50°C (122°F). Derate the distances by 0.4% per °C over 50°C.
2. Minimum wire gauge for NEC compliance is AWG 14.
3. Network power wiring must be run in a conduit separate from the utility/genset power cables.
4. Wire sizes given in mm^2 are for the nearest standard metric wire size.
5. CCM's each have a load factor of 2.40. CCM's have minimum operation voltage of 4 VDC.

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TABLE 2-7. 24V GENSET BATTERY POWER SUPPLY FOR CCM'S ONLY

WIRE AWG	18 (0.50 mm^2)		16 (0.50 mm^2)		14 (0.75 mm^2)		12 (1.25 mm^2)	
TOTAL LOAD FACTOR	MAXIMUM DISTANCE BETWEEN THE NETWORK POWER SOURCE AND THE FARTHEST LOAD DEVICE IN FEET OR METERS							
	FEET	METERS	FEET	METERS	FEET	METERS	FEET	METERS
2.40	183	55.7	291	88.6	462	140.8	734	223.7
4.80	92	28.0	146	44.5	231	70.4	367	111.8
7.20	61	18.5	97	29.5	154	46.9	245	74.6
9.60	46	14.0	73	22.2	116	35.3	183	55.7
12.00	37	11.2	58	17.6	92	28.0	147	44.8
14.40	31	9.4	49	14.9	77	23.4	122	37.1
16.80	26	7.9	42	12.8	66	20.1	105	32.0
19.20	23	7.0	36	10.9	58	17.8	92	28.0
21.60	20	6.0	32	9.7	51	15.5	82	24.9
24.00	18	5.4	29	8.8	46	14.0	73	22.2
26.40	17	5.1	26	7.6	42	12.8	67	20.4
28.80	15	4.5	24	7.3	39	11.8	61	18.5
31.20	14	4.2	22	6.7	36	10.9	56	17.0
33.60	13	3.9	21	6.4	33	10.0	52	15.8
36.00	12	3.6	19	5.7	31	9.4	49	14.9
38.40	11	3.3	18	5.4	29	8.8	46	14.0
40.80	11	3.3	17	5.1	27	8.2	43	13.1
43.20	10	3.0	16	4.8	26	7.9	41	12.5
45.60	10	3.0	15	4.5	24	7.3	39	11.8
48.00	9	2.7	15	4.5	23	7.0	37	11.2

NOTES
1. This table is for copper wire at 50°C (122°F). Derate the distances by 0.4% per °C over 50°C.
2. Minimum wire gauge for NEC compliance is AWG 14.
3. Network power wiring must be run in a conduit separate from the utility/genset power cables.
4. Wire sizes given in mm^2 are for the nearest standard metric wire size.
5. CCM's each have a load factor of 2.40. CCM's have minimum operation voltage of 4 VDC.

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3. Network Installation – LonMaker

ABOUT THIS SECTION

This section describes procedures for the *logical* installation and connection of the various modules on the network using LonMaker. Refer to the Glossary section for definitions of network terms.

Much of the material in this section is derived from the Echelon *LonMaker Installation Tool Users Guide.* The Echelon manual is included with the LonMaker software, and should be considered a reference companion to this manual.

Use this manual for basic, Onan-specific network installation, operation and service information (hardware and software).

This section covers the following topics:

1. Network Overview
2. Network Installation Scenarios
3. Setting up Network Installation Tools
4. Starting LonMaker Software
5. Using LonMaker Software
6. LonMaker Network Setup
7. Installation of Devices with LonMaker
8. Connect Procedure
9. Install Procedure
10. Checking Connections
11. Checking Input and Output Values
12. Network Service Procedures
13. Testing Devices and Verifying Installation

Items 1 through 3 cover introductory and background information.

Items 4 through 10 cover the basic elements of a typical installation.

Items 11 through 13 cover service and troubleshooting procedures.

The following section (Section 4) describes the installation and use of PowerCommand Configuration Tool (PCT). PCT is used to complete the network installation.

The step-by-step procedural information in this section is intended for use in conjunction with operating LonMaker software. Read all introductory and overview material, and skim over the major headings of the procedures ahead of time; but do not expect the procedural text to be very useful until you are operating the software and can view its menus and features.

Refer to the Echelon LonMaker manual for a detailed explanation of how to use the LonMaker graphical display screens, and for in-depth coverage of definitions, concepts, software installation and setup procedures, device installation procedures, maintenance and test procedures, error messages and troubleshooting.

POWERCOMMAND NETWORK OVERVIEW

Devices, or modules on a PowerCommand Network communicate with one another by sending measurements, instructions, signals, and other messages. The devices sense monitored conditions and network input messages, and respond with appropriate actions and output messages.

In a PowerCommand Network, modules are connected to a physical transmission media. In the PowerCommand Network, however, physical attachment (wiring) is not enough to “install” the system. The physical connections only provide a path for sending and receiving control messages.

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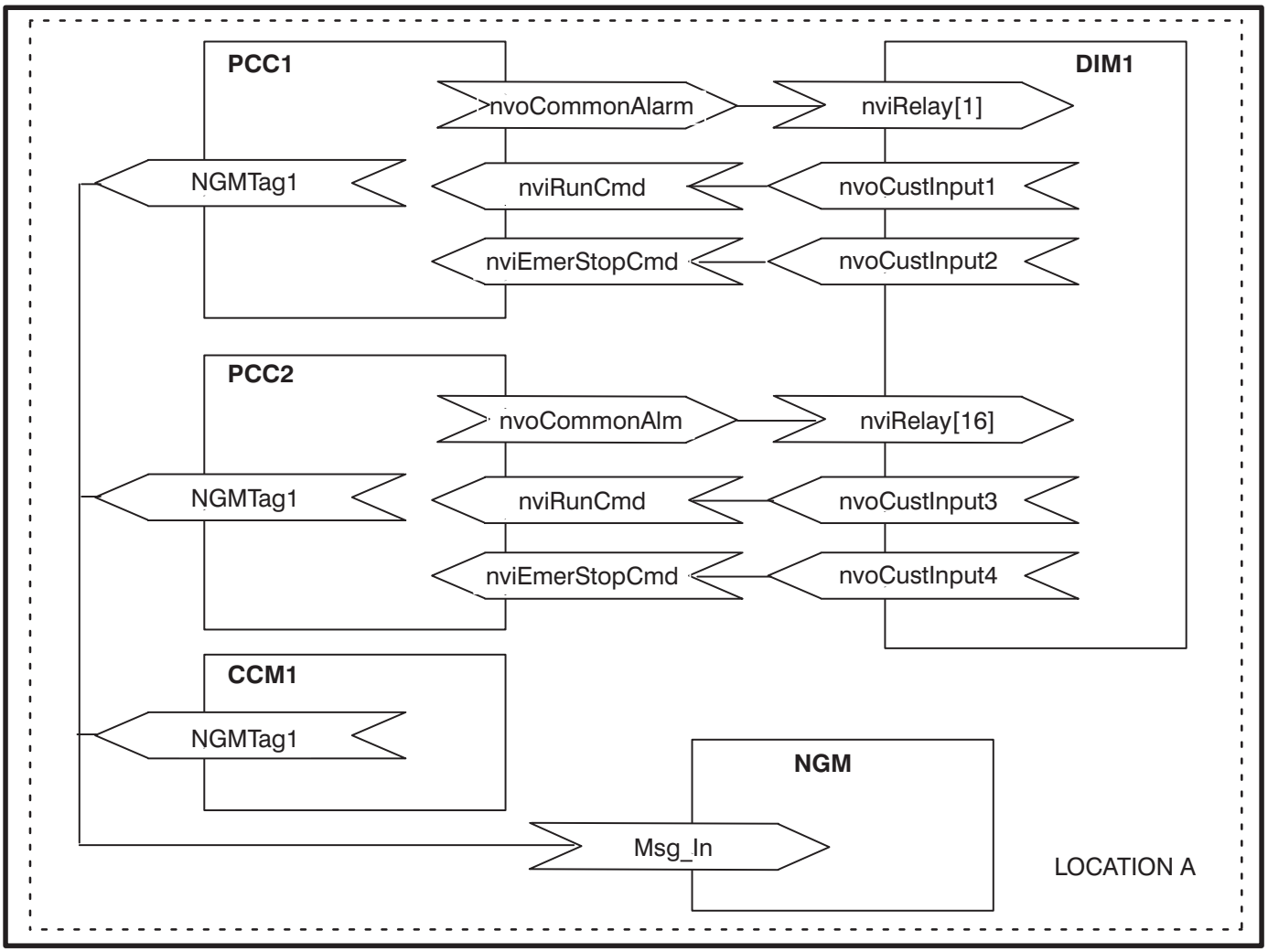

FIGURE 3-1. NETWORK MODULES IN ONE LOCATION AND ONE DOMAIN

With a PowerCommand Network, you must also install and connect devices by using the LonMaker software, a personal computer, and a Network Installation Gateway to send messages over the network to each device. This procedure, the logical installation and connection of devices using LonMaker software, identifies all devices on the network and assigns, or links, outputs from specified devices to inputs on other specified devices (binding). Many of these terms are defined in the Glossary in Appendix A.

After installing and connecting devices with LonMaker, use the PowerCommand Configuration Tool (PCT) software to further define and install configuration information and to make a CSV file for use by PowerCommand Software for Windows (refer to PowerCommand Configuration Tool in this section).

The network installer will need documentation listing the device-specific network variable input and output connection pairs. These network variable connection instructions define *logical* input/output connected pairs, just as a point-to-point wiring diagram defines *physical* input/output connected pairs. Refer to the Forms in Appendix C.

Device-specific network installation procedures are covered in the individual module sections.

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NETWORK INSTALLATION SCENARIOS

There are two basic installation scenarios that you can use when installing a new network:

- Setup before going to the site, then install and test at the site.
- Setup, install and test at the site

Setup Before Going To The Site

With this scenario, everything about a new network configuration is predefined using LonMaker and PCT before you go to the site. Defining network components like domain, channel, location, devices, and defining connections can be done before going to the actual installation site. This information is stored in the site directory for use at the site.

At the installation site, the network installer uses LonMaker to “install” each physical device and PCT to install configuration information and to make a CSV file for use by PowerCommand Software for Windows (PCW). Any changes must be made at the site.

Setup At The Site

With this scenario, the network installer connects to the site network and uses LonMaker to define network components such as domain, channel, location, devices and define and make connections between device inputs and outputs. The installer will also use PCT to define module configuration information and to make a CSV file for use by PCW at the network site.

Procedure Overview

Initial network setup, including assigning connections (binding), can be done off-site, prior to the physical installation or at the site. This creates a site database.

After the devices are physically connected at the site, the installer must connect a PC (with LonMaker installation software and the site database) to the Network Installation Gateway Module.

The installer then runs the LonMaker installation software to perform several functions including defining components of the network and identify specific device nodes by pressing their individual service pins when prompted to do so. Next the installer runs the PCT software to further define and download module configuration information and to make a CSV file for use by PowerCommand Software for Windows.

As a final checkout, the installer should run PowerCommand Software for Windows to thoroughly test the installation connections, alarms, etc. Refer to the PCW manual for PCW operating instructions. This must be done with an NGM configured for PCW (not the Network Installation Gateway).

Any future modification of an existing network installation must be done on-site.

SETTING UP NETWORK INSTALLATION TOOLS

Refer to the the *Required Installation Tools* in Section 1 for the minimum PC system requirements. LonMaker software, a network gateway driver, Network Module Library and PCT must be installed on your computer before you can begin the network installation procedures.

Normally the LonMaker software, Network Module Library, the network gateway driver and PCT are installed before you arrive at the installation site. These programs only need to be added to the installation computer once.

To connect the installation PC that runs LonMaker software to a PowerCommand network, you must connect a Network Installation Gateway between the network and the PC. This gateway can be connected to the network at a Junction Box/Terminator, a GCM or at a CCM.

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Network Module Library Installation

The Network Module Library (NML) contains the data files that are used to create or update a PowerCommand Network. The NML software is used in conjunction with LonMaker software to install a PowerCommand Network. The NML software is updated as additional features and modules become available.

Install the latest NML software as follows:

1. Insert the **Module Library** Disk into the floppy drive (A:).
2. At the DOS prompt type:
   A:\INSTALL [drive] ↵ **Enter\Return**.

Note: [drive] Optional. If the drive is not specified, the drive defaults to C:. To install to a drive other than C:, enter the drive letter and colon.

The install routine creates a directory called \ONAN. The Module Library is installed in the \ONAN directory in a subdirectory called NML (e.g. C:\ONAN\NML).

The install routine also creates a subdirectory named BIN (C:\ONAN\BIN). BIN contains the driver for the Network Installation Gateway.

The install program deletes previous versions of the Module Library and updates the Installation Gateway driver. Review the README.TXT file for the latest information on the NML software.

A line must be added to the config.sys file using a text editor. Example using MS DOS:
From the C:\ prompt, type *edit config.sys* to edit the config.sys file.

Add the following line:
devicehigh=c:\onan\bin\ldvslta.sys /p1 /b9600 /m

Note: Be sure to include a space between ldvslta.sys and /p1, between /p1 and /b9600, and between /b9600 and /m.

The /p1 specifies that the Network Installation Gateway is connected to COM1 on the computer. Use /p2 if connected to COM2.

The /b9600 specifies the Network Installation Gateway baud rate (do not change). The /m specifies the protocol (do not change).

Network Module Library Removal

To remove the Network Module Library:

1. Insert the **Module Library** Disk into the floppy drive (A:).
2. At the DOS prompt type:
   A:\BIN\DINSTALL ↵ **Enter\Return**.

LonMaker Software Installation

This software is provided on two floppy disks. The files on these disks are compressed, so you must use the INSTALL program on the LonMaker disks to transfer the files to your computer.

The INSTALL program will modify the the PATH statement in the AUTOEXEC.BAT file so that when the computer is rebooted, the LonMaker directory is in the defined path.

Insert disk 1 and type: **A:\INSTALL** (press ↵ **Enter\Return**).

Follow the prompts and choose a drive when requested. When prompted for a subdirectory, editing the path to add the ONAN directory (\ONAN\LNM) will help organize the network installation files. Select the *graphical version.* Answer yes "Y" to modify the config.sys file.

The software installation places LonMaker files in a new directory named LNM. Reboot the computer to activate these changes.

Create Or Update A Network

Each PowerCommand Network installation site must have its own site directory. This directory will contain the files necessary to run LonMaker. There can be many site directories on your computer with each one corresponding to a different network installation. LonMaker software resides in its own directory (C:\ONAN\LNM), separate from any of the site directories.

A utility program is included to create a new site directory or update a current site with new NML data files. The NML install routine created a subdirectory named SITES (C:\ONAN\SITES) to contain network sites. To create or update a site:

1. Change directories (**CD**) to **ONAN**
2. From the C:\ONAN> directory enter the following:

   pcnet c:\onan\sites\<site_id>

Example where the site_id is site_10:
pcnet c:\onan\sites\site_10 ↵ **Enter\Return**

This utility creates a site directory (\site_10) located in the \onan\sites directory or updates the existing site.

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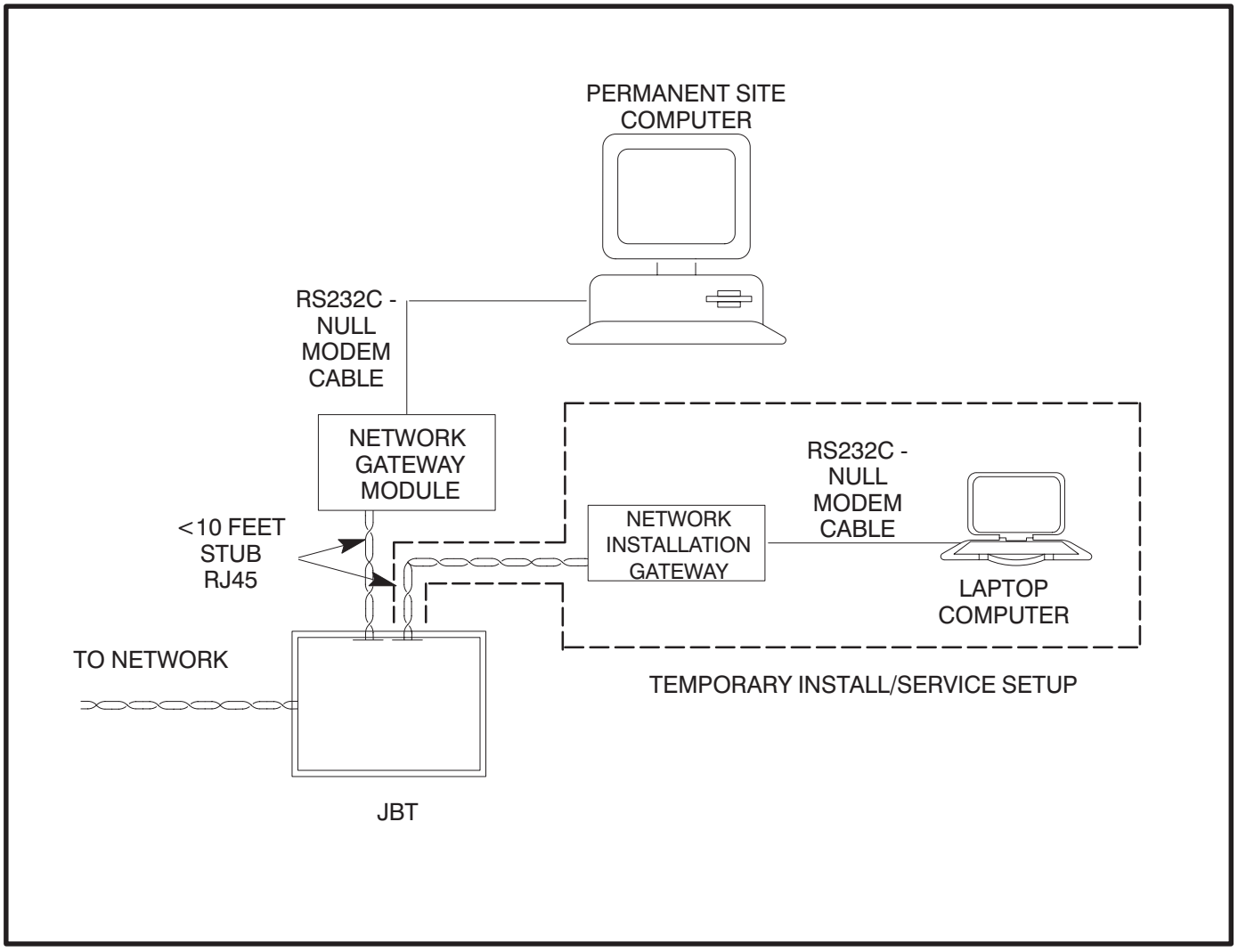

FIGURE 3-2. TYPICAL PC TO NETWORK CONNECTION VIA A JUNCTION BOX/TERMINATOR MODULE

Connecting the Installation PC to the Network

Connect PC the Network Installation Gateway with a null modem cable. The gateway can be connected to the network via a JBT, GCM or a CCM. See Figure 3-2. (The RJ45 connector on the GCM and CCM should only be used for service or installation.)

STARTING LONMAKER SOFTWARE

1. Before starting the LonMaker program, change to the desired site directory. At the DOS prompt, enter these commands:

   cd\onan\sites\[site_id] ↵ **Enter\Return**

   EXAMPLE: cd onan\sites\site_10

2. Start LonMaker by entering the following command at the site directory:

   lnmg ↵ Enter\Return

When you start LonMaker, the it displays copyright information and the following messages:

Initializing...
Accessing network...
Parts Catalog Rev *n*

Then the Main screen appears.

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USING LONMAKER SOFTWARE

Figure 3-3 shows the various parts of the LonMaker Main screen for INSTALLATION.

Task Buttons

Tasks are defined as the procedures that you can carry out on specific network components. Tasks include Domain, Channel, Location, and Device Set-up procedures, as well as Installation, Control, and Repair procedures.

Task buttons appear in a column at the left of the screen. Choosing a task button takes you to the appropriate screen for the selected task.

To select a task, use the mouse to move the cursor/pointer to the task button and click the left mouse button or type the underlined keyboard access letter.

Action Buttons

Actions are defined as activities that you can request during each task.

Action buttons appear at the bottom of the screen. Choosing an action button either initiates an activity or takes you to another screen, where you can enter or observe information.

Most action buttons refer to an item that you select from a list on the screen.

To select an action, use the mouse to move the cursor/pointer to the action button and click the left mouse button or type the function key shown below the action button.

Lists

Some lists show specific components that have already been defined for installation. Other lists show *types* of components that you use only when defining specific components.

You can select components or *types* of components from these lists so that LonMaker can act on them. Action button activities often affect only the items that you select from a list.

Selected Device and Domain

This area at the top of the screen shows the domain and device that you have selected.

Network Interface Status/Action Button

This area shows whether LonMaker is communicating with the network gateway. It is also an action button that you can use to attach LonMaker to the network, through the network gateway.

Write Text Areas

Many LonMaker screens let you enter information. Figure 3-4 shows a DEFINE DEVICE screen. In this example, the write text areas prompt you to enter information about a Device Name, and the read-only area provides information about the location of the device.

To select a write text area, move the cursor/pointer to the area and click the left mouse button. When the text area is activated, its background turns gray and the editing cursor appears.

↓ This symbol, next to a write text area, indicates a hidden list. To see the list, point and click on the symbol. To select an item from the list to fill in the text area, point and click on the item name.

↕ This symbol, next to a write text area, indicates a toggle between Yes or No. To toggle between Yes and No, point and click on the symbol.

Read-Only Text Areas

Read-only text areas provide information. You cannot activate these text areas or change their contents. Read-only text areas are the same color as the background area of the screen.

Additional Support

If you are familiar with Microsoft Windows, or similar graphical user interfaces, you'll know how to use many of the features on LonMaker screens. If you need more information, refer to the *LonMaker Installation Tool Users Guide and to the* On-line Help system.

On-line Help

Select the Help action button on any LonMaker screen to see a HELP screen with information about each action and text area.

Select the Index action button on any LonMaker HELP screen to see the HELP INDEX screen containing a list of all LonMaker screens. If you choose one of these screen names, the Help system displays help information for the selected screen.

You can use the Index button to see a succession of HELP screens. When you choose the Done action button, the program returns directly to the LonMaker screen from which you started.

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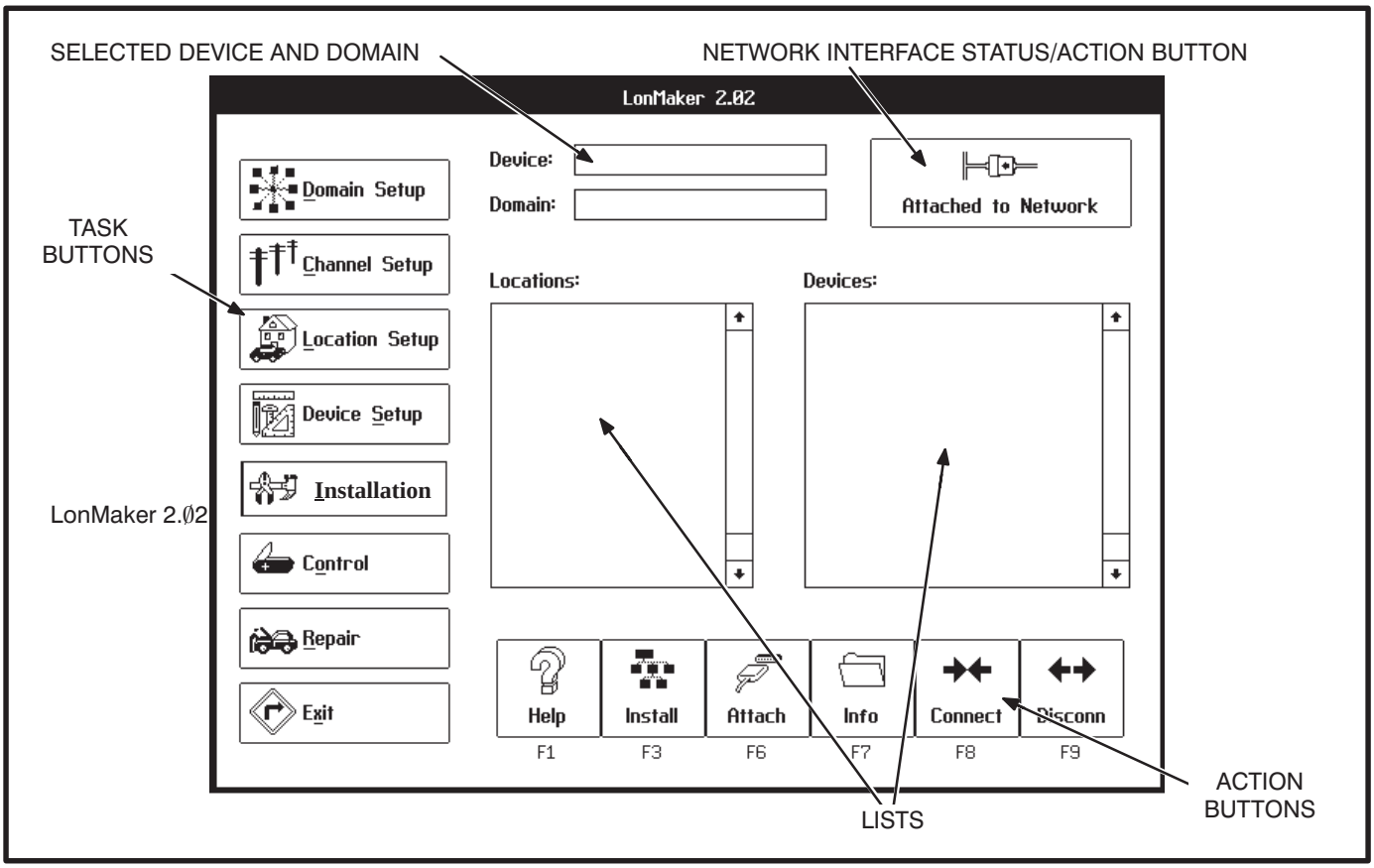

FIGURE 3-3. LONMAKER MAIN SCREEN

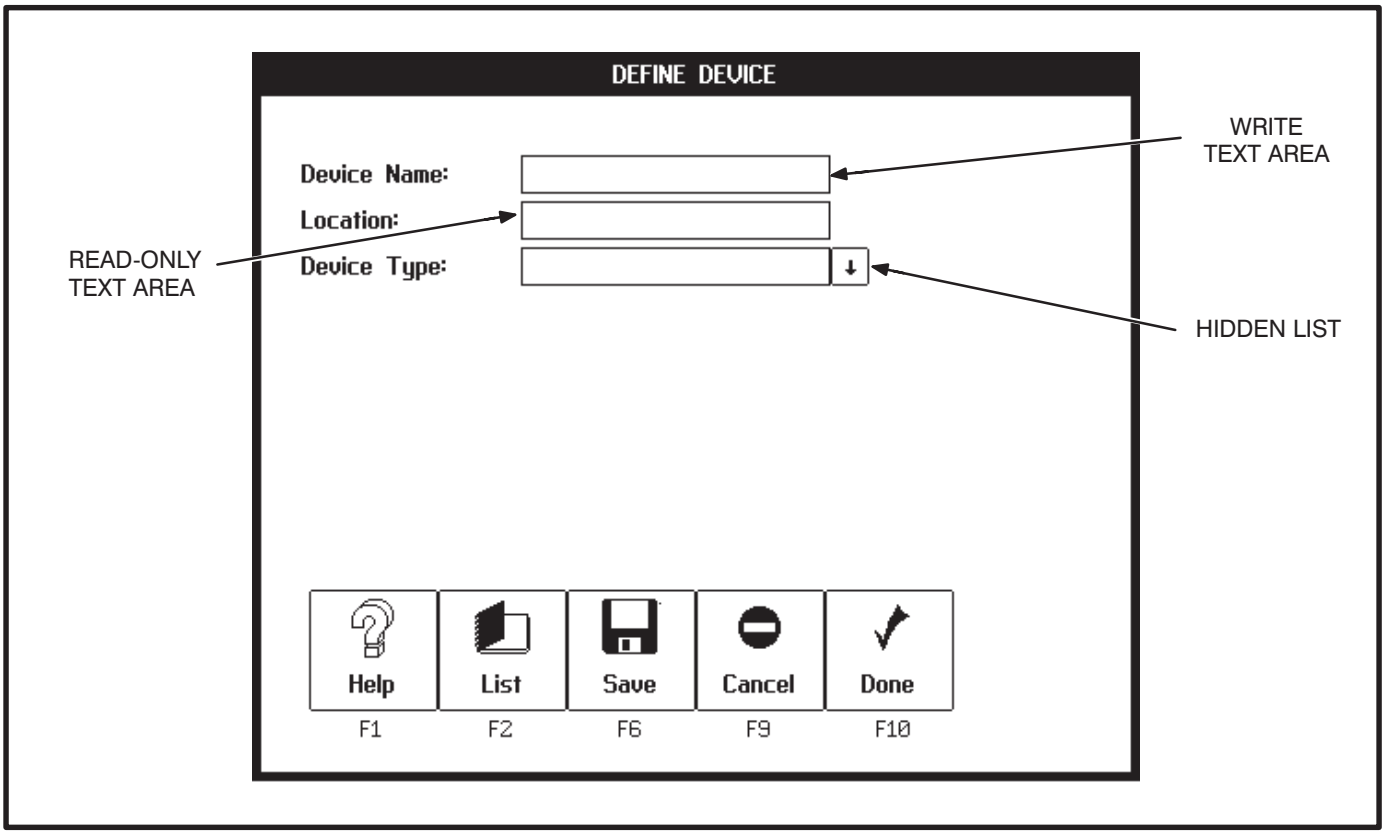

FIGURE 3-4. LONMAKER DEFINE DEVICE SCREEN

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LONMAKER NETWORK SETUP

The first steps for installing a network require that you describe the specific components of the network to the LonMaker program. With this network setup procedure, you define domains, channels, locations, and devices. If you encounter error messages, refer to the LonMaker Installation Tool User's Guide, section on *Error Messages and Troubleshooting*.

The network designer supplies most of this information, along with a plan for the physical installation of devices and communications media. Forms for network design are provided in Appendix C.

As you define components (domains, locations, channels, and devices) LonMaker records them in a network database—in the project subdirectories DB_INST. These definitions affect the operation of the network only after you install the components.

Installing and connecting devices is covered later in this section.

Defining and Selecting a Domain

You must name at least one domain for the devices on your network.

A domain is the top level of organization of the network. Normally, all of the devices in a domain are assigned only to that one domain.

- A network must have at least one domain.
- A domain has a unique name.
- A domain has a unique ID number. Normally, this ID limits communication to devices in the same domain.
- An application device can belong to one or two domains.

  Most PowerCommand network installations will have only one domain.

Procedure to Define a Domain

You must define a domain for the devices you are going to install. Follow these steps:

1. Click on the Domain Setup task button. The list of defined domains appears on the DOMAIN SETUP screen (Figure 3-5).
2. Click on the Define action button. The DEFINE DOMAIN screen appears.
3. Type in "domain_∅∅" for the new domain name (in special cases, use a new name of up to 16 characters, including spaces). Use the default ID of **"**∅∅" in the domain ID, if provided. **Do not change the Domain Auth. Key**, (all F's) unless instructed specifically, to do so.
4. Click on the Done action button if this is the only domain you want to define at this time. Click on the Save action button if you want to define another domain.

Procedure to Select a Domain

If your network installation contains more than one domain, before you work with application devices, you must select the domain that they belong to.

1. Click on the Domain Setup task button. The list of defined domains appears on the DOMAIN SETUP screen (Figure 3-5).
2. Click on the domain you want to select. The name of the selected domain appears at the top of the screen.

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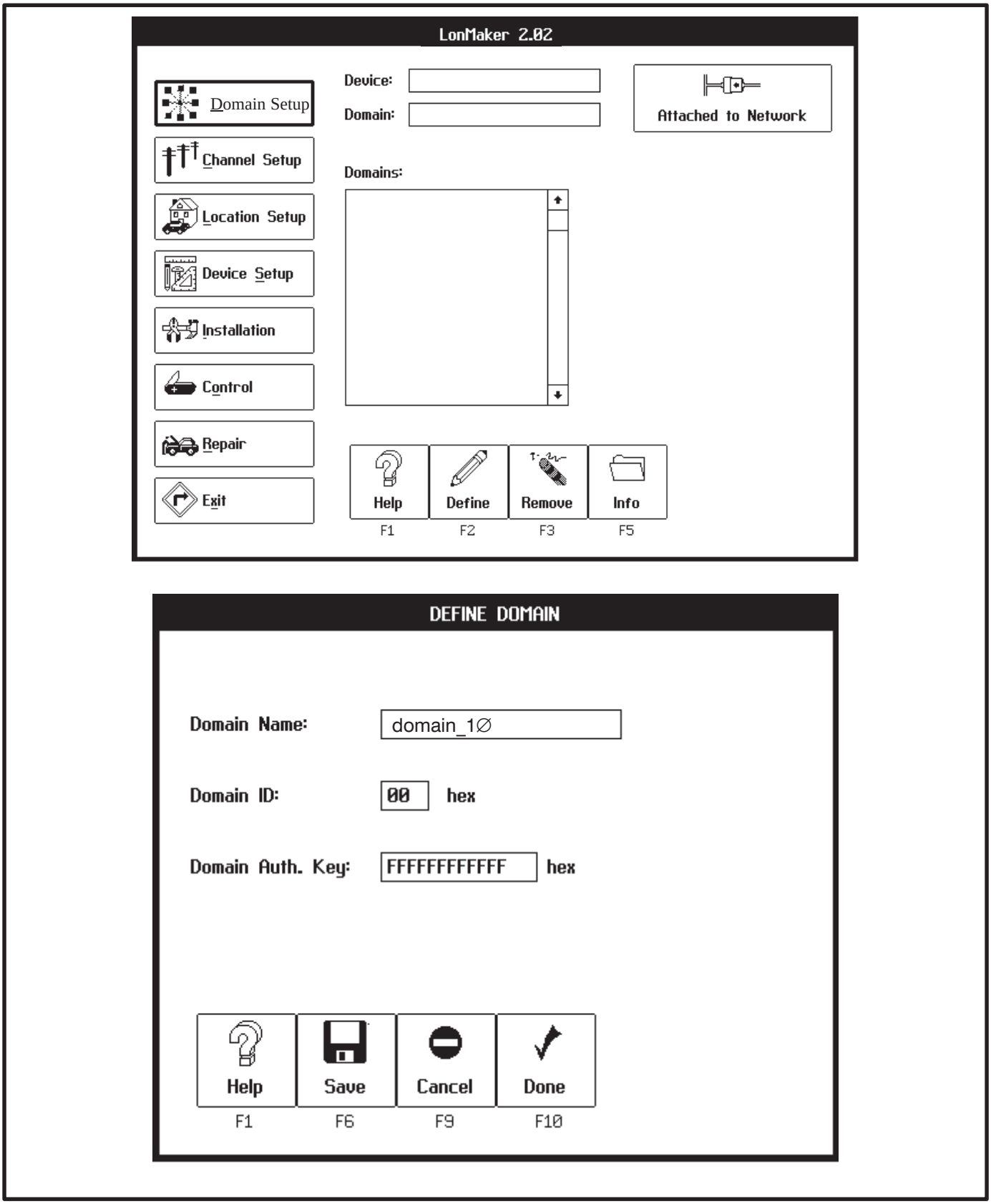

FIGURE 3-5. DOMAIN SETUP SCREENS

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Defining and Selecting a Channel

You must name at least one channel for your network.

Channels are the physical communications media that connects the devices and the properties of these media (such as transmission speed). Most PowerCommand network installations will have only one channel (twisted-pair wiring and 78 k bits/second transmission speed).

An additional channel will be required if the distance between devices exceeds the operating range of the communications medium or if the number of devices exceeds the capacity of the channel. Although LonMaker can install up to 127 devices on a channel, the communications media (22 AWG twisted pair) has a lower limit (44). Refer to the material on data transmission media and network data specifications in Section 2.

If the network contains a Router, two channels must be defined (Refer to the Router Section). One additional channel must be defined for each additional router.

Procedure to Define a Channel

You must define a channel for the devices you are going to install. Follow these steps:

1. Click on the Channel Setup task button. The list of defined channels are displayed.
2. Click on the Define action button. The DEFINE CHANNEL screen appears.
3. Channel Name: Type in the channel name “tp78_channel1”.
4. Channel Type: Click on the ↓ symbol to the right of the Channel Type text area to see a list of available channel types. Double click on channel type “tp/xf–78” to choose it.
5. Click on the Done action button if done defining channels, otherwise select save.

Procedure to Select a Channel

1. Click on the Channel Setup task button.
2. Click on channel name. From here, you can remove an unused channel, display name and type information about a channel, or attach the Network Installation Gateway. You can initiate these actions by clicking on the Remove, Info, or Attach action buttons, respectively.
3. Select the channel that the Network Installation Gateway is connected to. Select Attach.

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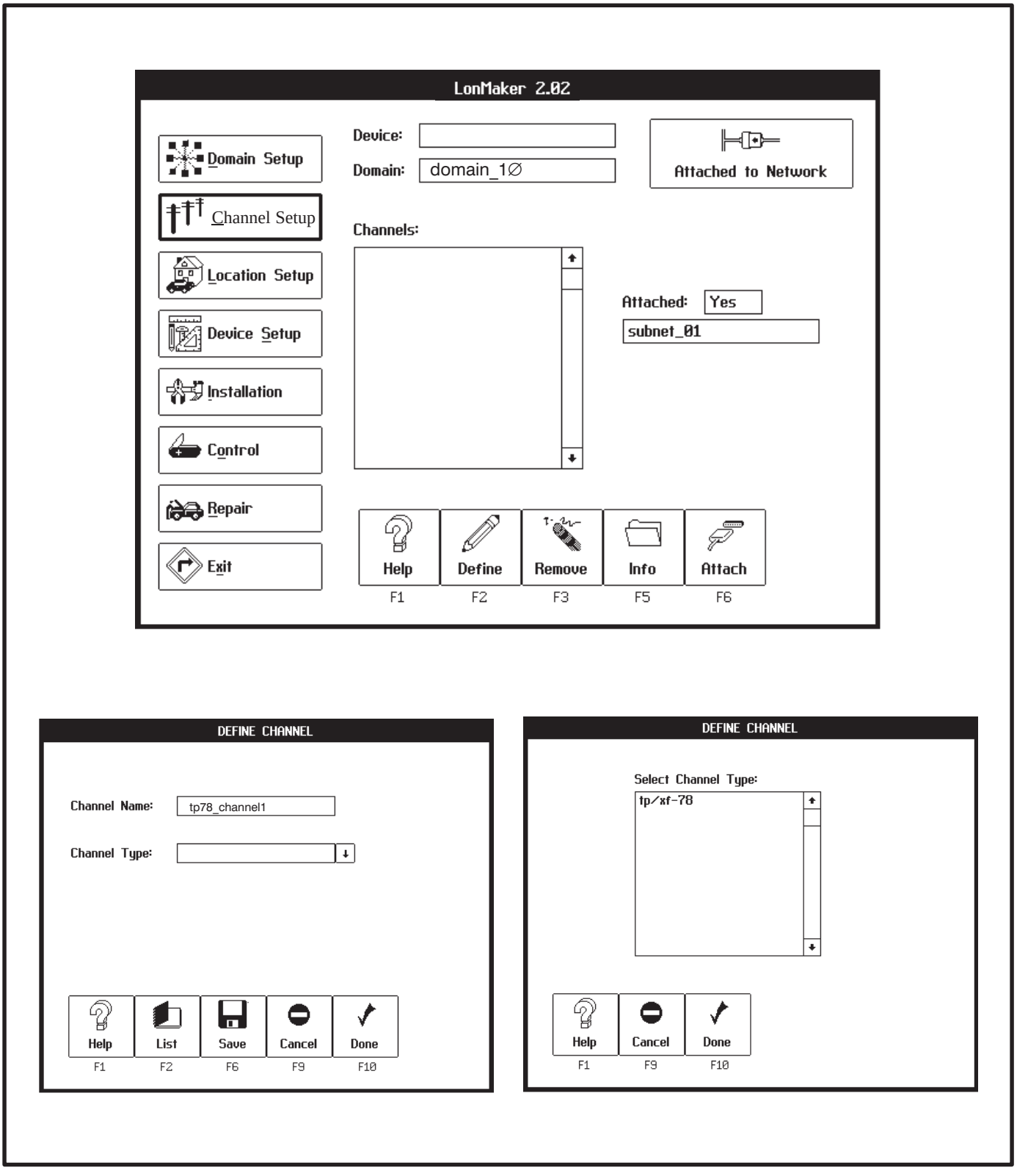

FIGURE 3-6. CHANNEL SETUP SCREENS

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Defining and Selecting a Location

You must name at least one location for the devices on your network.

A location is a subdivision of a network that contains one or more related devices. Locations are available for the convenience of the designer and installer. They allow you to organize a network installation.

Locations can be defined to correspond to physical sites in the project. How locations are defined for a particular installation project is up to the discretion of the designer and the installer.

- A network must have at least one location.
- All modules must be assigned a location.
- A module can belong to only one location.

Procedure to Define a Location

You must define a location for the devices you are going to install. Follow these steps:

1. Click on the Location Setup task button. The list of defined locations appears on the LOCATION SETUP screen (Figure 3-7).
2. Click on the Define action button. The DEFINE LOCATION screen appears.
3. Type in the new location name (up to 16-characters, including spaces).
4. Click on the Done action button if this is the only location you want to define at this time. Click on the Save action button if you want to define another location.

Procedure to Select a Location

Before you work with application devices, you must select the location that they belong to.

On any screen that shows the Locations list, click on the location name. A ♦ symbol appears to the left of the selected locations name.

The “ALL” locations name will show all devices in all locations.

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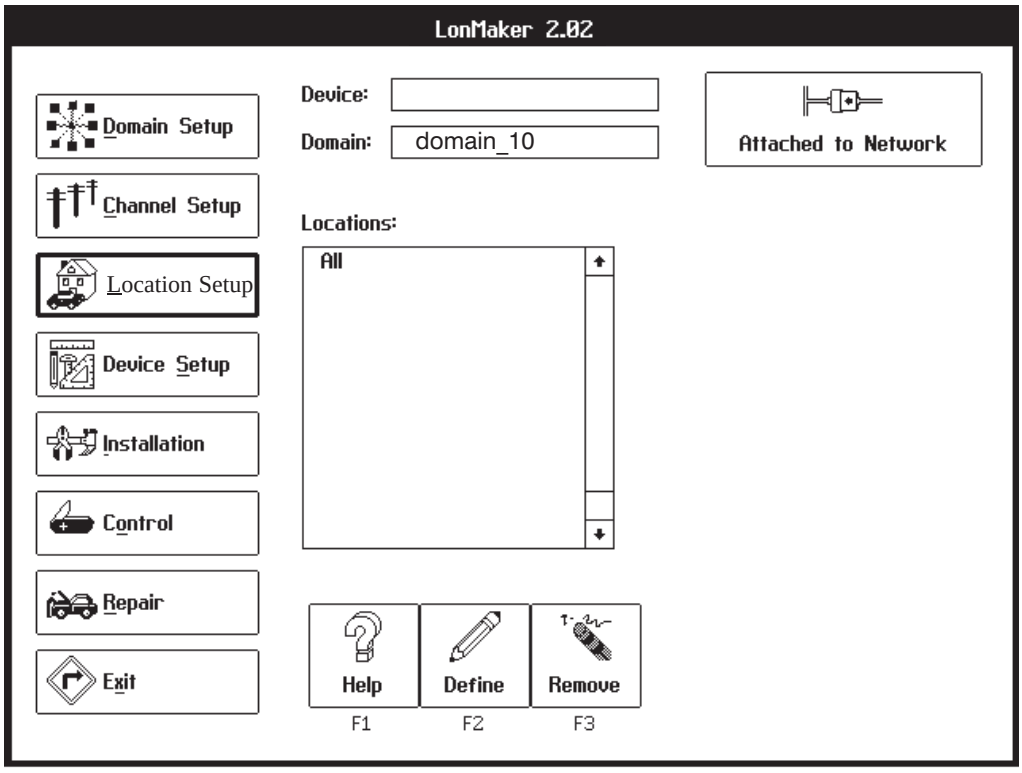

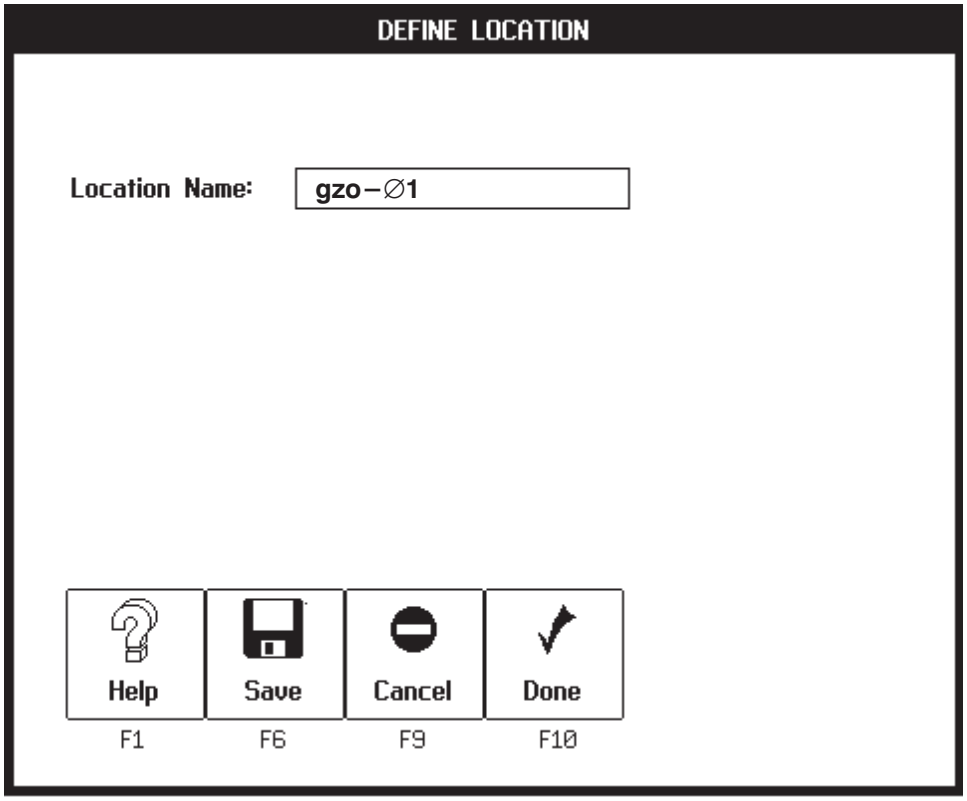

FIGURE 3-7. LOCATION SETUP SCREENS

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Modules

Every module in the network must be defined.

Modules are the various components of the network, such as the Network Annunciator Module, the Controls Communications Module, the Genset Communications Module, etc.

You must identify a domain and location before you can add a module to the network.

Device Type Names

The following list shows most of the common device types. These device types will be displayed when you click on the ↓ symbol to the right of the Device Type text area.

- ccm vX.XX (ccm /ats vX.XX)* (ccm/gen vX.XX)* — Controls Communications Module
- dim vX.XX — Digital I/O Module
- pcc w/gcm vX.XX — GenSet Communications Module
- mbi /XXX vX.XX — Modbus Interface (5 types)
- nam vX.XX — Network Annunciator Module
- ngm vX.XX — Network Gateway Module
- rtr vX.XX — Router

vX.XX = Device Software Version

Modules not covered in this manual may appear in this list.

*Note: ccm/ats and ccm/gen have pre-defined configuration data (Refer to Autobindings in Appendix C).

Procedure to Define Application Devices

You must define the devices you are going to install. (Routers are covered in a separate section because the steps are different). Follow these steps:

1. Click on the Device Setup task button.
2. Choose a location for the device. Do not choose the All location.
3. Click on the Define (F2) action button. The DEFINE DEVICE screen appears (Figure 3-8).
4. **Device Name:** Type in the device name (up to 16 characters, including spaces). An application device must have a unique name in the LonMaker database. This name can occur only once in all domains and locations in a network. (The period, slash and underscore characters may be used in the name).
5. **Device Type:** Click on the ↓ symbol to the right of the Device Type text area to see a list of available device types. Double click a device type to choose it.
6. **Chan Name:** Click on the ↓ symbol to the right of the Chan Name text area to see a list of available channel names. Double click a channel name to choose it.
7. **Chan Priority:** Click on the ⇕ to toggle Yes/No. A channel priority slot can be assigned to CCMs, GCMs, and NGMs. The tp/xf-78 channel type has 16 priority slots available per channel. This means that up to 16 modules can be assigned a priority slot. Though not required, a priority slot assigned to a CCM or GCM gives dial-out alarm messages priority access over other network traffic.
8. Click on the Done (F10) action button if you are done defining devices. Click on the Save action button if you want to define another device.

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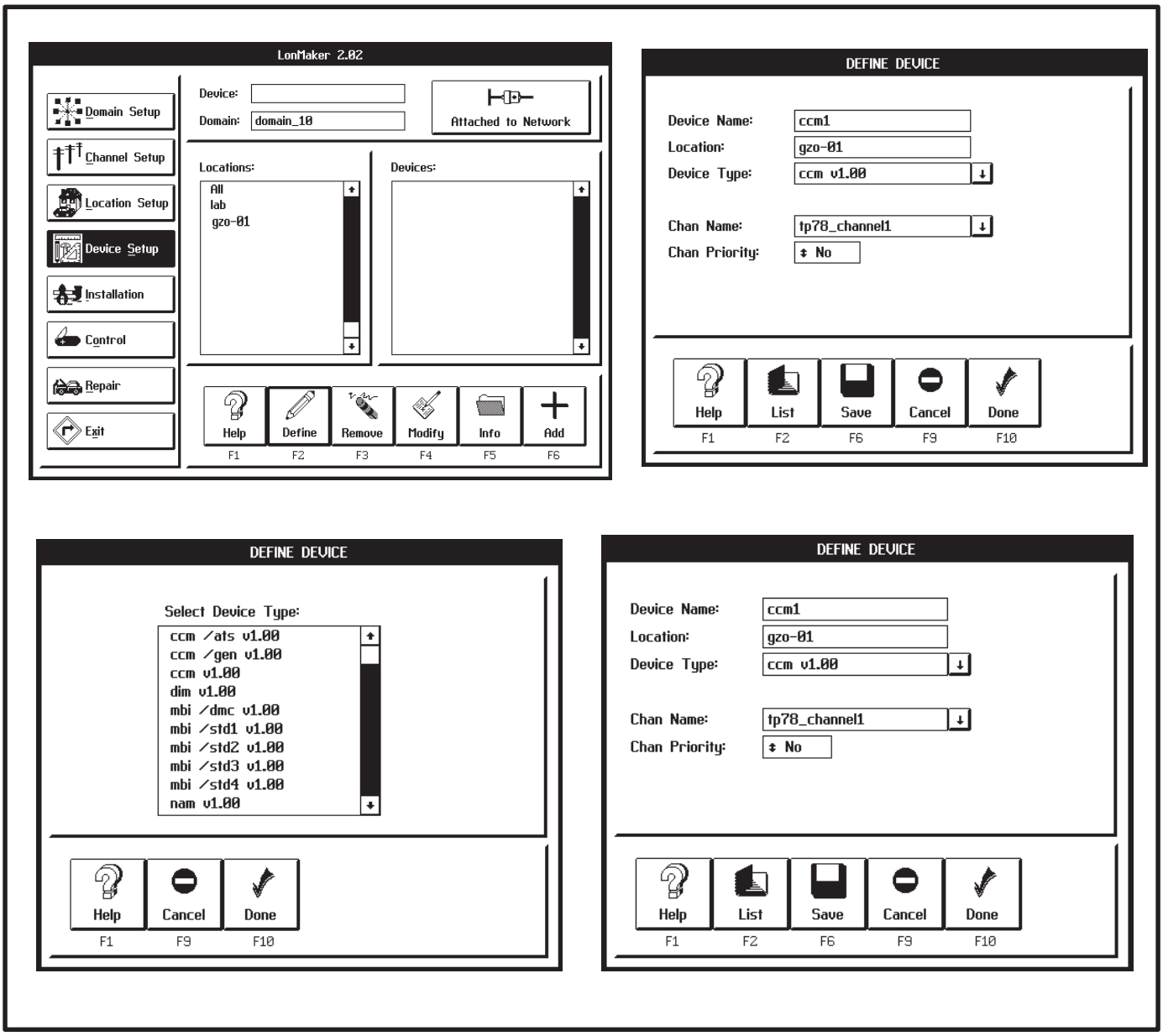

FIGURE 3-8. DEFINE DEVICE SCREENS

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Procedure to Define a Router

Before you can define a Router, select a Domain and Location and define the two channels that the router will connect. Follow these steps to define a router:

1. Click on the Device Setup task button.
2. Choose a location for the Router. Do not choose the All location.
3. Click on the Define (F2) action button. The DEFINE DEVICE screen appears (Figure 3-9).
4. **Device Name:** Type in the Router name (up to 16 characters, including spaces). Each Router must have a unique name in the LonMaker database. This name can occur only once in all domains and locations in a network.
5. **Device Type:** Click on the ↓ symbol to the right of the Device Type text area to see a list of available device types. Double click Router (rtr vx.xx) to choose it.
6. **Chan A/B Name:** Click on the ↓ symbol to the right of the Chan A Name text area to see a list of available channel names. Double click a channel name to choose it. Repeat this step to select a channel name for channel B.
7. **Channel A Priority:** Click on the channel A ↕ to toggle Yes. A channel priority slot can be assigned to a Router for each channel. The tp/xf-78 channel type has 16 priority slots available. This means that up to 16 modules per channel can be assigned a priority slot. A priority slot assigned to a Router gives dial-out alarm messages priority access over other network traffic. An error message will occur if all 16 priority slots are taken.
8. **Channel B Priority:** Repeat step 7 for channel B.
9. Click on the Done action button if this is the last device. Click on the Save action button if you want to define another device.

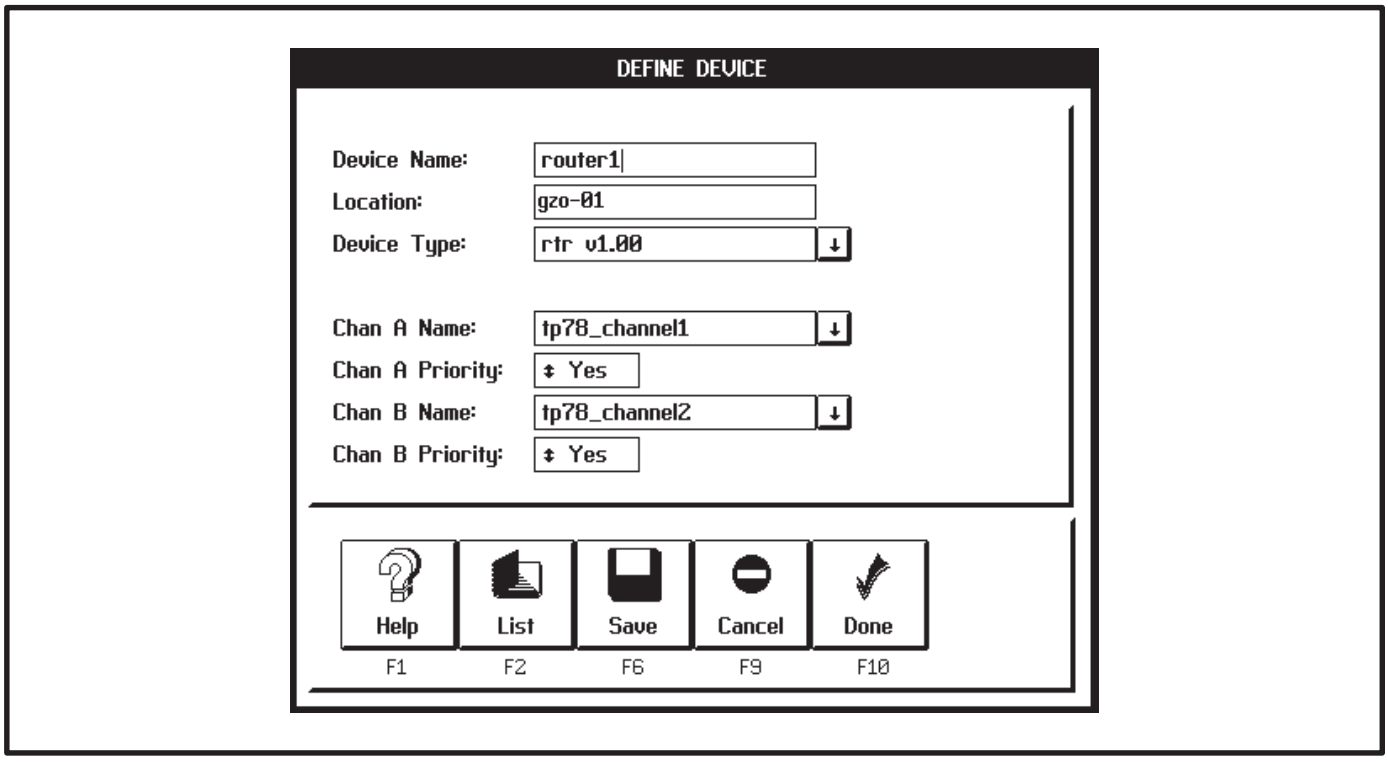

FIGURE 3-9. DEFINE DEVICE SCREENS

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INSTALLATION OF DEVICES WITH LONMAKER

Network installation actually involves two distinct processes:

- **Connecting Modules** is the process of assigning (or "binding") device-to-device connections—linking an output variable of one device to an an input variable of another device. This procedure is described under: *CONNECT PROCEDURE.*

  Initial network setup, including assigning connections (binding), can be done off-site, prior to the physical installation.

  (Any modification of an existing network installation must be done on-site.)

- **Installing Modules** is the process of identifying each device as a unique member of the network. This procedure is described under: *INSTALL PROCEDURE.*

  The installer selects the Installation task, and identifies specific device nodes by pressing their individual service pins when prompted to do so by the LonMaker installation program.

CONNECT PROCEDURE

This section covers setting up connections between outputs and inputs of application devices. This process is also referred to as "binding." (Refer to the end of each module section for available bindings.)

You can connect application devices before or after installing them.

The devices you connect must be in the same domain, but they can be in different locations.

These connections are software (logical) connections, not physical connections between devices.

LonMaker software is used to connect selected pairs of application devices. The first step in connecting devices is to select a "hub" device. The hub device is the first device that you will use to connect to several other devices. For example, to connect the device named "GCM_1" to the devices named "DIM_1" and "DIM_2," you should select "GCM_1" as the hub device. You then select devices to connect to the hub. Refer to Appendix C for *Application Table Consumption* to review the number of connections that can be made. In general the DIM and NAM can connect to a maximum of 5 devices and the CCM and GCM can connect to up to 15 modules.

You can connect a device to itself by connecting (binding) its inputs to its outputs.

Connections occur in two steps:

- **Pending:** When you first specify connections, they are stored as proposed or pending connections. LonMaker places a**+** symbol next to device names involved in pending connections.
- **Completed:** When you click on the Done action button on the CONNECT screen (and the devices are already installed), LonMaker sends connection information to the devices and removes the**+** symbol next to device name. If the devices are not installed yet, LonMaker saves the connection information and sends it to the devices when you do install them.

LonMaker refers to the inputs and outputs of devices as network variables (NVs). Inputs and outputs on a LonWorks network are not hard-wired connections, but flexible software connections.

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Procedure for Connecting Devices

1. Click on the Installation task button. (Figure 3-10).
2. Select the specific location that contains the "hub" device—or select the All location.
3. Select the "hub" device from the Devices list. The hub device is the device that you will to connect to several other devices.
4. Click on the Connect (F8) action button. The CONNECT screen appears (Figure 3-11).
5. Select the next device to connect to from the Devices list.
6. Choose the Auto or Manual actions.
   Auto: If there are automatic **(predefined)** connections for the two selected devices, this button appears at the bottom of the screen. Click on the Auto action button to add these connections to the pending list. Refer to Appendix C for a list of Automatic Connections.
   Manual: If the selected pair does not have predefined connections, or if you want to set up other connections, click the Manual action button. Manual connections are described below.
7. Repeat steps 5 and 6 for each device that connects to the hub device.
8. Click on the Done action button to complete the pending connections.
9. Repeat steps 2 thru 8 for the next designated hub device and each of its connected devices.

Procedure for Manual Connections

The network designer will provide instructions and/or forms that define these connections. (Sample forms and schematics are provided in the back of this manual.)

From step 7 above: If the selected pair does not have predefined connections, or if you want to set up other connections:

1. Click on the Manual action button. The MANUAL CONNECT screen appears (Figure 3-12).
2. Select an output for one device and an input for the other device. A ♦ symbol appears to the left of your selections.

   The inputs and outputs must be of the same *type*.

   LonMaker checks your choices for connections to see if a connection is already pending or completed, and whether it is appropriate for the types of inputs and outputs involved.
3. Choose the Add or Next actions.
   Add: Adds the input/output connection to the list of pending connections.
   Next: Toggle the display of inputs and outputs between the two selected devices.
4. Repeat steps 2 and 3 to set all connections between these two devices.
5. Click on the Done action button to return to the CONNECT screen. LonMaker completes the pending connections when you click on the Done action button on the CONNECT screen.

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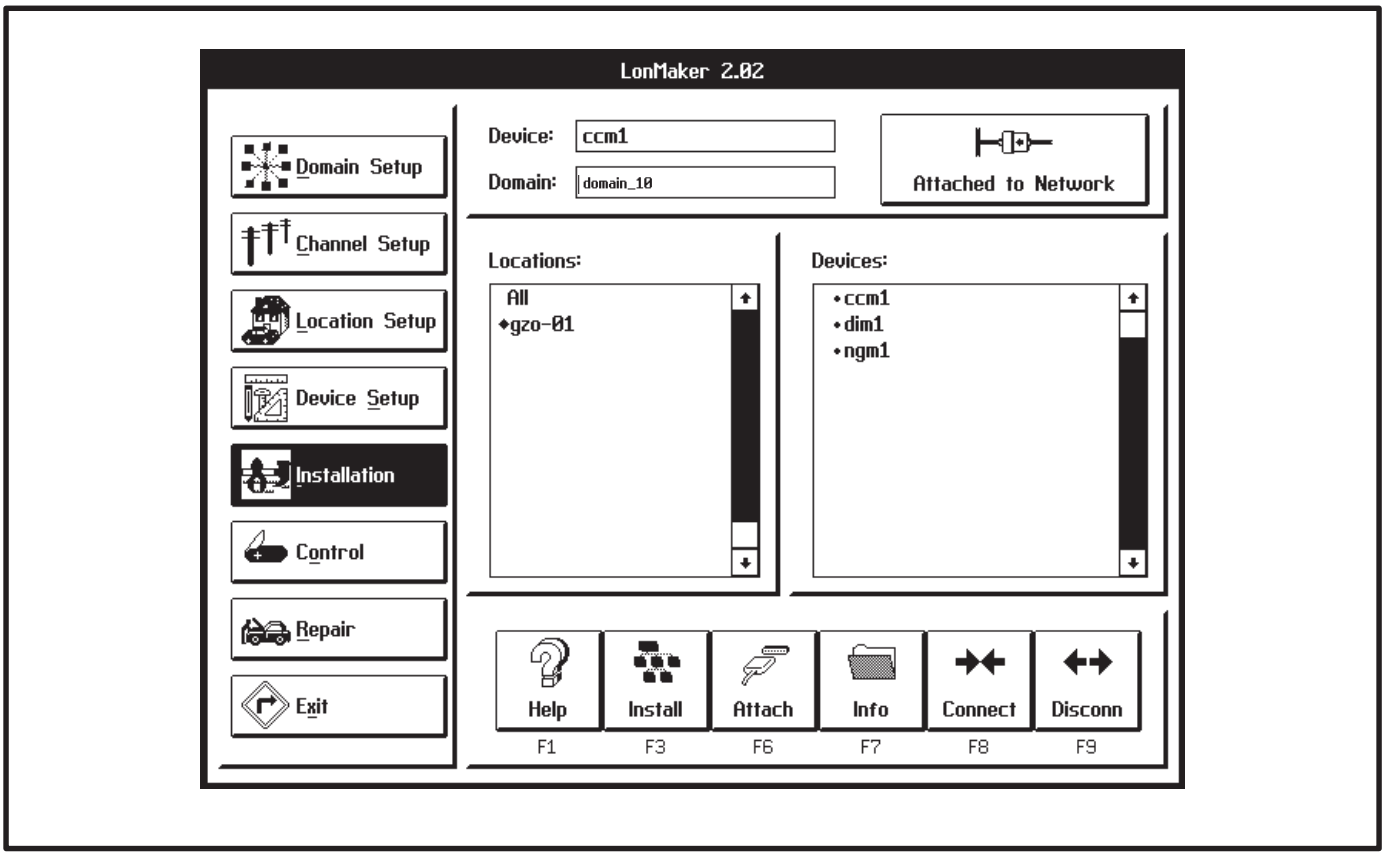

FIGURE 3-10. INSTALLATION SCREEN

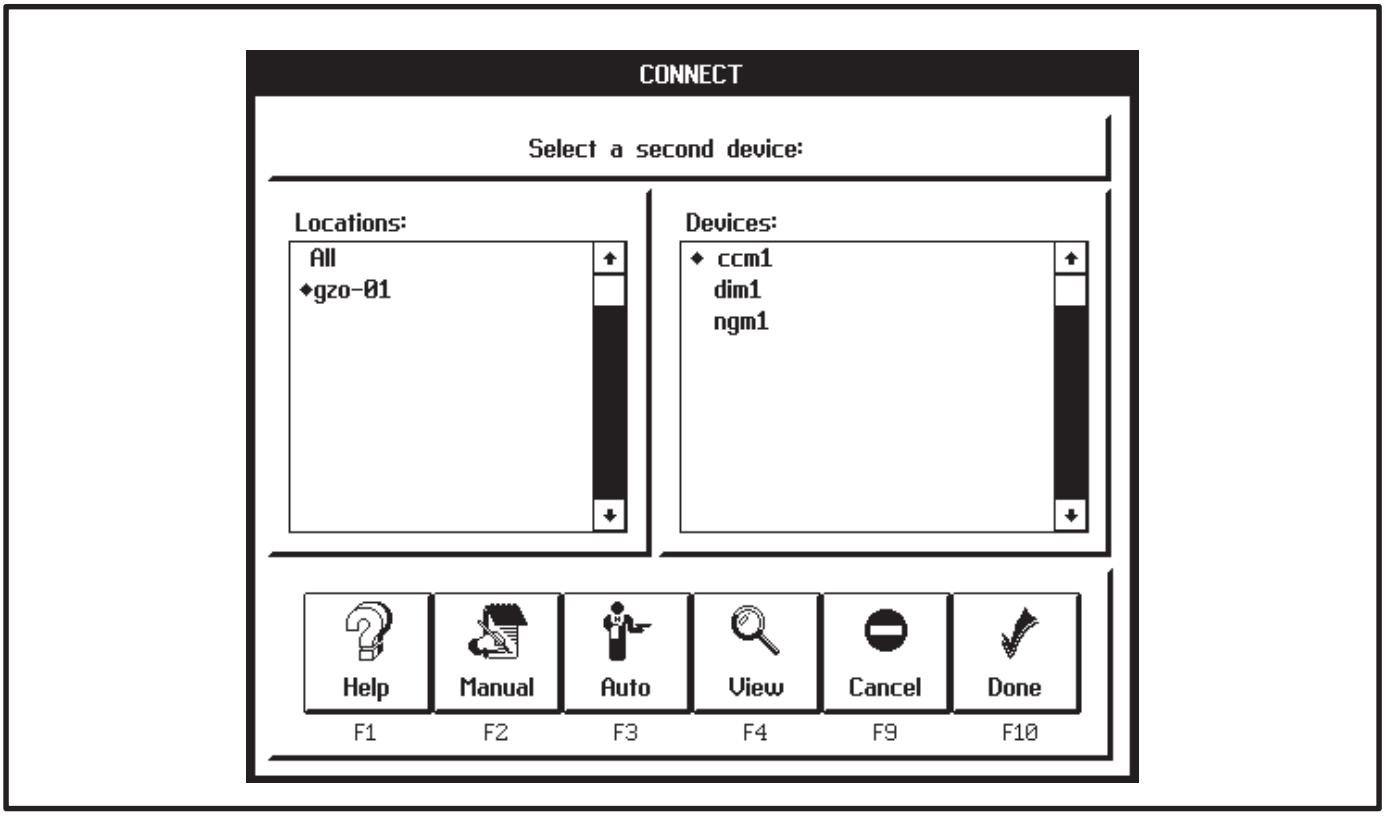

FIGURE 3-11. CONNECT SCREEN

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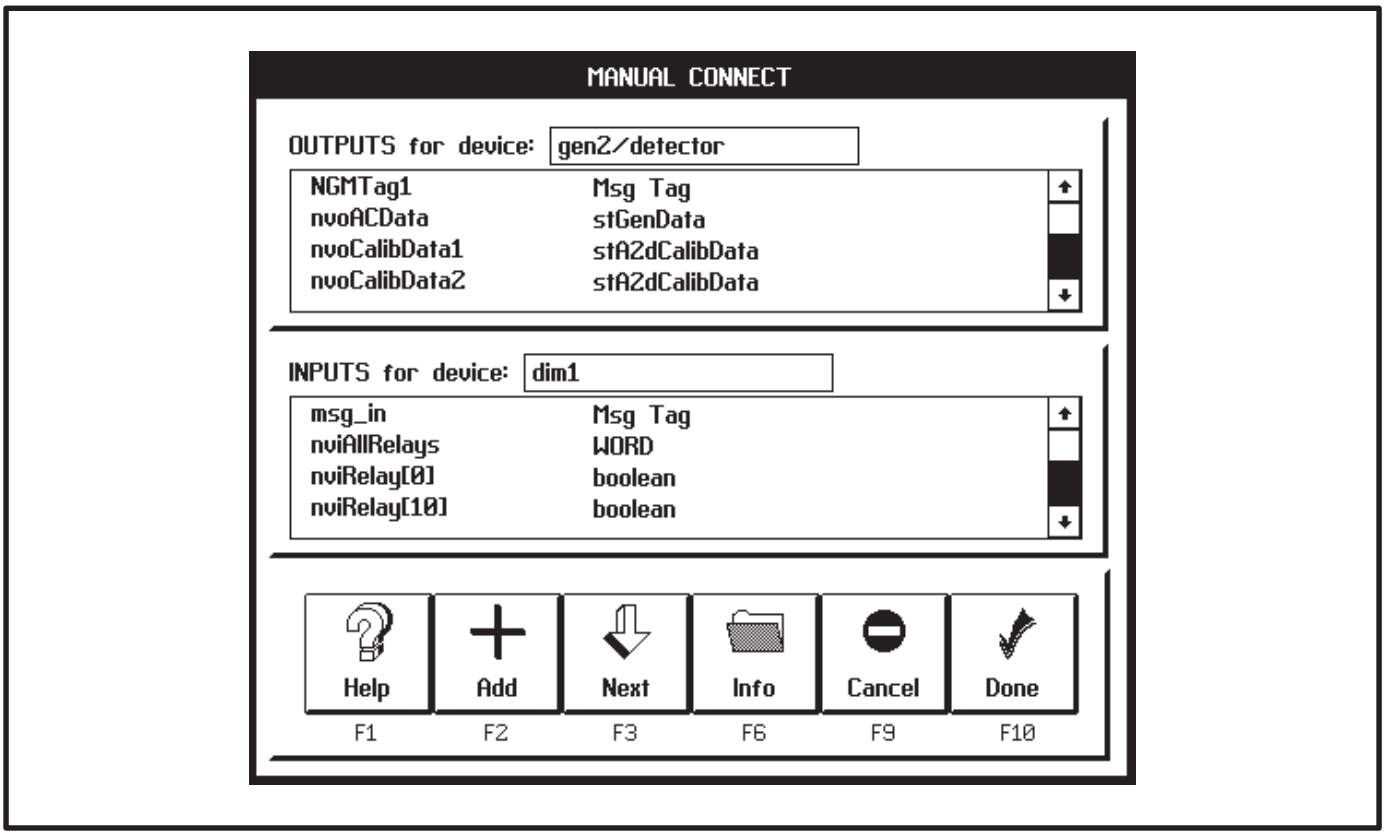

FIGURE 3-12. MANUAL CONNECT SCREEN

INSTALL PROCEDURE

Preliminary Steps

Before you perform these steps, the specific components of the network must be defined. The last step in setting up LonMaker for network installation is to identify the channel to which LonMaker is attached. (If the network has only one channel, LonMaker automatically selects this channel.) The setup procedures are covered under *LonMaker Network Setup.*

⚠WARNING ***Network service procedures can cause accidental starting of the generator set or operation of a transfer switch or other auxiliary equipment connected to the network—which can cause severe personal injury or death.***

Place the generator set RUN/OFF/AUTO switch in the OFF position. Prevent accidental operation of the transfer switch by disabling the actuating mechanism (see Operator's Manual).

Before you use LonMaker to install devices on a network, you must also complete the following steps:

1. Connect the computer to the Network Installation Gateway.
2. Physically connect the Network Installation Gateway to the network channel.
3. Turn on the computer and network interface.
4. Start LonMaker.
   (From the site directory you created, type: lnmg)
5. Make sure that LonMaker is "attached" to the correct channel. Refer to the icon in the upper right corner of the screen (Figure 3-13) to determine if the Network Installation Gateway is attached. If it is not attached, click on this icon.
   If it will not *attach*, check the cable connection to the PC and verify that it is connected to the correct COM port as identified in the config.sys file (/P1, /P2, etc.). Also try cycling power on the Network Installation Gateway and make sure its service LED blinks once when the power is cycled On.

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Procedure to Install Devices

In networks with Routers, the order of installation is important. Install the Router(s) first. Routers connect different channels. Once they are installed the other channels can be accessed so that modules on those channels can be installed.

1. Click on the Installation task button (Figure 3-13).
2. Choose a location for the device. Choose the All location or the specific location for the device.
3. Select the device from the Devices list (Routers first if applicable). Uninstalled devices have a • symbol next to their names.
4. Click on the Install action button. The INSTALL screen appears.
5. LonMaker displays a message asking you to press the service pin on the device to install. LonMaker waits until you press the service pin (or until you press the <ESC> key to cancel the process).

   (Service pin location for a specific device is provided in the hardware description of that device. Make sure that you press the service pin on the correct device.)

6. After the service pin is pressed, it can take a few minutes to install the device. Wait until the LonMaker popup indicates that the device is successfully installed.

   If the device was previously installed, LonMaker informs the installer that the device has been configured. Select Continue (F2).

When installation of a device is complete, LonMaker removes the • symbol from the left side of the device name.

Repeat steps 2, 3, 4, and 5 for each device in the network.

Reset Modules

When finished using LonMaker, push the reset button on each of the modules.

Make Backup Copies

When finished with the installation, make a backup copy of the entire LonMaker site directory on a separate floppy disk. Keep the LonMaker site directory structure intact when backing it up.

Use Microsoft Windows File Manager to copy the site directory and files to the floppy drive. **The directory structure MUST be preserved.**
Store the backup in a safe place.

⚠ CAUTION ***If this database is lost or corrupted, the entire installation procedure must be repeated. In addition to making and safely storing backup copies, keep documentation of the network design (device names, connections, locations, etc.) up to date with the LonMaker database. This is the responsibility of the network designer and the network installer.***

Refer to the remainder of this section for the installation verifying procedure.

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CHECKING CONNECTIONS

From the CONNECT screen (Figure 3-11), you can use action buttons to get information about inputs and outputs, and their connections.

Procedure for Selecting Connection Viewing screens

To select these information screens, perform the following steps:

1. From the MAIN screen, select the INSTALLATION screen.
2. Select the location and the hub device.
3. From the INSTALLATION screen, select the CONNECT screen.
4. If applicable, select the second location and second device.
5. Click on the View action button. The VIEW PENDING screen appears.

This screen shows all incomplete (pending) connections **between the first selected device and any other device**. This screen also shows a new set of action buttons:

- **Pairs:** This action button takes you to the VIEW PAIR screen.
- **All:** This action button takes you to the VIEW ALL screen.
- **Pending:** This action button returns you to the VIEW PENDING screen.

Viewing Information about Pending Connections to One Device

When you select the View action button, the VIEW PENDING screen (Figure 3-15) appears.

This screen shows all pending connections **between the first selected device and any other device**.

Each pair of text lines shows the names of the connected devices and the **pending** input/output network variable pair.

This screen also shows the Pairs/All/Pending set of action buttons.

Viewing Information about Completed Connections between Two Devices

When you select the Pair action button, the VIEW PAIR screen (Figure 3-13) appears.

This screen shows a list of all completed connections **between the two selected devices**.

Each pair of text lines shows the names of the connected devices and the **connected** input/output network variable pair.

This screen also shows the Pairs/All/Pending set of action buttons.

Viewing Information about All Completed Connections to One Device

When you select the All action button, the VIEW ALL screen (Figure 3-13) appears.

This screen shows a list of all completed connections **between the first selected device and all other devices**.

Each pair of text lines shows the names of the connected devices and the **connected** input/output network variable pair.

This screen also shows the Pairs/All/Pending set of action buttons.

Further Information

Viewing connections gets its information from the LonMaker site database on the PC, and not from the individual devices. In a properly installed network both will contain the same information.

For information and procedures about checking input and output values, disconnecting devices, taking devices off line or placing them online, modifying and replacing devices, moving devices, or removing devices; refer to the to the Online Help, the remaining pages of this section and to the LonMaker Users Guide.

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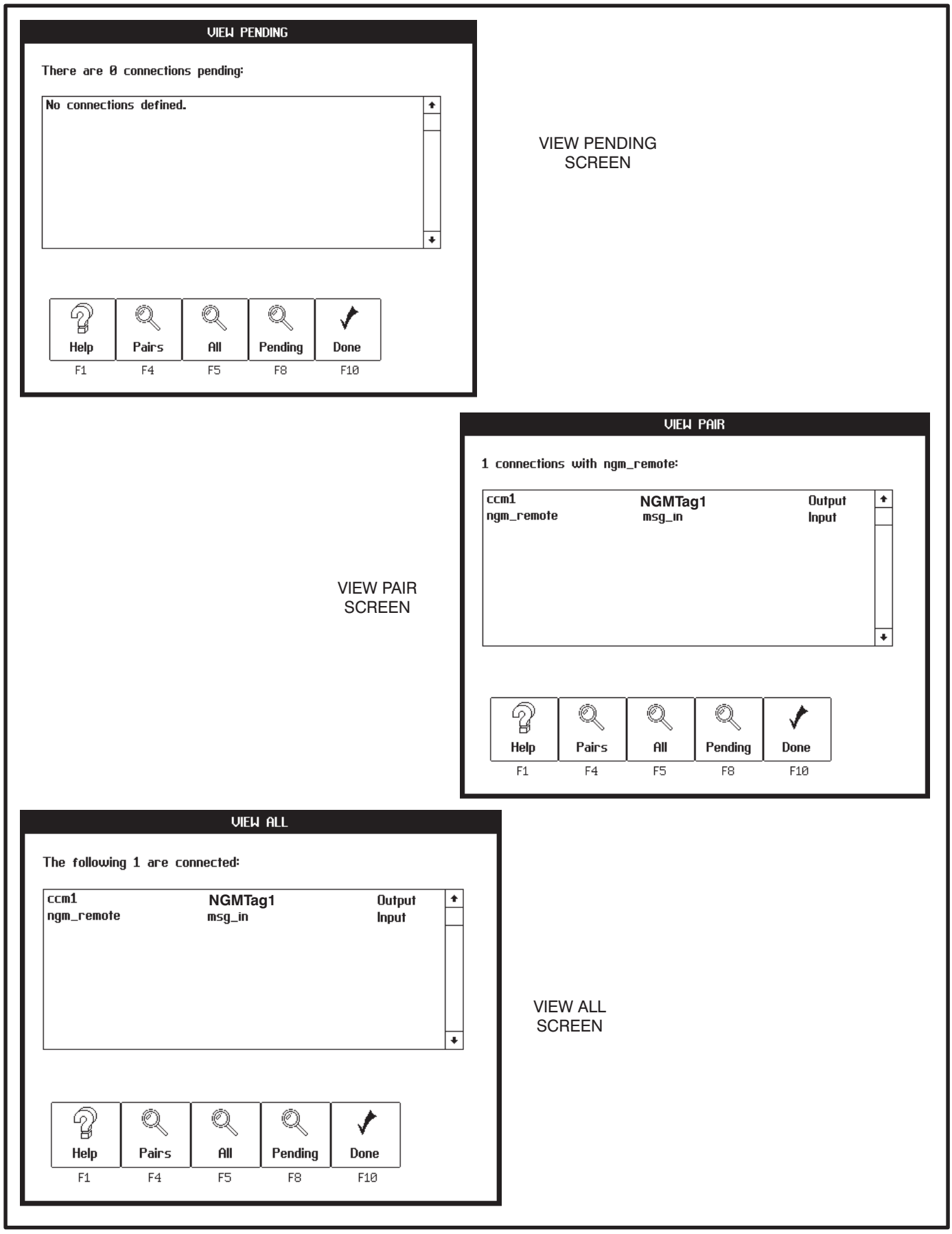

FIGURE 3-13. CONNECTION VIEWING SCREENS

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CHECKING INPUT AND OUTPUT VALUES

From the CONTROL screen (Figure 3-14), you can use the Data action button to get information about the values of individual device input and output variables.

To select the information screens, perform the following steps:

1. From the MAIN screen, select the CONTROL task button.
2. Select the location and the device.
3. From the CONTROL screen, click on the Data action button. The DATA screen appears.

This screen shows the following data:

NOTE: These data lists can be scrolled, using the scroll bars on the left hand side of the lists.

- **Outputs/Inputs:** This field displays the names of the output and input variables.
- **Type:** This field displays the types of inputs and outputs, from the parts catalog.
- **Value:** This field displays the most recent value sent or received. Until values are determined, LonMaker displays a "??." LonMaker polls the inputs and outputs, and periodically updates the display. As the values change, new values are displayed. Do not expect immediate updates, polling takes time.

  A value can be a number, text, or the word "INFO," indicating a value with multiple fields. If the value is INFO, click on the Info action button to view the DATA INFO screen.

  NOTE: Not all network variables can be viewed. For a list of the network variables that can be viewed, refer to the individual module sections.

Further Information

For information and procedures about disconnecting devices, taking devices off line or placing them online, modifying and replacing devices, moving devices, or removing devices; refer to the to the Online Help and to the remaining pages of this section.

For information and procedures about changing input and output values, refer to the Online Help and to the Echelon *LonMaker Installation Tool Users Guide.*

These may be tasks for a network designer or network support specialist. For further information, refer to the Echelon *LonMaker Installation Tool Users Guide.*

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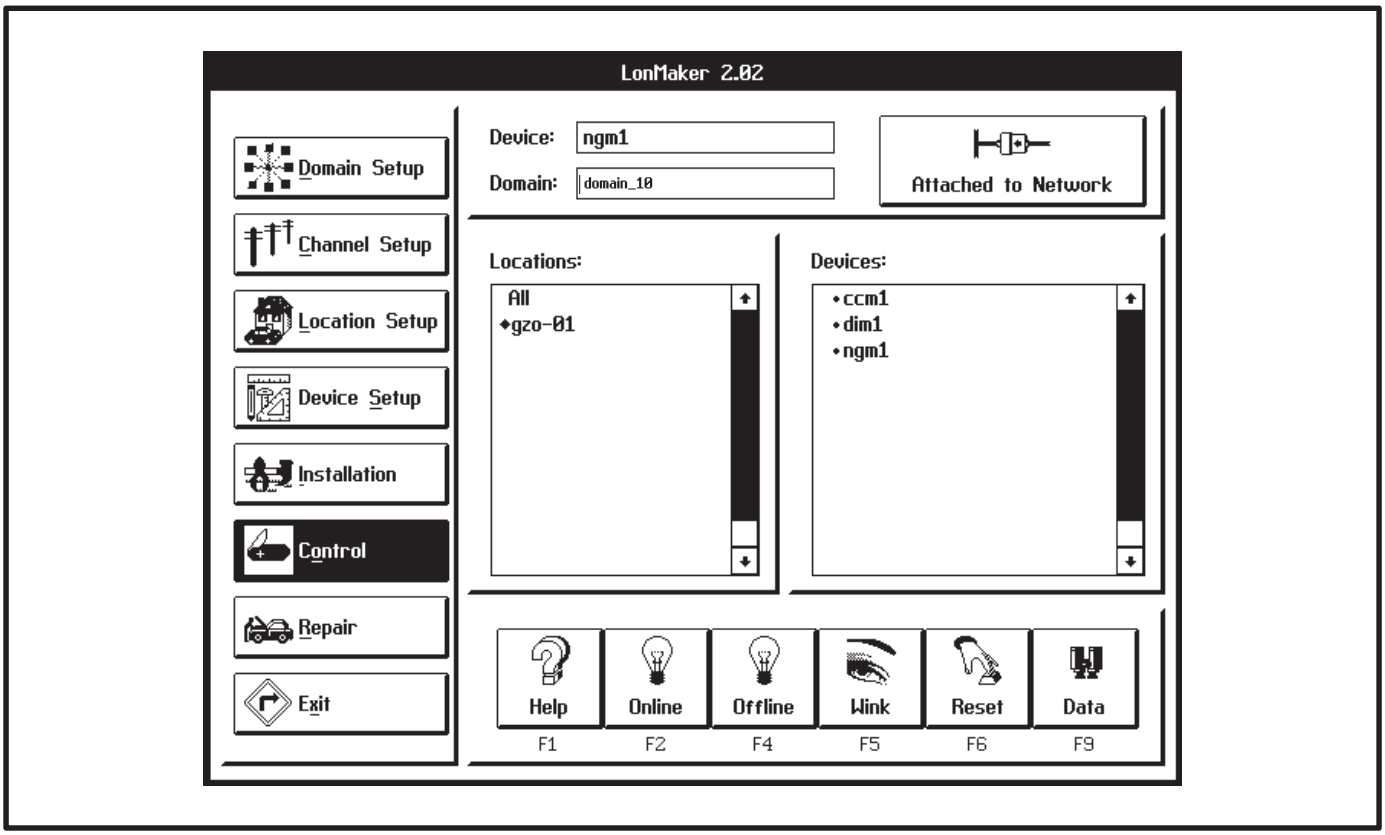

FIGURE 3-14. CONTROL SCREEN

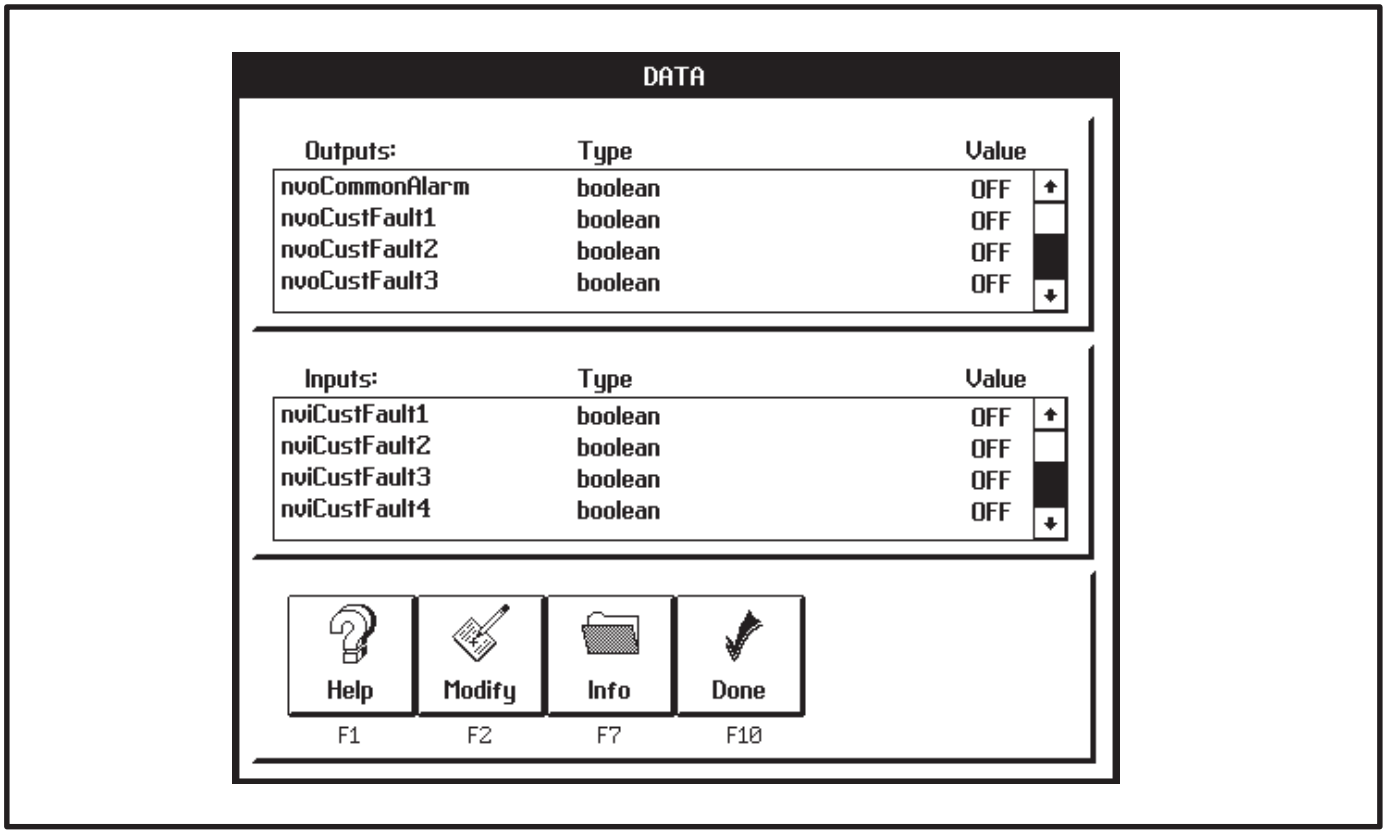

FIGURE 3-15. DATA SCREEN

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NETWORK SERVICE PROCEDURES

With LonMaker, you can take devices off line or place them online. You can reset devices, disconnect device input and output connections, and remove devices from the LonMaker database. You can modify device names and replace devices. These procedures are described below.

Other changes that can be made include:

- Adding a Device
- Remove or add channels
- Remove or add domains
- Remove or add locations
- Update device (node) software

Any changes must be backed up and the network documentation must be updated accordingly. Portions of PCT will need to be run again. Refer to (Additional Steps Required with PCT Beta Version – PCT Beta Limitations) for additional instructions.

⚠WARNING ***Network service procedures can cause accidental starting of the generator set or operation of a transfer switch or other auxiliary equipment connected to the network—which can cause severe personal injury or death.***

Place the generator set RUN/OFF/AUTO switch in the OFF position. Prevent accidental operation of the transfer switch by disabling the linear actuators.

Taking Devices Off Line or Placing Them Online

Using the Offline action, network application devices can be rendered inactive. You may want to deactivate certain devices while you are troubleshooting a network.

Offline devices receive inputs, but respond only to an Online or Reset action. The Online action restores the activity of an Offline device.

To execute Offline and Online actions, perform the following steps:

1. From the MAIN screen, click on the Control task button to select the CONTROL screen.
2. Select the location and the device.
3. From the CONTROL screen, click on the Offline or Online action button to initiate the desired action.

Resetting Devices

Using the Reset action, a network application device can be set to its initial state and restarted. A reset action may also reverse an Offline state, activating a device. However, an application device may be programmed to go off line after a reset. Resetting a device will cancel outgoing calls.

To execute the Reset action, perform the following:

1. From the MAIN screen, click on the Control task button to select the CONTROL screen.
2. Select the location and the device.
3. From the CONTROL screen, click on the Reset action button.

Replacing Devices

The Replace action allows you to substitute a new device for a defective device. You can only replace one device with an identical device type.

You can also use the Replace action to test a device that may be defective. Replacing a suspected defective device with a known good device will help determine whether the original device is defective.

The Replace action installs the new device and transfers input and output connections, recorded in the LonMaker database, from the original device to the replacement device.

Before you begin a replacement, physically remove the original device, and replace it with the new device. The replacement device must be installed on the same channel as the original.

To execute the Replace action, perform the following steps:

1. Install the replacement device on the network.
2. Click on the Repair task button. The REPAIR screen appears.
3. Choose a location, and select the device you are replacing.

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4. Click on the Replace action button. The REPLACE screen appears.
5. LonMaker displays a message asking you to press the service pin on the device to install. LonMaker waits until you press the service pin (or until you press the <ESC> key on the computer keyboard to cancel the process).

   (Service pin location for a specific device is provided in the hardware description of that device. Make sure that you press the service pin on the correct device.)

6. After the service pin is pressed, it can take a few minutes to install the device. When you see the message, “Device successfully installed,” click on the Done button to return to the REPAIR screen.

After replacing a device, the device will have to be reconfigured using PowerCommand Configuration Tool (PCT). Refer to the PCT section.

Modifying a Device Name

To execute the Modify action, perform the following steps:

1. From the MAIN screen, click on the Device Setup task button to select the DEVICE SETUP screen.
2. Select the device to be modified.
3. Click on the Modify action button. The MODIFY DEVICE screen appears.
4. Select the Device Name text area, and type the new name.
5. Click on the Done action button, to save the change.

After modifying a device name, the device will have to be reconfigured using PowerCommand Configuration Tool (PCT). Refer to the PCT section.

Moving Devices

To move a device to a different place on the same location, domain, and channel, you do not need to use LonMaker. Simply disconnect the device from the communications medium and install it at its new place.

Disconnecting Devices

The Disconn(ect) action removes all input and output connections between a selected pair of devices. A disconnected device is still installed on the network, but it cannot communicate bound NVs with other devices. Disconnect removes all records from the LonMaker database of input and output connections between the selected devices.

To execute the Disconnect action, perform the following steps:

1. From the MAIN screen, click on the Installation task button to select the INSTALLATION screen.
2. Select the location and the first device.
3. Click on the Disconn (F9) action button, to see the DISCONNECT screen.
4. Select the other device in the connection.
   If you do not select a second device, LonMaker removes all connections between the first device and all other devices.
5. Use the View Pairs and View All actions to see the connections.
6. Click on the Done action button to execute the disconnect. LonMaker prompts you to confirm.

Removing a Device

The Remove action removes an application device from the network and from the LonMaker database. Removing a device also removes all of its connections to other devices in the network.

To execute the Remove action, perform the following steps:

1. From the MAIN screen, click on the Device Setup task button to select the DEVICE SETUP screen.
2. Select the device to be removed.
3. Click on the Remove action button.

Further Information

For information and procedures about moving a device to another location, domain, or channel; or about removing a domain, removing a location, or removing a channel; refer to the Online Help and to the Echelon *LonMaker Installation Tool Users Guide.*

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TESTING DEVICES AND VERIFYING INSTALLATION

You can test installed and connected devices to see if they are working properly.

The following steps cover the procedure for testing a device to determine whether it can communicate—receive and send messages—over the network.

Procedure for Testing Devices

1. Click on the Repair task button (Figure 3-16).
2. Select a device from the Devices list.
3. Click on the Test (F3) action button. The TEST screen appears (Figure 3-17).

   The TEST screen displays the following fields:

   Test Results: PASSED or FAILED refer to whether or not LonMaker can communicate with the selected device.

   System Version #: Version of the firmware on the device's Neuron® chip.

   Error: The most recent error message that the device recorded, if any.

   Last Reset: The reason for the last reset. If the message "Watch-dog timer" occurs repeatedly, the device is defective.

   Device State: The activity of the device.

   Evaluation of these results may be a task for a network designer, system programmer, or network support specialist. For further information, refer to the Echelon *LonMaker Installation Tool Users Guide.*

   If the device TEST screen displays a "PASSED" message, you have verified that it can communicate over the network.
4. Click on the Done action button to return to the REPAIR screen.
5. Repeat steps 2 through 4 for each device to be tested.

Test Statistics

Evaluation of these statistics may be a task for a network designer, system programmer, or network support specialist. For further information, refer to the Echelon *LonMaker Installation Tool Users Guide.*

You can further examine the test results by choosing the TEST STATISTICS screen.

1. On the TEST screen, click on the Stats action button to see the TEST STATISTICS screen.
2. The TEST STATISTICS screen displays the following fields:

   CRC errors: The number of errors in the message accuracy test (cyclic redundancy check), detected on receiving a message packet at the device. These could result from collisions, noisy communications media, or signal attenuation.

   Transaction timeouts: The number of timeouts that occurred while the device tried to carry out a message transaction.

   Receive transaction errors: The number of times the device failed to receive messages because it had too many pending messages at one time.

   Msgs lost at application level: The number of messages discarded at the device because its incoming application buffers were full.

   Msgs lost at network level: The number of messages discarded at the device because its incoming network buffers were full.

Further Device Testing

For further device testing, you can check information about device input and output connections; and you can check the current values of a device's input and output variables.

These procedures are defined earlier in this section.

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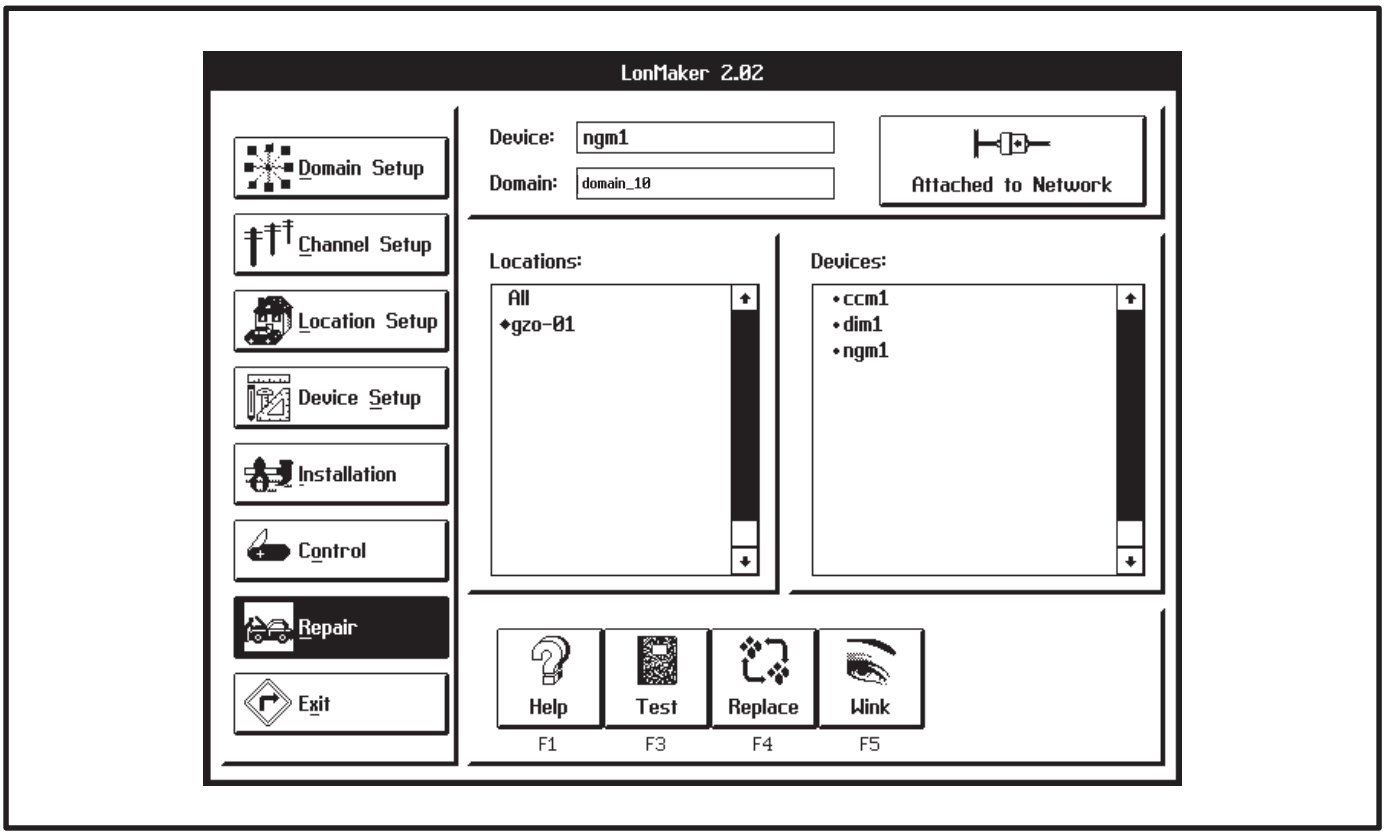

FIGURE 3-16. REPAIR SCREEN

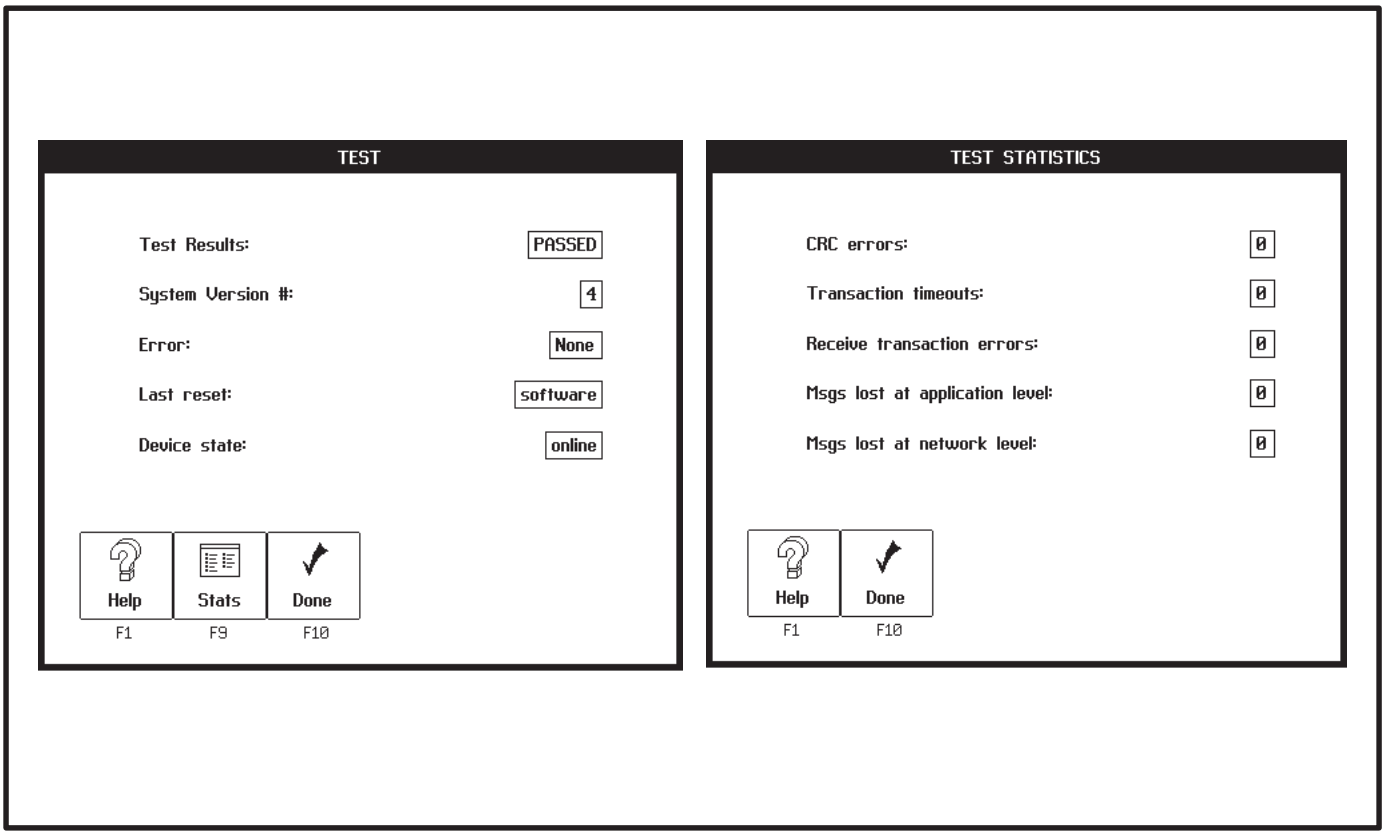

FIGURE 3-17. TEST SCREENS

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4. Network Installation – Configuration Tool

POWERCOMMAND CONFIGURATION TOOL (PCT)

This section describes installation and use of the PowerCommand Configuration Tool software, beginning with version 1.00.

Note: PCT v1.00 will not convert site files that were created with the Beta Release (v0.914). If site configuration data for all existing sites were recorded on the Network Design Forms, proceed with the installation. Otherwise, record all configuration data for each site on the design forms. Do this by running v0.914, open each site and record all configuration data. Sites that were configured with v0.914 are still valid and do not require servicing. However, when servicing is required on one of these sites, the site files will have to be recreated. All configuration data must be re-entered (and re-written) with the new software.

PCT is used to complete the installation of a PowerCommand Network. After using the LonMaker installation software to begin the network installation (Section 3), define and connect modules etc., the installer must run PCT. PCT is used to edit and install the network modules' configuration settings. PCT also creates a site information file (.CSV file) that is used by PowerCommand for Windows (PCW) software to communicate with the PowerCommand Network.

The site information file (.CSV) contains information necessary for PCW to communicate with the modules at the site, including their names, types and addresses. The file name for the site information file is the [Site_id].csv. The .CSV extension stands for Comma Separated Value. The CSV file must be imported by PCW in order to communicate with the site.

PCW must be updated with the latest .CSV file anytime a module is added or removed from a site, or the bindings are changed in LonMaker or the configuration is changed in PCT.

In this section, the network installer will install and use the PCT software to complete the network installation. To use this software, you will need to have experience using Windows application software.

Menu commands that are grayed out will not function. If a command is grayed (dimmed) in the menu bar or pull down menu list, it may not be available at that time or in the current software version.

The forms in Appendix C can be used to predefine and document the information that will be filled into the PCT screens. By completing these forms before using PCT, this process may be easier to complete.

The sections that follow this one (beginning with Section 5) provide detailed information on each of the individual modules available for the PowerCommand network.

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PowerCommand Configuration Tool Installation

Before starting installation, close all other applications including the Microsoft Office Shortcut Bar.

To install the PowerCommand Configuration Tool under Windows 95:

1. Insert the Configuration Tool Disk 1 into your floppy drive (A:).
2. Select **Run** from the Taskbar **Start** Menu.
3. Type: **A:\SETUP** (↵ **Enter**)

To install the PowerCommand Configuration Tool under Windows 3.1:

1. Insert the Configuration Tool Disk 1 into your floppy drive (A:).
2. Select **Run** from the Windows Program Manager **File** Menu.
3. Type: **A:\SETUP** (↵ **Enter**)

The install routine creates a subdirectory named PCT (C:\Onan\Pct) and a shortcut group folder on the desktop named PowerCommand (Figure 4-1).

Additional PC Setup (Windows 3.1)

In Windows 3.1 the installation computer requires **SMARTDrive** and **SHARE** to be loaded. To load these, add the following lines to your *autoexec.bat* file:

LH C:\DOS\SMARTDRV.EXE
LH C:\DOS\SHARE.EXE /L:100

(LH = Loads these programs in upper memory.)

Save the changes to the autoexec.bat file.
Exit Windows and restart the computer.

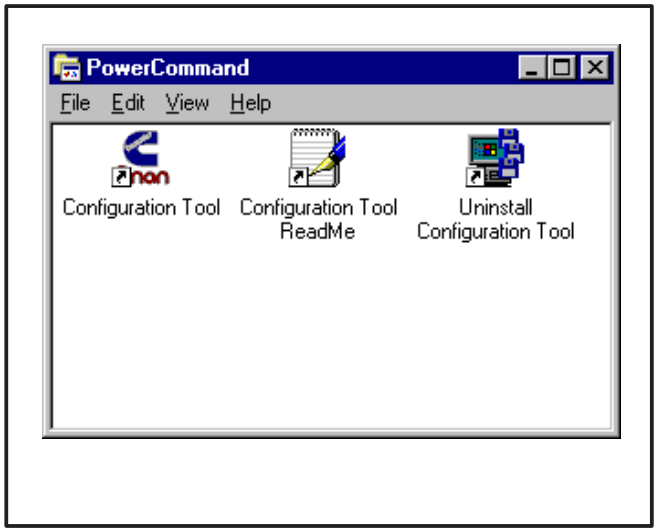

FIGURE 4-1. PCT GROUP FOLDER

ReadMe File

When PCT is installed a file named Configuration Tool ReadMe File is copied to the PowerCommand directory. This file contains last minute instructions for using PCT. Open and review each of these instructions.

Removing PowerCommand Configuration Tool

To remove PowerCommand Configuration Tool under Windows 95:

1. Select **Programs** from the Taskbar **Start** menu.
2. Select **Uninstall Configuration Tool** from the **PowerCommand** folder.

To remove PowerCommand Configuration Tool under Windows 3.1:

1. Open the **PowerCommand** group from within the Window **Program Manager**.
2. Double-click on **Uninstall Configuration Tool**.

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PowerCommand Configuration Tool Features

The PowerCommand Configuration Tool software operates in the Windows graphical environment and is completely compatible with Windows 3.1 and Windows 95. You can access the PCT software just like you would any other Windows application.

All systems commands are accessible by mouse and keyboard. Frequently used commands have keyboard shortcuts and toolbar access. Only commands applicable to the current active window are enabled. All other commands are grayed out.

The Main Window

The main window includes a *Menu Bar*, *ToolBar*, and *Status Bar*.

The *Menu Bar* contains the groups of commands that you will use when running the PowerCommand Configuration Tool. A list of menu options is available under each main menu entry (Figure 4-3).

When a menu command is grayed (dimmed), it means the command is not available at the current time. You may need to select another action (such as opening a site) before the grayed command will be displayed in black type – indicating that it is available.

The screen captures used in this section were made in Windows 95. When using Windows 3.1, the screens in PCT will look different.

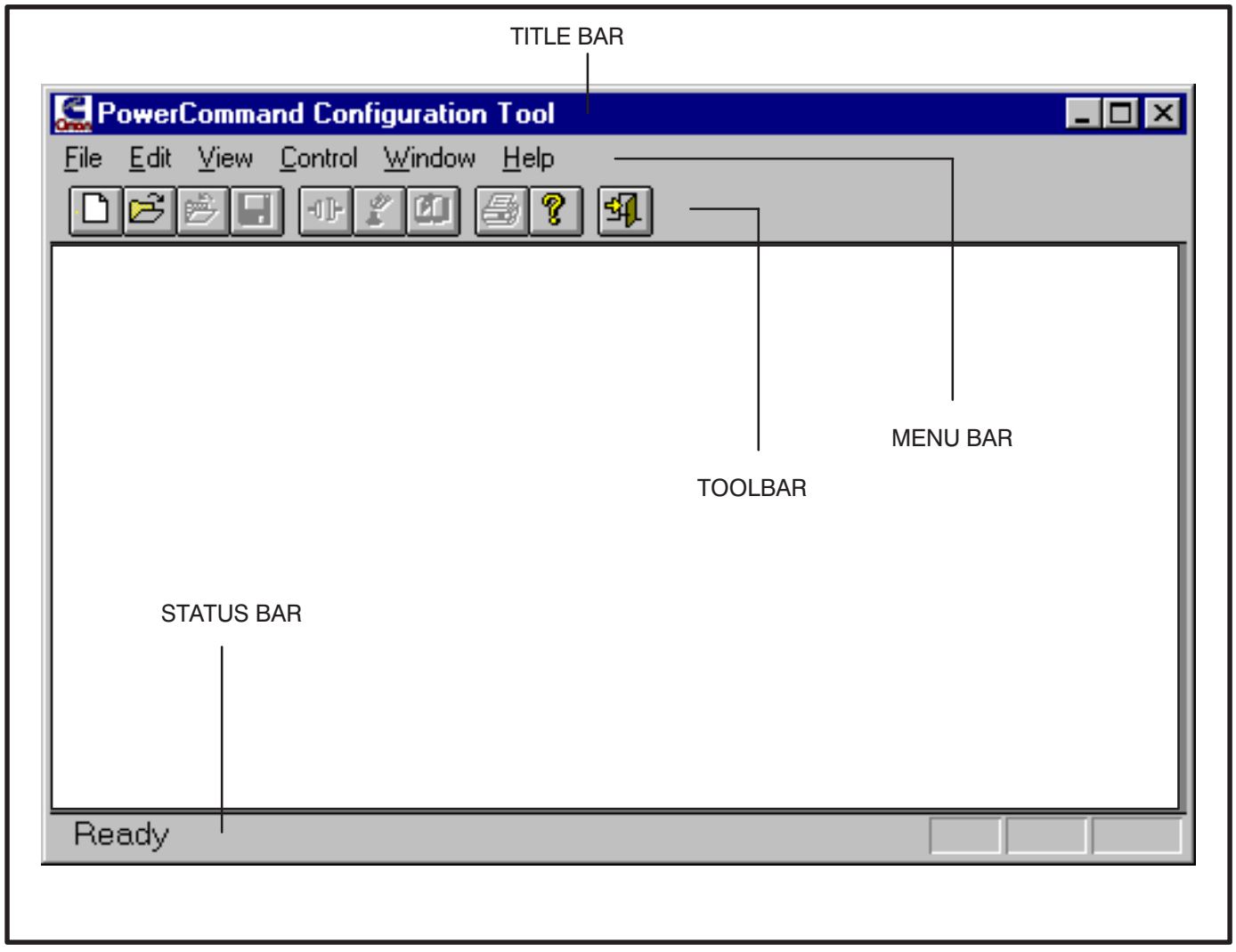

FIGURE 4-2. MAIN WINDOW

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Menu System

To display the list of options under a menu entry, move the mouse pointer to the menu name and click the left mouse button (Figure 4-3).

To select an option from a menu list, move the mouse pointer to the option name and click the left mouse button or enter the underlined keys (refer to Keyboard Access).

User Interface Features

Frequently used commands have keyboard shortcuts and toolbar access. Only commands applicable to the current active window are enabled. All other commands are grayed out.

Keyboard Access

- PowerCommand Configuration Tool uses standard Windows keyboard conventions.
- The underlined letter indicates the keyboard selection for a given menu option. For an example, refer to the File Menu in Figure 4-3.
- To select the File Menu, press and hold the “Alt” key and type an “F” (**Alt F**).
- To select Open from the File Menu, type an “O”.
- To select Open from the Main Window, without going through the File Menu, press and hold the “Ctrl” key and type an “O” (**Ctrl O**).

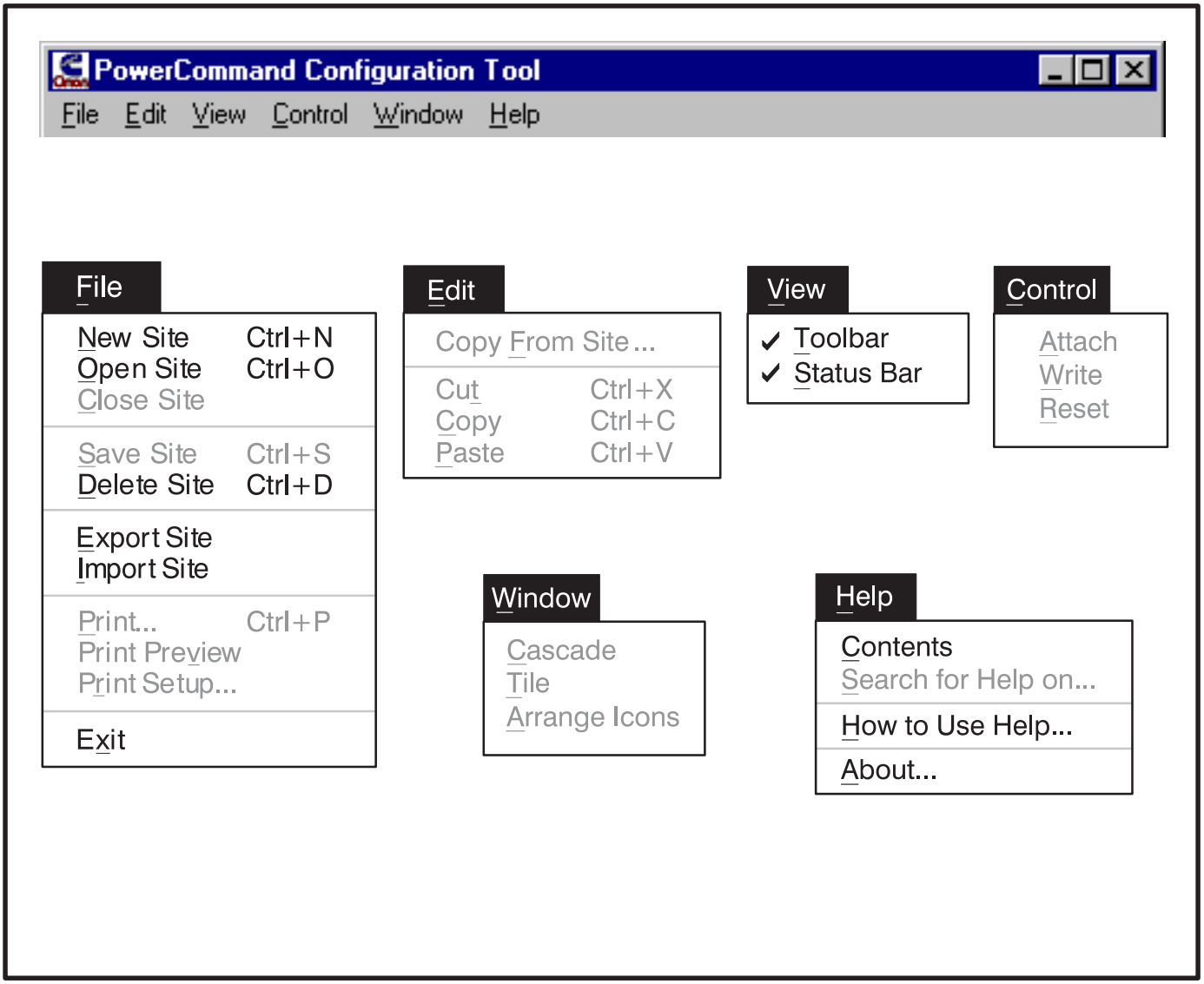

FIGURE 4-3. MENU PULL DOWN LISTS

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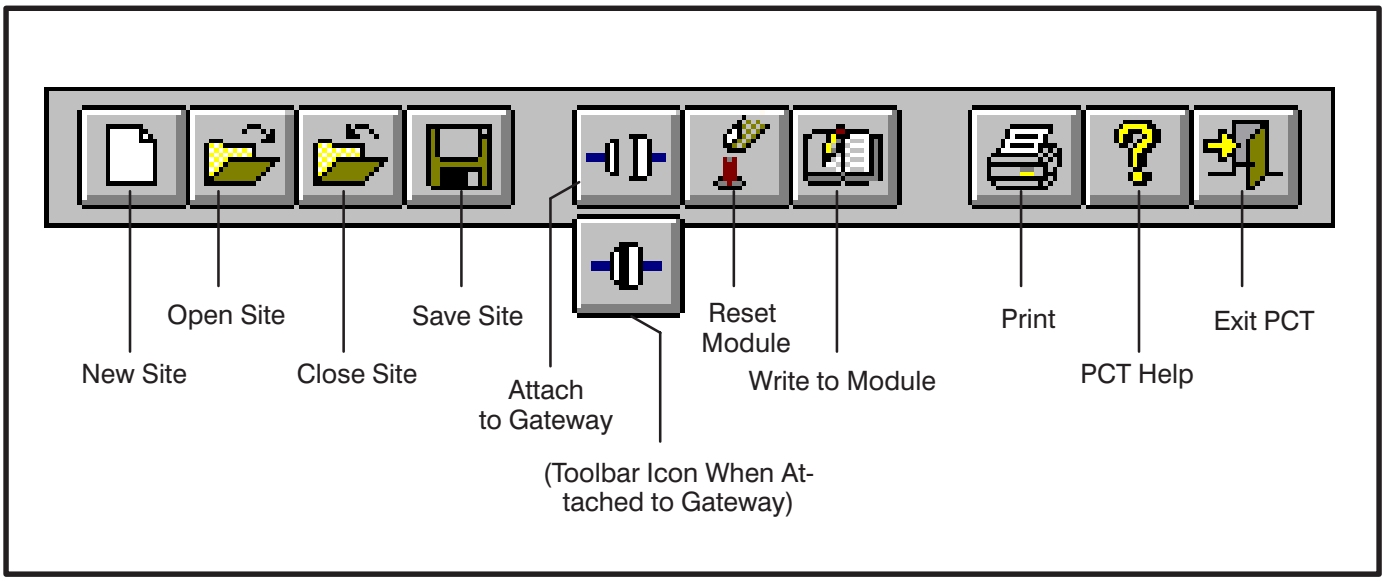

FIGURE 4-4. TOOLBAR

Toolbar

The Toolbar provides direct graphical interface shortcuts to some of the more frequently used menu options (Figure 4-4).

When a Toolbar button is grayed (dimmed), it means that the command is not available at the current time. You may need to select another action (such as opening a site) before the grayed command will be displayed in color (or black type) – indicating that it is available.

When you place the mouse pointer on a Toolbar button, a tool tip pop-up window describes the function of the button. The Status Bar shows a description of operations as they occur.

Dialog Boxes

A dialog box is a window that requires information from you. Often, when you select a function or menu option, the software will display a dialog box. You will then provide the required information by selecting an item from a list, by clicking on an option button, or by typing text. The dialog boxes are described throughout this manual.

These rules will apply to all the dialog boxes and system messages unless specified otherwise.

- The **Cancel** button allows you to close and exit a dialog box without saving any modifications and/or without executing any commands.
- The **OK** button allows you to save any changes made and/or execute a command and close the dialog or message box.

All lists that the dialog boxes display are alphabetically sorted.

Dialog boxes can also be accessed with the keyboard. The underlined letter indicates the keyboard entry for a desired selection.

- For example, if a selection bears the caption "OK," press and hold the "Alt" key and type an "O" (**Alt O**) to select it.

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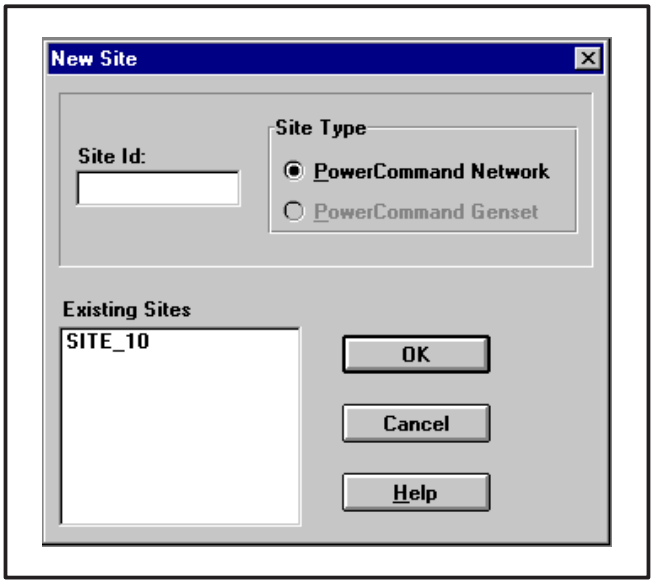

FIGURE 4-5. FILE – NEW SITE

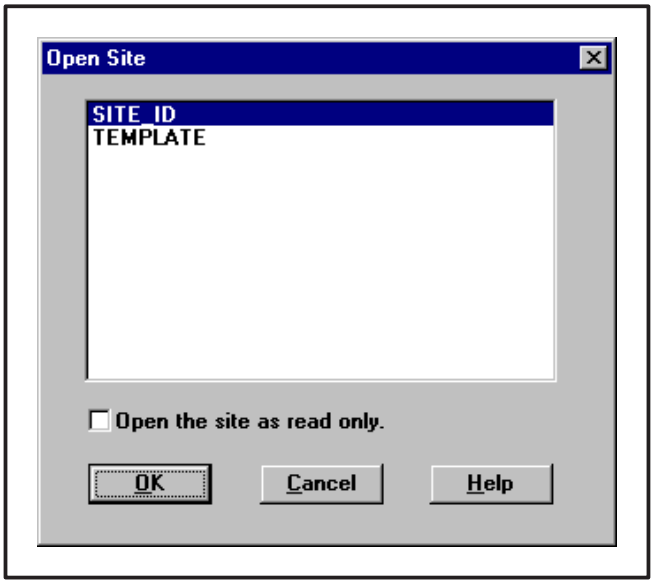

FIGURE 4-6. FILE – OPEN SITE

MENU SYSTEM DESCRIPTION

Continue through this section to review each of the file menu screens, or skip to the Setup Modules section to begin configuring a site.

File – New Site

New Site allows you to load a new site. The new site is added to the existing sites in PCT. The installer must enter a site ID with a maximum of eight characters. It is recommended that the site id be the same as name of the site directory.

File – Open Site

Open Site is used to open an existing site. The user will select a site and press OK or double click on the site. This will allow the user to view or edit an existing site or download data to a site that has already been configured and saved.

When the OK button is clicked the selected site is opened, and its modules list is displayed. The modules list will load its data from the database.

Each time the site is opened, the site information file (.CSV file) is updated. The .CSV file is used by PowerCommand for Windows (PCW).

Click on Open the site as read only box to view the current site configuration in a dialog box

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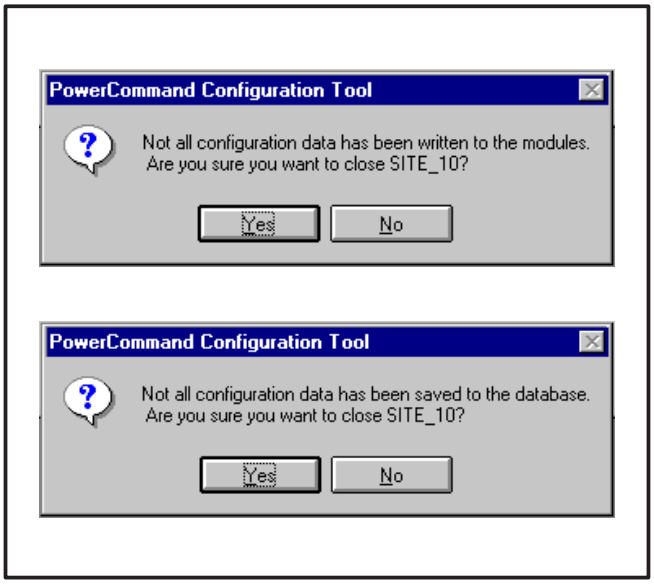

FIGURE 4-7. FILE – CLOSE SITE

File – Close Site

Closes the current site. If changes have not been written to the module(s) the user is given the option to write the changes to the module(s). If changes to the site have not been saved, the user is given the option to save the changes. Click on No to close the site and ignore the last changes.

Write will write all changes to the modules, if attached to the gateway, and save them. Save will save all changes but not write them to the module(s).

If attached to the gateway, closing will release the gateway.

File – Save Site

Saves the all configuration for the entire site.

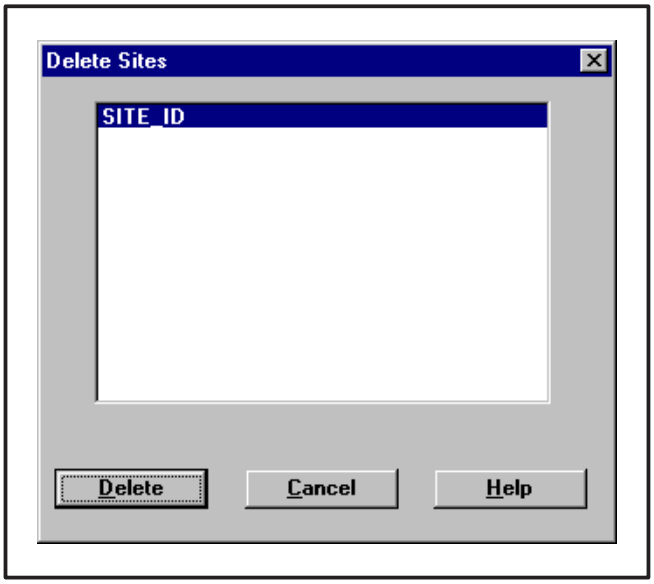

FIGURE 4-8. FILE – DELETE SITE

File – Delete Site

File – Delete Site will bring up a list of all existing sites. To delete a site, select the desired site by clicking on it, and click on Delete.

After clicking Delete, PCT will prompt you to confirm your action.

“Are you sure you want to delete <site_id>”

Click on Yes to confirm or No to cancel.

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FIGURE 4-9. FILE – EXPORT SITE

File – Export Site

File – Export Site allows the user to copy a site's configuration data to a file that may be imported into a different computer running PCT. This feature can also be used to backup a site's configuration data.

To export, select a site and click on the export button. PCT creates an export file and places it in the [PCT_PATH]\EXPORTS directory. The file name is the site ID and the extension is .pct. PCT will automatically overwrite any existing files of the same name.

The .pct file can be copied to a floppy disk for backup or for importing the configuration data into another site (refer to FIle – Import Site).

File – Print, Print Preview, Print Setup

PowerCommand Configuration Tool v1.00 does not support any printer functions.

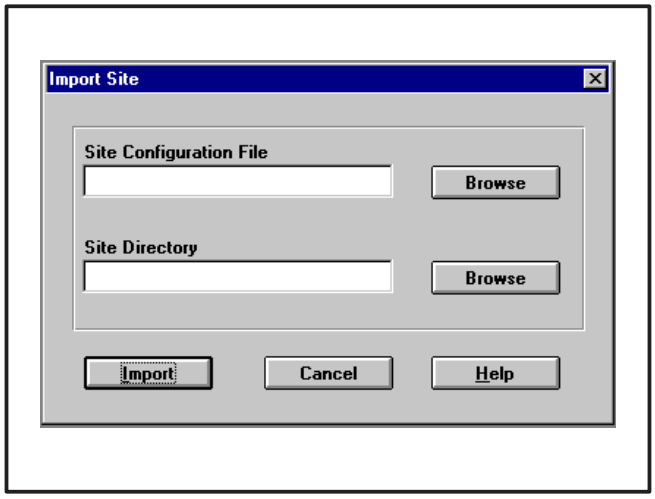

FIGURE 4-10. FILE – IMPORT SITE

File – Import Site

File – Import Site allows the user to load configuration data from an existing site to a new or existing site. The Import Site dialog prompts the user for the location of the site configuration file (.pct file) and the location of the site directory. Both must be provided.

The user can enter the location of the site configuration file manually (example: A:\site_id.pct) or click on the Browse button. (Refer to File – Export Site for creating a .pct file).

The user can type in the site directory path for the site that was created with pcnet (example: C:\onan\sites\site_id) or click on the Browse button.

PCT uses a standard windows browser to locate file types, drives, folders and files. Use the scroll bars and drop down menus to navigate to the the directory and/or file. Click on the desired directory and/or file and then click on OK.

When the Import button is clicked the configuration data is imported into the site. If that site id already exists, the user is warned and given the option to overwrite the existing site.

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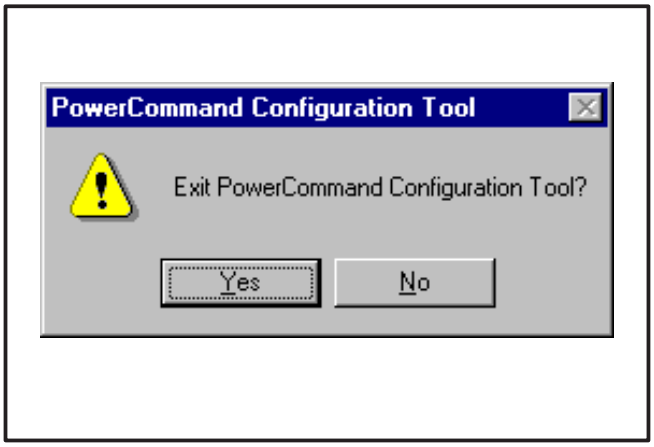

FIGURE 4-11. FILE – EXIT

File – Exit

File – Exit allows the user to exit the application. If a site is open, Exit closes the site. If changes to the site have not been saved, the user is given the option to write and/or save the changes.

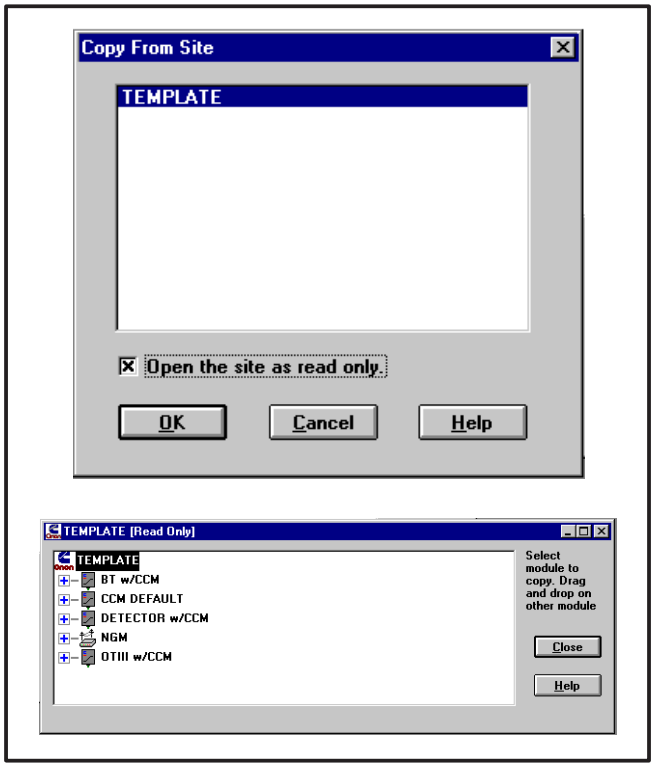

FIGURE 4-12. EDIT – COPY FROM SITE

Edit – Copy From Site

Edit – Copy From Site allows the user to copy a module's configuration from another site into the one they are currently editing.

The Copy From Site dialog displays a list of all existing sites. The user can select a site to copy from by double clicking on the site or click on the site and click on OK. This will open the site as read only.

A module's configuration can be copied by dragging the module from the Read Only Site and dropping it on a module in the current site. The drag and drop procedure only works with modules of the same type.

The drag and drop procedure does not copy: Module Name, Module Type, Site Id,

Edit – Cut, Edit – Copy, Edit – Paste

PowerCommand Configuration Tool v1.00 does not support these menu commands.

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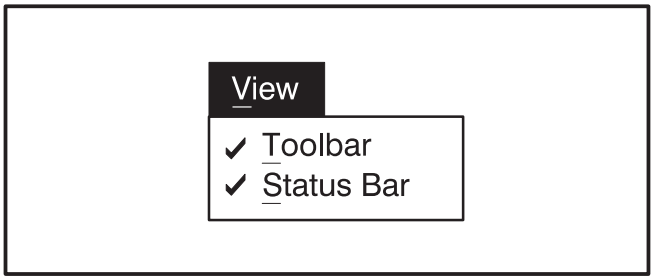

FIGURE 4-13. VIEW MENU

View Menu

The View Menu contains standard menu options for displaying (checked) or removing (unchecked) the Toolbar and Status Bar.

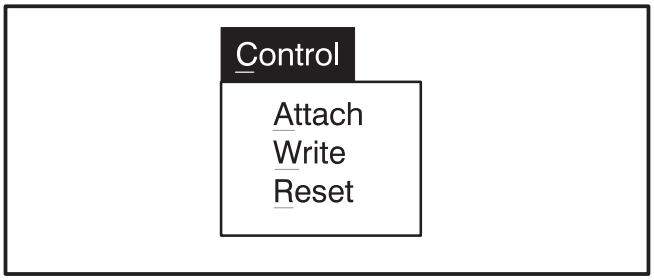

FIGURE 4-14. CONTROL MENU

Control – Attach

Control – Attach allows the user to attach to the Network Installation Gateway. The status of the connection is displayed on the Toolbar. The connector unplugged icon indicates that the PC is not attached to Installation Gateway. The connector plugged icon indicates that the PC is attached to the Installation Gateway.

If the Attach feature fails to initialize the Installation Gateway, an error message is displayed:

The gateway is not responding...

Check for the following:

1. Make sure the PC is attached to the Installation Gateway via the null modem cable. Verify that the cable connections are making good contact between the PC and Installation Gateway. Also verify that the Installation Gateway power switch is On. Try cycling power on the Installation Gateway and make sure its service LED flashes. If the service LED is blinking, exit PCT and run LonMaker and attach to the network.
2. Make sure that the Installation Gateway driver is installed as described in Network Module Library Installation section.
3. Check the COM port connection. Verify that the cable is attached to the correct COM port as specified when the driver was loaded in the config.sys file (/p1, /p2, etc.). IF PCW is setup to use the same COM port as PCT, make sure that PCW is not operating before attaching to the site with PCT.

If the Installation Gateway becomes unattached while a site is open, and the user attempts to Write to a module, the following message is displayed: *The gateway is not responding.*

Control – Write

Control – Write allows the user to download the configuration data which is selected. (Same function as the Write button in the configuration site dialog box.)

Write is enabled when a site is open, PCT is attached to the Installation Gateway and a writeable module, parameter or set of parameters is selected. (The Write feature is disabled when a module is selected that has no configurable parameters, such as a DIM or NAM.)

When the Repair – Replace feature has been used in LonMaker on a module, all configuration data must be rewritten to the module.

If the write feature fails to write to a module, the following error messages will be displayed:

Error writing LON network variable

Press the reset button on the module that is being configured. If the problem continues, refer to the Control – Attach section for troubleshooting.

Control – Reset

Control – Reset allows the user to rest a module.

Reset is enabled when a site is open and PCT is attached. Reset can be used to reset a module, or all modules in the site, depending on what is selected.

Control – Reset will not be able to reset a CCM if an error was produced while writing to the module. The reset button at the module must be used.

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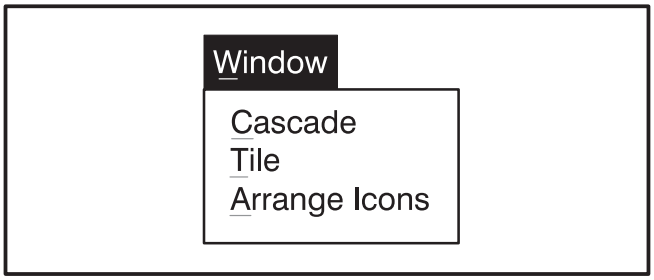

FIGURE 4-15. WINDOW MENU

Window Menu

The Window Menu contains standard Window commands for arranging dialogs.

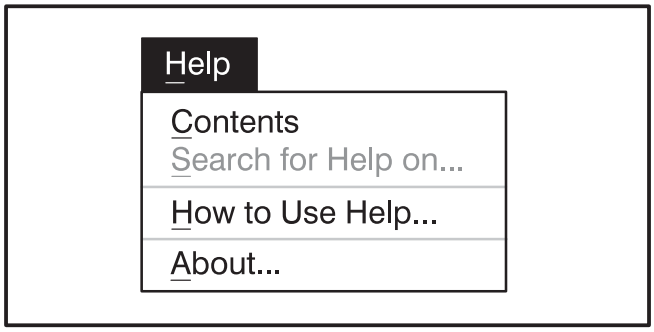

FIGURE 4-16. HELP MENU

Help Menu

The Help Menu contains standard Windows commands for accessing online help. Help – About displays the version, date, owner, company and serial number of the product.

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USING THE POWERCOMMAND CONFIGURATION TOOL

The following sections provide an overview of the tasks and procedures that can be performed with PCT. In some cases there can be more than one way to perform a function. Generally using the Toolbar or clicking a button will be easier than using the menu commands.

Creating a New Site

When the software is started, the PCT main window appears. Click on the New Site button (icon) on the Toolbar.

New Site allows you to load a new site. The new site is added to the existing sites in PCT. The installer must enter a site ID with a maximum of eight characters. It is recommended that the site id be the same as name of the site directory.

> ***Example:*** If the site directory is: "C:\onan\sites\site_10" use "SITE_10" as the Site Id.

The Site Type defaults to PowerCommand Network, the only type supported by PCT version 1.00.

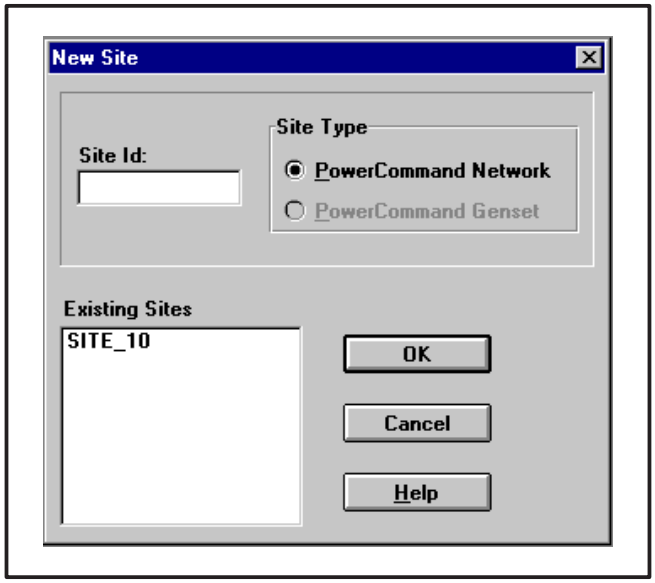

FIGURE 4-17. FILE – NEW SITE

The existing sites are displayed in the Existing Sites list box. The Existing Sites list (scrollable list) allows the user to view the installed sites when selecting a new Site Id.

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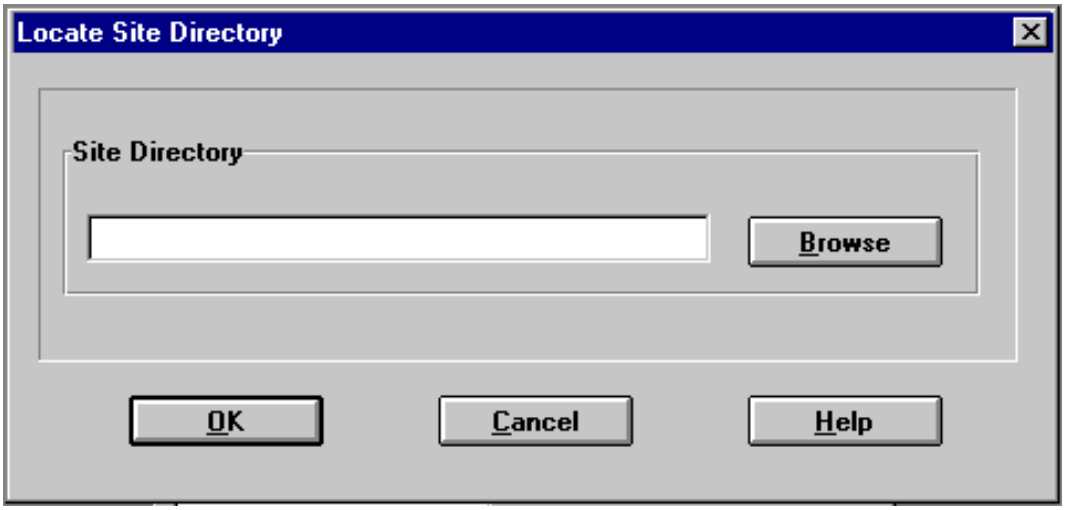

FIGURE 4-18. LOCATE SITE DIRECTORY

Site Directory Location

When the New Site OK button is clicked, the Site Directory Location dialog pops up. This dialog box allows the user to specify the location of the site directory for the new site being created.

The user can Browse for the site directory or manually enter the path of the site directory.

If the user chooses to overwrite an existing site, all information for the existing site will be lost.

Example: If the site directory is "C:\onan\sites\site_10" enter:
C:\ONAN\SITES\SITE_10
– OR –
Use the Browse button to browse to the site.

When the location of the site directory is shown, the user clicks the **OK** button and the site is loaded and opened. If the site directory is not valid, an error message will appear.

A large site may take some time to load. The modules list window will identify the modules that are present at the site (Figure 4-19). If changes have been made in LonMaker, refer to *Changes to the LonMaker Database* at the end of this section.

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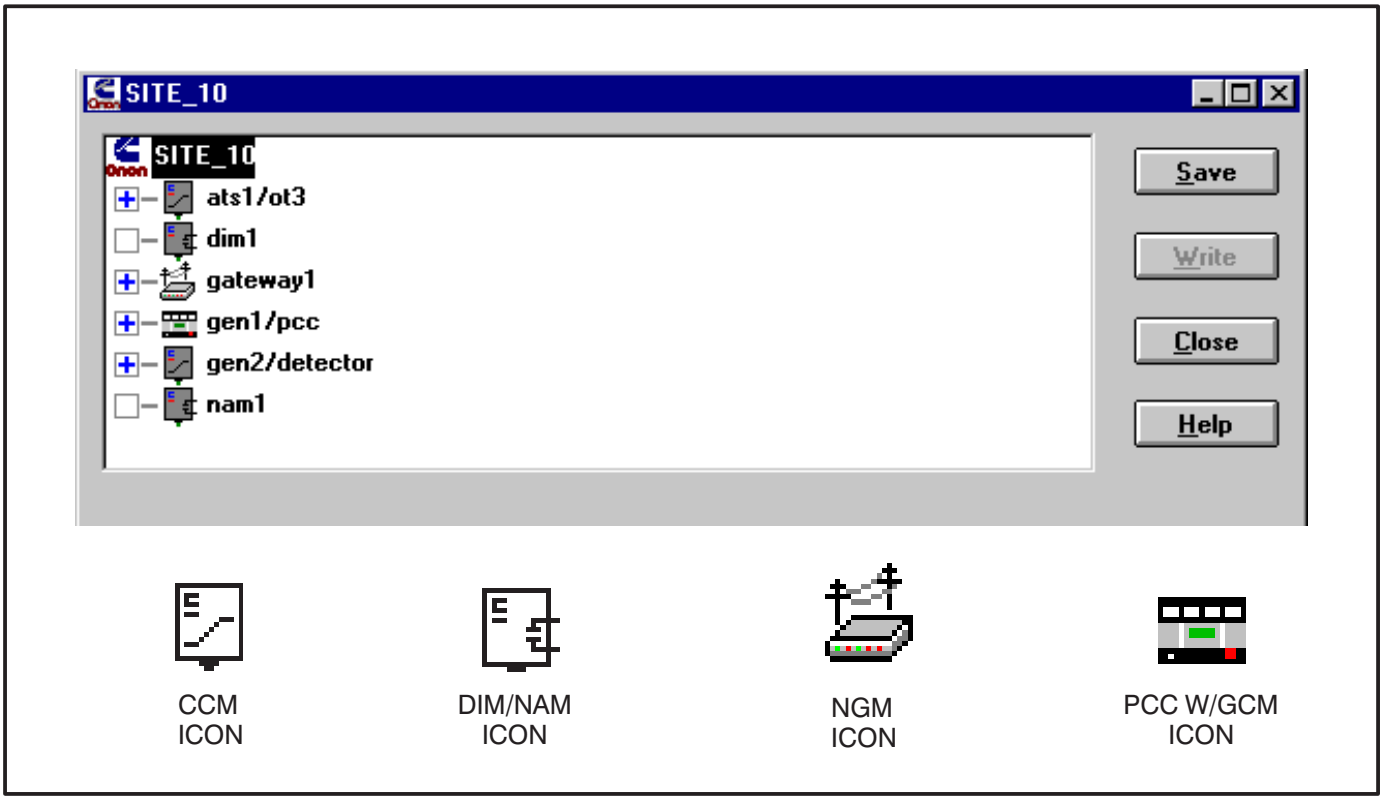

FIGURE 4-19. CONFIGURE SITE DIALOG (MODULES LIST)

Configuring a Site

Opening a site (or creating a new site), loads the Site dialog. There are four buttons allowing the user to save changes, write configuration to the module, close the site and get online help.

A box with a plus symbol (+) to the left of the module icon indicates the module has parameters to be configured. An empty box indicates the module has no configurable parameters.

Configuration information may be entered manually as described in the following sections or copied from another module (which has already been configured). To copy a module's configuration information to another module, drag the module which has already been configured (source) on top of the module which you want to configure (target) and drop it. You must confirm your action.

The source module may be in the same site or in another existing site. The target module cannot be in a site which has been opened as "Read Only". Copying a module will copy all parameters for for that module. It is not possible to copy only certain parameters.

The software is pre-loaded with five templates for quickly configuring Cummins/Onan equipment. These five templates (modules) are found in the TEMPLATE site. This site is "Read Only". Applying a template to a module is accomplished by copying a module from the TEMPLATE site. (Refer to Edit – Copy From Site, described earlier in this section).

The following section describes how to navigate the configure site dialog and how to configure modules.

To configure a module, click on the plus symbol (+) or double click on the module icon or name. The module list is expanded, listing its configurable parameters. Once expanded, A minus symbol (–) appears in the box to the left of the module allowing the user then "contract" the module. Selecting a parameter will display its configurable fields below. When displayed, the user may edit the parameter(s).

Digital I/O Modules (DIM) and Network Annunciator Modules (NAM) have no configurable parameters. Network Routers (RTR) will not appear in the site's module list.

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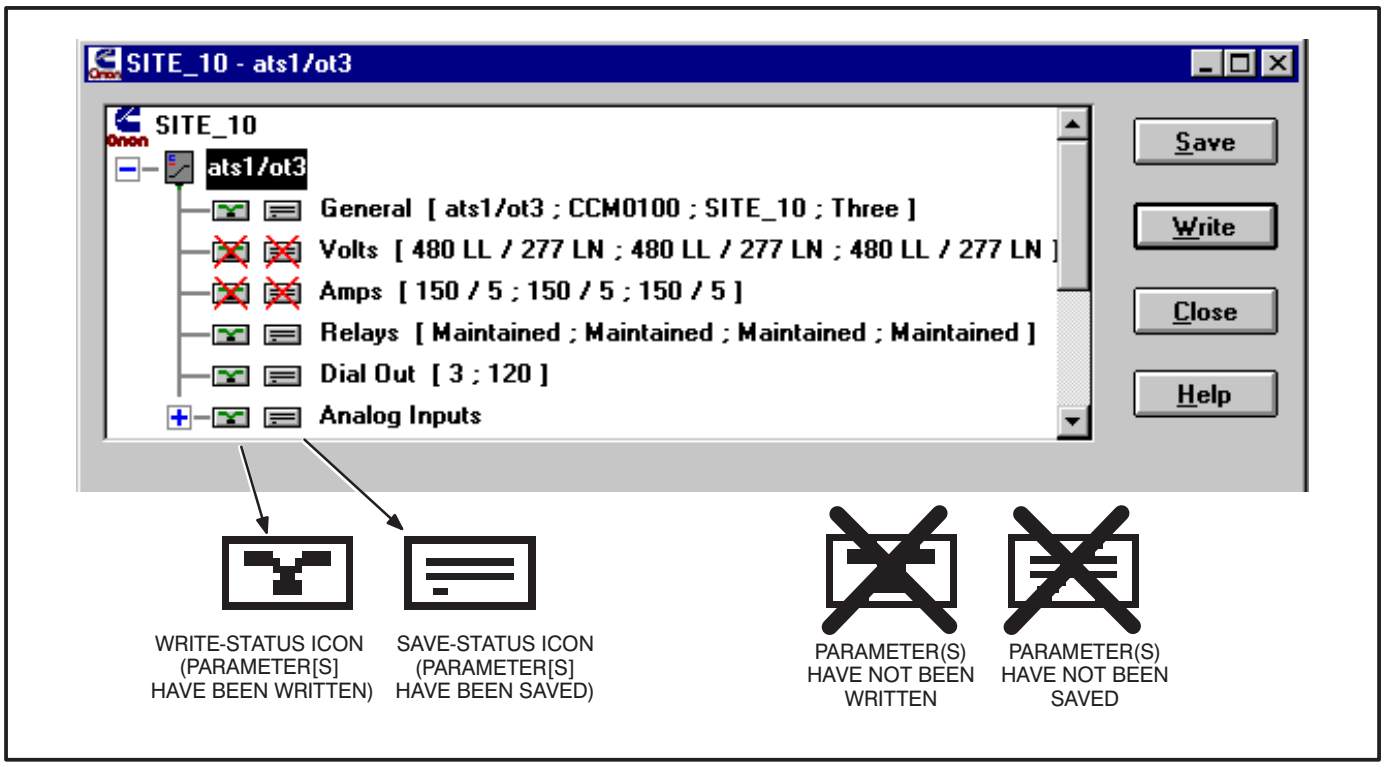

FIGURE 4-20. CONFIGURE CCM

When the list of parameters is displayed (Figure 4-20), two new icons appear to the left of each list.

The icons to the left of each parameter indicate its current status. The leftmost icon represents the write-status and the rightmost icon represents the save-status.

A red **"X"** over the write-status icon indicates that the parameter has not been written (to the module).

A red **"X"** over the save-status icon indicates that the parameter has not been saved (to the hard disk).

A description of the control buttons follows:

Save: Saves the selection (site, module, parameter or parameter set) in PCT. The user may save parameters individually as they are edited or or edit all parameters then save the entire module.

Write: Writes the selection (site, module, parameter or parameter set) to the module and then *saves*. The user may write parameters individually as they are edited or or edit all parameters then write the entire module.

When making minor changes, it is only necessary to write the parameters that have changed.

Close: Closes the site. If there are parameters in the site which have not been written, the user is informed and is allowed to return to the site. If there are parameters that have not been saved, the user is informed and allowed to return to the site.

Help: The Help button provides online help and information about the current software version.

The entire site may be configured before the user arrives at the site. To do this, the site is created using PCNET.BAT, defined using LonMaker and configured using PCT. At the site, the user must attach to the site, install the modules with LonMaker and then write their configuration with PCT.

The following sections describe how to fill in the configurable fields for each module.

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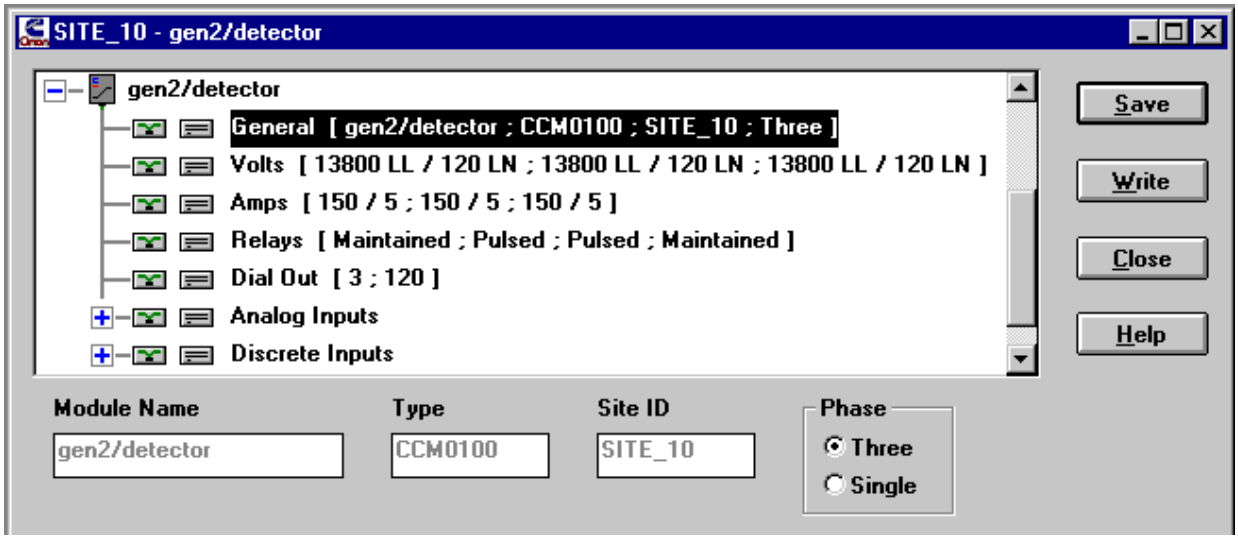

FIGURE 4-21. CONFIGURE CCM – GENERAL

CONTROLS COMMUNICATIONS MODULE

CCM – General

This parameter contains general information about the module. *Module Name*, *Type*, and *Site ID* are not configurable. They are needed for properly sending alarms and they need to be written to the module. *Phase* is the only configurable field. Phase information is needed for calculating voltages. Select Three if the CCM is monitoring three-phase voltages or Single if the CCM is monitoring single-phase voltages.

Module Name is read from the site directory. This is the device name that was defined in LonMaker.

Type is read from the site directory. This is the firmware version of the module.

Site ID was entered by the user when the site was created.

Phase selects the number of phases for the voltage of the equipment that is being monitored. Click on the radio button to select the desired phase setting. Match the phase setting with configuration of the equipment being monitored by the CCM.

Like any configurable field, the Phase selection can be made before going to a site. The new data can be saved ahead of time, but the computer running PCT must be attached to the site before writing to the network module.

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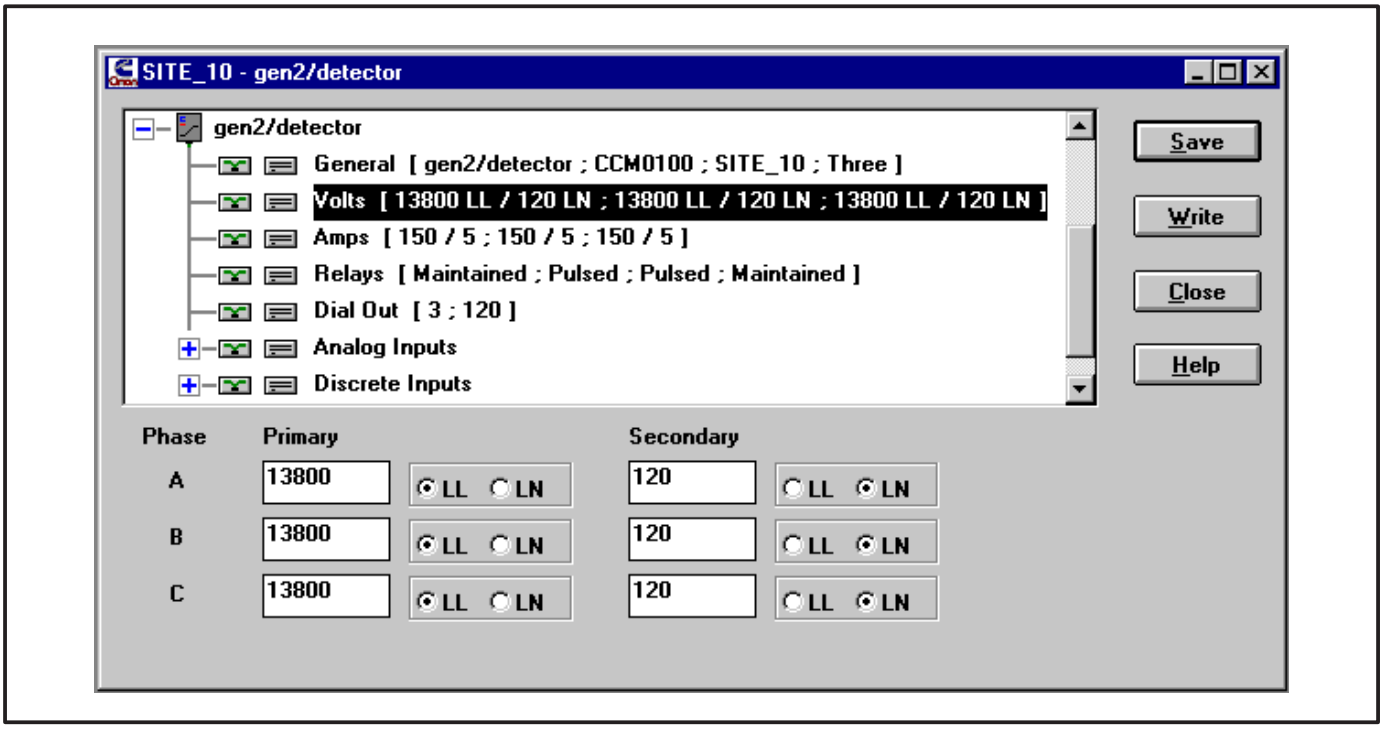

FIGURE 4-22. CONFIGURE CCM – VOLTS

CCM – Volts

This parameter contains information on external Potential Transformers (PTs) which may be used to step down the line voltages. Secondary refers to the voltage applied to the CCM. For each phase, enter the nominal *Primary* and *Secondary* voltages and units (volts LN or volts LL) of the PTs. If the CCM is directly monitoring the line voltage (external PTs are not used), enter the nominal line voltage in the *Primary* and *Secondary* fields.

Valid PT ratios (*Primary:Secondary*) are 0 to 138. Valid values for Secondary are 1 to 425 Volts LN (736 Volts LL).

Example 1: The CCM is monitoring the load-side of a Transfer Switch (3-phase, 13,800 volts LL). External PTs are used to step-down the line voltage from 13,800 Volts LL to 120 Volts LN.

General: Select Three.
Volts: *For each phase:* Enter 13800 for *Primary* and select LL. Enter 120 for *Secondary* and select LN.

Example 2: The CCM is directly monitoring a Genset with a single-phase output of 240 Volts LL.

General: Select Single.
Volts:

Phase A: Enter 120 for *Primary* and select LN. Enter 120 for *Secondary* and select LN.

Phase B: Enter 120 for *Primary* and select LN. Enter 120 for *Secondary* and select LN.

Phase C: Enter 0 for *Primary* and select LN. Enter 120 for *Secondary* and select LN.

When viewing the module in PowerCommand for Windows, if the displayed voltages are higher (on average) than the measured line voltages, decrease the *Primary* value(s). Likewise, if the displayed voltages are lower (on average) than the measured voltages, increase the *Primary* value(s).

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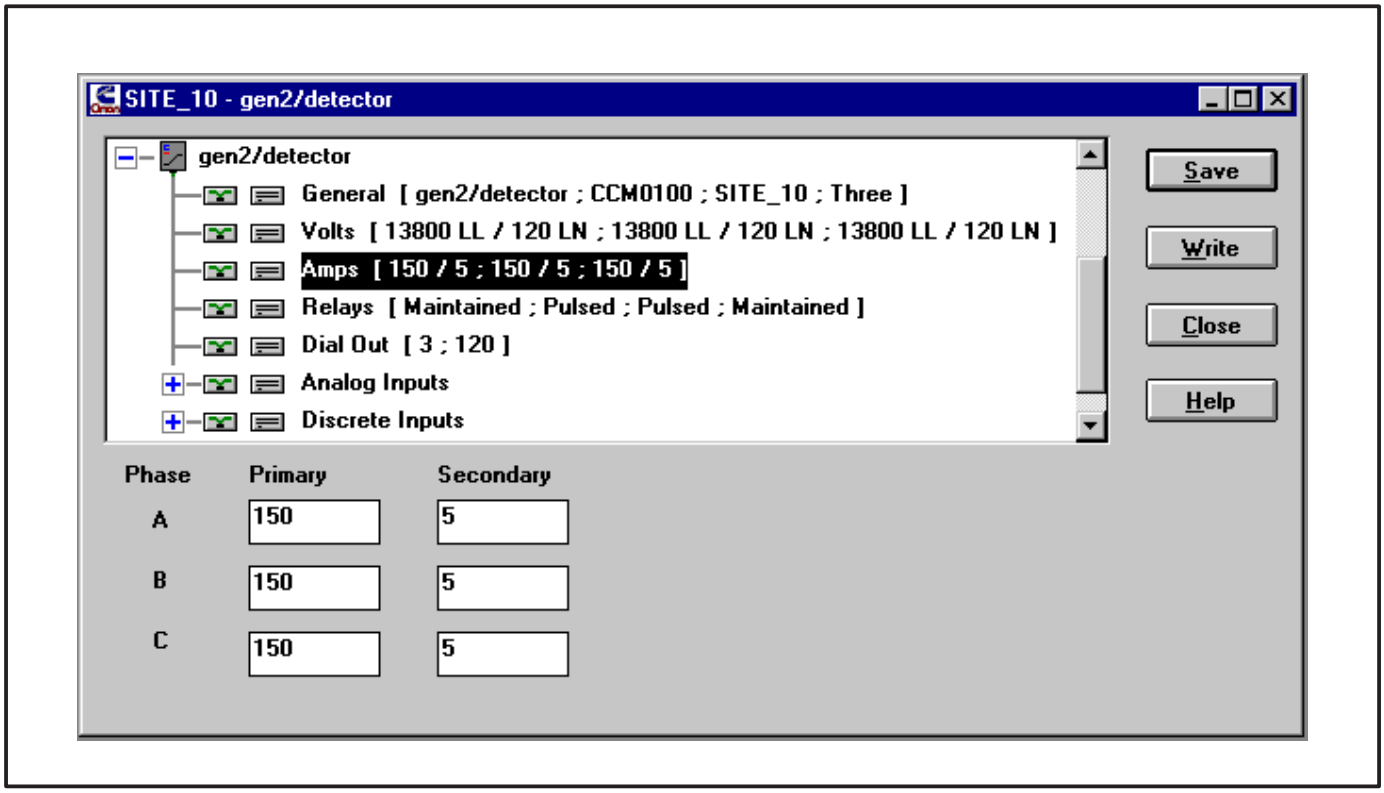

FIGURE 4-23. CONFIGURE CCM – AMPS

CCM – Amps

This parameter contains information on external Current Transformers (CTs) which must be used to step-down the line currents. *Secondary* refers to the current winding connected to the CCM. For each phase, enter the nominal *Primary:Secondary* CT ratio.

Valid CT ratios (*Primary:Secondary*) are 0 to 10,720. Valid values for Secondary are 1 to 5 (Amps).

Example: The CCM is monitoring the load-side of a Transfer Switch (3-phase). External CTs are used to step-down the line currents. The CT ratio is 10,000:5.

Amps: *For each phase:* Enter 10000 for *Primary* and 5 for *Secondary*.

When viewing the module in PowerCommand for Windows, if the displayed currents are higher (on average) than the measured line currents, decrease the Primary value(s). Likewise, if the displayed currents are lower (on average) than the measured currents, increase the Primary value(s).

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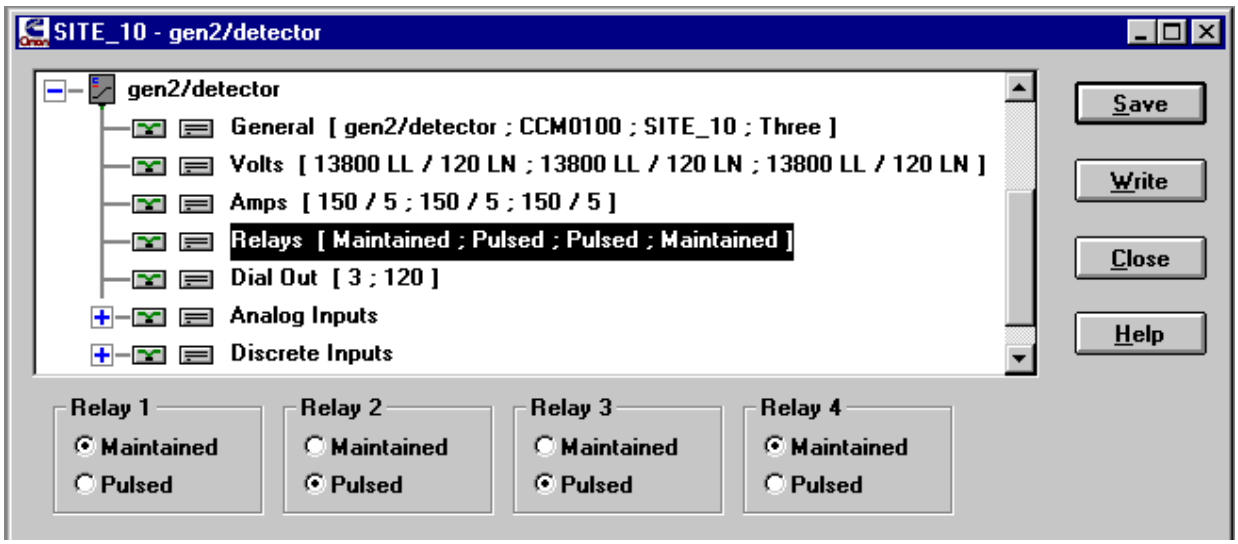

FIGURE 4-24. CONFIGURE CCM – RELAYS

CCM – Relays

This parameter configures the four CCM on-board relays (K1–K4). Each relay may be configured as *Maintained* or *Pulsed*. To configure the relays, click on the radio button below each relay to select the desired setting.

If configured as *Maintained*, when activated the relay is energized indefinitely. The relay remains energized until de-activated.

If configured as *Pulsed*, when activated the relay is energized for approximately 1 second, then it is de-energized. This is useful for signaling an alarm which has its own timing circuit (like a pulsed alarm input on a paralleling system). Or for resetting equipment that requires a pulsed contact closure.

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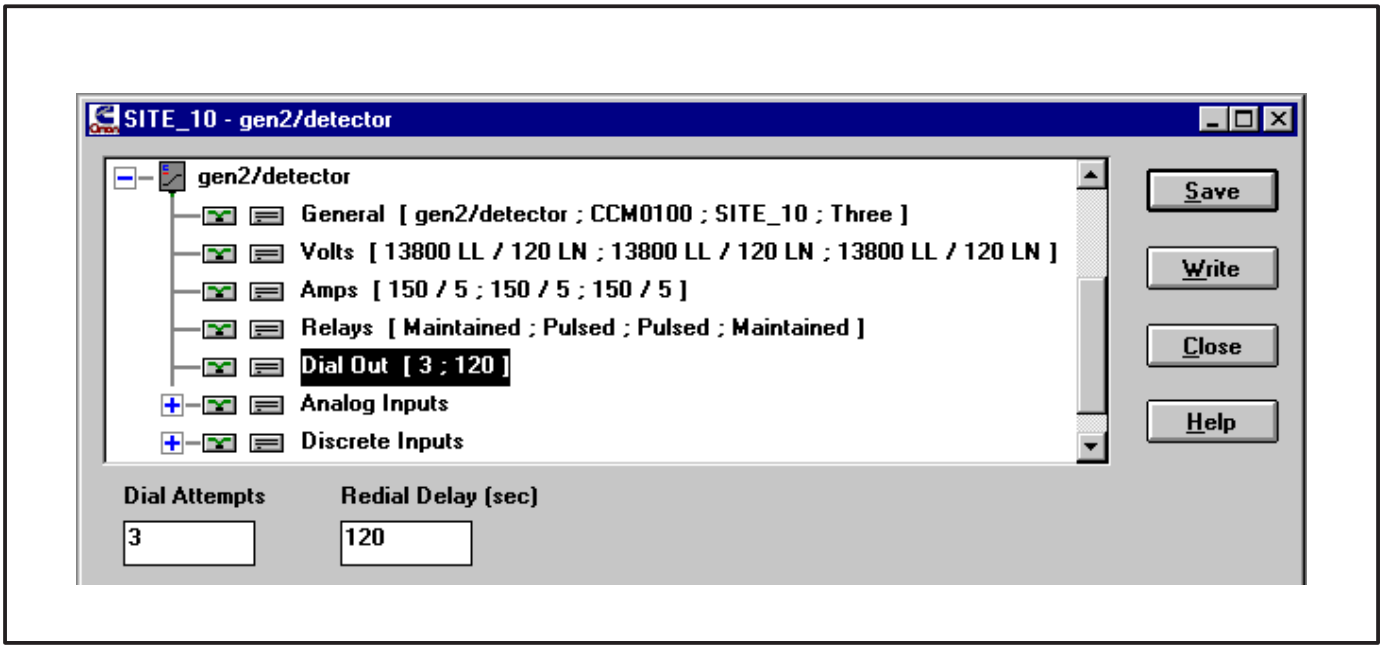

FIGURE 4-25. CONFIGURE CCM – DIAL OUT

CCM – Dial Out

This parameter configures the re-dial operation when sending an alarm. *Dial Attempts* controls the number of times the module will attempt to deliver an alarm. *Dial Attempts* must be between 1 and 255. The CCM will automatically retry sending an alarm if the first attempt fails (busy, no dial tone, etc.)

Redial Delay (in seconds) controls the delay between *Dial Attempts*. *Redial Delay* must be between 10 and 65,535 (seconds).

> ***Example:*** If sending an alarm fails on the first attempt, you would like the module to retry 5 times and wait 2 minutes between retries.
>
> ***Dial Attempts:*** Enter 6.
>
> ***Redial Delay:*** Enter 120.

CCM – Analog Inputs

All 7 analog input configurations are grouped together in their own parameter set (Figure 4-26). To view or edit any one of the 7 configurations, click on the plus symbol (+) or double click on the parameter set name (*Analog Inputs*). When expanded, all 7 analog input configurations are listed with their current settings. To contract the set, click on the minus symbol (–) or double click on *Analog Inputs*. (Refer to Appendix C, Determine Sender Settings section, for reference.)

CCM – Temperature 1, Temperature 2, Temperature 3

These parameters configure the I/O characteristic of analog inputs *Temperature 1*, Temperature 2 and *Temperature 3*. These inputs can be used to monitor various temperature senders. Select the desired input to configure and edit the *Sender Voltage*, *Meter Reading* and *Sender Gain* fields to yield meaningful temperature values.

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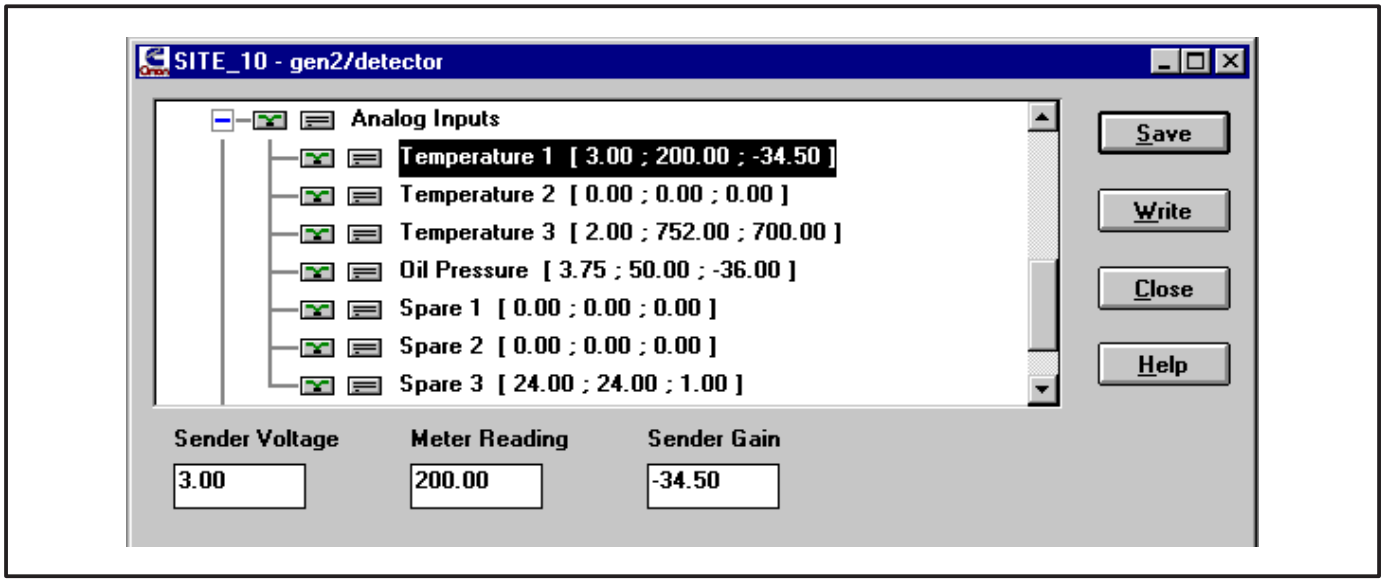

FIGURE 4-26. CONFIGURE CCM – TEMPERATURE INPUTS

Sender Voltage is the DC voltage of the sender at a known operating point. Valid values are 0 to +9 (VDC).

Meter Reading is the gauge value of the sender at the same known operating point. Valid values vary with *Sender Gain* (Units may vary).

Sender Gain is the relational slope of Meter Reading to Sender Voltage. Valid values are –838 to +838 (Units/VDC).

Refer to Table 4-1 for sample temperature sender settings.

These values are only nominal. Verify these values yield acceptable readings. If not, refer to Appendix C for determining the specific sender characteristics.

Example 1: The CCM is monitoring a Detector/DK Genset with Temperature 1 monitoring the coolant temperature and Temperature 3 monitoring the exhaust temperature. The customer would like to view all data in English (Imperial) units.

Temperature 1: Enter 3.00 for *Sender Voltage*, 200 for *Meter Reading* and –34.50 for *Sender Gain*.

Temperature 3: Enter 2.00 for *Sender Voltage*, 752 for *Meter Reading* and 700 for *Sender Gain*.

Example 2: The CCM is monitoring a non-Onan Genset with Temperature 1 monitoring an RTD coolant temperature sender and Temperature 3 monitoring an RTD exhaust temperature sender. The customer would like to view all data in Metric units.

Temperature 1: Enter 3.00 for *Sender Voltage*, 80 for *Meter Reading* and 53.9 for *Sender Gain*.

Temperature 3: Enter 2.00 for *Sender Voltage*, 400 for *Meter Reading* and 388.8 for *Sender Gain*.

TABLE 4-1. TEMPERATURE SENDER GAIN SETTINGS

	SENDER	SENDER VOLTAGE	METER READING	SENDER GAIN
TEMP (OIL/COOL)	Detector/DK (Imperial) Detector/DK (Metric)	3 (VDC) 3 (VDC)	200 (°F) 93.3 (°C)	–34.5 (°F/VDC) –19.2 (°C/VDC)
	500–2200 Ω RTD (Imperial) 500–2200 Ω RTD (Metric)	3 (VDC) 3 (VDC)	176 (°F) 80 (°C)	97.1 (°F/VDC) 53.9 (°C/VDC)
TEMP (EXHAUST)	80–390 Ω RTD (Imperial) 80–390 Ω RTD (Metric)	2 (VDC) 2 (VDC)	752 (°F) 400 (°C)	700 (°F/VDC) 388.8 (°C/VDC)

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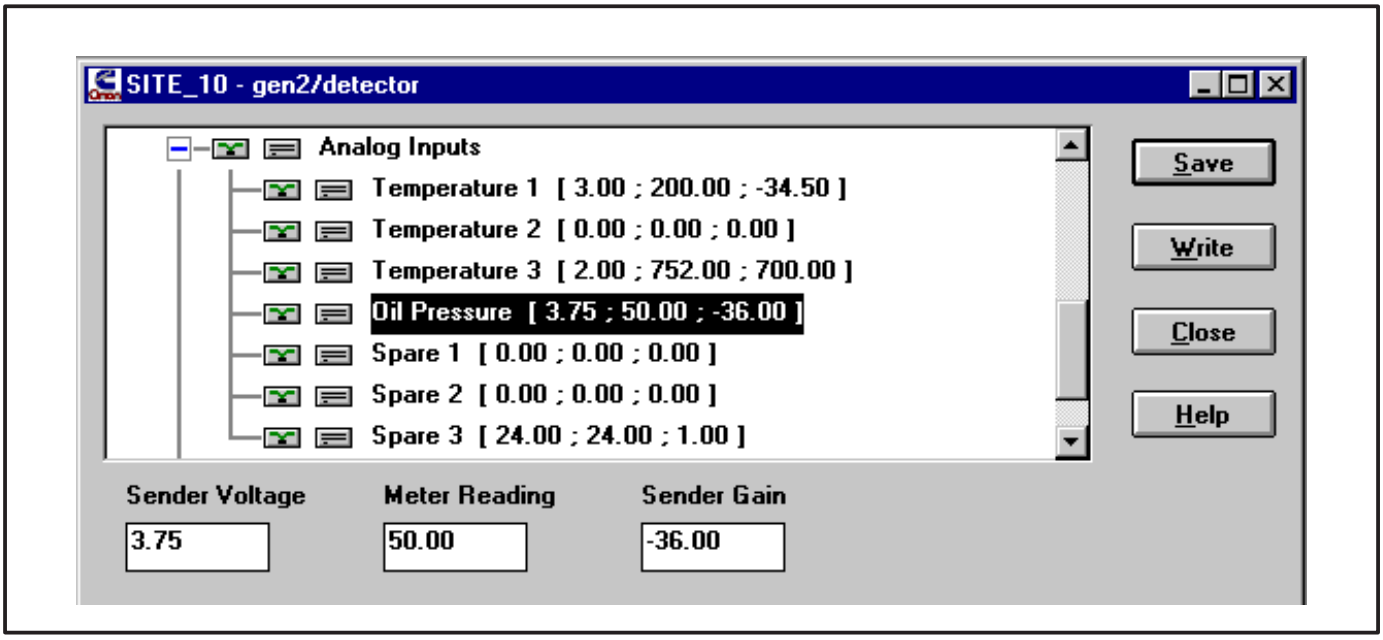

FIGURE 4-27. CONFIGURE CCM – OIL PRESSURE

CCM – Oil Pressure

This parameter configures the I/O characteristic of analog input *Oil Pressure*. This input can be used to monitor various oil pressure senders. Select *Oil Pressure* and edit the *Sender Voltage*, *Meter Reading* and *Sender Gain* fields to configure the input to yield meaningful pressure values.

Sender Voltage is the DC voltage of the sender at a known operating point. Valid values are 0 to +9 (VDC).

Meter Reading is the gauge value of the sender at the same known operating point. Valid values vary with Sender Gain (Units may vary).

Sender Gain is the relational slope of Meter Reading to Sender Voltage. Valid values are –838 to +838 (Units/VDC)

Refer to Table 4-2 for sample oil pressure sender settings.

These values are only nominal. Verify these values yield acceptable readings. If not, refer to Appendix C for determining the specific sender characteristics.

Example 1: The CCM is monitoring a Detector/DK Genset. The customer would like to view all data in English (Imperial) units.

Oil Pressure: Enter 3.75 for *Sender Voltage*, 50 for *Meter Reading* and –36 for *Sender Gain.*

Example 2: The CCM is monitoring a non-Onan Genset with a Kavlico oil pressure sender. The customer would like to view all data in Metric units.

Oil Pressure: Enter 2.50 for *Sender Voltage*, 344.8 for *Meter Reading* and 172.4 for *Sender Gain*.

TABLE 4-2. PRESSURE SENDER GAIN SETTINGS

	SENDER	SENDER VOLTAGE	METER READING	SENDER GAIN
PRESSURE	Detector/DK (Imperial) Detector/DK (Metric)	3.75 (VDC) 3.75 (VDC)	50 (PSI) 344.8 (kPa)	–36 (PSI/VDC) –248.2 (kPa/VDC)
	Kavlico (Imperial) Kavlico (Metric)	2.5 (VDC) 2.5 (VDC)	50 (PSI) 344.8 (kPa)	25 (PSI/VDC) 172.4 (kPa/VDC)

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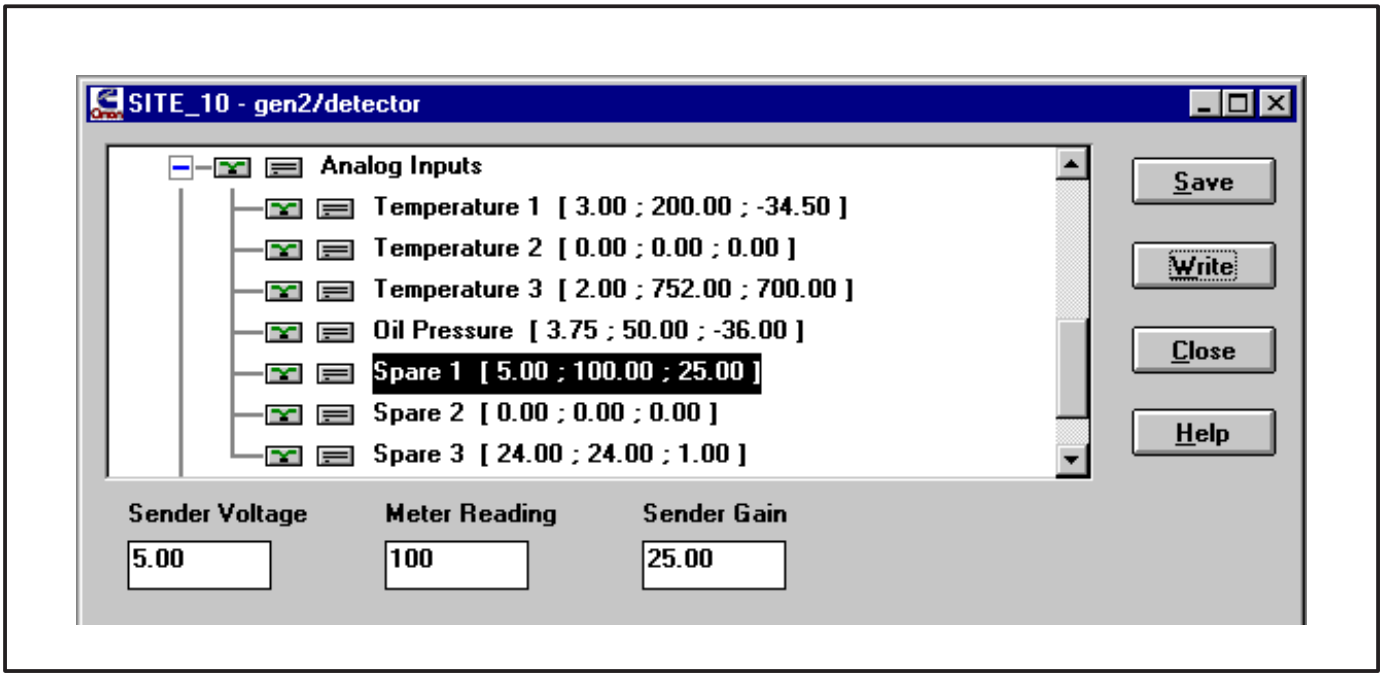

FIGURE 4-28. CONFIGURE CCM – SPARE INPUTS

CCM – Spare 1, Spare 2

These parameters configure the I/O characteristic of analog inputs Spare 1 and Spare 2. These can be used to monitor customer-defined 0–5 VDC analog voltages. Select the desired input to be configured and edit the *Sender Voltage*, *Meter Reading* and *Sender Gain* fields to yield meaningful values.

Sender Voltage is the DC voltage of the sender at a known operating point. Valid values are 0 to +5 (VDC).

Meter Reading is the gauge value of the sender at the same known operating point. Valid values vary with Sender Gain (Units may vary).

Sender Gain is the relational slope of *Meter Reading* to *Sender Voltage*. Valid values are –503 to +503 (Units/VDC) .

> ***Example:*** The CCM is monitoring a 24V Detector/DK Genset. Spare 1 is used to monitor the fuel level in the day tank. The fuel level sender gives 5.0 VDC when the tank is full (100 gal) and 1 VDC when the tank is empty. The customer would like to view all data in English (Imperial) units.
>
> ***Spare 1:*** Enter 5.00 for *Sender Voltage*, 100 for *Meter Reading* and 25.00 for *Sender Gain*.

CCM – Spare 3 (Battery Volts)

This parameter configures the I/O characteristic of analog input Spare 3. Because it allows 0 to 36 VDC, Spare 3 is typically used to monitor battery voltage, but may monitor any 0 to 36 VDC signal. Select *Spare 3* and edit the *Sender Voltage*, *Meter Reading* and *Sender Gain* fields to yield meaningful values.

Sender Voltage is the DC voltage of the sender at a known operating point. Valid values for Spare 3 are 0 to +36 (VDC).

Meter Reading is the gauge value of the sender at the same known operating point. Valid values vary with Sender Gain (Units may vary).

Sender Gain is the relational slope of *Meter Reading* to *Sender Voltage*. Valid values are –85 to +85 (Units/VDC) .

> ***Example:*** The CCM is monitoring a 24V Detector/DK Genset. The customer would like to view all data in English (Imperial) units.
>
> ***Spare 3:*** Enter 24.0 for *Sender Voltage*, 24.0 for *Meter Reading* and 1.00 for *Sender Gain*.

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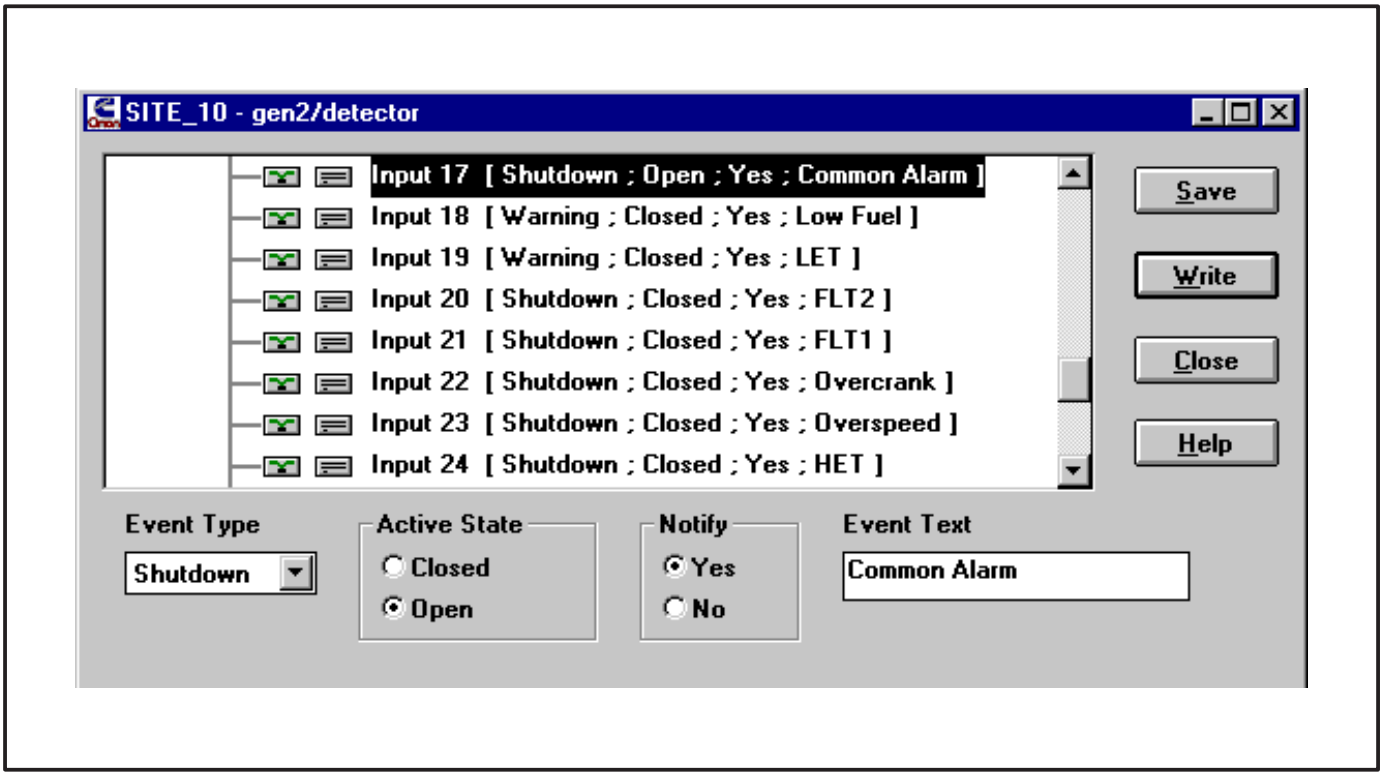

FIGURE 4-29. CONFIGURE CCM – DISCRETE INPUTS

CCM – Discrete Inputs

All 32 discrete input configurations are grouped together in their own parameter set. To view or edit any one of the 32 configurations, click on the plus symbol (+) or double click on the parameter set name *Discrete Inputs*. When expanded, all 32 analog input configurations are listed with their current settings. To contract the set, click on the minus symbol (–) or double click on *Discrete Inputs*.

These parameters configure the 32 discrete customer inputs. The inputs are used to monitor equipment status and send alarms to a remote or local PC if the status becomes active. If the input is also used to send an alarm (*Notify*), the *Event Type* and *Event Text* must be configured. The *Active State* of each input must be configured.

Event Type: This field configures the level of an alarm/event. *Event Type* only applies when *Notify* is "Yes".

Event: This will force the event message to be immediately logged at the host. This is useful for logging system events that do not require acknowledgment by a user. An Event will not send a popup alarm.

Warning: This may force a pop-up message at the remote PC (if remote PC is configured as such). The alarm requires acknowledgment by a user before it is logged.

Shutdown: This may force a pop-up message at the remote PC (if remote PC is configured as such). The alarm requires acknowledgment by a user before it is logged.

Active State: This field configures the state of the input which is considered "active". Some input signals are active when they go to ground while others are active when they go to B+. The Active State field allows the user to configure the input for either scenario. The *Active State* of each input must be configured.

Closed: The input is activated when the input is shorted to ground.

Open: The input is activated when the input is removed from ground.

Notify: This field configures the module to send an alarm when the input is activated or not to. If a user would like notification of this input becoming active, select "Yes". If this input does not require notification when activated, then select "No". If "No", *Event Type* and *Event Text* need not be configured.

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Event Text: This field configures the text message which will be sent when the input is activated. *Event Text* only applies when *Notify* is "Yes". The message may be 16 alpha-numeric characters including spaces. Enter a meaningful message describing the state of the input.

Example 1: The CCM is monitoring a Detector/DK Genset. The customer would like to be notified (via pop-up message at their office PC) on any change of the Genset status.

Open the TEMPLATE site. Drag the DETECTOR w/CCM template onto the CCM in the site you are configuring and drop. Confirm the copy command. Select *Discrete Inputs* and click on Write to complete this configuration.

Example 2: The CCM is monitoring a non-Onan Genset. The Genset has 2 output signals available: "Running" and "Genset Fault". The "Running" output is normally closed while the "Genset Fault" output is normally open. The customer would like to be notified (via pop-up message at their office PC) on any change of the Genset status.

Input 1: Select "Warning" for *Event Type*, "Closed" for *Active State*, "Yes" for *Notify* and enter "Running" for Event Text.

Input 2: Select "Warning" for *Event Type*, "Open" for *Active State*, "Yes" for *Notify* and enter "Genset Fault" for *Event Text*.

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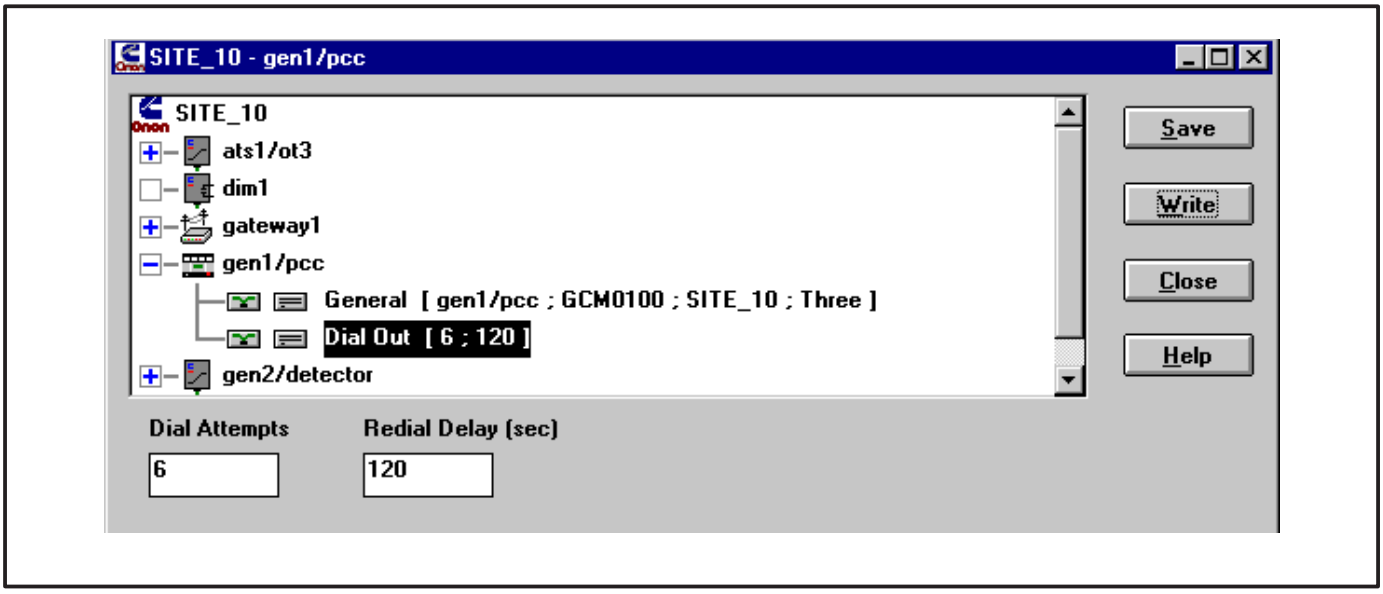

FIGURE 4-30. CONFIGURE GCM

GENSET COMMUNICATIONS MODULE

PCC W/GCM – General

This parameter contains general information about the module. *Module Name*, *Type* and *Site ID* fields are not configurable. They are needed for sending alarms properly, therefore must be configured. Phase is the only configurable field. Phase information is needed for calculating voltages. Select Three if the PowerCommand Genset is generating three-phase voltage or Single if it is generating single-phase.

Dial Out

This parameter configures the re-dial operation when sending an alarm. *Dial Attempts* controls the number of times the module will attempt to deliver an alarm. *Dial Attempts* must be between 1 and 255. The GCM will automatically retry sending an alarm if the first attempt fails (busy, no dial tone, etc.)

Redial Delay (in seconds) controls the delay between *Dial Attempts*. *Redial Delay* must be between 10 and 65,535 (seconds).

Example: If sending an alarm fails on the first attempt, you would like the module to retry 5 times and wait 2 minutes between retries.

Dial Out: Enter 6 for *Dial Attempts* and 120 for *Redial Delay*.

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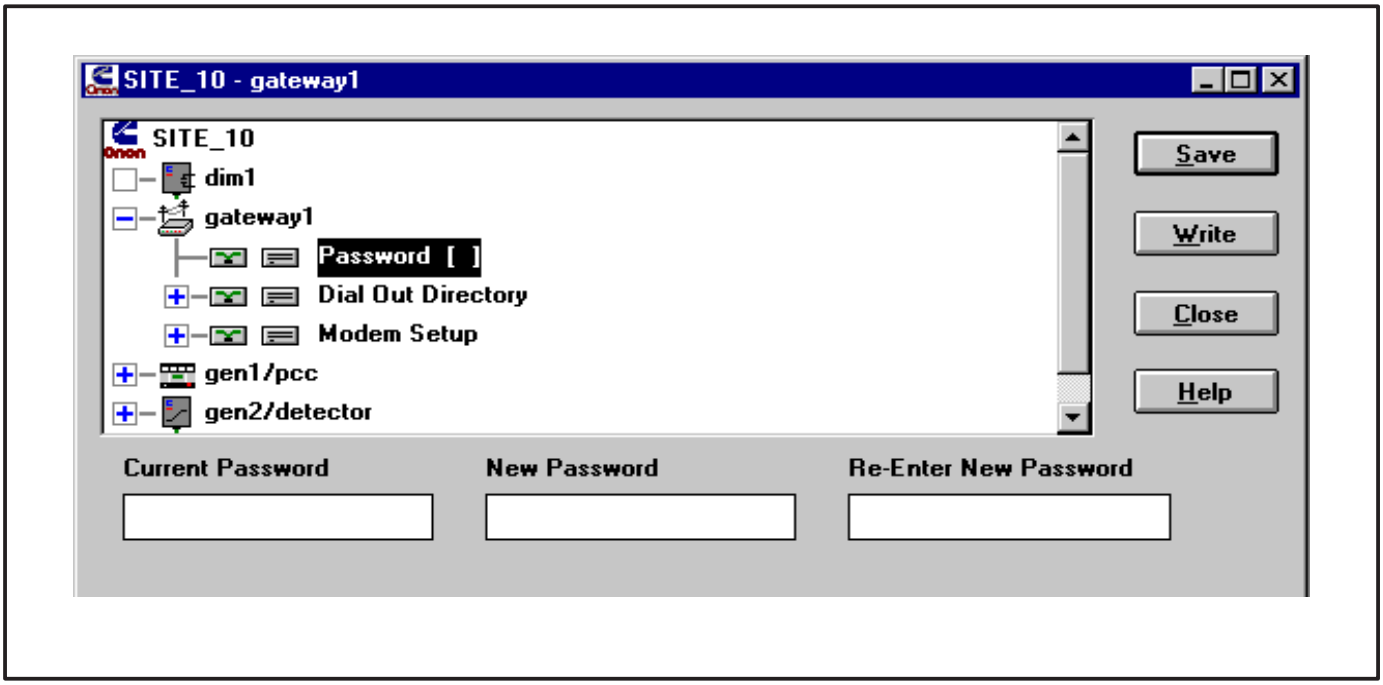

FIGURE 4-31. CONFIGURE NGM – PASSWORD

NETWORK GATEWAY MODULE

Cycle power on the NGM after all configuration settings have been written. To retrieve the default settings for an NGM (remote connection), copy the "NGM" template from the TEMPLATE site.

NGM – Password

This parameter configures the [site] password for a Network Gateway Module. If a password is used, a host must present the correct password before being allowed into the site. The password is limited to 8 characters. To change the password, the user must type the new password twice. An error will be produced if not re-entered correctly.

Setting a password is recommended to add security for the customers site. A password will also protect the site NGM from accidental loss of configuration information as the result of attempted use as a Network Installation Gateway.

Changing the password to "" (blank), removes the password and no password is required for access to the site. The user need not know the Current Password to change the password.

Whenever the Password is changed for a Local connection, the user must cycle power on the NGM before the new password takes effect.

Current Password: If a password was previously configured, this field will contain an * for each character, enter the current password. If no current password exists (the field is blank), then this field must be left blank. The default for new installations will not contain a current NGM password.

If a password is needed and the Current Password field is blank, tab to the New Password field to enter a new password (maximum of eight characters).

New Password: The new password (masked with * for each character) must be entered twice. Enter the password for the second time in the Re-Enter New Password field exactly the way it entered in the New Password Field. Record the password in a safe location.

This password must also be entered in the PCW Site Setup screen "Password:" in order to access this site.

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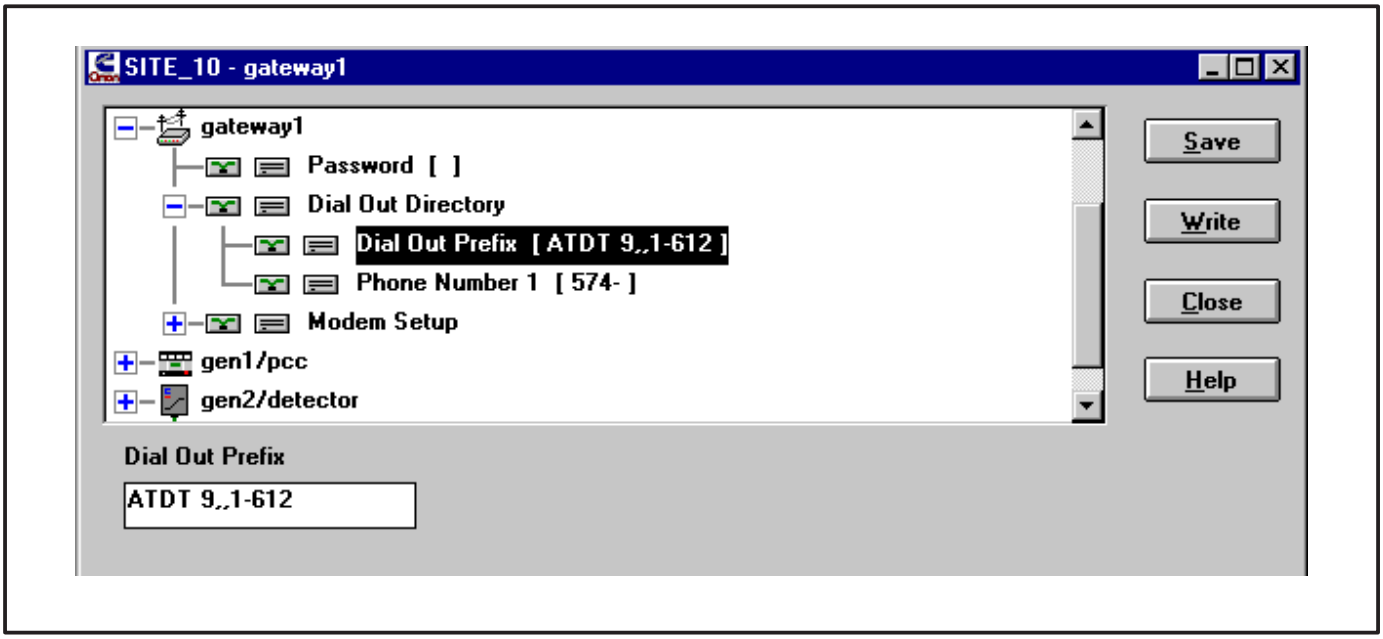

FIGURE 4-32. CONFIGURE NGM – DIAL OUT PREFIX

NGM – Dial Out Directory

Dial Out Prefix and Phone Number 1 are grouped together in their own parameter set. To view or edit either of these parameters, click on the plus symbol (+) or double click on the parameter set name *Dial Out Directory*. When expanded, all dial out parameters are listed with their current settings. To contract the set, click on the minus symbol (–) or double click on *Dial Out Directory*. *Dial Out Directory* only applies to Gateway Modules which are connected to a modem (remote connection).

Dial Out Prefix

This parameter configures the prefix string, which is sent to a modem before the phone number. The prefix is limited to 16 characters (hyphens and spaces are not required). The prefix "ATDT" instructs the modem to dial using touch-tone (DTMF) signaling. If pulse dialing is used, the prefix should be set to "ATDP".

If an outside line is required, the user may elect to place the "9" (or whatever number accesses an outside line) in with the prefix. Dial Out Prefix only applies to a remote connection incorporating dial out alarms.

> ***Example:*** The NGM is connected to a modem which is connected to a DTMF line. An outside line and the area code are needed to dial the remote host. Accessing an outside line usually takes about a second.
>
> ***Dial Out Prefix:*** Enter "ATDT 9,,1–612"

Spaces " " and hyphens "–" are ignored by the modem. Two commas ",," are needed to force the modem to pause long enough for outside line to be accessed. (A single comma forces a ½ second delay.)

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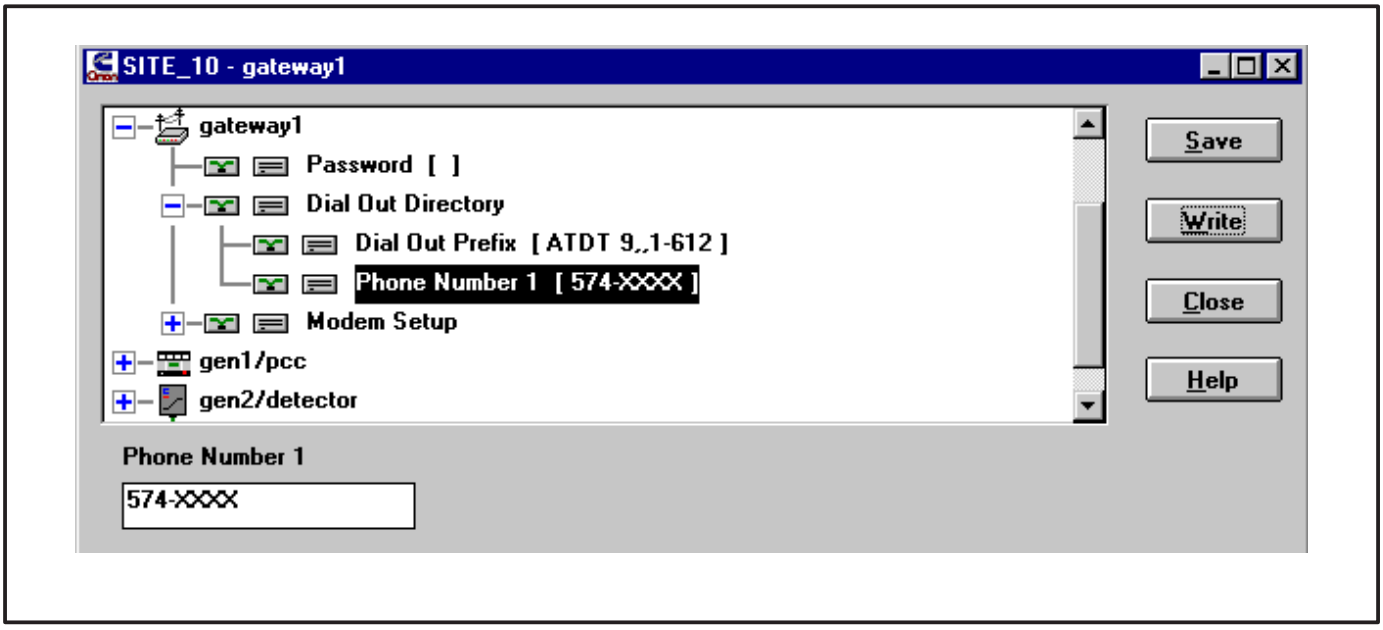

FIGURE 4-33. CONFIGURE NGM – PHONE NUMBER

NGM – Phone Number 1

This parameter configures the phone number of the remote host running PowerCommand for Windows. PowerCommand for Windows must be running to receive an alarm. The phone number is limited to 16 characters (hyphens and spaces are not required).

Use the *Dial Out Prefix* if the phone number exceeds 16 characters.

All modules at the site will use this phone number when sending an alarm. *Phone Number 1* only applies to a remote connection incorporating dial out alarms.

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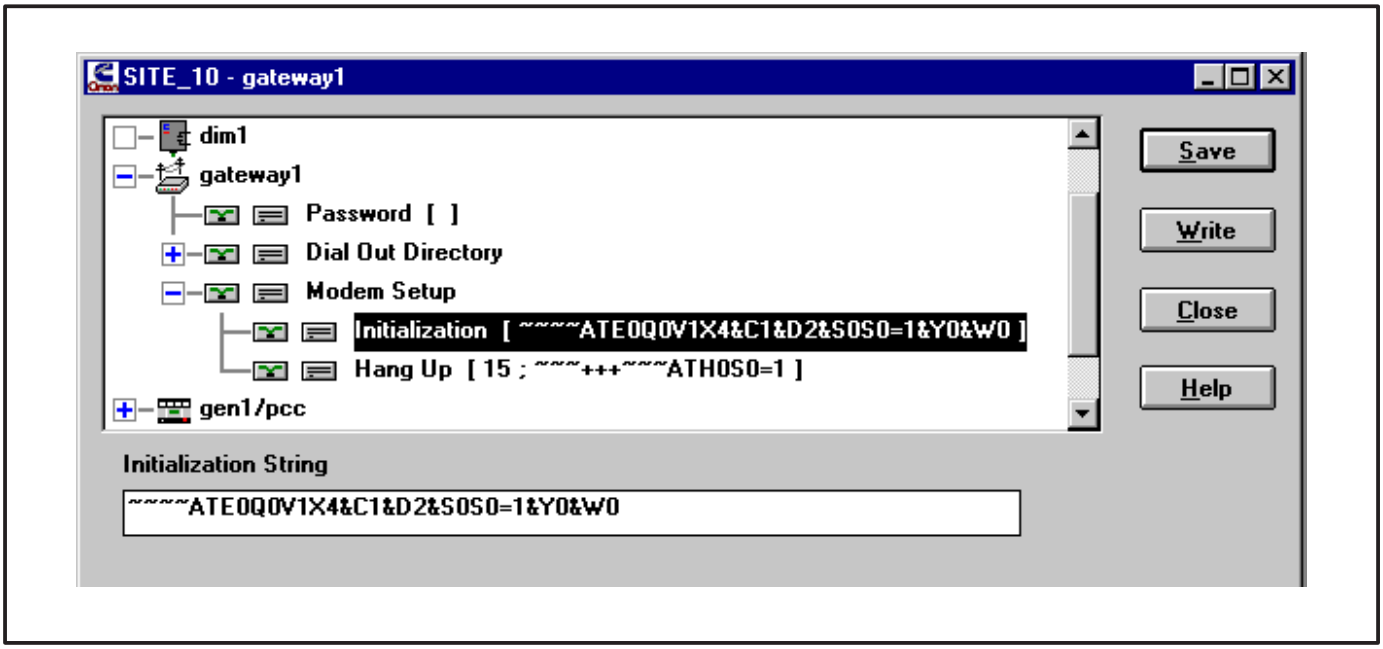

FIGURE 4-34. CONFIGURE NGM – MODEM INITIALIZATION STRING

NGM – Modem Setup

Modem Initialization and **Hang Up** are grouped together in their own parameter set. To view or edit either of these parameters, click on the plus symbol (+) or double click on the parameter set name (Modem Setup). When expanded, all dial out parameters are listed with their current settings. To contract the set, click on the minus symbol (–) or double click on *Modem Setup*. Modem Setup only applies only to Gateway Modules that are used with a modem (remote connection).

NGM – Modem Setup – Initialization

This parameter configures the string that the NGM uses to initialize the modem. The *Initialization String* is automatically sent to the modem each time the NGM is powered up.

The *Initialization String* is limited to 33 characters.

Enter the following information in the ***Initialization String*** field:

~~~~ATE∅Q∅V1X4&C1&D2&S∅S∅=1&Y∅&W∅

Note: ∅ is used to represent the number zero.

To save time and reduce errors it is generally best to use the Edit – Copy feature to copy this data from the Template site or other configured site.

If the site NGM is attached to a modem, turn Off the NGM power switch, then turn it back On. This step sends the information stored in the NGM to the modem to set the modem for proper operation.

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~~~~

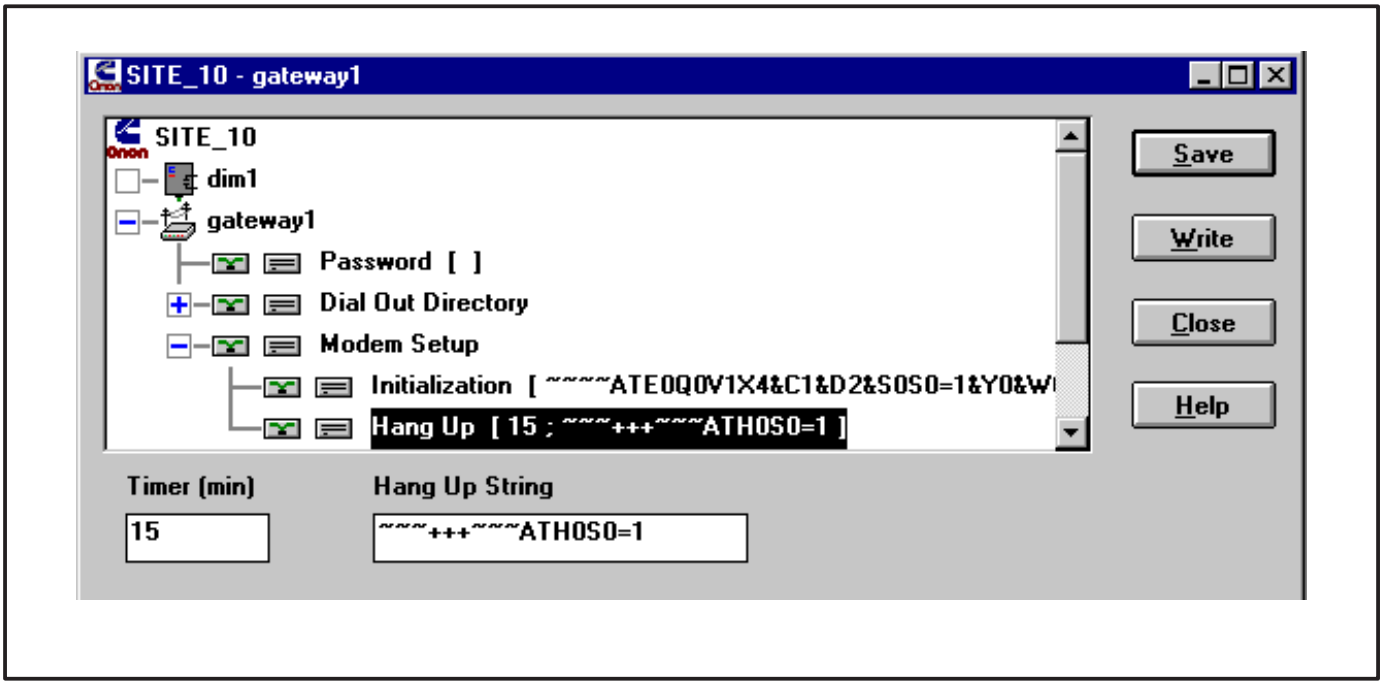

FIGURE 4-35. CONFIGURE NGM – HANG UP

NGM – Modem Setup – Hang Up

This parameter configures the NGM's hang up operation. The NGM will automatically hang up and break a connection (if connected) when the number of minutes specified by the *Hang Up Timer* have elapsed with no activity on the line. Valid values are 0 to 255 (minutes). A value of zero will disable the timer. Set the Hang Up Timer to 15 (minutes).

Hang Up String configures the string used to terminate a connection if the DTR control fails to do so. The Hang Up String is limited to 24 characters.

The ***Hang-up String*** should appear as follows:

~~~+++~~~ATH∅S∅=1

Note: ∅ is used to represent the number zero.

Do not alter this string unless otherwise instructed.

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ADDITIONAL INSTALLATION STEPS

After using PCT to configure a site, **always** perform these steps before testing out a network installation.

Reset Modules

When installation and configuration are complete, each of the modules (nodes) must be reset. This can be done by pressing the reset button on each module or with the reset feature in PCT. In PCT, attach to the site, select a module and click on the Reset button. Repeat this step for each module.

Repower NGM

Turn Off the NGM power switch, then turn it back On.

Note: A connection problem can occur with some computers when exiting PCT in Windows 95 to run LonMaker. If LonMaker will not *attach* to the Network Installation Gateway, Windows 95 may not be releasing the port.

If this occurs, the port will need to be disabled and re-enabled. Use Device Manager, located in the System folder of Control Panel, in Windows 95. Under Ports, select the COM port that the Network Installation Gateway is attached to and select Properties. Under Device Usage, unselect the check box to disable the port, then click OK. Repeat this procedure and click on the check box to select it and enable the COM port, then click OK.

INSTALLATION CHECKOUT

Make Backup Copies

Use File – Export Site to make a complete backup copy of the LonMaker site directory (the exported file [file.pct] will be located in C:\ONAN\PCT\EXPORTS). Also make a separate backup copy of the CSV file (located in C:\ONAN\PCT\CSV). Keep a copy of all of the “Binding Forms” used to describe the modules and connections etc., (see Appendix C).

Disconnect the installation setup.

⚠ CAUTION ***Do not use the “installation” computer to run PCW unless it has been disconnected from the Network Installation Gateway and reconnected to the site monitoring NGM.***

Refer to the PCW manual (900-0365) for instructions on installing and running PCW. Operate PCW to thoroughly check out the installation.

If installation problems are detected, reattach to the site through an Installation Gateway before running LonMaker or PCT. Failure to use a Network Installation Gateway will cause the NV data stored in the site NGM to be destroyed.

Each time a change is made in LonMaker (such as adding a module, repairing or replacing a module, or changing bindings) a new .CSV file is required for PCW. Open the site in PCT to create the new .CSV file.

CHANGES TO THE LONMAKER DATABASE

After a site has been updated with LonMaker (added, removed, replaced, or installed modules), PCT should be run to update the site’s configuration.

In PCT, open the site as normal. Each time PCT opens a site it checks the site directory to see if any changes have been made to the site. If changes to the site are detected, PCT will display a message stating the user must update the modules at the site (Figure 4-36). The PCT Database Discrepancies dialog will open, listing all the old and new modules at the site. Next to each module name is a unique identification number. No two modules will have the same identification number.

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FIGURE 4-36. CHANGES IN THE LONMAKER DATABASE

Pairing Unpaired Modules

The Discrepancies dialog (Figure 4-37) provides the option to manually "Pair" each old module configuration with a new module. This allows the user to retain a module's configuration. This is needed after configuring a site in advance of installing it. Or if a module has been physically replaced and the user would like to write the identical configuration to the new hardware.

To retain a module's configuration, pair the old module with the new one. This is done by selecting a module from the Unpaired Modules (Old Modules) list and then selecting the corresponding module in the Current Modules list. Then press the Pair button. This will move the two modules to the Paired Modules section.

CAUTION ***Old Unpaired Module configuration will be lost if not paired.***

To Pair Modules: In the Unpaired Modules section, click on the module in the Old Modules dialog, then click on the module in the Current Modules dialog. Click on the Pair button to pair the modules.

To Unpair Modules: To undo a pairing, select the two modules you want to unpair from the Paired Modules section and press the Unpair button.

When finished pairing modules, click on the Done button. Modules which have been paired will retain their configuration. All unpaired New Modules will be added to the site with their default configuration while all unpaired Old Modules will be removed from the site. Make sure the monitoring PC updates its site information with the latest site information file (.CSV file).

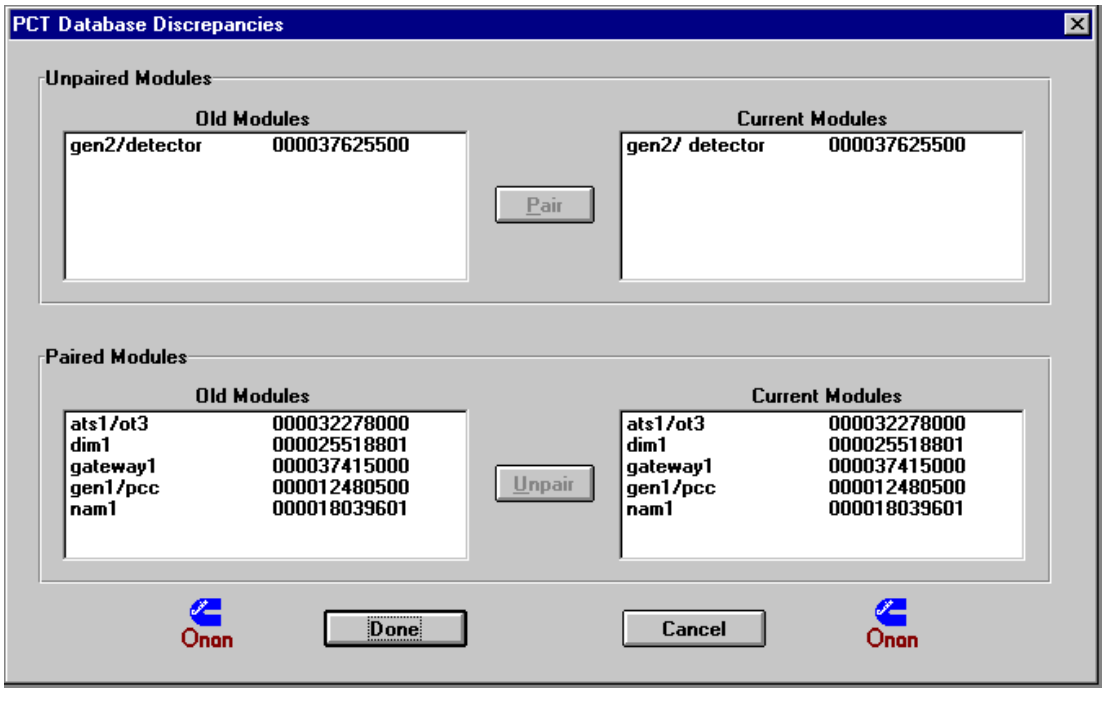

FIGURE 4-37. PAIRING MODULES

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5. GenSet Communications Module

OVERVIEW

This section describes the Genset Communications Module (GCM) and its functional role in the PowerCommand Network. This section also describes the physical mounting and wiring of this module, and provides information for the *logical* installation and *connection* of the GCM on the network.

In network terms, “logical installation and connection” refers to programming the various devices (or nodes) on the network so that they can communicate with one another. This communication takes the form of passing network variables from one device to another. The process of assigning connections—linking an output variable of one device to an an input variable of another device—is called “binding.”

In addition to functional and physical descriptions, this section provides definitions of the network input and output variables assigned to the GCM. Refer to section 3 for the step-by-step procedure for binding these variables to input and output variables assigned to other network devices.

Refer to Mounting in this section for GCM compatibility with PCC software versions.

DESCRIPTION

The GCM is mounted inside the PCC housing. It is required for connection of the PCC to the PowerCommand Network. Control and monitoring of the PCC can be accomplished over the network, via the GCM.

The GCM contains a terminate circuit for use at the end of a network data bus.

The GCM provides an interface for data from the PCC to other modules on the network. The GCM communicates with the PCC via the engine interface board, and it monitors various PCC circuits to determine the operating state of the control. For example, the GCM stores PCC data such as volts, current, engine speed, and oil temp; and then sends it out on the network when another network node requests the data.

Outputs from the GCM allow it to “wake up” the PCC when needed, or to cause an emergency shutdown on command. The GCM also provides some direct local control and monitoring of the PCC. It monitors for Not-In-Auto mode and High and Low battery voltage (when the PCC is asleep).

The GCM is powered from the genset battery. It remains powered even when the PCC is “asleep.”

Block Diagram

Refer to Table 5-1 and Figure 5-1 for a block diagram overview of the GCM.

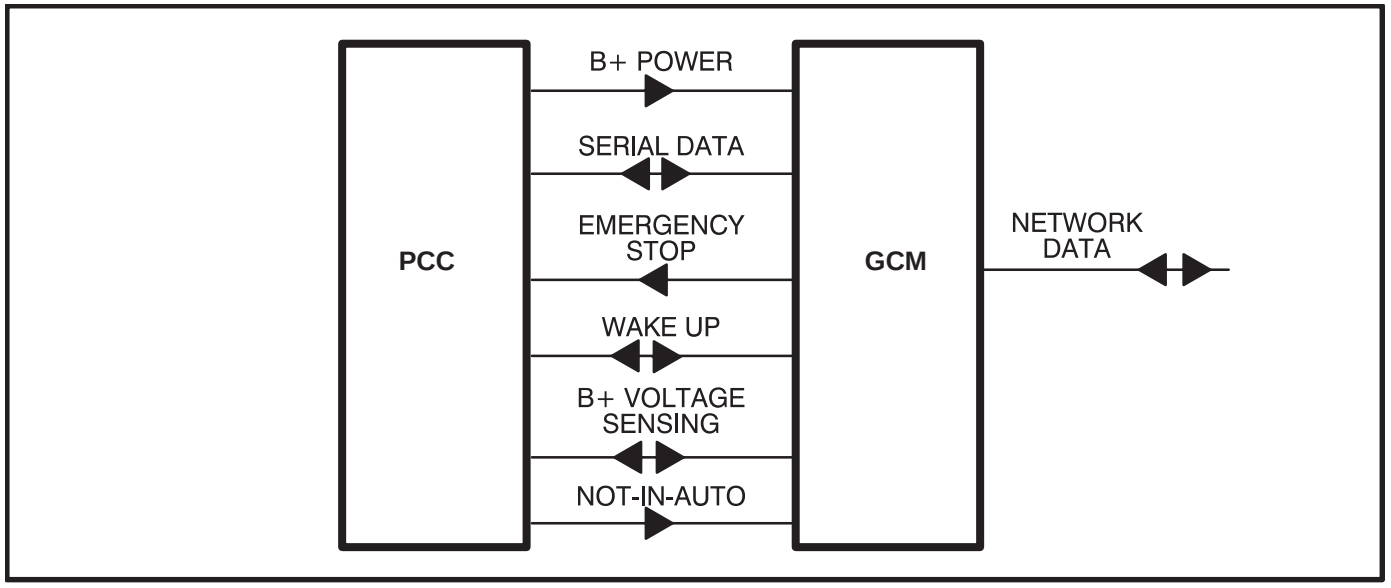

FIGURE 5-1. BLOCK DIAGRAM: GENSET COMMUNICATIONS MODULE (GCM)

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TABLE 5-1. GCM – BLOCK DIAGRAM DESCRIPTIONS

Function	Description/Specification
B+ Power	This is an output from the PCC to the GCM. The digital and analog circuitry on the GCM is powered from CNTRL B+ from the PCC. The GCM is always powered. It rides through starter dip and crank. The GCM is switch selectable for 12V or 24V systems.
Serial Data	This is a bidirectional data path between the PCC and GCM. The GCM communicates with the PCC through the PCC's serial port. Communication rate is 2400 baud. Starting, stopping and exercising of the set, readout of AC data, Engine data, and Set status information are done through this link. **NOTE: When the PCC's service port is connected (serial port) to an external device, the GCM cannot communicate with the PCC and thus the PCC state and data cannot be known on the network.**
Emergency Stop Control	This is an output from the GCM. The GCM can activate the PCC's Emergency Stop Latching Relay. This allows a remote emergency stop over the network. **NOTE: The Emergency Stop condition can only be reset at the PCC front panel. Can be reset once the E-Stop output from the GCM has been cleared.**
Wake Up Monitor and Control	This is both an output and an input for the GCM. The GCM has the capability to wake up the PCC. It would do this for example when a network message was telling the genset to start. The GCM also has the capability to monitor whether or not the PCC is awake (i.e. due to some other reason). This helps the GCM determine if it can communicate with the PCC.
B+ Voltage Sensing	This is an input to the GCM from the PCC. The GCM directly monitors battery voltage and determines high and low conditions. This function is needed when the PCC is not awake (and thus is not capable of monitoring battery voltage itself). A low or high condition will cause the GCM to wake up the PCC. The PCC then annunciates the warning. Voltage thresholds are the same as in the PCC. The GCM annunciates to the network a high or low voltage condition.
Not-In-Auto Monitor	This is an input to the GCM from the PCC. The GCM monitors the position of the front panel Run/Off/Auto switch. When the PCC is not awake, the GCM annunciates to the network a Not-In-Auto condition.
Network Data	Transformer Coupled into Category 4 Twisted Pair at 78,000 bits/sec.

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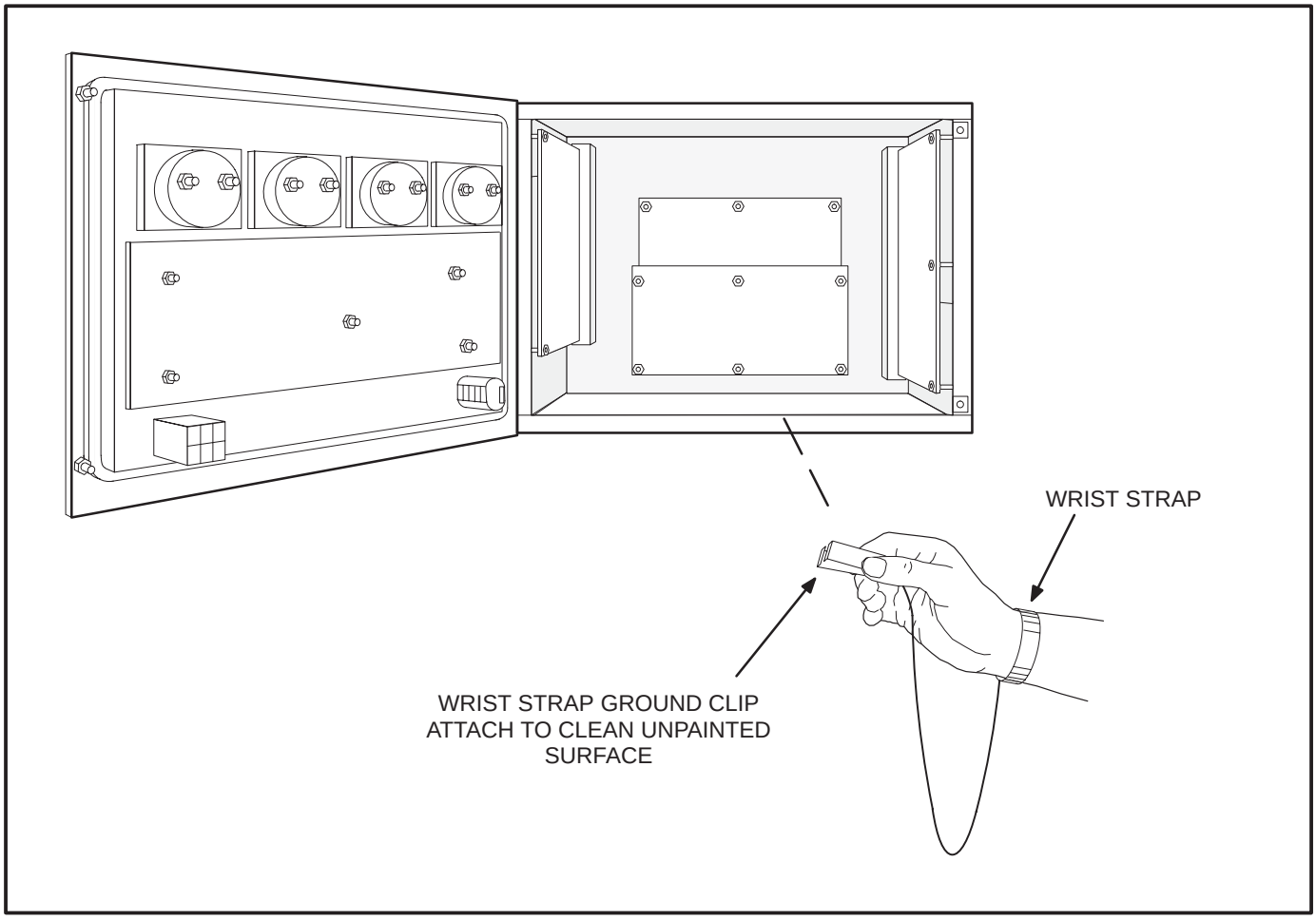

FIGURE 5-2. WRIST STRAP CONNECTION

MOUNTING

GCM is mounted inside PCC cabinet on top of the analog board (Figure 5-2).

⚠ CAUTION ***Electrostatic discharge will damage circuit boards. Do not remove the circuit board from the antistatic shipping bag until you are grounded to the PCC with a wrist strap.***

The GCM must be used with PCC operating software version 1.06 or newer for all models except DFHA, DFHB, DFHC and DFHD (these models have unique operating software and are GCM compatible with version 1.04 or newer). Check the version on the display menu. If the version is earlier than the version listed, obtain and install an EPROM upgrade kit.

Special Tools Required

- Grounding wrist strap with grounding clip

Circuit Board Handling Precautions

To help prevent circuit board damage due to electrostatic discharge (ESD), a grounding wrist strap must be worn when handling the circuit board. (The wrist strap **does not** provide a direct short to ground, it is typically rated at approximately 1 megohm to ground.)

Attach the clip to a clean unpainted surface of the control box (see Figure 5-2) and place the strap around your wrist before handling a circuit board.

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INSTALLATION

1. Place the genset Run/Off/Auto switch, on the control panel, in the Off position.

2. Disconnect the battery charger (if applicable). Remove all electrical supply sources.

   ⚠ CAUTION ***Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the system.***

3. Disconnect the genset starting battery cable(s). Disconnect the negative (–) cable(s) first to reduce the risk of arcing.

   ⚠ WARNING ***Accidental starting of the genset while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables. To reduce the risk of arcing, disconnect the negative (–) cable first. When reconnecting, connect the negative (–) cable last.***
   Make certain battery area has been well-ventilated before servicing battery. Arcing can ignite explosive hydrogen gas given off by batteries, causing severe personal injury. Make certain hydrogen gas, engine fuel, and other explosive fumes are fully dissipated. This is especially important if battery has been connected to a battery charger.

4. Open the control box door. Connect the wrist strap ground clip as shown in Figure 5-3.

5. Use a Phillips screwdriver to remove the four analog board mounting screws shown in Figure 5-3.

6. Install four new standoffs in place of the analog board mounting screws removed in step 5 (Figure 5-4). Tighten the standoffs securely.

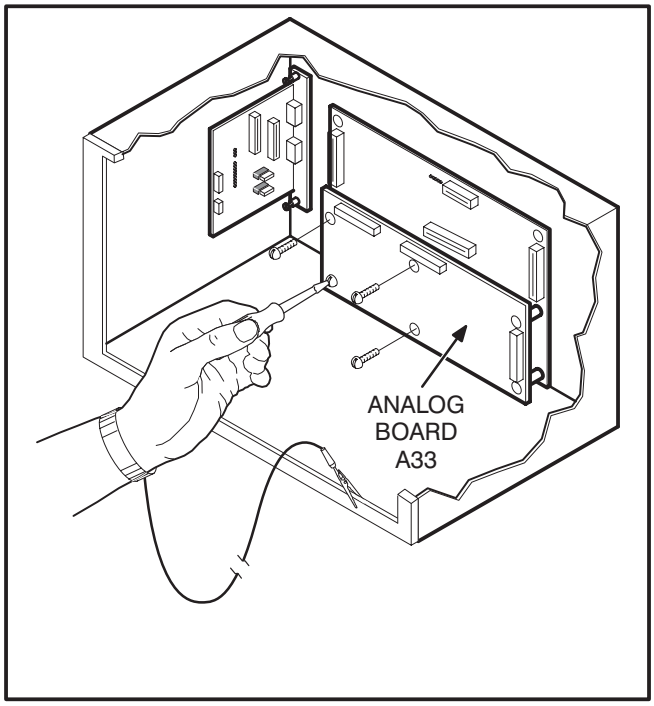

FIGURE 5-3. PREPARING TO MOUNT GCM BOARD

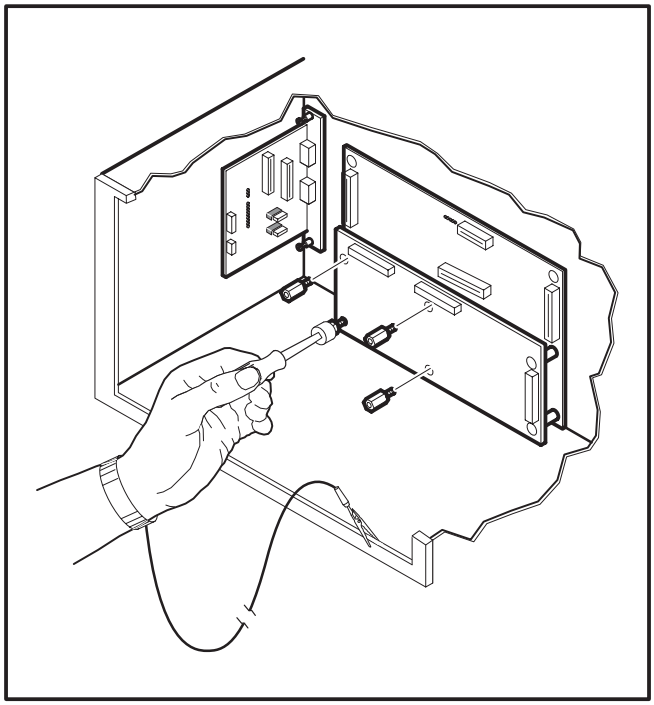

FIGURE 5-4. INSTALLING STANDOFFS

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7. Mount the GCM board as shown in Figure 5-5, using the screws removed from the analog board. Tighten the mounting screws securely.
8. Orient the J6 harness connector as shown in Figure 5-6. Push the J6 plug securely into the connector on the engine interface board.
9. Spread locking tabs apart on the J7 connector. Fold the ribbon cable, as shown in Figure 5-6, align key on plug with socket cutout. Insert the J7 harness plug into the J7 connector on the engine interface board. Press in on the harness connector, at the location indicated by the arrow, until the locking tabs lock into place.
10. Set the S4 switch on the GCM board to **24V** for a 24V-battery system or **12V** for a 12V-battery system (Figure 5-6).

Refer to sections 2 and 3 for instructions on network wiring, network software installation and connection of the GCM module to the network.

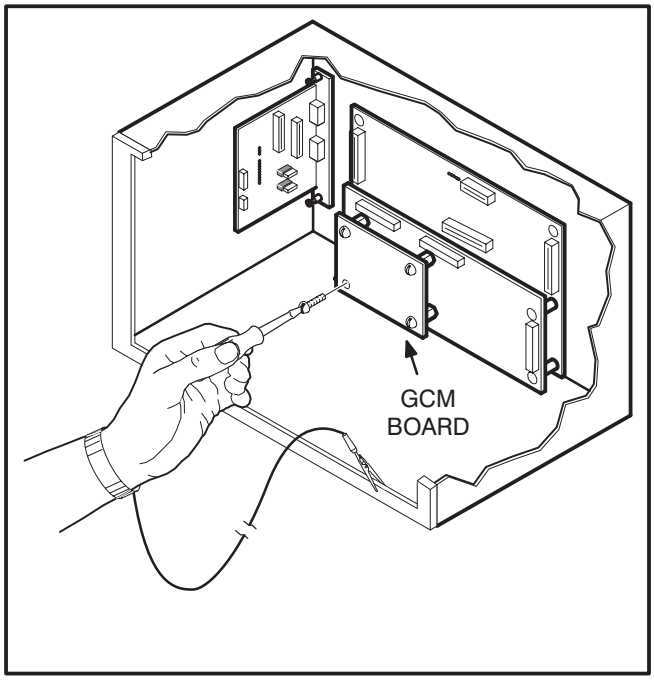

FIGURE 5-5. MOUNTING GCM BOARD

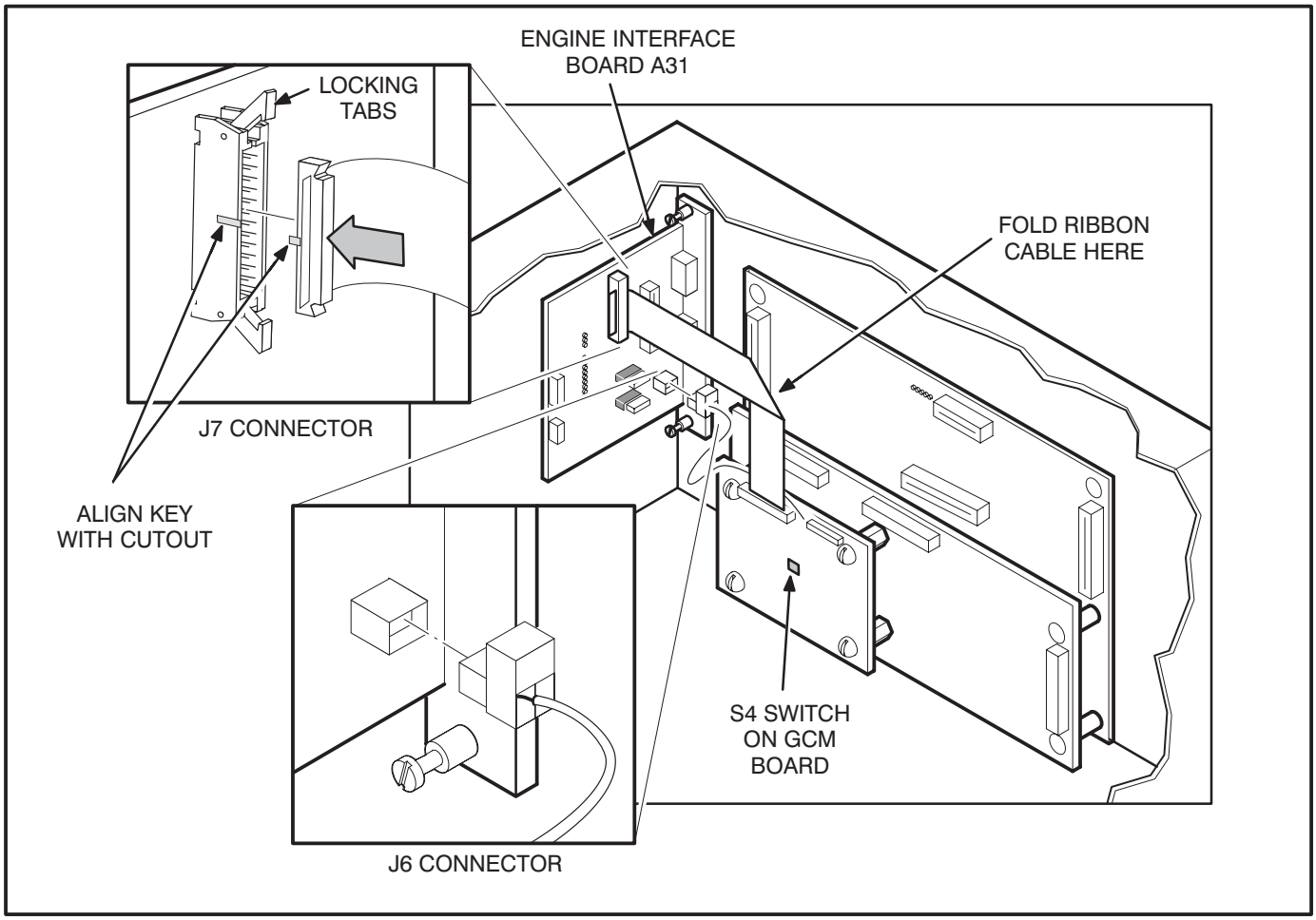

FIGURE 5-6. INSTALLING J6 AND J7 CONNECTORS

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GCM CONNECTIONS

GCM connections are made at connectors J1, J4, J6, and J7.

Refer to Table 5-2 and Figures 5-6 and 5-7.

NETWORK TOPOLOGY, DATA MEDIA AND NETWORK POWER

Refer to Section 2 for information on the network topology and data transmission media. Also refer to Section 2 for network power supply wiring calculation procedures.

NETWORK DATA MEDIA AND POWER WIRING

⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Only trained, experienced personnel are to perform the following procedures.***

TB1 Connections

Network data and power wiring connections are made at terminal block TB1 in the generator set accessory box, which is located on the back of the control housing (Figures 5-8 and 5-9).

Conduit

When installing conduit, observe the following precautions:

1. Before beginning conduit installation, cover the components in the accessory box to prevent accidental entry of metal chips.
2. If using rigid conduit, install at least 2 feet (610 mm) of flexible conduit between the rigid conduit and generator set to absorb vibration.
3. Always run DC circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.
4. Data wire can be run without conduit if it is adequately protected. Do not run data wire in conduit with network power wiring.

⚠CAUTION ***Installation debris can cause equipment failure and damage. Use extreme care to keep drill chips and filings out of the accessory box when mounting or connecting conduit. Screwdrivers should be used carefully to prevent damage to components.***

SWITCHES/SERVICE POINTS/LEDs

The Service switch is used during installation (when prompted by the LonMaker program). The Terminator switch must be set to the appropriate position at installation. Switches are described in Table 5-3. Service points are described in Table 5-4. LEDs are described in Table 5-5.

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TABLE 5-2. GCM – CONNECTIONS

Connector	Description
J7	Ribbon cable harness from GCM to A31 engine interface board. Plugs into outermost connector on engine interface board. Cannot physically mate with any of the other connectors. This cable carries all GCM/PCC interface signals except network data.
J6	Twisted pair cable harness from the GCM to the engine interface board. This cable carries network data to the engine interface board where it then goes out through the lower waterproof connector on its way to the customer connection terminal strip.
J1	26 pin header on the board used for factory test purposes only.
J4	RJ45 connector for network data – service and Installation use only.
TB1–14	Accessory Box — Network Data 1 signal from GCM
TB1–15	Accessory Box — Network Data 2 signal from GCM

TABLE 5-3. GCM – SWITCHES

Ref	Name	Type	Description
S1	SERVICE	momentary push	Used at time of logical installation to identify device to the installation software. Pressing S1 will light the DS1 LED.
S2	RESET	momentary push	Resets the Neuron Chip processor. Must be pushed after Install action.
S3	TERMINATOR	slide	Switch is set to position opposite of text “TERM” from factory. The two devices at ends of network data must have their switches set to “TERM”.
S4	12/24V SENSING	slide	Selects whether high/low battery sensing is for a 24VDC or 12VDC system. It is set to 24V position from the factory.

TABLE 5-4. GCM – SERVICE POINTS

Ref	Name	Description
TP1	GCM VCC	This is the 5.0VDC that supplies the logic on the GCM. It is measured with respect to TP2. This test point is for troubleshooting use only.
TP2	GND	Reference point for TP1.

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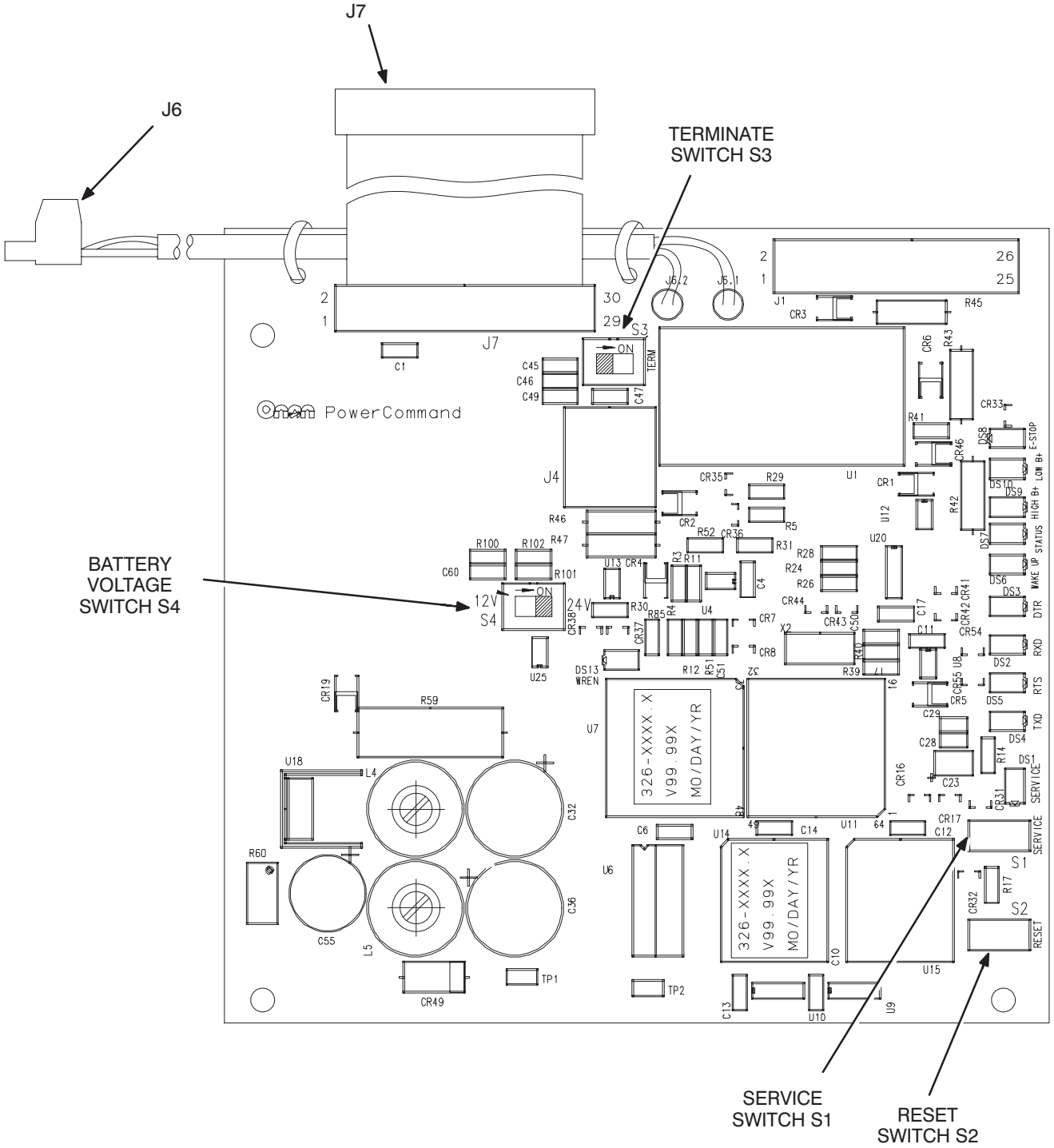

FIGURE 5-7. GENSET COMMUNICATIONS MODULE

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TABLE 5-5. GCM – LED INDICATORS

Ref	Color	Name	Description
DS1	Amber	SERVICE	Indicates various states of the GCM node. It will be ON if S1 is pressed and held. States without S1 pressed: **OFF** = All OK. GCM has application image and is installed in a network. **ON**= GCM is applicationless or has experienced a error that prevents Neuron Chip from executing application code. **1/2 Hz BLINKING (1 second on / 1 second off)** =GCM has an application, but has not been logically installed in a network. **FLASHING (momentarily)** once every 2–3 seconds=GCM is experiencing an error condition, causing a watchdog timeout reset.
DS2	Green	RXD	Indicates Serial Data output from the GCM to the PCC. If the PCC is awake and no service tool is connected, this LED should be flickering regularly. RXD may be steady ON if the PCC is not awake.
DS3	Green	DTR	ON indicates that the PCC is capable of communicating with the GCM (i.e. PCC is awake and no service tool is connected).
DS4	Green	TXD	Indicates Serial Data input to the GCM from the PCC. Should be flickering regularly if the PCC is awake. If the service tool is connected, flickering will indicate responses from the PCC to the service tool. TXD may be steady ON if the PCC is not awake.
DS5	Green	RTS	ON indicates that the PCC has new information for the GCM to retrieve. (May not be used.)
DS6	Green	WAKE UP	ON when the GCM has turned on the PCC.
DS7	Green	STATUS	**Approx. 1/2 Hz Blinking (1 second on / 1 second off)** indicates that the GCM's processor is executing the application code.
DS8	Red	E–STOP	ON when a network emergency stop is active.
DS9	Red	HIGH B+	ON for a high battery condition sensed by GCM.
DS10	Red	LOW B+	ON for a low battery condition sensed by GCM.
DS13	Green	WREN	ON (normal state) indicates that the off-chip EEPROM can be written to. Indicator must be ON if device is to be logically installed in a network. OFF could be caused by: 1) PCC CNTRL B+ is below 10VDC. 2) RESET switch being pressed and held. 3) Problem with board or connectors.

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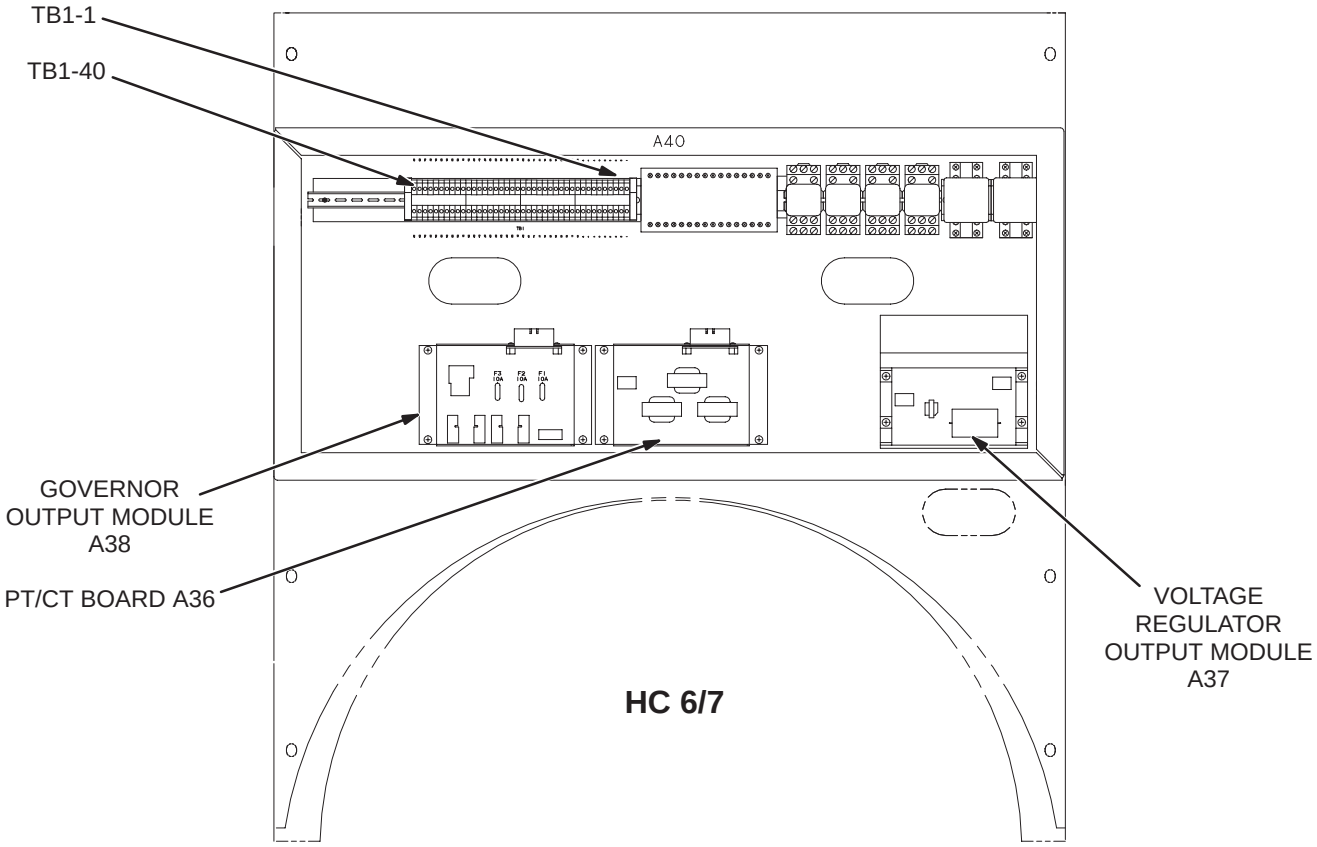

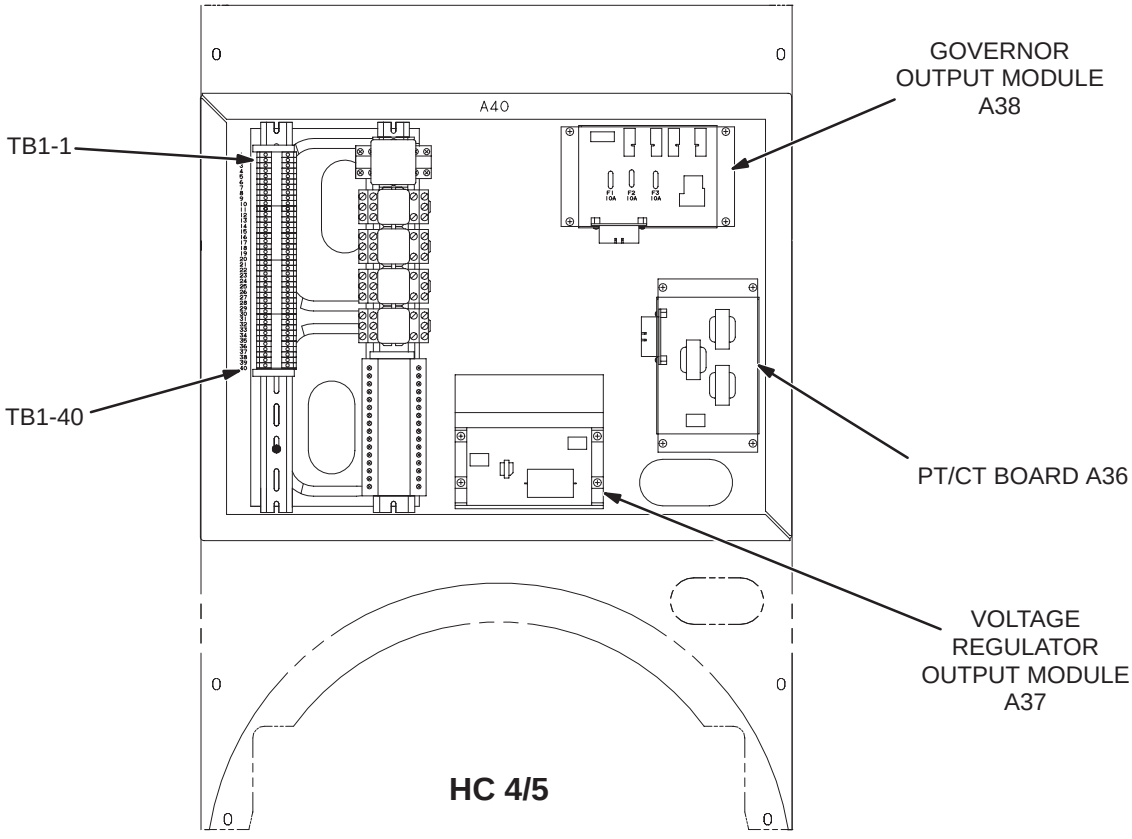

FIGURE 5-8. ACCESSORY BOX

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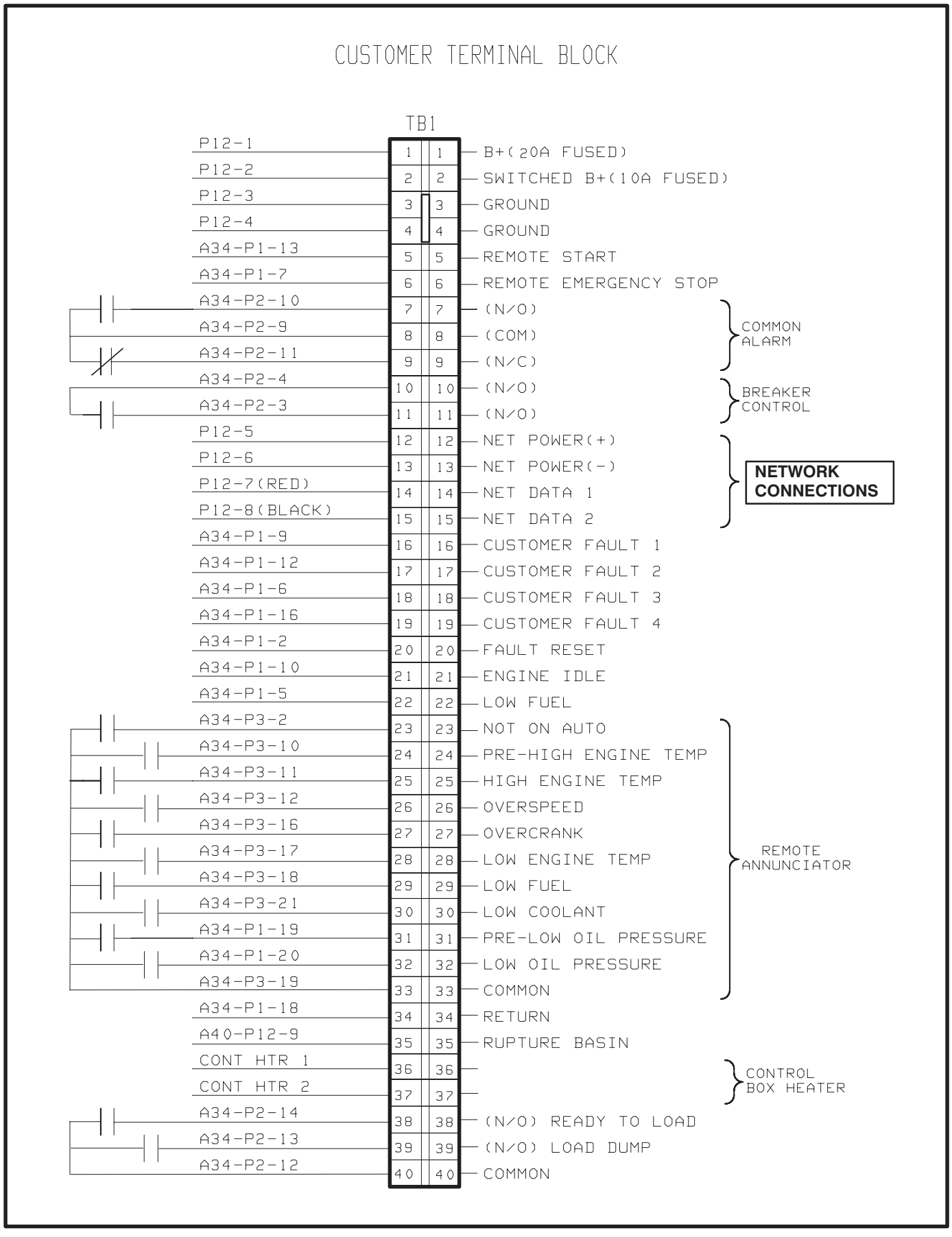

FIGURE 5-9. WIRING THE PCC/GCM

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NETWORK INSTALLATION

Section 3 provides a detailed description of the LonWorks network installation process. Read sections 1 and 2 before constructing the network. Sections 3 and 4 provide the following step-by-step installation procedures:

1. Setting up Network Installation Tools
2. Starting LonMaker Software
3. Using LonMaker Software
4. LonMaker Network Setup
5. Connecting Devices with LonMaker
6. Installing Devices with LonMaker
7. Testing Devices and Verifying Installation
8. Setting up PowerCommand Configuration Tool
9. Using PowerCommand Configuration Tool

NETWORK ALARMS

Refer to the generator set service manual for the PowerCommand fault codes.

NETWORK VARIABLES

Refer to the following tables of connectable network variables for the GCM during its logical installation on the network.

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TABLE 5-6. GCM NETWORK VARIABLE OUTPUTS

NV Name	Description	Used By	Data Type Info	Active State	Default Value(s)
nvoRemoteAnnun1	●16 bit value containing status of PCC faults and operating states. ●Intended to be connected to a Digital I/O Module ●Default is set up for **NFPA 110**: high batt volts, low batt volts, gen running, pre–lop, lop, pre–het, het, let, os, oc, not–in–auto, low fuel, and low coolant level. ●Normal Utility, EPS Supplying Load, and Battery Charger Malfunction come from CCM or PCC hardwired or network	●Net Connect	16 bits (long): (2 BYTES)(PCC SERIAL) Data Range nvoRemoteAnnun1 0..65535 bit 0 = High Batt Volts Warn bit 1 = Low Batt Volts Warn bit 2 = Genset Running bit 3 = not used bit 4 = not used bit 5 = Low Oil Press Warn bit 6 = Low Oil Press Shutdn bit 7 = High Cool Temp Warn bit 8 = High Cool Temp Shutdn bit 9 = Low Cool Temp Warn bit 10 = Overspeed Shutdn bit 11 = Fail to Start Shutdn bit 12 = Not In Automatic bit 13 = not used bit 14 = Low Fuel Day Warn bit 15 = Low Cool Lvl Warn/Shutdn Notes: 1. Low Batt Volts includes Weak Batt Warning. 2. Genset Running means Ready To Load state. 3. Low Oil Press Warn includes Press Sender Warning. 4. High Coolant Temp includes Temp Sender Warning. 5. Fail to Start combines Mag Pickup, Fail to Crank and Overcrank faults.	 1 1 1 x x 1 1 1 1 1 1 1 1 x 1 1	If no data is available, all are inactive (0). All “x” must always be 0.

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TABLE 5-7. GCM NETWORK VARIABLE OUTPUTS – Continued

NV Name	Description	Used By	Data Type Info	Active State	Default Value(s)
nvoRemoteAnnun2	●16 bit value containing status of PCC faults and operating states. ●intended to be connected to a Digital I/O Module ●Defaults are set up for **AC Alarms**: Customer Faults 2 and 4, High and Low AC voltage, UnderFreq, Overcurrent, Short Circuit, Reverse Power, Loss of Field, Loss of AC Input, Fail to Sync, Fail to Close, Overload, and Emergency Stop.	●Net Connect	16 bits (long): (2 BYTES)(PCC SERIAL) Data Range nvoRemoteAnnun2 0..65535 bit 0 = Customer Fault 2 Warn/Shutdn (default =ground fault warn) bit 1 = Customer Fault 4 Warn/Shutdn (default =high gen temp warn) bit 2 = High AC Voltage Shutdown bit 3 = Low AC Voltage Shutdown bit 4 = Under Frequency Shutdown bit 5 = Overcurrent Shutdown bit 6 = Short Circuit Shutdown bit 7 = Reverse Power Shutdown bit 8 = Loss of Field Shutdown bit 9 = Loss of AC Input Shutdown bit 10 = Fail to Sync Warning bit 11 = Fail to Close Warning bit 12 = Overload Warning bit 13 = Emergency Stop bit 14 = Communications Failure bit 15 = Common Alarm Notes: 1. Loss of AC Input is same as Low AC Voltage. 2. Fail to Close and Fail to Sync are not available on non–paralleling PCC.	 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	If no data is available, all are inactive (0).

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TABLE 5-8. GCM NETWORK VARIABLE OUTPUTS – Continued

NV Name	Description	Used By	Data Type Info	Active State	Default Value(s)
nvoRemoteAnnun4	●16 bit value containing status of PCC faults and operating states. ●intended to be connected to a Digital I/O Module ●Defaults are set up for **Paralleling Applications** : Emergency Stop, pre–lop, lop, pre–het, het, low coolant temp, os, oc, nia, low coolant level, fail to sync, fail to close, rev power, loss of field, overload, under freq.	●Net Connect ●Master	16 bits (long): (2 BYTES)(PCC SERIAL) Data Range nvoRemoteAnnun4 0..65535 bit 0 = Emergency Stop bit 1 = Low Oil Press Warn bit 2 = Low Oil Press Shutdown bit 3 = High Coolant Temp Warn bit 4 = High Coolant Temp Shtdn bit 5 = Low Coolant Temp Warn bit 6 = Overspeed Shutdown bit 7 = Fail To Start Shutdown bit 8 = Not In Auto bit 9 = Low Cool Lvl Warn/Shtdn bit 10 = Fail to Sync Warn bit 11 = Fail to Close Warn bit 12 = Reverse Power Shtdn bit 13 = Loss of Field Shtdn bit 14 = Overload Warn bit 15 = Under Freq Shtdn Notes: 1. .Low Oil Press Warn includes Press Sender Warning. 2. High Coolant Temp includes Temp Sender Warning. 3. Fail to Start combines Mag Pickup, Fail to Crank and Overcrank faults. 4. Fail to Close and Fail to Sync are not available on non–paralleling PCC.	 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	If no data is available, all are inactive (0).

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TABLE 5-9. GCM NETWORK VARIABLE OUTPUTS – Continued

NV Name	Description	Used By	Data Type Info	Active State	Default Value(s)
nvoRunCmd	●digital value indicating that the genset has an active run command (either from the network, front panel, or remote hardwired). Genset is not necessarily running — may be timing to start, or run inhibited. This Boolean goes True when the genset is requested to run.	●Net Connect	1 bit (Boolean): (1 BYTE)(PCC SERIAL) Data Range nvoRunCmd 0,1	1	not applicable
nvoRunning	●digital value indicating genset is running (starter disconnect has occurred)	●Net Connect	1 bit (Boolean): (1 BYTE)(PCC SERIAL) Data Range nvoRunning 0,1	1	not applicable
nvoReadyToLoad	●digital value indicating genset is within rated voltage and frequency (as determined by PCC specs.)	●Net Connect	1 bit (Boolean): (1 BYTE)(PCC SERIAL) Data Range nvoReadyToLoad 0,1	1	not applicable
nvoLoadDump	●digital value indicating that genset is overloaded (as determined by PCC specs. – overload or underfrequency)	●Net Connect	1 bit (Boolean): (1 BYTE)(PCC SERIAL) Data Range nvoLoadDump 0,1	1	not applicable
nvoCommonAlarm	●digital value indicating a PCC shutdown or warning condition	●Net Connect	1 bit (Boolean): (1 BYTE)(PCC SERIAL) Data Range nvoCommonAlarm 0,1	1	not applicable

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TABLE 5-10. GCM NETWORK VARIABLE OUTPUTS – Continued

NV Name	Description	Used By	Data Type Info	Active State	Default Value(s)
nvoCustFault1	●digital value indicating state of PCC Customer Fault #1 input	●Net Connect	1 bit (Boolean): (1 BYTE)(PCC SERIAL) Data Range nvoCustFault1 0,1	1	not applicable
nvoCustFault2	●digital value indicating state of PCC Customer Fault #2 input	●Net Connect	1 bit (Boolean): (1 BYTE)(PCC SERIAL) Data Range nvoCustFault2 0,1	1	not applicable
nvoCustFault3	●digital value indicating state of PCC Customer Fault #3 input	●Net Connect	1 bit (Boolean): (1 BYTE)(PCC SERIAL) Data Range nvoCustFault3 0,1	1	not applicable
nvoCustFault4	●digital value indicating state of PCC Customer Fault #4 input	●Net Connect	1 bit (Boolean): (1 BYTE)(PCC SERIAL) Data Range nvoCustFault4 0,1	1	not applicable

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TABLE 5-11. GCM NETWORK VARIABLE INPUTS

NV Name	**Description**	**Used By**	**Data Type Info**	**Active State**	**Default Value(s)**
nviRunCmd	●Boolean used to give PCC a run command — genset will start and run (if in auto, no inhibit, no shutdown faults, etc.)	●PCW ●Net Connect ●Master	1 bit (Boolean): (1 BYTE)(PCC SERIAL) Data Range nviRunCmd 0,1	1	0
nviResetCmd	●Boolean used to reset PCC faults (Emergency Stop has to be reset at PCC also)	●PCW ●Net Connect ●Master	1 bit (Boolean):(1 BYTE) (PCC SERIAL) Data Range nviResetCmd 0,1	1	0
nviEmerStopCmd	●Boolean used to e–stop the genset ●NOTE: Once set, setting nviEmerStopCmd back to the inactive state is not enough to clear this state. **SOMEONE MUST PHYSICALLY PRESS THE RESET SWITCH ON THE FRONT PANEL OF THE PCC ITSELF TO CLEAR THIS STATE OF THE PCC.**	●PCW ●Net Connect ●Master	1 bit (Boolean):(1 BYTE) Data Range nviEmerStopCmd 0,1	1	0
nviWakeUpCmd	●Boolean used to turn PCC power on ●used to turn on PCC without starting genset.	●PCW ●Net Connect	1 bit (Boolean):(1 BYTE) Data Range nviWakeUpCmd 0,1	1	0

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TABLE 5-12. GCM NETWORK VARIABLE INPUTS – Continued

NV Name	Description	Used By	Data Type Info	Active State	Default Value(s)
nviLoadDemandCmd (Note 1)	●Boolean used to turn put PCC in Load Demand mode (shutdown when nviLoadDemandCmd = 1, restart when it returns to 0)	●Net Connect ●Master	1 bit (Boolean):(1 BYTE) (PCC SERIAL) Data Range nviLoadDemandCmd 0,1	1	0
nviGenBrkrCtrl (Note 1)	●Boolean used to control a genset breaker connected to the PCC	●Net Connect ●Master	1 bit (Boolean):(1 BYTE) (PCC SERIAL) Data Range nviGenBrkrCtrl 0,1	1=close breaker 0=open	0
nviCustFault1	●Boolean used to activate PCC Customer Fault1 from a remote sensor	●Net Connect ●Master	1 bit (Boolean):(1 BYTE) (PCC SERIAL) Data Range nviCustFault1 0,1	1	0
nviCustFault2	●Boolean used to activate PCC Customer Fault2 from a remote sensor	●Net Connect ●Master	1 bit (Boolean):(1 BYTE) (PCC SERIAL) Data Range nviCustFault2 0,1	1	0
nviCustFault3	●Boolean used to activate PCC Customer Fault3 from a remote sensor	●Net Connect ●Master	1 bit (Boolean):(1 BYTE) (PCC SERIAL) Data Range nviCustFault3 0,1	1	0
nviCustFault4	●Boolean used to activate PCC Customer Fault4 from a remote sensor	●Net Connect ●Master	1 bit (Boolean):(1 BYTE) (PCC SERIAL) Data Range nviCustFault4 0,1	1	0

Note 1. Used in paralleling applications only.

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6. Digital I/O Module

OVERVIEW

This section describes the Digital I/O Module (DIM) and its functional role in the PowerCommand network. It also describes the physical mounting and wiring of this module, and provides procedures for the *logical* installation and connection of the DIM on the network.

In network terms, “logical installation and connection” refers to programming the various devices (or nodes) on the network so that they can communicate with one another. This communication takes the form of passing network variables from one device to another. The process of assigning connections—linking an output variable of one device to an an input variable of another device—is called “binding.” Refer to Appendix C for *Application Table Consumption* to review the number of connections that can be made.

In addition to functional and physical descriptions, this section provides definitions of the network input and output variables assigned to the DIM. Refer to section 3 for the step-by-step procedure for binding these variables to input and output variables assigned to other network devices.

DESCRIPTION

The DIM provides a group of relay contact outputs and discrete inputs for interfacing the PowerCommand Network to alarm or status outputs and to equipment that does not have compatible communications capability.

The DIM contains a terminate circuit for use at the end of a network data bus.

The DIM provides16 Form-C relay contacts, which are driven by data from the network. The contacts are connected to terminal blocks for field wiring. Each relay can be programmed to operate from connectable variables on the network. The module also includes four isolated digital inputs to couple user inputs to the network for additional control and monitoring.

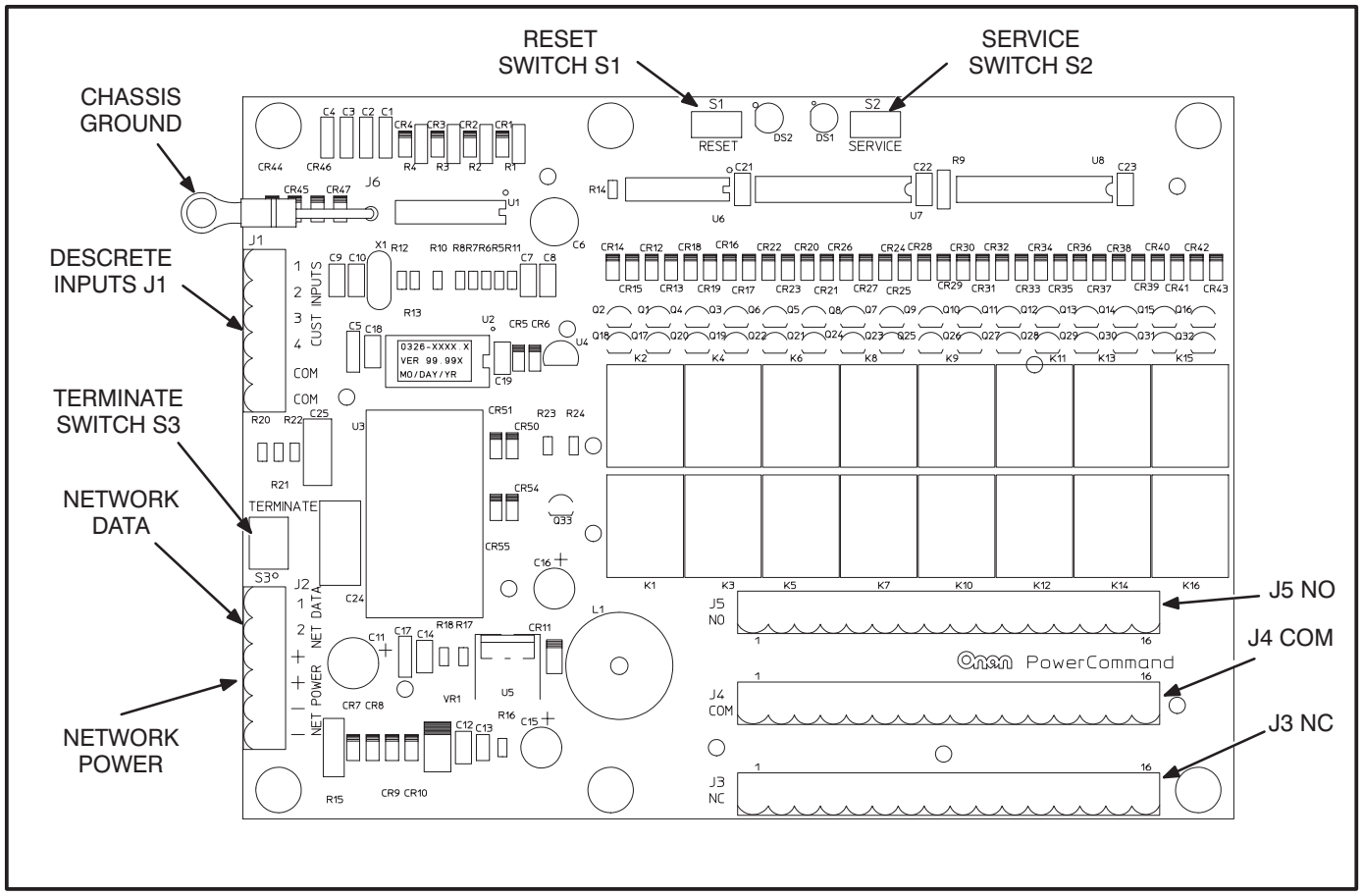

FIGURE 6-1. DIGITAL I/O MODULE

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Power Supply

The DIM requires power from the network power bus. Power supply wiring and connection is covered under *Wiring and Cabling* in Section 2. See Figure 6-5 for minimum power input.

Inputs

Four discrete inputs can be connected to external dry contacts. These inputs must be referenced back to either of two “input common” terminals through dry contacts (see note 6 on Figure 6-5).

Outputs

The DIM provides sixteen 5A, 250VAC/30VDC Form-C dry contact latching relay outputs. Secure wires in the terminal block to 2 inch-lbs. (0.23 N•m).

External devices that are wired to these relays should be fused appropriately to prevent damage to the DIM.

Block Diagram

Refer to Table 6-1 and Figure 6-2 for a block diagram overview of the DIM.

TABLE 6-1. DIM – BLOCK DIAGRAM DESCRIPTIONS

Function	Description/Specification
16 Form C Relay Outputs	16 separate sets of form C dry contacts rated individually at 250VAC/30VDC, 5AMPS. Relays are controlled and powered from the network. Relays are the latching type. They maintain their last state even when power is removed. When power is reapplied, all relays are first reset and then put to the correct state.
4 Discrete Inputs	Contact closure between an input and the input common activates the input. The state of the input is available on the network.
Network Data	Transformer Coupled into Category 4 Twisted Pair at 78,000 bits/sec.
Network Power	The DIM is powered by Network Power (see Section 2).

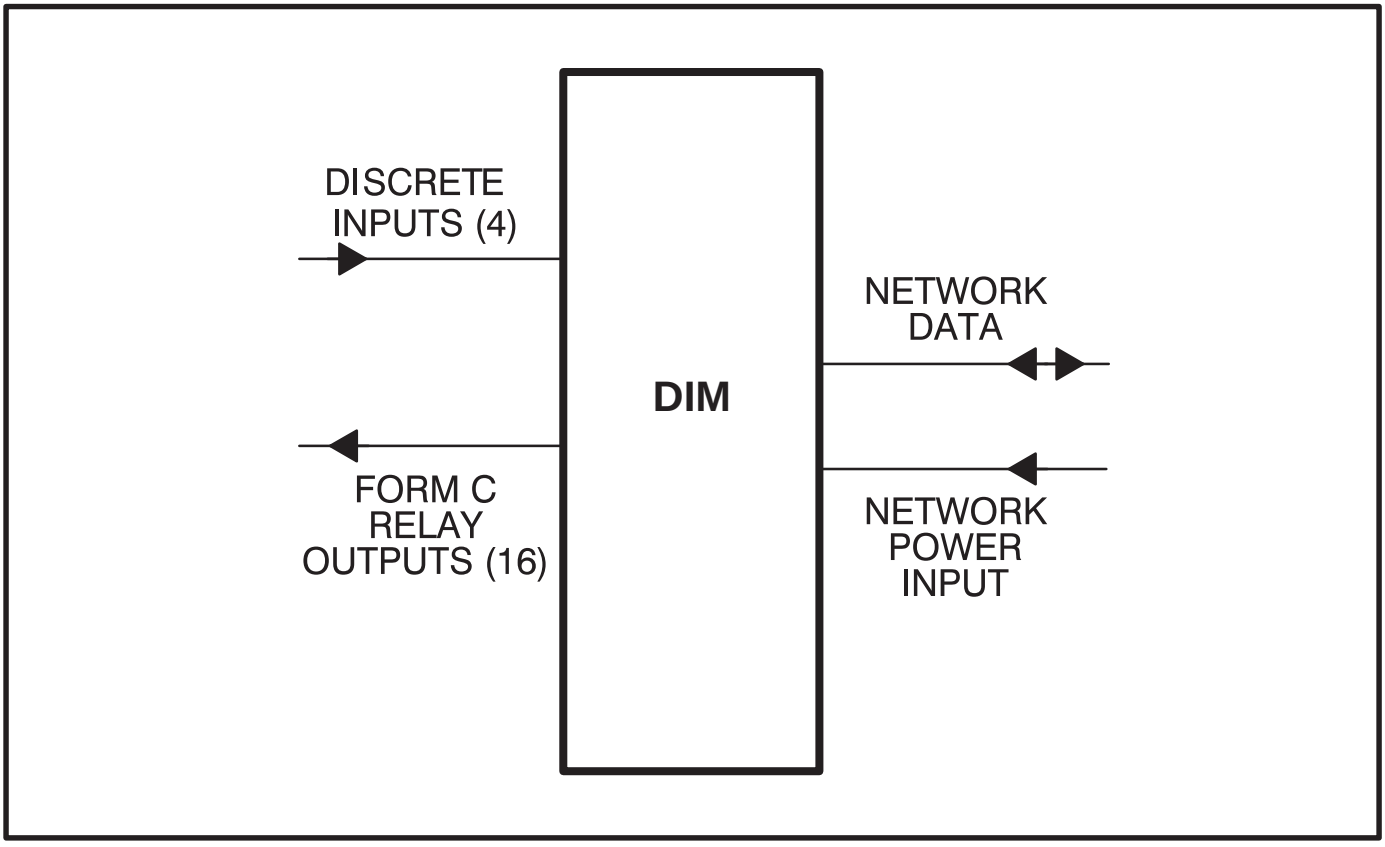

FIGURE 6-2. BLOCK DIAGRAM: DIGITAL I/O MODULE

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LOCATION

Refer to sections two and three for network topology and maximum network length. **All wiring must follow a specific network topology and must fall within distance limits.**

The module is packaged for panel mounting within other equipment enclosures. The module is potted with clear compound in a black molded shell.

Choose a clean, vibration-free mounting surface. Avoid locations that are hot, damp or dusty. The temperature range must not exceed –13°F (–25°C) to 158°F (70°C).

MOUNTING

Figure 6-3 shows the DIM module outline dimensions. The outside dimensions do not include necessary clearance for wire connections (dependant on conduit size and routing).

If mounting the module to a wall, make sure that no wires, plumbing, gas or exhaust lines run behind the wall before drilling the mounting holes.

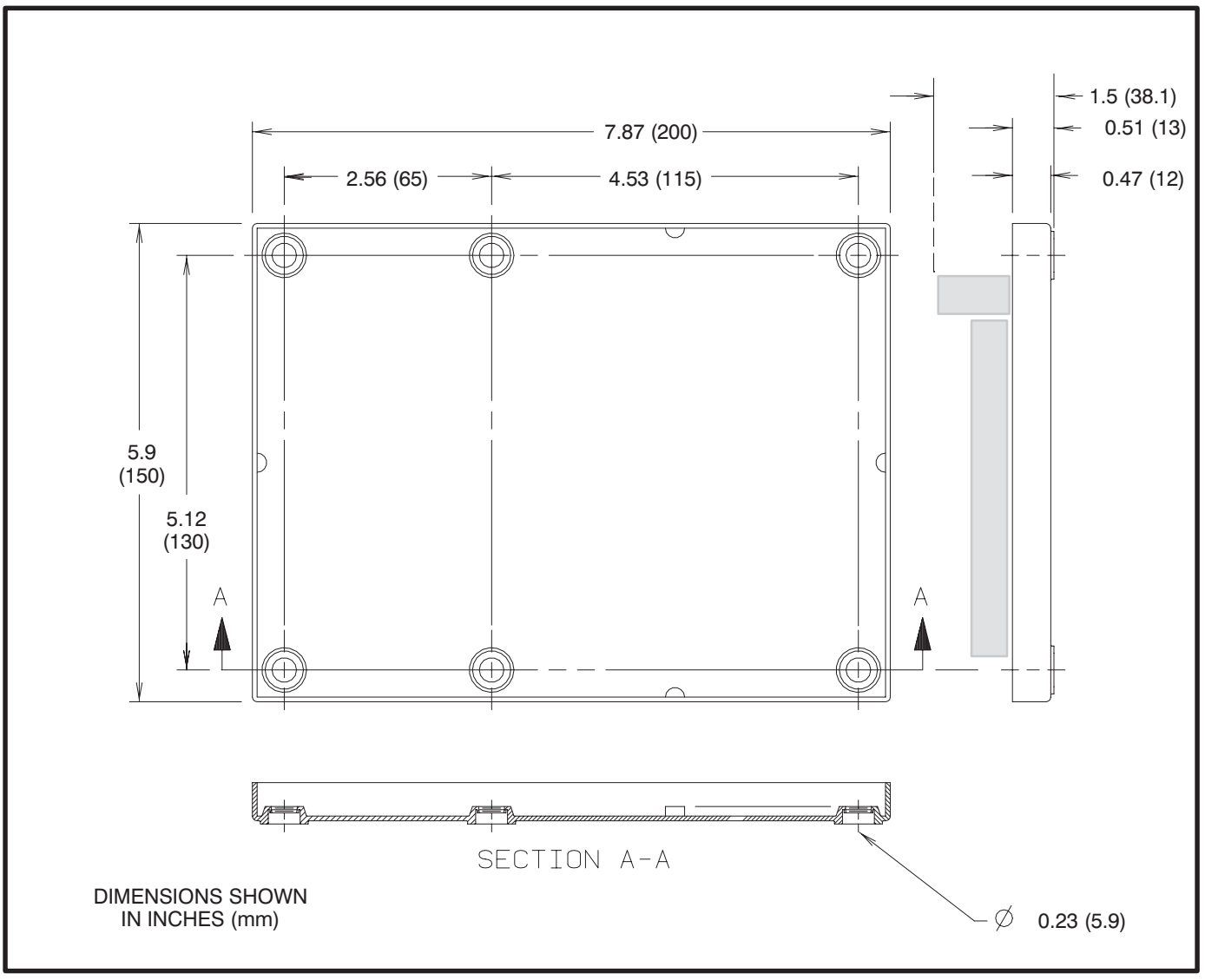

FIGURE 6-3. MOUNTING THE DIGITAL I/O MODULE

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WIRING DIAGRAM

Figures 6-4 and 6-5 show the interconnect wiring diagram and associated notes for the DIM. Refer to the specifications and notes on the drawing.

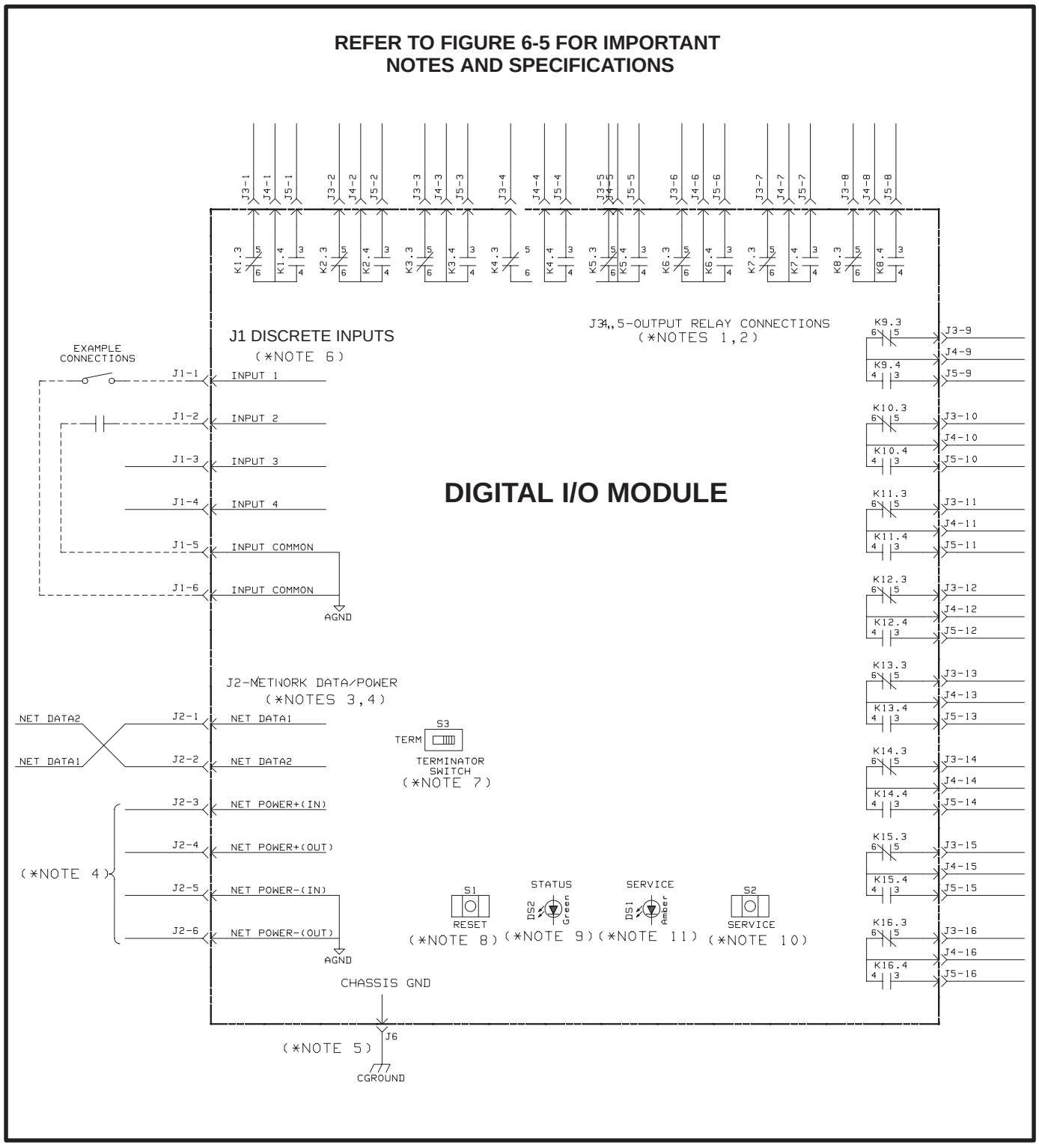

FIGURE 6-4. DIGITAL I/O MODULE INTERCONNECT WIRING DIAGRAM

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SPECIFICATIONS

1. NET POWER
   - 1.1 INPUT VOLTAGE = 10-36VDC (OPERATING RANGE)
   - 1.2 INPUT CURRENT = 30mA @ 36VDC
40mA @ 24VDC
60mA @ 12VDC
100mA @ 10VDC
   - 1.3 INPUT CURRENT(MAX) = 110mA @ 8VDC
   - 1.4 INPUT CONNECTIONS = J2-3(NET POWER+)
J2-5(NET POWER-)
   - 1.5 OUTPUT CONNECTIONS = J2-4(NET POWER+)
J2-6(NET POWER-)

2. NET DATA
   - 2.1 TYPE = ECHELON LONTALK™
78Kb TWISTED PAIR
TRANSFORMER COUPLED
   - 2.2 INPUT CONNECTIONS = J2-1(NET DATA1)
J2-2(NET DATA2)

3. CUSTOMER INPUTS
   - 3.1 TYPE = DISCRETE
   - 3.2 NUMBER = 4
CONNECT TO DRY CONTACTS ONLY
RETURN TO INPUT COMMON
   - 3.3 OUTPUT = 5VDC (OPEN)
5mA SOURCE MAX (CLOSED)
   - 3.4 INPUT CONNECTIONS = J1-1(INPUT 1)
J1-2(INPUT 2)
J1-3(INPUT 3)
J1-4(INPUT 4)
J1-5,6(INPUT COMMON)

4. OUTPUT RELAYS
   - 4.1 TYPE = LATCHING
   - 4.2 NUMBER = 16
   - 4.3 CONTACTS = 1 FORM C
5A(MAX) 250VAC OR 30VDC
   - 4.4 OUTPUT CONNECTIONS = J3(N/C CONTACTS)
J4(COMMON)
J5(N/O CONTACTS)

5. ENVIRONMENTAL
   - 5.1 STORAGE TEMPERATURE = -25 TO 70 °C
   - 5.2 OPERATING TEMPERATURE = -25 TO 70 °C
   - 5.3 HUMIDITY = 95% Non-Condensing

NOTES:

1. ALL RELAYS ARE SHOWN IN RESET OR DE-ENERGIZED POSITION. RELAYS MAINTAIN THE LAST STATE WHEN POWER IS LOST.
2. OUTPUT RELAYS ARE CONTROLLED VIA THE NETWORK.
3. REFER TO INTERCONNECTION PRINT(630-1670).
4. REFER TO POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL(900-0366).
5. CONNECT J6 RING TERMINAL TO A GOOD EMI EARTH GROUND. USE AN "EXTERNAL TOOTH" LOCKWASHER BETWEEN RING AND GROUNDING SURFACE.
6. DO NOT APPLY VOLTAGE TO CUSTOMER INPUTS 1-4.
7. S3, WHEN SET TO TERMINATE, WILL TERMINATE THE TWISTED PAIR NETWORK BUS. DATA LINES MUST BE TERMINATED WHEN THE DIM. IS PHYSICALLY LOCATED AT THE END OF THE NETWORK BUS.
8. S1, RESET PUSH-BUTTON SWITCH, WILL MANUALLY RESET THE DIM.
9. DS2, STATUS LED(GREEN), INDICATES DIM PROCESSOR IS RUNNING.
10. S2, SERVICE PUSH-BUTTON SWITCH, USED TO GENERATE NETWORK MANAGEMENT MESSAGE FOR NODE LOGICAL INSTALLATION.
11. DS1, SERVICE STATUS LED(AMBER), INDICATES THE INSTALLATION AND ERROR STATUS.

FIGURE 6-5. DIGITAL I/O MODULE INTERCONNECT WIRING DIAGRAM – NOTES

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NETWORK TOPOLOGY, DATA MEDIA AND NETWORK POWER

Refer to Section 2 for information on the network topology and data transmission media. Also refer to Section 2 for network power supply wiring calculation procedures.

NETWORK DATA MEDIA AND POWER WIRING

⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Only trained, experienced personnel are to perform the following procedures.***

Connections

Network data and power wiring connections are made at connector J2.

Refer to Figures 6-1 and 6-4. Follow standard wiring practices. Properly secure wire terminals when needed. Secure wires in the terminal blocks to 2 in-lbs. (0.23 N•m).

Conduit

When installing conduit, observe the following precautions:

1. Before beginning conduit installation, cover all components to prevent accidental entry of metal chips.
2. If using rigid conduit, install at least 2 feet (610 mm) of flexible conduit between the rigid conduit and generator set to absorb vibration.
3. Always run DC circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.
4. Data wire can be run without conduit if it is adequately protected. Do not run data wire in conduit with network power wiring.

   ⚠CAUTION ***Installation debris can cause equipment failure and damage. Use extreme care to keep drill chips and filings out of the components when mounting or connecting conduit. Screwdrivers should be used carefully to prevent damage to components.***

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CUSTOMER INPUT AND RELAY OUTPUT CONNECTIONS

Customer input and relay output connections are made at connectors J1, J3, J4, and J6.

Refer to Figures 6-1 and 6-4.

SWITCHES AND LEDs

The Service switch is used during installation (when prompted by the LonMaker program). The Terminator switch must be set to the appropriate position at installation. Switches are described in Table 6-2. LED indicators are described in Table 6-3.

TABLE 6-2. DIM – SWITCHES

Ref	Name	Type	Description
S2	SERVICE	momentary push	Used at time of logical installation to identify device to the installation software. Pressing S2 will light DS1 LED.
S1	RESET	momentary push	Resets the Neuron Chip processor. Must be pushed after Install action.
S3	TERMINATOR	slide	Switch is set to position opposite of text “TERM” from factory. The two devices at ends of network data must have their switches set to “TERM”.

TABLE 6-3. DIM LED INDICATORS

Ref	Color	Name	Description
DS1	Amber	SERVICE	Indicates various states of the DIM node. It will be ON if S2 is pressed and held. States without S2 pressed: **OFF** = All OK. DIM has application image and is installed in a network. **ON**= DIM is application-less or has experienced a error that prevents Neuron Chip from executing application code. **1/2 Hz BLINKING (1 second on/1 second off)** =DIM has an application, but has not been logically installed in a network. **FLASHING** once every 2–3 seconds=DIM is experiencing an error condition causing a watchdog timeout reset (fatal error).
DS2	Green	STATUS	**1/2 Hz BLINKING (1 second on/1 second off)** indicates that the DIM’s processor is executing the application code. In the future, may be used to indicate other conditions for troubleshooting purposes.

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NETWORK INSTALLATION

Section 3 provides a detailed description of the LonWorks network installation process. Read sections 1 and 2 before constructing the network. Section 3 provides the following step-by-step installation procedures:

1. Setting up Network Installation Tools
2. Starting LonMaker Software
3. Using LonMaker Software
4. LonMaker Network Setup
5. Connecting Devices with LonMaker
6. Installing Devices with LonMaker
7. Testing Devices and Verifying Installation
8. Setting up PowerCommand Configuration Tool
9. Using PowerCommand Configuration Tool

NETWORK VARIABLES

The 16 relays can be individually linked to alarm or status outputs from any system device. Four digital inputs are also provided for customer input to the network.

Network Variable Outputs:

Network variables nvoCustinput1 to nvoCustinput4 are for customer inputs to the Network (the inputs are located on the DIM). These variables are individually set by closing a corresponding external contact to short that input to the COM pin of the DIM.

Table 6-4 lists the connectable network variable outputs.

Network Variable Inputs:

When the DIM receives an update of any of the network variables within nviRelay1 to 16, the DIM sets the appropriate relay to the desired state.

Table 6-5 lists the connectable network variable inputs.

Refer to Appendix C for *Application Table Consumption* to review the number of connections that can be made.

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TABLE 6-4. DIM NETWORK VARIABLE OUTPUTS

NV Name	Description	Used by:	Data Type Info		Active State	Default Value(s)
nvoCustInput1	●digital value which indicates whether Customer Input #1 is closed (connected) to the Common. ● used to control other discrete inputs such as nviRunCmd on the PCC.	●Net Connect	1 bit (boolean): Data nvoCustInput1	Range 0,1	1 = input closed to common 0 = open	not applicable
nvoCustInput2	●same as nvoCustInput1	●Net Connect	1 bit (boolean): Data nvoCustInput2	Range 0,1	1 = input closed to common 0 = open	not applicable
nvoCustInput3	●same as nvoCustInput1	●Net Connect	1 bit (boolean): Data nvoCustInput3	Range 0,1	1 = input closed to common 0 = open	not applicable
nvoCustInput4	●same as nvoCustInput1	●Net Connect	1 bit (boolean): Data nvoCustInput4	Range 0,1	1 = input closed to common 0 = open	not applicable

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TABLE 6-5. DIM NETWORK VARIABLE INPUTS

NV Name	Description	Used by:	Data Type Info	Active State	Default Value(s)
nviAllRelays	●16 bit value which is used to control all 16 relays at once. ●logically or'ed with corresponding array element of nviRelay[0..16]. ●bind to nvoRemoteAnnun1 from the GCM for example.	●Net Connect	16 bits (long): Data — Range nviAllRelays — 0..65535 bit 0 = relay 1 bit 1 = relay 2 ..thru bit 15 = relay 16	in each bit: 1 = set relay (NO is closed and NC is open) 0 = reset	not applicable
nviRelay [0..16]	●an array of digital values allowing control of the relays individually. ●Only 1 thru 16 are applicable. ('0' is not used.) ●logically or'ed with appropriate bit from nviAllRelays.	●Net Connect	array: Data — Range nviRelay[0] — not used nviRelay[1] — 0,1 nviRelay[2] — 0,1 nviRelay[3] — 0,1 nviRelay[4] — 0,1 nviRelay[5] — 0,1 nviRelay[6] — 0,1 nviRelay[7] — 0,1 nviRelay[8] — 0,1 nviRelay[9] — 0,1 nviRelay[10] — 0,1 nviRelay[11] — 0,1 nviRelay[12] — 0,1 nviRelay[13] — 0,1 nviRelay[14] — 0,1 nviRelay[15] — 0,1 nviRelay[16] — 0,1	each array element: 1 = set relay (NO is closed and NC is open) 0 = reset	not applicable

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7. Network Gateway Module

OVERVIEW

This section describes the Network Gateway Module (NGM) and its functional role in the PowerCommand Network. It also describes the physical mounting and wiring of the NGM, and provides procedures for the *logical* installation and connection of the NGM on the network.

DESCRIPTION

The NGM provides a PowerCommand Network interface to a PC, either directly or through a modem. The NGM translates network protocol into a protocol that a PC can understand. Figure 7-1 is a block diagram of the NGM.

The NGM allows software running on a PC to access, poll, and control all devices on a network. PowerCommand Software for Windows (PCW) uses this device to access the network. In this application the NGM is referred to as a "Network Gateway Module."

LonMaker and PowerCommand Configuration Tool software require an NGM for installing a network (referred to as a "Network *Installation Gateway*.")

The PC can access the network locally via a direct connection to this module, or remotely for PCW only via a modem connection to this module.

The NGM (Figure 7-2) has an RJ45 connector on one end for connection to network data. It has a DB9 connector on the other end for connection to an RS–232 port on a PC or to an RS-232 port on a modem.

Externally the NGM has a DC power input jack, an ON/OFF switch, a SERVICE pushbutton, and a SERVICE LED indicator.

The NGM does not contain a terminate circuit for use at the end of a network data bus. If the NGM is located at the end of the network data bus, use a JBT to connect the NGM and set the JBT to terminate.

Power Supply

The NGM has a DC power input jack, that connects to utility power through a plug-in transformer.

If the NGM must remain powered during an electrical power failure, use an Uninterruptable Power Supply (UPS). Refer to the UPS section of this manual. If more than one device will be connected to the UPS, purchase a multi-outlet adapter or multi-outlet extension cord.

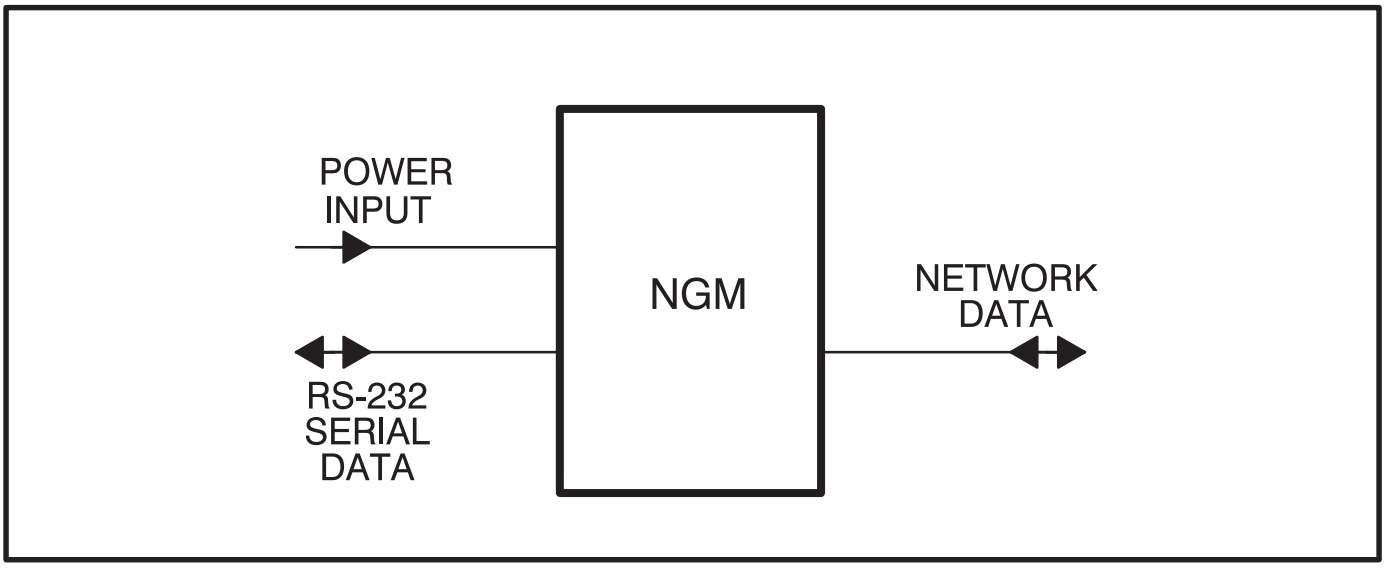

FIGURE 7-1. BLOCK DIAGRAM NETWORK GATEWAY MODULE

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LOCATION

Locate the NGM near an electrical outlet. Refer to section 2 for network topology and maximum network length. **All wiring must follow a specific network topology and must fall within distance limits.**

Choose a clean, vibration-free mounting surface. Avoid locations that are hot, damp or dusty. The temperature range must not exceed 32°F (0°C) to 131°F (55°C).

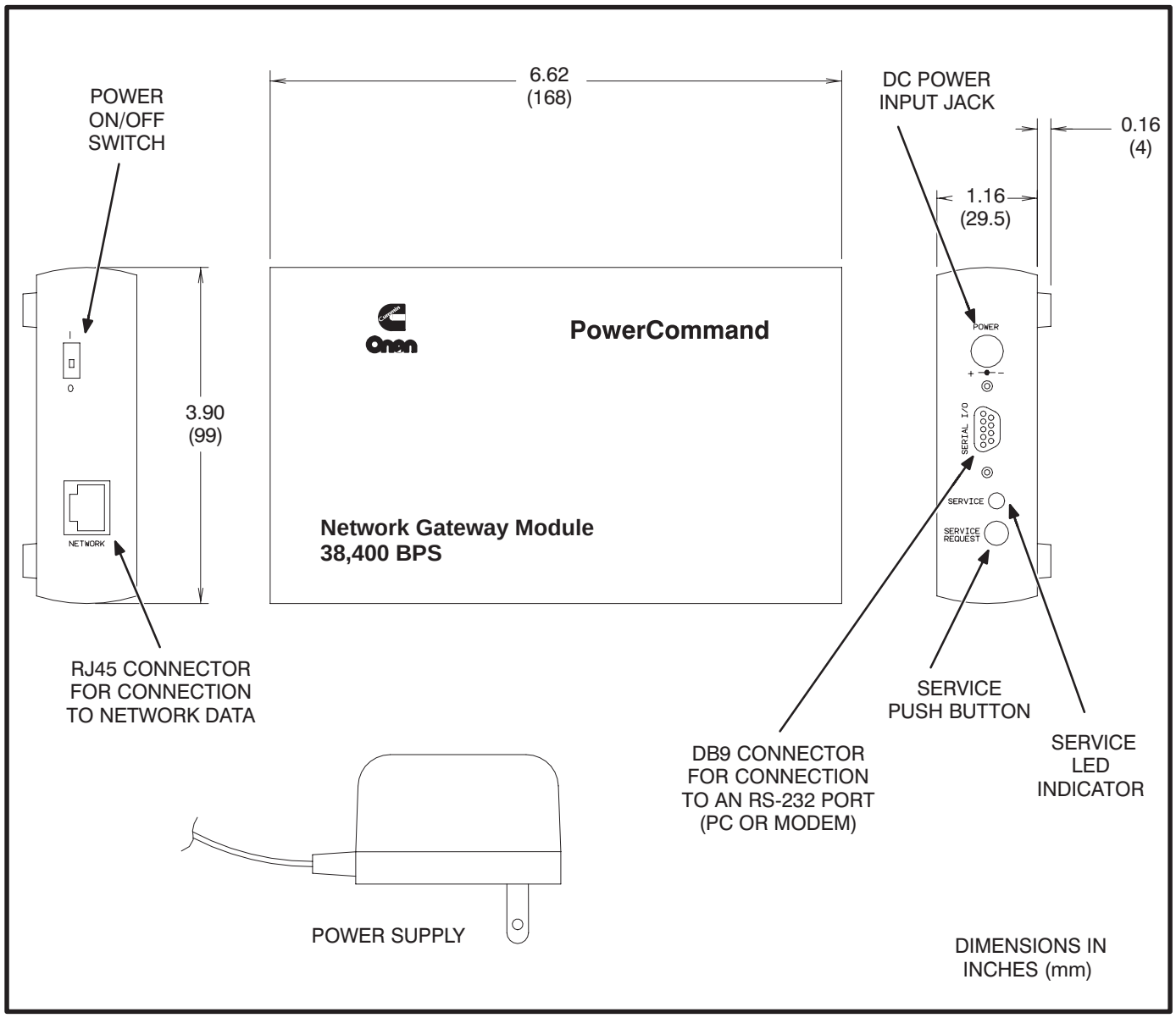

FIGURE 7-2. NETWORK GATEWAY MODULE OUTLINE DRAWING

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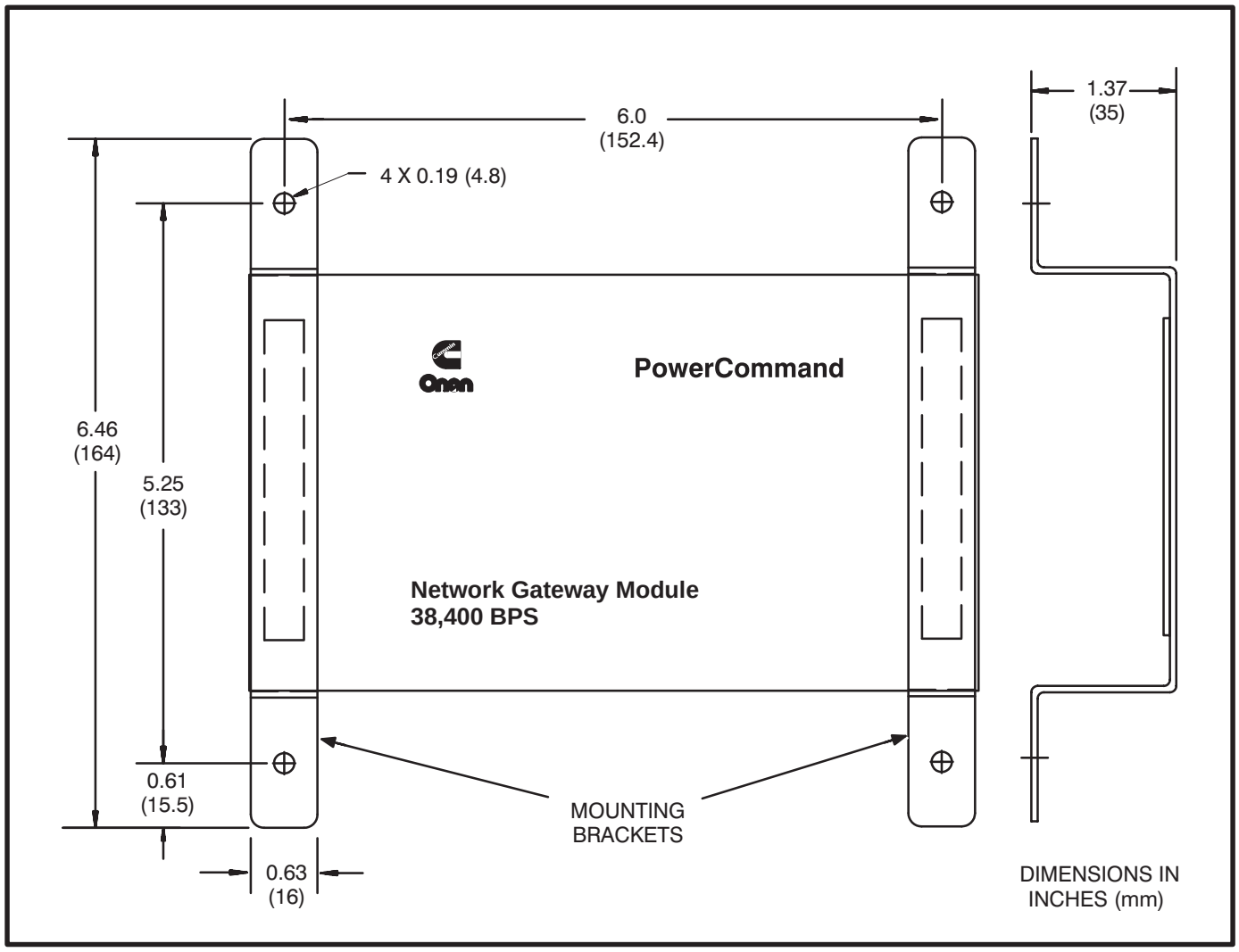

FIGURE 7-3. MOUNTING BRACKET OUTLINE

MOUNTING

Figure 7-2 shows the network gateway module outline dimensions and connection points.

The module can be placed on a clean flat surface or it can be mounted to a wall or other flat surface with mounting brackets. Figure 7-3 shows the outline and mounting hole locations for the mounting brackets.

If mounting to the wall, make sure that no wires, plumbing, gas or exhaust lines run behind the wall before drilling mounting holes.

The foam tape on the brackets is for spacing the brackets. The exposed covering can be removed to adhere the foam spacer to the NGM.

WIRE CABLES

⚠ CAUTION ***Use only the custom made cables that are supplied with this kit. Cables from a computer supply store may look the same, but they may cause equipment damage or connection problems.***

Figure 7-4 shows each of the cables included in this kit.

These cables provide the following interconnects:

- Network Gateway Module to a modem
- Network Gateway Module to a PC
- Network Gateway Module to a Junction Box/ Terminator Module or other network RJ45 connection

Only one of the top two cables shown in figure 7-4 will be used. The cables selected will depend on the application.

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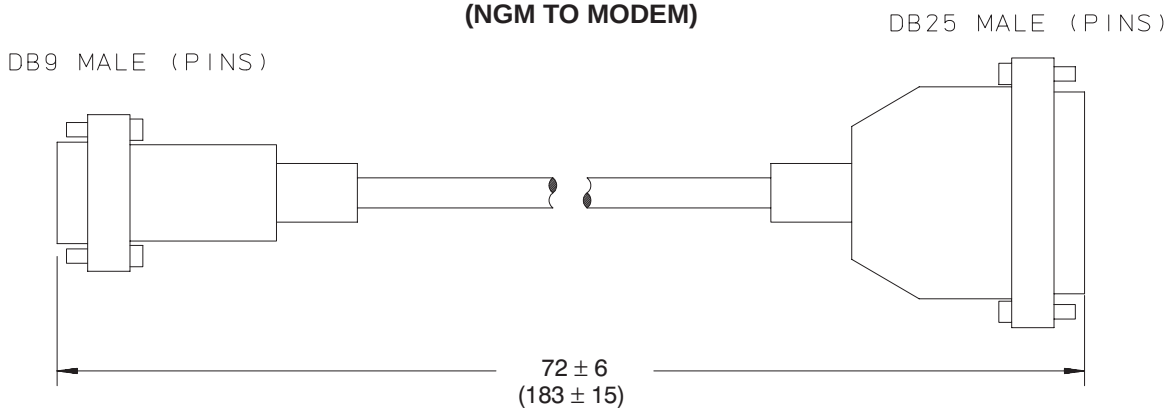
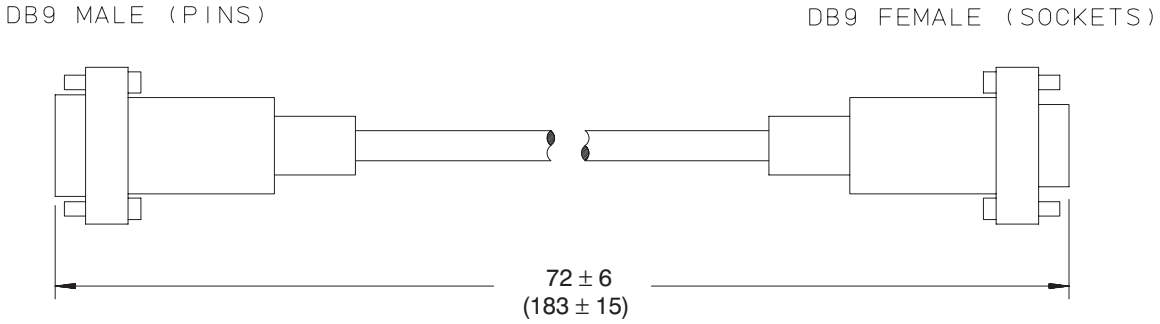
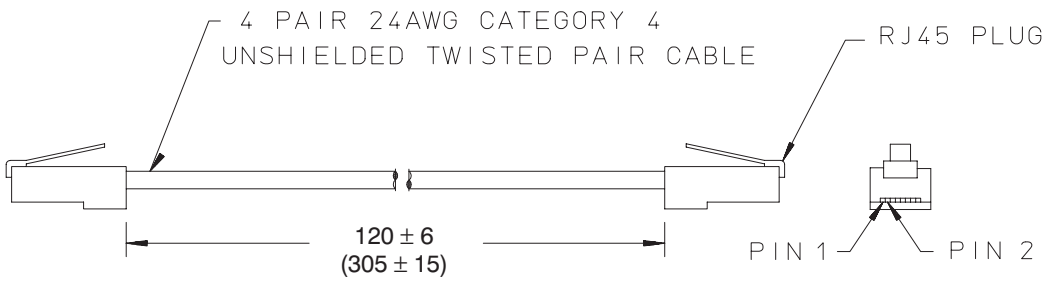
MODEM CABLE
(NGM TO MODEM)



NULL MODEM CABLE
(NGM TO PC)



NETWORK PATCH CABLE
(NGM TO JUNCTION BOX/TERMINATOR)



DIMENSIONS IN
INCHES (cm)

FIGURE 7-4. WIRE HARNESS DRAWINGS

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NETWORK TOPOLOGY AND DATA MEDIA

Refer to section 2 for information on the network topology and data transmission media.

⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Only trained, experienced personnel are to perform the following procedures.***

Connections

Network data connections are made at an RJ45 connector for LonWorks network data, and at a DB9 connector for connection to an RS-232 port on a PC or a modem. (Connectors are shown in Figure 7-2, cables supplied with the NGM are shown in Figure 7-4.)

SERVICE SWITCH AND LED

The Service switch is used during installation (when prompted by the LonMaker program)**. It is important to press the service switch on the NGM that is part of the permanent site ("Network Gateway Module") and not the "Network Installation Gateway" used temporarily as part of the service tools for setting up the network.**

The yellow LED indicates if the service switch is being pressed. The LED indicator blinks when the NGM is unconfigured and is off if the NGM is configured. The LED indicator remains on if an unrecoverable error is detected.

NETWORK INSTALLATION

Sections 3 and 4 provide a detailed description of the network installation process. Read Sections 1 and 2, before constructing the network. Sections 3 and 4 provide the following step-by-step installation procedures:

1. Setting up Network Installation Tools
2. Starting LonMaker Software
3. Using LonMaker Software
4. LonMaker Network Setup
5. Connecting Devices with LonMaker
6. Installing Devices with LonMaker
7. Testing Devices and Verifying Installation
8. Setting up PowerCommand Configuration Tool
9. Using PowerCommand Configuration Tool

Refer to Table 7-1 for an example of a message tag connection for dial-out.

TABLE 7-1. EXAMPLE OF A MESSAGE TAG CONNECTION FOR DIAL-OUT

MESSAGE TAG CONNECTION FOR DIAL–OUT	
From Tag Output: (CCM, GCM)	**To Tag Input (NGM)**
NGMTag1	*msg_in*

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8. Junction Box / Terminator

OVERVIEW

A Junction Box/Terminator (JBT) is a device that provides connection points for network power and data wires. The JBT contains a terminate circuit for use at the end of a network data bus. JBTs may be used throughout a network for connecting in Pass Thru or Local Loop configurations. A JBT is required to connect an NGM to the end of a network data bus.

The JBT is used to provide a network termination for NGM nodes that are located at an end of the network bus. Termination of nodes at the ends of the network is required.

DESCRIPTION

The JBT provides two 6-position pluggable terminal blocks for data and power (J1 and J2), and two RJ45 jacks for 24AWG stub connections (J3 and J4). The JBT also has a switch (S1) to connect the data lines to a terminator circuit, and a switch (S2) to select either Pass Thru or Local Loop connection between the data lines on the two terminal blocks.

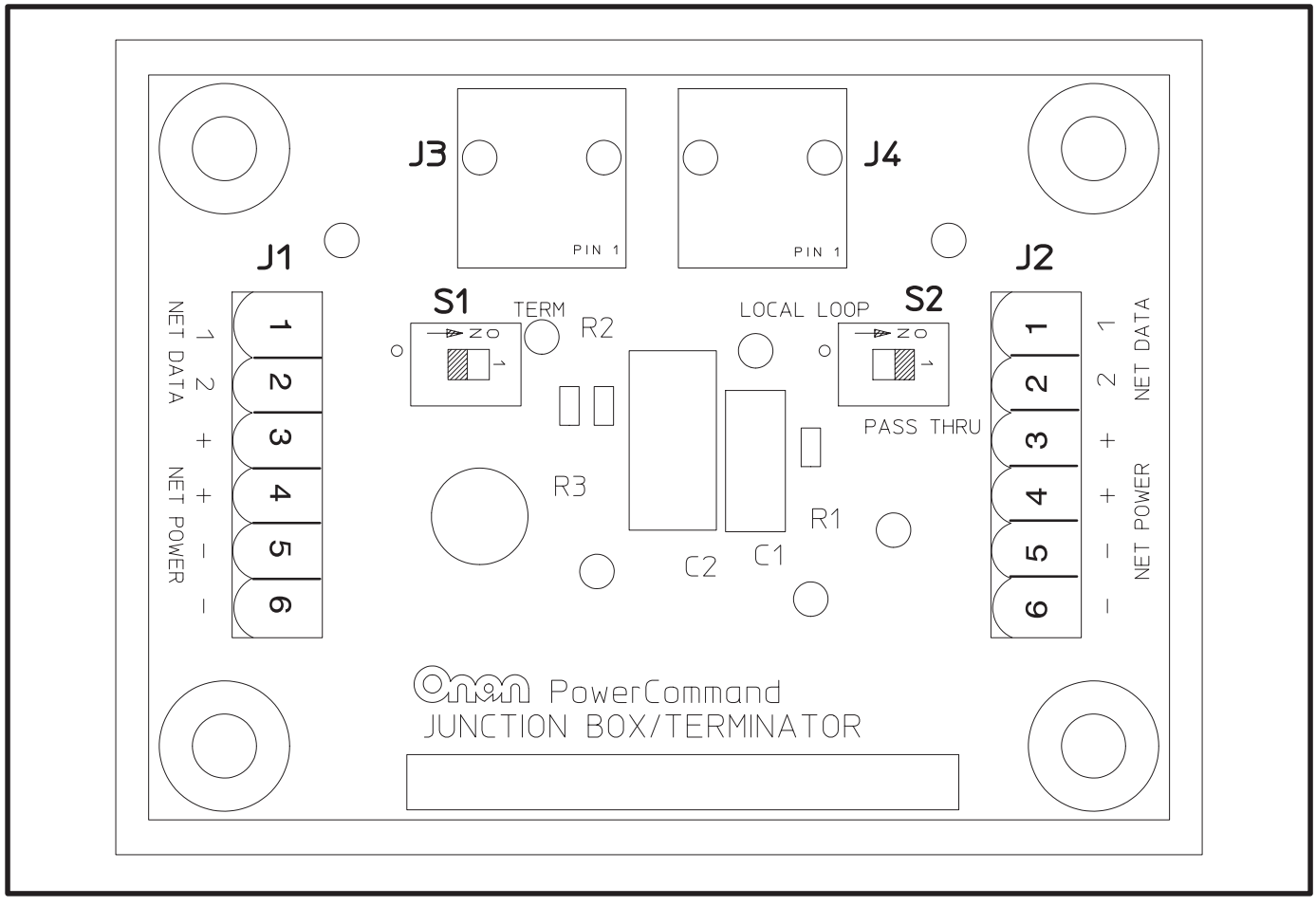

FIGURE 8-1. JUNCTION BOX / TERMINATOR MODULE

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LOCATION

Refer to Section 2 for network topology and maximum network length. **All wiring must follow a specific network topology and must fall within distance limits.**

The JBT is designed for panel mounting within other equipment enclosures. The module is potted with clear compound in a black molded shell.

Choose a clean, vibration-free mounting surface. Avoid locations that are hot, damp or dusty. The temperature range must not exceed –40°F (–40°C) to 158°F (70°C).

MOUNTING

Figure 8-2 shows the JBT outline dimensions. The outside dimensions do not include clearance for wire connections.

If mounting the module to a wall, make sure that no wires, plumbing, gas or exhaust lines run behind the wall before drilling the mounting holes.

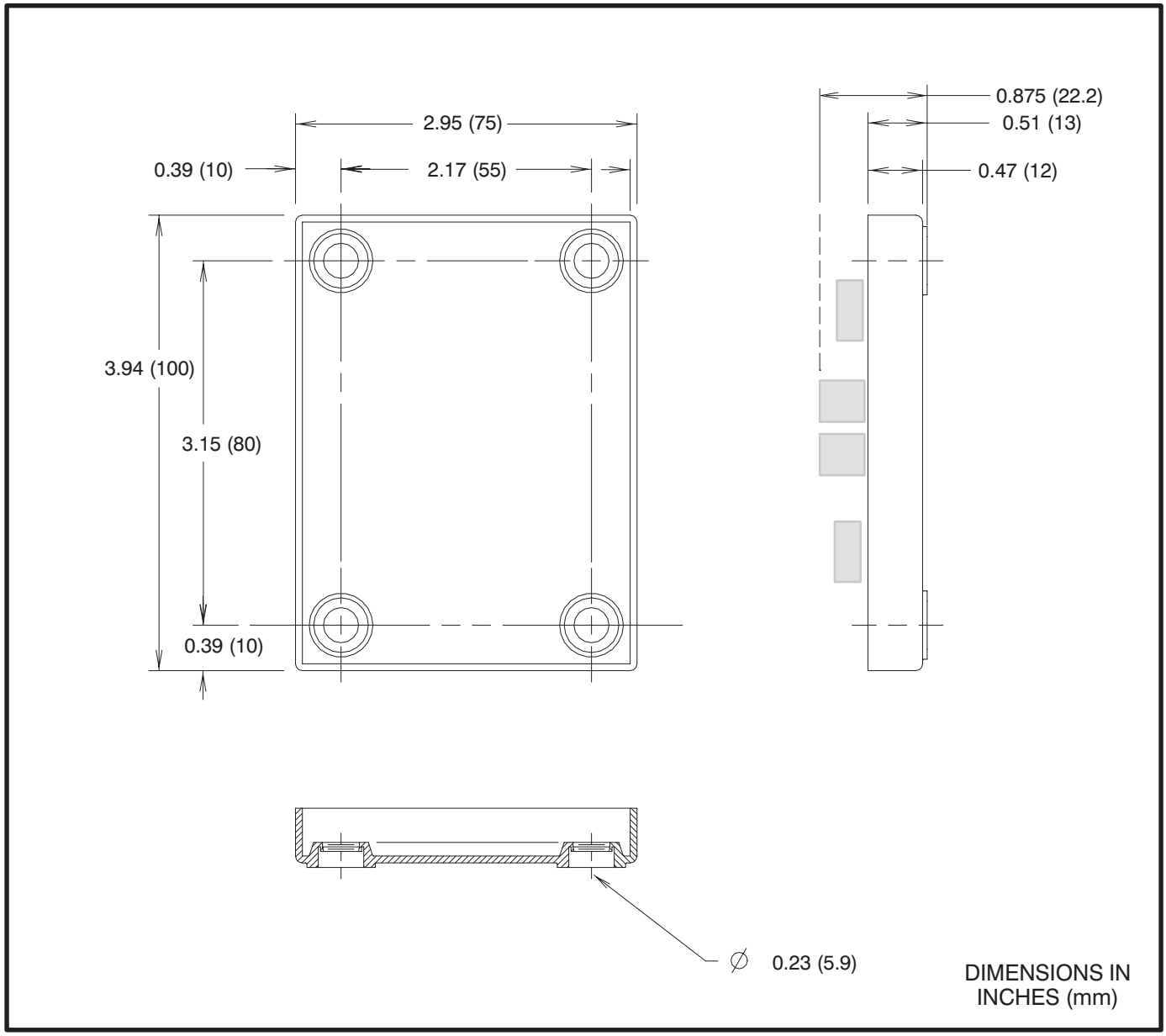

FIGURE 8-2. MOUNTING THE JUNCTION BOX / TERMINATOR MODULE OUTLINE DRAWING

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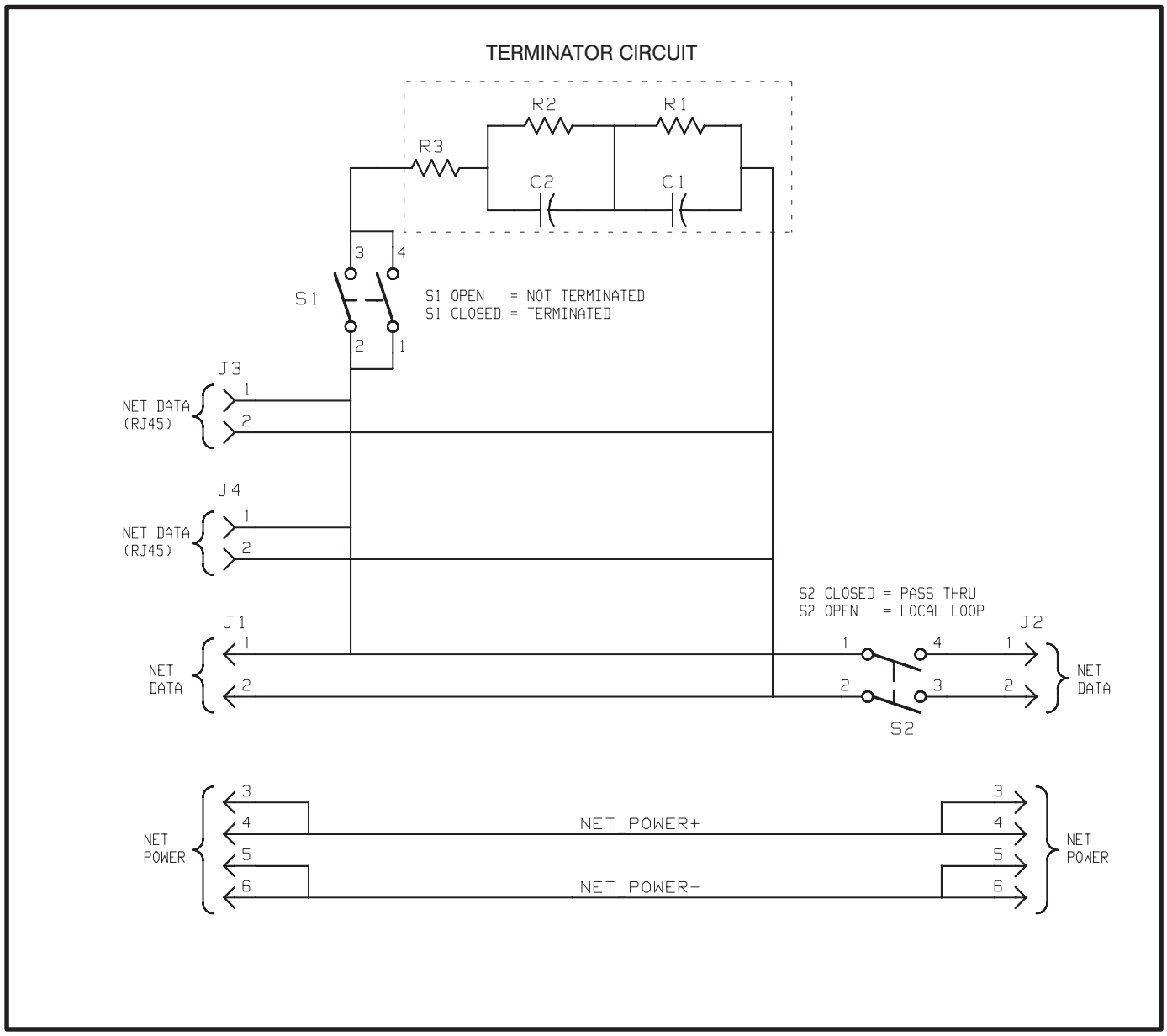

FIGURE 8-3. JUNCTION BOX/TERMINATOR MODULE SCHEMATIC

WIRING DIAGRAM

Figure 8-3 shows the wiring diagram for the JBT. The diagram shows the functions of the S1 and S2 switches on the module.

NETWORK TOPOLOGY, DATA MEDIA AND NETWORK POWER

Refer to Section 2 for information on the network topology and data transmission media. Also refer to Section 2 for network power supply wiring calculation procedures.

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NETWORK DATA MEDIA AND POWER WIRING

⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Only trained, experienced personnel are to perform the following procedures.***

Connections

Network data and power wiring connections are made at connectors J1, J2, J3, and J4. (Refer to Table 8-1 and Figure 8-1.)

Conduit

When installing conduit, observe the following precautions:

1. Before beginning conduit installation, cover all components to prevent accidental entry of metal chips.
2. If using rigid conduit, install at least 2 feet (610 mm) of flexible conduit between the rigid conduit and generator set to absorb vibration.
3. Always run DC circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.
4. Data wire can be run without conduit if it is adequately protected. Do not run data wire in conduit with network power wiring.

⚠CAUTION ***Installation debris can cause equipment failure and damage. Use extreme care to keep drill chips and filings out of the components when mounting or connecting conduit. Screwdrivers should be used carefully to prevent damage to components.***

SWITCHES

Terminator and Local Loop / Pass Thru switches are described in Table 8-2.

TABLE 8-1. JBT CONNECTIONS

Connector	Description
J1–1	Network Data1 signal
J1–2	Network Data2 signal
J1–3,4	Network Power+
J1–5,6	Network Power–
J2–1	Network Data1 signal
J2–2	Network Data2 signal
J2–3,4	Network Power+
J2–5,6	Network Power–
J3	Network Data — Use patch cable 0338–3240 to connect to NGM
J4	Network Data — Use patch cable 0338–3240 to connect to NGM

TABLE 8-2. JBT SWITCHES

Ref	Name	Type	Description
S1	TERMINATOR	slide	Switch is set to position opposite of text “TERM” from factory. If the JBT is used to connect an NGM at one end of the network data bus, then switch must be set to “TERM”.
S2	LOCAL LOOP/ PASS THRU SELECT	slide	Switch is set to position “PASS THRU” from factory. Switch should only be set to “LOCAL LOOP” for a local loop wiring arrangement. Setting switch to “LOCAL LOOP” breaks network data connection between J1 and J2. J3 and J4 are then connected as a stub from J1 only.

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9. Network Annunciator Module

OVERVIEW

This section describes the Network Annunciator Module (NAM) and its functional role in the PowerCommand network. It also describes the physical mounting and wiring of this module, and provides procedures for the *logical* installation and connection of the NAM on the network. Refer to the Network Annunciator Operator's Manual 900-0282 for features, customer options and operating procedures.

In network terms, "logical installation and connection" refers to programming the various devices (or nodes) on the network so that they can communicate with one another. This communication takes the form of passing network variables from one device to another. The process of assigning connections—linking an output variable of one device to an an input variable of another device—is called "binding." Refer to Appendix C for *Application Table Consumption* to review the number of connections that can be made.

The NAM contains a Digital I/O Module that provides a communications interface with other modules on the network. Refer to the Digital I/O Module section for network input and output variables assigned to the Digital I/O Module. Refer to Section 3 for the step-by-step procedure for binding these variables to input and output variables assigned to other network devices.

DESCRIPTION

The NAM shown in Figure 9-1, combines a hardwired PowerCommand System Annunciator with a Digital I/O Module. The NAM is connected to the network by twisted pair data wire.

The NAM contains a terminate circuit for use at the end of a network data bus.

The NAM has 20 LEDs to annunciate alarms. In NFPA 110 applications the network directly controls 16 of the LEDs and indirectly controls one LED (DS3), refer to Table 9-4). The remaining three LEDs can be hardwired. In non-NFPA 110 applications the network controls 16 of the LEDs and four can be hardwired.

The Digital I/O Module also includes four isolated digital inputs to couple user inputs to the network for additional control and monitoring.

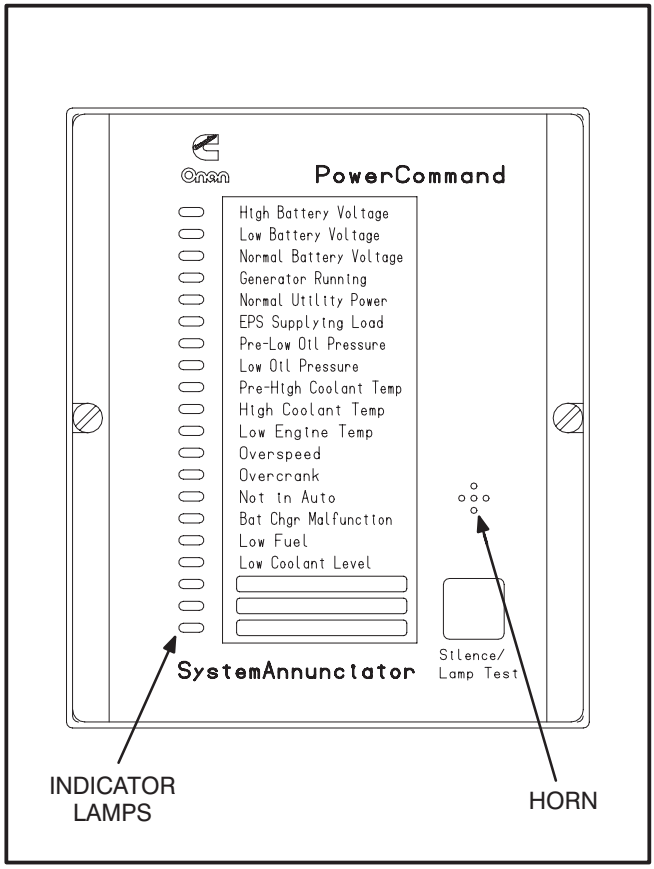

FIGURE 9-1. ANNUNCIATOR

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Block Diagram

Refer to Table 9-1 and Figure 9-2 for a block diagram overview of the network annunciator module.

LOCATION

Refer to Section 2 for network topology and maximum network length. **All wiring must follow a specific network topology and must fall within distance limits.**

This module is available in two versions: one has an oversize cover for flush mounting and the other has a smaller cover for surface mounting.

Choose a clean, vibration-free mounting surface. Avoid locations that are hot, damp or dusty. The temperature range must not exceed –13°F (–25°C) to 158°F (70°C).

MOUNTING

Figure 9-3 shows the network annunciator outline dimensions. The outside dimensions do not include necessary clearance for wire connections. If mounting the module to a wall, make sure that no wires, plumbing, gas or exhaust lines run behind the wall before drilling the mounting holes.

TABLE 9-1. NETWORK ANNUNCIATOR MODULE – BLOCK DIAGRAM DESCRIPTIONS

Function	Description/Specification
System Annunciator/ Digital I/O Module	Standard hardwired PowerCommand System Annunciator. (See Digital I/O Module section)
Common Alarm Form C Output	Same as on System Annunciator – 2A, 30VDC
Silence/Lamp Test Input/Output	Same as on System Annunciator – 2A, 30VDC. Also acts as input.
Unused Alarm Inputs (3 or 4)	Hardwired inputs to the System Annunciator. Only three are available in NFPA110 applications. Four are available for generic applications.
Customer Inputs (4)	Contact closure between an input and the input common on the DIM section activates the input. The state of the input is available on the network.
Network Data	Transformer Coupled into Category 4 Twisted Pair at 78,000 bits/sec.
Network Power	The NAM is powered by Network Power. See “Network Power” in section 2.

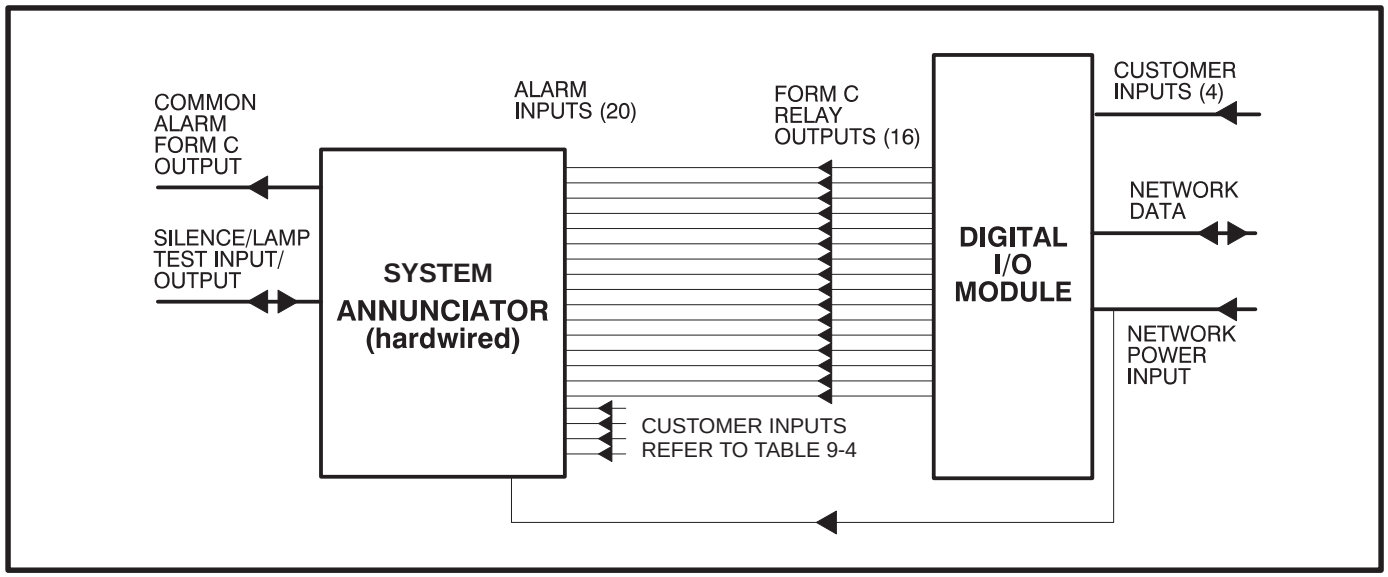

FIGURE 9-2. BLOCK DIAGRAM: NETWORK ANNUNCIATOR MODULE

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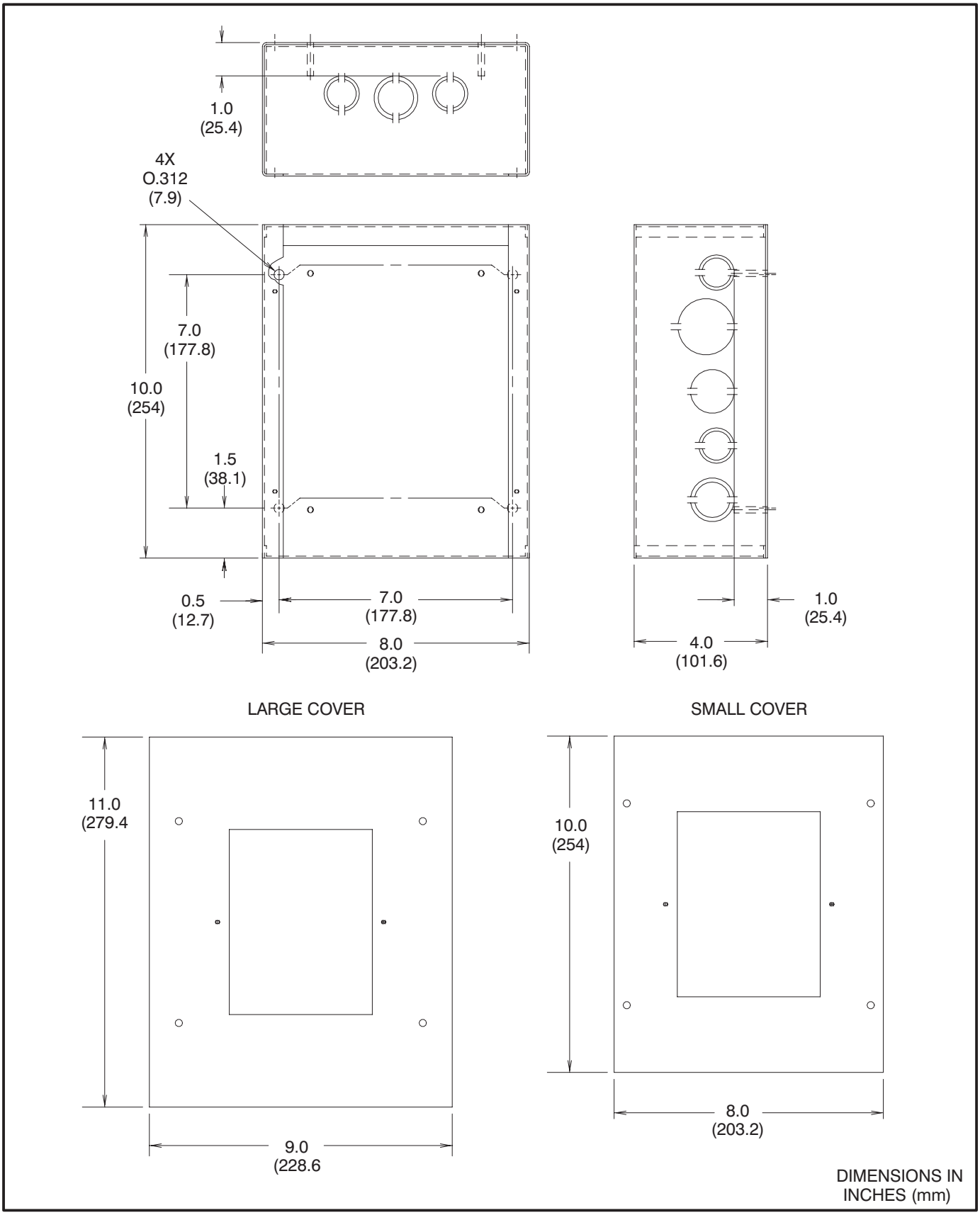

FIGURE 9-3. ANNUNCIATOR BOX OUTLINE

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WIRING DIAGRAM

Figures 9-4 and 9-5 show the interconnect wiring diagram and associated notes for the network annunciator module. Refer to the specifications and notes on the drawing. The DIM is prewired to the negative logic annunciator. Refer to the NAM Operator's Manual (900-0282) for complete wiring information.

Power Supply

The Network Annunciator Module requires network power. Power supply wiring and connection is covered in Section 2. See Figure 9-4 for minimum power input.

Inputs

Four digital inputs can be connected to external dry contacts (J1-1 thru J1-4). These inputs must be referenced back to either of two "input common" terminals through dry contacts (see note 2 on Figure 9-4). Three customer faults and one customer indication can be connected to the negative logic annunciator. These inputs must be referenced back to ground (TB1-24) through dry contacts (see notes 5, 6 and 15 on Figure 9-4).

TB1-20 can be used as both input and output for Silence/Lamp test (see notes 5 and 6 on Figure 9-4).

Outputs

Two Form C relays (K1 and K2) are available for remote Silence/Lamp Test and Remote Alarm. Both sets of contacts provide ground to an external circuit and are rated at 2 amps maximum at 30 VDC (see notes 5 and 6 on Figure 9-4).

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SPECIFICATIONS

```
1.NET POWER
  1.1 INPUT VOLTAGE = 10-36VDC
      (OPERATING RANGE)
  1.2 INPUT CURRENT(NORMAL) =  40mA @ 36VDC
                               55mA @ 24VDC
                               80mA @ 12VDC
                              110mA @ 10VDC
  1.3 INPUT CURRENT(LAMP TEST) = 200mA @ 36VDC
                                 250mA @ 24VDC
                                 500mA @ 12VDC
                                 650mA @ 10VDC
  1.4 INPUT CURRENT(MAX) = 1300mA @ 4VDC
  1.5 INPUT CONNECTIONS  = J2-3(NET POWER+)
                           J2-5(NET POWER-)
  1.6 OUTPUT CONNECTIONS = J2-4(NET POWER+)
                           J2-6(NET POWER-)
                           (SHARED CONNECTIONS WITH
                            ANNUNCIATOR HARNESS)

2.NET DATA
  2.1 TYPE = ECHELON LONTALK™
             78Kb TWISTED PAIR
             TRANSFORMER COUPLED
  2.2 INPUT CONNECTIONS = J2-1(NET DATA1)
                          J2-2(NET DATA2)

3.DIM CUSTOMER INPUTS(NETWORK)
  3.1 TYPE = DISCRETE
  3.2 NUMBER = 4
               CONNECT TO DRY CONTACTS ONLY
               RETURN TO INPUT COMMON
  3.3 OUTPUT = 5VDC (OPEN)
               5mA SOURCE MAX (CLOSED)
  3.4 INPUT CONNECTIONS = J1-1(INPUT 1)
                          J1-2(INPUT 2)
                          J1-3(INPUT 3)
                          J1-4(INPUT 4)
                          J1-5,6(INPUT COMMON)

4.ANNUNCIATOR CUSTOMER INPUTS(HARD-WIRED)
  4.1 TYPE = DISCRETE
  4.2 NUMBER = 4
               CONNECT TO DRY CONTACTS ONLY
               RETURN TO TB1-24
  4.3 OUTPUT = 5VDC (OPEN)
               20mA SOURCE MAX (CLOSED)
  4.4 INPUT CONNECTIONS = TB1-17(CUSTOMER FAULT 1)
                          TB2-5(CUSTOMER FAULT 2)
                          TB2-6(CUSTOMER FAULT 3)
                          TB1-20(SILENCE/LAMP TEST INPUT)

5.ANNUNCIATOR OUTPUT RELAYS
  5.1 TYPE = SEALED
  5.2 NUMBER = 2
  5.3 CONTACTS = 1 FORM C
                 2A @ 30VDC
  5.4 OUTPUT CONNECTIONS = TB2-7,8(N/C CONTACTS)
                           TB2-21,23(COMMON)
                           TB1-20,22(N/O CONTACTS)

6.ENVIRONMENTAL
  6.1 STORAGE TEMPERATURE = -25 TO 70°C
  6.2 OPERATING TEMPERATURE = -25 TO 70°C
  6.3 HUMIDITY = 45 TO 85% RH
```

NOTES:

1. ALL RELAYS ARE SHOWN IN RESET OR DE-ENERGIZED POSITION.
2. DO NOT APPLY VOLTAGE TO CUSTOMER INPUTS.
3. REFER TO INTERCONNECTION PRINT(630-1670).
4. REFER TO POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL(900-0366).
5. REFER TO NETWORK ANNUNCIATOR MANUAL(900-0282) AND DRAWING 300-4731.
6. TB1-20 USED AS BOTH INPUT AND OUTPUT FOR SILENCE/LAMP TEST.
7. S3, WHEN SET TO TERMINATE, WILL TERMINATE THE TWISTED PAIR NETWORK BUS. DATA LINES MUST BE TERMINATED WHEN THE NAM. IS PHYSICALLY LOCATED AT THE END OF THE NETWORK BUS.
8. S1, RESET PUSH-BUTTON SWITCH, WILL MANUALLY RESET THE NAM.
9. DS2, STATUS LED(GREEN), INDICATES DIM PROCESSOR IS RUNNING.
10. S2, SERVICE PUSH-BUTTON SWITCH, USED TO GENERATE NETWORK MANAGEMENT MESSAGE FOR NODE LOGICAL INSTALLATION.
11. DS1, SERVICE STATUS LED(AMBER), INDICATES THE INSTALLATION AND ERROR STATUS.
12. ANNUNCIATOR FRONT PANEL LEDS,(1,2,4-17), ARE CONTROLLED OVER THE NETWORK.
13. IN THE NFPA-110 APPLICATION, ANNUNCIATOR FRONT PANEL LED 3 (NORMAL BATTERY) IS ON WHENEVER BOTH LED 1(HIGH BATTERY) AND LED 2(LOW BATTERY) ARE OFF.
    IN AN APPLICATION OTHER THAN NFPA-110, LED 3 IS CONTROLLED BY HARDWIRED INPUT (SEE NOT 15).
14. ANNUNCIATOR FRONT PANEL LEDS 18-20,(CUSTOMER FAULT), ARE NOT USED, BUT MAY BE HARD-WIRED FOR CUSTOM USE.
15. CUSTOMER INDICATION 3 MAY ONLY BE USED FOR APPLICATIONS OTHER THAN NFPA-110.TO USE NETWORK ANNUNCIATOR FOR OTHER APPLICATIONS, CHANGE SYSTEM ANNUNCIATOR SWITCH S3 AS FOLLOWS.

S3	FROM (NFPA-110)	TO (NON-NFPA-110)
S3-1	CLOSED	OPEN
S3-2	CLOSED	OPEN
S3-3	CLOSED	OPEN
S3-4	CLOSED	CLOSED
S3-5	OPEN	CLOSED
S3-6	CLOSED	CLOSED

FIGURE 9-4. NOTES FOR INTERCONNECTION DIAGRAM (FIGURE 9-5)

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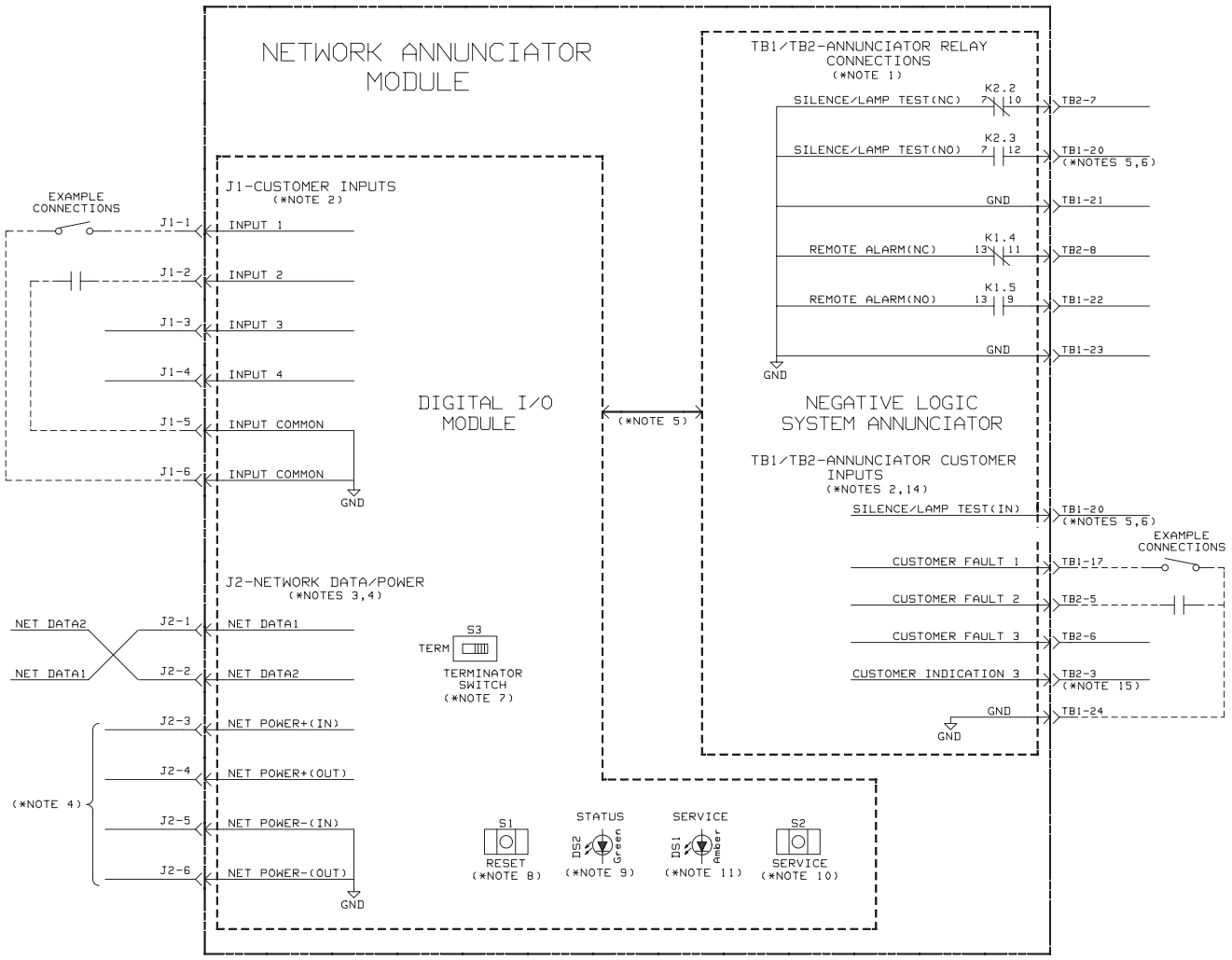
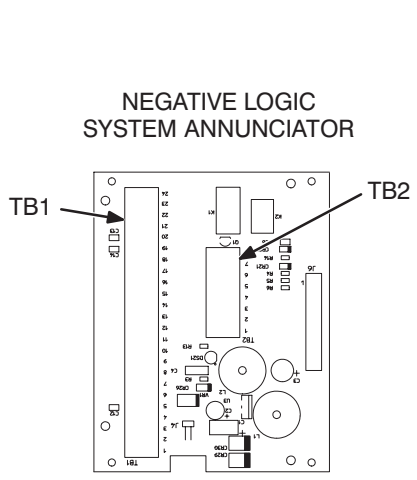
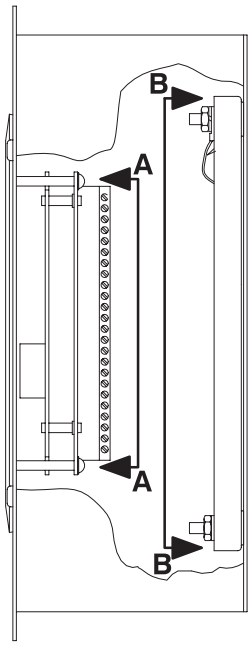
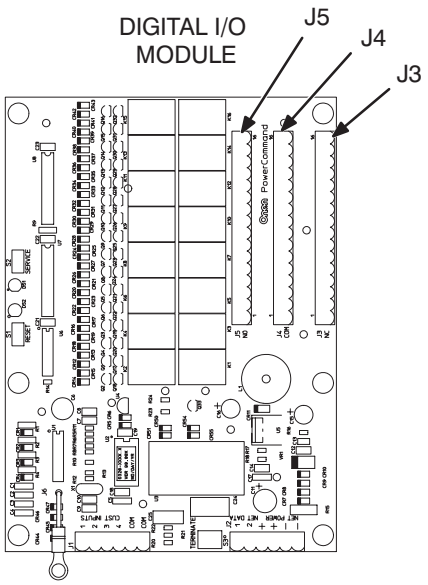
SEE FIGURE 9-4 FOR INTERCONNECTION DIAGRAM NOTES





View A-A





View B-B

FIGURE 9-5. NETWORK ANNUNCIATOR MODULE INTERCONNECTION DIAGRAM

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NETWORK TOPOLOGY, DATA MEDIA AND NETWORK POWER

Refer to Section 2 for information on the network topology and data transmission media. Also refer to Section 2 for network power supply wiring calculation procedures.

NETWORK DATA MEDIA AND POWER WIRING

⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Only trained, experienced personnel are to perform the following procedures.***

Connections

Network data and power wiring connections are made at connector J2. Refer to Figures 9-4 and 9-5.

Conduit

When installing conduit, observe the following precautions:

1. Before beginning conduit installation, cover all components to prevent accidental entry of metal chips.
2. If using rigid conduit, install at least 2 feet (610 mm) of flexible conduit between the rigid conduit and generator set to absorb vibration.
3. Always run DC circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.
4. Data wire can be run without conduit if it is adequately protected. Do not run data wire in conduit with network power wiring.

⚠CAUTION ***Installation debris can cause equipment failure and damage. Use extreme care to keep drill chips and filings out of the components when mounting or connecting conduit. Screwdrivers should be used carefully to prevent damage to components.***

SWITCHES AND LEDs

The Service switch (S2) is used during installation (when prompted by the LonMaker program). The Terminator switch (S3) must be set to the appropriate position at installation. Switches are described in Table 9-2. LED indicators are described in Table 9-3.

TABLE 9-2. NAM – SWITCHES (LOCATED ON THE DIM)

Ref	Name	Type	Description
S2	SERVICE	momentary push	Used at time of logical installation to identify device to the installation software. Pressing S2 will light DS1 LED.
S1	RESET	momentary push	Resets the Neuron Chip processor. Must be pushed after the Install action.
S3	TERMINATOR	slide	Switch is set to position opposite of text “TERM” from factory. The two devices at ends of network data must have their switches set to “TERM”.

TABLE 9-3. NAM LED INDICATORS (LOCATED ON THE DIM)

Ref	Color	Name	Description
DS1	Amber	SERVICE	Indicates various states of the DIM node. It will be ON if S2 is pressed and held. States without S2 pressed: **OFF** = All OK. DIM has application image and is installed in a network. **ON**= DIM is application-less or has experienced a error that prevents Neuron Chip from executing application code. **1/2 Hz BLINKING (1 second on/1 second off)** =DIM has an application, but has not been logically installed in a network. **FLASHING** once every 2–3 seconds=DIM is experiencing an error condition causing a watchdog timeout reset (fatal error).
DS2	Green	STATUS	**Approx. 1/2 Hz BLINKING (1 second on/1 second off, may appear erratic)** indicates that the DIM’s processor is executing the application code.

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NETWORK INSTALLATION

Sections 3 and 4 provide a detailed description of the network installation process. Read sections 1 and 2, before constructing the network. Sections 3 and 4 provide the following step-by-step installation procedures:

1. Setting up Network Installation Tools
2. Starting LonMaker Software
3. Using LonMaker Software
4. LonMaker Network Setup
5. Connecting Devices with LonMaker
6. Installing Devices with LonMaker
7. Testing Devices and Verifying Installation
8. Setting up PowerCommand Configuration Tool
9. Using PowerCommand Configuration Tool

NETWORK VARIABLES

The network variables for the NAM are the same as the network variables for the Digital I/O Module. Refer to the Digital I/O Module section under Network Variables for information pertaining to the connectable network variables for this module.

Table 9-4 correlates the network variable with the Network Annunciator Modules front panel LEDs and NFPA110 fault/event names. LED#s are sequential from the top of the annunciator to the bottom.

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TABLE 9-4. NAM NETWORK VARIABLE CORRELATION WITH ANNUNCIATOR FRONT PANEL (NFPA 110)

LED #	NFPA 110 PANEL INSERT	DIM NETWORK VARIABLE	COMMENTS
1	High Battery Voltage	nviRelay[1]	
2	Low Battery Voltage	nviRelay[2]	
3	Normal Battery Voltage	see Comments	For NFPA110 application, Normal Battery illuminates when both High and Low Battery Voltage LEDs are off. For generic annunciator applications this LED may be used as a hardwired input. This requires a switch setting change on the System Annunciator board. See operator's manual for Network Annunciator (900–0282).
4	Generator Running	nviRelay[3]	
5	Normal Utility Power	nviRelay[4]	
6	EPS Supplying Load	nviRelay[5]	
7	Pre–Low Oil Pressure	nviRelay[6]	
8	Low Oil Pressure	nviRelay[7]	
9	Pre–High Coolant Temp	nviRelay[8]	
10	High Coolant Temp	nviRelay[9]	
11	Low Engine Temp	nviRelay[10]	
12	Overspeed	nviRelay[11]	
13	Overcrank	nviRelay[12]	
14	Not In Auto	nviRelay[13]	
15	Bat Chgr Malfunction	nviRelay[14]	
16	Low Fuel	nviRelay[15]	
17	Low Coolant Level	nviRelay[16]	
18	Customer Fault #1 (blank)	hardwired ONLY	
19	Customer Fault #2 (blank)	hardwired ONLY	
20	Customer Fault #3 (blank)	hardwired ONLY	

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10. Controls Communications Module/GenSet

OVERVIEW

This section describes the Controls Communications Module (CCM) and its functional role in the PowerCommand network. This module is used to monitor and control both gensets and automatic transfer switches. This section describes the CCM and applications involving gensets. This section also describes the physical mounting and wiring of this module, and provides procedures for the *logical* installation and connection of the CCM-Genset on the network. Section 11 describes automatic transfer switch applications.

In network terms, “logical installation and connection” refers to programming the various devices (or nodes) on the network so that they can communicate with one another. This communication takes the form of passing network variables from one device to another. The process of assigning connections—linking an output variable of one device to an an input variable of another device—is called “binding.” Refer to Appendix C for *Application Table Consumption* to review the number of connections that can be made.

In addition to functional and physical descriptions, this section provides definitions of the network input and output variables assigned to the CCM-Genset.

DESCRIPTION

The CCM can be used to monitor and control a conventional (non-microprocessor controlled) genset. It provides a PowerCommand Network interface for remote monitoring and control.

The module can monitor digital inputs, and AC and DC analog inputs from generator sets and communicate monitored data to the PowerCommand network. Relay outputs on the CCM provide a limited amount of control of the monitored equipment from the network. For example, these outputs can be used to remotely start a generator set.

The CCM has 16 channels of analog input and 32 digital inputs. Most of the analog channels are configured for specific types of signals (AC volts, current, phase, oil temp, oil pressure, coolant temp, exhaust temp, etc.,see Figures E-4 and E-5 in Appendix E. The spare analog inputs are for signal monitoring (4-20 mA, 0-1 mA, 0-5V). The three temperature inputs and the oil pressure input can be used generically with any sensor that provides between 0-9 VDC.

The 32 discrete inputs permit monitoring of numerous status/fault conditions. These inputs must be referenced back to either analog ground (J6) or net power negative (–) through dry contacts or through a pulldown resistor when active “OPEN” input is +5 to +36 VDC (see notes 6 and 17 in Figure E-5).

The values of the analog and discrete inputs are read from the network.

The CCM contains a terminate circuit for use at the end of a network data bus.

CCM Outputs

The CCM has two Form-C relay outputs, and two Form-A relay outputs. The relays are controlled from the network and are used to transmit start/stop/reset control signals.

External devices that are wired to these relays should be fused appropriately to prevent damage to the CCM.

Standard Displays

Solid state indicators are provided to aid in diagnosis of module operating status. These include a service LED for the Neuron chip and a running LED on the main processor.

CCM Power Supply

For genset applications, the 12- or 24-volt set starting battery(ies) will be used to power the CCM. The genset must have a battery charger capable of maintaining the starting battery(ies) with the CCM load.

Refer to *Section 2* for a detailed description of *Network Power* and *Network Power Wire Sizing* requirements.

Block Diagram

Refer to Table 10-1 and Figure 10-1 for a block diagram overview of the CCM-Genset.

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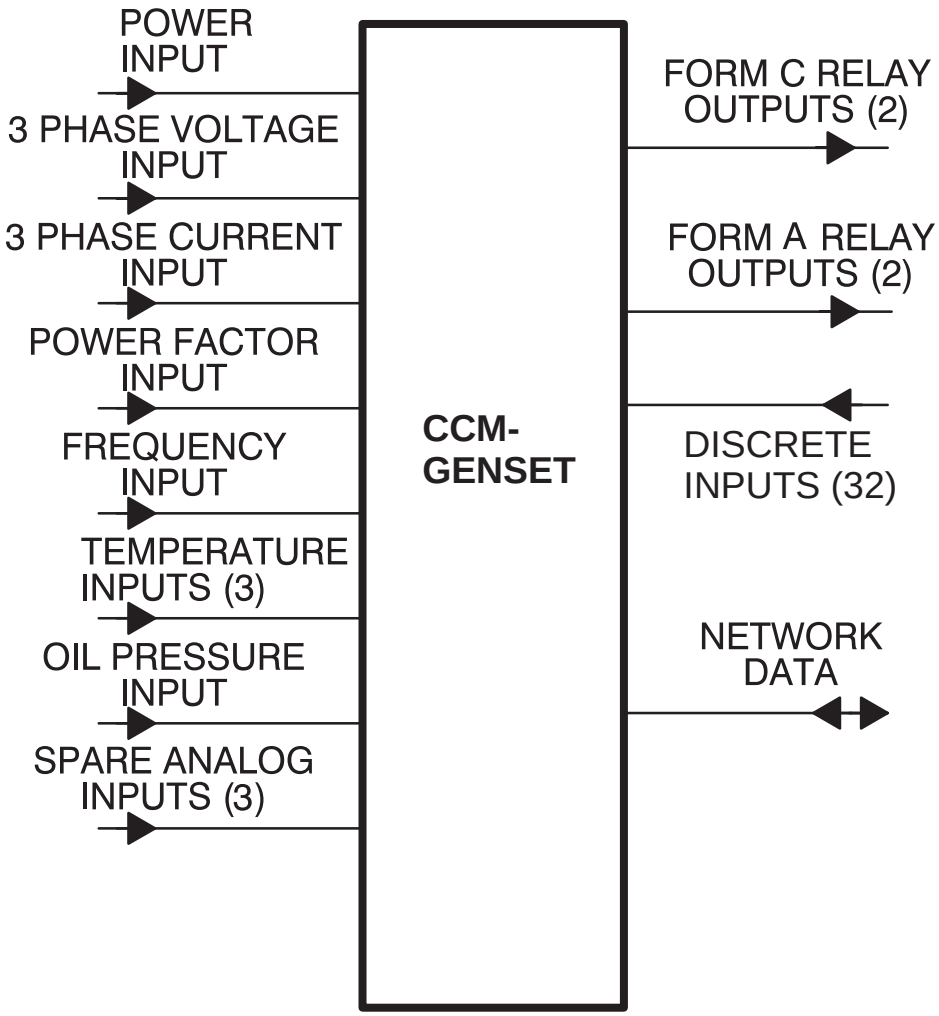

FIGURE 10-1. BLOCK DIAGRAM: GENERATOR SET MONITORING MODULE

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TABLE 10-1. CCM – BLOCK DIAGRAM DESCRIPTIONS

Function	Description/Specification
Power Input	The CCM may be either powered from DC or AC. Local Power Input accepts nominal voltage of 5–36VDC or 12–24VAC. (Refer to Section 2.)
3 Phase Voltage Input	Directly accepts up to 600 VAC nominal line-to-line. (**Direct reading, external** PTs to be used for medium voltage). Can be wired for either delta or wye. Can accept either 3 phase or single phase.
3 Phase Current Input	Directly accepts 0–5 amps AC.
Power Factor Input	Power factor is **not a physical input**, but is derived from voltage and current inputs.
Frequency Input	Frequency is **not a physical input**, but is derived from one of the three phase voltage inputs.
Temperature Inputs (3)	Inputs are set up to either drive RTD senders or just read voltage on existing senders. Driving an RTD: These inputs are set up for connection to RTD senders for measuring oil, exhaust, or coolant temperature. Two of the inputs are switch selectable for connection to either 500–2200 ohm (OIL/WATER Temp) or 80–390 ohm (Exhaust Temp) RTDs. The other is fixed for 500–2200 ohm only. Reading an RTD: If the input is just reading the sender voltage, it can read a range of 0–9VDC.
Oil Pressure Input	Input can provide sender drive if needed. Input driving the sender: Intended for use with Kavlico capacitive sensor 0–100 PSIG, 0.5–4.5VDC Reading only: The input can read in a range from 0–9VDC.
Spare 1, 2	Accept 0–5V directly or 0–1mA or 4-20 mA signals with addition of an external resistor.
SPARE 3	Accepts input from 0–36VDC.
Form-C Relay Outputs (2)	These relays are used to start/stop the genset, reset faults or other needed control functions. Contacts are rated 125VAC /0.6A or 30VDC/2A.
Form-A Relay Outputs (2)	Solid state relays used for control. Rated at 100mA, 150VDC/VAC, 50 ohm ON resistance.
Digital Inputs (32)	Used to monitor various status and fault conditions. Inputs are activated through a contact closure to GND. Inputs 1–24 source 0.5 mA when closed to GND. Inputs 25–32 source 0.05 mA when closed to GND. When the inputs are open, voltage at the CCM input terminals is less than 5Vdc.
Network Data	Transformer coupled into Category 4 twisted pair at 78,000 bits/sec.

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LOCATION

Mount the CCM control box as close as possible to the genset so the wire size can be kept to a minimum.

The CCM is preassembled inside an enclosure that is designed for wall mounting. Choose a clean, vibration-free mounting surface near the genset. Avoid locations that are hot, damp or dusty. The temperature range must not exceed –40°F (–40°C) to 158°F (70°C).

Refer to Section 2 for network topology and maximum network length.

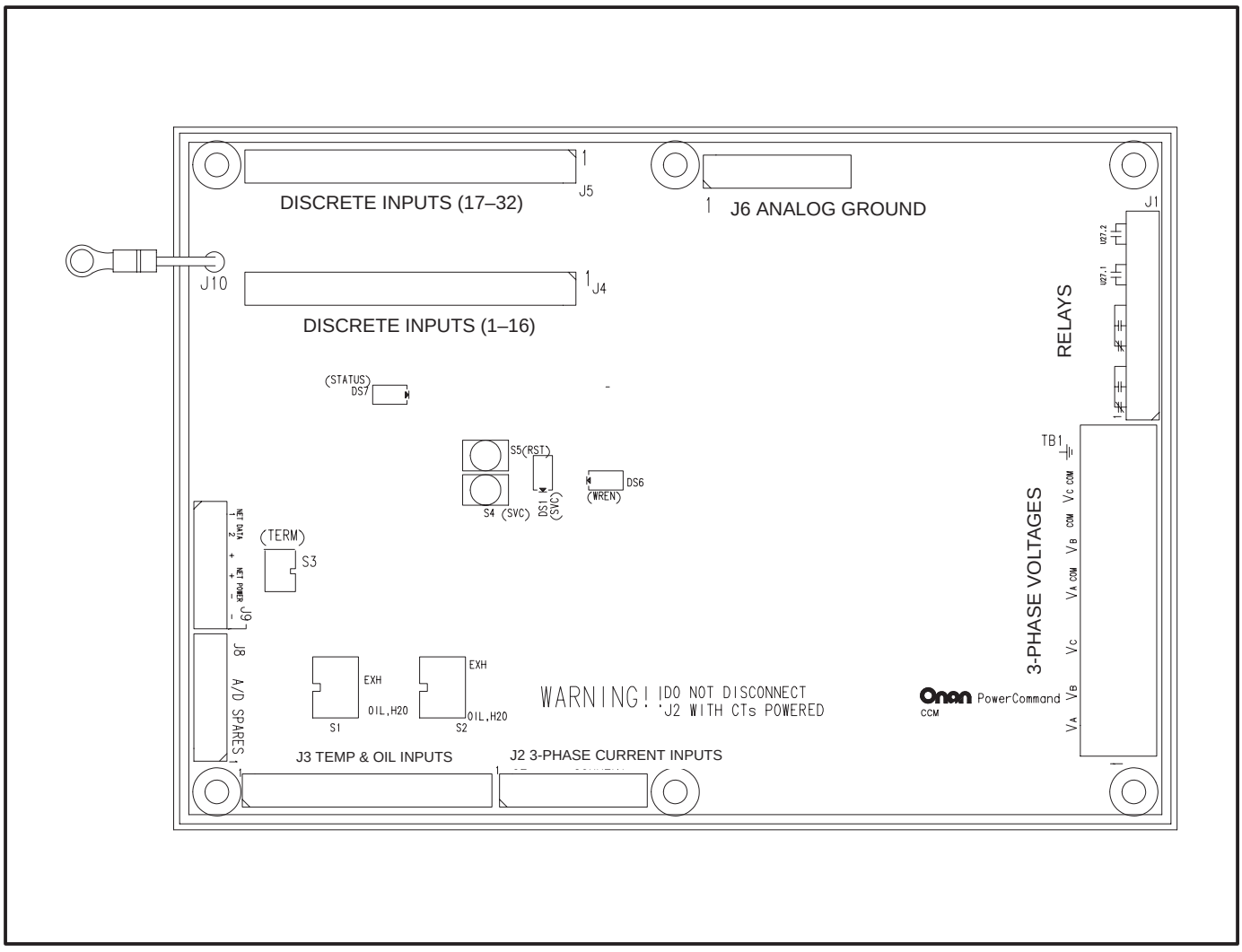

FIGURE 10-2. CONTROLS COMMUNICATION MODULE (CCM)

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CCM CONTROL BOX MOUNTING

Figure 10-3 shows the CCM control box outline dimensions. The outside dimensions do not include clearance for wire connections (dependant on conduit size and routing). When the mounting location and wire routing are determined (see Wiring Connections section), make holes in the control box for AC, DC, and data wire routing. Be careful not to damage the CCM module. Remove the CCM if drilling is required. If the CCM is removed during mounting, make sure the ground lead is reconnected to the mounting stud when reinstalling the CCM.

⚠ CAUTION ***Installation debris can cause equipment failure and damage. Use extreme care to keep drill chips and filings out of the CCM control box. Use tools carefully to prevent damage to components.***

Make sure that no wires, plumbing, gas or exhaust lines run behind the wall before drilling the mounting holes.

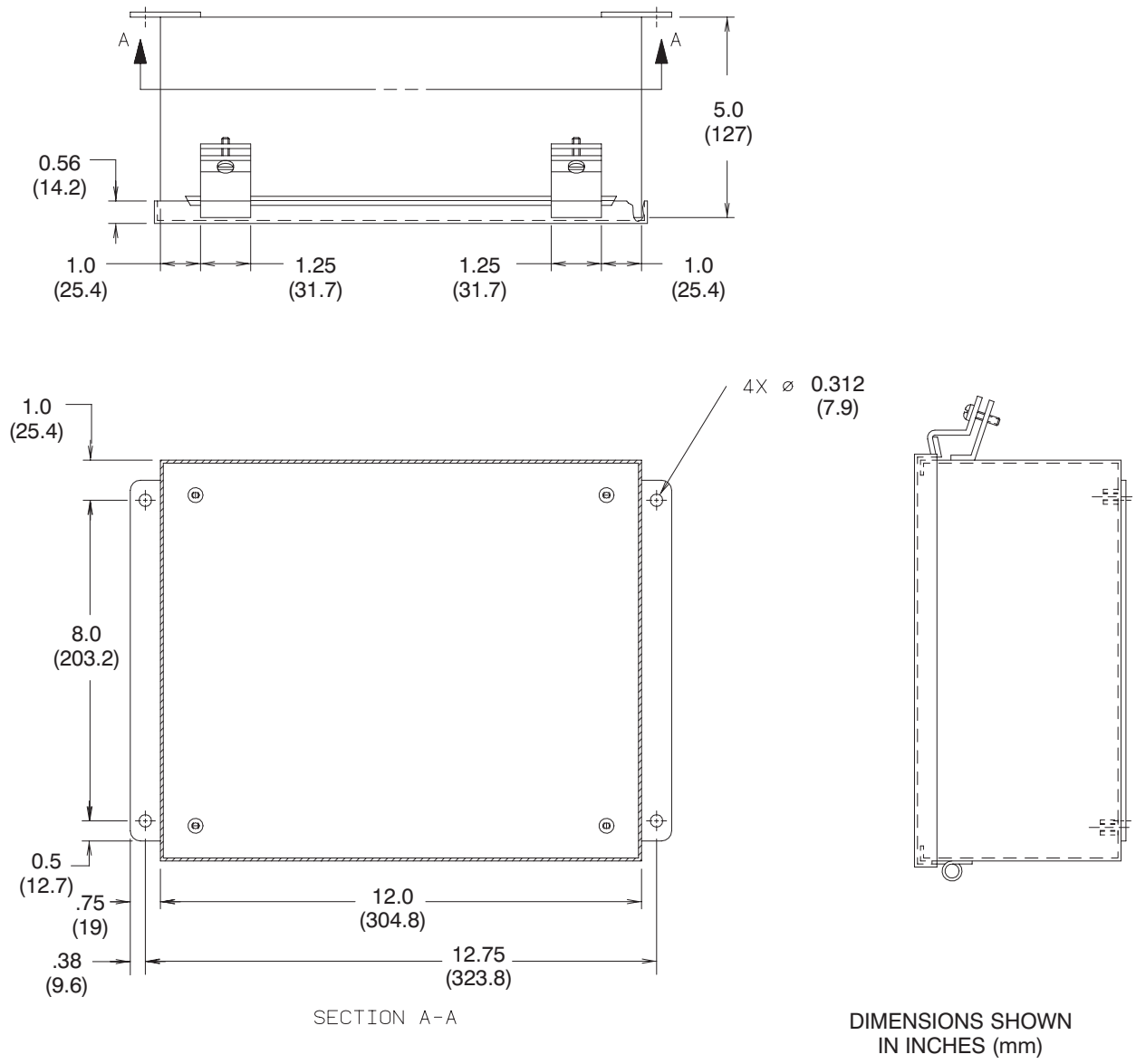

FIGURE 10-3. CCM CONTROL BOX MOUNTING

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WIRE AND CONDUIT

Measure the distance, one way, between the CCM mounting location and the genset control. Refer to the wire size chart in Figure E-13 (in Appendix D) to determine the appropriate wire gauge for CT wires, power supply wires and monitor and control wires (see Table 10-2 for additional CT wire information). Use stranded wire with a minimum insulation rating of 600V and a temperature rating of 105°C.

Run *one conduit for the AC wire connections* and a *second conduit for the DC wire connections* between the CCM and the genset control box. The data wire does not require conduit unless mechanical protection is desired. The data wire can be strapped to the outside of the DC conduit and be run into the control box through a rubber grommet. Make sure wiring meets all applicable wiring codes.

Install at least 2 feet (610 mm) of flexible conduit on both lines at the genset control box connection to allow for genset vibration during operation. Round off or cover the ends of the conduit to prevent sharp edges from cutting the insulation. Use waterproof conduit if the CCM will be exposed to moisture.

The number of leads pulled through each conduit will be determined by the type of genset control and the desired monitor and control features selected. Refer to the table in Figure E-14 for a list of the possible AC and DC connections. Number both ends of each lead for identification before pulling the wire through the conduit.

Grounding must comply with all codes. Mount the enclosed ground lug inside the mounting box (refer to the instructions provided with the lug). Make sure the paint is removed from the ground lug mounting location to provide a good ground.

WIRING CONNECTIONS

This section describes connecting the CCM to a genset with a Detector or DK type of control. Figures E-13 and E-14 show the interconnect wiring diagram specifically for the CCM to Detector or DK control. (Figures E-13 and E-14 apply to both 7-light and 12-light Detector controls. Connections for Low Fuel, Low Engine Temp, Fault1 and Fault2 are not available from the 7-light control.)

Figures E-4 and E-5 provide basic CCM interconnect wiring diagram information, review the notes on figures E-4 and E-5 and use these drawings for reference.

⚠WARNING ***Accidental starting of the generator set while working on it can cause severe injury or death. Disconnect the battery cables to prevent accidental starting. Be sure to move the generator set operation selector switch to Stop, disconnect the battery charger, disconnect the starting battery (negative [–] lead first).***

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark or flame while servicing batteries.***

⚠CAUTION ***Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the generator set.***

1. Before making any wiring connections, make sure the genset cannot be started by moving the RUN/STOP/REMOTE switch to STOP. Disconnect the power to the battery charger and disconnect the starting battery (negative [–] battery cable[s] first).

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2. Refer to Figures E-13 and E-14 for point-to-point wiring information and component and terminal locations. Follow standard wiring practices. Properly secure wire terminals when needed. Secure wires in the CCM terminal blocks to 2 in-lbs. (0.23 N•m). Observe wire gauge requirements for CT wires, power supply wires and monitor and control wires.

3. The table in Figure E-13 identifies the DC and AC connections. The DC leads must be run inside a separate conduit from the AC leads.

   It may be easiest to start at the top of the table with the DC connections and make all the connections inside the CCM control box. Then move to the genset control to complete the wiring. Make sure that each lead is marked and pay close attention to the associated notes in the wiring table. Some connections are for jumpers inside the CCM only.

4. When making connections inside the genset control box, provide enough wire so that the leads can be secured to the existing harness. Leads that connect to components on the control panel door should be routed near the hinges and be secured to the existing leads.

5. Connect the data wire to the CCM and provide an adequate length of twisted pair wire for future connection to a junction box. Tighten the tamperproof control box mounting screws securely to prevent tampering.

6. The module is now ready for network wiring. Network wiring must be done by a trained network installer. Refer to sections 2, 3 and 4 for instructions on network wiring the CCM and for installation and connection of this module to the network.

7. When the network installation is complete, reconnect battery (negative [–] battery cable[s] last), reconnect battery charger and return the generator control switch to the Remote position.

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TABLE 10-2. CT WIRE SIZE VS. DISTANCE

			MAXIMUM DISTANCE BETWEEN CCM AND CT'S IN FEET (M) BLANK ROWS INDICATE THAT A CT KIT IS REQUIRED CONTACT YOUR AUTHORIZED PARTS DISTRIBUTOR		
CT Number	Application	Ratio	#12 AWG	#14 AWG	#16 AWG
			FEET (M)	FEET (M)	FEET (M)
302–1984–02	Genset(DK)	25/5			
302–1984–02	Genset(DK)	50/5			
302–1984–03	Genset(DK)	100/5			
302–1984–03	Genset(DK)	50/5			
302–1984–04	Genset(DK)	150/5			
302–1984–04	Genset(DK)	75/5			
302–1984–05	Genset(DK)	100/5			
302–1984–05	Genset(DK)	200/5			
302–1868–01	Genset(DG)	25/5			
302–1868–01	Genset(DG)	50/5			
302–1868–02	Genset(DG)	100/5			
302–1868–02	Genset(DG)	50/5			
302–1868–03	Genset(DG)	150/5			
302–1868–03	Genset(DG)	75/5			
302–1868–04	Genset(DG)	100/5			
302–1868–04	Genset(DG)	200/5			
302–1868–05	Genset(DG)	150/5			
302–1868–05	Genset(DG)	300/5			
302–1868–06	Genset(DG)	200/5			
302–1868–06	Genset(DG)	400/5			
302–1868–07	Genset(DG)	250/5			
302–1868–07	Genset(DG)	500/5			
302–1868–08	Genset(DG)	375/5	35 (10.7)	22 (6.7)	14 (4.1)
302–1868–08	Genset(DG)	750/5	72 (22.1)	45 (13.7)	28 (8.6)
302–1868–09	Genset(DG)	400/5	35 (10.7)	22 (6.7)	14 (4.1)
302–1868–09	Genset(DG)	800/5	79 (24)	49 (14.9)	31 (9.3)
302–1868–10	Genset(DG)	1000/5	104 (31.6)	64 (19.6)	40 (12.3)
302–1868–10	Genset(DG)	500/5	41 (12.5)	26 (7.8)	16 (4.9)
302–1868–11	Genset(DG)	1200/5	129 (39.2)	80 (24.3)	50 (15.3)
302–1868–11	Genset(DG)	600/5	54 (16.3)	33 (10.1)	21 (6.4)
302–1868–12	Genset(DG)	1500/5	166 (50.6)	103 (31.4)	65 (19.7)
302–1868–12	Genset(DG)	750/5	79 (24)	49 (14.9)	31 (9.3)
302–1794–01	Genset(DF)	150/5			
302–1794–01	Genset(DF)	75/5			
302–1794–02	Genset(DF)	100/5			

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TABLE 10-2. CT WIRE SIZE VS. DISTANCE (Continued)

			MAXIMUM DISTANCE BETWEEN CCM AND CT'S IN FEET (M) BLANK ROWS INDICATE THAT A CT KIT IS REQUIRED CONTACT YOUR AUTHORIZED PARTS DISTRIBUTOR		
CT Number	Application	Ratio	#12 AWG	#14 AWG	#16 AWG
			FEET (M)	FEET (M)	FEET (M)
302–1794–02	Genset(DF)	200/5			
302–1794–03	Genset(DF)	150/5			
302–1794–03	Genset(DF)	300/5			
302–1794–04	Genset(DF)	200/5	41 (12.5)	26 (7.8)	16 (4.9)
302–1794–04	Genset(DF)	400/5	104 (31.5)	64 (19.6)	40 (12.3)
302–1794–05	Genset(DF)	250/5	54 (16.3)	33 (10.1)	21 (6.4)
302–1794–05	Genset(DF)	500/5	135 (41.1)	84 (25.5)	53 (16)
302–1794–06	Genset(DF)	300/5	54 (16.3)	33 (10.1)	21 (6.4)
302–1794–06	Genset(DF)	600/5	135 (41.1)	84 (25.5)	53 (16)
302–1794–07	Genset(DF)	375/5	54 (16.3)	33 (10.1)	21 (6.4)
302–1794–07	Genset(DF)	750/5	135 (41.1)	84 (25.5)	53 (16)
302–1794–08	Genset(DF)	400/5	104 (31.5)	64 (19.6)	40 (12.3)
302–1794–08	Genset(DF)	800/5	228 (69.6)	142 (43.2)	89 (27.2)
302–1794–09	Genset(DF)	1000/5	291 (88.6)	181 (55)	114 (34.6)
302–1794–09	Genset(DF)	500/5	135 (41.1)	84 (25.5)	53 (16)
302–1794–10	Genset(DF)	600/5	135 (41.1)	84 (25.5)	53 (16)
302–1794–10	Genset(DF)	1200/5	291 (88.6)	181 (55)	114 (34.6)
302–1794–11	Genset(DF)	750/5	135 (41.1)	84 (25.5)	53 (16)
302–1794–11	Genset(DF)	1500/5	291 (88.6)	181 (55)	114 (34.6)
302–1794–12	Genset(DF)	1000/5	291 (88.6)	181 (55)	114 (34.6)
302–1794–12	Genset(DF)	2000/5	353 (107.5)	219 (66.7)	138 (42)
302–1794–13	Genset(DF)	1500/5	291 (88.6)	181 (55)	114 (34.6)
302–1794–13	Genset(DF)	3000/5	353 (107.5)	219 (66.7)	138 (42)
302–1794–14	Genset(DF)	2000/5	291 (88.6)	181 (55)	114 (34.6)
302–1794–14	Genset(DF)	4000/5	603 (183.7)	374 (113.9)	236 (71.9)
302–1794–15	Genset(DF)	3000/5	291 (88.6)	181 (55)	114 (34.6)
302–1794–15	Genset(DF)	6000/5	603 (183.7)	374 (113.9)	236 (71.9)
302–1417	Genset(ES)	150/5			
302–1845–XX is the same as 302–1868–XX (Example: 302–1845–02 refer to 302–1868–02 row for distances)					

NOTES: 1. This table is for copper wire at 50°C (122°F). Derate the distance by 0.4% per °C over 50°C.
2. Minimum wire gauge for NEC compliance is AWG 14

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NETWORK TOPOLOGY, DATA MEDIA AND NETWORK POWER

Refer to Section 2 for information on the network topology and data transmission media. Also refer to Section 2 for network power supply wiring calculation procedures.

NETWORK DATA MEDIA AND POWER WIRING

⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Only trained, experienced personnel are to perform the following procedures.***

Connections

Network data and power wiring connections are made at connector J9.

Conduit

When installing conduit, observe the following precautions:

1. Before beginning conduit installation, cover all components to prevent accidental entry of metal chips.
2. If using rigid conduit, install at least 2 feet (610 mm) of flexible conduit between the rigid conduit and generator set to absorb vibration.
3. Always run DC circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.
4. Data wire can be run without conduit if it is adequately protected. Do not run data wire in conduit with network power wiring or other non-power–limited circuits. Make sure wiring meets all applicable wiring codes.

⚠CAUTION ***Installation debris can cause equipment failure and damage. Use extreme care to keep drill chips and filings out of the components when mounting or connecting conduit. Screwdrivers should be used carefully to prevent damage to components.***

NETWORK INSTALLATION

Sections 3 and 4 provide a detailed description of the network installation process. Read sections 1 and 2, before constructing the network. Sections 3 and 4 provide the following step-by-step installation procedures:

1. Setting up Network Installation Tools
2. Starting LonMaker Software
3. Using LonMaker Software
4. LonMaker Network Setup
5. Connecting Devices with LonMaker
6. Installing Devices with LonMaker
7. Testing Devices and Verifying Installation
8. Setting up PowerCommand Configuration Tool
9. Using PowerCommand Configuration Tool

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SWITCHES AND LEDs

The Service switch (S4) is used during installation (when prompted by the LonMaker program). The Terminator switch (S3) must be set to the appropriate position at installation. Switches are described in Table 10-3.

LEDs are described in Table 10-4.

TABLE 10-3. CCM SWITCHES

Ref	Name	Type	Description
S4	SERVICE	momentary push	Used at time of logical installation to identify device to the installation software. Pressing S4 will light the DS1 LED.
S5	RESET	momentary push	Resets the Neuron Chip processor. Must be pressed after Install action.
S3	TERMINATOR	slide	Switch is set to position opposite of text “TERM” from factory. The two devices at ends of network data must have their switches set to “TERM”.
S1	TEMP#2 SELECT	slide	When the input is driving the sender, selects whether temperature input#2 RTD is 500–2200 ohm or 80–390 ohm. Set to “OIL/H2O” for 500–2200 ohm. Set to “EXH” for 80–390 ohm.
S2	TEMP#3 SELECT	slide	When the input is driving the sender, selects whether temperature input#3 RTD is 500–2200 ohm or 80–390 ohm. Set to ”OIL/H2O” for 500–2200 ohm. Set to “EXH” for 80–390 ohm.

TABLE 10-4. CCM LED INDICATORS

Ref	Color	Name	Description
DS1	Amber	SERVICE	Indicates various states of the CCM node. It will be ON if S1 is pressed and held. States without S1 pressed: **OFF** = All OK. CCM has application image and is installed in a network. **ON**= CCM is applicationless or has experienced a error which prevents Neuron Chip from executing application code. **1/2 Hz BLINKING (1 second on / 1 second off)** =CCM has an application, but has not been logically installed in a network. **FLASHING (momentarily)** once every 2–3 seconds=CCM is experiencing an error condition causing a watchdog timeout reset.
DS6	Green	WREN	ON (normal state) indicates that the off–chip EEPROM can be written to. Indicator must be ON if device is to be logically installed in a network. OFF could be caused by: 1)CCM’s power input is below 10VDC. 2)RESET switch being pressed and held. 3)problem with board or connectors.
DS7	Green	STATUS	**1/2 Hz BLINKING (1 second on / 1 second off)** to indicate that the CCM’s processor is executing the application code. **In the future,** may be used to indicate other conditions for troubleshooting purposes.

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NETWORK VARIABLES

Table 10-5 shows the correlation between actual inputs and outputs for the CCM and the CCM's connectable network variables based on CCM-Genset Interconnect Drawing Figures E-13 and E-14 (located in Appendix E).

Refer to the connectable network variable outputs in Tables 10-6 and 10-7 and the connectable network variable inputs in Table 10-8 during the logical installation of CCM on the network.

TABLE 10-5. ACTUAL INPUTS AND OUTPUTS FOR THE CCM

Signal	CCM Network Variable		Options Required
	Name	Active State	
DISCRETE INPUTS			
Common Alarm	nvoCustInput[17]	Open (0)	standard
Low Fuel	nvoCustInput[18]	Closed (1)	not available on Detector-7 Lite
Low Engine Temperature	nvoCustInput[19]	Closed (1)	not available on Detector-7 Lite
Fault2 (Customer)	nvoCustInput[20]	Closed (1)	not available on Detector-7 Lite
Fault1 (Customer)	nvoCustInput[21]	Closed (1)	not available on Detector-7 Lite
Overcrank	nvoCustInput[22]	Closed (1)	standard
Overspeed	nvoCustInput[23]	Closed (1)	standard
High Engine Temperature	nvoCustInput[24]	Closed (1)	standard
Low Oil Pressure	nvoCustInput[25]	Closed (1)	standard
Pre–High Engine Temperature	nvoCustInput[26]	Closed (1)	standard
Pre–Low Oil Pressure	nvoCustInput[27]	Closed (1)	standard
Genset Running	nvoCustInput[28]	Closed (1)	standard
Switch in Off	nvoCustInput[29]	Open (0)	standard
RELAY OUTPUTS			
Remote Start	nviRelayControl1		standard
Remote Reset/Lamp Test	nviRelayControl2		standard

Notes for PowerCommand Configuration Tool (Section 4):

1. **Set the active state as indicated in the table.**
2. **Coolant Temperature Sensor: Gain = –34.5 degF/V**
3. **Oil Pressure Sensor: Gain = –36.0 psi/V**
4. **Battery Voltage: Voltage = 24, Reading = 24, Gain = 1**

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TABLE 10-6. CCM NETWORK VARIABLE OUTPUTS

NV Name	Description	Used By	Data Type Info	Active State	Default Value(s)
nvoCustInput[0..32]	●a network variable array of digital values representing the state of the corresponding physical discrete input ●the active state is configured with PCT ●only 1 thru 32 are used (0 is not used)	●Net Connect	array: (1 BYTE EACH) Data — Range nvoCustInput[0] — not used nvoCustInput[1] — 0,1 nvoCustInput[2] — 0,1 nvoCustInput[3] — 0,1 nvoCustInput[4] — 0,1 nvoCustInput[5] — 0,1 nvoCustInput[6] — 0,1 nvoCustInput[7] — 0,1 nvoCustInput[8] — 0,1 nvoCustInput[9] — 0,1 nvoCustInput[10] — 0,1 nvoCustInput[11] — 0,1 nvoCustInput[12] — 0,1 nvoCustInput[13] — 0,1 nvoCustInput[14] — 0,1 nvoCustInput[15] — 0,1 nvoCustInput[16] — 0,1 nvoCustInput[17] — 0,1 nvoCustInput[18] — 0,1 nvoCustInput[19] — 0,1 nvoCustInput[20] — 0,1 nvoCustInput[21] — 0,1 nvoCustInput[22] — 0,1 nvoCustInput[23] — 0,1 nvoCustInput[24] — 0,1 nvoCustInput[25] — 0,1 nvoCustInput[26] — 0,1 nvoCustInput[27] — 0,1 nvoCustInput[28] — 0,1 nvoCustInput[29] — 0,1 nvoCustInput[30] — 0,1 nvoCustInput[31] — 0,1 nvoCustInput[32] — 0,1	each array element: 1=active 0=inactive Active state of the Customer Input is set by PCT	

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TABLE 10-7. CCM NETWORK VARIABLE OUTPUTS – Continued

NV Name	Description	Used By	Data Type Info	Active State	Default Value(s)
nvoCustIn1_16	●16 bit value containing status of Customer Inputs 1 thru 16 ●intended to be connected to a DIM or NAM	●Net Connect	16 bits (long):(2 BYTES) Data Range nvoCustIn1_16 0..65535 bit 0 = Input 1 bit 1 = Input 2 etc...	 1 1 ...	
nvoCustIn17_32	●16 bit value containing status of Customer Inputs 17 thru 32 ●intended to be connected to a DIM or NAM	●Net Connect	16 bits (long):(2 BYTES) Data Range nvoCustIn17_32 0..65535 bit 0 = Input 17 bit 1 = Input 18 etc...	 1 1 ...	
nvoRelayState1	●Boolean value indicating the state of Relay #1	●Net Connect	1 bit (boolean): (1 BYTE) Data Range nvoRelayState1 0,1	 1=relay energized	
nvoRelayState2	●Boolean value indicating the state of Relay #2	●Net Connect	1 bit (boolean): (1 BYTE) Data Range nvoRelayState2 0,1	 1=relay energized	
nvoRelayState3	●Boolean value indicating the state of Relay #3	●Net Connect	1 bit (boolean): (1 BYTE) Data Range nvoRelayState3 0,1	 1=relay energized	
nvoRelayState4	●Boolean value indicating the state of Relay #4	●Net Connect	1 bit (boolean): (1 BYTE) Data Range nvoRelayState4 0,1	 1=relay energized	

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TABLE 10-8. CCM NETWORK VARIABLE INPUTS

NV Name	Description	Used By	Data Type Info	Active State	Default Value(s)
nviRelayControl1	●Boolean value used to directly control relay#1	●Net Connect ●PCW	1 bit (boolean): (1 BYTE) Data nviRelayControl1 Range 0,1	1=energize the relay	0
nviRelayControl2	●Boolean value used to directly control relay#2	●Net Connect ●PCW	1 bit (boolean): (1 BYTE) Data nviRelayControl2 Range 0,1	1=energize the relay	0
nviRelayControl3	●Boolean value used to directly control relay#3	●Net Connect ●PCW	1 bit (boolean): (1 BYTE) Data nviRelayControl3 Range 0,1	1=energize the relay	0
nviRelayControl4	●Boolean value used to directly control relay#4	●Net Connect ●PCW	1 bit (boolean): (1 BYTE) Data nviRelayControl4 Range 0,1	1=energize the relay	0

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11. Controls Communications Module/ATS

OVERVIEW

This section describes the Controls Communications Module (CCM) used for monitor and control in automatic transfer switch applications (CCM-ATS). This section describes the physical mounting and wiring of this module, and provides procedures for the *logical* installation and connection of the CCM-ATS on the network.

In network terms, “logical installation and connection” refers to programming the various devices (or nodes) on the network so that they can communicate with one another. This communication takes the form of passing network variables from one device to another. The process of assigning connections—linking an output variable of one device to an an input variable of another device—is called “binding.” Refer to Appendix C for *Application Table Consumption* to review the number of connections that can be made.

In addition to functional and physical descriptions, this section provides definitions of the network input and output variables assigned to the CCM-ATS.

DESCRIPTION

The CCM-ATS can be used to monitor and control a transfer switch. It provides a PowerCommand™ Network interface for remote monitoring and control. The relay outputs of the CCM provide control of the transfer switch from the network.

The CCM contains a terminate circuit for use at the end of a network data bus.

CCM Inputs

The CCM has 16 channels of analog input and 32 digital inputs (refer to Figures E-4 and E-5 in Appendix E).

Most of the analog channels are configured for specific types of signals (AC volts, current, power factor, oil temp, oil pressure, coolant temp, exhaust temp, etc). The spare analog inputs are for signal monitoring (4-20 mA, 0-1 mA, 0-5V). The three temperature inputs and the oil pressure input can be used generically with any sensor that provides between 0-9 VDC.

The 32 discrete inputs permit monitoring of numerous status/fault conditions. These inputs must be referenced back to either analog ground (J6) or net power negative (–) through dry contacts or through a pulldown resistor when active “OPEN” input is +5 to +36 VDC (see notes 6 and 17 in Figure E-5).

The values of the analog and discrete inputs are read from the network.

CCM Outputs

The CCM has two Form-C relay outputs, and two Form-A relay outputs. The relays are controlled from the network and are used to transmit Remote Test, Transfer Inhibit, and Load Shed control signals.

External devices that are wired to these relays should be fused appropriately to prevent damage to the CCM.

CCM Power Supply

The CCM power supply consists of a sealed 12-volt battery and a battery charger. These parts are included in the kit and are located inside the CCM control box. A separate 120 VAC source is needed to power the battery charger. If a utility outlet is not available, a transformer kit is available for obtaining 120 VAC from the ATS.

The battery should be replaced every two years. Make a note in the Maintenance section of the ATS Operator’s Manual, or add this information to a master maintenance schedule for the facility. Maintain power to the circuit during battery replacement by connecting the new battery in parallel with the power supply circuit, then disconnect the old battery. If a low battery condition is being monitored, this will prevent a low battery alarm signal.

Standard Displays

Solid state indicators are provided to aid in diagnosis of module operating status. These include a service LED for the Neuron chip, a running LED on the main processor.

Block Diagram

Refer to Table 11-1 and Figure 11-1 for a block diagram overview of the CCM-ATS.

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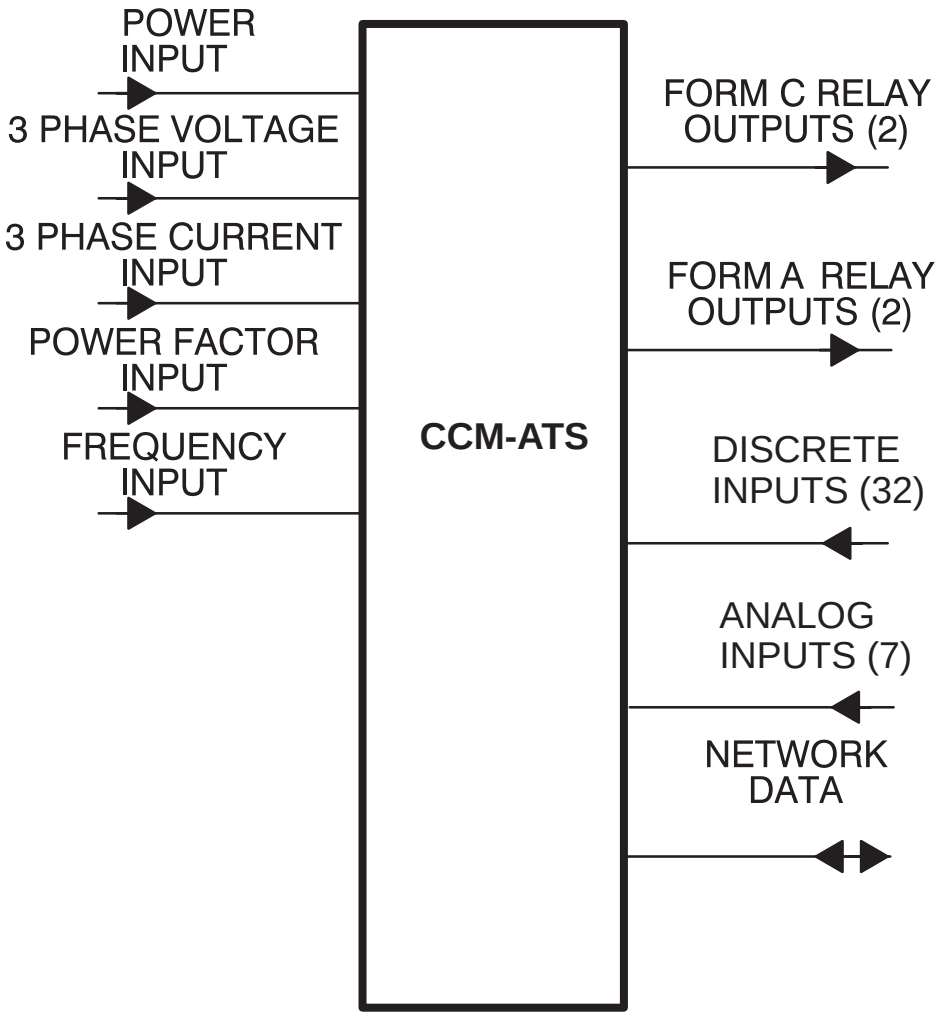

FIGURE 11-1. BLOCK DIAGRAM: CCM-ATS

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TABLE 11-1. CCM-ATS – BLOCK DIAGRAM DESCRIPTIONS

Function	Description/Specification
Power Input	The CCM may be either powered from DC or AC. Local Power Input accepts nominal voltage of 5–36VDC or 12–24VAC. (Refer to Section 2.)
3 Phase Voltage Input	Directly accepts up to 600 VAC nominal line-to-line. (**Direct reading, external** PTs to be used for medium voltage). Can be wired for either delta or wye. Can accept either 3 phase or single phase.
3 Phase Current Input	Directly accepts 0–5 amps AC.
Power Factor Input	Power factor is **not a physical input**, but is derived from voltage and current inputs.
Frequency Input	Frequency is **not a physical input**, but is derived from one of the three phase Voltage inputs.
Form-C Relay Outputs (2)	These relays are used to start/stop the genset, reset faults or other needed control functions. Contacts are rated 125VAC /0.6A or 30VDC/2A.
Form-A Relay Outputs (2)	Solid state relays used for control. Rated at 100mA, 150VDC/VAC, 50 ohm ON resistance.
Discrete Inputs (32)	Used to monitor various status and fault conditions. Inputs are activated through a contact closure to GND. Inputs 1–24 source 0.5mA when closed to GND. Inputs 25–32 source 0.05mA when closed to GND. When the inputs are open, voltage at the CCM input terminals is less than 5Vdc.
Spare 3	Accepts input from 0 – 36VDC. Battery voltage monitor.
Network Data	Transformer coupled into Category 4 twisted pair at 78,000 bits/sec.

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LOCATION

Mount the CCM control box as close to the ATS as possible so the wire size can be kept to a minimum.

The CCM is preassembled inside an enclosure that is designed for wall mounting. Choose a clean, vibration-free mounting surface near the transfer switch. Avoid locations that are hot, damp or dusty. The temperature range must not exceed –40°F (–40°C) to 158°F (70°C).

Refer to Section 2 for network topology and maximum network length.

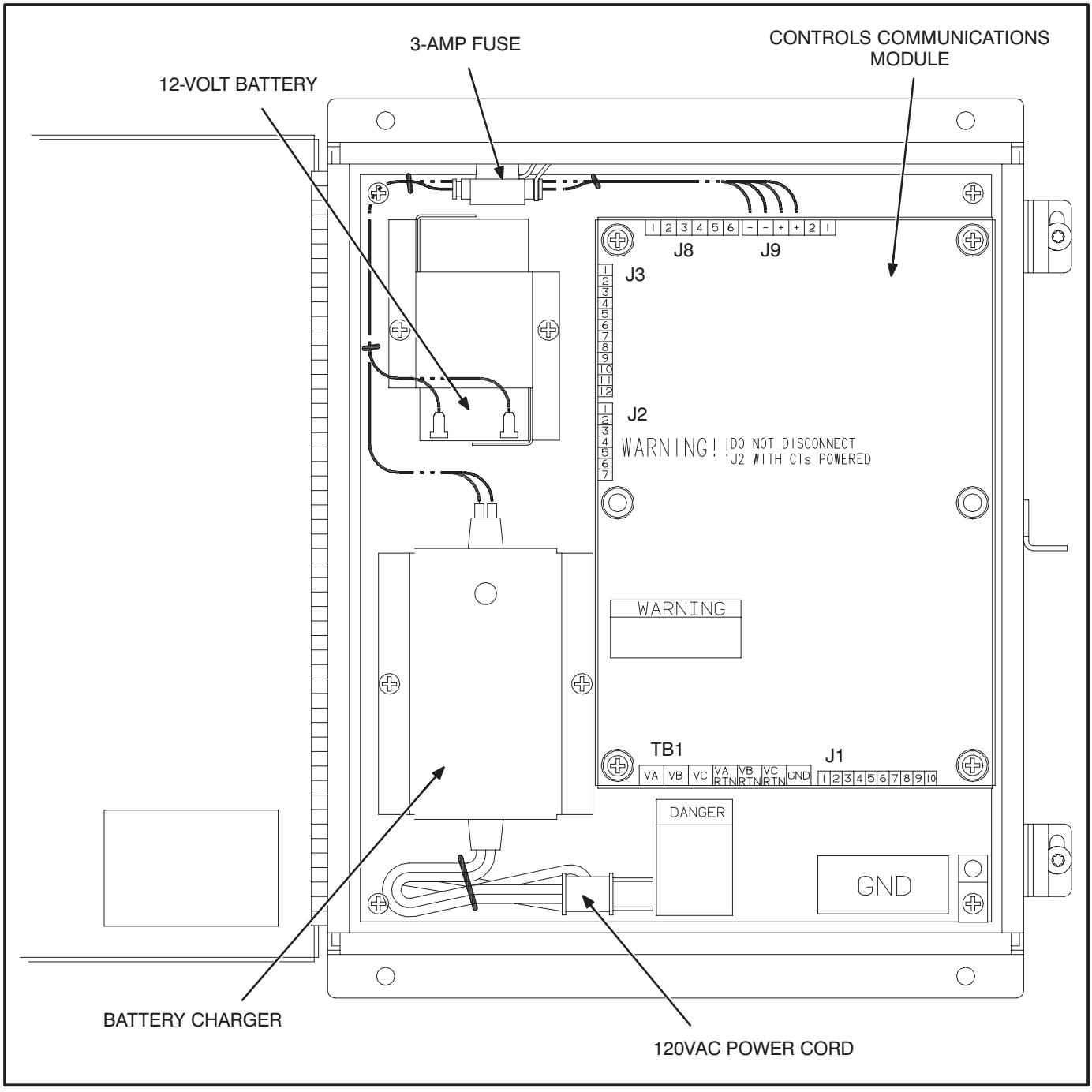

FIGURE 11-2. CONTROLS COMMUNICATION MODULE FOR ATS APPLICATIONS

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CCM CONTROL BOX MOUNTING

Figure 11-3 shows the CCM control box outline dimensions. The outside dimensions do not include clearance for wire connections. When the mounting location and wire routing are determined (see Wiring Connections section), make holes in the control box for AC, DC, and data wire routing. A separate connection will be needed for powering the battery charger inside the CCM control box if it is run from a utility outlet. Be careful not to damage the CCM module. If the CCM is removed during mounting, make sure the ground lead is reconnected to the mounting stud when reinstalling the CCM.

⚠ CAUTION ***Installation debris can cause equipment failure and damage. Use extreme care to keep drill chips and filings out of the CCM control box. Use tools carefully to prevent damage to components.***

Make sure that no wires, plumbing, gas or exhaust lines run behind the wall before drilling the mounting holes.

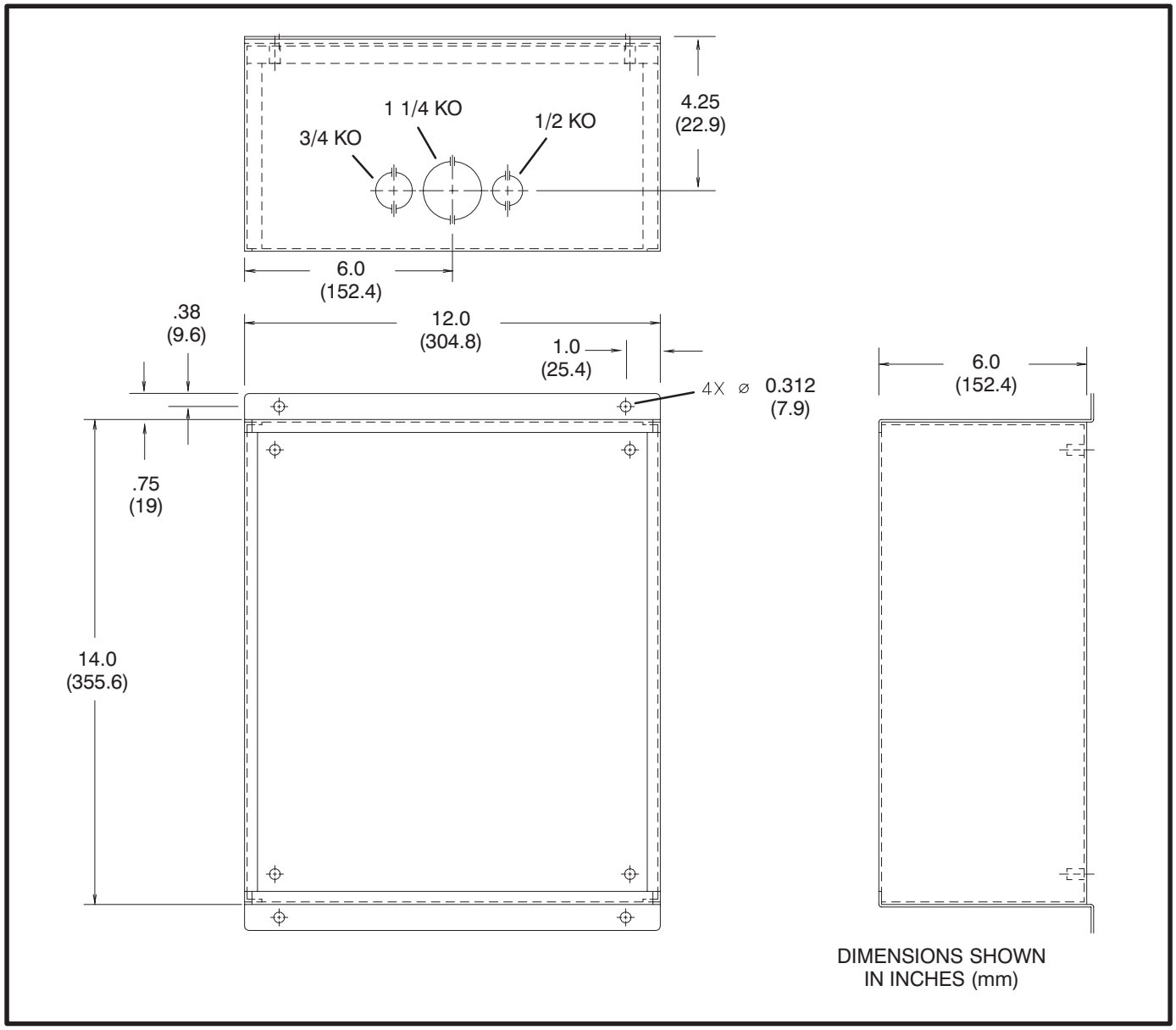

FIGURE 11-3. CCM CONTROL BOX MOUNTING

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WIRE AND CONDUIT

Measure the wiring distance, one way, between the CCM mounting location and the ATS connection points. Refer to notes 7 and 8 in Figure E-9 to determine the appropriate wire gauge for CT, monitor and control wires (see Table 11-2 for additional CT wire information). Use stranded wire with a minimum insulation rating of 600V and a temperature rating of 105°C.

Run *one conduit for the AC wire connections* and a *second conduit for the DC wire connections* between the CCM and the ATS. Round off or cover the ends of the conduit to prevent sharp edges from cutting the insulation. Use waterproof conduit if the CCM installation will be exposed to moisture. The data wire does not require conduit unless mechanical protection is desired. The data wire can be strapped to the outside of the DC conduit and be run into the control box through a rubber grommet. Make sure wiring meets all applicable wiring codes.

The number of leads pulled through each conduit will be determined by the features available on the ATS and the desired monitor and control features selected. Refer to Figures E-9 thru E-12 for a list of the possible AC and DC connections. Number both ends of each lead for identification before pulling the wire through the conduit.

Grounding must comply with all codes. Use the ground lug located inside the CCM control box.

PREPARE CCM POWER SUPPLY

A separate 120 VAC source is needed to power the battery charger. If a utility outlet is not available, a kit is available for obtaining the voltage from the ATS.

1. Install the enclosed 3-amp fuse in the location as shown in Figure 11-2. An arc may occur when the fuse is installed, this is normal.
2. If a 120 VAC outlet is available for the charger, make a hole in the control housing and route the power cord to the outlet.

   If a power source is not available, refer to the instructions in the transformer kit.

WIRING CONNECTIONS

Figures E-9 thru E-12 show the interconnect wiring diagram for connecting the ATS to the CCM. Refer to the notes on these drawings. Figures E-4 and E-5 provide basic CCM interconnect wiring diagram information. Review the notes on these drawings and use these drawings for reference. Follow standard wiring practices. Properly secure wire terminals when needed. Secure wires in the CCM terminal blocks to 2 in-lbs. (0.23 N•m).

⚠WARNING ***The transfer switch presents a shock hazard that can cause severe personal injury or death unless all AC power is removed. Disconnect both the Normal and the Emergency power sources from the transfer switch. Be sure to move the generator set operation selector switch to Stop, disconnect the battery charger, disconnect the starting battery (negative [–] lead first), and disconnect AC line power before beginning the installation.***

⚠WARNING ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or cause any spark or flame while servicing batteries.***

⚠CAUTION ***Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the generator set.***

1. Disconnect both the Normal and the Emergency power sources from the transfer switch.
2. If a generator set provides Emergency power, make sure that the generator set cannot be started by moving the selector switch to Stop. The selector switch is located on the generator set control panel on two-wire start systems and inside the transfer switch cabinet door on three-wire start systems. If there is an external battery charger, disconnect it from its AC power source. Then disconnect the set starting battery(ies) (negative [–] lead first).
3. Remove the accessory panel cover on the back of the cabinet door.

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4. Refer to the interconnect wiring diagrams (Figures E-9 thru E-12). Note that Figure E-9 is for switches without meters and Figure E-10 is for switches with meters. Locate the wiring termination points inside the transfer switch. Identify which installed options are available for monitoring and control.
5. Refer to the outline drawing provided with the transfer switch to locate and make knockouts for the wire routing to the CCM. Plan the wire routing so the monitor and control leads from the CCM follow the existing harness leads. Provide adequate wire protection at the knockout. Follow standard wiring practices. Wiring must meet all applicable codes.
6. Observe minimum wire gauge requirements for CT, monitor and control wiring. Connect the monitor and control wires to the locations shown in Figures E-9 and E-10. Provide enough wire so that the leads can be secured to the existing harness.

   The CT wiring shown in Figure E-9 is for transfer switches that do not have meters. If monitoring features that require CTs (i.e. current, power factor, etc.), a separate CT kit is required.
7. Position and secure the accessory panel cover.
8. Close and lock the cabinet door.
9. Connect the data wire to the CCM and provide an adequate length of twisted pair wire for future connection to a junction box or other network module. Tighten the tamper-proof control box mounting screws securely to prevent tampering.
10. Connect the normal AC power source, connect the genset starting battery(ies) (negative [–] lead last), and return the genset control switch to the Remote position. Connect the battery charger, if applicable.
11. The CCM is now ready for network wiring. Network wiring must be done by a trained network installer. Refer to sections 2 and 3 for instructions on network wiring the CCM and for installation and connection of this module to the network.

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TABLE 11-2. CT WIRE SIZE Vs. DISTANCE CHART

CURRENT CT MAXIMUM DISTANCE BETWEEN CT AND CCM BLANK ROWS INDICATE THAT A CT KIT IS REQUIRED CONTACT YOUR AUTHORIZED PARTS DISTRIBUTOR				
CT LIST	RATIO	AWG 12	AWG 14	AWG 16
		FEET (M)	FEET (M)	FEET (M)
302–0209	250/5			
302–1392	150/5			
302–1393	300/5			
302–1394	400/5	41 (12.5)	26 (7.9)	16 (4.9)
302–1395	750/5	41 (12.5)	26 (7.9)	16 (4.9)
302–1396	1000/5	41 (12.5)	26 (7.9)	16 (4.9)
302–1809	500/5	291 (88.6)	181 (55.1)	114 (34.6)
302–1810	1200/5	291 (88.6)	181 (55.1)	114 (34.6)
302–1811	200/5			
302–1820–13	1500/5	1102 (335.9)	685 (208.8)	431 (131.3)
302–1821	50/5			
302–1822	75/5			
302–1830–04	2000/5	603 (183.8)	374 (114)	236 (71.9)
302–1830–05	2500/5	603 (183.8)	374 (114)	236 (71.9)
302–1830–06	3000/5	603 (183.8)	374 (114)	236 (71.9)

NOTES: 1. This table is for copper wire at 50°C (122°F). Derate the distance by 0.4% per °C over 50°C.
2. Minimum wire gauge for NEC compliance is AWG 14.

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NETWORK TOPOLOGY AND DATA MEDIA

Refer to Section 2 for information on the network topology and data transmission media.

NETWORK POWER

The CCM-ATS receives its network power from a sealed 12-volt battery and a battery charger. These components are included in CCM control box. A separate 120 VAC source is needed to power the battery charger. If a utility outlet is not available, a transformer kit is available for obtaining the voltage from the ATS. Refer to the transformer kit for transformer installation and power supply wiring information.

NETWORK DATA MEDIA AND POWER WIRING

⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Only trained, experienced personnel are to perform the following procedures.***

Connections

Network data connections are made at connector J9.

Conduit

When installing conduit, observe the following precautions:

1. Before beginning conduit installation, cover all components to prevent accidental entry of metal chips.
2. If using rigid conduit, install at least 2 feet (610 mm) of flexible conduit between the rigid conduit and generator set to absorb vibration.
3. Always run DC circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.
4. Data wire can be run without conduit if it is adequately protected. Do not run data wire in conduit with network power wiring or other non-power–limited circuits. Make sure wiring meets all applicable wiring codes.

⚠CAUTION ***Installation debris can cause equipment failure and damage. Use extreme care to keep drill chips and filings out of the components when mounting or connecting conduit. Screwdrivers should be used carefully to prevent damage to components.***

NETWORK INSTALLATION

Sections 3 and 4 provide a detailed description of the network installation process. Read sections 1 and 2 before constructing the network. Sections 3 and 4 provide the following step-by-step installation procedures:

1. Setting up Network Installation Tools
2. Starting LonMaker Software
3. Using LonMaker Software
4. LonMaker Network Setup
5. Connecting Devices with LonMaker
6. Installing Devices with LonMaker
7. Testing Devices and Verifying Installation
8. Setting up PowerCommand Configuration Tool
9. Using PowerCommand Configuration Tool

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SWITCHES AND LEDs

The Service switch (S4) is used during installation (when prompted by the LonMaker program). The Terminator switch must be set to the appropriate position at installation. Switches are described in Table 11-3.

LEDs are described in Table 11-4.

TABLE 11-3. CCM SWITCHES

Ref	Name	Type	Description
S4	SERVICE	momentary push	Used at time of logical installation to identify device to the installation software. Pressing S4 will light the DS1 LED.
S5	RESET	momentary push	Resets the Neuron Chip processor. Must be pushed after Install action.
S3	TERMINATOR	slide	Switch is set to position opposite of text “TERM” from factory. The two devices at ends of network data must have their switches set to “TERM”.

TABLE 11-4. CCM LED INDICATORS

Ref	Color	Name	Description
DS1	Amber	SERVICE	Indicates various states of the CCM node. It will be ON if S1 is pressed and held. States without S1 pressed: **OFF** = All OK. CCM has application image and is installed in a network. **ON**= CCM is applicationless or has experienced a error which prevents Neuron Chip from executing application code. **1/2 Hz BLINKING (1 second on / 1 second off)** =CCM has an application, but has not been logically installed in a network. **FLASHING (momentarily)** once every 2–3 seconds=CCM is experiencing an error condition causing a watchdog timeout reset.
DS6	Green	WREN	ON (normal state) indicates that the off–chip EEPROM can be written to. Indicator must be ON if device is to be logically installed in a network. OFF could be caused by: 1)CCM’s CNTRL B+ is below 10VDC. 2)RESET switch being pressed and held. 3)problem with board or connectors.
DS7	Green	STATUS	**1/2 Hz BLINKING (1 second on / 1 second off)** to indicate that the CCM’s processor is executing the application code. **In the future,** may be used to indicate other conditions for troubleshooting purposes.

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NETWORK VARIABLES

Table 11-5 shows the correlation between actual inputs and outputs for the CCM and the CCM's network variables based on CCM-ATS Interconnect Drawing Figures E-9 thru and E-12 (located in Appendix E).

Refer to the connectable network variable outputs in Tables 10-6 and 10-7 (Section 10) and the connectable network variable inputs in Table 10-8 (Section 10) during the logical installation of CCM on the network.

TABLE 11-5. ACTUAL INPUTS AND OUTPUTS FOR THE CCM-ATS

Signal	CCM Network Variable		Options Required
	Name	Active State	
DISCRETE INPUTS			
Normal Available	nvoCustInput[1]	Closed (1)	Signal Module
Emergency Available	nvoCustInput[2]	Closed (1)	Signal Module
Normal Connected	nvoCustInput[3]	Closed (1)	Auxiliary Relay
Emergency Connected	nvoCustInput[4]	Closed (1)	Auxiliary Relay
Test/Exercise Mode	nvoCustInput[5]	Closed (1)	Signal Module
Backup Source Failure	nvoCustInput[6]	Closed (1)	Signal Module
Low Genset Battery Voltage	nvoCustInput[7]	Closed (1)	10A Battery Charger, TB3 Extension
High Genset Battery Voltage	nvoCustInput[8]	Closed (1)	10A Battery Charger, TB3 Extension
Elevator Transfer Signal	nvoCustInput[9]	Closed (1)	Signal Module
Battery Charger Failure	nvoCustInput[10]	Closed (1)	10A Battery Charger, TB3 Extension
Bypass to Normal	nvoCustInput[11]	Closed (1)	Bypass Transfer Switch Only
Bypass to Emergency	nvoCustInput[12]	Closed (1)	Bypass Transfer Switch Only
RELAY OUTPUTS			
Load Shed	nviRelayControl1		Load Shed from Emergency Option
Transfer Inhibit	nviRelayControl2		standard
Remote Test	nviRelayControl3		standard

Notes for PowerCommand Configuration Tool (Section 3):

1. Set the active state as indicated in the table.

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12. Network Router

OVERVIEW

This section describes the PowerCommand Network Router (RTR) and its use in a PowerCommand Network. It also describes the physical mounting and wiring of the Router, and provides procedures for the *logical* installation and connection of a Router within the network.

DESCRIPTION

A Router connects two communications channels by passing messages between the two channels. The PowerCommand Network Router is configured to connect two twisted pair/transformer isolated 78kb (TP/XF-78) channels.

The Router, shown in Figure 12-1, can be used within a PowerCommand Network to extend the physical length of the network beyond 4600 feet (1402 m) and/or increase the maximum number of nodes to more than 44 nodes.

Two separate (physical and logical) TP/XF-78 channels must be defined, and at least one installed, before installing the router. Both channels must be properly terminated at each end (four terminations total). The router must also be installed before installing nodes that are physically located on the other side of the Router. Each additional Router adds one more channel.

Each PowerCommand Network is limited to a maximum of 20 channels. Each channel is limited to 4600 feet (1402 m) with a maximum of 44 nodes.

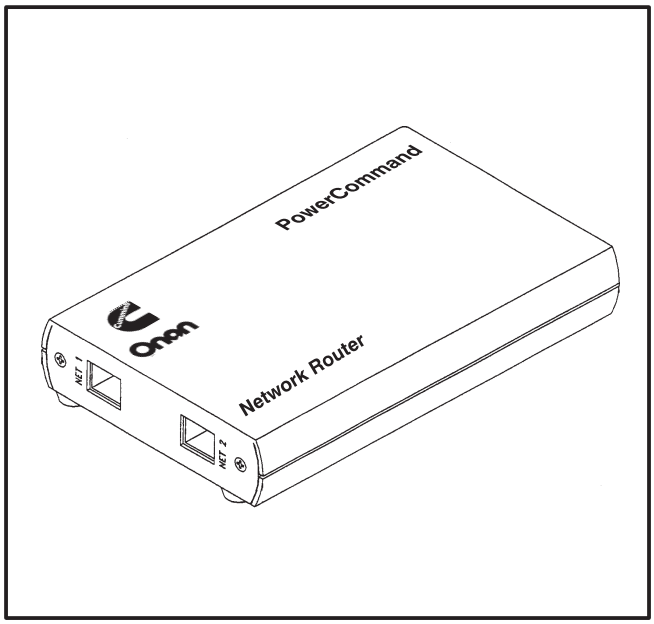

FIGURE 12-1. NETWORK ROUTER

In addition to extending the length of a network and/or increasing the number of nodes, Routers can also be used to improve the reliability of the overall network. When connecting two or more channels in a network, each channels is physically isolated so a failure in one channel will not affect the other channels.

Power Supply

The Router has a 9 VDC input power jack, that connects to utility power through a plug-in transformer. The Router will not operate when utility power is lost (no messages are passed).

If the Router must remain powered during an electrical power failure, use an Uninterruptible Power Supply (UPS). Refer to the UPS section of this manual. If more than one device will be connected to the UPS, purchase a multi-outlet adapter or multi-outlet extension cord.

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LOCATION

Locate the Router near an electrical outlet.

Choose a clean, vibration-free mounting surface. Avoid locations that are hot, damp or dusty. The temperature range must not exceed 32°F (0°C) to 131°F (55°C).

Figure 12-2 shows the Router outline dimensions.

Refer to section 2 for network topology and maximum network length. **All wiring must follow a specific network topology and must fall within distance limits.**

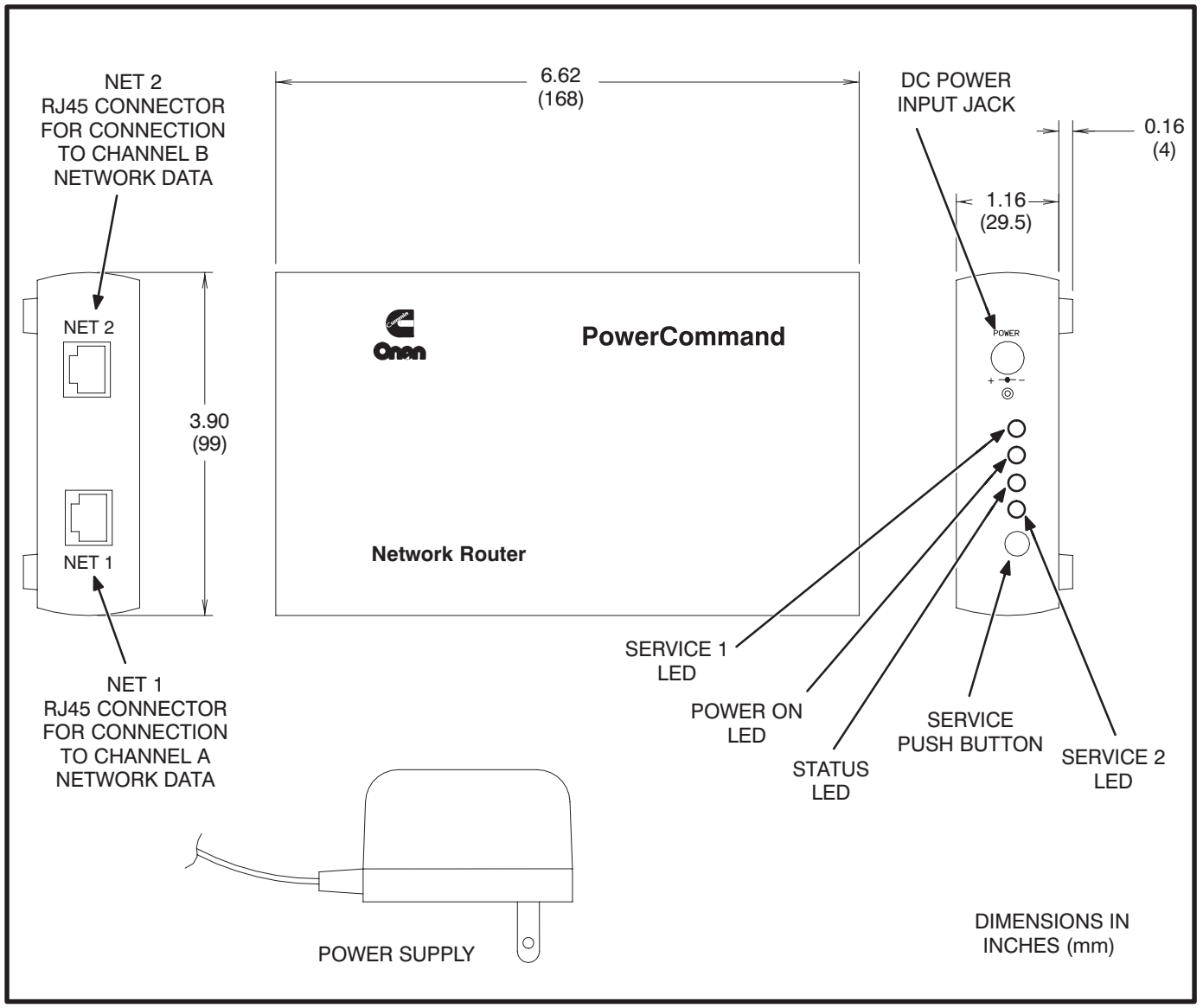

FIGURE 12-2. NETWORK ROUTER OUTLINE DRAWING

TABLE 12-1. ROUTER – OUTLINE DRAWING DESCRIPTIONS

Function	Description/Specification
DC Power	Input connector for power supply.
Net 1	RJ45 modular connector for connecting side one of the router to a twisted-pair channel (Transformer Coupled into Category 4 Twisted Pair at 78,000 bits/sec).
Net 2	RJ45 modular connector for connecting side two of the router to a twisted-pair channel (Transformer Coupled into Category 4 Twisted Pair at 78,000 bits/sec).

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MOUNTING

The Router can be placed on a clean flat surface or it can be mounted to a wall or other flat surface with the enclosed mounting brackets. Figure 12-3 shows the outline and mounting hole locations for the mounting brackets.

⚠ CAUTION ***Make sure that no wires, plumbing, gas or exhaust lines run behind the mounting area before drilling the mounting holes.***

The foam tape on the brackets is for spacing the brackets. The covering can be removed to adhere the foam spacer to the Router.

ROUTER PATCH CABLES

The patch cables included in this kit are shown in Figure 12-4. Connect one cable to each channel (NET1 and NET 2) on the Router (Figure 12-5).

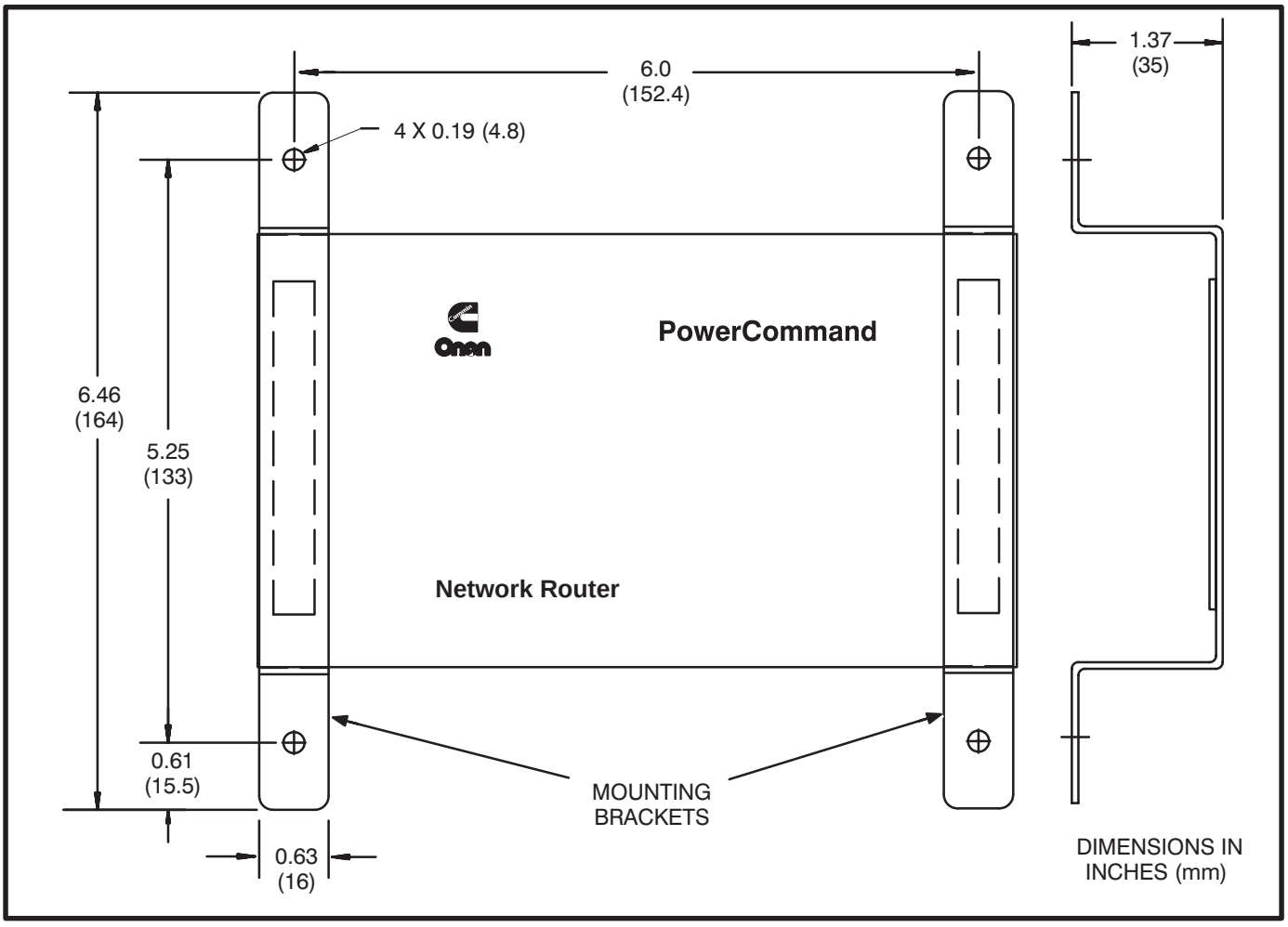

FIGURE 12-3. MOUNTING BRACKET OUTLINE

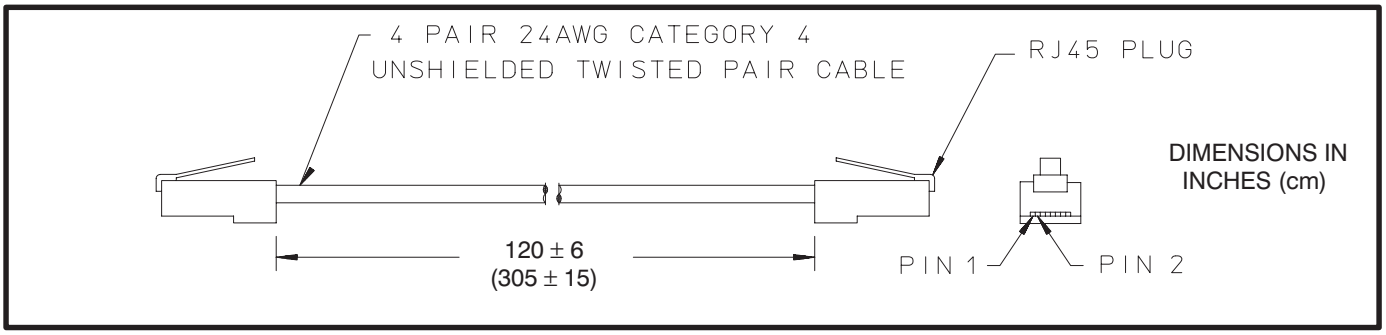

FIGURE 12-4. RJ45 ROUTER PATCH CABLE

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ROUTER WIRING

Two Junction Box/Terminator (JB/T) modules are required to connect the two channels to the Router. The Router may connect to the end of a channel (see CHANNEL A) or any convenient point on the channel (see CHANNEL B).

Routers are not equipped with a termination switch. When a Router is connected to the end of a channel, the termination switch on the JB/T must be set to terminate (TERM), as shown in Channel A of Figure 12-5.

Figure 12-5 shows a typical Router installation. Installing the Router connects two separate physical (and logical) channels. Each channel requires termination at each end of the channel.

Each additional channel is limited to 4600 feet (1402 m) and a maximum of 44 nodes. Routers are not required for a network that are less than 4600 feet (1402 m) and have no more than 44 nodes.

Each Router allows one additional channel in the network. PowerCommand Networks are limited to a maximum of 20 channels.

Refer to Figure 12-2 for the Router connection points.

⚠ CAUTION ***Do not route wires over hot, sharp, or abrasive surfaces.***

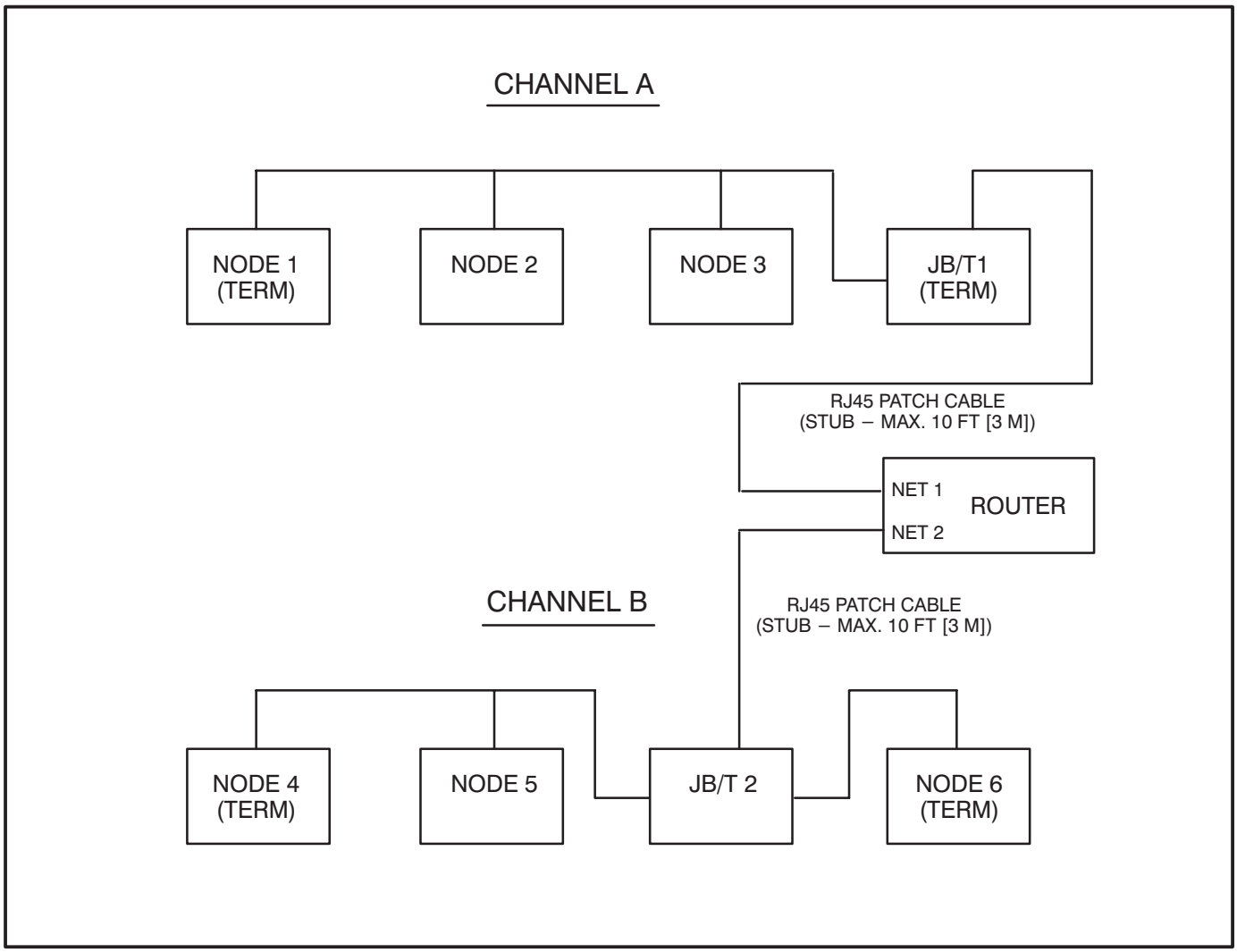

FIGURE 12-5. ROUTER USED TO CREATE A NETWORK WITH TWO CHANNELS

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SERVICE SWITCH AND LEDs

The Service switch is used during installation (when prompted by the LonMaker program)**.**

The yellow LEDs indicate if the service switch is being pressed. The yellow LED indicators blink when the RTR is unconfigured and are off if the RTR is configured. One or both of the yellow LED indicators remains on if an unrecoverable error is detected.

Switches are described in Table 12-2. LED indicators are described in Table 12-3.

TABLE 12-2. ROUTER – SWITCHES

Name	Description
SERVICE	Momentary push type switch used at time of logical installation to identify the device to the installation software. Pressing the SERVICE switch will light both Service LEDs to maximum intensity.

TABLE 12-3. ROUTER – LED INDICATORS

Color	Name	Description
Yellow	SERVICE 1	Indicates various states of the Router. LED is ON with maximum intensity when the Service switch is pressed and held. States without Service switch pressed: **ON**= An unrecovered error has been detected that prevents the Neuron Chip on side one from executing application code. **BLINKING** = Router side one unconfigured. Routing tables or router node address assignment have not been loaded. **OFF** = All OK. Router has application image and is installed in a network.
Green	POWER ON	Indicates that power is being supplied to the router.
Green	STATUS	**BLINKING** = Indicates that packets are are being passed in either direction. The rate of blinking can be used as a rough indicator of router activity.
Yellow	SERVICE 2	Indicates various states of the Router. LED is ON with maximum intensity when the Service switch is pressed and held. States without Service switch pressed: **ON**= An unrecovered error has been detected that prevents the Neuron Chip on side two from executing application code. **BLINKING** = Router side two unconfigured. Routing tables or router node address assignment have not been loaded. **OFF** = All OK. Router has application image and is installed in a network.

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NETWORK TOPOLOGY AND DATA MEDIA

Refer to section 2 for information on the network topology and data transmission media.

⚠WARNING ***AC voltages and currents present an electrical shock hazard that can cause severe personal injury or death. Only qualified personnel are to perform the following procedures.***

Connections

Network data connections are made at the RJ45 connectors marked Net 1 and Net 2 (shown in Figure 12-2, cables supplied with the Router are shown in Figure 12-4.)

NETWORK INSTALLATION

Sections 3 and 4 provide a detailed description of the network installation process. Read Sections 1 and 2, before constructing the network. Sections 3 and 4 provide the following step-by-step installation procedures:

1. Setting up Network Installation Tools
2. Starting LonMaker Software
3. Using LonMaker Software
4. LonMaker Network Setup
5. Connecting Devices with LonMaker
6. Installing Devices with LonMaker
7. Testing Devices and Verifying Installation
8. Setting up PowerCommand Configuration Tool
9. Using PowerCommand Configuration Tool

Logical Installation

After the Router is physically attached to the network, and powered up, it must be logically installed using LonMaker. The logical installation is covered in the LonMaker Installation Tool Users Guide.

When installing a network that contains a Router, the Router must be installed first.

This section provides an overview of the logical installation of a Router.

A Router is a single device that contains two Neuron chips, one serving each channel. In a network with one Router, Channel A can have up to 43 additional nodes and Channel B can have up to 43 additional nodes, for a maximum of 44 nodes per channel.

A network diagram is needed to determine the number of channels in the network and which nodes are assigned to each channel.

The following is an outline of the steps needed to Define and Install a Router.

1. Create/Select one Domain and define the channels that the Router(s) will connect.
2. Choose a Location and Define the Router(s) using Device Setup. Use a unique name for each Router, this name can only be used once in the network. Set up both sides of the Router(s) as using priority.
3. Select Install Devices and **install the Router(s) first**. This will allow access for installing the other nodes on the channels.

For specific details on filling in LonMaker Fields when Defining and Installing Routers, refer to the LonMaker Installation Tool Users Guide.

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A. Glossary of Network Terms

Attaching – Term used in this manual to describe connecting the PC, used for network installation and service, to the PowerCommand Network via the Installation Gateway.

Binding – The process of making the logical connections on the network (also called connecting). This involves connecting network variable outputs to network variable inputs using LonWorks software.

Binding – The process of making the logical connections on the network (also called connecting). This involves connecting network variable outputs to network variable inputs using LonWorks software.

Boolean – A logical system used to express one of two states, such as *on* or *off* (*yes* or *no, 1 or 0* etc.).

Bound – A network communication technique whereby a node automatically receives a network variable from a sender node whenever the sender node sends it out. The sending is completely controlled by the sender node. The network variables involved are said to be "bound."

Bus – The main "backbone" of the network data wire. It must start at one point and end at another. Stubs off the main bus wire must not exceed ten feet. The wire is said to be "daisy-chained" from one node to the next. Without using a router, the maximum bus length is 4600 feet (1402 m).

Controls Communications Module (CCM) – A module for monitoring genset or transfer switch parameters. It also provides some control capability. There are two kit versions: CCM-Genset that can be used on gensets that do not have a PowerCommand Control, and CCM-ATS that can be used to monitor and control transfer switches. (Refer to the CCM-Genset or CCM-ATS sections of this manual for application information.)

Channel – A Channel is the physical communications media that connects the devices and the properties of these media (such as transmission speed). Most PowerCommand network installations will have only one channel (twisted-pair wiring and 78 KBaud transmission speed). In a large network, there may be multiple channels and each channel may or may not be of the same media type. Channels are linked together using Routers.

Comma Separated Value (CSV) – A record layout that separates data fields with a comma and usually surrounds character data with quotes.

PCW uses the CSV record format.

Configured/Unconfigured – The term configured, as used in this manual, refers to a module that has been logically installed with LonMaker Software. A "network image" (address and binding information) is stored in the node. A module that has not been logically installed with LonMaker is referred to as being unconfigured. The service LED will blink on an unconfigured module.

Connecting Devices – Connecting refers to the process of assigning connections—linking an output variable of one device to an an input variable of another device. This process is also called "binding."

Customer Site Database/ "Site Directory" – A database that is specific to a customer's installed network. It contains two subdirectories, "DB_TYPE" and "DB_INST". When the PCNET utility is executed, this directory structure is set up. "DB_TYPE" contains the information LonMaker needs in order to know what each module is and what it can do. Once LonMaker is run and a specific customer site is set up (devices and binding defined), this information is stored in the "DB_INST" subdirectory.

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Digital I/O Module (DIM) – A network module with four discrete customer inputs, and sixteen 5A, 250 VAC Form-C dry contact outputs. The four customer inputs are available on the network to control other devices or to indicate status. The 16 relays are controlled by other devices on the network.

Distributed Control System – A collection of nodes that interact to control a system whose components are spread out over some distance. Each node has intelligence for operating its own particular component of the system. Different parts of the system communicate status and control information with one another to form a distributed control system. Typically they communicate on a peer-to-peer level. This is different from a type of system where all control and interaction between components is dictated by one central control (this type of system typically communicates in a master/slave arrangement).

A distributed control system can be more robust than a central control type because failure of one node will not shut down the whole system. The other working nodes will still interact. If a central control fails, the whole system shuts down.

Domain – A domain is a network concept that allows independently functioning networks to share resources, such as transmission media. A domain designation provides an ID number to identify the devices that can communicate within that domain. A network must have at least one domain. PowerCommand network installations will usually have only one specified domain.

Gateway – A device that acts as interface between two different communication protocols. The network gateway module (NGM) is an example that translates PowerCommand network protocol into a protocol that a PC can understand. Other gateway devices may translate between PowerCommand network protocol and other systems such as SCADA, building automation systems, UNIX systems, etc.

Genset Communications Module (GCM) – The GCM provides a communications gateway between the PCC and the network. The GCM communicates with the PCC over a serial data link. The GCM gets data from the PCC such as volts, current, engine speed, oil temp, etc. and then sends it out on the network if another network node is bound to it or is requesting data. The GCM also provides some direct local control and monitoring of the PCC. It monitors for “Not-In-Auto”, and both High and Low Battery voltage (when the PCC is asleep) then sends it out on the network if another network node is bound to it or is requesting data.

Installation Gateway – The term used in this manual to describe the special Gateway (refer to Gateway) used only when installaing or servicing a PowerCommand Network.

Junction Box/Terminator (JBT) – A device that provides connection points for network power and data wires. It also contains a network terminator circuit for use at the end of a network.

Onan has created a junction box/terminator potted assembly. *The JBT is required to connect an NGM to the network. The JBT provides a (required) terminator circuit for NGM nodes that are located at an end of a network.* The JBT can also be used as a convenient device for wiring pass thru, local loop and stub connections throughout a network. It provides two 6-position pluggable terminal blocks for data and power, two RJ45 jacks for temporary 24AWG stub connections (e.g. NGM), a switch to connect the data lines to a terminator circuit and a switch to select either a pass thru or a local loop connection between the data lines on the terminal blocks.

Local Loop – A method of branching out to a node that is farther away from the main network bus than a stub would allow (i.e. >10 feet [3m]). It uses two wire pairs — one pair to go out to the node, and the other to return from the node. Effectively the node is “daisy-chained” into the network bus. The effective bus length for that particular run will be twice the distance to that node. The total local loop distance must be added into the maximum network length of 4600 feet (1402 m).

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Locations – Locations are subdivisions of a network that can be selected strictly for convenience and organization. Locations may be used to designate physical places, but they do not have to do so. For example, a “location” designator could refer to one row of devices, while another “location” designator could refer to an adjacent row of devices on the same wall.

Network devices in one location can communicate with network devices in another location. A network must have at least one location name. A device can be in only one location.

LonMaker Site Database – See Customer Site Database

Manchester Encoding – a method of representing 1’s and 0’s on a media which results in polarity insensitive wiring.

Master/Slave – A type of communication protocol whereby one device controls all communication on the channel. This is the master. The slaves are all of the other devices. The slave devices talk only when the master tells them they can. An example of this is a computer and a printer. The printer is the slave device. See Peer-to-Peer.

Media – The hardware level of communications. This defines two things: 1) what the electrical signal levels will be and 2) over what they will travel. Examples of media are: RS-232, RS-485, transformer coupled twisted pair, radio frequency, fiber optic, coax, infrared, and power line. Note that the media does not define what “language” (protocol) nodes will use to communicate information with one another.

Modem – (MOdulator DEModulator) A device that adapts a terminal or computer to a telephone line. It converts the computer’s digital pulses into audio frequencies (analog) for the telephone system and converts the frequencies back into pulses at the other side. The modem also dials the line, answers the call and controls transmission speed. (The modem should be set to operate at 9600 bps for use in a PowerCommand Network.)

Modules (Nodes) – Modules (sometimes called nodes or devices) are the various hardware modules on the network, such as the Digital I/O Module, the Controls Communications Module, and the Genset Communications Module.

Multidrop Bus Topology – The wiring arrangement used for the network data. The bus that starts at one point and ends at another. The topology allows “drops”(or stubs) off of the bus up to 10 feet (3 m) from the bus. One or more “Drops” can be made any place along the bus (hence “multidrop”).

Network – A collection of Nodes that communicate with one another over a distance. The PowerCommand network communication is implemented transformer coupled twisted pair data wire. The “language” that is “spoken” on the network is called the protocol.

Network Annunciator Module (NAM) – An application which combines a hardwired PowerCommand System Annunciator with a Digital I/O Module. This module is available in two versions: one has an oversize cover for flush mounting and the other has a smaller cover for surface mounting. The module is prewired for NFPA110 applications. The module can be modified for generic annunciation applications.

Network Data – A signal that carries messages between nodes. In this network, it is a Manchester encoded digital signal. Manchester encoding makes the signal insensitive to polarity (i.e. the two data wires may be connected in either polarity). The signal is transformer-coupled to the network data wire at a rate of 78 k bits/sec. Transformer coupling into twisted pair wire gives excellent noise immunity. (It is far superior to either RS-232 or RS-485 for example.) Shorting of the wire pair will cause no permanent damage, but communications will be affected. Opens prevent nodes on each side of the open from communicating, but nodes on one side of the open will still communicate. An unpowered node will not prevent other powered nodes from communicating.

Network Data Wire – Twisted pair communications wire that carries the network data communication signals. The wire must meet UL Level IV requirements (as listed in UL’s document: “UL’s LAN Cable Certification Program”). Equally acceptable is wire conforming to EIA/TIA Category 4 (as described in EIA/TIA Technical System Bulletin #36). These requirements specify the transmission line characteristics for the wire (attenuation, characteristic impedance, crosstalk, etc.). These characteristics are critical to maintaining a good signal. 22 AWG wire must be used for the network bus. 24 AWG may be used on stubs. The cable does not need to be shielded. Maximum bus length is 4600 feet (1402 m).

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Network Module Library – The Network Module Library (NML) is a software database that describes devices, channels, and predefined input/output connections. The NML is used by PCNET to create the “Site Directory.”

Network Gateway Module (NGM) – A network device that acts as a gateway between a PC or modem and the network. The “site“ NGM allows software running on a PC to access, poll, and control all devices on a network. The PowerCommand Software uses this device to access the network.

The NGM connects to network data through an RJ45 jack. Connecting to it requires a 24 AWG cable. The NGM receives its power from AC utility power.

Network Installation Gateway – A special NGM that is configured for installing and servicing a network. Do not use the Network Gateway Module to install or service a network or its configuration information will be lost. Always use the Network Installation Gateway for installing and servicing networks.

Network Power – B+ is used to power remote network devices such as the Digital I/O Module, Network Annunciator and Controls Communications Module. For limited distances, this may be supplied by the genset battery. For greater distances, an auxiliary battery will be needed to prevent module power loss during cranking.

Network Power Wire – Wire used to run power to nodes that do not have a local source of power (e.g. Digital I/O Module, Network Annunciator Module , etc.). The wire gauge must be chosen for the number and type of nodes and the maximum distance from the power source to a load node. Refer to the *Network Power* section for data on wire selection.

Network Variable (NV) – Network Variables send a value with defined units from one device (the output) to another (the input). Each network variable is either an input or an output. Also see *Connecting Devices.*

Data that can be accessed or driven through the network. Examples would be: Genset voltages, genset start/stop, etc. Some NVs are used purely for monitoring purposes. Others are used for control between devices.

LonMaker recognizes device inputs and outputs as network variables (NVs) and message tags. This is because inputs and outputs for a LonWorks network are not hard-wired connections, they are programmable software values.

Neuron Chip – A communIcations processor developed by Echelon Corporation for use in distributed control systems. The Neuron chip firmware implements a sophisticated communications protocol, allowing nodes to communicate through the passing of network variables. The Neuron chip also has I/O to support modest application circuits.

Node – A module that can communicate over the network data wire to other modules. A module containing a Neuron chip.

Pass Thru – Refers to a junction box connection where the network bus comes to a connector and then continues straight on through. It is merely a point for splicing wires. The Onan junction box/terminator provides this function.

PCNET – A utility program that is used to create a “customer site” or update an existing site with the latest NML. This utility program is loaded when NML is installed. Refer to Section 3, *Create or Update a Customer Site*.

Peer-to-Peer – A type of communication protocol whereby any device on the communication channel can communicate with any other device at any time. That is, no one device is the master of the communication medium. The PowerCommand Network is a peer-to-peer type network.

Polling – A network communication technique whereby a node asks another node for its current value of a network variable. The node doing the asking forces the other node to send out that network variable.

Protocol – The protocol is a language that each node on the network knows how to speak and interpret. It is not to be confused with communications media. The media is the hardware level of the communications. The protocol is what allows devices to exchange messages with one another. A protocol can be very simple or very complex. Echelon’s LonTalk Protocol, used in the Neuron Chip, is very sophisticated.

RJ45 Connector – An 8-position phone jack connector. Some nodes (e.g., NGM) connect to the network via an RJ45 connector. Network data is brought in on positions 1 and 2 (the two left-most positions as the plug is viewed from the contact side (as opposed to the side with the latch).

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Router – A router is a device that connects one channel to another. Routers are not required when there is only one channel in a network.

A router can also be used to extend the PowerCommand Network bus or extend the number of modules on the network.

Standby Uninterruptible Power Supply – See Uninterruptible Power Supply

Stub – A branch off of the network bus. It must not exceed 10 feet (3m).

Terminator – A circuit that is required at both ends of the network bus. This circuit acts to optimize the transmission line characteristics (minimizes signal reflections). It is critical that the network bus be properly terminated. Without terminators or terminators in the wrong places, network communications can be severely hampered. Even if the network appears to be working, messages are likely getting lost or unnecessarily repeated, increasing network traffic. Noise immunity is also greatly reduced. Each network module except the NGM has a terminator built in. On Onan-designed nodes, a slide switch is used to connect the terminator circuit to the network data lines. Junction boxes also contain built in terminators with a slide switch to activate it. The terminator on the junction box would only be used if an NGM was located at the end of the network bus because the NGM has no terminator circuit.

Topology – The physical wiring arrangement for the network data communications. Example topologies are bus, ring (e.g. Token Ring), star and mixed. The network data described in this document communicates on a multidrop bus topology.

Twisted Pair Communications Cable – A cable containing typically one, two or four twisted wire pairs. The cable is specified according to its characteristic impedance, maximum operating frequency, attenuation, capacitance, and cross-talk. These are all important parameters for reliable data transmission.

Single pair cable will contain one white/blue and one blue wire. This would only carry network data. Two pair cable will contain one pair of white/blue & blue and one pair of white/orange & orange. The blue pair would carry network data. the orange pair could be used in local loop configurations. Four pair cable will contain paired colors of blue, orange, green and brown. Again, blue is primary for network data. Orange, Green and Brown can be used for network data — may be used for a local loop.

The wire comes as either 22 AWG (for main bus or stubs) or 24 AWG (for stubs only), plenum or PVC insulation, and with or without a drain/shield. The PowerCommand Network does not require the use of shielded cable. Plenum vs. PVC insulation will be chosen based on code requirements for fire resistance. If network power is being run in the cable, then the cable must be in conduit.

Uninterruptible Power Supply (UPS) – A backup power supply used when the electrical power fails or drops to an unacceptable level. Small UPS systems provide power to operate equipment for a number of minutes. There are two main types of UPS: an online UPS that provides a constant source of electrical power from the battery and an offline UPS, also known as a standby UPS, that switches to battery power a few milliseconds after detecting a power failure.

Onan has an optional standby UPS that can be used to provide backup power for a modem and network gateway module.

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B. Accessories

MODEM

The modem provides a dial in/out link to other communications sites. The modem is AC powered. The modem communicates with the Network Gateway Module that communicates at 38,400 bps (on the serial (RS-232 side). The Onan Model PMDM 100 is the only approved modem for operation in the PowerCommand Network as of this printing.

STANDBY UNINTERRUPTABLE POWER SUPPLY (UPS)

Onan has an optional standby UPS that can be used to provide backup AC power for the Network Gateway Module and a modem. The UPS will provide backup power for a minimum of 30 minutes.

Use of a UPS will allow the modules (that are battery powered) on the PowerCommand network to communicate a power failure to a remote location via the NGM and modem during a power failure.

A multi-plug receptacle will be needed to connect more than one device to the UPS.

MULTI-SITE COMMUNICATIONS MODULE

The Multi-Site Communications Module allows a single computer running PowerCommand Software to communicate with up to eight remote sites simultaneously. This module is installed in an ISA bus compatible personal computer and it contains all of the necessary RS-232 communications connections for use with external communications equipment. This module should only be installed by someone familiar with computer servicing.

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C. Application Notes and Forms

NETWORK VARIABLES

The PowerCommand network recognizes module inputs and outputs as network variables (NVs) and message tags. Both network variables and message tags perform the same basic functions, they exchange values and information between modules. These inputs and outputs are not hard-wired connections between the modules, they are software values.

Network variables send a value with defined units from one device (the output) to another (the input). Each network variable is either an input or an output.

Message tags are similar to network variables, but they are used to send explicit messages. In the PowerCommand network, message tags are only used to send alarms to the PowerCommand software. The CCM and GCM have message tag outputs and the NGM has a message tag input.

Some network variables are of the analog data type structure. These network variables are not connected or *bound*. Instead, these network variables are made available to application programs (such as PowerCommand Software for Windows), which can then request the data from the source module (GCM or CCM).

BINDING NETWORK VARIABLES

Logically connecting network variables between modules is referred to as *binding*. Connecting the network variables results in a *bound* connection. The result of a bound connection is that when a module updates an output network variable, input network variables in other modules that are bound to it, are automatically updated via the network. Making these bound connections creates a network where control signals and data are automatically sent and received.

When installing the PowerCommand network you will need a diagram of all the logical connections. The logical connection diagram should be prepared before starting the installation to save time during the installation. A list of the network variables that can be connected are listed with each module in the back of the section.

Network Variable Rules and Limits

Network variables and message tags are connected using the LonMaker Installation software (refer to Section 3). Certain network variable rules and limits must be followed when making these connections. Refer to the following rules and limits when designing or troubleshooting a logical binding diagram.

Data Type Matching: Connect only variables of the same data type. The installation tool (LonMaker) will not allow mismatched types to be connected. For example, connect only Booleans to Booleans, words to words, message tags to message tags, etc.

Connections Within One Node: It is acceptable to connect one network variable output to one network variable input on the same module. The result will function as expected, but the network update will not appear on the network media, instead it will remain within the module.

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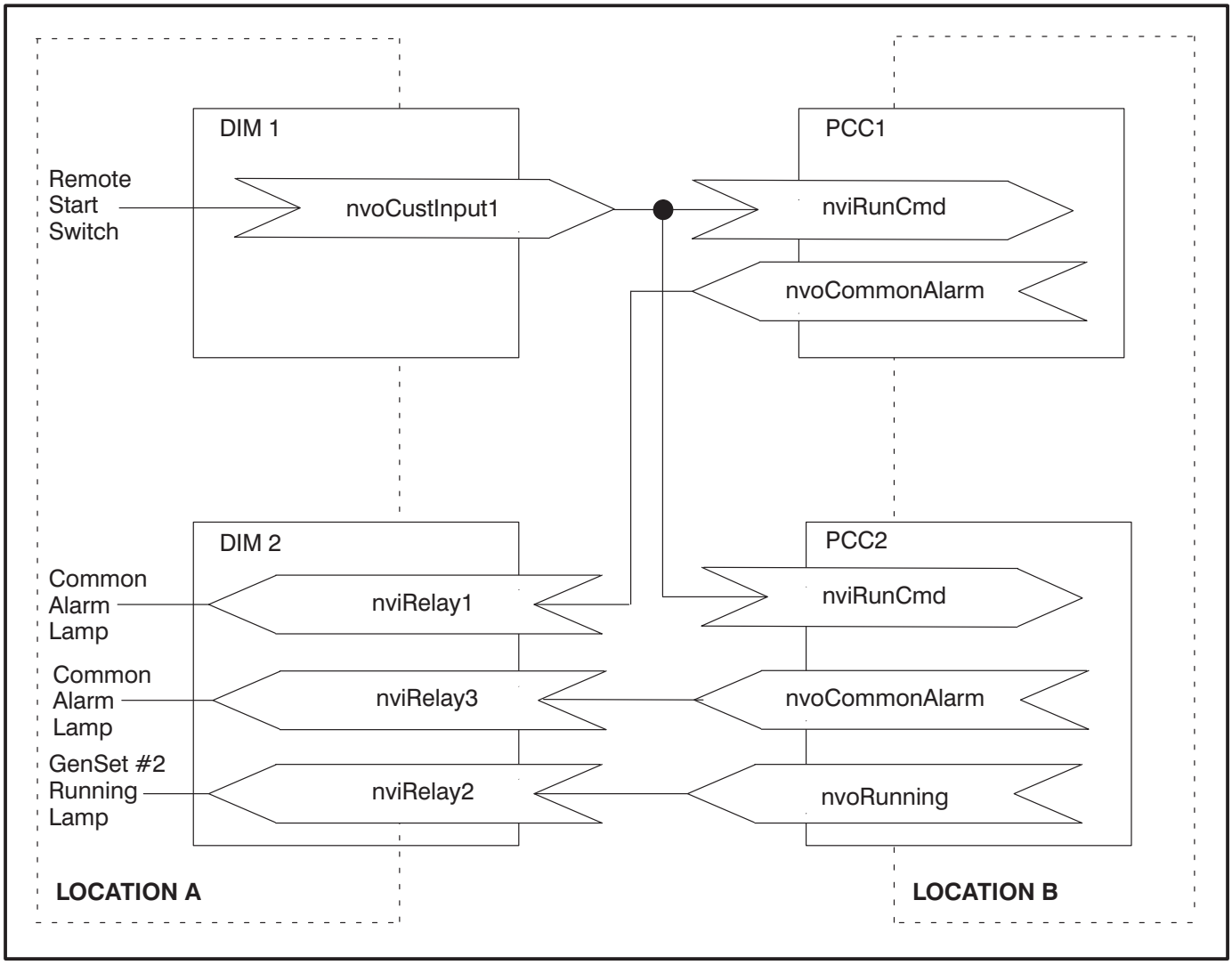

FIGURE C-1. TYPICAL BINDING DIAGRAM

Making Connections Other Than One Output to One Input: Making connections other than one-to-one is allowed, but it must be clearly understood how the resulting system will behave. The other scenarios are: 1) multiple outputs connected to one input; 2) One output connected to multiple inputs; and 3) multiple outputs connected to multiple inputs. These are discussed in more detail below.

Multiple Boolean Outputs: When multiple Boolean outputs are involved in one connection, it is necessary to understand how the connected Boolean input(s) will respond to updates. Some node types implement an equivalent hardwired OR'ing scheme while others do not. Refer to the following section called Multiple Outputs to One Input for a description of the possible results.

More Than One NV Input Controlling the Same Device: The Digital I/O Module has two means of controlling the relays. There are the individual Boolean inputs, *nviRelay[x]*, and there is the 16–bit word, *nviAllRelays*. If both are used, the result will be that the inputs are logically or'ed within the module.

For example:

If both *nviRelay[1]* and bit 0 in *nviAllRelays* (bit which controls Relay1) start out both as "0" (relay in reset state). If *nviRelay[1]* is updated to "1", the relay will be set. If bit 0 of *nviAllRelays* then is updated to "1", the relay will remain in the set state. Now, if *nviRelay[1]* is set to "0", the relay will still remain set until bit 0 of *nviAllRelays* is set to "0".

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Address Table Consumption: Bindings consume memory in each module. There is a limited amount of memory for storing the binding information. It is stored in a place called the “address table”. The installation tool (LonMaker) acts to optimize the addressing so that minimal address table space is consumed. However, in certain situations, all address table entries will be consumed. LonMaker will inform the user when this occurs.

Due to the complexity of the addressing schemes that the protocol uses, it would be difficult to create simple rules to determine whether the address table limit was going to be exceeded for a particular system binding design. In general, the greater the number of connections, the more address table space consumed. Address table consumption is increased when connections are made between many different NV’s on one device to single NV’s on many different modules. If in doubt about whether a particular application will exceed the limits, try it out by creating a test site and then make the connections using LonMaker. LonMaker will inform the user if the limits are exceeded.

The most severely limited device in terms of address table entries is the Digital I/O Module. It has only 5 address table slots, whereas the CCM and GCM module types have 15.

An example of a situation that would **NOT WORK** with the DIM or NAM is shown in Table C-1.

Only 5 of the 7 connections listed could be made due to the address table limit. This is a worst case example. In this case, add another DIM to the network.

Having only 5 address table entries on the DIM DOES NOT mean that there can be no more than 5 connections. This example illustrates a particular situation where this can occur. If connection numbers 6 and 7 had both come from GCM1, then all connections could be made.

TABLE C-1. EXAMPLE OF CONNECTIONS THAT EXCEED THE ADDRESS TABLE LIMIT

CONNECTION NUMBER	FROM		TO	
	MODULE NAME	NV OUTPUT	MODULE NAME	NV INPUT
1	ccm1	nvoCustInput[1]	dim1	nviRelay[1]
2	gcm1	nvoLoadDump	dim1	nviRelay[5]
3	ccm2	nvoCustInput[13]	dim1	nviRelay[2]
4	ccm3	nvoCustInput[1]	dim1	nviRelay[7]
5	dim2	nvoCustInput1	dim1	nviRelay[11]
6	gcm2	nvoRunning	dim1	nviRelay[3]
7	gcm3	nvoCustFault1	dim1	nviRelay[14]

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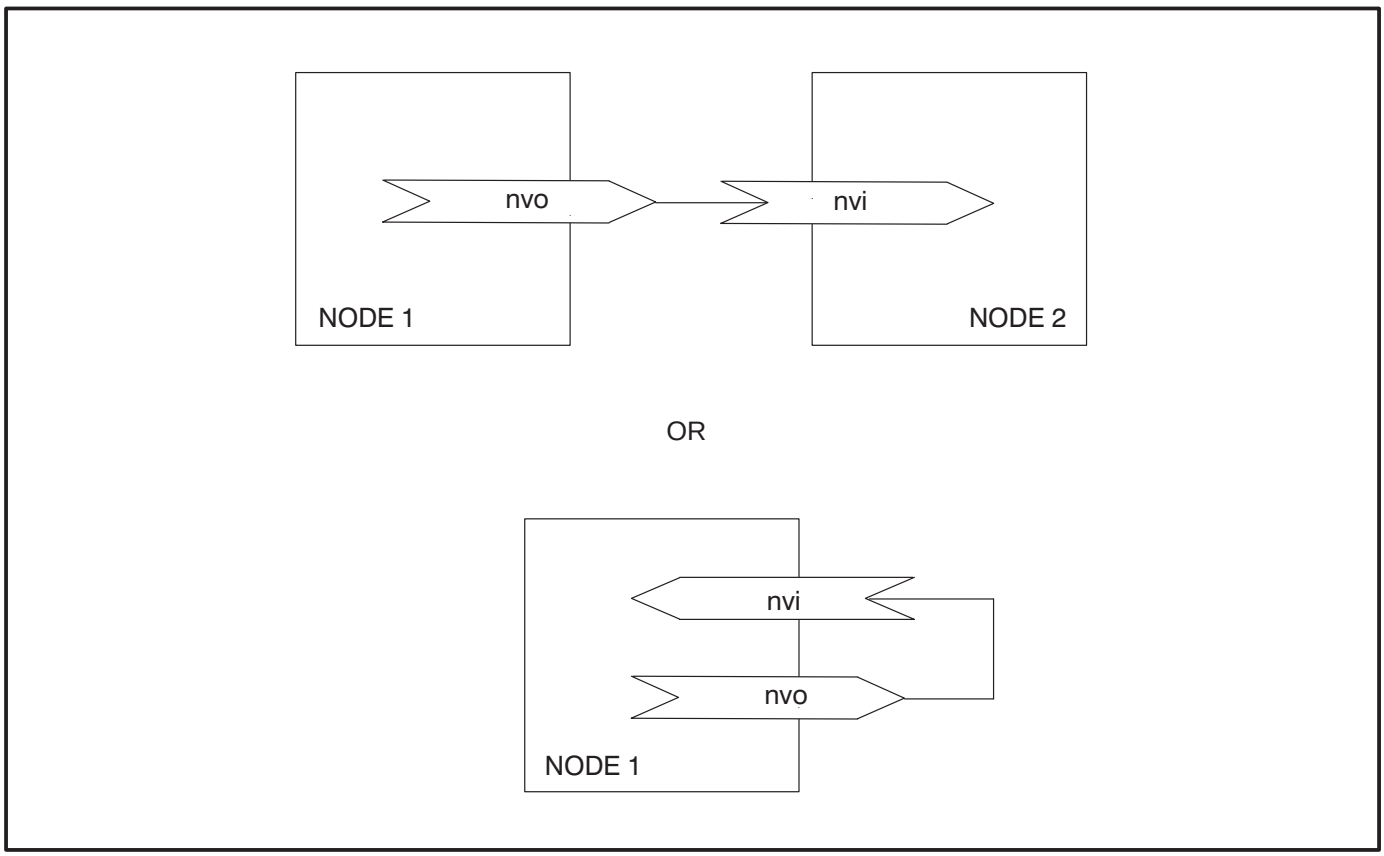

FIGURE C-2. ONE OUTPUT TO ONE INPUT BINDING DIAGRAM

TYPES OF CONNECTIONS

The different types of connections are explained in the following sections. It is important to consider the type of connections being designed or made and how the results of these connections will affect other devices. The logic involved may not behave in an intuitive or familiar manner.

One Output to One Input

This is the most straightforward type of connection. The only requirement is that the data types must match. When the output is sent on the network, the input will automatically get it and take appropriate action.

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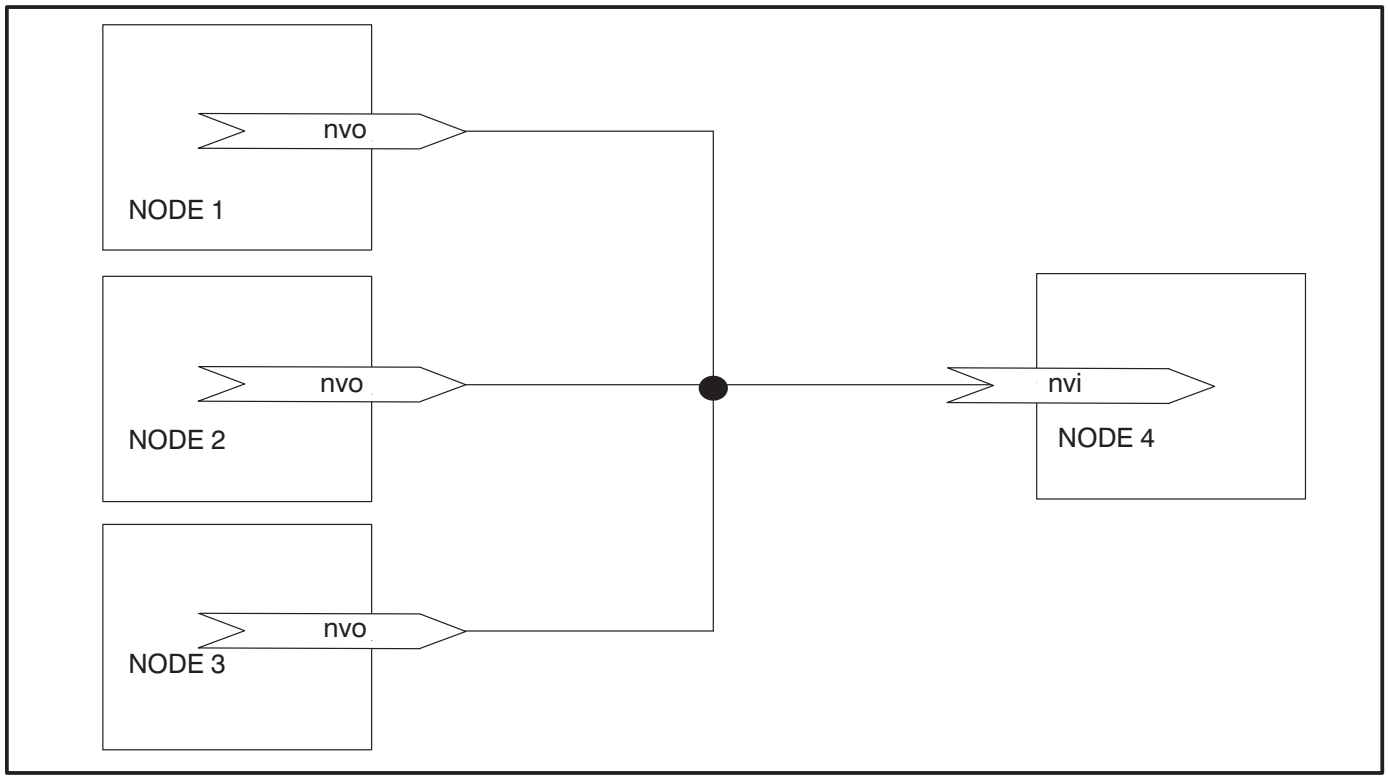

FIGURE C-3. MULTIPLE OUTPUTS TO ONE INPUT BINDING DIAGRAM

Multiple Outputs to One Input

Multiple outputs from one module cannot be connected to one input on a single module.

Some of the Boolean network variable inputs on the CCM and on the GCM implement a "wired OR" functionality. All of the Boolean inputs shown in Table C-2 implement this functionality. When multiple Boolean outputs from other modules are connected to one Boolean input, that Boolean input will remain a "1" until all of the connected Boolean outputs are "0". The modules implement this by polling all connected outputs each time a "0" is received from one of them. If, as a result of the poll, all outputs say they are a "0", the input is set to "0" and appropriate I/O action is taken.

The ***DIM's Boolean inputs do not implement a "wired OR"*** **function.** Therefore, if multiple outputs are connected to a Boolean input, the input will be in whatever state it received from the most recent update. If one output tells it to be "1" and another afterwards tells it to be a "0", it will be a "0". This is "standard functionality" behavior as described in the next section.

Standard Functionality: For all network variable inputs except the Boolean inputs on the CCM and GCM listed in Table C-2, when multiple outputs are connected to one input, the input will contain the state/data of the most recent update.

TABLE C-2. MULTIPLE OUTPUTS TO ONE INPUT "WIRED OR" BOOLEAN NETWORK VARIABLE INPUT

GCM	CCM
*nviRunCmd**	*nviRelayControl1* (MAINTAINED mode only)*
nviEmerStopCmd	*nviRelayControl2* (MAINTAINED mode only)*
*nviCustFault1**	*nviRelayControl3 (MAINTAINED mode only)*
*nviCustFault2**	*nviRelayControl4 (MAINTAINED mode only)*
*nviCustFault3**	
*nviCustFault4**	

***** ⚠ CAUTION ***A Start command will NOT be sent from the network if the network is not operating. Do not use the network to send system or generator set Start commands. Use hardwired Start signals.***

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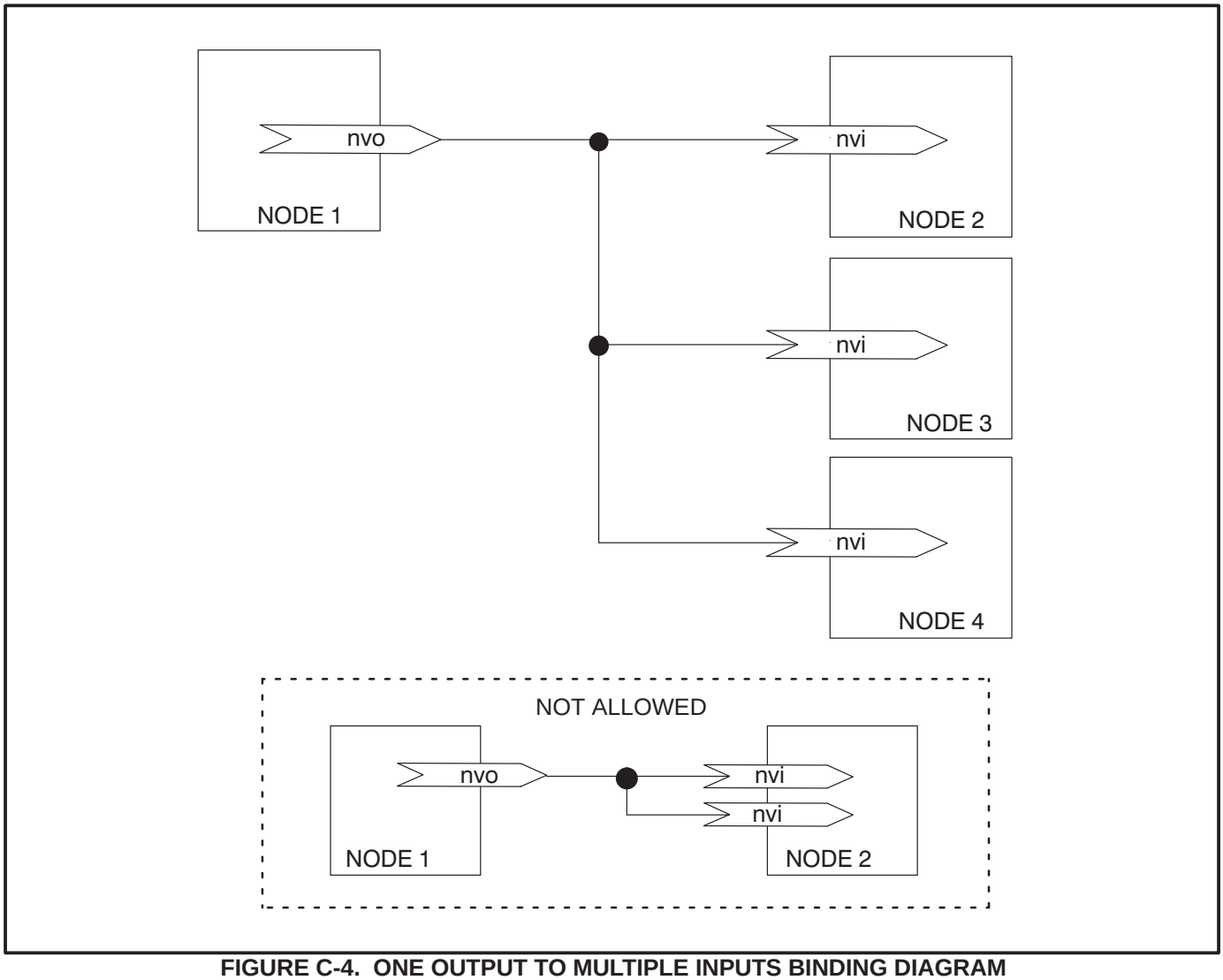

FIGURE C-4. ONE OUTPUT TO MULTIPLE INPUTS BINDING DIAGRAM

One Output to Multiple Inputs

When the one output is sent out on the network, all of the inputs will receive it. The output is only sent once (i.e. it is not sent out once for each input).

The only limitation or rule is that one output cannot be connected to more than one input on one specific module. For example, the connections shown in Table C-3 are **NOT** allowed. In this example the same output from DIM1 is sent to two inputs on the same module, CCM1.

Multiple Outputs to Multiple Inputs

This is not recommended due to the complications involved in determining possible outcomes.

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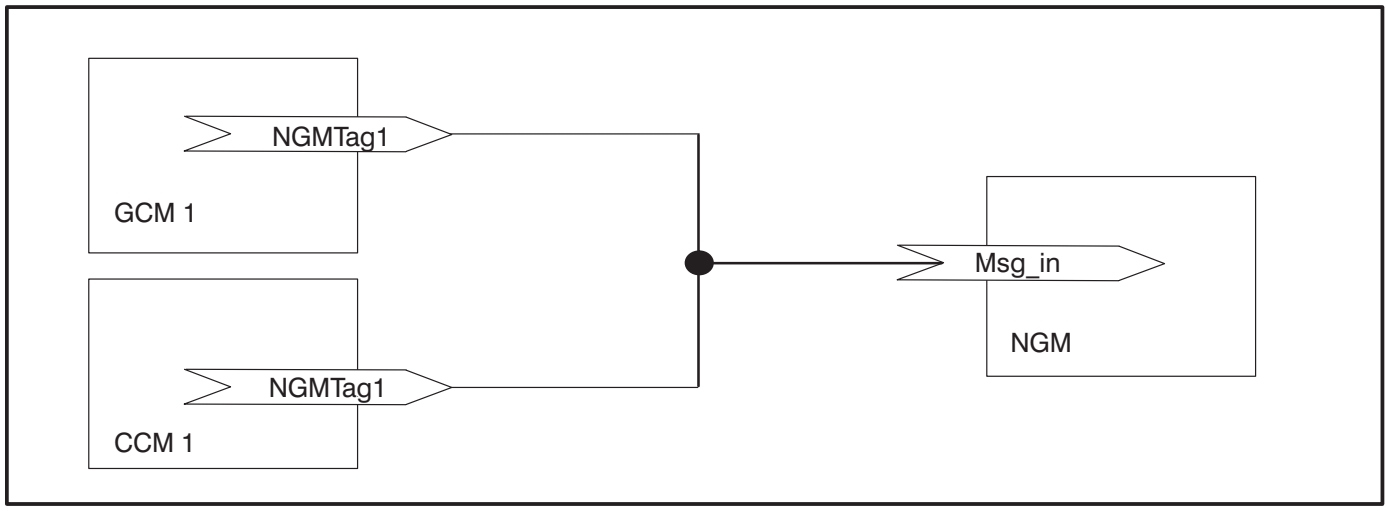

FIGURE C-5. TYPICAL MESSAGE TAG CONNECTIONS

Message Tag Connections

Message tag connections are a special class of connections. In the PowerCommand Network, the only purpose they serve is as the link for alarms to be sent to PowerCommand Software through either a local or a remote connection. The CCM and GCM have message tag outputs. The NGM has a message tag input. In order for alarm notification to work, the tags must be connected using the LonMaker installation tool.

Table C-4 shows a typical message tag output and input for a dial out connection.

⚠ CAUTION ***DO NOT connect message Tag outputs to more than one input. It is OK to connect multiple message tag outputs to one message input. The result of this restriction is that alarm notification from a module can only go out through ONE Network Gateway.***

TABLE C-3. EXAMPLE OF ONE OUTPUT TO MULTIPLE INPUTS ON THE SAME MODULE – *THIS IS NOT ALLOWED*

CONNECTION NUMBER	FROM		TO	
	MODULE NAME	NV OUTPUT	MODULE NAME	NV INPUT
1	dim1	nvoCustInput1	ccm1	nviRelay1
2	dim1	nvoCustInput1	ccm1	nviRelay4

TABLE C-4. EXAMPLE OF A MESSAGE TAG CONNECTION FOR DIAL-OUT

MESSAGE TAG CONNECTION FOR DIAL–OUT	
From Tag Output: (CCM, GCM)	**To Tag Input (NGM)**
NGMTag1	*msg_in*

PowerCommand Software

PowerCommand Software does not participate in network variable connections. If PowerCommand Software has been used to start a genset, it is possible that another bound node may stop the genset (if the node gets reset or otherwise has reason to send a “0”).

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DETERMINING SENDER SETTINGS

The following examples can be used to determine sender settings for unknown senders. Refer to the service manual of the equipment being monitored for important safety precautions.

WARNING ***Severe personal injury or death can result from working on equipment while it is operating. Refer to the service manual of the equipment being monitored for important safety precautions.***

Example 1: **Unknown Coolant Temperature Sender**

The CCM's *Temperature 1* input will be monitoring an unknown engine temperature sender. You would like to find *Sender Voltage, Meter Reading* and *Sender Gain* for the sender. The customer prefers English (Imperial) units.

1. Start the genset (with no load).
2. Wait for the engine temperature to reach steady–state.
3. Measure the DC voltage at the sender (VDC).
   Voltage (no load) = 2.92 VDC
4. What is the engine temperature (degrees F)?
   Temperature (no load) = 172°F
5. Increase the load on the genset to at least 50% load.
6. Wait for the engine temperature to reach steady–state.
7. Measure the DC voltage at the sender (VDC).
   Voltage (load) = 3.23 VDC
8. What is the engine temperature (degrees F)?
   Temperature (load) = 197°F
9. Enter the following values for *Temperature 1*:
   Sender Voltage = Voltage (no load) = 2.92
   Meter Reading = Temperature (no load) =172
   Sender Gain = 80.65

$$\text{SENDER GAIN} = \frac{\text{TEMPERATURE (LOAD)} - \text{TEMPERATURE (NO LOAD)}}{\text{VOLTAGE (LOAD)} - \text{VOLTAGE (NO LOAD)}} = \frac{197 - 172}{3.23 - 2.92} = 80.65$$

FIGURE C–6. DETERMINING TEMPERATURE SENDER SETTINGS (EXAMPLE 1)

Example 2: Unknown Oil Pressure Sender

The CCM's *Oil Pressure* input will be monitoring an unknown oil pressure sender. You would like to find *Sender Voltage, Meter Reading* and *Sender Gain* for the sender. The customer prefers Metric units.

1. With the genset <u>not</u> running, measure the DC voltage at the sender (VDC).
   Voltage (not running) = 5.71 VDC
2. Start the genset (no load).
3. Wait for the oil pressure to reach steady–state.
4. Measure the DC voltage at the sender (VDC).
   Voltage (running) = 4.13 VDC
5. What is the oil pressure (kPa)?
   Oil Pressure (running) = 360 kPa
7. Enter the following values for *Oil Pressure*:
   Sender Voltage = Voltage (running) = 4.13
   Meter Reading = Oil Pressure (running) = 360
   Sender Gain = – 227.85

$$\text{SENDER GAIN} = \frac{\text{PRESSURE (RUNNING)} - \text{PRESSURE (NOT RUNNING)}}{\text{VOLTAGE (RUNNING)} - \text{VOLTAGE (NOT RUNNING)}} = \frac{360 - 0}{4.13 - 5.71} = -227.85$$

FIGURE C–7. DETERMINING PRESSURE SENDER SETTINGS (EXAMPLE 2)

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Example 3**: **Unknown Oil Pressure Sender

The CCM's *Oil Pressure* input will be monitoring an unknown oil pressure sender. You would like to find *Sender Voltage, Meter Reading* and *Sender Gain* for the sender. The customer prefers English (Imperial) units.

1. With the genset running and the oil pressure at 30 psi, measure the DC voltage at the sender (VDC).
   Voltage (at 30 psi) = 4.7 VDC
2. With the genset running and the oil pressure at 50 psi, measure the DC voltage at the sender (VDC).
   Voltage (at 50 psi) = 2.5 VDC
3. Enter the following values for *Oil Pressure*:
   Sender Voltage = Voltage (30 psi) = 4.7
   Meter Reading = Oil Pressure = 30 (psi)
   Sender Gain = – 9.1

$$\text{SENDER GAIN} = \frac{\text{PRESSURE (30 psi)} - \text{PRESSURE (50 psi)}}{\text{VOLTAGE (30 psi)} - \text{VOLTAGE (50 psi)}} = \frac{30 - 50}{4.7 - 2.5} = -9.1$$

FIGURE C–8. DETERMINING PRESSURE SENDER SETTINGS (EXAMPLE 3)

***Example 4:* Unknown Fuel Level Sender**

The CCM's *Analog channel Spare 1* (0 to 5 volts) input will be monitoring fuel level in a 100 gallon (378.5 liter) fuel tank with an unknown sender. You would like to find *Sender Voltage, Meter Reading* and *Sender Gain* for the sender. The customer prefers English (Imperial) units.

1. Measure the DC voltage at the sender (VDC).
   Voltage with the fuel tank empty = 1.92 VDC
2. The fuel gauge reads 0 gallons (0 liters).
3. Fill the fuel tank with 100 gallon (378.5 liters) of fuel and measure the DC voltage at the sender (VDC).
   Voltage (full tank) = 0.24 VDC
4. The fuel gauge reads 100 gallons (378.5 liters).
5. Enter the following values for *Spare 1*:
   Sender Voltage = Voltage (full tank) = 0.24
   Meter Reading = Fuel Gauge (full tank) =100
   Sender Gain = – 59.5

$$\text{SENDER GAIN} = \frac{\text{FUEL LEVEL (EMPTY)} - \text{FUEL LEVEL (FULL)}}{\text{VOLTAGE (EMPTY)} - \text{VOLTAGE (FULL)}} = \frac{0 - 100}{1.92 - 0.24} = -59.5$$

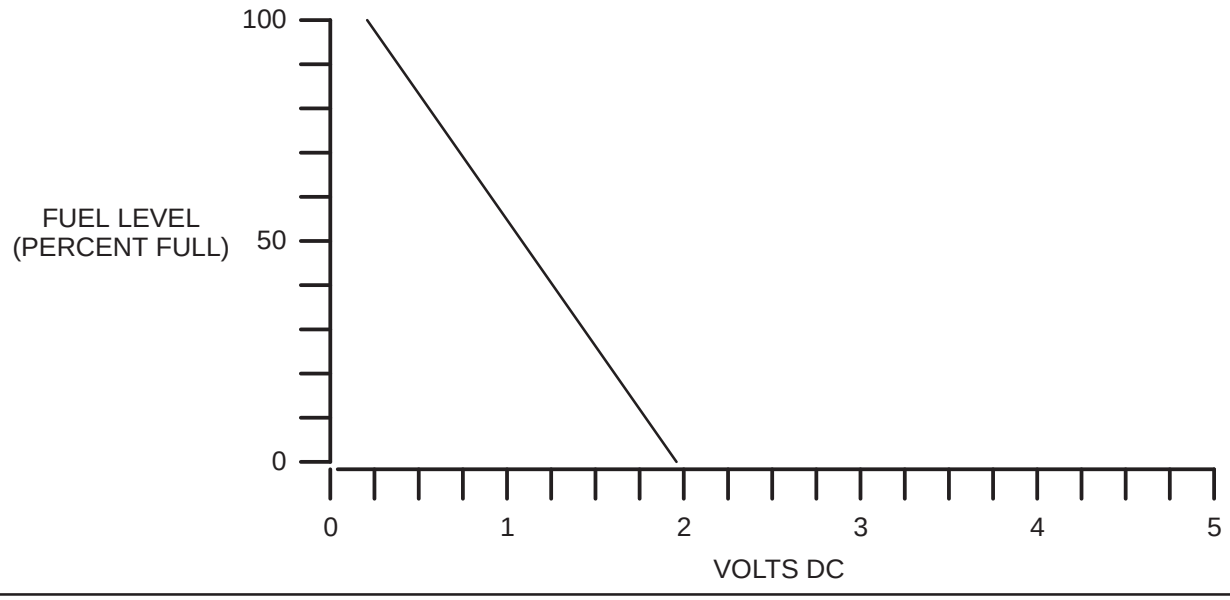

FIGURE C–9. DETERMINING SPARE 1 SENDER SETTINGS (EXAMPLE 4)

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CONNECTION TABLE EXAMPLES

The following connection tables are examples of how network variable input and network variable outputs are typically connected.

Automatic bindings are available to make some of the common bindings easier to connect. Refer to Table C-5 for a listing of the Auto-Bindings.

TABLE C-5. AUTO–BINDINGS (NML V1.10)

Device Type	Network Variable	Device Type	Network Variable	Data Point
ccm v1.00	NGMTag1	ngm v1.00	msg_in	Alarm Message
ccm /ats v1.00	NGMTag1	ngm v1.00	msg_in	Alarm Message
ccm /gen v1.00	NGMTag1	ngm v1.00	msg_in	Alarm Message
pcc w/gcm v1.00	NGMTag1	ngm v1.00	msg_in	Alarm Message
pcc w/gcm v1.00	nvoRemoteAnnun1	nam v1.00	nviAllRelays	NFPA 110 Annunciator
ccm /gen v1.00	nvoCustIn[28]	nam v1.00	nviRelay[3]	Genset Running
ccm /gen v1.00	nvoCustIn[27]	nam v1.00	nviRelay[6]	Pre–Low Oil Pressure
ccm /gen v1.00	nvoCustIn[25]	nam v1.00	nviRelay[7]	Low Oil Pressure
ccm /gen v1.00	nvoCustIn[26]	nam v1.00	nviRelay[8]	Pre–High Eng. Temp
ccm /gen v1.00	nvoCustIn[24]	nam v1.00	nviRelay[9]	High Engine Temp
ccm /gen v1.00	nvoCustIn[19]	nam v1.00	nviRelay[10]	Low Engine Temp
ccm /gen v1.00	nvoCustIn[23]	nam v1.00	nviRelay[11]	Overspeed
ccm /gen v1.00	nvoCustIn[22]	nam v1.00	nviRelay[12]	Overcrank
ccm /gen v1.00	nvoCustIn[29]	nam v1.00	nviRelay[13]	Switch in OFF
ccm /gen v1.00	nvoCustIn[18]	nam v1.00	nviRelay[15]	Low Fuel
ccm /gen v1.00	nvoCustIn[21]	nam v1.00	nviRelay[16]	Low Coolant Level
ccm /ats v1.00	nvoCustIn[8]	nam v1.00	nviRelay[1]	High Battery Voltage
ccm /ats v1.00	nvoCustIn[7]	nam v1.00	nviRelay[2]	Low Battery Voltage
ccm /ats v1.00	nvoCustIn[3]	nam v1.00	nviRelay[4]	Normal Utility Power
ccm /ats v1.00	nvoCustIn[4]	nam v1.00	nviRelay[5]	EPS Supplying Load
ccm /ats v1.00	nvoCustIn[10]	nam v1.00	nviRelay[14]	Bat. Chrgr. Malfunction

Note: Automatic connections must still be created in LonMaker using the Auto button (refer to the Connect Procedure in Section 3).

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TABLE C-6. CONNECTING CCM-GENSET (DETECTOR/DK) AND CCM-ATS (OT/BT) TO NETWORK ANNUNCIATOR (NFPA110)

FROM		TO	
Signal	NV	NV	Indication
CCM Genset (Detector/DK)		**Network Annunciator Module (NFPA110)**	
Switch in Off	nvoCustInput[29]	nviRelay[13]	Not In Auto
Low Fuel	nvoCustInput[18]	nviRelay[15]	Low Fuel
Low Engine Temperature	nvoCustInput[19]	nviRelay[10]	Low Engine Temp
Fault1 connected to a Low Coolant Level Switch	nvoCustInput[21]	nviRelay[16]	Low Coolant Level
Overcrank	nvoCustInput[22]	nviRelay[12]	Overcrank
Overspeed	nvoCustInput[23]	nviRelay[11]	Overspeed
High Coolant Temperature	nvoCustInput[24]	nviRelay[9]	High Coolant Temp
Low Oil Pressure	nvoCustInput[25]	nviRelay[7]	Low Oil Pressure
Pre–High Coolant Temperature	nvoCustInput[26]	nviRelay[8]	Pre–High Coolant Temp
Pre–Low Oil Pressure	nvoCustInput[27]	nviRelay[6]	Pre–Low Oil Pressure
Run	nvoCustInput[28]	nviRelay[3]	Generator Running
CCM Transfer Switch (OT/BT)			
Normal Connected	nvoCustInput[3]	nviRelay[4]	Normal Utility Power
Emergency Connected	nvoCustInput[4]	nviRelay[5]	EPS Supplying Load
Battery Charger Failure	nvoCustInput[10]	nviRelay[14]	Bat Chgr Malfunction
Low Battery Voltage	nvoCustInput[7]	nviRelay[2]	Low Battery Voltage
High Battery Voltage	nvoCustInput[8]	nviRelay[1]	High Battery Votlage

Note1: The “Normal Battery” Indication is automatically illuminated whenever Low and High Battery Voltage are both absent. Battery Voltage sensing is done by the battery charger in the Transfer Switch.

Note2: These bindings can be made automatically using the “Auto” button under Installation.

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TABLE C-7. CONNECTING PCC GENSET AND CCM-ATS TO NETWORK ANNUNCIATOR (NFPA110)

FROM		TO	
Signal	NV	NV	Indication
PCC Genset Communications Module		**Network Annunciator Module (NFPA110)**	
Low Battery Voltage	nvoRemoteAnnun1	nviAllRelays	Low Battery Voltage
High Battery Voltage			High Battery Votlage
Not in Automatic			Not In Auto
Low Fuel			Low Fuel
Low Engine Temperature			Low Engine Temp
Low Coolant Level			Low Coolant Level
Overcrank			Overcrank
Overspeed			Overspeed
High Coolant Temperature			High Coolant Temp
Low Oil Pressure			Low Oil Pressure
Pre–High Coolant Temperature			Pre–High Coolant Temp
Pre–Low Oil Pressure			Pre–Low Oil Pressure
Run			Generator Running
CCM Transfer Switch (OT/BT)			
Normal Connected	nvoCustInput[3]	nviRelay[4]	Normal Utility Power
Emergency Connected	nvoCustInput[4]	nviRelay[5]	EPS Supplying Load
Battery Charger Failure	nvoCustInput[10]	nviRelay[14]	Bat Chgr Malfunction

Note: The “Normal Battery” Indication is automatically illuminated whenever Low and High Battery Voltage are both absent. Battery voltage sensing is done at the PowerCommand Control, not at the Annunciator.

TABLE C-8. CONNECTING CONTROLS COMMUNICATIONS MODULE TO DIGITAL I/O MODULE

FROM		TO	
Signal	NV	NV	Action
Controls Communications Module		**Digital I/O Module**	
dry contact closure input	nvoCustInput[x]	nviRelay[x]	relay control
inputs 1 thru 16	nvoCustIn1_16	nviAllRelays	controls all 16 relays
inputs 17 thru 32	nvoCustIn17_32	nviAllRelays	controls all 16 relays
relay1 state indication	nvoRelayState[X]	nviRelay[x]	relay control
Digital I/O Module		**Controls Communications Module**	
dry contact closure input	nvoCustInput[X]	nviRelayControl[X]	relay control

Note: This table shows representaive connection possibilities

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TABLE C-9. CONNECTING DIGITAL I/O MODULE TO PCC GENSET

FROM		TO	
Signal	NV	NV	Action
PCC Genset Communications Module		**Digital I/O Module**	
status/fault indications	nvoRemoteAnnun	nviAllRelays	controls all 16 relays
Genset has run command	nvoRunCmd	nviRelay[x]	relay control
Genset is running	nvoRunning	nviRelay[x]	relay control
ready to load	nvoReadyToLoad	nviRelay[x]	relay control
load dump	nvoLoadDump	nviRelay[x]	relay control
common alarm	nvoCommonAlarm	nviRelay[x]	relay control
customer fault	nvoCustFault	nviRelay[x]	relay control
Digital I/O Module		**PCC Genset Communications Module**	
dry contact closure input	nvoCustInput	nviRunCmd	run Genset
dry contact closure input	nvoCustInput	nviResetCmd	reset fault
dry contact closure input	nvoCustInput	nviEmerStopCmd	emergency stop
dry contact closure input	nvoCustInput	nviWakeUpCmd	turn on PCC
dry contact closure input	nvoCustInput	nviLoadDemandCmd	load demand shutdown
dry contact closure input	nvoCustInput	nviGenBrkrCtrl	operate Genset breaker
dry contact closure input	nvoCustInput	nviCustFault*	active Customer fault

Note: This table shows representative connection possibilities.

NETWORK DESIGN/INPUT FORMS

These forms are designed to serve as a means of preparing information prior to the installation of a network. The information will be used for LonMaker, PowerCommand Configuration Tool, and PowerCommand Software. They will also serve as a paper record for the site.

The “Site Form” contains information common to a specific site. Fill in all the applicable blank fields in the form and keep this information along with information from the other forms as part of a permanent record.

The “Binding Form” shows all network variable/message tag bindings between pairs of modules. A network installer using LonMaker will need this information to set up the manual connections between devices. You can enter this information either before or after Lonmaker is attached to the network.

The “Module Forms” are customized for each module type and contain all naming and configuration information, etc.

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PowerCommand™ Network **SITE INFORMATION FORM**			Site ID: _____ Page ____ of ____
Site Name (16)			
Site ID (8)			
Domain Name (16)			
Domain ID	00 hex		
Domain Auth Key	FFFFFFFFFFFF hex		
Channel 1 Name (16)			
Channel 1 Bus Length			
Channel 1 Type (8)	tp/xf–78		
Channel 2 Name (16)			
Channel 2 Bus Length			
Channel 2 Type (8)	tp/xf–78		
Module Quantities by Channel	**Channel 1**	**Channel 2**	
CCM			
GCM			
DIM			
NAM			
NGM			
RTR			
Total			
NOTES:			

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PowerCommand™ Network — **BINDING FORM**						Site ID: _____ Page ____ of ____
From			✓	**To**		
Real World Function	Module Name	Network Variable		Network Variable	Module Name	Real World Function

Place a check in the center column when network variables are bound.

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PowerCommand^{TM} Network **DIGITAL I/O MODULE FORM: Part A**	Site ID: _____ page ____ of ____

Module Name (16)	
Module Location (16)	
Module Type	DIM_____
Channel Name	
Use a Channel Priority Slot?	NO
Terminator Switch	____ ON (TERM) ____ OFF

NOTES:

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PowerCommand™ Network **DIGITAL I/O MODULE FORM: Part B**	Site ID: _____ page ____ of ____

Customer Inputs	
Input Number	Name (16)
1	
2	
3	
4	

Relay Outputs	
Relay Number	Name (16)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

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PowerCommand™ Network **GENSET COMMUNICATIONS MODULE FORM**		Site ID: _____ page ____ of ____
Module Name (16)		
Module Location (16)		
Module Type	GCM_____	
Channel Name		
Use a Channel Priority Slot?		
Module to Dial–out On Events?		If YES, bind *NGMTag1* to *msg_in* on the dial–out NGM. (Put on BINDING FORM)
Phase	____ Three ____ Single	
Number of Dial Attempts (1–255)		
Redial Delay (1–65535 seconds)		
Terminator Switch	____ ON (Term) ____ OFF	
NOTES:		

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PowerCommand™ Network **CONTROLS COMMUNICATIONS MODULE FORM: Part A**	Site ID: _____ page ____ of ____

Module Name (16)		
Module Location (16)		
Module Type	CCM_____	
Channel Name		
Use a Channel Priority Slot?		
Module to Dial–out On Events?		If YES, bind *NGMTag1* to *msg_in* on the dial–out NGM. (Put on BINDING FORM)
Phase	____ Three ____ Single	
Number of Dial Attempts (1–255)		
Redial Delay (1–65535 seconds)		
Terminator Switch	____ ON (Term) ____ OFF	

Relays

Relay Number	Relay Type	Name When Energized	Name When De-energized	MAINTAINED or PULSED
1	1 Form C			
2	1 Form C			
3	1 Form A			
4	1 Form A			

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PowerCommand™ Network **CONTROLS COMMUNICATIONS MODULE** **FORM: Part B**			Site ID: _____ page ____ of ____	
Discrete Customer Inputs				
Input Number	Event Type (Event, Warning, Shutdown)	Active State (Closed/Open)	Notify Dial–Out? (Yes/No)	Event Text Name (16)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
NOTES:				

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PowerCommand™ Network **CONTROLS COMMUNICATIONS MODULE** **FORM: Part C**			Site ID: _____ page ____ of ____	
Discrete Customer Inputs				
Input Number	Event Type (Event, Warning, Shutdown)	Active State (Open/Closed)	Notify Dial–Out? (Yes/No)	Event Text Name (16)
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
NOTES:				

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PowerCommand™ Network **CONTROLS COMMUNICATIONS MODULE FORM: Part D**				Site ID: _____ page ____ of ____	
Analog Input Scaling/Offset					
Voltage Channels	**Primary Voltage (System Line Volts)**		**L–L or L–N**	**Secondary Voltage (@CCM Terminals)**	**L–L or L–N**
Phase A (A–B)					
Phase B (B–C)					
Phase C (C–A)					
Current Channels	**Primary Current (System Line Current)**			**Secondary Current (thru CCM Terminals)**	
Phase A					
Phase B					
Phase C					
Sensor Channels	**Data Point**			**Slope**	
Name (16)	Sender Voltage at CCM (VDC)	Meter Reading	Meter Units	Sensor Gain (Units/VDC)	
Temp1				–34.5 (degF/V — CCM Detector)	
Temp2					
Temp3					
Oil Pressure				–36.0 (psi/V — CCM Detector)	
Spare1					
Spare2					
Spare3 (Battery Volts)					

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PowerCommand™ Network **NETWORK GATEWAY MODULE FORM**		Site ID: _____ page ____ of ____
Module Name (16)		
Module Location (16)		
Module Type	NGM_____	
Channel Name		
Use a Channel Priority Slot?		
Receives Module Dial–Outs?		If YES, bind module *Tags* to *msg_in* on the NGM. (Put on BINDING FORM)
Connected to Modem?/Type?		
Modem Phone Number (Dial–in)		
Dial–In Password		
Dial–Out Prefix		
Dial–Out Phone Number1		
Modem Setup: Initialization (String)		
Hangup (string)		
NOTES:		

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PowerCommand™ Network **JUNCTION BOX/TERMINATOR MODULE FORM**	Site ID: _____ page ____ of ____

Module Name	
Module Location	
Channel Name	
Terminate Switch (S1)	____ ON ____OFF
Local Loop/Pass Thru (S2)	_____ Local Loop _____Pass Thru
From (Bus)	
To (Bus)	
From (Local Loop)	
To (Local Loop)	
To (Stub)	

NOTES:

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D. Network Troubleshooting

INTRODUCTION

This section provides a troubleshooting information to help diagnose PowerCommand Network problems. Refer the *Error Message and Troubleshooting Section,* in the LonMaker Users Guide, for problems with LonMaker that are not covered here.

The PowerCommand™ Network can be used to remotely operate power transfer equipment (e.g., transfer switches, paralleling systems) and start and stop generator sets. All of the safety precautions for that equipment must observed. Refer to the Operator's Manual for the equipment that is being monitored and controlled by the network for important safety precautions. Review the Safety Precautions listed in the front of this manual for important safety information.

Most network problems are related to poor or improper wiring connections. Make a through inspection of the network wiring to make sure that good connections are made and the modules are wired correctly. Correct all wiring problems before proceeding with troubleshooting.

Refer to the Additional Installation Steps near the end of Section 4. Make sure each of the modules have been **reset** after using PCT for configuring the network **or** making changes. Also make sure the config.sys file has been edited to include the Installation Gateway driver (refer to *Network Module Library Installation* in Section 3).

Refer to specific module sections to review the LED indicator location and descriptions. The SERVICE and STATUS indicator LEDs can be used as a visual aid in diagnosing problems.

Use the following troubleshooting Tables to help diagnose PowerCommand Network problems. The troubleshooting Tables are divided into sections based on the symptom. Common problems are listed with their possible causes. Refer to the corrective action column for the appropriate procedure.

⚠WARNING ***Power equipment presents a shock hazard that can cause severe personal injury or death. The PowerCommand Network allows remote operation of equipment. PowerCommand Software for Windows can remotely start and stop a genset or exercise a transfer switch. Network modules can independently control other network modules and operate other electrical devices such as fans or pumps etc. Make certain that all appropriate personnel are notified before remotely operating equipment and make them aware of any equipment that can be energized automatically.***

TABLE D-1. PCNET PROBLEMS/ERROR CODES

PROBLEM "MESSAGE"	CORRECTIVE ACTION
1. "Bad command or file name"	1a. Make sure you are in the Onan directory. 1b. Make sure PCNET is in the \ONAN directory 1c. Make sure the Network Module Library installed without errors.
2. "Unable to create directory '[site_path]'."	2a. PCNET is only able to create a sub-directory <u>one</u> level below an existing directory. (If 'C:\ONAN\SITES' is an existing path without a sub-directory called 'NEW_SITE', then PCNET would be able to create a new site at 'C:\ONAN\SITES\NEW_SITE' but not at 'C:\ONAN\SITES\NEW_SITE\TEST'. The path 'C:\ONAN\SITES\NEW_SITE' must already exist to create the sub-directory 'TEST'.)

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TABLE D-2. LONMAKER PROBLEMS/ERROR CODES

PROBLEM "MESSAGE"	CORRECTIVE ACTION
1. "WARNING: For access to all LonMaker functions, an additional xxK bytes of memory... – OR – "LonMaker requires at least xxK bytes of additional free memory to operate."	1a. Not enough conventional or lower memory. LonMaker requires about 582K of conventional memory. Free up memory by: 1b. Loading drivers in upper memory: "DEVICEHIGH=C:\... " (Note: NOT ALL drivers can be loaded high.) 1c. Loading gateway driver in upper memory: "DEVICEHIGH=C:\ONAN\BIN\LDVSLTA.SYS /M /B9600 /P1" 1d. Running DOS command MEMMAKER to optimize memory usage. 1e. Create an alternate boot up configuration to load only drivers needed to run DOS and LonMaker. 1f. (Contact a PC service center for assistance if required.)
2. "Error opening database." (This comes after the Lon Maker Introductory screen and the "Initializing..." screen.)	2a. The site path is more than 26 characters (including characters for drive "C:" and backslashes "\"). Move site directory to a location with a path less than 26 characters. (e.g. If the site directory is located at "C:\ONAN\SITES\MINN\FRIDLEY\SITE_12" you would get this error message since the path is 34 characters. Moving the directory to "C:\ONAN\SITES\MN\SITE_12" would work. 2b. If LonMaker ended abruptly the last time you ran it for this site, the LonMaker database may be corrupt. Try running "PCNET..." again to the problem site directory and run LonMaker again. If LonMaker still will not run, you'll have to: Delete the directory where the site database is located and re-run "PCNET..." and define and install all the modules again.
3 "The Network interface could not be initialized. Check ..." (A 19) (LonMaker could not attach to the Network Installation Gateway.)	3a. Make sure you are connected to the "Network Installation Gate way". 3b. Make sure the Gateway driver and settings are properly loaded in CONFIG.SYS. 3c. During NML installation the LDVSLTA.SYS file moved from \NGM to \ONAN\BIN. Your CONFIG.SYS file has to be updated to reflect this. ("DEVICEHIGH=C:\ONAN\BIN\LDVSLTA.SYS /B9600 /M /P1") 3d. Make sure you are using the proper null-modem cable. 3e. Make sure the Installation Gateway has power. (The yellow SERVICE LED will flash once when you cycle power.) 3f. Make sure you are attached to the correct COM port with appropriate LDVSLTA.SYS setting (/P1,/P2). 3g. Verify the driver is in memory as follows: At DOS prompt type "mem /c /p" and "LDVSLTA" module should be in [upper] memory. 3h. Add /F setting to the driver in the CONFIG.SYS file, then reboot: "DEVICEHIGH=C:\ONAN\BIN\LDVSLTA.SYS /B9600 /M /P1 /F"
4. "An error occurred while per forming the requested function." (C 40)	4a. PCNET may not have run properly. At DOS prompt, re-run "pcnet [site_path]"

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TABLE D-2. LONMAKER PROBLEMS/ERROR CODES – CONTINUED

PROBLEM "MESSAGE"	CORRECTIVE ACTION
5. A message failed. Verify that the network interface and the target device are properly ..." (C 27)	5a. Make sure you have continuity of data lines. Measure resistance from *Data1* to *Data2*. Resistance from *Data1* to *Data2* should be less than 100 Ohms. 5b. Make sure network terminations are correct. Verify that only the two ends of <u>each</u> channel are terminated. 5c. Make sure each 'stub' is less than 10 feet in length. 5d. Make sure module has adequate DC power (> 9 VDC). 5e. Make sure your are using Onan specified twisted-pair wire and that the connections are good.
6. "The device whose service pin was pressed (or NID...) is not of the correct type..." (C 22)" – OR – "The device type and the selected hardware are not compatible..." (C 60)	6a. Make sure your pressed the service pin of the module you <u>intended</u> to install. 6b. Make sure the module you are installing was defined with the correct Device Type. At *Installation* screen, press 'Info' or F7 to view the Device Type.

TABLE D-3. POWERCOMMAND CONFIGURATION TOOL PROBLEMS/ERROR CODES

PROBLEM "MESSAGE"	CORRECTIVE ACTION
1. [Installation] "You must install a Gateway driver to use the Configuration Tool."	1a. The gateway driver has not been installed or is not properly loaded in your CONFIG.SYS file. 1b. Make sure the driver has been added to your CONFIG.SYS file.
2. "The gateway is not responding. The network driver may not be installed. ERROR CODE: 20"	2a. The gateway driver has not been installed or is not properly loaded in your CONFIG.SYS file. 2b. Verify the Baud rate setting is /9600. 2c. Make the Installation Gateway is turned on.
3. "The gateway is not responding. Make certain the gateway is turned on and connected. ERROR CODE: 26" (PCT could not attach to the Network Installation Gateway.)	3a. Make sure LonMaker has properly attached to the gateway at least once. 3b. Make sure you are using the proper null-modem serial cable. 3c. Make sure the Installation Gateway has power. (The yellow SERVICE LED will flash once when you cycle power.) 3d. Make sure you are attached to the correct COM port. 3e. Make sure the NGM driver is properly loaded in CONFIG.SYS, verify /B9600, /M , /P1 settings. 3f. Verify driver is in memory. At DOS prompt type "mem /c /p" and "LDVSLTA" module should be in [upper] memory. 3g. Add /F to the NGM driver and reboot. ("DEVICEHIGH=C:\ONAN\BIN\LDVSLTA.SYS /B9600 /M /P1 /F")
4. "The gateway is not responding. ERROR CODE: 29"	4a. The gateway driver has not been installed or is not properly loaded in your CONFIG.SYS file. 4b. Verify the driver is loaded with setting /M.

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TABLE D-3. POWERCOMMAND CONFIGURATION TOOL PROBLEMS/ERROR CODES – CONTINUED

PROBLEM "MESSAGE"	CORRECTIVE ACTION
5. "Error reading LON Network variable."	5a. Make sure module has power and network data lines are properly connected. 5b. Make sure network data lines follows multidrop bus topology. 5c. Make sure Installation Gateway is powered and properly connected to the Network. 5d. Module may be busy processing configuration updates. Try operation again. 5e. For CCMs, press the hardware reset button and try writing again.
6. "Error writing LON Network variable."	6a. Make sure module has power and data lines are properly connected. 6b. Make sure network data lines follows multidrop bus topology. 6c. Make sure Installation Gateway is powered and properly connected to the Network. 6d. Module may be busy processing configuration updates. Try operation again. 6e. For CCMs, press the hardware reset button and try writing again.
7. "Error writing LON Network NGM variable."	7a. Make sure NGM has power and data lines are properly connected. 7b. Make sure network data lines follows multidrop bus topology. 7c. Make sure Installation Gateway is powered and properly connected to the Network. 7d. Disconnect 9-pin serial cable from NGM and try writing again. 7e. Make sure NGM has power and data lines are properly connected.

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TABLE D-4. MODULES AND MISCELLANEOUS PROBLEMS/ERROR CODES

PROBLEM "MESSAGE"	CORRECTIVE ACTION
1. Any Module type – Code will not load into module during install. "The device whose service pin was pressed (or NID...) is not of the correct type..." (C 22) – or similar message.	1a. Wrong module type. 1b. Pressing the wrong service pin. 1c. Cycle power to the module and retry install. 1d. Refer to LonMaker Users Guide, *Error Message and Troubleshooting* section.
2. CCM Relays will not toggle.	2a. Reset the CCM.
3. CCM/GCM alarms not dialing out.	3a. Check configuration in PCT. 3b. Reset module.
4. GCM not responding to Start/Stop command.	4a. Reset the GCM.
5. NGM Password not working (wrong/old password being accepted by NGM.)	5a. Cycle power on the NGM to initialize the new password.
6. Site modem not answering.	6a. Write Modem Init string to NGM (with PCT). Make sure S∅=1 6b. Cycle power on NGM to initialize modem.

COM Port Connection Problems

Check the COM port connection. Verify that the cable is attached to the correct COM port as specified when the driver was loaded in the config.sys file (/p1, /p2, etc.). IF PCW is setup to use the same COM port as PCT, make sure that PCW is not operating before attaching to the site with PCT.

A connection problem can occur with some computers when exiting PCT in Windows 95 to run LonMaker. If LonMaker will not *attach* to the site, Windows 95 may not be releasing the port.

If this occurs, the port will need to be disabled and re-enabled. Use Device Manager, located in the System folder of Control Panel, in Windows 95. Under Ports, select the COM port that the NGM is attached to and select Properties. Under Device Usage, unselect the check box to disable the port, then click OK. Repeat this procedure and click on the check box to select it and enable the COM port, then click OK.

File Directory

When the Network Module Library and the PowerCommand Configuration Tool software are installed on the installation PC, the file directory structure should appear as shown in Figure D-1.

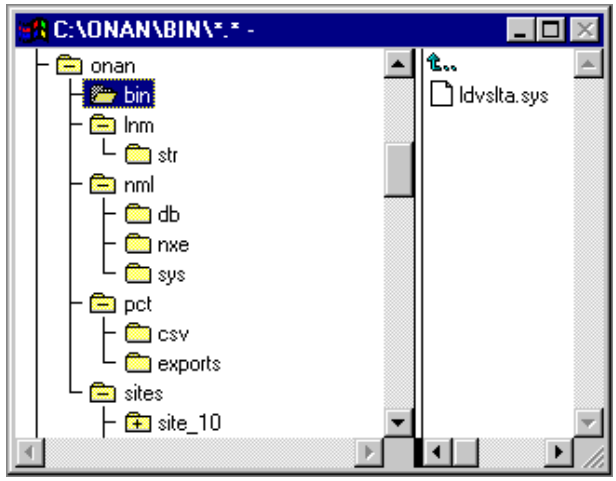

FIGURE D-1. FILE DIRECTORY STRUCTURE

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E. Wiring Diagrams

DRAWING NUMBER	DESCRIPTION	PAGE
630-1670	PowerCommand Network Interconnect	E-2
630-1671	Controls Communications Module Interconnect	E-5
630-1672	Network Annunciator Module Interconnect	E-7
630-1673	Digital I/O Module Interconnect	E-9
630-1723	Controls Communications Module - ATS Interconnect	E-10
630-1724	Controls Communications Module - Genset Interconnect	E-14

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TYPICAL PowerCommand™ NETWORK EXAMPLE (NETWORK DATA CONNECTIONS)

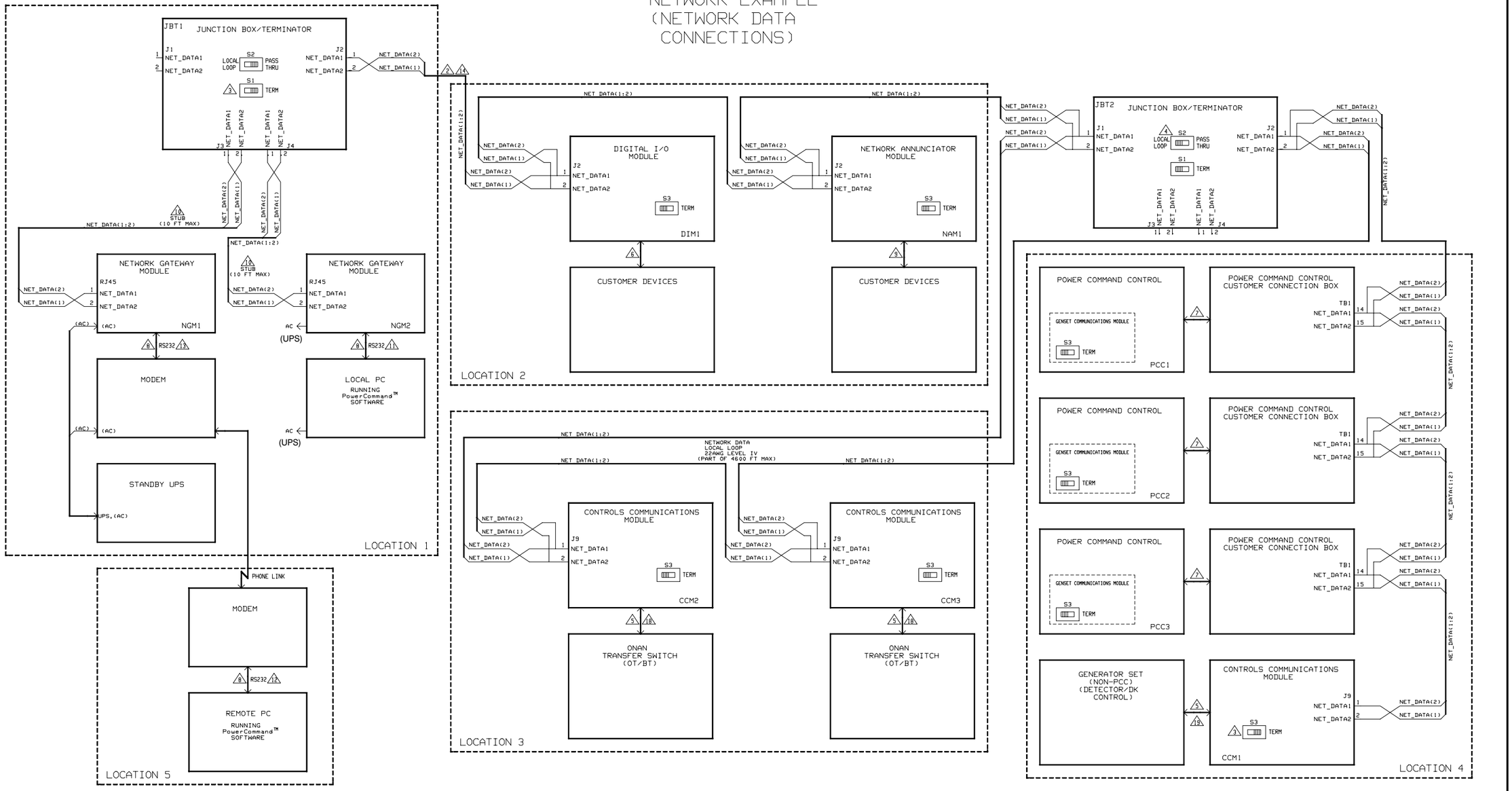

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FIGURE E-1. POWERCOMMAND NETWORK INTERCONNECT (1 of 3)

TYPICAL PowerCommand™ NETWORK EXAMPLE (NETWORK POWER CONNECTIONS)

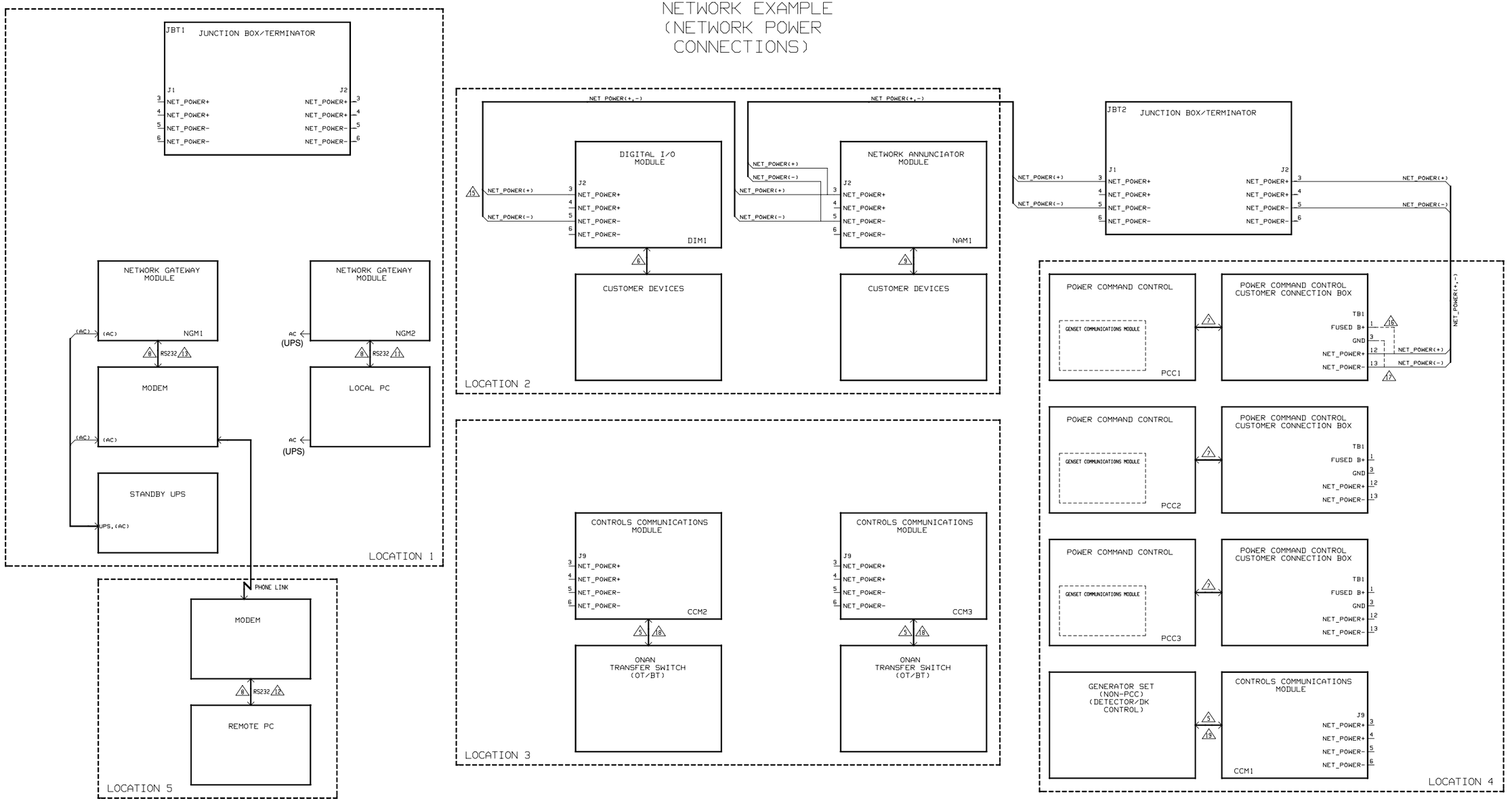

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FIGURE E-2. POWERCOMMAND NETWORK INTERCONNECT (2 of 3)

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TYPICAL PowerCommand™ NETWORK EXAMPLE

SPECIFICATIONS

1.NET DATA
  1.1 TYPE = ECHELON LONTALK™
             78Kb TWISTED PAIR
             TRANSFORMER COUPLED
  1.2 WIRING TOPOLOGY = MULTIDROP BUS
  1.3 POLARITY = POLARITY INSENSITIVE
  1.4 MAX BUS LENGTH = 4600 FT
  1.5 MAX STUB LENGTH = 10 FT
  1.6 TERMINATION = TERMINATORS REQUIRED AT BOTH ENDS OF THE BUS
  1.7 MAX NUMBER OF NODES = 64(0 TO +70 °C)
                            44(-40 TO +85 °C)

2.NET DATA WIRE
  2.1 TYPE
    2.1.1 BUS = UNSHIELDED 22AWG UL LEVEL IV OR
                EIA CATEGORY 4 TWISTED PAIR WIRE
    2.1.2 STUBS = SAME AS BUS OR MAY BE 24AWG INSTEAD OF 22AWG
                  (24AWG NEEDED WITH RJ45)
  2.2 COLOR CODES
    2.2.1 BLUE/WHITE = PRIMARY WIRE PAIR FOR DATA
    2.2.2 ORANGE/WHITE= SECONDARY WIRE PAIR FOR DATA
                        (USE WITH LOCAL LOOP)

3.CONNECTIONS
  3.1 TYPE
    3.1.1 ONAN NODES = 6 POSITION PLUGGABLE SCREW TERMINAL BLOCK
    3.1.2 ONAN JUNCTION BOX/TERMINATOR = PLUGGABLE SCREW TERMINAL
                                         BLOCK AND RJ45
    3.1.3 NETWORK GATEWAY MODULE = RJ45

4.NET POWER
  4.1 REFER TO THE POWERCOMMAND NETWORK INSTALLATION AND OPERATION
      MANUAL,0900-0366, FOR DETAILS.

NOTES:

1. THIS IS A SAMPLE APPLICATION REPRESENTING DEVICE TYPES AND TYPICAL NETWORK WIRING ARRANGEMENTS. REFER TO THE POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL,0900-0366, FOR DETAILS.

2. NETWORK DATA WIRE SHALL BE 22AWG LEVEL IV (OR CATEGORY 4) TWISTED PAIR COMMUNICATIONS CABLE (MAXIMUM TOTAL NETWORK LENGTH 4600 FT). STUBS SHALL BE 22AWG OR 24AWG LEVEL IV (OR CATEGORY 4) WITH A MAXIMUM LENGTH OF 10 FT. NETWORK DATA WIRING TOPOLOGY IS CRITICAL TO RELIABILITY. REFER TO THE POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL,0900-0366, FOR DETAILS.

3. TO ENSURE RELIABLE COMMUNICATIONS ,SET TERMINATOR SWITCHES TO "TERM". AT EACH OF THE TWO ENDS OF THE NETWORK DATA BUS. ALL OTHERS SET TO POSITION OPPOSITE OF "TERM".

4. SET S2 ON JUNCTION BOX/TERMINATOR TO "LOCAL LOOP" IF BEING USED TO CREATE A LOCAL LOOP, OTHERWISE SET TO "PASS THRU".

5. FOR GENERIC CUSTOMER CONNECTION DETAILS FOR THE CONTROLS COMMUNICATIONS MODULE(CCM),REFER TO INTERCONNECT DIAGRAM 0630-1671 AND POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL,0900-0366.

6. FOR GENERIC CUSTOMER CONNECTION DETAILS FOR THE DIGITAL I/O MODULE(DIM), REFER TO INTERCONNECT DIAGRAM 0630-1673 AND POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL,0900-0366.

7. FOR CUSTOMER CONNECTION DETAILS FOR THE POWERCOMMAND CONTROL(PCC), REFER TO SYSTEM DIAGRAM 0612-6658(NON-PARALLELING) OR 0612-6675 (PARALLELING).

8. FOR CONNECTION DETAILS BETWEEN MODEMS,NETWORK GATEWAY MODULES(NGM), AND PC'S, REFER TO POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL,0900-0366.

9. FOR GENERIC CUSTOMER CONNECTION DETAILS FOR THE NETWORK ANNUNCIATOR (NAM),REFER TO INTERCONNECT DIAGRAM 0630-1672 AND POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL,0900-0366.

10. ONAN PART NUMBER 0338-3240(10 FT PATCH CABLE WITH RJ45 PLUGS AT THE ENDS).

11. ONAN PART NUMBER 0338-3277(6 FT NULL MODEM CABLE, DB9P TO DB9S).

12. ONAN PART NUMBER 0338-3278(6 FT STANDARD MODEM CABLE, DB9S TO DB25P).

13. ONAN PART NUMBER 0338-3279(6 FT MODEM CABLE, DB9P TO DB25P).

14. ONAN PART NUMBER 0334-1351(PLENUM) OR 0334-1350(PVC).

15. NETWORK POWER WIRING SHALL BE SIZED IN ACCORDANCE WITH THE CHART LOCATED IN THE POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL,0900-0366.

16. IF NO B+ IS PRESENT AT TB1-12 & TB1-13,USE TB1-1 & TB1-3(EARLY SPECS OF PCC DO NOT HAVE B+ AT TB1-12 & TB1-13).

17. NET_POWER IS FUSED AT 10A. FUSE IS LOCATED ON GOVERNOR MODULE.

18. FOR SPECIFIC INTERCONNECT DIAGRAM REFER TO 0630-1723.

19. FOR SPECIFIC INTERCONNECT DIAGRAM REFER TO 0630-1724.

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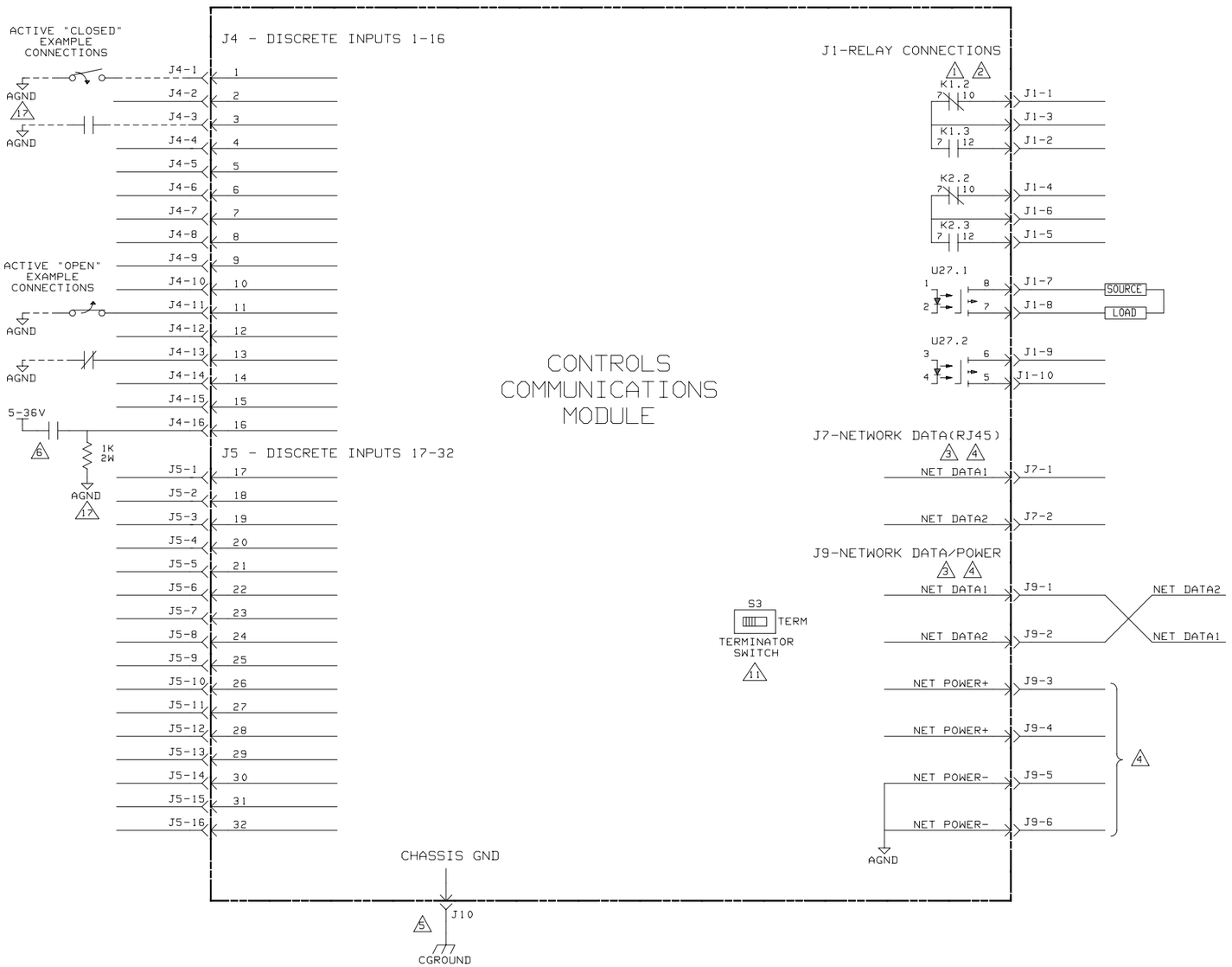
FIGURE E-3. POWERCOMMAND NETWORK INTERCONNECT (3 of 3)



SPECIFICATIONS

1.NET POWER
  1.1 INPUT VOLTAGE = 5-36VDC (OPERATING RANGE)
  1.2 INPUT CURRENT = 150mA @ 36VDC
  200mA @ 24VDC
  400mA @ 12VDC
  1.25A @ 5VDC
  1.3 INPUT CURRENT(MAX) = 2.4A @ 3.5VDC
  1.4 INPUT CONNECTIONS = J9-3,4(NET POWER+)
  J9-5,6(NET POWER-)

2.NET DATA
  2.1 TYPE = ECHELON LONTALK™
  78Kb TWISTED PAIR
  TRANSFORMER COUPLED
  2.2 INPUT CONNECTIONS = J9-1(NET DATA1)
  J9-2(NET DATA2)
  J7-1(RJ45-NET DATA1)
  J7-2(RJ45-NET DATA2)
  (J7(RJ45), SERVICE/INSTALLATION USE ONLY)

3.DISCRETE INPUTS
  3.1 TYPE = DISCRETE
  3.2 NUMBER = 32
  CONNECT TO DRY CONTACTS ONLY
  RETURN TO ANALOG GROUND(J6)
  3.3 OUTPUT CURRENT = 0.5mA SOURCE (INPUTS 1-24, CLOSED)
  0.05mA SOURCE (INPUTS 25-32,CLOSED)
  3.4 VOLTAGE THRESHOLDS (TO ACTIVATE) = 1V (FOR ACTIVE "CLOSED")
  4V (FOR ACTIVE "OPEN")
  3.5 INPUT CONNECTIONS = J4(INPUT 1-16)
  J5(INPUT 17-32)
  J6(ANALOG GROUND)

4.RELAY OUTPUTS
  4.1 TYPE = ELECTROMECHANICAL
  4.2 NUMBER = 2 (K1,K2)
  4.3 CONTACTS = 1 FORM C
  2A @ 30VDC
  0.6A @ 120VAC
  4.4 OUTPUT CONNECTIONS = J1-1,4(N/C CONTACTS)
  J1-3,6(COMMON)
  J1-2,5(N/O CONTACTS)

5.RELAY OUTPUTS(PMOS)
  5.1 TYPE = SOLID STATE
  5.2 NUMBER = 2 (U27.1,U27.2)
  5.3 CONTACTS = 1 FORM A
  100mA @ 150VDC/AC
  CONTACT RESISTANCE = 50 OHM
  5.4 OUTPUT CONNECTIONS = J1-7,9(AC/DC)
  J1-8,10(LOAD)

6. 3 PHASE VOLTAGE INPUTS
  6.1 INPUT VOLTAGE = 0-600VAC(LINE-TO-LINE) OR 0-347VAC(LINE-TO-NEUTRAL)
  6.2 INPUT CONNECTIONS = TB1-1,2,3(VA,VB,VC)
  TB1-4,5,6(VA RTN,VB RTN,VC RTN)
  TB1-7(DO NOT CONNECT)
  6.3 MAXIMUM VOLTAGE BETWEEN ANY LINE(TB1-1 TO 6)
  AND CHASSIS GND(J10) = 0-600VAC

7. 3 PHASE CURRENT INPUTS
  7.1 INPUT CURRENT = 0-5A AC
  7.2 INPUT CONNECTIONS = J2-1,3,5(CT1,CT2,CT3)
  J2-2,4,6(CT1 RTN,CT2 RTN,CT3 RTN)
  J2-7(DO NOT CONNECT)
  7.3 BURDEN = 1.1 VA

8.RTD TEMPERATURE INPUTS
  8.1 NUMBER = 3
  8.2 TYPE = 1 FIXED,2 SWITCH SELECTABLE
  8.3 INPUT VOLTAGE RANGE(READ) = 0-9VDC
  8.4 DRIVE CURRENT = 2mA OR 8mA
  8.5 INPUT CONNECTIONS(READ) = J3-2,5,8(V-IN)
  J3-3,6,9(V+IN)
  8.6 INPUT CONNECTIONS(DRIVE) = J3-1,4,7(IOUT)

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FIGURE E-4 CONTROLS COMMUNICATIONS MODULE INTERCONNECT (1 of 2)

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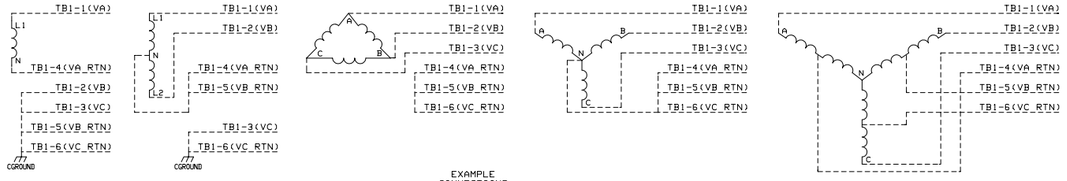
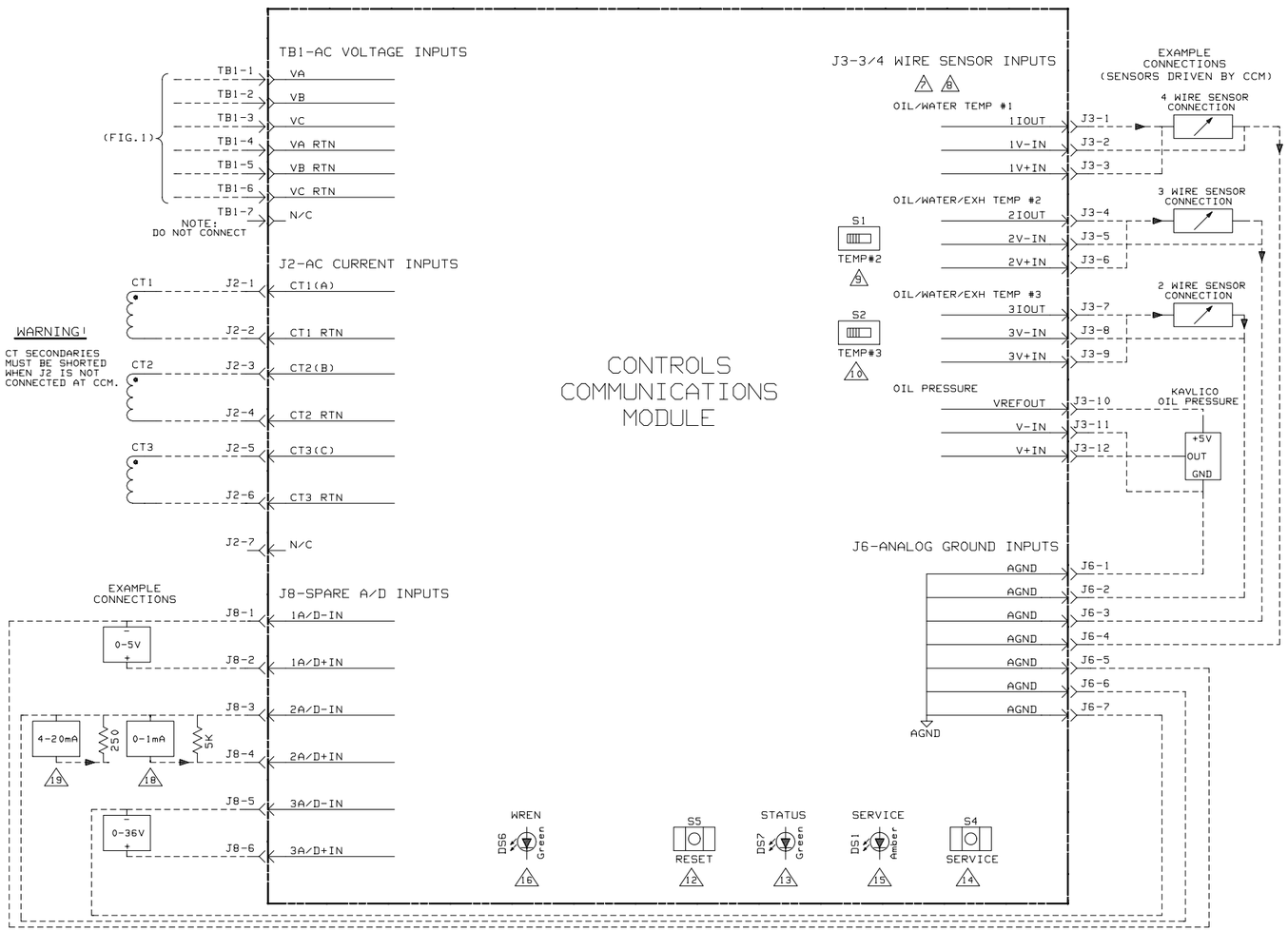


EXAMPLE CONNECTIONS

FIG. 1



SPECIFICATIONS

9. OIL PRESSURE INPUT
   - 9.1 NUMBER = 1
   - 9.2 TYPE = FIXED
   - 9.3 INPUT VOLTAGE RANGE(READ) = 0-9VDC
   - 9.4 INPUT CONNECTIONS(READ) = J3-11(V-IN), J3-12(V+IN)
   - 9.5 DRIVE VOLTAGE = 5VDC
   - 9.6 DRIVE CURRENT = 8mA(MAX)
   - 9.7 INPUT CONNECTIONS(DRIVE) = J3-10(VOUT) (DESIGNED FOR USE WITH KAVLICO CAPACITIVE SENSOR, 0-100 PSIG, 0.5-4.5VDC)

10. SPARE ANALOG INPUTS(1 & 2)
    - 10.1 NUMBER = 2
    - 10.2 INPUT VOLTAGE = 0-5VDC
    - 10.3 INPUT CURRENT = 0-1mA OR 4-20mA(WITH EXTERNAL RESISTOR)
    - 10.4 INPUT CONNECTIONS = J8-1,3,(A/D-IN) J8-2,4,(A/D+IN)

11. SPARE ANALOG INPUT(3)
    - 11.1 NUMBER = 1
    - 11.2 INPUT VOLTAGE = 0-36VDC
    - 11.3 INPUT CURRENT = 0-1mA OR 4-20mA(WITH EXTERNAL RESISTOR)
    - 11.4 INPUT CONNECTIONS = J8-5(A/D-IN) J8-6(A/D+IN)

12. ANALOG GROUND INPUTS
    - 12.1 NUMBER = 7
    - 12.2 INPUT CONNECTIONS = J6-1-7
    - 12.3 ELECTRICALLY COMMON WITH J9-5,6

13. ENVIRONMENTAL
    - 13.1 STORAGE TEMPERATURE = -40 TO 85 °C
    - 13.2 OPERATING TEMPERATURE = -40 TO 70 °C
    - 13.3 HUMIDITY = 95% RH (NON-CONDENSING)

NOTES:

1. ALL RELAYS ARE SHOWN IN RESET OR DE-ENERGIZED POSITION.
2. RELAY OUTPUTS ARE CONTROLLED VIA THE NETWORK.
3. REFER TO INTERCONNECTION PRINT(0630-1670).
4. REFER TO POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL(0900-0366).
5. CONNECT J10 RING TERMINAL TO A GOOD EMI EARTH GROUND. USE AN "EXTERNAL TOOTH" LOCKWASHER BETWEEN RING AND GROUNDING SURFACE.
6. INSERT 1K OHM(2W) "PULLDOWN" RESISTOR BETWEEN INPUT TERMINAL AND J6(GND) WHEN ACTIVE "OPEN" INPUT IS 5-36VDC.
7. SENSOR #1 FIXED FOR A 500-2200 OHM RTD INPUT(OIL/WATER TEMP,2mA).
8. SENSOR #2 & #3 SWITCH SELECTABLE FOR A 500-2200 OHM RTD INPUT (OIL/WATER TEMP,2mA) OR A 80-390 OHM RTD INPUT(EXHAUST TEMP,8mA).
9. TEMP #2 SELECT SWITCH(500-2200 OHM OR 80-390 RTD INPUT).
10. TEMP #3 SELECT SWITCH(500-2200 OHM OR 80-390 RTD INPUT).
11. S3, WHEN SET TO TERMINATE, WILL TERMINATE THE TWISTED PAIR NETWORK BUS. DATA LINES MUST BE TERMINATED WHEN THE CCM IS PHYSICALLY LOCATED AT THE END OF THE NETWORK BUS.
12. S5, RESET PUSH-BUTTON SWITCH, WILL MANUALLY RESET THE CCM.
13. DS7, STATUS LED(GREEN). FLASHING INDICATES CCM PROCESSOR IS RUNNING.
14. S4, SERVICE PUSH-BUTTON SWITCH, USED TO GENERATE NETWORK MANAGEMENT MESSAGE FOR NODE LOGICAL INSTALLATION.
15. DS1, SERVICE STATUS LED(AMBER), INDICATES INSTALLATION AND ERROR STATUS.
16. DS6, WREN LED(GREEN), INDICATES THAT THE OFF-CHIP EEPROM CAN BE WRITTEN TO(USED FOR TROUBLESHOOTING).
17. CUSTOMER INPUT RETURN CONNECTED TO J6(ANALOG GROUND) OR NET POWER-.
18. 5K OHM YIELDS 0-5VDC. LOWER RESISTANCE IF CURRENT SOURCE CANNOT DRIVE TO THIS VOLTAGE(THIS WILL REDUCE SENSOR RESOLUTION).
19. 250 OHM YIELDS 5VDC FULL SCALE. LOWER RESISTANCE IF CURRENT SOURCE CANNOT DRIVE TO THIS VOLTAGE(THIS WILL REDUCE SENSOR RESOLUTION).

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FIGURE E-5. CONTROLS COMMUNICATIONS MODULE INTERCONNECT (2 OF 2)

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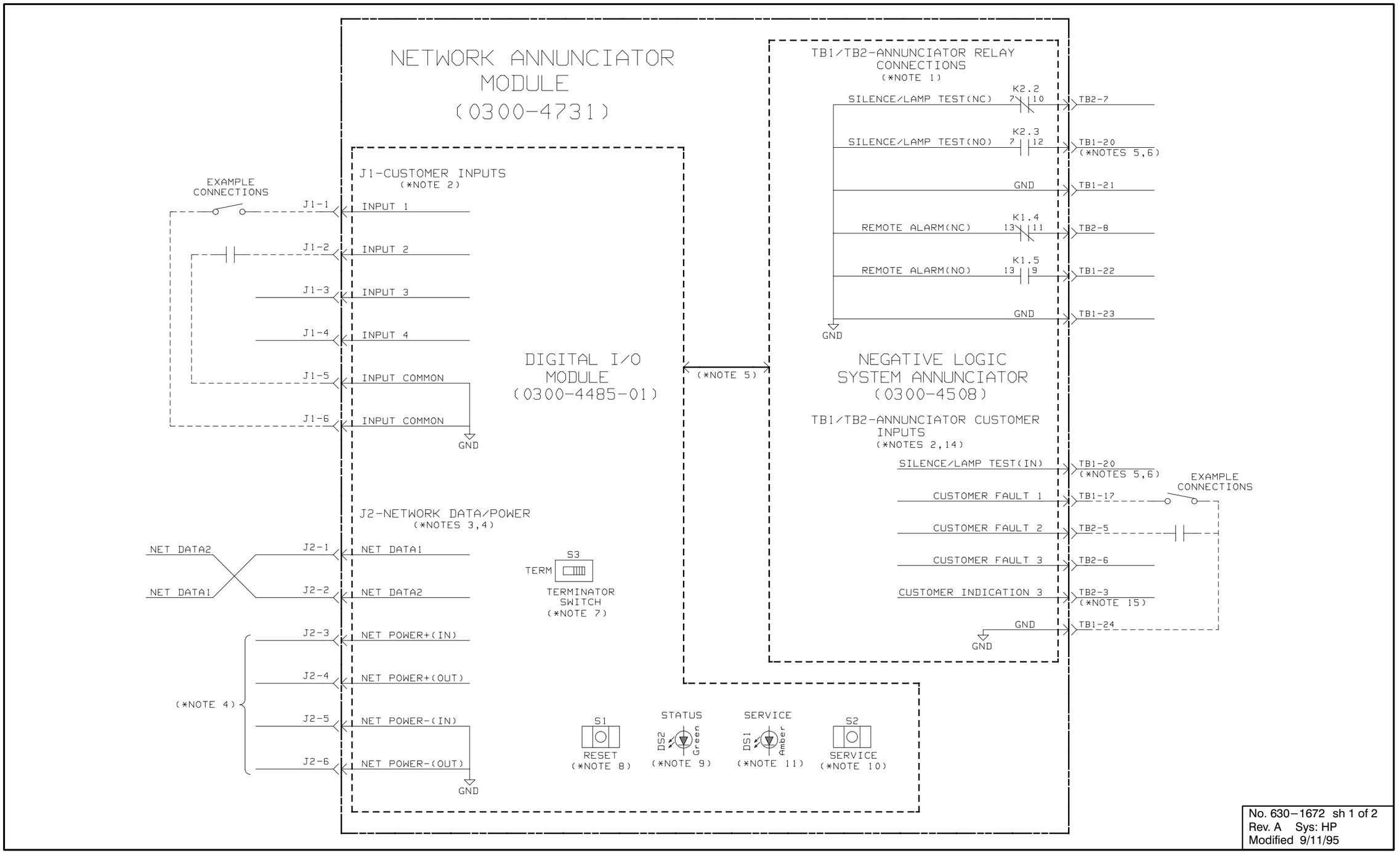

FIGURE E-6. NETWORK ANNUNCIATOR MODULE INTERCONNECT (1 of 2)

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SPECIFICATIONS

1. NET POWER
   - 1.1 INPUT VOLTAGE = 10-36VDC (OPERATING RANGE)
   - 1.2 INPUT CURRENT(NORMAL) = 40mA @ 36VDC
55mA @ 24VDC
80mA @ 12VDC
110mA @ 10VDC
   - 1.3 INPUT CURRENT(LAMP TEST) = 200mA @ 36VDC
250mA @ 24VDC
500mA @ 12VDC
650mA @ 10VDC
   - 1.4 INPUT CURRENT(MAX) = 1300mA @ 4VDC
   - 1.5 INPUT CONNECTIONS = J2-3(NET POWER+)
J2-5(NET POWER-)
   - 1.6 OUTPUT CONNECTIONS = J2-4(NET POWER+)
J2-6(NET POWER-)
(SHARED CONNECTIONS WITH ANNUNCIATOR HARNESS)

2. NET DATA
   - 2.1 TYPE = ECHELON LONTALK™
78Kb TWISTED PAIR
TRANSFORMER COUPLED
   - 2.2 INPUT CONNECTIONS = J2-1(NET DATA1)
J2-2(NET DATA2)

3. DIM CUSTOMER INPUTS(NETWORK)
   - 3.1 TYPE = DISCRETE
   - 3.2 NUMBER = 4
CONNECT TO DRY CONTACTS ONLY
RETURN TO INPUT COMMON
   - 3.3 OUTPUT = 5VDC (OPEN)
5mA SOURCE MAX (CLOSED)
   - 3.4 INPUT CONNECTIONS = J1-1(INPUT 1)
J1-2(INPUT 2)
J1-3(INPUT 3)
J1-4(INPUT 4)
J1-5,6(INPUT COMMON)

4. ANNUNCIATOR CUSTOMER INPUTS(HARD-WIRED)
   - 4.1 TYPE = DISCRETE
   - 4.2 NUMBER = 4
CONNECT TO DRY CONTACTS ONLY
RETURN TO TB1-24
   - 4.3 OUTPUT = 5VDC (OPEN)
20mA SOURCE MAX (CLOSED)
   - 4.4 INPUT CONNECTIONS = TB1-17(CUSTOMER FAULT 1)
TB2-5(CUSTOMER FAULT 2)
TB2-6(CUSTOMER FAULT 3)
TB1-20(SILENCE/LAMP TEST INPUT)

5. ANNUNCIATOR OUTPUT RELAYS
   - 5.1 TYPE = SEALED
   - 5.2 NUMBER = 2
   - 5.3 CONTACTS = 1 FORM C
2A @ 30VDC
   - 5.4 OUTPUT CONNECTIONS = TB2-7,8(N/C CONTACTS)
TB2-21,23(COMMON)
TB1-20,22(N/O CONTACTS)

6. ENVIRONMENTAL
   - 6.1 STORAGE TEMPERATURE = -25 TO 70°C
   - 6.2 OPERATING TEMPERATURE = -25 TO 70°C
   - 6.3 HUMIDITY = 45 TO 85% RH

NOTES:

1. ALL RELAYS ARE SHOWN IN RESET OR DE-ENERGIZED POSITION.
2. DO NOT APPLY VOLTAGE TO CUSTOMER INPUTS.
3. REFER TO INTERCONNECTION PRINT(630-1670).
4. REFER TO POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL(900-0366).
5. REFER TO NETWORK ANNUNCIATOR MANUAL(900-0282) AND DRAWING 300-4731.
6. TB1-20 USED AS BOTH INPUT AND OUTPUT FOR SILENCE/LAMP TEST.
7. S3, WHEN SET TO TERMINATE, WILL TERMINATE THE TWISTED PAIR NETWORK BUS. DATA LINES MUST BE TERMINATED WHEN THE NAM. IS PHYSICALLY LOCATED AT THE END OF THE NETWORK BUS.
8. S1, RESET PUSH-BUTTON SWITCH, WILL MANUALLY RESET THE NAM.
9. DS2, STATUS LED(GREEN), INDICATES DIM PROCESSOR IS RUNNING.
10. S2, SERVICE PUSH-BUTTON SWITCH, USED TO GENERATE NETWORK MANAGEMENT MESSAGE FOR NODE LOGICAL INSTALLATION.
11. DS1, SERVICE STATUS LED(AMBER), INDICATES THE INSTALLATION AND ERROR STATUS.
12. ANNUNCIATOR FRONT PANEL LEDS,(1,2,4-17), ARE CONTROLLED OVER THE NETWORK.
13. IN THE NFPA-110 APPLICATION, ANNUNCIATOR FRONT PANEL LED 3 (NORMAL BATTERY) IS ON WHENEVER BOTH LED 1(HIGH BATTERY) AND LED 2(LOW BATTERY) ARE OFF.
IN AN APPLICATION OTHER THAN NFPA-110, LED 3 IS CONTROLLED BY HARDWIRED INPUT (SEE NOT 15).
14. ANNUNCIATOR FRONT PANEL LEDS 18-20,(CUSTOMER FAULT), ARE NOT USED, BUT MAY BE HARD-WIRED FOR CUSTOM USE.
15. CUSTOMER INDICATION 3 MAY ONLY BE USED FOR APPLICATIONS OTHER THAN NFPA-110.TO USE NETWORK ANNUNCIATOR FOR OTHER APPLICATIONS, CHANGE SYSTEM ANNUNCIATOR SWITCH S3 AS FOLLOWS.

S3	FROM (NFPA-110)	TO (NON-NFPA-110)
S3-1	CLOSED	OPEN
S3-2	CLOSED	OPEN
S3-3	CLOSED	OPEN
S3-4	CLOSED	CLOSED
S3-5	OPEN	CLOSED
S3-6	CLOSED	CLOSED

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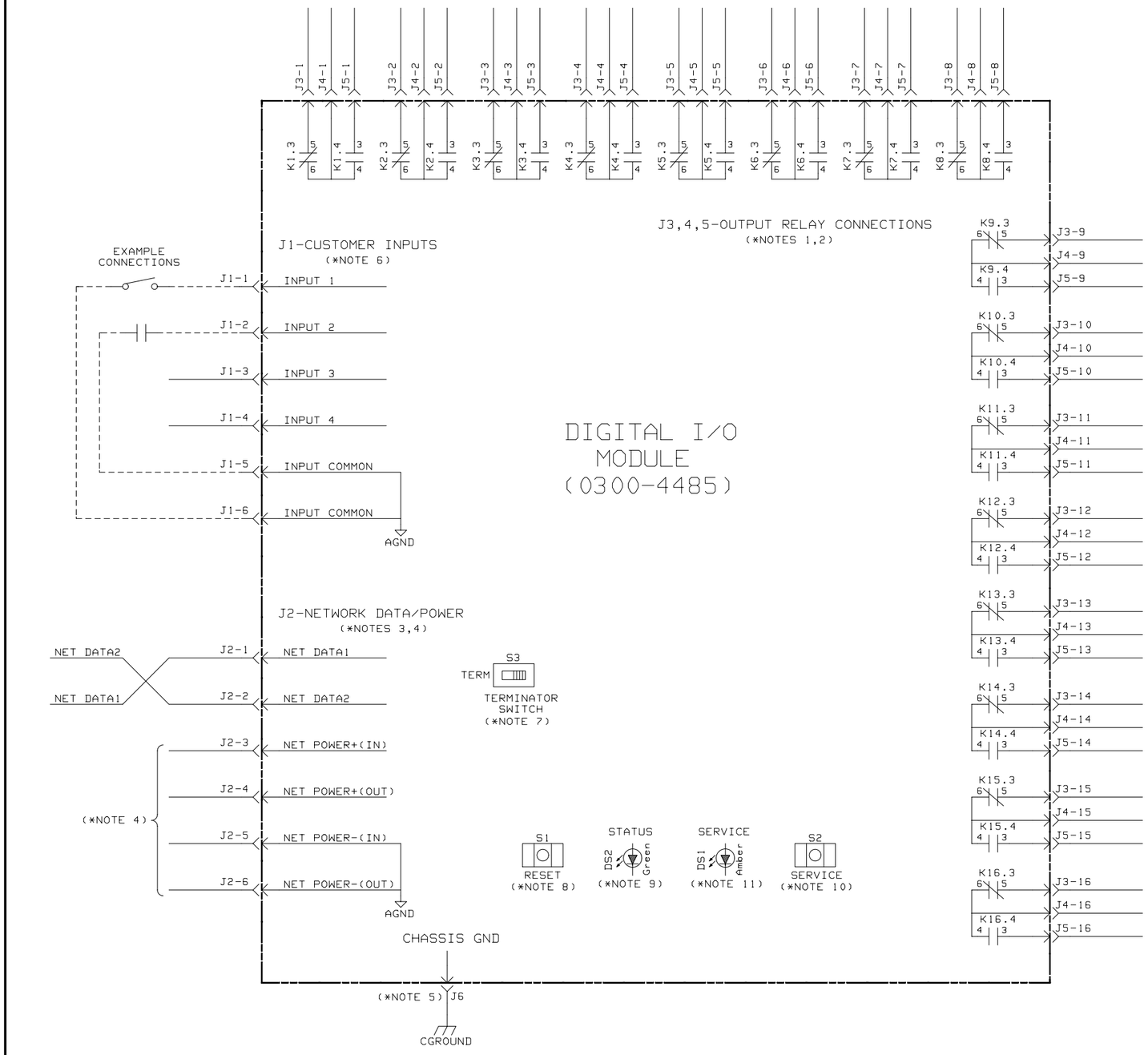
FIGURE E-7. NETWORK ANNUNCIATOR MODULE INTERCONNECT (2 of 2)



SPECIFICATIONS

1. NET POWER
   - 1.1 INPUT VOLTAGE = 10-36VDC (OPERATING RANGE)
   - 1.2 INPUT CURRENT = 30mA @ 36VDC, 40mA @ 24VDC, 60mA @ 12VDC, 100mA @ 10VDC
   - 1.3 INPUT CURRENT(MAX) = 110mA @ 8VDC
   - 1.4 INPUT CONNECTIONS = J2-3(NET POWER+), J2-5(NET POWER-)
   - 1.5 OUTPUT CONNECTIONS = J2-4(NET POWER+), J2-6(NET POWER-)

2. NET DATA
   - 2.1 TYPE = ECHELON LONTALK™ 78Kb TWISTED PAIR TRANSFORMER COUPLED
   - 2.2 INPUT CONNECTIONS = J2-1(NET DATA1), J2-2(NET DATA2)

3. CUSTOMER INPUTS
   - 3.1 TYPE = DISCRETE
   - 3.2 NUMBER = 4 CONNECT TO DRY CONTACTS ONLY, RETURN TO INPUT COMMON
   - 3.3 OUTPUT = 5VDC (OPEN), 5mA SOURCE MAX (CLOSED)
   - 3.4 INPUT CONNECTIONS = J1-1(INPUT 1), J1-2(INPUT 2), J1-3(INPUT 3), J1-4(INPUT 4), J1-5,6(INPUT COMMON)

4. OUTPUT RELAYS
   - 4.1 TYPE = LATCHING
   - 4.2 NUMBER = 16
   - 4.3 CONTACTS = 1 FORM C, 5A(MAX) 250VAC OR 30VDC
   - 4.4 OUTPUT CONNECTIONS = J3(N/C CONTACTS), J4(COMMON), J5(N/O CONTACTS)

5. ENVIRONMENTAL
   - 5.1 STORAGE TEMPERATURE = -25 TO 70°C
   - 5.2 OPERATING TEMPERATURE = -25 TO 70°C
   - 5.3 HUMIDITY = 45 TO 85% RH

NOTES:

1. ALL RELAYS ARE SHOWN IN RESET OR DE-ENERGIZED POSITION. RELAYS MAINTAIN THE LAST STATE WHEN POWER IS LOST.
2. OUTPUT RELAYS ARE CONTROLLED VIA THE NETWORK.
3. REFER TO INTERCONNECTION PRINT(630-1670).
4. REFER TO POWERCOMMAND NETWORK INSTALLATION AND OPERATION MANUAL(900-0366).
5. CONNECT J6 RING TERMINAL TO A GOOD EMI EARTH GROUND. USE AN "EXTERNAL TOOTH" LOCKWASHER BETWEEN RING AND GROUNDING SURFACE.
6. DO NOT APPLY VOLTAGE TO CUSTOMER INPUTS 1-4.
7. S3, WHEN SET TO TERMINATE, WILL TERMINATE THE TWISTED PAIR NETWORK BUS. DATA LINES MUST BE TERMINATED WHEN THE DIM. IS PHYSICALLY LOCATED AT THE END OF THE NETWORK BUS.
8. S1, RESET PUSH-BUTTON SWITCH, WILL MANUALLY RESET THE DIM.
9. DS2, STATUS LED(GREEN), INDICATES DIM PROCESSOR IS RUNNING.
10. S2, SERVICE PUSH-BUTTON SWITCH, USED TO GENERATE NETWORK MANAGEMENT MESSAGE FOR NODE LOGICAL INSTALLATION.
11. DS1, SERVICE STATUS LED(AMBER), INDICATES THE INSTALLATION AND ERROR STATUS.

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FIGURE E-8. DIGITAL I/O MODULE INTERCONNECT (1 of 1)

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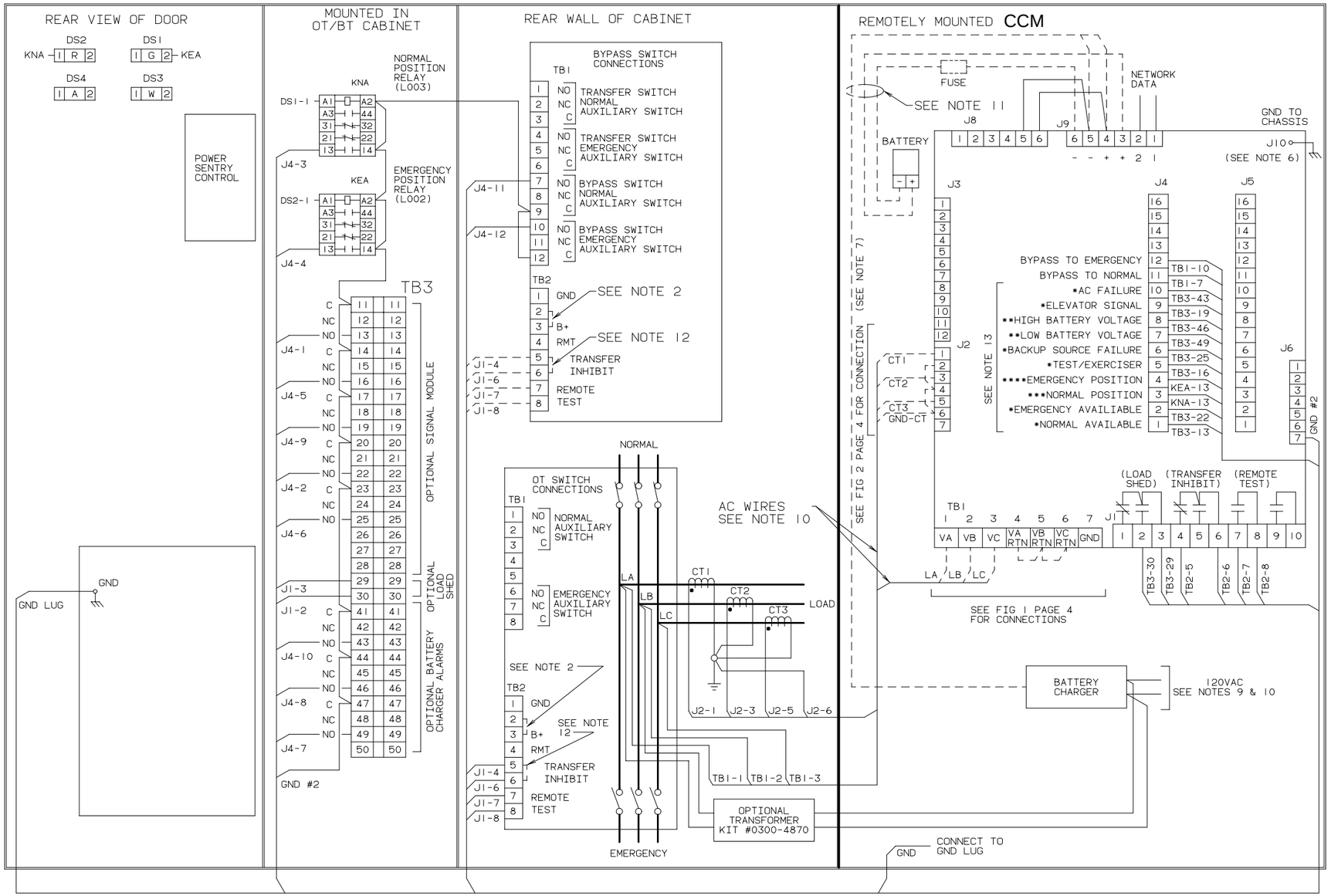
OT & BT
UTILITY TO GENSET



WITHOUT METERS

NOTES:

1. ALL RELAYS ARE SHOWN IN RESET OR DE-ENERGIZED POSITION.
2. INSTALL JUMPER BETWEEN TB2-1 & TB2-2 FOR GENSETS WITH PCC CONTROL OR 3 WIRE START. ALL OTHERS INSTALL JUMPER BETWEEN TB2-2 & TB2-3.
3. LIST OF OPTIONS SHOWN ON DRAWING

LOAD SHED	M007
BATTERY CHARGER 10 AMP	K002 OR K003
EMERGENCY AUXILIARY RELAY	L002
NORMAL AUXILIARY RELAY	L003
METERS OR CT KIT	N002 OR KIT
BATTERY CHARGER ALARMS	N002
SIGNAL MODULE	M001

4. REFER TO INTERCONNECTION PRINT (0630-1670) FOR SYSTEM CONNECTION.
5. REFER TO POWER COMMAND NETWORK INSTALLATION AND OPERATION MANUAL (0900-0366).
6. CONNECT J10 RING TERMINAL TO A GOOD EMI EARTH GROUND. USE AN "EXTERNAL TOOTH" LOCKWASHER BETWEEN TERMINAL AND GROUNDING SURFACE.
7. MAX WIRING DISTANCE FROM CURRENT TRANSFORMER TO CCM (ONE WAY):
   #12 AWG WIRE····30 FT*
   #14 AWG WIRE····20 FT*
   #16 AWG WIRE····14 FT*
   * NOTE: FOR GREATER WIRING DISTANCE, SEE INSTRUCTION MANUAL.
8. MAX WIRING DISTANCE FOR ALL OTHER WIRING IS 1000 FT USING #16 AWG WIRE.
9. CONNECT TO 120VAC. IF NOT AVAILABLE, USE KIT #0300-4870.
10. SEPARATE CONDUIT IS REQUIRED FOR AC WIRING.
11. WIRING HAS BEEN PRE-INSTALLED.
12. FOR NETWORK CONTROL OF TRANSFER INHIBIT REMOVE JUMPER.
13. * SIGNAL AVAILABLE WHEN SIGNAL MODULE M001 IS INSTALLED.
    ** SIGNAL AVAILABLE WHEN 10 AMP BATTERY CHARGER K2 OR K3 IS INSTALLED ALONG WITH BATTERY CHARGER ALARM N002.
    *** SIGNAL AVAILABLE WHEN NORMAL POSITION RELAY (L003) IS INSTALLED.
    **** SIGNAL AVAILABLE WHEN EMERGENCY POSITION RELAY (L002) IS INSTALLED.
    L002 AND L003 ARE USED INSTEAD OF THE AUXILIARY SWITCHES ON TRANSFER SWITCH, BECAUSE OF THE LOW CURRENT REQUIREMENTS OF THE CCM.

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FIGURE E-9. CONTROLS COMMUNICATIONS MODULE - ATS INTERCONNECT (1 of 4)

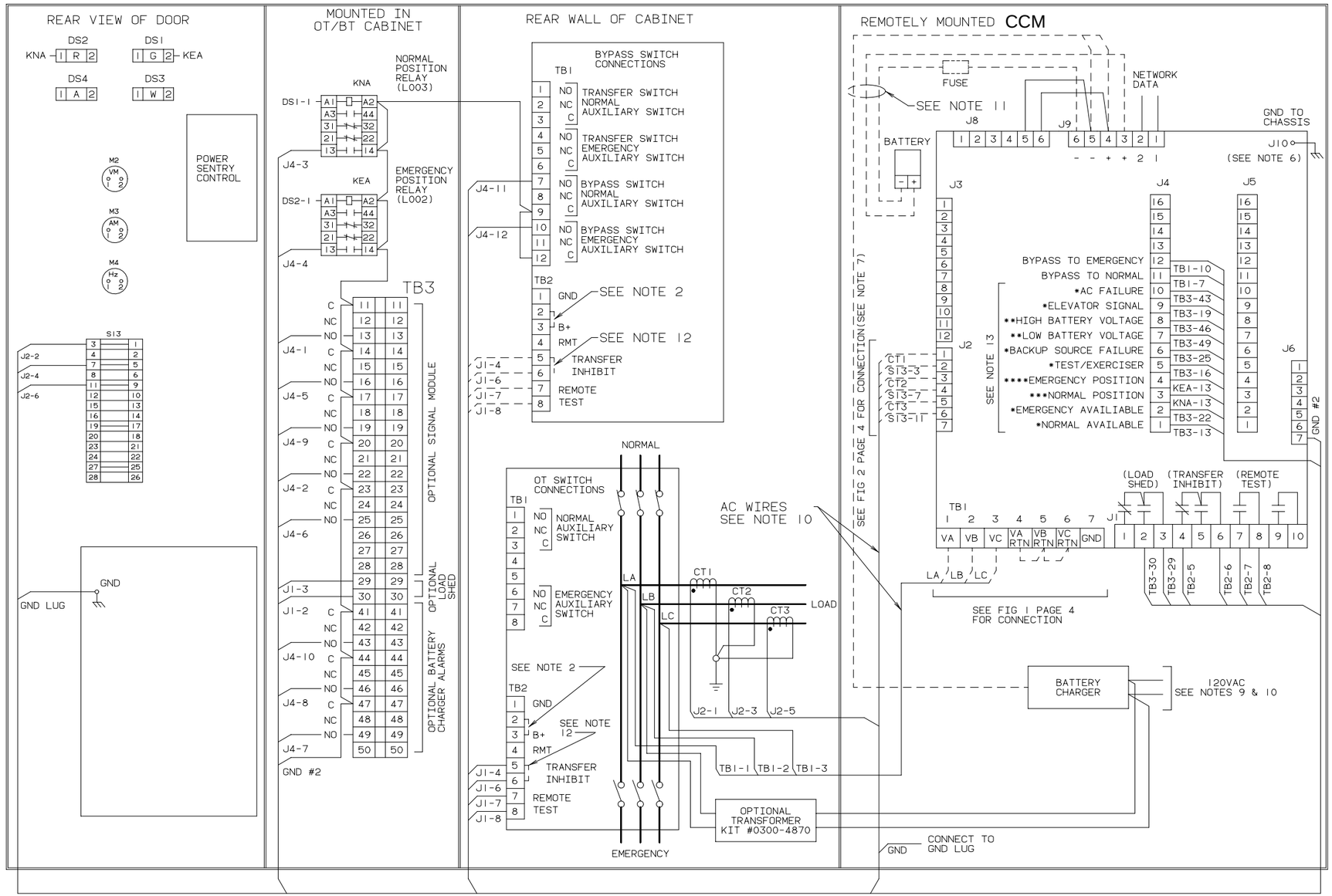

FIGURE E-10 CONTROLS COMMUNICATIONS MODULE - ATS INTERCONNECT (2 of 4)

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SEE FIGURE E-9 FOR NOTES

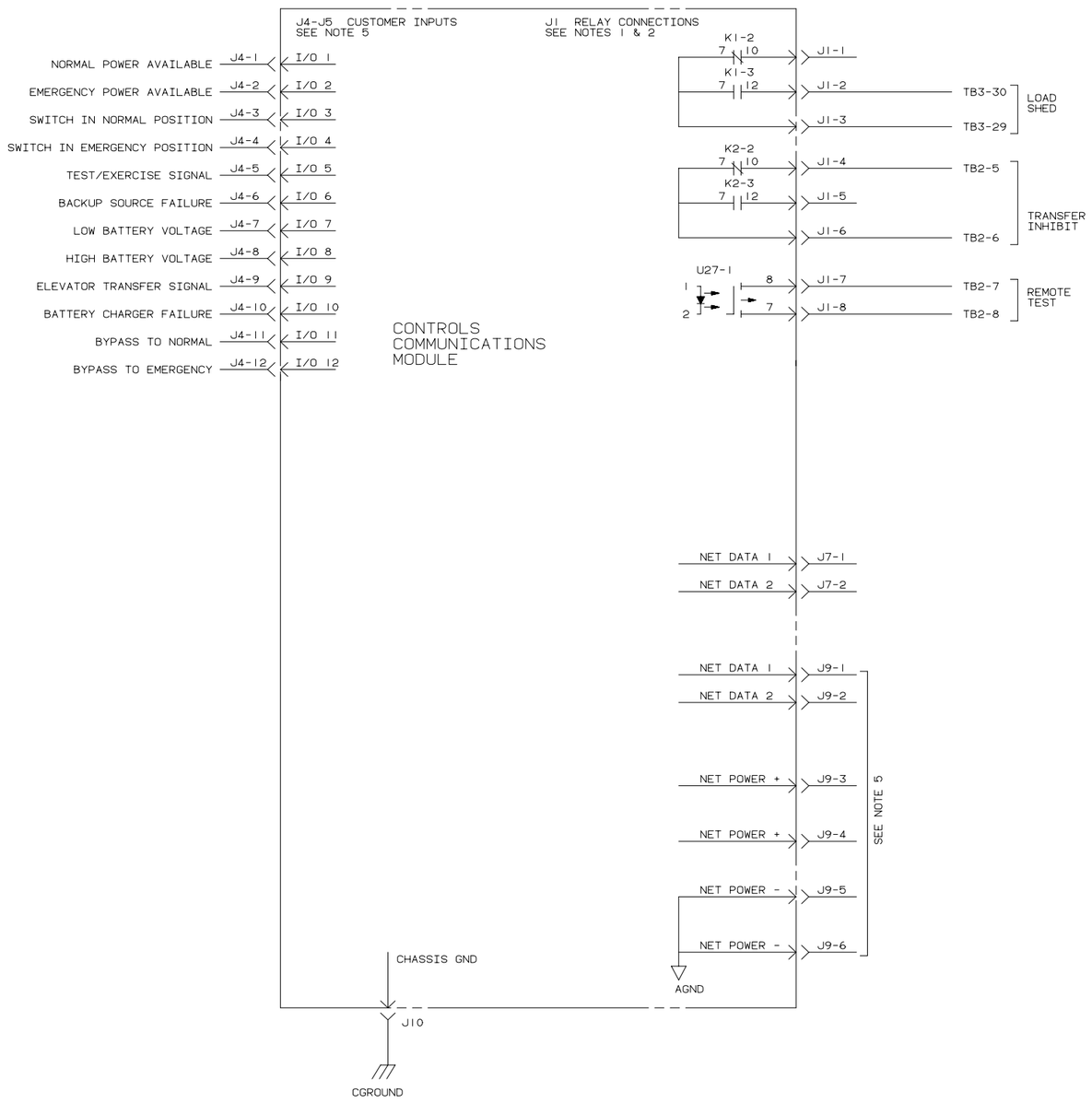

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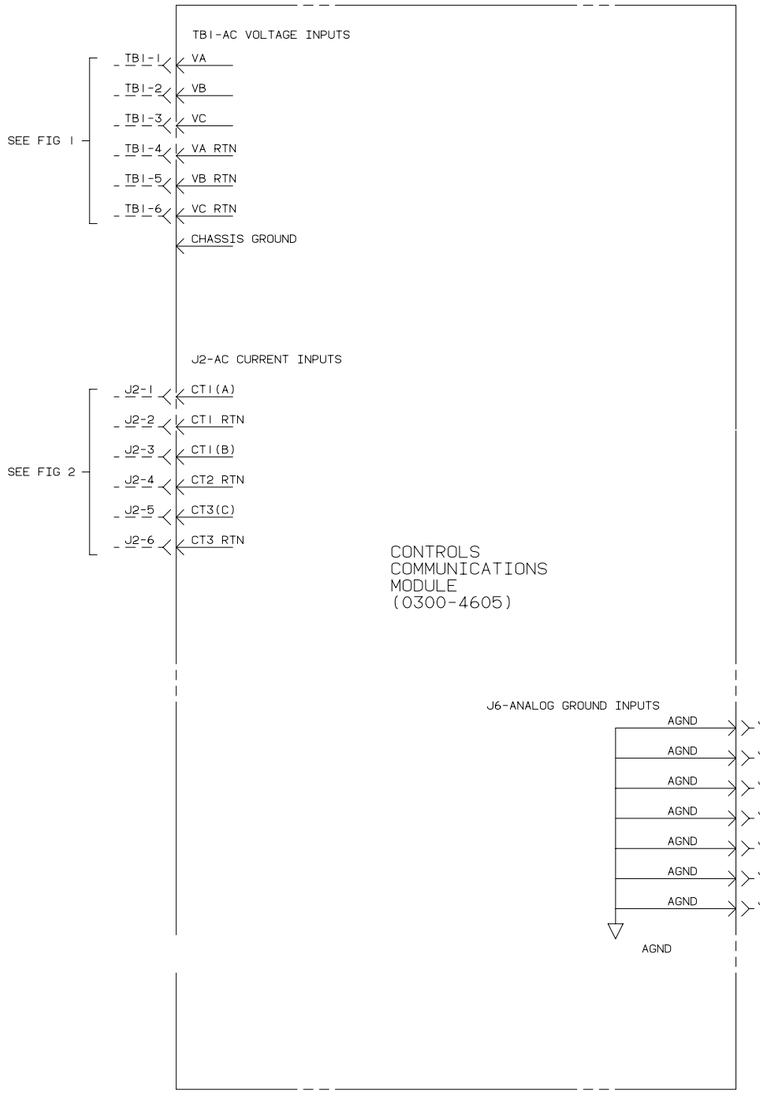
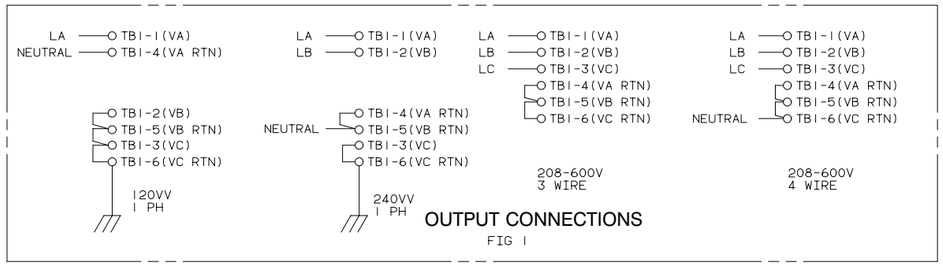
FIGURE E-11. CONTROLS COMMUNICATIONS MODULE - ATS INTERCONNECT (3 of 4)



SEE FIGURE E-9 FOR NOTES



OUTPUT CONNECTIONS
FIG 1

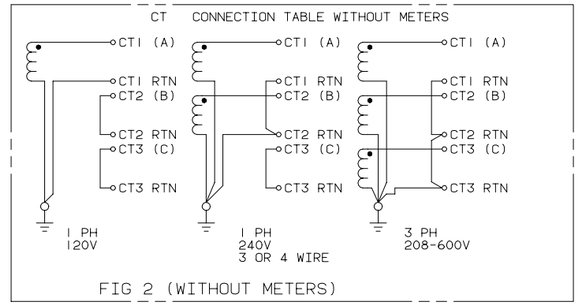


FIG 2 (WITHOUT METERS)

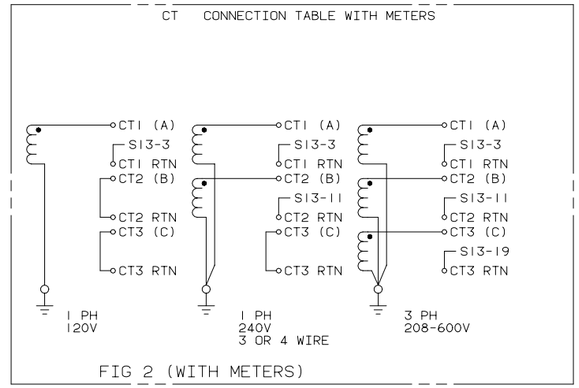


FIG 2 (WITH METERS)

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FIGURE E-12. CONTROLS COMMUNICATIONS MODULE - ATS INTERCONNECT (4 of 4)

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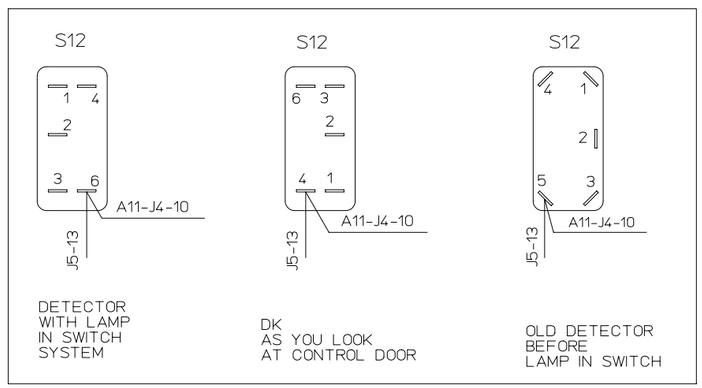
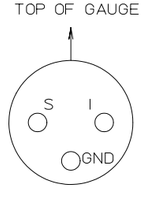
J5-13 CONNECTION (2)



TOP OF GAUGE



ON DK, REMOVE GAUGE BOARD BEFORE CONNECTING WIRE TO "S" TERMINAL

WIRE SIZE	DISTANCE IN FEET ONE WAY			
AWG	A 12/24V	B 12 VOLT	B 24 VOLT	C
24	500	----	----	----
22	700	----	----	----
18	1500	20	175	----
16	3000	35	250	14
14	----	55	400	20
12	----	90	650	30

FOR CTs USE COLUMN C
FOR B+, GND USE COLUMN B
FOR ALL ELSE USE COLUMN A
(4)

NOTES:

(1) IF SET IS EQUIPPED WITH TIME DELAY START/STOP MODULE, THE START SIGNAL FROM CCM-J1-2 SHOULD BE CONNECTED TO A15-TB1-5. IF NOT EQUIPPED THE START SIGNAL WILL BE CONNECTED TO A11-TB1-6.

(2) S12 IDENTIFICATION:

DK CONTROL...S12, AS YOU LOOK AT THE CONTROL DOOR OPEN, IS LOCATED ON YOUR LEFT. YOU NEED TO CONNECT THE RESET POWER LEAD TO TERMINAL NUMBER 4. TERMINAL 4 WILL BE LOCATED TO THE OUTSIDE EDGE OF THE CONTROL ON THE LEFT.

CHECK TO SEE THAT IT IS CONNECTED TO A11-J4-10. REMOVE THE FASTON, CONNECT THE PIGGY BACK AND REPLACE THE FASTON.

DETECTOR IDENTIFCATION...IF YOUR CONTROL HAS A RESET SWITCH WITH INDICATOR LAMP IN IT, S12 WILL BE TO YOUR RIGHT WITH THE DOOR OPEN. YOU NEED TO CONNECT THE RESET POWER LEAD TO TERMINAL NUMBER 6.

TERMINAL 6 WILL BE ON THE RIGHT HAND SIDE OF THE SWITCH AT THE BOTTOM. CHECK TO SEE THAT IT IS CONNECTED TO A11-J4-10. REMOVE THE FASTON, CONNECT THE PIGGY BACK AND REPLACE THE FASTON.

IF YOUR CONTROL DOES NOT HAVE AN INDICATOR LAMP IN THE RESET SWITCH, S12 WILL BE LOCATED TO YOUR RIGHT WITH THE DOOR OPEN. YOU NEED TO CONNECT THE RESET POWER LEAD TO TERMINAL NUMBER 5.

TERMINAL 5 WILL BE ON THE LEFT HAND SIDE OF THE SWITCH AT THE BOTTOM. CHECK TO SEE THAT IT IS CONNECTED A11-J4-10. REMOVE THE FASTON, CONNECT THE PIGGY BACK AND REPLACE THE FASTON.

(3) THE GAUGE SIGNAL CIRCUIT SHOULD BE CONNECTED TO THE "S" TERMINAL OF THE GAUGE.
DK CONTROL...THE "S" TERMINAL IS LOCATED TO THE RIGHT SIDE OF THE GAUGE WITH THE DOOR OPEN.

REMOVE THE GAUGE BOARD ON THE WATER TEMP GAUGE AND CONNECT THE SIGNAL WIRE THEN REPLACE THE GAUGE BOARD. CHECK TO SEE THAT THE EXISTING WIRE IS MARKED M12-S OR M11-S.

DETECTOR CONTROL...THE "S" TERMINAL IS LOCATED TO THE LEFT SIDE OF THE GAUGE WITH THE DOOR OPEN. CHECK TO SEE THAT THE EXISTING WIRE IS MARKED M12-S OR M11-S. CONNECT THE SIGNAL WIRE AND TIGHTEN THE NUT.

(4) USE COLUMN "C" FOR DETERMINING WIRE SIZES BASED ON DISTANCE FOR CT'S. USE COLUMN "B" FOR DETERMINING WIRE SIZES BASED ON DISTANCE FOR B+ AND GND CIRCUITS. COLUMN "A" CAN BE USED FOR ALL OTHER CIRCUITS.

NOTE THAT THE DISTANCE IS MEASURED IN FEET FROM THE SET TO THE CCM BOARD ONE WAY ONLY.

STRANDED WIRE IS PREFERED FOR VIBRATION RESISTANCE.

(5) REMOVE WIRE FROM TB21-28,29,30 AND REMOVE THE SPADE LUG. RELUG WITH SPLICE AND CONNECT WIRE TO CCM BOARD TERMINAL J2-2,J2-4,J2-6. CONNECT ADDITIONAL WIRE FROM TB21-28,29,30 AND CONNECT TO CCM BOARD TERMINAL J2-1,J2-3,J2-5.

(6) CT CIRCUITS MUST BE FULLY CONNECTED BEFORE STARTING SET. ELECTRICAL HAZARD OR DAMAGE TO EQUIPMENT COULD RESULT.

(7) WHEN CCM IS USED WITH A 7 LIGHT CONTROL THESE CONNECTIONS WILL NOT BE AVAILABLE.

(8) FOR DELTA WIRED SETS, TIE ALL RETURNS TOGETHER. NO CONNECTION IS MADE TO TB21-26. LEAVE FLOATING.

(9) IF SENDER READINGS ARE REQUIRED WHEN GENSET IS NOT RUNNING, THE FOLLOWING CONNECTIONS MAY BE NECESSARY:
(DETECTOR ONLY) REMOVE THE WIRE M12-1 (TEMP GAUGE) AND SAFELY TIE THE LEAD BACK INTO THE HARNESS;
INSTALL A JUMPER FROM A11-TB1-7 (B+ FUSED) TO M12-1.

(10) WHEN THE INPUT IS ACTIVE "OPEN" (5-36VDC), YOU MUST CONNECT A 1K,2W PULL-DOWN RESISTOR BETWEEN J5-13 AND J6-3 (AGND). FOR DK AND DETECTOR SETS, A11-J4-10 IS ACTIVE "OPEN" 12V - 24V.

	FROM:		TO:		
NOTES	CCM	FUNCTION	CONTROL	CCM	OPTIONAL CONNECTIONS
	CCM DC CONNECTIONS				
NOTE 1	J1-2	START	A11-TB1-6		A15-TB1-5
	J1-3	CCM B+		J9-3	
	J1-5	RESET	A11-TB2-5		
	J1-6	GND		J9-6	
NOTE 3	J3-12	OP GAUGE	M11-S		
NOTE 3,9	J3-3	WT GAUGE	M12-S		
	J3-11	GND		J3-2	
	J3-2	GND		J6-2	
NOTE 2,10	J5-13	SW OFF	SEE NOTE 2,10		
	J5-12	RUN	A11-TB1-3		
	J5-11	PLOP	A11-TB2-11		
	J5-10	PHET	A11-TB2-10		
	J5-9	LOP	A11-TB2-9		
	J5-8	HET	A11-TB2-8		
	J5-7	OS	A11-TB2-7		
	J5-6	OC	A11-TB2-6		
NOTE 7	J5-5	FAULT 1	A11-TB2-4		
NOTE 7	J5-4	FAULT 2	A11-TB2-2		
NOTE 7	J5-3	LET	A11-TB2-13		
NOTE 7	J5-2	LOW FUEL	A11-TB2-15		
NOTE 10	J5-1	COM ALARM	A11-TB1-4		
	J5-1	1K,2W RSTR		J6-1	
	J8-5	SENSED GND	A11-TB1-5		
	J8-6	SENSED B+	A11-TB1-7		
NOTE 4	J9-4	CCM B+	A11-TB1-7		
NOTE 4	J9-5	CCM GND	A11-TB1-5		
	CCM AC CONNECTIONS				
	TB1-1	VA GEN8	TB21-22		
	TB1-2	VB GEN7	TB21-23		
	TB1-3	VC GEN6	TB21-25		
	TB1-4	NEUTRAL	TB21-26		
	TB1-5	NEUTRAL	TB1-5		
	TB1-6	NEUTRAL	TB1-6		
	GND LUG IN BOX		CONTROL GND STUD	(J10)	
NOTE 4,5	J2-1	CT21-(-)	CT21		
NOTE 4,5	J2-2	CT21-(+)	TB21-28		
NOTE 4,5	J2-3	CT22-(-)	CT22		
NOTE 4,5	J2-4	CT22-(+)	TB21-29		
NOTE 4,5	J2-5	CT23-(-)	CT23		
NOTE 4,5	J2-6	CT23-(+)	TB21-30		

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FIGURE E-13. CONTROLS COMMUNICATIONS MODULE - GENSET INTERCONNECT (1 of 2)

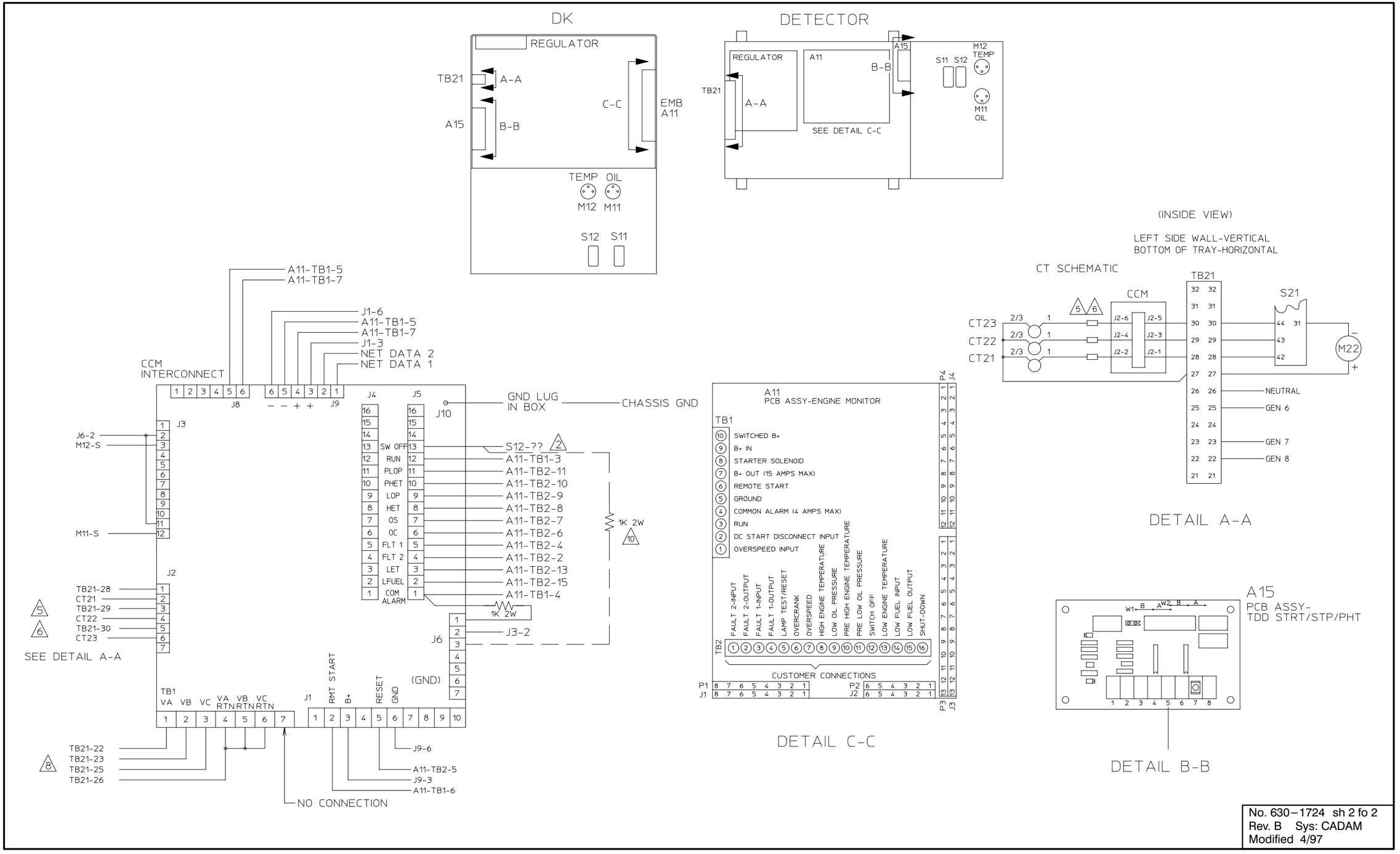

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FIGURE E-14. CONTROLS COMMUNICATIONS MODULE - GENSET INTERCONNECT (2 of 2)

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F. Index

This section contains a partial index of terms that are used when installing a network.

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