Honeywell

PLC Gateway Planning, Installation, and Service

PL02-500

Total Plant

Implementation
PLC Gateway

PLC Gateway Planning, Installation, and Service

PL02-500
Release 500
CE Compliant
12/95

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Revision 01 – December 15, 1995

ACKNOWLEDGEMENTS AND CREDITS

About This Publication

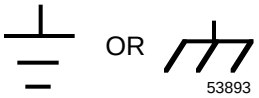
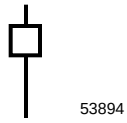
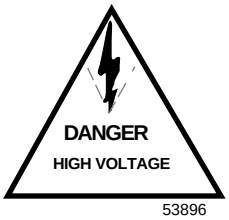
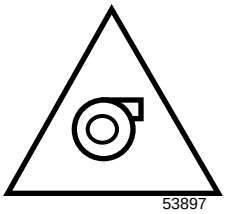
This publication is provided to guide the user in planning, installing, and servicing the Programmable Logic Controller Gateway (PLCG). Only those components unique to the PLCG are covered in detail. It is not intended to be a substitute for standard LCN Site Planning, System Installation, and Service manuals, which are referenced for further detail.

This manual describes PLCI board 51400997-100 with Firmware Revision J and PLCG relay panel 51304421-100. Early-production relay panel 51304154-100 may be used in all applications except Allen-Bradley™ protocol using redundant PLCGs.

This publication supports TDC 3000^X software release 500 and CE Compliant hardware.

> Any equipment designated as "CE Compliant" complies with the European Union EMC and Health and Safety Directives. All equipment shipping into European Union countries after January 1, 1996 requires this type of compliance—denoted by the "CE Mark."

Standard Symbols

Scope	The following defines standard symbols used in this publication
ATTENTION	Notes inform the reader about information that is required, but not immediately evident
CAUTION	Cautions tell the user that damage may occur to equipment if proper care is not exercised
WARNING	Warnings tell the reader that potential personal harm or serious economic loss may happen if instructions are not followed
 53893	Ground connection to building safety ground
 53894	Ground stake for building safety ground
 53895	Electrical Shock Hazard—can be lethal
 53896	Electrical Shock Hazard—can be lethal
 53897	Rotating Fan—can cause personal injury

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INTRODUCTION
Section 1

This section provides an overview of the PLCG equipment, and lists reference documents available from Honeywell.

1.1 GENERAL DESCRIPTION

The Programmable Logic Controller Gateway provides a method of economically connecting various Programmable Logic Controllers to your Honeywell TDC 3000X System.

This manual guides you through the planning and installation considerations unique to the PLCG equipment. However, this manual is not intended to be a substitute for the *LCN Site Planning* manual and *LCN System Installation* manual, listed in the standard LCN publications referenced in subsection 1.3 of this manual.

The PLCG runs under an unmodified HG (Hiway Gateway) software personality. The hardware is similar to HG hardware, contained in a standard TDC 3000X five-slot equipment module that supports the Local Control Network (LCN). In the PLCG, the Data Hiway Interface (DHIF) board and its I/O board are replaced with the Programmable Logic Controller Interface (PLCI) board and its I/O board. A PLCG Relay Panel is installed on the rear of the module.

A redundant PLCG pair is composed of two PLCG modules equipped as above, but sharing one relay panel.

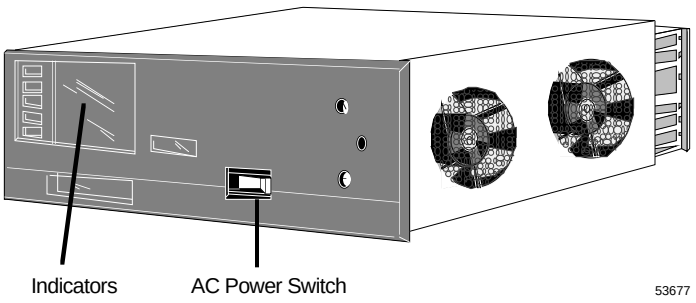


Figure 1-1 — PLCG Nonredundant Five-Slot Module

1.2 PLCG MODULE FOR EC

The CE compliant PLCG and PLCI I/O cage supports the three styles of modules. It supports the non-redundant PLCG, the redundant PLCG and the communications redundant PLCG. The CE compliant modules are capable of holding both the older and newer types of I/O board designs.

The I/O File has been modified to make electrical contact with face plates attached to the I/O boards. This provides low impedance ground path for the cable shields. The face plates and the wire mesh covering the fan openings also provides EMI shielding around the module . The module is similar in all other respects.

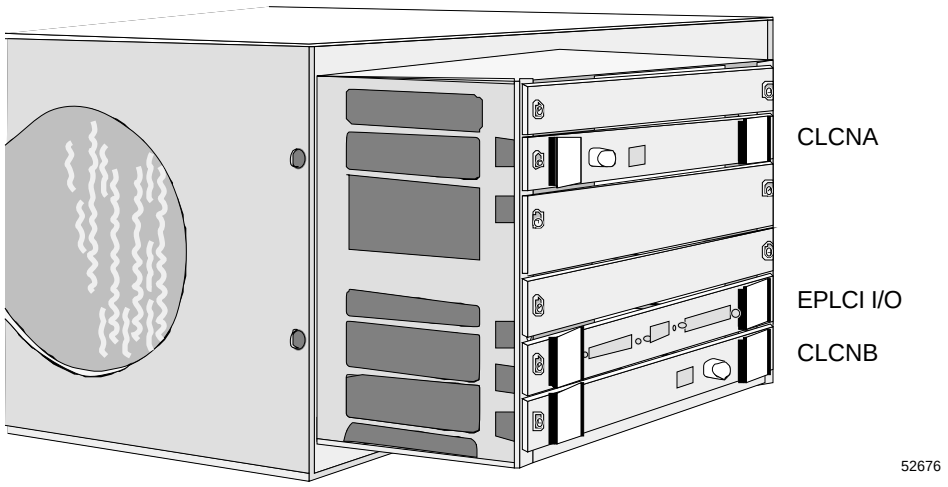


Figure 1-2 — CE Compliant PLCG Nonredundant Dual Node Module

1.3 HONEYWELL SUPPORT SERVICES

Optional Installation Support, Field Services, and Technical Support are available during the on-site installation and checkout of TDC 3000^X system equipment. Honeywell representatives are available to assist in interpreting this manual and to help resolve problems or situations not covered by this manual. A toll-free number (800-822-7673; in Arizona, 602-863-5558) is available for technical assistance.

1.4 RELATED PUBLICATIONS

Honeywell's standard documentation is included with the system. The following publications apply to the TDC 3000^X system and should be referred to as required and available:

Publication Title	Publication Number	Binder Title	Binder Number
Local Control Network Planning	SW02-501	System Site Planning - 1	3020-1
LCN System Installation	SW20-500	LCN Installation	3025
LCN System Checkout	SW20-510	LCN Installation	3025
Hiway Gateway Specification and Technical Data	HG03-500	System Summary - 2	3010-2
Five/Ten-Slot Module Service	LC13-500	LCN Service - 2	3060-2
Dual Node Module Service	LC13-510	LCN Service - 2	3060-2
Maintenance Test Operations	SW11-502	LCN Service - 1	3060-1
Test System Executive	SW13-510	LCN Service - 3	3060-3
Hardware Verification Test System	SW13-511	LCN Service - 3	3060-3
Core Module Test System	SW13-512	LCN Service - 3	3060-3
Maintenance Test Operations	SW11-502	LCN Service - 1	3060-1
Process Operations Manual	SW11-501	Operation/Process Operations	3050
PLCG Specification & Technical Data	PL03-500	System Summary - 2	3010-2
PLCG Control Functions	PL09-500	Implementation/PLC Gateway	3080
PLCG Implementation Guidelines	PL12-500	Implementation/PLC Gateway	3080
PLCG Parameter Reference Dictionary	PL09-540	Implementation/PLC Gateway	3080
PLCG Forms	PL88-500	Implementation/PLC Gateway	3080

SITE PREPARATION
Section 2

This section provides the following information for the PLCG: Storage conditions, site requirements, electrical requirements, and configuration information.

2.1 STORAGE CONDITIONS

If the PLCG is to be placed in storage, follow these environmental constraints:

Temperature	-35° – +70°C
Humidity (RH)	10 – 80%, max wet bulb 20 – 30°C
Shock*	3.0 g for 10 milliseconds

* When enclosed in the original shipping container.

Note that the temperature/relative humidity cannot be cycled such that moisture or condensation occurs on the equipment—keep the rate of change less than 6% per hour. These storage and shipping requirements are for one year duration only, provided the equipment is properly packaged and contains an adequate amount of desiccant (moisture removing agent).

2.2 SITE REQUIREMENTS

The PLCG is designed for a Class A General Industrial environment. It must be operated in a temperature environment of 0° – 50°C (32° – 122°F). While operating, components of this system are not designed to withstand greater vibration than 1g.

This equipment is intended for use in a controlled environment. Although TDC 3000^X equipment will operate at 0 – 50°C, Honeywell recommends a normal environment of 25°C (77°F) with a relative humidity of 40 – 50% to realize maximum life and enhanced reliability.

2.2.1 Dimensions and Weight

The approximate dimensions and weight for each PLCG 5-slot module are:

Height	17 cm	(7")	Weight	21.5 kg	(46 lb)
Width	48 cm	(19")			
Depth	61 cm	(24")			

2.3 ELECTRICAL REQUIREMENTS

The customer selected ac power option is installed in the PLCG before shipment.

The inrush current to each electronics module is limited to 15 A @ 120 V, 30 A @240 V.

2.3.1 AC Voltage Options

120, 220, 240 Vac +10%, -15%

2.3.2 Frequency

47 Hz to 63 Hz

2.3.3 Current in Amperes at 120 Vac

		Avg	True RMS	Peak	Wattage	BTUs/hr
MP-PLCGN1 — 68000 based, Nonredundant Module	typical	1.34	1.82	8.86	217.8	742.7
	maximum	2.06	2.78	13.14	283.1	965.4
MP-PLCGR1 — 68000 based, 2 Redundant Modules (Two modules required)	typical	2.68	3.64	17.72	435.6	1485.4
	maximum	4.12	5.56	26.28	566.2	1930.8
MP-PLCGN3 — 68020 based, Nonredundant Module	typical	0.939	1.27	6.99	152.5	520.0
	maximum	1.45	1.94	10.35	198.3	676.2
MP-PLCGR3 — 68020 based, 2 Redundant Modules (Two modules required)	typical	1.878	2.54	13.98	305.0	1040.0
	maximum	2.90	3.88	20.70	396.6	1352.4

2.4 CONFIGURATIONS

Various nonredundant and redundant configurations of the PLCG connected to PLCs of different manufacture are available. Depending upon certain limitations, the PLCG may communicate to the PLCs either through short-haul modems or by a direct-connection.

2.4.1 Nonredundant Configurations

Figure 2-1 shows a PLCG connected in a nonredundant 5-slot module configuration. Connections for a dual node module configuration are the same, but the PLCG Relay Boards are mounted horizontally on the rear of the module. Each PLC port (**PORT 1** and **PORT 2** in the figure) may service any number of individual Programmable Logic Controllers up to a Honeywell-supported total of 16 PLCs per PLCG. See subsection 2.5.2 for examples of nonredundant port cabling configurations.

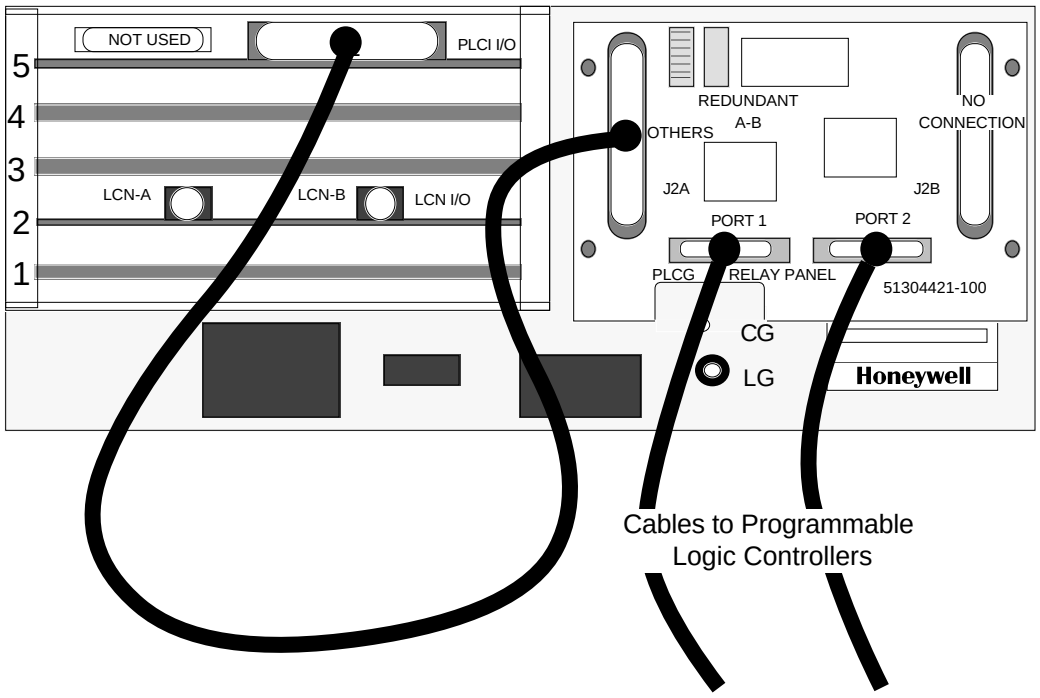


Figure 2-1 — PLCG in a Nonredundant Configuration 3066

Each port may be configured to either the Modbus or Allen-Bradley (A-B) protocol. That is, in the **nonredundant** configuration, you may have Port 1 connected to a Modbus and Port 2 connected to A-B equipment, or both ports configured to the same bus type.

In all nonredundant configurations, the pinning header on the PLCG Relay Panel must be plugged into the **OTHERS** socket on the relay panel. See subsection 3.2.4 and Figure 3-3 for a more detailed illustration of the pinning sockets and header.

2.4.2 Redundant Configurations

Figure 2-2 shows two PLCG 5-slot modules connected in a redundant configuration. This configuration also supports up to a total of 16 PLCs. Notice only one PLCG Relay Panel is used. In this configuration, the PLCG electronics within the modules are redundant with the relay panel the only nonredundant part of the system. Again, connections for a dual node module configuration are the same; the single relay panel being mounted horizontally. To reduce the possibility of failure of the relay panel, the relay used is a special, high-reliability device. See subsection 2.5.3 for examples of redundant port cabling configurations.

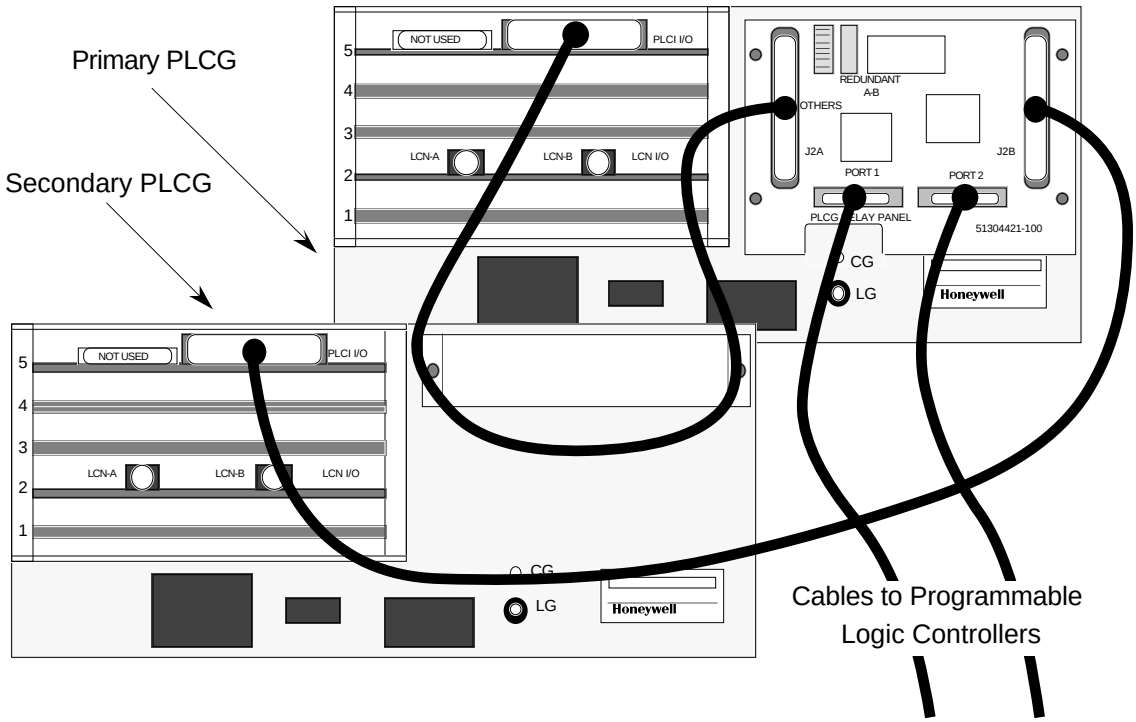


Figure 2-2 — PLCG Modules in a Redundant Configuration 3062

If you use Modbus protocol in this redundant configuration, both ports (Port 1 and Port 2) must be connected to Modbus compatible equipment. The configuration is again capable of serving up to 16 PLCs on both ports. The pinning header on the PLCG Relay Card must be plugged into the **OTHERS** socket. See subsection 3.2.4 and Figure 3-3 for a more detailed illustration of the pinning sockets and header.

If you use A-B protocol in a redundant configuration, only Port 1 may be used. You must plug the pinning header on the PLCG Relay Card into the **REDUNDANT A-B** socket and be sure no cable is connected to Port 2. This configuration is capable of serving up to 16 PLCs on Port 1 through an Allen-Bradley communications controller. See subsection 3.2.4 and Figure 3-3 for a more detailed illustration of the pinning sockets and header.

NOTE

Ports 1 and 2 are independent ports in either nonredundant or redundant configurations and, as such, cannot support the same tag names on different ports. For this reason, PLCG redundancy applies to the electronics modules within the TDC 3000^X equipment and cannot be configured to provide PLC Network Cable redundancy.

2.4.3 Limitations

There are certain limitations and several options which must be considered in planning your installation.

2.4.3.1 Physical Limitations

In a redundant application, the primary and secondary PLCG modules generally mount in the same rack, or in the same dual node module. They are normally installed close to each other because the interconnect cable (between primary and secondary PLCGs) is only 2 meters long.

If you have a specific reason for separating the PLCG modules further, thereby substituting a longer interconnect cable, you must reduce the cable-length of each cable connected to Port 1 and Port 2 by the same amount that you have increased the length of the interconnect cable. Obviously, the length of a substitute interconnect cable must be less than 15 meters.

2.4.3.2 Single vs Multidrop Cabling

There must be only a single cable from a port to the PLC, modem, or communications controller that port is to service.

If you want to use a Modbus protocol multidrop arrangement, you must place a local modem at the PLCG with remote modems connected to each of the PLCs in the network.

Allen-Bradley (A-B) protocol multidrop arrangements always connect through an Allen-Bradley communications controller (a CIM for Communications Interface Module). Since this communications controller supplies the multidrop connections, only a single cable is needed from the PLCG port to the A-B controller.

2.4.3.3 Cable Lengths

The cables from the PLCG ports cannot be longer than 15 cable-meters (50 cable-feet). If the distance to a PLC or communications controller exceeds this limit, you must use short-haul modems. See subsection 2.5 for modem considerations. Subsection 3.2.6 shows how to wire the RS-232 cable supplied by Honeywell so that it will interface a modem.

2.4.3.4 Direct-Connection

If you are connecting a single PLC (or an A-B communications controller) to one of the ports, and the cable-length from the PLCG to the PLC is less than 15 cable-meters, you may use an RS-232 direct-connection (no modems).

In this arrangement, the RS-232 cable supplied by Honeywell must be specifically wired to a connector which mates your PLC. Subsections 3.2.7 and 3.2.8 show cable wiring schemes for several types of PLCs and interface devices.

2.5 PLCG TO PLC CONNECTIONS

2.5.1 Modem Usage and Selection

Either direct-connection or short-haul modems (sometimes called line-drivers) can be used with the PLCG. As mentioned earlier, direct-connection is limited to a maximum of 15 cable-meters.

A short-haul modem presents an RS-232 hardware interface to the PLCG or PLC similar to that presented by conventional telephone modems. The short-haul modem, however, uses separate lines (not telephone lines) and may take some liberties with interface protocol that would not be acceptable in conventional telephone modem communications.

Conventional telephone modems are not used with the PLCG because they severely limit bandwidth, and their necessary low speeds (baud rate) might degrade performance. Where the text that follows reads "modem," substitute "short-haul modem" because of these limitations.

Use short-haul modems over moderate distances (a maximum range of 2 to 4 kilometers). Honeywell has given limited exposure to a couple of these modems and have found they performed adequately with the PLCG—see Table 2-1 for their specifications.

Table 2-1 — Short-Haul Modem Examples

MANUFACTURER	MODEL NO.	DESCRIPTION
Black Box Co. Box 12800 Pittsburgh, PA 15241 (412) 746-5500	LD485A	64 Drops* maximum, 4-wire 26 AWG Twisted Pair Estimated maximum distance versus speed: 2.0 km (1.2 Miles) @ 19.2 k baud 2.7 km (1.7 Miles) @ 9600 baud 3.7 km (2.3 Miles) @ 4800 baud
AEG-Modicon, Inc. (see Local Representative)	J478	32 Drops* maximum, 4-wire 22 AWG Shielded twisted pair (Modicon recommends Belden #8777 or equivalent) Maximum distance: 4.5 km (2.8 Miles) Maximum speed: 19.2 k baud

* Honeywell supports a maximum of 16 drops on both ports of the PLCG.

There are also some fiber-optic "modems" on the market that may be used where the maximum distances above are insufficient. Please check with your Honeywell representative before utilizing this type of equipment in your application.

2.5.2 Nonredundant PLCG Port Connections

Figure 2-3 (A) and (B) illustrate examples of directly connecting PLCs to a nonredundant PLCG. A maximum of only two PLCs may be connected in this manner.

Notice the cables can be no longer than 15 meters. Also note the cables must be wired so that both the PLCG and the PLCs "think" they are connected to a modem. Details of this cross-wiring will be covered in subsections 3.2.7 and 3.2.8.

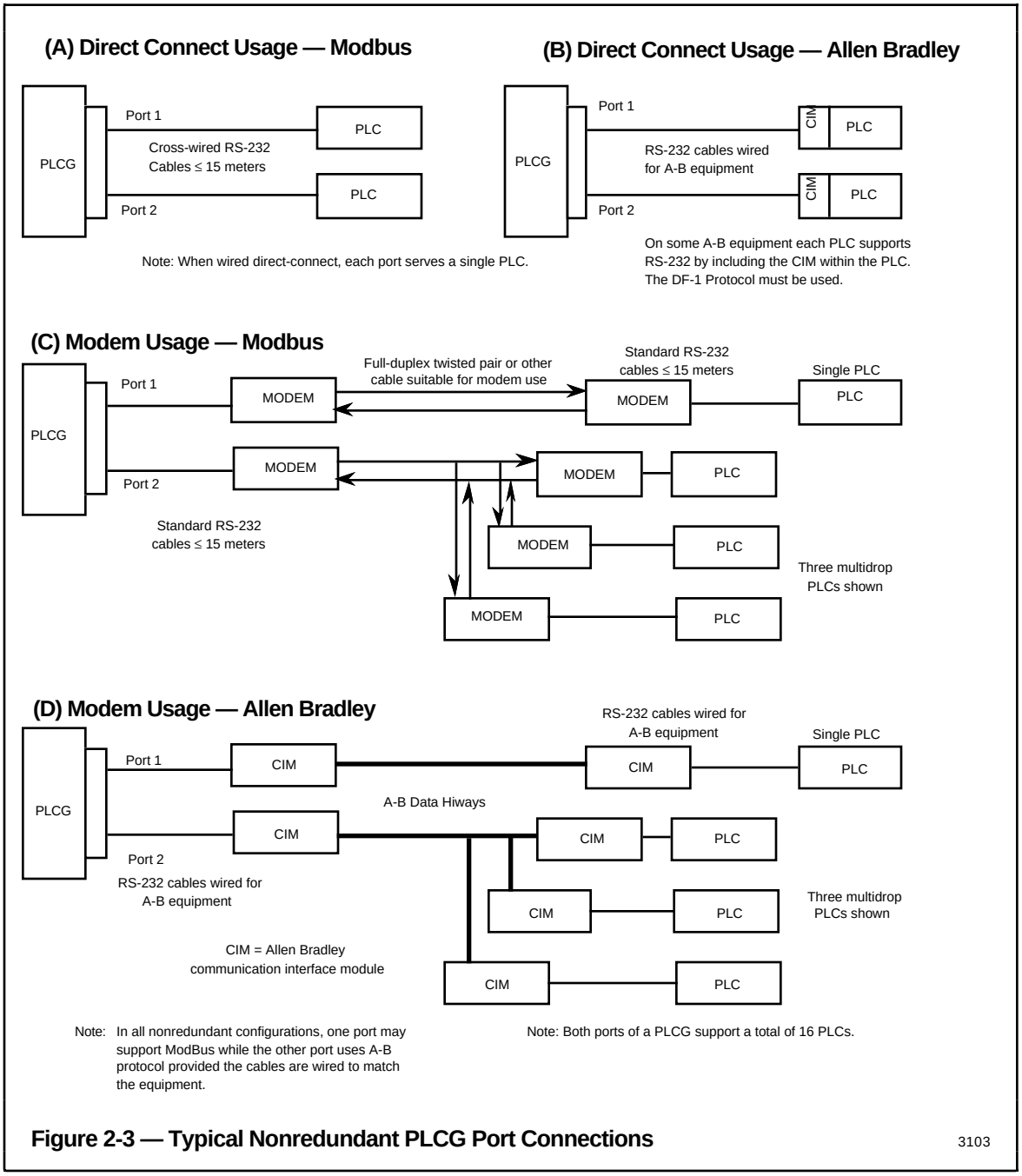


Figure 2-3 — Typical Nonredundant PLCG Port Connections 3103

Allen-Bradley includes their CIM (Communications Interface Module) inside some PLC models, allowing the "direct" connection shown in (B). See Section 3 for detailed wiring of this cable.

Figure 2-3 (C) and (D) illustrate examples of modem usage from a nonredundant PLCG.

The modems used in illustration (C) are the short-haul modems previously discussed. The single PLC connected via two modems to Port 1 illustrate a maximum-length configuration which will service a PLC at the greatest distance from the PLCG.

The multidrop PLCs connected to Port 2 in illustration (C) show a typical "network" of PLCs using the Modbus protocol. These drops are connected half-duplex with the "local" modem connected to the PLCG and "remote" modems connected to the PLCs. The local is a "master" which commands each remote to respond at a specific time. Additional loading caused by several modems on the network may reduce the overall length of the network twisted pair cable; consult the manuals for your modem for particulars. Specific details for wiring and pinning these modems are contained in subsection 3.2.6.

Illustration (D) shows Allen-Bradley equipment connected in similar arrangements to illustration (C). Allen-Bradley protocol is full-duplex; that is, any PLC or the PLCG may "talk" at any time. Allen-Bradley requires use of their own CIMs which interface their own Data Hiway. Refer to subsection 3.2.8 and your Allen-Bradley manuals for specifics.

2.5.3 Redundant PLCG Port Connections

Figure 2-4 (A) and (B) illustrate examples of direct-connection to PLCs from a redundant PLCG. Note there can be only two PLCs connected in this manner if you are using Modbus protocol or only one PLC if you are using the Allen-Bradley protocol.

Port 2 cannot be used with Allen-Bradley protocol because the protocol is full-duplex and messages may be sent and received simultaneously. The redundant PLCG firmware uses that port to "listen" to outgoing messages while Port 1 is receiving messages. Modbus protocol is half-duplex and messages are not sent and received simultaneously.

Notice Figure 2-4 (C) and (D) are very similar to those illustrations in Figure 2-3. Allen-Bradley full-duplex operation prevents Port 2 from being used, but there is little loss of capability since up to 16 PLCs may be connected to the same network.

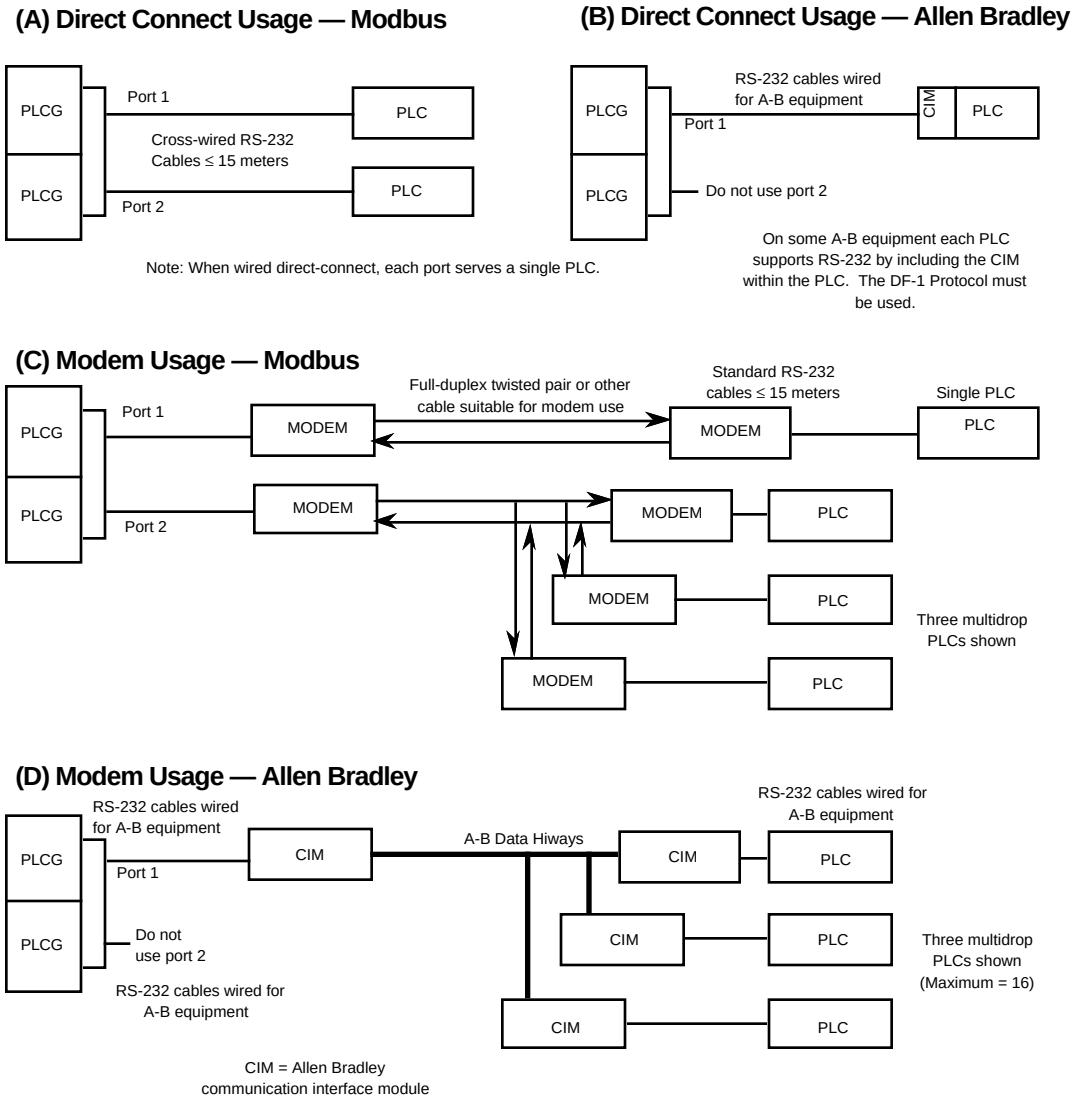


Figure 2-4 — Typical Redundant PLCG Port Connections 3104

INSTALLATION
Section 3

This section provides information for unpacking and assembling the PLCG.

3.1 UNPACKING

When the equipment arrives at the system site, open each shipping box, remove the protective wrapping and carefully inspect each piece for any physical damage. If damaged, immediately notify the carrier and your Honeywell sales representative as to the extent and type of damage. Also check each piece of equipment against the invoice list for any missing items.

3.2 ASSEMBLY AND CABLING

Refer to Figure 2-1 for an illustration of a nonredundant PLCG installation. Note the PLCG relay panel located on the rear of the module.

Refer to Figure 2-2 for an illustration of a redundant PLCG installation. Note the PLCG relay panel is only mounted on the primary PLCG.

NOTE

Some assembly and cabling of this equipment may have been done at the factory. If so, please check your equipment and verify its installation is similar to that described.

3.2.1 Module Installation

If you are installing a redundant PLCG pair, you have two PLCG modules. Install the primary PLCG module first.

1. Remove the primary PLCG module (with relay panel) from its shipping carton.
2. Securely fasten the PLCG module to its rack-mount with the hardware provided.
3. Connect ground straps or leads from the base of the cabinet (or a nearby module) to the appropriate chassis-ground and logic-ground connections on the rear of the PLCG module. Refer to the *LCN System Installation* manual in the *LCN Installation* binder for further grounding information.
4. Insure the power switch on the front of the PLCG module is off. Install the module power cord supplied. Refer to *LCN System Installation* manual in the *LCN Installation* binder for power wiring information.

If this is a redundant installation, repeat steps 1 through 4 on the secondary PLCG module.

3.2.2 LCN Node Pinning

By convention, the node address for a nonredundant PLCG is even. The node addresses for a redundant pair is even for the primary PLCG and numerically one higher (odd) for the secondary PLCG.

If you are installing a nonredundant PLCG, perform the following steps on the PLCG module. If this is a redundant PLCG installation, perform these steps twice, using a node address on the secondary PLCG one higher from that of the primary PLCG.

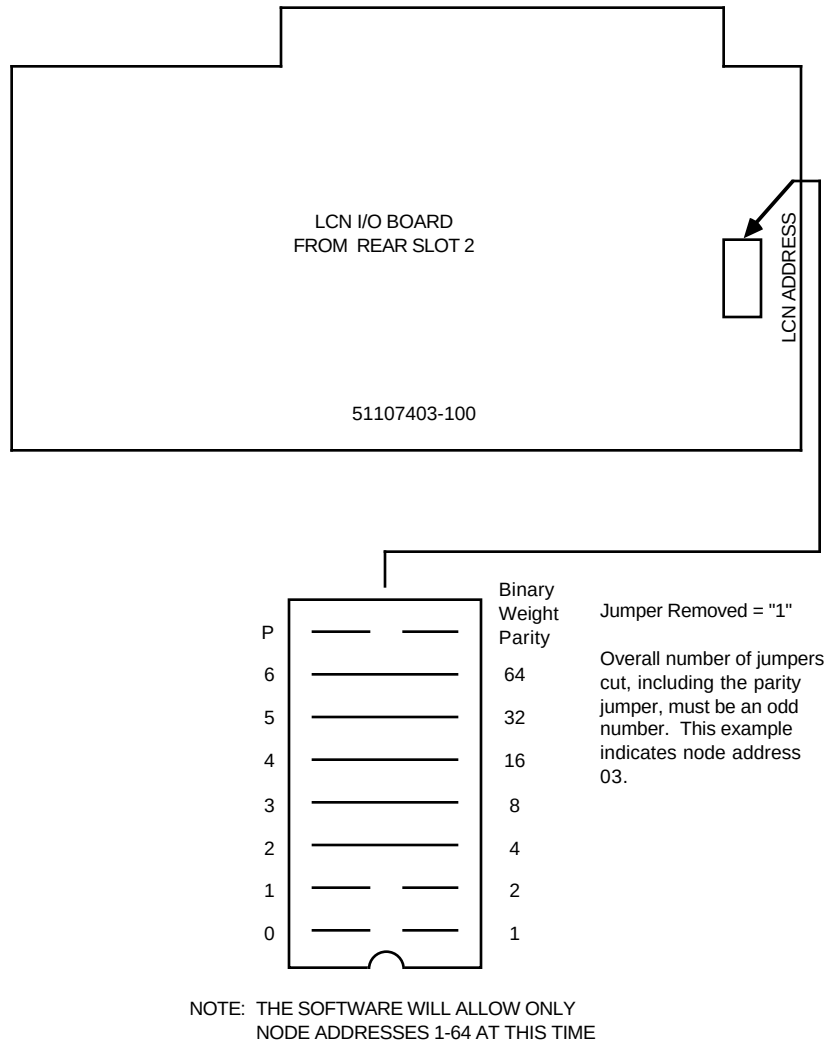


Figure 3-1 — LCN I/O Board, Address Jumpers 2923

3.2.3 CLCN Node Pinning

By convention, the node address for a nonredundant PLCG is even. The node addresses for a redundant pair is even for the primary PLCG and numerically one higher (odd) for the secondary PLCG.

If you are installing a nonredundant PLCG, perform the following steps on the PLCG module. If this is a redundant PLCG installation, perform these steps twice, using a node address on the secondary PLCG one higher from that of the primary PLCG.

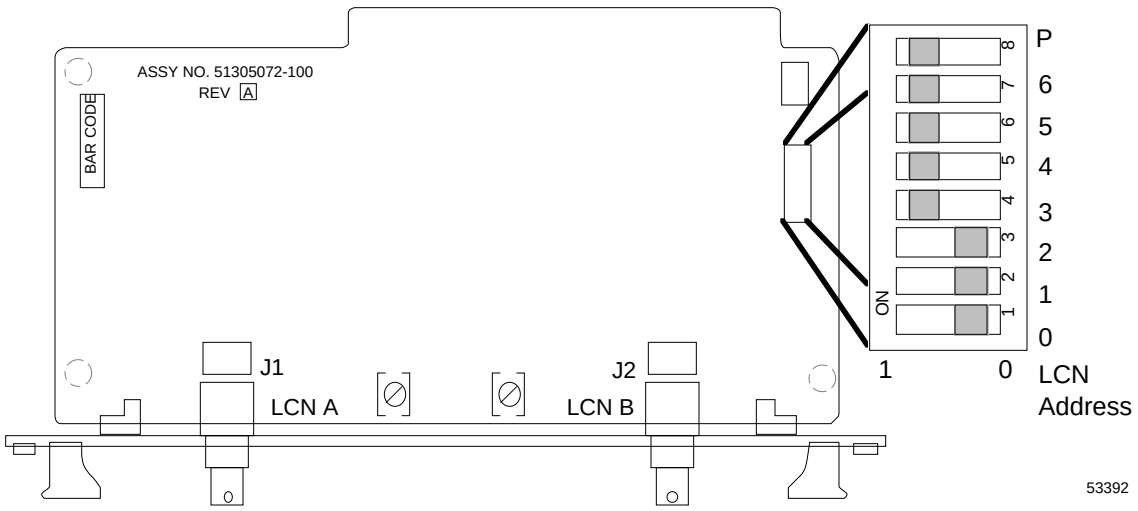


Figure 3-2 — LCN I/O Board, Address Jumpers

1. Remove the LCN I/O paddleboard from rear slot 2 in the PLCG module. Refer to Figure 3-1 for instructions and the location of the pinning header on the LCN I/O board. Pin the node address as shown. Be sure to adjust the parity jumper as required.

2. Reinstall the LCN I/O paddleboard.

3.2.4 EC Equipment Installation

The I/O board interfaces both LCN cable A and Cable B to the KxLCN board or LLCN in a Five-Slot Module and Ten-Slot Module. New I/O boards and inteface cabling are developed to support the EC community standards. The following illustrations show the new hardware.

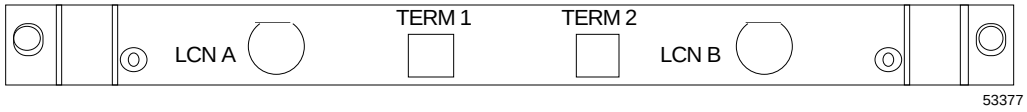


Figure 3-3 — CLCN A/B Faceplate

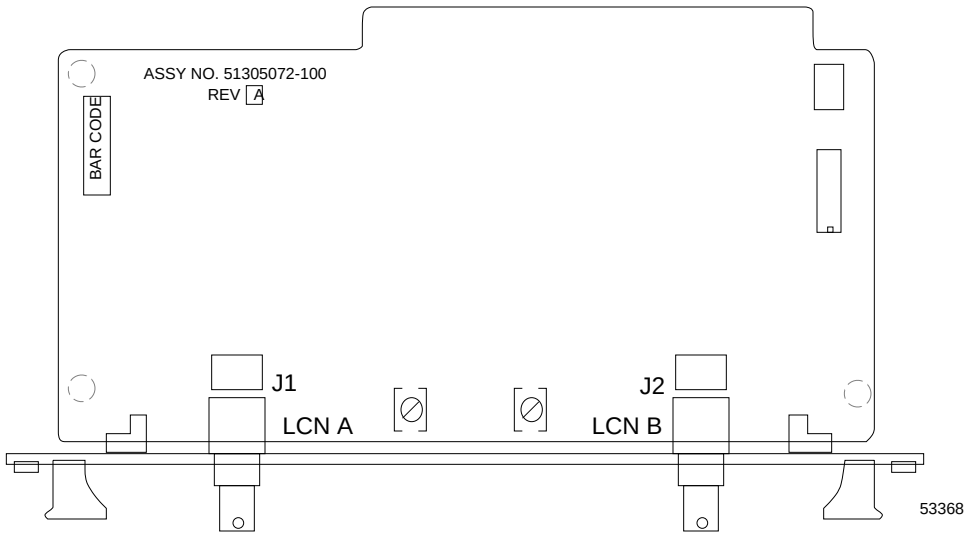


Figure 3-4 — CLCN A/B I/O Board

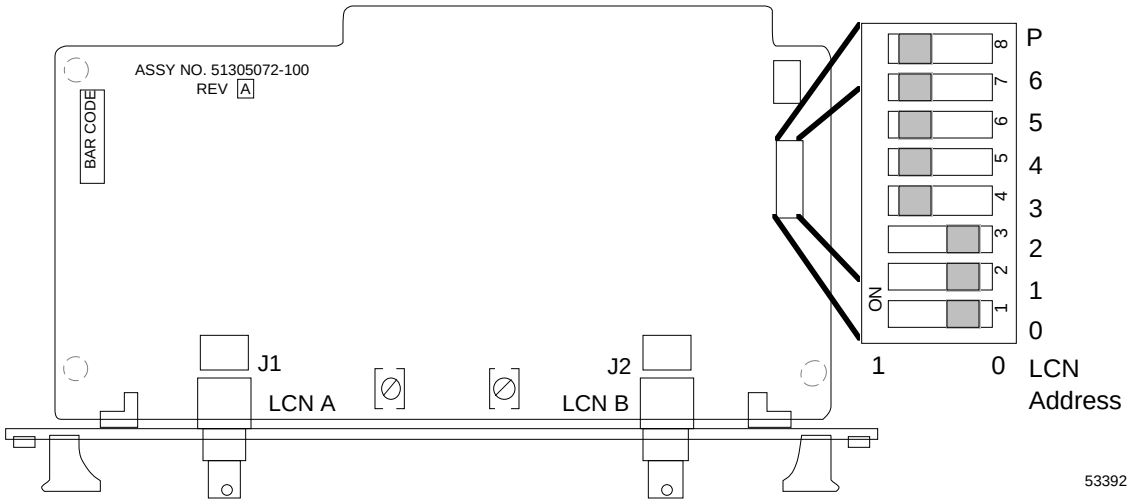


Figure 3-5 — CLCN A/BI/O Address Pinning

3.2.5 PLCI Pinning

Refer to Figure 3-6 to locate the pinning headers and jumpers in the following steps. If you are installing a redundant PLCG pair, both PLCI boards must be pinned the same way.

3.2.5.1 Ram Clear (J1)

Locate J1 and insure that a jumper is installed.

3.2.5.2 Board Revision (TS1)

Do not alter TS1, the Board Revision header.

3.2.5.3 Baud Rate and Parity (TS2)

The baud rate of the two serial interfaces serving Ports 1 and 2 are set-up with the jumpers on TS2 (near right-center in Figure 3-6). See Table 3-1 (or the table on the PLCI board) for the pinning information. Be sure the baud rate for a given port matches the PLC(s) it is communicating with. The baud rates of the ports may be set at different speeds. Notice Port 1 uses the higher-numbered pins.

The transmit and receive data parity for Ports 1 and 2 are set by jumpers 5 and 1, respectively. To send and receive odd parity on a port, its respective jumper must be shorted. Conversely, even parity is obtained by the jumper being open. Make sure the parity of a port agrees with the parity sent and expected by the PLC(s) to which it is connected.

Table 3-1 — Baud Rate Pinning on PLCI Board

BAUD RATE	PORT 2			PORT 1		
	PIN 2	PIN 3	PIN 4	PIN 6	PIN 7	PIN 8
50	OPEN	OPEN	SHORT	OPEN	OPEN	SHORT
150	OPEN	SHORT	OPEN	OPEN	SHORT	OPEN
300	OPEN	SHORT	SHORT	OPEN	SHORT	SHORT
1200	SHORT	OPEN	OPEN	SHORT	OPEN	OPEN
2400	SHORT	OPEN	SHORT	SHORT	OPEN	SHORT
4800	SHORT	SHORT	OPEN	SHORT	SHORT	OPEN
9600*	SHORT	SHORT	SHORT	SHORT	SHORT	SHORT
19.2KB	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN

*Honeywell factory setting is 9600 baud

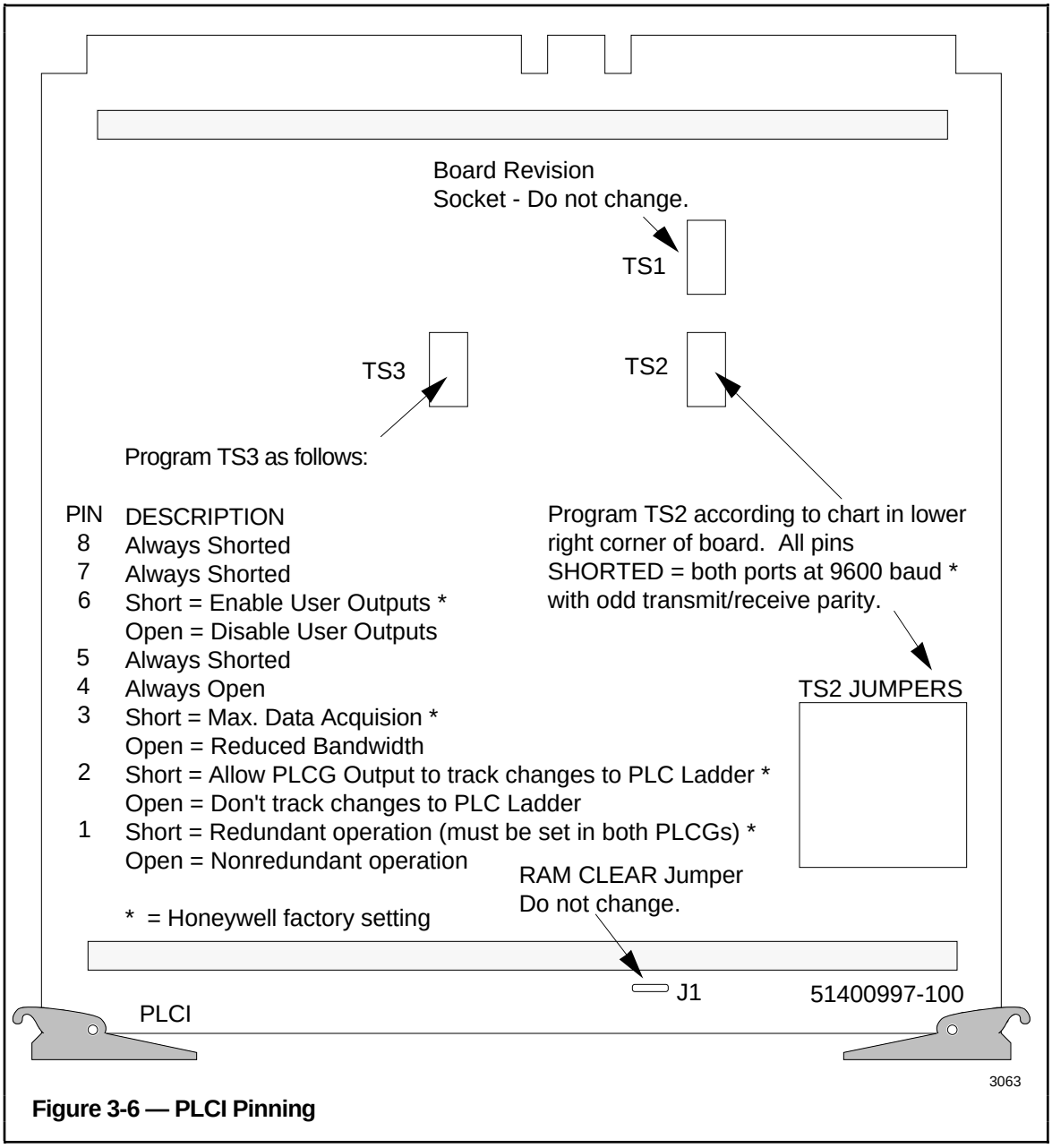


Figure 3-6 — PLCI Pinning

3.2.5.4 Program Options (TS3)

Pin 1 If you are installing a redundant PLCG, leave pin 1 shorted (it must be shorted on the PLCI board in both PLCGs). If you are installing a nonredundant PLCG, open pin 1.

Pin 2 This pin is only recognized in applications involving Modbus protocol. If you want the PLCG to track changes to the digital outputs made by the PLC ladder logic, leave pin 2 shorted. The PLCG will include the digital outputs in its periodic scan.

If you do not want changes in the ladder logic tracked, open this pin. Note that in this mode, the Modbus digital outputs are scanned immediately after the emulated DHP Enable Processing command. Thereafter, digital outputs are updated using PLC write echo data.

Pin 3 If you want the PLCG to acquire data at the maximum rate, leave pin 3 shorted. If you want the acquisition rate reduced, open this pin. Note that with this pin shorted, data is double-buffered; when the pin is opened, one data buffer is disabled.

Pin 4 Always leave this pin open.

Pin 5 Always leave this pin shorted.

Pin 6 If you want the PLC to receive user outputs via Analog outputs, Digital outputs, and Timer/Counters, leave Pin 6 shorted. If you want to suppress user outputs to the PLC, open Pin 6.

Pins 7 & 8—Always leave these pins shorted.

3.2.6 PLCG Relay Panel Pinning

Refer to Figure 3-7. If you are installing a nonredundant PLCG or if you are assembling a redundant Modbus installation, check that the header on the relay panel is in the **OTHERS** socket.

If you are assembling a redundant Allen-Bradley installation, be sure the relay panel header is in the **REDUNDANT A-B** socket.

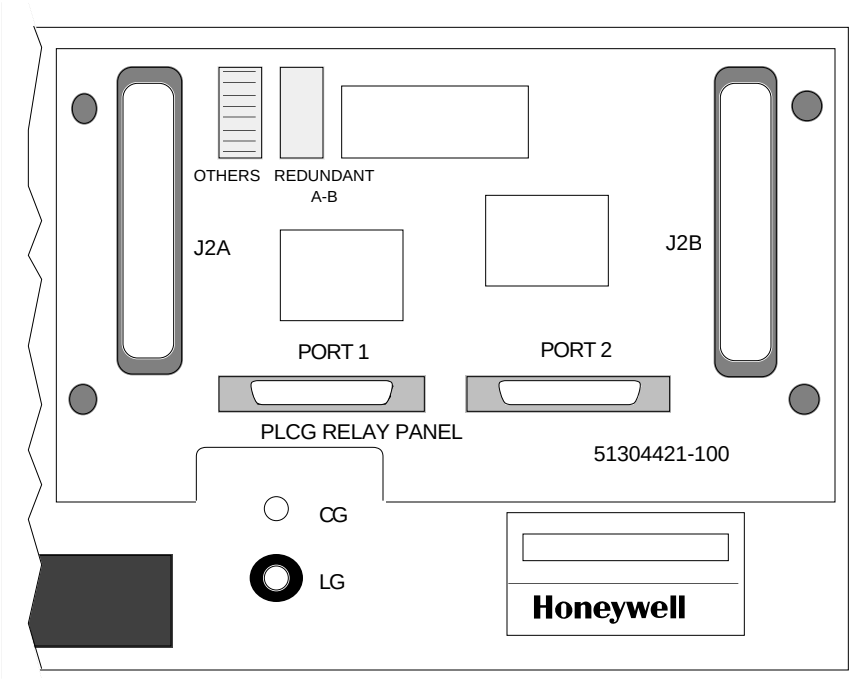


Figure 3-7 — PLCG Relay Panel 3105

3.2.7 PLCG Cabling

1. Connect a 1 meter (3 ft.) cable (30731611-001) from J2A on the relay panel to J2 on the PLCI I/O board in same PLCG module. If necessary, refer to Figure 2-1.

2. If this is a redundant PLCG installation, connect a 2 meter (6 ft.) cable (30731611-002) from J2B on the relay panel to J2 on the PLCI I/O board in the secondary PLCG module. If necessary, refer to Figure 2-2.

3. Be sure the two latches which secure each cable-end to its connector are fastened on all of the cables.

3.2.8 Port Cabling and Pinning for Modems Using Modbus Protocol

NOTE

Two 51304514-100 field port cables, each without a plug on one end, have been shipped with your PLCG. You must purchase and install the proper plugs to mate your brand and model of equipment. This section will aid you in selecting and wiring those plugs.

3.2.8.1 Modem Cable

For connection to a Modicon J478 modem or other short-haul modem serving a Modbus port as illustrated in Figure 2-3 (C) or 2-4 (C), install a connector on the free-end of cable 51304514-100 using Figure 3-8 as a guide. Use a standard 25-pin male, D-Sub connector.

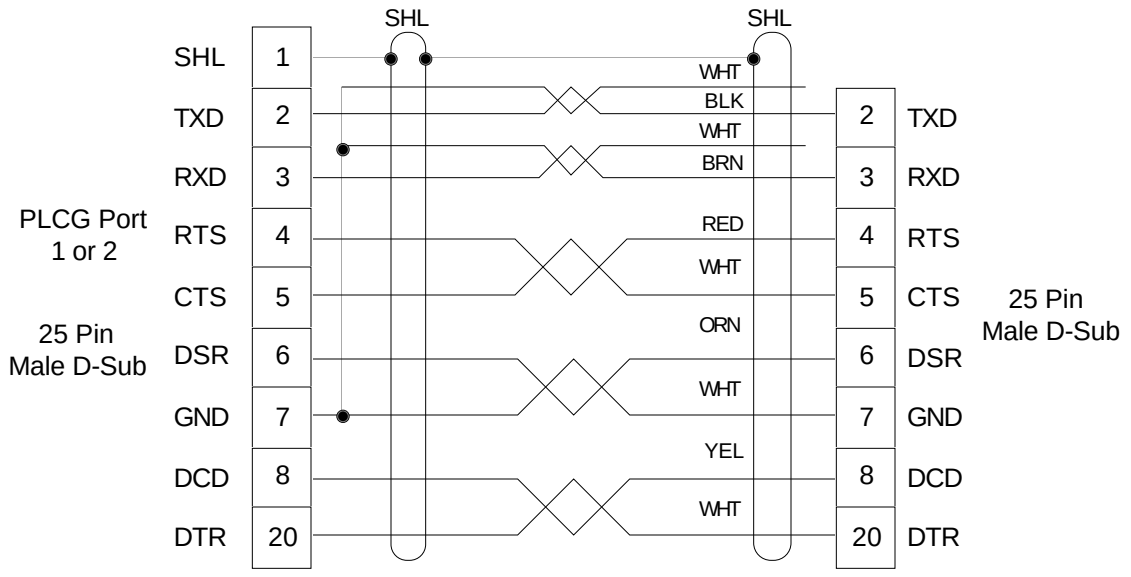


Figure 3-8 — Cable for a Modem Serving Modbus Protocol 3067

3.2.8.2 Modem Wiring

Use the instruction manual provided with your modems to install modem wiring between all of the modems. Be sure the wiring meets the following criteria.

- The multidrop modem "telephone lines" must be 4-wire, full-duplex with the line-driver of the local modem (PLCG end) in parallel with the line-receivers of all remote modems (PLC ends). Likewise, the line-drivers of all remote modems are in parallel with the line-receiver of the local modem.

- A single pair of modems (point-to-point) must also be 4-wire, full-duplex with the line-driver of each modem in parallel with the line-receiver of the other modem.

3.2.8.3 Modem Pinning

Use the instruction manual provided with your modems to properly pin your modems. Be sure they meet the following criteria.

- The local (PLCG end) modem must be pinned to hold its transmitter enabled at all times, normally by putting RTS/CTS in the ON position.

  The local modem must also be pinned to hold RXD in the marking state in the absence of a valid carrier.

- Each remote (PLC end) multidrop modem must be pinned to enable its transmitter only when the PLC raises RTS.

  All remote modems must also be pinned for an RTS/CTS delay of approximately 5 to 15 milliseconds. This delay can be determined empirically by the user, based upon the hardware he has chosen. We have found the LD485A Black Box modems (Table 2-1) operate satisfactorily using the 5 millisecond delay.

- RTS/CTS delay need not be pinned in the local modem of a multidrop network, and is also immaterial in a point-to-point arrangement.

3.2.9 Port Cabling for Direct Connection to Modbus Equipment

NOTE

Two 51304514-100 field port cables, each without a plug on one end, have been shipped with your PLCG. You must purchase and install the proper plugs to mate your brand and model of equipment. This section will aid you in selecting and wiring those plugs.

If wiring information is not given here for your equipment, check with Honeywell's Multivendor Interface Program. If an MVI Program Test Report is available for that equipment, cable wiring information will be given in that report.

For direct connection to Modbus protocol PLCs as illustrated in Figure 2-3 (A) or 2-4 (A), use Table 3-2 to find the model number of the equipment you are using. From the table, locate the Figure which will aid you in obtaining the proper connector, then install it on the free-end of cable 51304514-100.

Table 3-2 — Modbus Protocol Cable Wiring Locator

PROGRAMMABLE CONTROLLER MAKE AND MODEL		FIGURE NUMBER
Honeywell	Honeywell 620 with 620-0043 CIM	Figure 3-9
Modicon	184 with J347 interface	Figure 3-9
Modicon	384 with J347 interface	Figure 3-9
Modicon	584	Figure 3-10
Modicon	884	Figure 3-9
Modicon	984	Figure 3-9
Triconex	4101 EICM	Figure 3-13 *

*This device employs the Modbus protocol but uses a cable identical to one used for Allen-Bradley devices.

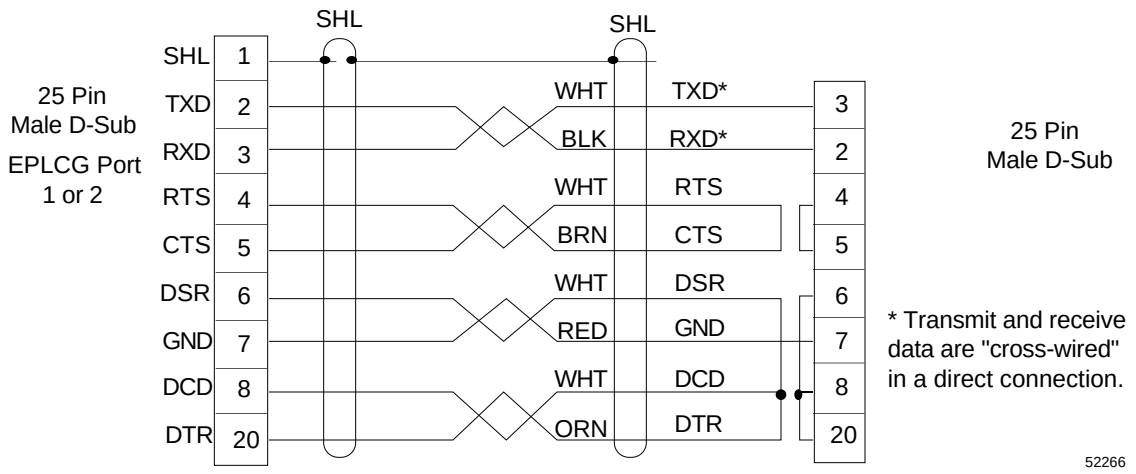


Figure 3-9 — Cable for Direct Connection to Modicon 884/984 and Others

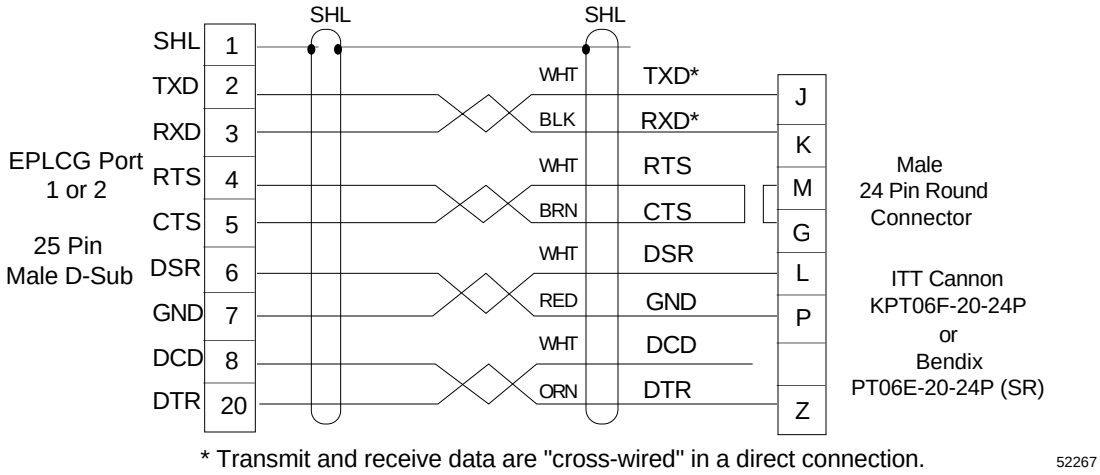


Figure 3-10 — Cable for Direct Connection to Modicon 584

3.2.10 Port Cabling for Equipment Using Allen-Bradley Protocol

NOTE

Two 51304514-100 field port cables, each without a plug on one end, have been shipped with your PLCG. You must purchase and install the proper plugs to mate your brand and model of equipment. This section will aid you in selecting and wiring those plugs.

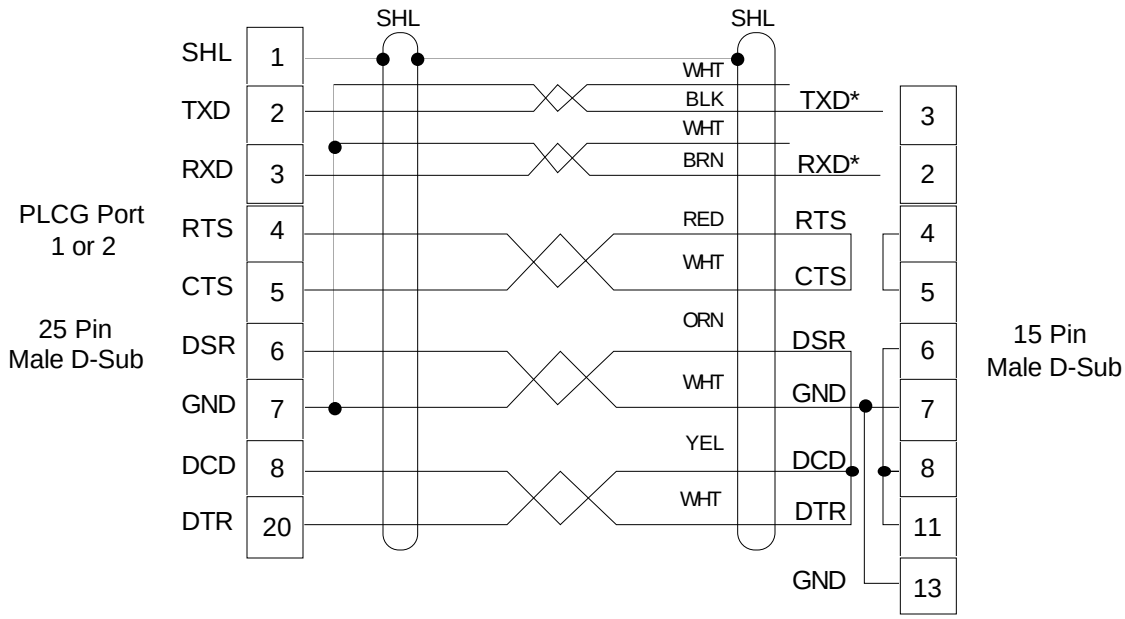
If wiring information is not given here for your equipment, check with Honeywell's Multivendor Interface Program. If an MVI Program Test Report is available for that equipment, cable wiring information will be given in that report.

3.2.10.1 Direct Connection to Allen-Bradley Controllers

For connection to Allen-Bradley protocol PLCs as illustrated in Figure 2-3 (B) or (D) and 2-4 (B) or (D), use Table 3-3 to find the model number of the equipment you are using. From the table, locate the figure which will aid you in obtaining the proper connector, then install it on the free-end of cable 51304514-100.

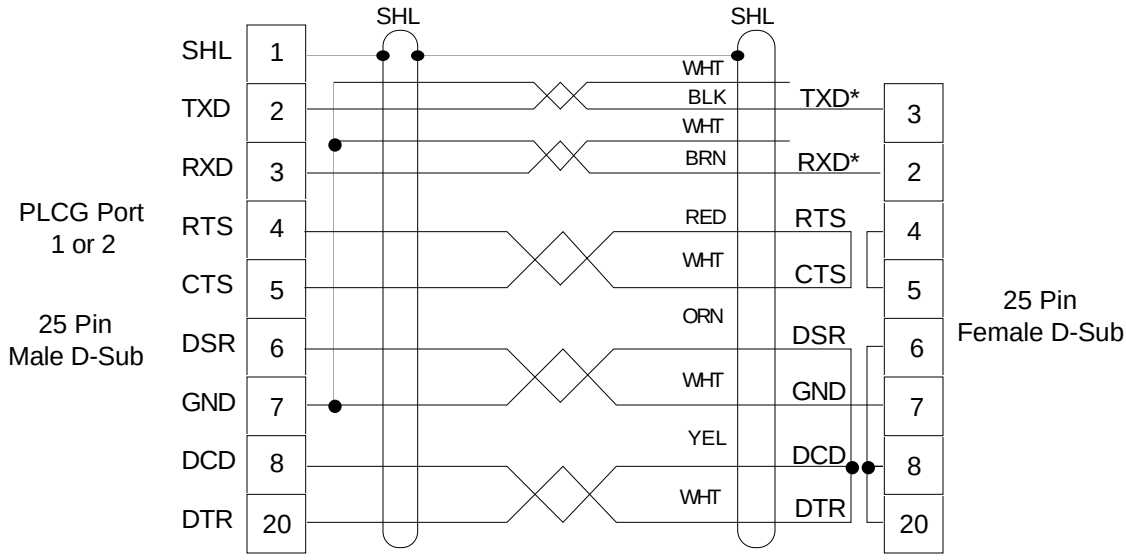
Table 3-3 — Allen-Bradley Protocol Cable Wiring Locator

PROGRAMMABLE CONTROLLER MAKE & MODEL		FIGURE NUMBER
Allen-Bradley	1770-KF2	3-8
Allen-Bradley	1771-KE	3-7
Allen-Bradley	1771-KF	3-7
Allen-Bradley	1771-KG	3-7
Allen-Bradley	1775-KA	3-8
Allen-Bradley	1779-KFL	3-9
Allen-Bradley	1779-KFLR	3-9
Allen-Bradley	1785-KE	3-7



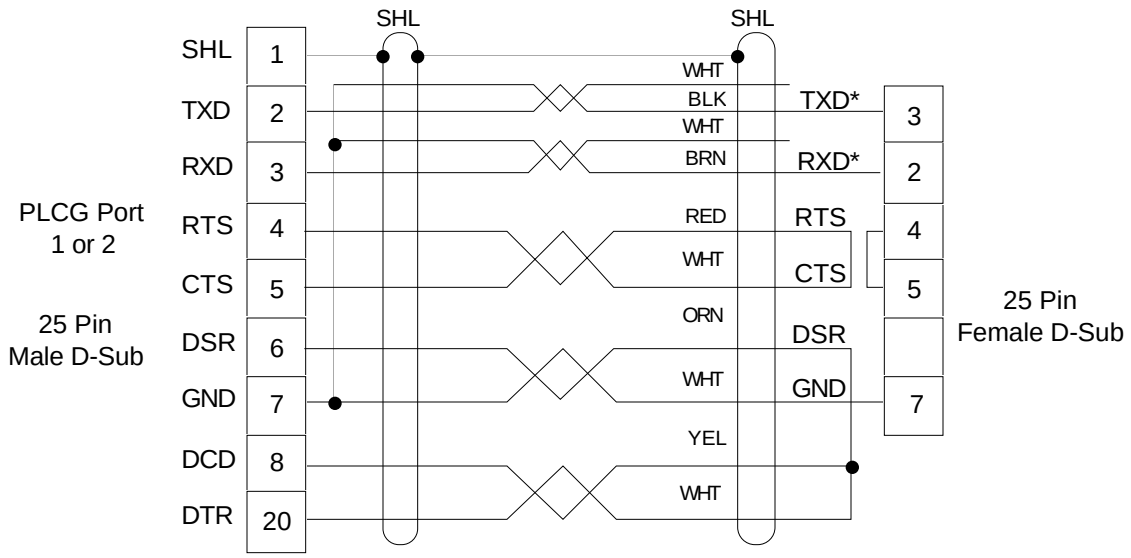
* Transmit and receive data are "cross-wired" in a direct connection

Figure 3-11 — Cable for Allen-Bradley 1771-KE, KF, KG and 1785-KE 3070



* Transmit and receive data are "cross-wired" in a direct connection

Figure 3-12 — Cable for Allen-Bradley 1770-KF2 and 1775-KA 3071



* Transmit and receive data are "cross-wired" in a direct connection

Figure 3-13 — Cable for Allen-Bradley 1779-KFL, KFLR and Triconex 4101 EICM 3072

3.2.10.2 Allen-Bradley CIM Pinning

Methods for pinning CIMs vary between models. The parameters listed in Table 3-4 are common to all PLCG/A-B configurations—use them as a guide.

Table 3-4 — Allen-Bradley Communications Interface Module Settings

PARAMETER	SETTING
BAUD RATE	Set the same as the PLCG field port. Do not set above 9600 baud on the KF2. The KE/KF may be set to 19.2 kbaud (see A-B manual).
PARITY	EVEN
BCC/CRC	BCC (Block Check Character)
HANDSHAKING	OFF
DH/DH+	As required by A-B devices
RS-232/422	RS-232
DIAGNOSTICS	Execute diagnostics locally
EMBEDDED RESPONSES	ON
DUPLICATE MESSAGE DETECT	ON

3.3 INSTALLATION WRAP-UP

Dress all cables neatly and out of the way to protect them from accidental damage. Plug all modems and PLCG modules into their proper receptacles.

CHECKOUT
Section 4

This section tells you how to check the PLCG after it has been installed, plugged in and is ready to go.

4.1 POWER-ON TESTS

You do not need to have the PLC equipment installed or connected to perform the checks in this section. Do not, however, perform any of these tests until all other parts of the PLCG have been installed according to Section 3.

4.1.1 Electronics Checks

Perform these electronics checks on the PLCG electronics module. If this is a redundant PLCG installation, perform these checks on both PLCG modules.

1. Remove the front cover of the PLCG module. Before turning power on, ensure the **LO-NOM-HI** jumper or switch on the front of the power supply is in the center or **NOM** position.

2. Set the **POWER** switch to **ON** while observing the LEDs on the power supply, fan assembly, and on the individual cards in the unit.

   Note that the red LEDs on the boards light for a few seconds (it takes less than 30 seconds to complete the power-up tests), then they turn off and the green LEDs turn on. If any red LEDs on the boards remain on, some portion of the power-up tests have failed—record the alphanumeric status display code and proceed to *Five/Ten-Slot Module Service* manual in the *Service* binder.

   If the power-up test is successfully completed for all nodes, all green LEDs on all boards are on (there may also be some yellow LEDs on or flashing), and the alphanumeric status display indicates the node address you set in Section 3.2.2 of this manual.

3. Check the power supply status LEDs (**POWER OK** and **ERROR**) and the **FAN ALARM** LED. Note that the **FAN ALARM** and **ERROR** LEDs are off and the **POWER OK** LED is on (it is a fault condition if both the **ERROR** and **POWER OK** LEDs are **ON**).

4. Press the momentary **RESET** switch. Note the power-up tests are initiated similar to step 2, and the results are satisfactory.

5. Replace the front cover.

4.2 STARTUP

The PLCG software performs exactly like an HG (Hiway Gateway) and looks exactly like an HG to the operator. To continue further, load the PLCG with the HG personality, use PLCG configuration rules, and later use HG operations.

Configuration information is in the remaining publications in this binder. Loading and operating procedures are in the *Process Operations* binder.

4.3 COMMUNICATIONS AND PERFORMANCE STATISTICS

To assist installation and on-going performance monitoring, the PLC Gateway provides information about PLC communications and certain PLCG performance statistics. Once per second the information is transferred to the database of each (on-scan) emulated DHP making it available at the Universal Station via the System Maintenance Control Center (SMCC). To prevent interference with off-line operations, statistical information is not transferred to the database of an emulated DHP which is not enabled (on-scan). See Figure 4-1.

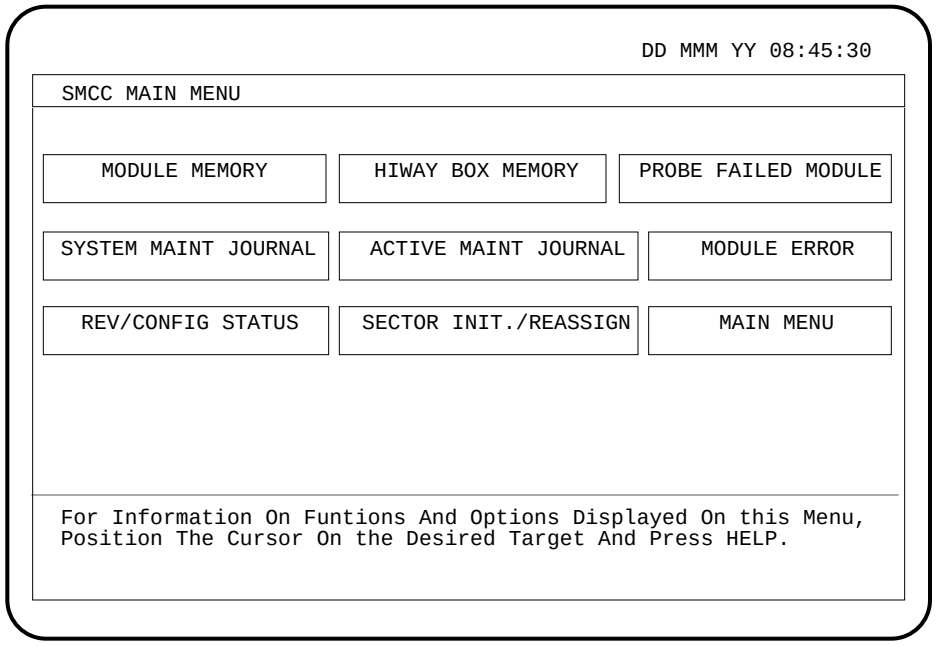


Figure 4-1 — System Maintenance Control Center Main Menu Display

General information on use of the SMCC is in *Maintenance Test Operations* section of the *LCN Service -1* binder.

Selection of the HIWAY BOX MEMORY target of the SMCC's Main Menu brings up a screen requiring specific data to be filled-in. See Figure 4-2.

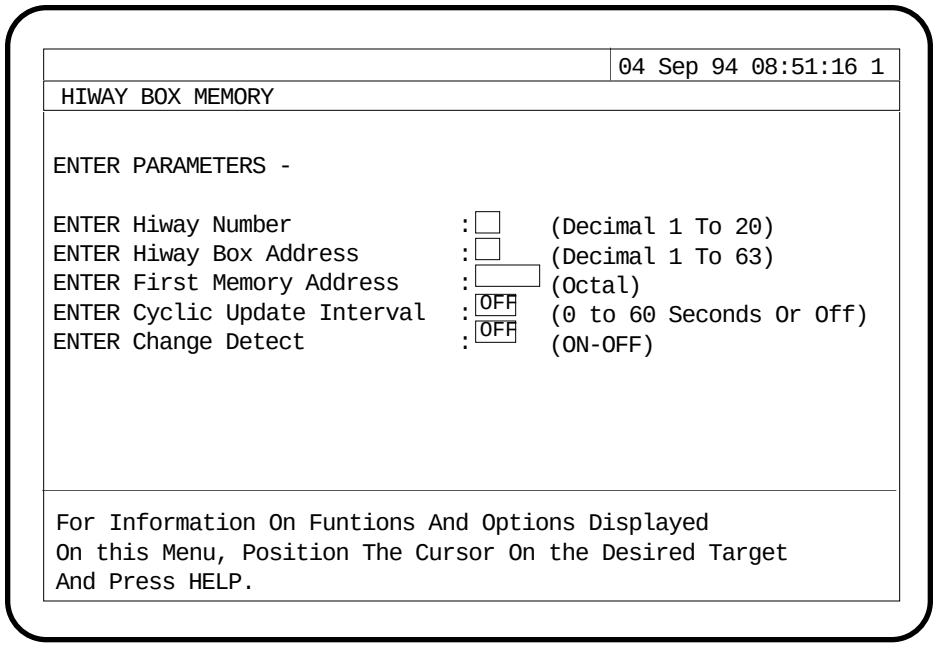


Figure 4-2 — Hiway Box Memory Selection Display

Enter the correct Data Hiway number in the first "port." Add 32 (decimal) to the DHP box number and enter the result in the next "port." Enter "1700" for the First Memory Address. Also, enable "Cyclic Update Interval" and "Change Detect," if desired. Press the Enter key to display the data. See Figure 4-3.

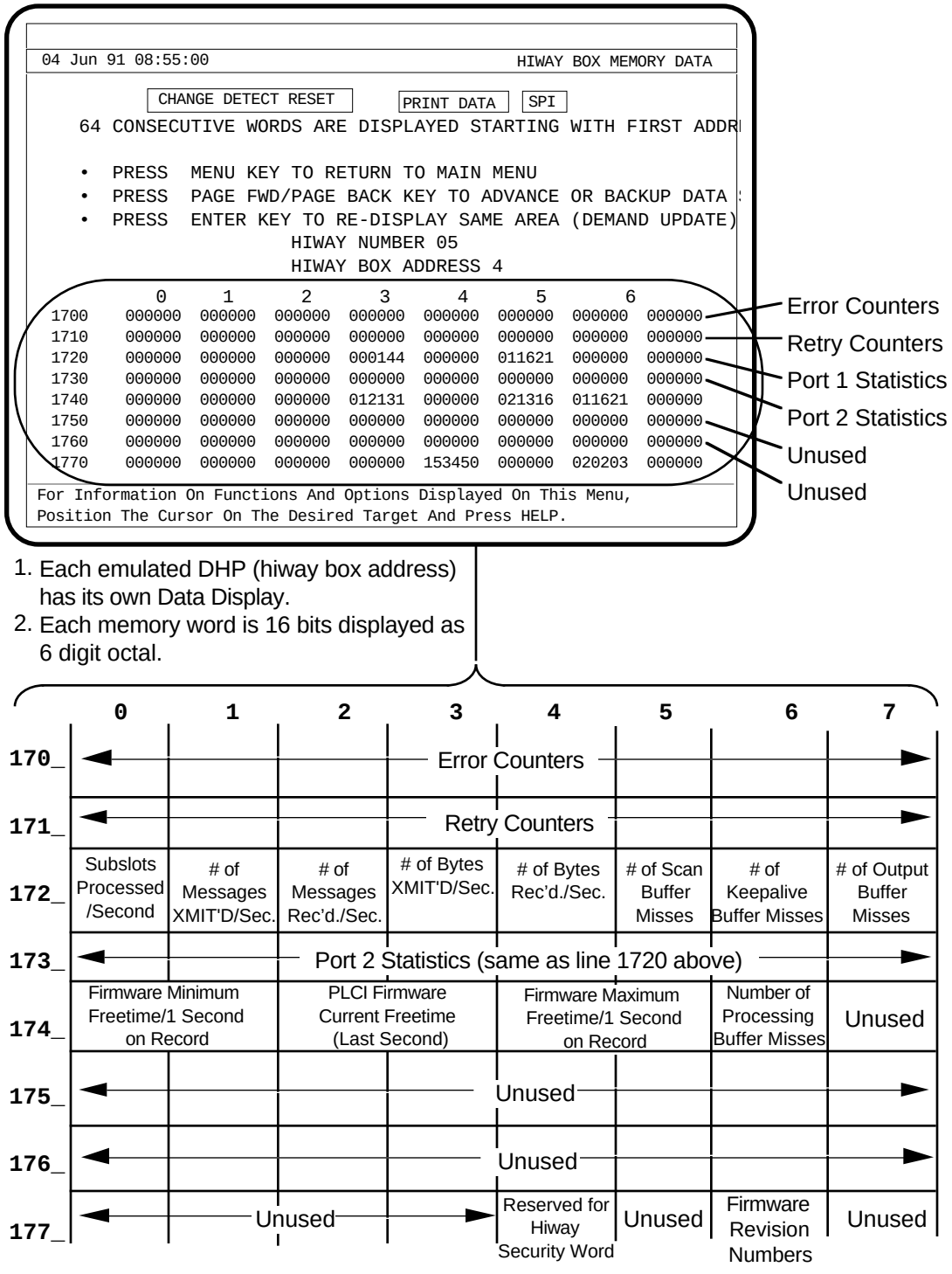


Figure 4-3 — Hiway Box Memory Data Display

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4.3.1 PLC Error and Retry Counters

The PLCG maintains eight communications error counters (Memory addresses 1700-1707 = PC Index 1-8) and eight communications retry counters (1710-1717 = PC Index 1-8) for each configured physical PLC. When a communications error is detected between the PLCG and the physical PLC, the error counter is incremented. If a retry is permitted, the retry counter is incremented before the retry is performed. Once-a-second the counters' results are transferred to the (enabled) DHP's database. Since the counters are kept by physical PLC, all logical PLCs (PC index values) referencing the same physical PLC will show the same counter value. This is true even if the logical PLCs (PC index values) are in different emulated DHPs. The counters are allowed to rollover after reaching maximum value (16-bit counters at maximum displayed as 6 octal digits = $177777_{(8)}$ = $65{,}535_{(10)}$) and are only reset when all emulated DHPs that reference a given physical PLC are disabled (off-scan).

4.3.2 Port Statistics

Statistics for both ports are provided as an approximate measure of PLCG performance

4.3.2.1 Subslots Processed Per Second

Each time the PLCG processes a subslot (parameter) assigned to a given port, a 16-bit counter is incremented and once-per-second the results are transferred to the emulated DHP database. The counter provides a measured (versus calculated) value of the number of subslots processed per second as seen by the PLCG. The number of subslots processed during the last second before the transfer is then displayed in this location (1721/1731) for the respective port.

NOTE

Although TDC 3000^X system software treats a composite tag as a single data point, its implementation requires the use of 2, 3, or 4 subslots in the PLCG. Since the PLCG must collect the data for each subslot in use, PLCG performance must be measured and compared in subslots (parameters) per second. If you wish to convert to TDC tags per second from subslots per second, you must use a correction factor which expresses the number of subslots per TDC tag. To calculate the correction factor, use the equation below. If the system being measured contains any composite TDC tags, the correction factor will have a value less than one.

$$\frac{\text{SUBSLOTS}}{\text{TIME}} \times \frac{\text{overall TAG count}}{\text{overall SUBSLOT count}} = \frac{\text{TAGs}}{\text{TIME}}$$

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4.3.2.2 Number of Messages Transmitted/Second

This location (1721/1731) contains the number of complete messages transmitted through this port in the previous 1- second period.

4.3.2.3 Number of Messages Received/Second

This location (1722/1732) contains the number of complete messages received through this port in the previous 1- second period.

4.3.2.4 Number of Bytes Transmitted/Second

This location (1723/1733) contains the number of bytes transmitted through this port in the previous 1- second period. It includes all control, header, trailer, and BCC/CRC bytes. Multiplying this parameter by 11 (1 start bit + 8 data bits + 1 parity bit + 1 stop bit = 11) and dividing by the port's baud rate will yield an approximate indication of port utilization, on transmit, as a fraction of the baud rate selected for this port (bandwidth used).

4.3.2.5 Number of Bytes Received/Second

This location (1724/1734) contains the number of bytes received through this port in the previous 1- period. It includes all control, header, trailer, and BCC/CRC bytes. Multiplying this parameter by 11 (1 start bit + 8 data bits + 1 parity bit + 1 stop bit = 11) and dividing by the port's baud rate will yield an approximate indication of port utilization on receive (bandwidth used).

4.3.2.6 Number of Scan Buffer Misses/Second

This location (1725/1735) contains the number of times, in the previous second, that the PLCG was ready to build a Data Request to a PLC on this port, but did not have a Scan Buffer available. This value is typically nonzero, indicating that PLCG data acquisition is running faster than the connected I/O subsystem network.

4.3.2.7 Number of Keepalive Buffer Misses/Second

This location (1726/1736) contains the number of times, in the previous second, that the PLCG was ready to build a Keep Alive "refresh" message for this port, but did not have a buffer available. This value is typically nonzero, indicating that PLCG Keep Alive writes are running faster than the connected I/O subsystem network.

4.3.2.8 Number of Output Buffer Misses/Second

This location (1727/1737) contains the number of times, in the previous second, that the PLCG was ready to build a User Output message for this port but did not have an Output buffer available. This value is typically nonzero, indicating that PLCG output writes are running faster than the connected I/O subsystem network.

4.3.2.9 Firmware Freetime/Second Counters

These three counters (1740-1741,1742-1743, 1744-1745) display approximations of PLCI processor free time. The MINIMUM value indicates the least free time per second on record, which equates to the heaviest loading. The MAXIMUM value indicates the most free time per second on record, which equates to the lightest loading. The CURRENT value indicates the free time during the previous 1- second period.

4.3.2.10 Number of Processing Buffer Misses/Second

This location (1746) contains the number of times, in the previous second, that the PLCG was ready to process a requested PLC reply or unsolicited write (exception reporting) from the PLC, but none was pending. When this location is nonzero, the PLCG is running faster than the connected I/O subsystem network is transferring data.

SERVICE
Section 5

This section presents service instructions unique to the PLCG.

5.1 OVERVIEW

The Programmable Logic Controller Gateway (PLCG) is housed in a standard TDC 3000^X five-slot module, or in a newer (also standard) Dual Node Module. A PLCG Relay Panel, a unique functional circuit board (PLCI), an input/output card (PLCI I/O), and special cabling have been added to this standard module.

This manual provides instructions to test, troubleshoot, and repair those components unique to the PLCG. Troubleshooting, disassembly, and assembly procedures for the remaining five-slot module and its components are contained in the *Five/Ten-Slot Module Service* or *Dual Node Module Service* manual in the *LCN Service* -1 binder.

The PLCG Relay Panel contains special high-quality, high-reliability components and is relatively expensive. It is an ORU (Optimum Replaceable Unit) item and must be replaced if found faulty, however, attempt to prove the relay panel has truly failed before replacing it indiscriminately.

Although cables are not considered ORU items, their part numbers are listed in subsection 5.5 for reference.

The following is the board complement for the 68000-based PLCG:

Slot	Front	P/N	Rear	P/N
5	PLCI	51400997-100	PLCI I/O	51195096-100
4	EMEM	51400910-100		
3	EMEM	51400910-100		
2	LCN	51400667-100	LCN I/O	51107403-100
1	EMPU	51400901-100		

The following is the board complement for the 68020-based PLCG:

Slot	Front	P/N	Rear	P/N
5	PLCI	51400997-100	PLCI I/O	51195096-100
4				
3				
2	LLCN	51401291-100	LCN I/O	51107403-100
1	HPK2-2	51401288-100		

The following is the board complement for an 2-slot node Dual Node Module-based PLCG:

Slot	Front	P/N	Rear	P/N
2	PLCI	51400997-100	PLCI I/O	51195096-100
1	K2LCN	51401288-100	KLCNA	51304542-100

The following is the board complement for a 3-slot node Dual Node Module-based PLCG:

Slot	Front	P/N	Rear	P/N
3	PLCI	51400997-100	PLCI I/O	51195096-100
2				
1	K2LCN	51401288-100	KLCNB	51304544-100

One of the following PLCG Relay Panels is mounted on the rear of the PLCG module:

PLCG RELAY PANEL	51304154-100	(Early custom production—can't use A-B protocol in redundant configuration)
PLCG RELAY PANEL	51304421-100	(Current Production-—required for the Dual Node Module-based unit)

5.2 FIELD ADJUSTMENT

There are no field adjustments for the PLCG. When replacing a board, you may have to change some pins (or jumpers) on the board to make the board correspond with the counterpart it is replacing. Do not alter pinning on a board revision socket—the revision number might have changed on the newer board.

5.3 GENERAL TROUBLESHOOTING

Before investigating deeply into a problem, make some preliminary checks:

- Is power applied to the module? Check switches, fuses, and circuit breakers on all equipment to insure they are functioning.

WARNING

DO NOT REMOVE OR REPLACE CIRCUIT BOARDS WITH THE POWER ON.

Do not remove, handle, or transport circuit boards without observing proper Electrostatic Discharge (ESD) procedures. To review ESD procedures, see the *LCN Site Planning* manual in the *LCN Site Planning & Installation* binder.

- Note that the functional boards can be accessed through the front of each module by removing the front cover. Inspect the confidence indicators on each processor (EMPU, HPK2, or K2LCN board and the PLCI board). Check power supply and fan confidence indicators. Double check the pinning on the PLCI board (shown in subsection 3.2.3).

- The small I/O or paddleboards are accessed from the rear of the module.

To isolate a failed board, power supply, fan assembly, or other Optimum Replaceable Unit (ORU), follow the service procedures provided in the *Five/Ten-Slot Module Service* manual or the *Dual Node Module Service* manual in the *LCN Service* -1 binder.

5.4 PLCI TROUBLESHOOTING

The PLCI board has unique indicators on its front edge to offer confidence that the board is working, and to provide assistance in case of a failure. The board also communicates with the Universal Station to report software indications of hardware failures. This section explains the function of these hardware/software indicators and will guide you in finding a failure.

5.4.1 PLCI Hardware Indicators

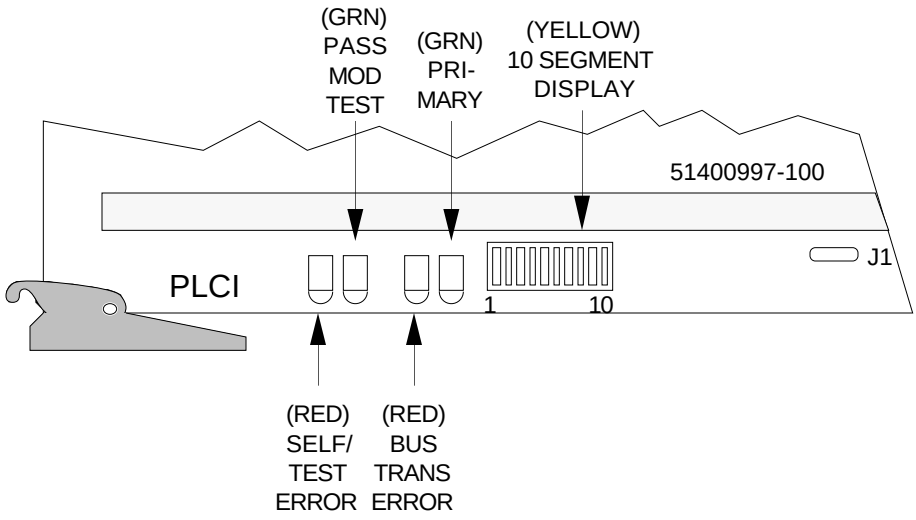

Figure 5-1 — PLCI Test and Status Indicators 3106

There are four LEDs located on the front left edge of the PLCI board (see Figure 5-1). Each LED's definition and a brief description of its use follows. They are listed as shown in the figure, from left to right.

SELF-TEST or BOARD FAILURE (Red)

This LED lights under the following conditions:
- Module power coming on
- Module or PLCI reset sequence working
- PLCI self-test in progress
- Self-test failed
- Local parity errors

This LED is extinguished under the following conditions:
- Self-test is completed successfully
- Module or PLCI reset sequence completed successfully
- PLCI Abort Command sequence completed

PASSED MODULE TEST (Green)

This LED is lighted after the PLCI successfully completes the CPU tests.

TRANSACTION ERROR (Red)

This LED lights under the following conditions:
- Module bus data parity error
- Bus error occurred during DMA access to module RAM

This LED is extinguished under the following conditions:
- Self-test is completed successfully
- Module power coming on
- Module or PLCI reset completed
- PLCI Abort Command in process

PRIMARY PLCI (Green)

This LED is lighted when the PLCI is on-line and functioning as the primary "HG."

10-SEGMENT DISPLAY (Yellow)

Also, on the front edge of the PLCI board, there is a 10-Segment display composed of yellow LEDs (see Figure 5-1). The function of each LED in this display, numbered 1 to 10 from left to right, are:

Segments 1, 2, and 3 monitor Field Port 1. Their functions are:
1. **TX RTS**—Illuminates when the transmit Request To Send is asserted.
2. **RX DATA**—Illuminates when Receive Data goes to a spacing condition.
3. **DSR/CD**—Illuminates when Data Set Ready and Carrier Detect are asserted.

Segments 4, 5, and 6 monitor Field Port 2. Their functions are:
4. **TX RTS**—Illuminates when the transmit Request To Send is asserted.
5 **RX DATA**—Illuminates when Receive Data goes to a spacing condition.
6. **DSR/CD**—Illuminates when Data Set Ready and Carrier Detect are asserted.

Segments 7, 8, and 9 are used at the factory. They have no use in field troubleshooting.

10. **REDUNDANT PARTNER**—Illuminates when the redundant partner is on-line.

5.4.2 PLCI Hardware Indicator Troubleshooting Chart

Use Table 5-1 to aid you in determining the cause of a failure detected by the two fault indicators on the PLCI.

Table 5-1 — PLCI Hardware Indicator Troubleshooting Chart

INDICATION	POSSIBLE CAUSE	SOLUTION
SELF-TEST ON after power-up or reset sequence	Missing PLCI I/O Paddleboard	Install PLCI I/O Paddleboard in the correct slot behind PLCI board.
	Failed PLCI or PLCI I/O Board	Substitute known good boards.
SELF-TEST goes OFF, then ON after the HG personality has been loaded	Incorrect Software Release	Check that Software Release 200 or later is being used.
	Incorrect Configuration	Check that emulated Data Hiway ports used are addresses 8 through 15. Check that PLCGs are configured for Hiway addresses 2 and 3. Check that PLCG is configured to perform the HTD functions. Check for hardware configuration errors; re-read Sections 2.4, 2.5, and 3.2 of this manual.
TRANSACTION ERROR ON	Memory Board Error	Substitute known good memory board(s). If memory board(s) are OK, suspect the PLCI itself.

5.4.3 PLCI System Software Indications

System software indications that indicate hardware failures are presented in the Hiway Status display on the Universal Station (US). The Hiway Status display lists those brief error statements and codes and describes where they came from.

5.4.3.1 Battery Failure

The Hiway Status display at the US (Universal Station) indicates BATT FAIL when a slot 16 failure has been posted from a emulated DHP. This does not indicate a battery failure—instead it has been used to show the **REDUNDANT PARTNER IS NOT ON-LINE**. This indication is only valid when the corresponding emulated DHP is enabled (on scan). The status of the redundant partner is also indicated by the 10-segment display—see subsection 5.4.1.

If you get this BATT FAIL indication when using a nonredundant PLCG, recheck the PLCI pinning in subsection 3.2.3.

5.4.3.2 Device Failure

The Device Failure codes listed in Table 5-2 are posted in the Box Status Display at the US when the Hiway Status display indicates DEV FAIL. The error code presented at the US is in the form **11DC** where **D** = Device Number (PLC index) and **C** = Error Code in Table 5-2.

NOTE

Table 5-2 indicates Modbus protocol errors presented by Modicon controllers.

Other brands of controllers may not present the same errors as Modicon under the same circumstances, or may not present any error at all. Check the instruction manuals with your controller to verify the similarities and differences in error codes.

NOTE

PLCI Communications Retry Guidelines:

Retries on transient communication errors will be performed for all messages, but timeouts are given special processing. The PLCI will perform retries until three consecutive timeouts have accumulated against a PLC. Data collection from the PLC is suppressed for the remainder of the current scan. On the next scan it will attempt to collect the suspect PLC's data but with Timeout Retries still suppressed. If any response is received, even with an error, Timeout Retries are enabled and normal data collection attempts are resumed.

Infrequent transient errors will allow communications to be restored before three consecutive timeouts occur and will cause minimal impact on scan times. If communication cannot be re-established, the PLCI will wait for the next scan to try again. Retries are not allowed on certain errors where they are deemed unlikely to succeed. Each error code explanation in Table 5-2 indicates whether retries are allowed or not.

Table 5-2 — PLCI Software Indication Troubleshooting Chart

CODE	FAILURE	POSSIBLE PROBLEM
1	Link Failure	Communications protocol violation detected by PLCI. Possible errors are Receive Buffer Overflow, Parity Error, Framing Error, etc. Retries allowed. A-B: Posted on receipt of local error code 03 or 04.
2	Communications Timeout	Verify by monitoring RX DATA and RTS indicators on indicated PLCG field port (see subsection 5.4.1). Timeout indicated by RTS blinking while RX DATA is dark. Retries allowed. Possible causes are: • PLC cable disconnected or connected to wrong field port. • PLCI pinning of baud rate/parity does not match PLC pinning. • DHP definition of PLC address does not match that at PLC. • PLCI I/O paddleboard not cabled to relay panel. • Relay panel failure (see pinning in subsection 3.2.3). A-B: May also be local error code 02 or remote error codes 20 and 30. Also check DHP definition of PLC address—may not match that selected at the PLC.
3	Configuration Failure	The definition of a PLC unacceptable to the PLCI. No retry. Possible causes are: • Assigned protocol (Modbus or A-B) conflicts with PLC. • The model code for a physical PLC conflicts with the model code already assigned to that physical PLC. • Any of the currently defined DHP configuration errors (see subsection 2.5 in the *PLC Gateway Control Functions* manual in the *Implementation/PLC Gateway* binder for hints on avoiding configuration errors).
4	CRC Error	The Cyclic Redundancy Check for a reply was incorrect. Retries allowed. A-B: Not used.
5	Message Error	The received reply was incorrect for the query sent. Retries allowed. Possible causes are: • Wrong PLC answered. • Reply size incorrect for number of parameters requested. • Message length inconsistent with message count byte. A-B: Posted on receipt of remote error code 10.

(Continued)

Table 5-2 — PLCI Software Indication Troubleshooting Chart (Continued)

CODE	FAILURE	POSSIBLE PROBLEM
6	Illegal Function	Modbus: Presented when the PLC returns the ILLEGAL FUNCTION exception code (01). No retry. A-B: Not used.
7	Illegal Data Address	Modbus: Presented when the PLC returns the ILLEGAL DATA ADDRESS exception code (02). No retry. See subsection 2.5 in the *PLC Gateway Control Functions* manual in the *Implementation/PLC Gateway* binder for hints on avoiding configuration errors. A-B: Posted on receipt of remote error code 50 or 80.
8	Illegal Data Value	Modbus: Presented when the PLC returns the ILLEGAL DATA VALUE exception code (03). No retry. A-B: Not used.
9	Device Fault	Modbus: Presented when the PLC returns the FAILURE IN ASSOCIATED DEVICE exception code (04). No retry. A-B: Posted on receipt of remote error code 40.
A	Entered Program Mode	Modbus: Presented when the PLC returns the PROGRAM ACKNOWLEDGE exception code (05). The PLCG considers this response an error because the PLCG cannot issue the PROGRAM command. No retry. A-B: Posted on receipt of remote error code 70 or 80.
B	Busy/Insufficient Buffers	Modbus: Presented when the PLC returns the BUSY, REJECTED MESSAGE exception code (06). Retries allowed. A-B: Posted on receipt of local error code 01 or remote error code 90.
C	NAK/Negative Acknowledge	Modbus: Presented when the PLC returns the NAK/ NEGATIVE ACKNOWLEDGE exception code (07). No retry. A-B: Not used.

(Continued)

Table 5-2 — PLCI Software Indication Troubleshooting Chart (Continued)

CODE	FAILURE	POSSIBLE PROBLEM
D	Access Blocked	Modbus: Not used. A-B: Posted on receipt of remote error code 60.
E	Spare	Not used by either Modbus or A-B protocol.
F	Unspecified Error	Modbus: Not used. A-B: Posted on receipt of local errors 05 through 0F and remote errors A0 and C0 through F0.

5.4.3.3 Data Hiway Port Error Codes

The Device Failure codes listed in Table 5-2 does not show all error codes that may appear on the journals. Table 5-3 provides a list of the Data Hiway Port (DHP) error codes.

Table 5-3 — Data Hiway Port Error Codes

ERROR CODE	DISPLAY MNEMONIC	NAME	MEANING
1100	RESET	RESET	DHP in Reset
1100	WDT FAIL	DHP ERROR	Watch Dog Timer has expired
1101	DHP FAIL	WDT Expiration	Unknown Link Card in WDT Expiration
1102	DHP FAIL	Link Card CPU Test	Link Card CPU Test failure*
1103	DHP FAIL	Link Card ROM Test	Link Card ROM Test failure*
1104	DHP FAIL	Link Card RAM Test	Link Card RAM Test failure*
1105	DHP FAIL	Link Card Initialization Error	Link Card Initialization failure*
1106 to 110F	DHP FAIL ↓ DHP FAIL	Unknown Failure ↓ Unknown Failure	Unknown Failure ↓ Unknown Failure*
1191	BAT FAIL	Battery Failure	Memory Battery failure. This is a nonfatal failure; device status remains OK
1192	OVERLOAD	Processor Overload	Processor Overload
1193	SAVED	In Hard Save	Primary IPC HIM failure
1194	RC FAIL	RC Failure	Backup IPC HIM failure
1195	SF	Incorrect CPU Configuration	IPC HIM firmware not at proper revision
1196	UNDEFINE	Undefined Error	Probable cause is failure of box I/F card; Continuous Notification Writes from the box and no response to the HG callup.
1198	ALM FAIL	Box Reporting Failure Detected	Box reporting failure detected
1199	ALM FAIL	Box Reporting Failure Detected	Alarm reporting device changed
11A0…F	NULL	Box Error	Slot failures, 01-16
11B0…F	NULL	Box Error	Slot failures, 01-16
11BC	DEV FAIL (See Table 5-2)	Device failure	Device failure

1 = Device Link Failure
2 = Device Box or Communications Failure
3 = Device Configuration Error
4 to F = Unknown Device Failure

Box Number

* Not applicable to Honeywell-620 HIM

5.5 SPARE PARTS

Spare parts for the Five-Slot Module or the Dual Node Module and its components (fan, power supply, boards, etc.) are listed in the *Five/Ten-Slot Module Service* manual or in the *Dual Node Module Service* manual in the *LCN Service* -1 binder.

Spare parts unique to the PLCG are listed in Table 5-4.

Table 5-4 — Parts List

PART NUMBER	DESCRIPTION	
51201420-001	CABLE ASSY	PLCI I/O Board to Relay Panel, 1 meter
51201420-002	CABLE ASSY	Secondary PLCG I/O to Relay Panel, 2 meter
* 51107403-100	LCN I/O	LCN Adapter Board Assembly
* 51190516-100	RELAY, SOLID STATE	Optically-Isolated Relay
* 51190526-100	RELAY, DC, GEN PUR	High-Reliability Relay
* 51195096-100	PLCI I/O ADAPTER	PLCI Paddleboard
* 51304421-100	PLCI RELAY PANEL	Relay Panel on rear of Primary PLCG Module **
51401596-200	MOUNTING BRACKET	Bracket for Relay Panel on dual node chassis
51304514-100	RS232 DATA CABLE	PLCG Field Port Cable
* 51400667-100	LCNI	Local Control Network Board
* 51400901-100	EMPU	Enhanced Microprocessor Board
* 51400910-100	EMEM	Enhanced Memory Board, 1 M-Word
* 51400997-100	PLCI	Programmable Logic Controller Interface Board
* 51401288-100	HPK2-2	High Performance Kernel Processor/2MW Mem.
* 51401291-100	LLCN	Low Power Local Control Network Board
* 51401551-200	K2LCN	Dual Node Processor/LCN Board/2MW Mem.
* 51304542-100	KLCNA	LCN A Cable Interface Converter Board
* 51305072-200	CLCN-A	CLCN A Cable Interface Converter Board (EC)
* 51304981-100	CLCN-A	CLCN A Faceplate (EC)
* 51304544-100	KLCNB	LCN B Cable Interface Converter Board
* 51305072-300	CLCN-B	LCN B Cable Interface Converter Board (EC)
* 51304982-100	CLCN-B	CLCN B Faceplate (EC)

* ORU Level Replacement Item
** This item replaces 51304154-100.

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