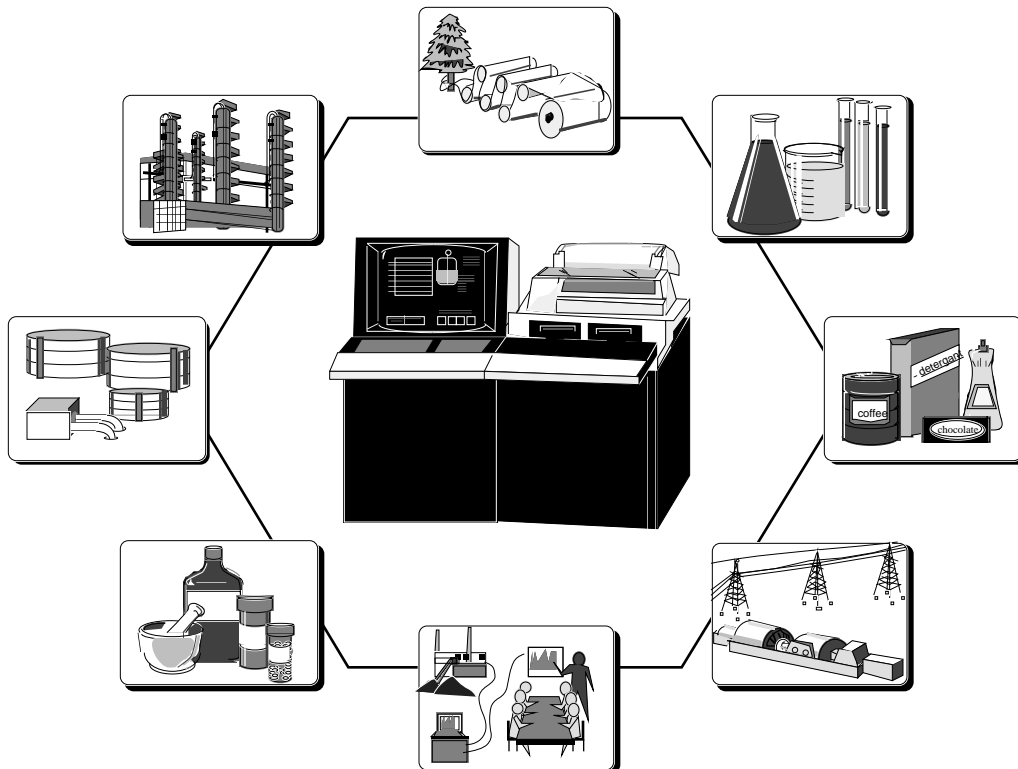


Programmable Logic Controller Gateway Specification and Technical Data

PL03-400
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TDC 3000 Programmable Logic Controller Gateway

Specification and Technical Data

Introduction

This publication defines the significant functions of the TDC 3000 Programmable Logic Controller Gateway (PLCG). The PLCG provides a link between the Local Control Network (LCN) and Programmable Controllers that use Allen-Bradley or Modbus subsystem protocols.

The PLCG is one of the modules on the Local Control Network. As Figure 1 indicates, it communicates with other modules on the Local Control Network and with Programmable Controllers, which

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are connected to one of the PLCG's two EIA RS232 ports. In this position in the TDC 3000

System architecture, the PLCG makes the transition from the transmission technique and protocol of the Local Control Network to the transmission techniques of the Allen-Bradley or Modbus protocols.

Each of two ports on the PLCG serves an independent Programmable Controller subsystem network. The two ports are guaranteed to support up to 16 Programmable Controllers (up to 64 Programmable Controllers can be addressed). The PLCG handles up to 3000 process points (tags).

Programmable Controller Protocols

Programmable Controllers operating on either the AEG-Modicon Modbus (RTU) protocol or the Allen-Bradley DF-1 protocol are accommodated by the PLCG (for both protocols on one PLCG, each is accommodated by one of the two ports). The PLCG accomplishes data-form conversions necessary to provide data to the Local Control Network (LCN) and to transfer data from the LCN to the Programmable Controllers.

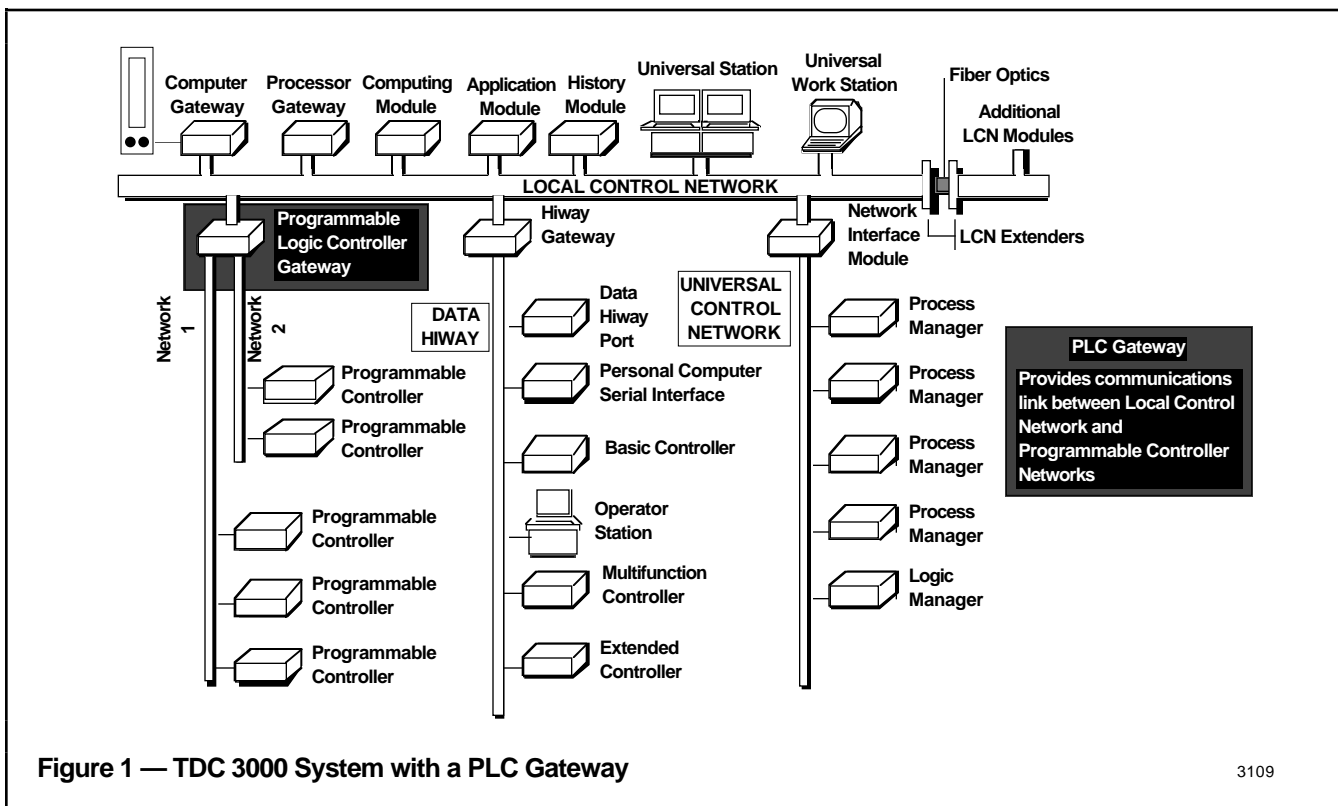


Figure 1 — TDC 3000 System with a PLC Gateway

Functions

- Provides secure communication link between the TDC 3000 Local Control Network and the Programmable Controllers.
- Converts data and protocol between the Local Control Network and the two Programmable Controller ports.
- Scans the Programmable Controller data for alarm conditions.

The PLCG can operate as a single node on the LCN or it can operate as a node pair, with two PLCGs, one operating and the other serving as its redundant partner, with an exact, up-to-date copy of the database, ready to take over full operation, should the operating member of the pair fail or be taken out-of-service.

The PLCG provides the data conversion, buffering, and sequencing necessary to provide an efficient interchange of information between the Local Control Network and the Programmable Controllers, and to accomplish the following services.

PLCG configuration, its relationship to the Programmable Controllers, and data-point (tag) data.

- Organizes and optimizes Programmable Controller scanning tasks on the basis of ports and device addresses.
- Initiates communication over the external networks connected to the two ports to the Programmable Controllers, as defined by the configuration data, and reinitiates communication after an interruption in communication.
- Maintains an image of network and Programmable Controller status for presentation on a Universal Station's Hiway Status display.
- Maintains an image of values for all defined data points.
- Maintains port operational statistics for use by technicians, including error and retry counts, port traffic, and firmware freetime indicators.

System Services

The PLCG provides the following system-level services:

- Stores user-defined configuration data, including

Functional Description

The relationships of the PLCG functions are shown on Figure 2.

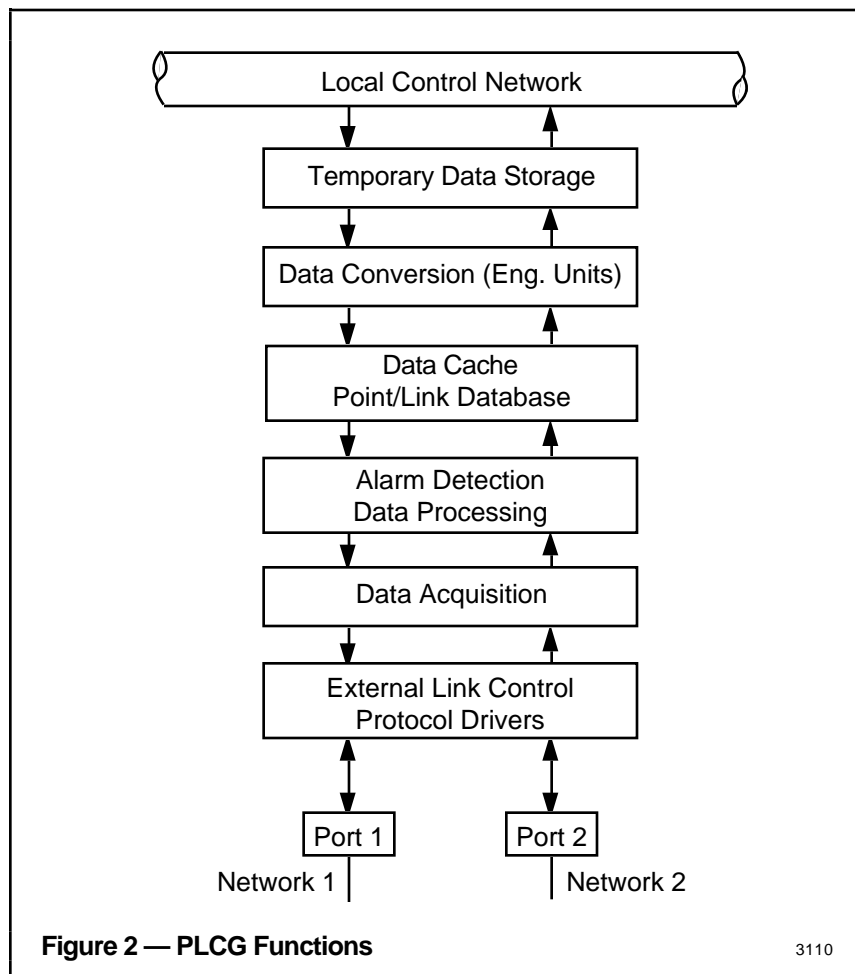


Figure 2 — PLCG Functions

Data/Acquisition and Monitoring Services

The PLCG provides the following services for acquiring process data:

- Repetitively acquires all defined Programmable Controller data as fast as possible in a free-running mode. A report-by-exception option is available for the Allen-Bradley protocol.
- Monitors alarm condition and generates alarms when so dictated by the acquired data. Provides change-of-state alarms for digital data

and value-limit or deviation alarms for analog data.

- Provides a contact-cutout function that suppresses unnecessary alarms from a secondary point, when configured predefined conditions, such as out-of-service equipment, are detected by a primary point.

Supervisory Control Services

- Continuously “reads” subsystem output values for defined points to provide feedback to operators about commands issued, and to detect changes by subsystem logic.
- Detects events configured to initiate programs in Application Modules.
- Links input and output points together in a composite point with one tag name to support command-disagree alarming.
- Provides a “red tag” function to prevent unauthorized changes in output values.

PLCG Data Points

The types of data points listed below can be configured for a PLCG. Configuration data and process data for each of these points resides in one of up to eight emulated Data Hiway Ports (DHPs) in the PLCG.

DHPs can be thought of as subdivisions of the PLCG. Functionally, they are virtually identical to DHPs that operate as individual boxes on Honeywell Data Hiways. Each DHP in a PLCG provides 30 memory slots, so a PLCG has $8 \times 30 = 240$ such slots. The numbers of points per slot are defined in the following list.

- Digital Input point
Reads the status of a discrete Programmable Controller digital input. Sixteen points per slot.
- Digital Output point
Reads the status of a Programmable Controller digital-output memory location. Eight points per slot.
- Digital Composite Point
A digital input and a digital output, combined under one tag name, for display and control purposes.
- Analog Input point
Reads a Programmable Controller analog input (register) value. Six points per slot.
- Analog Output point
Reads a Programmable Controller analog output value (register). Four points per slot.
- Analog Composite point
An analog input and an analog output, combined under one tag name, for display and control purposes.
- Counter point
Reads the accumulated value from a counter and can be commanded to write a value to the counter. Eight points per slot.

Alarm Scanning

The PLCG monitors the input data for user-defined alarm conditions. Up to 50 critical process alarms may be specified by the process engineer to be scanned each 1/2 second by the PLCG. The remaining alarms receive normal handling. Alarm types include

- High and low limit or deviation alarms for analog input points.
- Change-of-state alarms for digital input points.
- Command-disagree alarms for digital composite points.
- Preset-value-reached alarms for counter points.

PLCG Operates on Standard Hiway Gateway Software

The PLCG appears to the TDC 3000 software to be a Hiway Gateway with a Data Hiway on which up to eight Data Hiway Ports reside. No changes to the HG software are made to accommodate the PLCG.

The standard process network display for Data Hiways depicts the emulated DHPs in the PLCG just as if they were physical boxes on a real Data Hiway. The PLCG behaves so that these displays indicate the normal Data Hiway functions, including periodic swapping of hiway cables, and the functions of the Hiway Traffic Director.

Data in the emulated DHPs is saved (checkpointed) and restored through the process network display in the same manner as if they were on a real Data Hiway.

PLCGs operate on TDC 3000 software release 200 and later.

Options

The PLC Gateway is available in a 5-card electronics module and a dual node electronics package. For additional information about the two types of enclosures, see the latest *System Technical Data*.

Each PLCG can be backed up by a redundant PLCG to assure maximum dependability. The backup PLCG is kept up-to-date

with relevant information from the primary PLCG so that the backup can take over at any time with virtually no disruption in system operation. This option does not provide subsystem (Modicon or Allen Bradley) cable-communication redundancy. PLCGs are available with standard, 68000-type microprocessor or with enhanced, 68020-type microprocessors. There is little, if any, difference in performance between these two versions. These versions are available to support parts compatibility with the remainder of existing TDC 3000 systems. Software release R210M1 or beyond is mandatory for the enhanced 68020 version.

Modification kits are available to convert from single PLCGs to a redundant pair, and to convert from 68000 microprocessors to 68020 microprocessors.

Model Numbers

MP-PLCGN1
Single PLCG, standard (68000)
microprocessor

MP-PLCGR1
PLCG redundant pair, standard
(68000) microprocessor

MP-PLCGN3
Single PLCG, enhanced (68020)
microprocessor

MP-PLCGR3
PLCG redundant pair, enhanced
(68020) microprocessor

Physical Description

When packaged as a 5-card module, the PLC Gateway contains a Local Control Network Interface board, a microprocessor/memory board, a Programmable Controller

interface board, a power supply, a relay panel that mounts the two I/O port connectors, and a fan assembly. The dual node version of the PLC Gateway consists of a high-density K2LCN board, a Programmable Controller Interface board, power supply, relay panel, and fan assembly. Each of these items is an Optimum Replaceable Unit for maintenance purposes. Both types of electronics modules can be mounted in an Operator Console or in a system cabinet.

The Local Control Network is connected to the PLCG through coaxial connectors. PLCGs are connected to the RS232 ports on the relay panel through multiconductor cables.

Under a separate model number, the PLCG is available in the Micro TDC 3000 system, and consists of three main cards (boards).

PLCG Specifications

Physical Characteristics (5-card module)

Approximate Dimensions (5 Card and Dual Node)

Height	18.8 cm (7")
Width	48.3 cm (19")
Depth	53.3 cm (21")

Approximate Weight

5-Card File	21 kg (46 lb)
Dual-Node File with	
Single Node	14.6 kg (32 lb)
Two Nodes	18 kg (40 lb)

Power Options

Strap-selected ac-Voltage Options

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

Frequency Options

50 Hz or 60 Hz, +3%, -6%

PLCGs operate without disruption through an interruption in the input ac voltage of up-to-40 msec duration.

Summary of Operating Characteristics

PLCG

Point Handling Capacity

Up to 3000 points-per-PLCG or PLCG pair. Maximums per point type are:

Digital inputs	3000
Digital Outputs	1920
Digital Composite (1 in and 1 out)	1280
Analog Inputs	1440
Analog Outputs	960
Analog Composite(1 in and 1 out)	576
Critical alarms	50

Other Data Types

Event-initiated processing triggers	600
Point contact cutout capability	500

Data Acquisition Performance

The principal performance factor is the rate at which the Programmable Controllers respond to scan requests by the PLCG. The point-scanning rate is equal to, or better than, 500 points-per-second per-PLCG port. If digital points predominate in the point mix, the scan rate can reach 1000 points-per-second per-port.

Output Performance

At 19200 baud, the output rate can range from 5 to 10 points-per-second per-port, depending on configuration (see the Note on page 7).

PLCG Specifications *(continued)*

Configuration Capability

Maximum Number of PLCGs per LCN	20, or 20 redundant pairs*
Communication Networks (each port)	RS232C, dc isolated, no handshaking
Modems	Short haul, 4-wire only
Speed Selections (each port)	50, 150, 300, 1200, 2400, 4800, 9600, 19,200 baud

Protocols (per port on nonredundant PLCGs)

Modicon	Half duplex, Modbus, RTU mode
Allen Bradley	Full-duplex, DF-1 with PLC-2 emulator mode

Commands Available

Modbus	01	Read Coil
	02	Read Discrete
	03	Read Holding Register
	04	Read Input Register
	05	Write (single) Coil (See Note)
	06	Write (single) Holding Register (See Note)
	Accepts Modbus exception responses 01 through 07.	
Allen Bradley "basic commands"	01	Unprotected Read
	05	Unprotected Bit Write (See Note)
	08	Unprotected (single) (word) Write (See Note)
	Accepts selected Allen Bradley error codes.	

Note: Single point outputs are interleaved with scan requests in the next available port buffer. The output rate at 19200 baud can range from 5 to 10 points-per-second per-port, depending on the configuration. Operation at 9600 baud nominally supports 3 to 5 outputs-per-second per-port. Output requests from other LCN nodes are stacked in a request buffer and are output in the order they are received at the above rate.

*Total HG pairs, NIM pairs, and PLCG pairs per LCN \leq 20.

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