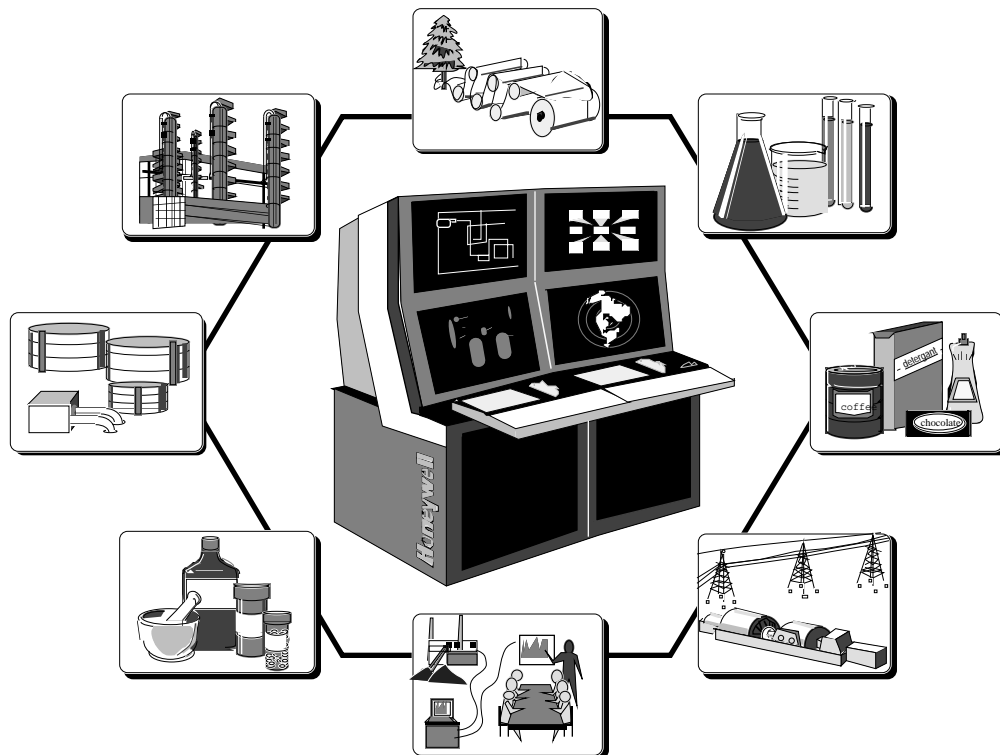


Enhanced Programmable Logic Controller Gateway Specification and Technical Data

EP03-500
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TDC 3000X Enhanced Programmable Logic Controller Gateway

Specification and Technical Data

Introduction

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

The EPLCG 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 Logic Controllers, which are connected to one of the EPLCG's two EIA RS232 ports.

In this position in the TDC 3000X system architecture, the EPLCG 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.

Two ports on the EPLCG can serve independent Programmable Logic Controller networks or can be optionally configured to provide redundant communication paths to a PLC network—including Allen-Bradley's. The two ports are guaranteed to support up to 16 Programmable Controllers (up to 64 Programmable Controllers can be addressed). The EPLCG handles up to 3000 process points (tags).

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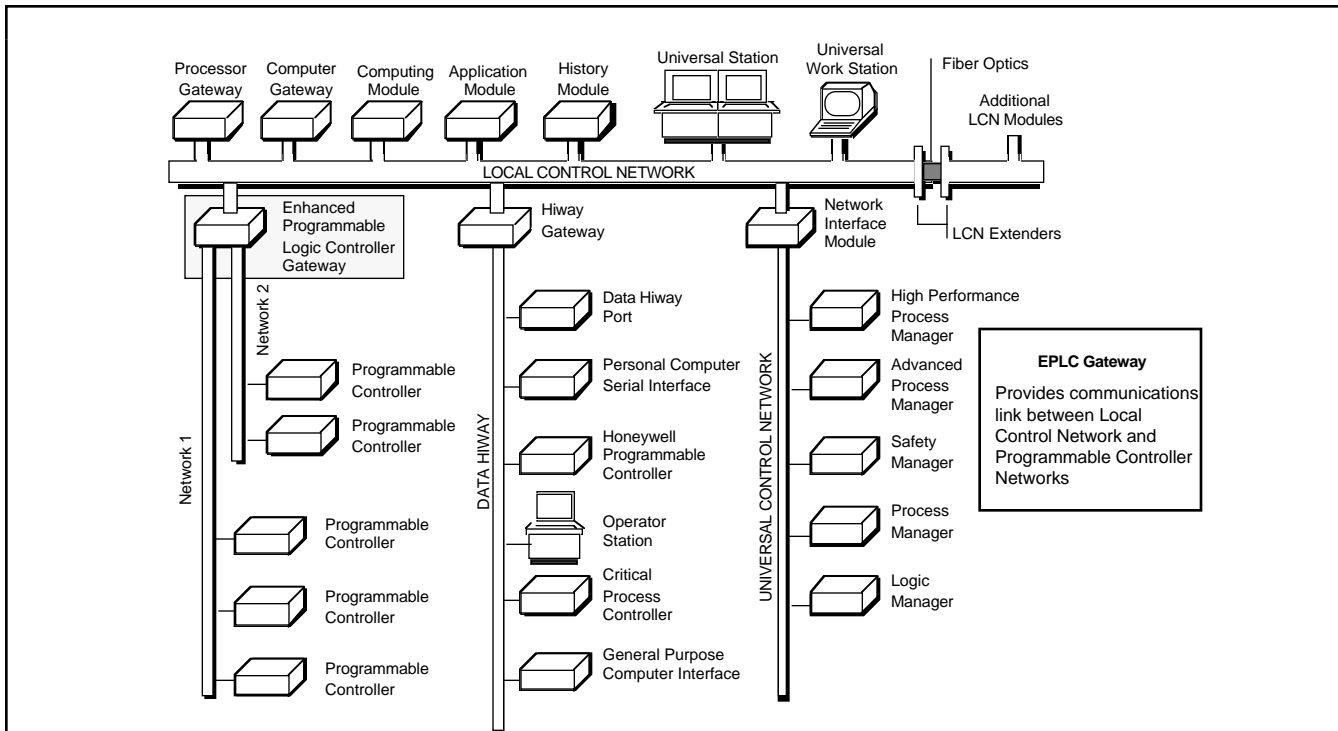


Figure 1 — TDC 3000X system with an EPLC Gateway

Programmable Controller Protocols

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

Functions

- Provides secure communication link between the TDC 3000^X 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.

Functional Description

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

The EPLCG can operate as a single node on the LCN or it can operate as a node pair, with two EPLCGs, 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 EPLCG 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.

System Services

The EPLCG provides the following system-level services:

- Stores user-defined configuration data, including

EPLCG 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, last error codes, view words, port traffic, firmware freetime counters, and number of (Allen-Bradley) reports-by-exception processed.

Data/Acquisition and Monitoring Services

The EPLCG 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 mode is available for the Allen-Bradley protocol.
- Monitors alarm conditions 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.

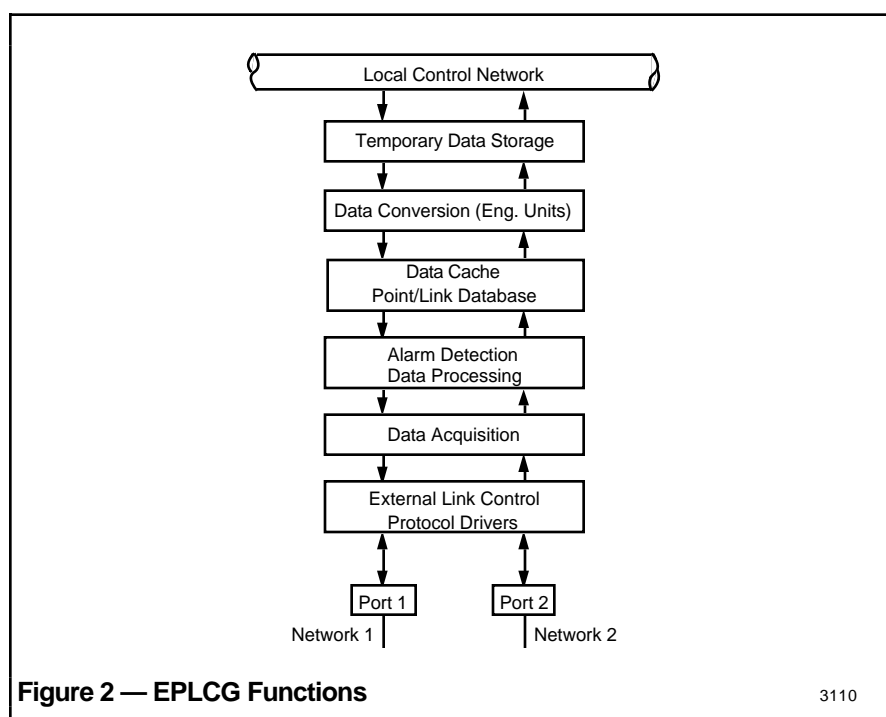


Figure 2 — EPLCG Functions

- 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.

EPLCG Data Points

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

DHPs can be thought of as subdivisions of the EPLCG. Functionally, they are virtually identical to DHPs that operate as individual boxes on Honeywell Data Hiways. Each DHP in an EPLCG provides 30 memory slots, so an EPLCG 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 and writes 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 and writes 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.
- 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.

EPLCG Operates on Standard Hiway Gateway Software

The EPLCG appears to the TDC 3000^X 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 EPLCG.

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

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.

Alarm Scanning

The EPLCG 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 EPLCG. The remaining alarms receive normal handling. Alarm types include

Options

The EPLCG is available as a single (non-redundant) node, or as a redundant node-pair.

The single EPLCG, with EPLCG I/O subsystem interface board, can be used with Allen-Bradley or Modbus or "mixed" protocols (i.e., Allen-Bradley on one EIA RS232 port and Modbus on the other EIA RS232 port).

As a redundant node-pair, the "primary" EPLCG is backed up by its redundant partner, to assure maximum dependability. The backup EPLCG is kept up-to-date with relevant information from the primary EPLCG so that the backup can take over at any time with virtually no disruption in system operation. The redundant communication option can provide redundant data paths (i.e., cable-communication redundancy) to the subsystem (Modicon or Allen-Bradley).

Two versions of the redundant EPLCG node pair are available.

One version has EPLCG I/O subsystem interface boards, and is used only for redundant communications in Allen-Bradley protocol.

The other version of the redundant EPLCG node-pair has PLCI I/O subsystem interface boards with a separate relay panel. This version supports redundant or non-redundant communications in Modbus protocol, as well as non-redundant communications (only) in Allen-Bradley protocol.

Physical Description

The EPLCG is currently supplied from the factory as a module (boardset) that installs in a dual node cardfile (electronic chassis). For additional information on the dual node cardfile (DNCF) see *System Technical Data*.

The single (nonredundant) EPLCG boardset consists of a dual node power supply, a Programmable Logic Controller Interface (PLCI) board, an EPLCI I/O board, and an LCN processor board. A choice of two LCN processor boards are available: K4LCN (68040 microprocessor) and K2LCN (68020 microprocessor). The K4LCN requires R500 (or higher) LCN system software, while the K2LCN is compatible with R320 (or higher) LCN system software.

For the redundant node-pair the above quantities are doubled (i.e., two dual node power supplies, two LCN processor boards, two PLCI boards, and two I/O boards).

Also, as previously noted, the redundant EPLCG node-pair version used for redundant/nonredundant Modbus communications (or nonredundant Allen-Bradley communications) has PLCI I/O boards with separate relay panels, whereas the other redundant node-pair version (for redundant Allen-Bradley communications) has EPLCI I/O boards.

The EPLCG connects to the Local Control Network through standard LCN coaxial connectors. EPLCGs are connected to the PLC subsystem network via RS232 ports on the EPLCI I/O boards (or on the relay panel) through multiconductor cables.

PLCG-to-EPLCG Upgrade Kits

Upgrade kits are available to convert a single (non-redundant) EPLCG to a redundant node-pair.

Additional upgrade kits are also available to convert a PLCG to an EPLCG, or to upgrade a PLCG redundant pair to an EPLCG redundant pair, either with or without the redundant communication feature for Allen-Bradley PLCs.

EPLCG Specifications

Physical Characteristics

<u>Approximate Dimensions</u> (In dual node cardfile)		<u>Approximate Weight</u>	
Height	18.8 cm (7")	Dual-Node Module with	
Width	48.3 cm (19")	Single Node	14.6 kg (32 lb)
Depth	53.3 cm (21")	Two Nodes	18 kg (40 lb)

Power Supply

Universal AC Input

120-264 V AC (autoranging power supply)
47-63 Hz (frequency range)

EPLCGs operate without disruption through an interruption in the input ac voltage of up to 40 mSec duration.

Summary of Operating Characteristics

EPLCG

Point Handling Capacity	Up to 3000 points-per-EPLCG or EPLCG 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
	Counters 1920
	Critical alarms 50
Other Data Types	Event-initiated processing triggers 600
	Point contact cutout capability (primaries) 500
	Point contact cutout capability (secondaries) 127 per primary
Data Acquisition Performance	The principal performance factor is the rate at which the Programmable Logic Controllers respond to scan requests by the EPLCG. For each EPLCG port, the point-scanning rate is equal to or better than 500 points per second, depending on configuration. If digital points predominate in the point mix, the scan rate per port can exceed 6000 points per second.
Output Performance	At 19,200 baud, the output rate for each EPLCG port can range from 12 to 42 points per second, depending on configuration (see the Note on page 7).

EPLCG Specifications (continued)

Configuration Capability

Maximum Number of EPLCGs per LCN 20, or 20 redundant pairs*

Data Link Specifications (EPLCG to Programmable Logic Controller Network)

Communication Networks (each port) EIA 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

Parity Selections (each port) Odd, Even

Protocols (per port on nonredundant EPLCGs)

 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)

 Allen-Bradley PLC5 commands 0F ASCII Mode Word Read/Write and Bit Write

 Accepts selected Allen-Bradley error codes.

Note: Single point outputs are interleaved with scan requests in the next available port buffer. The EPLCG reduces its read request block size from 64 words to 8 words (**only** while an output is pending), improving output rate by as much as three times. Using this technique, the output rate per port, at 19,200 baud, can range from 12 to 42** points per second, depending on the configuration. Output requests from other LCN nodes are stacked in a request buffer and are output in the order they are received.

* Total HG pairs, NIM pairs, and EPLCG pairs per LCN ≤ 20.

** Output rate of 42 points per second is achieved only by using the Allen-Bradley protocol in 'report-by-exception' mode.

EPLCG Specifications (continued)

CE Conformity (Europe)

This product is in conformity with the protection requirements of the following European Council Directives: 73/23/EEC, the Low Voltage Directive, and 89/336/EEC, the EMC Directive. Conformity of this product with any other "CE Mark" Directive(s) shall not be assumed.

Deviation from the prescribed procedures and conditions specified in the installation manuals may invalidate this product's conformity with the Low Voltage and EMC Directives.

Product Classification	Class I: Permanently mounted, permanently connected Industrial Control Equipment with protective earthing (grounding). (EN 61010-1-1993)
Installation Category	Category II: Energy-consuming equipment supplied from the fixed installation. Local Level Appliances and Industrial Control Equipment . (EN 61010-1-1993)
Pollution Degree	Pollution Degree 2: Normally non-conductive pollution with occasional conductivity caused by condensation. (IEC 664-1-1992)
EMC Classification	Group 1, Class A, Industrial, Scientific and Medical (ISM) Equipment. (EN55011-1991; Emissions)
Method of Assessment	EMC: Technical Construction File (TCF) LVD: Technical File (TF)

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TDC 3000 system

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