Programmable Logic Controller Gateway Specification and Technical Data

PL03-400
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**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 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).

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**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.
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:

**System Services**

The PLCG provides the following system-level services:

- Stores user-defined configuration data, including 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.

**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, for display and
control purposes.

- 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 x 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.

- **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)

<table>
<thead>
<tr>
<th>Approximate Dimensions (5 Card and Dual Node)</th>
<th>Approximate Weight</th>
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</thead>
<tbody>
<tr>
<td>Height 18.8 cm (7”)</td>
<td>5-Card File 21 kg (46 lb)</td>
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<tr>
<td>Width 48.3 cm (19”)</td>
<td>Dual-Node File with</td>
</tr>
<tr>
<td>Depth 53.3 cm (21”)</td>
<td>Single Node 14.6 kg (32 lb)</td>
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<tr>
<td></td>
<td>Two Nodes 18 kg (40 lb)</td>
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</tbody>
</table>

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.

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