Honeywell

Programmable Logic Controller Gateway Implementation Guidelines

PL12-500

Total Plant

Implementation
PLC Gateway

Programmable Logic Controller Gateway Implementation Guidelines

PL12-500
12/95

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Revision 01 – December 15, 1995

About This Publication

This publication summarizes the Programmable Logic Controller Gateway (PLCG) implementation process, guides you to procedures and references you need to implement PLCGs, defines the hiway and box/slot entities you must build for each PLCG, and describes PLCG operation considerations in implementing and using PLCGs.

This publication supports TDC 3000^{X} software release 500.

Table of Contents

INTRODUCTION
Section 1

This section summarizes the Programmable Logic Controller Gateway implementation tasks, lists publications that you will refer to in order to implement PLCGs, and describes implementation dependencies.

1.1 SUMMARY OF PLCG IMPLEMENTATION TASKS

While most of the the information in this publication relates to Programmable Logic Controller Gateway (PLCG) functions, PLCG data points, and PLCG operating considerations, other implementation activities must also be completed to make the PLCG functional. The Engineering Personality activities listed below may be affected by the implementation of a PLCG or must be used to implement a PLCG.

See subsection 1.2 for references to instructions for each of the activities listed below.

Activities named in THIS TYPEFACE are activated by targets on the Engineering Personality Main Menu.

- UNIT NAMES—The process units defined for each PLCG data point are established in this activity.
- AREA NAMES—The area name and descriptor for any units with PLCG points that are assigned to an area are established in this activity.
- LCN NODES—Identifies and defines the nodes on the Local Control Network. In the case of PLCGs, this activity defines the node numbers for the PLCGs and the process network number for the PLCGs' emulated Data Hiways. Note that because the PLCG is supported by the Hiway Gateway software, you configure PLCGs as if they were HGs.
- VOLUME CONFIGURATION—The PLCG (HG) checkpoint volume(s), &7np is established in this activity. Volume &7np must have adequate storage space to accommodate the PLCG checkpoint data, including the data for its emulated DHPs (boxes).
- APPLICATION MODULE—Any AM points that are members of a control strategy that includes PLCG points are built in this activity. Connections to the PLCG points are defined in `tagname.parameter` form.
- HIWAY GATEWAY—The Hiway point that defines the PLCG's emulated Data Hiway and the Box/Slot points that define the functions and content of the emulated DHPs are built in this activity. Also, the PLCG data points are built in this activity.
- PICTURE EDITOR, FREE FORMAT LOGS, BUTTON CONFIGURATION—Any of the pictures, logs, and buttons built by these activities can access PLCG points, once the points are built and loaded.

- HM HISTORY GROUPS—PLCG data point values for which continuous history is to be collected are defined in this activity by assigning them to specific HM history groups.

- AREA DATA BASE—This activity defines how and where data for data points, including PLCG data points, are used and displayed in a given process area. The area database is the database loaded into a Universal Station, so that the database defines the process area monitored and controlled through the US.

- Control Language (CL)—The PLCG does not have a CL program feature, but CL/AM programs can read from and write to PLCG data points.

- Ladder Logic Programming—The make and model of the PLC(s) connected to the PLCG can widely differ, so the Honeywell IAC publications do not provide information for ladder logic programming. Consult the manuals provided by the PLC vendor(s).

1.2 REFERENCES

1.2.1 References for Engineering Activities

- UNIT NAMES and AREA NAMES

  Network Form Instructions in the *Implementation/Startup & Reconfiguration - 1* binder.

  Network Data Entry in the *Implementation/Startup & Reconfiguration - 1* binder.

- VOLUME CONFIGURATION—Section 7 of the *Engineer's Reference Manual* in the *Implementation/Startup & Reconfiguration - 2* binder. For the PLCG checkpoint volume(s), follow the instructions for HG checkpoint volumes.

- APPLICATION MODULE

  Application Module Control Functions in the *Implementation/Application Module - 1* binder.

  Application Module Algorithm Engineering Data in the *Implementation/Application Module - 1* binder.

  Application Module Parameter Reference Dictionary in the *Implementation/Application Module - 1* binder.

  Data Entity Builder Manual in the *Implementation/Engineering Operations - 1* binder.

- HIWAY GATEWAY (PLCG)

  System Control Functions in the *Implementation/Startup & Reconfiguration - 2* binder.

Programmable Logic Controller Gateway Control Functions in the *Implementation/PLC Gateway* binder.

Programmable Logic Controller Gateway Parameter Reference Dictionary in the *Implementation/PLC Gateway* binder.

Data Entity Builder Manual in the *Implementation/Engineering Operations - 1* binder.

- PICTURE EDITOR,

  Instructions for reference, data entry, and form instructions for the Picture Editor are in the *Implementation/Engineering Operations - 2* binder.

- HM HISTORY GROUPS, FREE FORMAT LOGS, BUTTON CONFIGURATION

  Instructions for these activities are in the *Implementation/Engineering Operations - 1* binder.

  Data Entity Builder Manual in the *Implementation/Engineering Operations - 1* binder.

- AREA DATA BASE

  Area Form Instructions in the *Implementation/Engineering Operations - 1* binder.

  Data Entity Builder Manual in the *Implementation/Engineering Operations - 1* binder.

1.2.2 References for Hardware Implementation

1.2.2.1 Site Planning

LCN Site Planning manual in the *System Site Planning* binder.

Programmable Logic Controller Gateway Planning, Installation, and Service in the *Implementation/PLC Gateway* binder.

1.2.2.2 Installation and Checkout

Programmable Logic Controller Gateway Planning, Installation, and Service in the *Implementation/PLC Gateway* binder.

1.2.2.3 Service

Five/Ten-Slot Module Service in the *LCN Service - 2* binder (Programmable Logic Controller Gateway).

Programmable Logic Controller Gateway Planning, Installation, and Service in the *Implementation/PLC Gateway* binder.

1.3 PLCG IMPLEMENTATION DEPENDENCIES

Figure 1-1 shows which PLCG implementation tasks depend on information entered in other tasks. This figure does not necessarily dictate the order in which the tasks must be completed, but it does show all dependencies that must be satisfied before the PLCG can be fully operational.

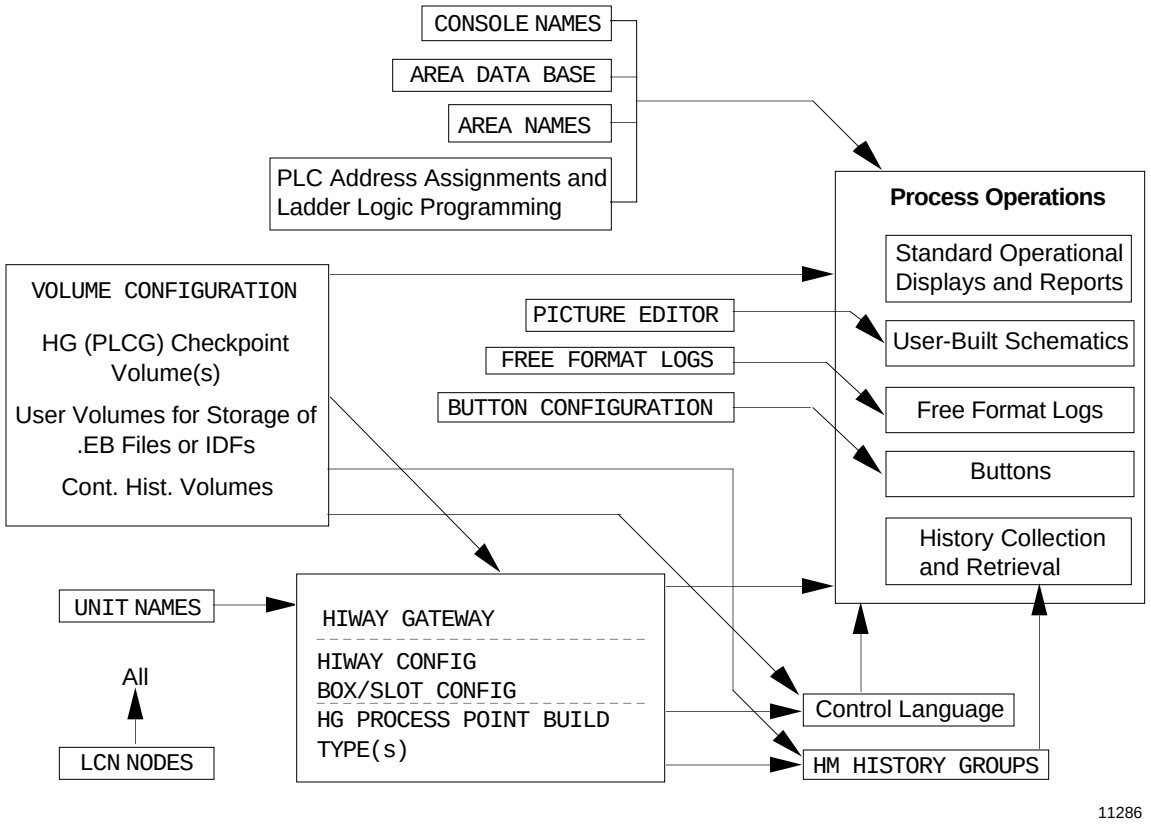


Figure 1-1 — PLC Gateway Implementation Dependencies

HIWAY AND BOX/SLOT CONFIGURATION
Section 2

This section provides guidelines for building hiway and box/slot configuration entities for each PLC Gateway.

2.1 PURPOSE OF THE HIWAY AND BOX/SLOT ENTITIES

Each hiway entity (point) defines for the LCN system, the PLC Gateway (PLCG), and the emulated Data Hiway. Each box/slot entity defines for the LCN system and the PLCG, one of the emulated Data Hiway Ports (DHPs) in the PLCG, and each slot in each DHP.

2.2 HIWAY AND BOX/SLOT ENTITIES TO BE BUILT

The PLCGs in a PLCG pair always use hiway addresses 02 and 03 on the emulated Data Hiway. The emulated DHPs in each PLCG or PLCG pair always use hiway addresses 08 through 15. For more information about this addressing scheme, refer to subsection 2.5 in *PLC Gateway Control Functions* in the *Implementation/PLC Gateway* binder.

2.2.1 Hiway Entities

You must build a hiway entity for each PLC Gateway. Each LCN can have up to 20 process networks. Each Data Hiway or Universal Control Network is one process network, so the sum of PLCG Hiway Entities, hiway entities for Data Hiways connected to HGs, and UCNs cannot exceed 20. Please note that the emulated hiway counts as a process network, even though it is not a physical hiway.

Hiway entities are reserved entities; that is, they are entities whose names are reserved for use by the system and begins with a dollar sign. The names are in this form:

$HIWAYnn

where nn is the hiway number (01 through 20).

2.2.2 Box/Slot Entities

You must build one box/slot entity for each emulated DHP for which you need to build data points. Each PLCG can have up to eight DHPs.

Like hiway entities, box/slot entities are reserved entities; that is, they are entities whose names begin with a dollar sign, and are reserved for use by the system. The names are in this form:

$HYnnBxx

where nn is the hiway number (01 through 20) and xx is the hiway box number (2 and 3 for the PLCG partners (primary and backup) and 8 through 15 for the DHPs).

2.3 ORDER FOR HIWAY AND BOX/SLOT ENTITY BUILDING

The order in which the Hiway and Box/Slot Configuration activities are accomplished is important. To build them, select HIWAY GATEWAY on the Engineering Main Menu, which calls up the HG Build Type Configuration Menu. Then select HIWAY CONFIG to build the hiway entity and BOX/SLOT CONFIG to build the box/slot entities.

Do these activities in this order:

1. HIWAY CONFIG
2. BOX/SLOT CONFIG for this PLCG pair (HG 2 and 3).
3. BOX/SLOT CONFIG for each DHP in use in this PLCG pair (8 through 15).

NOTE

When performing this initial load of a DHP's Box/Slot Configuration, an "A80" Addressing Error will occur. To clear the error, select Init Addr from the Hiway Command menu under the Hiway Status Display. Load the DHP Box/Slot Configuration a second time. This time there should be no errors.

The reserved entities that are defined by these tasks must be loaded in the order listed above. This means you must use individual Load commands to load the entities separately in this order, or you must use a Load Multiple command that loads them together in the proper order. For a Load Multiple command, the order in which the entities are loaded is specified by the order that the entity names appear in the selection list file.

You could also load these entities from an exception build source file (.EB file). In the .EB file, entities must be listed in the proper order.

2.4 HIWAY CONFIGURATION

The emulated Data Hiway in a PLCG is not a physical process network, so the PLCG does not have remote or added gateways, as does the Hiway Gateway.

2.4.1 Hiway Number

Each pair of PLCGs (a primary and secondary) on an LCN is assigned a unique process network number (01 through 20). The process network number identifies the hiway database to be used by the PLCG pair.

2.4.2 Hiway Traffic Director Functions

Because there is no physical Data Hiway associated with a PLCG or PLCG pair, the PLCG has complete control over all transactions on the emulated Data Hiway, so a Hiway Traffic Director (HTD) is physically impossible and functionally unnecessary. Therefore, always select ThisHG as the value for parameter HWYHTD in the hiway entity.

2.4.3 Sequence-of-Events Synchronization

The PLCG does not support sequence-of-events synchronization; therefore, always select Disable as the value for parameter SOESYNCH in the hiway entity.

2.5 BOX/SLOT CONFIGURATION

The type of box on the Data Hiway (HG for the PLCG and DHP for the emulated boxes) is defined in this task, as is each device's address on the hiway. You must configure a box/slot entity for each PLCG in a PLCG pair and you must configure a box/slot entity for each DHP for which you intend to build data points.

NOT RECOMMENDED BY TAC:

Because box/slot configuration takes only a few minutes, you should consider configuring all eight DHPs even if you do not intend to use them. This will make it easier to implement additional DHPs in the future.

After selecting `BOX/SLOT CONFIG` for the BOXTYPE parameter, select `HG` to configure a `PLCG` box/slot entity; and select DHP to configure a DHP box/slot entity.

2.5.1 PLCG Data Hiway Addresses

Assign the first PLCG to hiway address 02 and assign its partner (if present) to hiway address 03.

2.5.2 Emulated DHP Hiway Address Assignments

Assign the emulated DHPs to hiway addresses 08 through 15.

2.5.3 PLCG and DHP Box Assignment

The PLCG does not support remote or added gateways, as does the HG, so always configure ThisHG as the value for the BOXASSN parameter in both the PLCG box/slot entities and the DHP box/slot entities.

2.5.4 Event Processing

The emulated DHPs support the generation and reporting of events (Process Alarms, Process Changes, etc.). The parameter EVENT PRC should be set to ENABLE to allow routing of these events through the PLCG to the LCN.

2.5.5 Change Detection

Since there are no other Masters on the Emulated Hiway in the PLCG, there is no need to signal or detect changes made by other Masters. The CHNG FLAG parameter should be set to NOT CONFG.

PLCG OPERATIONAL CONSIDERATIONS
Section 3

This section describes operational characteristics of PLC Gateways (PLCGs) that you should consider during PLCG implementation.

3.1 THE PLCG SUBSYSTEM

The PLCG appears to the remainder of the LCN-based system to be a Hiway Gateway (HG) with a Data Hiway and up to eight Data Hiway Ports. It is supported by the HG software with no modifications. Therefore, all standard displays, including Status displays, Group displays, Detail displays, and Engineering Personality displays are the same as if the PLCG was an HG, including all HG, Data Hiway, and DHP terminology.

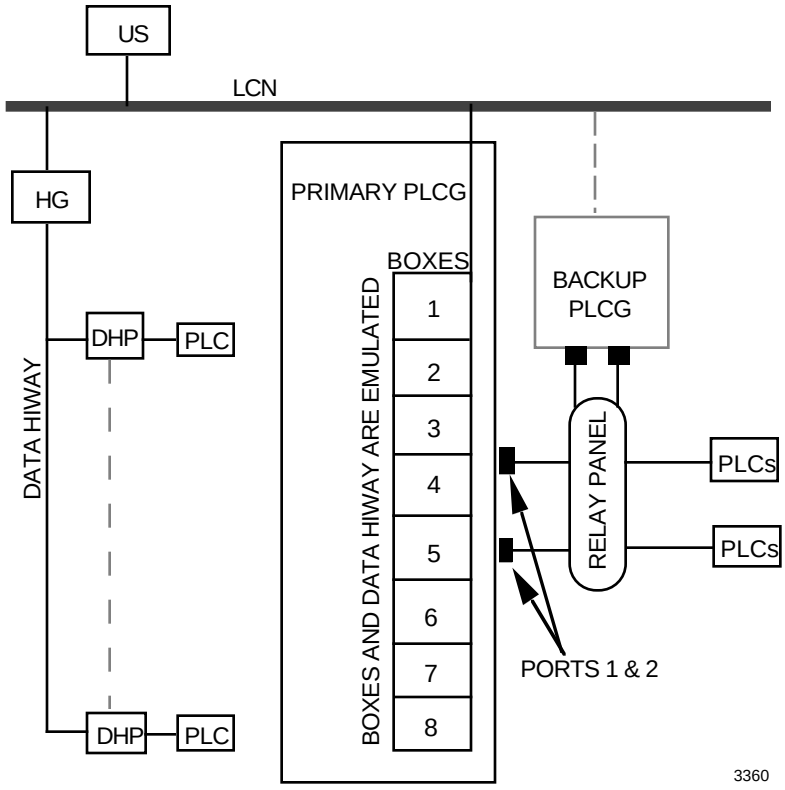


Figure 3-1 — Emulated Data Hiway and DHPs in the PLCG Subsystem

3.2 LOADING, SAVING, AND RESTORING OF PLCG DATA

3.2.1 PLCG Initial Startup or Restart

PLCGs are loaded with software and data through the Gateways and Interfaces display, which is called up through the System Status display. On the Gateways and Interfaces display, select the node number (or pair of node numbers) for the PLCG that is to start up as the primary PLCG. Then select the appropriate node loading targets and follow the prompters to initiate loading of the PLCG (select OPERATOR PROGRAM to load with the operating personality). After the status for the primary PLCG goes to OK, you can initiate loading of the backup PLCG. When it is loaded, its status becomes BACKUP.

The PLCG is loaded with its software personality image and a data image. The data image consists of previously checkpointed data or null checkpoint (a set of Honeywell-provided checkpoint files with no point data). The data that is loaded from the Gateways and Interfaces display does not include data for the emulated DHPs, which is loaded or restored through the Hiway Status display (for more information, see subsection 3.2.2).

CAUTION

Do not try to load both PLCGs in a PLCG pair concurrently—one of the PLCGs will fail. Complete loading one of the PLCGs as the primary, then the other PLCG can be loaded as the secondary.

For more information about starting or restarting PLCGs, refer to the information about loading of gateways and HG modules in Section 15 of the *Process Operations Manual* in the *Process Operations* binder. For instructions for using null-checkpoints in the initial startup of a PLCG, refer to Task 18 in the *System Startup Guide* (cartridge drives) in the *Implementation/Startup & Reconfiguration - 1* binder.

3.2.2 Initial Startup of a PLCG

A summarized example of 10 steps required to start up a PLCG is presented in this table. Publication references given in this section are here for convenience to the startup effort and some are duplicates of those in the list in subsection 1.2.

STEPS 1 THROUGH 4	NOTES	REFERENCE PUBLICATIONS
1. Physically install the PLCG or redundant PLCG pair; including power, grounding, and LCN cabling.	• The connection between the PLCG(s) and the PLC(s) will be discussed in a later step.	* Refer to the publications listed by these numbers below for useful information you may need to accomplish each task: 1, 2, 3, 4, 5
2. Configure the PLCG or PLCG pair as a node or node pair on the LCN.	• The PLCG configures as a Hiway Gateway (HG) and looks exactly like an HG to the operator. • If the PLCG is redundant, you will need to enter the Redundant Node Number ID (the two digit LCN node number). • You will be asked to enter a two digit Hiway number (01 through 20).	* 6, 7, 8, 9, 10
3. Perform a volume configuration to provide checkpoint space on a History Module within your system.	• Although having a checkpoint on your LCN network is not absolutely mandatory (you could store it on removable media), it is highly recommended. • Do not simply add a directory to an existing volume on an HM.	* 6, 7, 8, 9, 10
4. Complete the PLCI board pinning in the PLCG(s) and the PLCG relay panel pinning on the back of the PLCG(s).	• PLCG parity can be either odd or even, no parity is not an option. • If you chose Redundant Allen-Bradley for the relay panel pinning, the port 1 and port 2 pinning of TS2 on the PLCI board must be for identical baud rate and parity.	* 1

* See pages 3-5 and 3-6 for publication references.

STEPS 5 THROUGH 8	NOTES	REFERENCE PUBLICATIONS
5. Complete the cabling between the PLCG relay panel and the PLC(s).	• This is a good time to complete any dip switch settings and/or configuration in the PLC(s) you are interfacing to.	* 1
6. Power on the PLCG(s) and load it/them with the HG null checkpoint.	• The null checkpoint files are on volume &HGC, cartridges &CR6 or &C6 • The directory names are &I01 through &I20 corresponding to the appropriate hiway number chosen. • The file name that will be loaded is HG0xxMAS.CP where xx corresponds to the appropriate hiway number chosen. • At the Gateway Status display, the PLCG(s) should show as OK for the primary HG and Backup for the redundant HG (if present).	* 1, 6, 7, 10
7. Build and load the PLCG Hiway Data Point.	• The PLCG configures as a Hiway Gateway (HG) and looks exactly like an HG to the operator.	* 6, 7, 8, 9, 10, 11
8. Build and load the PLCG Box Data Point(s).	• **IMPORTANT** - Do not build and load any of the PLCG Box/Slot Data Points until this step is complete. • The PLCG configures as a Hiway Gateway (HG) and looks exactly like an HG to the operator. • For the primary PLCG, the box number has only one valid choice and it is 02. • For the backup PLCG, the box number has only one valid choice and it is 03.	* 6, 7, 8, 9, 10, 11

* See pages 3-5 and 3-6 for publication references.

STEPS 9 AND 10	NOTES	REFERENCE PUBLICATIONS
9. Build and load the PLCG Box/Slot Data Point(s).	• **IMPORTANT** - Do not do this by exception building or the use of the load multiple command with IDFs. • **WARNING** - After the initial load of a DHP there will be an associated A80 addressing error seen from the Hiway Status Display. To clear the error, perform an INIT ADDR command from the HIWAY COMMANDS function. Then reload each and every Box/Slot Data Point again. **DO NOT PROCEED WITHOUT COMPLETING THIS PROPERLY.** • Each DHP should come up in the RESET mode. Performance of an ENABLE PROCESSING command should make each DHP go to an OK state.	* 6, 7, 8, 9, 10, 11
10. Build and load Point(s).	• One point is enough to cause communications to start between the PLCG(s) and a PLC. Thus, it is recommended that only one point be built and loaded before going further. • Perform a demand checkpoint now. This way you will have something to go back to in case of a power failure or equipment malfunction. It is best to do a save using the ALL BOXES target to insure saving both the HG and DHP box portions of the database.	* 8, 9, 10, 11, 12, 13

* Startup publications references:

PUBLICATION TITLE	BINDER TITLE
1. PLCG Planning, Installation, and Service	Implementation/PLC Gateway
2. PLCG Specification and Technical Data	Implementation/PLC Gateway
3. LCN Site Planning	System Site Planning
4. LCN System Installation	LCN Installation
5. LCN System Checkout	LCN Installation

PUBLICATION TITLE	BINDER TITLE
6. System Startup Guide - Cartridge Drives	Implementation/Startup & Reconfiguration - 1
7. PLC Gateway Implementation Guidelines	Implementation/PLC Gateway
8. Data Entity Builder Manual	Implementation/Engineering Operations - 1
9. Engineer's Reference Manual	Implementation/Startup & Reconfiguration - 2
10. PLC Gateway Forms	Implementation/PLC Gateway
11. PLC Gateway Control Functions	Implementation/PLC Gateway
12. PLCG Parameter Reference Dictionary	Implementation/PLC Gateway

3.2.3 Saving of PLCG and DHP Data

After its initial startup, you can begin to build the database for your PLCG(s), including the data points and hiway and box/slot entities described in Section 2. These entities (points) are built with the Data Entity Builder, which you activate by selecting HIWAY GATEWAY on the Engineering Main Menu.

As you load points into the PLCG and during operation, you should periodically checkpoint (save) your PLCG and DHP data on an HM or removable media (cartridges or floppies). Use the SAVE DATA target on the Hiway Status display to request a demand checkpoint. You can enable automatic, periodic checkpointing to an HM through the AUTO SAVE target on the Gateways and Interfaces display (you should disable periodic checkpointing while you are building data points). For more information on checkpointing, refer to Section 21 of the *Engineer's Reference Manual* in the *Implementation/Startup & Reconfiguration - 2* binder.

We recommend that, in addition to checkpoints being saved automatically on an HM, you periodically request demand checkpoints through the SAVE DATA target on the Hiway Status display to be stored on removable media. This will serve as backup data if the HM should become unavailable. We do not recommend copying checkpoint files from an HM to removable media, because if more than one cartridge is needed, the data for one unit may be split between cartridges or floppies, and such data cannot be reloaded.

NOTE

It is possible to save data for individual DHPs (boxes), but before you can do so, you must have saved a complete checkpoint for the PLCG and all its emulated DHPs. Because the DHPs are not really individual physical boxes, but are integral parts of the PLCG, it is probably best to select ALL BOXES, rather than individual boxes. This ensures that all data changes in the PLCG and all DHPs are saved.

3.2.4 Restoring PLCG and DHP Data

PLCG and DHP data can be restored from checkpoint files through the LOAD DATA target on the Hiway Status display. A successful load replaces any data in the PLCG and DHP(s) with data from the checkpoint files. These loads can be directed to any box (DHP), or you can select ALL BOXES to direct the load to all DHPs.

NOTE

After reloading the PLCG personality, all configured DHPs will have A80 Address Errors. These errors must be cleared using the INIT ADDR command in the Hiway Command Menu from the Hiway Status Display. The configured DHPs will now be in "Reset." The DHP data can now be restored.

To accept a load, the PLCG and DHP status on the Hiway Status display must be OK, and the box control state must be BASIC. When a load is completed successfully, the word RESTORED appears adjacent to the box's status indicator.

3.2.5 Recovering from Checkpointing and Loading Errors

The following error messages may appear on the Gateways and Interfaces display or on the Hiway Status display when you attempt to save PLCG checkpoint and box checkpoint data, when you attempt to load a PLCG or boxes, or when you attempt to save box checkpoint data:

- FILE ERROR—See subsection 3.2.4.2.
- BAD REQUEST—A request was made for a box configured as AddedHG or RemoteHG, and not ThisHG. The PLCG and all emulated DHPs must be configured as ThisHG.
- CONFLICT—The PLCG is busy with another save or load operation.
- NO VOLUME—Either no cartridge is mounted in the drive specified, or the volume doesn't exist on the HM, or no checkpoint files were found on the specified medium (cartridge or HM).
- BAD STATE—The box was not in a proper state to accept the command. See subsection 3.2.2.

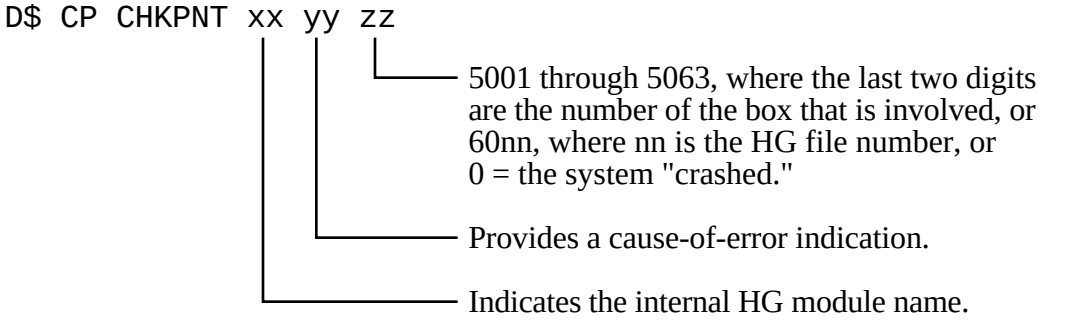
- ??????????—A communication error or some other error occurred that prevents the Universal Station from displaying the correct status.

Some operations might terminate because of an error, such as a cartridge not mounted, or a bad medium, and a message such as FAIL;HGnn appears. This doesn't mean the PLCG failed, it's the operation that failed.

3.2.5.1. Recommended Actions for Error Recovery

1. Use the SCREEN PRINT function to print a copy of the Gateway Status display or the Hiway Status display. If boxes are involved, you may need to print more than one display to document both the HG status and box status.

2. Check the Real-Time Journal print out(s) on the printer. This information will be useful if you need to consult with Honeywell about the problem. Error messages that result from these operations are in this form:



3.2.5.2 Recovery from a FILE ERROR

A FILE ERROR message is caused by one of the following:

- An attempt to load a box that was not previously checkpointed.
- Needed checkpoint files were not found on the medium (cartridge or HM) that was specified.
- A hiway error occurred as access to a box was attempted.
- On a SAVE DATA operation, the medium was full (too few files formatted) or the directory was too small to accept the data.
- An error occurred as access to the medium was attempted.

You should use the Catalog (LS or CAT) command in the Engineering Personality's Utilities to check the number of available files and sectors for the PLCG checkpoint data. Use the command's detail (-d) option. See *Command Processor Operation* in the *Implementation/Engineering Operations - 1* binder.

You can determine if checkpoint data for a specific box is on the medium by using the Utilities List File Attributes (LS) command to find information for the HG0hhbbr.CP file for the box. It may be useful to check the time stamps that are in the catalog data to see if an incompatible time stamp may be causing a problem. For example, box data should not be older than PLCG data.

3.3 USE OF HOLDING REGISTERS IN MODICON PLCs

The holding registers in Modicon and Modicon-compatible PLCs can be used as sources of PLCG digital input data, thereby increasing throughput by transferring blocks of digital data rather than single bits. To do so, a Digital Input or Digital Composite point's subslot address in parameter INPTSSLT specifies the bit to input from the holding register, as follows:

Subslot number in INPTSSLT	16 15 14 - - - - - - - - - - - - - - - - - 02 01
Holding register bit number	16 15 14 - - - - - - - - - - - - - - - - - 02 01

3.4 REPORTING BY EXCEPTION IN ALLEN-BRADLEY PLCs

To reduce the communication load presented to Allen-Bradley PLCs by the PLCG, the PLC's exception-reporting feature can be used. If this option is chosen after the initial PLC data has been scanned by the PLCG, it expects PLCs to notify it of significant changes in the PLC data by sending unsolicited inputs to the PLCG.

To avoid undetected loss of communication from the PLCs, keep-alive PLC addresses and bits must be configured in the box/slot entity for the DHP serving each Allen-Bradley PLC (parameters PCnALIVE AND PCnALVBT, where n = PLC numbers 1 through 8). If communication of a keep-alive bit fails, the PLCG places all points in the target PLC on continuous scan until the data is reestablished, and all data points that reference that PLC fail. Once communication is reestablished and new values are obtained, reporting by exception resumes.

If this option is chosen, the ladder-logic program in the PLC must support reporting by exception and must initiate all such reporting. Because periodic scanning of the PLC data is not occurring, changes by Universal Station operators and user-written programs must be reported back to the PLCG by the PLC. If it is not, the operators or user-written programs will not be able to see the status changes.

3.4.1 Activating Reporting by Exception

To activate reporting by exception, add two to the port address in the PCnPORT parameter (n = PLC number, 1 through 8). A port address of 1 or 2 specifies that the PLC is connected to ports 1 or 2, respectively, and that continuous scanning of the PLCs is configured. A port address of 3 or 4 specifies that the PLC is connected to ports 1 or 2, respectively, and that reporting by exception from the PLCs is configured.

PLCG PERFORMANCE CONSIDERATIONS
SECTION 4

4.1 FACTORS LIMITING PERFORMANCE

Although it is a very fast processor of data, the PLCG has finite computational capacity as its upper limit. If the processing of input/output data is restricted by the PLCG's inability to perform required computations, it is known as "compute bound." Limiting factors at the other extreme are baud rate and PLC I/O delays. If computations must wait for data to be received or transmitted, the condition is called "I/O bound." As baud rate is increased and/or PLC I/O delays are decreased, performance improvement is linear and usually proportionate. The performance improvement degrades, however, as compute limits are approached.

Statistics are maintained at various levels which can be used to monitor the performance of the PLCG. See *PLCG Planning, Installation, and Service* manual, subsection 4.3.2 for details and subsection 4.3 for how to display them.

4.2 EFFECTS OF DATABASE COMPOSITION

The performance of a data base chiefly composed of analog inputs, analog outputs and/or counters (numeric points) is primarily limited by baud rate and PLC performance. This is because numerics are easily processed in less than the 16 bit times required to transmit them to the PLCG. The performance of a data base which is predominantly digital inputs and digital outputs (Boolean points) places a greater burden on computational power because only one bit time is available for processing.

4.3 ADJUSTING A PLCG FOR PERFORMANCE

Of the factors affecting PLCG performance, the most significant is baud rate. As a rule of thumb, doubling the baud rate will double performance. If you are already running at the maximum baud rate, consider dividing the data base between the PLCG's two ports, if possible. This has the same effect as doubling the baud rate. Pinning the PLCI board to double buffer Data Requests (pipelined operation) will also improve performance. See *PLC Gateway Planning, Installation, and Service* manual, subsection 3.2.3.4, for pinning information.

At the PLC end, a dedicated communications module should be used if supported by the PLC. These modules usually contain a dedicated processor that utilizes a high-speed access mechanism, such as DMA, to access the PLC data. The PLCG requests data in blocks of up to 64 words. Unused data elements in the block will be read and discarded. For example: Two 30 word blocks separated by 4 unused words will be collected as a single 64 word block. This is faster than two 30 word requests. If a 60 word block is preceded or followed by unused words, only the 60 word block will be requested. By using consecutive storage elements within the PLC, the amount of excess data requested by the PLCG can be reduced.

The PLCG will sort all PLC database addresses before starting to request data, so the order of the points in the emulated DHP is not critical. As long as the PLC data elements are contiguous, the desired result will be achieved.

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Title of Publication: **PLC Gateway Implementation Guidelines** Issue Date: **12/95**

Publication Number: **PL12-500**

Writer: **G. Danner**

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