APM/HPM I/O Simulator

MU-SWSM22
APM/HPM I/O Simulator

MU-SWSM22
Release 500
11/95
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About This Publication

This *APM/HPM I/O Simulator* manual provides a guide to installing, operating, and using the Advanced Process Manager and or High-Performance Process Manager simulator software. This manual also describes how the simulator software is supported in the R500 versions of both the Advanced Process Manager and the High-Performance Process Manager.

Prior experience configuring APM or HPM data points and using APM or HPM status displays is recommended for users of this product. For users requiring APM or HPM configuration information, references to related publications are provided.
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<th>Definition</th>
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<td>AO</td>
<td>Analog Output</td>
</tr>
<tr>
<td>APM</td>
<td>Advanced Process Manager</td>
</tr>
<tr>
<td>APMM</td>
<td>Advanced Process Manager Module</td>
</tr>
<tr>
<td>DI</td>
<td>Digital Input</td>
</tr>
<tr>
<td>DO</td>
<td>Digital Output</td>
</tr>
<tr>
<td>EB</td>
<td>Exception Build</td>
</tr>
<tr>
<td>HLAI</td>
<td>High Level Analog Input</td>
</tr>
<tr>
<td>HM</td>
<td>History Module</td>
</tr>
<tr>
<td>HPM</td>
<td>High-Performance Process Manager</td>
</tr>
<tr>
<td>HPMM</td>
<td>High-Performance Process Manager Module</td>
</tr>
<tr>
<td>IDF</td>
<td>Intermediate Data Files</td>
</tr>
<tr>
<td>IOP</td>
<td>Input Output Processors</td>
</tr>
<tr>
<td>LCN</td>
<td>Local Control Network</td>
</tr>
<tr>
<td>LLAI</td>
<td>Low Level Analog Input</td>
</tr>
<tr>
<td>LLMUX</td>
<td>Low Level Analog Input Multiplexor</td>
</tr>
<tr>
<td>NAN</td>
<td>Not a Number</td>
</tr>
<tr>
<td>NIM</td>
<td>Network Interface Module</td>
</tr>
<tr>
<td>PI</td>
<td>Pulse Input</td>
</tr>
<tr>
<td>PWM</td>
<td>Pulse Width Modulated</td>
</tr>
<tr>
<td>SI</td>
<td>Serial Interface</td>
</tr>
<tr>
<td>SOE</td>
<td>Sequence of Events</td>
</tr>
<tr>
<td>STI</td>
<td>Smart Transmitter Interface</td>
</tr>
<tr>
<td>TAC</td>
<td>Technical Assistance Center</td>
</tr>
<tr>
<td>UCN</td>
<td>Universal Control Network</td>
</tr>
<tr>
<td>US</td>
<td>Universal Station</td>
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### Parameters

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<td>Off Normal Alarm</td>
</tr>
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<td>OFFINAL</td>
<td>Output Final</td>
</tr>
<tr>
<td>OPTDIR</td>
<td>Output Direct/Reverse Action</td>
</tr>
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<td>PV</td>
<td>Process Variable</td>
</tr>
<tr>
<td>PVHH</td>
<td>PV High High Alarm</td>
</tr>
<tr>
<td>PVHI</td>
<td>PV High Alarm</td>
</tr>
<tr>
<td>PVLL</td>
<td>PV Low Low Alarm</td>
</tr>
<tr>
<td>PVLO</td>
<td>PV Low Alarm</td>
</tr>
<tr>
<td>PVRAW</td>
<td>Raw PV (in EUs if Simulation Mode)</td>
</tr>
<tr>
<td>PVROCN</td>
<td>PV Rate of Change Negative</td>
</tr>
<tr>
<td>PVROCP</td>
<td>PV Rate of Change Positive</td>
</tr>
<tr>
<td>PVSOURCE</td>
<td>PV Source</td>
</tr>
<tr>
<td>TF</td>
<td>PV Filtering Lag Time</td>
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## References

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## Requirements for Using the Simulator

### Introduction
Before continuing in this manual, it is important that you understand the requirements of the Advanced Process Manager and High-Performance Process Manager I/O Simulator and your need to complete the software registration form.

### Registration responsibilities
Please take the following steps now to ensure support from Honeywell:

- Familiarize yourself with the enclosed Software License Agreement, Copyright Statements, Trademarks, and Credits.
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### Hardware requirements
The minimum hardware you need for the installation and operation of the APM/HPM I/O Simulators is as follows:

- Local Control Network (LCN)
- Network Interface Module (NIM)
- Universal Station (US)
- Advanced Process Manager (APM)
- High-Performance Process Manager (HPM)

A History Module (HM) is not required, but provides ease of use.

### Software requirements
Release 500 LCN and UCN software is required.

### Compatibility
The APM/HPM I/O Simulators are compatible with LCN Release 500.
Figure 1 represents an example system configured to support the Advanced Process Manager I/O Simulator or the High-Performance Process Manager I/O Simulator.

Note: It is not necessary to have both the APM and HPM nodes present.
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(CITY) (STATE) (ZIP)

PLANT OR MILL SITE _______________________________________________________
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MAIL ADDRESS _____________________________________________________________
(CITY) (STATE) (ZIP)

PHONE ____________(__________)____________________________________________
AREA CODE

SERIAL NUMBER

DATE PURCHASED _______________________________________________________

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AUTHORIZED SIGNATURE ____________________________________DATE________

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Revision 5 Dated 15 March 1995
Packing List

Items Contained in This Manual

The following items are contained in this manual.

• Read me first section
• Copyright and trademarks
• Registration and license
• Overview description
• Installation and operation instructions
• Technical Assistance Center (TAC) procedures
• Software policy
• Comment forms
• Notes
• Honeywell APM/HPM I/O Simulator distribution cartridge
## Overview Description

### Overview of I/O Functions

**Intended uses**

Both APM and HPM I/O Simulator Personalities provide you the capability to simulate functions of the APM or HPM’s Input/Output Processors (IOPs). They support a low cost, high fidelity approach to simulation intended for use in control strategy checkout or as a support tool in an operator training environment.

**Simulated I/O types**

The I/O Simulation Personalities simulate the operation of all APM and HPM I/O Processor Modules, including:

- High Level Analog Input (HLAI)
- Smart Transmitter Interface (STI)
- Low Level Analog Input (LLAI)
- Low Level Analog Input Multiplexor (LLMUX)
- Analog Output (AO)
- Pulse Input (PI)
- Digital Input (DI)
- Digital Output (DO)
- Serial Interface (SI)
- High density IOPs (DO_32 and AO_16)

Note that installed I/O processors and associated hardware are not required for the IOP simulation software to operate.

**Supported functions**

The simulation personality supports the following functions:

- Configuration of I/O database without requiring physical IOPs.
- Real-time simulation of Primary I/O Processor functions including data owner logic and alarm processing.
- Checkpoint save and restore of simulated Process Manager database—PVRAW (AI, DI Status/latched), OP (AO, DO), AV (DI Accumulation).
- Checkpoint restore of simulation database to a target Process Manager and I/O.
- Write access to input values (PV for all input types, PVRAW for AI, AV and PVFL for DI) for all input type modules.
- Pause and resume capability to interrupt and restart simulations.
- IOP hard failure simulation.

*Continued on next page*
Simulation Personality provides functions

These functions are provided through the use of I/O Simulation Personalities which may be loaded into any APM or HPM. When loaded with this personality, either controller runs in a Simulation Mode. All references to the I/O database are handled internally by the Communication Processor. An overview block diagram of the APM I/O Simulator is provided in Figure 2. An overview block diagram of the HPM I/O Simulator is provided in Figure 3.

Simulation Mode overview

When operating in the Simulation Mode, physical I/O is not required, and if present, is not used by either the APM or the HPM. Program access to read simulated output data and to write simulated PV data is enabled. This allows a user program in a DEC VAX (connected by way of a Computer Gateway), or an Application Module, or an APM or HPM to perform the process simulation function. Figures 2 and 3 represent an overview of the APM and HPM simulator software.

Figure 2 APM Simulator Overview

Continued on next page
You may wish to write your own simulation program to complement the functionality provided by the Process Manager I/O Simulation Personality. This document occasionally refers to a customer written process simulation program as “I/O stimulation software,” in order to distinguish it from Honeywell’s I/O Simulation Personality option.
Simulated IOP Functions

Summary of functions

All IOP functions needed to enable your control strategy checkout are provided by the Simulation Personality. However, some time-related functions (such as filtering) use default values and are not supported when the APM or HPM is in a Simulation Personality. Database support (that is, configuration) is available for nonsupported functions. A summary of key functions simulated, as well as functions not supported, is provided.

Analog Input Modules

Analog Input modules (HLAI, STI, LLAI, LLMUX) have the following functions simulated:

- An operator or program is permitted to make stores to PVRAW. When an APM or HPM is in Simulation Mode, PVRAW is in engineering units.
- PVRAW may be set to NAN (that is, Not A Number, ----) to simulate a sensor or transmitter input failure.
- Alarms are detected and processed for the following IOP alarms—PVHI, PVLO, PVHH, PVLL, and BADPV. This includes alarm priority, enabling/disabling, and contact cutout functions. (PVROCP or PVROCN are not supported, although database configuration is supported.)
- PV range checking and PVSOURCE selection functions are supported.

The following functions are not simulated:

- PV Characterization. Since a user-written process simulation program (that is, I/O simulation software) normally stores to PVRAW in engineering units, PV characterization is not needed. When PVRAW is stored, the value is transferred directly to PVCALC.
- PV Filtering Lag Time (TF). Assumes TF = 0 minutes. After a new range-checked value is determined, it is transferred directly to PVAUTO.

Figure 4 Overview of Analog Input Simulation

Continued on next page
Simulated IOP Functions, Continued

**Analog Output Module**

Analog Output modules have the following functions simulated:

- Mode, initialization, and full point form functions.
- Output Direct/Reverse action (OPTDIR).
- Output characterization (OPFINAL).

**Figure 5** Overview of Analog Output Simulation

**Support for time-based functions**

The HPM I/O Simulator tasking architecture operates differently than the actual IOPs being simulated, and as such, the following time-based functions may not execute faithfully within their exact real-time specifications:

- DI latched input processing
- DI PV change delay and alarm delay processing
- DO Pulse Width Modulation (PWM) and one shot processing.

Note that the APM I/O Simulator does not support these time-based functions, so this applies to the HPM I/O Simulator only.

**Digital Input Module**

Digital Input modules have the following functions simulated:

- An operator or program is permitted to make stores to PVRAW.
- Alarms are detected and processed for all IOP alarms (OFFNORM). This includes alarm priority, enabling/disabling, and contact cutout functions.
- PV Event Reporting is supported, including Sequence of Events (SOE).
- PVSOURCE selection is supported.
- When a digital input point is configured as an accumulation type, the accumulated value (AV) can be set by the operator or program.
- Input direction (DIRECT/REVERSE) is supported.
- For accumulation type digital input points, the point processing relating to AV target value (AVTV) and overflow is executed whenever AV is written to by an operator or program.
The following functions are not simulated:

- Debounce and PV change delay filters (DEBOUNCE, PVCHGDLY) can be configured, but these functions are not supported by either APM or HPM Simulation.
- DI latch function can be configured, but is not supported by either APM or HPM Simulation.
- SOE 1 ms resolution
Simulated IOP Functions, Continued

Serial Interface module: Simulation software permits read and write access to the I/O simulation database for an Array point.

Figure 7: Overview of Serial Input Simulation

Table 1: Simulated/Nonsimulated Functions

<table>
<thead>
<tr>
<th>DO</th>
<th>Simulated Functions</th>
<th>Nonsimulated Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>APM</td>
<td>Digital Output Status, except OFFPULSE/ONPULSE, can be configured</td>
<td>• OFFPULSE/ONPULSE outputs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pulse Width Modulated (PWM) Digital Outputs</td>
</tr>
<tr>
<td>HPM</td>
<td>• Status &amp; Pulse Width Modulated (PWM) Digital Output</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• OPFINAL timing for pulse and PWM outputs.</td>
<td></td>
</tr>
</tbody>
</table>

Digital Output Module: Table 1

Figure 8: Overview of Digital Output Simulation

Continued on next page
Simulated IOP Functions, Continued

**Pulse Input Module**

When a Pulse Input module is in the simulation mode, the accumulation source (ACCSRC) is automatically set to PV. The totalizer algorithm then uses the PV instead of delta AV for its input source.

- An operator or program is permitted to make stores to PVRAW. When the APM or HPM is in Simulation Mode, PVRAW is in engineering units.
- PVRAW may be set to NAN (that is, Not A Number, ----) to simulate a sensor or transmitter input failure.
- Alarms are detected and processed for the following IOP alarm—PVHI, PVLO, PVHH, PVLL, and BADPV. This includes alarm priority, enabling/disabling, and contact cutout functions. (PVROCP or PVROCN are not supported, although database configuration is supported.)
- PV range checking and PVSOURCE selection functions are supported.

The following functions are *not* simulated:

- PV Characterization. Since a user-written process simulation program (that is, I/O simulation software) normally stores to PVRAW in engineering units, PV characterization is not needed. When PVRAW is stored, the value is transferred directly to PVCALC.
- PV Filtering Lag Time (TF). Assumes TF = 0 minutes. After a new range-checked value is determined, it is transferred directly to PVAUTO.

**Figure 9** Overview of Pulse Input Simulation

![Diagram of Pulse Input Simulation]

*Continued on next page*
The I/O Simulator maintains the IOP database as part of the APMM's Communications Processor memory. The configuration constraints, summarized in Table 2, are dependent upon either

- the maximum of any one IOP type configuration limit, or
- the IOP configuration mix has resulted in using the amount of available memory. Each IOP has a scaling factor or weight for the amount of memory it requires, the total for all IOPs cannot exceed 120.

**Table 2  APM Configuration Limits**

<table>
<thead>
<tr>
<th>IOP Type</th>
<th>Maximum per IOP type</th>
<th>Memory factor for each IOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>DO</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>DO32</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td>DISOE</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>HLAI</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>LLAI-8</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td>LLMUX</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>SI</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>PI</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td>STI</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>AO</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>AO16</td>
<td>40</td>
<td>3</td>
</tr>
</tbody>
</table>

**Example calculations**

A configuration of 27 AOs and 13 HLAI results in the following:

\[(27 \times 2 \text{ weight of AO}) + (13 \times 5 \text{ weight of HLAI}) = 119.\]

This IOP configuration mix is less than the total memory constraint of 120, so the maximum of 40 IOPs is configured.

A configuration of 8 SIs, 8 DIs, 8 DOs results in the following:

\[(8 \times 9 \text{ wt of SI}) + (8 \times 4 \text{ wt of DI}) + (8 \times 2 \text{ wt of DO})= 120.\]

This IOP configuration reaches the total memory constraint of 120, even though the maximum of 40 IOPs is not configured.

*Continued on next page*
Simulated IOP Functions,  Continued

<table>
<thead>
<tr>
<th>HPM Configuration</th>
<th>The HPM does not have any IOP configuration limits. The full complement of 40 IOPs can be configured.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard failure simulation</td>
<td>A hard failure simulation function is provided through setting the hard failure status of an IOP to any hard failure code. You can access the hard failure codes through a schematic or program, using $NMnnBxx.FAILCODE(i), where nn=UCN network number xx=APM or HPM address number i = IOP number Once a hard failure is set, a nonredundant IOP acts as if it were a physical nonredundant IOP. Question marks are displayed on operator displays and access to the PV results in an error code. When a hard failure is simulated in the primary of a redundant IOP pair, both the primary and secondary IOPs go to a No Response state. When a hard failure is simulated in the secondary of a redundant IOP pair, only the secondary IOP goes to a No Response state. To recover from a simulated IOP hard failure, you can clear the previous hard failure code (FAILCODE) by setting it to UNKNOWN. The IOP returns to IDLE.</td>
</tr>
<tr>
<td>Example failure simulation</td>
<td>The parameter for an IOP's last hard fail status, IOMLHFST, lists the errors that FAILCODE can be set to. For example, the power down (no response) hard failure status is &quot;POWERDWN.&quot; An example simulation follows: SET $NM03B09 . FAILCODE(1) = POWERDWN RESULT: The status of IOP module #1 goes to the No Response (NR) state. To remove the error, the failcode is set to UNKNOWN: SET $NM03B09 . FAILCODE(1) = UNKNOWN RESULT: The status of IOP module #1 goes to the IDLE state.</td>
</tr>
</tbody>
</table>
## Physical IOP Functions

<table>
<thead>
<tr>
<th>Overview</th>
<th>Because IOP functions are simulated by the APM or HPM Communication Processor in a Simulation Mode, all IOP data and status information accessed represent <em>simulated</em> data and status.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical IOPs are inaccessible</td>
<td>If physical IOPs are installed, the database and status of the physical IOPs are not accessible when in a Simulation Mode. Because the physical I/O is not accessible, field wiring checkout in parallel with control strategy checkout is not supported in the same APM or HPM. Additionally, any physical IOP failure is not detected or reported when either APM or HPM is in the simulation mode; therefore, the IOPs will be left in the FAILURE state.</td>
</tr>
<tr>
<td>Accessing IOPs after simulation</td>
<td>In order to access physical IOPs after a simulation is complete, the APM or HPM must be reloaded with the on-control personality. The APM or HPM must go to the ALIVE state in order to load the on-control personality after a simulation.</td>
</tr>
<tr>
<td>Physical output action during simulation</td>
<td>For all physical output type modules (AO and DO) present in either APM or HPM loaded with the Simulator Personality, the Time Out Gate function on these I/O Processors will expire. When the Time Out Gate expires, the physical output type processors will “think” they have lost communication with the APMM or HPM. As a result, the physical outputs will be set to the user-configured “Fail State”—which can be either hold the last output value or go to an unpowered state.</td>
</tr>
</tbody>
</table>
Redundancy Functions

Redundancy configuration is supported

Configuration of APMM or HPMM and I/O redundancy is supported by the I/O Simulator. Checkpoint of databases with redundant configurations can be transported to and from the target APM or HPM. The target APM or HPM can be an APM or HPM designated for on-process control.

APMM or HPMM redundancy behavior

APMM or HPMM redundancy behavior is summarized as follows:

- Both the primary and secondary APMM or HPMM can be loaded with the simulation personalities. When this occurs, the simulation APMM or HPMMs appear as physical APMM or HPMMs in the status displays. Operational commands such as IDLE, STARTUP, and SHUTDOWN are permitted.
- In a redundant APMM or HPMM with I/O Simulation Personality loaded, the secondary is in the backup state.
- After a failover or swap, all IOPs go to the Idle state, with DB_INVALID displayed. This means that the IOP database has been defaulted (cleared). Also, the APMM or HPMM goes to the Idle state and control database is defaulted (cleared) to no points.
- Redundant APMM or HPMMs cannot be loaded with both the on process and I/O Simulator Personalities at the same time. That is, mixed on-process and I/O Simulator Personalities cannot coexist in redundant APMM or HPMMs. In each case, the secondary will go to the Fail state.

ATTENTION

ATTENTION—When redundant APMMs or redundant HPMMs are swapped (that is, the secondary becomes the primary), all IOP databases are cleared. To avoid unintended loss of the IOP databases, you may wish to leave the secondary in the ALIVE state when an APM or HPM is loaded with the Simulation Personality.

IOP redundancy behavior

IOP redundancy behavior is summarized as follows:

- IOPs configured as redundant appear as OK/BKP.
- Redundant IOPs ignore swap commands from an operator and will not failover if a simulated hard failure is requested.

The effect of transition into a Simulation Mode for redundant configurations is described in the Simulation Status Indications portions (see tab Install & Operate) of this manual.
## Overview of Topics

These are the topics covered in this section:

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<th>See Page</th>
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</thead>
<tbody>
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<td>Transporting Databases</td>
<td>54</td>
</tr>
</tbody>
</table>
Before You Begin

Introduction

Review this section to ensure that you have made backup copies and are aware of any additional considerations.

File naming

The APM and HPM Simulation Personalities are contained on cartridge. Although these personalities can be copied to and loaded from your HM, you may wish to load the Simulation Personality from removable media only. The reason for loading from removable media is to keep the Simulation Personalities off of the network, where an operator could inadvertently load them into an operating system controlling the process.

The filename for the Simulation Personalities are as follows:

<table>
<thead>
<tr>
<th>DIR</th>
<th>FILENAME</th>
<th>EXT</th>
</tr>
</thead>
<tbody>
<tr>
<td>APM</td>
<td>&amp;UCN APMCOMS1 .PI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp;UCN APMCOMS2 .PI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp;UCN APMCTLS1 .PI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp;UCN APMCTLS2 .PI</td>
<td></td>
</tr>
<tr>
<td>HPM</td>
<td>&amp;UCN HPCMHS1 .PI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp;UCN HPCMHS2 .PI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp;UCN HPCTHS1 .PI</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp;UCN HPCTHS2 .PI</td>
<td></td>
</tr>
</tbody>
</table>

The letter “S” in the file name indicates a simulation personality that is loaded into the either APM or HPM.

Example of backing up media

Prepare a formatted cartridge for the purpose of backing up the Simulation programs. Copy the entire contents of the distribution media to the blank cartridge.

```
CP $F1>&UCN>*.* $F2>UCN>=  -D
```

where $F1 is the drive you are copying from and $F2 is the drive you are copying to.

Operate with the backup media

Store the distribution media in a safe place. Use the backup copy for installing and operating the APM or HPM Simulator.

Backup your system data

Back up network resident checkpoints on another cartridge, in case they become unintentionally overwritten. Place this backup in a safe place and mark it appropriately. List the files on the cartridge to make sure you have a good backup.
Installing the I/O Simulator

Introduction

Installing the I/O Simulator is easy. Simply load the simulation personality to the APM or HPM as you normally would using the same UCN Status Displays for the on control personality. In R500, the UCN Status Displays provide a [SIMULATOR LOAD] target for loading the I/O Simulator. The Simulator Personalities can be copied to and loaded from the History Module but for the safety of your process, it is suggested that you load the personalities from the R500 APM/HPM I/O Simulator Bernoulli.

ATTENTION

ATTENTION—The following usage guidelines are applicable to using the Simulation Personality in systems connected to the process and simulation:

• Do not operate the APM or HPM I/O Simulator in an on-process system. Do not load it to the APM or HPM when operating on-process system. In both cases when the Simulation Personality is loaded, the physical IOPs become inaccessible.

• Note that the automatic checkpoint function is the same for an on-process APM or HPM, which means that the automatic checkpointing is disabled after the simulation personality is loaded into either. Automatic checkpointing is disabled because if an automatic checkpoint is made to the History Module, it will overwrite the previous checkpoint (which may have been a checkpoint intended for control, training, or strategy checkout).

• We suggest that simulation mode checkpoints be made to removable media. Checkpoints to removable media let you set up a variety of simulation states, which are useful for operator training and system checkout.

Systems not connected to the process

For systems not connected on-process (typically for operator training and control strategy checkout systems), the I/O Simulator Personality can be loaded to the appropriate HM system volume. However, it is easier to manage and maintain control of your simulation and operating personalities when you load them from removable media.

Continued on next page
Installing the I/O Simulator, Continued

Changing APM or HPM address

If the target APM or HPM (that is, an APM or HPM intended for process control, which can be on a separate network) has a different node address than the Simulation APM or HPM, the hardware address of the Simulation APM or HPM can be reset to match the target APM or HPM.

Example APM address

The location of the APM address settings is given in Figure 10, while a full description is available in Honeywell technical publication PM13-501, Process Manager/Advanced Process Manager Service manual.

Figure 10 APM Address Jumper Location

Continued on next page
Installing the I/O Simulator,  Continued

Example HPM address  The location of the HPM address settings is given in Figure 11, while a full description is available in Honeywell technical publication *HP13-500, High-Performance Process Manager Service* manual.

Figure 11  HPM Address Jumper Location

Primary and secondary addresses  Recall that the primary and secondary APM or HPM addresses are pinned to the same number when APMM or HPMM redundancy is file-to-file. For example, if the primary APM or HPM address is set to “7,” the secondary APM or HPM is also set to “7.”

NIM address and UCN recommendation  NIM address settings and UCN Network numbers in the off-process simulation system and target system should be set to the same address. This enables checkpoint transportability between systems.

Continued on next page
Installing the I/O Simulator,  Continued

Loading the program

The user is assumed to have prior knowledge of loading an APM or HPM on control personality. For further explanation and procedures, refer to the Process Operations Manual, SW11-501 (binder TDC 3050).

ATTENTION

ATTENTION—If the target APM or HPM for the simulation personality is connected to process control hardware and you are not sure of FAILOPT action (unpowered or hold), you may want to reconfirm the configured FAILOPT for output type IOPs prior to loading the simulation personality.

Load procedure

The steps in Table 3 show you one way to load the APM or HPM’s simulator program. Loading the APM’s simulator program follows the same steps. The display results are shown in Figure 12.

Table 3  Load APM or HPM Simulator Program

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From the UCN Status Display, select the target representing the primary APM or HPM you wish to load. (Note: The APM or HPM and its redundant partner must be shutdown and in the ALIVE state to load the simulation personality).</td>
</tr>
<tr>
<td>2</td>
<td>Select the LOAD/SAVE RESTORE target.</td>
</tr>
<tr>
<td>3</td>
<td>Select the SIMULATOR LOAD target, press [ENTER].</td>
</tr>
<tr>
<td>4</td>
<td>Select the ALTERNATE SOURCE targets if your APM or HPM Simulator personalities and checkpoints are on removable media. Select the EXECUTE COMMAND target. Repeat steps 1 through 4 for a redundant APM or HPM if one is present. Response: After loading is completed, the primary APM or HPM appears in the simulation Idle (S_IDLE ) state. Note: If the APM or HPM is loaded with just the simulation personality and no checkpoint, the APM or HPM has no control or I/O database. You can load an APM or HPM checkpoint using RESTORE DATA or load new points from the Data Entity Builder while the APM or HPM is in S_IDLE.</td>
</tr>
<tr>
<td>5</td>
<td>After issuing startup commands to the APM or HPM the status is displayed as S_OK/ALIVE.</td>
</tr>
</tbody>
</table>

Continued on next page
Loading the program

Figure 12 is an example of the display results you could expect to see.

Figure 12 Program Load Example
Simulation Group and Detail Indications

Simulation indications

Standard indication of the Simulation Mode is provided on the node status displays, while per point indication of Simulation Mode is based on your configuration of the simulation display indicator parameter, DISP_SIM, specified during node specific configuration (refer to Figure 24).

Display text examples

After the I/O Simulation Personality is loaded and points are operational, the optional text appears for simulation points in group and detail displays.

Table 4 Simulation Text Indicators

<table>
<thead>
<tr>
<th>Text</th>
<th>Meaning of Simulation Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMULATE</td>
<td>The point is in a simulation state, the APM or HPM is in a simulation mode other than pause (S_PAUSE or S_PFPAUS), and the simulation display indicator parameter, DISP_SIM, is configured as “on.”</td>
</tr>
<tr>
<td>PAUSE</td>
<td>The APM or HPM is in a simulation pause (S_PAUSE or S_PFPAUS), state. An APM or HPM in pause (S_PAUSE or S_PFPAUS) always shows PAUSE indication, regardless of DISP_SIM selection.</td>
</tr>
</tbody>
</table>
Simulation Status Indications

An example display with an HPM in simulation mode appears in Figure 14.

Figure 14 Overall UCN Simulation Status

Simulation meanings

The simulation states are similar to the on-process states, except that the simulation states have an “S_” prefix.

Table 5 APM or HPM Simulation State Indicators, UCN Status Display

<table>
<thead>
<tr>
<th>State</th>
<th>Meaning of Simulation State</th>
<th>Example State Transitions Permitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>S_OK</td>
<td>OK simulation mode; IOPs and APMM or HPM are processing points and performing normally.</td>
<td>• S_OK to S_PAUSE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• S_OK to S_IDLE</td>
</tr>
<tr>
<td>S_IOIDL</td>
<td>An IOP is in Idle; APM or HPM is in simulation mode.</td>
<td></td>
</tr>
<tr>
<td>S_IDLE</td>
<td>APM or HPM in IDLE simulation mode, no point processing occurs.</td>
<td>• S_IDLE to S_OK (cold or warm restart)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• S_IDLE to ALIVE (database cleared)</td>
</tr>
<tr>
<td>S_PFIOIL</td>
<td>Partial failure(s) in one or more Idle IOP(s).</td>
<td></td>
</tr>
<tr>
<td>S_PFIDLE</td>
<td>Partial failure in APMM or HPM that is in Idle state</td>
<td></td>
</tr>
<tr>
<td>S_PTFFAIL</td>
<td>Partial failure occurred in simulation APMM or HPM.</td>
<td></td>
</tr>
<tr>
<td>S_PAUSE</td>
<td>APM or HPM in PAUSE simulation mode, no point processing occurs</td>
<td>• S_PAUSE to S_OK (hot restart)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• S_PAUSE to S_IDLE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• S_PAUSE to ALIVE (database cleared)</td>
</tr>
<tr>
<td>S_PFPAUS</td>
<td>Partial failure occurred in pause state.</td>
<td></td>
</tr>
</tbody>
</table>

Continued on next page
Simulation Status Indications, Continued

HPM simulation status indications

An example display with an HPM in simulation mode appears in Figure 15.

Figure 15 Overall HPM Simulation Status

UCN Status Simulation indications

The simulation states are similar to the on-process states, except that the simulation states have an “S_” prefix.

Table 6 Simulation State Indicators, APM or HPM Status Display

<table>
<thead>
<tr>
<th>State</th>
<th>Meaning of Simulation State</th>
</tr>
</thead>
<tbody>
<tr>
<td>S_OK</td>
<td>OK simulation mode, point processing occurring.</td>
</tr>
<tr>
<td>S_IDLE</td>
<td>Idle APMM or HPMM in the simulation mode.</td>
</tr>
<tr>
<td>S_IDLESF</td>
<td>Idle simulation mode APMM or HPMM with soft failure.</td>
</tr>
<tr>
<td>S_SFAIL</td>
<td>Point processing occurring, however a soft failure occurred in simulation mode.</td>
</tr>
<tr>
<td>S_PAUSE</td>
<td>PAUSE state in simulation mode APMM or HPMM.</td>
</tr>
<tr>
<td>S_PAUSSF</td>
<td>PAUSE state in simulation mode APMM or HPMM with soft failure.</td>
</tr>
</tbody>
</table>

Continued on next page
Simulation Status Indications, Continued

Mismatched personalities

If a redundant APMM or HPMM partner is loaded with the simulation personality and the other partner with the on-line personality (or conversely), the second node loaded will fail. A load of the secondary of an on-line node with the simulation personality is intentionally prevented for security reasons.

ATTENTION

ATTENTION—When APMMs or HPMMs are swapped all IO database is cleared.

Simulated redundant IOP status

The I/O Simulator supports I/O redundancy configuration, but not IOP redundancy operation. For any configured redundant IOP pairs, the “B” appears as a backup (BKP), as shown in Figure 16.

Figure 16 Simulated Redundant IOP Status Example

Continued on next page
The simulation status is also shown on the associated UCN Status and APM or HPM node status displays. The following status information is available on their diagnostic displays:

- The message IOP in Simulation is shown in red.
- The firmware revision field indicates the simulator software version.

The APM display is similar to this HPM display.
APM node diagnostic indication

In addition to the Simulation Mode indicator on the IOP diagnostic display, the APM node diagnostic display can be checked to verify that the I/O Simulator Personality is loaded.

In the Simulation Mode, the Communication Personality Version is "5x" (where “xx” indicates a revision series).

Figure 18 Revision Status Example

Continued on next page
In the Simulation Mode, the Communication Personality Version is “5x” (where “x” indicates a revision series).

Figure 19  Revision Status Example
Pausing and Resuming Simulations

Introduction

On occasion you may wish to pause a simulation to check conditions, checkpoint, and then resume the simulation.

Pause

You can pause a simulation in progress when the APM or HPM is in S_OK or S_PTFAIL. In the Pause state, the Simulation PVRAW and OP cannot be changed except through a checkpoint restore; additionally, control points are kept at their previous value. Because the LCN system time clock cannot be frozen, any configured history collection will continue while in Pause.

Pause procedure

Table 7  Pause APM or HPM Simulation

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>After setting the access key to Engineering, select the primary APM or HPM that is in the S_OK or S_PTFAIL state.</td>
</tr>
<tr>
<td>2</td>
<td>Select the <strong>RUN STATES</strong> target.</td>
</tr>
<tr>
<td>3</td>
<td>Select the <strong>SIMULATOR PAUSE</strong> target, press [ENTER].</td>
</tr>
</tbody>
</table>

Continued on next page
**Pausing and Resuming Simulations, Continued**

**Idle versus Pause**

While an Idle command can be used to interrupt a simulation, the effect of issuing an Idle command to a simulation mode APM or HPM is to permit some initialization of dynamic values to occur. For example, upon issuing a startup command to an APM or HPM in S_IDLE, you need to select whether you want a cold or warm startup.

While a Pause command can be used to interrupt a simulation, the effect of issuing a Pause command to a simulation mode APM or HPM is to permit a hot restart. For example, upon issuing a startup command to an APM or HPM in S_PAUSE, you do not need to select whether you want a cold or warm startup, a hot start occurs after selecting the Resume target.

**Resume**

To resume simulation, the paused APM or HPM should be issued a resume command. Internal control dynamics are not lost during the start initialization pass. However, if the APM or HPM is restored with a checkpoint from actual IOPs, the dynamic values (PVRAW, AV, OP) would have to be set to desired values. Also, CL/AM or HPM programs are restarted from the CL/APM or HPM statement in the first sequence Phase and Step. However, CL/AM or HPM programs will be lost and “NL” will be displayed of the Process Module Detail Display if checkpoints are restored during S_PAUSE.

Figure 21 Resuming a Simulation

---

*Continued on next page*
Pausing and Resuming Simulations, Continued

Resume procedure

Table 8 Resume APM or HPM Simulation

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>After checking that the access key is set to Engineering, select the target representing the primary APM or HPM in S_PAUSE or S_PFPAUS you wish to resume.</td>
</tr>
<tr>
<td>2</td>
<td>Select the RUN STATES target.</td>
</tr>
<tr>
<td>3</td>
<td>Select the SIMULATOR RESUME target, press [ENTER].</td>
</tr>
</tbody>
</table>

Previous checkpoints

To resume a previously checkpointed simulation
- Pause the Simulation APM or HPM
- Restore the checkpoint to be used as starting point for replay
- Start the APM or HPM with a Resume command.

The simulation will resume using checkpointed PVRAW data with limitations as described above in the “pause” and “resume” descriptions.

APM or HPM pause behavior

When the APM or HPM goes to the Pause state, the following applies:
- Control execution is suspended.
- No initialization to Bad Values occurs.
- Parameter access is permitted. However, an exception to this is that PVRAW and OP cannot be changed during the Pause state.
- Alarm detection and reporting is suspended.
- Checkpoint loading is permitted.
- Hot restart (that is, use current dynamic values for PVRAW, AV) occurs upon resume command invocation.
Building a New Database

Background
When an I/O Simulation Personality is loaded without a checkpoint, the simulation IOP database is marked “Invalid” for any newly configured IOP. To create a database, the standard procedures for I/O processor point building can be followed. If an existing database is available, from an online system or from a previously saved simulation database, this database can be loaded by placing the APM or HPM into S_Idle or S_Pause and following APM or HPM checkpoint restore procedures (an example appears in Table 10).

Configuring IOPs
The simulated I/O Processors are configured as part of APM or HPM Box Configuration using the Parameter Entry Display, just as in configuring an actual physical APM or HPM with IOPs. The simulated IOPs may be deleted or changed on-line if the IOP is in an S_Idle or S_Pause state.

Quick reference list
An overview of the APM and HPM node configuration procedure is described in this section. Additional details are available in Section 3, Point Building in either the APM Implementation Guidelines, AP12-500 or the HPM Implementation Guidelines, HP12-500.

Configuring APM/HPM points
The simulated I/O data points are configured using the Parameter Entry Displays, just as in configuring the actual physical APM or HPM with IOPs. Both APM and HPM Point Configuration procedures are described in Honeywell Technical Publications.

Simulation parameters
The following parameters have been added to the APM and HPM in support of the R500 I/O Simulation Personalities. You may find these parameters useful in monitoring the I/O Simulation Personality. Additional details about these parameters can be found in the Advanced Process Manager Parameter Reference Dictionary, AP09-540 (binder TDC 3042-2) or the High-Performance Process Manager Parameter Reference Dictionary, HP09-540 (binder TDC 3066-2).

Table 9 Simulation Parameter Support

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
<th>Type of support</th>
</tr>
</thead>
<tbody>
<tr>
<td>NODECMD</td>
<td>Node command</td>
<td>Enumerations include pause and resume.</td>
</tr>
<tr>
<td>NODESTS</td>
<td>Node status</td>
<td>Enumerations for simulation states that appear in UCN Status display.</td>
</tr>
<tr>
<td>PMMSTS</td>
<td>APM or HPM primary status</td>
<td>Enumerations for simulation states that appear in APM or HPM Status display.</td>
</tr>
<tr>
<td>SIM_TXT</td>
<td>Simulation Indicator</td>
<td>Eight character string (simulate or pause), view only.</td>
</tr>
<tr>
<td>DISP_SIM</td>
<td>Simulation Indicator Option</td>
<td>Option is on or off to display “simulate” text in group and detail displays.</td>
</tr>
</tbody>
</table>
Recall that APM and HPM node specific configurations are performed by selecting the **NETWORK INTERFACE MODULE** and **NODE SPECIFIC CONFIGURATION** targets from the configuration menus seen in Figure 22.

**Figure 22 Configuration Menus**

*Continued on next page*
Node specific configuration is required for those IOPs you wish to simulate.

Figure 23  Example Page 1
An example page 3 showing the simulation indicator option appears in Figure 24. When the simulation indicator option is “ON,” the text “SIMULATE” or “PAUSE” appears in group and detail displays for all points assigned to that HPM (refer to Figure 13). When the indicator option is OFF, “PAUSE” only appears when the APM or HPM is in a simulation mode.

Selecting "ON" determines whether the simulation text "SIMULATE" or "PAUSE" appears in group or detail displays for HPMs in simulation mode.
Configuration Overview, Continued

Example IOP page

Note the IOP simulation selections for:

- High Level Analog Input (HLAI)
- Smart Transmitter Interface (STIM)
- Pulse Input (PI)
- Low Level Analog Input Multiplexer (LLMUX)
- Low Level Analog Input (LLAI)
- Analog Output (AO and AO_16)
- Digital Input (DI)
- Digital Input Sequence of Events (DISOE)
- Digital Output (DO and DO_32)
- Serial Interface (SI)

Figure 25 Example IOP Page

REFERENCE—Additional detail about any of these configuration choices can be found in the reference documentation listed at the beginning of this publication.
## Checkpointing Simulation Database Guidelines

### Background
Checkpointing operations access either the physical I/O database or the simulation database. With the standard *on-process* personality loaded, the physical IOP database can be saved or restored.

### Checkpointing simulation database
With the I/O Simulator Personality loaded, the simulated IOP database can be saved or restored. When switching between on-control and simulation, the I/O database should be saved *before* shutting down the APM or HPM. This is because the Shutdown command causes the database to be cleared (initialized) in an APM or HPM.

### Manual/auto checkpoints
The I/O Simulation database can be manually or automatically saved in Simulation Mode. Manual save is provided on operator command. Auto checkpointing, if desired, must be re-enabled after the APM or HPM has started up in the simulation mode. If automatic checkpointing is enabled, the simulation database will be automatically saved at user-specified intervals. In addition to the standard database parameters, checkpointing a database in Simulation Mode also saves the PVRAW and output parameters.

### ATTENTION
ATTENTION—When a checkpoint save occurs to the History Module, the existing checkpoint for that APM or HPM node address will be overwritten, even if the APM or HPM is operating in a Simulation Mode. If you desire to save various stages of a simulation, you can do the following:

- Checkpoint to removable media for each stage of the simulation. Or,
- Checkpoint to the History Module, then copy the checkpoint files to user directories.
## Effects of Checkpoint Save and Restore

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checkpoint save from actual IOP</td>
<td>When an actual IOP database (that is, a physical IOP database) is checkpointed, the checkpoint contains only “static” type data. Examples of static data include user-entered values, such as ranges, alarm limits, setpoint limits, and filter values.</td>
</tr>
<tr>
<td>Checkpoint save from simulated IOP</td>
<td>When a simulated IOP database is saved, this static checkpoint database has the current PVRAW, and output values added to the checkpoint. These values are saved to enable capturing your current simulation state.</td>
</tr>
<tr>
<td>Checkpoint restore to actual IOP</td>
<td>When a checkpointed database is restored to actual IOPs, only the static data is restored. Actual IOPs do not need the checkpointed PVRAW data. Output checkpoint values are ignored. This means that an output returns to the previous IOP output value prior to the checkpoint restore. Mode values return to the default value of manual.</td>
</tr>
<tr>
<td>Checkpoint restore to simulated IOP</td>
<td>When a checkpointed database is restored into a Simulation Mode APM or HPM, the PVRAW, and output, if contained in checkpoint, is restored along with the static database.</td>
</tr>
<tr>
<td>Summary</td>
<td>To summarize the previous considerations, all you need to be aware of is that a checkpoint saved from an actual IOP and then restored to simulated IOP does not include dynamic data. This means that you would have to set the dynamic values in simulated IOPs to desired values after you have restored the database with a checkpoint from actual IOPs.</td>
</tr>
</tbody>
</table>

*Continued on next page*
Effects of Checkpoint Save and Restore, Continued

CL/APM programs are not checkpointed

Note that CL/APM programs are not part of the APM checkpoint. CL/APM programs reside on &E##, where ## is the UCN network number.

CL/HPM programs are checkpointed

Note that CL/HPM programs are part of the HPM checkpoint. CL/HPM simulation programs requiring modification should be recompiled and recopied to the appropriate directory. CL/HPM programs reside on &E##, where ## is the UCN network number. The modified programs can then be checkpointed after they have been loaded to the HPM.

Checkpointing summary

The overall relationship between database handling for checkpoint save/restore operations for actual IOPs and simulated IOPs is summarized in Table 10.

Table 10 Effects of Save and Restore

<table>
<thead>
<tr>
<th>WHEN the database is saved from...</th>
<th>THEN the IOP database is saved as follows:</th>
<th>IF this database is restored to...</th>
<th>THEN the IOP database is restored as follows:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual IOP database</td>
<td>• Static IOP database is saved</td>
<td>Actual IOP database</td>
<td>• Static IOP database is restored</td>
</tr>
<tr>
<td></td>
<td>• PVRAW is not saved</td>
<td></td>
<td>• PVRAW = current field input</td>
</tr>
<tr>
<td></td>
<td>• OP is not saved</td>
<td></td>
<td>• OP = previous value</td>
</tr>
<tr>
<td></td>
<td>• Mode is not saved</td>
<td></td>
<td>• Mode defaults to manual</td>
</tr>
<tr>
<td>Actual IOP database</td>
<td>• Static IOP database is saved</td>
<td>Simulated IOP database</td>
<td>• Static IOP database is restored</td>
</tr>
<tr>
<td></td>
<td>• PVRAW is not saved</td>
<td></td>
<td>• PVRAW = NAN (Not a number, ---)</td>
</tr>
<tr>
<td></td>
<td>• OP is not saved</td>
<td></td>
<td>• OP = -6.9% for analog outputs; off for digital outputs</td>
</tr>
<tr>
<td></td>
<td>• Mode is not saved</td>
<td></td>
<td>• Mode defaults to manual</td>
</tr>
<tr>
<td>Simulated IOP database</td>
<td>• Static IOP database is saved</td>
<td>Actual IOP database</td>
<td>• Static IOP database is restored</td>
</tr>
<tr>
<td></td>
<td>• PVRAW is saved</td>
<td></td>
<td>• PVRAW = current field input</td>
</tr>
<tr>
<td></td>
<td>• OP is saved</td>
<td></td>
<td>• OP = previous value</td>
</tr>
<tr>
<td></td>
<td>• Mode is not saved</td>
<td></td>
<td>• Mode defaults to manual</td>
</tr>
<tr>
<td>Simulated IOP database</td>
<td>• Static IOP database is saved</td>
<td>Simulated IOP database</td>
<td>• Static IOP database is restored</td>
</tr>
<tr>
<td></td>
<td>• PVRAW is saved</td>
<td></td>
<td>• PVRAW = checkpointed value</td>
</tr>
<tr>
<td></td>
<td>• OP is saved</td>
<td></td>
<td>• OP = checkpointed value</td>
</tr>
<tr>
<td></td>
<td>• Mode is not saved</td>
<td></td>
<td>• Mode defaults to manual</td>
</tr>
</tbody>
</table>
Restoring the Database

To restore a simulation database to the target APM or HPM controlling a process, the target APM or HPM first should be idled. The simulation database can then be directly loaded following standard checkpoint restore procedures.

The user is assumed to have prior knowledge of restoring a checkpoint to an APM or HPM. For further explanation and procedures not explained here, refer to the *Process Operations Manual, SW11-501* (binder *TDC 3050*).

The steps in Table 11 show you one way to restore an APM or HPM’s database. The display results are shown in Figure 26.

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From the UCN Status Display, select the target representing the primary APM or HPM you wish to load. (Note: The APM or HPM must be in the Idle (S_IDLE or S_PFIDLE) or Pause (S_PAUSE or S_PFPAUS) state to restore a checkpoint. Select either the [IDLE] or the [SIMULATOR PAUSE] target to place the APM or HPM in the proper state.)</td>
</tr>
<tr>
<td>2</td>
<td>Select the [LOAD/SAVE RESTORE] target.</td>
</tr>
<tr>
<td>3</td>
<td>Select the [RESTORE DATA] target, press [ENTER].</td>
</tr>
<tr>
<td>4</td>
<td>Select the [ALTERNATE SOURCE] target if your APM or HPM checkpoint is on removable media. Select the [EXECUTE COMMAND] target, press [ENTER].</td>
</tr>
<tr>
<td>5</td>
<td>After issuing a startup (or resume) command to the Primary APM or HPM, the status is displayed as S_OK/ALIVE. (Note: If state is not S_OK, refer to Table 4 and Table 5 for status explanation.)</td>
</tr>
</tbody>
</table>

Continued on next page
Restoring the Database, Continued

Figure 26 Example Display Results of Restore Procedure
Saving the Database

Saving checkpoints

If there are several starting points from which simulation could resume, several different checkpoints for the same APM or HPM at different times should be saved. When saved to the History Module, each checkpoint overwrites the last copy. However, multiple checkpoints of the same APM or HPM node can be saved by specifying an alternate destination(s) for storing each checkpoint on removable media.

Save procedure

The user is assumed to have prior knowledge of saving a checkpoint to an APM or HPM. For further explanation and procedures not explained here, refer to the Process Operations Manual, SW11-501 (binder TDC 3050).

The steps in Table 12 show you one way to save an APM or HPM’s database. The displays you would use are shown in Figure 26, except that you would select the SAVE DATA target for a checkpoint save.

Table 12  Save APM or HPM Database

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>From the UCN Status Display, select the target representing the primary APM or HPM you wish to save.</td>
</tr>
<tr>
<td>2</td>
<td>Select the LOAD/SAVE RESTORE target.</td>
</tr>
<tr>
<td>3</td>
<td>Select the SAVE DATA target, press [ENTER].</td>
</tr>
<tr>
<td>4</td>
<td>Select the ALTERNATE SOURCE target if your APM or HPM checkpoint is on removable media. Select the EXECUTE COMMAND target.</td>
</tr>
<tr>
<td>5</td>
<td>The status S_OK/ALIVE is to be expected with a Primary APMM or APM or HPMM in the Simulation Mode.</td>
</tr>
</tbody>
</table>
Simulating the Process

Stimulating I/O

The basic function of the I/O Simulator is to support another device which can act like the process to “Stimulate” the I/O—that is, to read outputs and to write to inputs. This capability is enabled by the I/O Simulator changing the access level for PVRAW stores to Operator. Based on this change, a user’s I/O Simulation program (in a VAX, Application Module, or even within the APM or HPM) can stimulate the input by writing directly to PVRAW. The PVRAW parameter can also be changed manually by an operator at a Universal Station (Figure 27).

Manual PV change

To manually change PVRAW, select the PVRAW parameter on an IOP Detail display at the Universal Station and enter a new value. Note that PVSOURCE remains in AUTO. Internally the APM or HPM transfers the manually entered PVRAW engineering unit value to PVCALC, then to the PV parameter that an operator can see.

While in Idle, PVRAW is always displayed as “---” which means “Not a Number (NaN).” The user can set PVRAW to a desired value during the Idle state. However, PVRAW is seen as NaN even after setting PVRAW to a value other than NaN. The desired value set by the user will be shown correctly after the IOP state is set to run (OK).

Figure 27  Example of Changing the PV in Simulation Mode

Continued on next page
Simulating the Process,  Continued

**Programmed PV change**

A variety of approaches are available in simulating I/O. Some of the approaches include:

- Process simulation program in a VAX
- Process simulation program in an Application Module
- Process simulation program in a CL/APM or CL/HPM program

**Example CL/HPM statements**

The following example CL/HPM statements are valid, and show the parameters you can use in a process simulation (I/O stimulation) program.

Figure 28  Sample HPM Program Statements

```
SEQUENCE HPMSIM (HPM; POINT SIMLATR1)

EXTERNAL AI5, TIC22, DI21, DO21

PHASE START

STEP BEGIN

--TO PASS ENGINEERING UNITS TO ANALOG INPUT FROM
--AN OUTPUT, USE OP, CV, or OPEU PARAMETERS
--THIS EXAMPLE SETS ANALOG INPUT=REG. CONTROL OUTPUT
SET AI5.PVRAW = TIC22.OP * (TIC22.PVEUHI-TIC22.PVEULO)/100

--TO PASS BOOLEAN TO DIGITAL INPUT PV, USE PVRAW
SET DI21.PVRAW = DO21.SO

END HPMSIM
```

**APM prefetch limits**

Previous R400 prefetch limits (12 prefetches per step) apply to APMs operating on R500.

**HPM prefetch limits**

Prefetch limits (12 prefetches per step) do not apply to HPMs.

**Performance**

Estimated performance for supporting read/write access by upper level process simulation program in a VAX or AM is 100-200 parameters per second. This estimated performance is in addition to the standard product throughput capability for display, history, and peer-to-peer data.

*Continued on next page*
Peer-to-peer communication is permitted when an APM or HPM is in a simulation mode. However, when an on control peer node attempts to communicate peer-to-peer with a node in the simulation mode, it has no way of “knowing” that the device is in a simulation mode. For that reason, Honeywell suggests that you lock out a simulation mode HPM from communicating with on control peer nodes (Note: This function is not available in the APM). In the HPM schedule and configuration display, you can enable the write lockout function. Note that HPM write lockout only prevents writes; nodes can still read (pull) data.
Transporting Databases

Introduction

Transporting databases between an actual physical APM (or HPM) and an APM (or HPM) in the Simulation Mode is possible in the following circumstances:

• Target and simulation mode APM (or HPM) are the same node.
• APM (or HPMs) on separate LCNs.
• APM (or HPMs) on same LCN, separate UCNs.

Target and simulation APM or HPM are same

As implied throughout this document, the same checkpoint is available for use when the target APM (or HPM) and simulation APM (or HPM) are the same node. The following discussion does not imply an APM's checkpoint can be loaded to an HPM, or an HPM's checkpoint to an APM.

APM or HPMs on separate LCNs

NIM and APM (or HPM) checkpoints from an off-process simulation system can be transported to or from a target system on a separate LCN if the following conditions are true:

• The UCN Network numbers (Process Network numbers) on the separate LCNs are the same.
• The NIMs on the separate LCNs have the same LCN node number.
• The NIMs on the separate LCNs have the same UCN node number.
• The APM (or HPMs) on the separate LCNs have the same UCN node number.

Database considerations

When database building occurs with APMs (or HPMs) on separate LCNs and separate UCNs, the following database considerations apply:

• Ideally, one of the two separate system databases is considered by the user as the “master” database. The “master” database is then used to startup the other system. For example, the on-process system database and checkpoints are used to startup the off-process simulation system.
• To ease management of checkpoints, NIM and APM (or HPM) database modifications are checkpointed from the system the user regards as the “master” database. Then, at the user’s convenience, the checkpoints are transported from one system to the other system to keep the databases synchronized.
• If new NIM points were built, the synchronization means rebooting the NIM and restoring the APM (or HPM) on the other LCN system with what the user regards as the “master” checkpoint. This step keeps the internal NIM point references the same for LCN configuration tasks (such as schematics and groups).

Continued on next page
Transporting Databases, Continued

Database considerations, continued

- If no new NIM points were built but changes were made to APM (or HPM) point parameters, the synchronization means restoring the APM (or HPM) on the other LCN system with the user’s new “master” checkpoint.

- If parallel LCN database development (that is exclusive of NIM point building and NCF configuration) is occurring on both the off-process and on-process systems, the user takes the necessary steps (for example, Area Database Intermediate Data Files (IDF), recompiling pictures, Exception Build files, etc.) to synchronize the databases.

APM or HPMs on same LCN, separate UCNs

Exception Build Files (EB files) from a Simulation Mode APM or HPM can be transported to or from a target APM or HPM on the same LCN, separate UCNs. The Exception Build files would have to be modified to change at least the following parameters:

- The UCN process network number.
- The APM (or HPM’s) UCN node number.

You can conveniently change these values by using the replace function from the Text Editor.
Technical Assistance

Assistance Information

Before You Call
Jotting down important information before calling our Technical Assistance Center (TAC) can expedite answers.

Who to call
If you need technical assistance with a problem, contact your local Honeywell Service Organization. If you are not sure of the location or number, call your Honeywell representative for this information.

For technical assistance within the United States, call the Technical Assistance Center. The toll free number within the United States is 1-800-822-7673. For calls from within Arizona, the number is 602-863-5558. Our Technical Assistance Center maintains its own TDC 3000X system and frequently can duplicate problems on this equipment. Calls to the center will be answered by a dispatcher between 7:00 A.M. and 4:00 P.M., Mountain Standard Time. Emergency calls received outside normal working hours—that is, those which affect ability to control or view a process—will be received by an answering service and returned within 1 hour.

What information is needed
Information that will help us assist you:

• The LCN Software Release in use on your system.
• Descriptions in detail of what you were doing when the problem occurred.
• A list of the board types you had configured for the simulator.

If possible, please make your call while you have access to your system, in case additional information is needed.
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Writer: **L. Orlowski**

**COMMENTS:**

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**RECOMMENDATIONS:**

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