### Revision History

<table>
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<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 2017</td>
<td>Release version</td>
</tr>
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1. PROFIBUS DP Overview

1.1. PROFIBUS DP Concepts and Terms

PROFIBUS is an open, digital communication system with a wide range of applications, particularly in the fields of factory and process automation. PROFIBUS is suitable for both fast, time-critical applications and complex communication tasks. PROFIBUS offers a wide selection of device types. (Over 2000 devices from over 300 vendors).

PROFIBUS is supported by various transmission technologies:

- **PROFIBUS DP** – Decentralized Periphery is available in three versions (V0, V1, and V2)
  - DP V0 – (Cyclic-data) process data & station, module, and channel specific diagnostics
  - DP V1 – (Acyclic-data) parameter assignment, alarms, visualization, asset management
  - DP V2 – (Isochronous/DBX) Drive synchronization, time sync, and slave-to-slave communications.

- **PROFIBUS PA** – Process Automation (FF H1 like network)

- **ProfiNet** – PROFIBUS over Ethernet

All of these transmission technologies can be used together to satisfy a broad spectrum of automation needs.

PROFIBUS DP is a master/slave, token passing network, which utilizes a request/response protocol. Basic data exchange (DP V0) operations enable a deterministic paradigm that ensures process related inputs and outputs are transferred on a known and deterministic basis. DP V1 provides a non-deterministic data paradigm for the transfer of non-control type data like status/alarms, parameterization, running of maintenance routines, etc. (DP V0) is often referred to as cyclic-data and (DP V1) is referred to as acyclic-data. DP is typically used to interface devices like I/O racks, drives, smart MCCs, etc.

PROFIBUS PA is a powered network very similar to Foundation Fieldbus. PA is typically used to interface devices like valves, transmitters, analyzers, etc.

Experion directly supports DP networks and can also access PA networks using DP/PA converter devices.

ProfiNet is the newest iteration of PROFIBUS technology. It enables PROFIBUS communications over Ethernet.

1.1.1. Common Terminology

The following provides some common terminology used to describe various node types (Stations in the PROFIBUS vernacular).

**Station**

A station is any node on the network with a unique PROFIBUS physical address, which includes master devices, slave devices, communication interfaces/gateways and segment repeaters. Up to 126 unique stations can be configured on a PROFIBUS DP network. The valid station address range spans from 0 to 125.
DPM1 (PROFIBUS DP Master Class-1)
This device type cyclically (deterministically) scans assigned SLAVES for process input, output, and diagnostic information (Request/Respond paradigm). DPM1 devices are responsible for controlling network usage and access. When a DPM1 has completed all Slave read/writes it can grant access (by passing a token) to a DPM2 device to complete acyclic information access.

DPM2 (PROFIBUS DP Master Class-2)
Once a DPM2 device receives the token from the DPM1 it can perform Slave operations related to alarm handling (with acknowledgement), parameter assignment, visualization, and asset management. This traffic is acyclic and is handled on a lower priority than the process data accessed by the DPM1.

SLAVE (PROFIBUS DP Slave)
These devices provide the actual process related tasks (like I/O systems, drive controllers, PLC’s, valves, transmitters, analyzers, HMI terminals, etc.). They are generally respond only devices and respond to commands from DPM1 and DPM2 devices for information or complete commanded changes.

Exception: DP version V2 added the concept of Slave-to-Slave (peer) communications to provide for drive synchronization and fast/accurate drive speed control.

1.2. PROFIBUS DP Data Transfer Concepts

1.2.1. What is DP V0
DPV0 is the original version of the DP protocol. PROFIBUS DP implements a Master/Slave (Request/Respond) paradigm for the transfer of data. DP version zero (DPV0) supports the transfer of data in a cyclic (deterministic) fashion. For this reason, the data that is passed between the master and the slave stations using this methodology tends to be process related information that is required for the direct monitoring and control of the process. It is data (like PVs, Outputs) that must be available in a cyclic (deterministic) fashion and must be transferred as fast as possible.

1.2.2. DP V0 Messaging
The DP Master Class-1 device is assigned to manage and communicate with a given set of Slave devices on the DP network. The DPM1 will ensure that the Slave is available, operating normally, and configured correctly (as dictated by the network engineer). Under normal operation the DPM1 cycles through each assigned Slave, (in succession, lowest to highest address) and performs the following tasks for each:

- DPM1 requests the Slave to send its input data
- Slaves send the input data to the DPM1 (along with Slave status information)
- DPM1 writes any output data to the Slave
- DPM1 moves on to the next Slave

Communication with all Slaves occurs in a fixed window of time. DPV0 data transfer has the highest priority and must occur within the given time window. In a multi master system there can be more than one DPM1 device. In this case a token is passed between masters to determine network use. Each master is assigned a set of Slaves for which it is responsible.
Standard and Extended Diagnostics: The 244 byte input data message from each Slave includes a flag that when set indicates that the Slave has diagnostic information to report. Seeing this flag set, the master will request the Slave to transmit this information. The diagnostic information (referred to as standard and extended diagnostics) is then transmitted from the Slave as a 244 byte max message. This data may need to be interpreted as it can vary on a Slave-by-Slave basis.

1.2.3. DP V0 Input/Output Messaging

PROFIBUS DP is very simple in terms of data transfer. Each Slave can send 244 bytes of input data and can receive 244 bytes of output data from the master. 244 bytes is the max, but the Slave will only use the number of bytes required for the current configuration. Consider a Slave that provides the typical I/O function. The I/O rack will be populated with a number of I/O modules of various types. Discrete I/O (On/Off signals) will use much less of the 244 bytes as compared to analog I/O which will utilize multi-bit words (8, 16, 32 bit) to represent the input and output values. The factors that determine the bytes consumed are the number of I/O modules, channels per module, and channel type (discrete or analog). Most Slaves do not use all 244 bytes, but this is something that must be considered when designing the DP network and the solution.

A variable speed drive (as compared to an I/O rack) would use much less of the 244 bytes of input and output data.

The DPM1 has two major tasks. The first is to collect all of the input and send all of the output data to and from the Slave. The second is to provide this data to and from the Host control system where functions such as control, data acquisition, history collection, trending, etc are completed. Although the data transfer mechanism is very simple (244 bytes of input and output data), the complexity is in the task of accurately and efficiently assembling and dissembling the message (total bytes) into the individual process signals (discrete and analog). The true worth of any DPM1 is in how efficiently it handles the data transfer between the Slaves and the host control system.

1.2.4. Masters and V0 Data Capacity

One of the essential specifications of any DPM1 is the amount of V0 input and output data memory it has. This determines how many Slaves it can interface with before it runs out of memory and requires you to add another DPM1. Always determine the amount of V0 memory the DPM1 has. It is then a simple calculation to add up all of the input and output bytes coming from each Slave to determine the total memory required by the master (plus any spare memory for future expansion).

1.2.5. What is DPV1

DPV1 was added to the DP protocol to accommodate acyclic data transfer. That is data that does not need to be handled in a deterministic manner. Status information, alarms/alerts, device parameterization, maintenance activities, device management, etc would fall into this category.

All DP V0 data transfer must occur at a fixed deterministic time interval. At the end of the DPV0 cycle a gap time can be established. This time window is allocated for V1 data transfer. During this time a master is given the token and can communicate with a Slave to read or write any data related to a particular task. What is important to note is that the master has a limited amount of time and will probably only complete a portion of the total task. When the gap time window comes up again and the master has the token it can complete a bit more of the task. In this way, DPV1 is said to be acyclic.

Important! It can be seen that there is no guarantee as to timing of data that is transferred using DPV1. Therefore it should not be used for any data that must be transferred between the host system and the Slave in a deterministic manner. DPV0 is used for that data type.
1.2.6. Masters - DPM1 and DPM2

There are two master types DPM1 (DP master class-1) and DPM2 (DP master class-2). They can coexist on the same DP network and the DP protocol supports multi-master implementations. A token is rotated to each master allowing each to gain access (one at a time) to the network and their assigned Slaves.

The DPM1 communicates with assigned Slaves using DPV0. They are therefore responsible for data related to the monitoring and control of the process. The DPM1 stations have the highest priority with regard to access to the network.

The DPM2 communicates with assigned Slaves using DPV1. They tend to be connected to engineering or maintenance PCs that allow for Slave configuration and/or maintenance tasks.

Any master can be designed to be both a DPM1 and DPM2 in the same box. This is becoming more and more common. This allows one master to serve the needs of both control and asset management.

1.3. Slave Configuration

1.3.1. Using GSD Files

PROFIBUS supports a uniform standard for the configuration of PROFIBUS slaves/modules that utilizes GSD files which allow “open” configuration of PROFIBUS devices. A GSD file is essentially an electronic data description of a slave device. In accordance with a standard format, the GSD file is a text file that is defined and supplied by the device vendor. The file can be imported and interpreted by the DP Master Class 2 device such that it can supply the user with an interface to configure the slave device. Essentially, the GSD file and supporting infrastructure provides a uniform method of defining the configuration profile of a slave device such that any DP Master Class 2 configuration tool can configure a slave device.

1.3.2. Device Profiles

Due to the lack of definition at the presentation layer, the PROFIBUS Trade Organization (PTO) has defined a set of device profiles that provide some level of standardization for certain complex devices. These profiles are not formally a part of the PROFIBUS protocol definition, so they are not considered a part of the PROFIBUS communication model depicted above. However, for certain devices these device profiles provide some degree of standardization at the data management layer. Note that device vendors are not required to utilize these profiles.

Some profile examples for context:

- Profile for communication between controllers
- Profile for process control devices
- Profile for NC/RC controllers (robotics)
- Profile for variable speed drives
- Profile for Encoders
- Profile for HMI systems
- Profile for safety
- Profile for remote I/O systems
- Etc.
1.4. **DP Physical Media**

At the physical layer, PROFIBUS DP can be hosted on two transmission media:
- RS-485 – Electrical connection employing a shielded, twisted pair
- Fiber optic

Since the physical interface to Experion currently employs an electrical connection, the use of fiber optic media will not be discussed in this document. It is expected, however, that various commercially available products can be used with the Experion system, which will allow the use of electrical, as well as fiber optic media on a PROFIBUS DP network.

1.4.1. **Bus Wiring (electrical)**

PROFIBUS DP utilizes a “daisy-chain” bus topology, with a single PROFIBUS cable wired from the master to the first slave and through each slave in the network. “Branches” can be supported through the use of segments, isolated by repeaters, which is described briefly below.

The electrical wiring media used for PROFIBUS is a shielded twisted pair (2 conductors plus the shield). Specialized cable that meets the PROFIBUS application is commercially available.

The connectors used are typically a 9 pin Sub-D connector, with pins 3 and 8 used for the positive/negative data signals. Refer to wiring diagrams for the equipment in use for additional details.

The devices at the ends of each segment require active termination, the circuitry for which is generally specified on a per-device basis. Alternatively, PROFIBUS connectors with an integrated termination circuit are commercially available. Refer to the device technical documentation for additional details on wiring and termination.

1.5. **PROFIBUS DP Network Topology**

Several unique types of devices can exist on a PROFIBUS network. The sections below provide a brief summary of the terminology.

1.5.1. **Typical PROFIBUS DP Topology Diagram**

The following diagram depicts the basic components in a typical PROFIBUS DP network, and a possible set of station and module number assignments. Specific definitions are cited in the sections to follow.
In this architecture, individual slave devices can utilize multiple “virtual” modules, which is common with complex devices such as motor-drives (frequency converters). In normal cyclic communication operations, the class 1 master communicates with each slave station, not necessarily directly with each module. In the example of the modular I/O station (#8), the Class 1 master exchanges I/O data with the station or “gateway module”, which in turn disseminates the appropriate portions of the message to/from each module. In this example, each PROFIBUS (data) module is equivalent to one physical module.

“Physical” Modules

With some devices, there exists a one-to-one correspondence between physical devices and PROFIBUS modules. For example, a typical rack/rail I/O system on PROFIBUS may contain several different interchangeable physical I/O modules. When this system is configured on PROFIBUS, each physical device is represented as one “module” on PROFIBUS. The typical I/O subsystem will consist of a rack (or chassis) that provides the mounting, communications, and power for an associated set of electronics cards or modules. The first position or card slot usually contains a PROFIBUS DP gateway. The DP gateway provides communications on the DP network and the I/O cards in the chassis. The other slots contain various I/O modules (AI, AO, DI, DO, pulse I/O, etc.). From a data access perspective, information is accessed by module (I/O card slot position) and channel (the particular input or output on that module).

“Virtual” Modules

There are DP devices (such as motor and drive controllers) that do not have a physical layout that matches the module/channel paradigm above. In this case the physical device is mapped into the module/channel paradigm and may be represented as multiple PROFIBUS modules. This simply means that if the device accepts/provides many bytes of I/O data, the data may be split up into multiple parts, each of which is considered a different module. In this context, the term “module” can be confusing. It can more appropriately be conceived of as a “virtual module” or “data object”.

2. Experion Interface - Introduction

PROFIBUS is a supplier-independent, open field bus standard for a wide range of applications in manufacturing and process automation. PROFIBUS DP is the most frequently used communication profile in PROFIBUS. It is optimized for speed, efficiency and low connection costs and is designed especially for communication between automation systems and distributed peripherals. The Experion to PROFIBUS DP interface provides a communication path from the PROFIBUS network to the C200/C200e and C300 controller through a dedicated hardware interface module. There are two solutions available for use with Experion (CIOM-A SST PBIM) and the (Series C PGM2).

2.1. CIOM-A SST PBIM Module

The first (and oldest version), is a PROFIBUS Interface Module (PBIM) that is manufactured and sourced from a 3rd party vendor (Molex, formerly SST Technologies). It is ordered under model number SST-PB3-CLX-HWL and is fully qualified and supported by Honeywell.

Form factor and mounting: The SST PBIM is a single-wide module and resides in a standard Chassis Series-A (CIOM-A) chassis slot position. The module provides the interface between a PROFIBUS DP network and either the C200, C200e, or C300 Control Processor. Although the PBIM cannot be redundant, it can be used in non-redundant or redundant C200/C300 processor configurations.

2.2. Series C PGM2

The second of the two available PROFIBUS DP modules is the Series C PGM2 (PROFIBUS Gateway Module). It is available for the first time in Experion release R400. It is designed and manufactured by Honeywell and is delivered in the Series C form factor.

The PGM2 mounts in the same fashion and shares all characteristics, power and grounding, certifications, and meets all environmental ratings as all other Series C components.

The PGM2 is optionally redundant and supports two DP networks per module.
## 2.3. Quick comparison of key features and functions

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<th>Feature/Function</th>
<th>SST PBIM</th>
<th>SC PGM2</th>
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<tr>
<td>Number of DP networks supported per module</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Optional module redundancy supported?</td>
<td>No</td>
<td>Yes</td>
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<td>DP V0 input memory / output memory per DP network</td>
<td>496/492 bytes</td>
<td>3.5K/3.5K bytes</td>
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<tr>
<td>DP V1 messaging supported?</td>
<td>No</td>
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<tr>
<td>Validated for use with C200 and C200e (redundant or non-redundant)</td>
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<td>No</td>
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<tr>
<td>Validated for use with C300 (redundant or non-redundant)</td>
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<td>Form Factor</td>
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<td>3rd party tool from within Control Builder</td>
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<td>All configuration is downloaded over FTE</td>
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<td>Module supports DP multi-master topologies?</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Module can be used as DP Master Class-2 device?</td>
<td>No</td>
<td>Yes¹</td>
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**Note 1** - PGM2 serves as DP Master Class-2 device to allow Honeywell FDM to access DP Slaves and devices to provide for asset management (see FDM documentation for details).

**Note 2** - SST PBIM is interfaced to the C300 using the FTEB module connected to the CF9.
2.3.1. PBIM PROFIBUS Network Connection

The SST PBIM provides two connectors on the front of the module. A DB9F connector for interface to the DP network and a serial com connector for the PC that will host the SST PROFIBUS DP network configuration tool.

The PBIM is a PROFIBUS DP Class 1 Master; capable of functioning in 'multi-master' configurations. PROFIBUS DP supports both stand-alone and modular I/O devices and multiple PBIM modules can be used either on separate PROFIBUS DP networks or on the same PROFIBUS network (a multi-master configuration).

**SST Configuration tool**: The PBIM and all PROFIBUS DP network configuration is completed using the RS-232 connection (local to module) and a dedicated SST PROFIBUS configuration tool (from Molex).

**Note**: All Experion related configuration is completed in Control Builder using SST PBIM PROFIBUS specific function blocks and the Control Builder environment.

2.3.2. Series C PGM2 Connections

As with all Series C modules, the PGM2 mounts on a Series C IOTA (I/O Terminal Assembly). There is only one (6 inch) IOTA for the PGM2. Redundancy is accomplished using two IOTAs, two PGM2s, and an interconnecting sync cable.

**IOTA connectors:**
- FTE A (yellow) and FTE B (green) CAT5e connectors.
- A DB9F connector for DP network 1 (top) and 2 (bottom).
- A CAT5e connector for the redundancy sync cable. This is used when the PGM2 is configured in a redundant configuration. The sync cable interconnects to the primary and backup IOTA and PGM2 modules.
- Three thumb wheel switches to establish the PGM2 FTE index address.

When redundant, primary PGM2 is assigned an odd address and backup is set to the next even address.

**As with all Series C modules and IOTAs, power and grounding is accomplished using the SC power system and bus bar arrangement.**
3. SST PBIM & Control Processor Integration

3.1. C200 and C200e Integration

Refer to Figure 1 (Left portion of the diagram). The SST PBIM (PROFIBUS Interface Module) can be inserted into a Local (Downlink C200) chassis slot position (when C200 is not redundant) and/or any Uplink (remote) I/O chassis slot position. The PBIM can be implemented on an I/O Control Network along with Rail-A and Rail-H I/O modules. The PBIM can also be used in configurations that include PMIO (not shown in the diagram). The total number of PBIMs that can be interfaced to one C200 must be calculated based on the mix of I/O types, families, and the topology implemented with the C200.

Important! For the latest capacities, specifications, and rules refer to specification document EP03-300-xxx (Experion Networks & CEE Controller Capacities and Specifications, xxx is the Experion release).

3.2. C300 Integration

Refer to Figure 1 (Right portion of the diagram). The SST PBIM is mounted into a standard CIOM-A (Chassis Series-A) chassis slot position. The chassis and all inserted PBIM’s are connected to the CF9 (Control Firewall) and the C300 through an FTE bridge module mounted in the same chassis. All communications are over the redundant FTE (Honeywell Fault Tolerant Ethernet). The PBIM can be implemented in the same chassis with other CIOM-A Modules (except the FIM2). A separate FTEB is required for each chassis, no downlink (remote) I/O chassis are allowed.

Important! For the latest capacities, specifications, and rules refer to specification document EP03-300-xxx (Experion Networks & CEE Controller Capacities and Specifications, xxx is the Experion release).

3.3. Combination Topologies

Systems containing both SST PBIM modules and Series C PGM2 modules are allowed. When combined, only FTE supervisory networks are allowed.

Refer to document EP03-300-xxx (Experion Networks & CEE Controller Capacities and Specifications, xxx is the Experion release) for more details.
Figure 1 PROFIBUS C200/C200e and C300 Integration
4. Series C PGM2 & Control Processor Integration

4.1. C300 Integration

Refer to Figure 2. As shown, the PGM2 is a standard FTE node and interfaces to the C300 through the CF9. Both figures show a redundant configuration, but the PGM2 can also be implemented in a non-redundant configuration by using only one PGM2.

Figure 2 depicts a local configuration. Both the C300 and PGM2s are in the same cabinet complex and use the same CF9.

Figure 3 depicts a remote configuration. The C300 is in one cabinet and PGM2 is in another cabinet. In this case the PGM2 is remote from the C300 (or local to the process equipment).

Important Note: Differences for end-to-end response time between local and remote configurations is negligible. Recovery time from FTE fault difference is significant – rough numbers are a few hundred msecs (local) vs. a few seconds (remote).

Important! For the latest capacities, specifications, and rules refer to specification document EP03-300-xxx(Experion Networks & CEE Controller Capacities and Specifications, xxx is the Experion release).
Figure 2 Series C and C300 Integration (local configuration)
Figure 3 Series C and C300 Integration (remote configuration)
4.2. **PGM2 - HART Device Interface**

4.2.1. **HART Device Commands**

HART is said to be a hybrid protocol in that it consists of both an analog and digital component. The analog signal, either an input value or an output value is used for primary control. The digital component allows for the transfer of additional data resident in the HART device using digital signaling that rides on top of the analog signal. HART uses a command paradigm where a command is sent to the HART device to read data, write data, or command some action. The HART device responds to every command with the requested data or an acknowledgement that the write or action was successful (or not).

4.2.2. **PGM2 HART Command Pass-through**

Many 3rd party I/O vendors provide analog input and analog output modules that include HART modems to access the digital information resident in the HART field device.

Starting with the first release of the PGM2, HART commands could be sent through the PGM2 to HART devices connected to these I/O modules. The HART device then sends the command response back through the I/O module, over the DP network, to the PGM2.

4.2.3. **FDM HART Interface**

Starting with the first release of the PGM2, the Honeywell FDM (Field Device Manager) could issue HART commands through the PGM2 to HART devices connected to HART enable I/O modules. Using vendor supplied DDs/EDDs and/or DTMs FDM could issue any HART command (Universal, Common Practice, or Device-specific). In this way, FDM can fully access any and all HART device data and functions to fully manage and maintain the HART device.

4.2.4. **R431 PGM2 HART Functionality**

Starting with Experion release R431, the PGM2 is enhanced with the ability to directly issue certain HART commands and cache the resulting data for use by the Experion system. The commands selected and the resulting data are considered to be the online data that has value to the Experion system and the control strategy.

The following data is collected and cached in the PGM2:

<table>
<thead>
<tr>
<th>HART Device Data</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification data: (Tag, device manufacturer, device type, ID, software/hardware revision data, configuration counter, message, descriptor, assembly number)</td>
<td>Scanned on initial connection or following a disconnect event</td>
</tr>
<tr>
<td>Range related data</td>
<td>Scanned on initial connection or following a disconnect event</td>
</tr>
<tr>
<td>Standard and device-specific diagnostic data</td>
<td>Periodically scanned per user setting</td>
</tr>
<tr>
<td>Dynamic Variables (digital PV, SV, TV and QV)</td>
<td>Periodically scanned per user setting</td>
</tr>
<tr>
<td>Device Variables: (Slot-1 to Slot-4) for HART 5 and 6 devices (Slot-1 to Slot-8) for HART 7 devices</td>
<td>Periodically scanned per user setting</td>
</tr>
</tbody>
</table>

**IMPORTANT Note!** To use the R431 HART functionality, 3rd Party I/O system must support the PROFIBUS HART profile.
4.3. PGM2 – DPV1 Data Reads & Writes

PROFIBUS DPV1 messaging represents the acyclic portion of the PROFIBUS protocol. This mechanism is used to access data that does not need to be updated in a fast or deterministic manner. It is important that implementers use this data with the understanding that it may vary in terms of update times. DPV0 messaging is cyclic and used for data that must be fast and deterministic (updated on a fixed and repeatable cycle).

Starting with Experion R431, users can now configure reads and/or writes of DPV1 data resident in PROFIBUS slave devices. The Slave device must support DPV1 messaging and provide a set of parameters that can be accessed using this mechanism. The actual data available (for reads and writes) and its representation and behavior is determined by the 3rd party vendor and the functions provided by the Slave device. Therefore, you must reference the 3rd party vendor and particular device documentation to determine what DPV1 data is available and what functionality is associated with this data.

4.4. PGM2 – DPV1 Usage

Refer to section 1.2 for details on the difference between DPV0 and DPV1.

It is important to note that DPV1 messaging is used to support communications for both the HART and DPV1 read/write features described in the previous sections. It is also important to note that both DPV0 and DPV1 traffic will both combine to consume available PGM2 communication resources.

The DP network cycle time is essentially determined by the DP network baud rate setting, number of DP devices, types of devices, response time of each device, and the amount of DPV0 data transferred for each device. All DPV0 data transfers must be completed within this cycle time and in a very repeatable manner.

Percentage of DPV1 bandwidth allocated for DPV1 request response transactions: When configuring the DP network settings, the user will determine what percentage of the DP network cycle time will be devoted to DPV1 data transactions. Although this setting will not affect the determinism of DPV0 traffic, higher DPV1 bandwidth percent settings will have the result of extending the overall DP network cycle time. On the other hand, lower DPV1 percentage settings will decrease the overall DP cycle time while slowing the update times for all DPV1 traffic. The implementer must consider and balance the required DPV0 (cyclic) update time with the desired/acceptable update times for the DPV1 (acyclic) data needs.

The implementer must keep in mind that DPV0 data is used for primary control and logic, while DPV1 is used for secondary control and data access. They must configure a solution that meets the needs of the primary controls and logic while providing a DPV1 response time that is acceptable.

The following will utilize the DPV1 channel and collectively determine the response time at any given point in time:

- PGM2 HART device cached data ……… As configure by user
- PGM2 DPV1 reads and writes ………….. As configured by user
- FDM Slave and HART device access and management ……… Periodic, when user opens device in FDM

Note: All items above are affected by the DPV1 bandwidth percent (%) setting.
5. Models, Specifications and Capacity (SST PBIM)

Note: the original model number “SST-PFB-CLX” was withdrawn from sale in Dec, 2008. It was replaced by module “SST-PB3-CLX-HWL” from the Molex Co. The new module is a direct replacement for the older module.

5.1. SST-PB3-CLX-HWL Module Specifications

5.1.1. PROFIBUS Interface Module (PBIM)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module Type</td>
<td>CIOM-A form-factor; single slot-width</td>
</tr>
<tr>
<td>Physical Interface</td>
<td>PROFIBUS DP Class 1 Master; capable of functioning in ‘multi-master’ configurations</td>
</tr>
<tr>
<td>Chassis Locations</td>
<td>Non-redundant Controller or Remote I/O Chassis (does not support redundancy)</td>
</tr>
<tr>
<td>Number of Networks / PBIM</td>
<td>1 (plus one RS232 configuration port)</td>
</tr>
<tr>
<td>Support for PROFIBUS Slave Diagnostics</td>
<td>Configurable up to 244 bytes</td>
</tr>
<tr>
<td>Valid PROFIBUS Station address range</td>
<td>0 – 125 ²</td>
</tr>
<tr>
<td>Maximum number of modules per PBIM block (identified by a unique station/module number combination)</td>
<td>100</td>
</tr>
<tr>
<td>Maximum Input Data Size per PFB Module (all slave stations)</td>
<td>496 bytes (valid range = 4-499)</td>
</tr>
<tr>
<td>Maximum Output Data Size per PFB Module (all slave stations)</td>
<td>492 bytes (valid range = 4-495)</td>
</tr>
<tr>
<td>PROFIBUS Device Profiles Supported (with custom function blocks)</td>
<td>PROFIDRIVE, Encoder</td>
</tr>
<tr>
<td>Devices supported with custom function blocks</td>
<td>Siemens Simatic® ET200M I/O, Siemens Simocode 3UF5 Motor Protection and Control Unit, Bizerba Weighing Terminal ST</td>
</tr>
<tr>
<td>Data types supported by the “Generic” PROFIBUS Channel Blocks²</td>
<td>Single bit (Discrete), 8 bit signed/unsigned integer, 16 bit signed/unsigned integer, 32 bit signed integer, 32 bit IEEE floating point</td>
</tr>
<tr>
<td>PROFIBUS Baud Rates Supported</td>
<td>12 Mbps, 6 Mbps, 3 Mbps, 1.5 Mbps, 500 Kbps, 187.5 Kbps, 93.75 Kbps, 19.2 Kbps, 9.6 Kbps</td>
</tr>
<tr>
<td>PROFIBUS Electrical Connection</td>
<td>9 Pin Female – Optically Isolated</td>
</tr>
</tbody>
</table>
5.1.2. Other notable module specifications

- The module internally stores the PROFIBUS configuration into flash-ROM, and supports automatic reconfiguration of slave devices on repower.
- Input and output messages from/to the various PROFIBUS station/slave devices are ‘bundled’ at the ControlNet level into 2 assemblies (data objects) which are available for transport across ControlNet or FTE from/to the C200, C200e, or C300:
  - As configured with the PROFIBUS network configuration, all input data messages (from PROFIBUS input devices) are packed into a 496 byte input assembly. Input data is bound from input devices to the C200/C300.
  - As configured with the PROFIBUS network configuration, all output data messages (from PROFIBUS input devices) are packed into a 492 byte output assembly. Output data is bound from the C200/C300 to the output device.

The PROFIBUS Interface Module hardware is produced and distributed by the Molex Co. They deliver the module with a supporting set of software utilities used for configuration, monitoring, and documentation/help. Their PROFIBUS Module model number is SST-PB3-CLX-HWL.

e-mail: sales.sst@molex.com

5.1.3. Configuration Tools

Each affected hardware component in the Experion PROFIBUS architecture requires specific configuration tools as listed in the table below:

<table>
<thead>
<tr>
<th>Component</th>
<th>Configuration Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>SST-PB3-CLX-HWL</td>
<td>SST PROFIBUS Configuration Tool</td>
</tr>
<tr>
<td>PROFIBUS Network</td>
<td>SST PROFIBUS Configuration Tool</td>
</tr>
<tr>
<td>Slave Module/Station/Device (using GSD file)</td>
<td>SST PROFIBUS Configuration Tool</td>
</tr>
<tr>
<td>All Experion Blocks</td>
<td>Experion Control Builder</td>
</tr>
</tbody>
</table>
5.2. PROFIBUS Licenses

PROFIBUS licensing is required to use the PROFIBUS Interface Module. Licenses are assigned per module. When loading a CM to a particular PROFIBUS Module (PBIM), adequate licensing will be confirmed. An error will be returned if insufficient licenses are available. Licenses are additive. This allows for the ability to incrementally add licenses if required. For example, if four PROFIBUS Modules are required, the system would be required to purchase four TC-PBLX01 licenses. The table below depicts the available license increments.

Note that these are only required for the SST PBIM. The Series C PGM2 does not require these licenses.

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC-PBLX01</td>
<td>PROFIBUS Usage License, 1 PBIM</td>
</tr>
<tr>
<td>TC-PBLX05</td>
<td>PROFIBUS Usage License, 5 PBIMs</td>
</tr>
<tr>
<td>TC-PBLX10</td>
<td>PROFIBUS Usage License, 10 PBIMs</td>
</tr>
<tr>
<td>TC-PBLX50</td>
<td>PROFIBUS Usage License, 50 PBIMs</td>
</tr>
</tbody>
</table>

5.3. Generic PROFIBUS I/O Blocks

5.3.1. Overview

The “generic” PROFIBUS blocks described in this section consist of a module block, an input channel block and an output channel block, that are capable of being configured to provide a simple interface to most PROFIBUS DP devices. They’re referenced as “generic” blocks because they have not been designed for the sole purpose of interfacing to a specific device.

5.3.2. Template Names

The block template names for the generic blocks are the following:

- PBI_DEVICE – Generic device/module block
- PBI_INCHAN – Generic input channel block
- PBI_OUTCHAN – Generic output channel block

5.3.3. Data Formats

Because PROFIBUS DP does not enforce the use of a standard for structured data, such as floating point values, integer values, Boolean/discrete values, enumeration ordinals, etc., there exists a great variation in how data messages are formatted and interpreted amongst the vendor community. Thus, data interpretation is a complex problem for the controller. In fact, it would be virtually impossible to create a single function block that could anticipate every possible means of data representation.

The data formats for the messages for a particular device are generally specified in the technical documentation that accompanies the device. The GSD file generally does not contain all of the information necessary to interpret or assemble the data messages for a particular device.
Numeric/Real Data Types

Typical Numeric Data Representation on PROFIBUS DP

Numerical data (such as real or integer numbers) is most commonly transported across PROFIBUS DP in integer format. Real numbers are converted to/from integer values through a simple linear conversion process. For example, the following equations show how a 4-20 mA value could be represented using a 16 bit unsigned integer.

- Bottom of raw integer value range = -20,000 = 4 mA = 0%
- Top of raw integer value range = 20,000 = 20 mA = 100%

Each equation represents a unique point on a linear equation, and any two points define a line, from which a linear conversion equation can be derived.

Numeric data handling capability in the generic channel blocks

The generic blocks are configured with the necessary linear scaling parameters necessary to convert I/O data from/to integer format.

Five integer formats are supported for both input and output channel blocks. The table below lists the data types, sizes and the minimum and maximum mathematical ranges for the data types. This information is a property of the device of interest and must be known by the configuration engineer in order to properly configure the generic input and output channel blocks.

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Description</th>
<th>Size (bytes)</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYTE_SIGNED</td>
<td>Signed 8 bit integer</td>
<td>1</td>
<td>-128</td>
<td>127</td>
</tr>
<tr>
<td>BYTE_UNSIGND</td>
<td>Unsigned 8 bit integer</td>
<td>1</td>
<td>0</td>
<td>256</td>
</tr>
<tr>
<td>WORD_SIGNED</td>
<td>Signed 16 bit integer</td>
<td>2</td>
<td>-32,767</td>
<td>32,768</td>
</tr>
<tr>
<td>WORD_UNSIGND</td>
<td>Unsigned 16 bit integer</td>
<td>2</td>
<td>0</td>
<td>65,536</td>
</tr>
<tr>
<td>DWORD_SIGNED</td>
<td>Signed 32 bit integer</td>
<td>4</td>
<td>-2,147,483,648</td>
<td>2,147,483,647</td>
</tr>
</tbody>
</table>

Discrete/Boolean Data

Discrete Data Representation on PROFIBUS DP

Discrete (Boolean) data is generally represented on PROFIBUS DP as a specific bit, which may be packed into an array of bits, where each of 8 bits per byte represents a different discrete value.

Discrete data handling capability in the generic channel blocks

The generic blocks are configured with the necessary parameters to specify the particular byte and bit necessary to convert discrete I/O data from/to integer format.
5.3.4. Scope of Application

This section provides the available information necessary to determine whether the generic blocks are applicable for use with a particular device. This determination is not easily made given that it also requires intimate knowledge of the input/output data message structure for the device of interest.

Application Constraints

The data representation of various PROFIBUS DP devices was considered in the design of the generic blocks. As a result, these blocks can interface with most, but not all, PROFIBUS DP devices. The following constraints bound the scope of application:

- The generic blocks provide the CEE with I/O data of FLOAT64 and BOOLEAN data types only, for analog and discrete devices, respectively. Note that I/O parameters can be connected to blocks such as the TypeConvert block in order to effectively interpret other data types.

- Although analog/numeric data is exposed to the control process in the FLOAT64 data type, as described above, the generic blocks interpret/package all numerical data in integer format for transport from/to PROFIBUS. The following integer formats are supported for data transport by the generic channel blocks:
  - Signed or unsigned 16 bit integer (most commonly used)
  - Signed or unsigned 8 bit integer
  - Signed 32 bit integer

- The generic blocks interpret/package all discrete/Boolean data as an individual bit, where the byte and bit number can be specified. Conventional logic polarity is assumed, whereby a “1” corresponds to an On/True condition and a “0” corresponds to an Off/False condition. Note that the use of logic blocks, such as the NOT block, can be used to effectively invert the polarity of the logical conditions.

- The generic blocks are capable of interpreting I/O data that is of a fixed format; I/O data of variable format cannot be interpreted. An example of a fixed format device is a 4-channel AI module that provides an 8-byte input data structure, with 2 bytes representing each channel. An example of a variable format data structure is a 6-byte output data structure where the first two bytes specify a numerical parameter identifier (selects one of several parameters) and the remaining 4 bytes represent the value that is being stored.

- The generic output channel blocks do not provide back-initialization capability to any regulatory control blocks that are connected.

Configuration Guidelines and Considerations

The following configuration guidelines apply to the use of the generic PROFIBUS blocks:

- A maximum of up to 16 input channels and 16 output channel blocks can be associated with the device/module block.
- Each input and output channel is capable of mapping/interpreting up to 8 numerical values. At 16 channels per module, this provides a maximum of 128 numerical values per device/module.
- Each input and output channel is capable of mapping/interpreting up to 32 discrete values. At 16 channels per module, this provides a maximum of 512 discrete values per device/module.
- Input and output parameter names are fixed at the parameter names indicated in the following table. However, 24 character descriptors are configurable on each parameter.
Input Channel Block | Output Channel Block
--- | ---
Numeric Parameter Name | PV[0-7] | OP[0-7]
Discrete Parameter Name | PVFL[0-31] | OPFL[0-31]

- All data sizes are indicated in units of bytes.
- All byte and bit offsets are zero based specifications. Therefore, the first byte of a data message is considered byte 0, not byte 1. A data message of 8 bytes in size would span bytes 0-7.
- All data offsets are indicated in units of bytes and are “left justified”, meaning that byte 0 is the byte at the lowest memory address location.
- All bit offsets are made relative to a particular byte, and therefore span the range 0 to 7. Bit offsets are “right justified”, meaning that when a byte is presented in binary numerical format, bit 0 is on the right side. In the following example, only bit 0 is set: 00000001
- Although the input and output channel blocks are capable of specifying and interpreting a discrete value in a single bit, the entire byte (which contains the referenced bit) is read and written by the input/output channel blocks, respectively. Although this is not a problem for inputs, it does present a problem for outputs. For example, if two different output channel blocks are used to write discrete output values that are contained within the same byte of the channel output data message, the execution order of the channel blocks and/or their containing Control Modules will determine which values are written to the device. Thus it is recommended that all discrete output channel values that are contained within a specific byte be referenced from a single output channel block.
- Numerical inputs and outputs do not support underrange or overrange protection in the form of fail-safe behavior nor are alarms generated at such limits.
6. Models, Specifications and Capacity (Series C PGM2)

6.1. Model Numbers – PGM2 and IOTA

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC-IP0101</td>
<td>PROFIBUS Gateway Module with (2) DP networks</td>
</tr>
<tr>
<td>CC-TPOX011</td>
<td>PGM2 IOTA (six inch)</td>
</tr>
</tbody>
</table>

Note 1 - use two of these IOTAs for redundant configurations.

6.2. PGM2 Solution Block Types

The following Control Builder block types have been developed to support the PGM2 solution.

<table>
<thead>
<tr>
<th>Block Name</th>
<th>Description</th>
<th>Named Block with Detail Display?</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGM2</td>
<td>Represents one PGM2 module (or redundant pair).</td>
<td>Yes</td>
</tr>
<tr>
<td>PB</td>
<td>Represents one DP network (for an associated PGM2). Each PGM2 supports up to two DP networks.</td>
<td>Yes</td>
</tr>
<tr>
<td>DSB</td>
<td>Represents one DP Slave (one for each Slave on a DP network).</td>
<td>Yes</td>
</tr>
<tr>
<td>PIOMB</td>
<td>Represents one module of a DP Slave (for concept this is similar to a standard Experion I/O module with channels).</td>
<td>Yes</td>
</tr>
<tr>
<td>PBHIOMB</td>
<td>Starting with R431. Represents one HART enabled I/O module.</td>
<td>Yes</td>
</tr>
<tr>
<td>Channel</td>
<td>Provides the input and output channels for use in CMs.</td>
<td>CM has the detail</td>
</tr>
</tbody>
</table>
6.3. PGM2 DSB Types

6.3.1. Generic DSB
Provides a general block structure that will allow the user to interface any DP compliant slave to the Experion system. Degree of integration will vary from vendor to vendor and Slave type to Slave type.

6.3.2. Device-specific DSB:
These blocks are preconfigured to meet the needs of a particular vendor and Slave model. They will enable easier engineering as the blocks are created for the particular Slave and its functions and features.

<table>
<thead>
<tr>
<th>Generic DSB</th>
<th>For general support for all DP compliant Slaves.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generic Drive DSB</td>
<td>Support for drives that comply with DP PPO Type 1-5</td>
</tr>
<tr>
<td>Device-Specific DSB</td>
<td>For Siemens DP/ASi link 20E</td>
</tr>
<tr>
<td>Device-Specific DSB</td>
<td>For Siemens ET 200M I/O (no HART, SOE, or redundancy)</td>
</tr>
<tr>
<td>Device-Specific DSB</td>
<td>For Turck Excom IO Gateway (no HART or redundancy)</td>
</tr>
<tr>
<td>Device-Specific DSB</td>
<td>For CEAG PROFIBUS Remote I/O (no HART or redundancy)</td>
</tr>
</tbody>
</table>

Important: A Honeywell DSB represents (is assigned to) one DP Slave. The user can only assign one DSB to a given DP Slave. In R400 a DSB can support up to 16 modules/slots maximum per DSB. This must be considered in your planning as some DP Slaves support more than 16 module/slot assignments.

6.4. PGM2 Communication PDA vs. CDA

6.4.1. PDA (Process Data Access)
PDA is a new data transfer mechanism (C300 to PGM2) specifically developed for the PGM2. It is optimized to transfer process control related data between the PGM2 (connected DP Slaves) and the C300 in a deterministic manner and at the highest data rate possible.

Important Configuration Rules:
- A given PGM2 (and its two DP networks) can form a PDA connection with one and only one C300.
- A given C300 can form a PDA connection with up to (4) PGM2s max. This provides access to up to 8 DP networks per C300.

C300 loading calculation:
With respect to PDA, each PGM2 will impose a processing load on its associated C300. This is directly related to the number of PIOMBs that are configured for all connected PGM2s. A PIOMB is equivalent to a PROFIBUS Slave module. Each Slave module (and its associated I/O channels) will require one PIOMB block.

See section “PGM - C300 Loading Calculation Details” for more details.
6.4.2. CDA (Control Data Access)

The PGM also supports the traditional CDA data transfer methodology. See section Error! Reference source not found. for more details.
### 6.5. General PGM2 Characteristics

<table>
<thead>
<tr>
<th>Function or Feature</th>
<th>Support level and notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module Naming</td>
<td>Series C PROFIBUS Gateway Module. Acronyms <em>(PGM)</em> or <em>(PGM-2)</em> 2 indicates 2 DP networks per module.</td>
</tr>
<tr>
<td>Module form factor</td>
<td>Series C form factor.</td>
</tr>
<tr>
<td>Series C IOTA size</td>
<td>Six inch IOTA.</td>
</tr>
<tr>
<td>Supervisory network type</td>
<td>SC PGM is a standard FTE node.</td>
</tr>
<tr>
<td>Environment and agency certifications</td>
<td>Same as all other Series C components (refer to Series C specification docs).</td>
</tr>
<tr>
<td>SC PGM mounting</td>
<td>Mounts on the standard SC mounting assembly (on an IOTA) and must mount in a standard SC cabinet.</td>
</tr>
<tr>
<td>SC PGM power and grounding</td>
<td>Must use the standard SC power system.</td>
</tr>
<tr>
<td>PROFIBUS DP (V0) supported?</td>
<td>Yes – including standard and extended status bytes.</td>
</tr>
<tr>
<td>PROFIBUS DP (V1) supported?</td>
<td>PGM acts as a DP Master Class-2 device for FDM. FDM uses vendor provided DTMs to enable DPV1 messaging over the DP network. Profidrive DSB has some V1 capabilities (see users manual).</td>
</tr>
<tr>
<td>PROFIBUS DP (V2) supported?</td>
<td>Not supported in releases below R431 R431 and above, support for the HART profile R500 and above, support for DP network time synchronization</td>
</tr>
<tr>
<td>DP network media redundancy</td>
<td>Supported using 3rd party Redundancy Link Modules (like ABB RLM and Siemens Y Link).</td>
</tr>
<tr>
<td>DP Slave device redundancy</td>
<td>DP network can include redundant slaves. PGM has no V1 capability with respect to Slave redundancy. FDM may be able to manage this using vendor supplied DTMs.</td>
</tr>
<tr>
<td>PROFIBUS PA and PA devices supported?</td>
<td>Yes, using 3rd party PA to DP converters/couples.</td>
</tr>
<tr>
<td>HART over PROFIBUS support</td>
<td>In releases below R431, using vendor DD/EDD/DTM, FDM can be used to manage a HART device over the DP network. With R431 and above, FDM can be used and PGM HART enhancements apply (see section 4.2.)</td>
</tr>
</tbody>
</table>
6.6. PGM2 Capacities and Limits

6.6.1. PGM2 Configuration Options

<table>
<thead>
<tr>
<th>PGM2 Configuration Specifications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFIBUS Communication Profiles(Device Type Manager) Supported</td>
<td>DPV0, DPV1, DPV2 – PGM2 is DP Master</td>
</tr>
<tr>
<td>PROFIBUS Baud Rates Supported(^1)</td>
<td>12 Mbps, 6 Mbps, 3 Mbps, 1.5 Mbps, 500 Kbps, 187.5 Kbps, 93.75 Kbps, 19.2 Kbps, 9.6 Kbps</td>
</tr>
<tr>
<td>Maximum number of SC PGMs per Server Cluster</td>
<td>80 PGM2s (or redundant pair)</td>
</tr>
<tr>
<td>Maximum number of C300s per PGM [Starting in R500]</td>
<td>5 C300s (or redundant pair)</td>
</tr>
<tr>
<td>Maximum number of SC PGMs per C300</td>
<td>4 PGMs (or redundant pair)</td>
</tr>
<tr>
<td>Support for Multi-Master Configurations</td>
<td>Yes</td>
</tr>
<tr>
<td>Support for PROFIBUS Slave Diagnostics</td>
<td>Yes</td>
</tr>
<tr>
<td>Valid PROFIBUS Station address range(^2)</td>
<td>0 - 127</td>
</tr>
<tr>
<td>Number of Profibus Networks per PGM2</td>
<td>2</td>
</tr>
<tr>
<td>Maximum DSB Blocks/slaves with no DPV1/HOP(^3,4)</td>
<td>250 per PGM</td>
</tr>
<tr>
<td>Maximum DSB Blocks/slaves when DPV1 or HOP is used(^3,4)</td>
<td>125 per link</td>
</tr>
<tr>
<td>Maximum Input Data Size per PGM2 Profibus Network 1 (all slave stations)</td>
<td>3.5K Bytes</td>
</tr>
<tr>
<td>Maximum Output Data Size per PGM2 Profibus Network 2 (all slave stations)</td>
<td>3.5K Bytes</td>
</tr>
<tr>
<td>Devices supported with custom DSB blocks</td>
<td>Siemens Simatic® ET200M I/O, Siemens DP/AS-i Link, Turck Excom Gateway, CEAG (P+F) I/O system, ProfiDrive Application</td>
</tr>
<tr>
<td>Data types supported</td>
<td>Single bit (Discrete),</td>
</tr>
<tr>
<td></td>
<td>8 bit signed/unsigned integer,</td>
</tr>
<tr>
<td></td>
<td>16 bit signed/unsigned integer,</td>
</tr>
<tr>
<td></td>
<td>32 bit signed integer,</td>
</tr>
<tr>
<td></td>
<td>32 bit IEEE floating point</td>
</tr>
<tr>
<td>Blocks supported for Automatic slave configuration (^6)</td>
<td>DSB, PIOMB, and PBHIOMB, PDC blocks</td>
</tr>
<tr>
<td>Support for Time synchronization between PGM master-Slaves(^5)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Note 1 – Each Profibus Network per PGM2 may be configured with a different Baud Rate. Any change to the PGM2 Baud Rate

---

**Note:**

- **DPV0, DPV1, DPV2** – PGM2 is a DP Master.
- **Baud Rates Supported**
  - 12 Mbps, 6 Mbps, 3 Mbps, 1.5 Mbps, 500 Kbps, 187.5 Kbps, 93.75 Kbps, 19.2 Kbps, 9.6 Kbps
- **Maximum number of SC PGMs per Server Cluster**
  - 80 PGM2s (or redundant pair)
- **Maximum number of C300s per PGM**
  - 5 C300s (or redundant pair)
- **Maximum number of SC PGMs per C300**
  - 4 PGMs (or redundant pair)
- **Support for Multi-Master Configurations**
  - Yes
- **Support for PROFIBUS Slave Diagnostics**
  - Yes
- **Valid PROFIBUS Station address range**
  - 0 - 127
- **Number of Profibus Networks per PGM2**
  - 2
- **Maximum DSB Blocks/slaves with no DPV1/HOP**
  - 250 per PGM
  - 125 per link
- **Maximum DSB Blocks/slaves when DPV1 or HOP is used**
  - 200 per PGM
  - 100 per link
- **Maximum Input Data Size per PGM2 Profibus Network 1**
  - 3.5K Bytes (all slave stations)
- **Maximum Output Data Size per PGM2 Profibus Network 2**
  - 3.5K Bytes (all slave stations)
- **Devices supported with custom DSB blocks**
  - Siemens Simatic® ET200M I/O, Siemens DP/AS-i Link, Turck Excom Gateway, CEAG (P+F) I/O system, ProfiDrive Application
- **Data types supported**
  - Single bit (Discrete),
  - 8 bit signed/unsigned integer,
  - 16 bit signed/unsigned integer,
  - 32 bit signed integer,
  - 32 bit IEEE floating point
- **Blocks supported for Automatic slave configuration**
  - DSB, PIOMB, and PBHIOMB, PDC blocks
- **Support for Time synchronization between PGM master-Slaves**
  - Yes

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**Version 1.0**  
**Honeywell Proprietary**  
**Jan 2017**
may require restart of all PB slave devices.

Note 2 – Some PROFIBUS Station Addresses are reserved for special purposes as follows:
- Address 0 is Master class 2 default address
- Address 1 is reserved for master class 1 (PGM2)
- Address 2 is reserved for slave with changeable address
- Address 126 is reserved for slave with changeable address
- Address 127 is reserved for broadcast messages
- Addresses 3 – 125 are reserved for PROFIBUS slaves

Note 3 – Only 100 slaves/DSB Blocks per link is supported when HOP/DPV1 support is enabled. If existing pre-R431 installations have more than 100 slaves/link, then they should not enable DPV1/HOP unless the links are reconfigured to be within the 100 slave limit.

Note 4 – Per RS485 standard, maximum number of devices per a given electrical segment is 32. Repeaters are required to achieve the maximum of 100 or 125 slaves per link.

Note 5 – Slave devices must support DPV2 to synchronize the time interval between the slave and the master.

Note 6 – The slave blocks include DSB, PIOMB, and PBHIOMB, PDC blocks. However, HART channels (PBHCHANNEL) must be manually configured after auto-configuring PBHIOMBS.

### 6.6.2. PGM2 DSB & PDC Configuration Limits

<table>
<thead>
<tr>
<th>DSB Type</th>
<th>Max PDCs/DSB</th>
<th>Max Channels/PDC</th>
<th>Max Configurable Alarms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generic DSB</td>
<td>16</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Generic I/O DSB</td>
<td>64</td>
<td>16</td>
<td>130</td>
</tr>
<tr>
<td>Siemens ET200M DSB</td>
<td>8</td>
<td>16</td>
<td>Variable based on I/O module types configured</td>
</tr>
<tr>
<td>Siemens DP/AS-i Link DSB</td>
<td>16(^4)</td>
<td>Slave1-7 group = 28 Other Slave groups = 32</td>
<td>31 or 62(^5)</td>
</tr>
<tr>
<td>Turck Excom DSB</td>
<td>32(^{4,8,9})</td>
<td>8(^7)</td>
<td>Variable based on I/O module types configured</td>
</tr>
<tr>
<td>CEAG DSB</td>
<td>48(^{4,10})</td>
<td>8(^7)</td>
<td>Variable based on I/O module types configured</td>
</tr>
</tbody>
</table>

#### Misc. DSB and PDC limits

- **Input Channel Blocks** support array based channel data\(^1\) *(see channel data limit below)*
- **Array data types supported** uint8 or single string (char array)
- **Maximum size of channel data in one PDC** (sum of all channels)\(^2\) 244 bytes
- **Maximum number of PDCs** 1000 PDCs per link 2000 PDCs per PGM

<table>
<thead>
<tr>
<th>DPV1/HOP limits</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Maximum DPV1 data Records

| Maximum DPV1 data Records¹¹ | 800 Per Link  
|                            | 1600 Per PGM |

Maximum Number of PBHCHANNELs per PGM

| Maximum Number of PBHCHANNELs per PGM | 256 Per Link  
|                                       | 512 Per PGM |

Note: One PBHCHANNEL represent one HART device

Maximum Number of PBHIOMBs per PGM

| Maximum Number of PBHIOMBs per PGM | 256 Per Link  
|                                    | 512 Per PGM |

Note: One PBHIOMB represent one PDC (Physically a part or one/more HART IOM)

Maximum number of PBHCHANNELs per PBHIOMB

| Maximum number of PBHCHANNELs per PBHIOMB | 16 HART Channels |

Note 1 – Must be associated with PIOMB that supports array data

Note 2 – Includes both Scalar and Array type channels

Note 3 – 4 Boolean-only data type channels per slave group. PDC types (groups) available = “Slave 1-7 inputs”, “Slave 8-15 inputs”, “Slave 16-23 inputs”, “Slave 24-31 inputs”, “Slave 1-7 outputs”, “Slave 8-15 outputs”, “Slave 16-23 outputs”, and “Slave 24-31outputs.”

Note 4 – Each PDC must be configured for only “Inputs” or only “Outputs”. Minimum of 2 PDCs required for any slave having both inputs and outputs.

Note 5 – 1 alarm for each slave allowed per DSB. *AS-i Link 20E* gateway supports 31 slaves, and *AS-i Link Advanced* supports 62 slaves (2 links X 31 slaves per link). Other AS-i link diagnostic alarms not included in this count.

Note 6 – Only one input PPO type PDC and one output PPO type PDC can be configured. Any additional PDCs must be of type “User Configurable” or “PKW.”

Note 7 – Channels per PDC is constrained by the I/O Module type selected.

Note 8 – Only 16 PDCs allowed in R400. Increased to 32 PDCs allows all 16 IOMs selected to be “bi-directional” (input+output) types.

Note 9 – Turck supports Redundant Gateways in the I/O Rack. If Gateway redundancy is configured, 2 PDC must be configured to collect Redundancy status and issue commands.

Note 10 - Only 24 PDCs allowed in R400. Increased to 48 PDCs allows up to 23 multi-channel modules to be selected with “bi-directional” (input+output) types or up to 46 “1-Channel” modules.

Note 11 - The following DSB blocks supports a maximum number of 16 DPV1 data access requests from data records.

- GENDSB
- TURCKDSB
- CEAGDSB
- SIEMENSET200

However, the GENIODSB supports 64 data access requests from data records.

Note 12 - The PBHIOMB function block can only be associated with the following DSB blocks.

- GENDSB
- GENIODSB
- TURCKEXCOM
- CEAGDSB
- SIEMENSET200MSTD
### 6.6.3. PGM2 CDA Communications Performance

<table>
<thead>
<tr>
<th>PGM2 CDA Communications Performance</th>
<th>PGM2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Definitions:</strong></td>
<td></td>
</tr>
<tr>
<td>PPS = Average Parameters Per Second</td>
<td></td>
</tr>
<tr>
<td>PPM = Average Parameters Per Minute</td>
<td></td>
</tr>
<tr>
<td><strong>Overall Data Access Performance</strong></td>
<td>CDA</td>
</tr>
<tr>
<td>Maximum Total Parameter Access Response Rate</td>
<td>2500 PPS</td>
</tr>
<tr>
<td>(Includes all Server Data Requests, Console Station Data Requests, and peer communications to C300s and SIM-C300s)</td>
<td></td>
</tr>
<tr>
<td><strong>Display Data Access Capacity</strong></td>
<td>CDA</td>
</tr>
<tr>
<td>Maximum Total Subscribed Parameters per PGM2</td>
<td>2500</td>
</tr>
<tr>
<td>(Includes all Server Data Requests + Console Station Data Requests)</td>
<td></td>
</tr>
<tr>
<td>Maximum Number of Display and Server CDA Connections</td>
<td>22</td>
</tr>
<tr>
<td><strong>Profibus Configuration Connections</strong></td>
<td>TCP</td>
</tr>
<tr>
<td>Maximum Number of TCP Configuration and Monitoring connections per PGM2</td>
<td>10</td>
</tr>
<tr>
<td>(These are in addition to CDA &amp; PDA connections and are used for ControlBuilder to configure Profibus Networks, by some embedded Detail Display forms, and by FDM HART RCI connections)</td>
<td></td>
</tr>
<tr>
<td><strong>Request/Response Data Access Performance</strong></td>
<td>CDA</td>
</tr>
<tr>
<td>Max Request/Response Parameter Access Rate</td>
<td></td>
</tr>
<tr>
<td>(Includes all Slow Server Data Requests, e.g. Greater than 10 sec OPC data, Slow History, Data Writes, etc.)</td>
<td>2000 PPM Read</td>
</tr>
<tr>
<td></td>
<td>1000 PPM Write</td>
</tr>
<tr>
<td><strong>Peer-to-Peer Performance</strong></td>
<td>CDA</td>
</tr>
<tr>
<td>Maximum Initiator Pull/Get Subscribe Rate to all target nodes. (incoming data)</td>
<td>NA</td>
</tr>
<tr>
<td>Maximum Target Publish Rate to Pull/Get Subscriptions from all initiator nodes. (outgoing data)</td>
<td>1000 PPS</td>
</tr>
<tr>
<td>Maximum Peer Subscribed Parameters per PGM2</td>
<td>1000</td>
</tr>
<tr>
<td>(Includes all Peer Data Requests)</td>
<td></td>
</tr>
<tr>
<td>PGM2 Peer Update Rate (fixed)</td>
<td>1 sec</td>
</tr>
<tr>
<td><strong>Push/Store Request Performance</strong></td>
<td>CDA</td>
</tr>
<tr>
<td>Maximum Push/Store Request Rate to all target nodes</td>
<td>NA</td>
</tr>
<tr>
<td>Maximum Response Rate to Push/Store Requests from all initiator nodes</td>
<td>50 PPS</td>
</tr>
<tr>
<td>Peer-to-Peer Capacity</td>
<td>CDA</td>
</tr>
<tr>
<td>Peer Connection Units (PCUs)</td>
<td>5</td>
</tr>
<tr>
<td>(Number of remote C300s or SIM-C300s that this PGM2 can form a peer connection with)</td>
<td></td>
</tr>
</tbody>
</table>

Note 1 – PGM2 cannot initiate a Peer connection or Push Data to another CEE.

Note 2 – PGM2 processes all peer data requests at a 1 sec fixed rate, regardless of the Initiator’s subscription rate. This means that
6.6.4. PGM2 PDA Capacity and Performance

<table>
<thead>
<tr>
<th>Definitions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPS = Average Parameters Per Second</td>
</tr>
<tr>
<td>PDA = Profibus Data Access</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall Profibus Data Access (PDA) Performance</th>
<th>PDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Number of PDA connections per PGM2¹</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C300 Profibus Function Block Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum number of PIOMBs that consume or provide data from/to a Profibus Slave (DSB)</td>
</tr>
<tr>
<td>Maximum number of channels per PIOMB</td>
</tr>
</tbody>
</table>

Note 1 – PGM2 PDA connections are only supported by C300 Controllers

6.6.5. PGM2 Redundancy Performance

<table>
<thead>
<tr>
<th>Specification</th>
<th>PGM2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGM Function Block Redundancy Configuration Selection:</td>
<td>&quot;Module is Redundant&quot;</td>
</tr>
<tr>
<td>Number of IOTAs used for Redundant PGM2</td>
<td>2</td>
</tr>
<tr>
<td>Redundant Device Index Configuration</td>
<td>Device Index = n, where n is an odd value Partner Device Index = n+1</td>
</tr>
<tr>
<td>Redundancy Cable Medium</td>
<td>Ethernet STP</td>
</tr>
<tr>
<td>Redundancy Cable Lengths</td>
<td>36, 48, 60, 84 inches</td>
</tr>
<tr>
<td>Gateway Processing Switchover Interruption Time¹</td>
<td>&lt; 1sec</td>
</tr>
</tbody>
</table>

Note 1 – Switchovers can be caused by PGM2 Power loss, critical PGM2 software or hardware failures, loss of field network communications (connection loss to all slaves on one PB Network), or loss of FTE communications on both ports. Watchdog Control Time, and the Data Control Time may need to readjust properly based on Baud rate to avoid loss of field network communications during PGM switchover.
6.7. **PGM Hardware Concepts**

6.7.1. **IOTA Layout**

6.7.2. **IOTA Characteristics:**

- Standard six inch Series C IOTA.
- Mounts onto a standard Series C mounting channel. Power per standard Series C bus bar and power subsystem.
- Redundancy is configured with two IOTAs interconnected by a redundancy sync cable (orange CAT5e, uses the same as those used for C300 redundancy).
- Provides two to 9-pin D-subminiature female PROFIBUS network connections.
- Each 9-pin D-sub connector provides 5 Vdc +/-5% for terminator bias voltage (power is sourced from the PGM module).
- Provides Cat5e connections for standard FTE cables.
- Provides 3 rotary switches to set FTE device index (address)
7. PGM - C300 Loading Calculation Details

7.1. Some Essential PROFIBUS Concepts

All PROFIBUS devices (referred to as Slaves in the PROFIBUS vernacular) provide their DPV0 data using the modular concept. This is best understood by considering a typical I/O subsystem. I/O comes in many form factors (like chassis based, rail mounted modular backplanes, individual block I/O, to mention a few).

To help with your understanding of this concept, an example of an I/O chassis is shown in the photo below. As shown, this chassis allows for up to 16 I/O modules. Each I/O module (depending on the type, AI, AO, DI, DO, etc.) provides for a number of I/O channels.

As an example, a given AI module may provide 4 (4-20 mA) analog inputs (or channels). The Slave in the photo below provides up to 16 module positions. The user would then select a desired module type and insert that module into one of the 16 positions. Then depending on the module type selected you would have access to some number of I/O channels.

No matter what I/O form factor is used, they all share the modular concept. That is, there are electronic modules that provide the typical I/O functions like AI, AO, DI, and DO. Each module (as determined by the vendor design) will provide for some number of inputs and/or outputs (also called I/O channels).

Access to the modular Slave’s process data is accomplished by identifying the Slave (by its assigned DP address), the specific I/O module, and the desired channel.

Other PROFIBUS devices (like drive controllers, motor starters, valves, transmitters, etc.) do not have a physical architecture that matches the modular layout of an I/O system. In these cases the modular concept is mapped onto the device in memory. So although they do not have actual physical modules and channels their data is accessed using this paradigm.

7.2. PGM - PDC (Process Data Collection)

Within the PGM, one PDC holds all real time process data of one input or output IO module in the IO rack (or other compliant PROFIBUS Slave device).

For the purposes of this document, it is important to understand that one PDC represents one Slave device module and its channel data. To be able to accurately calculate the loading on the associated C300 (due to the PGM) you must know how many PDCs will be configured to the PGM.
With respect to the context and intent of this document (to be able to estimate C300 loading) there is a direct correlation to the terms PDC and PIOMB (one PDC = one PIOMB). See PIOMB details below.

7.3. C300 - PIOMB Blocks

A subsystem specific IO module block for PDC data access. In the Experion Control Builder you must create a PIOMB block for every PDC (Slave module). This PIOMB block is then assigned to the desired C300. This is the mechanism for associating a PGM PDC (Slave module) to a specific C300. In essence, every C300 PIOMB represents one PROFIBUS Slave "Module".

Some important rules:

- A given PGM can be assigned to one and only one C300.
- A given C300 can be assigned to a maximum of up to four PGMs (or redundant pair).
- Each PGM supports up to two separate DP networks.
- Therefore, a C300 can be assigned to up to 4 PGMs with 2 DP networks each allowing a given C300 to access a total of 8 DP networks.
- To determine the % processor load on the C300 (due to the PGM) you must know the total number of PIOMBs required to interface with all Slaves on all eight possible DP networks.
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To learn more about Honeywell's products or solutions visit our website
www.honeywellprocess.com or contact your Honeywell account manager.

Automation & Control Solutions
Process Solutions
Honeywell

1250 West Sam Houston Parkway South
Houston, TX 77042

Honeywell House, Arlington Business Park,
Bracknell, Berkshire, England RG12 1EB UK

Shanghai City Centre, 100 Junyi Road
Shanghai, China 20051

www.honeywellprocess.com

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