

GENERAL SPECIFICATION

FIELD OPERATIONS

GS EP EXP 131

**Design and installation of Process Data Server -
Creation and administration of Asset Model using
Field Share™ method**

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1. Scope

This specification defines the mandatory requirements for the design, configuration and installation of Process Data Server (PDS) at Company's Affiliates.

{Rule 1

This specification shall be applied each time a project includes ICSS installation or upgrade with data acquisition by the PDS.}

This specification applies to any equipment part of a PDS (servers, data acquisition nodes, data replication nodes, etc.). The PDS components are split between Industrial Information System (SII) and Enterprise Information System (SIE).

This document also presents the general specifications that apply to the processes of creating and administrating Asset Models of oil & gas production using the Field Share™ method. Appendix 1 presents the architecture of this methodology and shows how it supports installation monitoring.

This general specification covers three areas:

- The conventions for naming attributes of equipment models (wells, compressors etc.) and functions (water injection, separation, etc.).
- The general principles for defining and structuring an Asset Model.
- The rules governing Asset Model updates.

Its purpose is to harmonize the practices of creating and administrating Asset Models by introducing a common framework for managing data in line with the Field Share™ method.

This GS provides a user guide for creating and structuring Asset Models.

This general specification applies to all initiatives by specialties or projects to realize Asset Model (rotating machinery, metering and allocation, Well Performance, etc.)

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
PI ProcessBook	PI ProcessBook documentation, OSIsoft

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
GS EP EXP 501	Equipment and piping numbering
GS EP INS 102	Instrumentation identification
GS EP INS 110	Instrumentation for package units
GS EP INS 135	Cyber Security requirements for design and supply of ICSS and Package Systems
GS EP SPS 019	Subsea Production Control Systems
Guidelines for PI-AF	Guidelines for PI-AF Asset Model Implementation
User Manual	Asset Model Administration Tools User's Manual

3. Glossary

3.1 Abbreviations

AD	Active Directory
AM	Asset Model
CPU	Central Processing Unit
DCS	Distributed Control System
DHSV	DownHole Safety Valve
FPSO	Floating Production Storage and Offloading unit
FPU	Floating Production Unit
FS	Field Share™
Gb	Giga-byte
GPS	Global Positioning System
ICSS	Integrated Control and Safety System
OPC	OLE for Process Control
I/O	Input/Output
IFM	Integrated Field Management by PetEX
IP	Internet Protocol
IST	Information System Telecom
LIMS	Laboratory Information Management System
Mbps	Mega-bit per second
MOV	Motor Operated Valve
OS	Operating System
PDCS	Power Distribution Control System

PDS	Process Data Server
PI	Plant Information
PLC	Programmable Logic Controller
QoS	Quality of Service
SCADA	Supervisory Control And Data Acquisition
SIE	Enterprise Information System (French: Système Informatique Entreprise)
SII	Industrial Information System (French: Système Informatique Industriel)
SOE	Sequence Of Events
TCP	Transmission Control Protocol
VSAT	Very Small Aperture Terminal
OFMS	Overall Flow Metering System

3.2 Definitions

3.2.1 Asset (production Asset)

Set of installations, equipment and company heritage serving in the production of oil/gas.

Examples: FPSO GIRASSOL; FPU ALIMA; OML100.

3.2.2 Asset Model

An Asset Model is the equivalent, in numeric format, of a production Asset.

It is modelled by object templates and intended for use in monitoring by several specialties.

3.2.3 Attribute

Parameter defined as part of a Template or an Element. An attribute can be a static value, a value of an Instrument Tag, a value linked to another data source (e.g. a relational database) or calculation.

An attribute is the Asset Framework equivalent of an equipment parameter.

Examples: Allocated oil volume (in an FPSO modelling template); DHSV status (in a producer well modelling template).

3.2.4 Attribute variant

There may be several different forms of an attribute.

Example: "Well Name" attribute of the template for oil producer wells on Akpo:

- Variant 1 = Well Name used in the Field Operations Division.
- Variant 2 = Well Name used in the Geosciences & Reservoir Division.
- Variant 3 = Well Name used in the Drilling & Completion Division.
- Variant 4 = Well Name used by the local authorities in the country Data Source.

3.2.5 Element

Representation in numeric format, created from a template, of a physical object in the Asset Model.

Example: In the Girassol numeric format database installed on server in Luanda, "GIR 101" and "GIR 105" are the elements for modelling Girassol's oil producer wells.

3.2.6 Data Source

The origin of the data.

Examples: the source for a value typed on the keyboard will be "Manual input"; for a piece of data generated by IFM and stored in PDS it will be "IFM".

3.2.7 Equipment

Physical unit designed to perform a specific task.

Examples: oil producer well; turbo generator; turbo compressor, test separator.

3.2.8 Parameter

An equipment characteristic that is either fixed or variable over time.

Example: Well head pressure of an oil producer well.

3.2.9 Template

Definition of standard attributes for all Elements of the same type.

A template is the equivalent, in numeric format, of an equipment family associated with a production asset. It groups together and structures the attributes for the type of equipment modelled.

Example: Oil Producer Well template to model wells of this type.

4. Architecture philosophy

4.1 Introduction

Production monitoring and optimisation of operations are mandatory to guarantee the Company's performances. Today a real time database (or PDS as Process Data System) collecting all measurements, status and events from production sites is a central tool for this purpose.

This specification describes the architecture and components to ensure availability and reliability of such a system.

{Rule 2

All Process Data Server System Architecture shall be reviewed and validated by Head Quarter Specialists from the Company (Field Operations Methods Department).

This review shall be started at the pre-project stage.}

4.2 General principles

The general principles for the implementation of a PDS at the Company's Affiliate are the following:

{Rule 3

One PDS shall be installed at the Company's Affiliate premises.}

- The production site(s) infrastructure is made of:
 - One or several Data Acquisition nodes:
 - . For ICSS data.
 - . For P3 packages (as defined in **GS EP INS 110**).
 - . For P4 packages (as defined in **GS EP INS 110**).
 - One optional local PDS, depending of telecom infrastructure.
 - One optional Data Replication node, for data replication between the local PDS at production site and Company's Affiliate PDS in.
- During the Project Phase a complete set of hardware and software with the relevant licences is provided for the PI completion and the testing.

Other principles are:

{Rule 4

Data collection shall be achieved using redundant data collection nodes for ICSS data, Subsea data (as per **GS EP SPS 019).}**

- Data from the Company's Affiliate PDS is replicated to the PDS at the Company's Headquarters in Pau.
- Data collection from ICSS and P3 packages is mandatory. For P4 packages it is optional when not specified in this document, but highly recommended.

{Rule 5

PDS shall be installed on his own hardware server not virtualized.}

- Node replication installed on a mutualised hardware as the frequency of computer reboot is over than one per week.

When OSIsoft products are used, see Appendix 2 for specific information to be considered.

4.3 Outline drawing

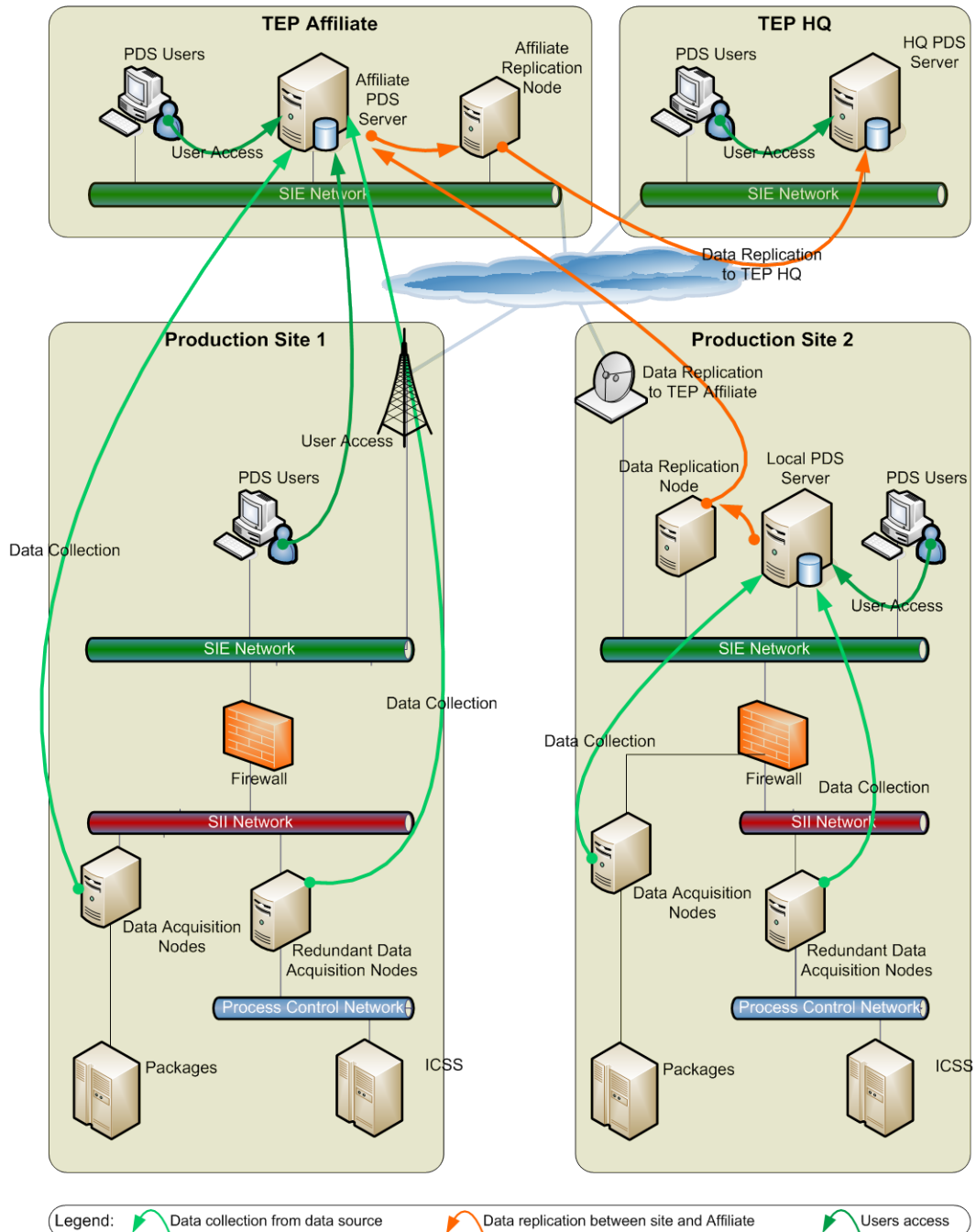


Figure 1: PDS infrastructure

4.4 Infrastructure at production site

Two distinct PDS infrastructures are allowed for the production sites as described in Figure 1. The difference lies in whether or not a PDS is installed locally.

4.4.1 No local PDS (ex : Production Site 1)

No local PDS is installed at the production site. Data is collected from the data sources by the Data Acquisition node(s) and directly transmitted to the PDS at the Company's Affiliate. Both local and Affiliates PDS users are accessing data from the Affiliate PDS.

{Rule 6

This infrastructure shall be applied when the network link between production site and the Company's Affiliate is efficient (bandwidth greater than 10 Mbps), reliable (redundant link), or when the number of PDS users at production site is limited (no more than 5). This architecture is also acceptable when local needs can be satisfied by the ICSS historian.}

4.4.2 Local PDS (ex : Production Site 2)

One local PDS and one Data Replication node are installed at the production site.

Data is collected from the data sources by the Data Acquisition node(s) and archived in the local PDS.

Data from the local PDS is replicated to the PDS at the Company's Affiliate by the Data Replication node.

Local PDS users access data from the local PDS, while PDS users at the Company's Affiliate access data from the PDS at the Affiliate.

{Rule 7

This infrastructure shall be applied when the number of PDS users working at the production site is greater than five and the overall bandwidth of the network between the production site and the Company's Affiliate premises is below 10Mbps.}

4.5 Infrastructure at the Company's Affiliate

{Rule 8

The infrastructure at the Company's Affiliate shall contain:

- One PDS that will gather data from all the production sites of the Affiliate.
- One replication node to transmit data to the Headquarter of Company in France. As this functionality requires very little IT resources it can be installed on mutualised hardware as long as the frequency of computer reboot is lower than one per week.}

4.6 Network

{Rule 9

PDS network communications are using TCP/IP protocol on Ethernet links. A unique TCP/IP port (5450) is dedicated to PDS communications between SII and SIE. The port shall be configured to allow outgoing request from SII to SIE, on port 5450.}

This chapter describes the requirements relevant to network architecture and performance.

4.6.1 Network bandwidth

Communications between the production sites and Company's affiliates premises rely on network links that may use different technologies: microwaves, VSAT, Fiber-Optic, etc.

{Rule 10

Network QoS shall give a high priority to PDS TCP/IP port (5450) as soon as a link is used for data acquisition or data replication (a continuous real time flow is much better in bandwidth usage and PDS behaviour compared to bursts or batch of data).}

4.6.2 Network topology

As a minimum requirement regarding the network, one firewall must be installed and configured to prevent users connected on SIE network to access the equipments on the SII network (ICSS workstations, etc.).

The firewall rules to be configured are described in **GS EP INS 135**.

4.6.3 Other network aspects

All equipments involved in the PDS system (PDS, acquisition and replication nodes, etc. But not the users workstations) shall have fixed IP addresses.

Remote access to Data Acquisition nodes located in SII from SIE for maintenance is not allowed. Changes of the configuration of the PDS interface running on the acquisition node should be done by a local administrator.

4.7 PDS collector for Packages

The PDS is used to collect data from P3 packages and some P4 packages. These Packages may be the Overall Flow Monitoring System, Pipeline Monitoring System, MetOcean Monitoring System, Tank Gauging System, Ballast Monitoring, Marine Monitoring System, Mooring Monitoring System, Fatigue Monitoring System, Vessel Motion Monitoring System, Vessel Dynamic Positioning Monitoring System, Tendon Tension Monitoring System, Riser Monitoring System, Bio Diversity Monitoring System, etc.

{Rule 11

All these Packages shall be identified during the pre-project phase and clearly stated in the Statement Of Requirement.

During the Basic Engineering / Front End Engineering Design an architectural drawing shall be issued based on the requirement of this specification.}

The quantity of Data Acquisition nodes should be minimized in order to take into account the Obsolescence effects. For this Virtualisation Principle can be used.

{Rule 12

During the Basic Engineering / Front End Engineering Design Contractor shall clearly state in the relevant Package Specifications the requirement for Hardware and Software design and supply.}

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{Rule 13

During the Basic Engineering / Front End Engineering Design Contractor shall prepare a PDS Specification which defines the split of work and supply between all Parties involved e.g. ICSS Suppliers, Packages Suppliers, PDS software Vendor for having consistency during the design, the supply and the testing phases.}

{Rule 14

This PDS Specification shall also state the responsibility of each Party and define an Integrator for the Overall solution.

Specifications in **GS EP INS 110** are applied for data transfer from packages to PDS. Not all packages have to be linked to PDS but at least for the following ones data acquisition shall be installed:

For P3 packages:

- When we have subsea operations Subsea Control System as per **GS EP SPS 019**.
- Rotating equipments.

For P4 packages:

- GPS or DGPS system if the corresponding site is a floating unit (FSO, FPSO, etc.).
- Meteo system (and Oceano system if relevant).}

Appendix 3 contains specifications for tags to be acquired and their corresponding naming.

{Rule 15

One interface node can share data acquisition for several packages of same type (as per **GS EP INS 110**). It is not allowed to use a single interface node to host data acquisition interfaces to both P3 and P4 packages as this may lead to cyber security threat. In the same way the network from interface node to PDS server cannot be shared between P3 and P4 system: a dedicated port on firewall shall be used for an interface node collecting data from P4 packages.}

{Rule 16

The network between interface nodes and packages shall be separated from those between interface nodes and firewall.}

4.8 Data Acquisition nodes

Data Acquisition nodes are used to collect data from one or several data sources:

- Systems connected to SII: ICSS, P3 type packages PLC, etc.
- P4 type data sources: PDCS, SOE, weather station, FPSO mooring and tensioning system, etc.
- SIE data sources: LIMS, PDMS, OFMS, relational databases (Oracle, SQL Server), etc.

{Rule 17}

One Data Acquisition node can host several PDS Interfaces, depending on SII network architecture and performance of the node. An interface node shall never host interfaces to more than one type of source (ICSS, P3 or P4 packages).

If several systems have the same characteristics regarding cyber security rules then one interface node shall host the corresponding data acquisition softwares whenever possible.

The interface node shall use standard protocols for data acquisition: OPC, modbus, NMEA.

The ICSS shall not be used as a gateway to collect data from packages. In case information from these systems is not already available in the ICSS, it shall be acquired directly using a dedicated PDS interface as long as the corresponding data is not needed on operator control stations. Details on interfacing packages are given in **GS EP INS 110.**

Data Acquisition nodes are usually running:

- One software provided by the data source Vendor, in charge of low level communication with the hardware and collecting data from the relevant data source.
- One standard PDS interface software, to manage data transmission to the PDS.

{Rule 18}

For the ICSS the data acquisition nodes shall be redundant and dedicated to the ICSS. Whenever possible they shall be installed on hardware provided by the ICSS vendor.}

4.9 Data acquisition redundancy

{Rule 19}

Redundancy of data collection, also known as "failover" mechanism, is provided by most PDS interfaces. Except for PDS interfaces not allowing failover, this functionality shall be configured for ICSS data acquisition. For other systems not hosting important data for production redundancy is recommended but not mandatory.}

In addition, "disconnected start-up" of the PDS Interface is used when available. This feature allows starting the data acquisition even if the PDS is not reachable. In such case the data are stored in a local buffer waiting for PDS reconnection.

{Rule 20}

A test of the failover mechanism shall be rolled out at least once a year. During this test the switch of data acquisition from primary to secondary node is checked. The procedures for redundancy tests are provided as part of the PDS documentation and procedures.}

4.10 Buffering mechanism

PDS interfaces include a buffering mechanism to avoid data loss in case of communication problem between the data acquisition node and the receiving PDS (network issue, PDS stopped for maintenance, etc.).

The buffering mechanism should be installed and configured on the data acquisition node.

The size of the buffer should allow a 48-hour disconnection with the PDS.

A test of this buffering mechanism should be rolled out at least once a year. During this test the gateway is disconnected from the PDS and the data acquisition must go on. At end of the test when the gateway is connected to the PDS one should verify that no data loss has occurred. The procedures for buffering tests are provided as part of the PDS documentation and procedures.

4.11 Configuration of the PDS Interface

The configuration of the PDS interface shall take care of the following:

- Explicit PointSource.
- Optimized scan classes.
- Use of I/O rate tags to monitor the data acquisition.

4.11.1 Explicit PointSource

The PointSource parameter, identifying the PDS interface is no more limited to one character. It will explicitly refer to the corresponding data source.

{Rule 21

The PointSource parameter shall be defined as: a prefix identifying the production site (e.g. "DAL_", "GIR_", etc.). This prefix shall be the same used for PDS tags naming. It shall have a size of 3 to 6 characters.}

- A functional identification of the data source (e.g. "ICSS", "LIMS", "MetOcean", etc.)

Examples:

- DAL_MetOcean for Meteo data acquisition on Dalia.
- PAZ_EXA_OPC for Yokogawa Exa_OPC gateway on Pazflor.

Note: the prefix used for PointSource are similar to the prefix used for the tags naming (see section 5.2)

4.11.2 Optimized scan classes

{Rule 22

The offsets of each scan class shall be defined to avoid several scan classes to be triggered at the same second, even if one of them is scheduled rarely.}

4.11.3 Use of I/O Rate tags

PDS interfaces can update an "I/O Rate" tag if proper configuration is applied. This tag records the throughput of an interface expressed in events per minute. In particular, the value of an I/O Rate point represents a 10-minute average of the total number of values per minute that the Interface sends to the PI Server.

The I/O Rate tag is defined and tuned in order to have a compression not higher than 1 event/minute and the step parameter set 'ON' (no data interpolation between two values). It is used to monitor the performance, reliability and availability of the data collection.

4.12 Data acquisition throughput

The data throughput of the acquisition infrastructure will ensure at least 2000 events read per second for each block of 10,000 PDS tags. For instance it means that for 20,000 tags a throughput of 4,000 events per second is required. If this is not possible on a single interface due to software or hardware limitations then one splits data acquisition on several gateways/interfaces.

4.13 Data Replication node

A Data Replication node is installed at a production site when a local PDS is available.

The goal of the Data Replication node is to transfer real-time data from the local PDS to the PDS installed at the Company's Affiliate.

All the tags from the local PDS are replicated, except PDS standard test tags and tags that could impact network performance (e.g. SOE through VSAT link).

4.14 Affiliate PDS

{Rule 23

The server used as the Affiliate PDS shall be a computer complying with the Company's requirements for servers. It is connected to SIE network. Hardware and software for this PDS are provided by the Company.}

Software packages are installed and configured according to the Information System documentation of the Company.

4.15 Hardware requirements

In addition to the Company's requirements regarding Vision servers, the Affiliate PDS have at least the following characteristics:

- CPU: four cores for each 10,000 tags in PDS database (can be limited to a maximum of 16 cores).
- Memory: 4 Gb of RAM for each 10,000 tags (can be limited to a maximum of 16 Gb).
- For the storage subsystem, as the need for IOs can be very high, an approval from entity "Systèmes d'Information/Architecture Plan Gouvernance" should be obtained.