StruxureWare™
Power Monitoring Expert 8.0

Design Guide

7EN42-0109-00

05/2015
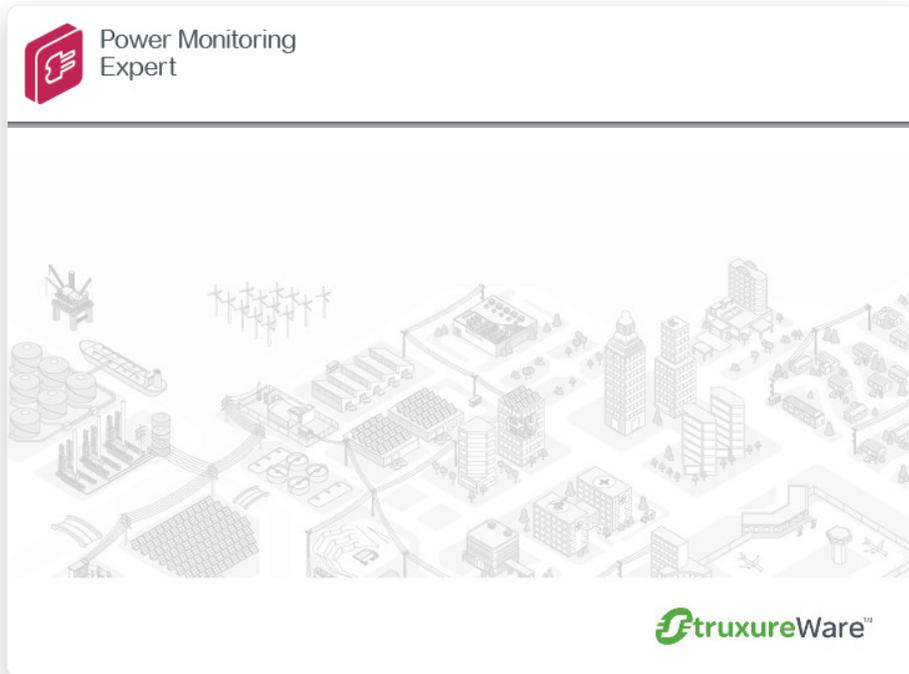
Safety information

Important information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a "Danger" or "Warning" safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please note

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Safety precautions

During installation or use of this software, pay attention to all safety messages that occur in the software and that are included in the documentation. The following safety messages apply to this software in its entirety.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not use the software for critical control or protection applications where human or equipment safety relies on the operation of the control action.
- Do not use the software to control time-critical functions because communication delays can occur between the time a control is initiated and when that action is applied.
- Do not use the software to control remote equipment without securing it with an authorized access level, and without including a status object to provide feedback about the status of the control operation.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING

INACCURATE DATA RESULTS

- Do not incorrectly configure the software, as this can lead to inaccurate reports and/or data results.
- Do not base your maintenance or service actions solely on messages and information displayed by the software.
- Do not rely solely on software messages and reports to determine if the system is functioning correctly or meeting all applicable standards and requirements.
- Consider the implications of unanticipated transmission delays or failures of communications links.

Failure to follow these instructions can result in death, serious injury, equipment damage, or permanent loss of data.

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Contents

Introduction

This Design Guide provides an overview of items to consider when designing a StruxureWare™ Power Monitoring Expert system. Most of the information in this document applies to the Segment editions of Power Monitoring Expert, however you should consult the respective Design Guides when deploying those editions.

Power Monitoring Expert Architecture

This section describes the different server, client, and architecture types that can be used when setting up Power Monitoring Expert on your network.

Client Types

The Power Monitoring Expert system contains two different types of client interfaces:

- The Web Client is any computer on the network that provides access to energy dashboards, real-time trends and tables, reports, alarms, and custom graphical representations of the power monitoring system.

- The Engineering Client is the administrator interface that is used to manage, build, maintain, and customize the power monitoring system.
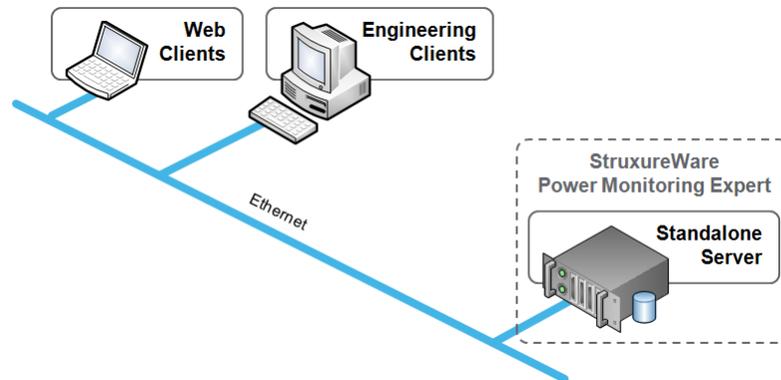
Note

The minimum display resolution for Power Monitoring Expert software is 1024 x 768.

Engineering Client

An Engineering Client workstation provides administrators and power users access to the Power Monitoring Expert graphical user interface as well as design and system configuration components (Management Console, Vista, Designer). You can use these components to:

- Manage communications to devices.
- Design custom user diagrams to represent the power monitoring system.
- Develop system-level applications.

The Engineering Client is a thick client that is installed on the main Power Monitoring Expert server, but it can also be installed on additional client computers where a user will administer the system. The following tools are included with the Engineering Client:

Application	Description
Management Console	Manage communications to devices and open system configuration tools.
Vista	Design, manage, and monitor the power monitoring system.
Designer	Develop system-level applications.

Web Client

The Web Client is any computer on the network that is most commonly used in day-to-day power management tasks. The Web Client is a thin client that connects to the Power Monitoring Expert server via Web browser, through which you access the Web Applications component of the Power Monitoring Expert system. The applications within this component display real-time and historical information, and alarms.

For performance reasons, it is recommended that you access the Web Applications component from a Web Client rather than from the Power Monitoring Expert server so that you are not using the server's CPU and memory resources. The Power Monitoring Expert Installer creates a shortcut on the server that you can use to access the Web Applications component if required.

The following applications are included in the Web Applications component.

Application	Description
Dashboards	Displays historical energy data in an easily viewable dashboard.
Diagrams	Custom graphical representation of the power monitoring system (designed in Vista).
Tables	Real-time data from the system displayed in a table format.
Trends	Displays real-time and historical data in a graphical format to assist with the monitoring of current system conditions.
Alarms	Alarm management portal to view and acknowledge both active and historical alarms. Alarms are configured through the Alarm Configuration application.
Reports	Generate energy, power quality, and generic system reports, based on data logged by the power meters.

Recommended Web Client Specifications

Before connecting to the Web Applications component (Dashboards, Diagrams, Tables, Trends, Alarms, and Reports), you should ensure that the Web Client computer meets the following recommended specifications:

Processor	RAM	Minimum	Browser
2GHz Dual Core	2GB	1024 x 768	Internet Explorer versions 10 and 11
			Google Chrome version 42[1] or later
			Mozilla Firefox version 35 or later
			Apple Safari versions 7 or 8 and later versions , respectively, on Mac computers

1. Chrome browser support is dependent on its support of the Silverlight plugin.

The Diagrams application is supported only on tablets using the following browsers:

- Safari on iPad tablets using iOS 7 or iOS 8 operating systems.

- All browsers using Android operating systems 4.4 - 4.4.4, and 5.0.

Note

The user is prompted to install Microsoft Silverlight 4.0 or later if it has not already been installed on the computer.

Architecture Types

A Power Monitoring Expert system contains many components, but it can only be installed in one of two methods:

- **Standalone** installation
- **Distributed Database** installation (optional, based on specific customer requirements for SQL Server)

The difference between the two architectures is based on where the SQL Server database engine is installed.

Note

A distributed architecture does not provide any performance gains over a standalone architecture and may, in fact, result in lower performance. It is recommended that you use the Standalone Server installation unless a customer's IT environment requires a different system configuration.

Standalone vs. Distributed

The standalone architecture is the preferred and most common installation method in use because it is lower in cost (only one server required) and easier to commission. In some cases, however, the distributed architecture may be required due to local IT policy, such as:

- Not installing SQL Server with another application on the same server.
- Meeting SQL Server redundancy requirements with SQL Clustering or other third-party tools.
- Following specific rules for database management (for example, SQL jobs, back-ups, data security, and so on).

Standalone Architecture

The most common type of Power Monitoring Expert architecture is called "standalone" where one computer hosts:

- **Power Monitoring Expert** software (that is, configuration files, communication services, Web Applications, Virtual ION Processor, SQL Server connection, and so on).
- **Microsoft SQL Server** to host the historical databases for logged data.

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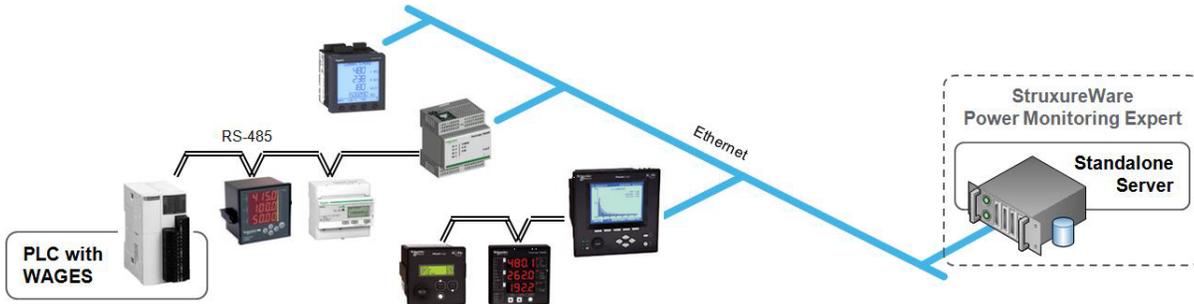
Unlike other software packages (for example, SCADA) all custom application logic, I/O management, alarm management, reports, and device communication for Power Monitoring Expert perform optimally when installed on a single server.

Distributed Architecture

A distributed architecture has system components installed across multiple computers. Power Monitoring Expert supports the ability to distribute either a **Database** server or additional communication servers called **Secondary** servers. However, these distributed systems should only be used if the standalone architecture is not possible.

Distributed Database

If the standalone architecture is not possible due to specific customer requirements, it is possible to distribute the database to another server. This is called a "distributed database" installation, where two computers work together to create the Power Monitoring Expert environment:

- **Primary server** hosts the Power Monitoring Expert software.
- **Database server** hosts the SQL Server databases.
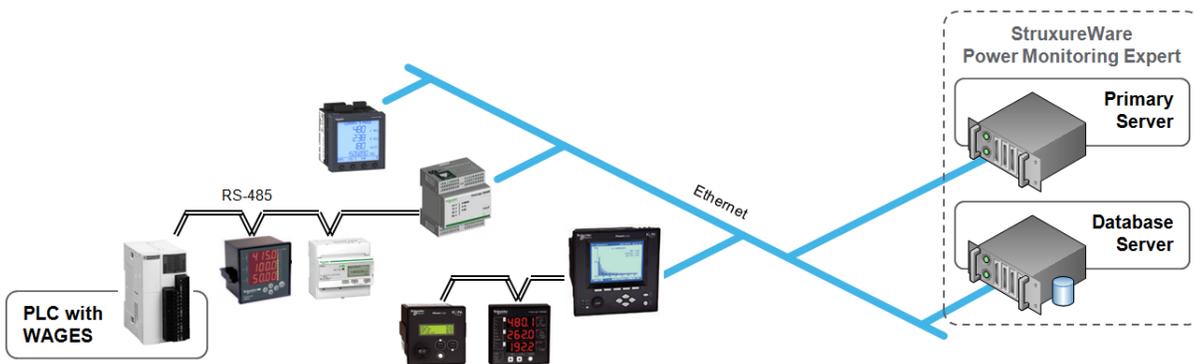
The distributed database architecture is less common than the standalone architecture.

Note

There is no performance improvement by using the distributed database architecture over the standalone architecture.

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Distributed Web Server

Distributed Web Servers are not supported by Power Monitoring Expert.

Server Types

In a standalone architecture there is only one server: the **Standalone / Primary** server.

In a distributed architecture there are two servers: the **Primary** server and **Database** server.

Standalone / Primary Server

Every Power Monitoring Expert system has a minimum of one server. In the standalone architecture it is called a **Standalone** server, but in the distributed architecture it is called a **Primary** server.
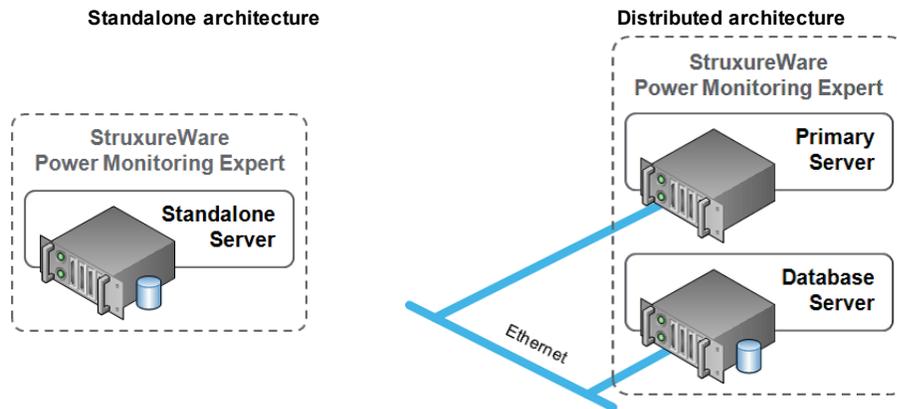
This single server hosts the Engineering Client tools and a collection of services and configurations vital for the functioning of the system.

Component	Description	Standalone server	Primary server
Engineering Client tools	Management Console, Vista, Designer, Configuration files	✓	✓
Communication Services	Manage device communications Data management and routing 3rd-party software integration	✓	✓
Web Applications server	Internet Information Services (IIS)	✓	✓
Microsoft SQL Server	Host historical data for logged data	✓	x

Database Server

Due to specific customer requirements, an independent server can be used to host the Microsoft SQL Server engine. This type of server is called a **Database** server and it is used in conjunction with a Primary server in a distributed architecture.

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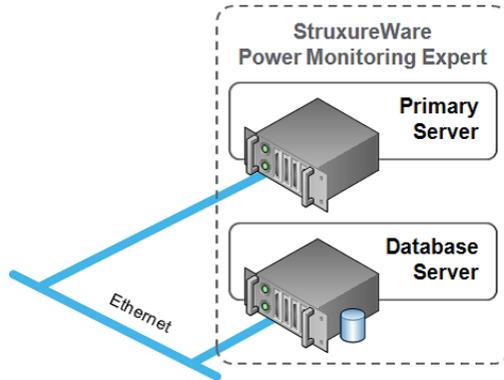
The Database server contains the following components:

Component	Description
Communication Services	Data management and routing
Microsoft SQL Server	Host historical data for logged data

See "Database Servers" on page 38 for more information about Database servers in a distributed architecture.

Secondary Server

In extremely rare circumstances for very large systems, additional communication servers can be installed as part of either a standalone or distributed architecture. These servers are known as **Secondary** servers.
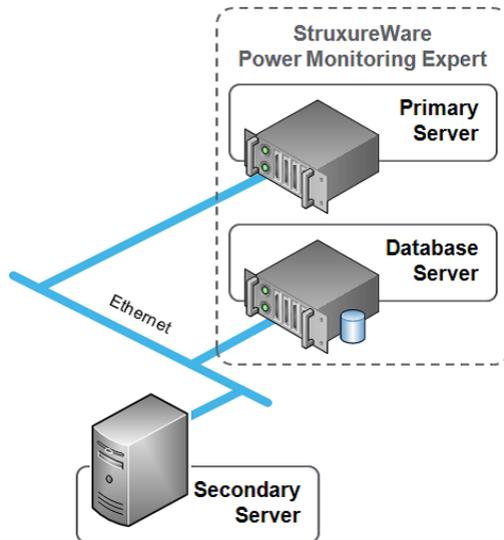
See to calculate if a Secondary server is required. It is recommended that you contact your Schneider Electric representative if you require a Secondary Server installation.

Note

In 2012, about 0.3% of new system deployments required a Secondary server.

Recommended Power Monitoring Expert Systems

Power Monitoring Expert can vary in size from just a few devices with limited logging to thousands of devices with extensive logging and custom applications. The following system specifications are sufficient for the majority of customers, but can be adjusted if needed.

Systems Up To 250 Devices

System[1]	Devices	Users	Server Recommendations	Years of Logging[2]	OPC Tags	VIP Tags[3]
B1	≤ 50	≤ 5	**Computer Type**: Desktop **OS**: Windows 8.1 (64-bit) **SQL**: 2014 Express **CPU**: Intel Core i3 (2 core), or better **RAM**: 2+ GB **HDD**: 500+ GB	~4 years (10 GB)	1000	250
B2	≤ 100	≤ 5	**Computer Type**: Desktop **OS**: Windows 8.1 (64-bit) **SQL**: 2014 Express **CPU**: Intel Core i3 (2 core), or better **RAM**: 4+ GB **HDD**: 500+ GB	~2 years (10 GB)	1000	250
B3	≤ 100	≤ 5	**Computer Type**: Desktop **OS**: Windows 8.1 (64-bit) **SQL**: 2012 Standard SP1 **CPU**: Intel Core i3 (2 core), or better **RAM**: 4+ GB **HDD**: 500+ GB	~6 years (30 GB)	1000	250
A1	≤ 100	≤ 15	**Computer Type**: Workstation **OS**: Windows 8.1 (64-bit) **SQL**: 2012 Standard SP1 **CPU**: Intel Xeon E56xx (4 core), or better **RAM**: 8+ GB **HDD**: x2 500+ GB	<6 years (30 GB)[4]	5000	1500
B4	≤ 250	≤ 10	**Computer Type**: Workstation **OS**: Windows Server 2012 R2 **SQL**: 2014 Standard **CPU**: Intel Xeon E56xx (4 core), or better **RAM**: 8+ GB **HDD**: x2 500+ GB	~2.5 years (30 GB)	5000	1000
A2	≤ 250	≤ 20	**Computer Type**: Server **OS**: Windows Server 2012 R2 **SQL**: 2014 Standard **CPU**: Intel Xeon E56xx (4 core), or better **RAM**: 16+ GB **HDD**: x4 300+ GB	<2.5 years (30 GB)[4]	10000	3000

[1] Basic or Advanced system (for example, B3 denotes the third of the basic systems in a larger order of magnitude).

[2] Years of data in the database is calculated based on a 10 GB database for SQL Server Express and 30 GB (or larger) for SQL Server Standard edition.

[3] VIP "tags" are measurements used for alarming and/or logging.

[4] Based on the following device mix: 10% advanced; 20% intermediate; 70% basic/entry.

It is recommended that you calculate the ION_Data size and number of years of logging using the DB Growth Calculator tool.

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Systems Up To 2500 Devices

System[1]	Devices	Users	Server Recommendations	Years of Logging[2]	OPC Tags	VIP Tags[3]
B5	≤ 600	≤ 10	**Computer Type**: Workstation **OS**: Windows Server 2012 R2 **SQL**: 2014 Standard **CPU**: Intel Xeon E56xx (4 core), or better **RAM**: 16+ GB **HDD**: x6 300+ GB	~1 year (30 GB)	5000	1000
A3	≤ 600	≤ 35	**Computer Type**: Server **OS**: Windows Server 2012 R2 **SQL**: 2014 Standard **CPU**: x2 Intel Xeon E56xx (4 core), or better **RAM**: 24+ GB **HDD**: x6 300+ GB	<1 year (30 GB)[4]	30000	10000
B6	≤ 2500	≤ 10	**Computer Type**: Server **OS**: Windows Server 2012 R2 **SQL**: 2014 Standard **CPU**: x2 Intel Xeon E56xx (4 core), or better **RAM**: 24+ GB **HDD**: x5 300+ GB x1 1.5+ TB	~2 years (200 GB)	10000	2500
A4	≤ 2500	≤ 50	**Computer Type**: Server **OS**: Windows Server 2012 R2 **SQL**: 2014 Standard **CPU**: x2 Intel Xeon E5-2xxx (6 core), or better **RAM**: 32+ GB **HDD**: x6 300+ GB x2 1.5 TB	<2 years (200 GB) [4]	50000	15000 (See Notes 1 and 2)

1. The need for using the VIP for PC alarming configuration is no longer required. Use the Alarm Configuration application to configure alarms.
2. Contact your Regional Competency Center for larger systems.

Basic Systems

The majority of Power Monitoring Expert systems are basic systems with out-of-the box functionality and meets most customer needs. A basic system presumes the following:

- Factory default device logging

- No high-speed (that is, faster than 15 minutes) logging

- No custom applications

A basic system contains a mixture of advanced and basic power meters. These basic systems use the following devices:

- 70% Entry/Basic Meters

- 20% Intermediate Meters/Trip Units/Relays

- 10% Advanced/Utility Meters

These systems do not include large numbers of BCPM or EM4800 device types. In cases where these device types are installed, use the Advanced version of that system.

Small Basic System Example

A small basic system uses **System B1** above. The following table summarizes additional system usage and other details.

Server Requirements	Quantity	Details
Number of Devices	50	x35 PM1200 x10 PM8000 x5 ION7650
Hard Drive(465 GB available)	80 GB 93 GB 12 GB 50 GB **235 GB**	Windows OS 20% Free hard drive space Power Monitoring Expert and SQL Server ION_Data and its backups **Total Usage**

Large Basic System Example

A large basic system uses **System B6** above. The following table summarizes additional system usage and other details. See for information about hard drive groups.

Server Requirements	Quantity	Details
Number of Devices	2500	x2200 PM3200 x200 PM8000 x100 ION7650
Hard Drive Group 0 (279 GB available)	100 GB 56 GB 12 GB **168 GB**	Windows OS 20% Free hard drive space Power Monitoring Expert and SQL Server **Total Usage**
Hard Drive Group 1 (279 GB available)	56 200 **256 GB**	20% Free hard drive space SQL Server tempDB **Total Usage**
Hard Drive Group 2 (279 GB available)	56 200 **256 GB**	20% Free hard drive space ION_Data .mdf **Total Usage**
Hard Drive Group 3 (1397 GB available)	279 200 600 **1079 GB**	20% Free hard drive space ION_Data .ldf ION_Data backups **Total Usage**

Advanced Systems

An advanced system may be required to meet specific customer needs that cannot be met with a basic out-of-the box system. An advanced system might include one or more of the following:

- Custom applications in the VIP.

- Non-default logging (shorter than 15 minute intervals).

- High concurrent system usage with report generation.

- OPC server with thousands of tags.

- High number of concurrent users accessing the system.

- Mixture of different device types, including advanced PQ meters.

Which is More Important: CPU or RAM?

They are both important for different reasons. The CPU plays a critical role for executing Power Monitoring Expert operations. It is especially important when using a large number of translated devices. On the other hand, RAM is very important for SQL Server. SQL Server is a memory intensive program which requires more RAM for running reports, logging a large number of measurements, and other database-intensive operations. During deployment, it is important to cap SQL memory because the SQL Server can use all available RAM, which may impact the performance of other operations.

Supported Operating Systems and SQL Server Editions

The following information summarizes the 32-bit and 64-bit versions of Microsoft Windows operating systems and SQL Server editions that support Power Monitoring Expert installations.

Windows operating systems

You can install Power Monitoring Expert software on servers using any of the following Windows operating systems.

Note

Power Monitoring Expert software can be installed on servers in a domain environment, however it cannot be installed on domain controllers. If Power Monitoring Expert software is installed on a server that is subsequently changed to a domain controller, the software ceases to function correctly.

- Windows 7 Professional/Enterprise, SP1
- Windows 8.1 Professional/Enterprise
- Windows Server 2008 R2 Standard/Enterprise, SP1
- Windows Server 2012 Standard, SP1
- Windows Server 2012 R2 Standard

SQL Server editions

If no supported SQL Server version is detected during the installation of Power Monitoring Expert on a Standalone Server, then SQL Server 2014 Express is installed.

If a supported edition of SQL Server Express is already installed but not configured with a database instance for use with Power Monitoring Expert, the installer adds the required database instance. Otherwise, one of the following SQL Server editions needs to be installed prior to installing Power Monitoring Expert software. (See the "Installing SQL Server" topic in the *StruxureWare Power Monitoring Expert Installation Guide* for more information.)

Note that supported 32-bit and 64-bit SQL Server editions can only be installed on supported 32-bit and 64-bit Windows operating systems, respectively. For example, a 32-bit SQL Server edition is not supported on a 64-bit Windows operating system.

SQL Server Editions	Standalone Server	Distributed Database Server
SQL Server 2008 R2 Express, SP3	Yes	No
SQL Server 2012 Express, SP2	Yes	No
SQL Server 2014 Express, SP1	Yes	No
SQL Server 2008 R2 Standard/Enterprise, SP3	Yes	Yes [1]
SQL Server 2012 Standard/Enterprise/Business Intelligence, SP2	Yes	Yes [2]
SQL Server 2014 Standard/Enterprise/Business Intelligence, SP1	Yes	Yes [2]

[1] Supported for a distributed database server configuration on Windows Server 2008 R2 Standard/Enterprise SP1.

[2] Supported for a distributed database server configuration on Windows Server 2012 Standard SP1, and on Windows Server 2012 R2 Standard.

See the *StruxureWare Power Monitoring Expert Installation Guide* (7EN02-0358) for more information.

32-bit versus 64-bit Operating Systems

It is recommended that you use a 64-bit operating system for any size Power Monitoring Expert system. The gain in using a 64-bit operating system comes from the better performance of software that works with Power Monitoring Expert. For example, a SQL Server 64-bit edition can perform much faster than a SQL Server 32-bit edition.

In addition, 32-bit operating systems are limited to just 4 GB of RAM, whereas 64-bit operating systems are not restricted to the same extent.

Note

Power Monitoring Expert is a 32-bit software package. However, 64-bit operating systems support 32-bit software.

Windows 8.1 versus Windows Server 2012 R2

It is also recommended that Microsoft Windows Server operating systems be used, for two important reasons:

- Windows Server has the ability to utilize server-class hardware, which means being able to run more CPUs and to add more RAM as needed. Windows 8.1 Professional/Enterprise is limited to two physical CPUs.

- Windows Server offers better performance for running Power Monitoring Expert services.

Hard Drive Considerations

The hard disk drives (HDD) in the Power Monitoring Expert server are critical to the operation of the software. The configuration of the hard drives and distribution of software components can have a significant effect on the performance of the server.

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Hard Drive Space for Software Components

Each component on the server (that is, the Windows operating system, the page file, Power Monitoring Expert software, SQL Server databases, and so on) requires hard drive space. Aside from the main Power Monitoring Expert database, ION_Data, the remainder of the server components are relatively static in size and will not change much throughout the life of the system.

The following table summarizes the approximate hard drive space required for each component. All remaining space will be reserved for ION_Data.

Component	Hard Drive Space Required[1]
Windows OS[2]	80 – 100 GB
Power Monitoring Expert[3]	5 GB
Power Monitoring Expert databases[4]	5 GB
SQL Server	2 GB
Free hard drive space[5]	10% - 30% of the total hard drive space
TOTAL	**~ 100 GB + 30% of Total Hard Drive Space**

[1] The hard drive space requirements for each component have been rounded up to account for variations throughout the life of the system.

[2] Includes the Windows operating system, page file, temp directory, Windows updates, restore points, and so on. The initial hard drive space for Windows is between 16 GB and 40 GB, but it will grow over time.

[3] Accounts for future Power Monitoring Expert updates and service packs.

[4] Includes Power Monitoring Expert databases (that is, ION_Network, ION_SystemLog and ApplicationModules) and database backups. ION_Data is not included.

[5] Required for hard disk drive defragmentation and unexpected usage (that is, downloads, file copying, and so on). Solid state drives (SSD) do not require defragmentation and will require less available space.

Note

1 GB = 1024 MB = 1,048,576 kB = 1,073,741,824 bytes on a NTFS formatted hard drive.

All remaining hard drive space will be reserved for the ION_Data database and its backups, and the SQL Server tempDB.

Example

A server has two 500 GB hard drives configured using RAID 1 (that is, they are exact copies of each other – see *Hard Drives and RAID* below). However, there is only 465 GB of usable space. If all software components are installed on this hard drive group, there will be **225 GB** of hard drive space remaining for the ION_Data database and its backups, and the SQL Server tempDB.

$$Remaining\ HDD\ Space\ (GB) = Total\ HDD - Software\ Components - \%\ Free\ Space$$
$$= 465 - 100 - 0.3(465)$$
$$= 225.5\ GB$$

Hard Drive Contention

Hard drive contention is a term used when the hard drives cannot keep up with the read and write operations from the operating system or an application. Essentially, the hard drives become a bottleneck, causing the entire server to slow down even if the processors (CPU) and memory (RAM) are performing as effectively as possible. Two examples of this are:

- SQL Server read and write operations to the database (.mdf) and transaction log (.ldf).
- Operating system read and write operations to the pagefile.

Hard Drive Groups

For a basic system, a single hard drive (or hard drive group with RAID 1) is sufficient to install the operating system, Power Monitoring Expert software and SQL Server without causing any hard drive contention.

For improved hard drive and system performance, it is recommended (if possible) that you separate major components onto different hard drive groups.

Hard Drives and RAID

In addition to separating the software components onto different hard drive groups, RAID 1 can be used to add simple redundancy in case of an inoperable hard drive. RAID 1 is where one hard drive is a fully-mirrored clone of a second hard drive. If either hard drive stops operating, no data is lost and a new hard drive can be inserted to become the new clone.
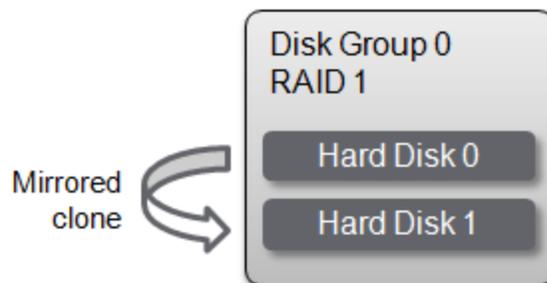
It is possible to use other RAID configurations (that is RAID 0, RAID 5, and so on), but they are not addressed in this document.

Recommended Hard Drive Configurations

It is important to plan for system growth by having a chassis that will hold additional hard drives. The cost of the larger hard drive chassis is often minimal. Throughout the life of the system, additional hard drives can be added so that the software components can be moved as the system grows.

The following tables provide recommended standalone server configuration options for data redundancy (using RAID 1) and reduced hard drive contention. Other configurations are also possible.

Option 1 (2x Hard Drives)

The following configuration is sufficient for most applications.

Component	Group 0 HDD1 + HDD2
OS[1]	✓
tempDB[2]	✓
MDF[3]	✓
LDF[4]	✓
Backups[5]	✓

[1] Includes the Operating System, page file, Power Monitoring Expert and any other applications.
[2] SQL Server temporary system database.
[3] SQL Server main databases.
[4] SQL Server transaction log files.
[5] Power Monitoring Expert database backups.

Option 2 (4x Hard Drives)

The following configuration is sufficient for most applications.

Component	Group 0 HDD1 + HDD2	Group 1 HDD3 + HDD4
OS[1]	✓	
tempDB[2]		✓
MDF[3]	✓	
LDF[4]		✓
Backups[5]		✓

Option 3a (6x Hard Drives)

The following configuration is for data redundancy, but hard drive contention is not considered.

Component	Group 0 HDD1 + HDD2	Group 1 HDD3 + HDD4	Group 2 HDD5 + HDD6
OS[1]	✓		
tempDB[2]	✓		
MDF[3]		✓	
LDF[4]			✓
Backups[5]			✓

Option 3b (6x Hard Drives)

The following configuration is for reduced drive contention and data redundancy for the operating system and main database file.

Component	Group 0 HDD1 + HDD2	Group 1 HDD3	Group 2 HDD4 + HDD5	Group 3 HDD6
OS[1]	✓			
tempDB[2]		✓		
MDF[3]			✓	
LDF[4]				✓
Backups[5]				✓

Option 4 (8x Hard Drives)

The following configuration is for minimized drive contention with data redundancy for all components.

Component	Group 0	Group 1	Group 2	Group 3
	HDD1 + HDD2	HDD3 + HDD4	HDD5 + HDD6	HDD7 + HDD8
OS[1]	✓			
tempDB[2]		✓		
MDF[3]			✓	
LDF[4]				✓
Backups[5]				✓

Database Considerations

SQL Server Express vs. Standard/Enterprise

Power Monitoring Expert can install SQL Server Express 2014 to host the databases if no other SQL Server edition is already installed. SQL Server Express is the free version of Microsoft's SQL Server and is suitable for most users. However, there are some limitations in its capabilities:

- Maximum size of 10 GB per database (.mdf). Transaction logs (.ldf) are excluded from this limit.

- No SQL Server Agent service.

- Limited to lesser of 1 socket or 4 cores.

- Limited to use a maximum of 1 GB of the total system RAM.

Example

Power Monitoring Expert is installed with SQL Express on a single powerful server with two physical quad core CPUs and 24 GB of RAM. SQL Server Express only uses one of the quad core CPUs and just 1 GB of RAM.

This server is far too large for SQL Server Express and does not provide any database performance gains.

Databases in Power Monitoring Expert

Power Monitoring Expert uses four databases to store device communication parameters, system configuration settings, and logged historical data.

Database	Description
ApplicationModules	Contains all of the configuration data for the Dashboards, Trends, and Tables applications in the Web Applications component.
ION_Data	Contains the logged historical data, events, and waveforms from devices.
ION_Network	Contains device communication information and general Power Monitoring Expert settings.
ION_SystemLog	Contains Power Monitoring Expert events that occur during the operation of the software.

Only the historical data database, ION_Data, is considered when calculating hard drive space requirements and growth. The other databases are relatively static in size and should not exceed 5 GB in size under normal operation (includes database backups).

Database Growth Calculations

The ION_Data main database (.mdf) size and growth is dependent on what is stored in the database and can be estimated by three primary types of measurements in the devices and/or software:

- Factory default measurement logging.

- Power Quality (PQ) events.

- Custom measurement logging.

Each factory or custom logged measurement in the database uses approximately **75 bytes** for each record, which also accounts for indexing and other factors. From this value it is possible to estimate the **daily growth rate (kB)** based on the device type, the number of logged measurements, and the logging frequency (typically 15 minutes) for the factory default devices.

Recording PQ events and waveform captures are event driven, so it is impossible to predict the exact frequency of these records and how they affect database growth.

In addition, the database occasionally grows by 10% to create room for additional measurements. This growth operation can occur at any time and should be accounted for in database size calculations.

These periodic database growth operations in larger systems (that is, +100 GB databases with +10 GB growth operations) can have a severe impact on server and database operation. Therefore, it is recommended that you pre-allocate the hard drive space for the database during the initial commissioning phase of the system. For example, if you calculate that a database will grow to 500 GB over 5 years, it is recommended that you pre-allocate the hard drive space to avoid the effects of the periodic growth operations.

Device Range	Device Type	Daily Growth Rate (kB)	Has Waveforms[1]
Utility Meter	ION8800A (with IEC 61000-4-30[2])	560 (745)	Yes
	ION8800B	560 (680)	No
	ION8800C	30	No
	ION8650A (with IEC 61000-4-30[2])	525 (710)	Yes
	ION8650B (with IEC 61000-4-30[2])	525 (645)	Yes
	ION8650C	30	No
	ION8600A	525	Yes
	ION8600B	525	Yes
	ION8600C	30	No
Advanced Meter	ION7650 (with IEC 61000-4-30[2])	565 (780)	Yes
	ION7550	545	Yes
	CM4000 series	800	Yes

Device Range	Device Type	Daily Growth Rate (kB)	Has Waveforms[1]
Intermediate Meter	PM8000 series	950	Yes
	CM3000	765	Yes
	PM870	110	Yes
	PM850	110	Yes
	PM820	85	No
	PM810 (PM810LOG)	140 (85)	No
	ION7350	410	Yes
	ION7330	195	No
	ION7300	0	No
Multi Circuit Meter	BCPM (42 circuits)	1060	No
	EM4800-24	2900	No
	EM4800-12	2220	No
	EM4800-08 Wye	1830	No
	EM4800-08 Delta	1830	No
	EM4800-12 ckt	950	No
	EM4800-24 ckt	691	No
	EM4800-8 ckt Delta	346	No
	EM4800-8 ckt WYE	864	No
Basic Meter	PM5350	225	No
	PM700 series	45	No
	PM3200 series	85	No
	ION6200	60	No
	PM200	45	No
	CM100_200	216	No
	EM3460	108	No
	EM3550	43	No
	EM3555	58	No
	Enercept Meter	173	No
	PM3250	86	No
	PM3255	108	No
	PM5100	144	No
	PM5300	158	No
	PM5350 Busway	209	No
	PM5350_PB_IB	209	No
	PM5500	230	No
Entry Meter	EM1200	50	No
	PM1200 / DM6200	50	No
	PM9c	170	No
	iEM3000	70	No
	EM1000	101	No
	EM6400	108	No
	EM6430	79	No
	EM6433	50	No
	EM6434	58	No
	EM6436	79	No
	EM6436 Dual	94	No
	EM6438	36	No
	EM6439	58	No
	iEM3x50	36	No
	iEM3x55	72	No

Device Range	Device Type	Daily Growth Rate (kB)	Has Waveforms[1]
Circuit Breaker Trip Units	Micrologic H	350	Yes
	Micrologic A, E, and P	70 / 295 / 350	No
	Micrologic Compact NSX A and E	170	No
	Micrologic A IFE_IFM	65	No
	Micrologic E IFE_IFM	302	No
	Micrologic H IFE_IFM	353	No
	Micrologic P IFE_IFM	353	No
Protective relays	Sepam series 80	565	Yes
	Sepam series 48 and 40	270	Yes
	Sepam series 20	50	Yes
	Sepam series 10	40	No
	Enersure BCPM/iBCPM	1814	No
Demand Controller	EM7000	29	No
Motor Controller	Altivar 61	43	No
	Tesys T	108	No
Power Quality Meter	Varlogic NRC 12	50	No
Sequence of Event Recorder	SER2408	0	No
	SER3200	0	No
Switchboard Monitoring	Acti 9 Smartlink	0	No
	Acti 9 Smartlink Ethernet	0	No

[1] Devices with waveforms contribute approximately 10% - 20% to the total size of the database. See below for details.

[2] Includes IEC 61000-4-30 (10 minute and 2 hour logging). IEC 61000-4-30 3 second logging must be enabled manually and contribute 14.4 MB of logs per day. EN50160 (weekly logging) contributes approximately 2 kB per day.

These numbers may change with any meter logging configurations and should only be used as an estimated baseline. Use the Database Growth Estimation Tool to calculate the estimation.

Factory Default Measurement Logging

For a system where the devices only log factory default measurements, the database size can be calculated based on the number of each device type in the system.

Example

A Power Monitoring Expert system contains devices with the factory default measurement logging enabled with PQ frameworks. The estimated annual growth rate for the ION_Data .mdf is **11.84 GB**.

Device Type	Daily Growth Rate (kB)	Number of Devices	Total Daily Growth (MB)	Total Annual Growth (GB)
ION7650	780	10	7.62	2.72
PM8000	950	20	19.00	6.94
PM3200	85	70	5.81	2.07
TOTAL	-	100	32.43 MB	11.84 GB

$$ION\_Data.mdf\,(GB) = 11.84\ +10\%\ for\ growth$$
$$= 13.02\,GB$$

Power Quality Events

If there are devices in the network that have waveform logging and PQ detection enabled, they usually account for approximately 10% to 20% of the total database size. This estimation is based on observing hundreds of customer databases, but will vary depending on the frequency of PQ events in the electrical network and the specific configuration of the PQ enabled power meters.

In addition to the basic measurement logging, PQ events can be included in the estimate to get a better understanding of the possible range of database growth.

NOTICE

LOSS OF DATA

Do not incorrectly configure PQ power meters, otherwise excessive database growth and decreased system performance can occur.

Failure to follow these instructions can result in corrupt databases and an unusable system.

Example

A Power Monitoring Expert system contains twelve ION7650s enabled to record waveforms for PQ events. In an average system, this could contribute approximately 10% to the total database size.

Therefore, the new estimated annual growth rate for the ION_Data .mdf is **14.32 GB**.

$$ION\_Data.mdf\ (GB) = 13.02\ + 10\%\ for\ PQ\ events$$
$$= 14.32\ GB$$

Custom Logging Profiles

In addition to the factory default logging profiles for the devices, database size estimates can include custom measurement logging:

- In the devices
- In the Virtual ION Processor (VIP)

Accurate database size estimates should take into consideration the logging frequency for each measurement (that is, 1 minute logging, 15 minute logging, and so on). A single custom measurement that is logged every 15 minutes contributes approximately **2.5 MB** towards the annual database growth.

$$Single\ Measurement\ (MB) = \frac{365\ \frac{Days}{Year} * 24\ \frac{Hours}{Day} * 4\ \frac{Measurement}{Hour} * 75\ \frac{bytes}{Measurement}}{1,048,576\ \frac{bytes}{MB}}$$
$$= 2.51\ MB\ /\ YR$$

Example

The VIP is used to calculate and log ten key performance indicators (KPI) every 15 minutes. The annual contribution to the database size for those metrics will be:

$$Annual\ Growth\ (MB) = \frac{365\ \frac{Days}{Year} * 24\ \frac{Hours}{Day} * 4\ \frac{Measurement}{Hour} * 75\ \frac{bytes}{Measurement}}{1{,}048{,}576\ \frac{bytes}{MB}} \times 10$$

$$= 25.06\ MB/YR$$

Therefore, the new estimated annual growth rate for the ION_Data .mdf is **14.34 GB**.

$$ION\_Data.mdf\ (GB) = 14.32 + 0.02\ GB$$
$$= 14.34\ GB$$

Hard Drive Space Requirements

The hard drive space requirements for ION_Data include more than just the main database file. Hard drive space is also required to hold the transaction log, database backups, and regular SQL operations in the tempDB. A simplified formula can be applied to quickly determine the hard drive space requirements for the ION_Data databases in a default Power Monitoring Expert system.

$$HDD\ Space\ for\ ION\_Data\ (GB) = 5 \times .mdf\ (GB)$$

The formula can be broken down into the following components:

Component	Component Details
Main database file (.mdf)	x1 .mdf
Transaction log file[1] (.ldf)	x1 .mdf
Backups[2]	x2 .mdf
Free Space for Backups or tempDB[3]	x1 .mdf
Total	**x5 .mdf**

[1] The .ldf is typically just 10% of the total .mdf size, but occasionally expands to 100% during normal operation. Each calculation presumes that the .mdf and .ldf are equal in size.

[2] The system default is to keep two database backups.

[3] Free space is required for database backups and requires 100% of the total .mdf size. The tempDB will occasionally expand to 100% of the total .mdf size, but not at the same time as a backup. If the backups and tempDB are on different hard drive groups, they each require x1 .mdf in hard drive space.

Example

A new Power Monitoring Expert installation has been estimated to require **71.7 GB** of hard drive space to account for the live database, database backups, and regular SQL operations each year.

$$HDD\ Space\ for\ ION\_Data\ (GB) = 5 \times .mdf\ (GB)$$
$$= 5 \times (14.34)$$
$$= 71.7\ GB$$

Hard Drive Space for Database Backups

A backup is a copy of a live database (for example, ION_Data, ION_Network and ApplicationModules) and is used to recover the live database if it becomes corrupt (resulting from manual database editing, unexpected server shutdown, an inoperable hard drive, and so on).

By default, the system automatically backs up the databases on a daily (ION_Network) or weekly (ION_Data and ApplicationModules) basis, and **keeps two backups** of each database in the main installation folder:

...\Schneider Electric\Power Monitoring Expert\config\cfg\DBBackups

If there is limited hard drive space available for the live database, it is recommended that you change the folder location of the database backups to a different hard drive group.

Database Archives

An archive is a copy of a subset of data from the live ION_Data database based on a date range and the type of data (Data Records, Waveforms and Events). When an ION_Data archive is created it remains attached to the SQL Server database engine so that its data is still accessible to Vista and Diagrams. However, the data is not available to other applications in the Web Applications component.
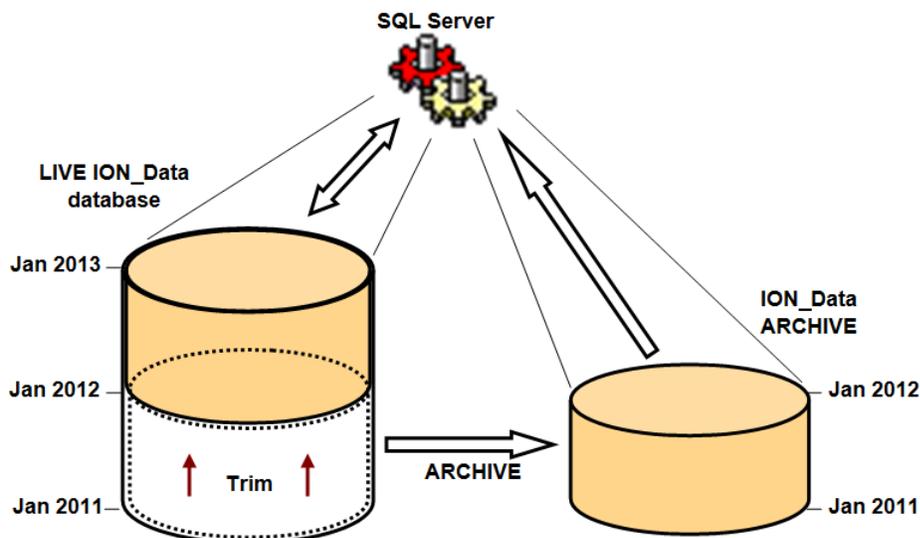
Considerations for Archives

The purpose of the archive is to remove data from the live ION_Data database to reduce its overall size. In most cases this is **not recommended** since the archive fractures the data into multiple databases. Power Monitoring Expert is unable to query multiple databases at the same time to make comparisons in the data. (It is possible to run reports against an archived database, but it can only be done on one database at a time.)

However, the ION_Data database may need to be reduced in size for two reasons:

- SQL Server 2014 Express is used as the database engine, which has a limit of 10 GB for the .mdf file.

- SQL Server (Standard or Enterprise edition) is used as the database engine and the ION_ Data database has become so large that query performance (in Vista for example) is not acceptable to the Power Monitoring Expert system users. It is also important to ensure that the ION_Data database is trimmed well within the hard drive size, as it can affect the operation of Power Monitoring Expert.

Advanced Architectures

Virtual Environments

Power Monitoring Expert can be installed in supported virtual environments that have equivalent performance to a recommended physical computer (described in "Recommended Power Monitoring Expert Systems" on page 14).

The FLEXnet License Administrator software, which is used to manage StruxureWare Power Monitoring Expert licenses, supports virtual machine licensing for the following hypervisors:

- VMware ESX 4.1/ESXi 4.1 and 5.1

- Microsoft Hyper-V

- Citrix XenServer 6.0

- VMware Workstation 8.

Consider these main points for the virtual environment:

- The combination of Windows operating system and SQL Server edition.

- The processor (CPU) performance and memory (RAM). The CPU and RAM must be dedicated to the virtual machine containing Power Monitoring Expert so that the performance is as expected. If no other virtual machines in the same environment take resources from the Power Monitoring Expert system, then performance may degrade.

- The hard drive group configuration and space.

Physical ports (that is, serial COM, modems, and USB) are not recommended in a virtual environment.

See the *Power Monitoring Expert* 8.0 *Installation Guide* for more information.

SQL Server Clustering

Clustering allows one physical server to automatically take over the tasks and responsibilities of another physical server that is no longer in operation. More specifically, clustering refers to a group of two or more servers (generally called nodes) that work together and represent themselves as a single virtual server to a network. When a client connects to clustered SQL Servers, it appears that there is only a single SQL Server. Using clustering helps ensure that applications that are running have little or no downtime when a node becomes non-operational.

Power Monitoring Expert software can function in a clustered environment. Note that it is only the Database Server component that is deployed in the clustered environment. The Primary Server must reside in a non-clustered environment.

Schneider Electric representatives and certified partners should refer to RESL207774 *Installing Power Monitoring 7.0 on a SQL 2008 R2 Cluster* in the Schneider Electric Knowledge Base for additional information.

Server Redundancy

Power Monitoring Expert supports redundancy via Stratus Everrun® Enterprise. It supports being set up in a Fault Tolerant (FT) configuration. The licensing for Power Monitoring Expert supports the failover scenario.

Contact Stratus for more details on the setup and licensing required for Everrun Enterprise:

http://www.stratus.com/solutions/software/everrun-enterprise-express/

Communication Network Design

Devices in the Network

The Power Monitoring Expert system is used to communicate primarily with the following devices:

- Power and energy monitoring devices.
- Protection relays and trip units.
- Programmable Logic Controllers (PLCs).
- WAGES devices via PLC I/O.

Many devices have an Ethernet port for direct connection to Power Monitoring Expert via the network, but low cost devices only have a serial port (typically RS-485). These serial devices require an intermediate converter or gateway (for example, Com 'X 200, EGX100, EGX300, ION7650, ION8800, PM8000, and so on) to establish a network connection with Power Monitoring Expert.

Supported Protocols

Power Monitoring Expert supports the following protocols to communicate to devices and gateways:

- Modbus™ TCP
- Modbus RTU (via Ethernet gateway)
- ION™

For more information about these protocols, see the "Glossary" on page 49.

Ethernet Devices

Follow commonly recommended practices for Ethernet design when connecting Ethernet devices to the network.

Serial Devices

Follow commonly recommended practices for RS-485 serial daisy chain wiring according to the device installation guides.

Design a New Communication Network

A tool has been designed that helps estimate communication utilization for serial daisy chains. This tool can be used for both new system design and for optimizing existing Power Monitoring Expert systems for existing serial daisy chains.

See the "Daisy Chain Calculator" on page 32 for more information about tuning serial daisy chain performance.

Power Monitoring Expert Performance

The performance of Power Monitoring Expert is dynamic and directly related to how the user interacts with the system: does the user actively monitor real-time data and expect one second updates, or do they want historical data and alarm conditions to be downloaded quickly from devices after an event occurs? There are two types of transactions to devices that consume network bandwidth:

- Real-time data requests through Power Monitoring Expert tools (for example, OPC Server, Vista, Designer, and so on).

- Periodic polling and uploading of new data logs, events, and waveform records. This is managed by the ION Log Inserter Service and can be scheduled by device type or instance.

The system and daisy chain should be tuned to give improved performance as required by the user.

Daisy Chain Calculator

The Daisy Chain Calculator is available for use by Schneider Electric representatives and certified partners. Customers should contact their local representative for additional information.

The daisy chain calculator provides Basic and Advanced usage options:

- Basic

This selection assumes that you are using default device/driver configurations, that UI usage is light, and that Log Inserter polling is in a 60-second to 90-second range.

- Advanced

This selection assumes that non-default device/driver configurations (additional measurements) are being used, that Log Inserter polling is at 30 seconds or more frequently, that VIPs are heavily polling devices, that software-based alarming is in place, and that other polling is taking place to expose device data to OPC or EWS.

(Note that the text in the following image has been repositioned for illustration purposes only.)

CONTROLLED DISTRIBUTION

	QUANTITY	METER TYPE	USAGE	TOTAL
6	1	ION 7650	Basic	0.07
7	3	PM8000	Basic	0.20
8	10	iEM3X5X	Basic	0.33
14			TOTAL	0.60

[PME][Calculator]Daisy Chain Calculator

Power Monitoring Expert 8

Do not exceed 1. Otherwise, start a new daisy chain loop.

Usage notes (Please read First!):

1. We now have support for 20 meter types, you can select meter types and enter quantities as you fill out the table.
   The cells in Column B support a drop-down so you can select a meter type
2. Usage is configurable (Basic/Advanced). You can set this for individual devices to provide more flexibility and granularity.
   Select "Basic" usage if you have: default device/driver configuration, light UI usage, log polling 60-90 seconds
   Select "Advanced" usage if you have : non-default device/driver configuration and/or heavier usage such as:
   faster polling, more logging, software alarming, VIP or other processing, OPC, EWS, etc
* For the ION 7650, 7550, 8650, PM8000 devices, connect to those using the ION protocol.
   Do not put those devices on an EGX daisy-chain.

Assess Power Monitoring Expert Performance

There are two operating conditions that Power Monitoring Expert experiences when communicating with devices in the network:

- **System start-up** (when first connecting to devices in Management Console).
- **Steady-state** (during normal operation of the software).

During system start-up it is normal for the software to perform slowly as it communicates to devices in the network and downloads the available historic logs. Depending on how long the device has been in service there could be over a month of historic logs, PQ events, and waveforms to download. This behaviour is particularly noticeable on long daisy chains that include meters with a high quantity of on-board logged data.

Once the system has downloaded the available logs from devices, the performance of Power Monitoring Expert can be measured and, if necessary, appropriate action can be taken to improve it. The Diagnostics Viewer in Management Console should be used to determine when the historic logs have been downloaded from devices.

1. In Diagnostics Viewer, expand **Service Diagnostics** and click **LOGINSERTER.<server_name>**.
2. Select the available devices in the **Select Nodes** list.
3. Select the **Log Performance** tab to display the status of the historic logs in the devices.
4. Scroll to the right to show the **CaughtUp** column.

During system start-up the **CaughtUp** column displays **No**, indicating that there are historic logs on the devices that have not yet been downloaded to the database. As the logs are downloaded the individual rows change to **Yes**. Continue to monitor this column for several minutes to verify that the logs have been completely downloaded. At this point the software is in steady-state operation.
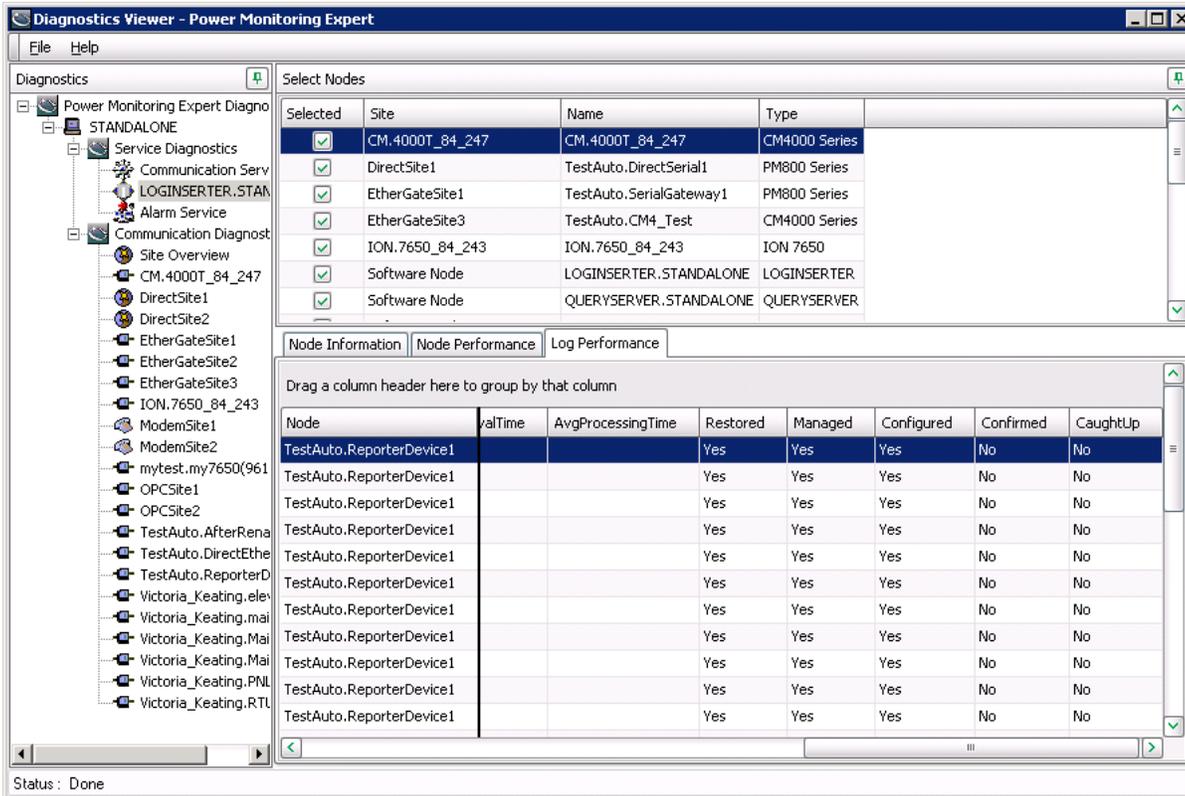
Recommendations to Improve Power Monitoring Expert Performance

To improve the overall performance of Power Monitoring Expert, it is recommended that you reduce or control the communication traffic as much as possible. The following points must be addressed to manage the overall communication traffic for serial daisy chains:

- Disable devices in Management Console that are not presently commissioned or functional (for example, devices that are inoperable, devices that have a communication error rate >5%, or not physically connected, and so on).

- Connect high-end PQ meters which can generate events and waveforms directly to the Ethernet. If this is not possible, isolate them to a smaller daisy chain (one or two devices).

- Do not log measurements that are not needed.

- Schedule log upload to occur at times when system usage is less intensive.

Improve an Existing Communication Network

In many cases, the devices and communication network are installed and wired long before the software is even specified. For sites where the communication network is already wired, some adjustments and tests can be performed by the software to make improvements or to make recommendations with minimal re-wiring.

The Daisy Chain Calculator tool (see "Daisy Chain Calculator" on page 32) can be used to determine how to tune Power Monitoring Expert for improved performance.

What Settings Can Improve Performance?

Due to network architectural limitations, it may not be possible to reduce the number of the devices on a daisy chain. In cases like these, consider the following to help improve performance:

- The **ConnectedThreadPoolSize** is a registry key that should be equal to or greater than the number of sites plus EGX devices in Management Console.

- The Log Inserter can be configured using **LogAcquisitionControl.xml**, such that logs are uploaded on a scheduled basis, rather than constantly whenever new logs are detected. Real-time performance is better when the Log Inserter is not uploading logs.

- The **LI_PollingPeriod_s** is a registry key that controls how often the Log Inserter checks for logs from devices.

- The transmit delay for gateways in Management Console (for example, an EGX100 site) can be reduced from the default of 50ms to 0ms in some cases. Check the % error rate in Diagnostics Viewer to help ensure that problems have not been introduced. Note that some devices, CM2000 in particular, should not have the transmit delay set lower than 50ms to avoid overloading the device and potentially resulting in bad logged data.

- Real-time data clients (for example, Vista, Diagrams, Tables, OPC, VIP, and Trends) polling periods can be adjusted.

See "Performance Tuning" on page 45 for details about these settings.

Applications and System Integration

Virtual ION Processor (VIP)

The Virtual ION Processor (VIP) is a Windows service that operates on the Power Monitoring Expert server (and Secondary server), providing coordinated data collection, data processing, and control functions for groups of devices. The VIP is capable of collecting and processing data from several power monitoring devices, analyzing the information, and performing control functions using a wide selection of ION modules.

Multiple VIPs can be created to manage server load and improve system performance. Each VIP has a global polling period for real-time data, which can be tuned based on the VIP's application. In addition, a single application can be split across multiple VIPs if it is very large.

Note

A single VIP is sufficient for most basic systems.

The size of the VIP can be determined by the size of the VIP files (that is, the vip.cfg and vip.bak) that reside in the following location:

...\Schneider Electric\Power Monitoring Expert\config\cfg\vip\

Each file should be no more than 2 MB (that is, approximately 350 loaded Arithmetic Modules). The number of VIP instances on the server is limited by the power of the CPU and not the software.

EWS 1.1

EWS is a set of Schneider Electric corporate web services that facilitates data exchange between software applications. Power Monitoring Expert is an EWS v1.1 server that is able to share real-time, historical, and alarm data with StruxureWare software and other third-party software applications.

Export Data from Power Monitoring Expert

Power Monitoring Expert and OPC DA v2.05A

OPC is a set of open standards for connectivity and interoperability between industrial automation and the enterprise system. OPC is not a native protocol for Schneider Electric devices; however, Power Monitoring Expert can act as a translator and host metering data as an OPC server as well as an OPC client.

When acting as an OPC server, Power Monitoring Expert translates ION data into OPC data, for exporting and viewing in other third-party OPC client systems. The Power Monitoring Expert OPC client, on the other hand, takes OPC standardized measurements from third-party systems and translates them into a data format that Power Monitoring Expert can use.

For additional information regarding the configuration and operation of the OPC server component of Power Monitoring Expert, see the *StruxureWare Power Monitoring Expert 8.0 User Guide*.

Appendix A: Distributed Power Monitoring Expert Architectures

A distributed system is one that has components of Power Monitoring Expert installed on multiple computers.

Distributed Architecture Examples

The following three examples of distributed system configurations show Engineering Clients (optional) and Web Clients (optional).

Standalone Architecture with Secondary Server
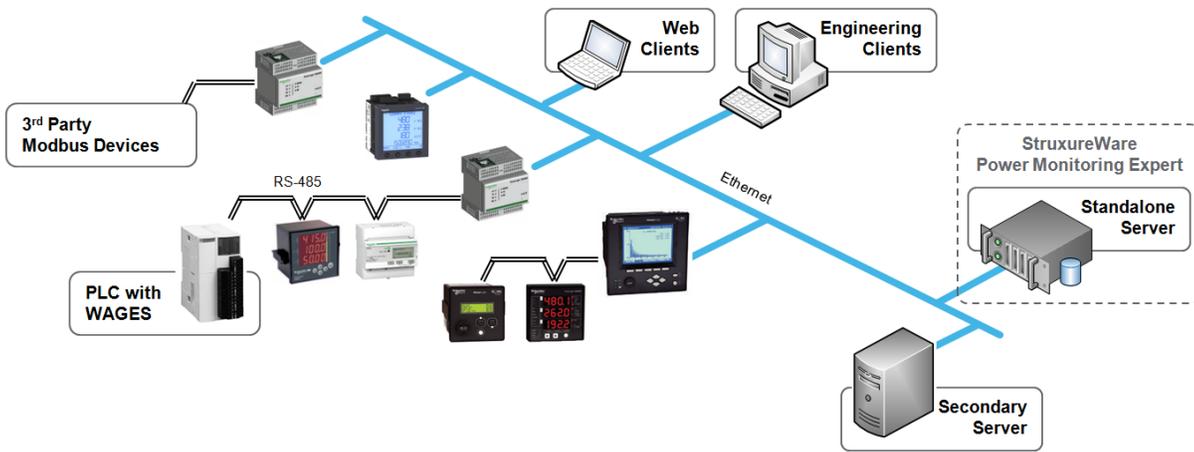
Distributed Database Architecture

Distributed Database Architecture with Secondary Server
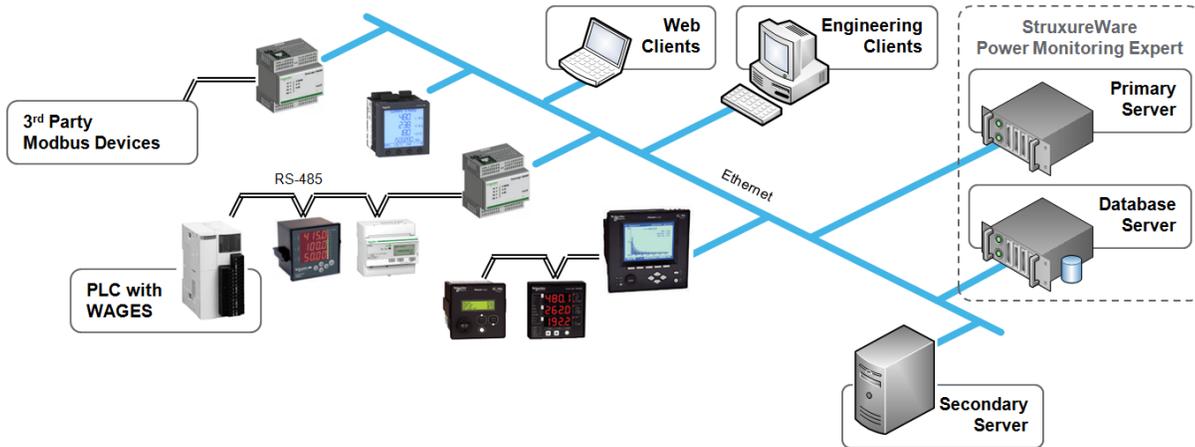
Engineering Clients

An Engineering Client can be installed in addition to the Primary server to allow an administrator or power user to access the system (for example, to connect to new devices, to edit Vista diagrams, to program the VIP, and so on).

Recommended Engineering Client

Server Recommendations
OS: Windows 8.1
CPU: Intel Core i3 (2 core), or better
RAM: 2+ GB
HDD Space: 2GB for software installation

Database Servers

In some cases, a Database server may be required due to local IT policy. It is recommended that both the operating system and SQL Server are 64-bit since it greatly improves SQL Server performance.

Recommended Database Server

Refer to "Recommended Power Monitoring Expert Systems" on page 14 to determine the appropriate database server size. The database server should have the same specification as the primary server.

Secondary Servers

In very rare cases (less than 1%), Secondary servers are used to reduce the ION SiteServer load on the Primary Server. However, there is only ever one ION RealTime Data service, which runs on the Primary Server. A Secondary server contains the following components:

Component	Description
Engineering Client tools	Management Console, Vista, Designer Configuration files
Communication Services	Manage device communications Data management and routing 3rd-party software integration

When is a Secondary Server Needed?

A simple formula is used to determine when a Secondary server might be needed: multiply the **Device Type Weight** by the number of devices in the system. If the result is greater than 100%, then a secondary server is required.

Device Range	Device Type	Device Type Weight (%)
Utility Meter	ION8800	0.10
	ION8650	0.10
	ION8600	0.10
Advanced Meter	ION7650	0.10
	ION7550	0.10
	CM4000/CM3000 Series	0.15
Intermediate Meter	PM8000	0.10
	PM800 Series	0.06
	ION7300 Series	0.06
Basic Meter	PM5350	0.05
	PM700 Series	0.03
	PM3200 Series	0.03
	ION6200	0.03
	PM200	0.03
	CM100_200	0.04
	EM3500 Series	0.03
	Enercept Meter	0.04
	PM5100	0.04
	PM5300	0.05
	PM5350 Busway	0.05
	PM5500	0.06
Entry Meter	EM1200	0.03
	PM1200 / DM6200	0.03
	PM9c	0.04
	iEM3000	0.03
	EM1000	0.03
	EM6400 Series	0.03
Multi Circuit Meter	BCPM (42 circuits)	0.20
	BCM42	0.04
	EM4800 Series	0.10
Circuit Breaker Trip Units	Micrologic A	0.05
	Micrologic E, P and H	0.07
	Micrologic Compact NSX A and E	0.06
	Micrologic A IFE_IFM	0.05
	Micrologic E IFE_IFM	0.07
	Micrologic P IFE_IFM	0.07
	Micrologic H IFE_IFM	0.07

Device Range	Device Type	Device Type Weight (%)
Protective Relays	Sepam Series 80	0.08
	Sepam Series 48 and 40	0.07
	Sepam Series 20	0.06
	Sepam Series 10	0.05
	Enersure BCPM/iBCPM	0.20
Demand Controller	EM7000 Series	0.03
Motor Controller	Altivar 61	0.03
	Tesys T	0.03
Power Quality Meter	Varlogic NRC 12	0.03
Sequence of Event Recorder	SER2408	0.10
	SER3200	0.10
Switchboard monitoring	Acti 9 Smartlink	0.02
	Acti 9 Smartlink Ethernet	0.02
Custom Modbus[2]	Real-time only	0.02
	Real-time with PC-logging (16 registers)	0.03

[1] These device weights presume that PC-logging has been enabled for up to 16 measurements.

[2] Custom Modbus device drivers must be created in the Modbus Device Importer.

Examples

Device Type	Device Weight (%)	System 1		System 2		System 3	
		Num. of Devices	Total Usage (%)	Num. of Devices	Total Usage (%)	Num. of Devices	Total Usage (%)
ION7650	0.10	100	10	100	10	50	5
PM820	0.06	200	12	200	12	100	6
PM3200	0.03	700	21	2200	66	3000	90
TOTAL		**1000**	**43 %**	**2500**	**88 %**	**3150**	**101 %**

In the first two systems, the total device weight is **43%** and **88%** respectively; therefore a Secondary server **is not required**. In the third system, the total device weight is **101 %**; therefore a Secondary server **may be required**.

Device Type	Device Weight (%)	System 4		System 5	
		Num. of Devices	Total Usage (%)	Num. of Devices	Total Usage (%)
CM4000	0.15	100	15	100	15
BCPM	0.20	200	40	200	40
BCM42	0.04	700	28	2200	88
TOTAL		**1000**	**83 %**	**2500**	**143 %**

For the fourth system, the total device weight is **83%**; therefore a Secondary server is still **not required**. The fifth system will require a Secondary server.

If your system exceeds 100%, contact your Regional Competency Center to discuss specific needs to determine if a Secondary Server is required.

Recommended Secondary Server

The following server specification is typical for a Secondary server. If a Secondary Server is required, contact your Regional Competency Center to discuss specific needs.

Server Recommendations
Computer Type: Server
OS: Windows Server 2012 R2
CPU: Intel Xeon E56xx (4 core), or better
RAM: 8+ GB
HDD: x2 300+ GB

Appendix B: Power Monitoring Expert Components

This section shows the different components of the Power Monitoring Expert system, including databases, windows services, and web applications.
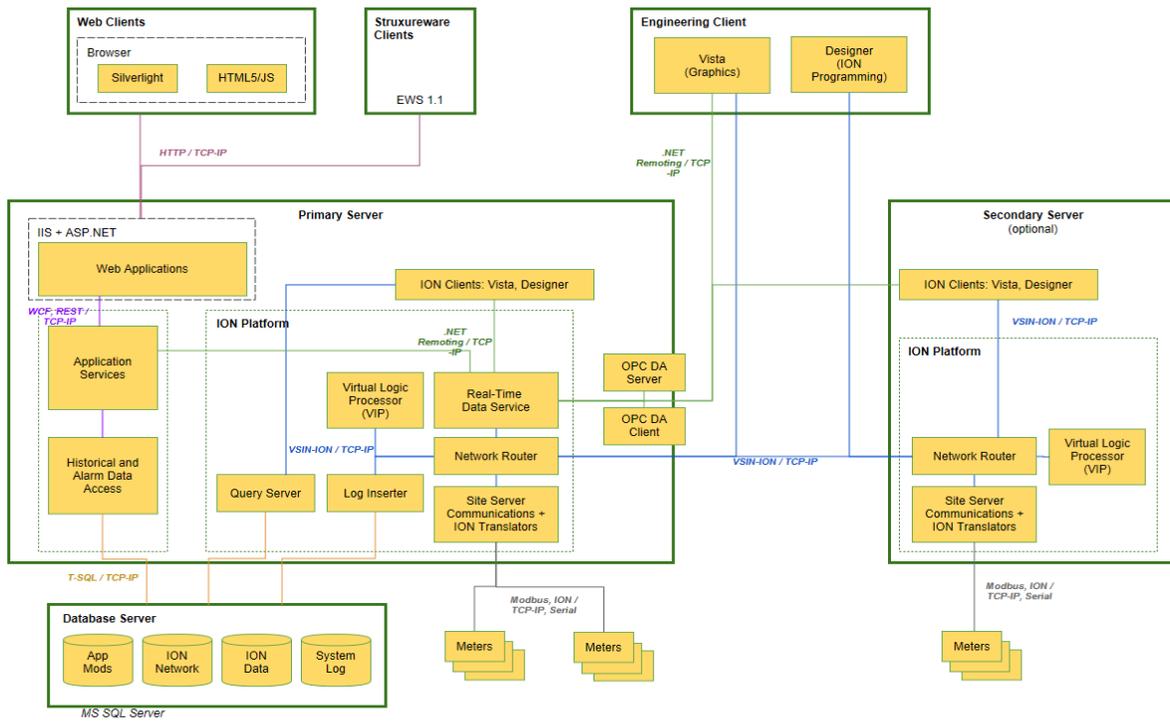
The diagram above illustrates much of the Power Monitoring Expert architecture, but the following internal connections are not shown:

- Diagrams (which is logically in "Web Applications") has a connection indirectly to Query Server and Real-time services.

- Vista/Designer on the primary server has a connection to Network Router (netman).

Additional communication notes:

- Designer uses VSIN only, Vista uses both, VSIN (comm to designer) and .Net Remoting (communication to ION Services).

- Platform components typically use netman (Network Router) to route ION-related requests except for stand-alone Engineering Clients, where no netman service is running locally.

- VIP uses .NET remoting to subscribe to real-time data from ION Services (Real-Time Data Service).

- Vista uses .NET remoting to subscribe to real-time data and VSIN for everything else (including historical requests to Query Server).

Note

VSIN is a proprietary application-layer protocol (ION) that runs on TCP/IP.

Windows Services

Many of Power Monitoring Expert's core components run as Windows Services. This allows Power Monitoring Expert to continue monitoring your power management system when no users are logged on. As these components play a critical role in the operation of Power Monitoring Expert, it is important to understand what they do.

The following table summarizes the Power Monitoring Expert services:

Note

ION Network Router Service has many dependent Power Monitoring Expert services. For example, the ION Virtual Processor, ION Log Inserter Service, and ION Site Service cannot start and operate without the ION Network Router Service running.

Service Name	Description	Manual/Automatic
ApplicationModules AlarmServiceHost	Hosts alarm services used by the Web Applications component.	Manual
ApplicationModules CoreServicesHost	Hosts common web services used by the Web Applications component.	Automatic
ApplicationModules DataServicesHost	Hosts web services that provide low-level access to system data for the Web Applications component	Automatic
ApplicationModules ProviderEngineHost	Hosts web services that provide data processing for the Web Applications component.	Automatic
ION Alert Monitor	Checks the computer's communications ports continuously for high priority events occurring at remote modem sites. When this happens, Alert Monitor initiates a communications connection to the remote modem site.	Manual
ION Component Identifier Service	Locates local and remote product components. Although this service is configured as Manual, the service starts when a client attempts to connect to it.	Manual
ION Connection Management Service	Determines the connection status of sites and devices in the system, and handles allocation of resources such as modems. This service manages the state of site and device connectivity for the system. In order to establish the most appropriate state for the system, each connection and disconnection request is evaluated against the overall state of the system and availability of communications channels.	Manual
ION Event Watcher Service	Monitors system events for conditions specified in Event Watcher Manager. See the "Event Watcher Manager" topic in the Management Console tools chapter of the *StruxureWare Power Monitoring Expert 8.0 User Guide*.	Automatic
ION Log Inserter Service	Provides historical data collection and storage for your power-monitoring system. See the "Log Inserter" topic in the Database Manager and Windows Task Scheduler chapter of the *User Guide*.	Automatic
ION Managed Circuit Service	This service is used to create individual real-time and historical data sources for multi-circuit meters	Automatic
ION Network Router Service	Routes all ION requests between the software components, such as client workstations and the Log Inserter. The service dynamically detects changes to the network configuration, including the addition of new servers; it can also recognize new software nodes, such as Vista, that are added to an existing server.	Automatic
ION OPC Data Access Server	Manages and is responsible for supplying OPC data to client applications. Although this service is configured as Manual, the service starts when an OPC client attempts to connect to it.	Manual
ION PQDIF Exporter Service	Translates data from the product's databases to PQDIF file format and manages scheduled PQDIF exports.	Manual

Service Name	Description	Manual/Automatic
ION Query Service	Provides historical data retrieval for your power-monitoring system. See the "Linking a Data Log Viewer or Event Log Viewer" topic in the Vista chapter of the *User Guide*.	Automatic
ION Real Time Data Service	Manages and provides access to real time data from the power management system.	Automatic
ION Report Subscription Service	This service manages report subscriptions in the Reports application. (This service is only available if you are using a supported edition of SQL Server Standard or Enterprise with the software product.)	Automatic (Delayed Start)
ION Site Service	Manages communication links to and from the product. ION Site Service is responsible for handling packet communications to system devices and controlling direct device communications. The service reacts to changes in network configuration: for example, often changes to certain channels, configuration parameters, ports, or device parameters can interrupt a connection.	Automatic
ION Software Alarm Service	Performs alarm evaluation based on real-time data from the power monitoring system.	Automatic
ION Modbus Gateway Service	Enables doftware data services via Modbus TCP/IP.	Manual
ION Virtual Processor Service	Provides coordinated data collection, data processing, and control functions for groups of meters. See the "Virtual Processor setup" topic in the Management Console tools chapter of the *User Guide*.	Automatic
ION XML Subscription Service	Manages subscriptions to XML data for Vista user diagrams. This service is used only by the Diagrams application. When you open a Vista user diagram in a web browser, the ION XML Subscription Service creates a subscription and delivers the real-time data in XML format.	Automatic
ION XML Subscription Store Service	Stores XML data subscriptions for the power monitoring devices on the network. This service is used only by the Diagrams application.	Automatic

Appendix C: Performance Tuning

Power Monitoring Expert is installed with a number of factory default settings that should be acceptable for most installations. However, the needs of individual systems can be different from one another and there are several parameters that can be used to fine-tune Power Monitoring Expert (for example, real-time or historic polling periods).

How to Measure the Utilization of a Daisy Chain?

If the performance is still poor after making the improvements suggested above, the software can measure how saturated the daisy chains are. This indicates how saturated/utilized a given daisy chain is based on how the customer uses the system (that is, the customer may prefer real-time data over historical data).

1. In Management Console, ensure that all of the devices on the daisy chain to be tested are enabled.

2. Apply the desired test load to the devices on the daisy chain (for example VIP, Vista, OPC, Diagrams, Tables, or Log Inserter).

3. In the Diagnostics Viewer, expand **Communications Diagnostics** and select the site of the associated daisy chain.

4. Select the **Communication Status** tab.

5. Right-click the **Communication Status** pane and select **Reset**.

6. Let the system gather metrics. For real-time data loads, a few minutes is usually enough. For logging, it is better to leave it for an hour or more, depending on logging intervals.

7. Make note of the value in the **Time Util (%)** column. A value at or near 100% indicates that the daisy chain is saturated and may not be providing responses as quickly as all requesting clients are configured to meet. For example, this could mean that instead of 5 second updates in Vista, you may see it as 6 or more seconds depending on how saturated the site is.

Note

If the communication % error rate is >0%, further investigation may be required.

See the *StruxureWare Power Monitoring Expert 8.0 User Guide* (7EN02-0357) for more information about the Diagnostics Viewer.

Registry Settings

The registry keys itemized below can be used to make adjustments to Power Monitoring Expert's performance. These keys should be located under HKEY_LOCAL_MACHINE\SOFTWARE\Schneider Electric\StruxureWare Power Monitoring Expert in the registry. If the impact of the change is not well understood, then consider an alternate fix or consult Technical Support for guidance.

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NOTICE

IRREVERSIBLE OPERATING SYSTEM DAMAGE OR DATA CORRUPTION

- Do not modify system registry keys without sufficient knowledge or experience in these procedures.
- Before making any changes, back up your system registry in a network folder or other remote location.
- Obtain assistance from knowledgeable and qualified personnel.

Failure to follow these instructions can result in irreparable damage to your computer's operating system and all existing data.

</div>

ConnectedThreadPoolSize (DWORD; default 200): The number of sites ION SiteServer service sends requests to simultaneously. Ideally, this value is equal to or greater than the number of sites in the system (that is, serial sites, Ethernet gateway sites, and Ethernet devices) up to a maximum of 400.

LI_PollingPeriod_s (DWORD; default 30): The minimum time (in seconds) between polls for a historic log position of a given log. This is a global setting used to adjust the amount of Log Inserter driven communication traffic for the entire system.

LI_MaxPollingPeriod_s (DWORD; default 60): This is the maximum value that LI_PollingPeriod_s can be set to. If you increase LI_PollingPeriod_s beyond 60, you also need to increase this setting.

IONServicesCachePollingRate (DWORD; default 10): This is a multiplier that controls how often the software checks the ION Real Time Data Service cache for real-time data updates. This reduces jitter to 10% of the polling period. Jitter, in this context, means inconsistency of data "age" by the time the user or processing component (for example, the VIP) "sees" the new value. Increase this value if there are long polling periods and you wish to minimize jitter.

Note

Other performance tuning settings may be available. Contact a Technical Support representative to look at your specific needs.

Scheduled Log Upload

Power Monitoring Expert 8.0 introduces an xml file called **LogAcquisitionControl.xml** that can be used to control how and when the Log Inserter uploads logged data. It is possible to define which device logs are uploaded on a per-device basis. and when they are uploaded. By reducing Log Inserter-generated communications traffic, real-time performance can be improved.

This control is achieved by editing the .xml file. The file includes examples of required syntax and possible configurations. Note that this feature is for advanced users only.

LogAcquisitionControl.xml is located in the \config\cfg\logsrv folder in Power Monitoring Expert.

To begin, open the control file **LogAcquisitionControl.xml**. It specifies:

- Which device types or device instances you want to exclude from the device polling list. Excluding a device from the polling list has the same effect as disabling it in

Management Console as far as Log Inserter is concerned. If a device is disabled in this file, the Log Inserter will no longer check it for current log position counters or other device properties that Log Inserter usually cares about (aggregate setup counter, device type, and serial number).

- It is possible to exclude specific recorders from specific devices from the polling ION request.

- Polling intervals can be set for any device type or device instance. They can also be set to change based on a schedule. The schedules used by this feature are defined using the TOU Editor tool that is available from the **Tools** menu in Management Console.

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Glossary

Ethernet devices

An Ethernet device is a type of device that can directly connect to an Ethernet network (as defined by IEEE 802.3). Ethernet devices typically have an 8P8C modular connector (commonly called RJ-45) and can usually transmit data at either 10 (10BASE-T), 100 (100BASE-TX) or 1000 (1000BASE-T) Mbits/s, depending on what both the device and network supports.

Serial devices

A serial device sends data on a communications cable one bit at a time, making it slower than an Ethernet device. Serial devices with RS-485 can communicate over long distances in electromagnetically noisy environments, making them ideal in industrial and commercial applications.

The following diagram shows RS-485 2-wire slave devices connected to an EGX master (on the left).
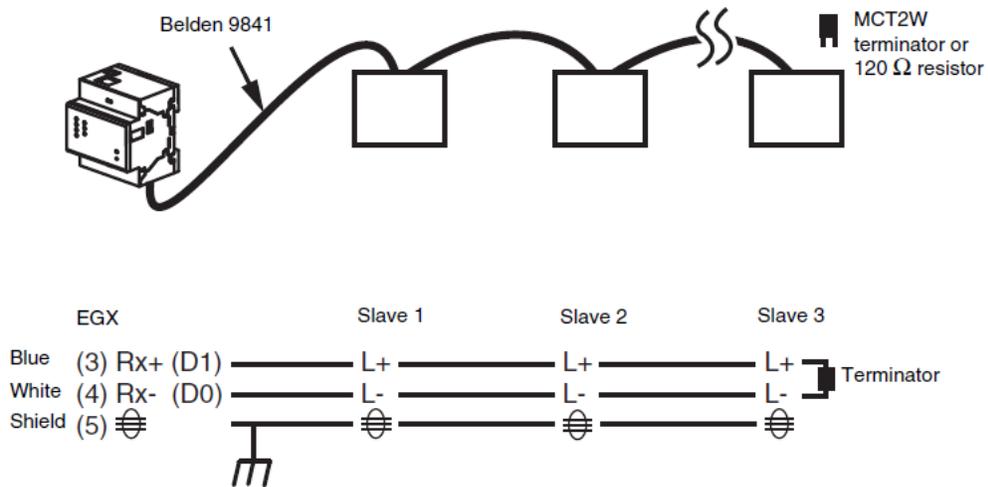
Converters

A converter (for example, EtherGate) is a device that enables an RS-485 chain of serial devices to communicate with an Ethernet network. They change the physical network from serial RS-485 to Ethernet, but do not change the communication protocol.

Gateways

A gateway (for example, EGX, PM8ECC, or Modbus Gateway) is a type of device that enables an RS-485 daisy chain of serial devices to communicate with an Ethernet network. They change both the physical network from serial RS-485 to Ethernet and the communication protocol.

Example:

An EGX100 allows a serial RS-485 daisy chain of Modbus devices (using Modbus RTU protocol) to communicate via Ethernet to a Power Monitoring Expert server (using Modbus TCP).

RS-232 Standard

RS-232 is a common physical communications network, allowing the connection of two devices using a cable no longer than 15 m (50 ft). To connect to more than one device, this physical standard must be converted to RS-485.

RS-485 Standard

RS-485, as defined by the Telecommunications Industry Association/Electronic Industries Alliance (TIA/EIA), is a common standard that defines the electrical characteristics of the serial devices, but does not specify or recommend any communication protocol (for example, Modbus). RS-485 supports a multi-drop network, where a single driver (that is, a Modbus Master) can communicate to multiple receivers (that is, Modbus Slaves) in a single line, without "T" or "star" connections.

Modbus RTU

A serial communication protocol developed by Modicon™ (now Schneider Electric) in 1979. Modbus is an open protocol and commonly accepted across the industry. It is a simple and robust protocol that allows for the communication of field devices to supervisory monitoring or control software.

Modbus TCP

A variant of the MODBUS family of simple, vendor-neutral communication protocols intended for supervision and control of automation equipment. Specifically, it covers the use of MODBUS messaging in an "Intranet" or "Internet" environment using the TCP/IP protocols. The most common use of the protocols at this time are for Ethernet attachment of PLCs, I/O modules, and "gateways" to other simple field buses or I/O networks. Connected over Ethernet port 502; it does not require a checksum calculation as lower layers already provide checksum evaluation. Modbus TCP/IP specification was developed in 1999 combining a ubiquitous physical network (Ethernet) with a universal networking standard (TCP/IP) and a vendor-neutral data representation. Modbus TCP/IP uses the Modbus instruction set and wraps TCP/IP around it.

ION

Stands for "Integrated Object Network" and is a proprietary communication protocol developed by Power Measurement Ltd. (now Schneider Electric) for use between Power Monitoring Expert and PowerLogic™ ION power meters. The ION protocol allows for real-time communication, historical data logging, waveform data, and custom framework programming. The packet structure of ION is the same for both serial communication (RS-232, RS-485) and Ethernet, making it very versatile.

StruxureWare™ Power Monitoring Expert 8.0
Design Guide