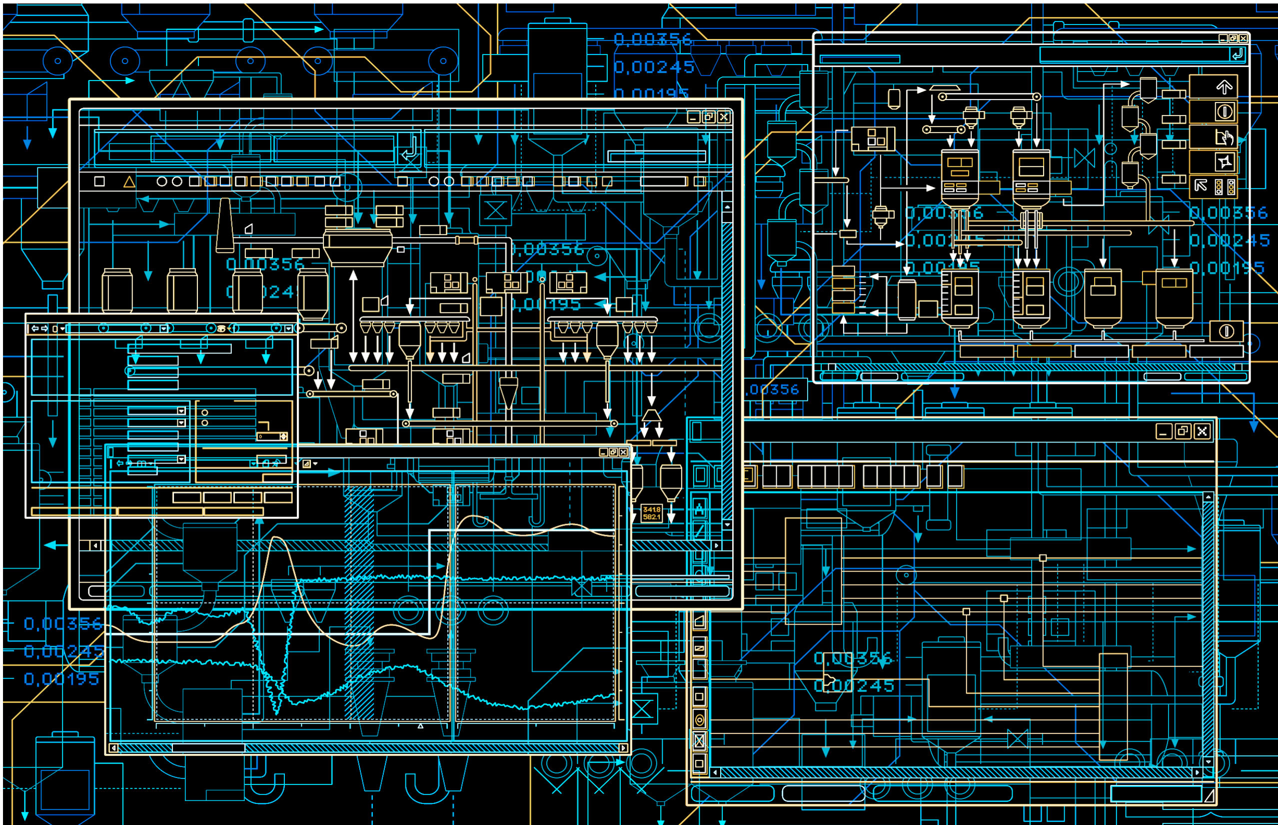

System 800xA

System Guide

Technical Data and Configuration

System Version 5.1

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System 800xA

System Guide
Technical Data and Configuration

System Version 5.1

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About this System Guide

Any security measures described in this document, for example, for user access, password security, network security, firewalls, virus protection, etc., represent possible steps that a user of an 800xA System may want to consider based on a risk assessment for a particular application and installation. This risk assessment, as well as the proper implementation, configuration, installation, operation, administration, and maintenance of all relevant security related equipment, software, and procedures, are the responsibility of the user of the 800xA System.

This document contains technical data and performance information for the System 800xA 5.1. The document also specifies configuration and dimensioning rules. This document is intended for use during system design, engineering, and commissioning. The document is delivered on the System 800xA software media.

This document contains the performance and capacity data of System 800xA as of the release date and includes configuration and dimensioning rules. The information in this document may be subject to adjustments due to changes made in rollups and service packs. Refer to the appropriate Release Notes instructions for accurate and detailed information.

Feature Packs

Feature Packs are intended to release new features and functions in between system version releases. Feature Packs are intended as "add-ons" to an already available system version. Feature Packs allow a more agile response to market requirements without revising or releasing a system version.

Feature Packs are available to holders of a Sentinel agreement, refer to Licensing of Revisions and Feature Packs on page 28. The expiry date of the sentinel agreement is checked at installation time, and the license system will continue to remind the user until a license file with a valid Sentinel expiry date is installed.

Users are not forced to adopt the Feature Pack. A new installation can choose to install the main version only, or to also add the Feature Pack. An existing installation can choose to stay on the main version, or to install the Feature Pack at any time.

A Feature Pack is compatible with one particular system version, including revision level. Feature Packs follow the life cycle of its main system version (transitions to Classic and Limited will follow the system version the Feature Pack is compatible with).

Feature Packs are accumulative. If additional features become available after the initial Feature Pack release, the Feature Pack is updated (a new version of it). This means there is only one Feature Pack available per system version.

A Feature Pack is one package. Users cannot "pick and choose" among features. Separate features can however be released. Those will be purchased through a price list, and will be possible to install independent from other features and Feature Packs.

Revisions contain error corrections only. A user can choose to update to the current revision and keep the installation at that level. This means users will get the recently found problems corrected, and the functionality of the system will remain like it was at the point in time when the original installation was made. This improves the stability of the actual installation, and the user does not have to adopt any new functions, updated user interfaces or anything else that differs from before the revision was installed.

The Feature Pack installation kits will in many cases contain also the revision (this is the case for Feature Pack 1 on 800xA 5.1), which means that when checking the installation after it is done there is usually only one entry in addition to the base installation. For some functional areas in 800xA, where the whole installation of it is replaced when an update is made, there is only one entry visible for the whole functional area. An installation that has the Feature Pack installed at some point in time needs to follow that track (the Feature Pack cannot be uninstalled).

Revisions to features released in Feature Packs will be part of upcoming Feature Packs, or possibly pure Feature Pack revisions when there are no longer new features added to the system version (this is when the system version is in classic life cycle). In practice this means that users have to install consecutive Feature Packs in order to have revisions to previously released feature.

The Feature Pack content (including text, tables, and figures) included in this User Manual is distinguished from the existing content using the following two separators:

Feature Pack Functionality

<Feature Pack Content>

Feature Pack functionality included in an existing table is indicated using a table footnote (*):

*Feature Pack Functionality

Unless noted, all other information in this System Guide applies to 800xA Systems with or without a Feature Pack installed.

Document Conventions

Microsoft® Windows® conventions are normally used for the standard presentation of material when entering text, key sequences, prompts, messages, menu items, screen elements, etc.

Warning, Caution, Information, and Tip Icons

This publication includes **Warning**, **Caution**, and **Information** where appropriate to point out safety related or other important information. It also includes **Tip** to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:

Electrical warning icon indicates the presence of a hazard which could result in *electrical shock.*

Warning icon indicates the presence of a hazard which could result in *personal injury.*

Caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in *corruption of software or damage to equipment/property*.

Information icon alerts the reader to pertinent facts and conditions.

Tip icon indicates advice on, for example, how to design your project or how to use a certain function

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, **fully comply** with all **Warning** and **Caution** notices.

Terminology

Refer to [1] in Table 1 on page 19 for a complete and comprehensive list of Terms. The listing includes terms and definitions that apply to the 800xA System where the usage is different from commonly accepted industry standard definitions and definitions given in standard dictionaries such as ***Webster's Dictionary of Computer Terms*.**

Section 1 Introduction

System 800xA is scalable in both functionality and size. A system is configured based on different functionalities combined on different node types in a system. Different system functions are provided by different node types in a system installation. A node in this context is a computer that has a network address on the System 800xA network and is used as a server or client.

Related Documentation

Refer to [2] in Table 1 on page 19 for a complete list of all documents applicable to the 800xA System that are included on the Release Notes/Documentation media provided with the system or available from ABB SolutionsBank. This document is provided in PDF format and is also included on the Release Notes/Documentation media. This document is updated with each release and a new file is provided.

Specific documents referred to in this instruction are presented in Table 1.

The asterisk (*) appended to each document number is a wildcard character used in place of the document revision. The wildcard allows searches in ABB SolutionsBank to be independent of revision. All revisions of the document will be displayed in the search result.

Table 1. Reference Documents

Item	Document Title	Document Number
[1]	System 800xA System Guide Functional Description	3BSE038018*
[2]	System 800xA Released User Documents	3BUA000263*
[3]	System 800xA Virtualization	3BSE056141*
[4]	System 800xA PLC Connect Operation	3BSE035040*
[5]	System 800xA PLC Connect Configuration	3BSE035041*

Table 1. Reference Documents (Continued)

Item	Document Title	Document Number
[6[1]]	System 800xA Verified Third Party Products	3BSE046579*
[7]	System 800xA Automated Installation	3BSE034679*
[8[1]]	System 800xA Third Party Software	3BUA000500*
[9]	System 800xA Information Management Getting Started	3BUF001091*
[10]	System 800xA Information Management Configuration	3BUF001092*
[11]	System 800xA Information Management Display Services	3BUF001093*
[12]	System 800xA Information Management Data Access and Reports	3BUF001094*
[13]	System 800xA Control AC 800M Configuration	3BSE035980*
[14]	Device Management FOUNDATION Fieldbus Linking Device LD 800HSE	3BDD013086*
[15]	800xA for Advant Master Configuration	3BSE030340*
[16[1]]	800xA for MOD 300 Performance Considerations Technical Description	3BUA000733*
[17[1]]	System 800xA Expansion Pricelist	3BSE073828*
[18[1]]	800xA for Advant Master Performance Guideline	3BSE042621*
[19]	800xA for AC 100/AC 100 OPC Server Product Guide	3BDS013980*

NOTE:
1. Document is not supplied on the Release Notes/Documentation media provided with System 800xA. It is available from ABB SolutionsBank.

Graphical Notation for Nodes

In graphical drawings depicted throughout this instruction (Figure 1), a node is represented with a rectangle listing its functions. Optional functionality is indicated by parenthesis. The supported operating systems are indicated with WS (for workstation) and S (for Server).

Redundancy is indicated as 1oo2 or 2oo3 (one-out-of-two or two-out-of-three). If no redundancy is indicated, redundancy is not supported for the node type (or for the node type in that configuration).

Optional node types are represented with dashed lines.

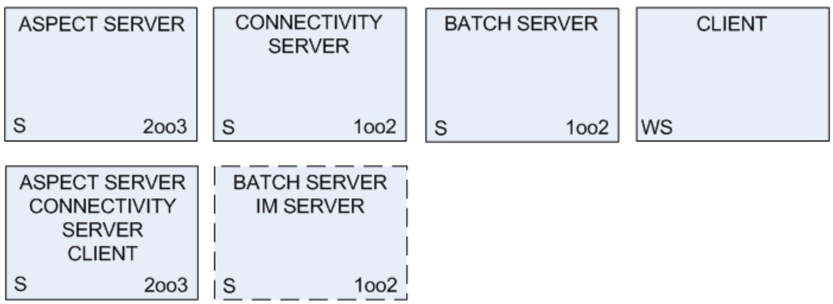

Figure 1. Graphical Notation for Nodes - Example

Section 2 System 800xA

This section defines the combinations and rules for System 800xA along with definitions of node types and system configurations.

Node Types

Different system functions are provided by different types of nodes in a System 800xA installation. The generic system configuration rules define Basic Node Types. Some of these can be combined into Combined Node Types to provide more optimal solutions for smaller systems.

Client nodes are used for user interaction. Server nodes can be configured for redundant operation as either 1oo2 or 2oo3. In order to achieve the intended increase in system availability, server redundancy requires that System 800xA networks be redundant.

Basic Node Types

The basic node types are as follows:

- **Domain Server** - runs the Domain Controller and Domain Name System (DNS). Supports 1oo2 redundancy.
- **Aspect Server (AS)** - runs the central intelligence in the system, including the aspect directory and other services related to object management, object names, and structures, security, etc. Can be the Domain Controller of DNS when separate Domain Servers are not used. Supports 1oo2 or 2oo3 redundancy.
- **Connectivity Server (CS)** - runs the Connect services providing access to controllers and other data sources. Supports 1oo2 redundancy.
- **Application Server** - runs various types of system applications such as:

- **Batch Server** - runs Batch Management. Supports 1oo2 redundancy.
- **IM Server** - runs Information Management. Dual servers supported.
- **Other applications**:

  - Asset Optimization (redundancy is not supported).

  - 800xA for Harmony and 800xA for AC 870P/Melody Configuration Servers.

  - Softpoints: 1oo2 redundancy.

  - Calculations: 1oo2 redundancy.

  - Integrated third party applications. Depending on the functionality, these Application Servers may or may not support redundancy.

- **Remote Client Server** - provides terminal server functionality to connect to remote workplaces.

Remote clients are based on the terminal server (or remote desktop) feature in Windows. Earlier versions of 800xA were based on Citrix software. 800xA 5.1 is no longer verified against Citrix.

- **Client** - runs workplace functionality such as operator and engineering workplaces, including Batch, Information Management, and Asset Optimization clients.
- Information Client - thin client that presents process related information as well as historical information, typically used for management applications.

Combined Node Types

In order to optimize the cost/performance ratio for a particular installation, certain server functions can be combined in the same node. Depending on what functions are combined there are different limitations to system sizes.

The combined node types are as follows:

- **AS + CS** - Aspect Server and Connectivity Server.
- **Batch + IM** - Batch Management and Information Management Servers.
- **AS+CS+Batch+IM** - Aspect Server, Connectivity Server, Batch Management Server, and Information Management Server.

- **Single node engineering system** - a system that consists of one node of type AS+CS. Only a few controllers can be connected and the applications are small. Refer to Engineering Systems on page 40 for more detailed information.

Combined Node Type Configurations

Using combined node types makes it possible to optimize the system configuration for small, medium, and larger sized applications. A single node system is a system that consists of one node of type AS+CS or AS+CS+Batch+IM with a server based client.

It is allowed to install and run the Domain Controller and DNS in an AS+CS node type. However, it is still not allowed to install and run the Domain Controller and DNS in an AS+CS+Batch+IM node type.

Figure 2, Figure 3, and Figure 4 illustrate example configurations with combined node types. For information on the maximum number of each node type, refer to Table 4.

System size is limited when the Windows workstation operating system is used to run 800xA Aspect and Connectivity services (refer to Supported Operating Systems on page 38 for more detailed information).

For a particular system, application size may require that separate servers are used even though the node count is within the limits stated for combined server types.

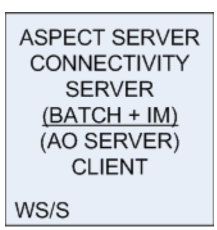

Figure 2. Single Node Combined System

The AO service can be installed and run either together with a connectivity service (in a Connectivity Server), a separate Application Server, or in any mixture of these alternatives. Refer to Table 12 for the maximum number of AO services in a system.

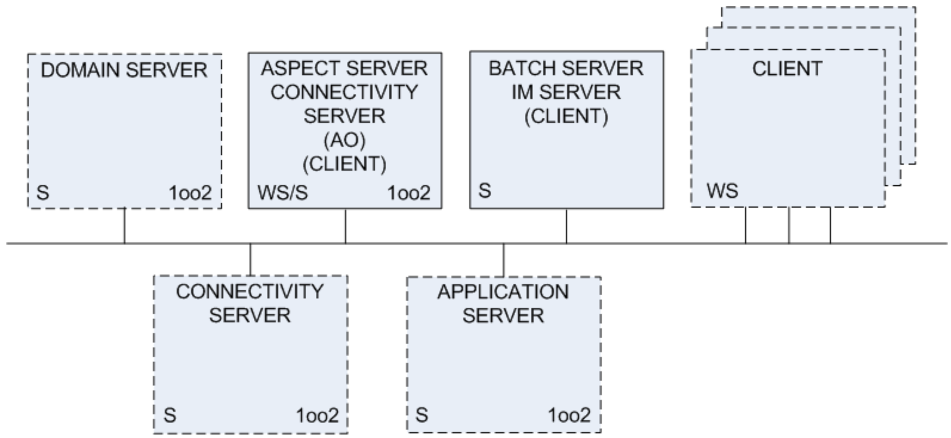

Figure 3. Multi Node Combined System

For larger applications, Information Management and Batch should run on separate servers. Refer to Batch Management on page 79 for more detailed information. The Aspect and Connectivity servers are also separated to ensure proper capacity and performance.

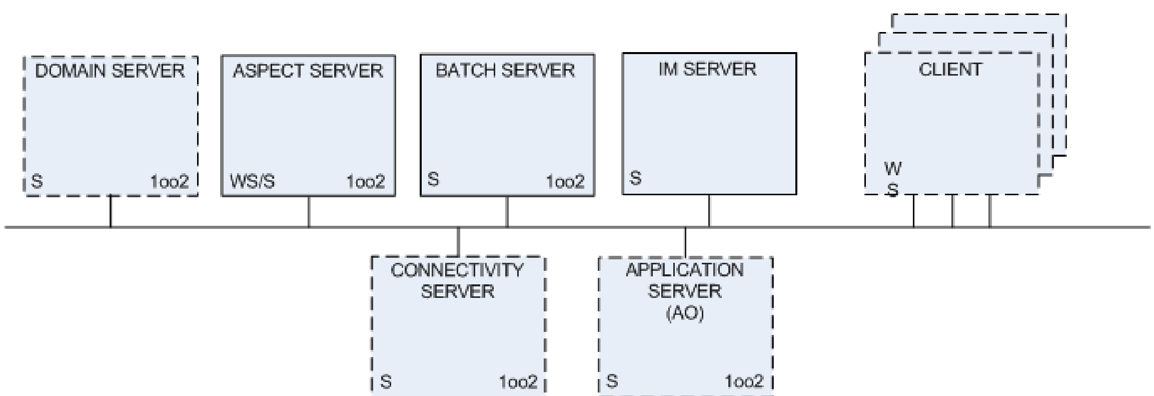

Figure 4. Large System

System 800xA Dimensioning

Dimensioning rules for System 800xA are determined by:

- Tag Calculation and Aspect Object Creation on page 27.
- Control Software Licensing on page 28.
- Connectivity Server Capacity Calculation, the Optimized Calculation Rule on page 29.

Tag Calculation and Aspect Object Creation

A tag is any Aspect Object that has one or more Faceplate Aspects attached.

Contained objects that have a faceplate aspect are included in the count.

A larger tag count is possible from 800xA 5.1 onwards. Refer to Table 5 for the current limits. As large as 120,000 tag systems can be built with review by product management through the TSA process.

The primary intention with large systems is to enable the use of multisystem integration, where the subscriber system can be that large, while each provider system is a medium sized or even a small sized system.

Minimizing of Aspect Object Creation in the Control Structure

In order to avoid unnecessary creation of Aspect Objects in the Aspect Directory, there is a way to minimize the number of created Aspect Objects from the AC 800M engineering tools.

There are two attributes in the AC 800M engineering tools that affect the creation of Aspect Objects in the Control Structure.

- **Alarm Owner:** This is an attribute on Types in the libraries. The default setting for this attribute is true for both Control Modules and Function Blocks. The default setting can be changed on the Type in the library. If **Alarm Owner** is true, an Aspect Object is created upon instantiation of the Type.
- **Aspect Object:** This is an attribute on instances in the application, and on formal instances (instances inside function block or control module types). If the attribute **Alarm Owner** is true on the Type, the **Aspect Object** attribute is

set to true when the instance is created, and an Aspect Object is created. Otherwise, no Aspect Object is created.

It is possible to change the **Aspect Object** attribute on the instance in the AC 800M engineering tools if it is desired to override the default creation as previously described.

For objects created from the Plant Explorer Workplace the **Aspect Object** attribute is always set to true by default.

Licensing of Revisions and Feature Packs

Revisions and Feature Packs are available free of charge only to holders of a valid Sentinel agreement. The expiry date of the Sentinel agreement is checked at the time of installation and a warning appears before the installation starts. If the installation is completed, the license system continues to remind the user until a license file with a valid Sentinel expiry date is installed. The system is operational even if the license warnings are displayed. Non-Sentinel users cannot order for a Feature Pack or individual features from a Feature Pack.

Control Software Licensing

The licensing model for the Control Software Integration has changed in 800xA 5.1. Licensing is now scaled on installed controller capacity instead of licensing on connected signals and devices to the controllers (CLPs). This change has been made to make the calculation of required Control Software licenses easier.

Each installed controller or redundant pair in the plant requires a separate Control Software license, which is ordered through the price list. The easiest way to calculate the licenses is using the 800xA Wizard. Each controller type has its own license, where the price of it depends on the capacity of the controller.

If a Control Software license that is too small is chosen initially, it is possible to upgrade to a larger one by ordering one, or several expansion items. Refer to [17] in Table 1 on page 19 for more information. The 800xA Wizards helps to do the calculation in this scenario as well.

Each processor module type has internally a unique Controller Capacity Points figure that relates to the capacity for the controller.

While ordering the different controller licenses, the total Controller Capacity Points are automatically calculated and summed up in the license.

The 800xA System calculates the total Controller Capacity Points for the installed controllers and compares to the point count in the license file. The license is granted as long as there are enough points in the license. This means there is no immediate correlation between the controller licenses ordered and the way they are counted in the runtime system. In practice the mix of controllers can be different versus the ones ordered as long as there is enough license points and it is possible to order spare license points to prepare for expansions during commissioning or later.

Feature Pack Functionality

Control Libraries Licensing

Certain libraries require an additional license to be used.

This is applicable for the libraries – *TCPHwLib*, *UDPHwLib*, and *ProtectionLib.*

- *TCPHwLib*: The TCP Communication Library.
  One licence is needed for each controller using the library.
- *UDPHwLib*: The UDP Communication Library.
  One licence is needed for each controller using the library.
- *ProtectionLib*: The Machine Safety Library.
  Same amount of library points is needed as the summed up Controller Capacity Points using the library.

Connectivity Server Capacity Calculation, the Optimized Calculation Rule

Typically the following is known when a project is being defined:

- Number of controllers and tags per connectivity type.
- Number of operator workplaces, screens, and the complexity of displays.
- Number of Primary logs and Information Manager logs, and their sample rate.
- Number of Asset Monitors.
- Amount of data required from external clients.

- Number of connected field devices for the fieldbus protocols FOUNDATION Fieldbus, PROFIBUS and HART.
- Number of IEC 61850 OPC Servers per Connectivity Server.
- Number of Intelligent Electronic Devices (IEDs) per IEC 61850 OPC Server.
- Number of data attributes per IEC 61850 OPC Server.

The default dimensioning rule for Connectivity Server count is based on controller count. This is an empirical parameter that has proven to provide predictable results for standard configurations. However, there is no direct relationship between controller count and Connectivity Server capacity. The basic idea with the alternative model is to allow different load parameters to combine efficiently instead of just stating a maximum value per parameter. This means a Connectivity Server can be more efficiently used, leading to fewer servers for a given size of an installation resulting in a smaller footprint.

The controller count per Connectivity Server will typically increase with this method. The required number of controllers is distributed across the calculated amount of Connectivity Servers, considering the maximum number of controllers per Connectivity Server. If this number is exceeded, an additional server has to be used even if the data need does not require it.

The alternative dimensioning method will be referred as the *optimized rule* since it allows optimization of the number of servers and workstations in a system configuration.

There are two options available:

- Stay with the default rule.
- Use the new method to calculate throughput (*optimized rule*).

It is not possible to mix and match the two rules in a System Configuration, only choose one of the rules depending upon preconditions.

The *optimized rules* are only applicable in the following cases:

- Configurations with AC 800M Connect, including Fieldbus.

- Configurations that use separate Connectivity Servers. For smaller configurations, when combining the Aspect Server and Connectivity Server, the default rules stated in this System Guide still apply.
- When using the PM 866 controller CPU, which allows larger applications, it is recommended to apply the *optimized rules*.

In the following cases the default rule should NOT be used:

- Configurations with Asset Optimization installed in the Connectivity Servers.
- Connectivity Servers that contain connectivity to any of the traditional Open Control Systems (OCS).

The calculation for the *optimized rule* is done using a new version of the 800xA Wizard (that is the Sales Wizard used to dimension a System). The *optimized rules* of the 800xA Wizard can be used for capacity calculations in the following cases:

- At initial purchase, where the 800xA Wizard will calculate the total Connectivity Server need.
- When extending a plant, where the 800xA Wizard will calculate if there is a need to add more Connectivity Servers.
- For checking the capacity of an existing installation.

There is no manual methodology available, but the basic concepts are described in the following topics to provide an understanding of how the calculations work.

The total throughput will increase. However, maximizing all or several parameters may over-dimension the server. The 800xA Wizard will optimize the usage. For a given case the result may be that some parameters exceed the default rule, while others may be lower than the default rule.

The Optimized calculation rule allows to increase the following parameters. This is indicated by an alternative parameter value in the parenthesis and in the footnote referring to the optimized calculation rule. The parameters are:

- Controller Count, refer the Table 4 on page 48 and the Table 10 on page 55.
- Volume of subscribed data via a connectivity server, refer the Table 9 on page 54.
- Volume of externally subscribed data, refer the Table 12 on page 57.

Operator Client Displays

Load from operator client displays (graphics subscription) mainly depends on the following parameters:

- Number of currently open displays. This is normally the same as the number of screens used (number of clients times their screen count).
- Update rate (how fast is a display point updated). The update rate can be configured from one second and upwards.
- Number of displays that are currently open.
- Complexity of the display (this is a predefined parameter that can be modified by the 800xA Wizard user).

History Logs

Load from history logs depends on the following parameters:

- Log count.
- Log rate.
- Whether Information Manager is used or only primary logs. This will also impact the required throughput. An Information Manager log always assumes a primary log, but not vice versa.

Data is transferred to Information Manager in blocks at certain intervals using OPC HDA (Figure 5). This is called blocking rate. The blocking rate to Information Manager is a function of the collection rate, for example a one-second log would have a blocking rate by default of four minutes. Logs that are collected at a slower rate will have a proportionally slower blocking rate.the default values for blocking rate are typically sufficient. The stagger utility must be used after a configuration is configured or changed to balance the load on the 800xA System. It is not recommended to manually adjust stagger for logs.

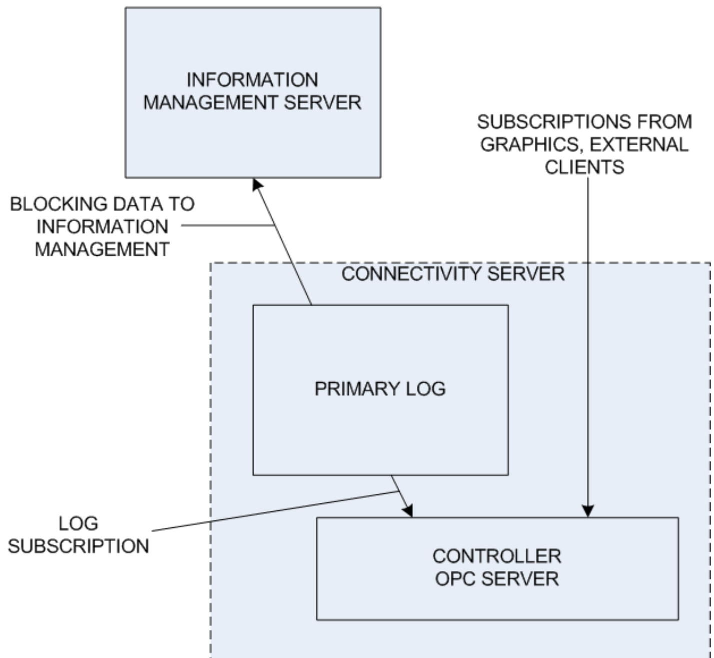

Figure 5. Data Transfer to Information Manager

External Subscription

The external subscription will apply a load similar to the graphics subscription. Now that the impact of external load can be calculated, it is possible to increase the specification, given that the calculation rules are used. The load from the external subscription depends on the following parameters:

- Number of OPC items subscribed by the external client.
- Subscription rate.

The OPC server function in System 800xA that serves external clients is called the OPC surrogate. The surrogate reroutes the OPC request to the appropriate

Connectivity Server. It is possible to use several OPC surrogate processes (Figure 6).

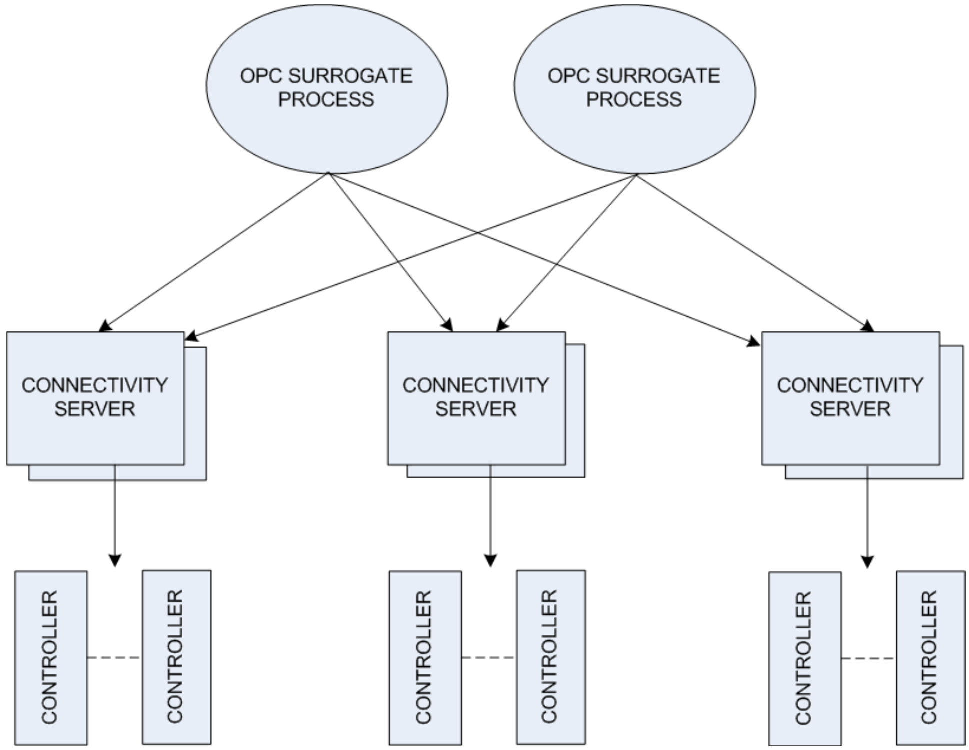

Figure 6. OPC Surrogate Process

The OPC server surrogate is normally running in one of the Aspect Servers, if it communicates with the external application via DCOM. If the external application has an access agent that needs to run in the 800xA System it is not recommended to install that agent in the Aspect Server. Instead, a separate Application Server should be set up, running the third party access agent and the corresponding surrogate process. Also, for very large external data volumes (>10,000 OPC items), it is recommended to install the surrogate in a separate Application Server.

General Considerations for OPC Subscriptions

Setting up or changing the subscription will cause a load peak. This happens normally in the system when calling up a display, etc., but for external clients there is a potential for making large changes in this sense. Therefore, the amount of items subject to a new/changed subscription is limited.

The load impact from Asset Optimization access to Fieldbus Connectivity Servers (FOUNDATON Fieldbus, PROFIBUS, and HART OPC servers) is based on device count and required scan rates. Usually the scan rate is fairly low in the order of hours per device, but with a large device count the resulting load may be significant.

The controller load impacts the throughput and the responsiveness of the Connectivity Server. To use the *optimized rules*, the controller load should not exceed 60-percent total load.

The rate of change for the subscribed signals has a certain impact on the capacity of the Connectivity Server (the OPC server detects if the signal has changed since the last sample). The given parameters are relevant for a change rate of around 50 percent (half of the values have changed since last sample, or a parameter changes on average every second sample).

When the same value is subscribed with the same update rate from more than one client (more than one graphics display, a display and a log, or even graphics and external subscription), the Connectivity Server will optimize the requests to the controller with significant capacity optimization as result. The 800xA Wizard will consider this combination effect and compensate for it according to typical usage. This means choosing the same update rate for different applications will pay back in capacity need.

Different update rates can be configured to save Connectivity Server capacity. For example, some displays can be set to update each three seconds instead of one second. Logs can be tuned according to process needs and in accordance with the execution of the control algorithm, etc. The characteristics of the connectivity is not fully linear, managing several update rates/log rates will decrease the throughput in items per second, but there is still a gain in optimizing the update rates.

The CPU power of the server usually is not the determining factor. This is why the computer type is not a variable (input parameter) in the current version of the calculation rules. Further steps will incorporate impact from additional disks and other optimizations of the PC itself. Recommended RAM size has to be followed.

General Configuration Rules

Figure 7 shows the general System 800xA Configuration rules. The maximum numbers of each node type are listed in Table 4.

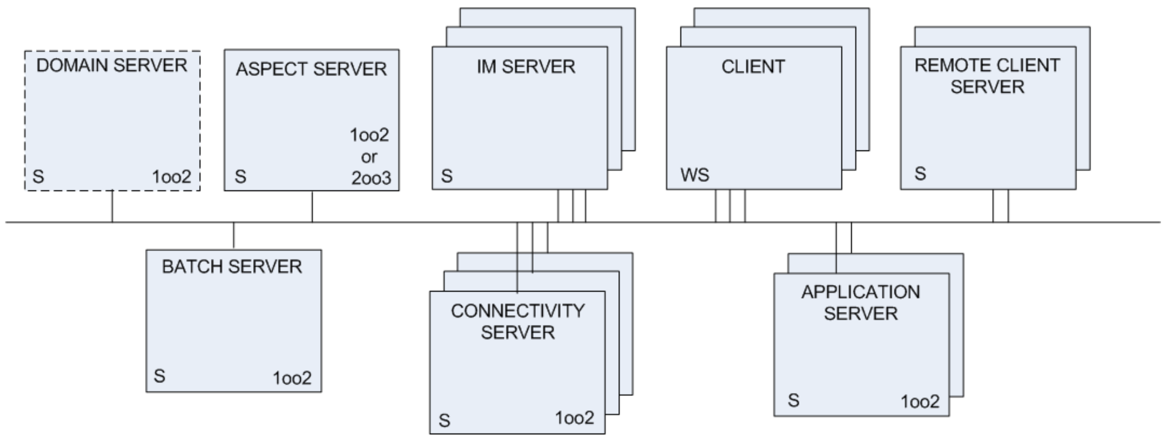

Figure 7. General Configuration

Depending on the system and application size, there are different ways to optimize the system configuration. The following options are available:

- Using a workgroup instead of a domain as described in Domain vs. Workgroup on page 37.
- Using a workstation operating system for certain servers as described in Supported Operating Systems on page 38.
- Combining different connect services in the same Connectivity Server as described in Connect Service Combinations in a System on page 44.
- Using combined node types:
  - Combining Aspect Server and Connectivity Servers (AS+CS).
  - Combining Information Management and Batch Management (IM+BM).
  - Run Asset Optimization on Connectivity Servers.
  - Use server based clients.

Server Based Clients

Technically, any node in a system (except Domain Server nodes) can be used as a client node. In smaller systems with workstation operating systems and workstation hardware, this works well. However, server hardware usually has low performance graphic cards which do not give the appropriate display exchange characteristics. Additionally, the overall performance of the server node may be negatively affected when calling up graphic displays.

Domain vs. Workgroup

A System 800xA installation can be configured either as a Windows Domain or as a Windows Workgroup.

When the system is configured as a domain, the Domain Controller and DNS can be installed either in separate Domain Servers or in Aspect Servers (node type AS, AS+CS, **but not** AS+CS+Batch+IM). For redundancy, two servers are used.

When the Domain Controller is installed on Aspect Servers, certain procedures must be followed during installation and when promoting the servers as Domain Controllers.

For installation as a production system, it is recommended that the system forms its own domain. It should not be part of a larger domain, such as a corporate network domain.

A workgroup becomes increasingly difficult to administrate as the number of users and computers grows. Therefore, workgroups should be considered only for small systems with few users.

Supported Operating Systems

System 800xA 5.1 version runs on 64-bit (x64) and 32-bit (x86) operating systems. The initial System 800xA 5.1 version was 32-bit and Revision A had separate media boxes for 64- and 32-bit operating systems. The later revisions and feature packs are in a single media supporting both options. New installations should be installed on 64-bit operating systems. However, if desired older hardware and available operating system licenses can be used, it is possible to install the 800xA software on a 32-bit operating system.

It is possible to install **mixed 64- and 32-bit systems**. The most common use case is when a client is added or exchanged. Here it is possible to use a 64-bit node with 64-bit operating system, even if the rest of the system is running on 32-bit. Exchanging a Connectivity Server or even an Aspect Server to a node running on a 64-bit operating system is possible under certain circumstances. It is recommended to discuss this with Product Management. Swapping nodes to a 32-bit operating system on a system generally running on a 64-bit operating system is not considered as a relevant use case and should not be done.

The supported operating systems, service packs, and hot fixes are listed in *System 800xA 5.1, 5.0, 4.x, 3.1 Third Party Software (3BUA000500)*. This document can be found in ABB SolutionsBank.

Server Operating System and Workstation Operating System will be used throughout the remainder of this document.

The same capabilities and performance as the previously released 32-bit version apply also to the 64-bit version.

The US English version of the operating system is required even if a translation NLS package for System 800xA is used.

Upgrades from previous versions that are still supported (Version 4.1, 5.0 SP2) to the new 64-bit version is supported, including on-line upgrade for 5.0.

The 800xA services can run on both Workstation and Server Operating Systems (OS). Depending on Microsoft licensing rules, the system size is limited when the Workstation Operating System is used for any server node.

- When the Workstation Operating System is used for the Aspect Server(s), the system size is limited to nine nodes, not counting Domain Servers.

- When the Workstation Operating System is used for any other server, but not for the Aspect Server(s), the system size is limited to 11 nodes, not counting Domain Servers.
- The Aspect Server must use the Server Operating System if it will run the Domain Controller and DNS.
- Some Server types always require the Server Operating System:
  - Domain Server.
  - Aspect Server when it runs the Domain Controller and Domain Name System (DNS).
  - Batch Server (except in a Single Node Engineering System).
  - Information Management Server.

    - Information Management Desktop Client supports Windows 7 (32-bit, 64-bit), Windows Server (32-bit, 64-bit), Windows XP, and Windows Server 2003 32-bit Operating Systems. The Microsoft Office environment follows the 800xA Microsoft Office environment specification.
  - Servers that run Asset Optimization (except in a Single Node Engineering System).
  - 800xA for Harmony Connectivity Server, Configuration Server, and Configuration Server with Connectivity Server.
  - 800xA for AC 870P/Melody Connectivity Server and Configuration Server.
  - 800xA for MOD 300 Connectivity Server.
  - Servers that run PC, Software and Network Monitoring Connectivity Server (except in a Single Node Engineering System).

All servers in a redundant group (1oo2 or 2oo3) must always use the same operating system.

Microsoft has different models for licensing of server operating systems. Windows Server 2008 is licensed either with a Per Server model or with a Per Device or Per User model. In System 800xA the Per Device or Per User model is normally the most cost efficient.

One server license is required for each node in System 800xA running Windows Server 2008. In addition a number of Client Access Licenses (CALs) are required.

The selected licensing model as well as the number of CALs is given at the point of operating system installation.

The Per Device model means all physical devices, in System 800xA terms all client nodes and all server nodes, each represent one CAL. This model is advantageous when multiple operators share the same operator client (shift operators). The number of CALs required equals the sum of all PC nodes in the system.

The Per User/Device model means each named user/device accessing the server software represents one CAL. This model may be advantageous if a relatively small number of operators operate the plant from different clients throughout the plant but at different points in time. A larger number of operator client nodes can be installed without purchasing CALs for each and everyone of them. The number of CALs required equals the sum of all named users accessing servers in the system simultaneously.

It is not possible to have one single operator account and let all operators use it - this would require as many CALs as there are simultaneous operators.

Engineering Systems

An engineering system is intended for engineering functions only, with no production or control operations. Except for the single node engineering system, the same basic configuration rules apply to an engineering system as to systems intended for production.

Engineering results produced in an engineering system are transferred to the production system, or to other engineering systems, such as an on-site engineering system, using the Export/Import function.

The engineering system is used stand-alone (in an engineering office). There are four alternatives with respect to the domain membership:

- The system can be added to an existing domain (in an office network domain).
- The system can be defined as a new domain added to an existing Domain Controller.
- They system can be defined as a new domain in a separate Domain Controller (isolated engineering system).
- The system can be defined as a workgroup.

Engineering node configuration examples are shown in Figure 8 and Figure 9.

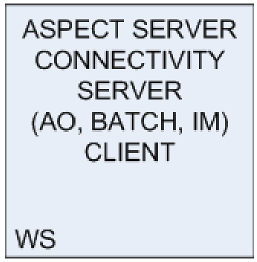

Figure 8. Single Node Engineering System

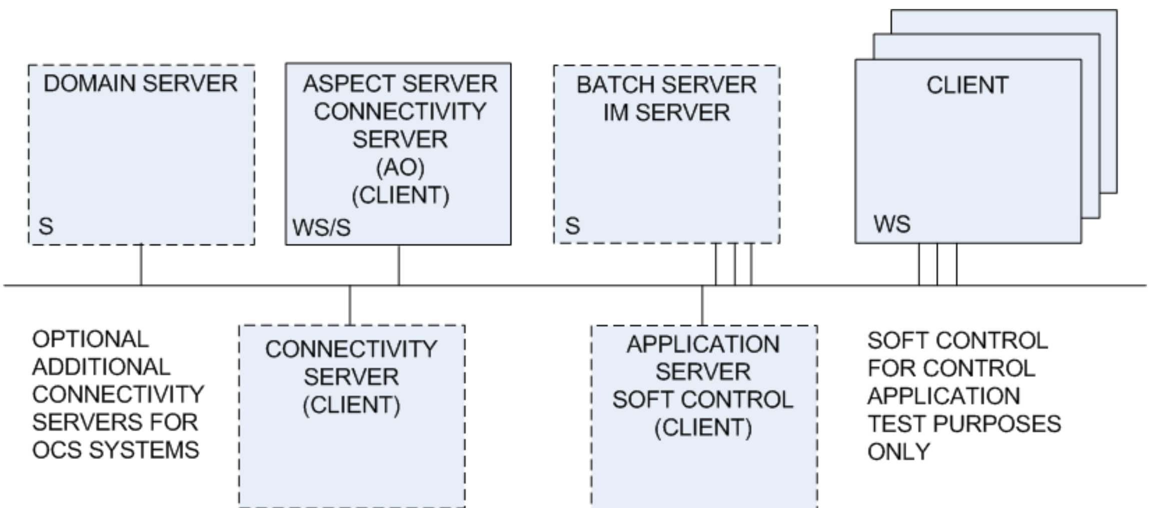

Figure 9. Multi User Engineering System

Server Node Virtualization

[3] in Table 1 on page 19 may contain limitations applicable to the virtualized configurations. It is recommended to read this guide prior to offering a virtualized installation.

Virtualization can be used in 800xA Systems to combine multiple 800xA server nodes onto a single computer. The total number of physical computers required in an installation is reduced significantly. This also reduces the required space for computers, hardware acquisition cost for computers and cabinets, and operating costs (such as energy costs). Virtualization can be used for engineering systems as well as for production systems.

Essentially, the configuration and dimensioning rules for 800xA server nodes stated in this document apply also when the node is installed as a virtual machine. Given that the rules in this System Guide are followed, the performance data stated here will be fulfilled. [3] in Table 1 on page 19 details how a virtualized system is planned, set up, and taken into operation. Note that there may be exceptions to this. Refer to the system configuration limit Table 5 on page 51 through Table 12 on page 57.

800xA Single Node System Deployment

It is possible within certain limitations to set up a single node 800xA system, or dual nodes if redundancy is required. In such a setup the 800xA server functionality as well as the 800xA clients are running on one and the same server machine. The visualization is streamed to the physical clients (thin clients) using remote desktop protocol. The thin clients do not have 800xA software installed.

The single node deployment can be done in two ways, running multiple servers using virtualization, or by running the services and the clients on the same Server Operating System. When using a single physical Server Operating System several remote desktop sessions are running on the machine. Remote desktop sessions are enabled by adding the remote desktop session role. Note that a Microsoft Remote Desktop Services CALS license is required for each client.

The functionality of such a setup is limited to the default set of server node functionality (like AC 800M, PROFIBUS/Hart, and Foundation Fieldbus connects). One additional connect can be used, for example IEC 61850.

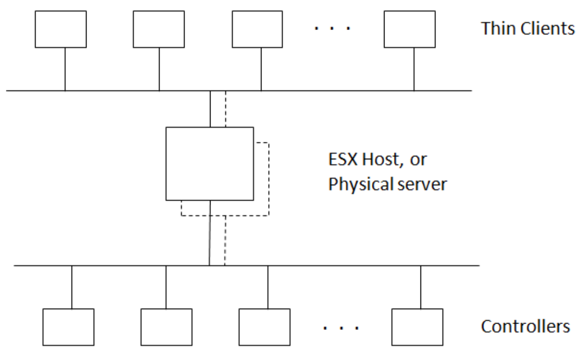

Figure 10. Single Node Deployment

Table 2 describes the dimensioning rules for 800xA Single Node Deployment.

Table 2. 800xA Single Node System Deployment

	Virtualized (ESXi + Windows Server 2008 R2)	**Physical server (Windows Server 2008 R2)**
System Maximum Specification		
Tags	5000	5000
Clients	8	8
Controllers (AC 800M)	12	12
Field connectivity - PROFIBUS/Hart	1	1
Field connectivity - Foundation Fieldbus	1	1
Additional connect	1	1
Hardware Specification		

Table 2. 800xA Single Node System Deployment

CPU	6 core, 2.6GHz, HT enabled	6 core, 2.6GHz, HT enabled
RAM	16 GB	16 GB
Hard Drive	120 GB, Raided	120 GB, Raided
Operating System	Windows Server 2008 R2	Windows Server 2008 R2
Remote Desktop Services Device CAL licenses	8	8
NOTES: 1. Need Ethernet port quantity as required. 2. Ensure to purchase Windows Server 2008 Remote Desktop Services Device CAL licenses.		

Refer to [3] in Table 1 on page 19 for additional information on to install and configure a single node 800xA System, including thin client hardware to use and its setup.

Connect Service Combinations in a System

Connect services provide integration with various types of devices and control systems. With some exceptions connect services, including the Default Set can be freely combined in a system.

The Default Set of connect services are:

- AC 800M Connect.
- Device Management FOUNDATION Fieldbus.
- Device Management PROFIBUS & HART.

Connect services which cannot coexist in one and the same system are:

- Melody Connect and Harmony Connect.
- Harmony Connect and DCI Connect.

Connect Service Combinations in Server Nodes

This section lists how connect services can be combined in one and the same node. The rules in this section ***must be strictly followed***.

Default Set connect services can all be combined in the same CS or AS+CS. One other connect service can be combined with the Default Set in the same CS or used instead of the Default Set in the AS+CS. Or, used as the only connect service in the AS+CS+Batch+IM as specified in Table 3.

Table 3. Connect Service Combinations in Server Nodes

Connect Service	Can Be Combined With Default Set In The Same CS (select one)	Allowed Instead Of Default Set In AS+CS (select one)	Allowed As Only Connect Service In AS+CS+Batch+IM (select one)
800xA for AC 800M	Included in default set	Included in default set	X
800xA for Advant Master with Safeguard	X	X	
800xA for Harmony		X	
800xA for AC 870P/Melody		X	
800xA for MOD 300		X	
800xA for AC100		X	
800xA for DCI		X	
800xA for AC 800F			X
PLC Connect	X [1]	X	
Multisystem Integration	X	X	
800xA for IEC 61850		X	

NOTES:
1. A third party OPC server may require that PLC Connect is installed in a separate CS or that the third party OPC server is installed in a separate node. Refer to [4] and [5] in Table 1 on page 19 for more detailed information.

Available Functions Per Controller Connectivity

All system functions normally work together with all connect services. However, there are certain restrictions in the functionality. Those are listed below. Details can be found in the referred sections.

- **Batch Management**

  For allowed combinations with connect services, refer Batch Management on page 79.

- **Load-Evaluate-Go**

  Supported with AC 800M.

- **Device Management HART**

  Routing of the HART information through the controller is only supported with AC 800M and AC 870P controllers. For all other controllers the HART Multiplexer Connect option needs to be selected in addition to Device Management HART to collect the data from HART multiplexers.

- **Device Management PROFIBUS**

  Supported together with AC 800M controllers.

- **Device Management FOUNDATION Fieldbus**

  Supported for AC 800M controllers and is required to configure FOUNDATION Fieldbus networks together with AC 800M.

- **800xA for IEC 61850**

  Supported in the same system with AC 800M Connect, Harmony Connect, Melody Connect, and DCI Connect. IEC61850 Connect has to run on separate Connectivity Servers from the other Connects.

Network Configuration

The maximum number of nodes (PC nodes and controllers) in one control network area is given in Table 4. The limitation is primarily due to limited network resources in controller nodes.

For larger systems a split into separate client/server and control networks is recommended, if needed with several control network areas (refer to [1] in Table 1 on page 19 for more detailed information). The maximum number of nodes on a client/server network is stated in Table 4.

Also for smaller systems, and for systems where the server functions are normally combined (AS+CS), the network can be split into separate client/server and control networks.

It is recommended to use 100 megabits/second switched, fast Ethernet communication between clients and servers. Controllers use 10 megabit/second (with the exception of PM 891 which uses 100 megabit/second).

Redundant Ethernet networks need to have similar timing properties. The throughput on the primary and the secondary network must be similar so that the network performance, in case of a network failure, is the same as when both networks are operational. The message transport time between any two nodes must not differ more than 300 milliseconds between the primary and the secondary network.

System Size Summary

System 800xA has the following general capabilities:

- Up to 12 Connectivity Servers (24 if redundant).
- Up to 10 Application Servers.
- Up to 80 Clients. Up to 80 rich clients or up to 30 remote clients (using three servers with a maximum of 10 clients per server) can be used in any combination, but do not exceed 80 total clients.
- Up to 80 AC 800M Controllers.
- Up to 120,000 tags.

Maximum Number of Nodes

The maximum number of nodes of each node type depends on the selection of a separate or combined AS and CS. For example, if AS+CS is selected, one CS node with connect services additional to those in AS+CS is allowed.

Refer to Table 4 for a maximum number of nodes per node type.

Numbers in parenthesis in Table 4 state the number of nodes for redundant configurations.

Table 4. Maximum Number of Nodes Per Node Type

Node Type	AS and CS (Separate)		AS+CS (Combined)		AS+CS+Batch+IM (Combined Single Node)	
	Max. Per System	Out Of Which	Max. Per System	Out Of Which	Max. Per System	Out Of Which
Domain Server (Optional)	**1 (2)**		**1 (2)**		**1 (2)**	
Aspect Server						
AS	**1 (2 /3)**		**—**		**—**	
AS+CS	**—**		**1 (2)**		**—**	
AS+CS+Batch+IM	**—**		**—**		**1 (2)**	
Connectivity Servers	**12 (24)**		**1 (2)**[1]		**1 (2)**[1]	
Default Set		8 (16)		1 (2)		1 (2)[2]
PLC Connect		8 (16)		1 (2)		—
800xA for IEC 61850		8 (16)		1 (2)		—
Multisystem Integration Remote Access Client		4 (8)		1 (2)		—
Multisystem Integration Remote Access Server		1 (2)		1 (2)		—
800xA for AC100[3]		2 (4)[4]		1 (2)		—
800xA for AC 800F		4 (8)		—		1 (2)
800xA for Advant Master[5]		6 (12)		1 (2)		—
800xA for DCI		4 (8)		1 (2)		—
800xA for Harmony		8 (16)		1 (2)		—
800xA for AC 870P/Melody		12 (24)		1 (2)		—
800xA for MOD 300		6 (12)		1 (2)		—
800xA for Safeguard[6]		6 (12)		1 (2)		—
Application Servers	**10**		**7**		**—**	
Batch		1 (2)		1 (2)[7]		—
IM		6		2[7]		—
Batch+IM		—		1[8]		—
Other Applications		6		2		—

Table 4. Maximum Number of Nodes Per Node Type (Continued)

Node Type	AS and CS (Separate)		AS+CS (Combined)		AS+CS+Batch+IM (Combined Single Node)	
	Max. Per System	**Out Of Which**	**Max. Per System**	**Out Of Which**	**Max. Per System**	**Out Of Which**
Remote Client Servers						
Operator Workplaces	**3**[17]		**—**		**—**	
Engineering Workplaces	**1**[17]		**1**		**—**	
Rich Clients (Concurrent)[19,20]	**40(80)**		**8**		**5**	
Operator Workplaces[19]		40(80)		8		5
Batch Workplaces		40		5		5
IM Workplaces[19]		40(80)		5		5
Engineering Workplaces		20[9]		3		1
Remote Clients (Concurrent)	**30**		**—**		**—**	
Operator Workplaces per Remote Server[18]		10		—		—
Eng. Workplaces per Remote Server[10, 18]		5		5		—

Table 4. Maximum Number of Nodes Per Node Type (Continued)

Node Type	AS and CS (Separate)		AS+CS (Combined)		AS+CS+Batch+IM (Combined Single Node)	
	Max. Per System	Out Of Which	Max. Per System	Out Of Which	Max. Per System	Out Of Which
Network Nodes[11]						
Server and Client Nodes[12]	**100**		**21**		**11**	
AC 800M Controllers[13, 14]	**80**		**20**		**20**	
Per Separate CS		12 (48)[16]		12		12
Per Combined CS		—		8		8
Total nodes per Control Network[15]		60(100)		24		24
Total nodes per Combined Network[15]		60(100)		41		31

NOTES:

1. Additional to combined server.
2. Only 800xA for AC 800M.
3. Maximum 1(2) per AF100 network.
4. The data refers to a validated configuration and it is not a technical limitation.
5. Maximum 4 (8) per MB300 network.
6. Refer to 800xA for Advant Master.
7. If no Batch+IM.
8. If no Batch or IM.
9. Larger engineering client count may impact performance and should be used in plain engineering systems only, or in production systems during commissioning and startup.
10. Not supported by System Installer.
11. When Windows 7 is used in servers, the system size is limited by Microsoft licensing rules.
12. Excluding remote clients.
13. For other controller types, refer to the respective section in this System Guide.
14. Application dependent.
15. Controllers and servers. The larger value is when only PM89x is used (i.e. no other CPU types).
16. Up to 48 controllers per separate Connectivity Server possible when applying the optimized calculation rules, using the 800xA Wizard.
17. Windows Server 2008 Enterprise Edition 32-bit (x86) and 8 GB of RAM is recommended for performance reasons for the Remote Client Server.
18. The specified number of Remote Clients per Remote Server is the maximum number of clients. Depending on how the clients are used, the actual number of clients might be lower, due to memory consumption and CPU load. This needs to be tested in the actual configuration.
19. TSA is required for more than 40 clients.
20. One Extended Operator Workplace (EOW) is counted as 3 operator workplaces.

System Level Parameters

Table 5 shows the system configuration limits for system level parameters.

When the Load-Evaluate-Go functionality is used for downloading applications to the controllers, the system size is limited.

Load-Evaluate-Go is not supported together with certain controller connects other than 800xA for AC 800M.

Table 5. System Configuration Limits - System Level Parameters

Parameter (Maximum Numbers)	AS and CS (Separate)	AS+CS (Combined)	AS+CS+Batch+IM (Combined Single Node)
Tags (items with faceplates)	60,000 (120,000)[1]	15,000	3,000
Tags if AO on the CS node	60,000 (120,000)[1]	3,000	Not supported
Tags if AO on the AS+CS node	Not supported	3,000	Not supported
Aspect Objects	200,000 (400,000)[2]	30,000	10,000
Information Manager History Logs	180,000	1,500	200
Tags when using Load-Evaluate-Go	25,000	1,500	1,500
Aspect objects when using Load-Evaluate-Go	50,000	15,000	15,000

NOTE:
1. Tag count up to 60,000 tags per system. For larger systems (up to 120,000 tags), a TSA is required.
2. Aspect Object count up to 200,000 Aspect Objects per system. For larger systems (up to 400,000 Aspect Objects), a TSA is required.

System Level Client Count Limits

Table 6 details the maximum numbers of clients when combined and separate node types are used.

Table 6. System Configuration Limits - Client Count

Parameter (Maximum Numbers)	AS and CS (Separate)	AS+CS (Combined)	AS+CS+Batch+IM (Combined Single Node)
Clients (concurrent) per system[4]	55(80)	8	5
Operator screens per system	125(160)[1]	16[1]	10[2]
Operator screens per system if AO on Connectivity Server node [1]	125	10	Not supported
Rich Clients (concurrent)[4]	40(80)	8	5
Rich Clients (concurrent) if AO on Connectivity Server node	40	5	Not supported
Engineering Clients (800xA)	20[3]	3	1
Batch Clients	40	5	5
IM Clients[4]	40(80)	5	5

NOTES:
1. A client can have up to four screens depending on licensing. Depending on subscription load and display complexity, large screen count can impact failover/failback time.
2. Presume 2 x number of clients = 10.
3. Larger engineering client count may impact performance and should be used in plain engineering systems only, or in production systems during commissioning and startup.
4. TSA is required for more than 40 clients or more than 125 screens.

System Level Aspect Server Limits

Table 7 details system parameters as limited by the Aspect Server for combined and separate node types. Certain aspect types can expose OPC properties for write and read operations through the Aspect Server.

Table 7. System Configuration Limits - Aspect Server Parameter Limits

Parameter (Maximum Numbers)	AS and CS (Separate)	AS+CS (Combined)
DA Subscriptions Reads/Aspect Object	50/sec	50/sec
DA Subscriptions Writes/Aspect Object	1/sec	1/sec

System Level Alarm Parameter Limits

Table 8 details system parameters as limited by the Alarm Parameters Limits for combined and separate node types

Table 8. System Configuration Limits - Alarm Parameter Limits

Parameter (Maximum Numbers)	AS and CS (Separate)	AS+CS (Combined)
Continuous alarm/event throughput/sec	30	20
Event burst (events per 100 msecs) applied to one Controller	200 per CS maximum	200 per CS maximum
Event burst (events evenly distributed over controllers)	1,000/sec for 3 secs, plus 10/sec for 15 mins	1,600 total over 3 secs
Event burst recovery time, 1,000 events evenly distributed	< 60 secs	< 60 secs
Simultaneously presented alarm and event lists, including alarm line, per system	100	20
Displayed alarm and event lists, including alarm line, per client	8	8
Simultaneously presented unique alarm and event lists, including alarm line, per system	50	10

Table 8. System Configuration Limits - Alarm Parameter Limits (Continued)

Parameter (Maximum Numbers)	AS and CS (Separate)	AS+CS (Combined)
Simultaneously presented alarm band buttons per system	500	100
Simultaneously presented alarm unique band buttons per client	20	10
Simultaneously presented unique alarm band buttons per system	25	10
External alarms (an event list on which an alarm will activate a binary output for audible and/or visual indication)	25	10

Connectivity Server OPC DA/AE Limits

Table 9 details the Connectivity Server OPC DA/AE rules when combined and separate node types are used. These numbers reflect what the base system can support. Each connect option will be equal to or less than these numbers.

Table 9. Configuration Limits per Node for Connectivity Server Parameters

Parameter (Maximum Numbers)	AS and CS (Separate)	AS+CS (Combined)
Number of Active OPC DA Subscriptions	20,000/CS[1]	6,000
Active OPC DA Subscriptions per AC 800M Connectivity Server	20,000 (100,000)[2]	6000
OPC DA throughput (items per sec) per AC 800M Connectivity Server	30,000[2]	Not specified
OPC AE Event Burst (events per 100 msecs)	200/CS	200

NOTE:

1. This number is based on 5000 History Sources with parallel redundancy which has a 1 to 4 loading ratio if enabled and includes History subscriptions.
2. Larger subscription volume and throughput possible per separate CS when applying the optimized calculation rules, using the 800xA Wizard.

OPC Server Limits for 800xA for IEC 61850 Connectivity Server

Configuration rules and dimensioning parameters for the 800xA for IEC 61850 Connectivity Server can be found in Section 12, 800xA for IEC 61850.

Control and I/O Limits

Table 10 details the Control and I/O size when combined and separate node types are used.

The number of AC 800M controllers in an 800xA System is dependent on the number of Connectivity Servers used, and the required throughput in terms of subscribed data volume. Each server can handle between 12 and 24 controllers depending on the amount of data that is subscribed from them, which in turn depends on the application size, and the size of the CPU selected.

The number of I/O channels per controller ranges from a few hundred to over 1,000 depending on the CPU type and application. An I/O count parameter on the system level is hence not possible to give.

Table 10. System Configuration Limits - Control and I/O Parameters

Parameter (Maximum Numbers)	AS and CS (Separate)	AS+CS (Combined)	AS+CS+Batch+IM (Combined Single Node)
AC 800M Controllers	80	20[1]	8
AC 800M Controllers per separate CS (single or redundant)	12 to 48 (subject to calculation) [2]	8	Not supported

NOTES:
1. 12 controllers per separate Connectivity Server and 8 controllers per combined Connectivity Server.
2. Instead of using the default rule of 12 controllers per Connectivity Server, a load calculation using the *optimized rule* can be performed, which may allow up to 48 controllers per Connectivity Server. Refer to Connectivity Server Capacity Calculation, the Optimized Calculation Rule on page 29 for more detailed information. This potentially supports more controllers than the maximum number stated above. Applications using more than the maximum specified number of controllers should minimize their risk by filing a TSA to get their configuration reviewed by Product Management.

Device Management and Fieldbuses

800xA Device Management software packages are available for PROFIBUS, HART, and FOUNDATION fieldbus protocols. The access to the specific field devices for condition monitoring, visualization, and alarm/event reporting is mainly realized via Fieldbus OPC Servers, which are executed on Connectivity Server nodes.

The following Fieldbus OPC Server types are available:

- Device Management FOUNDATION Fieldbus (OPC Server FOUNDATION Fieldbus).
- Device Management PROFIBUS & HART (OPC Server PROFIBUS/HART).

OPC Server FOUNDATION Fieldbus and OPC Server PROFIBUS/HART can be combined on one Connectivity Server, whereas only one instance of each Fieldbus OPC Server can be executed per Connectivity Server.

Table 11 details the maximum number of field devices loaded in the specific Fieldbus OPC Server when combined and separate node types are used.

Table 11. Fieldbus OPC Server Limits per Node for Connectivity Server Parameters

Parameter (Maximum Numbers)	AS and CS and AO (All Separate)	AS+CS[1] (Combined) and AO	AS+CS+AO[1] (Single Node)
Field devices - FOUNDATION Fieldbus	4 OPC Server FF per CS; 1,000 devices per OPC Server FF = 4,000 device per CS	1,000 per CS	1,000
Field devices - HART	2,500 per CS	1,000 per CS	500
Field devices - PROFIBUS	2,500 per CS	1,000 per CS	500
Field devices - FOUNDATION Fieldbus, HART, PROFIBUS	PROFIBUS+HART = 2,500 per CS FOUNDATION Fieldbus = 1,000 per CS	PROFIBUS+HART = 500 per CS FOUNDATION Fieldbus = 1,000 per CS	PROFIBUS+HART = 500 FOUNDATION Fieldbus = 1,000

Table 11. Fieldbus OPC Server Limits per Node for Connectivity Server Parameters (Continued)

Parameter (Maximum Numbers)	AS and CS and AO (All Separate)	AS+CS[1] (Combined) and AO	AS+CS+AO[1] (Single Node)
Field devices - HART and PROFIBUS	PROFIBUS+HART = 2,500 per CS	PROFIBUS+HART = 1,000 per CS	PROFIBUS+HART = 1,000

NOTE:
1. To have sufficient capacity for non cyclic tasks (Engineering or Alarm Burst), it is recommended to use high-performance hardware.

Application Rules

Table 12 details the system configuration for application specific parameters when combined and separate node types are used.

Table 12. Configuration Limits Per Node for History Parameters

Parameter (Maximum Numbers)	AS+CS (Combined)	Separate AS, CS, and Application Server
Connectivity Server History Capabilities[2]		
Event Storage, number of events per event category	10,000 (by default) Max 50,000	10,000 (by default) Max 50,000
Retention Period Recommended	3 months	3 months
Number of Data Sources per connectivity server[1]	1,500	5,000
Number of History Logs in a connectivity server	1,500	10,000
Average change Rate (OPC DA) change Rate/sec for connectivity server logs	300	1,000
Average storage (OPC DA) Rate/sec, data written to disk for connectivity server logs	250	500
Burst change rate (OPC DA) for connectivity server logs	600	2,000
Average number of Trend requests (OPC HDA) request per minute	300	1,000

Table 12. Configuration Limits Per Node for History Parameters (Continued)

Parameter (Maximum Numbers)	AS+CS (Combined)	Separate AS, CS, and Application Server
Average trend retrieval rate for historical data (OPC HDA) values/sec	1,200	4,000
Trend retrieval burst rate for historical data (opcHDA) values/sec	2,400	8,000
Number of Data Sources per Connectivity Server with Redundancy and Parallel Disabled	1,500	5,000
Number of Data Sources per Connectivity Server with Redundancy and Parallel (default)	3,000	10,000
Information Management History [2]		
Number of Primary History Logs in an Information Manager Server	1,500	30,000
Data Transfer rate Values/sec from Connectivity Server History to Information Manager History Logs (opcHDA)	2,000	2,000
Average number of trend requests (opcHDA) per min. from an Information Management Server	300	1,000
Average number of values (opcHDA) Values/sec. for a trend request from Information Management log	1,200	4,000
Burst Trend Requests (opcHDA) Values/sec. for data from and Information Management log	2,400	8,000
Average Number of Events transfer from Event Server to Information Manager Message Log	20	30
Recommended Maximum History Transfer Rates to Information Manager server from Connectivity (opcHDA) Rate per min. (Staggering can be used to balance and improve performance)	300	1,000
Scheduling Service [2]		
Simultaneous jobs, maximum, if used for reporting, capacity to contain reports is based on available disk capacity	200	200

Table 12. Configuration Limits Per Node for History Parameters (Continued)

Parameter (Maximum Numbers)	AS+CS (Combined)	Separate AS, CS, and Application Server
Calculations [2]		
Number of Services	1	10
Write transactions/sec to AC 800M	10	10
Write transactions/sec to Softpoint objects	100	100
Write transactions/sec to Lab Data Logs	2	2
Softpoint Service [2]		
Number of Objects	75	2,500
Number of Signals, maximum	750	25,000
OPC Clients (800xA OPC Client Connection) [3]		
OPC items from external subscription per surrogate process	500	2000 (10,000)
Externally subscribed OPC items throughput (items per sec.) per surrogate process	25	4000
Maximum OPC items subject to a new or changed external subscription (one request in one group)	100	2500
Maximum surrogate processes	1	4
Property Transfer (OPC Bridging Function) [2]		
OPC items via Property Transfer	500	1,000
OPC items/sec via Property Transfer	25	100
Batch Management [2]		
Active Batch Phases	100[4]	300[4]
Asset Optimization [2]		
Assets Monitors per system	2,000	20,000

Table 12. Configuration Limits Per Node for History Parameters (Continued)

Parameter (Maximum Numbers)	AS+CS (Combined)	Separate AS, CS, and Application Server
Asset Monitors per Asset Optimization Server or Asset Conditions per Asset Optimization Server	2,000 or 15,000	10,000 or 30,000
Asset Optimization Servers per system	1	4

NOTES:

1. OPC DA items or corresponding for OCS connects (TTD logs, etc.
2. Refer to the specific tables throughout this section for information on AS/CS/Batch/IM nodes.
3. A larger volume of external subscription in systems with separate CS is possible when applying the optimized calculation rules, using the 800xA Wizard. Note, for connects other than AC 800M other limitations may apply.
4. This value is reduced by 50% when virtualization host software is used for the 800xA Batch Management server node. For maximum performance and capacities, physical server nodes must be used.

Third Party Hardware and Software

System 800xA is verified with a defined set of workstations and servers. For an up-to-date listing of supported PCs and communication hardware, refer to [6] in Table 1 on page 19.

System 800xA is verified on the PCs listed in [6] in Table 1 on page 19. Although PCs from different vendors are normally very similar and do not present any significant differences to the software running on them, performance and function cannot be guaranteed if other PCs than the ones referred to are used.

In some cases the PC vendors have vendor specific software pre-installed on the machines, for example to perform diagnostics. [6] in Table 1 on page 19 indicates when vendor specific software is certified with the recommended machines.

Hardware recommendations to be used with virtualized installations is essentially the same, but selected such that special provisions for disk arrangement, multiple CPU cores, etc., can be fulfilled. For best performance and capacity in virtual environments these recommendations should be followed. Refer to the [6] in Table 1 on page 19 for more information.

To safeguard the quality of the system, all recommended PC hardware configurations are tested by ABB before approval. This means that all models listed have been installed and run with relevant system functions in these tests. If, for any reason there is a need to use a non-recommended hardware configuration, this has to be approved by the System 800xA Product Management.

Generally, customer support for systems based on non-supported hardware will be charged, above and beyond any maintenance contracts, if the problem is related to the non-supported hardware.

DVD Formats

The 800xA software is delivered on dual layer DVDs.

Comments to Cloning of PCs at Installation Time

It is strictly recommended to perform the 800xA software installation on all nodes using the System Installer.

In a system, there are usually many nodes that will have the same installation, such as all clients, or certain server groups. In these cases, efficiency may increase if PCs can be cloned instead of installing them one by one. Hardware independent disk imaging tools may solve this problem by backing up an installed PC and transferring the image to another PC. Pure disk imaging tools allow making an image backup of a PC. However, if this image is installed on another PC, any small differences (such as different vendors for the hard disk or different BIOS versions) may not be correctly detected by the operating system and could jeopardize the result. In some cases, no issues will be identified during the initial startup and operation, but will show up later during regular operation. No third party packages are formally verified with System 800xA and therefore proper function cannot be guaranteed. Any usage must be based on knowledge about the limitations and risks presented by these tools.

Regardless of how this procedure is performed, the end user is responsible to ensure that third party software license agreements are not violated.

Environmental Considerations

The environmental specification provided for the respective PCs by the PC vendor applies. Normally this means workstations and servers need to be installed in the control room or the electrical room. Installation in the production area or in the field normally requires special measures. Installation in harsh environments like ships and vehicles may require additional mechanical measures.

The recommended hardware list does not contain any recommendations for Marine classified PCs. The reason is that projects usually have different preferences and a general recommendation would not be commonly used to the extent necessary to justify the verification and the continued regression testing for new system versions. Instead it is recommended that these projects make their choices on a per project basis, or as a local preferred standard, and certify these against a specific system version.

Contact IITCertification@se.abb.com for PCs suitable for embargo (T6) countries.

Recommended PC Performance and Capacity

Recommended performance and capacity of the PCs for different node types can be found in [6] in Table 1 on page 19.

This document also contains recommendations for memory size. Read it carefully to fully understand implications pertaining to memory size.

For best readability, the recommended screen resolution is 1680 x 1050 or 1280 x 1024. It is also possible to use 1600 x 1200, 1920 x 1080, or 1920 x 1200, but fonts and icons may appear small in some cases.

Virtualization Host Software

System 800xA continuously follows the life cycle of third party software. This is also valid to virtualization host software. Refer to [3] and [8] in Table 1 on page 19 for the supported versions.

Other Third Party Software

Each version of the System 800xA is verified with particular versions and revisions of underlying third party software. It is mandatory that the correct versions of the software are used. In 800xA 5.1, the majority of third party software is installed by the System Installer.

Refer to [8] in Table 1 on page 19 for a complete and up to date list of third party software evaluated for use with System 800xA.

Base System Performance and Capacities

Redundancy Switchover Time

At switchover of redundant Connectivity- and Aspect servers you will experience a short non-responsiveness of the clients, while they are connecting to the redundant server. Likewise when they re-connect to the original server when it comes back again. This time will depend on several factors, and will be arbitrary different for different clients. Larger systems typically experience the longer time. Aspect Servers in 2oo3 redundant configuration typically experience shorter switchover time versus 1oo2 configuration, depending on affinity setting. The normal fault condition is when the server hardware breaks and a switchover is triggered. Manually initiated switchover, by for example shutting down the server, may cause longer switchover time.

Aspect servers in 2oo3 redundant configuration are capable of determining if write operations to the Aspect Directory have been made (majority decision). This would occur if dual network failures happen. If one server is lost the remaining two servers will still synchronize. The 2oo3 recovers automatically after a single server failure.

In 1oo2 configuration it is not possible to determine which server is correct if both have changed their content while being separated (due to for example a dual network failure). This can happen if there are applications that make write operations to the Aspect Directory, or if engineering changes are made while the servers were separated. The system will decide itself which server is considered correct.

The switchover times for redundant Connectivity Server and Aspect Server are shown in Table 13.

Table 13. Redundancy Switchover Time

Parameter	Description
Switchover time Connectivity Server	Typically <2 secs.
Switchover time Aspect Server (1oo2, 2oo3 redundancy)	Typically 2-4 secs.

Scheduling Service

The maximum scheduling capacity is 200 simultaneous jobs per scheduling server.

Softpoint Service

The Softpoint Server can have up to 2,500 SoftPoint objects. Each SoftPoint object can have up to 100 signals; however, the total number of signals cannot exceed 25,000. Softpoint Server redundancy is also supported. CPU time for each read or write transaction is one millisecond. The Softpoint server can write 10 events per second to platform-based Aspect Objects.

Calculations

Table 14 provides Calculations parameters.

Table 14. Calculations Parameters

Parameter	Description
OPC Base Rate	Rate at which input variables are updated by their respective OPC data sources. Range: 100 msecs. to 1 hour. Default: 1,000 msecs. (1 sec.).
Cycle Base Rate	Rate at which the Calculations Scheduler scans the list of cyclically scheduled calculations. Range: 100 msecs. to 1 hour. Default: 500 msecs. (1/2 sec).
Number of calculations that may be queued waiting to be executed	1,000 enabled calculations per Calculation Server.
Execution Rate	100 calculations/sec., refer to write transaction rates specified below to determine capabilities.
Write transactions/sec.	Refer to Table 12 on page 57.
Write transaction/sec. to SoftPoints	
Write transaction/sec. to Lab Data Logs	

800xA for AC 800M

Control Network Clock Synchronization

Table 15 shows the clock synchronization accuracy based on the type of control protocol.

Table 15. Control Network Clock Synchronization

Type of Clock Synchronization	Accuracy Per Node
High Precision SNTP	1 msec.
SNTP	200 msecs.
CNCP (between AC 800M)	1 msec.
CNCP (AC 800M to AC 800M)	200 msecs.
CNCP (AC 800M to Process Portal)	200 msecs.
MB 300 network	3 msecs.

Process Graphics 2

Process Graphics 2 (PG2) is new, enhanced graphics package that replaces Visual BASIC® 6 (VB6) graphics. To use PG2, users are required to update/upgrade to 800xA System Version 5.0 Service Pack 2 Revision A. Users upgrading from earlier versions of System 800xA can continue to use VB6 graphics since they are still supported by the system. PG2 and VB6 graphics can coexist in parallel in the same system enabling a smooth transition to PG2.

PG2 does not require any third party software license since it is based on Windows Presentation Foundation (WPF), an inherent part of the operating system.

The recommended client hardware for good performance using PG2 is as follows:

- Workstation hardware with Windows 7 operating system.
- Dual core processor.
- 3 gigabytes of RAM.
- DirectX® 9.0 or greater.
- Video RAM - 120 megabytes or greater.

Display Call-up Time

The OPC Server for AC 800M collects data from controllers via MMS, and makes it available to OPC clients. Table 16 shows the display call-up time of a process display containing 100 objects, faceplates, and trend displays.

Table 16. Call-up Time for Displays

Graphic Displays	Display Call-up Time
Graphic Display with maximum 800 OPC items (100 objects)	≤ 1 secs.[1]
Group Display with 10 faceplates	≤ 5 secs.
Faceplate	≤ 1 secs.
Extended Faceplate	≤ 2 secs.
Trend Display, at first call-up of trend with 10 variables	≤ 2 secs. typical [2]

NOTE:
1. Graphic display references are cached after the first call up which makes subsequent display call ups faster. Each display in a system is cached after the first call up which means there is no limitation in the number of cached displays. The performance figure reflects a cached display.
2. When a trend display contains OPC string values (engineering units), the call-up time will depend on the OPC server string handling configuration. With the default configuration the call-up time will typically be higher.

For Multisystems, call-up times for displays, faceplates, trends, etc. in a subscriber system where provider data is subscribed, the time will be less than 1.2 (+20%) of the corresponding performance for a single system.

For remote clients the call-up time will be longer, and will depend on network performance, firewall performance, as well as how many clients are being served by the terminal server machine. As an indication, with five clients on a state of the art server, and under normal conditions for a 100 megabit/second network, call-up time may be up to 500 milliseconds longer than for regular client nodes.

Command Response Time

The Command response time (Table 17) is given as two values, one being the time from command in a faceplate until an I/O signal reacts in the controller, and the other from command in a faceplate until the feedback indication shows up on the faceplate. All values are first time call-up, and with Audit Trail off. Audit Trail on adds an additional 0.5 - 1 seconds.

Table 17. Command Response Time

Measurement	Response Time (Average)
Command to I/O	$\leq$ 1 sec.
Command to feedback indication	$\leq$ 2 secs. typical

VideONet Connect

Feature Pack Functionality

The VideONet Connect for 800xA is used to visualize and manage video cameras connected to the 800xA system through the VideONet Server. This enables the operator to have a live view of the process within the Operator Workplace.

The VideONet Connect for 800xA is a system extension to the 800xA system. The following are the features of VideONet aspects that belong to the VideONet Connect for 800xA:

- Connection to a VideONet Server.
- Video camera graphic elements for presentation in 800xA graphic displays.
- Video camera faceplates for configuring, recording, and generating log files for the video.
- Camera View aspect for playback and live view of video.

Camera to VideONet Server Communication

The IP cameras send data to one or several VideONet servers during continuous video recording. Communication increases for each camera with recording or active live stream.

One stream to a camera is shared between configured recording and all live streams to 800xA clients. This means that additional clients to a camera do not increase communication.

VideONet Server to 800xA Client Communication

The VideONet Server streams the requested video to the 800xA nodes. Communication increases for each recorder playback or live stream presented in an 800xA client, through a faceplate, graphic element or camera view.

It is recommended to use a separate network to setup the integrated 800xA and VideONet System, for the following reasons:

- Video consumes large bandwidth; 8-15 IP cameras consume 100 MBits/s.
- Lower risk of disturbances in the process network.

Higher resolutions, frame rates, and image quality requires more bandwidth. Each video stream consumes 1 to 15 MBits/s on the network depending on the camera type, video format, resolution, and frame rate. Refer Table 18 for details.

Table 18. Video Resolutions and Bandwidth

Video Format (MJPEG @ 80% quality)	**Recording disk space**			**Stream Bandwidth**	
		@ 1 fps	**@ 25 fps**	**@ 1 fps**	**@ 25 fps**
CIF (384x288)	< 30 KB/frame	< 100 MB/h	< 2.5 GB/h	< 250 Kbit/s	< 6 Mbit/s
VGA (640x480)	< 80 KB/frame	< 300 MB/h	< 7 GB/h	< 650 Kbit/s	< 16 Mbit/s
Full HD (1920x1080)	< 150 KB/frame	< 600 MB/h	< 14 GB/h	< 1250 Kbit/s	< 32 Mbit/s

NOTE:
In actual implementation these figures can be as much as 30% lower.

To calculate the bandwidth for a recording, take the average image size, multiply by 8 and frame rate. The average image size is available in **System > Status VnHistory** in the **VideONet Server** application.

Table 19. Video Performance

Parameters	Descriptions
Maximum number of streams per client*	50
Client memory allocation per stream, first connected stream	< 50 MB
Client memory allocation per stream, streams 2 -50	< 5 MB/stream
Maximum number of active cameras connected to one video server*	32
Typical Video Stream Bandwidth (server to client)	See above
Typical Video Stream Bandwidth (camera to server)	See above
Maximum number of video recordings per video server*	64
Maximum number of streams server to clients	128
Number of clients per recording	16
NOTES: * Depending on Client HW, bandwidth the actual number can be lower.	

Information Management

History Services

The Information Management History Services (Inform IT Service Provider for one Information Management node) can manage up to 50,000 history logs (combination of primary and secondary).

In a system, the maximum number of history logs is according to Table 5. The maximum number of history logs supported is dependent on the configured system including connectivity options, cycle times, and collection rates. Refer to [9], [10], [11], and [12] in Table 1 on page 19 for more detailed information.

Disk and Memory Capacity Requirements

Requirements are shown in Table 20, Table 21, and Table 22.

Table 20. System Limits and Capabilities - Information Management Server

Capability	Capacity
PDL Option - Additional disk capacity	4 Gbytes disk for Batch Management
PDL Option - Additional memory	256 Mbytes for large applications
Audit Trail Option - Additional Disk capacity	2 Gbytes additional disk

NOTE:
Estimated PDL space required in bytes = ab(c(JOB) + 484):
a = number of days to keep PDL data before deleting.
b = average number of jobs per day.
c = average number of tasks and subtasks per JOB where JOB = (366 + 366d + 366e + 366f).
d = average number of resource transactions per task (which transaction causes this).
e = average number of history associations per task.
f = average number of task variables per task. 366 and 484 are the number of bytes required in various tables per entity of that type. Estimated PDL message log size in bytes = 3776 * PDL message log capacity.

Table 21. System Sizing Examples - Information Management

System Requirements [1, 2]	Number of Disks (SCSI Recommended)	Disk Capacity (Gbytes)	RAM (Gbytes)
Base - Includes: 1,000 TYPE5 History logs with 1-min storage rate, 90-day period, one OPC message log w/1,000,000 message capacity, small PDL application	2	15	2
Up to 10,000 TYPE5 Logs	3	50	3

Table 21. System Sizing Examples - Information Management (Continued)

System Requirements [1, 2]	Number of Disks (SCSI Recommended)	Disk Capacity (Gbytes)	RAM (Gbytes)
Up to 50,000 TYPE5 Logs	4	200	4
Large PDL Application	—	4	0.5
Audit Trail	—	2	—
Large System - 50,000 logs and all options	4	208	4.5

NOTES:
1. TYPE5 logs are file based logs with a variable size.
2. The maximum space for flat files that IM can consume on a physical or virtual disk is 2 TB no matter how large the disk is.

Table 22. Information Management Server Capacity

Feature	AS+CS+Batch+IM (Combined Single Node)	Batch + IM Combined	Application Servers Separate
Maximum number of Primary History logs per server	200	1,500	30,000 [1]
Maximum number of History data points logged per min in IM	3,000	10,000	120,000
Maximum number of alarms/messages logged/sec per IM server	20	20	40
Maximum number of SoftPoints objects [2]	—	75	2,500
Maximum number of History data points collected from one connectivity server	200	1,500	10,000

Table 22. Information Management Server Capacity (Continued)

Feature	AS+CS+Batch+IM (Combined Single Node)	Batch + IM Combined	Application Servers Separate
Maximum number of calculations and execution rate	30 at 15/sec.	Maximum of 75 at 15/sec	Refer to Table 12 on page 57

NOTES:
1. Plus additional 20,000 secondary logs (calculated).
2. Refer to Base System Performance and Capacities on page 63 for additional details regarding Softpoints and Calculations.

Licensing of Information Management logs is based on the initial (primary) log for each signal that is stored in the Information Management server. Secondary logs are not counted as part of the license count.

Computing PDL Data Disk Space

Where:

a = number of days to keep PDL data before deleting.

b = average number of jobs per day.

c = average number of records (tasks) and subtasks per job.

A record is created for a job (campaign) another record is created for a batch. Every time a phase executes a new record is created. This also includes subprocedures.

d = average number of resource transactions per task.

Resource transactions are created as a result of following BMAs actions, Acquire, Reserve, Select, Release, Unreserved, Deselect. Each time one of those blocks execute a new resource transaction is sent to PDL. The database level Acquire is always matched with Release, Reserve with Unreserved and Select with Deselect. As a result there is a single record in PDL for each pair Acquire-Release pair.

e = average number of history associations per task.

Every time the Data Collection BMA with Start option is used a new history association is created.

Data Collection BMA blocks with the Once option does not create an association. An association links numeric trend data with the production data record.

f = average number of task variables per task.

There are approximately 12 task variables that get created every time a batch starts and ends. Each completed batch will have at least 12 variables associated with the batch. Every time a bdbput() function is used in an expression, a task variable would be created. All procedure and phase parameters are also recorded as task variables.

g = PDL message log capacity (number of messages), the PDL message log will store all events where the batch has acquired the equipment, basically a batch id is included in the message.

Estimated PDL space required in bytes = ab(c(366 + 366d + 366e + 366f) + 484) 366 and 484 are the number of bytes required in various tables per entity of that type.

Estimated PDL message log size in bytes = 3776*g. 3776 is approximately the number of bytes required per message.

Message sizes can vary.

Maximum Number of Entries Per Log (Nominal)

Log capacity and number of logs determine tablespace and disk requirements. The limits indicated in Table 23 should be sufficient for most applications.

Table 23. Entries Per Log

Log Type	Entries
TYPE1 - File-based 24-byte	5,000,000
TYPE2 - File-based 4-byte	32,000,000
TYPE3 - File-based 8-byte	16,000,000
TYPE5 - File-based variable size	315,000,000 (10 years of data at 1-sec sample rate)

Table 23. Entries Per Log (Continued)

Log Type	Entries
Oracle-based	50,000
OPC Message Logs	12,000,000 per log
Restored Logs	Limit based on available restored table space
Report Log	5,000 reports

History Collection Maximum Sample Rate

History Services can collect from different types of data sources, and limitations on sample rate are imposed based on the type of data source. These limitations are described in Table 24.

Table 24. Maximum Sample Rates

Collection Type	Rate [1]
Numeric data supplied manually and by data clients	350 - 400 values/sec
IM Primary History Log	30,000 logs at 120,000 samples/min
Consolidation Node (via TCP/IP)	50,000 logs at 60,000 samples/min

NOTE:

1. Actual performance is based on the platform where History software runs, and control system topology. Blocking rate and stagger function must be used to balance CPU loading.

Fastest Sample Rate and Timestamp Resolution

TYPE 1, 3, and 5 and Oracle-based logs support microsecond timestamp resolution and collection at a one-second sample rate. TYPE2 logs can also collect at a one-second rate; however, they support one-second resolution on timestamps.

Some connectivity servers may not support (be able to provide data at) the one-second sample rate. Refer to the applicable documentation for more detailed information.

Disk Requirements Per Log Entry

Disk space requirements for each History value stored are indicated in Table 25. As an example, Disk Space for TYPE1 Log with one minute storage interval, and 90-day log period would be as follows:

1,440 samples/day * 90 days = 129,600 samples
129,600 samples * 24 bytes/sample = 3.1 megabytes per log

Table 25. Bytes Required Per Log Entry

Log Storage Type	Bytes Per Entry [1]
TYPE1 file-based	24
TYPE2 file-based	4
TYPE3 file-based	8
TYPE5 file-based	16-32 based on data type (float, double, etc.)
Oracle-based Numeric	110
DCS Message in a message log	250
OPC Message in a message log (IMMSGLOG/PDLMSGLOG) [2]	3076

Table 25. Bytes Required Per Log Entry (Continued)

Log Storage Type	Bytes Per Entry [1]
Restored log entry	100

NOTE:
1. It is recommended to leave 5% to 20% extra capacity for expansion.
2. OPC message storage is based on the alarm/event generation for a system. Systems typically have an average event generation with occasional bursts of events. The average alarms per second (or hour or day) should be used to calculate the events per archive interval. The 3076 message size is also the average. Each system generates different types of events and the size can vary with messages being smaller and larger than 3076. Using 3076 as a starting point should allow for adequate initial calculations for archive usage.

History Objects Miscellaneous Capacities

Table 26 describes size limitations for composite logs, log sets, and archive groups.

Table 26. History Object Miscellaneous Capacities

Object	Size
Maximum number of Primary and Secondary Logs in a Composite Log	16
Maximum number of Logs in a Log Set	10,000
Maximum number of Logs in an Archive Group	10,000

History Archive

IM supports several methods to move archive information off the IM system. These options should be evaluated based on the archive data generated by the configuration.

Disk Archiving. Consider the following for disk archiving:

- Disk archiving requires local disk space to store archive data. Options exist to create ISO images, volume backups, or both.
- ISO images can be recorded to DVD or CDs and other ROM media types.
- The volume backups are copied to a local or remote destination. From this location, the information can be backed up with any appropriate method to transfer the data to the backup medium.

Cost Considerations for Permanent Storage of Archive Data. The amount of archive data generated will result in a certain cost for backing up archive data. However, the use of CD/DVD requires a separate step to burn the ISO image to CD/DVD. If a remote file server is used and the local IT department backs up the data, the information can be backed up with your organizations IT backup process. These options should be evaluated based on the configuration requirements, the data collected, convenience, and the cost per archive.

Display Services MDI (Multiscreen Display Interface)

Table 27. Multiscreen Display Interface

Feature	AS+CS+Batch+IM (Combined Single Node)	Batch + IM Combined	Application Servers Separate
Total MDI clients in a system	5	15	150
Maximum number of graphic display clients (MDI/SDI) per Basic Historian server	5	10	64
Total Excel Data Access clients in a system	5	15	150
Maximum number of Excel Data Access clients per Basic Historian server	5	10	64
Supported data rate feeding Multiscreen Display Interface [1]	—	200/sec nominal	
Maximum size of request returned by Excel Data Access	—	Functions: 5,460 elements/function call Dialogs: History - 500 history values/log SQL - 65,536 records	
Maximum rate for writing to process objects	—	1 value/sec	
Maximum rate for writing to history logs	—	5 values/sec	

Table 27. Multiscreen Display Interface (Continued)

Feature	AS+CS+Batch+IM (Combined Single Node)	Batch + IM Combined	Application Servers Separate
Maximum number of desktop trends	5	15	150
Maximum number per History server	5	10	64

NOTE:
1. Using LastHistoryValue option will minimize the load while providing near-realtime data

Desktop Trends

Table 28. Desktop Trends

Feature	Batch+IM Combined	Application Servers Separate
Maximum number of Desktop Trend clients in a system	15	150
Maximum number of Desktop Trend clients per Basic Historian Server	10	64
Maximum number of trends on a trend display	8 traces	8 traces
Maximum number of tags per Tag Explorer Group	50 tags	50 tags
Maximum number of tags per Ticker file	50 tags	50 tags
Maximum number of concurrent trend controls on one client	4	4
Trend display call-up from local Information Management server with eight trends	15 secs or less	15 secs or less

ODBC Client

Table 29. ODBC Client

Feature	Characteristic or Value

Table 29. ODBC Client (Continued)

Maximum number of ODBC-Client Connections in a system	60
Maximum number of ODBC-Client Connections per ODBC Historical Data Server	10

Open Data Access (ODA)- Excel Data Access (EDA)

Each ODA server supports up to 20 concurrent client connections. The maximum number of values for one query against History is unlimited. However, large queries may cause the client application (Crystal Reports or Microsoft Excel) to time out.

Batch Management

The following tables provide the tested capacities of a number of Batch Management features. If the deployed application will exceed one or more of these feature capacities, contact ABB Product Management for further consultation.

Using the virtualization host software with 800xA Batch Management server nodes affects the capacity levels through which the software can be supported. Refer to the related notes for each of the following tables.

The following table presents the capacities for Batch Management features that are controller independent. All times and rates are typical and dependent upon the connected system configuration and system load.

Table 30 details the capacities of Batch Management features.

Table 30. Batch Management Capacities (Controller Independent)

Feature	AS+CS+Batch+IM (Combined Single Node)	Batch+IM Combined	Application Servers Separate
Maximum Batch Equipment Of Any Controller Type (refer to specific controller type capacities as shown in Table 31, Table 32, Table 33, and Table 34)	30[3]	150[3]	300[3]
Maximum Batch Equipment Of Type Pseudo	50[3]	100[3]	200[3]

Table 30. Batch Management Capacities (Controller Independent) (Continued)

Feature	AS+CS+Batch+IM (Combined Single Node)	Batch+IM Combined	Application Servers Separate
Total Batch Equipment Defined in System	50[3]	150[3]	300[3]
Active Control Recipe Procedures [1]	20[3]	50[3]	100[3]
Procedure Execution (procedure block transitions, all levels) [1]	30 procedure block transitions/sec (burst) [2, 3] 3 procedure block transitions/sec (sustained) [2, 3]		
Control Recipe Procedure Execution [1]	Maximum 100 control recipe procedure completion events per day (24 hour period)[3]		
“Get” Batch/DBA Functions [1]	Maximum 50 “Get” functions executed within a 5 min period[3]	Maximum 100 “Get” functions executed within a 5 min period[3]	
“Put” Batch/DBA Functions [1]	Maximum 50 “Put” functions executed within a 5 min period[3]	Maximum 100 “Put” functions executed within a 5 min period[3]	

NOTES:
1. All times and rates are typical and dependent on the connected system configuration and system load.
2. Transition means the completion of one procedure block until the start of the next procedure (for blocks that do not access the OPC server or communicate with the controllers).
3. This value is reduced by 50% when virtualization host software is used for the 800xA Batch Management server node. For maximum performance and capacities, physical server nodes must be used.

Table 31, Table 32, Table 33, Table 34, and Table 35 show the Batch Management feature capacities that are dependent upon the controller deployed.

Table 31. Batch Management Capacities (AC 800M Controller)

Feature	AS+CS+Batch+IM (Combined Single Node)	Batch+IM Combined	Application Servers Separate
Batch Equipment of type Advanced AC 800M or EPT	30[2]	150[2]	300[2]
Active Phases (executing in the system controller(s)) [1]	60[2]	100[2]	300[2]

Table 31. Batch Management Capacities (AC 800M Controller) (Continued)

Feature	AS+CS+Batch+IM (Combined Single Node)	Batch+IM Combined	Application Servers Separate
Controller Phase State Transitions [1]	Maximum 100 controller phase transitions executed within a 5 min period[2]	Maximum 100 controller phase transitions executed within a 5 min period[2]	

NOTE:
1. All times and rates are typical and dependent on the connected system configuration and system load.
2. This value is reduced by 50% when virtualization host software is used for the 800xA Batch Management server node. For maximum performance and capacities, physical server nodes must be used.

Table 32. Batch Management Capacities (MOD300 Controller)

Feature	Batch+IM Combined	Application Servers Separate
Batch Equipment of type MOD300	25[2]	50[2]
Active Phases (executing in the system controller(s)) [1]	50[2]	100[2]
Controller Phase State Transitions [1]	Maximum 100 controller phase transitions executed within a 5 min period[2]	

NOTE:
1. All times and rates are typical and dependent on the connected system configuration and system load.
2. This value is reduced by 50% when virtualization host software is used for the 800xA Batch Management server node. For maximum performance and capacities, physical server nodes must be used.

Table 33. Batch Management Capacities (DCI Controller)

Feature	Batch+IM Combined	Application Servers Separate
Batch Equipment of type DCI	25[2]	50[2]
Active Phases (executing in the system controller(s)) [1]	50[2]	100[2]

Table 33. Batch Management Capacities (DCI Controller) (Continued)

Feature	Batch+IM Combined	Application Servers Separate
Controller Phase State Transitions [1]	Maximum 100 controller phase transitions executed within a 5 min period[2]	

NOTE:
1. All times and rates are typical and dependent on the connected system configuration and system load.
2. This value is reduced by 50% when virtualization host software is used for the 800xA Batch Management server node. For maximum performance and capacities, physical server nodes must be used.

Table 34. Batch Management Capacities (Harmony Controller)

Feature	Batch+IM Combined	Application Servers Separate
Batch Equipment of type Harmony	25[2]	50[2]
Active Phases (executing in the system controller(s)) [1]	50[2]	100[2]
Controller Phase State Transitions [1]	Maximum 50 controller phase transitions executed within a 5 min period[2]	

NOTE:
1. All times and rates are typical and dependent on the connected system configuration and system load.
2. This value is reduced by 50% when virtualization host software is used for the 800xA Batch Management server node. For maximum performance and capacities, physical server nodes must be used.

Table 35. Batch Management Capacities (AC 870P/Melody Controller)

Feature	Batch+IM Combined	Application Servers Separate
Batch Equipment of type Melody	150[2]	300[2]
Active Phases (executing in the system controller(s)) [1]	50[2]	100[2]

Table 35. Batch Management Capacities (AC 870P/Melody Controller) (Continued)

Feature	Batch+IM Combined	Application Servers Separate
Controller Phase State Transitions [1]	Maximum 100 controller phase transitions executed within a 5 min period[2]	

NOTE:
1. All times and rates are typical and dependent on the connected system configuration and system load.
2. This value is reduced by 50% when virtualization host software is used for the 800xA Batch Management server node. For maximum performance and capacities, physical server nodes must be used.

Use of Function Phase Driver

Function Phase Driver is a user configurable application which maps batch states, commands and parameters between the batch server and user defined OPC points representing the interface to an equipment phase in a PLC or other process controller. This feature is quite useful in process applications that include one or more process equipment skids that are supplied and installed with equipment manufacturer supplied controllers.

The Function Phase Driver is configured in the same manner as other batch expressions and functions utilizing the same batch variables and commands available in the expression editor and function wizard. Although an equipment phase programmed using the function phase driver is represented in the procedure function chart (PFC) as a standard phase type, the recipe manager processes and executes the commands in a manner similar to that of transitions and other programmed batch expressions.

Function Phase Driver - Performance Considerations

The impact of the function phase driver on the recommended limits on the processing of "get" and "put" commands presented in Table 30 must be considered. Actual performance and time duration for the processing of the phase commands from the batch server to the controller is dependent upon:

- The quantity of OPC points being processed for each phase.

- The configured function phase driver logic for the sequencing and processing of the commands and OPC points.
- The configured OPC update rate between the connectivity server and controller.

In many cases, the function phase driver programming limits the ability of the recipe manager to process the starting of multiple phases in parallel if so specified in the recipe procedure. The typical performance for a parallel branch specifying the start of two or more phases (using function phase driver) is that the phase starts will be processed serially, one after the other. This is different from the behavior when specifying the start of two or more phases (using a phase driver of type AC 800M, MOD 300, DCI, or Harmony) in a parallel branch, which will process multiple phase start commands in parallel.

Table 36 details AC 800M RAM usage for the Batch Advanced Templates library.

Table 36. AC 800M RAM Usage for BatchAdvTemplatesLib

Module	Type [1] (Kbytes)	Instance (Kbytes)
Unit [2]	73	7.5
Unit Attribute String [3]	—	0.7
Unit Attribute Float [3]	—	0.5
Unit Attribute Integer [3]	—	0.5
SEM with Server Communication Module [2]	78	12
SEM Attribute String [3]	—	0.7
SEM Attribute Float [3]	—	0.5
SEM Attribute Integer [3]	—	0.5
SEM Server Ext Comm Module	80	8.5
SEM Client Comm Module	77	10.5
Phase 2[2]	54	7.5
Phase Parameter String [2]	—	0.7

Table 36. AC 800M RAM Usage for BatchAdvTemplatesLib (Continued)

Module	Type [1] (Kbytes)	Instance (Kbytes)
Phase Parameter Float [2]	—	0.5
Phase Parameter Integer [2]	—	0.5
AE Named Value Item Numeric	—	0.1
AE Named Value Item String	—	0.17

NOTES:
1. Memory for type is allocated by the first existing instance in the controller, and is reused by all subsequent instances within the same controller.
2. These estimates are based on modules as delivered in BatchAdvTemplatesLib templates (no user logic).
3. The estimates for attribute and parameter modules assume that all ranges and description are configured to the maximum size.

PC, Network and Software Monitoring (PNSM)

The recommended maximum capacity for a single PC, Network and Software Monitoring Connectivity Server is dependent on what node the server is running and the power of the computer running the PNSM Server. Use a dedicated, powerful server, such as one with a dual multi core CPU, for larger configurations.

The working recommendations for computers on the System 800xA hardware certification list are:

- On its own connectivity server the limit is 150 PNSM assets with no more than 50 being SNMP devices.

Refer to [8] in Table 1 on page 19 for more information on SNMP devices.

- On a connectivity server being shared with another product the recommended limit is 50 assets with no more than 10 being SNMP devices.

Distribution of the PNSM Server on several nodes is another alternative with several options:

- Spread the PNSM Assets over multiple PNSM Server nodes (multiple PNSM Connectivity Server). This is accomplished by spreading the PNSM Assets in subdirectories of the IT Control structure and then creating and configuring additional OPC Data Source Definition for each main level of the subdirectories.

- Use Assets from the PNSM Device Library when possible.

Asset Optimization

Asset Monitoring Engines provide the execution environment for Asset Monitors. The startup time for Asset Monitoring Engines is dependent on the size and configuration of System 800xA. Factors affecting startup time include the number of Asset Monitor conditions and the number of Aspect Server nodes.

The Asset Monitor execution time is determined by the type of Asset Monitor. A simple Asset Monitor such as Bool Check, Running Time Check, or a field device Asset Monitor executes faster than a complex Asset Monitor such as CLAM or HXAM. An Asset Monitor with an active condition and an Auto Fault Report executes slower than the similar Asset Monitor without an Auto Fault Report.

An Asset Monitor detects a change in input data at a rate defined by the OPC Group Update rate. Asset conditions are evaluated at every execution cycle.

For maximum configuration limits, refer to Table 12.

Control Loop Asset Monitoring (CLAM)

System 800xA supports up to 500 control loops for monitoring. CLAM license is scalable from 100 to 500 control loops. The unlicensed version of CLAM only reports the overall health of the loop and the final control element, but does not provide detailed diagnostic information.

The licensed version of CLAM provides detailed diagnostic information about the final control element and loop performance as listed in the following.

- Final control element diagnostics include the following:
  - FCE Action.
  - FCE Leakage.
  - FCE Size.
  - FCE Stiction/Backlash.
  - Loop Nonlinearity.
- Loop performance diagnostics include the following:
  - Loop Tuning.

- SetPoint Oscillation.
- External Disturbances.
- Data Reliability.
- Harris Index.
- Setpoint Crossing Index.
- Oscillation Index.
- Controller Output Saturation.
- Manual Mode.
- Cascade Tracking.
- Response Speed.

Fieldbus

FOUNDATION Fieldbus Configuration Rules

The FOUNDATION Fieldbus basic layout rules are given in the Table 37.

Refer to FOUNDATION Fieldbus HSE Limitations and Performance on page 142 for more information.

Table 37. FOUNDATION Fieldbus Basic Layout Rules

Communication	Communication Unit	Data
HSE (High Speed Ethernet)	Maximum number of publish/subscriber signals per CI860	1,000 signals overall out of: - Max. 1,000 for analog input - Max. 500 for analog output - Max. 500 for discrete input - Max. 250 for discrete output
	Maximum no. of CI860 in an AC 800M (CEX Bus)	12 (a redundant pair consumes two of them)
	Maximum number of Linking Devices per HSE Subnet	30
	Maximum number of HSE Subnets per Connectivity Server	4 (each HSE Subnet requires 1 OPC Server FF, max 4 OPC Server FF per CS)
H1	Maximum no. of devices per H1 Link	16 (application dependent) [1]
	Maximum no. of publish/subscriber signals in total between one H1 Link and HSE	100
	Maximum no. of publish/subscriber signals/sec per H1 link between H1 and HSE	40 signals/sec
Access to contained FF Block parameters via CI860 Client/Server communication	to maximum number of LDs	30
	to maximum number of devices	150
	Maximum number of signals	300

Table 37. FOUNDATION Fieldbus Basic Layout Rules (Continued)

NOTE:
1. FOUNDATION Fieldbus recommendations for H1 segment layout is maximum 12 devices with up to 4 valves. Refer to the System Engineering Guidelines AG-181 issued by the Fieldbus Foundation.

Wireless HART

Wireless HART limitations and performance is described in a separate document. Contact ABB support for further information.

AC 800M Status Monitoring

Feature Pack Functionality

In a system, the maximum number of hardware that can be monitored using AC 800M Status Monitoring aspect is according to Table 5 on page 51 and Table 10 on page 55.

Multisystem Integration

Multisystem Integration (MI) allows the viewing and operating of objects configured in one system (provider) from another system (subscriber).

Geographically separated systems with local control rooms can be controlled from a common control room. MI enables sectioning of a multiline process to increase integrity and simplify maintenance. A common setup is to have one subscriber and several providers, but each provider system can also serve multiple subscriber systems in order to share a common resource (provider).

A subscriber requires one Remote Access Client (RAC) per provider system. Each provider requires a Remote Access Server (RAS). The RAC and RAS can be installed in separate nodes or combined with other services depending on system size.

MI is for operation, not for engineering. All engineering is done locally on each connected system.

The central licensing system (CLS) is local to each system. Each system is ordered separately, and a separate license file is fetched for each system from the Software

Factory. This also means that each system is managed individually regarding updates and upgrades, as well as initial system installation.

Supported System Functions

There is no limitation as to which system functions can be installed and used in a Subscriber System. The normal configuration rules apply.

For a Provider System certain limitations apply as follows:

- Information Manager can be used. Log consolidation must use the IM consolidation feature. MI does not transfer any data in between IMs in the different systems.
- Batch can be used, and is local to each provider (or subscriber). Batch communication with Control is not supported across multiple systems.
- PNSM is local to the provider system (or subscriber). There is no support for PNSM across multiple systems.

Supported Connects

The following connects are fully supported for Multisystem Integration:

Contact ABB technical sales support for advice on connects not listed.

- 800xA for AC800M.
- 800xA for Advant Master.
- 800xA for Harmony.
- 800xA for AC 870P/Melody.
- 800xA for MOD 300 (ADHOC subscriptions not supported).
- 800xA for Safeguard.
- PLC Connect.

Feature Pack Functionality

- Foundation Fieldbus.
- IEC 61850.

Configuration Rules

This describes the configuration limits for MI Function.

Subscriber System

In the subscriber system, all specifications valid for a local system applies. In a large subscriber system connected to several providers, attention must be paid to the total tag count (includes the local and uploaded tags).

Consider the number of provider connections that is possible to have per server (Table 38).

Table 38. Subscriber System Specification

Feature	AS + CS Separate (Subscriber)	AS + CS Combined (Subscriber)
Number of providers (RAC processes) per server	5	3

Provider System

The limiting factor is the load that the clients in the subscriber system will add to the provider system. Each workplace in the subscriber system is viewed as an external OPC client to the provider system. If several subscribers are connected to one provider the load of the all the workplaces in the subscriber systems must be considered. Calculations must be done to ensure that the connectivity server(s) in the provider system can handle the load. The Table 39 on page 91 displays the limit that the Multisystem Integration adds to the number of workplaces.

Table 39. Provider System Specification

Feature	AS + CS Separate (Subscriber)	AS + CS Combined (Subscriber)
Total Number of Workplaces	Depends on General Configuration Rule	8

General

A RAS/RAC may be combined with other services in the same node as described below but it is generally not recommended to add a RAS/RAC to any node with a base CPU load that exceeds 30%. It is recommended to increase the RAM to 4 GB in a combined RAC/RAS and CS.

It is possible to use a bandwidth down to 512 kilobits/second between a Provider and Subscriber but tests has shown that display call-up times increase drastically when using bandwidths below 1 Megabit/second.

Upload/Clean

It is recommended to upload maximum 5000 objects per upload session in order not to increase the load in the Subscriber system to a limit where it will become unresponsive. The Clean operation in the subscriber removes all objects uploaded from one Provider, since the impact may be an unresponsive system this is a potentially dangerous operation. Since it is not possible limit the number of object removed the recommendation is to only use Clean when the system is in maintenance phase. If all uploaded objects needs to be removed in a running system, Delete can be used to remove smaller portions of the objects at a time.

Compatibility between the Releases

Multisystem Integration has a possibility to communicate between providers and subscribers with different version. However, the subscriber must have the same or higher version as the provider with the highest version. Restrictions might apply for specific revisions, refer to compatibility matrix *Multisystem Integration version compatibility (3BSE066471*)*.

Configuration Examples

Figure 11 shows an example.

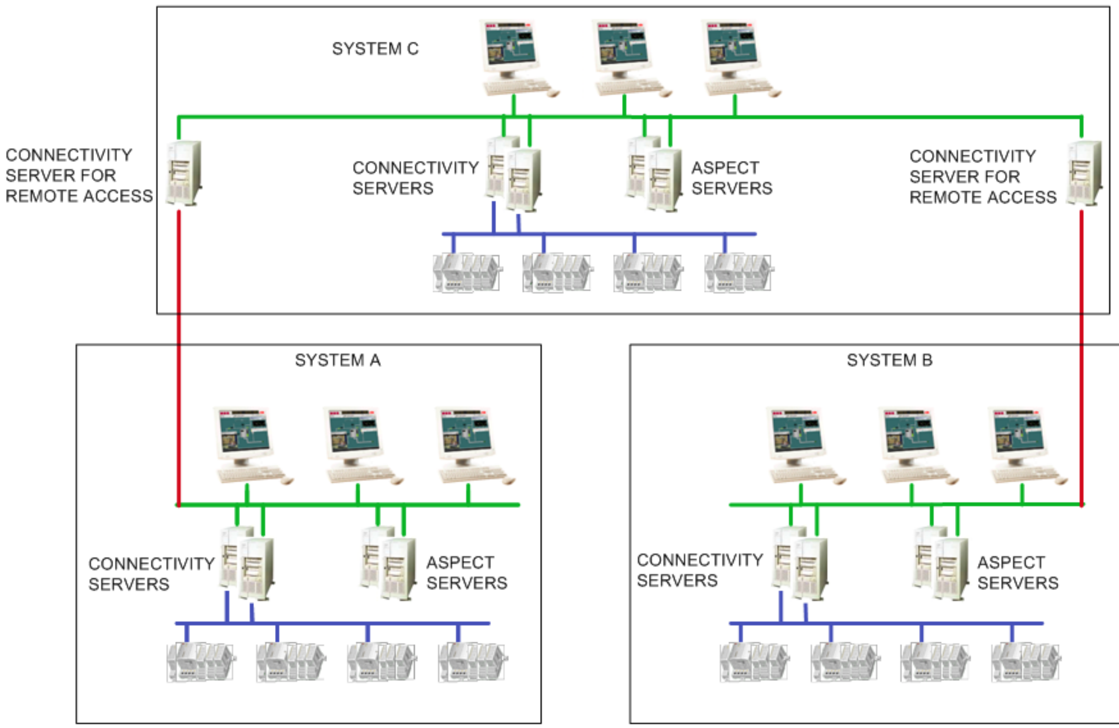

Figure 11. Multisystem Integration Configuration Examples

PLC Connect

Refer to Table 40 and Table 41 for general characteristics.

Table 40. PLC Connect General Characteristics

Characteristic	Specification
Supported System 800xA Configurations	Full-size, operating system optimized (medium size), server optimized (small size), and single node.
Maximum number of Connectivity Servers per system	3 (6) for dedicated Connectivity Servers 1 (2) for combined servers
Maximum number of PLC Connect signal objects in one PLC Connect Connectivity Server running in a separate node (large or medium size system)	25,000
Maximum number of PLC Connect signal objects in a server optimized or single node configuration (small or single node system)	Refer to system constraints.
Maximum number of serial channels used in one PLC Connect Connectivity Server for dialed communication with PLCs via Comli or Modbus Serial	10
PLC Connect Real Time Data Access	Set of Visual Basic and C++ methods for user written applications.
Communication Server Pre Treatment	Template dll with methods for user written applications in Visual Basic.
Event Server Pre Treatment	Template dll with methods for user written applications in Visual Basic.
Event Extended Options	OLE interface for integrating an application that is to be executed on an event.
PLC Connect properties	Most properties of the PLC Connect configuration aspects can be accessed via OPC or by the Bulk Data Manager.

Table 40. PLC Connect General Characteristics (Continued)

Characteristic	Specification
Dial Manager Server Access	Com interface for initiating and disconnecting calls handled by the Dial manager for dialed communication with PLCs.
Redundancy	Redundant pairs of parallel executing PLC Connect Connectivity Servers are supported. Configuration data is stored in the Aspect Directory. Aspect Server redundancy in 800xA covers PLC Connect Configuration Data.
Audit Trail	Audit of PLC Connect Configuration changes are supported. Re-authentication and double Authentication is supported for PLC Connect signals.
Remark	PLC Connect can be combined with AC 800M Connect in the same connectivity server in a small size or single node system.

Table 41. PLC Connect Characteristics

Characteristic	Specification
PLC Connect signal types	Boolean, integer, long integer, real, double, string
Supplied Faceplate templates for PLC Connect object types	3 variants
Supplied set of graphic elements for PLC Connect objects	16 variants
The time from a change of a value in the communication server until an indication on the screen	Typically less than 2 secs for a polled 9.6 Kbaud serial protocol.
Built in PLC protocol drivers	Modbus RTU Serial, Modbus TCP/IP, Comli, Sattbus over TCP/IP, and OPC DA client (2.05A)

Performance Data

PLC Connect performance data is listed in Table 42.

Table 42. PLC Connect Communication Characteristics

Characteristic	Specification
Time from a process change until signal is available in PLC Connect communication server.	Dependant on several parameters: Speed of field-bus used. Other products used (3rd party OPC servers). Requested update cycle time set in PLC Connect. Total number of signals using the available system capacity.
Time from a value change in PLC Connect communication server until an indication on screen.	Typically less than 2 secs for a polled 9.6 Kbaud serial protocol.
Time from a manual control in the process graphics until a value change on a terminal in PLC.	Typically less than 1 sec for a polled 9,6 Kbaud serial protocol.

Alarm and Event Performance Data

PLC Connect alarm and event performance data is listed in Table 43.

Table 43. PLC Connect Communication Characteristics

Characteristic	Specification
Continuous alarm load.	25 alarms/events/sec
Burst capabilities.	1000 alarms/events every 10 mins (as long as the continuous load is less than 25/sec)

System Configuration Examples

In the following two examples the “rules” defined above are applied to determine how to configure a system optimized on number of nodes.

Asset Optimization is not supported on a AS/CS/IM/Batch combined single node.

Example 1

The following requirements are assumed. Refer to Figure 12 for more detailed information.

- 5 Operator workplaces, one of which is also used as engineering workplace.
- 600 Tags.
- Batch.
- IM.
- 2 AC 800M Controllers.
- FOUNDATION Fieldbus with 300 Devices.
- 2 controller CPU licenses.
- Redundancy is required for Aspect and Connectivity Servers.

Applying the configuration rules defined in previous sections gives the following:

- To reduce the number of nodes a 1oo2 redundant combined Aspect and Connectivity server (AS+CS) is used.
- Since Batch redundancy is not required, it is also possible to use a combined Batch and IM server (Batch+IM).
- 2 AC 800M controllers are below the maximum number of controllers that can be connected to a combined AS+CS node.
- 300 FOUNDATION Fieldbus Devices, 2 controller CPU licenses, and 600 tags are all below the maximum numbers allowed for combined AS+CS node (maximum is 1,000 devices, 20 controllers, and 15,000 Tags).

Number of Nodes Needed

- 1 redundant pair of servers AS+CS. These nodes also serve as two Client nodes.

- 1 combined Batch+IM Server.
- 3 additional clients (one of which is also used as engineering workplace).

This sums up to a **total of 5 nodes**.

Domain or Workgroup

If the system is configured as a domain, an additional node (two for redundancy) is required for the Domain Server. A relatively small configuration like this may work well as a workgroup, however, if the system is later expanded with more computers and more users, the workgroup will become increasingly difficult to administrate.

Operating System

The operating system on all nodes except the Batch/IM node may be workstation OS. The Batch+IM server and Domain server require Server Operating System. Figure 12 shows the node layout for the system specified in this example.

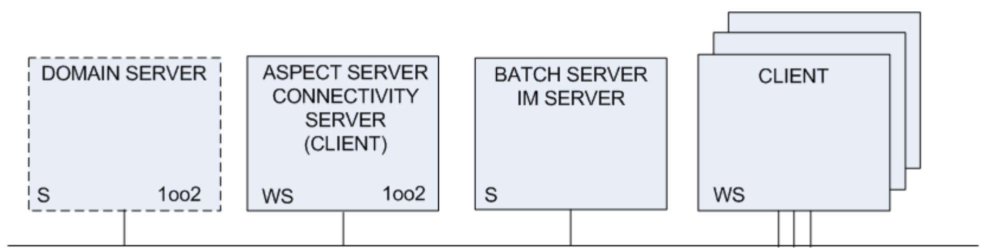

Figure 12. Configuration - Example 1

Example 2

The following requirements are assumed:

- Number of seats:
  - 21 workplaces. All of these shall be operator workplaces, 8 of them shall also function as engineering workplaces.
  - 5 Remote workplaces.

- Functionality:
  - Batch.
  - Information Manager.
  - Asset Optimization.
- Size:
  - 20,000 Tags.
  - 20 AC 800M Controllers.
  - 2 Harmony Controllers.
  - FOUNDATION Fieldbus with 2,500 Devices.
  - 20 controller licenses.
- Redundancy is required for all server functions (except AO).

Applying the configuration rules defined in previous sections gives the following:

- This system size must be built with basic node types (combined node types can not be used).
- 1oo2 redundant Aspect Servers are selected.
- Twenty AC 800M controllers require, according to the default rule (maximum 12 controllers per connectivity server (CS)), two redundant pairs of CS. However there is also an *optimized rule* that takes into consideration the actual load on the CS based on a more detailed calculation. These CSs can also handle 1,000 FOUNDATION Fieldbus devices each (AC 800M and FOUNDATION Fieldbus connect services can be combined in the same CS, and the redundant pair counts as logically one server).
- 2500 FOUNDATION Fieldbus devices require one Connectivity Server pair with three OPC Server FF instances connected to three HSE Subnets with max 1000 devices each.
- Two Harmony controllers require one separate redundant pair of Connectivity Servers.
- One redundant pair of Batch Server is needed.
- One pair of IM Server is needed.
- The AO service is run on the connectivity servers. No extra nodes required.
- Five remote clients require one Remote Client server.

Number of Nodes Needed

2 Aspect Servers, redundant (including Domain Controller).
4 AC 800M + FOUNDATION Fieldbus Device Connectivity Servers, redundant.
2 FOUNDATION Fieldbus Device Connectivity Servers, redundant.
2 Harmony Connect Servers, redundant.
2 Batch Servers, redundant.
2 IM Servers.
21 Client nodes assuming 8 clients will be server based.
1 Remote Client Server.
(5 Remote Clients.)
----
36 nodes in total.

Domain or Workgroup

A system this size is practically impossible to manage and maintain as a workgroup. A redundant Domain Server is needed, but which can be installed in the Aspect Servers (two of them for redundancy).

Operating System

All server nodes require Server Operating System, since the number of nodes exceeds 11. Client nodes run Windows 7. Figure 13 shows the node layout for the system specified in this example.

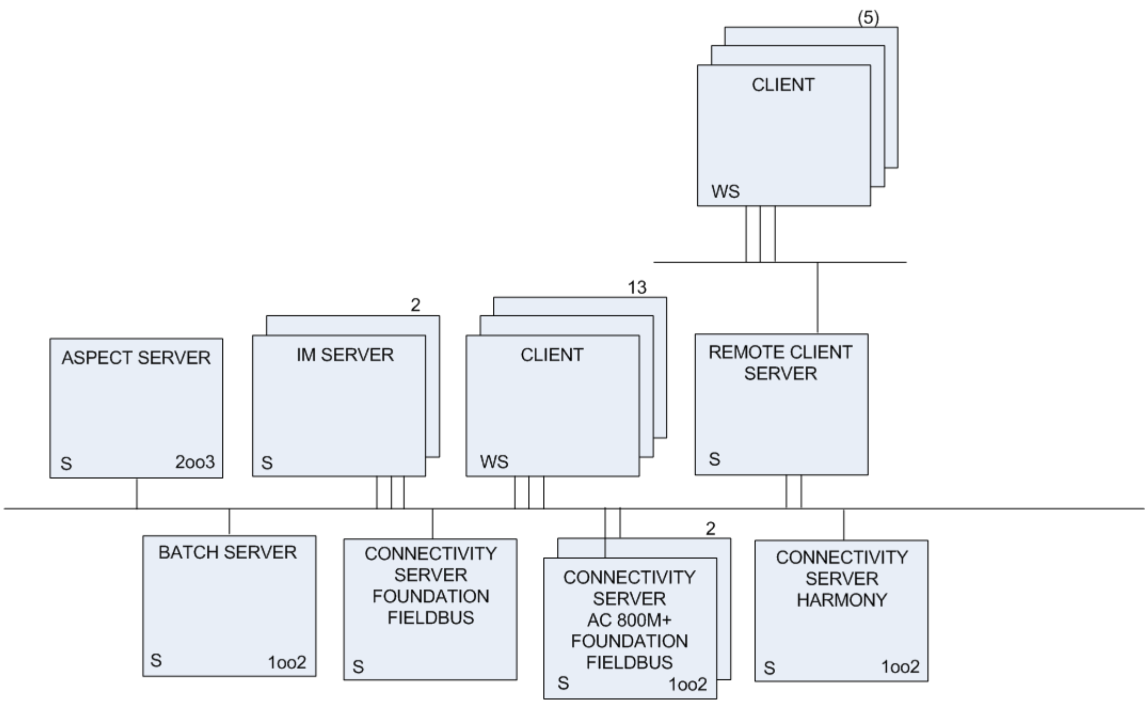

Figure 13. Configuration - Example 2

Example Connectivity Throughput Calculations

These calculations are made by the 800xA Wizard.

The following examples illustrate different load cases where a single Connectivity Server is used to the maximum of its capability. For redundant servers one of them need to be able to take the full load in the event of a failure, which means the dimensioning rules and the examples below apply also for a redundant configuration:

Example 1, graphics subscription only, at 1 second update rate:

- 15 clients with 2 screens each (30 screens).
- Each displays has 1000 OPC items each.
- Each display is configured for1 second update rate.

Graphics: 30,000 OPC items in total.

Example 2, graphics subscription only, at different update rates:

- 25 clients with 2 screens each (50 screens), out of which:
  - 10 screens with displays with 1000 OPC items each. 1 second update rate.
  - 20 screens with displays with 1000 OPC items each. 3 second update rate.
  - 20 screens with displays with 1000 OPC items each. 6 second update rate.

Graphics: 50,000 OPC items in total.

Example 3, combined graphics subscription and primary logs:

- 15 clients with 2 screens each (30 screens), out of which:
  - 10 screens with displays with 1000 OPC items each. 1 second update rate.
  - 10 screens with displays with 1000 OPC items each. 3 second update rate.
  - 10 screens with displays with 1000 OPC items each. 6 second update rate
- 800 primary logs at 1 second.
- 4400 primary logs at 10 seconds.
- 4800 primary logs at 30 seconds

Graphics: 50,000 OPC items in total.
Primary logs: 10,000 logs in total.

Example 4, combined graphics subscription, Information Manager logs, and external subscription:

- 5 clients with 2 screens each (10 screens), out of which:
  - 4 screens with displays with 1000 OPC items each. 1 second update rate.
  - 4 screens with displays with 1000 OPC items each. 3 second update rate.
  - 2 screens with displays with 1000 OPC items each. 6 second update rate
- 500 Information Manager/primary logs at 1 second.

- 1750 Information Manager/primary logs at 10 seconds.
- 2750 Information Manager/primary logs at 30 seconds.
- 10,000 OPC items external client subscription, out of which:
  - 3500 at 10 seconds.
  - 6500 at 30 seconds.

Graphics: 10,000 OPC items in total.
Primary logs: 5,000 logs in total.
External clients: 10,000 OPC items in total.

Section 3 Control and I/O

This section presents performance and technical data for Control Software and Control Builder key functions, configuration, and items.

The information given is valid for AC 800M with 5.1 Feature Pack 4.
Late changes might affect performance and/or functionality. For information on late changes and restrictions on the use of the product, please refer to the Release Notes.

Memory and Execution Performance

Memory Size

Figure 14 shows the memory organization. The total physical memory less the executing firmware is called “Memory size” by the “SystemDiagnostics” function block. This amount of memory is sometimes also called the “heap”.

The memory usage is also displayed in the Control Builder Heap Utilization dialog which can be displayed for each controller. The available memory is called “Non-Used Heap” and the rest is called “Used Shared Heap”.

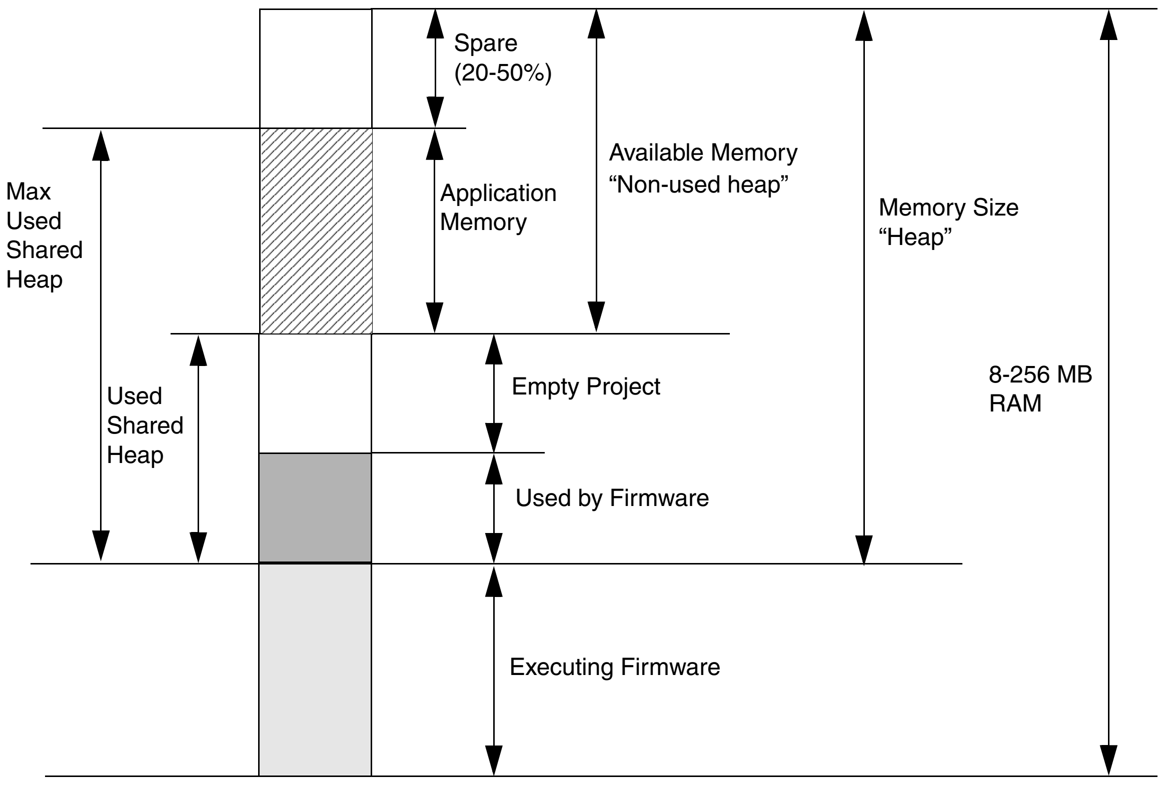

Figure 14. The Memory Organization

Available Memory

The amount of free memory in the controller decreases when the controller has started up, and an empty project has been downloaded from Control Builder M.

The remaining memory is what can be used for application code, and is hereafter referred as to “Available memory”.

The measurement results in Table 44 are made with IAC, but without any configured communication protocols and CEX units. Memory consumptions for used protocols and CEX units have to be added, according to Table 45.

Table 44. Available RAM Memory and Performance in AC 800M Controller (without Protocol Handlers)

Controller	Execution Performance Factor	Total RAM (kbytes)	Firmware and an Empty Project (kbytes)	Available Memory (kbytes)
PM851	0.5	8192	5909	2282
PM851A	0.5	12288	5916	6372
PM856	0.5	8192	5909	2282
PM856A	0.5	16384	5928	10456
PM860	1.0	8192	5909	2282
PM860A	1.0	16384	5927	10457
PM861	1.0	16384	9063	7320
PM861A	1.0	16384	9063	7320
PM864	1.5	32767	9104	23663
PM864A	1.5	32767	9104	23663
PM865	1.5	32767	9105	23662
PM865 SM810	0.9	32767	10352	22415

Table 44. Available RAM Memory and Performance in AC 800M Controller (without Protocol Handlers)

Controller	Execution Performance Factor	Total RAM (kbytes)	Firmware and an Empty Project (kbytes)	Available Memory (kbytes)
PM865 SM811	0.9	32767	10382	22386
PM866	2.1	65535	14133	51402
PM891	4.5	268032	68798	199233

Table 45. Memory Consumptions of Protocols and CEX Units

Protocol/ CEX Unit	PM864		PM866		PM891	
	First Unit (kbytes)	Next Unit (kbytes)	First Unit (kbytes)	Next Unit (kbytes)	First Unit (kbytes)	Next Unit (kbytes)
MODBUS RTU	74	13	74	16	63	5
COMLI	69	16	68	19	57	3
S3964R	61	14	60	15	52	4
SerialLib	59	18	59	18	47	6
IAC*	176		175		163	
UDP	36		35		35	
TCP	45		44		44	
CI853	4	4	4	3	4	4
CI854	233	30	234	29	150	12
CI855	96	11	96	11	88	3
CI856	96	10	95	12	89	2
CI857	177	13	178	12	169	4
CI858	59	19	60	18	47	9

Table 45. Memory Consumptions of Protocols and CEX Units

Protocol/ CEX Unit	PM864		PM866		PM891	
	First Unit (kbytes)	Next Unit (kbytes)	First Unit (kbytes)	Next Unit (kbytes)	First Unit (kbytes)	Next Unit (kbytes)
CI860	427	149	428	150	308	96
CI862	54	5	55	5	55	3
CI865	126	73	126	86	125	74
CI867	164	36	164	36	163	34
CI868	197	63	197	64	127	4
CI869	183	64	183	63	124	3
CI871	192	25	191	26	118	16
CI872	232	70	232	69	173	10
CI873	223	102	223	100	164	42
NOTE: *In addition, each communication connection requires about 40 kbytes memory.						

Execution Performance

Cyclic CPU load is calculated as a percentage using the following formula.

Cyclic CPU load (%) = 100(Total execution time / Total interval time)*

Depending on the amount of code and requested task interval times, applications may demand up to 70% of CPU capacity (never more)[1]; the execution of IEC 61131-3 code is called *Cyclic Load*. Should an application require more than

1. This is **not** true if load balancing is set to false or if you run with an AC 800M HI. The controller will run until it is forced to stop.

70% of CPU capacity, the task scheduler automatically increases the task interval times to re-establish a 70% load.

Load balancing can be disabled (see the manual *AC 800M Configuration (3BSE035980*)*. In a High Integrity Controller, load balancing is always replaced by overrun and latency supervision.

It is important to consider CPU load if communication handling is vital to the application. Running at the maximum cyclic load will result in poor capacity and response times for peer-to-peer and OPC Server communication.

Communication handling has the lowest priority in a controller. It is therefore important to consider controller CPU load if the communication handling is vital to the application. Running close to 100% total load will result in poor capacity and response times for peer-to-peer and (OPC Server for AC 800M) communication. It is recommended that peak total load will be kept below 100%.

Among the communication protocols, the IAC MMS protocol will be the last to be affected if there is a communication data starvation.

CPU load is also influenced by other factors, such as Modulebus scan interval and the number of modules on Modulebus (AC 800M), or the scanning of ABB Drives.

The PM860/PM860A and PM861/PM861A processor units have the same internal design and the same performance when execution application program.

The PM851/PM851A, PM856/PM856A and PM860/PM860A processor units have the same internal design. They differ only in performance when executing an application program. The execution time in PM851/PM851A and PM856/PM856A is approximately two times the execution time in PM860/PM860A.

The PM864/PM864A and PM865 processor unit, in single configuration, has performance data which theoretically peaks at twice the performance compared to the PM860/PM860A. The useful sustained performance improvement is, however, a bit lower and dependent on the actual application program but can be expected to be 10 to 50% compared to PM860/PM860A. The difference in execution performance is dependent on how much CEX bus accesses, and how much communication is running in the controller (both communication running as CEX bus interfaces and communication running on the built in ports on the CPU i.e. ModuleBus Ethernet and RS-232). CEX bus access and communication decreases execution performance.

In redundant configuration the execution performance is lower than in single configuration (reduction is typically less than 10%). Switch over time from primary controller to backup controller, in redundant configuration, is less than 10 ms.

The PM866 processor unit has performance data which is approximately 1.4 times the performance of PM864/PM864A.

The PM891 processor unit has performance data which is approximately 2 times the performance of PM866.

AC 800M High Integrity

The execution performance of an AC 800M High Integrity controller is 60-70% of an AC 800M Process Automation controller (PM864/PM864A). The number of code tabs used in a SIL application has greater influence to the performance of an AC 800M High Integrity controller compared to the performance of an AC 800M Process Automation controller. Also the FDRT setting affects the total cyclic load of a AC 800M High Integrity controller. However, the memory consumptions of function blocks and control modules are the same on both controllers.

The AC 800M High Integrity controller load is presented with two different values, *Cyclic Load* and *Total System Load*. In order to ensure reliable operation these values must be kept within certain limits. For the AC 800M High Integrity controller the following max values shall not be exceeded.

Cyclic Load: 50%
Total System Load: 90%

Cyclic Load:

Load generated by the IEC 61131-3 task execution. This load is mainly determined by:

- Application properties, that is size and complexity
- Task properties, that is interval time
- ModuleBus I/O scanning controlled by the ModuleBus scan time setting
- Copy in/out of Communication Variables

For further details, see the manual *AC 800M Configuration* (3BSE035980*).

Total System Load:

The total load for the controller, including the *Cyclic Load* (see above). The additional load mainly consist of:

- Communication handling (for example Ethernet and serial channels).
- Internal diagnostics (the contribution to the load is dependent on the application size e.g. the number of code tabs and the FDRT setting)
- General housekeeping

Considerations for AC 800M High Integrity Controller

The maximum total continuous execution time, should in an AC 800M High Integrity Controller be limited to approximately 40% of the FDRT setting. Depending on the application and the task parameter configuration, the maximum continuous execution in one controller could be reached at different circumstances for example during the execution of first scan code for one application or the accumulated execution time for all tasks in the controller.

For typical execution times in a High Integrity Controller, see Table 47 and Table 48.

It is recommended that the VMT task shall have the highest task priority and that no other task has the same priority.

Spare Memory Needed for Online Changes

As a general rule, an application should never exceed half the size of the available memory. The reason for this is the manner in which applications are updated online.

1. The modifications (the difference between the old and the updated application) are downloaded to the controller memory.
2. A new version of the application is created in controller memory, based on the old application and the modifications.
3. The controller switches from the old to the new application.
4. The old application is deleted.

This technique handles all updates in a controlled and efficient way. Free memory equal to the size of the largest application is required.

If an application comes close to this limit, it should be divided into two parts so that they can be updated separately.

One Application in the Controller

There must be spare memory in the available memory in order to be able to make on-line changes shown in the Figure 14. The amount of spare memory must be at least 20% of available memory, and may require up to 50%.

A minimum of 20% spare available memory may be sufficient, depending on a number of factors, such as the complexity of the application and the number of defined alarms.

The function block “SystemDiagnostics” reports used memory based on the memory size, not on the available memory, but the dialog “Heap Utilization” will show the available memory as “Non-Used Heap”.

The function block *SystemDiagnostics* also presents another figure: the “Maximum used memory”. This figure is presented in actual bytes, and as a percentage of the memory size. This figure is far more useful to look at when determining how close you are to being unable to make on-line changes. Several on-line changes must be made in order to catch the maximum memory need in the controller.

It is still possible to make on-line changes as long as the maximum used memory value is less than 100%.

More than One Application in the Controller

Less spare memory is needed when there is more than one application in the controller.

The on-line changes are done to one application at the time. This means that if changes are done to more than one application in the controller, these changes will not take effect in a synchronized way.

Example: One application requires 50% used memory and 70% maximum used memory. If you split this application into two equally smaller applications, it will still require 50% used memory, but only 60% maximum used memory, since the extra memory needed for the on-line changes will be half.

Comparing Memory Allocations Made with Different Versions

From the discussions above, you can see that the “used memory” value provided by the *SystemDiagnostics* function block cannot be used to compare different versions.

The amount of available memory in the controller varies between versions for a number of reasons, one being the number of functions implemented in the firmware.

Memory Consumption and Execution Times

Memory is reserved for each function block type defined. When another instance is created, the amount of memory reserved for the instance is very small in relation to the type. This means that the memory consumed by the type itself is of great importance.

The following tables show memory consumption and execution time for AC 800M PM864/PM866/PM891 controllers, for a number of common function blocks and control modules.

In the tables the *First Object* column shows the required memory for the object type and one function block or control module and *Next Object* column shows the required memory for every further function block or control module.

Table 46. AC 800M Memory Consumption for Function Blocks and Control Modules

Library	Object	PM864		PM866		PM891	
		First Object (kbyte)	Next Object (kbyte)	First Object (kbyte)	Next Object (kbyte)	First Object (kbyte)	Next Object (kbyte)
Function Blocks							
SignalLib	SignalInBool	23.2	3.7	23.5	4	23.8	4.2
SignalLib	SignalOutBool	20.7	2.8	28.33	4.27	26.18	4.24
SignalLib	SignalSimpleInReal	19.5	3.2	28.62	3.97	25.7	3.85
SignalLib	SignalInReal	55	9.7	62.39	12.42	61.1	10.54
SignalLib	SignalSimpleOut Real	16.5	2.8	22.3	3.46	22.69	3.57
SignalLib	SignalOutReal	52.8	8.8	58.3	9.39	57.53	9.4
AlarmEventLib	AlarmCondBasic	10.9	1.2	22.7	1.6	12.24	1.59
AlarmEventLib	AlarmCond	11.8	2	15.39	1.96	13.27	1.99
ProcessObjectExtLib	Uni	56.6	8.3	68.5	8.8	50.34	8.35

Table 46. AC 800M Memory Consumption for Function Blocks and Control Modules (Continued)

Library	Object	PM864		PM866		PM891	
		First Object (kbyte)	Next Object (kbyte)	First Object (kbyte)	Next Object (kbyte)	First Object (kbyte)	Next Object (kbyte)
ProcessObjectExtLib	Bi	56.6	12.4	49.51	5.53	47.21	5.56
ProcessObjectExtLib	MotorUni	57.9	10.4	50.24	6.66	47.96	6.6
ProcessObjectExtLib	MotorBi	67.7	14.4	54.9	7.6	52.68	7.65
ProcessObjectExtLib	ValveUni	47.6	7.6	42.2	4.2	39.98	4.05
ProcessObjectInsum Lib	McuExtended	116.5	28.1	126.6	28.3	121.3	19.42
ProcessObjectDrive Lib	ACStdDrive	88.5	16.1	86.8	16.95	91.95	16.88
ControlSimpleLib	PidSimpleReal	17.1	1.3	27.51	2	21.13	2
ControlBasicLib	PidLoop	63.4	5.7	64.18	5.8	62.42	5.83
ControlBasicLib	PidLoop3P	67.7	5.7	67.5	6.67	65.05	6.84
ControlBasicLib	PidCascadeLoop	76.5	11.5	75.89	12.78	74.33	12.78
ControlBasicLib	PidCascadeLoop3P	80.8	11.5	79.9	12.42	77.53	12.89
SignalBasicLib	SignalBasicBool	13.5	0.5	22.2	1.17	17.01	1.1
SignalBasicLib	SignalBasicInBool	14.5	0.1	20.43	1.25	18.07	1.2
SignalBasicLib	SignalBasicInReal	19.8	0.8	25.22	1.92	22.59	1.82
SignalBasicLib	SignalBasicOutBool	15.4	0.7	20.78	1.27	18.35	1.27
SignalBasicLib	SignalBasicOutReal	16.6	1	21.81	1.5	19.28	1.56
SignalBasicLib	SignalBasicReal	15.7	0.2	20.89	1.33	18.39	1.38
SupervisionBasicLib	SDBool	34.1	4.8	41.2	5.26	36.89	5.35
SupervisionBasicLib	SDInBool	35.3	4.4	39.99	5.85	37.68	5.83
SupervisionBasicLib	SDInReal	53.6	12.1	58.43	12.85	55.64	12.81
SupervisionBasicLib	SDLevel	33.7	5.4	38.82	5.6	36.56	5.58
SupervisionBasicLib	SDOutBool	38.3	5.9	42.93	7.17	40.55	7.35

Table 46. AC 800M Memory Consumption for Function Blocks and Control Modules (Continued)

Library	Object	PM864		PM866		PM891	
		First Object (kbyte)	Next Object (kbyte)	First Object (kbyte)	Next Object (kbyte)	First Object (kbyte)	Next Object (kbyte)
SupervisionBasicLib	SDReal	48.7	12	53.79	12.19	51.17	12.25
SupervisionBasicLib	SDValve	41	5.6	45.49	6.4	43.24	6.3
SupervisionBasicLib	StatusRead	23.7	3.7	28.93	3.71	26.58	3.69
SupervisionLib	DetectorBool	47.8	6.5	40.21	5.89	40.67	6.08
SupervisionLib	Detector2Real	69.01	12.1	75.08	10.85	73.66	10.81

Table 46. AC 800M Memory Consumption for Function Blocks and Control Modules (Continued)

Library	Object	PM864		PM866		PM891	
		First Object (kbyte)	Next Object (kbyte)	First Object (kbyte)	Next Object (kbyte)	First Object (kbyte)	Next Object (kbyte)
Control Modules							
SignalLib	SignalInBoolM	25.6	4.3	26.5	4	26.6	4.3
SignalLib	SignalOutBoolM	26.86	3.7	32.75	4.17	29.56	4.14
SignalLib	SignalInRealM	66.78	9.8	72.7	10	68.92	10
SignalLib	SignalOutRealM	61.14	9.7	67.17	10.13	65.18	10.07
AlarmEventLib	AlarmCondBasicM	6.9	1	12.9	1.01	12.21	0.91
AlarmEventLib	AlarmCondM	7.6	1.6	13.69	1.1	12.9	1.07
ProcessObjectExtLib	UniM	55.85	8.9	62.35	8.4	61.68	10.37
ProcessObjectExtLib	BiM	64.48	12.8	70.7	12.6	71.46	12.56
ProcessObjectExtLib	MotorUniM	77.1	11.4	69.9	10.8	76.1	6.54
ProcessObjectExtLib	MotorBiM	87.5	14.1	80.44	14.5	81.3	14.3
ProcessObjectExtLib	ValveUniM	67.9	8.3	61.05	8.6	61.72	8.7
ProcessObjectInsum Lib	McuExtendedM	127.8	27.7	120.9	27.7	122.09	27.82
ProcessObjectDrive Lib	ACStdDriveM	100.8	16.2	93.7	42.4	93.86	16.61
ControlStandardLib	AnalogInCC	37.2	3.7	30.4	3.6	30.07	3.67
ControlStandardLib	AnalogOutCC	34.2	3.8	27.25	3.8	27.19	3.77
ControlStandardLib	Level2CC	22.89	4.7	30.5	17	31	4.62
ControlStandardLib	Level4CC	44.5	7.1	37.9	6.4	38.51	6.4
ControlStandardLib	Level6CC	53.1	8.2	45.8	8.2	46.31	23.7
ControlStandardLib	ThreePosCC	22.53	4.3	30.4	4.19	29.5	4.35
ControlStandardLib	PidSimpleCC	29.5	2.4	22.1	2.5	22.23	2.35

Table 46. AC 800M Memory Consumption for Function Blocks and Control Modules (Continued)

Library	Object	PM864		PM866		PM891	
		First Object (kbyte)	Next Object (kbyte)	First Object (kbyte)	Next Object (kbyte)	First Object (kbyte)	Next Object (kbyte)
ControlStandardLib	PidCC	112.2	15	109.6	14.9	103.1	14.9
ControlAdvancedLib	PidAdvancedCC	225.3	23.2	224.7	24.4	206.6	25.23
ControlSolutionLib	SingleLoop	199.1	31.1	196.4	33.12	186.4	33.07
ControlSolutionLib	CascadeLoop	232.4	58.9	225.3	58.9	215.03	58.9
ControlSolutionLib	OverrideLoop	310.2	105.2	295.8	109.5	284.5	109.5
ControlSolutionLib	FeedForwardLoop	208.8	42.6	221.6	45.9	211.1	45.8
ControlSolutionLib	MidRangeLoop	204.3	44	220.5	46.5	210.1	46.44

Table 47. AC 800M Execution Time for Function Blocks and Control Modules

Library	Object	PM864 (μs)	PM865 NoSIL (μs)	PM865 SIL1-2 (μs)	PM865 SIL3 (μs)	PM866 (μs)	PM891 (μs)
Function Blocks							
AlarmEventLib	AlarmCondBasic	20	32	35	34	15	9
AlarmEventLib	AlarmCond	35	50	54	54	25	14
AlarmEventLib	ProcessObjectAE	22	30	30		16	9
AlarmEventLib	SimpleEventDetector	32	50	56	53	23	14
AlarmEventLib	SignalAE	39	57	57	57	28	16
BasicLib	CTD	8	29	29	16	6	3
BasicLib	CTU	8	16	16	16	6	3
BasicLib	CTUD	11	19	19	19	8	4
BasicLib	ErrorHandler	9	11	17	17	7	3
BasicLib	F_Trig	5	14	14	14	4	2
BasicLib	ForcedSignals	30	167	159	62	20	12

Table 47. AC 800M Execution Time for Function Blocks and Control Modules (Continued)

Library	Object	PM864 (μs)	PM865 NoSIL (μs)	PM865 SIL1-2 (μs)	PM865 SIL3 (μs)	PM866 (μs)	PM891 (μs)
BasicLib	PulseGenerator	9	17	17		6	3
BasicLib	R_Trig	5	13	13	14	4	2
BasicLib	RS	6	14	14	14	4	2
BasicLib	SR	5	14	14	14	4	2
BasicLib	SystemDiagnostics	622	530			443	185
BasicLib	SystemDiagnostics SM	21	36			15	9
BasicLib	TimerD	46	52	54		34	14
BasicLib	TimerU	35	44	45		25	9
BasicLib	TOf	9	17	17	17	6	3
BasicLib	TOn	8	16	16	15	6	3
BasicLib	TP	8	16	16	16	6	3
ControlBasicLib	PidLoop	284	434			203	102
ControlBasicLib	PidLoop3P	311	470			245	99
ControlBasicLib	PidCascadeLoop	580	763			378	155
ControlBasicLib	PidCascadeLoop3P	539	837			371	145
ControlSimplelib	PidSimpleReal	61	82			44	16
ProcessObjBasiclib	BiSimple	193	250	259		140	78
ProcessObjBasiclib	UniSimple	113	145	164		83	50
ProcessObjDriveLib	ACStdDrive	570	858			422	216
ProcessObjExtLib	Bi	313	505	530		229	135
ProcessObjExtLib	MotorBi	405	650	737		285	181
ProcessObjExtLib	MotorUni	306	461	544		242	139
ProcessObjExtLib	Uni	182	315	354		144	82

Table 47. AC 800M Execution Time for Function Blocks and Control Modules (Continued)

Library	Object	PM864 (μs)	PM865 NoSIL (μs)	PM865 SIL1-2 (μs)	PM865 SIL3 (μs)	PM866 (μs)	PM891 (μs)
ProcessObjExtLib	ValveUni	197	287	337		131	79
ProcessObjInsumLib	McuExtended	503	878			365	224
ProtectionLib	SF_Antivalent	13	21	22	24	10	5
ProtectionLib	SF_EDM	14	22	23	22	10	5
ProtectionLib	SF_EmergencyStop	12	21	20	20	9	4
ProtectionLib	SF_EnableSwitch	13	20	21	20	9	5
ProtectionLib	SF_Equivalent	12	20	21	21	8	4
ProtectionLib	SF_ESPE	12	20	20	20	9	4
ProtectionLib	SF_GuardLocking	14	22	23	23	10	5
ProtectionLib	SF_GuardMonitoring	13	21	21	22	9	5
ProtectionLib	SF_ModeSelector	20	29	30	30	14	7
ProtectionLib	SF_MutingPar	24	32	32	32	17	10
ProtectionLib	SF_MutingPar_2Sensor	17	25	25	25	12	5
ProtectionLib	SF_MutingSeq	17	25	25	25	12	7
ProtectionLib	SF_OutControl	13	21	21	21	9	4
ProtectionLib	SF_SafetyRequest	13	22	22	22	10	5
ProtectionLib	SF_TestableSafetySensor	18	26	26	26	13	7
ProtectionLib	SF_TwoHandControlTypeII	11	20	20	22	8	4
ProtectionLib	SF_TwoHandControlTypeIII	11	20	20	20	8	4
SignalBasicLib	SignalBasicBool	6	15	15	15	5	3
SignalBasicLib	SignalBasicInBool	7	15	15	15	5	3
SignalBasicLib	SignalBasicInReal	50	84	83	83	36	18

Table 47. AC 800M Execution Time for Function Blocks and Control Modules (Continued)

Library	Object	PM864 (μs)	PM865 NoSIL (μs)	PM865 SIL1-2 (μs)	PM865 SIL3 (μs)	PM866 (μs)	PM891 (μs)
SignalBasicLib	SignalBasicOutBool	7	16	15	15	6	3
SignalBasicLib	SignalBasicOutReal	13	21			10	4
SignalBasicLib	SignalBasicReal	16	24	24	24	12	5
SignalLib	SignalBool	57	77	89		41	24
SignalLib	SignalInBool	50	67	72		34	18
SignalLib	SignalInReal	206	241	296		143	85
SignalLib	SignalOutBool	48	70	79		34	21
SignalLib	SignalOutReal	127	157			89	51
SignalLib	SignalReal	152	193	262		119	60
SignalLib	SignalSimpleInReal	86	127	145		64	33
SignalLib	SignalSimpleOut Real	43	64			30	17
SupervisionBasicLib	SDBool	126	176	191	189	85	48
SupervisionBasicLib	SDInBool	94	159	167	164	67	36
SupervisionBasicLib	SDInReal	261	415	417	434	186	92
SupervisionBasicLib	SDLevel	78	119	122	121	57	31
SupervisionBasicLib	SDOutBool	122	210	218	233	88	45
SupervisionBasicLib	SDReal	249	345	359	337	169	80
SupervisionBasicLib	SDValve	165	257	265	272	117	68
SupervisionBasicLib	StatusRead	35	43	43	44	26	14

Table 47. AC 800M Execution Time for Function Blocks and Control Modules (Continued)

Library	Object	PM864 (μs)	PM865 NoSIL (μs)	PM865 SIL1-2 (μs)	PM865 SIL3 (μs)	PM866 (μs)	PM891 (μs)
Control Modules							
AlarmEventLib	AlarmCondBasicM	30	40	44		21	13
AlarmEventLib	AlarmCondM	24	34	38		16	9
BasicLib	CVAckISP	45	65	66	73	32	18
BasicLib	ErrorHandlerM	17	23	23		11	5
BasicLib	ForcedSignalsM	35	182	188		26	15
ControlAdvancedLib	PidAdvancedCC	885	1212			634	288
ControlSolutionLib	CascadeLoop	1779	2933			1279	658
ControlSolutionLib	FeedforwardLoop	1484	2302			1076	501
ControlSolutionLib	MidrangeLoop	1367	2127			978	472
ControlSolutionLib	OverrideLoop	3405	5555			2398	1237
ControlSolutionLib	SingleLoop	1063	1665			767	383
ControlSolutionLib	AnalogInCC	107	204			79	43
ControlSolutionLib	AnalogOutCC	88	154			62	32
ControlSolutionLib	Level2CC	63	98			45	25
ControlSolutionLib	Level4CC	95	126			67	39
ControlSolutionLib	Level6CC	120	157			86	52
ControlSolutionLib	PidCC	489	831			359	173
ControlSolutionLib	PidSimpleCC	106	131			69	32
ControlSolutionLib	ThreePosCC	153	218			110	52
FireGasLib	CO2	244	360	366		198	102
FireGasLib	Deluge	168	268	274		124	69
FireGasLib	FGOutputOrder	237	342	341		160	87

Table 47. AC 800M Execution Time for Function Blocks and Control Modules (Continued)

Library	Object	PM864 (μs)	PM865 NoSIL (μs)	PM865 SIL1-2 (μs)	PM865 SIL3 (μs)	PM866 (μs)	PM891 (μs)
FireGasLib	Sprinkler	146	228	234		101	57
ProcessObjBasicLib	BiSimpleM	183	251	270		142	77
ProcessObjBasicLib	UniSimpleM	121	163	170		88	51
ProcessObjDriveLib	ACStdDriveM	598	895			417	222
ProcessObjExtLib	BiM	346	527	560		249	138
ProcessObjExtLib	MotorBiM	403	657	739		295	161
ProcessObjExtLib	MotorUniM	315	474	542		223	137
ProcessObjExtLib	UniM	215	337	376		152	94
ProcessObjExtLib	ValveUniM	188	333	382		157	91
ProcessObjInsumLib	McuExtendedM	535	908			370	227
SignalLib	SDLevelAnd4	28	43	42		19	11
SignalLib	SDLevelBranch4	21	34	35		14	7
SignalLib	SDLevelM	102	146	175		74	44
SignalLib	SDLevelOr4	23	40	40		17	8
SignalLib	SignalBoolCalcInM	71	109	123		50	29
SignalLib	SignalBoolCalcOutM	92	142	146		65	36
SignalLib	SignalInBoolM	63	97	108		43	23
SignalLib	SignalInRealM	245	335	397		177	100
SignalLib	SignalOutBoolM	66	100	104		53	31
SignalLib	SignalOutRealM	219	263			145	86
SignalLib	SignalRealCalcInM	222	342	446		161	91
SignalLib	SignalRealCalcOutM	234	364	425		183	105
SignalLib	Vote1oo1Q	228	428	420		153	77
SignalLib	VoteBranch4	41	74	77		29	14

Table 47. AC 800M Execution Time for Function Blocks and Control Modules (Continued)

Library	Object	PM864 (μs)	PM865 NoSIL (μs)	PM865 SIL1-2 (μs)	PM865 SIL3 (μs)	PM866 (μs)	PM891 (μs)
SignalLib	VotedAnd4	37	68	68		27	14
SignalLib	VotedBranch4	25	58	61		18	8
SignalLib	VoteXoo2D	259	468	506		184	83
SignalLib	VoteXoo3Q	285	489	525		202	88
SignalLib	VoteXoo8	299	519	572		216	105
SupervisionLib	Detector1Real	329	417	422		232	127
SupervisionLib	Detector2Real	377	478	481		280	150
SupervisionLib	DetectorAnd	54	86	83		40	22
SupervisionLib	DetectorAnd4	60	89	89		43	26
SupervisionLib	DetectorAnd8	98	126	127		67	41
SupervisionLib	DetectorBranch	54	83	83		37	19
SupervisionLib	DetectorBranch4	65	93	93		45	25
SupervisionLib	DetectorBranch8	101	136	135		73	41
SupervisionLib	DetectorLoop Monitored	394	492	505		282	148
SupervisionLib	DetectorOr	54	85	84		39	21
SupervisionLib	DetectorOr4	58	89	87		42	24
SupervisionLib	DetectorOr8	90	121	120		65	37
SupervisionLib	DetectorRemote	177	268	287		126	70
SupervisionLib	DetectorVote	50	81	81		35	20
SupervisionLib	OrderOr	30	62	61		24	13
SupervisionLib	OrderOr4	53	58	59		21	11
SupervisionLib	OutputBool	125	168	168		96	52
SupervisionLib	OutputOrder	215	320	334		158	87

Table 48. Execution Time for a Number of Standard Operations and Function Calls

Operation/Function	Data Type	PM864 (μs)	PM865 NoSIL (μs)	PM865 SIL1-2 (μs)	PM865 SIL3 (μs)	PM866 (μs)	PM891 (μs)
a:= b or c	bool	0.7	0.7	0.7	0.7	0.5	0.3
a:= b and c	bool	0.7	0.7	0.7	0.7	0.5	0.2
a:= b xor c	bool	0.7	0.7	0.7	0.7	0.5	0.2
a := b + c	dint	0.7	0.7	0.7	0.7	0.5	0.2
a := b + c	real	1.9	1.9	1.9	2.0	1.4	0.2
a := b - c	dint	0.7	0.8	0.7	0.7	0.5	0.2
a := b - c	real	1.7	1.8	1.8	1.7	1.2	0.2
a := b * c	dint	0.7	0.8	0.7	0.7	0.5	0.3
a := b * c	real	1.8	1.8	1.8	1.8	1.3	0.2
a := b / c	dint	1.0	1.0	1.0	1.0	0.7	0.5
a := b / c	real	4.0	4.1	4.1	4.1	2.9	0.3
a:= b <> c	dint	0.8	0.9	0.9	0.9	0.6	0.3
a:= b <> c	real	1.8	1.9	1.9	1.9	1.3	0.3
a := b	string[140]	8.4	9.5	9.5	9.3	6.3	2.7
a := b + c	string[10]	17.5	28.2			11.9	3.4
a := b + c	string[40]	17.6	28.6			13.0	2.6
a := b + c	string[140]	27.8	38.8			20.1	5.5
a := AddSuffix (b + c)	string[10]	4.0	5.3	5.3	5.3	3.3	1.4
a := AddSuffix (b + c)	string[40]	7.6	8.5	8.5	8.4	5.3	2.4
a := AddSuffix (b + c)	string[140]	16.9	17.0	17.0	17.7	11.6	4.2
a := real_to_dint(b)	dint	15.6	15.6	15.7	15.5	11.2	0.9

Table 48. Execution Time for a Number of Standard Operations and Function Calls

Operation/Function	Data Type	PM864 (μs)	PM865 NoSIL (μs)	PM865 SIL1-2 (μs)	PM865 SIL3 (μs)	PM866 (μs)	PM891 (μs)
a := dint_to_real(b)	real	1.8	1.9	1.9	1.9	1.3	0.4
a := real_to_time(b)	time	22.0	22.3	22.5	22.0	15.6	1.5
a := time_to_real(b)	real	6.5	6.3	6.3	6.3	4.5	0.8

Online Upgrade

Stoptime

The total stop time of a controller when doing online upgrade is defined as the longest time the I/O is frozen. Generally, the following factors will have large impact on the total stop time.

- The stop time will increase with increased memory usage in the controller.
- The stop time will increase with increased number of alarm objects in the controller.

The following formula can be used to give guidance to what the total stop time in a controller will be, when doing an online upgrade:

$OLUStopTime_{LowPrioTask}$ =

$2.7 \times \sum_{AllApp} ApplicationStopTime + \sum_{AllTasks} FirstScanExecutionTime$

ApplicationStopTime andFirstScanExecutionTime can be found in the Task dialog online, after a successful download with warm restart.

Note 1: The formula is only approximate and the following factors will affect the accuracy of the formula:

- With increased cyclic load in the controller, the stop time might be larger than calculated.
- With increased number of string variables, the stop time might be larger than calculated.
- The actual stop time (compared to the calculated) will decrease if the controller is divided on several applications compared to only having one large application in the controller.

Note 2: This formula calculates the total freeze time of the I/O connected to the lowest priority task. To calculate freeze time of I/O connected to a higher priority task, the sum of first scan execution times shall only include task with same or higher priority.

Online Upgrade in a High Integrity Controller

During Online Upgrade of firmware in the AC 800M HI, the application controlling the process is stopped for a short period of time. During this time period the output signals are not updated, but keep their current values. The duration of this time is depending of the configured **Online Upgrade Handover Limit**.
For most processes it is possible to find a process state, or a period of time when the configured FDRT can be exceeded without creating any hazardous situation. Based on such a judgement of the process, the Online Upgrade Handover Limit can be set in accordance with the following formula.

Online Upgrade Handover Limit =
Max acceptable Output freeze time - 2 x actual Task Interval Time - 2 x ModuleBus scan time.

If the configured FDRT are to be maintained also during an Online Upgrade session, the Online Upgrade Handover Limit shall be set in accordance with the following formula:

Online Upgrade Handover Limit =
FDRT - 2 x the longest Task Interval Time - 2 x ModuleBus scan time.

The maximum length of the time period the outputs are not updated can be determined by using the following formula:

Output freeze time = Online Upgrade Handover Limit + 2 x the actual Task Interval Time + 2 x ModuleBus scan time.

Communication Disturbance

During the switchover of plant control, communication will be down for a while. Measurements have been done to show the impact on different communication protocols.

All the values listed below are typical values and can vary from system to system.

- The trend values in Process Portal are interrupted for approximately 20 s.
- The alarms are delayed in the range of 20 - 30 s during switch of primary controller.
- ComliSBConnect is down for approximately 2 s before and 250 ms after the switchover.
- MMSConnect is down for approximately 2 s before and 2 s after the switchover.
- SBConnect is down for approximately 2 s before and 250 ms after the switchover.

Hardware and I/O

The technical limitation for the number of I/Os in one AC 800M High Integrity Controller is 1344 in single I/O configuration, when only using digital I/O. The application complexity however restricts the practical number of I/O that can be used to approximately 500 in total for a High Integrity Controller, regardless of the distribution between different applications (including Non-SIL).

Modulebus Scantime for SIL3 Tasks

For each SIL3 task the fastest possible Modulebus scan time has to be increased based on the amount of application connected I/O Channels according to Table 49.

Table 49. Modulebus Scan Time for SIL3 Tasks

BaseLoad	DI880	AI880asDI	AI880	DO880
InCopy				
3000 μs	7 μs per channel	10 μs per channel	14 μs per channel	-
OutCopy				
2000 μs	-	-	-	9 μs per channels

Example: Consider a configuration with all channels connected to 1131 Variables with 24 AI880A (8 channels per IO -> 192 connections), 36 DO880 (16 channels per IO -> 576 connections) and 36 DI880 (16 channels per IO -> 576 connections) and three SIL3 tasks, where each task is connected to both input and output channels. This would require an additional 27 ms for the fastest possible Modulebus scantime.

Modulebus Response Time and Load

Modulebus scanning has a considerable influence on CPU load, since I/O copying on Modulebus is handled by the controller CPU.
The scan time increases as modules are added, and at a certain point Modulebus scanning will start to seriously influence CPU load.

The Modulebus scan cycle time can be set in Control Builder. The cycle time must be set to suit the module requiring the shortest scan interval. A solution to this problem is to connect I/O variables requiring shorter scan intervals via the CI854A PROFIBUS adapter.

In AC 800M, Modulebus scanning has the highest priority. The cyclic load presented for IEC 61131-3 applications includes extra load caused by Modulebus interrupts.

Calculation of Scan Time on the Modulebus and CPU Load

The following definitions are used in the calculations:

1. Amount of modules:

- n_1 = amount of Drives and DP, DI, DO, AI and AO modules (except AI880A, DI880 and DO880)
- n_2 = amount of AI880A, DI880 and DO880 modules

For the modules below, the following number of modules should be accounted:

- AO845 (redundant) = 2
- DO840 (redundant) = 2
- DO880 (redundant) = 2
- DP820 = 4
- DP840 (single) = 8
- DP840 (redundant) = 9
- ABB Engineered Drives = 3
- ABB Standard Drives = 2

For other redundant modules, only one should be accounted.

2. Scan time for different modules:

   t_1 = 0.5 ms (scan time for n_1)

   t_2 = 1.3 ms (scan time for n_2)

3. Load caused by n_1 module types:

   L_1 = 20% (PA and HI controller)

4. Load caused by n_2 module types:

   L_2 = 8% (PA controller)

   L_2 = 12% (HI controller)

For PM866, the values will be approximately half, that is, L_1 = 10% and L_2 = 4%.

For PM891, the values will be approximately one third, that is, L_1 = 7% and L_2 = 3%.

Calculation of Fastest Possible Scan Time

The fastest possible scan time is $n_1 * t_1 + n_2 * t_2$.

Example:
It can never take less than 10 * 0.5 = 5.0 ms to scan 10 non-High Integrity I/O modules.

Calculation of the Modulebus CPU Load

The Modulebus scanning causes the following CPU load if the chosen scan cycle time is less or equal to the fastest possible scan time:

$$\mathbf{Load_{(fastest)} = (n_1 / (n_1 + n_2) * L_1 + (n_2 / (n_1 + n_2) * L_2)}$$

The following CPU load is caused for other scan cycle times:

$$\mathbf{Load_{(chosen)} = Fastest\ Possible\ Scan\ Time / Chosen\ Scan\ time * Load_{(fastest)}}$$

The formulas are valid for all AC 800M processor unit types.

Example Scan Time and CPU Load

Assume that following units are used:

1 AI810: 0.5*1 = 0.5 ms
1 redundant DO880: 1.3*2= 2.4 ms
1 redundant DP840: 0.5*9 = 4.5 ms

This gives a scan cycle time of 8 ms (resolution = 1 ms).

CPU Load for a PA Controller will be: (10/12)*20 + (2/12)*8 = 18%

CPU Load for a HI Controller will be: (10/12)*20 + (2/12)*12 = 20%

Updating Rate of Data to an Application

The rate in milliseconds at which all channels of an I/O module are updated in the controller to be used in the IEC 61131-3 application, as a function of the scan time in milliseconds is as follows:

- For AI, AO and AI843 (except AI880A and other temperature measuring I/O than AI843) the updating time is equal to number of channels divided by two multiplied by the scan time.

- For temperature measuring I/O (except for AI843) the updating time is equal to number of channels multiplied by the scan time.
- For AI880A the updating time is equal to scan time.
- For Standard Drives the updating time is equal to scan time.
- For Engineered Drives the updating time is equal to scan time multiplied by 12.
- For DI, DO, DP the updating time is equal to scan time.

ModuleBus Scanning of ABB Drives

Scanning of ABB Drives on Modulebus also influences CPU load.

Modulebus Scanning of ABB Engineered Drives (AC 800M)

Scanning of an engineered Drive is distributed over 3 * 12 scan cycles. Three channels (DDS pairs) are scanned in each scan cycle. The first two are always channels 1 and 2 (i.e. DDS pairs 10/11 and 12/13); the third will be different for each scan cycle.

Table 50. Scan cycles for ABB Engineered Drives DDS Pair 3

Scan Cycle	DDS Pair 3
1, 5, 9	14/15
2, 6, 10	16/17
3, 7 11	18/19
4	20/21
8	22/23
12	24/25

To scan the three DDS pairs each cycle takes 3 * 0.5 = 1.5 ms. It is not possible to have a scan interval less then 2 ms (=PA controller) / 5 ms =HI controller) for the Modulebus scanner. Thus, for one drive the scan time will be 2 ms.

Example

For four drives, the scan time will be 1.5 ms * 4 = 6.0 ms for the DDS pairs 10/11 and 12/13, and the scan time for the remaining of the DDS pairs will be 1.5 ms * 4 * 12 = 72.0 ms.

ModuleBus Scanning of ABB Standard Drives (AC 800M)

For ABB Standard Drives, all data sets (DDS 1/2 and DDS 3/4) are scanned in each scan cycle. It takes 2 * 0.5 = 1.0 ms to scan a single Standard Drive.

Example

For four ABB Standard Drives the scan time will be 1.0 ms * 4 = 4.0 ms.

Dynamic Data Exchange S800 I/O Connected via CI854A

The transportation of dynamic data between PROFIBUS-DP/DPV1 master and the S800 I/O modules shown in the Figure 15.

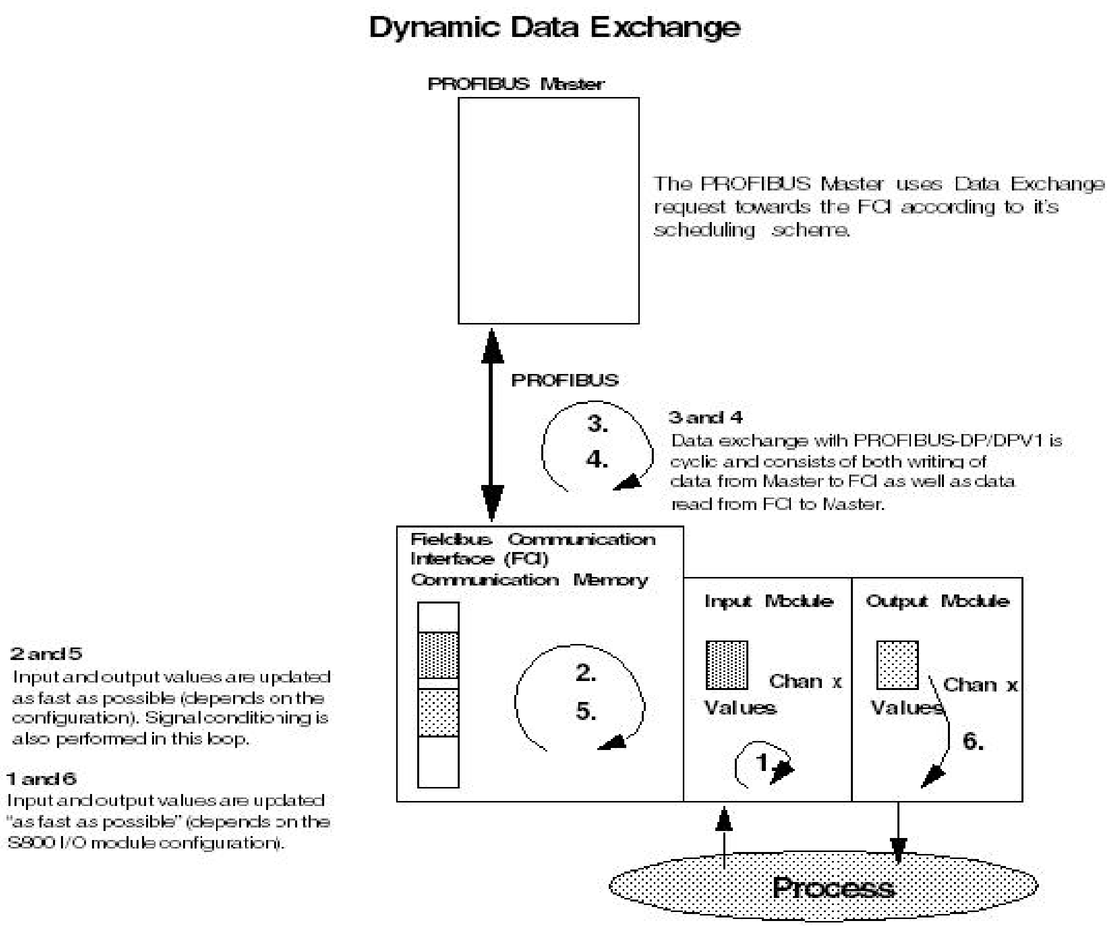

Figure 15. Transportation of dynamic data between PROFIBUS-DP/DPV1 master and S800 I/O modules.

The transportation of dynamic data between PROFIBUS-DP/DPV1 and the ModuleBus is the main task for the Field Communication Interface FCI. The FCI has a dedicated memory area where it sends the output values and reads the input values.

The CPU in the FCI performs the rest of the data transportation. It reads output values from the memory and writes to the I/O Modules via the ModuleBus and vice versa.

Data Scanning Principles

The data transfer between PROFIBUS-DP/DPV1 and the ModuleBus (3 and 4 in the figure) is not synchronized. Read and write operations are performed from and to a dual port memory in the FCI.

The ModuleBus data is scanned (read or written) (2 and 5 in the figure) cyclically, depending on the I/O module configuration. On one scan all digital modules, 1/4 of the analog modules and 1/10 of the slow analog modules (modules for temperature measurement) are scanned. It takes 4 scans to read all analog modules and 10 scans to read all slow analog modules.

At en typical configuration with 3 AI, 2 AO, 3 DI and 2 DO modules the data scan time will be 18 ms.

For calculation of the ModuleBus data scanning in the FCI, see S800 I/O User's Guide Fieldbus Communication Interface PROFIBUS-DP/DPV1 Section 3 Configuration and Chapter Data Scanning.

The internal data scanning (1 and 6 in the figure) on the I/O modules is not synchronized with the ModuleBus data scanning.

Typical data scanning on S800 I/O modules (filter times not included):

Digital modules 1ms.

Analog modules 10ms.

Slow analog modules 1s.

Data scanning on S800 I/O modules see, S800 User's Guide Module and termination Units Appendix A Specifications.

Calculation of Signal Delay

Signal delay from process to controller and vice versa can be calculated according to following:

Signal delay = Controller scan time + Profibus scan time + FCI scan time + Module scan time + Filter time.

For example:

Signal delay digital signal = Controller scan time + Profibus scan time + FCI scan time + Module scan time + Filter time.

Signal delay analog signal = Controller scan time + Profibus scan time + 4 * FCI scan time + Module scan time + Filter time.

Signal delay slow analog signal = Controller scan time + Profibus scan time + 10 * FCI scan time + Module scan time + Filter time.

S100 I/O Response Time and Load

The response time is the time it takes for a signal to go from the input terminals on a S100 I/O board to the double port memory on the CI856 unit or vice versa for output signals. The delay caused by the filtering of the input signals is not included.

The S100 I/O response time is the sum of the following times:
`Conversion Time + Internal Scan Time + Scan Interval CI856`

- `Conversion Time` = 0.1 ms for DSAI 130/130A. For other I/O boards it can be ignored.
- `Internal Scan Time` = The internal scan time on DSAX 110 and DSAX 110A is 20 ms for input signals and 8 ms for output signals. For other I/O boards it is 0 ms.
- `Scan Interval CI856` = The scan interval on the CI856 is set for each I/O board or I/O channel and is determined by "scan interval" or "update interval" in the I/O hardware editor, under settings tab for selected I/O unit.

Calculation of CI856 CPU Load

For each I/O board the load on CI856 is calculated as:

```
BoardLoad = (BaseLoad + N*ChannelLoad)/CycleTime
```

- `BoardLoad` = the CPU load on the CI856 caused by the board (unit = percent).
- `BaseLoad` = the base load to handle the board, see Table 51 below.
- `ChannelLoad` = the additional load for each I/O channel used on the board, see Table 51 below.
- `N` = number of used I/O channels on the board.
- `CycleTime` = the cycle time or update interval set for the board or I/O channel (unit = 0.1 ms).

Table 51. BaseLoad and ChannelLoad of S100 I/O

Board	BaseLoad	ChannelLoad
DSAI 130/130A	20	125
DSAI 130D, DSAI 133/133A	20	40
DSAO	7	3.5
DSDI	35	0
DSDO	45	0
DSDP 010	12	22
DSDP 170 Function Mode = Pulse25	25	30
DSDP 170 Function Mode = Frequency	25	30
DSDP 170 Function Mode = Pulse + Frequency	25	61
DSDP 170 Function Mode = Pulse light2513	25	13

To allow scan task overhead and event treatment, the total load from all I/O boards should not exceed 80%.

Drivebus Communication with CI858 Unit

Data transfer on Drivebus is managed through datasets pairs. For standard drives 2 dataset pairs can be used and for Engineered drives up to 8 data set pairs can be defined.

Dataset Priority

Datasets can be given two priorities, High and Normal. High priority datasets are associated with the high priority execution table which is scanned every 2 ms. Normal priority datasets are associated with the normal priority execution table. This table is built-up of several channels (slots). The number of channels depends on the maximum number of normal priority Datasets defined in any drives unit on the bus. Every 2 ms one of the normal priority table channels is scanned.

Example Dataset Priority

If the maximum number of low priority datasets defined in a drives unit on the bus is 6, the normal priority execution table contains 6 channels, each channel is scanned every 12th millisecond (`2ms * 6=12ms`).

Dataset Pairs

The transfer times for dataset pairs, for example, DS10/DS11, includes transferring the message from the drive to the AC 800M (DS10) and the response message, including return value, back to the drives unit (DS11).

Drivebus (CI858) Response Time and Load

When calculating the response times between drives units and AC 800M on Drivebus the following has to be considered:

- Application task interval time in the host system, that is PM86x.
- Dataset execution queue and communication handler in the CI858,
- Bus transfer time, including data handling time in the communication ASICs on the CI858 and in the drives units.
- Drives unit application program.

Drivebus Response Time Formula

#DS_Channels: Max number of normal priority datasets in one drives unit on the bus.

AC 800M Application Program

Application program: Task interval time

High Priority Datasets

High priority dataset execution queue and communication handler: 2 ms

Drivebus transfer time: 1 ms

Inverter system application program:

DS10/11: 2 ms
DS12/13: 4 ms
(Other DS: 10 - 500 ms)

Normal Prio Datasets

Normal Prio dataset execution queue and communication handler:
`2 * #DS_Channels`

Drivebus transfer time: 1 ms

Inverter system application program:

DS10/11: 2 ms
DS12/13: 4 ms
Other DS: 10 - 500 ms

The response time on Drivebus consists of the sum of the following:

```
TaskInterval + DataSet + DrivebusTransfTime + ApplTime
```

- `TaskInterval` = Application task interval
- `DataSet` = DataSet Execution queue and communication handler
- `DrivebusTransfTime` = Drivebus transfer time

- `ApplTime` = Inverter system application time

Example

Consider a Drivebus containing five drive units. Each drives unit is using one high priority dataset pair (DS10/DS11). One of the drives units is using five normal priority dataset pairs DS12/DS13 to DS20/DS21. The other drives are using four normal priority dataset pairs DS12/DS13 to DS18/DS19. In the drives units the application program is using an update time of 100 ms for the normal priority datasets.

In the AC 800M the high priority datasets are attached to a high priority application task using a task interval time of 10 ms. The normal priority datasets are attached to a normal priority task using a task interval time of 250 ms.

Table 52. Response Times for each Dataset

Dataset	Application Task Interval	DataSet Execution Queue and Comm. Handler	Drivebus Transfer Time	Inverter System Application Time	Response Time (ms)
DS10/DS11	10	2	1	2	15
DS12/DS13	250	2*5	1	4	265
DS14/DS15	250	2*5	1	100	361
DS16/DS17					
DS16/DS17					
DS18/DS19					
DS20/DS21					

PROFIBUS DP Limitations and Performance

For PROFIBUS DP there are some limitations and performance to take into consideration.

Limitations

- CI854A can only act as master.
- The network can have a maximum of 126 nodes. A maximum of 124 slaves can be connected to a CI854A since the node addresses 0 and 1 are reserved for CI854A.
- S800 I/O connected to CI840 and/or S900 I/O connected to CI920 supports cable redundancy together with slave redundancy.
- If the PROFIBUS master unit, CI854A, loses contact with a slave unit, for example due to a disconnected cable, input values are set according to ISP configuration. If the I/O unit does not support ISP, all input values will freeze.
- Reset of PROFIBUS DP master, CI854A, and the complete PROFIBUS is done if one of the following bus parameter settings are changed: Node address of CI854A, baud rate or highest station address (HSA). A change of the other bus parameters does not affect the running communication.
- If the CI854A is running with 12 Mbit/s, then in total 4000 bytes input and output data for the cyclic communication are allowed to be configured. For lower Baudrate than 12 Mbit/s there is no limitation.

S900 (CI920) and S800 (CI840 and CI801) support configuration change (changing the parameters) without disrupting the cyclic data communication.

Performance

The cycle time on PROFIBUS depends on the baud rate, the summary of I/O data and the slave timing parameter. The fastest cycle time is about 1 ms with a baud rate of 12 Mbit/s and only one slave device. The typical cycle time is about 10-20 ms with 1,5 Mbit/s and some slave devices.

CI854A slave devices can have node addresses in the range 2-125 (the node addresses 0 and 1 are reserved for the CI854A). The baud rate can be configured to be in the range of 9,6 kbit/s - 12 Mbit/s. There is a maximum length of I/O data at 4000 bytes of input and output data in total when using 12 Mbit/s. For slower baud rate, up to 1,5 Mbit/s, there is no limitation of the length of the I/O data.

PROFINET IO Limitations and Performance

The following limitations apply for PROFINET IO configurations with CI871 in AC 800M.

- Up to 12 CI871 per AC 800M controller.
- Up to 126 PROFINET IO devices per CI871.
- Up to 512 modules per device.
- One IOCR for each direction (Input and Output) per device,
  each IOCR up to 1440 bytes of I/O data.
- Update time down to 1 ms (only if CI871 has only one device configured).
- For CPU-load calculation of CI871, the Ethernet frames for inputs and outputs need to be calculated. CI871 can handle as a maximum one frame per ms in each direction.
  Example 1: Update times for all devices is configured to 32 ms (default), then up to 32 devices can be connected to CI871.
  Example 2: Update times for all devices is configured to 8 ms, then up to 8 devices can be connected to CI871.

The limitation for the CPU load of CI871 is checked by the system during download. If the system detects that there is a CPU overload, then it is indicated in the Compilation Summary window and the download is blocked. The CI871 may not function properly when there is an overload. The user can check the CPU load before and after download by use of the Web Interface. The limit for the CPU load is 100%. Up to that value the CI871 works stable without any problems or restrictions.

FOUNDATION Fieldbus HSE Limitations and Performance

The CI860 communication interface unit cannot be used in an AC 800M High Integrity controller.

The following FF data types can be communicated:

- Publisher/Subscriber communication:
  - DS65
  - DS66

- Client/Server communication via CI860:
  - FFBitStrLen16DS14
  - FFBitStrLen8DS14
  - FFDiscreteSTatusDS66
  - FFFloatDS8
  - FFFloatStatusDS65

Dimensioning Limits, Linking Device

The linking device LD 800HSE supports up to 4 FF H1 links. For more information on linking device limitations, please refer to the manual *FOUNDATION Fieldbus Linking Device LD 800HSE, User instruction (3BDD013086*)*.

Dimensioning Limits, FOUNDATION Fieldbus HSE Communication Interface Module CI860

Cyclic communication via Publisher/Subscribe

The CI860 can handle a maximum of 1000 VCRs (Virtual Communication Relationships). Each VCR defines one I/O channel. Analog channels are mapped to the RealIO data type whereas discrete channels can be mapped to either the BoolIO or the DwordIO data type. The number of CI860 channels to which variables can be mapped is limited to the following numbers:

- 1000 channels of type Real for analog inputs,
- 500 channels of type Real for analog outputs,
- 500 channels for discrete input in total of type Bool and Dword,
- 250 channels for discrete output in total of type Bool and Dword.

The CI860 Hardware Editor contains 3000 channels, but only 1000 channels can be used at the same time. This is the static load. For dynamic load, refer to the Average FF Load Calculation on page 144.

Acyclic communication via Client/Server

In Control Builder, it is possible to access the contained FF function block parameters, acyclically. This is done via client/server communication through CI860.

The following limitations apply for this communication per CI860 module:

- Maximum 30 Linking Devices
- Maximum 150 H1 devices
- Maximum 300 client/server signals

This is the static load. For dynamic load, refer to the Average FF Load Calculation on page 144.

Average FF Load Calculation

To ensure a proper functionality under all conditions the CPU load of the CI860 shall not exceed 80% at a maximum. This gives the limit of the Average FF load of 100% that can be operated by the CI860 during runtime.

```
Average FF Load = CPU Load * 1.25
```

The Average FF load is calculated and monitored by Fieldbus Builder FF depending on the actual configuration.

The CPU Load is given as Summery of the CPU Load for Publish/Subscribe (P/S) communication, the CPU Load for Client/Server (C/S) communication, and 9% idle load.

```
CPU Load = CPU_Load_P/S + CPU_Load_C/S + 9% Idle Load
```

Calculating CPU Load for P/S

```
CPU_Load_P/S = T*0.105% + N*0.015%
```

N: Number of configured channels on CI860

T: Number of transfers/sec (publish and subscribe)

Use the following formula for calculating **T** if number of cycles are used:

$$\mathbf{T = N_1/C_1 + N_2/C_2 + ... + N_n/C_n}$$

N: Number of configured channels on CI860

C: Used Signal Cycle time in [sec] for these channels

The formula accuracy is about +-5%.

Calculating CPU Load for C/S

```
CPU_Load_C/S = R/C*1.6%
```

R: Number of client/server requests

C: Cycle time of C/S requests in [sec]

Use the following formula for calculating CPU_Load_C/S if number of cycles are used:

$$\textbf{CPU\_Load\_C/S} = (R_1/C_1+R_2C_2+.....R_n/C_n)*1.6\%$$

The formula accuracy is about +-20%.

Verify the CI860 CPU load within Control Builder M, CI860 Hardware Configuration Editor in the Connections tab, diagnostic channel IW1.6502 CPU load and IW1.6505 Average FF load over a period of time when C/S requests were performed.

Table 53. Average FF Load Calculation Examples

Average FF Load Calculation Examples		
500 P/S signals with 1 sec cycle time	CPU_Load_P/S	60%
7 C/S signals with 1 sec cycle time	CPU_Load_C/S	+11%
Idle Load		+9%
CPU Load		80%
(Average FF Load = 100%)		
300 P/S signals with 1 sec cycle time	CPU_Load_P/S	36%
22 C/S signals with 1 sec cycle time	CPU_Load_C/S	+35%
Idle Load		+9%

Table 53. Average FF Load Calculation Examples

Average FF Load Calculation Examples	
CPU Load	80%
(Average FF Load = 100%)	

IEC 61850

The IEC 61850-Ed1 specification for Substation Automation System (SAS) defines communication between Intelligent Electronic Devices (IED) in the substation and other related equipment.

The IEC 61850 standard itself defines the superset of what an IEC 61850 compliant implementation might contain.

CI868 is modeled as an IED with one Access point and supports communicating with other IEDs through IEC 61850 GOOSE as well as IEC 61850 MMS client protocol.

The CI868 IEC 61850 Hardware Library 3.x available in Control Builder, supports CI868 to communicate over IEC 61850 GOOSE and MMS client protocols.

This section describes the configuration and performance limits for CI868 module.

CI868 Configuration Limit for AC 800M

Table 54. CI868 Configuration Limit for AC 800M

Description	Limit	Remarks
Maximum number of CI868 modules connected per Non-Redundant AC 800M controller.	12	CI868 Non-redundant units
Maximum number of CI868 modules connected per Redundant AC 800M controller.	6	CI868 Application-redundant units

CI868 Performance for GOOSE Protocol Usage

The following are the configuration and performance parameters related to CI868 module configured for GOOSE communication.

It is recommended to follow the mentioned limits to have CI868 CPU load levels less than 85% for satisfactory performance of CI868 module for GOOSE communication.

Following are the recommendations to be followed while engineering the Substation Configuration Description (SCD) file.

Table 55. Performance Parameters of CI868 Configured for GOOSE Protocol

Description	Limit	Remarks
Control Builder Configuration Data Per CI868 Module		
Maximum number of IEDs connected	80	
Maximum number of GOOSE Datasets	150	Subscribed Datasets count per CI868 monitored by the IEC 61850 Wizard.
Maximum number of Receive Blocks per IED	254	Each Receive Block constitutes 5 Data Objects. Each Data Object constitutes the Data Attributes. **For Example:** stVal / mag.f , q, t
Maximum number of LDs	10	
Maximum number of LNs per LD	253	
GOOSE Performance Data Per CI868 Module		

Table 55. Performance Parameters of CI868 Configured for GOOSE Protocol (Continued)

Description	Limit	Remarks
Maximum number of Static Data Objects (signals) configured	800	SCD file should not be configured for more than: Maximum 800 Data Objects (signals) from 80 IEDs 50 IEDs for 800xA SV5.0 80 IEDs for 800xA SV5.1 Analog, Integer or Boolean type of Data objects.
Maximum number of Data Objects per Dataset	10	Analog, Integer or Boolean type of Data objects. This number should not be increased, otherwise the CI868 board could be overloaded. For more data signals to CI868 from same IED, use additional Datasets.
Maximum number of changing Data Objects Received	160 / sec	Analog, Integer or Boolean type of Data objects. Subject to SCD file configuration. Refer CI868 GOOSE Performance Graph.
Maximum number of changing Data Objects Sent	10 / sec	Analog, Integer or Boolean type of Data objects. Subject to SCD file configuration. Refer CI868 GOOSE Performance Graph.

CI868 GOOSE Performance Graph

The GOOSE performance of CI868 module is a function of the following parameters:

CI868 Receive

- Number of Static signals configured in scd-file for CI868 Receive.
  This is the sum of all Data Objects (DO) signals subscribed to CI868 in all Datasets in all IEDs.
- Number of changing signals out of static signals for CI868 Receive.
  This is the sum of all Data Objects signals subscribed to CI868 changing at a given moment across all IEDs.

CI868 Send

- Number of Static Signals configured in scd-file from CI868 to other IEDs.
  This is the sum of all Data Objects signals in all Datasets from CI868 to other IEDs.
- Number of changing send signals out of static signals from CI868 to other IEDs.
  This is the sum of all Data Objects signals changing at a given moment from CI868.

Figure 16 provides the CI868 GOOSE performance for different configurations of Static and Changing Receive signals for operating within optimal load of CI868 CPU (85%).

This chart is applicable for CI868 configured for GOOSE communication.

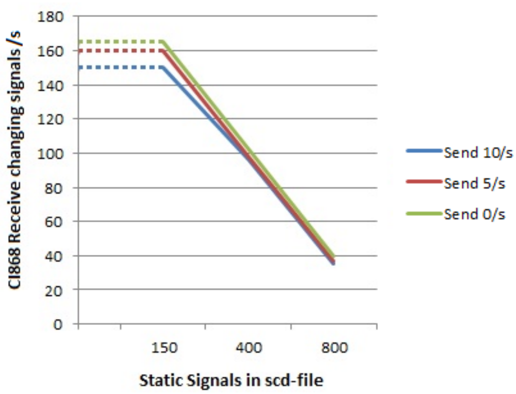

Figure 16. CI865 GOOSE Performance Chart

CI868 Performance for MMS Client Protocol Usage

The following are the configuration and performance parameters related to CI868 module configured for MMS communication.

It is recommended to follow the mentioned limits to have CI868 CPU load levels less than 85% for satisfactory performance of CI868 module for MMS communication.

Following are the recommendations to be followed while engineering the SCD file.

Table 56. Performance Parameters of CI868 Configured for MMS Client

Description	Limit	Remarks
Control Builder Configuration Data Per CI868 Module		
Maximum number of IEDs connected	20	
Maximum number of MMS Datasets	150	Subscribed Datasets count per CI868 monitored by the IEC 61850 Wizard.

Table 56. Performance Parameters of CI868 Configured for MMS Client (Continued)

Description	Limit	Remarks
Maximum number of LDs under MyIED	10	
Maximum number of LDs under other IEDs	50	Starting from Position 200 under other IED in Control Builder hardware tree.
Maximum number of LNs per LD	253	
MMS Performance Data Per CI868 Module		
Maximum number of Static Data Objects (signals) configured	1000	SCD file should not be configured for more than: Maximum 1000 Data Objects (signals) from 20 IEDs 20 IEDs for 800xA SV5.1 FP480 Analog, Integer or Boolean type of Data objects. When creating scd file, high CI868 load for MMS signals can be avoided by grouping the frequently changing signals in the same dataset. **For Example**: Measurement signals must be grouped in one dataset, Status signals must be grouped in another dataset.
Maximum number of Data Objects per Dataset	10	Analog, Integer or Boolean type of Data objects. This number should not be increased, otherwise the CI868 board could be overloaded. For more data signals to CI868 from same IED, use additional Datasets.
Maximum number of changing Data Objects Received	80 / sec	Analog, Integer or Boolean type of Data objects.
Maximum number of MMS Control Command sent	1 / sec	MMS Control Commands sent from CI868 via CSWI and XCBR LNs.

MMS performance of CI868 module functions are as follows:

CI868 Receive

- **Memory**: Number of Static RCB signals configured in SCD file for CI868 Receive.
  This is the sum of all Data Objects signals subscribed to CI868 in all Datasets in all IEDs.
- **Load**: Number of changing DO signals for CI868 Receive.
  This is the sum of all DO signals subscribed to CI868 changing at a given moment across all IEDs. The number of MMS signals changing in lesser number of Datasets consumes less CI868 load as against the same number of signals changing in more number of datasets.

CI868 Performance for MMS Client and GOOSE Protocol Combined Usage

The following are the configuration and performance parameters related to CI868 module configured for GOOSE and MMS communication.

It is recommended to follow the mentioned limits to have CI868 CPU load levels less than 85% for satisfactory performance of CI868 module for GOOSE and MMS communication.

Following are the recommendations to be followed while engineering the SCD file.

Table 57. Performance Parameters of CI868 Configured for GOOSE and MMS Client

Description	Limit	Remarks
Control Builder Configuration Data Per CI868 Module Refer to Table 55 and Table 56 for GOOSE and MMS Configuration Limits.		
GOOSE + MMS Performance Data Per CI868 Module		
Maximum number of IEDs connected	20	

Table 57. Performance Parameters of CI868 Configured for GOOSE and MMS Client (Continued)

Description	Limit	Remarks
Maximum number of Data Objects per Dataset	10	Analog, Integer or Boolean type of Data objects. This number should not be increased, otherwise the CI868 board could be overloaded. For more data signals to CI868 from same IED, use additional Datasets.
Maximum number of changing Data Objects Received	60 / sec	Analog, Integer or Boolean type of Data objects.
Maximum number of MMS Control Command sent	1 / sec	MMS Control Commands via CSWI and XCBR LNs.

Calculation of I/O Copy Time Estimate for ControlNet with CI865 Unit

Each ControlNet node (200-ACN, 200-RACN and CI865) has its own I/O data memory that is asynchronously updated.

Different configurations and parameters, depending on the I/O system type that is used, determine the total I/O update time.

To estimate the maximum time, from I/O point status change until it is processed in the application program, all times from I/O point to Task Interval Time, t_{ti}, have to be added according to the formula below.

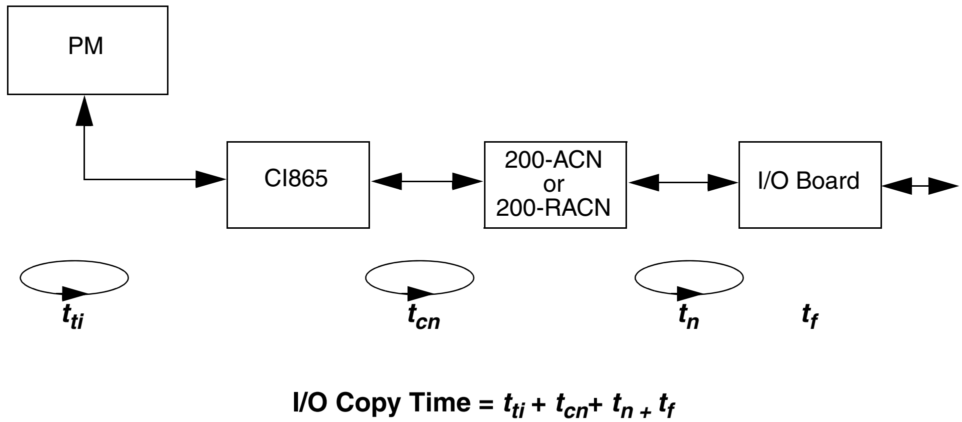

Figure 17. I/O Copy Schedule

Remote Series 200 I/O and Rack I/O

The transmission on the ControlNet network, t_{cn}, runs asynchronously with the execution of the application program and the I/O copy cycles on 200-ACN and 200-RACN, and is determined by the network parameters.

t_{cn} for input signals equals the EPR (Expected Package Rate) for the specific node. The EPR is a user definable setting, 5-60ms.

t_{cn} for output signals equals the NUT (Network Update Time) for the specific node. The NUT is a user definable setting, 5-60ms.

Series 200 I/O

The 200-ACN I/O memory is updated cyclically, asynchronously with the execution of the application program. The node update time, t_n, is determined by the number and type of I/O units. The approximate copying times are 0.05ms for digital I/O units and 0.2ms for analogue I/O units. There is an overhead of about 2ms for each cycle.

Example 1:
A 200-ACN configured with 8 analogue I/O units gives the following node update time:

$t_n \approx 2+8*0.2 \approx 3.6$ms

Example 2:
A 200-ACN configured with 8 digital I/O units gives the following node update time:

$t_n \approx 2+8*0.05 \approx 2.4$ms

Rack I/O

The 200-RACN I/O memory is updated cyclically, asynchronously with the execution of the application program. The node update time, t_n, is determined by the number and types of connected to 200-RACN.

The copying of the analogue input boards is spread out in time due to the relative long copying time. One analogue input board is copied each cycle (for example, if there are three analog input boards, each one of them will be copied every third cycle).

The approximate copying times are 0.14 ms for digital boards and analogue output boards and 1.2 ms for analogue input boards. There is an overhead of about 1ms for each cycle.

Example 1:
A 200-RACN is configured with 12 digital boards, 2 analogue output boards and 2 analogue input boards. The node update time, t_n, for this rack is calculated according to the following:

One cycle corresponds to: 1+14*0.14+1*1.2 ms ≈ 4.2ms

Two cycles are needed to copy all analogue input boards, which gives the total node update time for this node: $t_n \approx 2*4.2 \approx 8.4$ms

Example 2:
A 200-RACN is configured with 11 digital boards, 2 analogue output boards and 3 analogue input boards. The node update time, t_n, for this rack is calculated according to the following:

One cycle corresponds to: 1+13*0.14+1*1.2 ms ≈ 4.0ms

Three cycles are needed to copy all analogue input boards which gives the total node update time for this node: t_n ≈ 3*4.0 ≈ 12ms

Filter Time

The I/O filter time, t_f has to be added for input boards/units.

EtherNet/IP and DeviceNet

For EtherNetIP / DeviceNet configurations with CI873 the following dimensioning guidelines needs to be taken into account.

General

The limitations, with respect to the various devices in general are:

- CI873 can act only as a scanner.
  It does not accept class 1 and class 3 connections from any other scanner.
- The number of I/O modules that can be connected under Ethernet/IP or DeviceNet device adapter type device is 63.
- The number of configuration parameters supported per EtherNet/IP or DeviceNet device is 1000.
- The CI873 supports Listen only connection with EtherNet/IP device, provided there is already Exclusive owner connection in the device. The CI873 does not support Redundant owner connections for EtherNet/IP devices.
- The Read only parameter and monitoring parameters in EDS file are not supported in this release.
- The tag based Class 1 information should be there in EDS file for communication with Allen Bradley PLC where Class 3 tag can be added along with Class 1 connection.
- The total number of Input and Output bytes along with channel status bytes should not exceed more than 80Kb per CI873.
- The Configuration assembly size of 200 is supported per EtherNet/IP or DeviceNet device.

- The CI873 supports 20 CIP connections (including Class 1 and Class 3) per EtherNet/IP device. CI873 supports total of 128 connections.
- The CI873 only supports devices which uses EtherNet/IP encapsulation of CIP.
- CI873 does not support PCCC, Modbus encapsulation.
- CI873 supports CH1 Ethernet interface with a speed of 100 Mbps.
  CH2 is not supported.
- A maximum of 6 non redundant CI873 can be connected to each AC 800M controller.

EtherNet/IP

The limitations, with respect to the EtherNet/IP device involved are:

- EtherNet/IP supports three Class 1 connection and three Class 3 tag per Allen Bradley Control Logix PLC. The CI873 supports three Class 3 tags with 100ms cycle time.
- The data transfer, using the Class 3 connection is slower than the Class 1 connection.
- The Class 3 connection is not supported for any EtherNet/IP devices except Allen Bradley Control Logix PLC. The CI873 uses tag based Class 3 to write data to it.
- The maximum number of bytes support for Class 1 read tag is 496 and for Class 3 write tag is 432.
- 1000 bytes per Class 1 connection is supported,
  for example O->T: 500 and T->O : 500.

DeviceNet

The limitations, with respect to the LD 800DN linking device (for DeviceNet) are:

- The maximum number of input bytes supported by LD 800DN is 496 bytes. If the total number of input bytes of all DeviceNet slaves configured under the linking device exceeds 496 bytes, download is stopped.

- The maximum number of output bytes supported by LD 800DN is 492 bytes. If the total number of output bytes of all DeviceNet slaves configured under the linking device exceeds 500 bytes, download is stopped.
- A maximum of four LD 800DN linking devices can be connected under one CI873.
- Multiple CI873 cannot listen to same LD 800DN data.
- The maximum number of DeviceNet connections per device is restricted to 5.

Performance Data

Typical performance of the CI873 is:

- CI873 can handle a maximum of 10 CIP connections with 10ms RPI. However it can handle a maximum of 128 CIP connections.
- The reaction time of CI873, that is, the time from changed input channel to the time setting an output channel is less than 100ms at a maximum CI873 CPU Load of 80%, provided the data is sent over a connection operating at an RPI of 50ms or less.
- Data throughput of 1000 CIP I/O packets receive/second and 500 CIP I/O Packets sent/second can be achieved at an optimum load of 85%.
  Each I/O packet can have data size ranging from 4 to 500 bytes.
- Redundancy Switchover time is 120ms for 10 CIP connections operating at 10ms RPI, that is, the time I/O communication stops in primary to the time I/O communication starts in switched primary.

Communication

IAC and MMS Communication

Communication performance is affected by *bandwidth, message length* and *cyclic load*.

Higher load on the CPU will cause lower throughput in the communication, and lower load will give higher throughput.

The 10 Mbit/s is an ethernet speed which is in balance with the performance of the AC 800M controller. The maximum data flow to and from the software in an AC 800M is less than 10 Mbit/s. This means that the data flow for one AC 800M is not limited due to its ethernet speed of 10 Mbit/s.

The Ethernet standard allows bandwidth transmission at 10 Mb/s, 100 Mb/s (fast Ethernet), and 1000 Mb/s (Gbit Ethernet) and AC 800M supports 10 Mb/s and 100 Mb/s (PM891 only).

In a system with several controllers and PCs a switched network should be used between the nodes. If hubs are used instead of switches the number of connected nodes plays an important role for the throughput of the network and a single node may get an ethernet throughput which is less than the nominal network speed. With switches this is however not the case. Each node gets an ethernet throughput which is more or less independent of the number of connected nodes. This means that the data flow in the complete system is also not limited by AC 800M's ethernet speed of 10 Mbit/s.

For networks with several switches ABB recommend to use 100 Mbit/s or 1 Gbit between switches since those ports need to manage data from several nodes to several nodes. 10 Mbit/s should only be used on the ports where AC 800M controllers are connected. Those ports only need to manage data for one node.

The actual communication throughput for a controller thus mainly depends on other factors than the ethernet speed, for example the cycle times of the applications and the CPU load in the controller.

Inter Application Communication (IAC) uses communication variables (CVs). The controller with the application that holds the **out** communication variable is the Server. The controller with the application that holds the **in** communication variable is the Client. The communication with IAC is based on cyclic reading only.

Connections Cannot Block Each Other

The controller can handle a number of concurrent communication connections. All connections are handled in a round robin fashion. This means that no connection can block communication for any other connection.

For example this means that it is guaranteed that variable access from one controller to another can always be executed even if a Control Builder is downloading a very large application domain to one of the controllers.

Number of Connections

The controller's communication stack handles several simultaneous connections. Messages are treated in a round robin fashion that guarantees that no connection is starved, but the transmission rate through the stack decreases slightly with the number of active connections. With 20[1] or less connections the performance decrease per additional connection is however small. With more than 20[1] connections the amount of buffers per connection is reduced. This may decrease the performance for the connections substantially more, at least for connections transmitting much data.

Communication Load

Table 58 shows the execution time for transferring one variable of type dword between two AC 800M controllers using IAC or MMS, server or client.
It also tells the resulting cyclic and total load for communicating one dword per second.

The measurements were done by transferring as many dwords as possible in each transaction, that is, non-SIL IAC = 350 dwords, SIL IAC = 19 dwords, non-

1. 30 in PM866 and 40 in PM891.

SIL MMS = 166 dwords, SIL MMS = 4 dwords.
The task interval time was set to 200ms, and the IAC interval time to 100 ms.

Table 58. Load Caused by External IAC and MMS Communication

	PM864	PM865 SIL2	PM865 SIL3
IAC Server, Out variables			
Execution time/dword [us]	0,85714	5,26316	7,54386
Cyclic load /(dword/sec) [%]	0,00004	0,00025	0,00035
Total load /(dword/sec) [%]	0,00032	0,00129	0,00130
IAC Client, In variables			
Execution time/dword [us]	0,53333	1,64160	4,23977
Cyclic load /(dword/sec) [%]	0,00001	0,00010	0,00019
Total load /(dword/sec) [%]	0,00035	0,00151	0,00402
MMS Server, Read			
Execution time/dword [us]	0,00000	50,00000	50,00000
Cyclic load /(dword/sec) [%]	0,00000	0,00500	0,00500
Total load /(dword/sec) [%]	0,00188	0,08792	0,09458
MMS Client, Read			
Execution time/dword [us]	0,30120	106,25000	118,75000
Cyclic load /(dword/sec) [%]	0,00000	0,01000	0,01000
Total load /(dword/sec) [%]	0,00434	0,11000	0,11875

Communication Throughput at 40% Cyclic Load

Table 59 shows how many dwords an AC 800M can transfer via IAC or MMS, to or from, another controller in case its cyclic load (without communication) is at 40%.

The number of dwords were increased until the controller was considered to be throttled. The criteria for throttling were set to:

- Max. cyclic load
  - HI Controller: 50%
  - PA Controller: 70%
- Max. total load
  - HI Controller: 90%
  - PA Controller: N/A
- Numbers of transactions/sec is maximized and does not increase anymore

The underlined value shows what criteria caused the throttling. The given values show the maximum communication throughput.

The measurements were done by transferring as many dwords as possible in each transaction, that is, non-SIL IAC = 350 dwords, SIL IAC = 19 dwords, non-SIL MMS = 166 dwords, SIL MMS = 4 dwords.
The task interval time was set to 200ms, and the IAC interval time to 100 ms.

Table 59. External IAC and MMS Communication Throughput at 40% Cyclic Load

	PM891	**PM864**	**PM865 SIL2**	**PM865 SIL3**
IAC Server, Out variables				
Max no of dwords communicated	11550	6300	1596	1596
Transactions/sec	180	90	75	75
Cyclic load [%]	41	42	44	45
Total load [%]	54	69	73	75
IAC Client, In variables				
Max no of dwords communicated	5950	5250	798	532
Transactions/sec	90	87	45	30
Cyclic load [%]	40	41	41	42
Total load [%]	50	67	70	79

Table 59. External IAC and MMS Communication Throughput at 40% Cyclic Load

	PM891	PM864	PM865 SIL2	PM865 SIL3
MMS Server, Read				
Max no of dwords communicated	7470	3652	68	68
Transactions/sec	225	110	85	80
Cyclic load [%]	40	40	42	42
Total load [%]	71	89	90	90
MMS Client, Read				
Max no of dwords communicated	4150	1992	48	48
Transactions/sec	125	60	60	60
Cyclic load [%]	40	40	43	43
Total load [%]	91	93	90	90

Modbus RTU Master Communication

AC 800M **50% Load in the Controller** **300 Booleans in Each Telegram**	**Max Transmission Rate (Total Transactions/second)**			
	PM864A / PM866 / PM891			
	MBWrite		**MBRead**	
	1 channel	4 channels	1 channel	4 channels
1200 baud (8 data bits, 1 stop bit, odd parity)	1.3	2	1.7	5.6
19200 baud (8 data bits, 1 stop bit, odd parity)	10.1	19.8	10.5	36.3

MODBUS TCP

Table 60. MODBUS TCP Performance Data. Reading Dint using one CI867 as Master

Number of Slaves Connected and Communicating	Message Length (in Dint)	Total Transactions/s (Sum of all Slaves)	Average Transaction /Slave(1)
1 task time=100 ms	60	149	149
1 task time=250 ms	60	89	89
5 task time=100 ms	60	158	31
5 task time=250 ms	60	160	33
10 task time=100 ms	60	150	15
10 task time=250 ms	60	160	17
20 task time=100 ms	60	94	6
20 task time=250 ms	60	110	9
30 task time=100 ms	60	97	3
30 task time=250 ms	60	123	4

(1) Cyclic read at maximum possible rate is used.

Table 61. MODBUS TCP Performance Data. Reading Boolean using one CI867 as Master

Number of Slaves Connected and Communicating	Message Length (in Boolean)	Total Transactions/s (Sum of all Slaves)	Average Transaction /Slave(1)
1 task time=100 ms	60	114	114
1 task time=250 ms	60	104	104
5 task time=100 ms	60	130	26
5 task time=250 ms	60	129	26
10 task time=100 ms	60	113	11
10 task time=250 ms	60	121	12
20 task time=100 ms	60	100	5
20 task time=250 ms	60	141	7
30 task time=100 ms	60	113	3
30 task time=250 ms	60	124	4

(1) Cyclic read at maximum possible rate is used.

Table 62. MODBUS TCP Performance.Data. Reading Real using one CI867 as Master

Number of Slaves Connected and Communicating	Message Length (in Real)	Total Transactions/s (Sum of all Slaves)	Average Transaction /Slave[1]
1 task time=100 ms	60	104	104
1 task time=250 ms	60	95	95
5 task time=100 ms	60	120	24
5 task time=250 ms	60	120	24

(1) Cyclic read at maximum possible rate is used.

Table 63. MODBUS TCP Performance Data. Reading Dint using one CI867 as Slave

Number of Masters Connected and Communicating	Number of Data in Dint	Total Transactions/s (Sum of all Slaves)	Average Transaction /Master
1 task time=50 ms	50		20
1 task time=50 ms	100		20
2 task time=50 ms	50		20
2 task time=50 ms	100		20

Table 63. MODBUS TCP Performance Data. Reading Dint using one CI867 as Slave (Continued)

Number of Masters Connected and Communicating	Number of Data in Dint	Total Transactions/s (Sum of all Slaves)	Average Transaction /Master
8 task time=50 ms	50		20
8 task time=50 ms	100		20

Table 64. MODBUS TCP Performance. Data. Reading Boolean using one CI867 as Slave

Number of Masters Connected and Communicating	Number of Data in Boolean	Total Transactions/s (Sum of all Slaves)	Average Transaction /Master
1 task time=100 ms	1		10
1 task time=100 ms	525		10
2 task time=100 ms	1		10
2 task time=100 ms	525		10
8 task time=100 ms	1		10
8 task time=100 ms	525		10

MasterBus 300 Network

The MasterBus 300 network can have maximum 100 nodes on a CI855 in a control area. The maximum performance is 200 data set per second. Switch over time to a redundant bus is 3 seconds.

INSUM Network

Table 65. INSUM Design Limitations

Limitation		
Limitation type	**Value**	**Reason**
Number of MCUs per controller	128	Execution time for IEC 61131-3 application and system heap memory
Number of MCUs per CI857	128	CPU performance on CI857
Number of Gateways per CI857	2	CPU performance on CI857 and memory on CI857
Number of CI857 per AC 800M	6	CPU performance

Table 66. INSUM Communication Interface CI857 Performance

Response time			
Action	**Result**	**Condition**	**Comments**
Start/stop, - 64 MCUs - 128 MCUs	 5-8 s 15-16.5 s	Five NVs subscribed per MCU	Time measured inside the IEC 61131-3 application, from the time it sends the first command with INSUMWrite to NVDesState until it receives the last state change with INSUM Receive from NVMotorStateExt.
Stop one MCU due to chain interlock from other MCU	500 ms	Task cycle 250 ms, 66 MCUs, five NVs subscribed per MCU	Time measured on electrical state signals on the MCUs from the time the first MCU stop until the second MCU stop.

800xA for AC 800M Performance

The provided information is measured with the products running on a PC with an Intel Xeon®, 2.40 GHz processor and 4Gbyte RAM.

The following settings were applied during the measurements.
Graphic Display update rate 0 ms (default), OPC Server cache update rate 1000 ms, Controller task interval time 10 ms and Controller Modulebus scan time 100 ms.

Display Exchange Time

The OPC Server for AC 800M collects data from controllers via MMS, and makes it available to OPC clients. The table below shows the display exchange time of a process display containing 100 display elements.

Table 67. Display Exchange Time for Graphic Display Element

Object	100 Elements of Type	VB Graphics (Latest Data received)	Process Graphics 2 (Subscription Timings)
AnalogInCC	Value	400 ms	432 ms
AnalogInCC	Bar	622 ms	928 ms
AnalogInCC	Reduced Icon	731 ms	518 ms
AnalogInCC	Standard Icon	2562 ms	909 ms
MotorUniM	Reduced Icon	986 ms	939 ms
MotorUniM	Standard Icon	2291 ms	1014 ms
PidCC	Reduced Icon	895 ms	1009 ms
PidCC	Standard Icon	3592 ms	1909 ms

Command Response Time

The OPC Server for AC 800M collects data from controllers via MMS, and makes it available to OPC clients.The data below shows the response time for a signal to go from a button in the operator workplace to the I/O hardware (output channel), fed back to the input channel, until the operator gets the feedback indication.

Table 68. Command Response Time

Controller	Signal Data Type	Total Response Time (Seconds)
PM864A/PM866/PM891	Boolean (bool)	1.2
	Real	1.5

Section 4 Supported Hardware and I/O Families

The information given is valid for AC 800M with 5.1 Feature Pack 4.

For some hardware units a certain product revision is required, as described in Release Notes.

AC 800M Controllers

Figure 18 shows the symbol on the front of a CEX bus unit which indicates support for online replacement.

Figure 18. CEX Symbol

All communication interface units support firmware download by the Control Builder except CI858, which is upgraded with an external tool.

Supported AC 800M modules are shown in the Table 69.

Table 69. Supported Modules

Unit	Description	Online Replacement	Redundancy	Online upgrade (only valid for Control Builder Professional in 800xA)	
				Non-redundant	Redundant
PM851	Controller unit PM851 is a 32-bit, Single Board Computer, which directly connects to the S800 I/O system via ModuleBus (one electrical and one optical) and one communication interface. PM851 supports a maximum of one CEX bus module.	No	No	No	N/A
PM851A	This is a replacement for PM851 having 12 Mbyte RAM in total.	No	No	No	N/A
PM856	Controller unit PM856 is a 32-bit, Single Board Computer, which directly connects to the S800 I/O system via ModuleBus. PM856 supports a maximum of twelve CEX bus modules.	No	No	No	N/A
PM856A	This is a replacement for PM856 having 16 Mbyte RAM in total.	No	No	No	N/A
PM860	Controller unit PM860 is a 32-bit, Single Board Computer, which directly connects to the S800 I/O system via ModuleBus. PM860 is twice as fast as PM856 in executing an application program. PM860 supports a maximum of twelve CEX bus modules.	No	No	No	N/A

Table 69. Supported Modules (Continued)

Unit	Description	Online Replace-ment	Redun-dancy	Online upgrade (only valid for Control Builder Professional in 800xA)	
				Non-redun-dant	Redun-dant
PM860A	This is a replacement for PM860 having 16 Mbyte RAM in total.	No	No	No	N/A
PM861	Controller unit PM861 (Redundant and Singular) is a 32-bit, Single Board Computer, which directly connects to the S800 I/O system via ModuleBus. The unit has one optional Redundancy Control Link for redundant configuration. PM861 supports a maximum of twelve CEX bus modules.	Yes[1]	Yes	No	Yes
PM861A	This is a replacement for PM861 and can use redundant communication units.	Yes[1]	Yes	No	Yes
PM864	Controller unit PM864 (Redundant and Singular) is a 32-bit, Single Board Computer, which directly connects to the S800 I/O system via ModuleBus. PM864 is 50% faster than PM861 in executing an application program. PM864 supports a maximum of twelve CEX bus modules.	Yes[1]	Yes	No	Yes
PM864A	This is a replacement for PM864 and can use redundant communication units.	Yes[1]	Yes	No	Yes

Table 69. Supported Modules (Continued)

Unit	Description	Online Replacement	Redundancy	Online upgrade (only valid for Control Builder Professional in 800xA)	
				Non-redundant	Redundant
PM865	Controller unit PM865 (Redundant and Singular) is a 32-bit, Single Board Computer, which directly connects to the S800 I/O system via ModuleBus. The unit has one optional Redundancy Control Link for redundant configuration, and can use redundant communication units. PM865 supports a maximum of twelve CEX bus modules. PM865 can be used in an AC 800M High Integrity system.	Yes[1]	Yes	No	Yes
PM866	Controller unit PM866 (Redundant and Singular) is a high-performance, 32-bit, Single Board Computer, which directly connects to the S800 I/O system via ModuleBus. The unit has one optional Redundancy Control Link for redundant configuration. The PM866 processor unit has performance data which is approximately 1.4 times the performance of PM864.	Yes[1]	Yes	No	Yes

Table 69. Supported Modules (Continued)

Unit	Description	Online Replace-ment	Redun-dancy	Online upgrade (only valid for Control Builder Professional in 800xA)	
				Non-redun-dant	Redun-dant
PM891	Controller unit PM891 (Redundant and Singular) is a high performance controller, with four times higher memory than PM866, and about two times faster performance than PM866. PM891 is capable of handling applications with high requirements. PM891 connects to the S800 I/O system through the optical Modulebus. It can act as a stand-alone Process Controller, or as a controller performing local control tasks in a control network.	Yes[1]	Yes	No	Yes
BC810	CEX-bus interconnection unit.	Yes	N/A	N/A	N/A
SM810	Monitor the hardware and software execution of PM865. There must always be one running SM module in an AC 800M High Integrity controller. SM810 supports only SIL1-2 applications. In a redundant PM865 pair, it is only possible to perform online replacement on one of the supervisory modules at a time.	Yes	Yes	No	Yes

Table 69. Supported Modules (Continued)

Unit	Description	Online Replace-ment	Redun-dancy	Online upgrade (only valid for Control Builder Professional in 800xA)	
				Non-redun-dant	Redun-dant
SM811	Monitor the hardware and software execution of PM865. SM811 supports both SIL1-2 and SIL3. A SIL3 application code runs in this module in parallel with PM865. There must always be one running SM module in an AC 800M High Integrity controller. In a redundant PM865 pair, it is only possible to perform online replacement on one of the supervisory modules at a time.	Yes	Yes	No	Yes
CI853	The CI853 is the RS-232C serial communication interface unit for the AC 800M. Two possible settings of the serial ports on the CI853 unit are not valid and must not be used. These are 7 data bits, no parity, 1 stop bit or 8 data bits, parity, 2 stop bits. CI853 can be used in an AC 800M High Integrity system.	Yes	No	Yes[2]	N/A
CI854	The CI854 unit is the communication interface for PROFIBUS DP/V1 for the AC 800M with redundant PROFIBUS lines and DP/V1 communication. It is a master unit and you can connect up to 124 slaves to the master. However, you cannot connect more than 32 units in one segment.	No	No	Yes[3]	N/A

Table 69. Supported Modules (Continued)

Unit	Description	Online Replace-ment	Redun-dancy	Online upgrade (only valid for Control Builder Professional in 800xA)	
				Non-redun-dant	Redun-dant
CI854A	The CI854A unit is the communication interface for PROFIBUS DP/V1 for the AC 800M with redundant PROFIBUS lines and DP/V1 communication. It is a master unit and you can connect up to 124 slaves to the master. However, you cannot connect more than 32 units in one segment. CI854A can be used in an AC 800M High Integrity system.	Yes	Yes	Yes [3]	Yes [4]
CI855	The CI855 unit is the communication interface for MasterBus 300 for the AC 800M. CI855 houses two Ethernet ports to support MasterBus 300 Network redundancy. CI855 can be used in an AC 800M High Integrity system.	Yes	No	Yes [2]	N/A
CI856	The CI856 is a communication interface for the S100 I/O system for the AC 800M. Up to five S100 I/O racks can be connected to one CI856 where each I/O rack can hold up to 20 I/O boards. CI856 can be used in an AC 800M High Integrity system.	Yes	No	Yes [3]	N/A
CI857	The CI857 unit is the communication interface for INSUM for the AC 800M. CI857 can be used in an AC 800M High Integrity system.	Yes	No	Yes [5]	N/A

Table 69. Supported Modules (Continued)

Unit	Description	Online Replace-ment	Redun-dancy	Online upgrade (only valid for Control Builder Professional in 800xA)	
				Non-redun-dant	Redun-dant
CI858	The CI858 unit is the communication interface for ABB Drives using DDCS protocol for the AC 800M.	Yes	No	Yes[3]	N/A
CI860	The CI860 unit is the communication interface for Fieldbus Foundation HSE for the AC 800M.	Yes	Yes	Yes[3]	Yes[4]
CI862	The CI862 is the communication interface to the TRIO blocks (remote I/O) and manages the channel data for the AC 800M controller. The CI862 unit handles the I/O configuration and I/O scanning of up to 30 TRIO blocks.	Yes	Yes	Yes[3]	Yes[3]
CI865	The CI865 is the communication interface to Satt I/O on ControlNet for AC 800M.	Yes	No	Yes[3]	N/A
CI867	The CI867 unit is the MODBUS TCP communication interface for the AC 800M. CI867 houses two Ethernet ports. One port supports full duplex with 100 Mbps speed and one port supports half duplex with 10 Mbps speed. CI867 can be used in an AC 800M High Integrity system.	Yes	Yes[6]	Yes[2]	Yes[2]

Table 69. Supported Modules (Continued)

Unit	Description	Online Replace-ment	Redun-dancy	Online upgrade (only valid for Control Builder Professional in 800xA)	
				Non-redun-dant	Redun-dant
CI868	The CI868 unit is the IEC 61850 communication interface for the AC 800M. CI868 can be used in an AC 800M High Integrity system.	Yes	No	Yes [2,7]	N/A
CI869	The CI869 is the AF 100 communication interface for AC 800M. CI869 can be used in an AC 800M High Integrity system.	Yes	Yes	Yes [2]	Yes [2]
CI871	The CI871 is the PROFINET IO communication interface for the AC 800M.	Yes	No	Yes [2,3]	N/A
CI873	The CI873 is the EtherNet/IP and DeviceNet communication interface for AC 800M. CI873 can be used in an AC 800M High Integrity system.	Yes	Yes	Yes [2]	Yes [4]

NOTES:
1. Online replacement is only supported in a redundant configuration, the unit to replace MUST NOT be energized.
2. During an online upgrade, the communication between the communication interface and the connected sub units are interrupted.
3. During an online upgrade, the communication interface sets the outputs of connected I/O units to values specified by OSP control (Output Set as Predetermined).
4. Full support of online upgrade. One of the redundant communication interface units is always active during the online upgrade process.
5. During an online upgrade, CI857 is disconnected from INSUM Gateway and the connected INSUM devices keep on running with the values they have just before the switch.
6. Module redundancy only. It is not possible to get media redundancy by enabling the second Ethernet port (Ch2).
7. For CI868 Firmware Upgrade scenarios applicable during Control Builder project migration from earlier versions to Feature Pack version, refer to *AC 800M IEC 61850 Engineering and Configuration (9ARD171385*)* Manual.

Adapters for I/O Types

Table 70 shows the supported adapters for I/O types.

Table 70. Adapters for I/O Types

Adapter	Can be connected to	HART[1]	SOE[2]
TB820	PM851 and PM851A PM856 and PM856A PM860 and PM860A PM861 and PM861A (Single controller only) PM864 and PM864A (Single controller only) PM866 (Single controller only) PM891 (Single controller only)	Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes
TB840 TB840A	PM851 and PM851A PM856 and PM856A PM860 and PM860A PM861 and PM861A PM864 and PM864A PM865 PM866 PM891	Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes
DSBC 173A	CI856	No	Yes
DSBC 174	CI856	No	Yes
DSBC 176	CI856	No	Yes
CI801	CI854 and CI854A	Yes	No
CI830[3]	CI854 and CI854A	No	No
CI840	CI854 and CI854A	Yes	No
CI840A	CI854 and CI854A	Yes	No
CI920	CI854 and CI854A	Yes	No

Table 70. Adapters for I/O Types (Continued)

Adapter	Can be connected to	HART[1]	SOE[2]
CI920A	CI854 and CI854A	Yes	No
200-APB12	CI854 and CI854A	No	No
200-ACN	CI865	No	No
200-RACN	CI865	No	No
RPBA-01	CI854 and CI854A	No	No
NPBA-12	CI854 and CI854A	No	No
FPBA-01	CI854 and CI854A	No	No
RETA-02	CI871	No	Yes
FENA-11	CI871	No	Yes
MNS *i*S	CI871	No	Yes
LD800 DN	CI873	No	No

NOTES:
1. Only valid for Control Builder Professional in 800xA.
2. OPC Server for AC 800M must be used for alarms and events.
3. CI830 is replaced by CI801 at new installations.

Table 71 provides a description of the supported adapters.

Table 71. Adapter Description

Adapter	Description
TB820	ModuleBus Modem
TB840 TB840A	ModuleBus Modem, primarily for redundant ModuleBus.
DSBC 173A	The DSBC 173A unit is the bus extender slave inserted in the last position of a S100 I/O rack.

Table 71. Adapter Description (Continued)

Adapter	Description
DSBC 174	The DSBC 174 unit is the bus extender slave inserted in the last position of a S100 I/O rack.
DSBC 176	The DSBC 176 unit is the bus extender slave inserted in the last position of a S100 I/O rack.
CI801	The CI801 is a remote PROFIBUS DP-V1 adapter for S800 I/O units. The CI801 does not support redundancy. The CI801 can handle up to 24 S800 I/O-units. 12 I/O-units can be directly connected to the ModuleBus on the CI801, while the remaining I/O-units have to be connected via I/O-clusters. Up to 7 I/O-clusters can be connected to one CI801, and the numbering of I/O-units connected to a cluster will start with 101 for cluster 1, 201 for cluster 2 and so on.
CI840 CI840A	The CI840(A) is a remote PROFIBUS DP-V1 adapter for S800 I/O units, with redundancy capabilities. CI840 supports redundant I/O modules. The CI840(A) can handle up to 24 S800 I/O-units. 12 I/O-units can be directly connected to the ModuleBus on the CI840, while the remaining I/O-units have to be connected via I/O-clusters. Up to 7 I/O-clusters can be connected to one CI840(A), and the numbering of I/O-units connected to a cluster will start with 101 for cluster 1, 201 for cluster 2 and so on.
CI920 CI920A	The CI920(A) is a remote PROFIBUS DP-V1 adapter for S900 I/O units.
200-APB12	he 200-APB12 unit is a remote PROFIBUS DP slave I/O adapter for S200 I/O and S200L I/O units. 200-APB12 is connected to the controller via a PROFIBUS DP/V0 master unit on the controller system bus. A 200-APB12 unit can have up to eight S200 I/O units. The number of 200-APB12 slaves are, by the DIP switches, limited to 99.
200-ACN	The 200-ACN is a remote ControlNet I/O adapter for Series 200 I/O units. 200-ACN is connected to a controller via a CI865 communication interface on the controller system bus. 200-ACN units are used as nodes on the Satt ControlNet fieldbus. Each 200-ACN unit can handle up to eight Series 200 I/O units.

Table 71. Adapter Description (Continued)

Adapter	Description
200-RACN	The 200-RACN unit is a remote Concurrent adapter for rack based I/O units. 200-RACN is connected to a controller via a CI865 communication interface on the controller system bus. One or several adapter 200-RACN units are used as nodes. A maximum of eight I/O-racks are supported on the Satt Concurrent fieldbus.
RPBA-01 NPBA-12 FPBA-01	These PROFIBUS-DP adapter units are an optional device for ABB drives which enables the connection of the drive to a PROFIBUS system. The drive is considered as a slave in the PROFIBUS network. It is possible to: • give control commands to the drive (Start, Stop, Run enable, etc.) • feed a motor speed or torque reference to the drive • give a process actual value or a process reference to the PID controller of the drive • read status information and actual values from the drive • change drive parameter values • reset a drive fault.
RETA-02 FENA-11	These Ethernet Adapter modules are an optional device for ABB drives, which enables the connection of the drive to a PROFINET IO (PNIO) network. The drive is considered as a PNIO device on the PROFINET IO network, and it is compatible with all PNIO controller stations that support PROFINET IO and sub-slots. Through the Ethernet Adapter module, it is possible to: • give control commands • give control commands to the drive (Start, Stop, Run enable, etc.) • feed a motor speed or torque reference to the drive • give a process actual value or a process reference to the PID controller of the drive • read status information and actual values from the drive • change drive parameter values • reset a drive fault.

Table 71. Adapter Description (Continued)

Adapter	Description
MNS *i*S	MNS *i*S is a motor control center solution that can be used in PROFINET IO network. MNS *i*S delivers all the functions for control, protection, and monitoring of motors and motor starters using software and hardware modules for the specific tasks. M*Link*, one of the interface modules in MNS *i*S, serves as the serial gateway interface to higher level systems which communicate to all modules through PROFINET IO.
LD800 DN	The LD 800DN adapter, which functions as a gateway to connect control level networks with device level networks, provides a router or bridge functionality to connect EtherNet/IP to DeviceNet. The LD 800DN provides centralized data storage for data that is shared between the DeviceNet and Ethernet/IP networks.

The following adapters are supported (Table 72), but only for migration purposes, NOT at new installations.

Table 72. Supported Adapters for Migration

Adapter	Description
CI830	The unit CI830 is a remote PROFIBUS DP-V0 I/O adapter for units. CI830 is connected to a controller via a PROFIBUS DP-V0 master unit on the controller system bus. The CI830 can handle up to 24 S800 I/O-units. 12 I/O-units can be directly connected to the ModuleBus on the CI830, while the remaining I/O-units have to be connected via I/O-clusters. Up to 7 I/O-clusters can be connected to one CI830, and the numbering of I/O-units connected to a cluster will start with 101 for cluster 1, 201 for cluster 2 and so on. CI830 is replaced by CI801 at new installations. CI830 does not have full support for all S800 I/O-types.

I/O Families

All I/O units may be replaced in a running system. Table 73 shows the different I/O families.

Table 73. I/O Families

I/O Family	Connects To
S800 I/O	PM851, PM851A, PM856, PM856A, PM860, PM860A, PM861, PM861A, PM864, PM864A, PM865, PM866, PM891 TB820, TB840, TB840A CI801, CI830, CI840, CI840A
S900 I/O	CI920, CI920A
TRIO I/O	CI862
ABB Standard Drives	PM851, PM851A, PM856, PM856A, PM860, PM860A, PM861, PM861A, PM864, PM864A, PM865, PM866, PM891 TB820, CI801, CI830, CI858, RPBA-01, NPBA-12, FPBA-01, RETA-02, FENA-11
ABB Engineered Drives	PM851, PM851A, PM856, PM856A, PM860, PM860A, PM861, PM861A, PM864, PM864A, PM865, PM866, PM891 TB820, CI858, RPBA-01, NPBA-12, FPBA-01, RETA-02, FENA-11
S100 I/O	CI856
S200 I/O, S200L I/O and I/O 200C	200-APB12, 200-ACN
Satt Rack I/O	200-RACN

S800 I/O

Table 74 shows the different S800 I/Os.

Table 74. S800 I/O

Name	Description
AI801	Analog input unit, 8 inputs
AI810	Analog input unit, 8 inputs
AI815	Analog input unit, 8 inputs
AI820	Analog input unit, 4 differential inputs
AI825	Analog input unit, galvanic isolated analog input unit, 4 channels
AI830[1]	Analog input unit, 8 RTD inputs
AI835[2]	Analog input unit, 8 TC inputs
AI843	Analog input unit, 8 TC inputs, redundant possibilities
AI845	Analog input unit, 8 inputs, redundant possibilities, HART
AI880A[5]	Analog input unit, 8 inputs, SIL certified, redundant possibilities, HART
AI890	Analog input unit, 8 inputs, Intrinsic Safety interface
AI893	Analog input unit, 8 RTD/TC inputs, Intrinsic Safety interface
AI895	Analog input unit, 8 inputs, Intrinsic Safety interface, HART
AO801	Analog output unit, 8 outputs
AO810[3]	Analog output unit, 8 outputs
AO815	Analog output unit, 8 outputs
AO820	Analog output unit, 4 outputs
AO845	Analog output unit, 8 outputs, redundant possibilities, HART
AO890	Analog output unit, 8 outputs, Intrinsic Safety interface.
AO895	Analog output unit, 8 outputs, Intrinsic Safety interface, HART

Table 74. S800 I/O (Continued)

Name	Description
DI801	Digital input unit, 16 inputs
DI802	Digital input unit, 8 inputs
DI803	Digital input unit, 8 inputs
DI810	Digital input unit, 16 inputs
DI811	Digital input unit, 16 inputs
DI814	Digital input unit, 16 inputs
DI818	Digital input unit, 32 inputs
DI820	Digital input unit, 8 inputs
DI821	Digital input unit, 8 inputs
DI825[4]	Digital input unit, 8 channels with event recording (SoE, Sequence of events)
DI828	Digital input unit, 16 inputs
DI830[4]	Digital input unit, 16 inputs with event recording (SoE, Sequence of events)
DI831[4]	Digital input unit, 16 inputs with event recording (SoE, Sequence of events)
DI840[4]	Digital input unit 16 inputs, redundant possibilities with event recording (SoE, Sequence of events)
DI880[5]	Digital input unit, 16 inputs, SIL certified, redundant possibilities
DI885[4]	Digital input unit, 8 inputs
DI890	Digital input unit, 8 inputs, Intrinsic Safety interface
DO801	Digital output unit, 16 outputs
DO802	Digital output unit, 8 outputs
DO810	Digital output unit, 16 outputs

Table 74. S800 I/O (Continued)

Name	Description
DO814	Digital output unit, 16 outputs
DO815	Digital output unit, 8 outputs
DO818	Digital output unit, 32 outputs
DO820	Digital output unit, 8 outputs
DO821	Digital output unit, 8 outputs
DO828	Digital output unit, 16 outputs
DO840	Digital output unit 16 outputs, redundant possibilities
DO880[5]	Digital output unit, 16 outputs, SIL certified, redundant possibilities
DO890	Digital output unit, 8 outputs, Intrinsic Safety interface
DP820	Digital pulse counter
DP840	Pulse/Frequency input, 8 inputs, redundant possibilities, supported in CI830 but without redundancy

NOTES:
1. AI830/AI830A.
2. AI835/AI835A.
3. AO810/AO810V2.
4. No support in CI801 and CI840.
5. Only in PM865 and PM891 via TB840/TB840A.

S900 I/O

Table 75 shows the different S900 I/Os.

Table 75. S900 I/O

Name	Description
AI910N/S	Analog input unit, 4 inputs, 4-20 mA
AI920N/S	Analog input unit, 4 inputs, 4-20 mA, isolated
AI921N/S	Analog input unit, 4 inputs
AI930N/S	Analog input unit, 4 inputs, 4-20 mA, HART
AI931N/S	Analog input unit, 4 inputs, 0/4-20 mA, HART
AI950N/S	Analog input unit, 4 inputs, temperature sensor
AO910N/S	Analog output unit, 4 outputs, 4-20 mA
AO920N/S	Analog output unit, 4 outputs, 4-20 mA, isolated
AO930N/S	Analog output unit, 4 outputs, 4-20 mA, HART
DI920N	Digital input unit, 4 inputs, (NAMUR), isolated
DO910N/S	Digital output unit, 4 outputs, (for solenoid valves)
DO930N/S	Digital output unit, 4/6 outputs, dry contacts (relay)
DO940N/S	Digital output unit, 8 outputs
DO980N/S	Digital output unit, 16 outputs
DP910N/S	Frequency input and pulse counter, 2 inputs
DX910N/S	Bidirectional unit, 8 channels, (programmable) for digital input, 8 inputs, NAMUR/dry contacts or digital output, 8 outputs, for low power valves

TRIO I/O

Table 76 shows the different TRIO I/Os.

Table 76. TRIO I/O

Name	Description
4In2Out	Analog I/O unit, 4 inputs, 2 outputs
CSAnalogIO (CSANALOG)	Analog, current source I/O unit, 4 inputs / 2 outputs
CSAnalogIn (CSANAINP)	Analog, current source input unit, 6 inputs
CSAnalogOut (CSANAOUT)	Analog, current source output unit, 6 outputs
Thermocouple (TC)	Analog, circuit thermocouple input unit, 6 inputs
RTD	Analog, circuit resistive temperature detector, 6 inputs
16CircuitIO (IO_16CKT)	Digital, 16 circuit DC source and sink I/O, configurable as inputs or outputs
32CircuitIO (IO_32CKT)	Digital, 32 circuit DC source and sink I/O, configurable as inputs or outputs
8CircuitGrouped (GRP_8CKT)	Digital, 115 VAC 8 circuit grouped and low leakage I/O, configurable as inputs or outputs
8CircuitIsolated (ISO_8CKT)	Digital, 115 VAC / 125 VDC 8 circuit isolated I/O (4 groups of two I/O), configurable as inputs or outputs
16CircuitIn (IN_16CKT)	Digital, 115 VAC 16 circuit inputs (two banks of eight inputs)
16CircuitOut (OP_16CKT)	Digital, 16 relay outputs (four groups of four independent outputs each)
HighSpeed CounterA (HSC_A)	Counter, high speed counter A, four 16 bit up/down counters
HighSpeed CounterB (HSC_B)	Counter, high speed counter B, two bi-directional 24 bit up/down counters

S100 I/O

Table 77 shows the different S100 I/Os.

Table 77. S100 I/O

Name	Description
DSBC 173A/174 DSDC 176	Bus extender slave
DSAI 130 DSAI 130A	Analog input board, 16 inputs
DSAI 130D	Analog input board, 16 inputs with 4 sets of filter times
DSAI 133 DSAI 133A	Analog input board, 32 inputs
DSDI 110, DSDI 110A DSDI110AV1	Digital input board, 14 inputs, 24V
DSDI 115	Digital input board, 32 channels, 24 V
DSDI116	Digital input board, 32 channels, 24 V non-isolated
DSDI 120, DSDI 120A DSDI 120AV1	Digital input board, 32 inputs, 48 V
DSDI 125	Digital input board, 32 channels, 48 V
DSDI 126	Digital input board, 32 channels, 48 V non-isolated
DSDO 110	Digital output board, 32 outputs
DSDO 115	Digital output board, 32 outputs
DSDO 115A	Digital output board, 32 outputs, OSP control
DSDO 130	Digital output board, 16 relay outputs 24 - 240 VAC/VDC
DSDO 131	Digital output board, 16 relay outputs 24 - 240 VAC/VDC
DSAO 110	Analog output board, 4 outputs
DSAO 120	Analog output board, 8 outputs
DSAO 120A	Analog output board, 8 outputs, OSP control

Table 77. S100 I/O (Continued)

Name	Description
DSAO 130	Analog output board, 16 outputs
DSAO 130A	Analog output board, 16 outputs, OSP control
DSAX 110 DSAX 110A	Analog input/output board, 8 inputs 8 outputs
DSDP 010	Absolute binary decoder with hardware strobe, 2 channels
DSDP 140B	Positioning control board for one positioning loop
DSDP 160	Loop transducer interface board, 4 channels
DSDP 161	Loop transducer interface board, 4 channels
DSDP 170	Pulse counter board, 4 channels

S200 I/O

Table 78 shows the different S200 I/Os.

Table 78. S200 I/O

Name	Description
200-DUTB	Dummy I/O unit
200-IA8	Digital input unit, 8 inputs
200-IB10xOB6	Digital combined unit, 10 inputs and 6 outputs
200-IB16	Digital input unit, 16 inputs
200-IB16xOB16P	Digitally combined unit, 16 inputs and 16 outputs
200-IB32	Digital input unit, 32 inputs
200-IE4xOE2	Analog combined unit, 4 inputs and 2 outputs
200-IE8	Analog input unit, 8 inputs
200-IF4I	Analog input unit, 4 inputs

Table 78. S200 I/O (Continued)

Name	Description
200-IM8	Digital input unit, 8 inputs
200-IP2	Pulse counter board, 2 x 4 inputs
200-IP4	Pulse counter board, 4 x 2 inputs
200-IR8	Analog input unit, 8 inputs
200-IR8R	Analog input unit, 8 inputs
200-IT8	Analog input unit, 8 inputs
200-OA8	Digital output unit, 8 outputs
200-OB16	Digital output unit, 16 outputs
200-OB16P	Digital output unit, 16 outputs
200-OB32P	Digital output unit, 2 x 16 outputs
200-OB8EP	Digital output unit, 8 outputs
200-OE4	Analog output unit, 4 outputs
200-OF4I	Analog output unit, 4 outputs
200-OM8	Digital output unit, 8 outputs
200-OW8	Digital output unit, 8 outputs

S200L I/O and I/O 200C

Table 79 shows the different S200L I/Os and Table 80 shows I/O 200C.

Table 79. S200L I/O

Name	Description
AI210	Analog input unit, 8 inputs
AO210	Analog output unit, 4 outputs
AX210	Analog combined unit, 4 inputs and 2 outputs

Table 79. S200L I/O (Continued)

Name	Description
DI210	Digital input unit, 16 inputs
DO210	Digital output unit, 16 outputs
DX210	Digital combined unit, 10 inputs and 6 outputs

Table 80. I/O 200C

Name	Description
200C-IB10xOB6P	Digital combined unit, 10 inputs and 6 outputs
200C-IB16	Digital input unit, 16 inputs
200C-IE4xOE2	Analog combined unit, 4 inputs and 2 outputs
200C-IE8	Analog input unit, 8 inputs
200C-OB16P	Digital output unit, 16 outputs
200C-OE4	Analog output unit, 4 outputs

Satt Rack I/O

Table 81 shows the different Satt Rack I/Os.

Table 81. Satt Rack I/Os

Name	Description
IAPG	Digital input board with 16 inputs
IDLD	Digital input board with 16 inputs
IDP	Digital input board with 32 inputs
IDPG	Digital input board with 32 inputs
IDN	Digital input board with 32 inputs
IDI	Digital input board with 32 inputs
PTC	Digital input board with 32 inputs
ORG	Digital output board with 16 outputs
ORGH	Digital output board with 16 outputs
OATG	Digital output board with 16 outputs
ODP2	Digital output board with 16 outputs
ODPG2	Digital output board with 16 outputs
ORM	Digital output board with 16 outputs
ODP.5	Digital output board with 32 outputs
ODP.8	Digital output board with 32 outputs
ODPG.8	Digital output board with 32 outputs
ODPL.5	Digital output board with 32 outputs
ODPLD	Digital output board with 32 outputs
ODN.2	Digital output board with 32 outputs
ODLD.5	Digital output board with 32 outputs
ODSG	Digital output board with 32 optocoupled outputs, short circuit proof

Table 81. Satt Rack I/Os (Continued)

Name	Description
IBA	Analog input board with 8 inputs
IRA	Analog input board with 8 inputs
ICA	Analog input board with 8 inputs
IVA	Analog input board with 8 inputs
IVAPOT	Analog input board with 8 inputs
OCVA	Analog output board with 2 outputs
OCAHG	Analog output board with 4 outputs
OCAH	Analog output board with 4 outputs
OCAH with handstation	Analog output board with 4 outputs
IPA4	Input pulse analyzer board with 4 inputs, 8 bit counters

Drives System

There are two types of drives systems, ABB standard and ABB engineered.

ABB Standard Drives

Table 82 shows the ABB standard drives.

Table 82. ABB Standard Drives

Name	Application
ACS400	Standard drive
ACS600	Crane application
ACS600	Pump and fan application
ACS600	Standard application
ACS800	Crane application

Table 82. ABB Standard Drives (Continued)

Name	Application
ACS800	Pump and fan application
ACS800	Standard application
DCS400	Standard drive
DCS500	Standard drive

ABB Engineered Drives

Table 83 shows the ABB engineered drives.

Table 83. ABB Engineered Drives

Name	Application
ACS600	IGBT supply (ISU) application
ACS600	System application
ACS600AD	Asynchronous drive
ACS600C	Cycle converter drive
ACS600SD	Synchronous drive
ACS800	IGBT supply (ISU) application
ACS800	System application
ACS1000	Standard drive
DCS600	System application

Section 5 800xA for Advant Master

This section contains technical data and configuration information for 800xA for Advant Master.

800xA for Advant Master consists of two parts, one executing in the workstation and one on the RTA (Real Time Accelerator) unit. There are two types of RTA units and both are supported. The original RTA board is of PCI-bus type and is installed on the Connectivity Server. The replacement of the RTA board is a 19-inch RTA unit external to the Connectivity Server also enabling a virtualized environment. The software on the RTA board is automatically downloaded at start-up.

This software product utilizes the client/server technique, making it possible to run both client and server on one PC for a small configuration. For larger configurations, one or several servers can be used with a large number of client workplaces.

Prerequisites and Restrictions

The following prerequisites and requirements are necessary to support the 800xA for Advant Master software.

RTA Unit

The PU410 RTA Unit supports the Control Builder A engineering tool when Control Builder A version 1.3/0 or later is used.

The PU410 RTA Unit is needed for integration of the 800xA Operator Workplace with the AC 400 Series controllers, via the MasterBus 300 network. The PU410 is a separate unit connected to the Connectivity Server via Ethernet and to the MasterBus 300 network using RJ-45 connectors. The PU410 RTA Unit can be placed stand-alone beside a PC workstation (desktop or tower model) or mounted into a 19-inch cabinet. The software on the RTA board is automatically loaded when the 800xA for Advant Master software is started. Figure 19 shows the PU410 RTA Unit.

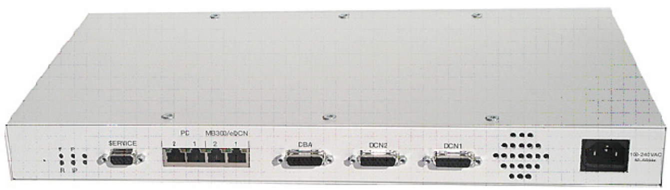

Figure 19. PU410 RTA Unit

PC Hardware for the Connectivity Server can be selected from the verified models in [6] in Table 1 on page 19.

The PU410 connects over single or dual line via its PC 1 and 2 ports using shielded RJ-45 connectors for 100 Mbit full duplex communication with the PC (Connectivity Server). On the control network side, the PU410 connects over single or dual line via its MB300 1 and 2 ports using shielded RJ-45 connectors for 10 Mbit half duplex communication with the MB 300 control network.

System redundancy is based on Connectivity Server redundancy in the same way as for the PU515A RTA Board. Only one RTA Unit can be connected per physical Connectivity Server.

The PU410 RTA Unit installed with a Connectivity Server can:

- Be mixed with current PU515A RTA Boards installed in other Connectivity Servers within one 800xA System.
- Be mixed within one redundant Connectivity Server pair.

  This means that one of the redundant Connectivity Servers in the pair can have the PU515A RTA Board installed, while the other Connectivity Server has the PU410 RTA Unit installed for the communication with the MB 300 network.

The PU410 RTA Unit supports point-to-point connection to the Connectivity Server which means that the PU410 RTA Unit will require its own dedicated network connection and cannot be connected via an Ethernet switch or hub.

RTA Board

The RTA board PU515A is needed for integration of the 800xA Operator Workplace with the AC 400 Series controllers, via the MB 300 network. This board is a PCI or PCI-X type and has to be installed on the PC, where the server part of the software is residing (in the Connectivity Server). The PU515A has two redundant bus connectors.

The software on the RTA board is automatically loaded when the 800xA for Advant Master software is started in the PC.

The 800xA for Advant Master hardware requirement (that is in addition to System 800xA hardware requirements) is a PCI or PCI-X slot for the bus interface board (RTA) in the Connectivity Server.

For configurations with large numbers of workplaces, the configuration can be duplicated and installed alongside the existing system.

For 800xA for Advant Master only one RTA board can be installed per physical Connectivity Server.

800xA for Advant Master supports and can derive advantage from PCs with hyper threading or multiple processors activated. For tested and recommended PCs, refer to [6] in Table 1 on page 19.

History Logs

TTD Logging

TTD logs is the preferred way to log data in an Advant Master system. This is a way to maintain a reasonable load throughout the control system. Data handling, all the way from the controller through the RTA unit and to the actual logging in System 800xA trend and in IM logs, is optimized for this in 800xA for Advant Master. Also, the signal errors are better handled when data is logged this way. System 800xA trend logs are updated with blocks of TTD data from the controller with the default interval of 20 minutes. This interval can be overridden by the IM log setting for the *sample blocking rate*, but it is not recommended.

Direct (OPC) Logging

Direct logs will be coordinated in the connectivity server (when the same objects are subscribed) to avoid unnecessary load on the controllers. Direct logging of data results in a continuous load of the involved connectivity server(s), the RTA unit(s) and controller(s). This is similar to having a display continuously presenting the same amount of data points.

Parameters and Controller Versions

This topic consists of:

- Maximum System Configurations.
- Subscription Limitations.
- Supported Networks.
- Supported Advant Master Controllers.

Maximum System Configurations

Table 84 details the maximum system configurations.

Table 84. Maximum System Configuration

Parameter (Maximum Number)	AS + CS Combined[1]	AS and CS Separate	Single Node Prod Syst[2]
Maximum no of tags	10,000	90,000[5]	3,000
Maximum no of operator clients	8	55	1
Maximum no of 800xA clients with Control Builder A and/or Online Builder[3]	4	10	1
Maximum no of Connectivity Servers per 800xA for Advant Master systems	2(4)	6(12)	1
Maximum no of Connectivity Servers per MB 300 network	2(4)	4(8)	1
Maximum no of MB 300 networks supported	1	6	1
Maximum no of screens per client	4	4	4

Table 84. Maximum System Configuration (Continued)

Parameter (Maximum Number)	AS + CS Combined[1]	AS and CS Separate	Single Node Prod Syst[2]
Maximum no of tags to subscribe via OPC Client Connection (Under evaluation. Contact technical sales)[4]	100/sec	100/sec	100/sec
Maximum no of controllers per MB 300 network	20	40	5

NOTES:
1. With default set.
2. Client +AS+CS in one PC node without default set (AC 800M).
3. The RTA unit(s) in the Connectivity Server(s) is used.
4. The RTA unit(s) in the Connectivity Server(s) is used.
5. Tag count up to 90,000 tags per system. For larger systems (up to 120,000 tags, a TSA is required.

800xA for Advant Master must be run in a dedicated Connectivity Server with the RTA unit.

Subscription Limitations

There are some controller limitations to consider when using 800xA for Advant Master.

Table 85 shows the maximum number of event subscribers and (1, 3, and 9-sec) data subscribers per controller node, type, and version.

Table 85. Data and Event Subscription Limitations

Controller Type	Controller Version	Maximum Data Subscriber Nodes[1]	Maximum Event Subscriber Nodes[1]
MasterPiece 200/1	Up to 4.0/1	16	8
MasterPiece 200/1	4.0/2 and later	16	16
Advant Controller 410, Advant Controller 450	Up to 1.1/latest	16	16

Table 85. Data and Event Subscription Limitations (Continued)

Controller Type	Controller Version	Maximum Data Subscriber Nodes[1]	Maximum Event Subscriber Nodes[1]
Advant Controller 410, Advant Controller 450	1.2/0 and later	16	32

NOTE:

1. One subscriber node could be, for example, one 800xA for Advant Master Connectivity Server, one Advant Station 500 Operator Station, or one MasterView 800/1.

Supported Networks

The following network types are supported:

- Multiple MB 300 networks.
- Redundant Connectivity Servers on MB 300 networks.
- Redundant MB 300 network.

Refer to [1] in Table 1 on page 19 for more detailed information on the integration of System 800xA with Advant Master controllers on the MasterBus 300 network.

Supported Advant Master Controllers

The supported Advant Master Controllers are:

- Advant Controller 400 Series with Master software.
- MasterPiece 200/1.

Table 86 shows the controller versions that is included in the test configuration together with System 800xA. For each controller version the latest revision is used.

Advant Master controller products are maintained according to the published Lifecycle Policy.

Table 86. Controller Versions Verified with System 800xA

Controller Type	Product Version	Software Version	Verified with System 800xA
MasterPiece 200/1	2.0	XMP200 SW*2.0 XMP200 SW*3.0	—
	2.1	XMP200 SW*4.0	—
	3.0	QMP220 SW* 5.0	—
	4.0	QMP220 SW* 6.0	—
Advant Controller 410	1.0	QC01-BAS11*7.0	—
	1.1	QC01-BAS11*7.0	—
	1.2/0	QC01-BAS11*8.0	—
	1.2/1-1.2/8	QC01-BAS11*9.0	—
	1.3	QC01-BAS11*9.0	—
	1.4	QC01-BAS11*10.0	—
	1.5	QC01-BAS11*11.0	yes
Advant Controller 450	1.0	QC02-BAS21*7.0	—
	1.1	QC02-BAS21*7.0	—
	1.2/0	QC02-BAS21*8.0	—
	1.2/1-1.2/8	QC02-BAS21*9.0	—
	1.3	QC02-BAS21*9.0	—
	2.0	QC07-BAS41*1.0	—
	2.1	QC07-BAS41*2.0	—
	2.2	QC07-BAS41*3.0	—
	2.3	QC07-BAS41*4.0	yes

Technical Data

Table 87 describes the technical data for 800xA for Advant Master.

Table 87. Technical Data

Description	Number
Process Objects	
Predefined ABB process object types	AI, AO, DI, DO, DAT, TEXT, GENBIN, GENCON, GENUSD, GROUP, MANSTN, RATIOSTN, SEQ, MOTCON, VALVECON, PIDCON, DRICONS, DRICONE, MOTCONI, and GRPALARM
Process Graphics	
Available update rate	From 1 sec and upwards. Three cyclic intervals are preconfigured for efficiency (1, 3, and 9 secs). Default update rate: 9 secs with event driven update for binary data.
Alarms	
Total number of system and process alarms in the alarm manager	10,000[1]
TTD (Time Tagged Data)	
Shortest TTD log sample interval	2 secs
Direct (OPC) Logging	
Recommended update rate when a process object is used directly as a data source	9 secs (1 and 3 secs possible)[2]
OPC 800xA Client Connection	
Recommended subscription update rates	9 secs (1 and 3 secs possible)[2]

Table 87. Technical Data (Continued)

Description	Number
Write operations	It is only supported to perform OPC write operations towards DAT objects. There are no hard limitations on the number of write operations that can be executed.

NOTES:
1. Shared with all other eventual alarms received from AC 800M, 3rd party OPC etc.
2. Not all properties are supported. Refer to [15] in Table 1 on page 19 for more detailed information.

Performance

The system performance in an open environment is dependent on many factors such as: PC type, size of memory, other installed software in use, etc.

It is the sum of data subscribed from displays, alarm and event handling, history subscriptions and the direct OPC access load, that results in the performance for the Connectivity Server. As all data has to pass through the MB 300 RTA unit, certain rules need to be applied by the applications and clients that subscribe and write to data located in the controllers. To improve performance in configurations where high amounts of data need to be transferred to and from the controllers, additional Connectivity Servers with MB 300 RTA units can be added to the configuration.

It is possible to divide the subscriptions using multiple Connectivity Servers on the same MB 300 network.

Process Data Acquisition

The total RTA CPU load may not exceed 50 percent. Table 88 briefly describes capacity examples per Connectivity Server (applies to both single and redundant pair). The performance depends on the total load influence on the RTA Unit primarily from TTD, OPC logging, data for Process Displays and third-party OPC clients, but also from Alarms and Events and Status List.

Refer to [18] in Table 1 on page 19 for more details.

Table 88. Capacity Examples per Connectivity Server[1]

TTD (Time Tagged Data)[2,3]	
Examples, each resulting in 20% RTA CPU load	1,400 log variables on 2-sec interval 7,000 log variables on 10-sec interval 14,000 log variables on 20-sec interval
Direct OPC Logging, OPC Client Connection, and Data for Process Graphics	
Examples, each resulting in 20% RTA CPU load[4]	9,000 process objects on 9-sec update rate 3,000 process objects on 3-sec update rate

NOTES:

1. Applies to both single and redundant pair.
2. The number of TTD logs must be decreased, if secondary IM logs exist for the TTD logs, where the sample blocking rate is faster than the 20-min. default.
3. The data source for an Historian log can be either a process object itself, or a TTD log in an Advant Controller 400 Series.
   For performance and signal error handling reasons, the recommendation is to use TTD logs in the Advant Controller 400 Series as primary logs. These TTD logs are then used as data sources for long-term storage in the Historian.
4. Typical mix of data from different process objects.

Display Call-up Time

The following information was measured with the product running on an 800xA Client PC with a 3.0 gigahertz processor and 2 gigabytes of RAM.

Table 89. Display Call-up Times

Displays	Display Call-up Time
Graphic Display with 40 objects (80 OPC items)	< 2 secs (cached)
Graphic Display with 120 objects (240 OPC items)	< 2.5 secs (cached)
Graphic Display with 192 objects (416 OPC items)	< 3 secs (cached)
Trend Display with 8 traces (TTD or OPC logs)	< 2 secs

The tests were made in a system using VB6 graphics consisting of three redundant Connectivity Server pairs, one redundant aspect server (1oo3), one Information Management server, five clients, and about 30 controllers. The CPU frequencies in the server nodes varied between 2.8 gigahertz and 3.2 gigahertz and the RAM varied between 2 and 3.5 gigabytes. Call-up times may vary depending on network traffic, controller load, PC hardware, and overall system activity.

System Configuration

Several types of system configurations are supported in 800xA for Advant Master. The below configurations are illustrated in this section:

- Single node production system without default set (combined aspect server, connectivity server and one client in the same PC node, maximum number of controllers and tags).
- System configuration with combined Aspect- and Connectivity Server with default set (maximum number of clients, maximum number of controllers).
- System configuration with combined Aspect- and Connectivity Server mixed with 800xA for AC 800M.
- System configuration with up to 40 controllers requiring two Connectivity Servers (single or redundant).
- Large system configuration (maximum number of clients, maximum number of remote clients, maximum number of Connectivity Servers, maximum number of controllers per MB 300 network).
- System configuration with Control Builder A and Online Builder installed in 800xA clients (maximum number of clients with Control Builder A and Online Builder).

This configuration requires a Control Builder A version supporting Windows 7. For more information refer to separate Control Builder A Release Note and Product Update.

For information about system configurations, refer to System Size Summary on page 47.

800xA for Advant Master supports multisystem integration. Refer to Multisystem Integration on page 89 for more detailed information.

800xA for Advant Master Configurations

Refer to Figure 20 through Figure 23 for more detailed information.

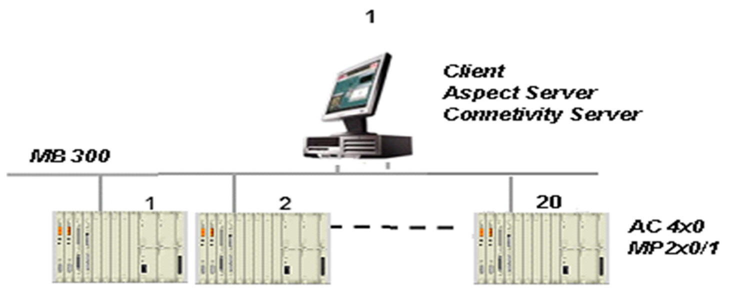

Figure 20. Single Node Production System

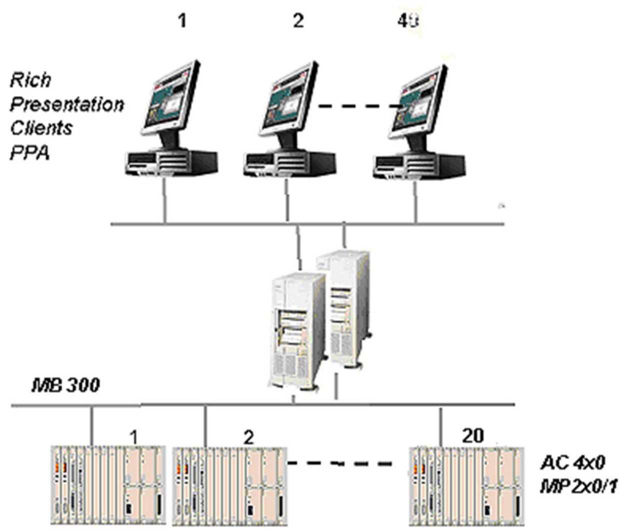

Figure 21. System Configuration with Combined Aspect Server and Connectivity Server

Figure 22 shows an example of a system with a large MB 300 control network. In large networks (>20 controllers) it is recommended to use multiple Connectivity Servers, redundant or non-redundant. In this example the clients are connected via redundant 800xA for Advant Master servers. The maximum number of controllers in a large MB 300 control network can be found in Table 84.

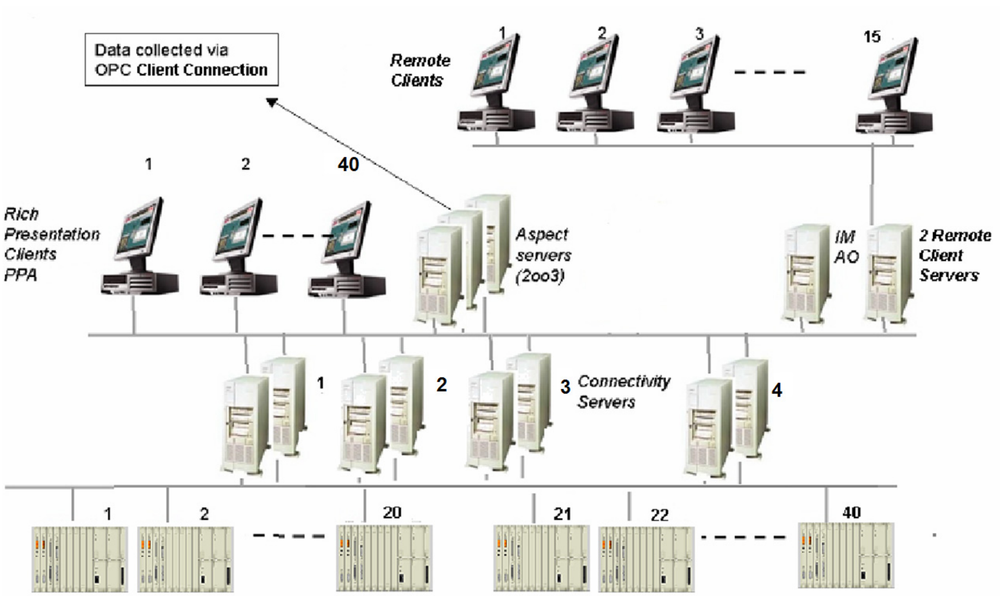

Figure 22. Large System Configuration (Maximum Number of Clients, Maximum Number of Remote Clients, Maximum Number of Connectivity Servers, Maximum Number of Controllers Per MB 300 Network)

Supported Control Builder A

The Control Builder A 1.3 supports Workstation Operating System and Server Operating System along with the RTA unit PU410.

The Control Builder A version 1.3/0 or later is supported on 32-bit environment, while the Control Builder A version 1.3/1 or later supports 64-bit environment in 800xA 5.1.

The configuration shown in Figure 23 requires a Control Builder A version supporting Workstation Operating System. For more information refer to separate Control Builder A Release Notes and Product Updates.

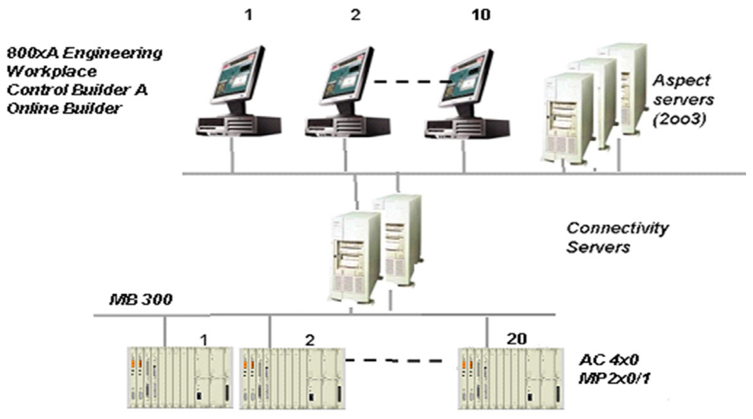

Figure 23. System Configuration with Control Builder A

Section 6 800xA for AC 100

This section contains technical data and configuration information for 800xA for AC 100. Refer to [19] in Table 1 on page 19 for more details.

A new driver has been included for 64-bit support for the 800xA for AC 100 in the 800xA 5.1 Rev B.

Section 7 800xA for DCI

This section contains technical data and configuration information for 800xA for DCI.

800xA for DCI is not included with the initial release of 800xA 5.1. It released after 800xA 5.1. Use the standard business channels for product updates.

The 800xA for DCI server application must not be combined with other control system server applications on the same Connectivity Server.

The client part of 800xA for DCI must be installed in all nodes except the Domain Server.

Technical Data

Table 90 and Table 91 provide general 800xA for DCI technical data.

Table 90. 800xA for DCI Technical Data

Characteristic	Specification
Maximum number of Operator Workplace Clients	40
Maximum number of Connectivity Servers per system	4 (single or redundant)
Maximum number of DCI tags per Connectivity Server	15,000
Maximum number of DCI tags per AS/CS combined	7,500
Maximum number of DCI tags per system	60,000

The US English version of the operating systems is required even if a translated version of System 800xA is used.

Table 91. Supported Operating Systems

Characteristic	Specification
800xA for DCI Connectivity Server (Primary & Redundant)	Windows Server 2008
800xA for DCI Client	Windows Server 2008 or Windows 7

Performance

Performance contains display exchange times and server switchover times.

Display Exchange Time

The 800xA for DCI server application collects data from controllers via GDBA, and makes it available to the OPC clients. Table 92 shows the display exchange time of a process display containing a certain amount and type of display elements.

Table 92. Display Exchange Time

Graphic Display Elements	Display Exchange Time
20 Tags/Graphic 164 Total OPC Items subscribed	2 secs typical (cached)
40 Tags/Graphic 230 Total OPC Items subscribed	3 secs typical (cached)
80 Tags/Graphic 660 Total OPC Items subscribed	5 secs typical (cached)

Table 93 specifications were measured with the product running on a PC with a Pentium IV, 2.4 gigahertz processor and 1 gigabyte of RAM. These values will vary depending on the Client Network traffic, number of tags, number of clients/nodes in System 800xA and overall activity.

Table 93. 800xA for DCI Specifications

Characteristic	Specification
Continuous alarm throughput	25 events/sec
Connectivity Server node DCI network connection	Compatible with ECC, ECC MUX, and standard non-redundant off-the-shelf Ethernet NICs. An ECCP board or ECC MUX connection is highly recommended.
Engineering Tools	Composer CTK version 6.0 and later. The CTK is required on at least one node in a system. It must be on a standalone node on the DCI control network.
Multiple Processor	Supported on Server and Client nodes

Server Switchover Time

The 800xA for DCI server application nodes provide redundant connectivity to the DCI Control network. The connection requires two PC's each with a dedicated ECCP, ECC MUX, or non-redundant Ethernet NIC to the Control Network. Table 94 specifications were measured with the products running on a PC with a Pentium IV, 2.4 gigahertz processor, and 1 gigabyte of RAM and using ECCP card connections. These values will vary depending on the Control Network connection used, Client Network traffic and the number of clients/nodes in System 800xA.

Table 94. Server Switchover Time

Redundancy Switchover Time	
ECCP/ECC MUX communications failure	<5 secs
800xA for DCI connectivity node failure	10-20 secs average
Manual Switchover	< 5 secs
800xA for DCI Server application failure	10 secs average

Recommended Hardware Configuration

Workstation requirements for 800xA for DCI are intended for new system purchases or expansions to existing systems. Requirements are for all PCs used within an 800xA for DCI system.

The ECCP or ECC MUX interface is used in 800xA for DCI servers when redundant DCU communication networks are required. The ECCP interface requires a full height 5 volt PCI slot. This PCI slot requirement limits the types of computers that can use the interface to workstation models and Windows 7. A server class machine running Server Operating System can be used when a single communication network is being used.

Additional Information

The following applies to all the 800xA for DCI applications:

- Refer to literature to determine CPU speed, RAM, hard disk capacity, etc. for 800xA PC requirements.
- Other ABB applications such as Asset Optimization and Information Management as well as third party applications may apply additional load on the workstation requiring additional workstation resources (CPU speed, RAM, hard disk capacity, etc.).
- Conductor NT Server or Client can never be installed on the same workstation along with 800xA for DCI software.

Section 8 800xA for MOD 300

This section contains technical data and configuration information for 800xA for MOD 300.

800xA for MOD 300 provides integration of 800xA and the Advant OCS/MOD 300 control network (DCN or eDCN). 800xA for MOD 300 consists of two parts:

- One to be run on the workstation.
- One on the RTA unit. The RTA unit is installed on the node where the Connectivity Server is executing. The software on the RTA unit is automatically downloaded at start-up.

A RTA unit mounted in a Connectivity Server node provides the physical connection to the DCN or eDCN and the following controllers:

- AC 460 Series.
- AC 410 Series.
- MOD 300 Controller Subsystem (SC Controllers and Model B).
- MOD 300 Multibus.

Prerequisites and Restrictions

The following prerequisites and requirements are necessary to support the 800xA for MOD 300 software.

RTA Unit Requirements

The RTA unit is required to connect the Connectivity Server to the Advant OCS Control Network (MOD 300 DCN/eDCN). If you require the RTA unit, you must install the PU412K01 (RTA unit for DCN) or the PU410K02 (RTA unit for eDCN) before you install the PAS System Services software.

Do not use the PU518 or PU519.

64-bit operating systems requires the PU412K01(DCN) or the PU410K02(eDCN) RTA units.

32-bit operating systems uses the PU514/PU515 or the PU514A/PU515A RTA boards and requires an available PCI card slot.

The RTA board is powered from the PCI bus supply in the computer. The PCI RTA board (PU514 or PU515) requires a 5V PCI slot.

Do not use the PU514 or PU515 RTA board in a PCI slot that uses the 3.3V standard.

The PU514A PCI RTABs use a PCI-X133 slot and are backward compatible to earlier PCI slot specifications. These cards cannot be used in PCI-X266 or higher, or in PCI-Express slots.

The PU514A and PU514/PU515 PCI RTABs is replaced with the PU410K02 and PU412K01 RTA Units.

The PU410K02 and PU412K01 external Real Time Accelerator (RTA) units are available for eDCN and traditional DCN communications respectively. These new communication units are mounted remotely from the workstation and connected via standard Ethernet. This removes the requirements and dependency of the host hardware.

800xA for MOD 300 System Requirements

800xA for MOD 300 software requires that the Advant OCS with MOD 300 System be at the following levels:

- AdvaBuild 3.3/2 P2 or higher for Windows.
- MOD 300 System Version 14.6/x or higher software.

One computer with AdvaBuild for Windows is required by the MOD Importer application to populate the Aspect Server with MOD 300 tag data. A GENERICD object must be configured in AdvaBuild to establish the MOD 300 Connectivity Server (with RTA unit) as an Advant OCS node in the MOD 300 database.

800xA for MOD 300 Software Requirements

800xA for MOD 300 software requires that either Workstation or Server operating system software and base System 800xA software be installed.

The US English version of the operating systems is required even if a translated version of System 800xA is used.

800xA for MOD 300 client software can be loaded alone, on a Connectivity Server, or on top of an Application Server such as Information Management. The Connectivity Server can be installed on Server Operating System only.

MOD PAS System Services is installed on the Connectivity Server only.

The Audit Trail option is required in order to record MOD 300 parameter changes to Information Manager.

800xA for MOD Hardware Requirements

Refer to the computer manufacturers documentation to determine if your computer is working properly when powered up. Basic power up and power down instructions for your computer are described in the computer manufacturers documentation. The computer must meet the minimum requirements for the 800xA product.

Multibus Restrictions

The 800xA for MOD 300 software requires that the MOD 300 System be at Version 14.6/x software. It is not possible to use the MOD Tag Importer, without the proper system version and AdvaBuild for Windows.

Functionality Not Supported in MOD 300

This release of the 800xA for MOD 300 software does not include support for the following functionality.

- MOD 300 Overview display.

- Unit relativity.
- MOD 300 PHL.
- Use MOD 300 Engineering Displays to view TRIO Config and PLC Config.
- Disk IO actions – open, close, remove, input, output, filesys.

Server Switchover Time Performance

800xA for MOD 300 Connectivity Server nodes provide redundant connectivity to the MOD 300 Control Network. The connection requires two workstations, each with a dedicated RTA Unit.

Table 95. Server Switchover Time Performance

Redundancy Switchover Time	
800xA for MOD 300 Connectivity Server node Failure	< 5 Sec [1]
Manual Switchover	< 5 Sec [1]
NOTE: 1. These will vary based on Control Network loading, Controller loading, and Connectivity Server loading.	

Product Capacity

Table 96. Product Capacity

Description	Number
Connectivity Servers	
Primary or Backup Connectivity Servers	6
Tags	

Table 96. Product Capacity (Continued)

Description	Number
Maximum number of tags per Connectivity Server (applies to both single and redundant pair). Include following items when calculating the load on the connectivity server: • CCF continuous and device loops imported for display • TLL objects imported for display • Number of historical logs recorded	6,000
Maximum number of tags per combined Connectivity and Aspect Servers (applies to both single and redundant pair). Include the following items when calculating the load on the Connectivity Server: • CCF continuous and device loops imported for display • TLL objects imported for display • Number of historical logs recorded	3,000
Alarm	**Number**
Event Burst (events per sec) applied to one Connectivity Server redundant pair.	350
History[1]	
Maximum number of OPC history subscriptions with dedicated Connectivity Server(s).	3,000/sec
The maximum number of OPC subscriptions with a combined history/data Connectivity Server(s) using a fixed rate OPC Server.	2,000/sec

NOTE:

1. When specifying the history storage interval: Storage intervals of 1, 2, 3 or greater than 8 seconds will be subscribed to the MOD system at the specified interval. Storage intervals of 4 through 8 seconds will be subscribed to the MOD system at 4 secs regardless of the specified interval.
   For design and performance considerations, refer to [16] in Table 1 on page 19.

Section 9 800xA for Harmony

This section contains technical data and configuration information for 800xA for Harmony.

800xA for Harmony consists of two primary components:

- Client software consisting of the operator interface such as faceplates and Harmony diagnostic displays.
- Harmony Connectivity Server which collects data from the Harmony controllers.

The deployment of 800xA for Harmony is accomplished by using the Harmony Configuration Servers and Harmony Connectivity Servers. The installation can be run to best support the Harmony engineering environment (the number of Composer engineering projects).

Technical Data

Table 97 through Table 99 provide 800xA for Harmony technical data to assist with the deployment solutions.

Table 97. 800xA for Harmony Technical Data

Characteristic	Specification
Maximum number of Operator Workplace Clients	40
Maximum number of Harmony Configuration application servers per system (non-redundant)	4
Maximum number of Connectivity Servers per system (redundant)	8 (16) - up to 4 Configuration Servers

Table 97. 800xA for Harmony Technical Data (Continued)

Characteristic	Specification
Maximum number of Connectivity Servers per system configured with a single Configuration Server	8 (16)
Maximum number of tags per system.	60,000
Maximum number of tags per Connectivity Server	30,000
Continuous alarm throughput	30 events/sec
Sequence of Events	Up to 5,000 events (distributed SOE) Up to 256 events (RIS recorder) 1 msec resolution
Alarm Priorities	Up to 16
Engineering Unit Descriptors	15 default configured, no preset user configurable limit
Logic State Descriptors	15 default configured, no preset user configurable limit
Text Select Messages/Alarm Comment Strings	Maximum 80 characters per message, no preset user configurable message quantity limit
Remarks	800xA for Harmony must not be combined with other connect servers on the same Connectivity Server

Table 98. 800xA for Harmony Characteristics

Characteristic	Specification
Engineering Tools	Composer for Harmony version 3.x or later.

Table 98. 800xA for Harmony Characteristics (Continued)

Characteristic	Specification
Computer Interface Unit (CIU) with Serial or SCSI interface	Control Network (Cnet), INFI-NET and PLANTLOOP via Harmony control equipment (INICI03, INICI12, INPCI01, INPCI02) **Notes:** 1. INICI03 or later interface equipment is required for Batch Management support. 2. All performance specifications are based on usage of INICI03 with SCSI interface.
Computer Interface (Ethernet)	Full support of IET800 interface (64-bit OS) Support of IET800 interface, Basic Mode only (32-bit OS)
Harmony Controllers Supported	Harmony Bridge Controllers (BRC100, 200, 300 and 400) Multi-Function Processors (MFP01, 02, 03, 04, 12) Multi-Function Controller (MFC01, 02, 03) Harmony Area Controller (HAC) Analog Master Modules (AMM01, 02, 03)

The US English version of the operating systems is required even if a translated version of System 800xA is used.

Table 99. Supported Operating Systems

Node Type	Operating System
Harmony Configuration Server (Primary & Redundant)	Windows Server 2008
Harmony Connectivity Servers	
800xA for Harmony Clients (Operator Workplaces)	Windows 7

Display Exchange Time Performance

The Harmony Connectivity Server collects data from Harmony controllers via semAPI and makes it available to OPC clients. Table 100 shows the display exchange time of a process display containing a certain amount and type of display elements.

Table 100. Display Exchange Time

Graphic Display Elements	Display Exchange Time
20 Tags/Graphic 160 Total OPC Items subscribed	1-2 secs typical (cached)
40 Tags/Graphic 360 Total OPC Items subscribed	
80 Tags/Graphic 720 Total OPC Items subscribed	2-3 secs typical (cached)

The information was measured with the 800xA for Harmony running on a workstation with the following specifications:

- Intel Core 2Duo CPU E7400 @ 2.8 GHz.
- 3.25 Gb RAM.
- SCSI connection.

These values will vary depending on the Client Network traffic, number of tags, number of clients/nodes in System 800xA, and overall activity. The tests where verified using one client node loaded to each of the three levels, while ten other client nodes where running with level 1 graphic being displayed (20 tags/graphic).

The system included a separate Harmony Configuration Server and three redundant pairs of Harmony Connectivity Servers.

Each pair of Connectivity Servers:

- Contained a minimum of 10,000 tags.
- Exception reporting on each pair of Connectivity Servers varied from 75-150 XR/second to 1500-1700 XR/second.
- The Event rate was 45-50 events/second for 15-20 seconds.

Server Switchover Time Performance

The Harmony Connectivity Server nodes provide redundant connectivity to the Harmony Control network. The connection requires two workstations, each with a dedicated Computer Interface Unit (CIU) to the Control Network. Table 101 shows the server switchover times.

Table 101. Server Switchover Time

Redundancy Switchover	Switchover Time
CIU communications failure	<5 secs
Harmony Server node failure	10-20 secs average
Manual Switchover	< 5 secs
Harmony Server failure	10 secs average

The information was measured with the 800xA for Harmony running on a workstation with the following specifications:

- Intel Xeon CPU E5420 @ 2.50 GHz.
- 8 Gb RAM.
- SCSI connection.

The values will vary depending on the Control Network used, CIU connection type, Client Network traffic and the number of clients/nodes in System 800xA.

Recommended Hardware Configuration

Table 102 provides general workstation requirements for the 800xA for Harmony system.

Workstation requirements for Harmony applications are intended for new system purchases or expansions to existing systems.

Table 102. General Workstation Requirements

Characteristics	Requirements
CIU	Compatible with Serial or SCSI Harmony/Infi90 CIU
Computer Interface (Ethernet)	Full support of IET800 interface (64-bit OS) Support of IET800 interface, Basic Mode only (32-bit OS)
Network connector	Ethernet (IEEE® 802.3) compliant (TCP/IP); best performance achieved with 100 Mbytes/sec requiring 100BaseT
Ethernet addressing	Fixed IP address required
Accessories, options	Adaptec® SCSI adapter required for SCSI INICI03 interface, model 29160N or 39160 PCI adapter. The Adaptec 29320LPE PCIe SCSI card driver version 7.2.0.0 that is included with the Windows Server 2008 operating system is not supported by 800xA for Harmony version 5.1. If the 7.2.0.0 version of the driver is loaded the 800xA for Harmony server will not go online. The 7.2.0.0 version of the driver must be updated by rebooting, in safe-mode, and installing the 7.0.0.10 or later version of the driver. The driver can be downloaded from the Adaptec web site. If INICI03 firmware is E-F, a hardware key is required for each INICI03 used. Hardware keys are not required if the INICI03 firmware is at G or later.

Additional Information

The following applies to all the 800xA for Harmony applications:

- Other ABB applications such as Batch Management and Information Management as well as third party applications may apply additional load on the workstation requiring additional workstation resources (CPU speed, RAM, hard disk capacity, etc.). Refer to literature on these products to determine what, if any, additional workstation resources are required.
- Composer Server should never be installed on any of the 800xA nodes, including the Harmony Server.

Section 10 800xA for AC 870P/Melody

This section contains technical data and configuration information for 800xA for AC 870P/Melody.

Sizing Data

Table 103 shows sizing data to be observed when planning a system:

Table 103. 800xA for AC 870P/Melody Sizing Data

Connections	Rate
(Optionally redundant) Connectivity Servers per project	≤ 12
PM 875, PM 876, or CMC 70 per (optionally redundant) Connectivity Server	≤ 10
Objects (tags) per Connectivity Server	≤ 10,000
No. of Melody tags per Melody system	≤ 90,000

To determine on site the number of tags relevant for 800xA for AC 870P/Melody sizing, open the Connectivity Server Faceplate and check the number in the *Tags* field.

Sizing Data (AC 870P/Melody)

Table 104 shows sizing data that is based in AC 870P/Melody Control. For details refer to the AC 870P/Melody documentation:

Table 104. AC 870P/Melody Sizing Data

Sizing Information	Value
Time stamp resolution	1 msec
Available different AC 870P/Melody message priorities	16
Module related message buffer size (raw messages)	≤ 4,000
No. of configurable process messages of CCO 30	≤ 22,500
No. of configurable process messages of PM 875, PM 876, or CMC 70	≤ 60,000

Performance

800xA for AC 870P/Melody **does not** limit the System 800xA data transfer rate.

Hardware Prerequisites

Table 105 and Table 106 show the preconditions for a personal computer being used as an AC 870P/Melody Connectivity Server or as an AC 870P/Melody Config Server.

AC 870P/Melody Connectivity Server

The AC 870P/Melody Connectivity Server is a dedicated Server (running only with AC 870P/Melody Connectivity Server components).

Table 105. Connectivity Server Hardware Preconditions

Condition	Specification
CPU clock	≥ 2.66 GHz
Memory (RAM) - in case of using ≤ 5,000 tags per Connectivity Server	≥ 1 Gbyte
Memory (RAM) - in case of using > 5,000 tags per Connectivity Server	≥ 2 Gbytes
Dual Processor	Multiple core

AC 870P/Melody Config Server

Table 106. Config Server Hardware Preconditions

Condition	Specification
CPU clock	≥ 2.66 GHz
Memory (RAM)	≥ 1 Gbyte
Memory (RAM) in case of > 5,000 tags	≥ 2 Gbyte
Dual Processor	Multiple core

Supported Operating Systems

The US English version of the operating systems is required even if a translated version of System 800xA is used.

Table 107. 800xA for AC 870P/Melody Supported Operating Systems

Server	Operating System
AC 870P/Melody Connectivity Server	Windows Server 2008
AC 870P/Melody Config Server	
Engineering Project Data Base	Windows Server 2008 or Windows 7
Operator Workplace	Windows 7
Aspect Server	Windows Server 2008

Supported Composer Version

Precondition for running 800xA for AC 870P/Melody with Composer is a Composer Version as from CSV 5.3 SP1.

Section 11 800xA for Freelance

This section contains technical data and configuration information for 800xA for Freelance.

800xA for Freelance is subject to a separate release. Contact ABB Technical Support for more detailed information. Refer to System Updates for prerequisites and requirements.

Sizing Details

The performance that can be expected regarding the OPC throughput and upload rate is determined by the Server hardware. The performance of data sources such as controllers, field devices, and etc. is important,

Table 108. Sizing Details

Subject	Details
Number of 800F CS objects in a 800xA for Freelance project: • A CS object represents one OPC gateway, or two in case of redundancy. • Four CS objects correspond to 4(8) OPC gateways.	Max. 4 CS objects per 800xA for Freelance project.
Number of Freelance OPC gateway instances running on a Connectivity node: • Install the 800xA for Freelance OPC gateway software on Connectivity nodes, only. • To ensure the required performance, exclusively use the 800xA for Freelance OPC gateway software on that PC.	Max. 3 OPC instances may run on a Server.

Table 108. Sizing Details (Continued)

Subject	Details
800xA tags per CS: • Provided the subscription rate is ≥1 sec. • 10,000 OPC items/s correspond to 2000 tags per sec. • ≥1 OPC gateway instance running on a CS requires sharing of the specified tag per sec. count. • For ≥ 10,000 items per sec., add additional CSs.	Typ. 10,000 OPC items per sec.
Upload rate to the aspect directory.	Typ. 1 sec. per tag.

NOTE:
More than one OPC instance on a CS does not increase the specified OPC data throughput. The performance remains constant.

Section 12 800xA for IEC 61850

This section contains technical data and configuration information for 800xA for IEC 61850. IEC 61850 is a communication protocol used to communicate between IEDs in substations and elsewhere where these devices are used for switching electrical power or for protection of electrical equipment.

The standard identifies communication requirements between technical services (control systems) and the substation and communication requirements between IEDs within the substation. A key goal of the IEC 61850 standard is interoperability between IEDs and between IEDs and automation systems. For this reason, System 800xA works equally well with ABB IEDs as well as third party IEDs. The standard does not put any requirements on the vendor (IED) application, it defines the communication interfaces.

The IEC 61850 standard is defined to have a long lifetime but be able to follow the fast changes in communication technology by both its technical approach and its document structure.

IEC 61850 OPC Server Performance Limits

The IEC 61850-Ed1 specification for Substation Automation System (SAS) defines communication between Intelligent Electronic Devices (IED) in the substation and other related equipment.

The IEC 61850 standard itself defines the superset of what an IEC 61850 compliant implementation might contain.

In 800xA 5.1 Feature Pack 4, IEC 61850 OPC Server supports flexible configuration scenarios intended for projects with large number of IEDs in IEC 61850 network.

Table 109 describes the configuration and performance limits for IEC 61850 OPC Server.

Table 109. IEC61850 OPC Server Performance Limits

Description	Limit	Remarks
Per 800xA Connectivity Server Node	4	IEC 61850 OPC server instances.
Maximum Number of Subnetworks per IEC 61850 OPC server instance	16	
Maximum Number of IEC 61850 OPC server instances per Subnetwork	2	Both instances running on Same Connectivity Server Node.
Maximum Number of IEDs per OPC Server instance	80	Same individual limits applicable for each OPC instance running per CS.
Maximum Number of Data Objects per IED	80	8 Nos. Datasets each containing 10 DOs. (1 DO= stVal + q + t).
Maximum Number of Data Objects per IEC 61850 OPC server instance	6400	Data Objects (1 DO= stVal + q + t).

Table 109. IEC61850 OPC Server Performance Limits (Continued)

Description	Limit	Remarks
Maximum Data Objects Change rate	960 / sec	**Changing data**: 15% of Data Objects are changing at any given time. 80 IEDs x avg. 80 DO per IED x 0.15 changing/sec = 960 changing DO out of 6400 DOs per OPC server instance.
Continuous event flow per IEC 61850 OPC Server instance	5 / sec	
Event burst capacity per IEC 61850 OPC Server instance	150 / 100 msec	
MMS command pass through time from 800xA > IEC 61850 OPC Server > IED	100 msec	

IEC 61850 OPC Server Configuration Limits

Table 110 describes the 800xA configuration limits for IEC 61850 OPC Server.

Table 110. IEC 61850 OPC Server 800xA Configuration Limits

Parameter (Maximum Numbers)	AS and CS (Separate)	AS+CS (Combined)
IEC 61850 networks per system	16	1
IEDs per 800xA System	1,280	80
Number of IEC 61850 OPC Server instances per CS	4	1

800xA for IEC 61850 Topology

Figure 24 shows an example configuration.

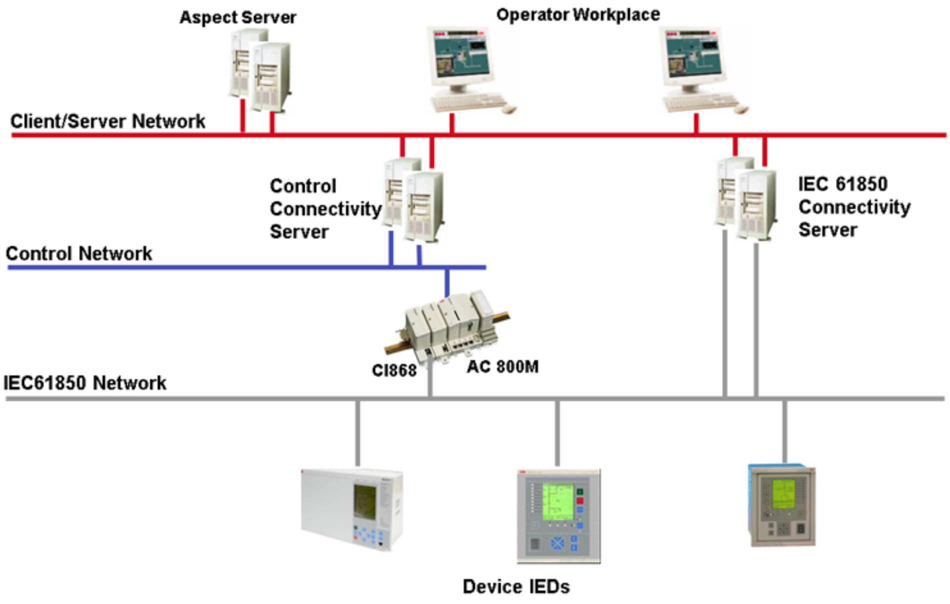

Figure 24. Example Configuration

Section 13 Process Engineering Tool Integration

This section contains technical data and configuration information for Process Engineering Tool Integration.

Process Engineering Tool Integration is installed on the same node as the 800xA Primary Aspect Server and may be installed on an Engineering Workplace node with Control Builder M installed. The Web Services and the INtools/SmartPlant® Instrumentation (SPI) database Import/Export utility are installed on the INtools/SPI node.

Performance

Table 111 details the performance data of Process Engineering Tool Integration features.

Table 111. Process Engineering Tool Integration Performance Data

Feature	Characteristic/Value
Create objects in 800xA	1,000 objects in 45 mins
Update properties of existing 800xA objects	400 objects of a 1,000 object database in less than 3 mins
SPI Powered by INtools Document call-up in 800xA	5 secs typical[1]
800xA Faceplate call-up during Data Transfer	$\leq$ 2 secs
Load SPI Data into PETI - Web Service (Database)	18 mins for 5,000 objects[2]

Table 111. Process Engineering Tool Integration Performance Data (Continued)

Feature	Characteristic/Value
Load SPI Data into PETI - File	10 secs for up to 1,000 objects

NOTES:
1. All times and rates are typical and dependent on the connected system configuration and system load. Depends on the size of the document being generated into PDF.
2. The web service web site has to be configured to increase the default time-out period.

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Revision History

This section provides information on the revision history of this System Guide.

The revision index of this System Guide is not related to the 800xA 5.1 System Revision.

The following table lists the revision history of this System Guide.

Revision Index	Description	Date
-	First version published for 800xA 5.1 release	June 2010
A	Updated for Windows 7 Versions	February 2011
B	Updated for 800xA 5.1 Revision A release	May 2011
C	Updated for 800xA 5.1 Feature Pack release	August 2011
D	Updated for 800xA 5.1 (64-bit) release	December 2011
E	Updated for 800xA 5.1 FP2 (64-bit) release	January 2012
F	Updated for 800xA 5.1 Revision B release	June 2012
G	Updated for 800xA 5.1 Feature Pack 3 release	August 2012
H	Updated for 800xA 5.1 Feature Pack 4 release	February 2013
I	Updated for 800xA 5.1 Rev D and FP4 releases	December 2013
J	Updated for 800xA 5.1 Rev D and FP4 releases	December 2013

Updates in Revision Index A

The following table shows the updates made in this System Guide that were made to correct supported versions of Windows 7.

Updated Section/Subsection	Description of Update
Section 2, Selecting the Windows Operating System	Changed the following statement from: 800xA System software may be installed on the 32-bit (x86) US English version of Windows Server 2008 Standard edition with Service Pack 2, or 32-bit (x86) US English version of Windows 7 Business or Enterprise edition. to: 800xA 5.1 System software may be installed on the 32-bit (x86) US English version of Windows Server 2008 Standard or Enterprise edition with Service Pack 2, or the 32-bit (x86) US English version of Windows 7 Professional or Enterprise edition. Windows Server 2008 R2 is not supported.

Updates in Revision Index B

The following table shows the updates made in this System Guide for 800xA 5.1 Rev A.

Updated Section/Subsection	Description of Update
Section 2, System 800xA > Connect Service Combinations in a System	Updated the Table: *Connect Services Combinations In a System* for **800xA for IEC 61850 (Rev A).**
: Section 9, 800xA for Harmony > Recommended Hardware Configuration	Updated the Table: *General Workstation Requirement*.
Section 3, Control and I/O > IEC 61850 Performance	Changed Table: *Performance and Capacity of IEC 61850 solution using CI868.*

Updated Section/Subsection	Description of Update
Section 12, 800xA for IEC 61850 > Configuration	Changed Table: *Performance and Capacity of IEC 61850 solution using CI868.*
Section 2, System 800xA > Virtualization Host Software	Changed VMware ESX version from 4.0 to 4.1.
: Section 2, System 800xA > Information Management Section 2, System 800xA > Application Rules	1. Changes in **Disk Requirements Per Log Entry** Table. 2. Changes in **History Archive** section. 3. Updated the Table: *Configuration Limits Per Node for History Parameters.*
Section 2, Available Functions Per Controller Connectivity	Changes done in the Table: *Available Functions Per Controller Connectivity.*
Section 2, Control Loop Asset Monitoring	Changes done for number of control loop license.
About this System Guide	Changes done in the Table: *Reference Table.*
Section 2, Connect Services Combinations in a System	Changes done in the Table: *Connect Services Combinations in a System.*
Section 2, Connect Service Combinations in Server Nodes	Changes done in the Table: *Connect Service Combinations in Server Nodes*.
Section 5, 800xA for Advant Master Configurations	Changes are done for Information icons on the page 197 and 200.
Section 5, Supported Advant Master Controllers	1. Changes done in the Table: *Controller Versions Verified with System 800xA.* 2. Changes to the description are done.
Section 6, 800xA for AC 100	A new section is added.
Section 3, Control and I/O > Hardware and I/O > FOUNDATION Fieldbus HSE Limitations and Performance	Added a subsection Average FF load Calculation.

Updated Section/Subsection	Description of Update
Section 8, 800xA for MOD 300	Subsection title **RTA Board Requirements** changed to **RTA Unit Requirements**. Changes are done for the description for the section.
Section 2, System 800xA	Subsection title **Connectivity Server Capacity Calculation** changed to **Connectivity Server Capacity Calculation, the Optimized Rule**. Changes are done for the description for the section.

Updates in Revision Index C

The following table shows the updates made in this System Guide for 800xA 5.1 Feature Pack.

Updated Section/Subsection	Description of Update
About this System Guide	Added a new section *Feature Pack* describing the system guide conventions used for indicating the Feature Pack content.
Section 2, System 800xA	Changes done in the following subsections: *Maximum Number of Nodes* *System Level Client Count Limits* *Connectivity Server OPC DA/AE Limits* *Control and I/O Limits* *Configuration Rules*
Section 3, Control and I/O	Changes done in the following subsections: *Modulebus Scantime for SIL3 Tasks* *Calculation of Scan Time on the Modulebus and CPU Load*

Updates in Revision Index D

The following table shows the updates made in this System Guide for 800xA 5.1 64-bit release.

Updated Section/Subsection	Description of Update
Section 2 System 800xA	Changes are done in the subsection Windows 7 and Windows Server 2008.
Section 8 800xA for MOD 300	Changes are done in the subsection RTA Unit Requirements.
Section 10 800xA for AC 870P/Melody	Changes are done in the subsection Supported Operating Systems.
Section 7 800xA for DCI	Changes are done in the section.
Section 1 Introduction	Changes are done in the section.
About this System Guide	Changes are done in the section.

Updates in Revision Index E

The following table shows the updates made in this System Guide for 800xA 5.1 FP2 64-bit release.

Updated Section/Subsection	Description of Update
Section 12, 800xA for IEC 61850	Changes are done in the subsection *OPC Server Limits for 800xA for IEC 61850 Connectivity Server*.

Updates in Revision Index F

The following table shows the updates made in this System Guide for 800xA 5.1 Rev B release.

Updated Section/Subsection	Description of Update
Section 1 Introduction	Changes are done in the Related Documentation subsection.
Section 2 System 800xA	Changes are done in the following: • Domain vs. Workgroup subsection. • Supported Operating Systems subsection changes. • Connect Service Combinations in Server Nodes subsection changes. • Table 4 - Multisystem Integration is removed. • Table 13 - Alarm Management, 800xA 5.1 Row changes is done. • Multisystem Integration section changes. • Provider System subsection changes. • Compatibility between the Releases subsection changes - removed Feature Pack icon.
Section 5 800xA for Advant Master	• Added Supported Control Builder A subsection. • RTA Unit subsection is added with Information icon.
Section 6 800xA for AC 100	Information icon is added in this section.

Updates in Revision Index G

The following table shows the updates made in this System Guide for 800xA 5.1 Feature Pack 3 release.

Updated Section/Subsection	Description of Update
Section 10 800xA for AC 870P/Melody	Changes are updated in the Table 107 in the Supported Operating Systems subsection. Changes are updated in the Supported Composer Version subsection.
About this System Guide	Changes are updated for Feature packs subsection.
Section 2 System 800xA	Changes in the following subsections are updated: • Combined Node Type Configurations • Licensing of Revisions and Feature Packs (added newly) • Control Software Licensing • Application Rules • Virtualization Host Software • Batch Management • Supported System Functions
Section12 800xA for IEC 61850	Changes done in the OPC Server Limits for 800xA for IEC 61850 Connectivity Server subsection (Table).

Updates in Revision Index H

The following table shows the updates made in this System Guide for 800xA 5.1 Feature Pack 4 release.

Updated Section/Subsection	Description of Update
Section 2 System 800xA	Changes are updated in the following subsections: • Control Software Licensing • Available Functions Per Controller Connectivity - Removed • AC 800M Status Monitoring • Connect Service Combinations in a System - added Available Functions Per Controller Connectivity subsection newly. • Control Libraries Licensing • VideONet Connect • 800xA Single Node System Deployment
Section 3 Control and I/O	Changes are updated in IEC 61850 subsection. Changes are done for different sections by Controls Team.
Section 12 800xA for IEC 61850	Changes are updated in this section.
Section 4 Supported Hardware and I/O Families	Following changes are updated in the subsections: • I/O Families • Table 70 • Changes are done for different sections by Controls Team.

Updates in Revision Index I

The following table shows the updates made in this System Guide for 800xA 5.1 Revision D and Feature Pack releases.

Updated Section/Subsection	Description of Update
Section 1. Introduction	Changes are done in Related Documentation subsection for the reference number.
Section 2. System 800xA	Changes are updated in the following subsections: • Supported Connects. • Supported Operating Systems
Section 4. Supported Hardware and I/O Families	Changes are done in Page 181 in the Table 69. Supported Modules.
Section 8. 800xA for MOD 300	New Section Server Switchover Time Performance is added in this section.

Updates in Revision Index J

The following table shows the updates made in this System Guide for 800xA 5.1 Revision D and Feature Pack releases.

Updated Section/Subsection	Description of Update
Section 2. System 800xA	Changes are updated in the Connect Service Combinations in a System subsection.

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