

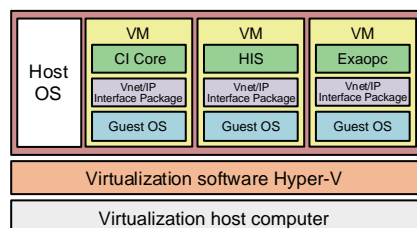
# General Specifications

## IA System Products Virtualization Platform

GS 30A05B10-01EN

### OVERVIEW

Yokogawa's virtualization platform is a system configured using high-performance computers (virtualization host computers) that are virtualized using the virtualization software Hyper-V provided by Microsoft Windows OS. Multiple OS execution environments (virtual machines) can be run on one virtualization host computer. Many Yokogawa IA system products are available as applications that run on virtual machines. Yokogawa's virtualization system, which is optimized for process control, satisfies the quality and performance requirements of process control, and achieves operations similar to systems using physical computers. By introducing a virtualization platform, it is possible to reduce the managed hardware.



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#### Virtualization platform specific features for increased availability

By taking advantage of the virtualization specific features provided by Hyper-V, a highly available system can be provided. This section provides an overview of typical functions: live migration, failover, and replication.

##### Live migration

This function moves a virtual machine to another virtualization host computer without stopping the running virtual machine. When applying security patches to the host OS of a virtualization host computer, it is necessary to stop and restart the virtualization host computer, but by using this function, maintenance of the virtualization host computer can be performed without shutting down the virtual machine. This function allows maintenance of the virtualization host computer without shutting down the virtual machine. This is expected to reduce downtime associated with system maintenance.

##### Failover

This function restores operation by restarting the virtual machine on another virtualization host computer in the event that the virtualization host computer stops due to a failure. This is expected to reduce system downtime.

##### Replication

This function periodically creates a replica of a virtual machine on a virtualization host computer (primary server) on another virtualization host computer (replica server). When the primary server stops due to a failure, the replica of the virtual machine can be run on the replica server to recover the processing on the virtual machine. This is expected to reduce downtime in the event of a failure of the primary server storage.

#### Connection to control network Vnet/IP

When configuring a system using a physical computer, the Vnet/IP interface card VI702 is required to connect the computer to Vnet/IP. On the other hand, in a virtualization platform, the control communication realized by the VI702 is realized by a software Vnet/IP interface package. Each virtual machine can connect to Vnet/IP using a common network card. However, a Vnet/IP interface package is required for the number of virtual machines that connect to Vnet/IP.

## ■ VIRTUALIZATION PLATFORM SYSTEM CONFIGURATION

It shows the basic configuration of the virtualization platform and the required equipment and networks.

### ● HA cluster configuration and single configuration

There are two basic configurations of virtualization platforms: HA (High Availability) cluster configuration and single configuration. The HA cluster configuration uses two to four virtualization host computers and a single shared storage to form a cluster, which provides higher recoverability in the event of a virtualization host computer failure. It is a configuration with higher availability than the single configuration described below.

The single configuration is a configuration in which virtual machines are run only on the virtualization host computer. Although a single virtualization host computer can be used, it is recommended that multiple virtualization host computers be installed and virtual machines be distributed in order to prepare for failures of the virtualization host computer.

In addition, the system configuration of the virtual platform can be flexibly combined, such as a virtualized system that mixes HA cluster configuration and single configuration, or a system that mixes a virtualized system and a system using conventional physical computers, regardless of HA cluster configuration or single configuration. This allows you to build system configurations that meet the needs of your customers.

### Virtualization specific functions available in each configuration

The following table shows the correspondence between the specific virtualization functions (live migration, failover, and replication) and each configuration. The appropriate configuration should be selected based on the scale of the system and the functions to be realized.

Function	HA cluster configuration	Single configuration (2 or more)	Single configuration (1 computer)
Live migration	Available	Available (*1)	Unavailable
Failover	Available	Unavailable	Unavailable
Replication	Available (*2)	Available	Unavailable

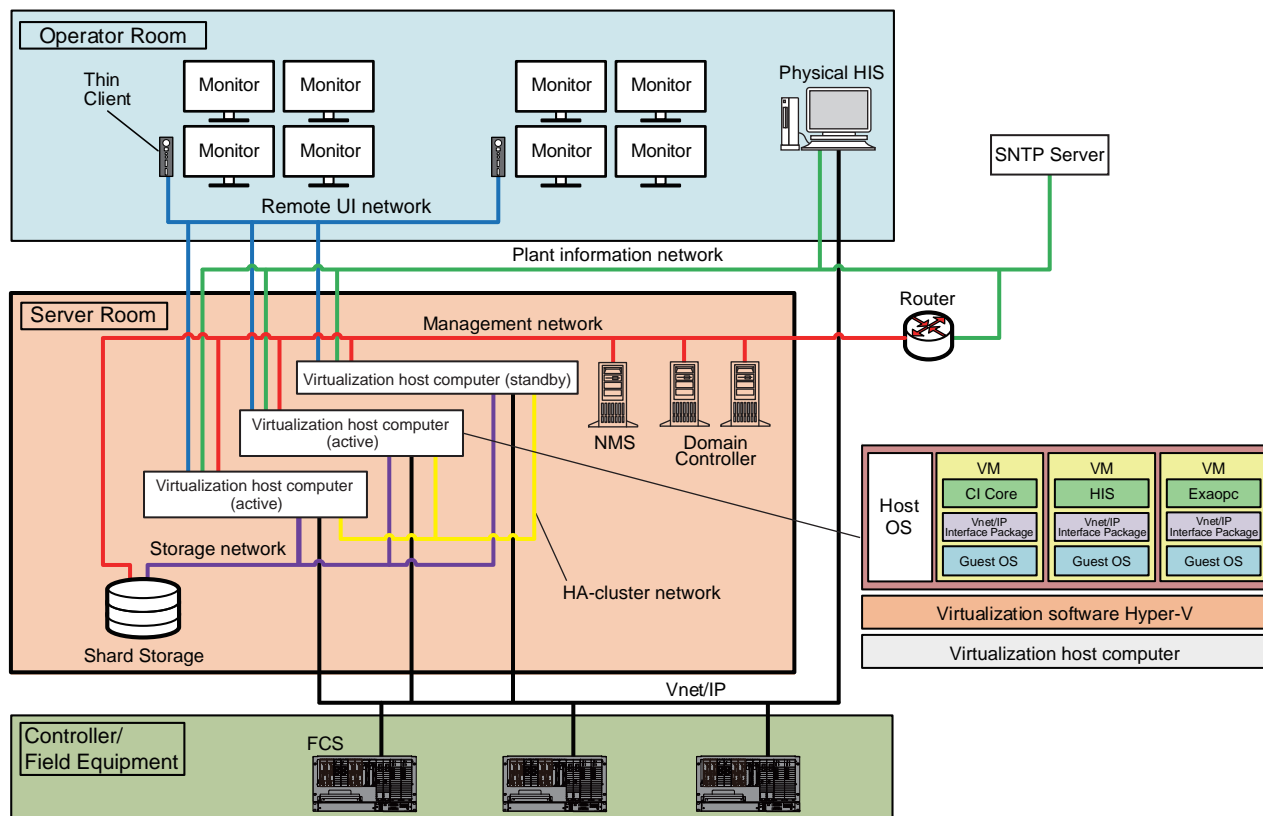
\*1: When performing live migration in an HA cluster configuration, control of the virtual machine is passed (switched) to the destination virtualization host computer in less than one second, so it is never judged as a fail. On the other hand, in a single configuration (two or more virtualization host computers), it takes more time to switch than in an HA cluster configuration, so a Vnet/IP station during live migration may be temporarily judged a fail by other stations. In addition, the system is under high load during live migration of virtual machines, so an HA cluster configuration with a short live migration runtime is recommended.

\*2: When replicating in an HA cluster configuration, replication cannot be performed between virtualization host computers in the same cluster. Therefore, it is necessary to prepare another cluster or virtualization host computer of single configuration as a replication destination.

The features of HA cluster configuration and single configuration are shown below, along with configuration examples.

### HA cluster configuration

This is a virtualization system configuration in which two to four virtualization host computers are arranged in a cluster. It consists of a virtualization host computer (active server) that runs virtual machines in normal times, a virtualization host computer (standby server) that is kept on standby in case of maintenance or failover, and storage (shared storage) for sharing data among the virtualization host computers. Compared to the conventional configuration using physical computers or a single configuration, this configuration provides higher availability. The virtualization host computers suitable for HA cluster configuration as Yokogawa specified models are provided.

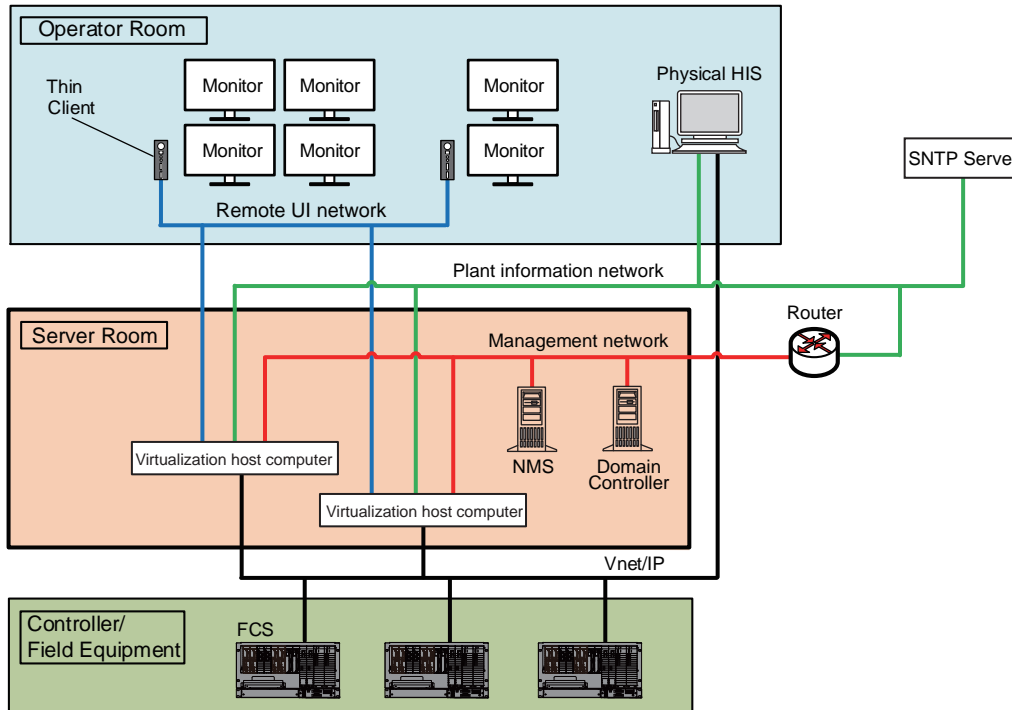


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Figure 1 HA cluster configuration example

### Single configuration

This is a virtualization system configuration that uses multiple virtualization host computers, and by distributing virtual machines across two or more virtualization host computers, the impact on plant operation can be minimized in the event that a virtualization host computer stops due to maintenance or hardware failure. The virtualization host computers suitable for single configuration as Yokogawa specified models are provided.



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**Figure 2 Single configuration ( two or more)**

It is also possible to build a single configuration (one computer) consisting of a single virtualization host computer. In this case, since the virtualization host computer has a low availability configuration, it is recommended to use this configuration in a system, such as an operation support system or training simulation system, where the failure of the virtualization host computer does not directly affect the customer's production.

### ● Networks for Virtualization Platforms

A virtualization platform requires networks, including networks for managing virtualization host computers and for configuring HA clusters.

#### Plant information network

The plant information network is a network used for file transfer and information communication with stations such as CENTUM VP HIS or ENG in virtual machines, general-purpose Ethernet devices, and stations such as CENTUM VP HIS in the physical environment, as well as an information network for connecting upper software package systems (solution products, etc.).

When connecting a UACS station to UACS clients, it is necessary to have a plant information network and a dedicated UACS Ethernet network.

#### Remote UI Network

The remote UI network connects the thin client, which is the HMI function of the virtual machine, and the virtual machine using RDP (Remote Desktop Protocol).

#### Vnet/IP

The Vnet/IP is a network that handles control communication between stations on virtual machines and control stations such as CENTUM VP FCS in the physical environment.

### **Management Network**

The Management network is a network dedicated to host OSs that interconnects host OSs on multiple virtualization host computers. On this network, the host OS on one virtualization host computer can be connected remotely to the host OS on another virtualization host computer. It also enables the users to monitor the settings and status of the virtualization software.

### **HA Cluster Network (HA cluster configuration only)**

The HA cluster network is a network that interconnects virtualization host computers within the same cluster.

### **Storage Network (HA cluster configuration only)**

A storage network is a network that connects virtualization host computers and shared storage that stores virtual machine images.

## **● Required components**

### **NMS (Network Management System)**

NMS detects and notifies the users about errors such as hardware failure of the virtualization host computer, shared storage, or network connectivity. It also utilizes NMS to collect trends in host OS performance data.

### **SNTP Server**

The SNTP server synchronizes the time of the entire virtualization platform. This component is required for virtualization specific features such as live migration and failover operations to function properly.

Time synchronization also makes it easier to investigate the cause of failures.

### **Domain Controller**

The domain controller centrally manages access privileges, etc., to individual users and computers, etc., on a windows OS Active Directory domain, and authenticates users.

Since the host OS must be in a domain environment to build an HA cluster configuration (\*1), installation is mandatory in an HA cluster configuration.

Also in a single configuration, when replication or live migration functions are used, the virtualization host computer must be placed in a domain environment. By installing two domain controllers for redundancy, it is possible to create a configuration that is resistant to hardware failures.

\*1: Requirements for using the failover clustering function of Windows Server

## **■ FUNCTIONAL SPECIFICATIONS**

### **● Vnet/IP Interface Package**

Required software, that is used when Yokogawa IA system products running on the guest OS of the virtual machine communicates Vnet/IP without using the Vnet/IP interface card (VI702), is provided.

### **● Virtualization Building Support**

Documents and tools that support for building the virtualization system are provided.

### **● Security Measure**

IT security tool can be hardened by using windows security functions. This tool is standardly provided with CENTUM VP, ProSafe-RS, etc., and it is now expanded for virtualization system to include the following components.

- Domain controller (for virtualization platform)
- Host OS
- Thin client

## ■ TARGET PRODUCTS

The following table shows the Yokogawa IA system products that correspond to the release number of the virtualization platform and the OS version of its guest OS.

Product, OS version	Release number			Description
Virtualization platform	R1.01.00 R1.01.10 R1.02.00 R1.02.10 R1.03.00	R1.02.00 R1.02.10 R1.03.00	R1.03.00	
Guest OS version	Windows Sever 2016	Windows Sever 2019 (*1)	Windows Sever 2022	
CI Server	—	R1.02.00 or later	R1.03.00 or later	
CENTUM VP	R6.06.00 or later	R6.06.00 or later	R6.11.00 or later	UACS is also supported in R6.10.00 or later, but configure UACS stations in pairs. Excepts APCS, GSGW, UGS, and UGS2
VTSPortal	—	R2.07.00 or later	R2.08.00 or later	Use the VTS Portal client on the Windows OS thin client.
ProSafe-RS	R4.04.00 or later	R4.07.00 or later	R4.10.00 or later	Excepts Vnet/IP-Upstream
ProSafe-RS Lite	R4.06.00 or later	R4.07.00 or later	R4.10.00 or later	Excepts Vnet/IP-Upstream
PRM	R4.02.00 or later	R4.05.00 or later	R4.07.00 or later	Excepts RS-232C, NI-FBUS, and COM Port Connection
Exaopc	R3.77.00 or later	R3.80.00 or later	R3.81.00 or later	Except redundancy
Exapilot	R3.98.00 or later	R4.01.00 or later	R4.04.00 or later	
AAASuite	R1.21.00 or later	R1.23.00 or later	R1.25.00 or later	
Exaquantum	R3.15.00 or later	R3.30.00 or later	R3.40.00 or later	
Platform for Advanced Control and Estimation	R5.02.20 or later	—	—	
Exaquantum Application	—	R3.40 or later	R3.40 or later	As for supported product, refer to "Table Virtualization platform support Information for using Exaquantum Application" in "Exaquantum Application Common Information GS (GS 36J40W10-01EN)".

\*1: When running CENTUM VP R6.09.00, ProSafe-RS R4.07.00, ProSafe-RS Lite R4.07.00, PRM R4.05.00, or Exaopc R3.80.00 using Windows Server 2019 as the guest OS on the virtualization platform R1.02.00/R1.02.10, contact Yokogawa.

## ■ HARDWARE ENVIRONMENT

Not only when building a new virtualization platform, but also when adding or updating hardware to an existing system, purchase “Software Media for Virtualization Platform (SS2CVKM-V11)” and set up with the latest information.

### ● Virtualization host computer for single configuration (using in the configuration shown in Figure 2)

Computers used for the virtualization platform are restricted to Yokogawa specified models.

#### Dell PowerEdge R760XL base

Refer to “Yokogawa specified model for Virtualization Platform (GS 30A05B80-01EN)” for detailed specifications.

#### Dell PowerEdge R740XL base (No longer sold by Dell) for 1 CPU type

Item	Specification	Description
CPU	Intel Xeon Gold 6148 2.4 GHz 20 cores	Total 20 cores
Memory	64 GB	With ECC
Storage	600 GB x 2	For Host OS RAID1: effective capacity 558 GB
	1.2 TB x 6	For virtual machine RAID10: effective capacity 3.2 TB
RAID card	PERC H740P	RAID1/10
Network	10 GbE SFP+ 4 ports	onboard
	1 Gb 8 ports	Installed into PCIe slot.
Optical drive	DVD+/-RW	
Power supply unit	Dual Hot-Plug Redundant (1+1), 1100W	
Installed OS (host OS)	Windows Server 2019	

#### for 2 CPU type

128 GB	Specification	Description
CPU	Intel Xeon Gold 6148 2.4 GHz 20 cores	2nd CPU is the same spec. Total 40 cores
Memory	128 GB	With ECC
Storage	600 GB x 2	For Host OS RAID1: effective capacity 558 GB
	1.2 TB x 10	For virtual machine RAID10: effective capacity 5.4 TB
RAID card	PERC H740P	RAID1/10
Network	10 GbE SFP+ 4 ports	onboard
	1 Gb 8 ports	Up to 5 cards by configuration. Installed into PCIe slot
Optical drive	DVD+/-RW	
Power supply unit	Dual Hot-Plug Redundant (1+1), 1100W	
Installed OS (host OS)	Windows Server 2019	

## ● Virtualization host computer for HA cluster configuration (using in the configuration shown in Figure 1)

Computers used for the virtualization platform are restricted to Yokogawa specified models.

### Dell PowerEdge R760XL base

Refer to “Yokogawa specified model for Virtualization Platform (GS 30A05B80-01EN)” for detailed specifications.

### Dell PowerEdge R740XL base (No longer sold by Dell)

Item	Specification	Description
CPU	Intel Xeon Gold 6148 2.4 GHz 20 cores	2nd CPU is the same spec. Total 40 cores
Memory	128 GB	With ECC
Storage	600 GB x 2	For Host OS RAID1: effective capacity 558 GB
	PERC H740P	RAID1
RAID card	10 GbE SFP+ 4 ports	onboard
Network	1 Gb RJ45 8 ports	Up to 4 cards by configuration. Installed into PCIe slot
	10 GbE SFP+ 4 ports	1 card. Installed into PCIe slot
Optical drive	DVD+/-RW	
Power supply unit	Dual Hot-Plug Redundant (1+1), 1100 W	
Installed OS (host OS)	Windows Server 2019	

## ● Shared storage for HA cluster

A shared storage used for the virtualization platform is restricted to Yokogawa specified model.

Refer to “Yokogawa specified model for Virtualization Platform (GS 30A05B80-01EN)” for detailed specifications.

## ● Network switch for shared storage

Network switches for shared storage used for the virtualization platform are restricted to Yokogawa specified model.

Refer to “Yokogawa specified model for Virtualization Platform (GS 30A05B80-01EN)” for detailed specifications.

## ● Thin client

Thin clients used for the virtualization platform are restricted to Yokogawa specified model.

Refer to “Yokogawa specified model for Virtualization Platform (GS 30A05B80-01EN)” for detailed specifications.

## ■ SOFTWARE ENVIRONMENT

### Host OS

The following three OSs of host OS are supported, but the installed OS differs depending on the generation of the virtualization host computer.

- Windows Server 2016 Datacenter
- Windows Server 2019 Datacenter
- Windows Server 2022 Datacenter

Virtualization host computer		R740XL base (Discontinued model)		R760XL base	
Host OS		Windows Server 2016 Datacenter	Windows Server 2019 Datacenter	Windows Server 2019Datacenter	Windows Server 2022 Datacenter
Release number	R1.01	X	-	-	-
	R1.02.00 R1.2.10	X	X	-	-
	R1.03	X	X	X	X

X: possible    -: not possible



**Guest OS (virtual machine), domain controller**

The following three OSs are supported.

- Windows Server 2016 Standard
- Windows Server 2019 Standard
- Windows Server 2022 Standard

Guest OS, domain controller OS		Windows Server 2016 Standard	Windows Server 2019 Standard	Windows Server 2022 Standard
Release number	R1.01	X	-	-
	R1.02.00 R1.2.10	X	X	-
	R1.03	X	X	X

X: possible      -: not possible

**Combination of Host OS and Guest OS**

Host OS	Guest OS		
	Windows Server 2016 Standard	Windows Server 2019 Standard	Windows Server 2022 Standard
Windows Server 2016 Datacenter	Supported	Prohibited (*1)	Prohibited (*1)
Windows Server 2019 Datacenter	Supported (*2)	Supported	Prohibited (*1)
Windows Server 2022 Datacenter	Supported (*2)	Supported (*2)	Supported

\*1: This combination is prohibited as it violates the Microsoft license.

\*2: These combinations must be upgraded by the end of the support dates listed below. After the expiration date, it will be a violation of Microsoft's license.

If the guest OS is Windows Server 2016 Standard: 12, January 2027

If the guest OS is Windows Server 2019 Standard: 9, January 2029

**Concept of Software and Licensing of Windows Server OS**

The Windows Server OS software and license are pre-installed in the virtualization host computer of Yokogawa specified model, so there is no need to prepare them separately.

Yokogawa's virtualization platform uses Windows Server Datacenter Edition. The Datacenter Edition license does not limit the number of virtual machines created on the virtualization host computer, therefore there is no need to prepare guest OS licenses.

**CAL required for thin clients**

A Server Client Access License (Server CAL) is required. In addition, to connect from a thin client to a virtual machine using Remote Desktop Service, an RDS Client Access License (Remote Desktop Service CAL: RDS-CAL) is required. There are two types of RDS-CAL: device CAL (license required for each number of devices) and user CAL (license required for each number of users). For virtualization platforms, use device CAL.

## ■ MODEL AND SUFFIX CODES

### ● Software Medium

One software medium for virtualization platform is required in the virtualization system, separately from a software medium of Yokogawa IA system products (e.g. VP6CKM).

In this medium, there are procedure documents, tools, and scripts to support various settings required for building the virtualization system.

#### Software media for virtualization platform

		Description
<b>Model</b>	SS2CVKM	Software media for virtualization platform
<b>Suffix Codes</b>	-V	Supplied media: DVD
	1	Always 1
	1	English version

Note: Virtualization Platform Setup (IM 30A05B20-01EN) is enclosed in paper format.

### ● Software License

For a virtual machine that connects with Vnet/IP network directly, Vnet/IP interface package is required for Yokogawa IA system product for each virtual machine. Even if different Yokogawa IA system products such as CENTUM VP ENG and ProSafe-RS SENG work on one virtual machine, only one Vnet/IP interface package is required.

A software of Vnet/IP interface package is in a software medium of each system product.

#### Vnet/IP Interface Package (for CI Server)

Refer to “Collaborative Information Server” (GS 36K01A10-01EN) for Vnet/IP Interface Package.

#### Vnet/IP Interface Package (for CENTUM VP)

		Description
<b>Model</b>	VP6C3300	Vnet/IP Interface Package
<b>Suffix Codes</b>	-V	Software license
	1	Always 1
	1	English version

#### Vnet/IP Interface Package (for ProSafe-RS/ProSafe-RS Lite)

		Description
<b>Model</b>	RS4C3300	Vnet/IP Interface Package
<b>Suffix Codes</b>	-V	Software license
	1	Always 1
	1	English version

#### Vnet/IP Interface Package (for PRM)

		Description
<b>Model</b>	PM4C3300	Vnet/IP Interface Package
<b>Suffix Codes</b>	-V	Software license
	1	Always 1
	1	English version

#### Vnet/IP Interface Package (for Exaopc)

		Description
<b>Model</b>	NTPF330	Vnet/IP Interface Package
<b>Suffix Codes</b>	-S	Software license
	1	Always 1
	1	English version

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## ■ ORDERING INFORMATION

Specify model and suffix codes.

Engineering for building the virtualization environment is required, in addition to the engineering for Yokogawa IA system products. It is recommended to build the virtualization environment by Yokogawa. Contact Yokogawa for further information.

## ■ TRADEMARK ACKNOWLEDGMENT

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