General Specifications

Integrated Production Control
System CENTUM VP
System Overview (Vnet/IP Edition)

CENTUM VP

Vnet/IP

GS 33K01A10-50E

[Release 5]

■ GENERAL

This document describes about CENTUM VP Production Control System (for Vnet/IP) which controls and monitors industrial plants such as oil and gas, petrochemicals, chemicals, electric power, pharmaceuticals, food and beverages, iron and steel, pulp and paper, and water supply and sewage treatment. The CENTUM VP system specifications, system components, and network specifications are found.

■ COMPONENTS AND SOFTWARE

CENTUM VP system consists of various components for operation and monitoring for process control and other equipments. CENTUM VP is composed of and communicates with each of those equipments via Vnet/IP, a real-time process control network and Ethernet.

● Human Interface Station (HIS)

CENTUM VP uses a PC (IBM PC/AT compatible machine) for its human machine interface. It is called HIS when the software packages for control and monitoring functions are applied on the PC. The desk top type and a solid style console type with assembled displays are selectable. It is also possible to apply both control and monitoring functions and engineering functions on the HIS. For more details, refer to the following General Specifications (GS).

- Enclosed Display Style Console Assembly
  (GS 33K50B40-50E)
- Open Display Style Console Assembly
  (GS 33K50B50-50E)
- Standard Operation and Monitoring Function
  (GS 33K05D10-50E)
- Vnet/IP Interface Card (GS 33K50C10-50E)

Operation and Monitoring Software

LHS1100	Standard Operation and Monitoring Function
LHS1120	Console HIS Support Package for Enclosed Display Style
LHS1130	Console HIS Support Package for Open Display Style
LHS1150	Server for Remote Operation and Monitoring Function
LHS2411	Exaopc OPC Interface Package (for HIS)
LHS2412	CENTUM Data Access Library
LHS4000	Million Tag Handling Package
LHS4100	Configured Information Reference Package
LHS4150	Output to External Recorder Package
LHS4190	Line Printer Support Package
LHS4200	Historical Message Integration Package (meeting FDA Regulations)
LHS4410	Control Drawing Status Display Package
LHS4420	Logic Chart Status Display Package
LHS4450	Multiple Project Connection Package
LHS4600	Multiple-Monitor Support Package
LHS4700	Advanced Alarm Filter Package
LHS6510	Long-term Data Archive Package
LHS6530	Report Package
LHS6660	Process Management Package (VP Batch)
LHS6710	FCS Data Setting/Acquisition Package (PICOT)

YOKOGAWA ◆

● **Engineering Station (ENG)**

CENTUM VP ENG is a PC used for system configuration and maintenance. It is also possible to use a single PC for both HIS and ENG functions. The engineering functions can be realized by applying the engineering-related software as listed below.

Engineering-related Software

Here is a list of engineering-related software for CENTUM VP. For more details, refer to the following GS.

LHS5100   Standard Builder Function
LHS5110   Access Control Package
LHS5150   Graphic Builder
LHS5165   Batch Builder (VP Batch)
LHS5166   Recipe Management Package (VP Batch)
LHS5170   Access Administrator Package
          (FDA:21 CFR Part 11 compliant) (*1)
LHS5420   Test Function
LHS5425   Expanded Test Functions
LHS5426   FCS Simulator Package
LHS5427   HIS Simulator Package
LHS5450   Multiple Project Connection Package
LHS5490   Self-documentation Package

*1:   This package includes LHS5110 Access Control
      Package functions.

Both HIS and ENG work on the following Microsoft ® Windows OS.

Windows Vista Business Edition
Windows 7 Professional Edition
Windows Server 2008 Standard Edition
Windows Server 2008 R2 Standard Edition

For the combination of CENTUM VP revisions and each of the OS Service Pack, please refer to GS for Standard Operation and Monitoring Function (GS 33K05D10-50E) and Standard Builder Function (GS 33K10D10-50E). As for other third-party software that works on the Windows OS, contact Yokogawa for limitations in use with CENTUM VP.

Documents

CENTUM VP instruction manuals are provided electronically in the DVD as same as other system software.

LHS5495   Electronic Instruction Manual
For more details, refer to GS for LHS5495 Electronic Instruction Manual (GS 33K01W10-50E).

● **Remote Operation and Monitoring Function (HIS-TSE)**

HIS-TSE enables to operate and monitor a plant, with some limitations, from a remote PC without installing CENTUM VP operation and monitoring functions. By utilizing the Windows server's terminal service (TS) it is possible to control and monitor CENTUM VP operations simultaneously from several PCs via network. Once the network is established, it is possible to display the same HIS views on a remote PC away from the control room.

LHS1150   Server for Remote Operation and
          Monitoring Function
For more details, refer to GS for LHS1150 Server for Remote Operation and Monitoring Function (GS 33K05D20-50E).

● **Field Control Station (FCS)**

FCS performs control computation functions for each function block and input/output functions for process and software inputs/outputs. Field control unit (FCU) is the core of FCS and following units are available.

AFV30S: Field Control Unit (for Vnet/IP and FIO,
          19-inch Rack Mountable Type)
AFV30D: Duplexed Field Control Unit (for Vnet/IP
          and FIO, 19-inch Rack Mountable Type)
AFV40S: Field Control Unit (for Vnet/IP and FIO,
          with Cabinet)
AFV40D: Duplexed Field Control Unit (for Vnet/IP
          and FIO, with Cabinet)
AFV10S   Field Control Unit (for Vnet/IP and FIO,
          19-inch Rack Mountable Type)
AFV10D   Duplexed Field Control Unit (for Vnet/IP
          and FIO, 19-inch Rack Mountable Type)
For more details, refer to GS for AFV30S, AFV30D Field Control Unit, Duplexed Field Control Unit (for Vnet/IP and FIO, 19-inch Rack Mountable Type) (GS 33K50E10-50E), AFV40S, AFV40D Field Control Unit, Duplexed Field Control Unit (for Vnet/IP and FIO, with Cabinet) (GS 33K50E20-50E) and AFV10S, AFV10D Field Control Unit, Duplexed Field Control Unit (for Vnet/IP and FIO, 19-inch Rack Mountable Type) (GS 33K50E30-50E).

Basic Software

LFS1700   Control Function for Field Control Station
          (for AFV30□/AFV40□, Vnet/IP and FIO)
LFS1750   Node Expansion Package
          (for AFV30□/AFV40□)
LFS1500   Control Function for Field Control Station
          (for AFV10□, Vnet/IP and FIO)
LFS1550   Node Expansion Package (for AFV10□)
For more details, refer to LFS1700 Control Function for Field Control Station (for AFV30□/AFV40□, Vnet/IP and FIO), LFS1750 Node Expansion Package (for AFV30□/AFV40□) (GS 33K15C10-50E) and LFS1500 Control Function for Field Control Station (for AFV10□, Vnet/IP and FIO), LFS1550 Node Expansion Package (for AFV10□) (GS 33K15C20-50E).

Subsystem Communication Function

FCS communicates with subsystems and field devices to exchange data via network. The following subsystem communication functions are available for CENTM VP. For more details, refer to the GS for each communication hardware.

Serial Communication:
          ALR111, ALR121 Serial Communication
          Module (for FIO) (GS 33K50G10-50E)
Ethernet Communication:
          ALE111 Ethernet Communication Module
          (for FIO) (GS 33K50G11-50E)
Foundation fieldbus Communication:
          ALF111 Foundation fieldbus
          Communication Module (for FIO) (GS
          33K50G20-50E)
PROFIBUS-DP Communication:
          ALP111 PROFIBUS-DP Communication
          Module (GS 33K50G80-50E)

Optional Software

Optional software packages are available that perform special functional blocks on FCS, other than the basic software.

LFS3132   Valve Pattern Monitor Package
LFS8620   Off-site Block Package
For details, refer to GS for each software package.

● **Generic Subsystem Gateway (GSGW)**

GSGW is a station for operation and monitoring subsystems. By using a PC as a platform, GSGW package establishes communications with subsystems via OLE for Process Control (OPC) interface defined by the OPC Foundation. Subsystem data is assigned to the GSGW's function blocks which can be controlled and monitored via HIS as same as other control stations.

LFS1250　Generic Subsystem Gateway Package
For more details, refer to GS for Generic Subsystem Gateway Package (GS 33K20F10-50E).

● **Unified Gateway Station (UGS)**

UGS is a station exclusively used for Vnet/IP to integrate CENTUM VP and subsystem controllers such as STARDOM controllers (FCN/FCJ) and other third-party programmable logic controllers (PLCs).

The UGS standard function allows CENTUM VP to communicate with subsystem controllers via various communication protocols such as Modbus, EtherNet/IP or OPC DA. And CENTUM VP is able to control and monitor those subsystems via UGS in the same way as its own FCS.

UGS is capable of processing 2000000 data and applicable for a large scale system.

LBC1500　Unified Gateway Station Standard Function
For more details, refer to GS for Unified Gateway Station Standard Function (GS 33K20C10-50E).

● **System Integration OPC Station (SIOS)**

SIOS is a station to integrate CENTUM VP and the third-party process control systems (PCSs). SIOS enables CENTUM VP exchanges data with and receives alarms and events from the third-party PCSs via OPC interface.

LBC2100　System Integration OPC Client Package
For more details, refer to GS for System Integration OPC client Package (GS 33K20D10-50E).

● **Advanced Process Control Station (APCS)**

APCS performs advanced control and computation for improving plant operation efficiencies.

LFS1200　APCS Control Functions
For more details, refer to GS for APCS Control Functions (GS 33K15U10-50E).

● **Peripheral Devices**

Printers and other peripherals devices which each OS support are available to use with CENTUM VP. For details of other peripherals, contact Yokogawa for information.

● **Layer 2 Switch (L2SW)**

L2SW relays communications among devices connected to the Vnet/IP network. The Vnet/IP domain refers to the Vnet/IP system area connected by L2SW. In the Vnet/IP domain, use L2SW with 1 Gbps communication speed.

● **Layer 3 Switch (L3SW)**

L3SW relays communications among Vnet/IP domains. For communication among Vnet/IP domains, use L3SW with 1 Gbps communication speed.

● **SNTP Server**

SNTP server performs time synchronization via networks. Connect Vnet/IP station to SNTP server for synchronizing its time to the Universal Time, Coordinated (UTC).

● **V net Router**

V net router connects and transmits control communications between the Vnet/IP and V net domains. The control data can be sent and received in both ways between the Vnet/IP and V net domains. Control and monitoring of the control stations in the other domain, and vice versa, is enabled.

AVR10D　Duplexed V net Router (duplexed communication modules and duplexed power supply modules)
For more details, refer to GS for Duplexed V net Router (GS 33K50D10-50E).

■ **RELEVANT SYSTEMS**

● **Plant Resource Manager (PRM®)**

PRM is a software package for online asset management of field devices and equipments. By monitoring and managing the device status and the maintenance information, it enables to reduce plant's Total Cost of Ownership (TCO).

PRM communicates with devices with digital communication functions such as FOUNDATION fieldbus, HART, and field wireless (complies with ISA 100.11a) devices, as well as conventional analog devices with no digital communication function.

For more details of the PRM specifications, refer to GS for Plant Resource Manager (GS 33Y05Q10-32E).

● **ProSafe-RS Safety Instrumented System**

ProSafe-RS has certified by Technische Überwachungs Verein (TÜV) as a safety system to satisfy safety integrity level (SIL) 3 of IEC 61508.

A safety control station (SCS) of ProSafe-RS monitors plant safety always, and it performs safety functions when needed. Safety engineering PC (SENG) performs engineering and maintenance of SCS. ProSafe-RS can be integrated with CENTUM VP, which enables SCS operation and monitoring from HIS.

For more details, refer to GS for ProSafe-RS Safety Instrumented System (GS 32Q01B10-31E).

　　　GS 33K01A10-50E Aug. 19, 2011-00

■ SYSTEM SPECIFICATIONS

● HIS Operation/Monitoring Tags:

Maximum 100000 per system (when LHS4000 is in use, up to 1000000 per system).

● Minimum System Configuration

A minimum system of CENTUM VP consists of the following equipments:

    HIS x 1 unit
    ENG x 1 unit
    FCS x 1 unit
HIS and ENG can be consolidated in one PC.

● Maximum System Configuration

    64 Vnet/IP devices/domain
    16 domains/system
    256 stations/system
For maximum number of FCS per an entire system, refer to ■ REMARKS FOR SYSTEM CONFIGURATIONS/
● Maximum number of FCS per an entire system.

The Vnet/IP devices refer to a PC with Vnet/IP Interface Card (VI702), an FCS for Vnet/IP, and/or a V net router.
Followings are Vnet/IP devices for CENTUM VP.

    HIS: Human Interface Station
    ENG: Engineering Station
    FCS: Field Control Station
    APCS: Advanced Process Control Station
    GSGW: Generic Subsystem Gateway
    UGS: Unified Gateway Station
    SIOS: System Integration OPC Station
    Exaopc: OPC Interface Package
    AVR10D: V net Router

Equipments connectable with CENTUM VP.

    SENG: Safety Engineering PC
    SCS: Safety Control Station
    PRM: PRM Server, Field Communications Server, etc.

Figure An Example of System Configuration

GS 33K01A10-50E Aug. 19, 2011-00
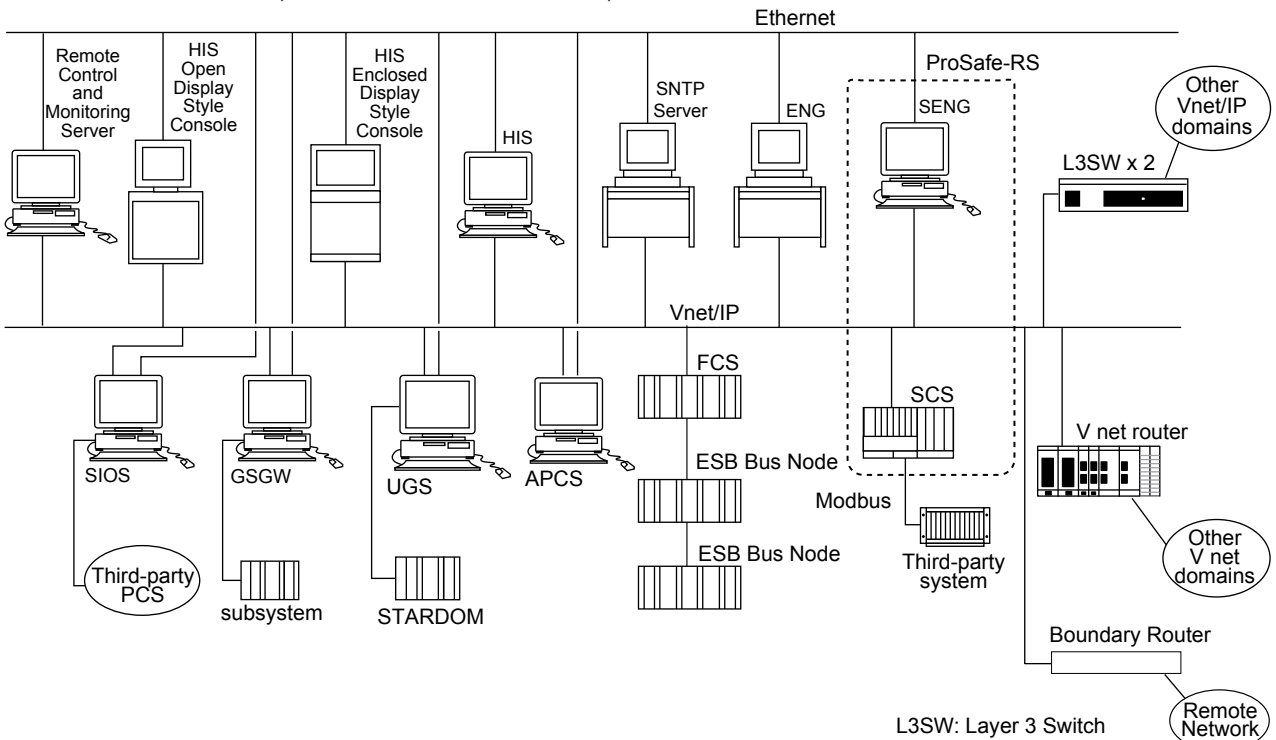
● **System Expansion**

By adopting layer 3 switch (L3SW), Vnet/IP domains can be connected to form a hierarchical system configuration. With a V net router, V net domains can be connected with other V net and/or VL net systems. The existing HF bus and/or RL bus systems cannot connect directly with Vnet/IP domains; however, it can be connected using a bus converter (BCV) on the V net via V net router. When the system is configured hierarchically using L3SW and V net routers, it is possible to expand the system scale exceeding the maximum system configuration per domain. It means that CENTUM VP system can be extendedly connected with other control systems in hierarchical layers beyond its maximum system scale.

No. of domains: Maximum 16 domains (Vnet/IP domains + V net domains)
No. of domain layers connected with Vnet/IP systems via V net routers:3 layers (2 layers for bus converter, 3 layers for V net)
No. of operation/monitoring tags: Maximum 100000 (when LHS4000 is in use, up to 1000000 per system)
Connecting devices: L3SW, V net router, and Bus converter

When counting the number of V net layers, Vnet/IP domains and V net routers in the access paths are not counted as a layer. The figure below shows an example of layers in hierarchical configuration.
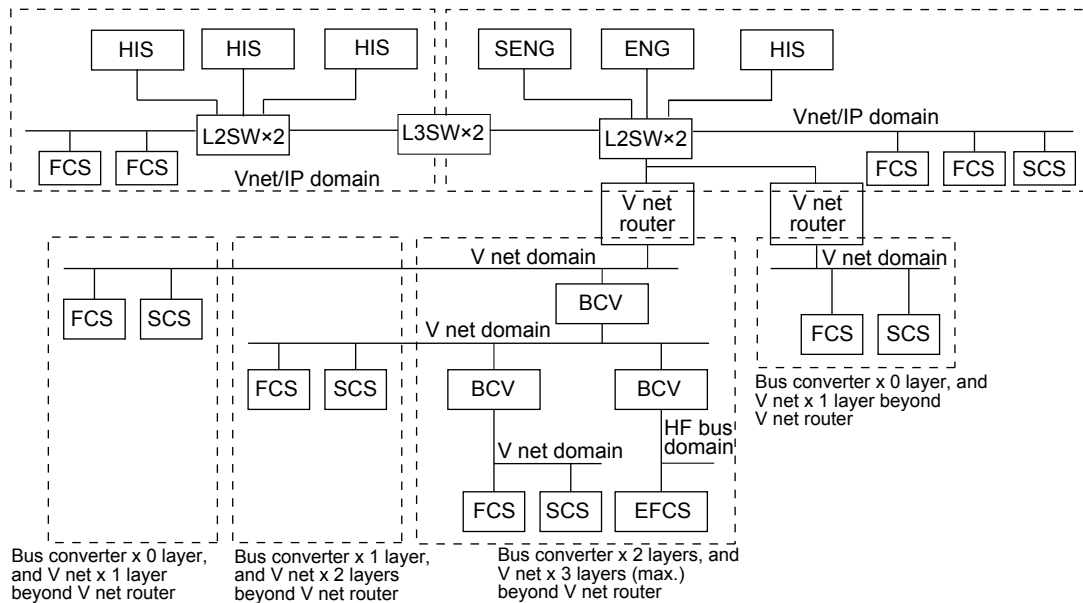
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Figure An Example of System Expansion

A Vnet/IP domain and a V net domain can be configured as a single project for engineering. Or, a Vnet/IP domain and a V net domain can be treated as different projects and connect them by LHS4450 multiple project connection package.

For more details, refer to GS for Multiple Project Connection Package (GS 33K05K20-50E).

■ MULTIPLE PROJECT CONNECTION

CENTUM VP manages FCS and HIS engineering data, generated by the system builder functions, by the unit of project. The multiple project connection is a function to integrate operation and monitoring of the multiple projects. CENTUM VP HIS integratively monitors CENTUM VP, CENTUM CS 3000, CENTUM CS 1000, and CENTUM CS projects without changing the identical names (e.g. tag name, project name, and plant hierarchy name) and common resources (e.g. engineering unit, and operation mark).

There are two ways of multiple project connection.

● Hierarchical Connection

CENTUM VP project on the upper-layer operates and monitors lower-level projects. In this case, CENTUM VP on the upper-level project requires installing a multiple project connection package. From the lower-level projects, operation and monitoring of the CENTUM VP on the upper-level is not available. Following types of multiple connections are available.

CENTUM VP→CENTUM VP   CENTUM VP→CENTUM CS 3000   CENTUM VP→CENTUM CS 1000   CENTUM VP→CENTUM CS

CENTUM VP upper-level project	CENTUM VP upper-level project	CENTUM VP upper-level project	CENTUM VP upper-level project
↓	↓	↓	↓
CENTUM VP lower-level project	CENTUM CS 3000 lower-level project	CENTUM CS 1000 lower-level project	CENTUM CS lower-level project
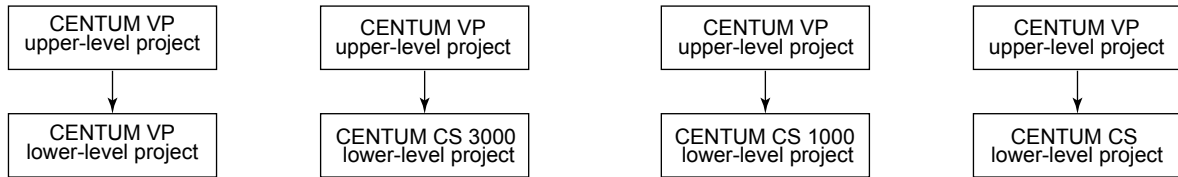
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● Bi-directional Connection

Operation and monitoring of the connected projects are enabled bi-directionally. The bi-directional connection is applicable only for CENTUM VP projects and/or CENTUM VP and CENTUM CS 3000 projects. Multiple project connection packages are required for both upper- and lower-levels of the systems.

CENTUM VP→CENTUM VP   CENTUM VP→CENTUM CS 3000

| CENTUM VP upper/lower level project	CENTUM VP upper/lower level project
↓ ↑	↓ ↑
CENTUM VP lower/upper level project	CENTUM CS 3000 lower/upper level project
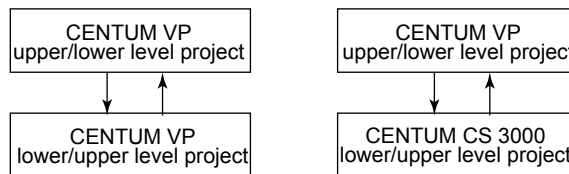
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For more details, refer to GS for LHS5450, LHS4450 Multiple Project Connection Package (GS 33K05K20-50E).

■ NETWORK SPECIFICATIONS

CENTUM VP uses Vnet/IP and Ethernet for communications among configured devices.

● Vnet/IP

Vnet/IP is a gigabit Ethernet-based control network for process automation. It provides real-time communication with high reliability which is indispensable for stable plant operations. Vnet/IP is a dual-redundant control network, consisting of Bus 1 and Bus 2. Bus 1 is normally used for control communication to transmit control data; however, when the Bus 1 fails, it automatically switches its communication path and Bus 2 continues the control communication without stopping.
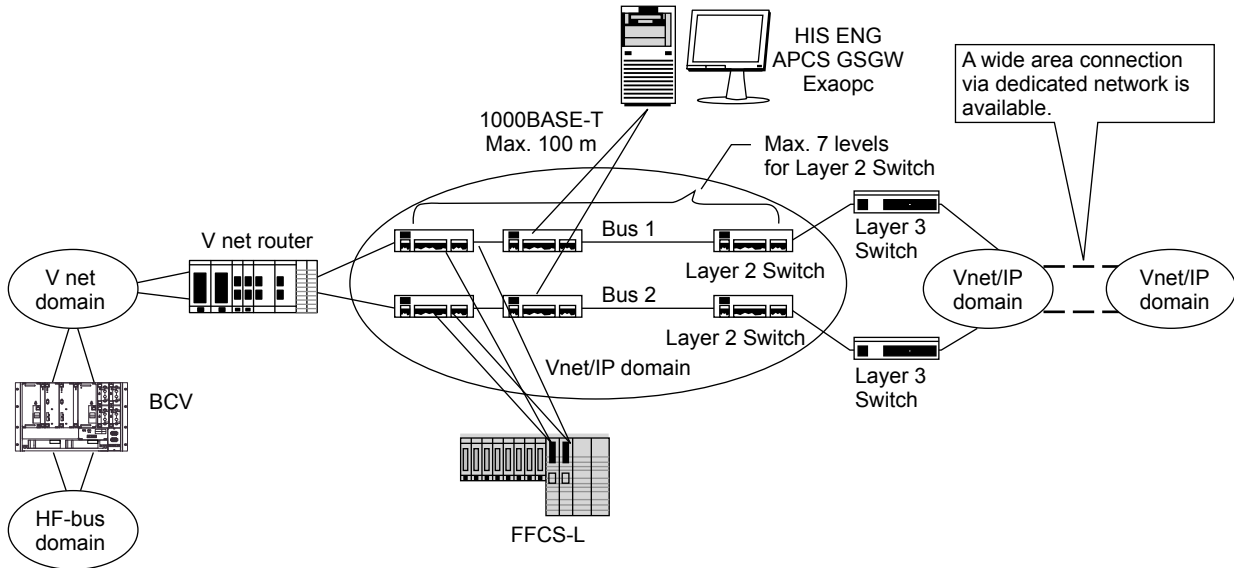
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Figure Network Configuration

● Communication Specification

Control Communication
  Communication method: Read/write communication, message communication, link transmission
  Link transmission period: 100 ms

Transmission specifications
  Network topology: Star topology
  Transmission redundancy: Dual-redundant (for control network communication only)
  Transmission cable: Unshielded twist-pair (UTP) with enhanced category 5 or superior

Connection	Cable Standard	Speed	Maximum Distance
Between component and a layer 2 switch	100BASE-TX (IEEE802.3u)	100 Mbps (*1)	100 m
	1000BASE-T (IEEE802.3ab)	1 Gbps	
Between layer 2 switches	1000BASE-T (IEEE802.3ab)	1 Gbps	100 m
	1000BASE-LX (IEEE802.3z)	1 Gbps	5 km (*2)
Between a layer 2 switch and a layer 3 switch	1000BASE-T (IEEE802.3ab)	1 Gbps	100 m
	1000BASE-LX (IEEE802.3z)	1 Gbps	5 km (*2)

*1:   Applicable only for V net Router and ProSafe-RS SCS.
*2:   1000 BASE-LX standard defines the transmission distance as up to 5 km for a single mode optical fiber. In case further length is required, refer to Network Switch for Vnet/IP (TI 30A10A30-01E).

● Communications between Instruments

Distance between the two arbitrary stations in a domain: Maximum 40 km
One level (a pair) of media converters can be connected in between the instruments.

● Ethernet

Ethernet is a network used for file transfer and information communication among HIS, ENG, and other general-purpose Ethernet instruments. Ethernet communication is usually performed via an Ethernet card mounted a PC or a server. In this section the term, Ethernet communication, refers to the communication based on the various Ethernet-based standard protocols.

Communication Protocol
 Based on IEEE802.3

Conditions for Ethernet Communication using Vnet/IP Bus 2
Ethernet communication usually uses a network independent from Vnet/IP. However, when all the following conditions are met, it is enabled to perform Ethernet communication by using Vnet/IP Bus 2. In case any one of the conditions is not met, it is recommended to use an independent network from Vnet/IP for Ethernet communication.

• A system is composed of only Vnet/IP network and has no connection with V net or VL net via V net router.
• A system includes none of the followings – Exaopc (*1), HIS-TSE, UGS, SIOS, GSGW, or APCS.
• No integration with ProSafe-RS.
• When using PRM, PRM server and field communications server run on the same PC, and PRM client runs on a PC with Vnet/IP Interface Card, such as HIS or PC on which field communications server runs.
• 16 or less PCs with Vnet/IP interface card for HIS and ENG. (*2)
• Instruments connected with L2SW for Bus 2 are Vnet/IP interface card's Bus 2 port mounted on the PC, a network printer (*3), and a file server (*3) only.

When the Ethernet communication is performed by the Vnet/IP Bus 2, it is called an open communication. Vnet/IP realizes dual-redundancy of the control communication. Bus 2 always performs the open communication while Bus 1 is for control communication. When the Bus 1 control communication fails, Bus 2 performs both the control and the open communications.

    *1:   NTPF100 Exaopc OPC Interface Package (refer to GS 36J02A10-01E). This condition is not applied for LHS2411 Exaopc
           OPC Interface Package (for HIS).
    *2:   When the number of PC with Vnet/IP interface card exceeds 16, it is suggested to perform Ethernet communication by
           the network connected to a PC's Ethernet card, and do not use Vnet/IP Bus 2 communication. When the number of PC
           exceeds 50, this method is strongly recommended.
    *3:   When the Vnet/IP Bus 2 performs Ethernet communication, it is possible to connect a network printer or a fileserver to the
           Vnet/IP Bus 2. However, the sum of the communication band by these equipments should not exceed 300 Mbps.

For more information about using Vnet/IP bus 2 to perform Ethernet communication, refer to Vnet/IP Network Construction Guide(TI 30A10A05-01E).

■ I/O COMMUNICATIONS BUS

● ESB Bus/Optical ESB Bus for AFV30□/AFV40□

An ESB bus and an optical ESB bus are used as an input/output communication bus connecting an FCS's intelligent part with an ESB bus node unit and optical ESB bus node unit.

Communication Specifications

Applicable units: ESB Bus Node Unit (ANB10□), Optical ESB Bus Node Unit (ANB11□), and Unit for Optical ESB Bus Repeater Module (ANT10U).

No. of communication units: Numbers of ESB bus node units and optical ESB bus node units that can be connected to ESB bus varies depending on the control functions. Number of unit for optical ESB bus repeater module is not included in the number of the communication devices.

Field Control Unit	Control Function	No. of ESB and Optical ESB Bus Node Units (*1)
AFV30□ (*2) AFV40□ (*2)(*3)	Control Function for Field Control Station (LFS1700)	Max. 3/FCU
	Control Function for Field Control Station (LFS1700) plus Node Expansion Package (LFS1750-V11)	Max. 9/FCU
	Control Function for Field Control Station (LFS1700) plus Node Expansion Package (LFS1750-V21)	Max. 13/FCU

*1: Model codes for ESB Bus Node Unit ANB10□ and Optical ESB Bus Node Unit is ANB11□.
*2: For connecting ESB bus node units and optical ESB bus node units to the FCUs (AFV30□/AFV40□), install ESB Bus Coupler Modules (EC401 or EC402) in slots No. 7 and 8. Maximum 9 units of node units can be connected to EC401. As for EC402, maximum 9 units of node units can be connected to upper and lower sides each; however, the total number of the connected node units must not exceed the maximum numbers indicated in the above table.
*3: As for AFV40□, the maximum 11 units of ESB bus node units, optical ESB bus node units, and units for optical ESB bus repeater module can be installed in a single cabinet.

Transmission Specifications

Network topology: Bus topology
Transmission: Dual-redundant or single. When the processor module has a dual-redundant configuration, the dual-redundant transmission is mandatory.
Transmission speed: 128 Mbps
Transmission cable: Dedicated cable (YCB301), or optical fiber cable (*1)
Transmission distance: Max. 10 m (*2), and 50 km (with Optical ESB Bus Repeater Module) (*3)

*1: Optical fiber cable specifications
Connector: LC type (compliant to IEC 61754-20)
Cable: Quartz single-mode fiber (JIS C6835 SSMA-9.3/125, IEC 60793-2-50B1.1) is recommended.
No. of cores: 2
*2: Max. 10 m for EC401. Max. 10 m each on the upper and lower sides for EC402.
*3: It is possible to extend up to 5 km using ANT401/ANT502 and 50 km using ANT411/ANT512. Chain or star type topologies are applicable.

ESB bus can be extended using an optical ESB bus repeater module. Chain, star, or combinations of others are available for communication topologies.
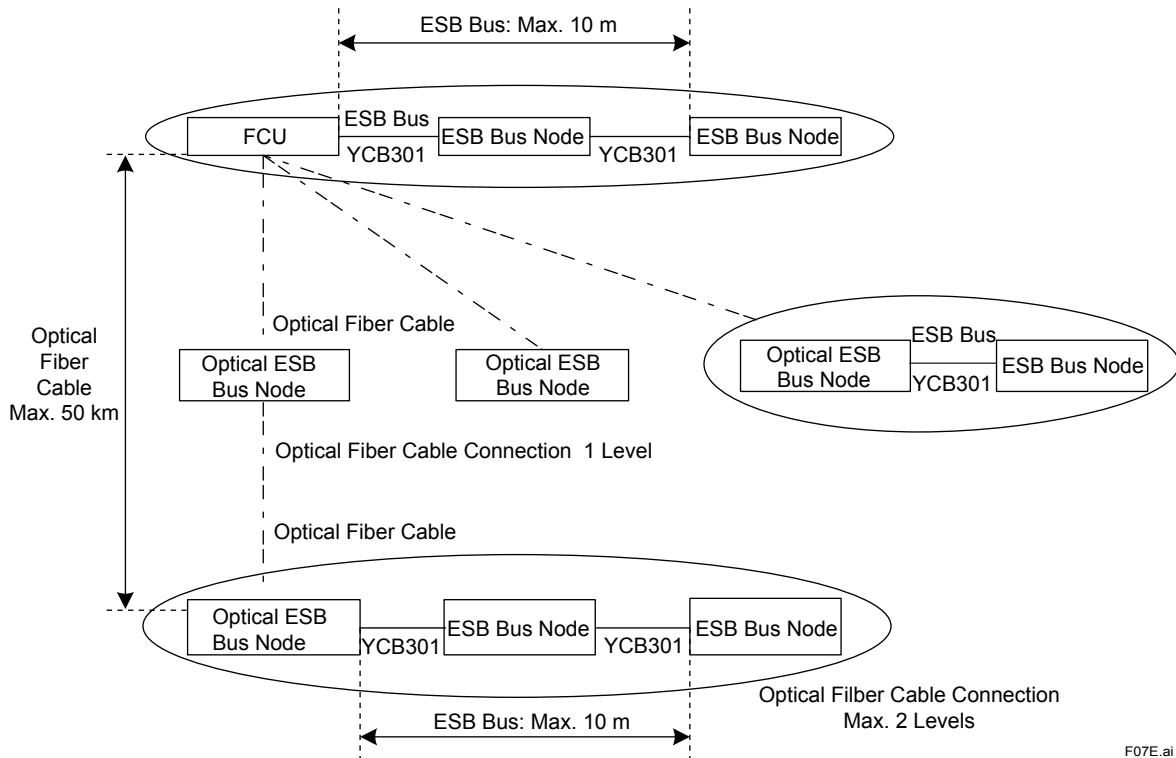

Figure Connecting Diagram of ESB Bus and Optical ESB Bus

● **ESB Bus for AFV10□**

An ESB bus is used as an input/output communication bus connecting an FCS's intelligent part with an ESB bus node unit and optical ESB bus node unit.

Communication Specifications

Applicable units: ESB Bus Node Unit (ANB10□)

No. of communication units: Numbers of ESB bus node units that can be connected to ESB bus varies depending on the control functions.

Field Control Unit	Control Function	No. of ESB Bus Node Units (*1)	No. of Optical ESB and ER Bus Node Units (*1)
AFV10□ (*2)	Control Function for Field Control Station (LFS1500)	Max. 3/FCU	Max. 3/FCU
	Control Function for Field Control Station (LFS1700) plus Node Expansion Package (LFS1750-V11)	Max. 9/FCU	Max. 14/FCU

*1:   Model codes for ESB Bus Node Unit is ANB10□ and ER Bus Node Unit is ANR10□.
*2:   For connecting ESB bus node units in an AFV10□, install ESB Bus Couple Modules (EC401) in slots No. 7 and 8.

Transmission Specifications

Network topology: Bus topology
Transmission: Dual-redundant or single. When the processor module has a dual-redundant configuration, the dual-redundant transmission is mandatory.
Transmission speed: 128 Mbps
Transmission cable: Dedicated cable (YCB301)
Transmission distance: Max. 10 m

● ER Bus for AFV10□

An ER bus is used as an input/output communication bus connecting an ER bus node unit with ESB bus node unit or FCU for AFV10□.

Communication Specifications

Applicable units: ER Bus Node Unit (ANR10□)
Number of ER buses: Max. 4 per FCU
No. of communication units: Numbers of ER bus node units that can be connected to ER bus varies depending on the control functions.

Field Control Unit	Control Function	No. of ER Bus Node Units (*1)	No. of ESB and ER Bus Node Units (*1)
AFV10□	Control Function for Field Control Station (LFS1500)	Max. 3/FCU	Max. 3/FCU
	Control Function for Field Control Station (LFS1500) plus Node Expansion Package (LFS1550)	Max. 14/FCU (*2)	Max. 14/FCU

Note: No. of ER bus: Max. 4/FCU.
*1:   Model codes for ESB Bus Node Unit is ANB10□ and ER Bus Node Unit is ANR10□.
*2:   Up to 8 ER bus node units per ER bus can be connected.

Transmission Specifications

Network topology: Bus topology
Transmission: Dual-redundant or single. When the processor module has a dual-redundant configuration, the dual-redundant transmission is mandatory.
Transmission speed: 10 Mbps
Transmission cable: Coaxial cable (YCB141, YCB311).
        Use "YCB147/YCB149" Bus Adapter unit to connect YCB311 with YCB141 cable for extension. Use a Grounding Unit (YCB117) per segment (*1) when YCB311 is used.
Transmission distance:
  For YCB141: Max. 185 m
  When YCB141 and YCB311 are connected: Length of YCB141 + (185/500) x Length of YCB311 ≤ 185 m
  No. of bus adapter units: Max. 4 per segment (*1)
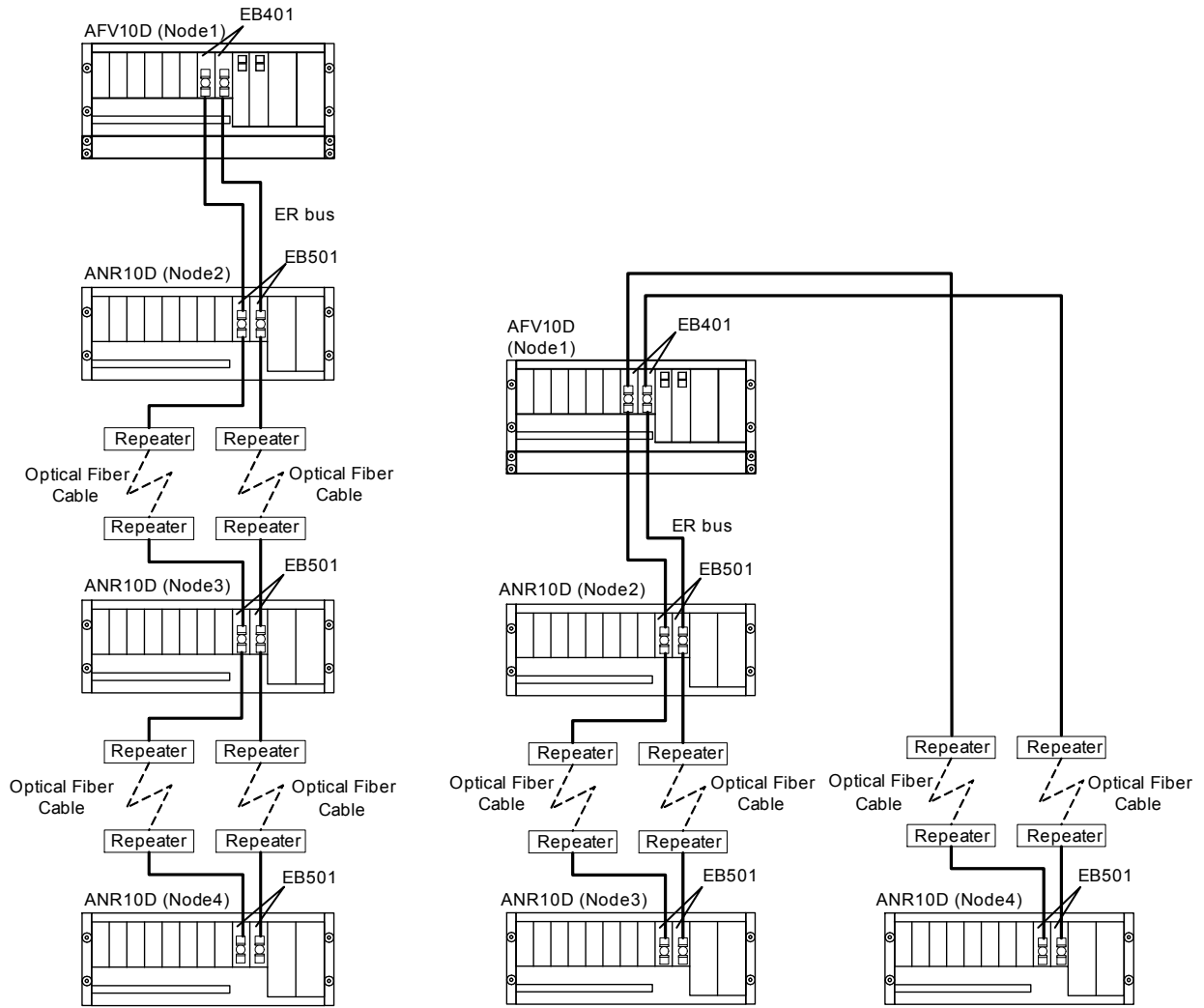
  For General-purpose Ethernet repeater:
  The total transmission distance is limited by the number of repeaters.
  $L \leq 4 - 0.5 \times n$
    L: Total transmission distance (km)
    N: No. of general-purpose Ethernet repeater (Max. 4 repeaters)

*1:   When ER bus is used with repeaters, each part of the ER bus segmented by a repeater is called a segment.

Figure Example of ER Bus connection

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■ REMARKS FOR SYSTEM CONFIGURATIONS

● Use of server due to the number of PC in a system

When a CENTUM VP system consists of five or more PCs, for use as HIS and others, consider if a server (OS: Windows Server) is required or not for storing CENTUM VP project data. A server is required when a CENTUM VP system with nine or more PCs and LHS5425 Expanded Test Functions are applied. In case LHS5170 Access Administrator Package (for FDA:21 CFR Part11 compliant) is applied where there are nine or more PCs connected, provide a server for historical data storage.

Project Data Storage

When a CENTUM VP system consists of more than five client PCs use below calculations to judge if it requires a server for project data storage or not. In case the calculated value is greater than the value on the right side (i.e. 9) save the project data in a server.

Judging Criteria

• SSS5700 Engineering Tool for Fieldbus is not in use

Equation 1	No. of Exaopc + No. of HIS + {(No. of ENG – 1) x 2} ≥ 9

• SSS5700 Engineering Tool for Fieldbus is in use

Equation 2	No. of Exaopc + No. of HIS + {(No. of ENG – 1) x 2} + 2 ≥ 9

• LHS4450 Multiple Project Connection Function is in use.
Calculate and judge by the criteria shown in the below table. When the number of stations is greater than the value on the right side of the equation, project data has to be stored on a server. Prepare two servers when the calculation results require one each for both upper and lower levels of the project. However, a server is not required when CENTUM CS is used for the lower-level project, and calculation is applied only for the upper-level project.

Table Judging Criteria

		SSS5700 Engineering Tool for Fieldbus	
		Not in use	**In use**
Multiple Project Connection Function is in use	Upper-level project	Equation 1	Equation 2
	Lower-level project	Equation 3	Equation 4

Judging Criteria

Equation 3	No. of Exaopc + No. of HIS + {(No. of ENG – 1) x 2} + α ≥ 9
Equation 4	No. of Exaopc + No. of HIS + {(No. of ENG – 1) x 2} + 2 + α ≥ 9

α: No. of HIS with LHS4450 Multiple Project Connection Packages on the upper-level project
No. of Exaopc: No. of PC with NTPF100 Exaopc OPC interface package.
(LHS2411 Exaopc OPC Interface Package is excluded.)
No. of HIS: No. of PC with LHS1100 Standard Operation and Monitoring Function
(Count all the number of this package used in the project.)
No. of ENG: No. of PC with LHS5100 Standard Builder Function.
(Count all the number of this package used in the project. When it is resided with the standard operation and monitoring function, count them independently.)

Audit Trail Management Data Storage

When the sum of PCs is nine or more (for ENG, and Recipe Management PC) for stations connected to CENTUM VP while LHS5170 Access Administrator Package (FDA: 21 CFR Part11 compliant) is resided, save the audit trail management data in a server. Calculate the sum of PCs to be connected by using the following Equation 5. When the calculation result is eight or less, there is no need for server.

Equation 5	No. of stations connected = No. of recipe management package + No. of ENG

No. of Recipe Management Package: No. of PC with LHS5166 Recipe Management Package (VP Batch).
ENG: No. of PC with LHS5100/LHM5100 Standard Builder Function.

● Maximum number of FCS per an entire system

A control drawing describes FCS's application program. It consists of several function blocks and inputs/outputs, and it describes a part of plant equipment control. When LFS1750 Node Expansion Package (for AFV30□/AFV40□) is used together with LFS1700 Control Function for Field Control Station (for AFV30□/AFV40□, Vnet/IP and FIO), the number of connectable nodes and application capacities can be expanded. When creating a new FCS definition using LFS1750, the number of control drawings can be specified by the builder function. The number of control drawings can be selectable as shown below.

No. of control drawings: Selectable from 200 (default), 300, 400, or 500

Note: When LFS1750 is not used, the number of control drawings is fixed at 200.

The maximum number of FCS to be configured in the entire system depends on how many control drawings per FCS are specified. The table below shows a guideline of the maximum number of FCS that can be configured in a system when all the FCS selects the same number of control drawings per FCS. When different number of control drawings are assigned per FCS, the maximum number of FCS per system changes. Please contact Yokogawa for details.

Table A Guideline of Maximum No. of FCS by the No. of Control Drawings

No. of control drawings per FCS	Maximum No. of FCS per system
200	114 (*1)
300	83
400	65
500	54

*1:   This is the sum of all types of FCS for Vnet/IP and V net. Out of 114 FCS, up to 86 of AFV30□/AFV40□ or 64 of AFV10□ can be configured. Please contact Yokogawa for details.

■ COMPLIANCE TO FDA: 21 CFR PART 11

Part 11 of Title 21 of the Code of Federal Regulations; Electronic Records; Electronic Signatures (21 CFR Part 11) is a regulation issued by the U. S. Food and Drug Administration (FDA) providing a criteria of electronic records, electronic signatures, and handwritten signatures executed to electronic records as equivalent to paper records and handwritten signatures executed on paper. The main categories of the FDA: 21 CFR Part 11 requirements to the process control system can be interpreted as "limiting system access to authorized individuals" and "audit trail" functions.

● Limiting System Access (Individual Authentication)

CENTUM VP has two approaches for limiting access to the system; one is "engineer/operator authentication" and the other is "confirmation of authentication." Engineer/operator authentication is to identify engineers and operators in operation as well as to maintain operation records. Names of the engineers and operators are registered to the system in advance, and if their names and the passwords are not identified, the control system does not allow them to perform further operations. Confirmation of authentication is to confirm if an engineer or an operator has appropriate authorities to perform certain operations. The engineer/operator authentication and the confirmation of authentication will be performed independently as necessary.

● Audit Trail Management

CENTUM VP audit trail function saves change data to the predefined database whenever an engineering work that may influence the product quality such as data downloads to FCS. All the actions performed are also stored in the historical log file. With this function, who, when, what, how, and why data is changed can be traced back.

Here is an example of CENTUM VP system configuration complied with 21 CFR Part 11. LHS5166 Recipe Management Package of VP Batch is adopted for recipe management.

*1: A removable media for storage.
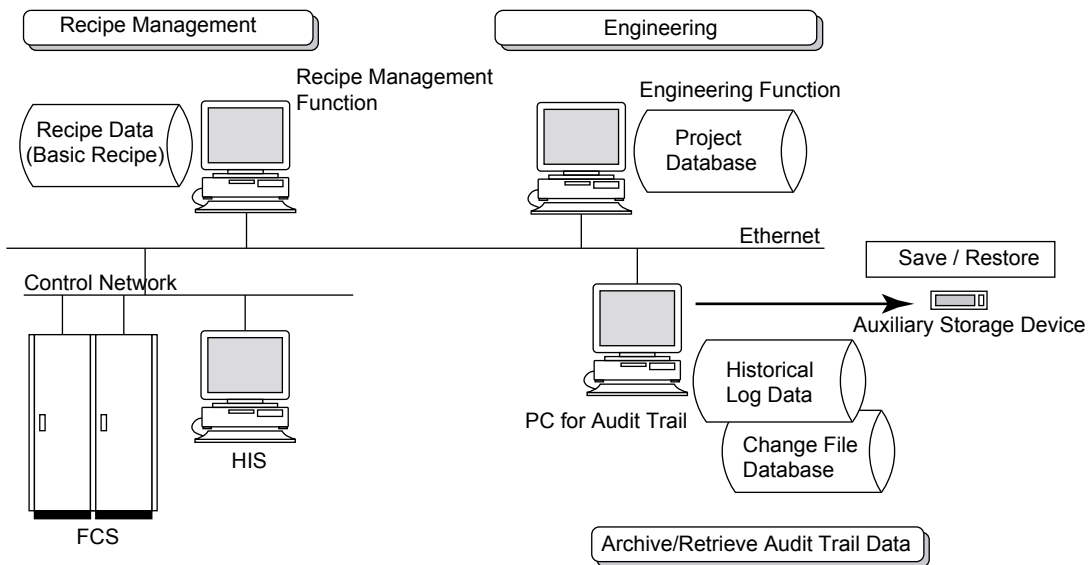
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Figure An Example of System Configuration

■ CENTUM VP ENTRY CLASS SYSTEM CONFIGURATION

CENTUM VP Entry Class is a system designed for a small-scale project. CENTUM VP Entry Class controls and monitors up to 8000 tags.

● System Configuration and Software

CENTUM VP Entry Class offers the following software packages.

Model Code for CENTUM VP Entry Class	Description	Remarks
LHM1101	Standard Operation and Monitoring Function	No. of Tags: Maximum 8000
LHM1150	Server for Remote Operation and Monitoring Function	—
LHM4410	Control Drawing Status Display Package	—
LHM4420	Logic Chart Status Display Package	—
LHM6660	Process Management Package	No. of Active Recipe: Type A: 4 or less Type B: 10 or less Type C: 999 or less
LHM6710	FCS Data Setting/ Acquisition Package (PICOT)	—

Software for Engineering

Model Code for CENTUM VP Entry Class	Description	Remarks
LHM5100	Standard Builder Function	—
LHM5150	Test Function	—
LHM5490	Self-documentation Package	—

The same packages for CENTUM VP system can be used other than the above packages. There is no limitation in FCS.

LHS4000 Million tag handling package (for one million tag) is not applicable to CENTUM VP Entry Class HIS. As for multiple project connection function for CENTUM VP Entry Class, refer to GS for Multiple Project Connection (GS 33K05K20-50E).

■ INSTALLATION ENVIRONMENT

Hardware standard installation environment is described as below, except for that of PC, Enclosed Display Style Console, Node Units and I/O Modules for FIO. For more details, refer to the specifications or GS for PC, HIS for enclosed display style console, open desktop style console, Node Units and I/O Modules for FIO node unit.

Ambient temperature:
  5 – 40 °C (Desk for CENTUM (YAX101), General-purpose Desk(YAX801))
  0 – 50 °C (FCS, BCV, Bus Repeater, Node Unit)
Ambient humidity:
  20-80 % RH
  10-90 % RH (FCS, BCV, Bus Repeater, Node Unit with no dew condensation)
Temperature change rate: ± 10°C/hour
Power supply:
  100-120V AC ± 10%, Frequency; 50/60 Hz ± 3 Hz
  220-240V AC ± 10%, Frequency; 50/60 Hz ± 3 Hz
  24 V DC ± 10%
Withstanding Voltage:
  100-120 and 220-240 V AC: 1500 V AC for 1 minute
  24 V DC: 500 V AC for 1 minute
Insulation resistance:
  20 MΩ/500 V DC
  10 MΩ/500 V DC (for YAX101 and YAX801)
Grounding: Independent ground of up to 100 Ω resistance
Noise:
  Electrical Field: Up to 3 V/m (26 MHz to 1.0 GHz)
    Up to 3 V/m (1.4 to 2.0 GHz)
    Up to 1 V/m (2.0 to 2.7 GHz)
  Magnetic Field: Up to 30 A/m (AC), Up to 400 A/m (DC)
  Static: Up to 4 kV (direct discharge), Up to 8 kV (aerial discharge)
Continuous Vibration:
  Displacement amplitude: Up to 0.25 mm (1 to 14 Hz)
  Acceleration: Up to 2 m/s^2 (14 to 100 Hz)

■ REGULATORY COMPLIANCE

CENTUM VP hardware conforms to the standards listed below. See respective GS to find out what standards each hardware complies.

Safety Standards (*1) (*2)
[CSA]

CSA C22.2 No.61010-1
[CE Marking] Low Voltage Directive

EN 61010-1 (*3)

EMC Conformity Standards (*2)
[CE Marking] EMC Directive

EN 55011 Class A Group 1 (*4)
EN 61000-6-2 (*5)
EN 61000-3-2 (*6)
EN 61000-3-3 (*7)
[C-Tick Marking]

EN 55011 Class A Group 1 (*4)
[KC Marking]

Korea Electromagnetic Conformity Standard

Standards for Hazardous Location Equipment (*8)
[CSA Non-Incendive] (*9)

Class I, Division 2, Groups A,B,C and D Temperature code T4
CSA Standard C22.2 No.157-92
CSA Standard C22.2 No.213-M1987
ISA Standard ISA-S12.12 1994
(for 100-120 V AC and 24 V DC power supply)
[FM Non-Incendive] (*10)

Class I, Division 2, Groups A, B, C and D Temperature code T4
FM Class Number 3600: 1998
FM Class Number 3611: 2004
FM Class Number 3810: 2005
(for 100-120 V AC, 220-240 V AC and 24 V DC power supply)
[Type n] (*11)

II 3G Ex nC [nL] II C T4
EN 60079-15: 2005
IEC 60079-0: 2004
IEC 60079-11: 1999
(for 24 V DC power supply)
II 3G EEx nA II T4
EN 50021: 1999
(I/O Module with built-in barrier, for 24 V DC power supply)
[Type i (Intrinsic Safety)]

II (1) G D [EEx ia] II C
EN 50014: 1997 +A1 +A2
EN 50020: 1994
[FM Intrinsic Safety]

Associated intrinsically safe apparatus for connection to
Class I, II and III, Division 1, Groups A, B, C, D, E, F and G or
Class I, Zone 0, Group II C
FM Class Number 3600: 1998
FM Class Number 3610: 2010
ANSI/ISA 60079-0: 2009
ANSI/ISA 60079-11: 2009

Note: According to th e New Approach Directive, the manufacturer and the representative office in EU are indicated below:
Manufacturer: Yokogawa Electric Corporation (2-9-32 Nakacho, Musashino-shi, Tokyo 180-8750, Japan).
Representative office in EU Community:
Yokogawa Europe B.V. (Euroweg 2, 3825 HD Amersfoort, The Netherlands).

*1: For ensuring all the hardware devices to satisfy the safety standards, the dedicated breakers in the power supply distribution board must conform to the following specifications.
[CSA] CSA C22.2 No.5 or UL 489
[CE Marking] EN 60947-1 and EN 60947-3
*2: To conform to the safety standards and the EMC conformity standards, install the 19-inch rack mountable type devices in a keyed metallic cabinet.
*3: Analog input side of this equipment has Measurement category I. For details, see "CENTUM VP Installation Guidance" (TI 33M01J10-40E).
*4: A Class A hardware device is designed for use in the industrial environment. Please use this device in the industrial environment only.
*5: A lightening arrestor or the like is required to meet this surge immunity standard. The length of the cable to feed the external power supply for AGS813 AO channels should not exceed 30 meters.
*6: An external device such as a power unit with harmonic current neutralizer and an active harmonics conditioner must be connected to meet this harmonic current emission standard.
*7: The specified limits of voltage drop across wiring must be satisfied to meet this standard.
*8: AFV30□, AFV40□, ANB11□, and ANT10U are not compliant with the standards for Hazardous Location Equipment.
Only sytle S1 of ANB10□ is compliant with the standards for Hazardous Location Equipment.
*9: To meet the standard for hazardous location equipment, 19-inch rack-mounted devices must be installed in a keyed metallic cabinet approved by CSA or non-incendive regulator in your area.
*10: To meet the standard for hazardous location equipment, 19-inch rack-mounted devices must be installed in a keyed metallic cabinet approved by FM or non-incendive regulator in your area.
*11: To be compatible with Type n, the specification requirements of EN 61010-1 and EN 60079-15 must be met, and a keyed metallic cabinet, whose degree of protection is IP 54 or above, prescribed by IEC 60529 must be used for housing.

■ TRADEMARKS

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