

General Specifications

ProSafe-RS Safety Instrumented System Overview



GS32S01B10-01E

■ GENERAL

This GS explains the components and system specifications of the ProSafe-RS system. The ProSafe-RS is a Safety Instrumented System that is certified by the German certification organization, Technische Überwachungs-Verein(TÜV) to meet Safety Integrity Level (SIL) 3 specified in IEC 61508.

■ COMPONENT EQUIPMENT AND SOFTWARE

The ProSafe-RS is composed of the Safety Control Station (SCS), the Safety Engineering PC (SENG), and the real-time control bus called V net that connects the SCS and the SENG.

The SCS performs safety control, and the SENG performs maintenance and engineering for the SCS. The ProSafe-RS can be integrated with the CENTUM CS 3000 R3 (hereinafter, "CS 3000"), an integrated production control system. The operation of the SCS can be monitored via the HIS (human interface station) of the CS 3000.

For specifications regarding the CS 3000, refer to its general specifications.

● Safety Engineering PC (SENG)

To configure the ProSafe system, the CHS5100 Safety System Generation and Maintenance Package needs to be installed on a general-purpose PC (IBM PC/AT-compatible computers). In this configuration, the SENG performs engineering and maintenance.

For details on the SENG's functions, refer to the general specifications document (GS 32S04C10-01E) for the CHS5100 Safe System Generation and Maintenance Package.

The SENG employs Microsoft Windows XP Professional as its operating system (OS).

Regarding compatibility problems between the SENG software and other companies' applications and their restrictions on use while running on Windows, consult with our sales/marketing department.

● Safety Control Station (SCS)

The SCS offers a safety control function, the sequence-of-events-recorder (SOER) function, the CENTUM CS 3000 integration function, and the Modbus connection function, which interfaces the SCS with another system.

The SCS consists of a safety control unit (CPU node) and safety node units (I/O node). There are two types of CPU nodes: a basic safety control unit and a temperature-adaptive safety control unit (equipped with a fan unit).

The CPU node can be connected with the I/O node via the ESB bus.

The I/O module can be mounted both on the CPU node and I/O node alike.

Basic Type

SSC10S-S (model name): Basic Safety Control Unit (rack-mounted type)

SSC10D-S (model name): Dual-redundant Basic Safety Control Unit (rack-mounted type)

Temperature-adaptive Type

SSC10S-F (model name): Temperature-adaptive Safety Control Unit (rack-mounted type)

SSC10D-F (model name): Dual-redundant Temperature-adaptive Safety Control Unit (rack-mounted type)

For details, refer to the general specifications (GS 32S06D10-01E) for the SSC10S/D Safety Control Unit.

Basic Software

For details on the safety control function of the CFS1100 SSC10S/D, refer to its general specifications (GS 32S03B10-01E).

● **Related Software**

- CHS5200 CS 3000 Integrated Engineering Package
- CHS2100 SOE Viewer Package
- CHS2200 SOE OPC Interface Package

For details, refer to the general specifications for the respective software applications above.

● **Document**

For details on the CHS5400 Electronic Document, refer to its general specifications (GS 32S07W10-01E).

● **Peripheral Equipment**

- Primary Power Distribution Unit (AEP7D)
- V net Interface Card (VF701)
- V net Optical Bus Repeaters (YNT511D and YNT521D)
- V net Bus Repeater (YNT512D)
- Safety Node Unit (SNB10D)
- I/O module and communication module
- Bus cables (for the V net and ESB bus)

For details, refer to the general specifications documents for the respective hardware above.

■ SYSTEM CONFIGURATION

● Minimum System Configuration

The minimum system configuration is composed of the following equipment:

SENG: 1 unit

SCS: 1 unit

● Maximum System Configuration

Component equipment	Number of connectable units
SENG and SCS	A total of 64 of these units

● Example Configuration of CENTUM CS 3000 Integrated System

Integrated with the CS 3000, the system can be configured in any size.

The number of hierarchically-connectable domains (*1): 16

The number of connectable stations in one domain: 64

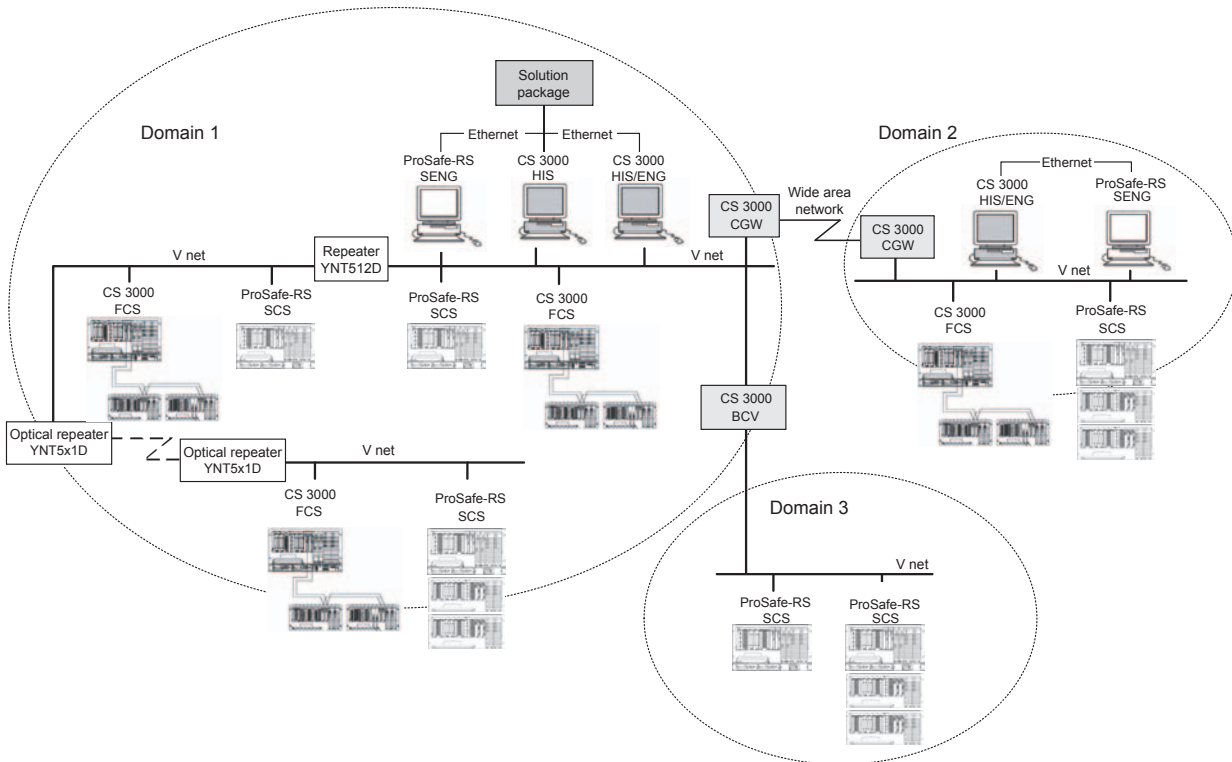
The number of hierarchically-connectable stations: 256

Hierarchy: three-level (three control-bus levels linked by two bus converters)

Connecting device (*2): bus converter (BCV) and communication gateway (CGW)

*1: A group of system components, which is configured without a bus converter is one domain.

*2: For details, refer to the general specifications document (GS 33Q06H20-31E) for the bus converter (BCV), and the general specifications document (GS 33Q06H10-31E) for the communication gateway (CGW).



F01E.ai

Figure Example of the ProSafe-RS/CS 3000 Integration Structure

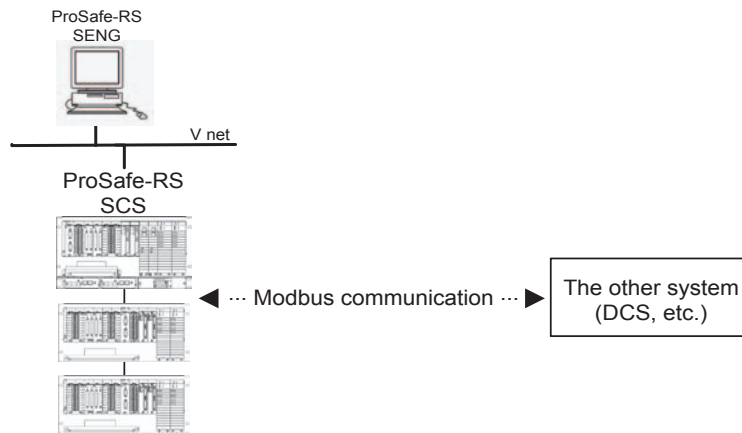
Also refer to the system specifications document (GS 33Q01B10-31E) for the CS 3000.

For integration, the version of the CS 3000 must be R3.06 or later. The number of safety control stations should not be included in that of control stations of the LHS1100 Standard Operation and Monitoring Function.

● **Example of the Connection with Another System**

Using the interference-free RS communication module, the ProSafe-RS can be connected with another system via the Modbus slave communication. The SCS acts as the 'slave' in this configuration.

An example of the system configuration is shown below:



Note: No more than two modules may be mounted on one SCS for Modbus communication.

F02E.ai

● **Cautions for System Configuration**

- The maximum number of SCS units to which Inter-SCS safety communication is possible from one SCS unit is 16 (when any two SCS units perform bidirectional communication each other, the number of units is counted as 2).
- For the ProSafe-RS system to employ a bus converter (BCV) and a communication gateway (CGW), the engineering function of the CS 3000 is needed.

■ NETWORK SPECIFICATIONS

The ProSafe-RS employs the V net, ESB bus, and Ethernet for its configuration station communications.

● V Net

The V net is a real-time control network that connects system configuration stations.

Communication Specifications

The number of connectable devices: 64 per domain

Communication method: read-write communication, message communication, Inter-SCS safety communication

Line access control: token passing method

Transmission Network Specifications

Network structure: bus type

Transmission channel redundancy: dual-redundant type

Network speed: 10 Mbits/sec.

Network cable:

Coaxial cable (YCB111: 10BASE-5; YCB141: 10BASE-2)

The SENG and the SCS are connected via the YCB141. For the use of the YCB111, the conversion units of the YCB141 and YCB111 (YCB147 and YCB149) need to be employed. The V net bus repeater (YNT512D) can also be used.

Optical fiber cable:

The V net optical bus repeater (YNT511D or YNT521D) needs to be used.

Transmission distance:

For coaxial cables (YCB111 and YCB141):

- Maximum transmission distance: 500 m for the YCB111 and 185 m for the YCB141.
- When the YCB141 is used alone, the number of connectable stations is 30 per segment.
- When the YCB141 and YCB111 are used together, the transmission distance is: $2.5 \times (\text{length of YCB141}) + (\text{length of YCB111}) \leq 462.5$ m. In such cases, the maximum number of conversion units is 4 per segment (*1), and the number of connectable stations is 30 per segment.

*1: When the V net is connected via optical bus repeaters, the unit connected by the repeater is referred to as the segment.

Extension with V net bus repeaters (YNT512D)

A maximum of 500 m can be extended with one repeater. A maximum of 4 repeaters can be used, and consequently the total transmission distance is 2.5 km.

Optical fiber cable

There are two types of V net optical bus repeater: the YNT511D (up to 4 km) and the NT521D (up to 15 km). They are both used as a pair of units. Up to four pairs of optical repeaters (eight optical repeaters) can be used. The total transmission distance is, in some cases, the maximum value incorporating the signal propagation delay time, as given in the table below (for serial connection).

The asterisks in the table indicate maximum values, which apply to the combined use of the YNT511D and the YNT521D.

V net total transmission distance	Total transmission distance depending on the number of optical bus repeaters			
	1 pair (2 units)	2 pairs (4 units)	3 pairs (6 units)	4 pairs (8 units)
YNT511D optical bus repeater	5 km max.	9.5 km max.	14 km max.	16 km max. (*)
YNT521D optical bus repeater	16 km max.	20 km max. (*)	18 km max. (*)	16 km max. (*)

● **Ethernet**

The Ethernet is used as an information network within the system that allows the connection between SENGs, as well as between the SENG and the HIS/ENG of the CS3000.

Communication specifications

IEEE 802.3-compliant

● **ESB Bus**

ESB buses are I/O communication buses that connect the safety node units with the safety control units of the SCS.

The number of Connectable Units

The maximum number of I/O nodes (SNB10D) that are connectable with the CPU node using the ESB bus is 9.

Transmission Network Specifications

Network structure: bus

Transmission channel redundancy: dual-redundant

Network speed: 128 Mbits/sec.

Network cable: dedicated communication cable (YCB301)

Maximum transmission distance: 10 m

■ CRITERIA FOR THE INSTALLATION ENVIRONMENT

The table below presents the criteria for the environment where the safety control unit and the safety node unit are to be installed. For general-purpose PCs, the V net, bus repeaters, optical bus repeaters, and I/O modules, refer to their respective general specifications.

Item		Specifications	
Temperature	Normal operation	-20 to 50 °C (basic safety control unit) -20 to 70 °C (temperature-adaptive safety control unit and safety node unit)	Maximum of 60 °C when the ALR111/ALR121 is mounted.
	Transportation/storage	-40 to 85 °C	
Humidity	Normal operation	5 to 95 % RH (non-condensing)	
	Transportation/storage	5 to 95 % RH (non-condensing)	
Temperature change	During operation	Within ±10 °C/h	
	Transportation/storage	Within ±20 °C/h	
Power supply	Voltage range	100 to 120 V AC -15 %, +10 % 220 to 240 V AC -15 %, +10 % 24 V DC: -10% to +20 %	
	Frequency	50/60 Hz± 3 Hz	
	Distortion factor	10% or less	
	Crest factor	100 V system: 125 V or larger 220 V system : 274 V or larger	
	Momentary failure	20 ms or less (when receiving the rated AC voltage)	
	DC power supply ripple rate	1% p-p maximum	
Withstanding voltage		1500 V AC for 1 minute (for 100 to 120/220 to 240 V AC)	Between power & ground terminals
Insulation resistance		20 megaohms at 500 V DC	Between power & ground terminals
Grounding		100 ohms or less, independent grounding	
Dust		Maximum of 0.3 mg/m ³	
Corrosive gas		ANSI/ISA S71.04 G3 (standard)	
Noise	Electric field	10 V/m maximum (80 MHz to 1 GHz)	
	Magnetic field	30 A/m (AC) and 400 A/m (DC) maximum	
	Static electricity	4 kV or less (direct discharge) 8 kV or less (aerial discharge)	
Vibration	Continuous vibration	Amplitude: 1.75 mm (5 Hz to 9 Hz) Acceleration: 4.9 m/s ² (9 Hz to 150 Hz)	
	Non-continuous vibration	Amplitude: 3.5 mm (5 Hz to 9 Hz) Acceleration: 9.8 m/s ² (9 Hz to 150 Hz)	
	Seismic	Acceleration: 4.9 m/s ² or less	
	Transportation	Horizontal: 4.9 m/s ² or less vertical: 9.8 m/s ² or less	when packaged
Impact		15 G (147 m/s ²), 11 ms	
Altitude		2000 m above sea level or less	

■ APPLICABLE STANDARDS

The hardware components of the ProSafe-RS comply with the standards below. However, the components comply with different standards, so refer to their respective general specifications documents.

PLC Standard

EN 61131-2

Functional Safety Standard

IEC 61508

Application Standards

EN 54, EN 298, IEC 61511

Safety Standards (*1)

[CSA]

CSA C22.2 No.1010.1 (for the 100-120 V AC power supply specification)

[CE Mark] Low Voltage Directive

EN 61010-1 (220-240 V AC and 24 V DC power supply specifications) (*5)

EMC Conformity Standards (*1)

[CE Mark] EMC Directive

EN61000-6-4 Group 1 Class A (220-240 V AC and 24 V DC power supply specifications)

(EN55011 Group 1 Class A equivalent)

EN61000-6-2 (220-240 V AC and 24 V DC power supply specifications) (*2)

EN61000-3-2 (220-240 V AC power supply specification) (*3)

EN61000-3-3 (220-240 V AC power supply specification) (*4)

- *1: For a rack-mounted device to comply with safety standards and EMC standards, it needs to be housed in a lockable metal cabinet.
- *2: For surge immunity, an external device, such as a lightning arrester, is needed.
- *3: To restrain the power supply's harmonic waves, a power supply device with harmonic wave restraining capability or an external device with such a capability (e.g. active filter) needs to be connected.
- *4: The specified values for voltage drop due to cable wiring must be satisfied.
- *5: The analog inputs of this system fall into Measurement Category 1 of IEC61010-1. For details, refer to the ProSafe-RS Installation Guidance (TI 32S01J10-01E).

■ TRADEMARKS

- CENTUM and ProSafe are registered trademarks of Yokogawa Electric Corporation.
- Windows is a registered trademark of Microsoft Corporation in the USA and other countries.
- Ethernet is a registered trademark of XEROX Corporation, USA.
- Modbus is a registered trademark of Schneider Electric SA.
- Other company and product names appearing in this document are trademarks or registered trademarks of their respective holders.