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Programmable Controllers

CS1D Duplex System

Redundant CPU Units, Power Supply Units, Communications Units, and Expansion I/O Cables



- » Select from a Wide Range of Redundant Systems
- » Easily Achieve Highly Reliable Systems

Failures occur in any system, but the effects of those failures can be alleviated.

- The system cannot be stopped during 24-h/day operation.
- Recovery costs are very high if the system goes down.
- If the system stops unexpectedly, there is a possibility for a disastrous incident, such as the leakage of a toxic substance.

In systems like these that demand high reliability, it is important to implement risk-management to prepare for hypothetical problems.

OMRON Duplex PLCs are used for risk management in the system.

Adding redundancy in the system is an effective step to reduce risk.

To respond to customer's needs regarding system reliability, OMRON applied its proven duplex PLC technology to the CS Series to provide a highly reliable PLC System.

These PLC Systems have redundant vital components (such as CPUs, power supplies, networks, and expansion cables), while retaining the CS1-series functions and capabilities that are suitable for a wide variety of applications.

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Programmable Controllers

CS1D

DUPLIX SYSTEM

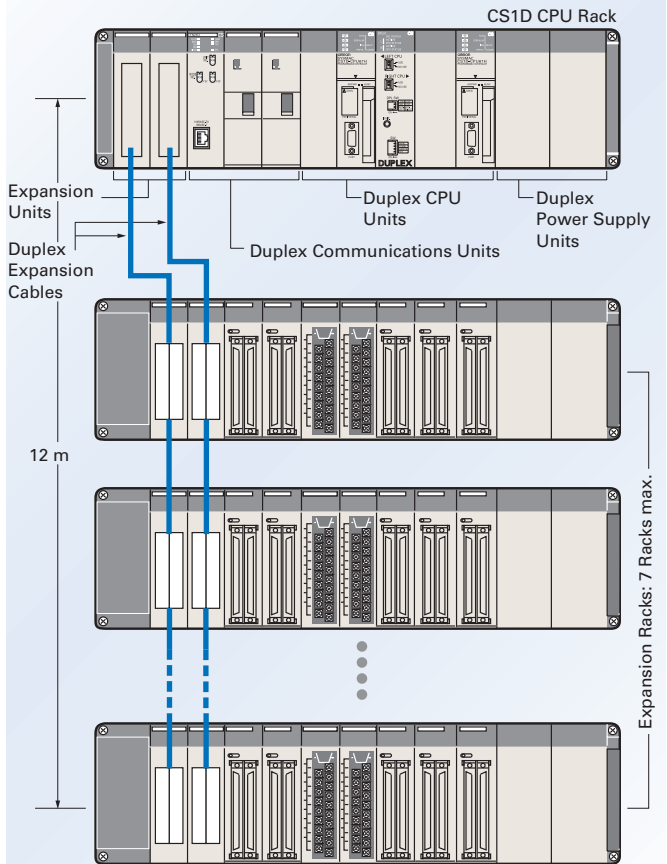
With the CS1D, you can select

In addition to duplexed CPU Units and Power Supply Units, the customer can duplex other components, such as Communications Units (Controller Link or Ethernet) and Expansion Cables, to match the system requirements and provide a diverse range of duplex system configurations.

System name	
Configuration	
Duplex	CPU Units
	Expansion Cables
	Power Supply Units
Online operation	Unit replacement
	Adding Units or Backplanes
Long-distance Expansion System	
Amount of I/O memory shared between CPU Units	
Switching time	CPU Unit
	Communications Unit (reference value)
Details	

SYSTEM 1 Duplex CPU, Dual I/O Expansion System

The entire system can be duplexed, including a Duplex CPU System, Expansion System, and Expansion Cables, for superior redundancy and maintainability.



Note: Requires CS1D CPU Units with unit version 1.3 or later.

<input type="radio"/>	
<input type="radio"/>	
<input type="radio"/>	
<input type="radio"/>	(Supports optical loop-back.)
<input type="radio"/>	
<input checked="" type="radio"/>	<ul style="list-style-type: none"> •CPU Units •Power Supply Units •Duplex Units •I/O Expansion Units •Basic I/O Units (can be replaced without a Programming Device) •Special I/O Units (can be replaced without a Programming Device) •CPU Bus Units (can be replaced without a Programming Device)
<input type="radio"/>	<ul style="list-style-type: none"> •Basic I/O Units •Special I/O Units •Expansion Backplanes
<input checked="" type="radio"/>	×
All of the CPU Unit's data areas (shared real-time)	
Within one CPU Unit cycle (within 0.5 ms min.) (See note 1.)	
Within approx. 900 ms (See note 2.)	
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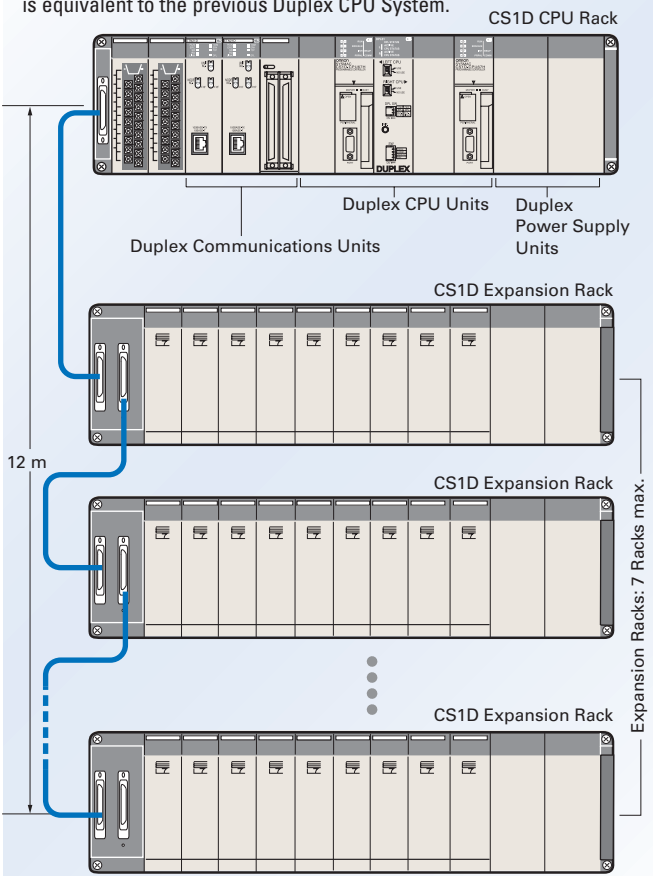
Note 1: Depends upon the timing when the CPU Units are switched.

Note 2: This value is for Duplex Controller Link Units. The value depends on the timing when the Units are switched.

from a variety of redundant systems.

SYSTEM 2 Duplex CPU, Single I/O Expansion System

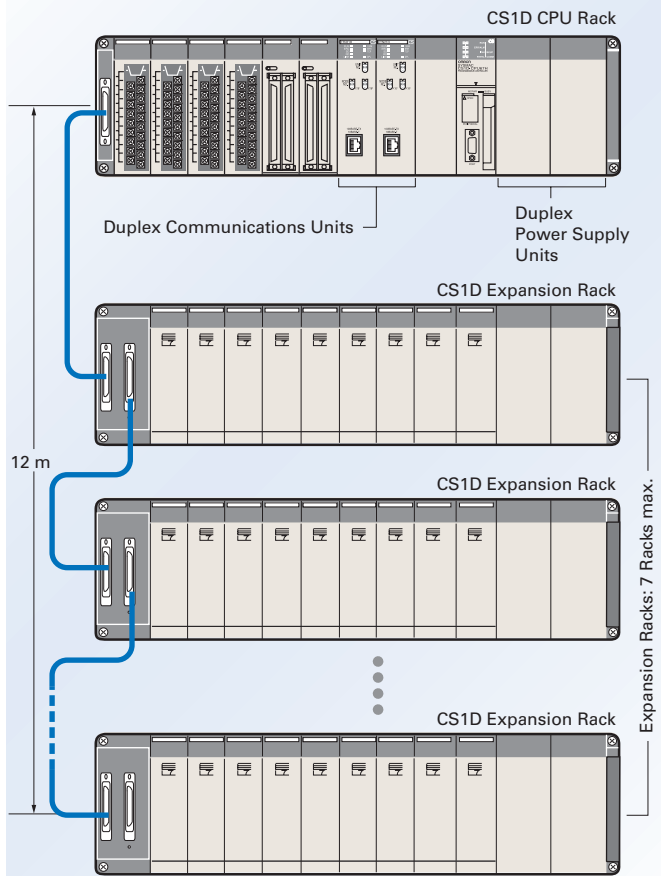
The main system components (such as the CPU Units, Power Supply Units, and Communications Units) can be duplexed and a Programming Device can be used to replace the Units during operation. This system is equivalent to the previous Duplex CPU System.



<input type="radio"/>
<input checked="" type="radio"/>
<input type="radio"/>
<input type="radio"/> (Supports optical loop-back.)
<input type="radio"/>
<input type="radio"/>
•CPU Units •Power Supply Units •Basic I/O Units (See note.) •Special I/O Units (See note.) •CPU Bus Units (See note.) Note: A Programming Device is required to replace these Units.
<input type="radio"/> (Requires CS1D CPU Units with unit version 1.3 or later.)
•Basic I/O Units •Special I/O Units (See note 3.)
<input type="radio"/>
All of the CPU Unit's data areas (shared real-time)
Within one CPU Unit cycle (within 0.5 ms min.) (See note 1.)
Within approx. 900 ms (See note 2.)
Page 20

SYSTEM 3 Single-CPU System

This system is ideal when you want to improve network redundancy and replace a Power Supply Unit or other Units online. The CPU Unit cannot be duplexed.



<input checked="" type="radio"/>
<input checked="" type="radio"/>
<input type="radio"/>
<input type="radio"/> (Supports optical loop-back.)
<input type="radio"/>
<input type="radio"/>
•Power Supply Units •Basic I/O Units (See note.) •Special I/O Units (See note.) •CPU Bus Units (See note.) Note: A Programming Device is required to replace these Units.
<input checked="" type="radio"/>
<input type="radio"/>
<input type="radio"/>
<input type="radio"/>
Within approx. 900 ms (See note 2.)
Page 26

Note 3: Expansion Backplanes cannot be added.

The CS1D supports a variety of

Ethernet can be duplexed as well as Controller Link, which both have a proven track record in FA applications.

In addition, a variety of networks are available for lower-level I/O, including DeviceNet, CompoNet, and the MECHATROLINK-II Motion Controller network. Both DeviceNet and CompoNet are open networks that boast a proven track record with the CS1 Series.

Ethernet

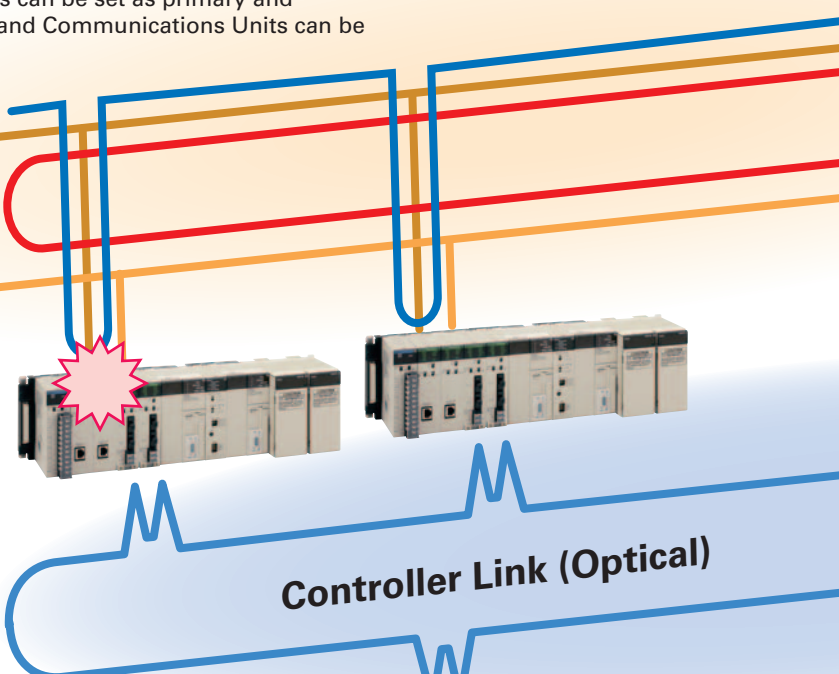


Ethernet is a general-purpose network used globally in a wide range of factory and office environments. Supports message service between PLCs or between a computer and PLC. In a duplex system, transmission paths can be set as primary and secondary paths, and Communications Units can be duplexed as well.

Ethernet Primary Network

Secondary Network

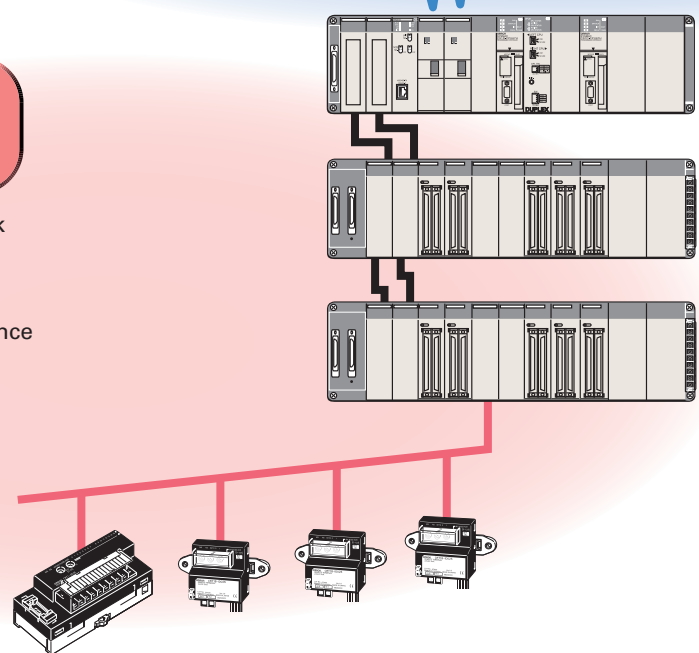
By duplexing Communications Units, communications will continue even if one Unit fails.



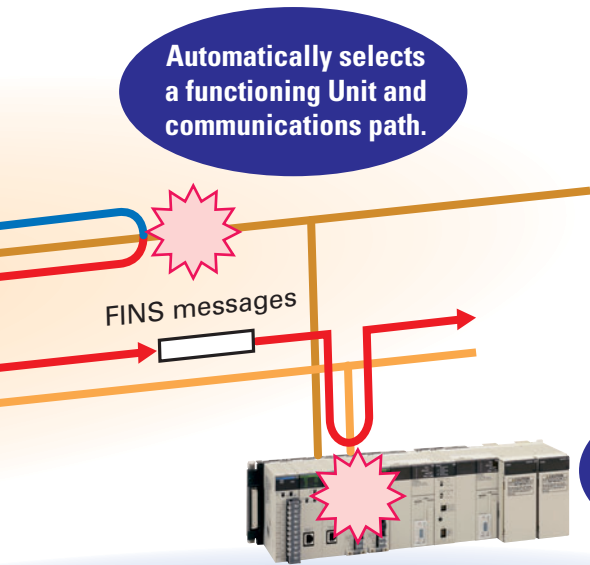
Multi-vendor Network for Sensors and Actuators **CompoNet**

CompoNet is a multi-vendor compatible network that can provide excellent bit-level control of 1,000 I/O points in about 1.0 ms. CompoNet supports message communications as well as sensor and actuator-level control. The maintenance information in each slave can be managed to use for preventive maintenance of the equipment.

Information useful for equipment maintenance can be collected.



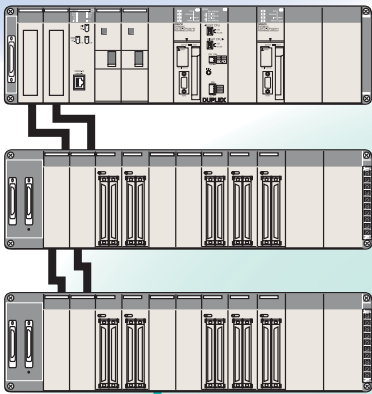
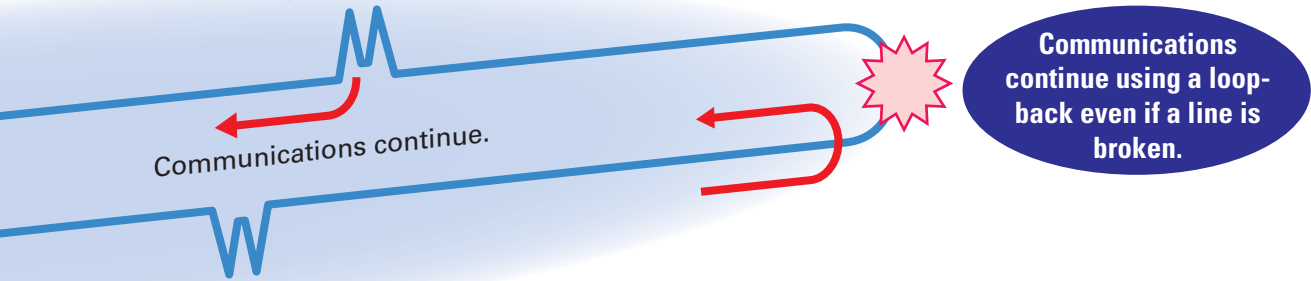
network configurations.



OMRON PLC Network Controller Link

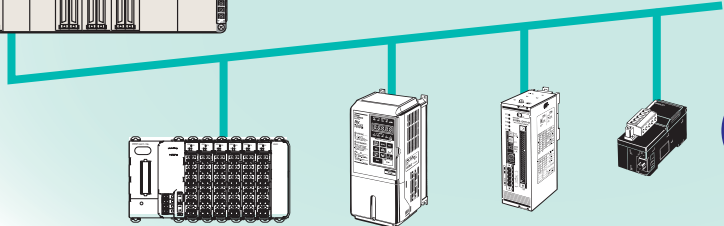
A Controller Link network supports high-volume data links and message service between PLCs and between computers and PLCs. In a duplex system, redundancy can be added by duplexing Communications Units and using optical cable loop-back.

Communications continue even if an error occurs in one of the Communications Units.



Open Multi-vendor Network DeviceNet

DeviceNet is a multi-vendor network. DeviceNet features superb environmental resistance and is used in all kinds of processes in the FA environment. The maintenance information in each slave can be managed and accessed from the host through message service.



Information useful for equipment maintenance can be collected.

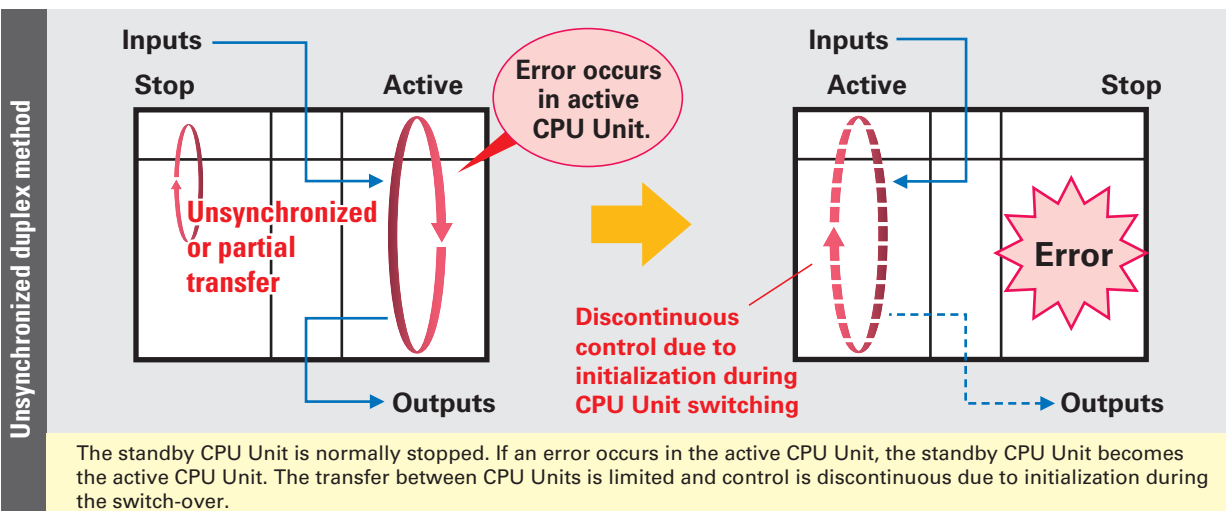
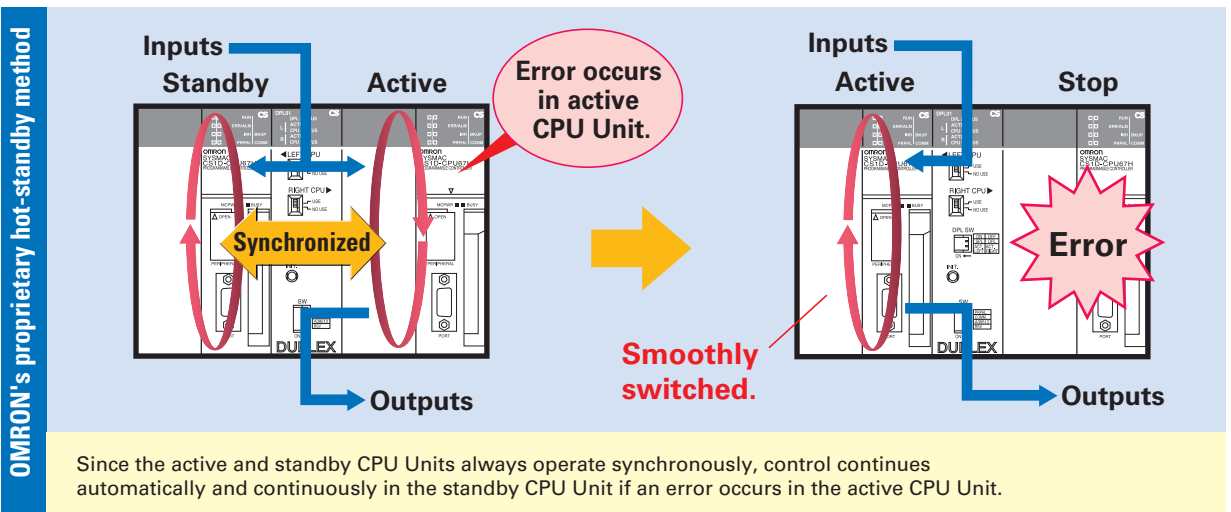
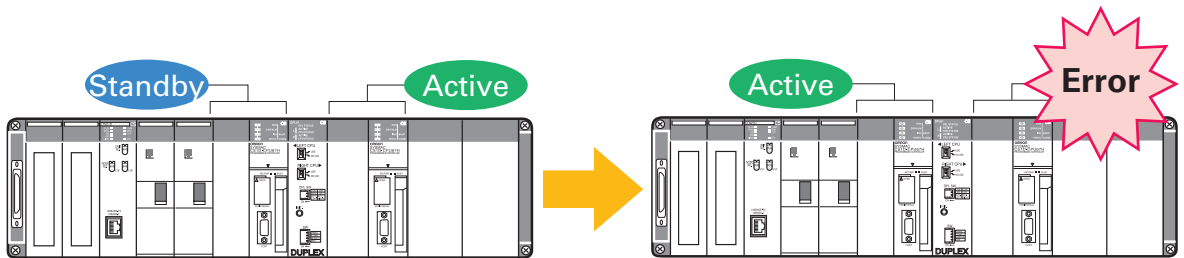
With the CS1D, a highly reliable

Of course, the standard CS-series PLC resources can be used as-is, and a CS1D Duplex System can be set up and used easily, even by users setting up a duplex system for the first time.

Duplexing CPU Units is Easy!

In OMRON's proprietary hot-standby method, all data is shared simultaneously.

- If an error occurs in the active CPU Unit, a switching program is not needed in the standby CPU Unit!
- CPU Unit operation switches smoothly. Switching time is short, so operation can continue without bumps.

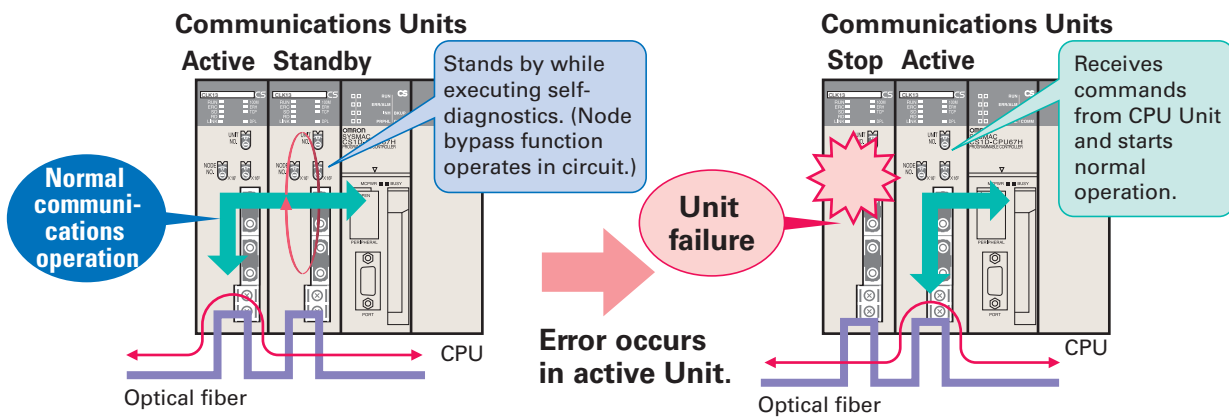


system can be introduced easily.

Duplexing Communications Units is Easy!

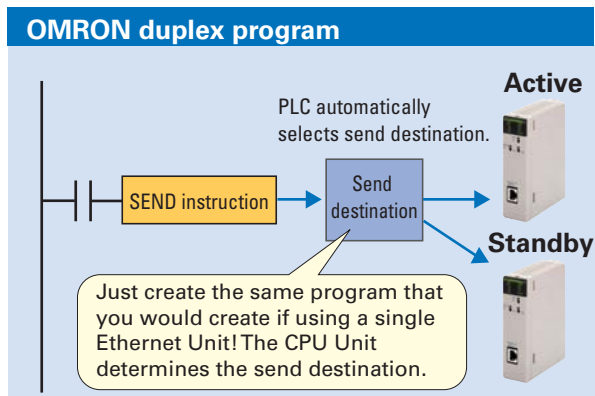
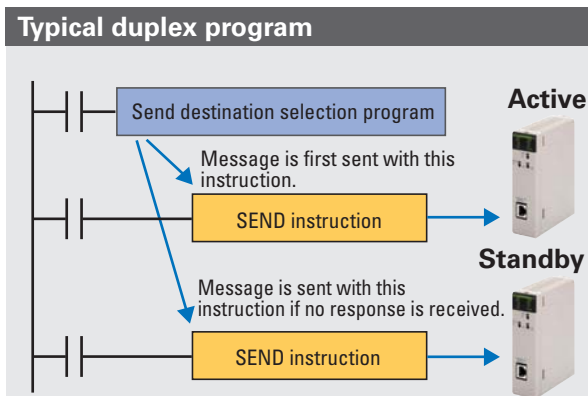
The CPU Unit automatically selects the normally functioning Communications Unit.

- When an error occurs, it is not necessary to use a complex switching program or special data link area for duplexing!

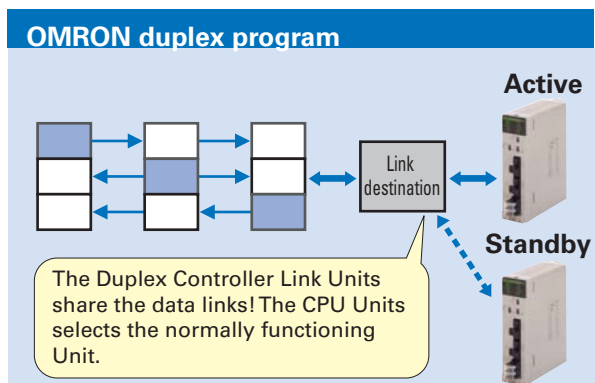
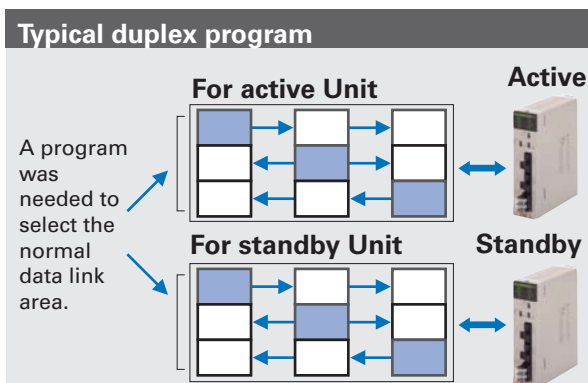


Note : The figure shows duplexing Controller Link Units. For details on wiring optical fiber cables, refer to the CS1W-CLK12-V1/CLK13/CLK52-V1/CLK53, CVM1-CLK12/CLK52 Optical Ring Controller Link Units Operation Manual (Cat. No. W370)

When Ethernet Units are used, complex switching programs for message communications can be simplified.



When using a Controller Link Unit, data link area allocations can be configured without waste.



New Release! The Ultimate

The newly released Duplex CPU, Dual I/O Expansion system draws attention in the maintenance field! This system answers the needs of users who want to make improvements and add functions without stopping the equipment. This strengthens the proven CS1D Duplex System even more.

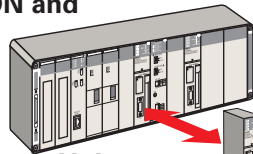
The functions in this section are supported only in a Duplex CPU, Dual I/O Expansion System.

Equipped with New Functions for Maintenance!

Special Programming Devices and Displays are not required for Online Unit Replacement.

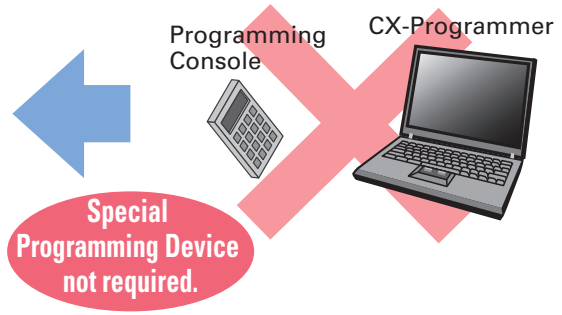
- A computer is not needed for onsite operations!
- Units can be replaced without knowing Programming Device procedures!

Power is ON and the PLC is operating.



Unit replacement

Can be removed directly.

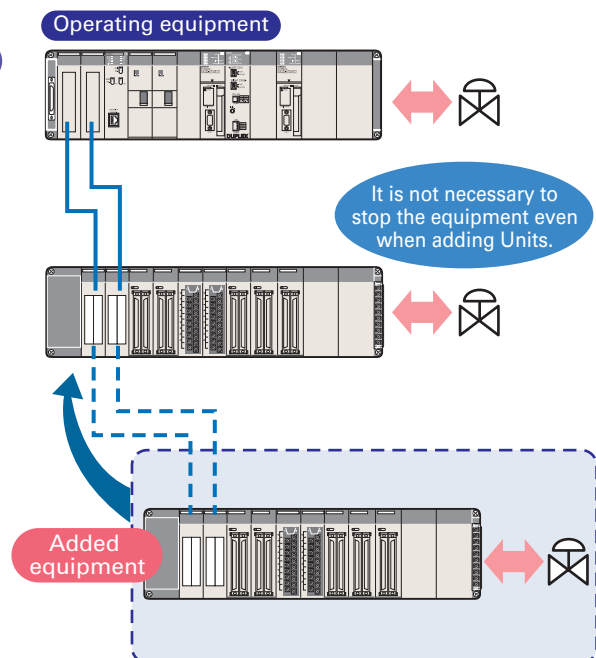
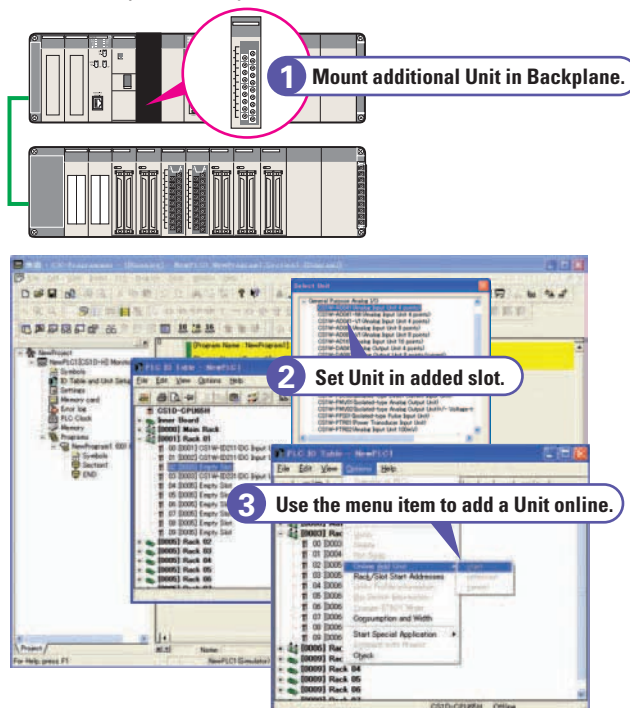


Units and Expansion Backplanes can be added online.

- Functions can be added easily after the system has started operating, even if the system cannot be turned OFF or stopped.
- Adjustments and improvements can be easily made when setting up new systems without turning OFF the power.

While online, a Unit can be added easily to an empty slot. (This function is supported in Duplex CPU Single I/O Expansion Systems and Duplex CPU Dual I/O Expansion Systems.)

In addition, an Expansion Backplane as well as its mounted Units can be added easily.

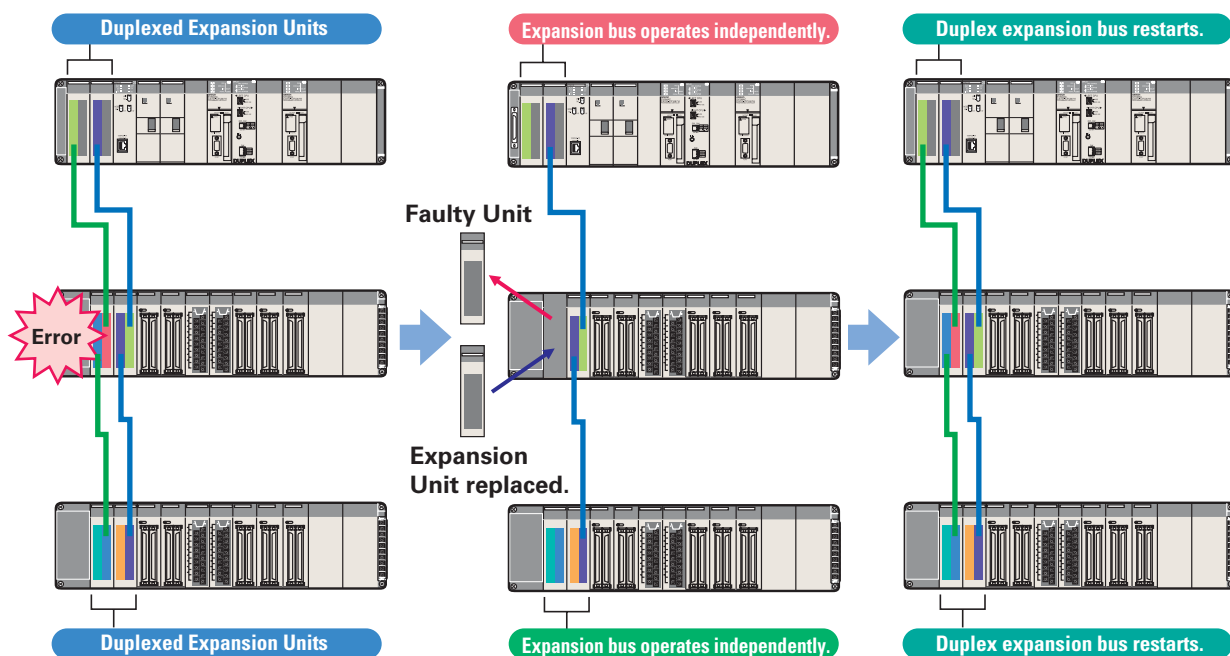


Duplex "Dual I/O Expansion" System

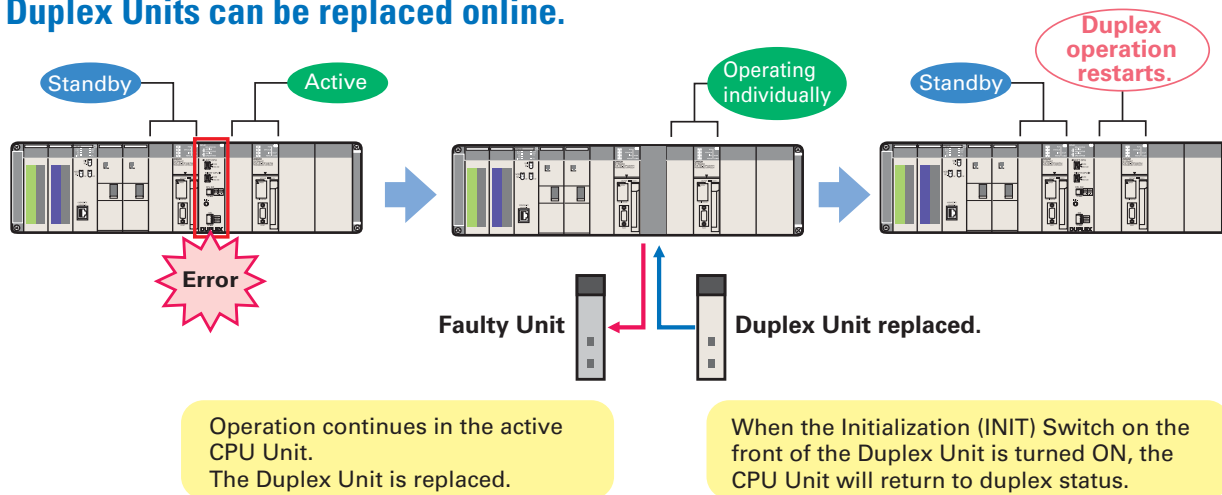
Even Stronger Redundancy!

Expansion Cables can be duplexed and Units can be replaced Online.

By duplexing the Expansion Units and Expansion Cables, the Expansion Cables are duplexed and can be replaced during operation. In addition, cable disconnections are monitored so failures can be located easily.



Duplex Units can be replaced online.

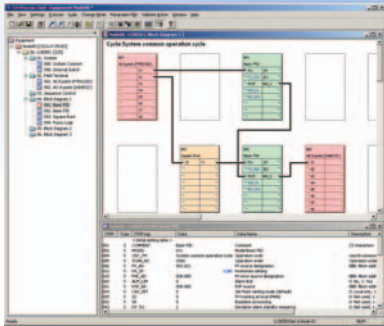


A PLC-based Duplex Process Control System That Achieves High Reliability

A variety of system configurations can be created, such as a Duplex CPU System using a CS1D Process-control CPU Unit with a built-in Loop Control Board (LCB) function or a Single CPU System using a Loop Control Board mounted in the CS1D CPU Unit's Inner Board slot. You can retain the openness and cost performance of a general-purpose PLC base while expanding the possible range of PLC control with process control functions and reliability that are equivalent to some of the functions and performance of DCS.

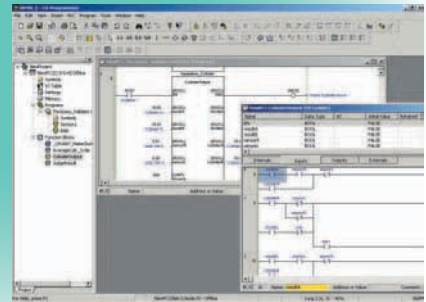
Loop control engine

Loop Control (LCB)
Section: CX-Process Tool



Sequence control engine

CPU Section: CX-Programmer



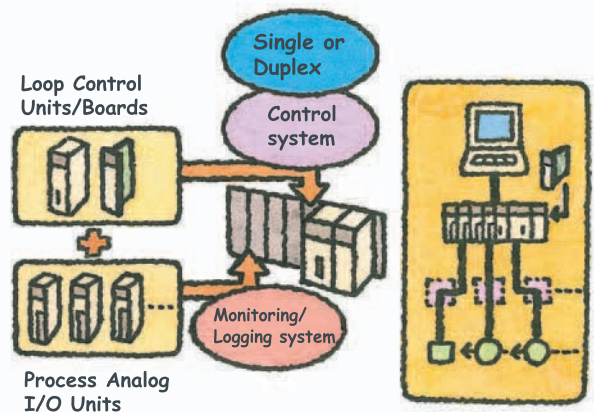
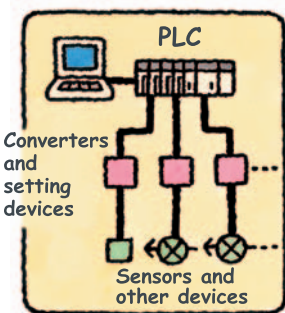
A Process Control System can be built based on PLCs, breaking the image of traditional process controllers. A system configuration can be created to match the applications and customer's system requirements.

Previous System Issues

(Initial costs are high because a large-scale system must be used.)

PLC-based Process Control Solution

(*Down-sizing* Using the PLC base saves cost, space, and time.)



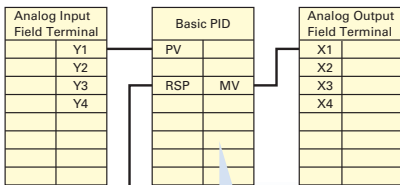
stem for Full-scale Process Control

Reduce the Total Cost of Ownership from Initial Costs to Operating Costs. A PLC-based Process Control System Answers the Customer's Needs.

Engineering: CX-Process Tool

Loop control programs can be created easily with function block programming.

Combine function blocks and use the mouse to connect them.

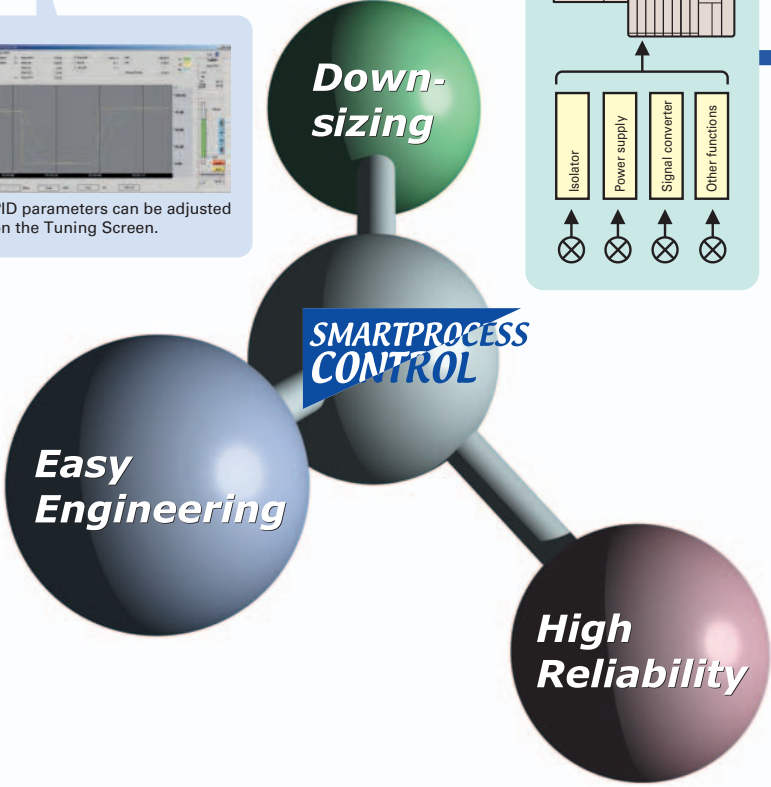
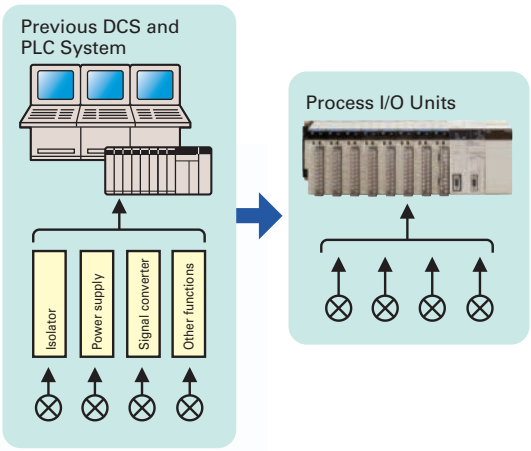


Segment Program	
Y1	

PID parameters can be adjusted on the Tuning Screen.

Input/Output: Process I/O Units

Functions such as isolator, power supply, and signal converter functions are implemented in these Analog I/O Units. Since functions such as process value alarms, rate-of-change calculations, and square-root calculations are built into the Units, significant cost and space savings can be realized compared to the previous system.



Duplex System: CS1D

Loop control programs can be duplexed, not just sequence control programs. The CS1D Duplex System can provide a solution to risk management in process applications that require high reliability.



MEMO

A large grid of dashed lines for writing a memo. The grid consists of 20 columns and 20 rows of squares, providing a structured space for notes or calculations.

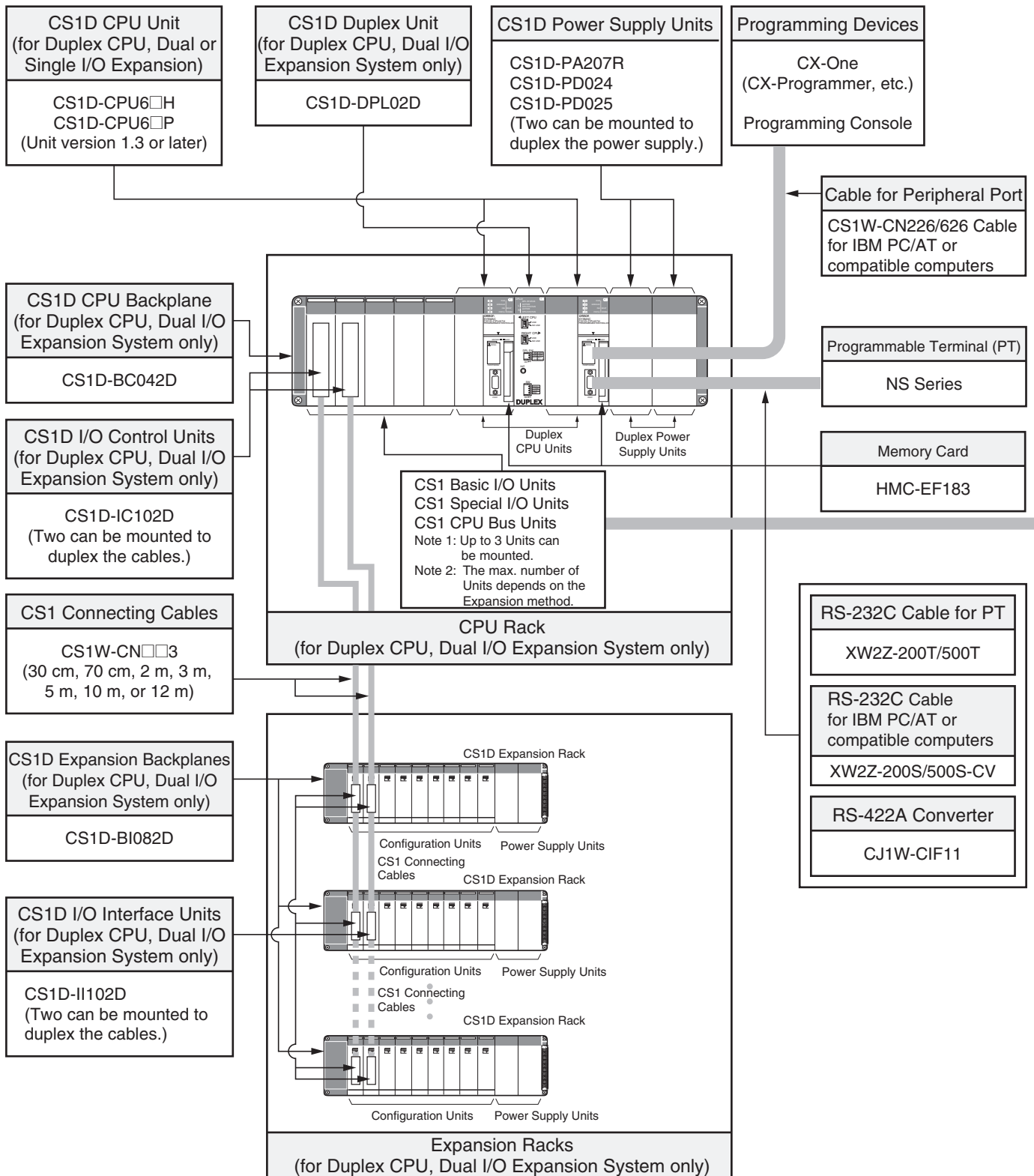
System Design Guide

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System Configuration

Basic System

SYSTEM 1 CS1D Duplex CPU, Dual I/O Expansion System



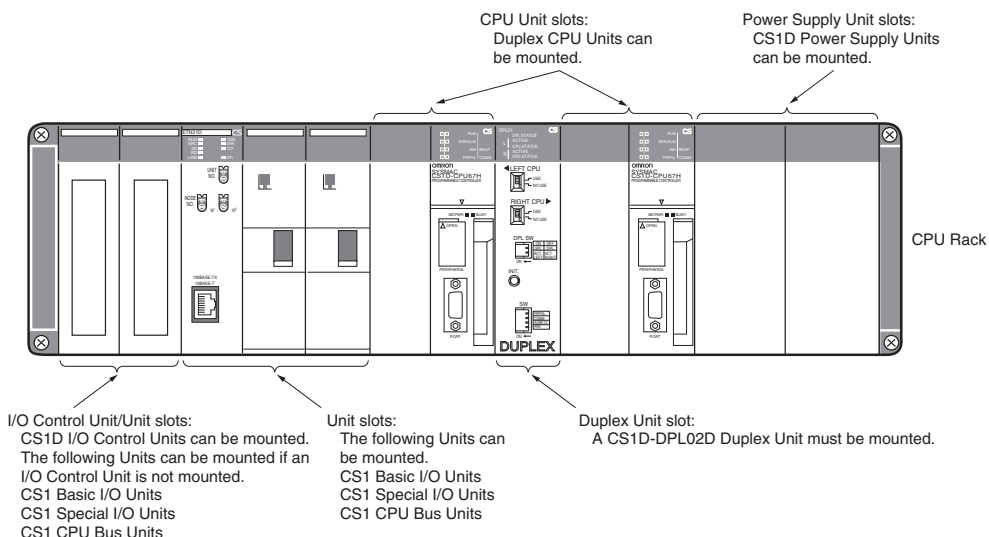
Basic System

SYSTEM 1 CS1D Duplex CPU, Dual I/O Expansion System

The entire system, including the expansion cables, can be duplexed for the most advanced redundancy and maintenance functions. The CPU Unit's version must be unit version 1.3 or later.

■ CPU Rack

System Configuration



List of Required Devices

Rack	Unit name	Number required	
CPU Rack	CS1D-BC042D CPU Backplane (for Duplex CPU Dual I/O Expansion Systems)	1 Backplane	
	CS1D-PA207R/CS1D-PD02□ Power Supply Unit	2 Units (Just 1 Unit can also be used.)	
	CS1D-CPU6□H/CS1D-CPU6□P CPU Unit	2 Units	
	CS1D-DPL02D Duplex Unit (for Duplex CPU Dual I/O Expansion Systems)	1 Unit	
	CS1D-IC102D I/O Control Unit (for Duplex CPU Dual I/O Expansion Systems)	Required only when there is an I/O Expansion System. Two Units are required for a Dual I/O Expansion System, and just one Unit is required for a Single I/O Expansion System.	
	Maximum number of I/O Units	Dual I/O Expansion System	3 Units
		Single I/O Expansion System	4 Units
No I/O Expansion		5 Units	

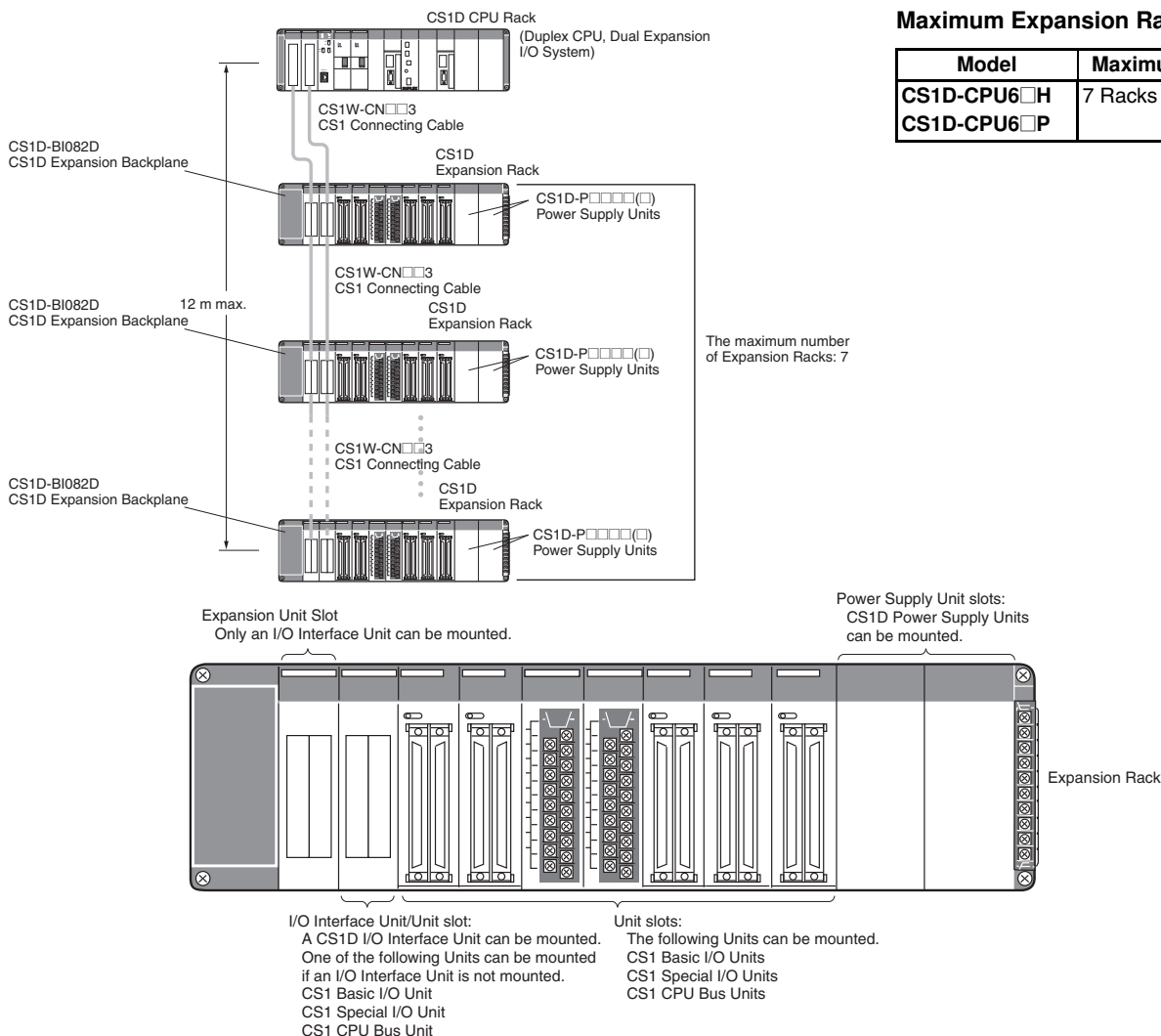
Limitations on the System Configuration

- Note:**
1. C200H-series Units cannot be used in either the CPU Rack or Expansion Racks.
 2. The CPU Units do not support FB or ST programming.
 3. CPU Units with unit version 1.3 or later can be used.

Dual I/O Expansion Racks

The Dual I/O Expansion System has a duplexed expansion bus and supports online replacement of a Duplex Unit, online replacement of Units without a Programming Device, and online addition of I/O Units and Expansion Backplanes. (These functions are supported by the Duplex CPU Dual I/O Expansion System only.) Special I/O Control Units and I/O Interface Units are used in the Dual I/O Expansion System. The expansion bus can be set to either single or dual operation.

System Configuration Diagram



List of Required Devices

Rack	Unit name	Number required	
CPU Rack	CS1D-IC102D I/O Control Unit (for Duplex CPU Dual I/O Expansion Systems)	Two Units are required for a Dual I/O Expansion System, and just one Unit is required for a Single I/O Expansion System.	
	Maximum number of I/O Units	Dual I/O Expansion System	3 Units
		Single I/O Expansion System	4 Units

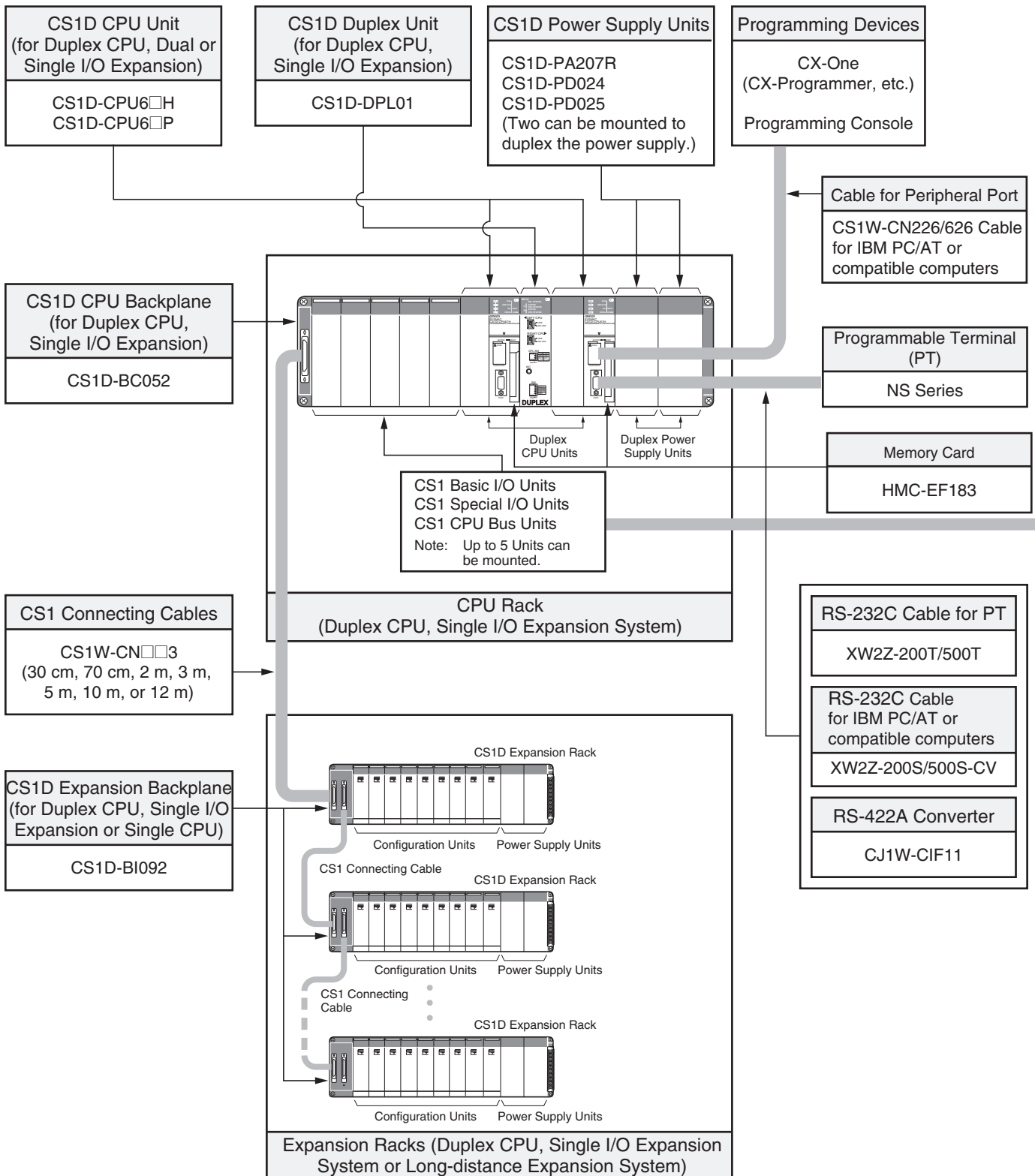
Rack	Unit name	Number required
Expansion Rack	CS1D-BI082D Expansion Backplane (for Duplex CPU Dual I/O Expansion Systems)	1 Backplane
	CS1D-PA207R/CS1D-PD02□ Power Supply Unit	2 Units (Just 1 Unit can also be used.)
	CS1D-II102D I/O Interface Unit (for Duplex CPU Dual I/O Expansion Systems)	Two Units are required for a Dual I/O Expansion System, and just one Unit is required for a Single I/O Expansion System.
	Maximum number of I/O Units	Dual I/O Expansion System
Single I/O Expansion System		8 Units

Limitations on the System Configuration

- Note:**
- Dual I/O Expansion cannot be used in a Duplex CPU Single I/O Expansion System or Single CPU System.
 - The number of I/O Units that can be mounted in the Backplanes depends on the expansion method being used.

Basic System

SYSTEM 2 CS1D Duplex CPU, Single I/O Expansion System



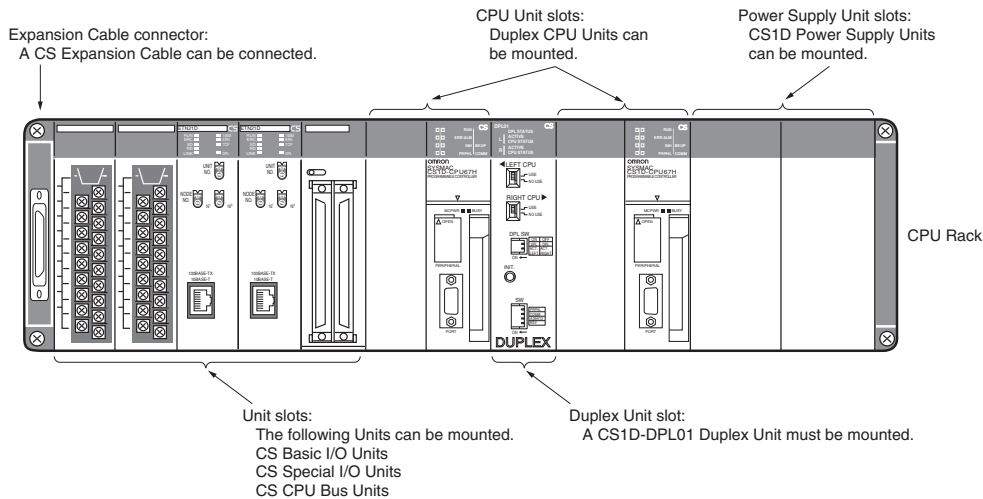
Basic System

SYSTEM 2 CS1D Duplex CPU, Single I/O Expansion System

The main system components can be duplexed, such as the CPU Unit, Power Supply Unit, and Communications Unit. Units can be replaced online using a Programming Device. This system is equivalent to the previous CS1D Duplex CPU System.

■ CPU Rack

System Configuration



List of Required Devices

Rack	Unit name	Number required
CPU Rack	CS1D-BC052 CPU Backplane (for Duplex CPU Single I/O Expansion Systems)	1 Backplane
	CS1D-PA207R/CS1D-PD02□ Power Supply Unit	2 Units (Just 1 Unit can also be used.)
	CS1D-CPU6□H/CS1D-CPU6□P CPU Unit	2 Units
	CS1D-DPL01 Duplex Unit (for Duplex CPU Single I/O Expansion Systems)	1 Unit
	Maximum number of Configuration Units	5 Units

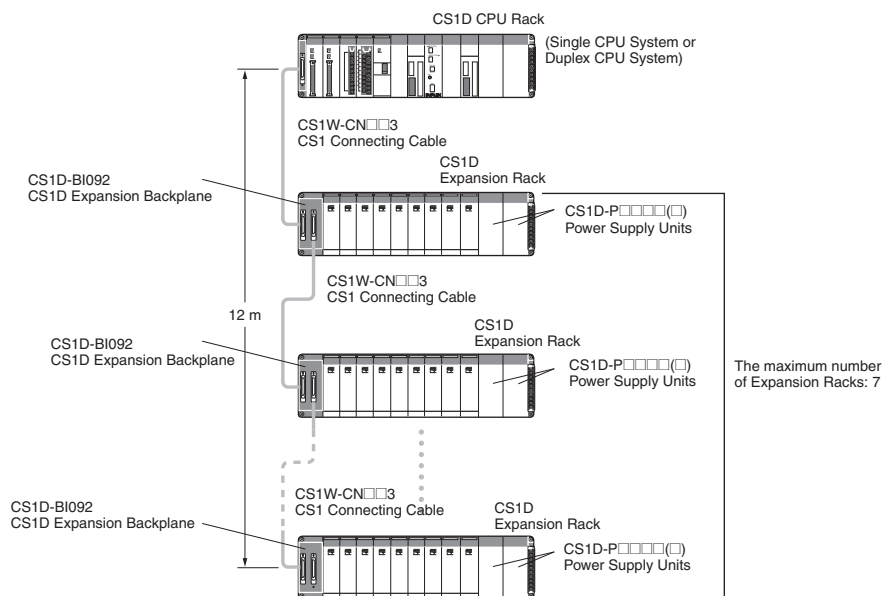
Limitations on the System Configuration

- Note:**
1. C200H-series Units cannot be used in either the CPU Rack or Expansion Racks.
 2. The CPU Units do not support FB or ST programming.

Single I/O Expansion Racks

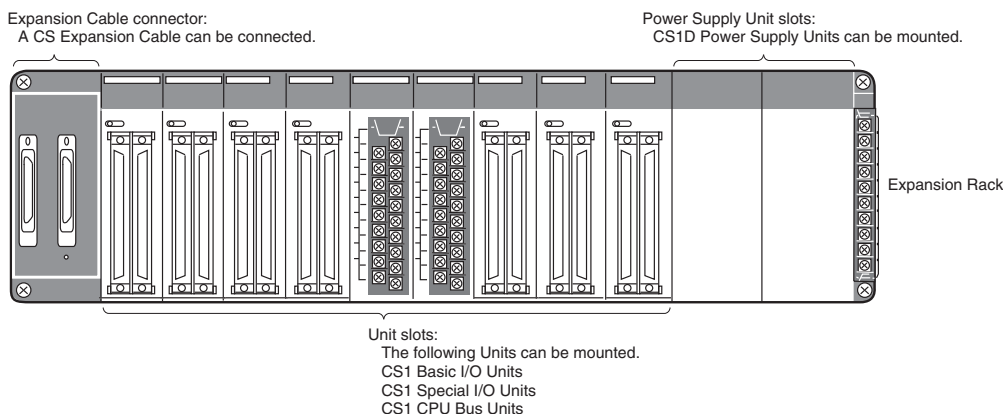
Like the CS1-series PLCs, it is possible to connect Expansion Racks and expand the PLC system just by connecting Expansion Cables. The Duplex CPU Single I/O Expansion System supports the same functions as Single CPU System. Special I/O Control Units and I/O Interface Units are not required.

System Configuration Diagram



Maximum Expansion Racks

Model	Maximum No. of Racks
CS1D-CPU6□H	7 Racks
CS1D-CPU6□P	



List of Required Devices

Rack	Unit name		Number required
CPU Rack	Maximum number of Configuration Units	Duplex CPU, Single I/O Expansion System	5 Units
		Single CPU System	8 Units

Rack	Unit name		Number required
Expansion Rack	CS1D-BI092 Expansion Backplane (for Duplex CPU Single I/O Expansion Systems or Single CPU Systems)		1 Backplane
	CS1D-PA207R/CS1D-PD02□ Power Supply Unit		2 Units (Just 1 Unit can also be used.)
	Maximum number of I/O Units (Duplex CPU Single I/O Expansion System or Single CPU System)		9 Units

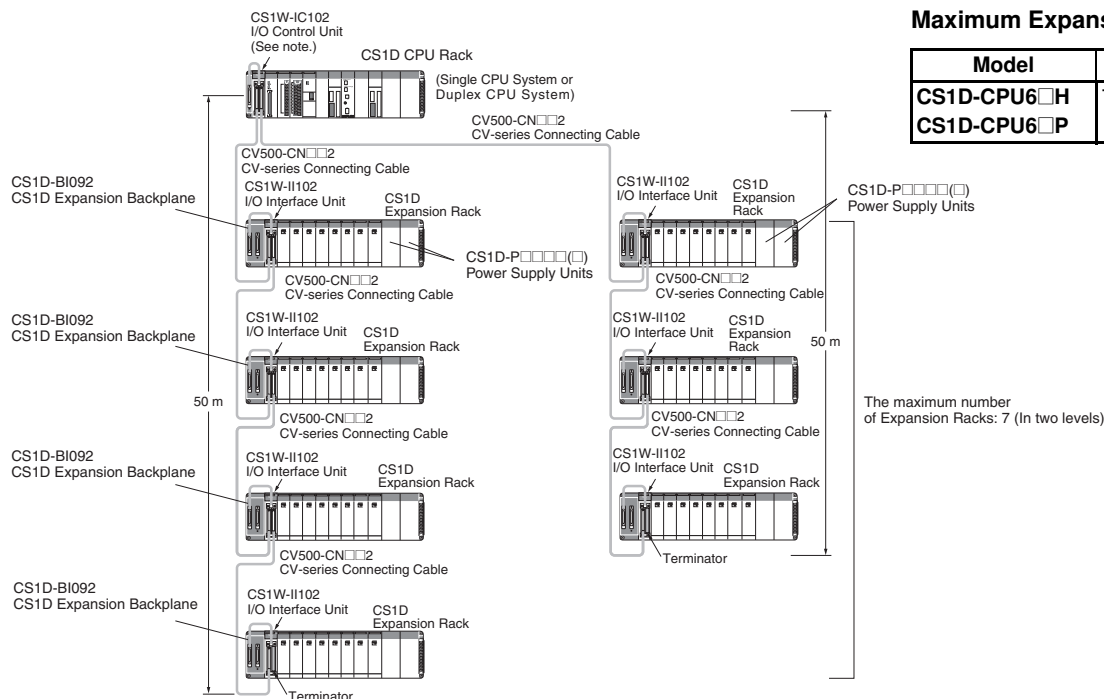
Limitations on the System Configuration

- Note:**
- These Racks cannot be used in a Duplex CPU Dual I/O Expansion System.
 - The following functions cannot be used: Duplex Expansion Cables, Online replacement of a Duplex Unit, Online replacement of Units without a Programming Device, and Online addition of I/O Units and Expansion Backplanes. If any of these functions are required, a Duplex CPU, Dual I/O Expansion System must be used.

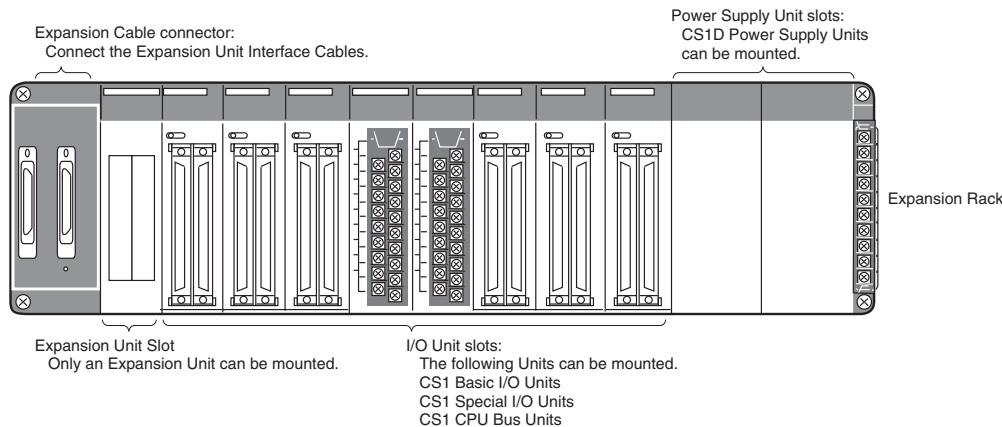
■ CS1D Long-distance Expansion Racks

A Long-distance Expansion System can connect a Rack at a distance of up to 50 m. The Long-distance Expansion System functions can be used in the Duplex CPU Single I/O Expansion System and Single CPU System. Special I/O Control Units and I/O Interface Units are used.

System Configuration Diagram



Note: If even one CV500-CN□□2 Cable for Long-distance Expansion is used in the PLC system, an I/O Control Unit is required in the source CS1 Rack.



List of Required Devices

Rack	Unit name	Number required	
CPU Rack	CS1D-IC102 I/O Control Unit (for Duplex CPU Single I/O Expansion Systems and Single CPU Systems)	1 Unit	
	Maximum number of Configuration Units	Duplex CPU Single I/O Expansion System	4 Units
		Single CPU System	7 Units

Rack	Unit name	Number required
Expansion Rack	CS1D-BI092 Expansion Backplane (for Duplex CPU Single I/O Expansion Systems or Single CPU Systems)	1 Backplane
	CS1D-PA207R/CS1D-PD02□ Power Supply Unit	2 Units (Just 1 Unit can also be used.)
	CS1W-II102 I/O Interface Unit (for Duplex CPU Single I/O Expansion Systems or Single CPU Systems)	1 Unit
	Maximum number of Configuration Units	8 Units

Limitations on the System Configuration

- Note:**
- These Racks cannot be used in a Duplex CPU Dual I/O Expansion System.
 - The following functions cannot be used: Duplex Expansion Cables, Online replacement of a Duplex Unit, Online replacement of Units without a Programming Device, and Online addition of I/O Units and Expansion Backplanes. If any of these functions are required, a Duplex CPU, Dual I/O Expansion System must be used.

