The Solution for Sustained Productivity Gains in Manufacturing

Our CS1 and CS1D duplex controllers deliver superior control performance, flexible communications and connectivity, powerful information management, extensive maintenance functionality . . . all in an enhanced design and development environment. These controllers can integrate logic, motion, drives and process in one system.

CS1 Rack System
- Ultra fast processing speed: basic instruction execution as fast as 20 ns
- Large local digital I/O capacity of 5120 points
- Up to 640 analog input/output points for process applications
- Extensive instruction set solves most control tasks in a minimum of steps
- Large built-in data memory up to 448 kwords
- Program memory up to 250 ksteps (1 MB)
- Use Compact Flash Memory Cards for up to 64 MB of removable data storage for backup and data logging
- E-mail using Internet (SMTP protocol)
- Supports a wide variety of communication platforms: open fieldbus Ethernet, DeviceNet and Profibus-DP and proprietary Controller Link and CompoBus/S
- Fully forward and backward compatible with popular C200H platform
- Protocol Macro function creates custom serial communication sequences

CS1D Duplex System
- Delivers hot standby for CPU and power supplies
- Offers on-line replacement (hot swapping) of CPU, power supplies, communications units, basic and special I/O modules for a quick recovery from equipment failures
- Get duplex communications and loop-back capability with Controller Link network
- Up to 500 function blocks, such as control blocks (for PID and other calculations) and operation blocks (for dead time and other calculations), can be combined in response to a wide range of applications
- Fast PID operation execution provides flexibility for multi-loop control
- A wide range of calculation functions includes floating point calculations, character string processing, and PID calculations with auto tuning
- Structured programming supports multitask and variable programming

CS1
- System Configuration . . . . C-9
- Basic I/O . . . . . . . . . . . . C-38
- Special I/O . . . . . . . . . . C-73
- Industrial Networks and Communications . . . . . . . . C-112
- System Power and Expansion . . . . . . . . . . . . . . . . C-149
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CS1D
- System Configuration . . . . C-207
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Paving the Way for Advances in Productivity

High-Speed Throughput and Easily Expandable Data Exchange

Omron’s combination of high-speed throughput and easily expandable data exchange ensure your investment in CS1 systems today will continue to yield exceptional production results. Every aspect demands less time from programmers and operators.

- All communications modules contain Omron’s unique FINS message routing and formatting tools for fast, expandable, and transparent exchange of data regardless of network type
- Over 150 different I/O, communication and special function modules available
- High-density I/O modules shorten installation time and increase accuracy with pre-terminated cables and wire terminal or relay terminal blocks
- Open fieldbus systems like DeviceNet and Profibus-DP allow the addition of another 10,000 remote I/O points
- Seamlessly combine continuous-path motion control or point-to-point positioning with high-speed sequencing operations using special function I/O modules
- Protocol Macro creates custom serial communication sequences eliminating trial-and-error development of handshaking scripts
- Fast 20 ns per instruction processing speeds help efficiently manage all the data

High-Speed Control for Converting and Bag Forming

High-function Motion Control Advantages
- Control up to 4 axes of motion from a single rack-mount module
- Powerful motion control functionality includes cam profiling, electronic gearbox, registration and multi-axis synchronization
- Reduce panel size and simplify wiring
- Eliminates the need for separate communications link between a PLC and stand-alone motion controller
- Real-time sharing of information

Fully Integrated Solution
- Omron E3M-V registration mark sensor detects marks at 50 ms
- Multi-loop temperature controller modules mounted to the PLC rack deliver accurate PID control for fast recovery of sealing temperature
- Touch screen NS-series HMI monitors and controls process activity and can be used to modify programs for the PLC
- Compact 3G3MV series inverter drives provide basic conveyor and speed control; for precise torque control to reduce stretching in rewound materials use 3G3PV inverter
Critical Processes Command Constant Vigilance

High Reliability is Key

- Ideal for process intensive applications
- Back up power supplies and CPUs and communications units
- Eliminate unexpected downtime in many process applications, especially in the middle of the process, which can be extremely costly
- Use CS1D with a Loop Control Board (CS1D-LCB05D) and process control modules
- Provide the reliability for process control applications in these industries:
  - Semiconductor
  - Food and Beverage
  - Petrochemicals
  - Marine Vessel
  - Water / Wastewater Treatment
  - Corrections

- Perform maintenance without downtime in these industries
  Critical processes such as boiler control or lighting control cannot be shut down for maintenance. Omron’s CS1D allows hot-swapping of I/O modules without the need to cut power or stop the PLC's program functions.

- Communications interface keeps operating
  In many cases, controller-to-controller communication is vitally important to the process. Not all manufacturers provide redundant Controller Link capabilities found in Omron’s CS1D. If one module fails, the second one will take over immediately.

Integrate Process, Motion, Sequencing and Supply Chain Management with One System

From ingredient blending through finished product to packaging and boxing for shipping, Omron’s CS1D delivers uninterruptible control to sustain productivity. We can also prepare your operation for increasing pressure from food, beverage and drug safety regulators for ingredient tracking from your supply chain. Omron offers unique asset tracking solutions for the CS1D that consolidate production functionality with plant/lot/date coding operations. Radio frequency identification controller modules and bar code readers are easily integrated into the same control system used to produce the goods in the first place. When goods ship out, complete records of plant/lot/date and the ingredients can be transmitted to front office systems for archiving.
**CS1 CONFIGURATION**

**CPU Rack**

NOTE: Connection is not possible to a 2-slot CPU Backplane.

**CS1 Expansion I/O Rack**

**C200HX/HG/HE Expansion I/O Rack**

**CS1 CPU Bus Modules**

- Serial Communications:
  - CS1W-SQ21-V1
- Ethernet:
  - CS1W-ETH2
- Controller Link (wired, optical):
  - CS1W-CL21-V1/12-V1/S2-V1
- SYSMAC Link (coaxial, optical):
  - CS1W-SLK21/SLK11
- DeviceNet:
  - CS1W-DRM21

**Power Supplies**

- C200HW-PA204/PA204R/PA209R/PD024

**Serial Communications Board**

- CS1W-SQ21-V1
- CS1W-SQ21-V1

**C200HW-BI2 (3, 5, 8 or 10 slots)**

NOTE: Expansion is not possible for 2-slot Backplanes. These Backplanes are for CS1 modules only. Use a CS1W-BIC33 Backplane for C200H modules.

**CS1W-BIC32**

NOTE: C200H modules cannot be mounted on the Long-distance Expansion Racks.

**CS1 Expansion Backplane**

- CS1W-BIC32
  - (3, 5, 8 or 10 slots)

NOTE: These Expansion Backplanes are for CS1 modules only. Use a CS1-BIC33 Backplane for C200H modules.

**CS1W-BIC32**

NOTE: Connection is not possible to a 2-slot CPU Backplane.

**CS1 I/O Connecting Cable**

- CS1W-CN/box3/box3/box3
  - (30 or 70 cm; 2, 3, 5, 10, or 12 m)

**C200H I/O Connecting Cable**

- CV500-CN/box3/box3
  - (Two provided with CS1W-IC102)

**Power Supplies**

- HMC-EF172/372/672

**Terminating Resistor**

- CV500-TER01

**Memory Card**

- CS1W-IC102

**I/O Control**

- CS1W-IC102

**I/O Interface**

- CS1W-II102

**Long-distance Expansion Connecting Cable**

- CV500-CN/box3/box3
  - (30 or 70 cm; 2, 3, 5, 10, or 12 m)
**CS1 Configuration**

**Basic I/O Modules**

**CS1 and C200H Basic I/O Modules**

- 16 pts Input Module CS1W-ID211
- 32 pts Input Module CS1W-ID231
- 64 pts Input Module CS1W-ID261
- 96 pts Input Module CS1W-ID291
- 16 pts Output Module CS1W-OC211
- 32 outs Outputs Module CS1W-OC291
- 48 inputs/48 outputs I/O Module CS1W-MD261
- 32 inputs/32 outputs I/O Module CS1W-MD291

**Interrupt Input**

Interrupt function supported on CPU rack only.

(2 modules mountable on CPU rack.)

C200H Interrupt input modules can also be used.

**Analog Timer**

- C200H-TM001

**B7A Interface**

- C200H-B7A11/01

**High-Speed Input**

- C200H-TM001

**Safety Relay**

- CS1W-SP200

**Special I/O Modules**

**CS1 Special I/O Modules**

- Process I/O CS1W-PD0
- Analog Input CS1W-AO04/AC001-V1
- Analog Output CS1W-DA04/DA08/DA08C
- Analog I/O CS1W-MA04/MA08/MAD04
- Position Control CS1W-NC0
- Motion Control CS1W-MC26/MD29
- Customizable Counter CS1W-HC22/HC03
- RFID Sensor CS1W-V600-C11/C12

**C200H Special I/O Modules**

- Temperature Sensor Input C200H-TS
- Temperature Control C200H-TC0
- Process Control C200H-PID0
- Fuzzy Logic* C200H-FZ001
- Cam Positioner* C200H-CP114
- Position Control* C200H-MC22
- 2-axis Motion Control* C200H-MC22
- RFID Sensor* C200H-ID30

**ASCII/BASIC**

- C200H-ASC2001

**Voice**

- C200H-CV01

**DeviceNet (CompoBus/D)**

- C200H-DRT21

**CompoBus/S Master**

- C200H-SRM21-V1

**PC Link**

- C200H-LK401

**Profibus-DP Master**

- C200H-PRM21

**Profibus-DP Slave**

- C200H-PRT21

**High-speed Counter**

- C200H-CT021

*There are restrictions in data transfers with the CPU module for bit and DM area specifications for the C200H Special I/O modules marked with, as well as in data transfers programmed from these modules. Refer to CS-Serie PLC Operation manuals for details.

These modules have been replaced by CS1W-NC, please refer to www.omron.com/oei for more information.
CS1 DUPLEX CONFIGURATION

CPU Rack

I/O Interface

Terminating Resistor

Memory Card

Power Supplies

Long-distance Expansion Connecting Cable

CS1 I/O Connecting Cable

CS1 Expansion I/O Rack

CS1D Expansion Backplane

CS1D Expansion I/O Rack

CS1 CPU Bus Modules

Serial Communications

Ethernet

Controller Link

SYSMAC Link (coaxial, optical)

DeviceNet

NOTE:
- This is not a PLC module, but a unit for the Duplex operation.
- Mount to active CPU only.

NOTE:
- Two provided with CS1W-IC102

NOTE:
- This is a unit for the Duplex operation.

NOTE:
- Mount to active CPU only.
**CS1 Duplex Configuration**

### Basic I/O Modules

- **CS1 Basic I/O Modules**
  - 16 pts Input Module CS1W-ID211
  - 32 pts Input Module CS1W-ID231
  - 64 pts Input Module CS1W-ID261
  - 96 pts Input Module CS1W-ID291
  - 16 pts Output Module CS1W-OD21
  - 32 pts Output Module CS1W-OD23
  - 64 pts Output Module CS1W-OD26
  - 96 pts Output Module CS1W-OD29

- **I/O Module CS1W-MD26**
  - 32 inputs/32 outputs
  - Can be used only as an ordinary input module.

- **I/O Module CS1W-MD29**
  - 48 inputs/48 outputs
  - 8 pts AC Input CS1W-IA111/211
  - 8 pts Triac Output CS1W-OA201
  - 8 pts (independent) Relay Output CS1W-OC201
  - 16 pts Relay Output CS1W-OC211

- **I/O Module CS1W-MD561**
  - 16 pts Triac Output CS1W-OA211
  - 16 pts Relay Output CS1W-OC211
  - 32 inputs/32 outputs

### Process I/O

- **CS1W-P**
  - Analog Input CS1W-AD041/AD081-V1
  - Analog Output CS1W-DA041/DA08V/DA08C
  - Analog I/O CS1W-MAO44
  - Position Control CS1W-NCH71
  - Motion Control CS1W-MC221/MO21/CS1W-MCH71

### Analog I/O

- **CS1W-MAD44**
  - 16 pts Analog Input CS1W-AD041/AD081-V1
  - 32 pts Analog Input/Output CS1W-AD081-V1/AD08V/AD08C
  - 64 pts Analog Output CS1W-DA08V/DA08C

### Customizable Counter

- **CS1W-HCP22**
  - 16 pts High-speed Counter CS1W-CT021/401
  - 32 pts High-speed Counter CS1W-CT021/401

### Safety Relay

- **CS1W-SF200**
  - Safety Relay

### Interrupt Input

- **CS1W-INT01**
  - 16 pts

### High-Speed Input

- **CS1W-IDP01**
  - 16 pts

### Motion Control

- **CS1W-MC221**
  - High-speed Counter CS1W-CT021/401

### RFID Sensor

- **CS1W-V600**
  - Customizable Counter CS1W-HCP22/HCA22/HIC01/12/16/24/32/48/64/96/128/192/256/384/512/1024

**NOTE:**
- **C200H** Basic I/O modules cannot be used.
When selecting the CPU for your system you’ll need to consider...

How many I/O points
Program memory storage
Data memory storage
Portable program storage options

For local Input Modules, consider...

What input voltage
How many points
Input current requirements
Are Terminal Blocks and connection cables necessary

For local Output Modules, consider...

How many points
What type of output
Are Terminal Blocks and connection cables necessary

For local Mixed I/O Modules, consider...

What input voltage
What type of output
How many I/O points
Are Terminal Blocks and connection cables necessary

Select CS1D Duplex system if any of these features are required (in addition to your CS1 requirements) consider...

CS1 System

If Special I/O capabilities are required, consider...

Analog input
Analog output
Temperature controllers
PID controllers
Position control

Motion control
High-speed counter
CAM positioner
ID Sensor
Voice output
Fuzzy Logic

For networked communications at information, controller and field device levels, consider...

Ethernet
Controller Link
DeviceNet
Profibus-DP
CompoBus/S distributed I/O

Sysmac Link
Serial

Configure your system by considering...

Basic CS1 configuration
Expansion I/O racks
Calculating overall current consumption
Power supply selection
Maximum system expansion
I/O allocations
Equivalence between C200H and CS1 I/O units

CS1D System

If Special I/O capabilities are required, consider...

Analog input
Analog output
Position control

Motion control
High-speed counter
ID sensor

For networked communications at information, controller and field device levels, consider...

Ethernet
Controller Link
Sysmac Link
DeviceNet
Serial

Configure your system by considering...

Basic CS1D configuration
Expansion I/O racks
Calculating overall current consumption
Power supply selection
Maximum system expansion
I/O allocations
What units and peripherals can be used on a CS1D Duplex system

Hot standby on CPU and Power Supplies
Duplex communications with Fiber Optic Controller Link
Controller Link Loopback configuration (Fiber Optic)
On line replacement of CPU, Power Supplies, Communication Units, Basic and Special I/O

Page C-207
Configuring a CS1 System

This section provides tools to configure a CS1 system. Included in this section are:

**Power and Expansion Selection**
Tools are provided to calculate the total current consumption of a CS1 system. With this information, the proper power supply can be selected. When the number of modules or power requirements exceeds the capability of the power supplies available, I/O expansion racks solve the problem. If the number of modules in the CPU rack exceeds 10 or the current consumption is greater than the capacity of the power supply units, use the CPU and rack configuration.

**I/O Allocations**
In CS1 PLC systems, part of the I/O memory is allocated to basic, special I/O units and CS1 CPU bus units. This section describes in detail how each of these units is allocated in the I/O memory.

**Replacing C200H I/O Units**
C200H I/O units are supported in a CS1 system but new CS1 equivalent units are being introduced periodically. Included in this section is a list of C200H I/O units and its CS1 equivalent. For each unit, differences between both are described in detail.

**What is the basic configuration?**
A CS1 system consists of a power supply, a CPU backplane, a CPU and up to 10 basic I/O, special I/O and CS1 CPU bus units. See page C-150.

**What goes on expansion racks?**
The expansion rack contains a power supply, an expansion I/O backplane, basic I/O units, special I/O units and CS1 CPU bus units.

**Where are ratings to calculate overall current consumption?**
All the current consumption ratings for the CPU, basic I/O, special I/O and CS1 CPU bus units are collected in the tables on page C-160.

**Which power supply is right?**
Calculate the total current consumption of basic I/O, special I/O and CS1 CPU bus units to determine which power supply to use.

<table>
<thead>
<tr>
<th>Input Voltage</th>
<th>100 to 240 VAC</th>
<th>24 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage</td>
<td>4.6 A, 5 VDC</td>
<td>4.6 A, 5 VDC</td>
</tr>
<tr>
<td>Output capacity</td>
<td>30 W</td>
<td>30 W</td>
</tr>
<tr>
<td>24 VDC service power</td>
<td>NO</td>
<td>YES (0.8 A)</td>
</tr>
<tr>
<td>RUN output contact</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Power supply model</td>
<td>C200HW-PA204</td>
<td>C200HW-PA204S</td>
</tr>
<tr>
<td>See page</td>
<td>C-150</td>
<td>C-150</td>
</tr>
</tbody>
</table>

The same power supply units can be used for both CPU and expansion racks.

**How many expansion racks can be used?**
The CS1 system can be expanded using CS1 expansion racks, C200H expansion racks or CS1 long distance expansion racks. The maximum number of expansion racks in any CS1 system will depend on the combination of these racks.

The following table outlines all acceptable combinations.

<table>
<thead>
<tr>
<th>Combination of Expansion Racks</th>
<th>CS1 Expansion Racks Only</th>
<th>CS1 and C200H Expansion Racks</th>
<th>CS1 Long Distance Expansion Racks</th>
<th>CS1 Expansion Rack and CS1 Long Distance</th>
<th>C200H Expansion Racks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum expansion racks per CPU</td>
<td>7</td>
<td>6 (Max. three C200H expansion racks)</td>
<td>7</td>
<td>7 (one CS1 exp. rack and six long distance)</td>
<td>3</td>
</tr>
<tr>
<td>Maximum distance from CPU rack</td>
<td>12 m</td>
<td>12 m</td>
<td>50 m</td>
<td>50.7 m</td>
<td>12 m</td>
</tr>
</tbody>
</table>

Note: On a CS1 long distance configuration, the following units are required:
- CS1W-IC102 – I/O control unit. One unit mounted on the CPU rack.
- CS1W-IL102 – I/O interface unit. One unit mounted on each CS1 expansion rack. See pages C-152 to C-153 to select the appropriate I/O connecting cables.

Note: It is not possible to go from a C200H expansion rack to a CS1 expansion rack.
CS1 CPU OVERVIEW

CPU Selection
This section describes the CPUs and memory cards for a CS1 system.

How many I/O points are needed?

<table>
<thead>
<tr>
<th>Number of I/O</th>
<th>960</th>
<th>1280</th>
<th>5120</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU models</td>
<td>CS1G-CPU42H</td>
<td>CS1G-CPU43H</td>
<td>CS1G-CPU44H</td>
</tr>
<tr>
<td></td>
<td>CS1G-CPU45H</td>
<td>CS1G-CPU63H</td>
<td>CS1H-CPU64H</td>
</tr>
<tr>
<td></td>
<td>CS1H-CPU65H</td>
<td>CS1H-CPU66H</td>
<td>CS1H-CPU67H</td>
</tr>
</tbody>
</table>

See page C-11

How much data memory storage is required?

<table>
<thead>
<tr>
<th>Data Memory Size</th>
<th>64 K Words</th>
<th>128 K Words</th>
<th>256 K Words</th>
<th>448 K Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU models</td>
<td>CS1G-CPU42H</td>
<td>CS1G-CPU43H</td>
<td>CS1G-CPU44H</td>
<td>CS1H-CPU65H</td>
</tr>
<tr>
<td></td>
<td>CS1H-CPU64H</td>
<td>CS1H-CPU66H</td>
<td>CS1H-CPU67H</td>
<td>CS1H-CPU67H</td>
</tr>
</tbody>
</table>

See page C-11

Note: The available data memory capacity is the sum of the Data Memory (DM) and the Extended Memory (EM).

How much program memory storage is required?

<table>
<thead>
<tr>
<th>Program Memory Size</th>
<th>CPU Models</th>
<th>See page</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 K steps</td>
<td>CS1G-CPU42H</td>
<td>C-11</td>
</tr>
<tr>
<td>20 K steps</td>
<td>CS1G-CPU43H</td>
<td>C-11</td>
</tr>
<tr>
<td>30 K steps</td>
<td>CS1H-CPU63H</td>
<td>C-11</td>
</tr>
<tr>
<td>60 K steps</td>
<td>CS1G-CPU44H</td>
<td>C-11</td>
</tr>
<tr>
<td>120 K steps</td>
<td>CS1H-CPU65H</td>
<td>C-11</td>
</tr>
<tr>
<td>250 K steps</td>
<td>CS1H-CPU67H</td>
<td>C-11</td>
</tr>
</tbody>
</table>

Selecting program storage options
Memory card uses:
• Download recipes
• Replace PLC program while operating
• Auto-boot the PLC upon power up

<table>
<thead>
<tr>
<th>Memory Size</th>
<th>15 MB</th>
<th>30 MB</th>
<th>64 MB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory card</td>
<td>HMC-EF172</td>
<td>HMC-EF372</td>
<td>HMC-EF672</td>
</tr>
</tbody>
</table>

See page C-150

Note: An adapter is available to insert the flash memory card into a computer. Go to page C-150 for details.