CS1 Series
CS1W-MC421/221
Motion Control Units

Specification Sheets

OMRON

CS1-series
Motion Control Units

CS1W-MC421/221

Multitasking G Language for Advanced, High-speed, and High-precision 2/4-axis Motion Control

■ The CS1W-MC421 and CS1W-MC221 are CS1-series Motion Control Units that control four axes and two axes, respectively. With their built-in G-language programming capability, they can be used for advanced motion control operations, such as traversing, and their multitasking capability allows operations to be performed independently for each axis. Two types of motion control are possible: Point-to-point and continuous path.

1. **Point-to-point Control:** With point-to-point (PTP) control, positioning is controlled independently for each axis. The pathway varies according to the travel distances, the feed rates, and other set parameters.

2. **Continuous Path Control:** With continuous path (CP) control, not only the start position and target position can be controlled but also the path between those points. Linear interpolation, circular interpolation, helical circular interpolation, and traversing are all possible.

   The MC Unit has been developed for use in simple positioning applications using servomotors. Applicable machines are as follows:

   • Conveyor Systems: X/Y tables, palletizers/depalletizers, loaders/unloaders, etc.

   • Assembling Systems: Automated assembling machines (such as coil winding, polishing, hole punching), simple robots, etc.

Note: The MC Unit is not designed to perform linear interpolation, circular interpolation, or helical circular interpolation with horizontal articulated robots or cylindrical robots, because it does not support coordinate conversions. The MC Unit can, however, perform PTP control with these robots.

CS1W-MC421   CS1W-MC221
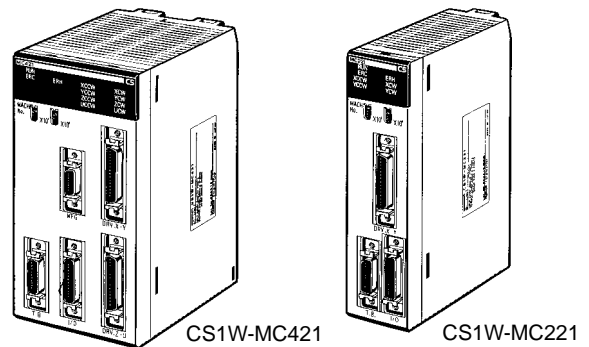
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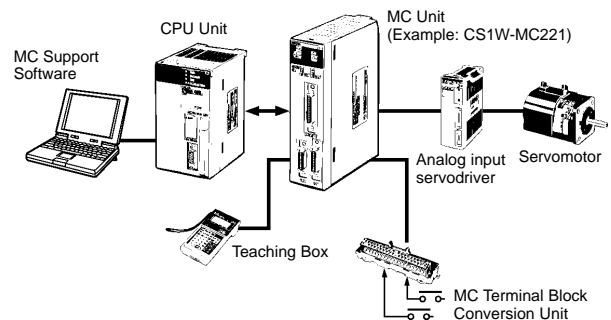
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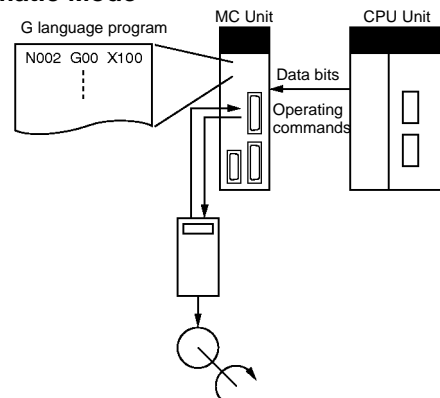
Manual Mode

"Programmable Controller" is abbreviated as "PC" in these *Specification Sheets*.

```
                                                                    ┌─── Stop Mode
                                          ┌─── Position control ─────┼─── Pass Mode
                                          │                          └─── In-position
                                          │                               Check OFF Mode
                                          ├─── Speed control
                      ┌─── Automatic Mode ├─── Origin search
                      │    (Executes G-language ├─── Interrupt feeding
                      │    programs in the MC Unit.) ├─── Traversing
                      │                          ├─── Dwell timer
                      │                          └─── Arithmetic operations, etc.
                      │
                      │                          ┌─── Jogging
                      │                          ├─── Deceleration stop
                      │                          ├─── Present position preset
                      │    Manual Mode           ├─── Origin search (manual)
  MC Unit functions ──┼─── (Executes manual ─────┼─── Servo lock/Servo unlock
                      │    commands from the CPU  ├─── Error counter reset
                      │    Unit or Teaching Box.) ├─── Forced origin
                      │                          ├─── Standard origin return
                      │                          └─── Absolute origin setting
                      │
                      │    Common to Automatic    ┌─── Teaching
                      └─── and Manual Modes ──────┼─── Zones
                                                  ├─── Backlash correction
                                                  ├─── Override
                                                  └─── Electronic gear
```
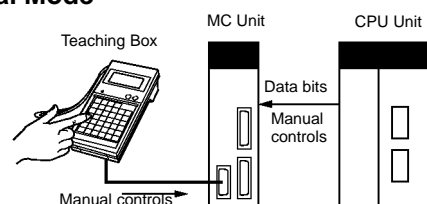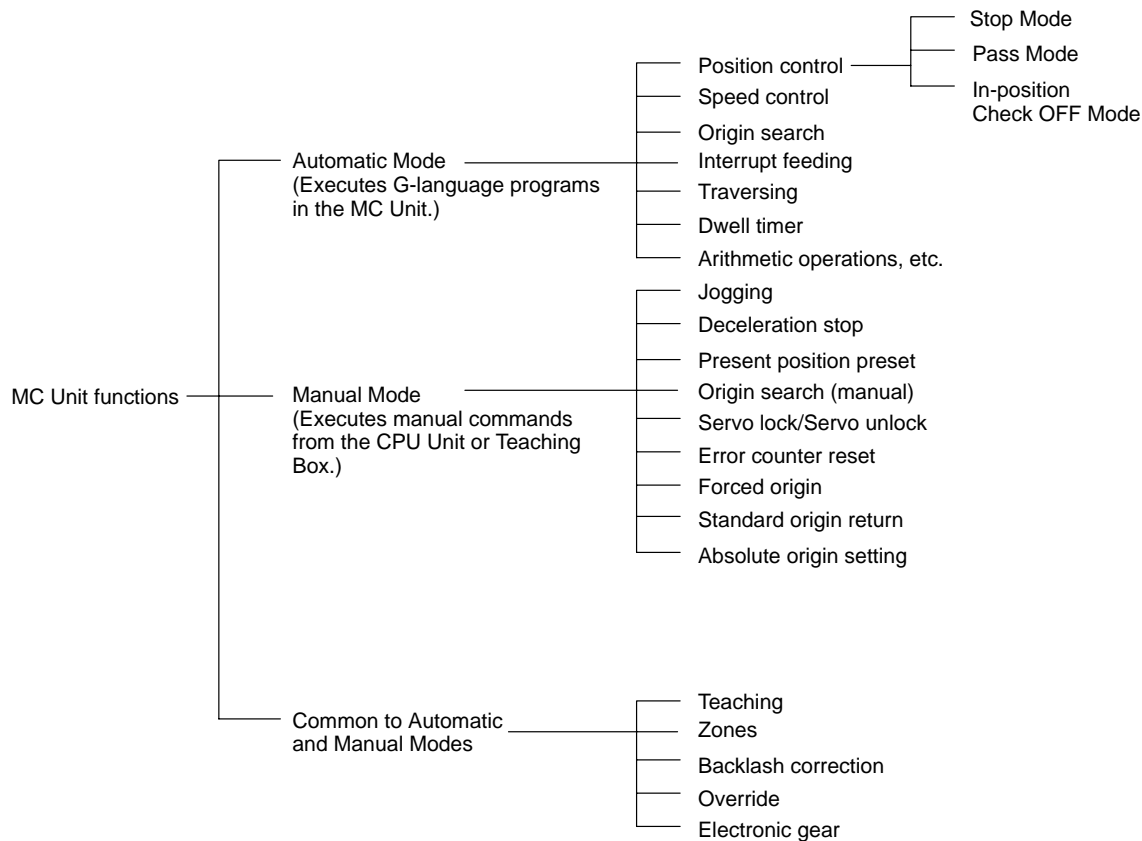
■ Features

Multitasking G Language

The MC Unit is provided with a multitasking G language, which is the optimum language for motion control. The G language makes it simple to create programs for multiaxis control, without placing a burden on the CPU Unit's ladder diagram program.

Simple and Fast Traverse Operations

Commands for 2-axis traverse operations enable simple and fast traverse operations.

Fast Pick-and-place Operations

After a positioning command has been output, the in-position check OFF function allows the next positioning operation to be started without waiting for the first positioning operation to be completed. This makes it possible to perform high-speed pick-and-place operations.

Supports Absolute Encoders

The MC Unit is compatible with absolute encoders as a standard feature, eliminating the need to perform an origin search. Incremental encoders can be used as well.

High-speed Response to Start Commands from CPU Unit

The response time from when a start command is received from the CPU Unit until the command voltage is output from the MC Unit is 8 ms for two axes and 13 ms for four axes (MC421 only). This is 1.5 times faster than the previous models.

Note: **Two-axis MC Unit**
This function applies to the X axis when a 2-axis, 1-task configuration is used.
Four-axis MC Unit
This function applies to the X axis when a 4-axis, 1-task configuration is used.

500-kp/s Encoder Response Frequency

The maximum feedback encoder response frequency is 500 kp/s, so the MC Unit can be used with high-speed and high-precision servomotors. This is double the response frequency of the earlier models.

CPU Unit Interrupts

A CPU Unit external interrupt task can be started by outputting a D code (interrupt code) for the CPU Unit when positioning is completed or when passing through a particular position. This feature is ideal for high-speed synchronization between the MC Unit and CPU Unit.

Other Functions

- **Unlimited Feeding**
  This function executes unlimited feeding for the specified axis. Use of this function allows the user to control unlimitedly fed axes, such as those for turntables or one-way conveyors. The present value can be increased or decreased within the specified range.

- **Synchronous Electronic Gear**
  Input pulses for a synchronous encoder can be accelerated or decelerated for each axis at any timing. The acceleration or deceleration rate is specified by a numerator/denominator ratio. To provide simple synchronous control, this function can also be enabled or disabled for each axis at any timing.

- **Error Counter Reset**
  After a deceleration command has been completed, the error counter reset function forcibly sets the error counter to 0 to stop the axis operation completely. This function is best suited for machine press control in molding and other processes.

- **Multiturn Circular Interpolation**
  The multiturn circular interpolation function has been added to the existing circular and helical circular interpolation functions. This function can be used for applications such as winding machine operations.

- **Override (Real Time Speed Change)**
  The speed can be changed during PTP, linear interpolation, or circular interpolation operations in which the axis stops during the positioning operation. (This function is invalid in pass mode or in-position check OFF mode.)

- **Pass Operations**
  The acceleration and deceleration times can be changed during pass operations. It is possible to specify whether to pass the operation using the previous acceleration time or pass the operation using the deceleration time during pass operations. It is also possible to pass the operation at a constant acceleration rate during single-axis pass operation.

- **Servo Parameter Changes**
  The servo gain, such as the feed-forward gain, can be changed from a G language program. Therefore, if position loop feed-forward gain is enabled during circular interpolation, the level of accuracy for circular interpolation can be improved.

- **Comprehensive Functions in Origin Search Mode**The
  The search pattern can be selected to reduce the origin search time. It is possible to select either deceleration stop or error counter-based stop when a limit input is received during origin search. Origin searches are also possible in absolute encoder systems.

- **Interrupt Feeding**
  This function uses general-purpose inputs (interrupt signals) to move the specified axis by the specified distance for positioning. It is possible to perform positioning operations when no interrupt signals are received during interrupt feeding.

- **Brake Signal Outputs**
  To make motor operation even easier, brake signal outputs (also used as a general-purpose output) can be used during servo lock or unlock.

- **Stopover**
  A stopover outputs M code or D (interrupt) code without stopping operation after feeding the axis by the specified distance during operation. The cycle time can be reduced by controlling peripheral devices before the operation is completed.

- **Error Logging**
  The error log can store up to 20 error records, such as positioning errors or hardware errors in the MC Unit or operation fatal errors in the CPU Unit, together with the date and time of each error. The error log can be read using the CX-Motion.

Windows-based MC Support Software: CX-Motion

- **Multiple MC Unit Management in Project Units**
  Multiple MC Units can be registered as one project. This allows simultaneous management of multiple MC Units.

- **Tree Display for Edit or Monitor Screens**
  Data will be displayed in tree format on the left side of the window

so that the user can easily understand the location of the data currently being set, edited, or monitored.

- **Servo Information Trace Function**
  Speed reference values, the present speed, and the error counter can be traced with specified starting conditions and a specified sampling period using the Windows-based CX-Motion. Up to 500 items can be traced, making it easy to adjust the servo system.

- **Automatic Loading Function**
  When it is necessary to use more programs or position data than can be stored in the MC Unit, programs or position data stored in an external memory device at the computer where CX-Motion is installed can be automatically downloaded to the MC Unit's internal memory. This function allows the system to cope with an application consisting of more than 100 programs.

- **Single-port Multiaccess Function**
  A Windows-based Support Software package called CX-Motion can be used on the same computer and through the same port as the CX-Programmer, enabling multiple programming environments on a single computer.

- **User-defined Mnemonics**
  The user can enter G codes or mnemonics corresponding to each G code when writing a program. The user can register or change these mnemonics as required, making it easy to write or analyze MC programs.

- **File Conversion**
  The existing system parameters, position data, and programs created using previous versions of the MC Support Software can be converted for use with the CX-Motion.

Data Creation Using Teaching Box

In addition to entering numbers in the Position Data Edit Window of the MC Support Software (CX-Motion), it is possible to create position data by using the Teaching Box to teach positions while actually moving the machinery.

Operate with MPG

Positioning and simple sync operations can be performed using an MPG (manual pulse generator).

■ Models

Applicable PCs	Unit classification	Controlled driver	Number of controlled axes	Model
CS1 Series	CS1 Special I/O Unit	Analog input servodriver	4	CS1W-MC421
			2	CS1W-MC221

MC Unit Support Software (Sold Separately)

Name	Computer	Supported MC Units	Specifications	Model
CX-Motion	IBM PC/AT or compatible	CS1W-MC421/221, C200H-MC221, CV500-MC421/221	Operating system: Windows 95/98/NT V4.0 CPU: Pentium, 100 MHz min. Memory: 32 MB min. Hard disk: 10 MB min. CD-ROM drive: 1 min. (for setup) Functions: Creating and editing system parameters, creating and editing position data, creating MC programs (G language), monitoring MC Units, saving data in flash memory, printing, automatic loading, file conversion, etc.	WS02-MCTC1-E

Connecting Cables

Connection to CPU Unit	Computer	Cable length	Cable model
Peripheral port	IBM PC/AT or compatible	2.0 m, 6.0 m	CS1W-CN☐☐☐
RS-232C port	IBM PC/AT or compatible	2.0 m, 5.0 m	XW2Z-☐☐☐S (-☐☐)

■ Specifications

Item	Specifications	
Model	**CS1W-MC221**	**CS1W-MC421**
Applicable PC	CS1 Series	
Type of Unit	CS1 Special I/O Unit	
Backplanes on which MC Unit can be mounted	CPU Backplane or CS1 Expansion I/O Backplane (See note 1.)	
Method for data transfer with CPU Unit — Words allocated to Special I/O Units in CIO Area	30 words/Unit (uses 3 unit numbers.) (See note 2.)	50 words/Unit (uses 5 unit numbers.) (See note 2.)
	CPU Unit to MC Unit: Commands: G-language program execution/stop, origin search, manual operation, etc. Data transfer: Position data, acceleration/ deceleration data, etc.	
	MC Unit to CPU Unit: Status: Positioning completed, zones, busy flag, etc. Monitor data: Present position, error codes, M codes, etc.	
Method for data transfer with CPU Unit — Words allocated to Special I/O Units in DM Area	Not used.	Not used.
Controlled Driver	Analog input servodriver (Example: OMRON OMNUC H, M, or U Series)	
Built-in program language	G language (Started by receiving a start command from the CPU Unit ladder diagram program.)	
Control — Control method	Speed reference voltage output-type semi-closed loop system, using incremental and absolute encoder inputs.	
Control — Number of controlled axes	2 max.	4 max.
	Multitasking can be used to execute independent operating modes and programs for each axis.	
Automatic/Manual Mode (for each task)	Automatic Mode: Mode for executing MC program created in G language. Manual Mode: Mode for executing manual commands from CPU Unit (PC interface area) or Teaching Box.	
	Note: The Automatic or Manual Mode is set according to the PC interface area of the CPU Unit.	
	There are a total of 11 Automatic Mode commands, including origin search, reference origin return, JOG, and error reset.	
	The operation cycle is started in Automatic Mode through dedicated bits in the CPU Unit or from the Teaching Box.	
Encoder interface	Line receiver input; maximum response frequency: 500 kp/s (before multiplication)	
	Pulse ratio: Select 1, 2, or 4	
	Note: The applicable absolute encoder is the OMRON OMNUC U Series.	
Control unit — Minimum setting unit	1, 0.1, 0.01, 0.001, 0.0001	
Control unit — Units	mm, inch, degree, pulse (There is no unit conversion function.)	
Maximum command value	–39,999,999 to +39,999,999 (When the minimum setting unit is 1.)	
Number of controlled axes	2 axes max.	4 axes max.
Positioning operations — PTP (independent) control	Execution by independent programs, operating modes for each axis.	
Positioning operations — Linear interpolation	2 axes max	4 axes max.
Positioning operations — Circular interpolation	Circular interpolation for a maximum of two axes on a plane.	
Positioning operations — Helical circular interpolation	---	Circular interpolation for a maximum of two axes on a plane + one axis for feed control
Positioning operations — Traverse function	Traverse operation for two axes	
Positioning operations — Speed control	Speed control for each axis	
Positioning operations — Unlimited Feed Mode	Axis feeding can be executed with no limit.	
Positioning operations — Interrupt feeding	Feeding a fixed distance after an interrupt input, for each axis. (Positioning with no interrupt input signals is also possible.)	
Speed reference	1 pps to 2,000 kp/s (when ratio is 4)	
Acceleration/deceleration curve	Trapezoidal or S-curve	
Acceleration/deceleration time	Individual acceleration/deceleration settings possible: 0 to 100,000 ms (2-ms increments)	

Note: 1. The MC Unit must be mounted to the CPU Rack to use D codes. D codes will not be sent to the CPU Unit if the MC Unit is mounted to a CS1 Expansion Rack.

2. The number of MC Units that can be mounted under one CPU Unit must be determined based on the maximum number of Special I/O Units that can be allocated words in the CPU Unit, the power supply capacity on the CPU or CS1 Expansion Rack, and the current consumption of the Units mounted to the Rack. Refer to the CPU Unit's operation manual for details on calculation methods.

Item		Specifications	
External I/O	Peripheral device	Teaching Box (1 only)	
	Encoder	Line receiver inputs: For two axes (500 kp/s before multiplication)	Line receiver inputs: For four axes (500 kp/s before multiplication)
	MPG/sync encoder	Line driver output-type MPG/sync encoder: 1 500 kp/s max. (before multiplication)	
	Servodriver relationships	The following signals are each provided for two axes:	The following signals are each provided for four axes:

		Inputs: Driver alarm signals
		
		Outputs: Driver alarm reset signals
		        High-speed reference voltage outputs (±10 V)
		        Operation command outputs
		        SEN signals (for absolute encoder)	

	Individual axis control	The following signals are each provided for two axes:	The following signals are each provided for four axes:

		Input: CCW limit inputs
		        CW limit inputs
		        Origin proximity inputs
		        Emergency stop inputs	

	Others	General inputs: 4 pts. (interrupt inputs) General outputs: 4 pts. (brake signal outputs)	
Feed operations	Rapid feed rate	Example: 36.86 m/min Conditions Encoder resolution: 2,048 p/r Motor speed: 4,500 r/m Control unit: 0.001 mm/pulse	
	Interpolation feed rate		
	Rapid feed override	0.1% to 100.0% (Setting unit: 0.1%)	
	Interpolation feed override	0.1% to 199.9% (Setting unit: 0.1%)	
	Jog feed override	0.1% to 100.0% (Setting unit: 0.1%)	
Axis control	Zone settings	Up to 8 zones/axis can be set.	
	Backlash correction	Can be set from 0 to 10,000 pulses.	
	In-position zone	Can be set from 0 to 10,000 pulses.	
	Position loop gain	1 to 250 (1/s)	
	Feedforward gain	0% to 100%	
Task program management	Number of tasks	2 max. (program execution units)	4 max. (program execution units)
	Number of programs	When 1 task is used: 100 When 2 tasks are used: 50	When 1 task is used: 100 When 2 tasks are used: 50 When 3 task are used: 33 When 4 tasks are used: 25

	Program capacity	When 1 task is used:
		        2,000 blocks
		When 2 tasks are used:
		        1,000 blocks/task
		
		The maximum number of blocks in a single program is 800.
			When 1 task is used:
			        2,000 blocks
			When 2 tasks are used:
			        1,000 blocks/task
			When 3 task are used:
			        666 blocks/task
			When 4 tasks are used:
			        500 blocks/task
			
			The maximum number of blocks in a single program is 800.

	Position data capacity	2,000 positions max. (total for all axes)	
	Number of registers	32 (Mainly used for specifying position data numbers.)	
	Subroutine nesting	5 levels max.	
Saving program data	MC Unit	Backed up by flash memory.	
	External peripheral devices	CX-Motion can be used to save data to a floppy disk or the hard disk at the personal computer.	

Item	Specifications	
Program and position data automatic download function	When the operation number (program or position data) is specified by an IOWR instruction from the CPU Unit, CX-Motion recognizes it and downloads the program or position data to the MC Unit.	
Self-diagnostic function	Memory corruption is detected.	
Error detection functions	Error counter warning, error counter over, absolute encoder error detection, CPU errors, communications errors (Teaching Box), flash memory error, EEPROM error, software limit over error, phase-Z error, overtravel, emergency stop, unit number error, driver alarm detection, driver reverse wiring detection, CPU Unit error detection	
Error log function	Stores up to 20 error log records.	
Model	**CS1W-MC221**	**CS1W-MC421**
Settings	Front panel: Rotary switches for unit number setting (0 to 93)	Front panel: Rotary switches for unit number setting (0 to 91)
	Rear panel: None	Rear panel: None
Indicators	7 LED indicators: Running, MC Unit error, CPU Unit error, motor rotation direction for each axis (CCW/CW)	11 LED indicators: Running, MC Unit error, CPU Unit error, motor rotation direction for each axis (CCW/CW)
Connections on front panel	Servodriver connector, I/O connector, Teaching Box connector (one each)	Servodriver connectors (two), I/O connector, Teaching Box connector, MPG connector
Power supply voltage	5 VDC (from Backplane)	
	24 VDC (from external power supply)	
Voltage fluctuation tolerance	4.75-5.25 VDC (from Backplane)	
	21.6-26.4 VDC (from external power supply)	
Internal current consumption	600 mA or less for 5 VDC (with Teaching Box connected: 800 mA or less)	700 mA or less for 5 VDC (with Teaching Box connected: 1,000 mA or less)
Weight (Connectors excluded)	450 g max.	540 g max.
Safety standards	Conforms to UL (Class 2), CSA (class 2), and EC specifications.	
External dimensions	$130.0 \times 35 \times 100.5$ mm (H $\times$ W $\times$ D) Single-slot size	$130.0 \times 70.0 \times 100.5$ mm (H $\times$ W $\times$ D) Double-slot size
Standard accessories	10136-3000VE snap-on connector for Servodrivers and 10336-52F0-008 Connector Cover (manufactured by Sumitomo 3M): 1 set	10136-3000VE snap-on connector for Servodrivers and 10336-52F0-008 Connector Cover (manufactured by Sumitomo 3M): 2 sets
	10126-3000VE snap-on connector for I/Os and 10326-52F0-008 Connector Cover (manufactured by Sumitomo 3M): 1 set	10126-3000VE snap-on connector for I/Os and 10326-52F0-008 Connector Cover (manufactured by Sumitomo 3M): 1 set
	Antistatic screws: 4	10114-3000VE snap-on connector for MPG and 10314-52F0-008 Connector Cover (manufactured by Sumitomo 3M): 1 set
		Antistatic screws: 8
Cat. No.	W359	

■ Options (Sold Separately)

Name	Specifications		Model
MC Terminal Block Conversion Unit	For easier wiring of I/O connectors	2-axis	XW2B-20J6-6
		4-axis	XW2B-40J6-7
MC Terminal Block Conversion Unit Cable	For connecting the I/O connectors on the front panel of the Unit		XW2Z-100J-F1
Snap-on connector for Servodriver connector on Unit front panel (1 or 2 sets provided as standard on the Unit)	Soldered connector		10136-3000VE (manufactured by Sumitomo 3M)
	Connector cover		10336-52F0-008 (manufactured by Sumitomo 3M)
Snap-on connector for I/O connector on Unit front panel (1 set provided as standard on the Unit)	Soldered connector		10126-3000VE (manufactured by Sumitomo 3M)
	Connector cover		10326-52F0-008 (manufactured by Sumitomo 3M)
Snap-on connector for MPG connector on Unit front panel (1 set provided as standard on the CS1W-MC421 Unit only)	Soldered connector		10114-3000VE (manufactured by Sumitomo 3M)
	Connector cover		10314-52F0-008 (manufactured by Sumitomo 3M)
Teaching Box	Jogging, origin search, present value monitoring, and other operations by means of manual commands		CVM1-PRO01-E
	Teaching (taking present values into position data)		
Teaching Box Connecting Cable	Cable length: 2 m		CV500-CN224
	Cable length: 4 m		CV500-CN424
	Cable length: 6 m		CV500-CN624
ROM Cassette	Required when the CVM1-PRS21-V1 Programming Console is used as a Teaching Box.		CVM1-MP702

CX-Motion Connecting Cables

Unit	Port on Unit	Computer	Port on computer	Serial communications mode (network)	Model numbers	Length	Remarks
CPU Unit	Peripheral	IBM PC/.AT or compatible	9-pin D-sub male	Peripheral bus or Host Link	CS1W-CN226	2.0 m	---
					CS1W-CN626	6.0 m	
	RS-232C (9-pin D-sub female)				XW2Z-200S-CV	2.0 m	ESD (static electricity)-resistant connectors used.
					XW2Z-500S-CV	5.0 m	
Serial Communications Board/Unit	RS-232C (9-pin D-sub female)			Host Link	XW2Z-200S-CV	2.0 m	
					XW2Z-500S-CV	5.0 m	

Connecting RS-232C Cable to Peripheral Port

Unit	Port on Unit	Computer	Port on computer	Serial communications mode (network)	Model numbers	Length	Remarks
CPU Unit	Peripheral port	IBM PC/.AT or compatible	9-pin D-sub male	Peripheral bus or Host Link	CS1W-CN118 + XW2Z-200S-CV or XW2Z-500S-CV	0.1 m + (2 or 5 m)	ESD (static electricity)- resistant connectors used for XW2Z-□00S-CV.
				Host Link	CS1W-CN118 + XW2Z-200S-V or XW2Z-500S-V		---

Connecting CQM1-CIF01/02 Cable to Peripheral Port

Unit	Port on Unit	Computer	Port on computer	Serial communications mode (network)	Model numbers	Length	Remarks
CPU Unit	Peripheral port	IBM PC/.AT or compatible	9-pin D-sub male	Host Link	CS1W-CN114 + CQM1-CIF02	0.5 m + 3.3 m	---

Connecting an IBM PC/AT or Compatible with RS-232C Cable

Unit	Port on Unit	Computer	Port on computer	Serial communications mode (network)	Model numbers	Length	Remarks
CPU Unit	RS-232C (9-pin D-sub female)	IBM PC/.AT or compatible	9-pin D-sub male	Host Link	XW2Z-200S-V	2 m	---
					XW2Z-500S-V	5 m	
Serial Communications Board/Unit	RS-232C (9-pin D-sub female)			Host Link	XW2Z-200S-V	2 m	
					XW2Z-500S-V	5 m	

■ Applicable CPU Units

PC	CPU Unit model number	Total number of MCUs that can be mounted on CPU Racks and Expansion I/O Racks	Unit location restrictions
CS1-series	CS1H-CPU□□ CS1G-CPU□□	CS1W-MC221: 32 Units (each Unit requires 30 words equivalent to 3 unit numbers; unit numbers 0 to 93)	None
		CS1W-MC421: 19 Units (each Unit requires 50 words equivalent to 5 unit numbers; unit numbers 0 to 91)	
		The current consumption must be within the allowable range for the Power Supply Unit.	

■ Overview of Operations

Item		Contents
Operating modes		The following two modes are available.
		Manual Mode: Operation according to CPU Unit memory area or commands from Teaching Box.
		Automatic Mode: Operation according to commands in G-language program.
Manual	Jogging	Moves axes continuously by manual operation.
	Handle feed	Moves axes by MPG.
	Deceleration stop	Decelerates to a stop according to command.
	Manual origin search	Searches for mechanical origin. (Origin search is possible in either an incremental or absolute encoder system.)
	Manual origin return	Moves to origin in reference coordinate system.
	Forced origin	Forcibly sets the present position to 0 to establish it as the origin. (In an absolute encoder system, only the present position of the MC Unit will be set to 0.)
	Absolute origin setting	Sets the origin for an absolute encoder.
	Servo-lock	Creates a position loop and turns ON the operation command output to the servodriver, while simultaneously releasing the brake. When an absolute encoder is used, the absolute position is read before the servo-lock is applied.
	Servo-unlock	Releases the position loop and applies the brake, and simultaneously turns OFF the operation command output to the servodriver. Servo-unlock can be executed even in Automatic Mode.
	Electronic gear function	A fixed ratio (numerator and denominator) can be applied to input pulses, and output to the servomotor driver.

Item		Contents
Automatic	Positioning with linear interpolation	Executes linear interpolation at the specified interpolation feed rate for up to either two or four axes simultaneously.
	Positioning with circular interpolation	Executes clockwise or counterclockwise 2-axis circular interpolation at the specified interpolation feed rate.
	Positioning with helical circular interpolation	Executes clockwise or counterclockwise 2-axis circular interpolation and 1-axis linear interpolation (i.e., helical interpolation) at the specified interpolation feed rate. (Available for CS1W-MC421 only.)
	Traverse function	Executes winding (traverse operation).
	Speed control	Moves a maximum of either two or four axes at a controlled speed.
	Interrupt feeding	Moves a specified axis for a fixed amount when a general input is turned ON. With interrupt feeding, positioning without an interrupt signal can be executed.
	Switching to Pass Mode	Changes to Pass Mode, in which operations are executed one by one with no deceleration stop. In Pass Mode, the interpolation acceleration or deceleration time of the previous operation can be specified for the next operation (Pass Mode time selection). A pass operation for only one axis can be executed at a fixed acceleration (with a fixed acceleration mode setting).
	Switching to In-position Check OFF Mode	Starts the next positioning operation without waiting for the current one to be completed.
	Stop-over function	Outputs an M code or a D code while axes are being moved by a fixed amount (determined by present position), without stopping the operation. G codes are also possible for all operations.
	Dwell timer	Pauses positioning for a specified time.
	Workpiece origin return	Automatically returns to workpiece origin.
	Automatic origin return	Automatically returns to reference coordinate system origin.
Automatic	Cycle start	Executes a specified program from the first block, or resumes execution of a stopped program.
	Single block	Executes the program one block at a time.
	Pause	Temporarily halts program execution.
	Forced block end	Forcibly ends execution of a block.
	Error reset	Clears error status.
	M code reset	Resets the M code (for interlock).
	Teaching	Creates position data for each task.
	Auxiliary	Optional inputs	20 points: Specify input information to be referenced by special G code.
			Of the 20 input points, 4 can be specified as general-purpose inputs for the MC Unit.
		M code	0 to 999
			0 to 499: M code for taking interlock 500 to 999: M code not taking interlock
		D code (interrupt code)	0 to 255
			Starts a CPU Unit external interrupt task when positioning is completed or when passing through a particular position.
Automatic and Manual Mode	Backlash correction	The amount of correction for backlash in the mechanical system can be registered in advance.
	Error counter reset	Forcibly resets the error counter to 0, and stops axis operation. (Enabled when no speed reference is provided to the servodriver.)
	Override	Changes the operating speed by applying a specified percentage to the speed specified in the system parameters or G-language program.
	Zones	A zone flag turns ON when the present position enters a preset range.
	Unlimited Feed Mode, unlimited present position display	Moves the axis with no limit. In this mode, a range for refreshing the present position can be specified.
	Origin search function	The search pattern can be selected to shorten the origin search time. Either a deceleration stop or accumulated pulse stop can be selected for when a limit input is received during the origin search.
	Trapezoid/S-curve acceleration and deceleration	Either trapezoid or S-curve acceleration and deceleration can be specified for starting and stopping each axis.
	Driver alarm reset	Resets the servodriver alarm.
	Data transfer	Data is transferred between the CPU Unit and the MC Unit by means of the CPU Unit's IORD and IOWR instructions. There are two modes for transferring data: One for transferring large amounts of data, and another for rapidly transferring small amounts of data.
	Servo data trace function	Up to 500 data items, including speed reference values, present speed, and error counter data, can be traced for each axis. This data can be referenced by CX-Motion.

■ Comparison with Earlier MC Unit Model

The following table shows the points of difference between the CS1W-MC221/MC421 and C200H-MC221 MC Units.

Item	CS1W-MC221/MC421	C200H-MC221
Number of control axes	2 or 4 axes	2 axes only
Binary indications	All binary (present position, program number, block number, M code, override, error code)	BCD
Encoder response frequency	500 kp/s (before multiplication)	250 kp/s (before multiplication)
Encoder pulse ratio	1, 2, or 4 times	4 times only
Program capacity	2,000 blocks	800 blocks
Acceleration/deceleration time	0 to 100.000 s	0 to 9.999 s
Speed reference range	1 pps to 2,000 kp/s	1 pps to 1,000 kp/s
Start time	2-axis Units: 8 ms max. 4-axis Units: 12 ms max.	2-axis Units: 12 ms max.

	Note: Two-axis MC Unit:
	    This function applies to the X axis when a 2-axis, 1-task configuration is used.
	    Four-axis MC Unit:
	    This function applies to the X axis when a 4-axis, 1-task configuration is used.	

Optional inputs	Optional No. 0 to 15: Inputs from CPU Unit	Optional No. 0 to 4: Inputs from CPU Unit
	Optional No. 16 to 19: General inputs 1 to 4	Optional No. 5 and 6: General inputs 1 and 2
General outputs, brake signal outputs	Four output signals are provided, and can be selected.	No output signals are provided.
MPG signals	500 kp/s max. (before pulse ratio of 1, 2, or 4)	Y axis instead of MPG
Circular interpolation (G02, G03)	Multiturn circular interpolation can be set.	Within one turn only.
Helical circular interpolation	With 4-axis Units, 2-axis circular interpolation on a plane + 1-axis feed control is possible.	Not supported.
Traverse command (G32)	A 2-axis traverse operation is available, with a traverse time of 4 ms max.	Not supported.
Unlimited Feed Mode	Unlimited feeding can be either specified or not specified for an axis. (The software limit is ignored.)	Cannot be specified.
Present position display for unlimited feeding	When unlimited feeding is specified for an axis, the software limit is ignored. The present position refresh range can be set.	Not supported.
Interrupt feeding (G31)	Positioning is possible even without any interrupt signal.	Speed control remains in effect when there is no interrupt signal.
Override	The feed rate can be changed during G00, G01, G02, G03, G26, G27, G30, G31, and G32 operations (except for pass operations).	The feed rate cannot be changed during operation.
Backlash setting range	0 to 10,000 pulses	0 to 999 pulses
In-position setting range	0 to 10,000 pulses	0 to 999 pulses
Zone setting	Conditions for using zones: Use only when origin is determined, or regardless of whether or not origin is determined. The initial setting is for zones to be used only when the origin is established.	Use regardless of whether or not the origin is established.
Origin search	Can be executed even when an absolute encoder is used. Parameter can be set to shorten origin search time. Either deceleration stop or accumulated pulse stop can be selected for when CW or CCW limit is detected.	Cannot be executed when an absolute encoder is used. Not possible to select deceleration stop or accumulated pulse stop for when CW or CCW limit is detected.
Forced origin	Present position can be forcibly set to 0, and established as the origin. (In an absolute encoder system, only the MC Unit's present position is set to 0.)	The present position is set to 0 by the present position preset function.

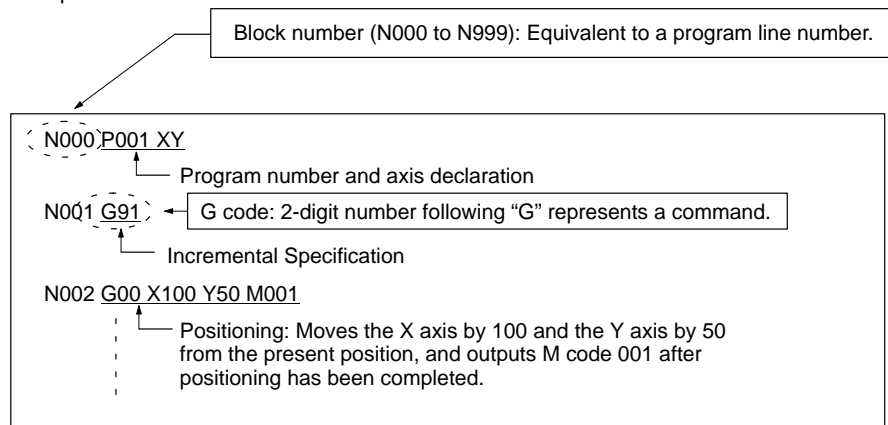| Item	CS1W-MC221/MC421	C200H-MC221
Absolute encoder origin setting	The absolute encoder origin can be set even while servo-lock is in effect.	Origin is set by either the absolute-value initial setting or the absolute-value software reset function. (It cannot be set while servo-lock is in effect.)
Electronic gear function	The numerator and denominator can be set.	Integers only
IN-POSITION CHECK OFF command (G13)	After a positioning command output has been completed, this command lets the next operation start without waiting for positioning to be completed.	Not supported.
Error counter reset	The error counter can be reset for each axis.	Not supported.
D code (interrupt code)	Can be used for notifying of the CPU Unit of interrupts.	Not supported.
Stopover function (Code output during axis movement)	An M code or D code can be output after a fixed amount of axis movement during operation.	Not supported.
Acceleration/deceleration time setting for pass operations	Either the acceleration or deceleration time of the previous operation can be selected for pass operations.	Pass operations are executed with the acceleration time.
Fixed acceleration mode for pass operations	A fixed acceleration mode is added for when pass operations are executed for one axis only.	Fixed acceleration time mode only
Servo system parameter changes (G code: G69)	Servo system parameters can be changed by a G code.	Not supported.
Servo-lock	There is a brake signal timing adjustment function.	There is no brake signal timing adjustment function.
Servo-unlock	There is a brake signal timing adjustment function. Servo-unlock can be used at any time.	There is no brake signal timing adjustment function. Servo-unlock cannot be used while other manual commands are being executed.
Error log	Up to 20 items can be saved.	Not supported.
Absolute value initial setting	Integrated with absolute origin setting.	Not supported.
Absolute value software reset		Not supported.
MPG Operating Flag	Busy signal is used instead.	Not supported.
Servo data trace function	Traces servo data. Can be used with CX-Motion.	Not supported.
Data transfer method	All data is transferred using IORD or IOWR.	Data is transferred by means of either I/O transfers or IORD/IOWR.
Present position preset	Executed by IOWR.	Executed by special interrupt bit.
Setting teaching address	Executed by IOWR.	Executed by special interrupt bit.
Saving to flash memory	Executed by IOWR.	Executed by special interrupt bit.
Emergency stop method	Stopped by accumulated pulse method or by operation command output turning OFF after a 0 V output.	Stop by turning OFF operation command output.
Automatic loading	G-language programs and position data are downloaded from a personal computer by means of commands from the CPU Unit, used in combination with CX-Motion.	Not supported.

■ Performance

The following table shows the typical values of each performance item. These values, however, vary according to the task configuration, axis configuration, and so on. For details, refer to the *Motion Control Units Operation Manual* (W359-E1-1).

Item	Typical value	Description
Power ON startup time	Average: 600 ms	Time from turning ON the power until manual operation commands are accepted.
Cyclic service time	CS1W-MC221: 0.8 ms/Unit CS1W-MC421: 0.85 ms/Unit	Time by which the CPU Unit cycle time will be extended per MC Unit.
IOWR execution time	0.7 ms/instruction	Time by which the cycle time will be extended when IOWR is executed.
IORD execution time	0.8 ms/instruction	Time by which the cycle time will be extended when IORD is executed.
Data write time	475 ms/1,000 words	Time from when IOWR is executed until data transfer is completed.
Data read time	470 ms/1,000 words	Time from when IORD is executed until data transfer is completed.
Operation startup time	CS1W-MC221: 8 ms CS1W-MC421: 12 ms	MC221: Time for X axis operation with a 1-task, 2-axis configuration. MC421: Time for X axis operation with a 1-task, 4-axis configuration.
Analog voltage output time lag per axis for interpolation	CS1W-MC221: 150 μs CS1W-MC421: 210 μs	Time delay when interpolation is performed for 1 task.
Analog voltage output time lag per axis for independent operation	CS1W-MC221: 4.3 ms/axis CS1W-MC421: 4.3 ms/axis	Time delay when one axis each is started for all tasks simultaneously.
Interrupt notification time	2.25 ms	When C200H□-series Special I/O Unit is not mounted.
G language interpretation time	CS1W-MC221: 2.0 ms CS1W-MC421: 4.2 ms	Interpretation time for G language when axis movement is not performed.
Minimum operation time	CS1W-MC221: 8.5 ms CS1W-MC421: 9.5 ms	When the time for linear interpolation is equal to or less than the values give, Stop Mode operation will be used even in Pass Mode or In-Position Check OFF Mode.
Minimum traverse reversal time	2 ms	Reversing operation is possible every 2 ms for traverse operation.
External input response time	General purpose input: 1 ms max. Emergency stop input: 4.5 ms max. CW/CCW limit input: 4.5 ms max. Origin proximity input: 4.5 ms	Response time to external input signals.
Zone Flag notification time	CS1W-MC221: 14.08 ms CS1W-MC421: 34.08 ms	The time required for one Zone Flag to respond.

■ G Language

Example

Block number (N000 to N999): Equivalent to a program line number.

N000 P001 XY
  └─ Program number and axis declaration

N001 G91 ◄─ G code: 2-digit number following "G" represents a command.
  └─ Incremental Specification

N002 G00 X100 Y50 M001
  └─ Positioning: Moves the X axis by 100 and the Y axis by 50 from the present position, and outputs M code 001 after positioning has been completed.

Code	Name	Function	
		4-axis MCU	**2-axis MCU**
		CS1W-MC221	**CS1W-MC421**
G00	Positioning	Positions up to 2 or 4 axes simultaneously with PTP control at the maximum feed rate.	
G01	Linear Interpolation	Performs linear interpolation on 1, 2, 3, or 4 axes (1 or 2 axes for MC221). The specified axes move simultaneously. The feed rate can be specified.	
G02	Circular Interpolation (Clockwise)	Performs 2-axis circular interpolation in the clockwise direction at the specified interpolation feed rate.	
G03	Circular Interpolation (Counterclockwise)	Performs 2-axis circular interpolation in the counterclockwise direction at the specified interpolation feed rate.	
G04	Dwell Timer	Waits for the specified length of time.	
G10	Pass Mode	Performs operations one-by-one in sequence without waiting for deceleration to stop.	
G11	Stop Mode	Performs the next operation after completing positioning.	
G13	IN-POSITION CHECK OFF MODE	Starts the next operation without waiting for positioning to be completed.	
G17	Circular Plane Specification (X-Y)	Sets the X-Y plane as the plane for circular interpolation.	
G18	CIRCULAR PLANE SPECIFICATION (X-Z)	Sets the X-Z plane as the plane for circular interpolation.	
G19	CIRCULAR PLANE SPECIFICATION (Y-Z)	Sets the Y-Z plane as the plane for circular interpolation.	
G20	CIRCULAR PLANE SPECIFICATION (X-U)	Sets the X-U plane as the plane for circular interpolation.	
G21	CIRCULAR PLANE SPECIFICATION (Y-U)	Sets the Y-U plane as the plane for circular interpolation.	
G22	CIRCULAR PLANE SPECIFICATION (Z-U)	Sets the Z-U plane as the plane for circular interpolation.	
G26	Reference Origin Return	Moves to the reference origin.	
G27	Workpiece Origin Return	Moves to the workpiece origin.	
G28	Origin Search	Performs an origin search on the specified axis.	
G29	Origin UNDEFINED	Sets the origin to an undefined state.	
G30	SPEED CONTROL	Feeds up to 2 axes simultaneously at the controlled feed rate.	
G31	INTERRUPT FEEDING	Performs an interrupt feeding operation.	
G32	traverse	Executes traverse operation.	
G50	Select Reference Coordinate System	Specifies the reference coordinate system.	
G51	Select Workpiece Coordinate System	Specifies the workpiece coordinate system.	
G53	Change Workpiece Origin Offset	Changes the origin of the workpiece coordinate system.	
G54	Change Reference Coordinate System PV	Changes the present value in the reference coordinate system.	
G60	Arithmetic Operations	Performs arithmetic operations on numerical values, position data, and registers.	
G63	Substitution	Substitutes numerical values, position data, or registers into other position data or registers.	
G69	Change Parameter	Changes the specified parameter.	
G70	Unconditional Jump	Unconditionally jumps to the specified block.	
G71	Conditional Jump	Jumps to the specified block when the condition is met.	
G72	Subroutine Jump	Calls the specified subroutine.	
G73	Subroutine End	Ends the subroutine.	
G74	Optional End	Ends the block currently being executed when the specified optional input is ON.	
G75	Optional Skip	Skips the block after this command when the specified optional input is ON.	
G76	Optional Program Stop	Pauses the program when the specified optional input is ON.	
G79	Program End	Ends the main program.	
G90	Absolute Specification	Positions with absolute coordinates when performing axis operations.	
G91	Incremental Specification	Positions with relative coordinates when performing axis operations.	

■ Auxiliary Codes

Code	Name	Function	
		4-axis MCU	**2-axis MCU**
		CS1W-MC221	**CS1W-MC421**
M	M code	Outputs an M code.	
D	D code	Starts an external interrupt task for the CPU Unit.	

■ System Configuration

Control System

Semi-closed Loop System

Feedback pulses and present value information (for absolute encoders)

Analog output

Servodriver

Servomotor

Tachogenerator
Rotary encoder

Connected Configuration

MPG or synchronous encoder

MC Unit (Example: CS1W-MC421)

MPG connector

DRV X, Y connectors

CPU Unit

Power Supply Unit

CX-Motion

Teaching Box

For connection to peripheral port on CPU Unit: CS1W-CN□□□
For connection to RS-232C port on CPU Unit: XW2Z-□00S(-CV)

XW2Z-100J-F1 MC Unit Terminal Block Connecting Cable or user-prepared cable

Servodriver Connecting Cable (for U/H/M-series) or user-prepared cable

DRV Z, U connectors

I/O connector

Servodriver

Servomotor

MC Unit Terminal Block
CS1W-MC421: XW2B-40J6-7
CS1W-MC221: XW2B-20J6-6

CS1W-MC421: 4 axes
CS1W-MC221: 2 axes

Servodriver

Servomotor

CCW limit input
CW limit input
Origin proximity input
Emergency stop input

for 4 or 2 axes

General-purpose inputs (4)
General-purpose outputs (4)

■ Exchanging Data

CS1 CS1W-MC221

CIO Area Words

2000 to 2029	Unit #0
2010 to 2039	Unit #1
2020 to 2049	Unit #2
2030 to 2059	Unit #3
n to n+29	
2900 to 2929	Unit #90
2910 to 2939	Unit #91
2920 to 2949	Unit #92
2930 to 2959	Unit #93
Reserved	Unit #94
Reserved	Unit #95

Transferred to each Unit during I/O refresh

I/O Refresh Data Area

n
⌇
n+9   OUT refresh
n+10
⌇   IN refresh
n+25
n+26
⌇   Reserved
n+29

A total of 30 words used.

n: 2000 + 10 × unit number

Internal memory

Address
0000   Position data

System parameters

Monitor information

6117   Special information

Data saved.   At startup or when restarted.

Flash memory

G-language program

N000 ······

Data Memory Area

(Allocated areas are not used)

Data transfer words

Data

IOWR/IORD instructions

CS1 CS1W-MC421

CIO Area Words

2000 to 2049	Unit #0
2010 to 2059	Unit #1
2020 to 2069	Unit #2
2030 to 2079	Unit #3
n to n+49	
2900 to 2949	Unit #90
2910 to 2959	Unit #91
Reserved	Unit #92
Reserved	Unit #93
Reserved	Unit #94
Reserved	Unit #95

Transferred to each Unit during I/O refresh

I/O Refresh Data Area

n
⌇
n+17   OUT refresh
n+18
⌇   IN refresh
n+47
n+48
n+49   Reserved

A total of 50 words used.

n: 2000 + 10 × unit number

Internal memory

Address
0000   Position data

System parameters

Monitor information

Special information

Data saved.   When powered up or restarted.

Flash memory

G-language program

N000 ······

Data Memory Area

(Allocated areas are not used)

Data transfer words

Data

IOWR/IORD instructions

■ Component Names

CS1W-MC221

CS1W-MC421

Indicators

Indicator	Color	Status	Meaning
RUN	Green	ON	The MC Unit is operating normally.
		OFF	The MC Unit is not recognized by the PC or is malfunctioning.
ERC	Red	ON	An error occurred in the MC Unit.
		OFF	The MC Unit is operating normally.
ERH	Red	ON	An error occurred in the CPU Unit.
		OFF	The CPU Unit is operating normally.
XCCW YCCW ZCCW (See note.) UCCW (See note.)	Yellow	ON	The motor for the applicable axis is turning in the CCW direction. (The X to U axes correspond to XCCW to UCCW.)
		OFF	The applicable axis is stopped or is turning in the CW direction.
XCW YCW ZCW (See note.) UCW (See note.)	Yellow	ON	The motor for the applicable axis is turning in the CW direction. (The X to U axes correspond to XCW to UCW.)
		OFF	The applicable axis is stopped or is turning in the CCW direction.

Note: The CS1W-MC221 does not have the ZCCW, UCCW, ZCW, and UCW indicators.
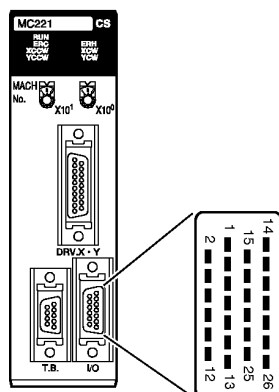
■ **I/O Connector Wiring**
I/O Connector
Snap-on Connector
Connector: 10126-3000VE (provided with the Unit, manufactured by Sumitomo 3M)
Case: 10326-52F0-008 (provided with the Unit, manufactured by Sumitomo 3M)

CS1W-MC221

CS1W-MC221

Pin	Symbol	Terminal on MC Unit terminal block	Name	Function		
1	+24 V	10	24-VDC input	Connects to the + terminal of the 24-VDC external power supply.		
2	XCWL (NC)	11	X-axis CW limit input	Limits movement of the X axis in the CW direction.		
3	YCWL (NC)	16	Y-axis CW limit input	Limits movement of the Y axis in the CW direction.		
4	XCCWL (NC)	12	X-axis CCW limit input	Limits movement of the X axis in the CCW direction.		
5	YCCWL (NC)	17	Y-axis CCW limit input	Limits movement of the Y axis in the CCW direction.		
6	XSTOP (NC)	14	X-axis emergency stop input	Disables the X-axis run output and stops it.		
7	YSTOP (NC)	8	Y-axis emergency stop input	Disables the Y-axis run output and stops it.		
8	IN1 (NO)	4	General input 1	General input 1		
9	IN2 (NO)	9	General input 2	General input 2		
10	XORG (NC, NO) (See note 1)	13	X-axis origin proximity input	Used for the X-axis origin search.		
11	YORG (NC, NO) (See note 1)	18	Y-axis origin proximity input	Used for the Y-axis origin search.		
12	OUT1 (See note 3)	15	General output 1	General output 1 or X-axis brake signal output		
13	OUT2 (See note 3)	19	General output 2	General output 2 or Y-axis brake signal output		
14	DC GND	0	24-VDC input ground	Connects to the – terminal (0 V) of the 24-VDC external power supply.		
15	---	---				
16	MPG-A	See note 2	MPG input phase A	MPG input phase A	See note 1
17	MPG-B	See note 2	MPG input phase B	MPG input phase B	
18	MPG-$\overline{A}$	See note 2	MPG input phase $\overline{A}$	MPG input phase $\overline{A}$	
19	MPG-$\overline{B}$	See note 2	MPG input phase $\overline{B}$	MPG input phase $\overline{B}$	
20	---	---				
21	IN3 (NO)	See note 2	General input 3	General input 3		
22	IN4 (NO)	See note 2	General input 4	General input 4		
23	---	---				
24	---	---				
25	OUT3	See note 2	General output 3	General output 3		
26	OUT4	See note 2	General output 4	General output 4		

"NC" stands for normally closed and "NO" stands for normally open.

Note: 1. For the CS1W-MC221, connect the MPG to this I/O connector. For the connection method, refer to *MPG Connection Example* on page 23.

          2. MPG inputs, and general outputs 3 and 4 cannot be connected from the terminal block.

CS1W-MC421

CS1W-MC421
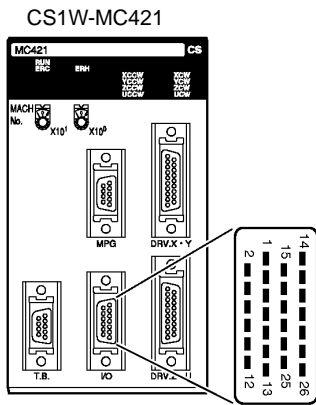
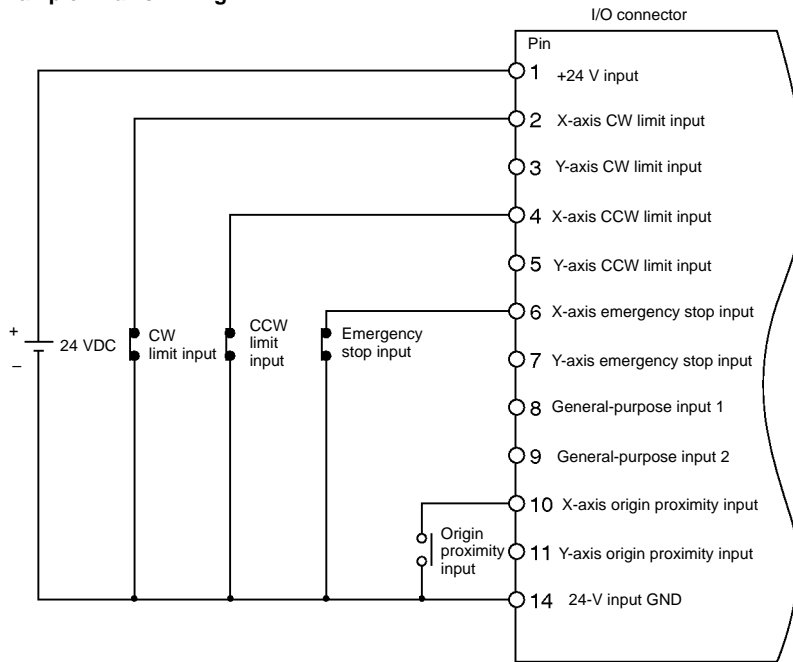| Pin	Symbol	Terminal on MC Unit terminal block	Name	Function
1	+24 V	20	24-VDC input	Connects to the + terminal of the 24-VDC external power supply.
2	XCWL (NC)	21	X-axis CW limit input	Limits movement of the X axis in the CW direction.
3	YCWL (NC)	26	Y-axis CW limit input	Limits movement of the Y axis in the CW direction.
4	XCCWL (NC)	22	X-axis CCW limit input	Limits movement of the X axis in the CCW direction.
5	YCCWL (NC)	27	Y-axis CCW limit input	Limits movement of the Y axis in the CCW direction.
6	XSTOP (NC)	24	X-axis emergency stop input	Disables the X-axis run output and stops it.
7	YSTOP (NC)	8	Y-axis emergency stop input	Disables the Y-axis run output and stops it.
8	IN1 (NO)	4	General input 1	General input 1
9	IN2 (NO)	9	General input 2	General input 2
10	XORG (NC, NO) (See note 1)	23	X-axis origin proximity input	Used for the X-axis origin search.
11	YORG (NC, NO) (See note 1)	28	Y-axis origin proximity input	Used for the Y-axis origin search.
12	OUT1 (See note 2)	25	General output 1	General output 1 or X-axis brake signal output
13	OUT2 (See note 2)	29	General output 2	General output 2 or Y-axis brake signal output
14	DC GND	0	24-VDC input ground	Connects to the – terminal (0 V) of the 24-VDC external power supply.
15	ZCWL (NC)	31 (See note 5)	Z-axis CW limit input	Limits movement of the Z axis in the CW direction.
16	UCWL (NC)	36 (See note 3)	U-axis CW limit input	Limits movement of the U axis in the CW direction.
17	ZCCWL (NC)	32 (See note 3)	Z-axis CCW limit input	Limits movement of the Z axis in the CCW direction.
18	UCCWL (NC)	37 (See note 3)	U-axis CCW limit input	Limits movement of the U axis in the CCW direction.
19	ZSTOP (NC)	34 (See note 3)	Z-axis emergency stop input	Disables the Z-axis run output and stops it.
20	USTOP (NC)	18 (See note 5)	U-axis emergency stop input	Disables the U-axis run output and stops it.
21	IN3 (NO)	14 (See note 4)	General input 3	General input 3
22	IN4 (NO)	19 (See note 4)	General input 4	General input 4
23	ZORG (NC, NO) (See note 1)	33 (See note 5)	Z-axis origin proximity input	Used for the Z-axis origin search.
24	UORG (NC, NO) (See note 1)	38 (See note 5)	U-axis origin proximity input	Used for the U-axis origin search.
25	OUT3	35 (See note 4)	General output 3	General output 3
26	OUT4	39 (See note 4)	General output 4	General output 4

"NC" stands for normally closed and "NO" stands for normally open.

3. When the CS1W-MC221 and the XW2B-40J6-7 are connected, these terminals will be used as MPG inputs.

4. When the CS1W-MC221 and the XW2B-40J6-7 are connected, these terminals will be allocated as general inputs/outputs 3 and 4.

5. When the CS1W-MC221 and the XW2B-40J6-7 are connected, these terminals will not be used.

External Connection Diagram

Using the Connector

Example: X-axis Wiring

I/O connector

Pin	
1	+24 V input
2	X-axis CW limit input
3	Y-axis CW limit input
4	X-axis CCW limit input
5	Y-axis CCW limit input
6	X-axis emergency stop input
7	Y-axis emergency stop input
8	General-purpose input 1
9	General-purpose input 2
10	X-axis origin proximity input
11	Y-axis origin proximity input
14	24-V input GND

24 VDC
CW limit input
CCW limit input
Emergency stop input
Origin proximity input

Connector:
Wire and assemble the connector by using the connector case provided with the Unit or by using the XW2Z-100J-F1 MC Unit Terminal Block Connecting Cable.

Using the MC Unit Terminal Block

Example: X-axis Wiring
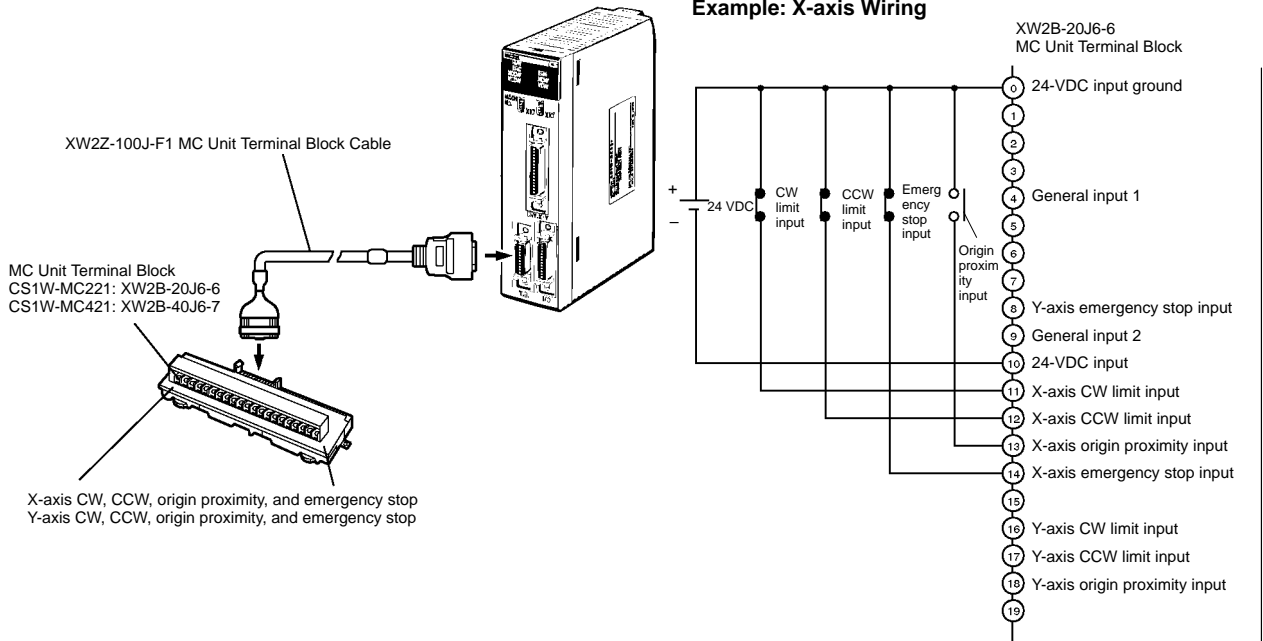
XW2Z-100J-F1 MC Unit Terminal Block Cable

MC Unit Terminal Block
CS1W-MC221: XW2B-20J6-6
CS1W-MC421: XW2B-40J6-7

X-axis CW, CCW, origin proximity, and emergency stop
Y-axis CW, CCW, origin proximity, and emergency stop

XW2B-20J6-6
MC Unit Terminal Block

Pin	
0	24-VDC input ground
1	
2	
3	
4	General input 1
5	
6	
7	
8	Y-axis emergency stop input
9	General input 2
10	24-VDC input
11	X-axis CW limit input
12	X-axis CCW limit input
13	X-axis origin proximity input
14	X-axis emergency stop input
15	
16	Y-axis CW limit input
17	Y-axis CCW limit input
18	Y-axis origin proximity input
19	

24 VDC
CW limit input
CCW limit input
Emergency stop input
Origin proximity input

19

■ DRV Connector Wiring
DRV X-Y and Z-U Connectors

The DRV connectors are used primarily to connect servodrivers. The DRV X-Y connector is for the X and Y axes, and the DRV Z-U connector is for the Z and U axes.
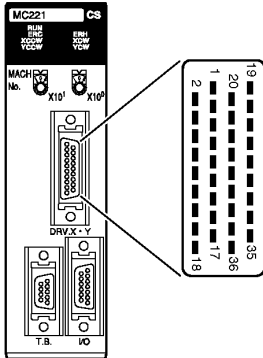
Special driver cables, which are sold separately, are available for OMRON U-, H-, and M-series Servodrivers.

Snap-on Connectors
    Connector: 10136-3000VE (provided with the Unit, manufactured by Sumitomo 3M)
    Case: 10336-52F0-008 (provided with the Unit, manufactured by Sumitomo 3M)

CS1W-MC221

CS1W-MC221

Pin	Symbol	Name	Function
1	+24 V	24 VDC input	External power supply's 24-VDC input (for the X-Y axes)
2	DC GND	24 VDC input ground	External power supply's 24-VDC ground (for the X-Y axes)
3	XALM	X-axis alarm input	Driver alarm input for the X-axis
4	XRUN	X-axis run output	Driver run output for the X-axis
5	XALMRS	X-axis alarm reset output	Reset output for the X-axis's driver alarm.
6	---	---	Not used.
7	---	---	Not used.
8	XSGND	X-axis SEN signal ground	SEN signal ground for the X-axis
9	XSOUT	X-axis SEN signal output	SEN signal output for the X-axis (absolute encoder driver)
10	X-GND	X-axis feedback ground	Feedback ground for the X-axis
11	X-A	X-axis phase A input	Phase A feedback input for the X-axis
12	X-$\overline{A}$	X-axis phase $\overline{A}$ input	Phase $\overline{A}$ feedback input for the X-axis
13	X-B	X-axis phase B input	Phase B feedback input for the X-axis
14	X-$\overline{B}$	X-axis phase $\overline{B}$ input	Phase $\overline{B}$ feedback input for the X-axis
15	X-Z	X-axis phase Z input	Phase Z feedback input for the X-axis
16	X-$\overline{Z}$	X-axis phase $\overline{Z}$ input	Phase $\overline{Z}$ feedback input for the X-axis
17	XOUT	X-axis speed control	Speed control voltage to the X-axis driver
18	XAGND	X-axis speed control ground	Ground for the X-axis's speed control voltage
19	+F24V	24 VDC output	24-VDC input to the driver (for the X-Y axes)
20	FDC GND	24 VDC output ground	Ground for 24-VDC outputs (for the X-Y axes)
21	YALM	Y-axis alarm input	Driver alarm input for the Y-axis
22	YRUN	Y-axis run output	Driver run output for the Y-axis
23	YALMRS	Y-axis alarm reset output	Reset output for the Y-axis's driver alarm.
24	---	---	Not used.
25	---	---	Not used.
26	YSGND	Y-axis SEN signal ground	SEN signal ground for the Y-axis
27	YSOUT	Y-axis SEN signal output	SEN signal output for the Y-axis (absolute encoder driver)
28	Y-GND	Y-axis feedback ground	Feedback ground for the Y-axis
29	Y-A	Y-axis phase A input	Phase A feedback input for the Y-axis
30	Y-$\overline{A}$	Y-axis phase $\overline{A}$ input	Phase $\overline{A}$ feedback input for the Y-axis
31	Y-B	Y-axis phase B input	Phase B feedback input for the Y-axis
32	Y-$\overline{B}$	Y-axis phase $\overline{B}$ input	Phase $\overline{B}$ feedback input for the Y-axis
33	Y-Z	Y-axis phase Z input	Phase Z feedback input for the Y-axis
34	Y-$\overline{Z}$	Y-axis phase $\overline{Z}$ input	Phase $\overline{Z}$ feedback input for the Y-axis
35	YOUT	Y-axis speed control	Speed control voltage to the Y-axis driver
36	YAGND	Y-axis speed control ground	Ground for the Y-axis's speed control voltage

CS1W-MC421   **CS1W-MC421**

Pin	Symbol	Name	Function
1	+24 V	24 VDC input	External power supply's 24-VDC input (for the Z-U axes)
2	DC GND	24 VDC input ground	External power supply's 24-VDC ground (for the Z-U axes)
3	ZALM	Z-axis alarm input	Driver alarm input for the Z-axis
4	ZRUN	Z-axis run output	Driver run output for the Z-axis
5	ZALMRS	Z-axis alarm reset output	Reset output for the Z-axis's driver alarm.
6	---	---	Not used.
7	---	---	Not used.
8	ZSGND	Z-axis SEN signal ground	SEN signal ground for the Z-axis
9	ZSOUT	Z-axis SEN signal output	SEN signal output for the Z-axis (absolute encoder driver)
10	Z-GND	Z-axis feedback ground	Feedback ground for the Z-axis
11	Z-A	Z-axis phase A input	Phase A feedback input for the Z-axis
12	Z-$\overline{A}$	Z-axis phase $\overline{A}$ input	Phase $\overline{A}$ feedback input for the Z-axis
13	Z-B	Z-axis phase B input	Phase B feedback input for the Z-axis
14	Z-$\overline{B}$	Z-axis phase $\overline{B}$ input	Phase $\overline{B}$ feedback input for the Z-axis
15	Z-Z	Z-axis phase Z input	Phase Z feedback input for the Z-axis
16	Z-$\overline{Z}$	Z-axis phase $\overline{Z}$ input	Phase $\overline{Z}$ feedback input for the Z-axis
17	ZOUT	Z-axis speed control	Speed control voltage to the Z-axis driver
18	ZAGND	Z-axis speed control ground	Ground for the Z-axis's speed control voltage
19	+F24V	24 VDC output	24-VDC input to the driver (for the Z-U axes)
20	FDC GND	24 VDC output ground	Ground for 24-VDC outputs (for the Z-U axes)
21	UALM	U-axis alarm input	Driver alarm input for the U-axis
22	URUN	U-axis run output	Driver run output for the U-axis
23	UALMRS	U-axis alarm reset output	Reset output for the U-axis's driver alarm.
24	---	---	Not used.
25	---	---	Not used.
26	USGND	U-axis SEN signal ground	SEN signal ground for the U-axis
27	USOUT	U-axis SEN signal output	SEN signal output for the U-axis (absolute encoder driver)
28	U-GND	U-axis feedback ground	Feedback ground for the U-axis
29	U-A	U-axis phase A input	Phase A feedback input for the U-axis
30	U-$\overline{A}$	U-axis phase $\overline{A}$ input	Phase $\overline{A}$ feedback input for the U-axis
31	U-B	U-axis phase B input	Phase B feedback input for the U-axis
32	U-$\overline{B}$	U-axis phase $\overline{B}$ input	Phase $\overline{B}$ feedback input for the U-axis
33	U-Z	U-axis phase Z input	Phase Z feedback input for the U-axis
34	U-$\overline{Z}$	U-axis phase $\overline{Z}$ input	Phase $\overline{Z}$ feedback input for the U-axis
35	UOUT	U-axis speed control	Speed control voltage to the U-axis driver
36	UAGND	U-axis speed control ground	Ground for the U-axis's speed control voltage

Servodriver Cables (Optional)

When using OMRON's U-, H-, or M-series Servodrivers, use Special Servodriver Cables that are available as options to connect the MC Unit to Servodrivers.

Connector:
When the Special Cables shown on the left are not to be used, wire and assemble the connector by using the connector case provided with the Unit.

Series		Cable model number		Length (m)
		For two axes	**For single axis**	
U-series	R88D-U for 30-W to 750-W Servodrivers	R88A-CPU001M2	R88A-CPU001M1	1.0
		R88A-CPU002M2	R88A-CPU002M1	2.0
	R88D-U for 1-W to 5-kW Servodrivers	R88A-CPUB001M2	R88A-CPUB001M1	1.0
		R88A-CPUB002M2	R88A-CPUB002M1	2.0
H-series	R88D-H	R88A-CPH001M2	R88A-CPH001M1	1.0
		R88A-CPH002M2	R88A-CPH002M1	2.0
M-series	R88D-M	R88A-CPM001M2	R88A-CPM001M1	1.0
		R88A-CPM002M2	R88A-CPM002M1	2.0
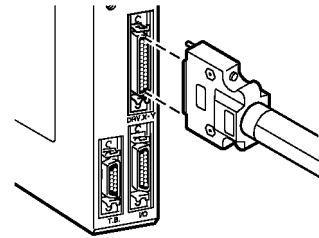
U-series Servodrivers:
R88A-CPU001M2/002M2 (30 to 750 W)
R88A-CPUB001M2/002M2 (1 to 5 kW)

H-series Servodrivers:
R88A-CPH001M2/002M2

M-series Servodrivers:
R88A-CPM001M2/002M2
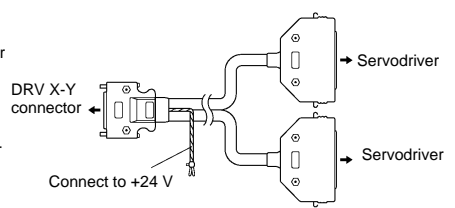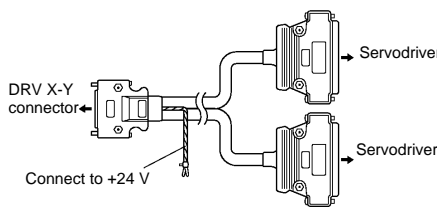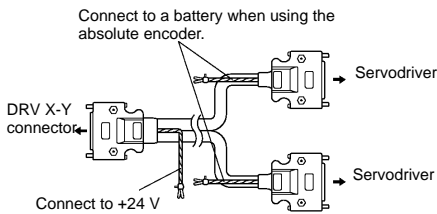
Connection Examples

Connection to U-series (30-W to 750-W) Models (Using an Absolute Encoder)
Special Driver Cable: R88A-CPU00□M2
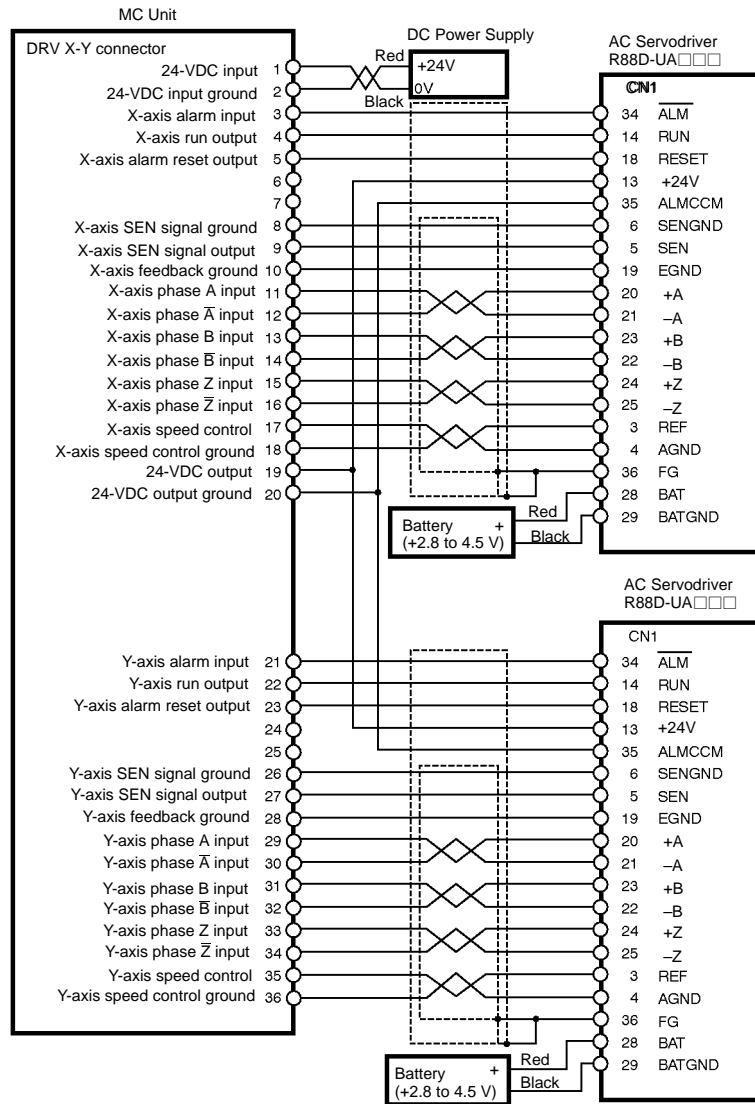
■ MPG Connector Wiring

MPG Connector (for CS1W-MC421 Only)

The MPG connector is used to connect a manual pulse generator (MPG). With the CS1W-MC421, it is wired with an MPG connector. With the CS1W-MC221, there is an MPG terminal on the I/O connector.
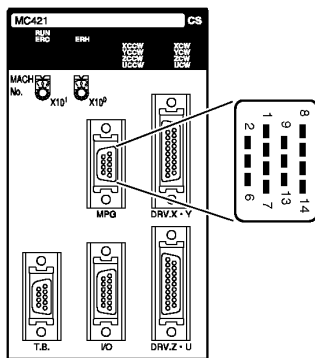
Manual Pulse Generator (MPG)

Use a line driver model for the MPG. The LGF-003-100 (by Sumtak) is recommended.
Snap-on Connectors
Connector: 10114-3000VE (provided with the Unit, manufactured by Sumitomo 3M)
Case: 10314-52F0-008 (provided with the Unit, manufactured by Sumitomo 3M)

CS1W-MC421

Pin	Symbol	Name
5	MPG-$\overline{A}$	MPG input phase $\overline{A}$
6	MPG-A	MPG input phase A
12	MPG-$\overline{B}$	MPG input phase $\overline{B}$
13	MPG-B	MPG input phase B

MPG Connection Example
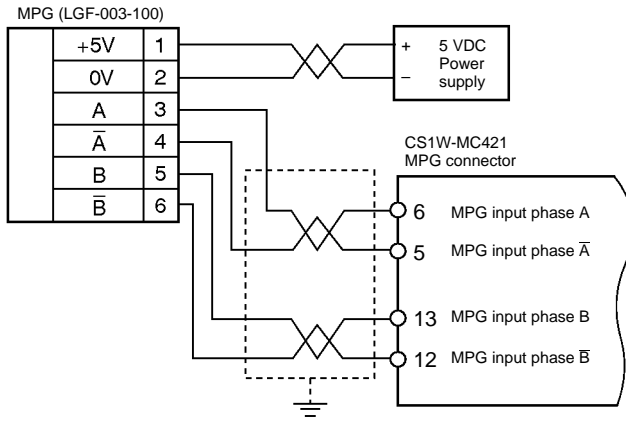
Note: For the CS1W-MC221, use the I/O connector.
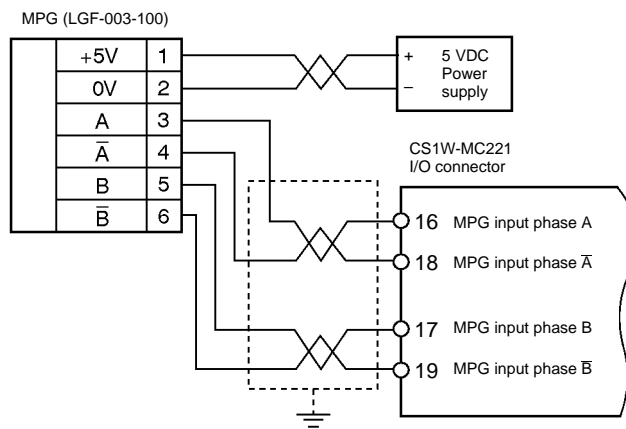
ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Authorized Distributor:

Note: Specifications subject to change without notice.

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