Personal Computer Embedded Type Servo System Controller
CC-Link IE Simple Motion Board/
MELSOFT EM Software Development Kit

Motion Control on PC Environment with
CC-Link IE Field Network
GLOBAL IMPACT OF MITSUBISHI ELECTRIC

We bring together the best minds to create the best technologies. At Mitsubishi Electric, we understand that technology is the driving force of change in our lives. By bringing greater comfort to daily life, maximizing the efficiency of businesses and keeping things running across society, we integrate technology and innovation to bring changes for the better.

Changes for the Better

Mitsubishi Electric is involved in many areas including the following:

**Energy and Electric Systems**
A wide range of power and electrical products from generators to large-scale displays.

**Electronic Devices**
A wide portfolio of cutting-edge semiconductor devices for systems and products.

**Home Appliance**
Dependable consumer products like air conditioners and home entertainment systems.

**Information and Communication Systems**
Commercial and consumer-centric equipment, products and systems.

**Industrial Automation Systems**
Maximizing productivity and efficiency with cutting-edge automation technology.

Through Mitsubishi Electric’s vision, “Changes for the Better” are possible for a brighter future.
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Personal Computer Embedded Type Servo System Controller

CC-Link IE
Simple Motion Board
Numerous motion control functions on PC environment
Numerous motion control functions are available and can be applied to various machines by the Simple Motion board being embedded to an industrial personal computer (IPC) which performs customer data processing (recipe data and logging data) and image data processing.

Easy programming and increased efficiency in debugging with engineering software
Easy programming is possible with Visual C++® by adding an API library and a PCI Express® device driver to the IPC. Additionally, the engineering software achieves increased efficiency in debugging because the software enables settings and monitoring of servo amplifiers and various field devices.

Seamless integration of Mitsubishi Electric’s servo system into one network
CC-Link IE Field Network is a single network which combines the versatility of Ethernet and highly accurate synchronous operation for motion control. With the single network, various field devices, such as servo amplifiers, I/O modules, and high-speed counter modules, are connected with no restriction.
Numerous motion control functions, such as positioning, synchronous control, and speed-torque control are performed by the Simple Motion board being embedded in a PC which supports PCI Express®.

- Various field devices, such as servo amplifiers, I/O modules, and high-speed counter modules are connected flexibly with the same network.
- The Simple Motion board functions as a master station of CC-Link IE Field Network.
- The interrupt function via PCI Express® enables an event-driven program to be created with Visual C++®.
Servo System Configuration

The Simple Motion board is equipped with not only functions for Motion control, but also a function as a master station of CC-Link IE Field Network. Up to 120 stations including servo amplifiers are connectable.

Motion mode:
This mode enables advanced motion control functions, such as positioning for multi-axis interpolation, synchronous control, and speed-torque control in combination with the Simple Motion board.
Maximum number of control axes: 16 axes

I/O mode:
With CC-Link IE Field Network, various field devices, such as servo amplifiers, I/O modules, and high-speed counter modules, can be connected with no restriction.
Maximum number of control stations: 120 stations (including the number of servo amplifiers for motion mode)

Application Examples
Selecting the best suitable control methods and functions for your machine achieves an optimal solution.
Positioning Control

● To respond to various application needs, the Simple Motion board offers various control functions, such as linear interpolation, 2-axis circular interpolation, fixed-pitch feed, and continuous trajectory control.
● Automatic operation can be executed easily by setting positioning addresses, speeds, and other setting items with the API library.
● Powerful sub-functions, such as M-code output, skip, speed change, and target position change, are available.

```
void StartPositioningSample( MMC_Axis* axis1 )
{
    unsigned long retCode;

    /* Starts positioning by positioning data No.1 */
    retCode = axis1->StartPositioning( 1 );
    if( retCode != MMC_OK ) {
        /* Error processing */
    }

    /* Waits until completion of positioning control */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_INP, 10000 );
    if( retCode != MMC_OK ) {
        /* Error processing */
    }
}
```

Helical interpolation

Helical interpolation draws a helical path by a linear interpolation axis (Z-axis) following to 2-axis circular interpolation control (X-axis and Y-axis). For applications that require the boring of deep, large holes, usually the helical interpolation of the three axes must be taken into consideration.

● Milling is done in a circle, with the X and Y axes synchronized to achieve the pre-set size.
● The depth of the hole is simultaneously controlled along the Z axis, ensuring minimal deviation in the cutting bit position.

Block-start

The block-start executes multiple sequential positioning data set as block start data by a single start trigger, and is used in control that follows the same repetitive path.

Positioning starts from “First point” in block start data to draw four squircles.
### Speed-Torque Control

Speed control follows speed commands to keep the speed constant, and torque control follows torque commands to keep the torque constant. The Simple Motion board can be used for the speed-torque control, such as unwinding and rewinding. Positioning using absolute position coordinates can be smoothly performed even after switching back to position control because the current position is controlled during the speed-torque control.

### Advanced Synchronous Control

Advanced synchronous control is software-based synchronous control as an alternative to mechanical control, such as gear, shaft, clutch, speed change gear, and cam. In addition, a cam is easily generated with cam auto-generation function. The synchronous control can be started and ended for each axis, allowing the synchronous control axis and positioning control axis within the same program.

```c
void SynchronizationSample
    ( MMC_Controller *controller,
      MMC_Axis *axis1, MMC_Axis *axis4 )
{
    unsigned long retCode;
    /* Starts synchronous control */
    retCode = axis1->StartSync();
    if( retCode != MMC_OK ) {
        /* Error processing */
    } /* Starts JOG operation of virtual servo axis */
    retCode = axis4->StartJog( 20000 );
    if( retCode != MMC_OK ) {
        /* Error processing */
    } /* Stops synchronous control */
    axis1->StopSync();
    if( retCode != MMC_OK ) {
        /* Error processing */
    }
}
```

#### Cam auto-generation

Cam data for a rotary knife can be automatically generated by parameter settings of sheet length, synchronization width, cam resolution, etc.
Direct control

The direct control is a function that controls servo amplifiers directly by transmitting set command positions for each operation cycle from a user program to the servo amplifiers.

- The direct control can be combined with positioning control.
- Control can be switched between the direct control and the positioning control.
- A personal computer with a real-time operating system can perform fixed-cycle Motion control using interrupts at every operation cycle.
- Thanks to the position command buffers of up to 16 phases, even non-real-time operating system (Windows®) can perform at 0.5 ms (the fastest rate) cycle command operation; This enables further increase in accuracy in trajectory control.

```
void __stdcall DirectControlInterruptHandler
    (MMST_InterruptData *interruptData)
{
    MMC_Controller *controller;  // Assume the controller's pointer
    for (axisCnt = 0; axisCnt < AXIS_MAX; axisCnt++)
    {
        // Direct control check enable flag
        if (enableFlag & (1 << axisCnt))
        {
            for (cmdCnt = 0; cmdCnt < dataCnt; cmdCnt++)
            {
                cmdPos[axisCnt] = cmdBuff.posData[cmdCnt];
                // Process the position command
            }
        }
    }
}
```

Event history

Events occurred on each slave device and servo amplifiers can be stored to the Simple Motion board. Information of "WRITE" operation to the program, error occurrence, etc. is listed chronologically, enabling an investigation of the cause of the error and a prompt restoration of servo amplifiers.
System configuration

- **Simple Motion board** MR-EM340GF
- Forced stop input (24 V DC)

**Engineering environment**
- MELSOFT EM Software Development Kit

**[External input signals of a servo amplifier]** (Note-1)
- FLS, RLS, DOG

**MR-J4-GF**
- Motion mode: Up to 16 axes
- **MR-J4-GF-RJ**
  - Motion mode: Up to 16 axes

**[External input signals]** (Note-1)
- FLS, RLS, DOG

**Rotary servo motor**
- Linear servo motor
- Direct drive motor

**CC-Link IE Field**
- Bridge module

**CC-Link AnyWire Bridge module**
- High-speed counter module

**Remote I/O module**
- Sensor
- Photoelectric sensor (diffuse reflection type)

**HMI (GOT)**
- Head module

**Inverter**
- Remote I/O module
- Sensor

**Remote I/O module**
- Sensor

**Inverter Local station**
- Analog module

**AnyWire Bridge module**
- Photoelectric sensor (diffuse reflection type)

(Note-1): An input destination of external input signals (FLS, RLS, and DOG) is changed by parameters.

Slave station: Up to 120 control stations (including the number of motion mode compatible servo amplifiers)

(Note): A switching hub is required for star topology.
MELSOFT EM Software Development Kit is a development software package, supporting the engineering process from system design and programming to debug and maintenance for the Simple Motion board.

**Included software**
- MELSOFT EM Configurator
- MELSOFT MR Configurator
- API library
- PCI Express® device driver

(Note): Contact your local sales office for the latest version of Software Development Kit.

**Development and Debugging Environments**

A user program is created by adding the API library (for motion control) to a project of Microsoft Visual Studio®.

- INtime® and RTX (real-time operating system) are supported.

(Note): Contact your local Mitsubishi Electric office for more details.

```c
voidStartPositioningSample( MMC_Axis* axis1 )
{
    unsigned long  retCode;
    /* Starts positioning by positioning data No.1 */
    retCode = axis1->StartPositioning( 1 );
    if( retCode != MMC_OK ) { /* Error processing */}
    /* Waits until completion of positioning control */
    retCode = axis1->WaitPositioningDone( MMC_POSITIONING_DONE_INP, 10000 );
    if( retCode != MMC_OK ) { /* Error processing */}
}
```

(Note): OS and the development environment are not included.
MELSOFT EM Configurator
Every step in the engineering process from system design and programming to debug and maintenance, is supported by this software.

API library
The API library is an add-on library which uses functions (method) and labels (member) of controller and axis classes, and enables easy programming with Visual C++®.

MELSOFT MR Configurator2
Primarily, tuning, monitoring, and diagnosis are easily performed with this software by being connected to a servo amplifier.

PCI Express® device driver
The PCI Express® device driver is software for a user program to gain access to the Simple Motion board via PCI Express®.

MELSOFT EM Configurator (Setting Tool for Simple Motion Board)

No need of manuals in system and parameter settings
- MELSOFT EM Configurator includes everything needed from system configuration to servo parameter settings.
- One-point help enables easy settings without manuals.

Easy system design

Increased usability in synchronous control and positioning settings
- Numerous sub-functions help you create positioning data easily.
- Synchronous control is performed easily simply by parameter settings.
- Creation of a rough cam waveform on a graph via drag & drop, or direct numerical value input to the graph enables easy creation of cam data.

Easy motion control

System Design

Programming

Debug

Maintenance

Easy startup

Easy maintenance

Increased efficiency in debugging and maintenance
- A customizable axis monitor increases efficiency in startup.
- An operation check of servo motors is possible by test operation before creating a program.

A wide variety of diagnosis functions
- Waveform display on a digital oscilloscope supports troubleshooting.
- Network errors are displayed with Network diagnostics.

Software Development Kit
API library (C++ motion class library)

With the C++ motion class library, a program is created using functions (method) and labels (member) of controller and axis classes, and other classes.

- The class library creates the program with high readability.
- Coding time is reduced with Microsoft Visual Studio® IntelliSense®.
- Compatibility with event-driven programming is improved by specifying any bit data as a condition of interruption.
- The library with the same interface specifications as PLCopen® Motion Control FB, is available and suitable for fixed-cycle programming.

[Conception diagram of class types in C++ motion class library]

**Programming using motion functions and axis labels**

```c
void ObjectSample( MMC_DeviceDriver *pciDev,
                  MMC_Controller* controller, MMC_Axis* axis1 )
{
  long data;
  unsigned long retCode;
  /* Generates PCI Express® device driver class objects */
  retCode = MmfCreatePciDevice( boardID, &pciDev );

  /* Generates MMC_EM340GF class objects */
  retCode = MmfCreateEM340GF( pciDev,
                              (MMC_EM340GF **)controller );

  /* Gets axis class objects */
  retCode = controller->GetAxis( 1, &axis1 );

  /* Sets parameters for acceleration time constant=0 */
  axis1->AxPrm.AccelerationTime0 = 1000;
  /* Gets the actual current value */
  data = axis1->AxMntr.ActualPosition;

  /* Starts positioning by positioning data No.1 */
  retCode = axis1->StartPositioning( 1 );
  if( retCode != MMC_OK ) { /* Error processing */ }
}
```

**Microsoft Visual Studio® IntelliSense®**

```c
void Sample( MMC_Axis* axis1 )
{
  axis1->AxMntr.
}
```

The complete word (IntelliSense) function lists the axis class motion functions (method) and axis labels (member) that can be used.

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**Software Development Kit**

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Software Development Kit
Event-driven programming (CPU resources are maximally used)

```c
void InterruptSample( MMC_Axis* axis1 )
{
    unsigned long retCode;
    MMST_PositioningData positioningData = { 0 };

    /* Structures positioning data No.1 */
    positioningData.OperationPattern   = 0;   /* [Da.1] Operation pattern */
    positioningData.ControlMethod      = 0x01; /* [Da.2] Control method */
    positioningData.AccelerationTimeNo = 0;   /* [Da.3] Acceleration time No. */
    positioningData.DecelerationTimeNo = 0;   /* [Da.4] Deceleration time No. */
    positioningData.PositioningAddress = -1000000; /* [Da.6] Positioning address */
    positioningData.CommandSpeed       = 20000; /* [Da.8] Command speed */

    /* Sets positioning data No.1 */
    axis1->SetPositioningData( 1, positioningData );

    /* Sets the interrupt event of positioning completion to a nonsignaled state */
    retCode = axis1->ResetPositioningDoneIntEvent( MMC_POSITIONING_DONE_INP );
    if( retCode != MMC_OK ) {
        /* Error processing */
    }

    /* Starts positioning by positioning data No.1 */
    retCode = axis1->StartPositioning( 1 );
    if( retCode != MMC_OK ) {
        /* Error processing */
    }

    /* Waits until completion of positioning control */
    retCode = axis1->WaitPositioningDoneIntEvent( MMC_POSITIONING_DONE_INP, 10000 );
    if( retCode != MMC_OK ) {
        /* Error processing */
    }
}
```

Fixed-cycle programming (API library with the same interface specifications as PLCopen® Motion Control FB)

The library is effective when the ST language is replaced with the C language or when the program cannot be in a wait state inside methods to keep the constant scan time.

```c
void FunctionBlockSample( MC_MoveAbsolute *fbMC_MoveAbsolute, AXIS_REF *axis, int phase )
{
    switch( phase )
    {
    case 0:
        /* Executes MC_MoveAbsolute */
        fbMC_MoveAbsolute->Axis = axis;   /* Axis information */
        fbMC_MoveAbsolute->PositionDataNo = 1; /* Positioning data No. */
        fbMC_MoveAbsolute->Position = -1000.0; /* Target position */
        fbMC_MoveAbsolute->Velocity = 20.00; /* Speed */
        fbMC_MoveAbsolute->Acceleration = 1000; /* Acceleration time */
        fbMC_MoveAbsolute->Deceleration = 1000; /* Deceleration time */
        fbMC_MoveAbsolute->Direction = 1;   /* Rotation direction */
        fbMC_MoveAbsolute->Execute = true;  /* Execute command ON */
        fbMC_MoveAbsolute->Update();       /* Executes FB */
        if( fbMC_MoveAbsolute->Error ) { /* Error processing */
            if( fbMC_MoveAbsolute->Done )
            {
                phase = 1;
            }
            break;
        }
    case 1:
        fbMC_MoveAbsolute->Execute = false; /* Execute command OFF */
        fbMC_MoveAbsolute->Update();         /* Executes FB */
        phase = 2;
        break;
    case 2:
        break;
    }
}
```
# Programming to start positioning

Positioning is started simply by setting positioning data to the Simple Motion board with the API library.

```c
void InterruptSample( MMC_Axis* axis1 )
{
    unsigned long retCode;
    MMST_PositioningData positioningData = { 0 };

    /* Structures positioning data No.1 */
    positioningData.OperationPattern   = 0;    /* [Da.1] Operation pattern */
    positioningData.ControlMethod      = 0x01;  /* [Da.2] Control method */
    positioningData.AccelerationTimeNo = 0;    /* [Da.3] Acceleration time No. */
    positioningData.DecelerationTimeNo = 0;    /* [Da.4] Deceleration time No. */
    positioningData.PositioningAddress = -1000000; /* [Da.6] Positioning address */
    positioningData.CommandSpeed       = 20000;  /* [Da.8] Command speed */

    /* Sets positioning data No.1 */
    axis1->SetPositioningData( 1, positioningData );
    retCode = axis1->ResetPositioningDoneIntEvent( MMC_POSITIONING_DONE_INP );
    if( retCode != MMC_OK ) { /* Error processing */ }

    /* Starts positioning by positioning data No.1 */
    retCode = axis1->StartPositioning( 1 );
    if( retCode != MMC_OK ) { /* Error processing */ }

    /* Waits until completion of positioning control */
    retCode = axis1->WaitPositioningDoneIntEvent( MMC_POSITIONING_DONE_INP, 10000 );
    if( retCode != MMC_OK ) { /* Error processing */ }
}
```

### Table: Positioning Data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0x01</td>
<td>0:1000</td>
<td>0:1000</td>
<td>-1000000</td>
<td>20000</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0x08</td>
<td>0:1000</td>
<td>0:1000</td>
<td>2000000</td>
<td>100000</td>
</tr>
</tbody>
</table>
Main API library list

**MMC_Controller Class**

Get object method
- GetAxis: Gets the object of the axis class.
- GetIovel: Gets the object of the I/O class.
- GetSyncEncoder: Gets the object of the synchronous encoder axis class.

System method
- ResetController: Executes remote RESET.
- SetUserProgramReady: Sets the user program ready signal [Y0].

Interrupt method
- SetInterruptParameter: Sets the interrupt parameter.
- EnableInterrupt: Enables the interrupt output.
- DisableInterrupt: Disables the interrupt output.

Synchronous control method
- CalcCamCommandPosition: Calculates cam axis feed current value.
- CalcCamCommandPositionPerCycle: Calculates cam axis current value per cycle.
- MakeRotaryCutterCam: Auto-generates the cam (central reference) for rotary cutter.
- MakeEasyStrokeRatioCam: Auto-generates the easy stroke ratio cam.
- MakeAdvancedStrokeRatioCam: Auto-generates the advanced stroke ratio cam.

**MMC_Axis Class**

Positioning data method
- SetPositioningData: Sets the positioning data.
- SetBlockStartData: Sets the block start data.
- SetBlockConditionData: Sets the condition data used by block start.
- GetPositioningData: Gets the positioning data.
- GetBlockStartData: Gets the block start data.
- GetBlockConditionData: Gets the condition data used by block start.

Operation method
- StartPositioning: Starts positioning control.
- StartBlockPositioning: Starts advanced positioning control.
- StopPositioning: Stops axis.
- RestartPositioning: Restarts stopped axis.
- WaitPositioningDone: Waits until completion of positioning control.
- SetPositioningDoneIntEvent: Sets the positioning complete interrupt event to a nonsignaled state.
- WaitPositioningDoneIntEvent: Waits until the positioning complete interrupt event is in a signaled state.
- StartJog: Starts JOG operation.
- StopJog: Stops JOG operation.
- EnableMPG: Enables manual pulse generator operation.
- DisableMPG: Disables manual pulse generator operation.
- ChangeControlMode: Changes control mode.

Change method
- ChangeSpeed: Changes speed and acceleration/deceleration time.
- ChangePosition: Changes target position and command speed.

Interrupt method
- SetInterruptParameter: Sets the interrupt parameter.
- ResetIntEvent: Sets the interrupt event to a nonsignaled state.
- SetIntEvent: Sets the interrupt event to a signaled state.
- WaitIntEvent: Waits until the interrupt event is in a signaled state.

Synchronous control method
- StartSync: Starts synchronous control.
- StopSync: Stops synchronous control.
- ChangeSyncPosition: Changes current value during synchronous control.
- MoveCamPosition: Moves cam axis during synchronous control.

**MC_FunctionBlock Class**

MC_Power: Changes the servo amplifier of the specified axis to an operable state.
MCv_Home: Executes home position return.
MC_Stop: Stops the specified axis.
MC_MoveAbsolute: Specifies the absolute target position of the specified axis and executes positioning.
MC_MoveRelative: Moves the specified distance from the current position.
MC_Reset: Cancels the errors and warnings of the specified axis.
MC_MoveAdditive: Adds the most recent relative position specified by the positioning command of the specified axis, and executes positioning.
MC_MoveVelocity: Executes speed control for the specified axis at the specified speed.
MC_TorqueControl: Executes torque control for the specified axis at the specified torque.
MC_SetPosition: Changes the current position (command position and feedback position) of the specified axis.
MC_SetOverride: Changes the target speed of the specified axis.
Servo Amplifiers

CC-Link IE Field Network servo amplifiers achieve an optimal solution and improve productivity in combination with the Simple Motion board.

- **Industry-leading basic performance**
  Industry-leading levels of servo amplifier basic performance shorten a machine cycle time.

- **Advanced servo gain adjustment**
  The advanced vibration suppression control function is easily used for maximizing your machine performance.

- **A wide range of product series and capacities**
  From rotary to linear and direct drive motors, a wide range of servo motors are available, significantly improving your machine performance.

- **Preventive maintenance**
  The data inside a servo amplifier are read via the network, and used for preventive maintenance, such as machine diagnostics.

### Control mode

Two types of modes are available according to your needs:

- **Motion mode** for a wide range of motion control functions, such as multiple-axis positioning, synchronous control, etc.
- **I/O mode** for single-axis positioning

**Motion mode**

This mode enables advanced motion control functions, such as multi-axis positioning, synchronous control, and speed-torque control in combination with the Simple Motion board.

**I/O mode**

This mode easily drives a belt conveyor, a rotary table, a ball screw mechanism, etc. by using the built-in positioning function in a servo amplifier.
**Direct Access to IT System**

Data of servo amplifiers and servo motors for each machine can be collected via CC-Link IE Field Network. The status of the entire product line can be visualized by batch management of the collected data. A CC-Link IE Field Network servo system supports to build IoT (Note-1) for your machine.

(Note-1): IoT (Internet of Things)

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**Monitoring of Servo Data**

Servo data up to fifty monitoring items can be monitored and modified successively during operation. The operation status of servo amplifiers and servo motors acquired via CC-Link IE Field Network is transferred and displayed on the host system.

---

**Preventive Maintenance**

Machine diagnosis function detects changes in mechanical components (ball screw, guide, bearing, belt, etc.) by analyzing machine friction, load moment of inertia, unbalanced torque, and changes in vibration components using the data inside a servo amplifier, supporting timely maintenance of these components. In addition, the data are transferred to a host system and used to monitor the entire line.
## Control specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum number of control axes</strong> (virtual servo amplifier axis included)</td>
<td>16 axes</td>
</tr>
<tr>
<td><strong>Operation cycle (operation cycle settings)</strong></td>
<td>0.5 ms, 1.0 ms, 2.0 ms, 4.0 ms</td>
</tr>
<tr>
<td><strong>Interpolation function</strong></td>
<td>Linear interpolation (up to 4 axes), Circular interpolation (2 axes), Helical interpolation (3 axes)</td>
</tr>
<tr>
<td><strong>Control modes</strong></td>
<td>Positioning, Trajectory control (linear, arc, and helical), Speed control, Speed-torque control</td>
</tr>
<tr>
<td><strong>Acceleration/deceleration process</strong></td>
<td>Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration</td>
</tr>
<tr>
<td>** Compensation function**</td>
<td>Backlash compensation, Electronic gear, Near pass function</td>
</tr>
<tr>
<td><strong>Synchronous control</strong></td>
<td>Synchronous encoder input, Cam, Phase compensation, Cam auto-generation</td>
</tr>
<tr>
<td><strong>Control unit</strong></td>
<td>mm, inch, degree, pulse</td>
</tr>
<tr>
<td><strong>Number of positioning data</strong></td>
<td>600 data/axis</td>
</tr>
<tr>
<td><strong>Backup</strong></td>
<td>Parameters, positioning data, and block start data can be saved on flash ROM (battery-less backup)</td>
</tr>
<tr>
<td><strong>Home position return</strong></td>
<td>Driver home position return method</td>
</tr>
<tr>
<td><strong>Fast home position return control</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Sub-function</strong></td>
<td>Provided (the sub-function of a servo amplifier)</td>
</tr>
<tr>
<td><strong>Positioning control</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Linear control</strong></td>
<td>Linear interpolation control (up to 4 axes) J(AX) 00000 (vector speed, reference axis speed)</td>
</tr>
<tr>
<td><strong>Fixed-pitch feed</strong></td>
<td>Fixed-pitch feed control</td>
</tr>
<tr>
<td><strong>2-axis circular interpolation</strong></td>
<td>Auxiliary point-specified circular interpolation, Central point-specified circular interpolation</td>
</tr>
<tr>
<td><strong>Speed control</strong></td>
<td>Speed control</td>
</tr>
<tr>
<td><strong>Speed-position switching</strong></td>
<td>INC mode, ABS mode</td>
</tr>
<tr>
<td><strong>Position-speed switching</strong></td>
<td>INC mode</td>
</tr>
<tr>
<td><strong>Current value change</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>NOP instruction</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>JUMP instruction</strong></td>
<td>Conditional JUMP, Unconditional JUMP</td>
</tr>
<tr>
<td><strong>LOOP, LEND</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>High-level positioning</strong></td>
<td>Block start, Condition start, Wait start, Simultaneous start, Repeated start</td>
</tr>
<tr>
<td><strong>Manual control</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>JOG operation</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Inching operation</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Manual pulse generator</strong></td>
<td>Provided (incremental), Unit magnification (1 to 10000 times)</td>
</tr>
<tr>
<td><strong>Expansion control</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Speed-torque control</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Direct control</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Absolute position system</strong></td>
<td>Made compatible by setting a battery to a servo amplifier</td>
</tr>
<tr>
<td><strong>Synchronous encoder interface</strong></td>
<td>16CH</td>
</tr>
<tr>
<td><strong>Via buffer memory</strong></td>
<td>Provided (incremental)</td>
</tr>
<tr>
<td><strong>Link device</strong></td>
<td>Provided (incremental)</td>
</tr>
<tr>
<td><strong>Via servo amplifier</strong></td>
<td>16CH</td>
</tr>
<tr>
<td><strong>Speed limit</strong></td>
<td>Speed limit value, JOG speed limit value</td>
</tr>
<tr>
<td><strong>Torque limit</strong></td>
<td>Torque limit value same setting, torque limit value individual setting</td>
</tr>
<tr>
<td><strong>Forced stop</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Buffer memory</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Link device</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Software stroke limit</strong></td>
<td>Movable range check with current feed value, movable range check with machine feed value</td>
</tr>
<tr>
<td><strong>Hardware stroke limit</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Speed change</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Override</strong></td>
<td>0 to 360 (%)</td>
</tr>
<tr>
<td><strong>Acceleration/deceleration time change</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Torque change</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Target position change</strong></td>
<td>Target position address and speed are changeable</td>
</tr>
<tr>
<td><strong>Other functions</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Parameter initialization function</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>External input signal setting function</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Via buffer memory</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Link device</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Via servo amplifier</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Amplifier-less operation function</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Mark detection function</strong></td>
<td>Continuous Detection mode, Specified Number of Detections mode, Ring Buffer mode</td>
</tr>
<tr>
<td><strong>Mark detection signal</strong></td>
<td>Up to 16 points</td>
</tr>
<tr>
<td><strong>Mark detection setting</strong></td>
<td>16 settings</td>
</tr>
<tr>
<td><strong>Digital oscilloscope function</strong></td>
<td>Provided</td>
</tr>
<tr>
<td><strong>Bit data</strong></td>
<td>16CH</td>
</tr>
<tr>
<td><strong>Word data</strong></td>
<td>16CH</td>
</tr>
</tbody>
</table>

(Note-1): 4-axis linear interpolation control is enabled only at the reference axis speed.  
(Note-2): 8CH word data and 8CH bit data are displayed in real time.  
(Note-3): The Mitsubishi Electric remote input module is required.
### Specifications

#### Simple Motion board specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servo amplifier connection system</td>
<td>CC-Link IE Field Network</td>
</tr>
<tr>
<td>Maximum distance between stations [m(ft.)]</td>
<td>100 (328.08)</td>
</tr>
<tr>
<td>Peripheral I/F</td>
<td>Ethernet (100BASE)</td>
</tr>
<tr>
<td><strong>Forced stop input signal (EMI)</strong></td>
<td></td>
</tr>
<tr>
<td>Number of input points</td>
<td>1 point</td>
</tr>
<tr>
<td>Input method</td>
<td>Positive Common/ Negative Common Shared Type (Photocoupler isolation)</td>
</tr>
<tr>
<td>Rated input voltage/current</td>
<td>24 V DC/ approx. 2.4 mA</td>
</tr>
<tr>
<td>Operating voltage range</td>
<td>20.4 to 26.4 V DC (24 V DC ±10 %, ripple ratio 5 % or less)</td>
</tr>
<tr>
<td>ON voltage/current</td>
<td>17.5 V DC or more/3.0 mA or more</td>
</tr>
<tr>
<td>OFF voltage/current</td>
<td>1.8 V DC or less/0.18 mA or less</td>
</tr>
<tr>
<td>Input resistance</td>
<td>Approx. 10 kΩ</td>
</tr>
<tr>
<td>Response time</td>
<td>1 ms or less (OFF to ON, ON to OFF)</td>
</tr>
<tr>
<td>Recommended wire size [mm²]</td>
<td>0.08 to 0.5 (AWG 20 to AWG 28)</td>
</tr>
<tr>
<td>Number of Simple Motion boards for one computer</td>
<td>4</td>
</tr>
<tr>
<td>Bus specification</td>
<td>PCI Express® 2.0 x 1</td>
</tr>
<tr>
<td>Size [mm(inch)]</td>
<td>Short sized version (167.65/6.60) x 111.15/4.38)</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>12 V DC/3.3 V DC</td>
</tr>
<tr>
<td>Current consumption [A]</td>
<td>0.4</td>
</tr>
<tr>
<td>3.3 V DC</td>
<td>0.6</td>
</tr>
<tr>
<td>Mass [kg]</td>
<td>0.13</td>
</tr>
</tbody>
</table>

#### Operation environment for MELSOFT EM Development Kit

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal computer</strong></td>
<td>Microsoft® Windows® supported personal computer</td>
</tr>
<tr>
<td><strong>OS</strong></td>
<td>Microsoft® Windows® 10 (Pro, Enterprise) English version (64-bit/32-bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® 8.1 (Pro, Enterprise) English version (64-bit/32-bit)</td>
</tr>
<tr>
<td></td>
<td>Microsoft® Windows® 7 (Professional, Ultimate, Enterprise) English version (64-bit/32-bit) (Service Pack 1)</td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td>Desktop: Intel® Celeron® Processor 2.8 GHz or more recommended</td>
</tr>
<tr>
<td></td>
<td>Laptop: Intel® Pentium® M Processor 1.7 GHz or more recommended</td>
</tr>
<tr>
<td><strong>Required memory</strong></td>
<td>1 GB or more recommended (For 32-bit edition)</td>
</tr>
<tr>
<td></td>
<td>2 GB or more recommended (For 64-bit edition)</td>
</tr>
<tr>
<td><strong>Available hard disk space</strong></td>
<td>When installing the test tool: 3 GB or more of available hard disk space required</td>
</tr>
<tr>
<td></td>
<td>When operating the test tool: 512 MB or more of available hard disk space required</td>
</tr>
<tr>
<td><strong>Disk drive</strong></td>
<td>DVD-ROM supported disk drive</td>
</tr>
<tr>
<td><strong>Monitor</strong></td>
<td>Resolution 1024 x 768 pixels or higher</td>
</tr>
<tr>
<td><strong>Communications interface</strong></td>
<td>PCI Express® 8/10/BUS</td>
</tr>
</tbody>
</table>

#### Development environment

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OS for user program operation</strong></td>
<td>The same operation environment as MELSOFT EM Software Development Kit</td>
</tr>
<tr>
<td><strong>Software development environment</strong></td>
<td>Microsoft® Visual C++® 2015/2013/2012/2010</td>
</tr>
<tr>
<td><strong>API library</strong></td>
<td>Class library (Only compiled into C++)</td>
</tr>
</tbody>
</table>
### Performance specifications of CC-Link IE Field Network

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum link points per network</strong></td>
<td></td>
</tr>
<tr>
<td>RX</td>
<td>16k points (16384 points, 2 kbytes)</td>
</tr>
<tr>
<td>RY</td>
<td>16k points (16384 points, 2 kbytes)</td>
</tr>
<tr>
<td>RWr</td>
<td>8k points (8192 points, 16 kbytes)</td>
</tr>
<tr>
<td>RWw</td>
<td>8k points (8192 points, 16 kbytes)</td>
</tr>
<tr>
<td><strong>Maximum link points per station</strong></td>
<td></td>
</tr>
<tr>
<td>Master station RX</td>
<td>16k points (16384 points, 2 kbytes)</td>
</tr>
<tr>
<td>Master station RY</td>
<td>16k points (16384 points, 2 kbytes)</td>
</tr>
<tr>
<td>Master station RWr</td>
<td>8k points (8192 points, 16 kbytes)</td>
</tr>
<tr>
<td>Master station RWw</td>
<td>8k points (8192 points, 16 kbytes)</td>
</tr>
<tr>
<td>Local station RX</td>
<td>2k points (2048 points, 256 bytes)</td>
</tr>
<tr>
<td>Local station RY</td>
<td>2k points (2048 points, 256 bytes)</td>
</tr>
<tr>
<td>Local station RWr</td>
<td>256 points, 512 bytes</td>
</tr>
<tr>
<td>Local station RWw</td>
<td>256 points, 512 bytes</td>
</tr>
<tr>
<td>Intelligent device station RX</td>
<td>2k points (2048 points, 256 bytes)</td>
</tr>
<tr>
<td>Intelligent device station RY</td>
<td>2k points (2048 points, 256 bytes)</td>
</tr>
<tr>
<td>Intelligent device station RWr</td>
<td>256 points, 512 bytes</td>
</tr>
<tr>
<td>Intelligent device station RWw</td>
<td>256 points, 512 bytes</td>
</tr>
<tr>
<td>Remote device station RX</td>
<td>128 points, 16 bytes</td>
</tr>
<tr>
<td>Remote device station RY</td>
<td>128 points, 16 bytes</td>
</tr>
<tr>
<td>Remote device station RWr</td>
<td>64 points, 128 bytes</td>
</tr>
<tr>
<td>Remote device station RWw</td>
<td>64 points, 128 bytes</td>
</tr>
<tr>
<td><strong>Ethernet</strong></td>
<td></td>
</tr>
<tr>
<td>Communication speed</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Connection cable</td>
<td>1000BASE-T Ethernet cable[^5e]^: category 5e or higher (double shielded/STP) straight cable</td>
</tr>
<tr>
<td>Maximum distance between stations <a href="%5B%5E5e%5D">m/ft.</a></td>
<td>100(328.08) (conforms to ANSI/TIA/EIA-568-B (category 5e))</td>
</tr>
<tr>
<td>Topology</td>
<td>Line type, star type, line/star mixed type</td>
</tr>
<tr>
<td>Overall cable distance</td>
<td></td>
</tr>
<tr>
<td>Line type <a href="%5B%5E5e%5D">m/ft.</a></td>
<td>12000(39370.08) (When 1 master station and 120 slave stations are connected)</td>
</tr>
<tr>
<td>Star type[^5e]^</td>
<td>Depends on system configuration</td>
</tr>
<tr>
<td>Maximum connectable stations per network</td>
<td>121 stations (1 master station, 120 slave stations)</td>
</tr>
<tr>
<td>Maximum number of networks</td>
<td>239</td>
</tr>
</tbody>
</table>

\[^5e\]: Use the cables recommended by CC-Link Partner Association for CC-Link IE Field Network.

\[^5e\]^: CC-Link IE Controller Network cables are not compatible with CC-Link IE Field Network.

### Ethernet Cable Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet cable</td>
<td>Category 5e or higher (double shielded/STP) straight cable</td>
</tr>
</tbody>
</table>

| Connector                   | RJ-45 connector with shield            |

### Products on the Market

<table>
<thead>
<tr>
<th>Ethernet Cable</th>
<th>Model</th>
<th>Specification</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>For indoor</td>
<td>SC-E5EW-S_M</td>
<td>: cable length (100 m max., unit of 1 m)</td>
<td>Double shielded cable (category 5e)</td>
</tr>
<tr>
<td>For indoor and moving part</td>
<td>SC-E5EW-S_M-MV</td>
<td>: cable length (45 m max., unit of 1 m)</td>
<td></td>
</tr>
<tr>
<td>For indoor/indoor</td>
<td>SC-E5EW-S_M-L</td>
<td>: cable length (100 m max., unit of 1 m)</td>
<td></td>
</tr>
</tbody>
</table>

For details, contact Mitsubishi Electric System & Service Co., Ltd. (Sales office) FA PRODUCT DIVISION mail: osb.webmaster@melsc.jp
Specifications

■ Exterior dimensions

Simple Motion board MR-EM340GF

[Diagram showing exterior dimensions]

[Unit: mm (inch)]

■ Product list

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Description</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple motion board</td>
<td>MR-EM340GF</td>
<td>Up to 16 axes</td>
<td>CE, UL, KC, EAC</td>
</tr>
<tr>
<td>MELSOFT EM Software</td>
<td>SW1DND-EMSDK-B</td>
<td>● MELSOFT EM Configurator (setting tool)</td>
<td></td>
</tr>
<tr>
<td>Development Kit</td>
<td></td>
<td>● MELSOFT MR Configurator2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● API library (C++ motion class library)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>● PCI Express® device driver (including the driver for interrupt)</td>
<td>—</td>
</tr>
</tbody>
</table>
Real-time motion control is realized by Windows® PC.

INtime is the real-time OS products which extend real-time performance for Windows® PC.

Real-time control is realizable only by installing in usual Windows® PC. Since parallel operation is carried out with Windows®, both the Windows® side processings, such as HMI and log file save, and the machine control processings which needs real-time performance are able to be realized on one set of hardware. Since applications are developed by Microsoft Visual Studio®, it is easy to introduce.

By introducing a dedicated position board, the motion positioning operation which utilizes CC-Link IE Field Network is realizable.

(Note): Mitsubishi Electric has confirmed that the Simple Motion board operates on the INtime 5.2. We also offer the API library/device driver for the Simple Motion board control. Contact your local Mitsubishi Electric office for more details.

RTX/RTX64 (Real-time Extensions)

Transform Windows® into a Real-Time Operating System

RTX (32-bit) and RTX64 (64-bit) real-time software are key components of the IntervalZero RTOS Platform that comprises x86 and x64 multicore multiprocessors, the Windows® operating system, and real-time Ethernet to outperform real-time hardware such as DSPs and radically reduce the development costs for systems that require determinism or hard real-time.

Features
- Multicore SMP aware Real-time scheduler
- RTX64 is supported on the 64-bit versions of Windows®, including Windows® Embedded Standard
- Real-time Win32 like API
- Direct access to hardware(U/O, Memory)
- Direct memory addressing
- Non-Page Pool - up to 128Gbyte on a 64-bit system
- Single integrated development environment
  Visual Studio - C# managed code and C++ support
- Provides a real-time network driver and Virtual Network driver

IntervalZero’s customer-centered philosophy combined with more than three decades of embedded software innovation, and the proven value of our RTX hard real-time software, which transforms Windows® into a real-time operating system (RTOS), have enabled us to build a global customer base of market-leading OEMs and end users in Industrial Automation, Medical Systems, Digital Media, Test & Measurement, Military & Aerospace, and other industries.

(Note): Mitsubishi Electric has confirmed that the Simple Motion board operates on the RTX2012 and RTX64 2014 with Service Pack 2. We also offer the API library/device driver for the Simple Motion board control. Contact your local Mitsubishi Electric office for more details.
Conformity with Global Standards and Regulations

Mitsubishi Electric servo system conforms to global standards.
(Note-1): This product is not subject to China Compulsory Certification (CCC).
(Note-2): Refer to relevant manuals and "EMC Installation Guidelines" when your system needs to meet the EMC directive.
(Note-3): Refer to "MELSERVO-J4 Series Catalog" for details of MR-J4 series conformity with global standards and regulations.
(Note-4): For corresponding standards and models, contact your local sales office.

Conformity with Restriction of Hazardous Substances Directive (RoHS)

The human and environment-friendly Mitsubishi Electric servo system is compliant with RoHS Directive.

< About RoHS directive >
RoHS Directive requires member nations to guarantee that new electrical and electronic equipment sold in the market after July 1, 2006 do not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants. <G> mark indicating RoHS Directive compliance is printed on the package.

(Note-1): Refer to relevant manuals and "EMC Installation Guidelines" when your system needs to meet the EMC directive.
(Note-2): Our optional cables and connectors comply with "Measures for Administration of the Pollution Control of Electronic Information Products" (Chinese RoHS).

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PCI Express is a registered trademark of PC-SIG (PCI Special Interest Group).
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This publication explains the typical features and functions of the products herein and does not provide restrictions or other information related to usage and module combinations. Before using the products, always read the product user manuals. Mitsubishi Electric will not be held liable for damage caused by factors found not to be the cause of Mitsubishi Electric; opportunity loss or lost profits caused by faults in Mitsubishi Electric products; damage, secondary damage, or accident compensation, whether foreseeable or not, caused by special factors; damage to products other than Mitsubishi Electric products; or any other duties.

For safe use
- To use the products given in this publication properly, always read the relevant manuals before beginning operation.
- The products have been manufactured as general-purpose parts for general industries, and are not designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the products for special purposes such as nuclear power, electric power, aerospace, medicine or passenger-carrying vehicles, consult with Mitsubishi Electric.
- The products have been manufactured under strict quality control. However, when installing the products where major accidents or losses could occur if the products fail, install appropriate backup or fail-safe functions in the system.
Maximizing productivity and reducing costs across the entire enterprise

e-F@ctory is the Mitsubishi Electric solution for improving the performance of any manufacturing enterprise by enhancing productivity, and reducing the maintenance and operations costs together with seamless information flow throughout the plant. e-F@ctory uses a combination of factory automation and IT technologies, offering solutions to reduce the total cost of development, production, and maintenance by supporting advanced Monozukuri*.

e-F@ctory helps to reduce overall costs and is achieved in the following four areas:

* Monozukuri is an initiative started in Japan for promoting its unique manufacturing style for continuous improvement in production processes and operations. The word is derived by combining the words “mono”, the thing that is manufactured, and “zukuri”, the process of manufacturing.

Reduce energy costs

**e&eco-F@ctory (energy saving solution)**

Modern manufacturing depends much on reducing energy costs as a way to realize an efficient manufacturing enterprise. e-F@ctory supports this by allowing visualization of real-time energy usage, helping to reduce the overall energy consumption.

Integrate FA and IT systems at low cost

**Connecting enterprise with the shop floor**

e-F@ctory solutions provide direct connectivity from the shop floor to enterprise, such as Manufacturing Execution System (MES) without requiring a gateway computer. This enables leaner operations, improved yield, and efficient management of the supply chain.

Reduce development, production, and maintenance costs

**iQ Platform**

The iQ Platform minimizes costs at all phases of the automation life cycle by improving development times, enhancing productivity, reducing maintenance costs, and making information more easily accessible. Integration is at the heart of the iQ Platform, with a highly intelligent controller platform as the core, combined with a seamless communication network and an integrated engineering environment.

Reduce setup and maintenance costs

**iQ Sensor Solution**

Easily setup and maintain various types of sensors. Maintenance and design costs can be reduced as compatible IQSS partner sensors can be managed together.

Best-in-class solutions across the ecosystem

**e-F@ctory Alliance**

The e-F@ctory Alliance is an ecosystem offering best-in-class solutions by combining products between Mitsubishi Electric and its various partners. Close collaboration with such partners broaden the choices for the customer and realize the best solution possible.
CC-Link Partner Association (CLPA) - Actively promoting worldwide adoption of CC-Link networks

Proactively supporting CC-Link, from promotion to specification development

The CC-Link Partner Association (CLPA) was established to promote the worldwide adoption of the CC-Link open-field network. By conducting promotional activities such as organizing trade shows and seminars, conducting conformance tests, and providing catalogs, brochures and website information, CLPA activities are successfully increasing the number of CC-Link partner manufacturers and CC-Link-compatible products. As such, CLPA is playing a major role in the globalization of CC-Link.

Visit the CLPA website for the latest CC-Link information.

URL: www.cc-link.org

Global influence of CC-Link continues to spread

CC-Link is supported globally by CLPA. With offices throughout the world, support for partner companies can be found locally. Each regional CLPA office undertakes various support and promotional activities to further the influence of CC-Link/CC-Link IE in that part of the world. For companies looking to increase their presence in their local area, CLPA is well placed to assist these efforts through offices in all major regions.
Warranty

1. Warranty period and coverage

We will repair any failure or defect (hereinafter referred to as "failure") in our FA equipment (hereinafter referred to as the "Product") arisen during warranty period at no charge due to causes for which we are responsible through the distributor from which you purchased the Product or our service provider. However, we will charge the actual cost of dispatching our engineer for an on-site repair work on request by customer in Japan or overseas countries. We are not responsible for any on-site readjustment and/or trial run that may be required after a defective unit is repaired or replaced.

[Limitations]

- The term of warranty for Product is thirty six (36) months after your purchase or delivery of the Product to a place designated by you or forty two (42) months from the date of manufacture whichever comes first ("Warranty Period"). Warranty period for repaired Product cannot exceed beyond the original warranty period before any repair work.

- (1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule. It can also be carried out by us or our service company upon your request and the actual cost will be charged. However, it will not be charged if we are responsible for the cause of the failure.

- (2) This limited warranty applies only when the condition, method, environment, etc. of use are in compliance with the terms and conditions and instructions that are set forth in the instruction manual and user manual for the Product and the caution label affixed to the Product.

- (3) Even during the term of warranty, the repair cost will be charged on you in the following cases:
  - a failure caused by your improper storing or handling, carelessness or negligence, etc., and a failure caused by your hardware or software problem
  - a failure caused by any alteration, etc. to the Product made on your side without our approval
  - a failure which may be regarded as avoidable, if your equipment in which the Product is incorporated is equipped with a safety device required by applicable laws and has any function or structure considered to be indispensable according to a common sense in the industry
  - a failure which may be regarded as avoidable if consumable parts designated in the instruction manual, etc. are duly maintained and replaced
  - any replacement of consumable parts (battery, fan, etc.)
  - a failure caused by external factors such as inevitable accidents, including without limitation fire and abnormal fluctuation of voltage, and acts of God, including without limitation earthquake, lightning and natural disasters
  - a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of the shipment of the Product from our company
  - any other failures which we are not responsible for or which you acknowledge we are not responsible for

2. Term of warranty after the stop of production

(1) We may accept the repair at charge for another seven (7) years after the production of the product is discontinued. The announcement of the stop of production for each model can be seen in our Sales and Service, etc.

(2) Please note that the Product (including its spare parts) cannot be ordered after its stop of production.

3. Service in overseas countries

Our regional FA Center in overseas countries will accept the repair work of the Product. However, the terms and conditions of the repair work may differ depending on each FA Center. Please ask your local FA Center for details.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Change of Product specifications

Specifications listed in our catalogs, manuals or technical documents may be changed without notice.

6. Application and use of the Product

(1) For the use of our Simple Motion Board, its applications should be those that may not result in a serious damage even if any failure or malfunction occurs in Simple Motion Board, and a backup or fail-safe function should operate on an external system to Simple Motion Board when any failure or malfunction occurs.

(2) Our Simple Motion Board is designed and manufactured as a general purpose product for use at general industries. Therefore, applications substantially influential on the public interest for such as atomic power plants and other power plants of electric power companies, and also which require a special quality assurance system, including applications for railway companies and government or public offices are not recommended, and we assume no responsibility for any failure caused by these applications when used.

In addition, applications which may be substantially influential to human lives or properties for such as airlines, medical treatments, railway service, incineration and fuel systems, man-operated material handling equipment, entertainment machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure caused by these applications when used.

We will review the acceptability of the abovementioned applications, if you agree not to require a specific quality for a specific application. Please contact us for consultation.
Warranty

1. Warranty period and coverage

- Limitations
- (1) You are requested to conduct an initial failure diagnosis by yourself, as a general rule.
- (2) This limited warranty applies only when the condition, method, conditions and instructions that are set forth in the instruction manual are duly maintained and replaced.
- (3) Even during the term of warranty, the repair cost will be charged to you in the following cases;
  - (i) a failure caused by your improper storing or handling,
  - (ii) a failure caused by a usage method, conditions and instructions that are not set forth in the instruction manual,
  - (iii) a failure which may be regarded as avoidable, if your Simple Motion Board is used in a manner not allowed by the instruction manual,
  - (iv) a failure which may be regarded as avoidable, if your Simple Motion Board is used in a manner not allowed by the instruction manual,
  - (v) a failure caused by a usage method, conditions and instructions that are not set forth in the instruction manual,
  - (vi) a failure caused by a usage method, conditions and instructions that are not set forth in the instruction manual,
  - (vii) a failure generated by an unforeseeable cause with a scientific technology that was not available at the time of production.
- (4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.
- (5) Mitsubishi Electric shall not assume responsibility for any failure caused by these machines, safety machines, etc. are not recommended, and we assume no responsibility for any failure that may occur.

2. Term of warranty after the stop of production

- 5. Change of Product specifications
- 6. Application and use of the Product

3. Service in overseas countries

- 3. Service in overseas countries

4. Exclusion of loss in opportunity and secondary loss from warranty liability

- 4. Exclusion of loss in opportunity and secondary loss from warranty liability

5. Change of Product specifications

- 5. Change of Product specifications

6. Application and use of the Product

- 6. Application and use of the Product

This is why you can rely on Mitsubishi Electric automation solution - because we know first hand about the need for reliable, efficient, easy-to-use automation and control in our own factories.

As one of the world's leading companies with a global turnover of over 4 trillion Yen (over $40 billion), employing over 100,000 people, Mitsubishi Electric has the resource and the commitment to deliver the ultimate in service and support as well as the best products.

* Not all products are available in all countries.

Mitsubishi Electric offers a wide range of automation equipment from PLCs and HMIs to CNC and EDM machines.

A NAME TO TRUST

Since its beginnings in 1870, some 45 companies use the Mitsubishi name, covering a spectrum of finance, commerce and industry.

The Mitsubishi brand name is recognized around the world as a symbol of premium quality.

Mitsubishi Electric Corporation is active in space development, transportation, semi-conductors, energy systems, communications and information processing, audio visual equipment and home electronics, building and energy management and automation systems, and has 237 factories and laboratories worldwide in over 121 countries.

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## CC-Link IE Simple Motion Board/
Personal Computer Embedded Type Servo System Controller

### Specifications

<table>
<thead>
<tr>
<th>Country/Region</th>
<th>Sales office</th>
<th>Tel/Fax</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USA</strong></td>
<td>MITSUBISHI ELECTRIC AUTOMATION, INC.</td>
<td>Tel : +1-647-478-2100, Fax : +1-647-478-2253</td>
</tr>
<tr>
<td><strong>Mexico</strong></td>
<td>MITSUBISHI ELECTRIC AUTOMATION, INC. Mexico Branch</td>
<td>Tel : +52-55-3067-7500</td>
</tr>
<tr>
<td><strong>Brazil</strong></td>
<td>MITSUBISHI ELECTRIC DO BRASIL COMERCIO E SERVICOS LTDA.</td>
<td>Tel : +55-11-4689-3000, Fax : +55-11-4689-3016</td>
</tr>
<tr>
<td><strong>Germany</strong></td>
<td>MITSUBISHI ELECTRIC EUROPE B.V. German Branch</td>
<td>Tel : +49-2102-486-0, Fax : +49-2102-486-1120</td>
</tr>
<tr>
<td><strong>UK</strong></td>
<td>MITSUBISHI ELECTRIC EUROPE B.V. UK Branch</td>
<td>Tel : +44-1707-28-8760, Fax : +44-1707-27-6965</td>
</tr>
<tr>
<td><strong>Ireland</strong></td>
<td>MITSUBISHI ELECTRIC EUROPE B.V. Irish Branch</td>
<td>Tel : +353-1-4198800, Fax : +353-1-4198890</td>
</tr>
<tr>
<td><strong>Italy</strong></td>
<td>MITSUBISHI ELECTRIC EUROPE B.V. Italian Branch</td>
<td>Tel : +39-039-60531, Fax : +39-039-6053-312</td>
</tr>
<tr>
<td><strong>Spain</strong></td>
<td>MITSUBISHI ELECTRIC EUROPE, B.V. Spanish Branch</td>
<td>Tel : +34-935-65-3131, Fax : +34-935-89-1579</td>
</tr>
<tr>
<td><strong>France</strong></td>
<td>MITSUBISHI ELECTRIC EUROPE B.V. French Branch</td>
<td>Tel : +33-1-55-68-55-68, Fax : +33-1-55-68-57-57</td>
</tr>
<tr>
<td><strong>Czech Republic</strong></td>
<td>MITSUBISHI ELECTRIC EUROPE B.V. Czech Branch, Prague Office</td>
<td>Tel : +42-025-759-200, Fax : +42-025-724-7241</td>
</tr>
<tr>
<td><strong>Poland</strong></td>
<td>MITSUBISHI ELECTRIC ELECTRO B.V. Polish Branch</td>
<td>Tel : +48-12-347-65-00, Fax : +48-12-347-67-01</td>
</tr>
<tr>
<td><strong>Sweden</strong></td>
<td>MITSUBISHI ELECTRIC AUTOMATION (Scandinavia)</td>
<td>Tel : +46-8-625-10-00, Fax : +46-30-70-10-18</td>
</tr>
<tr>
<td><strong>Russia</strong></td>
<td>MITSUBISHI ELECTRIC ELECTRO B.V. Russian Branch</td>
<td>Tel : +7-812-633-3497, Fax : +7-812-633-3499</td>
</tr>
<tr>
<td><strong>Turkey</strong></td>
<td>MITSUBISHI ELECTRIC TURKEY A.S. Umraniey Branch</td>
<td>Tel : +90-216-526-3990, Fax : +90-216-526-3995</td>
</tr>
<tr>
<td><strong>UAE</strong></td>
<td>MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD.</td>
<td>Tel : +82-2-3660-9529, Fax : +82-2-3664-8372</td>
</tr>
<tr>
<td><strong>China</strong></td>
<td>MITSUBISHI ELECTRIC ASIA PTE. LTD.</td>
<td>Tel : +65-6473-2308, Fax : +65-6476-7439</td>
</tr>
<tr>
<td><strong>Taiwan</strong></td>
<td>MITSUBISHI ELECTRIC FACTORY AUTOMATION (THAILAND) CO., LTD.</td>
<td>Tel : +66-2882-6522 to 31, Fax : +66-2882-6020</td>
</tr>
<tr>
<td><strong>Vietnam</strong></td>
<td>MITSUBISHI ELECTRIC VIETNAM COMPANY LIMITED</td>
<td>Tel : +84-8-3910-5945, Fax : +84-8-3910-5945</td>
</tr>
<tr>
<td><strong>Indonesia</strong></td>
<td>PT. MITSUBISHI ELECTRIC INDONESIA</td>
<td>Tel : +62-21-3192-6461, Fax : +62-21-3192-3943</td>
</tr>
<tr>
<td><strong>India</strong></td>
<td>MITSUBISHI ELECTRIC INDIA PVT. LTD. Pune Branch</td>
<td>Tel : +91-20-2710-2000, Fax : +91-20-2710-2100</td>
</tr>
<tr>
<td><strong>Australia</strong></td>
<td>MITSUBISHI ELECTRIC AUSTRALIA PTY. LTD.</td>
<td>Tel : +61-2-9864-7777, Fax : +61-2-9864-7245</td>
</tr>
</tbody>
</table>

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Mitsubishi Electric Corporation Nagoya Works is a factory certified for ISO 14001 (standards for environmental management systems) and ISO 9001 (standards for quality assurance management systems).