Simple Motion Module
LD77MH4
LD77MH16

Advanced motion control similar to a positioning module

Simple Motion Module, now part of MELSEC-L Series

Graphical setting software

Simple and smart system installation

Advanced and wide-range motion control
- Positioning control
- Speed control
- Torque control
- Cam control
- Synchronous control
- Mark detection function
Advanced Motion Control

The MELSEC-L Series lineup now includes the Simple Motion Module in addition to the regular positioning modules. Various control functions previously only possible with Motion Controllers, such as synchronous control, are now available in the same manner as a positioning module.

**Features**

**Making Motion Simple in various applications**

A variety of controls including positioning control, speed control, torque control, cam control and synchronous control can be realized easily just with simple parameter settings and a sequence program.

**Positioning control**

- Various applications are supported with extensive control formats including linear interpolation control (up to 4 axes), 2-axis circular interpolation control, fixed feed control and continuous orbit control.
- Execute automatic operation by setting the positioning addresses and speeds, etc., easily from a sequence program.
- Powerful auxiliary functions such as M codes, skip function, step operation and target position change function.

**Speed and torque control are also available**

- Tension control applications such as rewinding and winding axes are supported.
- Control can be switched between “positioning control”, “speed and torque control” and “position control”. As a result, it is now possible to maintain the positioning control with the absolute position coordinates after switching the control.

**Synchronous control and cam control**

- Synchronous control and cam control can be combined and used in systems requiring synchronous control.

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**Example applications for cam control**

When making a detour around workpiece A and transferring from point P1 to point P3, with positioning control the BUSY signal of axis 1 is checked at point P2, and axis 2 starts.

By using cam control, the BUSY signal does not need to be checked at point P2 so the positioning time is shortened.
Making Motion Simple with compactly packed extra functions

**Using synchronous control with a synchronous encoder**

- Realize synchronous control and cam control by using input pulses from a synchronous encoder.
- Use an incremental synchronous encoder with the directly built-in interface of LD77MH, or use an absolute synchronous encoder (coming soon) via a servo amplifier. Optional modules are no longer necessary.
- Further improve the synchronization accuracy with the phase compensation function, designed to compensate for synchronous encoder delays.

**Standard mark detection function**  
*New*

- The built-in mark detection signal interface allows incorporation in packaging systems etc., without optional modules.

**Automatic cam data generation**  
for rotary cutter

- Easily program and automatically generate difficult cam data for rotary cutters just by specifying the sheet length and synchronization width, etc.

Making Motion Simple with amplifier-less debugging functions

- Perform programming and debugging on a desktop using just the L Series CPU module, LD77MH and power supply module. This benefits your designing and debugging efficiency.
- Debug sequence programs and positioning data without the servo amplifier and servomotor.

**Amplifier-less operation function**

This function carries out the LD77MH positioning control without a servo amplifier connected. Use this to debug the user program for system installation, or to simulate the positioning operation.

Making Motion Simple in systems requiring high response

- The 50Mbps high-speed optical communication greatly increases the speed of data exchange between the Simple Motion Module and servo amplifier, and reduces the cycle time.
- The degree of freedom in system layout is enhanced for long-distance wiring.
- The adopted optical fiber cable has outstanding noise resistance properties.
- The SSCNET® compatible servo amplifier supports various servomotors, linear servomotors and direct drive motors, and can be used in various applications.
**Simple Settings without Programs**

### Simple setting of positioning data

Execute positioning control with the data table method.

- The Data Setting Assistant function simplifies settings.
- Positioning data can be set very simply by using functions such as Automatic Command Speed Calculation, Offline Simulation, and automatic calculation of auxiliary arc, etc.

![Data Setting Assistant function](image1)
![Automatic Command Speed Calculation](image2)
![Offline Simulation](image3)

### Simple setting of synchronous control data

Using software, realize synchronous control which replaces machine mechanisms, such as the gear, shaft, speed change gear and cam.

- It is possible to realize synchronous control easily with parameter settings. There is no need to create complicated programs.
- Start and stop synchronous control for each axis. Use the synchronous control axis and positioning control axis together.
- Convey the travel value of main shaft to the output axis via the clutch.

![Synchronous Control Parameter Settings](image4)

### Simple setting of cam control data

Easily prepare cam data for various patterns.

- Set cams with a high degree of freedom. There’s no need to worry about existing concepts of electronic cam control.
- Set the stroke, speed, acceleration and throb while simultaneously checking the profile on a graph.
- Easily check the created cam data by viewing as thumbnail displays of cam data.
- Import and export cam data in CSV format.

![Cam Data](image5)
![Cam Data List](image6)
Simple parameter settings

- One-point help allows parameters to be set without needing a manual.
- Easily set the applicable servo amplifier on a graphical screen.
- Do away with bothersome electronic gear calculation just by specifying the mechanism configuration (reduction ratio, ball screw pitch, etc.).

Simple installation

Digital oscilloscope function

- Collection of data in the Simple Motion Module synchronized with the operation cycle and waveform displays facilitate efficient start up.
- The assistant function explains all work steps.
- Set often-viewed data easily with the purpose-based probe setting.
- Sample 16CH word and 16CH bit data. Of this, 8CH words and 8CH bits can be displayed in real time.

Monitor and test functions

- Easily complete system installation and operation checks with powerful monitor and test functions.
- Select items to be displayed on the monitor from the voluminous information monitor options.
- Use the test function to check basic operations without a sequence program.

Simple setting of servo amplifier parameters

Collaboration with the MR Configurator2 increases the servo installation efficiency. Set and adjust servo amplifier parameters with the MR Configurator2, a treasure trove of Mitsubishi servo know-how.
System Configuration

Structure an integral system consisting of the MR-J3 Series servo amplifier and servomotor with the PLC CPU module and SSCNETIII integrated.

- LD77MH4 can control up to 4 axes and the LD77MH16 can control up to 16 axes.

<table>
<thead>
<tr>
<th>Setting software</th>
<th>MR Configurator2 (Note-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GX Works2</td>
<td>Simple Motion Module setting tool equipped as standard</td>
</tr>
<tr>
<td></td>
<td>Software supporting servo amplifier from startup to maintenance</td>
</tr>
</tbody>
</table>

- External input signal of servo amplifier:
  - Upper stroke limit
  - Lower stroke limit
  - Proximity dog

Connecting either a manual pulse generator (MR-HDP01) or incremental synchronous encoder.

- Specifications of force stop input (24VDC)
- External command signal/ Switching signal (4points)
## Simple Motion

**SBC** amplifier connection system: **SSCNET III**-compatible (50Mbps)

**Transmission Distance**: 50m (164.04 ft)

### External command signal/ Switching signal

<table>
<thead>
<tr>
<th>Item</th>
<th>LD77MH16</th>
<th>LD77MH4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of input points</td>
<td>4 points</td>
<td>4 points</td>
</tr>
<tr>
<td>Input method</td>
<td>Positive common/Negative common shared (Photocoupler)</td>
<td>Positive common/Negative common shared (Photocoupler)</td>
</tr>
<tr>
<td>Rated input voltage/Rated input current</td>
<td>24VDC/Approx. 5mA</td>
<td>24VDC/Approx. 2.4mA</td>
</tr>
<tr>
<td>Operating voltage range</td>
<td>21.6 to 26.4VDC (24VDC ±10%, ripple ratio 5% or less)</td>
<td>20.4 to 26.4VDC (24VDC±10%±15%, ripple ratio 5% or less)</td>
</tr>
<tr>
<td>ON voltage/current</td>
<td>17.5VDC or more/3.5mA or more</td>
<td>17.5VDC or more/2.0mA or more</td>
</tr>
<tr>
<td>OFF voltage/current</td>
<td>5VDC or less/0.9mA or less</td>
<td>1.8VDC or less/0.18mA or less</td>
</tr>
<tr>
<td>Response time</td>
<td>Approx 5 ms</td>
<td>1ms or less</td>
</tr>
<tr>
<td>Recommended wire size</td>
<td>AWG24 (0.2mm²)</td>
<td>AWG24 (0.2mm²)</td>
</tr>
</tbody>
</table>

### Specifications of force stop input signal

<table>
<thead>
<tr>
<th>Item</th>
<th>LD77MH16</th>
<th>LD77MH4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of input points</td>
<td>1 point</td>
<td>1 point</td>
</tr>
<tr>
<td>Input method</td>
<td>Positive common/Negative common shared (Photocoupler)</td>
<td>Positive common/Negative common shared (Photocoupler)</td>
</tr>
<tr>
<td>Rated input voltage/Rated input current</td>
<td>24VDC/Approx. 5mA</td>
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<tr>
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<td>17.5VDC or more/2.0mA or more</td>
</tr>
<tr>
<td>OFF voltage/current</td>
<td>5VDC or less/0.9mA or less</td>
<td>1.8VDC or less/0.18mA or less</td>
</tr>
<tr>
<td>Response time</td>
<td>Approx 10μs</td>
<td>1ms or less</td>
</tr>
<tr>
<td>Recommended wire size</td>
<td>AWG24 (0.2mm²)</td>
<td>AWG24 (0.2mm²)</td>
</tr>
</tbody>
</table>

### Manual pulse generator/ Incremental synchronous encoder signal

<table>
<thead>
<tr>
<th>Item</th>
<th>LD77MH16</th>
<th>LD77MH4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input frequency</td>
<td>1Mpps (After magnification by 4, up to 4Mpps)</td>
<td>200kpps (After magnification by 4, up to 800kpps)</td>
</tr>
<tr>
<td>High-voltage</td>
<td>20V to 2.52VDC</td>
<td>3.0 to 5.25VDC</td>
</tr>
<tr>
<td>Low-voltage</td>
<td>0 to 0.8VDC</td>
<td>0 to 1.0VDC</td>
</tr>
<tr>
<td>Differential-voltage</td>
<td>±0.2V</td>
<td></td>
</tr>
<tr>
<td>Cable length</td>
<td>30m (98.43 ft)</td>
<td>10m (32.81 ft)</td>
</tr>
</tbody>
</table>

### Number of I/O occupying points

- 32 points (I/O allocation: Intelligent, 32 points)

### Maximum number of modules specification

- Counts as 2 modules

### Internal current consumption (SVDC/A)

- 0.70 A
- 0.55 A

### Mass (kg)

- 0.22 kg

### Exterior dimensions (mm/inch)

- 90.0 (3.54) (H) x 45.0 (1.77) (W) x 95 (3.74) (D)

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### External Dimension Diagram

**LD77MH16**

- **LD77MH4**

UNIT: mm/inch
### Motion control

**Item** | LD77MH16 | LD77MH4
---|---|---
Number of control axes | 16 axes | 4 axes
Operation cycle | 0.88 ms (Note-1) | 0.88 ms
Interpolation function | Linear interpolation (up to 4 axes), Circular interpolation (2 axes) | | | | |
Control system | PTP (Point To Point) control, path control (both linear and arc can be set), speed control, torque control, speed-position switching control, position-speed switching control | | | | |
Acceleration/deceleration process | Trapezoidal acceleration/deceleration, S-pattern acceleration/deceleration | | | | |
Compensation function | Backlash compensation, Electronic gear, Near pass function | | | | |
Synchronous control | External encoder, Cam, Phase Compensation, Cam generated automatically | | | | |
Control unit | mm, inch, degree, PLS | | | | |
Positioning data | 600 data (positioning data No. 1 to 600)/axis (Can be set with GX Works2 or PLC program.) | | | | |
Backup | Parameters, positioning data, and block start data can be saved on flash ROM (battery-less backup) | | | | |
OPR control | Machine OPR control | Near-point dog method, Count method 1), Count method 2), Data set method, scale origin signal detection method | | | |
Fast OPR control | | Provided | | | |
Sub functions | | OPR retry, OP shift | | | |
Position control | Linear control 1-axis linear control, 2-axis linear interpolation control, 3-axis linear interpolation control, 4-axis linear interpolation control (Composite speed, Reference axis speed) | | | | |
Fixed-feed control | 1-axis fixed-feed control, 2-axis fixed-feed control, 3-axis fixed-feed control, 4-axis fixed-feed control | | | | |
2-axis circular interpolation control | sub point designation, center point designation | | | | |
Speed control | 1-axis speed control, 2-axis speed control, 3-axis speed control, 4-axis speed control | | | | |
Speed-position switching control | INC mode, ABS mode | | | | |
Position-speed switching control | INC mode | | | | |
Other control | Current value changing | Changing to a new current value using the positioning data, Changing to a new current value using the start No. | | | |
NOP instruction | Provided | | | | |
JUMP instruction | Provided | | | | |
COOP/PEND | Unconditional JUMP, Conditional JUMP | | | | |
High-level positioning control | Block start, Condition start, Wait start, Simultaneous start, Repeated start | | | | |
Manual control | JOG operation | Provided | | | |
Inching operation | Provided | | | | |
Manual pulse generator operation | Possible to connect 1 module (Incremental) | Unit magnification (1 to 10000times) | | | |
Expansion control | Speed-torque control | Speed control without positioning loops, Torque control without positioning loops | | | |
Absolute position system | Made compatible by setting battery to servo amplifier | | | | |
Synchronous encoder interface | Up to 4 channel (internal interface , servo amplifier, via the PLC CPU interface ) | | | | |
Internal interface | 1channel (Incremental) | | | | |
Via servo amplifier | Support coming soon | | | | |
Functions that limit control | Speed limit function | Speed limit value, JOG speed limit value | | | |
Torque limit function | Torque limit value, same setting, torque limit value, individual setting | | | | |
Forced step function | valid/invalid setting | | | | |
Software stroke limit function | Movable range check with current feed value, movable range check with machine feed value | | | | |
Hardware stroke limit function | Provided | | | | |
Functions that change control details | Speed change function | Provided | | | |
Override function | Provided | | | | |
Acceleration/deceleration time change function | Provided | | | | |
Torque change function | Provided | | | | |
Target position change function | Target position address and target position speed are changeable | | | | |
Other functions | M code output function | Provided | | | |
Step function | Deceleration unit step, Data No. unit step | | | | |
Skip function | Via sequence CPU, Via external command signal | | | | |
Teaching function | Provided | | | | |
Teaching function | Provided | | | | |
Mark detection function | Mark detection mode (Continuous Detection mode, Specified Number of Detections mode, Ring Buffer mode) | | | | |
mark detection signal | 4points | | | | |
mark detection setting | Provided | | | | |
master-slave operation function | Provided | | | | |
Amplifier-less operation function | Provided | | | | |
Digital oscilloscope function | bit data: 16channels, word data: 16channels | bit data: 8channels, word data: 4channels | | | |

Note-1: Default value is 1.77 ms. If necessary, check the operation time and change to 0.88 ms.
Note-2: 8CH word data and 8CH bit data can be displayed in real time.
### Synchronous control

<table>
<thead>
<tr>
<th>Item</th>
<th>LD77MH16</th>
<th>LD77MH4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input axis</td>
<td>servo input axis</td>
<td>16 axes/module</td>
</tr>
<tr>
<td>Composite main gear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main shaft input axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
</tr>
<tr>
<td>Main shaft sub input axis</td>
<td>1/output axis</td>
<td>1/output axis</td>
</tr>
<tr>
<td>Main shaft gear</td>
<td>1/output axis</td>
<td>1/output axis</td>
</tr>
<tr>
<td>Main shaft clutch</td>
<td>1/output axis</td>
<td>1/output axis</td>
</tr>
<tr>
<td>Auxiliary shaft</td>
<td>1/output axis</td>
<td>1/output axis</td>
</tr>
<tr>
<td>Auxiliary shaft composite gear</td>
<td>1/output axis</td>
<td>1/output axis</td>
</tr>
<tr>
<td>Main shaft composite gear</td>
<td>1/output axis</td>
<td>1/output axis</td>
</tr>
<tr>
<td>Speed change gear</td>
<td>1/output axis</td>
<td>1/output axis</td>
</tr>
<tr>
<td>Output axis</td>
<td>16 axes/module</td>
<td>4 axes/module</td>
</tr>
</tbody>
</table>

### Cam

<table>
<thead>
<tr>
<th>Item</th>
<th>LD77MH16</th>
<th>LD77MH4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory capacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage area for cam data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working area for cam data</td>
<td>256k bytes</td>
<td>1024k bytes</td>
</tr>
<tr>
<td>Number of registration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. 256 program items (according to memory capacity, cam resolution and number of coordinates)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. 32 characters (half-byte) for each cam data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cam data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke ratio data type</td>
<td>Cam resolution</td>
<td>256.512,1024.2048.4096.8192.16384.32768</td>
</tr>
<tr>
<td>Coordinate data type</td>
<td>Coordinate number</td>
<td>2 to 16384</td>
</tr>
<tr>
<td>Cam generated automatically</td>
<td>Cam generated automatically for rotary cutter</td>
<td></td>
</tr>
</tbody>
</table>

### Equipment

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>MELSEC-L series</td>
<td>Simple Motion Module</td>
<td>CE, UL</td>
</tr>
<tr>
<td>LD77MH4</td>
<td>Up to 4 axes control</td>
<td></td>
</tr>
<tr>
<td>LD77MH16</td>
<td>Up to 16 axes control</td>
<td></td>
</tr>
<tr>
<td>connector for external input signal cable</td>
<td>LD77MHIOCON</td>
<td></td>
</tr>
<tr>
<td>MR-J3BUSDM</td>
<td>Manual pulse generator/ incremental synchronous encoder interface/ Specifications of force stop input interface/ external command signal/ switching signal interface provided with Simple Motion Module</td>
<td></td>
</tr>
<tr>
<td>Standard cable for inside a panel:</td>
<td>0.15m(0.49ft.), 0.3m(0.98ft.), 0.5m(1.64ft.), 1m(3.28ft.), 3m(9.84ft.)</td>
<td></td>
</tr>
<tr>
<td>MR-J3BUSDM-A</td>
<td>Standard cable for outside a panel: 5m(16.4ft.), 10m(32.8ft.), 20m(65.6ft.)</td>
<td></td>
</tr>
<tr>
<td>MR-J3BUSDM-B</td>
<td>Long-distance cable: 30m(98.4ft.), 40m(131.2ft.), 50m(164.0ft.)</td>
<td></td>
</tr>
<tr>
<td>Manual pulse generator</td>
<td>MR-HDP01</td>
<td></td>
</tr>
<tr>
<td>Pulse resolution: 25 PLS/rev -- 100 PLS/rev after magnification by 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable speed: 200 rpm in normal rotation</td>
<td>Voltage output *</td>
<td></td>
</tr>
<tr>
<td>Allowable load Radial load: 19.6 N Thrust load: 9.8 N *</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1: shows cable length. (015: 0.15m(0.49ft.), 03: 0.3m(0.98ft.), 05: 0.5m(1.64ft.), 1: 1m(3.28ft.), 2: 2m(6.56ft.), 3: 3m(9.84ft.), 5: 5m(16.4ft.), 10: 10m(32.8ft.), 20: 20m(65.6ft.), 30: 30m(98.4ft.), 40: 40m(131.2ft.), 50: 50m(164.0ft.).)

Note 2: Check with Mitsubishi Electric regarding cables less than 30m long.

### MELSOFT-Related Tool

<table>
<thead>
<tr>
<th>Product</th>
<th>Model</th>
<th>Application version</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GX Works2</td>
<td>SW1DNC-GXW2-E</td>
<td>Version 1.48A or later</td>
<td>Setting of LD77MH4 and LD77MH16</td>
</tr>
<tr>
<td>MR Configurator2</td>
<td>SW1DNC-MRC2-E</td>
<td>Version 1.01B or later</td>
<td>Setting and adjustment of MR-J3 Series servo amplifier</td>
</tr>
</tbody>
</table>
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