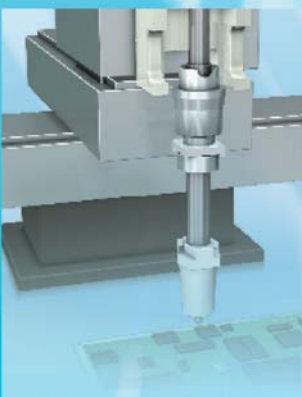
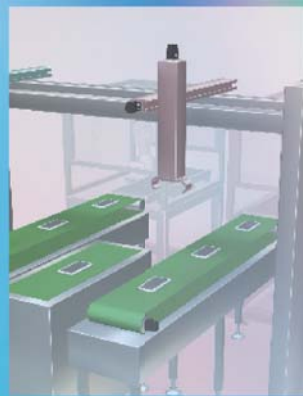
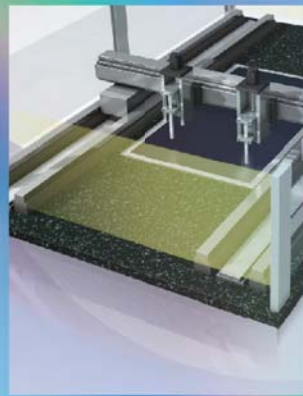
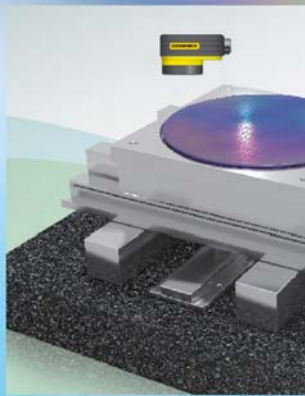
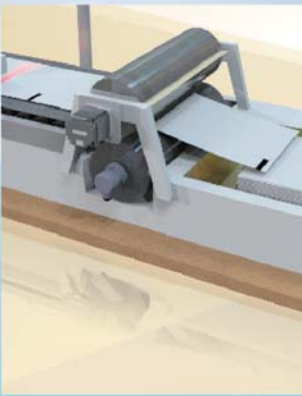


Servo Amplifiers & Motors
Servo System Controllers

MELSERVO SOLUTIONS

For your all production needs



Creating an ideal manufacturing environment

Exceptional Solutions for Your All Production Needs

Production sites are seeking to save more energy and resources as well as to create the safer and more user-friendly system. Mitsubishi helps you create these ideal manufacturing systems with our wide variety of products which offers various industry-leading basic and advanced functions.

Man



Functional safety and Easy to Use

[Compliant with functions of Safety standard]

The STO function is equipped as standard.

[Easy to Use]

Various functions, such as "One-touch tuning function", facilitates creating a better engineering environment.

[Preventive maintenance]

The machine diagnosis function is newly added for life diagnosis for mechanical parts.

Machine



Solutions for customers

[High response]

Speed frequency respond is increased to 2.5 kHz with the dedicated execution engine.

[High accuracy]

The high-resolution absolute encoder of 4,194,304 pulses/rev (22-bit) is equipped as standard.

[Vibration suppression]

Two types of low frequency can be suppressed automatically.

The Environment



Effort for energy and resource saving

[Energy saving]

Regenerative energy is utilized, and the "Power monitor function" is equipped.

[Reduced wiring and space-saving]

2/3-axis servo amplifier help reduce wiring and save space.

[International standard]

The MELSERVO-J4 amplifier is compliant with UL, CE and RoHS.

Man, Machine, Environment
in Perfect Harmony



● System examples

Exceptional solutions for your all production needs

>>CASE

01 Vertical Form, Fill & Seal P3

For food/beverage bag filling and packing

Issues

1. Stabilizing the packing quality
2. Shorter tack time without increasing shock to a machine
3. Creating a safety system



>>CASE

02 Rotary Knife P7

For steel & paper cutting, stamping and labeling

Issues

1. Cam creation on HMI screen
2. Cutting the sheet using registration mark as a reference



>>CASE

03 Motion Alignment (X-Y-θ) P11

For equipment requiring more accurate positioning

Issues

1. More accurate positioning
2. More precise drive operation
3. Shorter tact time



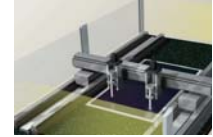
>>CASE

04 Gantry Application P15

For material handling, automotive assembly and scanning

Issues

1. Less machine vibration
2. Simpler construction for multi-head
3. Axis 1 and 2 synchronized movement



>>CASE

05 Pick and Place Robot P19

For material loading/unloading and sealing

Issues

1. Suppression of the machine vibration
2. Simple setting of the suppression function
3. Smaller size machine



>>CASE

06 Press-fit Machine P23

For pressing, bonding, clamping, and cap tightening

Issues

1. Pressing of the material with less shock to a machine
2. Monitoring of the machine movement



>>CASE

07 Conveyor System Utilizing Safety Observation Function P27

For safety observation of printing, packing, and other lines

Issues

1. Safety measures in case of people entering in a restricted area
2. Ensuring safe speed for area where people works



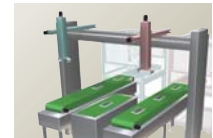
>>CASE

08 Eco-friendly Conveyors and Product Handling Equipment P31

For conveyors, Motion alignment, packing, and robots

Issues

1. Managing of total power consumption
2. Reduction of power consumption
3. Minimizing waste of power



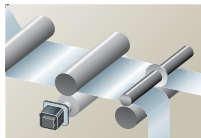
>>CASE

09 Film Slitting Machine P35

For equipment with rollers

Issues

1. Sending film with a constant speed and tension
2. Utilizing regenerative energy



>>CASE

10 Screw Tightening Machine P39

For tightening, pressing, and clamping

Issues

1. Tightening screws without using a torque sensor
2. Repeated accuracy in screw tightening operation



● Features of Servo System Controller P43

● Features of Engineering Software P45

● Features of MELSERVO-J4 P47

● Lineup P53

● Network & Support P55

CASE 01

CASE 02

CASE 03

CASE 04

CASE 05

CASE 06

CASE 07

CASE 08

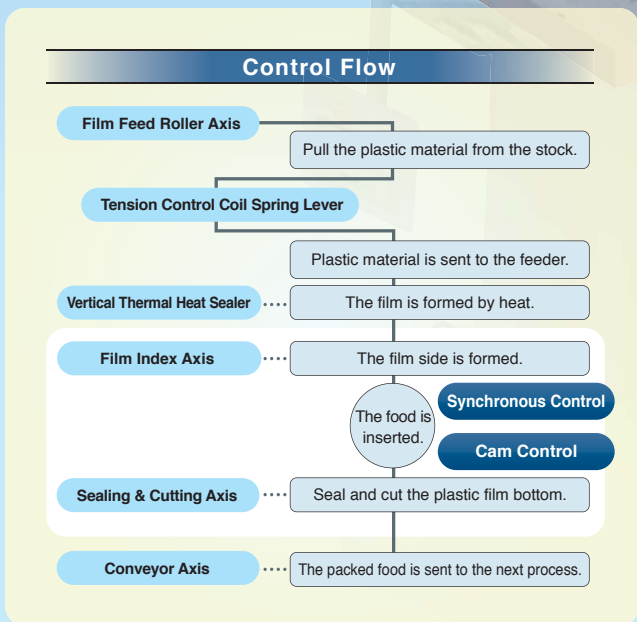
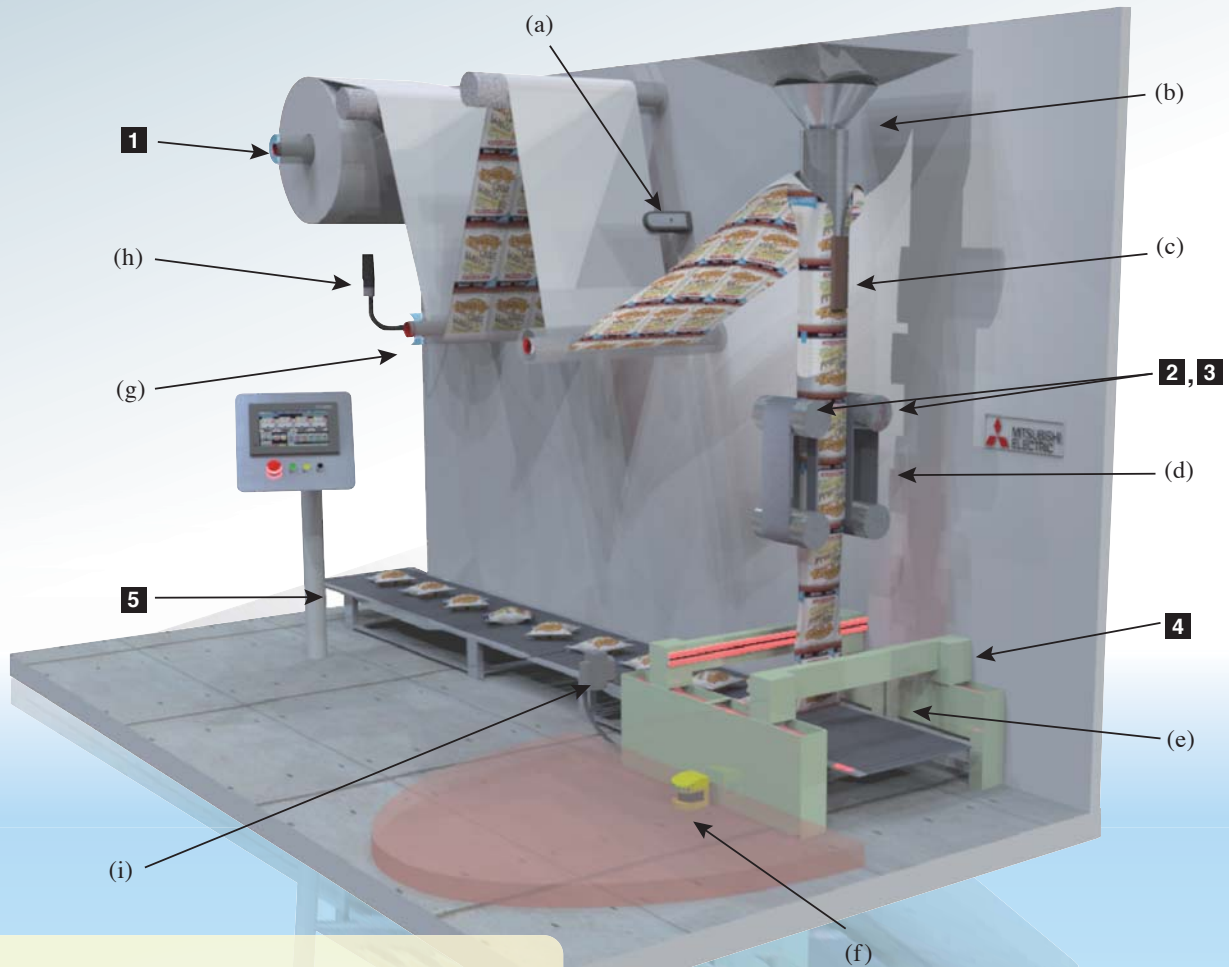
CASE 09

CASE 10

For food/beverage bag filling and packing

| CASE | 01

Vertical Form, Fill & Seal



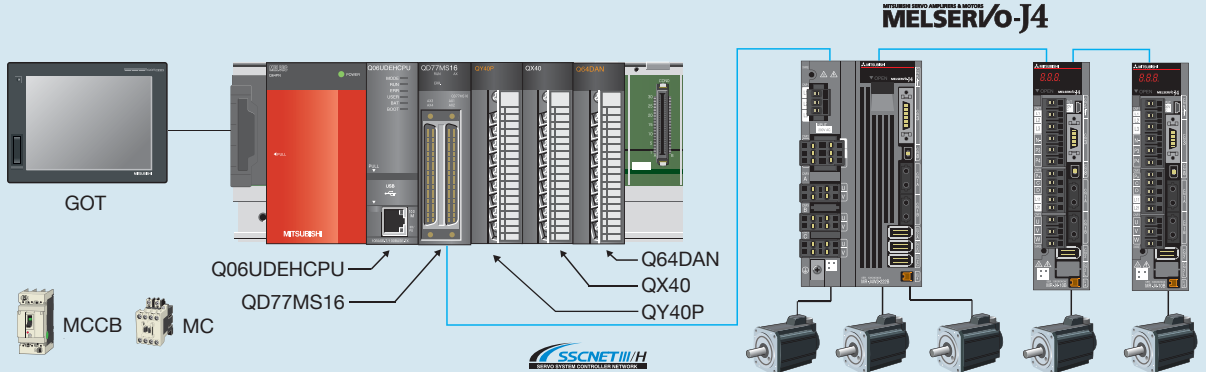
- 1** Film Feed Roller Axis
 - 2** Film Index Axis
 - 3** Film Index Axis
 - 4** Sealing & Cutting Axis
 - 5** Conveyor Axis
- (a) Registration Mark Detection Sensor
 - (b) Feeder
 - (c) Vertical Thermal Heat Sealer
 - (d) Film Index Drives
 - (e) Sealing & Cutting Arms
 - (f) Proximity Safety Sensor
 - (g) Tension Control Coil Spring Lever
 - (h) Low Roll Detection Sensor
 - (i) Product Present Sensor

Issues at production sites

- Issue 1 Stabilizing the packing quality
↳ **Synchronous Control**
- Issue 2 Shorter tact time without increasing shock to a machine
↳ **Cam Control**
- Issue 3 Creating a safety system
↳ **Safety Observation Function**

Q17nDSCPU QD77MS
Q170MPCPU QD77GF (Note-1)

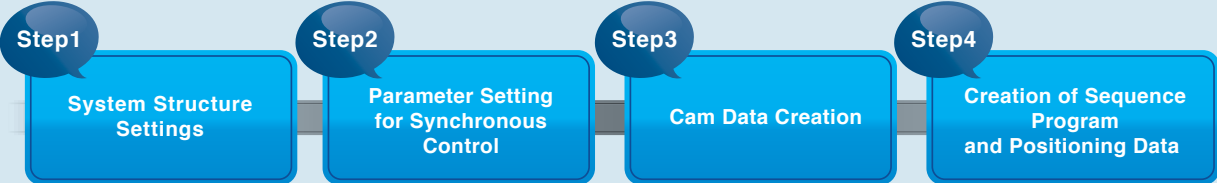
System Example



《Mitsubishi solution》

Simple Motion	: QD77MS16	Servo amplifier	: MR-J4W3-B	Servo motor	: HG-KR, HG-SR
PLC CPU	: Q06UDEHCPU	GOT	: GOT1000 series	I/O module	: QX40, QY40P
Analog output module	: Q64DAN	Main base unit	: Q35DB		

Setup Procedure



《Applications》

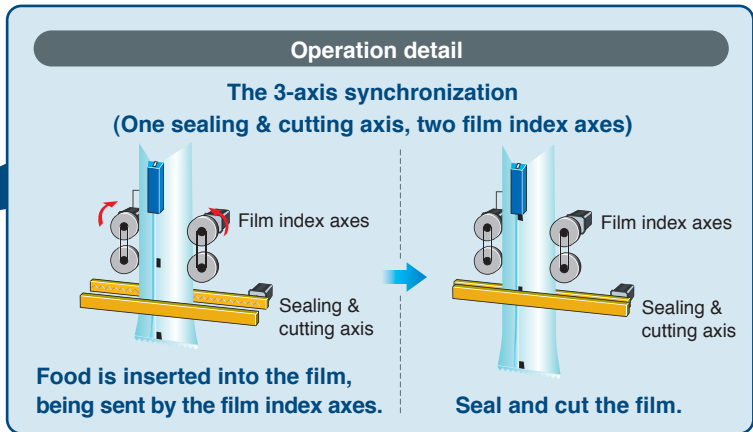
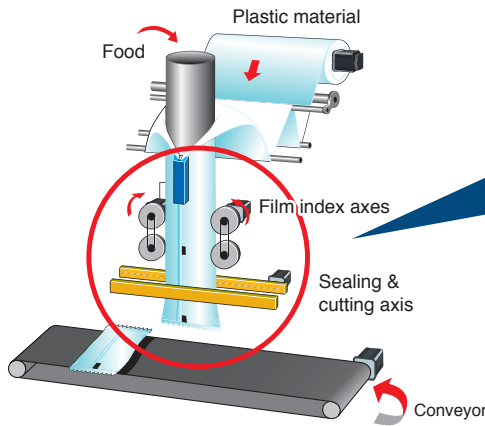
- Food/Beverage bag filling
- Pouch packing
- Powder filling

(Note-1): Use a 1-axis servo amplifier for QD77GF.

Solution 1 Synchronous Control

High Quality Production & Shorter Tact Time

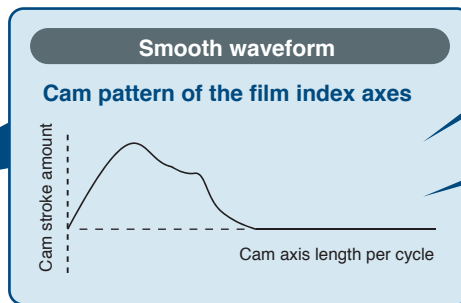
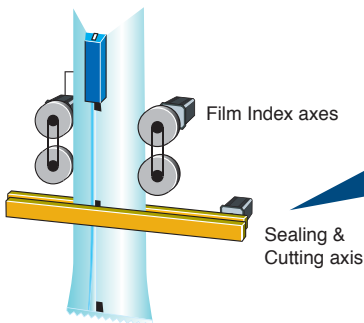
High-quality production is achieved by improving the process accuracy with the 3-axis synchronous control (One sealing & cutting axis, two film index axes). Eliminating an interlock also enables shorter tact time.



Solution 2 Cam Control

Smooth Sending & Stopping of the Film Material

Cam control enables the smooth sending and stopping of the film material. Thus high-speed operation and the shorter tact time are achieved.



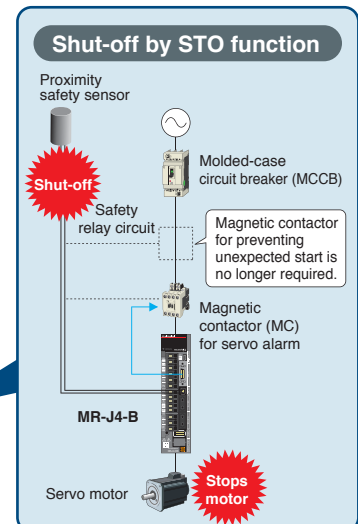
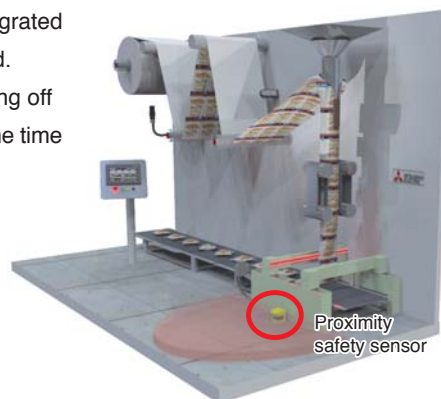
Possible to create the smooth pattern with the cam control.

Easily executes the cam control with the Simple Motion modules.

Solution 3 Safety Observation Function

Functions according to IEC/EN 61800-5-2

MR-J4-B series servo amplifiers have integrated STO (Safe torque off) function as standard. The machine can stop safely without turning off the main circuit power supply, cutting out the time for restart.



Setup Procedure

Step 1

System Structure Settings

Set the servo amplifiers and virtual servo amplifiers.

System Structure

Amplifier Setting

Obvious configuration

Double click

Virtual servo amplifier axis

Step 2

Parameter Settings for Synchronous Control

Set the axis-2 synchronous parameter for the axis-9 virtual servo amplifier.

Synchronous control parameter

Double click

Servo type

Axis No.

Set only what you need.

Main shaft	
Main input axis	Pr.400:Type 1: Servo Input Axis
Pr.400:Axis No.	9
Sub input axis	Pr.401:Type 0: Invalid
Pr.401:Axis No.	0
Output axis	
Cam axis cycle unit	Pr.438:Unit setting selection 0: Use Limits of Main Input Axis
Pr.438:Unit	0:mm
Pr.439:Number of decimal places	0
Pr.439:Cam axis length per cycle	4194304 PLS
Pr.441:Cam stroke amount	4194304 PLS
Pr.440:Cam No.	0
Pr.444:Cam axis phase compensation advance time	0 μs
Pr.445:Cam axis phase compensation time constant	10 ms
Pr.446:Synchronous control deceleration time	0 ms
Pr.447:Output axis smoothing time constant	0 ms

Step 3

Cam Data Creation

Create the cam data for the film index axes and the sealing & cutting axis.

Cam data

Cam data can be changed by dragging the waveform.

Cam data list

Display the cam data created.

Flexible cam pattern setting

Double click

Right click, and select "Add New Data"

Various curves such as constant acceleration and cycloid can be selected as the cam curves.

Step 4

Creation of Sequence Program and Positioning Data

Create a program that starts the synchronous control of the three axes (1 to 3) and the positioning operation of the axis 9.

Control flow

Synchronous control starts just by turning ON the bit of the axis.

Operation starts from the positioning data No.1 by starting the axis of virtual servo amplifier.

Data Setting Assistant

Click

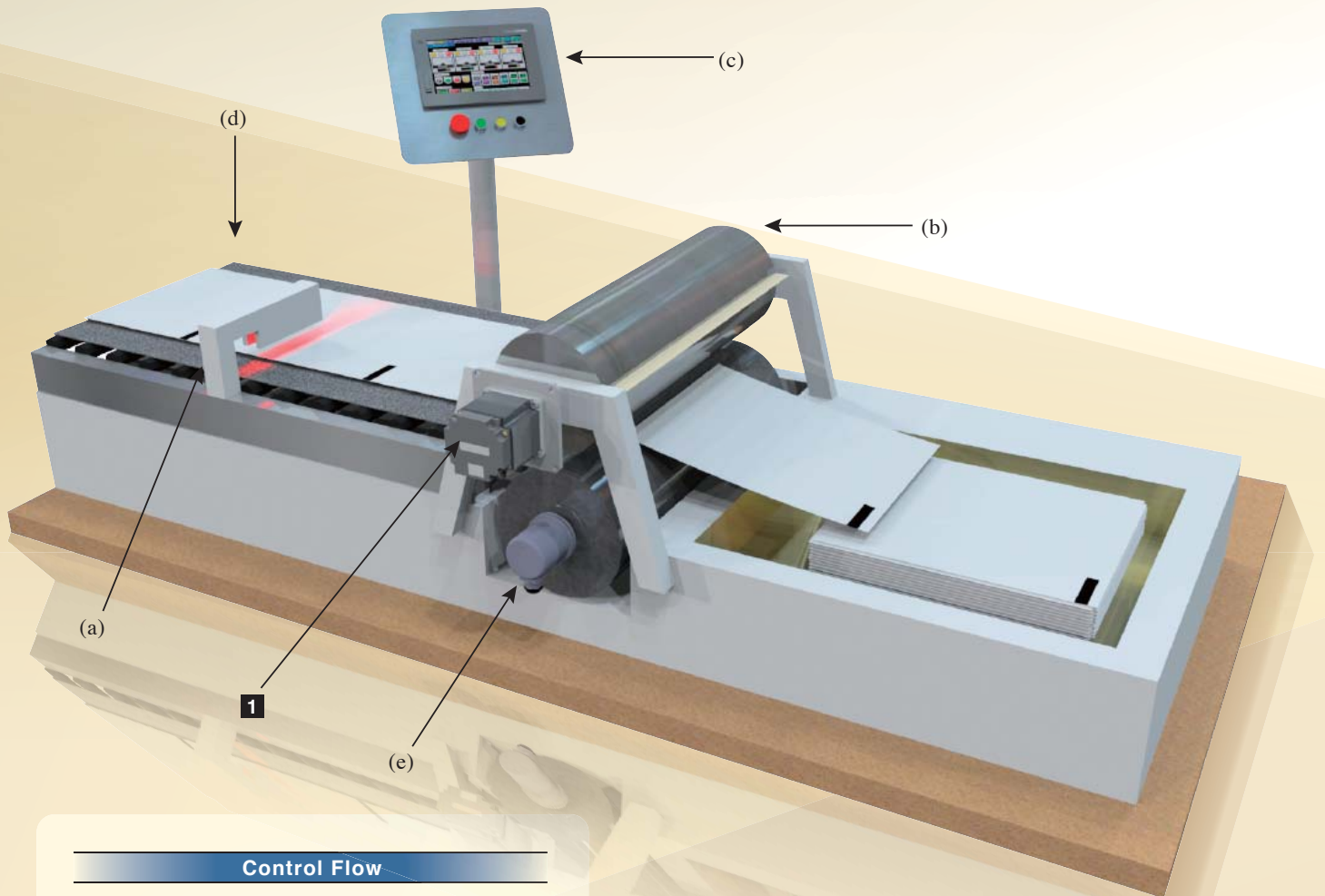
You can create a program just by setting data at the assistant screen.

Easy program start

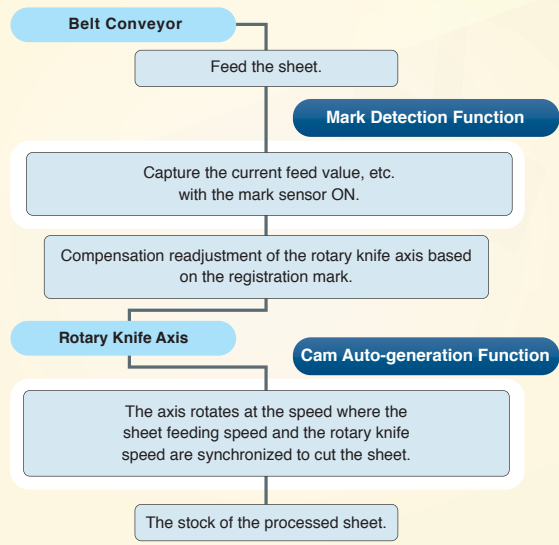
For steel & paper cutting, stamping and labeling

| CASE | 02

Rotary Knife



Control Flow



1 Rotary Knife Axis

- (a) Mark Sensor
- (b) Rotary Knife
- (c) HMI
- (d) Belt Conveyor
- (e) Synchronous Encoder



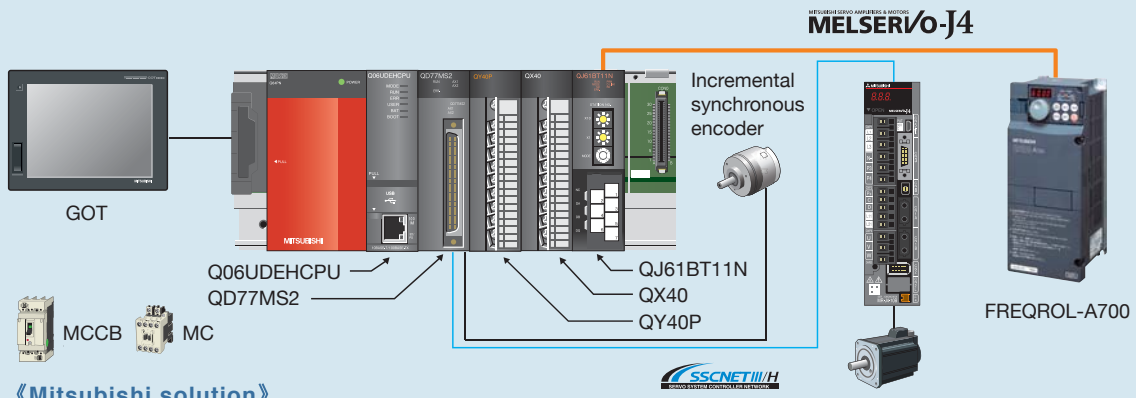
Q17nDSCPU QD77MS
Q170MSCPU QD77GF

Issues at production sites

- Issue 1 Cam creation on HMI screen
➔ **Cam Auto-generation Function**
- Issue 2 Cutting the sheet using the registration mark as a reference
➔ **Mark Detection Function**

CASE 02
Rotary Knife

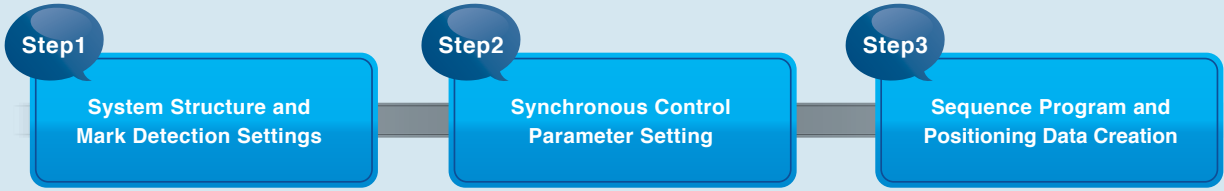
System Example



《Mitsubishi solution》

Simple Motion : QD77MS2	Servo amplifier : MR-J4-B	Servo motor : HG-SR
PLC CPU : Q06UDEHCPU	GOT : GOT1000 series	I/O module : QX40,QY40P
Main base unit : Q35DB	Inverter : FREQROL-A700	CC-Link Module : QJ61BT11N

Setup Procedure



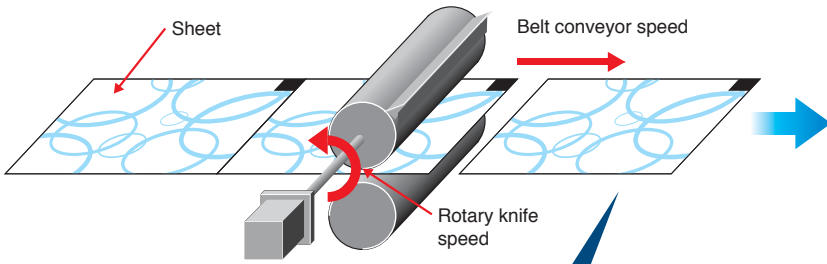
《Applications》

- Steel & paper cutting
- Perforation
- Labeling
- Stamping
- Scanning

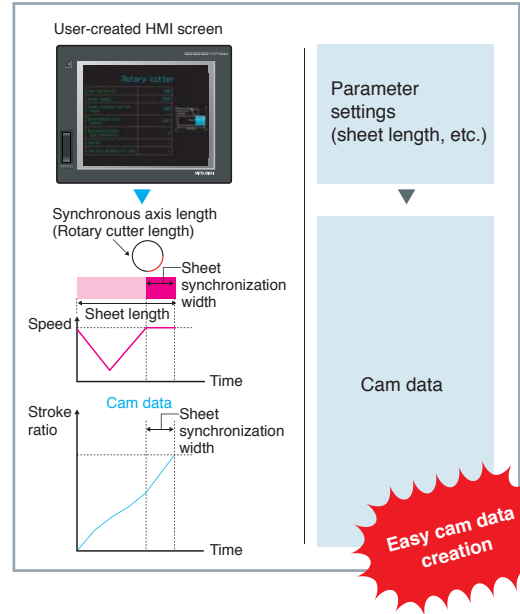
Solution 1 **Cam Auto-generation Function**

Reduced Designing and Programming Time and Increased Ease of Use

This function can create a cam automatically according to the sheet length and synchronization width, and the rotary knife axis dimension, which greatly reduces the designing and programming time.



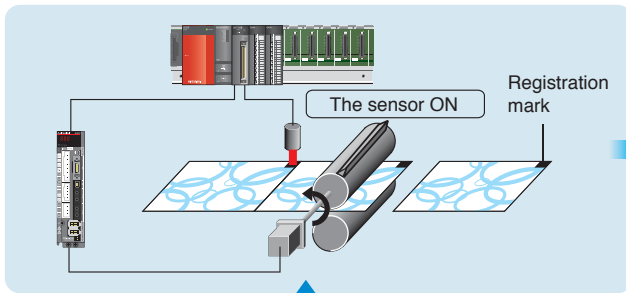
Auto-generated cam data for cutting the sheet:
Belt conveyor speed = Rotary knife speed



Solution 2 **Mark Detection Function**

Accurately Cutting by Responding Dynamically to Any Fluctuations

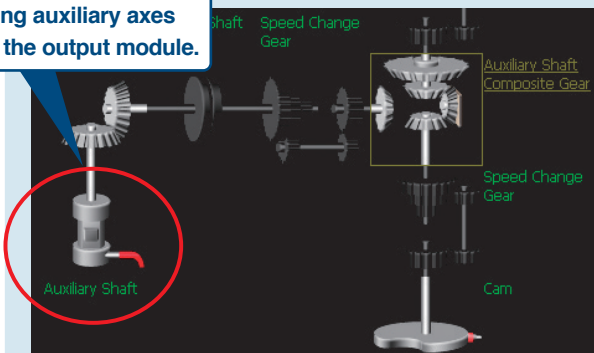
This function detects any fluctuations caused from the sheet tension or slippage when sending the sheet, and can cut the sheet at the set position by compensating these errors between the current sensed position and the standard position, referring to the registration mark.



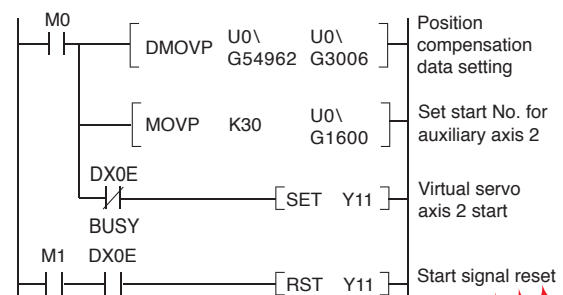
Capture the current feed value, etc. with the mark sensor ON. (Mark Detection Function)

Calculate the error compensation length from the current feed value.

Compensate the error using auxiliary axes for the output module.



Start the auxiliary axis to compensate the error by adjusting the rotary knife.



Easy error compensation

Setup Procedure

Step 1

System Structure and Mark Detection Settings

Set the system structure and mark detection.

System structure

[External I/O Connector Setting]

Buffer Memory Device Name	Setting Value
MAN-PLS Input Logic Selection	Negative Logic
MAN-PLS/Sync. Encoder (IYC) Input	Voltage
MAN-PLS Input Selection	A-phase/Bphase (4 Multiply)
Forced Stop Input	Valid

Mark detection setting window

Item	Setting 1
Mark detection setting	
Pr.800:Mark detection signal setting	2
Pr.801:Mark detection signal compensation time	0 μs
Mark detection data setting	
Pr.802:Type	12:Cam Axis Current Value
Pr.803:Axis No.	1
Pr.804:Buffer memory No.	0
Pr.805:Latch data range upper limit value	0 PLS
Pr.806:Latch data range lower limit value	0 PLS
Mark detection mode setting	
Pr.807:Mark detection mode	Continuous Detection Mode
Pr.807:Number of detections	0

After the parameter setting, turn ON the "External command valid" signal for the mark detection operation start.

Easy mark detection setting

Step 2

Synchronous Control Parameter Setting

Set the parameter where the rotary knife speed (axis 1) is synchronized to the belt conveyor speed.

Synchronous control parameter

Set the Axis #1 Synchronous Parameter to synchronize to the synchronous encoder.

Set the virtual servo amplifier to the auxiliary shaft.

Set the Cam axis length per cycle, Cam stroke amount, and Cam No., etc.

Synchronous control module setting

- Main shaft
 - Pr.400:Type
 - Pr.400:Axis No.
- Sub input axis
 - Pr.401:Type
 - Pr.401:Axis No.
- Main shaft composite gear
 - Pr.402:Main
 - Pr.402:Sub
- Main shaft gear
 - Pr.403:Numerator
 - Pr.404:Denominator
- Main shaft clutch
- Auxiliary shaft
 - Pr.418:Type
 - Pr.418:Axis No.

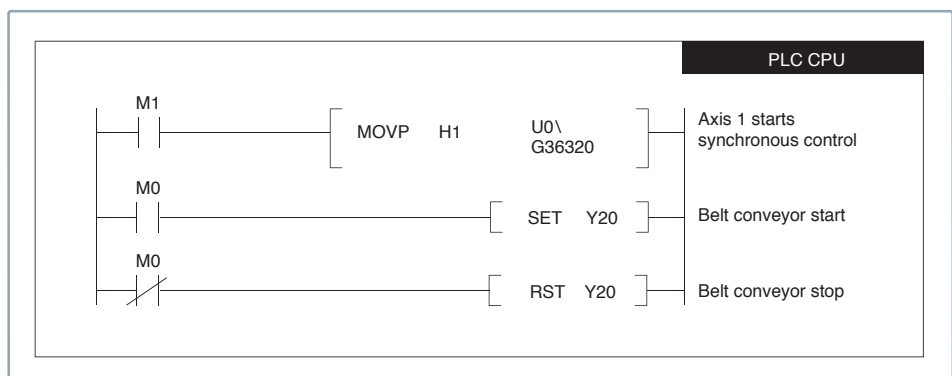
Output axis

- Cam axis cycle unit
 - Pr.428:Unit setting selection
 - Pr.430:Unit
 - Pr.430:Number of decimal places
 - Pr.439:Cam axis length per cycle
 - Pr.441:Cam stroke amount
 - Pr.440:Cam No.
 - Pr.444:Cam axis phase compensation advance time
 - Pr.445:Cam axis phase compensation time constant
 - Pr.446:Synchronous control deceleration time
 - Pr.447:Output axis smoothing time constant

Step 3

Sequence Program and Positioning Data Creation

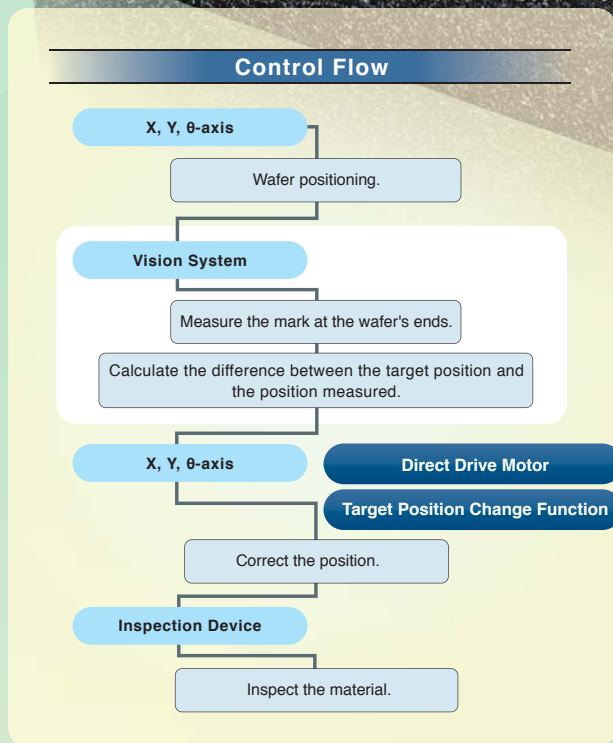
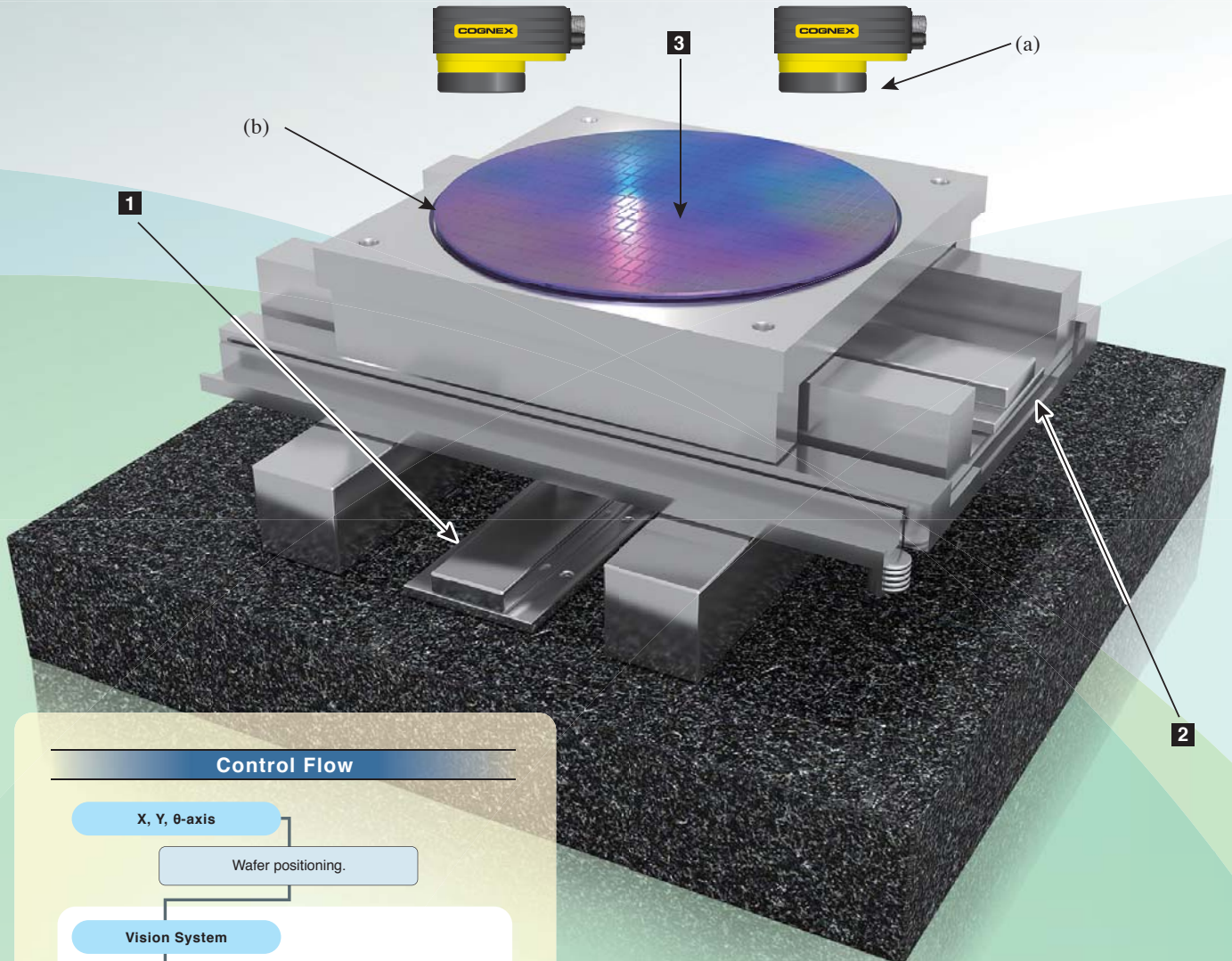
Create the program that starts the inverter which drives the belt conveyor after the rotary knife (axis 1) synchronization starts.



For equipment requiring more accurate positioning

| CASE | 03




Motion Alignment (X-Y- θ)



- 1** X-axis
 - 2** Y-axis
 - 3** θ -axis
- (a) COGNEX Vision System
(b) Wafer



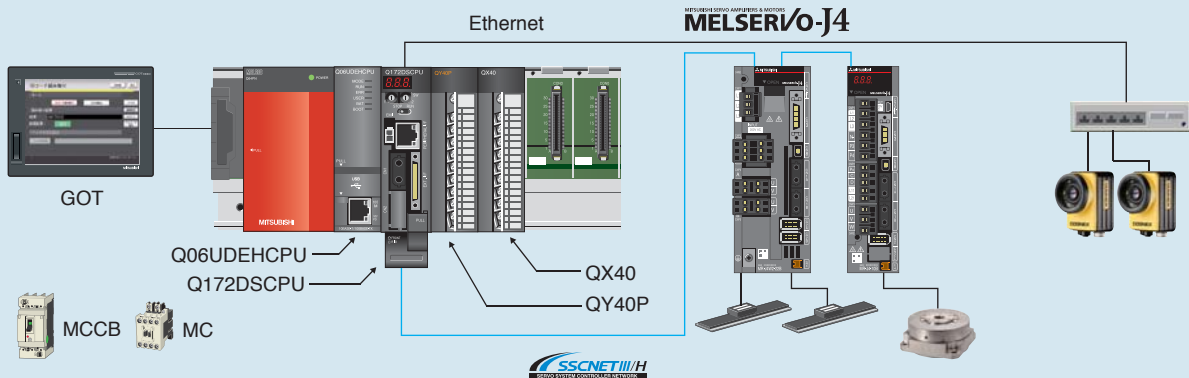
Issues at production sites

- Issue 1 More accurate positioning

COGNEX Vision System
- Issue 2 More precise drive operation

Direct Drive Motor
- Issue 3 Shorter tact time

Target Position Change Function

Q17nDSCPU
Q170MSCPU

CASE 03
Motion Alignment

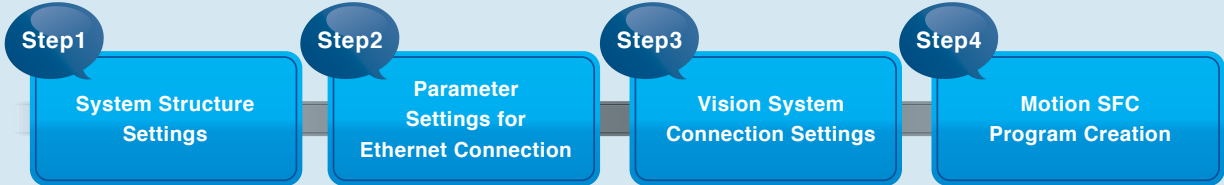
System Example



《Mitsubishi solution》

Motion CPU : Q172DSCPU	Servo amplifier : MR-J4-B, MR-J4W2-B	Servo motor : TM-RFM, LM-H3
PLC CPU : Q06UDEHCPU	GOT : GOT1000 series	I/O module : QX40, QY40P
Main base unit : Q35DB	Vision camera : COGNEX Vision system	

Setup Procedure



《Applications》

- Pre/Post inspection system imaging
- Solar panel production
- FPD manufacturing
- 3D LCD manufacturing
- SEMI logic inspection

J4 Offering the Best Solution

Solution
1

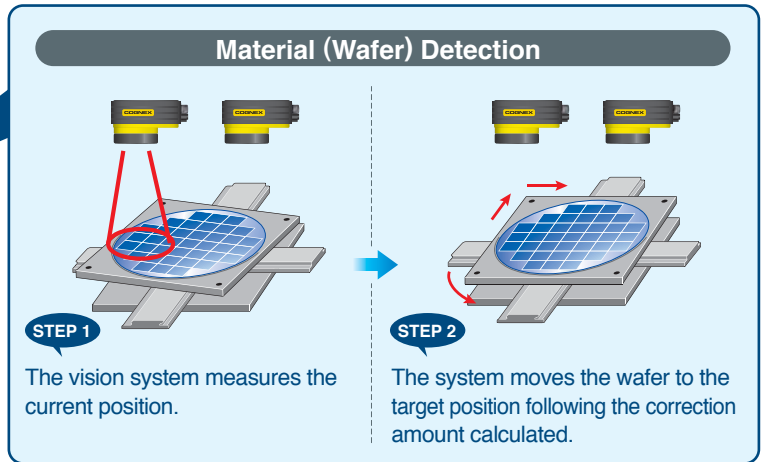
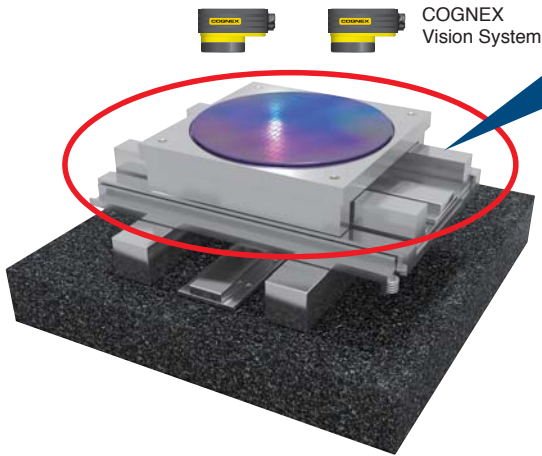
**COGNEX
Vision System**

Accurate Position Reading and Quick Location Readjustment



The vision system can easily read the current position, and quickly moves the material (wafer) to the target position, calculating the correction amount.

[Example of using wafer (material)]



Solution
2

Direct Drive Motor

Direct Connection to Drive Parts for High Response and Accuracy

High-response, high-accuracy, and stabilized positioning are achieved by using the direct drive motor. This motor is also suitable for a low-speed and high-torque operation.

[Direct Drive Motor Example]

- This hollow construction enables cables and wires to go through inside.
- Elimination of transmission mechanical parts



- Suitable for a low-speed and high-torque operation.
- Smooth operation with low noise
- Clean system without dust coming from worn out

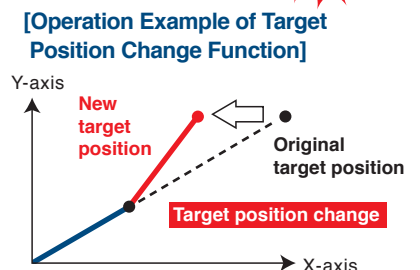
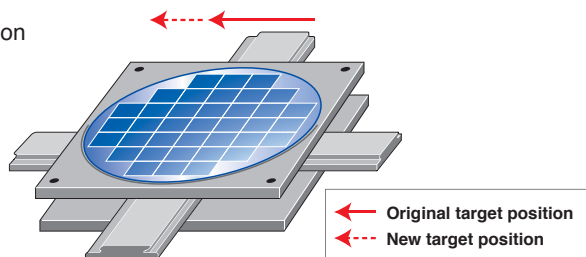
Solution
3

Target Position Change Function

Flexibly Responding to Changes in the Target Position



Since performing a position correction using the vision system data during positioning operation, the system can move the wafer to a new target position directly without starting positioning again. Thus shorter tact time is achieved.



Setup Procedure

Step 1

System Structure Settings

Set the servo amplifier.

SSCNET Structure

Amplifier Settings

MR Configurator2

Easy settings for DD motor

Step 2

Parameter Settings for Ethernet Connection

Set the IP address of the Motion controller.

Built-in Ethernet Port Setting

Built-in Ethernet port Open Setting

IP Address Setting Default: 192.168.3.39

Select from "MELSOFT Connection" or "MC Protocol" for protocol.

Step 3

Vision System Connection Settings

Set the parameter concerning the Ethernet communication and the vision program operation.

Ethernet Communication Line

Vision Program Operation

Step 4

Motion SFC Program Creation

Describe the vision system dedicated instructions, and then the positioning data from the vision system is possible to be read.

Motion SFC Program

These simple instructions enable reading of the data from the vision system.

For material handling, automotive assembly and scanning

| CASE | 04

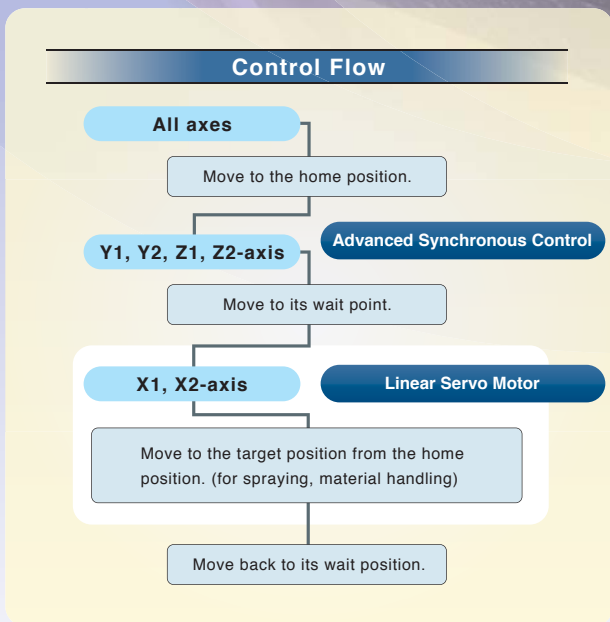
Gantry Application

Vibration Suppression Functions



- 1 X1-axis (Linear Servo Motor)
- 2 X2-axis (Linear Servo Motor)
- 3 Y1-axis (Linear Servo Motor)
- 4 Y2-axis (Linear Servo Motor)
- 5 Z1-axis (Vertical axis)
- 6 Z2-axis (Vertical axis)

- (a) Light Curtain
- (b) GOT (Graphical Operation Terminal)



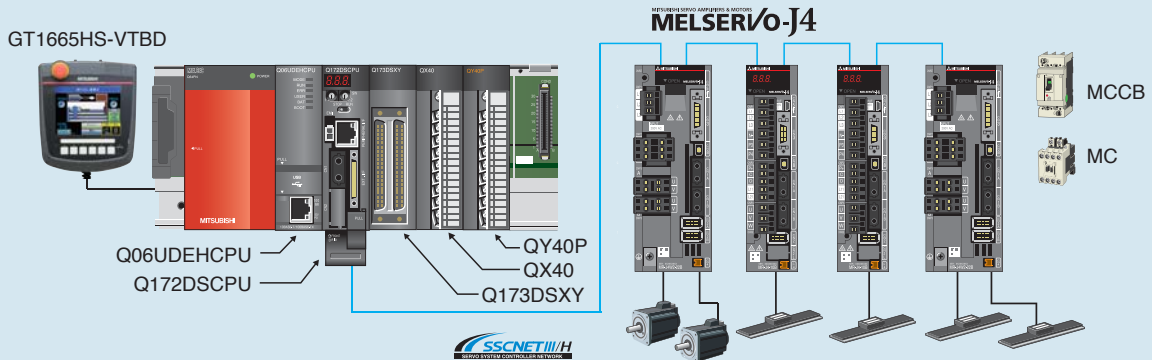


Q17nDSCPU QD77MS
Q170MSCPU

Issues at production sites

- Issue 1: Suppression of machine vibration
↳ **Vibration Suppression Functions**
- Issue 2: Simpler multi-head configuration
↳ **Linear Servo Motor**
- Issue 3: Synchronized movement of axis-1 and axis-2
↳ **Tandem Configuration**

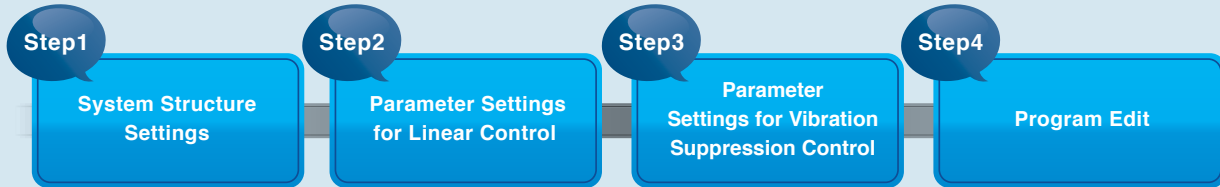
System Example



《Mitsubishi solution》

Motion CPU : Q172DSCPU	Servo amplifier : MR-J4-B,MR-J4-W2-B	Servo motor : HG-KR
Linear servo motor : LM-H3	Safety signal module : Q173DSXY	Main base unit : Q35DB
PLC CPU : Q06UDEHCPU	GOT : GT1665HS-VTBD	I/O module : QX40,QY40P

Setup Procedure



《Applications》

- General material handling
- Automotive assembly
- Machine tool loading
- Aircraft assembly
- Scanning device

CASE 04

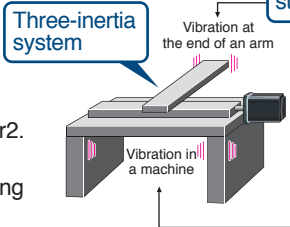
Gantry Application

Solution 1 **Vibration Suppression Functions**

Advanced Servo Gain Adjustment Enables Precise Vibration Suppression Control with One-touch Ease

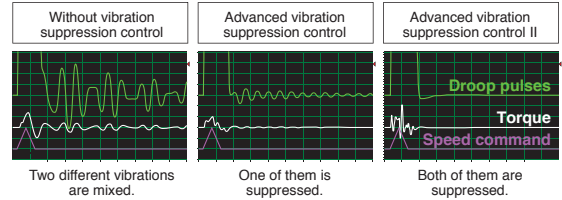
▶▶▶ **Advanced Vibration Suppression Control II**

Due to vibration suppression algorithm which supports three-inertia system, two types of low frequency vibrations are suppressed at the same time. Adjustment is performed on MR Configurator2. This function is effective in suppressing vibration at the end of an arm and in reducing residual vibration in a machine.



Two types of the vibrations are suppressed at the same time.

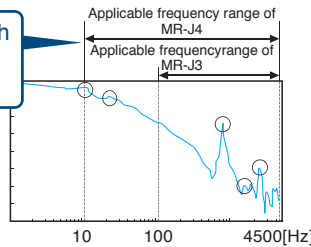
Patent Pending



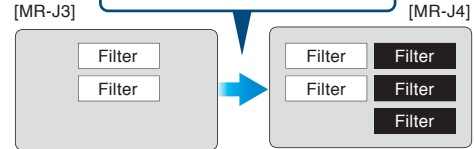
▶▶▶ **Machine Resonance Suppression Filter**

With advanced filter structure, applicable frequency range is expanded from between 100Hz and 4500Hz to between 10Hz and 4500Hz. Additionally, the number of simultaneously applicable filters is increased from two to five, improving vibration suppression performance of machine.

Frequency at which filter is applied is expanded.



The number of notch filters is increased from two to five.

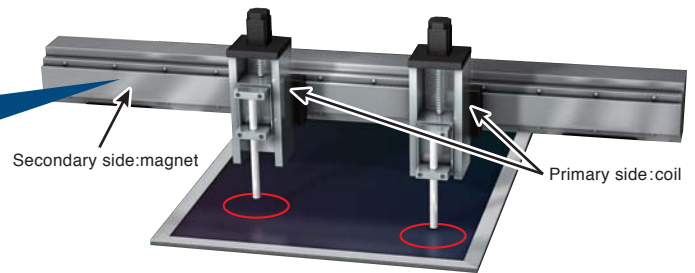


Solution 2 **Linear Servo Motor**

Controlling the Multi-head Freely and Dynamically

The multi-head system can be structured with the linear servo motor. (maximum speed: 3m/s (LM-H3 series), max. thrust: 150N to 18000N, compatible with a variety of serial interface linear encoders with resolution range from 0.005μm and up.)

Each of the motor coils can be controlled individually by different commands. This simple structure is suitable best for the machines requiring shorter tact time.

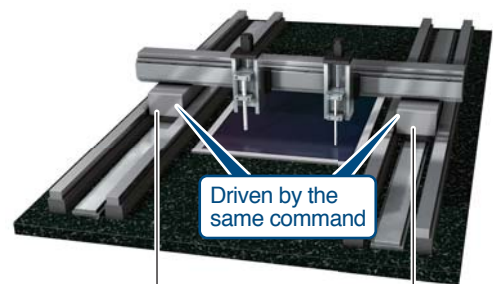
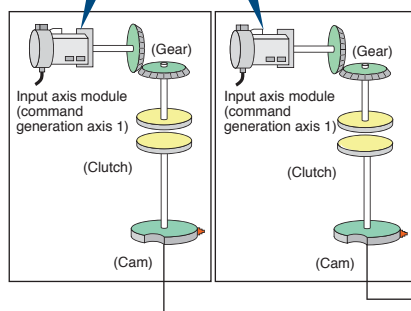


Solution 3 **Tandem Configuration**

Highly Synchronized Operation Between Two Axes

The parallel drive (tandem configuration) is achieved by outputting the same data to the cams using the advanced synchronous control.

The same axis No. for the input modules



Setup Procedure

Step 1

System Structure Settings

Set the servo amplifier and servo motor.

SSCNET Structure

Amplifier Setting

Amplifier Operation Mode:
 "Standard" for the rotary motor
 "Linear" for the linear motor
 "DD motor" for the direct drive motor

Step 2

Parameter Settings for Linear Control

Set just the Basic and Extension settings for linear control.

Parameter Setting

Linear control - Extension

Easy parameter setting

Step 3

Parameter Settings for Vibration Suppression Control

Select "3 inertia mode" in the "Vibration suppression control mode selection" to enable the "Advanced Vibration Suppression Control II".

Parameter Setting

Vibration suppression control mode selection: 3 inertia mode

Easy parameter setting

Step 4

Program Edit

Create the Motion SFC program and the servo program.

Motion SFC

X18X2 safety P

[G 20]
 // STOP check
 IM2001*IM2002*IM2003*IM2004*IM2005*IM2006

[K 31:Real Axis]
 I ABS-1
 Axis 5
 ->Address 10000.0 μm
 Speed 10000.0 mm/min

[G -1]
 // Start accept flag OFF check
 IM2005*IM2006
 END

Servo program list

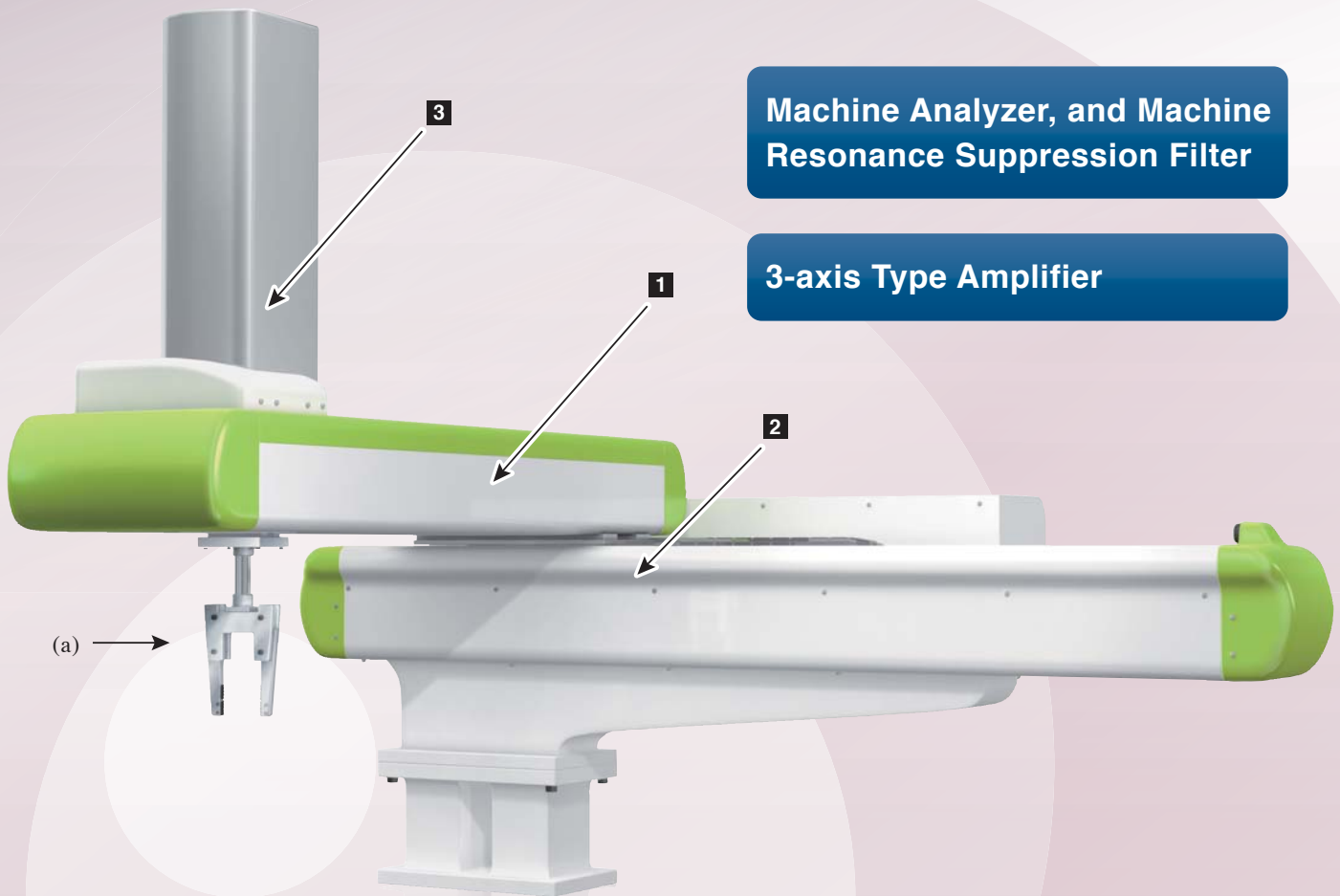
Load Step	Total Step	1/2000	1/2000	1/2000	1/2000	1/2000	1/2000
[K 1: Read 1X safety point]	[K 2: Read 2X safety point]	[K 3: Read 3X safety point]	[K 4: Read 4X safety point]	[K 5: Read 5X safety point]	[K 6: Read 6X safety point]	[K 7: Read 7X safety point]	[K 8: Read 8X safety point]
[K 9: Read 9X safety point]	[K 10: Read 10X safety point]	[K 11: Read 11 safety point]	[K 12: Read 12 safety point]	[K 13: Read 13 safety point]	[K 14: Read 14 safety point]	[K 15: Read 15 safety point]	[K 16: Read 16 safety point]
[K 17: Read 17 safety point]	[K 18: Read 18 safety point]	[K 19: Read 19 safety point]	[K 20: Read 20 safety point]	[K 21: Read 21 safety point]	[K 22: Read 22 safety point]	[K 23: Read 23 safety point]	[K 24: Read 24 safety point]
[K 25: Read 25 safety point]	[K 26: Read 26 safety point]	[K 27: Read 27 safety point]	[K 28: Read 28 safety point]	[K 29: Read 29 safety point]	[K 30: Read 30 safety point]	[K 31: Read 31 safety point]	[K 32: Read 32 safety point]
[K 33: Read 33 safety point]	[K 34: Read 34 safety point]	[K 35: Read 35 safety point]	[K 36: Read 36 safety point]	[K 37: Read 37 safety point]	[K 38: Read 38 safety point]	[K 39: Read 39 safety point]	[K 40: Read 40 safety point]
[K 41: Read 41 safety point]	[K 42: Read 42 safety point]	[K 43: Read 43 safety point]	[K 44: Read 44 safety point]	[K 45: Read 45 safety point]	[K 46: Read 46 safety point]	[K 47: Read 47 safety point]	[K 48: Read 48 safety point]
[K 49: Read 49 safety point]	[K 50: Read 50 safety point]	[K 51: Read 51 safety point]	[K 52: Read 52 safety point]	[K 53: Read 53 safety point]	[K 54: Read 54 safety point]	[K 55: Read 55 safety point]	[K 56: Read 56 safety point]
[K 57: Read 57 safety point]	[K 58: Read 58 safety point]	[K 59: Read 59 safety point]	[K 60: Read 60 safety point]	[K 61: Read 61 safety point]	[K 62: Read 62 safety point]	[K 63: Read 63 safety point]	[K 64: Read 64 safety point]
[K 65: Read 65 safety point]	[K 66: Read 66 safety point]	[K 67: Read 67 safety point]	[K 68: Read 68 safety point]	[K 69: Read 69 safety point]	[K 70: Read 70 safety point]	[K 71: Read 71 safety point]	[K 72: Read 72 safety point]
[K 73: Read 73 safety point]	[K 74: Read 74 safety point]	[K 75: Read 75 safety point]	[K 76: Read 76 safety point]	[K 77: Read 77 safety point]	[K 78: Read 78 safety point]	[K 79: Read 79 safety point]	[K 80: Read 80 safety point]
[K 81: Read 81 safety point]	[K 82: Read 82 safety point]	[K 83: Read 83 safety point]	[K 84: Read 84 safety point]	[K 85: Read 85 safety point]	[K 86: Read 86 safety point]	[K 87: Read 87 safety point]	[K 88: Read 88 safety point]
[K 89: Read 89 safety point]	[K 90: Read 90 safety point]	[K 91: Read 91 safety point]	[K 92: Read 92 safety point]	[K 93: Read 93 safety point]	[K 94: Read 94 safety point]	[K 95: Read 95 safety point]	[K 96: Read 96 safety point]
[K 97: Read 97 safety point]	[K 98: Read 98 safety point]	[K 99: Read 99 safety point]	[K 100: Read 100 safety point]	[K 101: Read 101 safety point]	[K 102: Read 102 safety point]	[K 103: Read 103 safety point]	[K 104: Read 104 safety point]
[K 105: Read 105 safety point]	[K 106: Read 106 safety point]	[K 107: Read 107 safety point]	[K 108: Read 108 safety point]	[K 109: Read 109 safety point]	[K 110: Read 110 safety point]	[K 111: Read 111 safety point]	[K 112: Read 112 safety point]
[K 113: Read 113 safety point]	[K 114: Read 114 safety point]	[K 115: Read 115 safety point]	[K 116: Read 116 safety point]	[K 117: Read 117 safety point]	[K 118: Read 118 safety point]	[K 119: Read 119 safety point]	[K 120: Read 120 safety point]
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[K 145: Read 145 safety point]	[K 146: Read 146 safety point]	[K 147: Read 147 safety point]	[K 148: Read 148 safety point]	[K 149: Read 149 safety point]	[K 150: Read 150 safety point]	[K 151: Read 151 safety point]	[K 152: Read 152 safety point]
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[K 177: Read 177 safety point]	[K 178: Read 178 safety point]	[K 179: Read 179 safety point]	[K 180: Read 180 safety point]	[K 181: Read 181 safety point]	[K 182: Read 182 safety point]	[K 183: Read 183 safety point]	[K 184: Read 184 safety point]
[K 185: Read 185 safety point]	[K 186: Read 186 safety point]	[K 187: Read 187 safety point]	[K 188: Read 188 safety point]	[K 189: Read 189 safety point]	[K 190: Read 190 safety point]	[K 191: Read 191 safety point]	[K 192: Read 192 safety point]
[K 193: Read 193 safety point]	[K 194: Read 194 safety point]	[K 195: Read 195 safety point]	[K 196: Read 196 safety point]	[K 197: Read 197 safety point]	[K 198: Read 198 safety point]	[K 199: Read 199 safety point]	[K 200: Read 200 safety point]

Click the box to change the value

For material loading/unloading and sealing

| CASE | 05

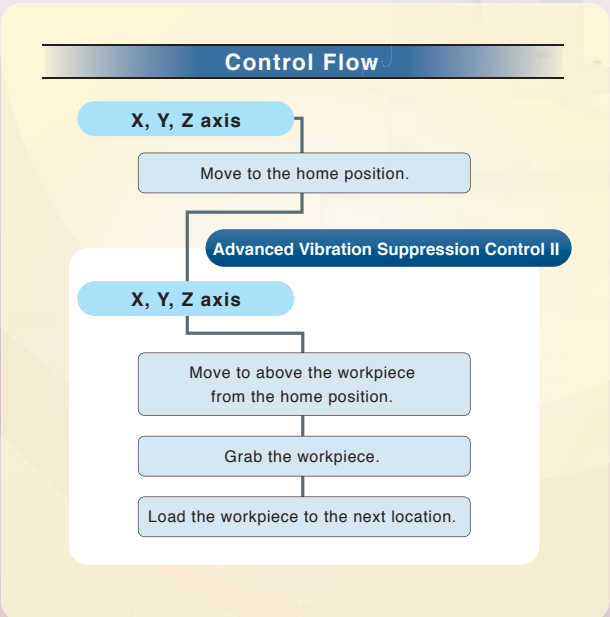
Pick and Place Robot



Machine Analyzer, and Machine Resonance Suppression Filter

3-axis Type Amplifier

- 1 X-axis
- 2 Y-axis
- 3 Z-axis
- (a) Hand



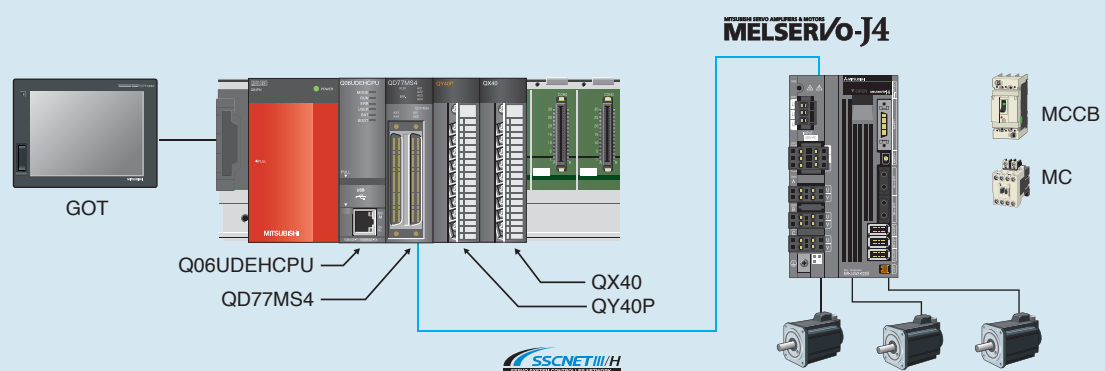


Q17nDSCPU QD77MS
Q170MPCPU QD77GF (Note-1)

Issues at production sites

- Issue 1: Suppression of the machine vibration
↳ **Advanced Vibration Suppression Control II**
- Issue 2: Simpler setting of the suppression function
↳ **Machine Analyzer and Machine Resonance Suppression Filter**
- Issue 3: Smaller size machine
↳ **3-axis Type Amplifier**

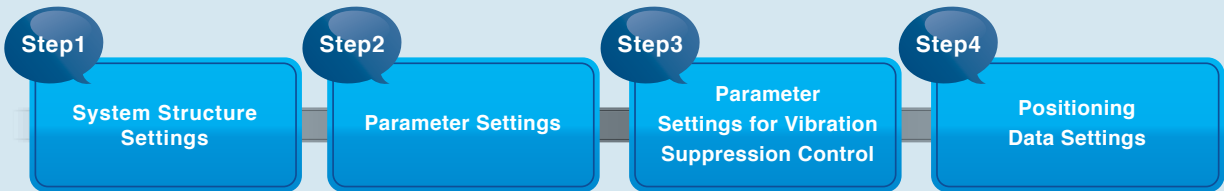
System Example



《Mitsubishi solution》

PLC CPU : Q06UDEHCPU	Simple Motion : QD77MS4	Servo amplifier : MR-J4W3-B
Main base unit : Q35DB	I/O module : QX40, QY40P	Servo motor : HG-KR
GOT : GOT 1000 series		

Setup Procedure



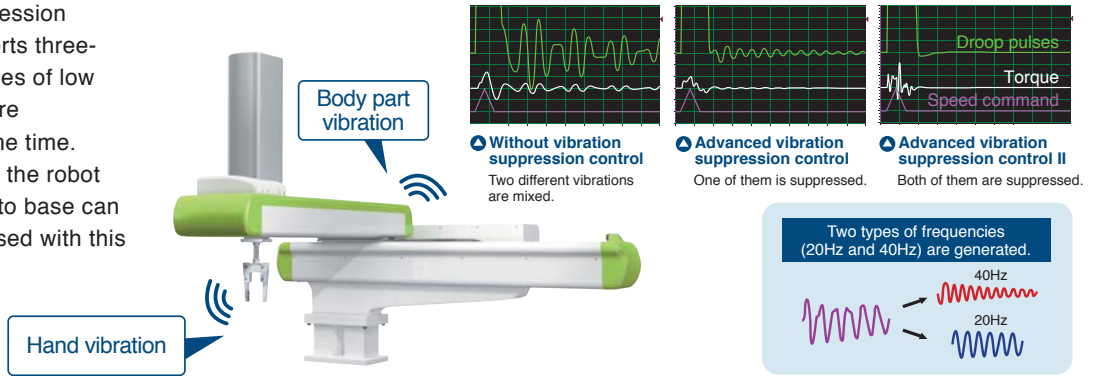
- 《Applications》
- X-Y table
 - Sealing
 - Material Loading/Unloading

(Note-1): Use a 1-axis servo amplifier for QD77GF.

Solution 1 **Advanced Vibration Suppression Control II**

Effectively Suppressing Two Types of Low Frequency Vibrations

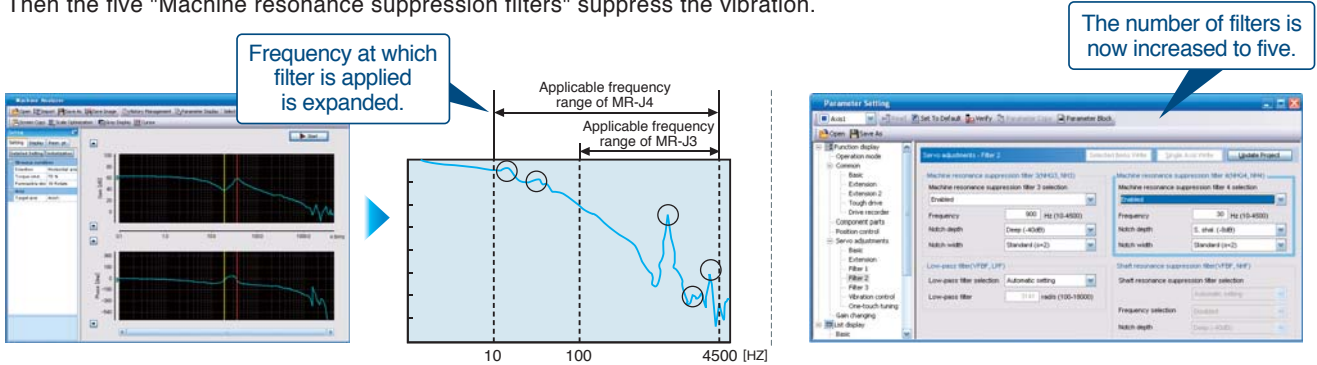
Due to vibration suppression algorithm which supports three-inertia system, two types of low frequency vibrations are suppressed at the same time. Thus, the vibrations of the robot existing from its hand to base can be effectively suppressed with this function.



Solution 2 **Machine Analyzer and Machine Resonance Suppression Filter**

Easy Suppression of Multiple Vibrations with the Machine Analyzer and Filter Option

First, the "Machine analyzer" function analyzes the machine frequency characteristics. Then the five "Machine resonance suppression filters" suppress the vibration.



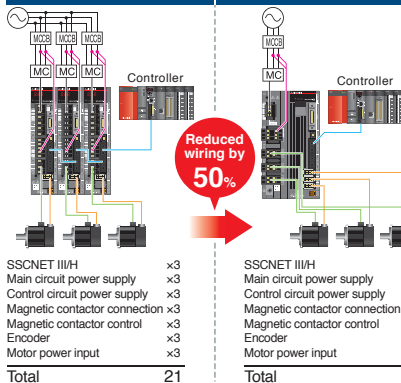
Solution 3 **3-axis Type Amplifier**

Designed to Cut Cost and Save on Space and Wiring

Reduced Wiring

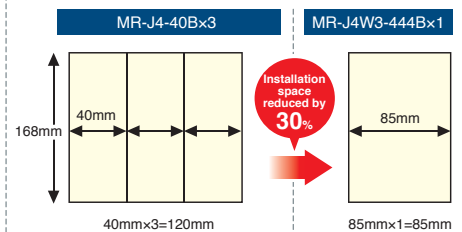
- SSCNET III/H compatible servo amplifier drastically reduces the wiring compared to the pulse train type.
- In 3-axis servo amplifier MR-J4W3-B, the three axes use the same connections for main and control circuit power, peripheral equipment, control signal wire, etc. Thus, the number of wirings and devices is greatly reduced.

Comparison of the number of wirings and devices



Space Saving

3-axis servo amplifier MR-J4W3-B requires 30% less installation space than three units of MR-J4-B.



Setup Procedure

Step 1

System Structure Settings

Set the servo amplifier.

Step 2

Parameter Settings

Open the "Compute Basic Parameter 1" screen and enter the mechanical data there. The parameter for electronic gear is calculated using the data automatically.

Step 3

Parameter Settings for Vibration Suppression Control

Select "Three-inertia mode" to start the "Advanced Vibration Suppression Control II".

Step 4

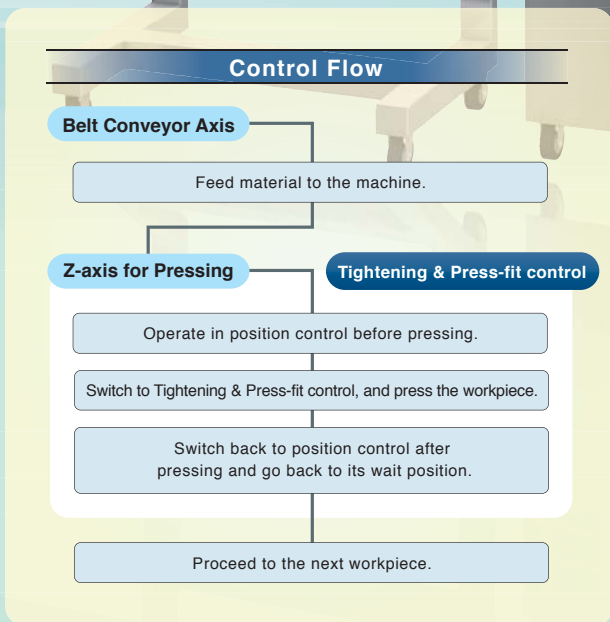
Positioning Data Settings

Set the positioning data for each axis.

For pressing, bonding, clamping, and cap tightening

| CASE | 06

Press-fit Machine



- 1** Belt Conveyor Axis
- 2** Belt Conveyor Axis
- 3** Z-axis
- (a) Ball Screw
- (b) Presser
- (c) Workpiece
- (d) Support Table

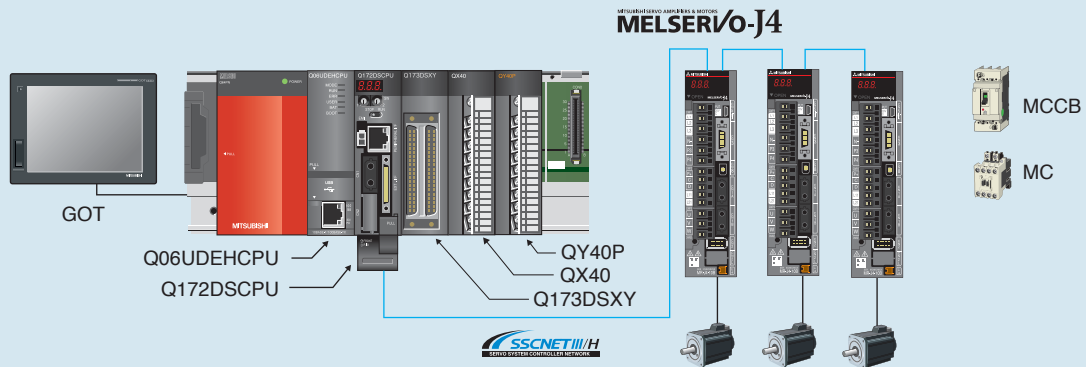


Q17nDSCPU QD77MS
Q170MSCPU

Issues at production sites

- Issue 1 Pressing of the material with less shock to a machine
➔ **Tightening & Press-fit Control**
- Issue 2 Monitoring of the machine movement
➔ **Safety Signal Comparison Function**

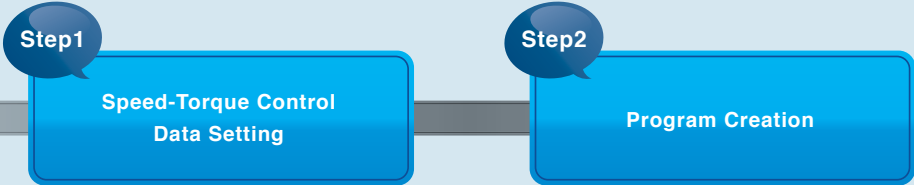
System Example



《Mitsubishi solution》

Motion CPU	: Q172DSCPU	Servo amplifier	: MR-J4-B	Servo motor	: HG-SR
PLC CPU	: Q06UDEHCPU	GOT	: GOT 1000 series	I/O module	: QX40, QY40P
Safety signal module	: Q173DSXY	Main base unit	: Q35DB		

Setup Procedure



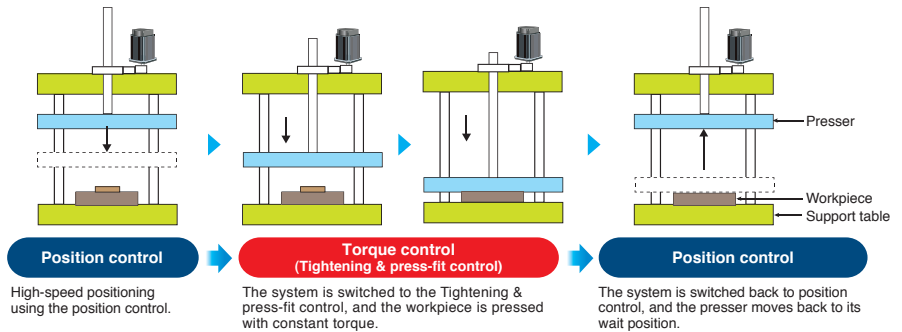
《Applications》

- | | |
|------------|------------------|
| ● Bonding | ● Pressing |
| ● Clamping | ● Cap tightening |

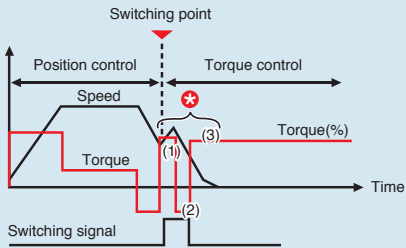
Solution 1 Tightening & Press-fit Control

Achieving Shorter Tact Time with Quick Mode Switching, and Less Shock with Smooth Movement

The system switches the control mode smoothly from position to Tightening & press-fit control without a stop. The current position is being stored in the system during the Tightening & press-fit control to perform a quick positioning after switching back to the position control. Thus shorter tact time is achieved.

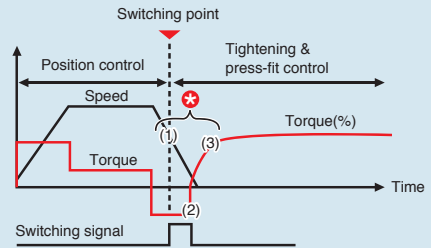


Torque control Sudden acceleration causes shock to the machine when switching control modes.



- ⊛ (1) Switching to torque control, where specified torque(%) is forcibly generated, causes sudden motor acceleration, giving shock to the machine.
- (2) System is forced into speed control when passing the speed limit, causing sudden deceleration.
- (3) The system is switched to the torque control after the speed is below the required limit.

Tightening & press-fit control A smooth torque causes less shock to the machine when switching control modes.



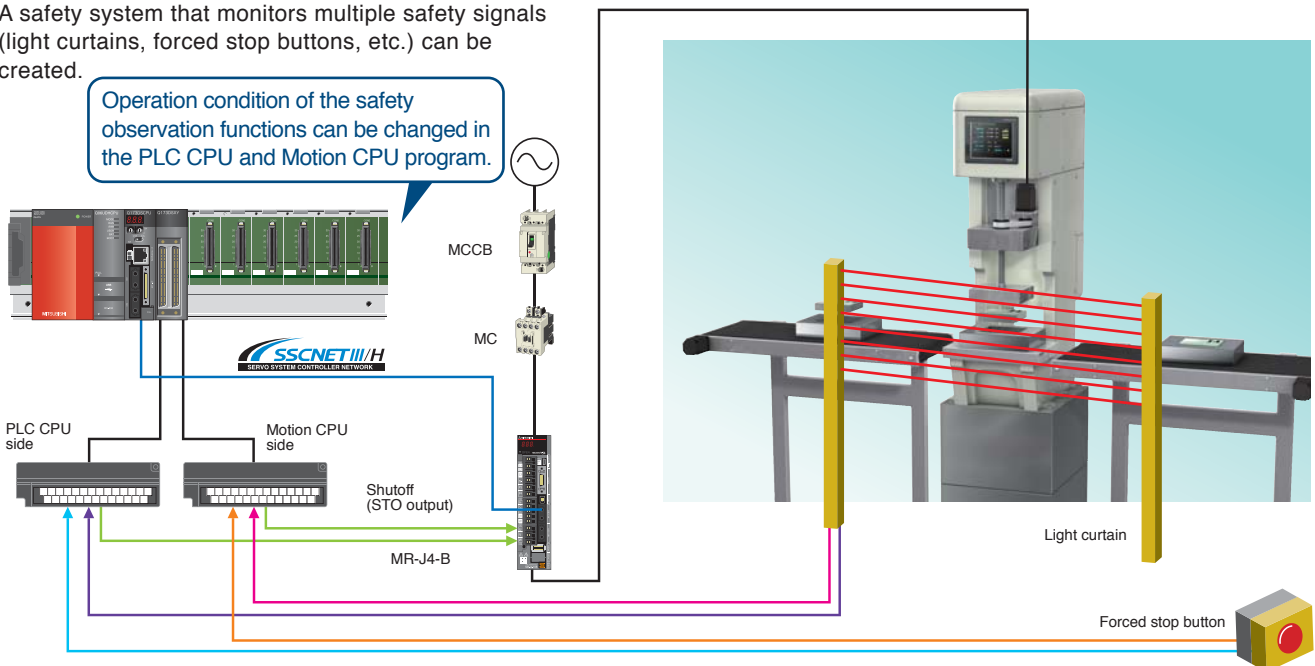
- ⊛ (1) In Tightening & press-fit control, the motor keeps decelerating until passing the speed limit.
- (2) The mode is switched to torque control when the speed passes the limit.
- (3) The torque increases constantly to the specified value(%).

Solution 2 Safety Signal Comparison Function

Motion Controller and Servo Amplifier (MR-J4-B) Ensuring Your Safety with the Safety Observation Function, Equipped as Standard

A safety system that monitors multiple safety signals (light curtains, forced stop buttons, etc.) can be created.

Operation condition of the safety observation functions can be changed in the PLC CPU and Motion CPU program.



Setup Procedure

Step 1

Speed-Torque Control Data Setting

After completing the System Structure, set the Speed-Torque data in Servo Data screen.

Item	Axis1
Speed-Torque Control Data	
Control Mode Switching Request Device	M1
Control Mode Setting Device	D1000(1)
Speed Limit Value in Speed-Torque Control	3000.00[mm/min]
Torque Limit Value in Speed-Torque Control	100.0[%]
Speed Command Device	D1002(2)
Command Speed Acceleration Time	1000[ms]
Command Speed Deceleration Time	1000[ms]
Torque Command Device	D1004(1)
Command Torque Time Constant (Positive Direction)	1000[ms]
Command Torque Time Constant (Negative Direction)	1000[ms]
Speed Initial Value Selection at Control Mode Switching	1:Feedback Speed
Torque Initial Value Selection at Control Mode Switching	1:Feedback Torque
Invalid Selection during Zero Speed at Control Mode Switching	0:Switching Condition at Switching Control Mode is Valid

Fixed Parameter
Set the fixed parameters for each axis and their data is fixed based on the mechanical system, etc.

Step 2

Program Creation

Create the Motion SFC program and servo program.

Just select a control mode and turn ON the mode switching flag.

Easy switching to the Tightening & press-fit control

```

[K 0 : Real]: Positioning control
1 ABS=1
Axis
-address # 1 μm
Speed 1000,00 mm/min

[G 0]
/////Movement amount detection(5mm above)/////
D2L >= #OL - 50000//Movement amount detection
//D2L : Axis1 current value [x0.1μm]
//#OL : Workpiece posi. (target posi.) [x0.1μm]

[G 1]:Tightening & press-fit control
/////Switched to T&P-fit control./////
//Variable value settings
D1000 = 30 //Control mode : [30]T&P-fit
D1002= 1000 //T&P-fit speed : 10.00[mm/min]
D1004 = 200 //T&P-fit torque : 20.0[%]
//Control mode switching request flag
SET M1
//Servo status mode confirmation[T&P-fit]
(#B012&H4000) = #H4000
//#B012 bit14(ON) : [T&P-fit]

[G 2]:Tightening & press-fit control 2
/////Pressing torque, position check/////
RST M1
//Control mode switching request flag RST
//Pressing torque check
ABS(#B001-D1004)<=10
//#B001 : Axis1 motor current [x0.1%]
//D1004 : Set pressing torque[x0.1%]

[G 17]
TIME 500// Timer 500ms

[G 3]:Position control 2
/////Back to position control/////
//Variable value settings
D1000 = 0 //Control mode : [0] Position control
//Control mode switching request flag SET
SET M1
//Servo status mode confirmation [position control]
((#B012&H4000) = 0) * (#B010&H000C = 0) = M2001
//#B010 bit2,3 (OFF, OFF) : [during position control]
//#B012 bit14(ON) : [during P&T-fit control]

[F 0]
//Control mode switching request flag RST
RST M1

[K 1 : Real]: Positioning control
1 ABS=1
Axis
-address # 1 μm
Speed 1000,00 mm/min
    
```

Moves to above a workpiece.

Detects 5mm above the workpiece.

Switches to Tightening & press-fit control while moving.

Difference between the command current and the motor current is within 1.0%

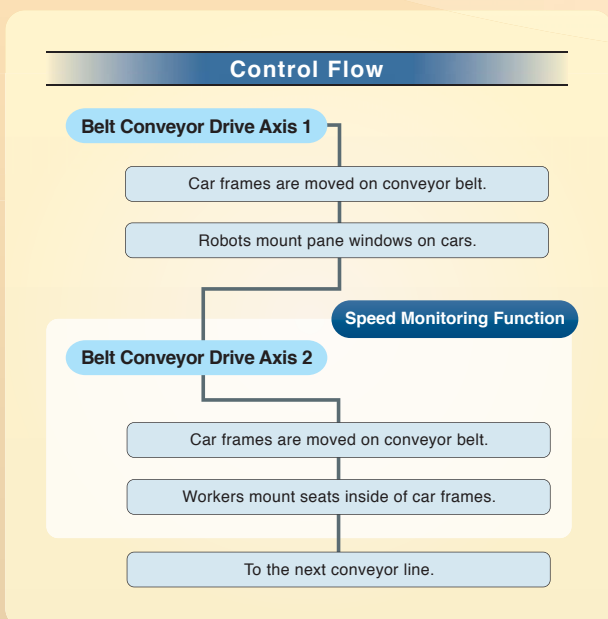
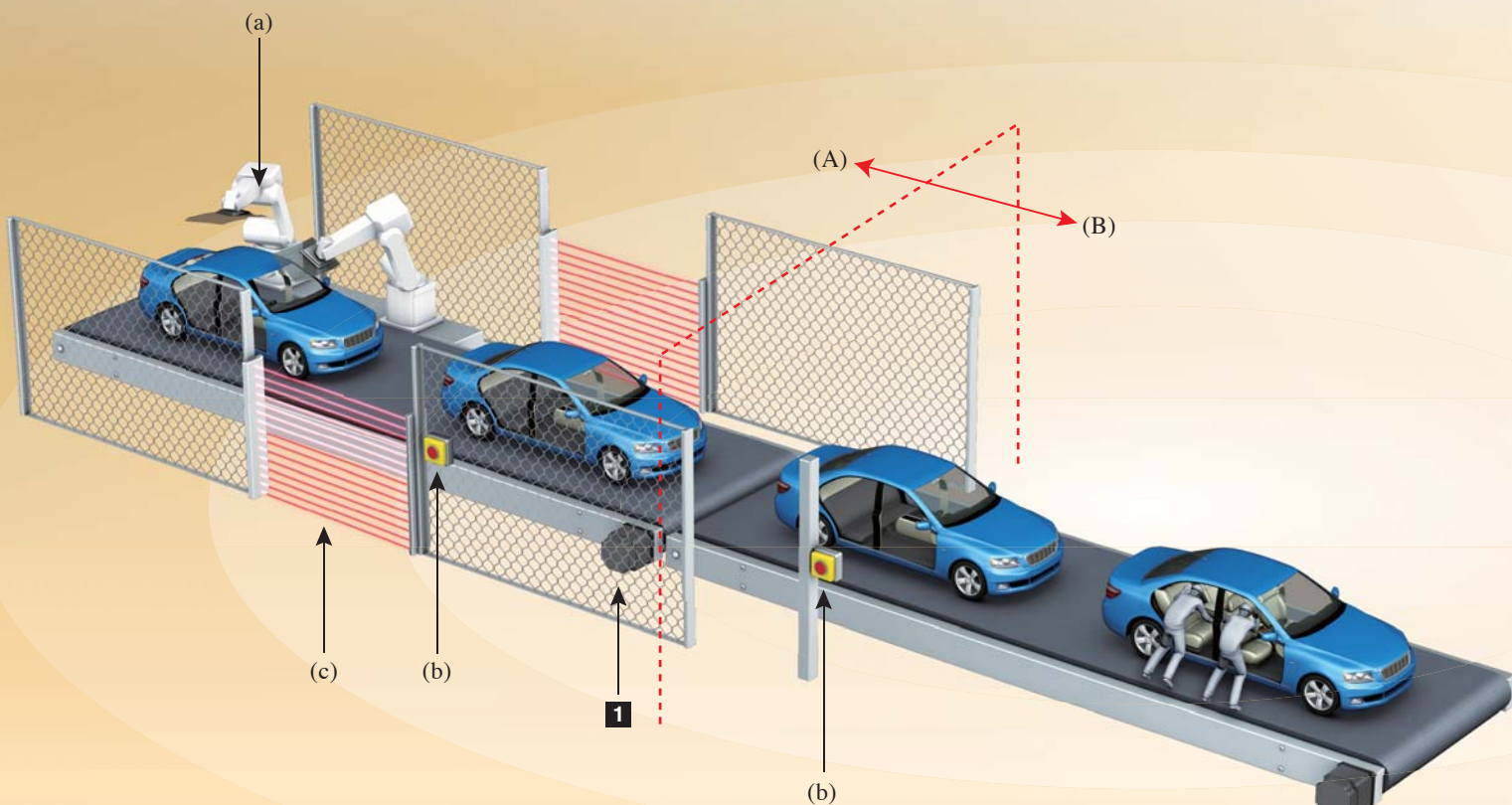
After pressing, switches back to position control.

Goes back to its wait position.

For safety observation of printing, packing, and other lines

| CASE | 07

Conveyor System Utilizing Safety Observation Function



- 1** Belt Conveyor Drive Axis 1
- 2** Belt Conveyor Drive Axis 2

- (A) Glass Window Pane Mounting Line (Restricted Area)
- (B) Car Seat Mounting Line (Non-restricted Area)
- (a) Window Glass Mounting Robot
- (b) Forced Stop Button
- (c) Light Curtain

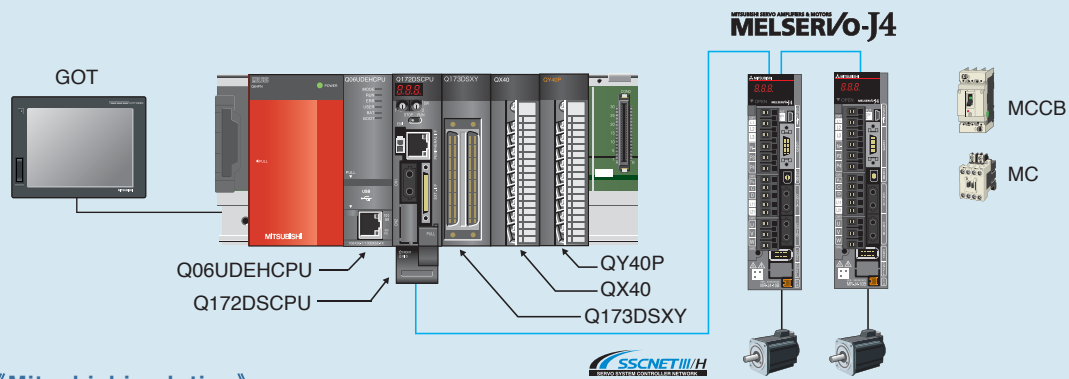


Q17nDSCPU

Issues at production sites

- Issue 1 Safety measures in case of a person entering in a restricted area
➔ Shut-off Function
- Issue 2 Ensuring safe speed for manned assembly line
➔ Speed Monitoring Function (SLS)

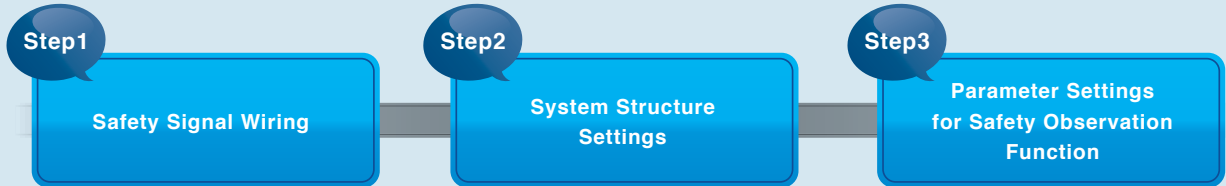
System Example



《Mitsubishi solution》

PLC CPU : Q06UDEHCPU	Motion CPU : Q172DSCPU	Servo amplifier : MR-J4-B
GOT : GOT 1000 series	Safety signal module : Q173DSXY	Servo motor : HG-SR
Main base unit : Q35DB	I/O module : QX40, QY40P	

Setup Procedure



《Applications》 (Note-1)

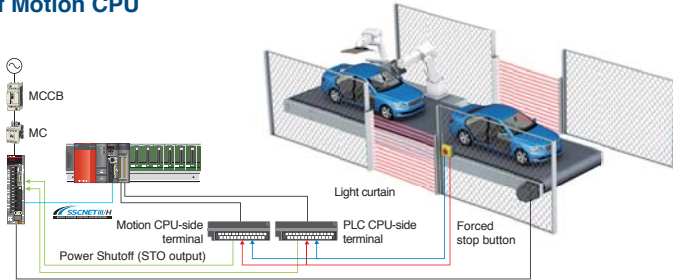
- Conveyor system
- Press-fit machine
- Press machine
- Printing machine
- Vertical form, fill & seal
- Horizontal form, fill & seal

(Note-1) Motion controllers and servo amplifiers attain "Safety category 3, SIL2". Take an additional safety measure or consider applicability based on the risk analysis.

Solution 1 Shut-off Function

Various Reliable Safety Systems Can Be Created with Safety Observation Function

System using "Safety signal comparison function" of Motion CPU



Each of the Motion and PLC CPU independently performs the safety monitoring functions at the same time (giving double CPU safety monitoring). Safety control can be combined with general control, which enables to create more flexible and simple safety systems. This is the best for a system monitoring multiple signals with safety monitoring equipment, such as forced stop buttons, light curtains, etc.

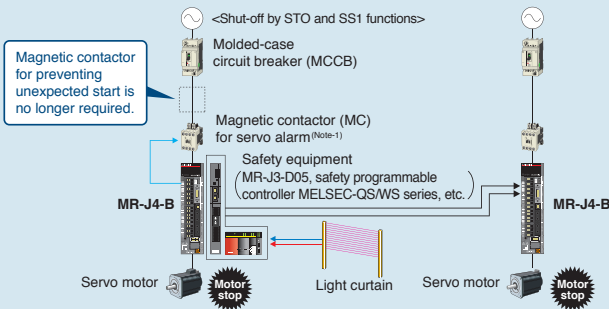
•Functions **STO,SS1,SS2,SOS,SLS,SBC,SSM**

•Specification of Q173DSXY Safety signal module

	Points	Purpose
Input signal	20 points × 2 systems	User safety signal
Output signal	1 point × 2 systems	Shut-off signal
	11 points × 2 systems	User safety signal

Functions achieved with the servo amplifier

• System using the Safety logic module MR-J3-D05



The MR-J3-D05 Safety logic module integrates the STO and SS1 functions, and has an equivalent number of safety I/O signals to that of two servo amplifiers.

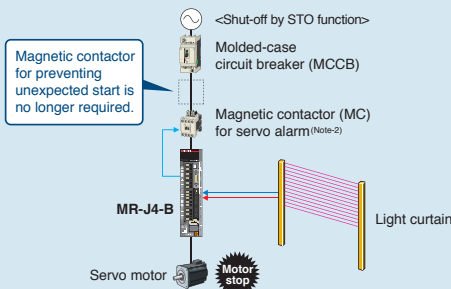
•Functions **STO,SS1**

•Specification of MR-J3-D05 Safety logic module

	Points	Purpose
Input signal	2 points × 2 systems	User safety signal
Output signal	4 points × 2 systems	Shut-off outputs

(Note-1): STO is not the electrical safety protection function but the function to turn off the output torque by shutting off the power supply inside the servo amplifier. For MR-J4 series servo amplifier, magnetic contactors are not required to meet the STO requirements. However, install a magnetic contactor to prevent the short circuit of servo amplifier or electric shock.

• System using the functions of the servo amplifier



The MR-J4-B Servo amplifier has integrated STO (Safe Torque Off) function as standard, being suitable for a system using only one piece of safety equipment.

•Functions **STO**

•Specification of MR-J4 Servo amplifier

	Points	Purpose
Input signal	1 point × 2 systems	User safety signal
Output signal	1 point × 2 systems	Shut-off status

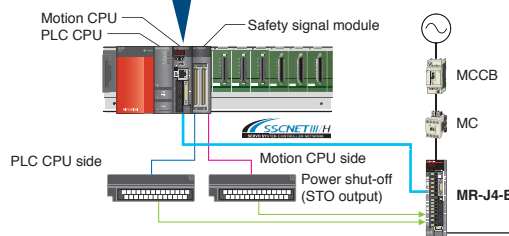
(Note-2): Refer to the (Note-1) above.

Solution 2 Speed Monitoring Function (SLS)

Securing Safe Speeds All the Time

This "Speed monitoring function" checks if the motor speed has exceeded the specified "Safety speed" or not. A safe operation speed can be ensured by comparing the feedback and command speed with the "Safety speed". When an error occurs, the STO and SS1 functions shut off the power.

This function ensures:
 •Safety speed>command speed
 •Safety speed>feedback speed
 PLC and Motion CPU both perform the Speed monitoring function.
 In case the Safety speed is exceeded, the power is shut off.



Monitoring with a standard servo motor

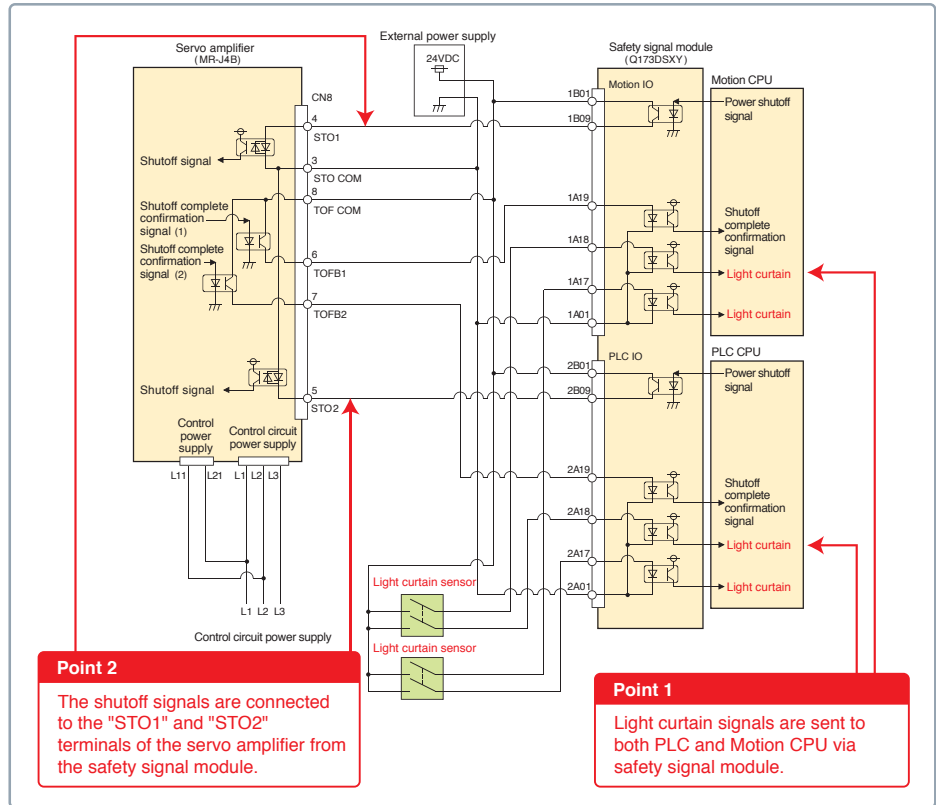
Setup Procedure

Step 1

Safety Signal Wiring

This diagram shows a wiring example of a safety system using a safety signal module. The light curtain signals are wired to the input terminals of the safety signal module, and the module's output terminals are to the STO terminal on the servo amplifier.

(Note) This example is compliant with EN ISO 13849-1 Category3 PLD.



Step 2

System Structure Settings

Set the servo amplifier and the servo motor on System Structure screen.

SSCNET Structure

Amplifier Setting

Step 3

Parameter Settings for Safety Observation Function

Set the Number of the safety signal modules, etc. with the Safety signal comparison parameter. Set the "Safety speed", Speed monitoring axis No., etc. with the Speed monitoring parameter.

Safety signal comparison parameter

Item	Set the data to execute the
Safety Signal Comparison	Set the data to execute the
Safety Signal Mismatch	Set the data to execute the
Start Device No.	Set the start device No.
PLC CPU Side	Set the start device No.
Motion CPU Side	Set the start device No.
Station No.	Set the station reference.
Multiple CPU Shared Device	Set the multiple CPU shares signal reference.
Set Address	Set the set address.
No.1	10000
No.2	10000
Start Address	Set the start address. (This)
No.1	USER[610000]
No.2	USER[610000]
Last Address	Set the last address. (This)
No.1	USER[610049]
No.2	USER[610049]

Speed monitoring parameter

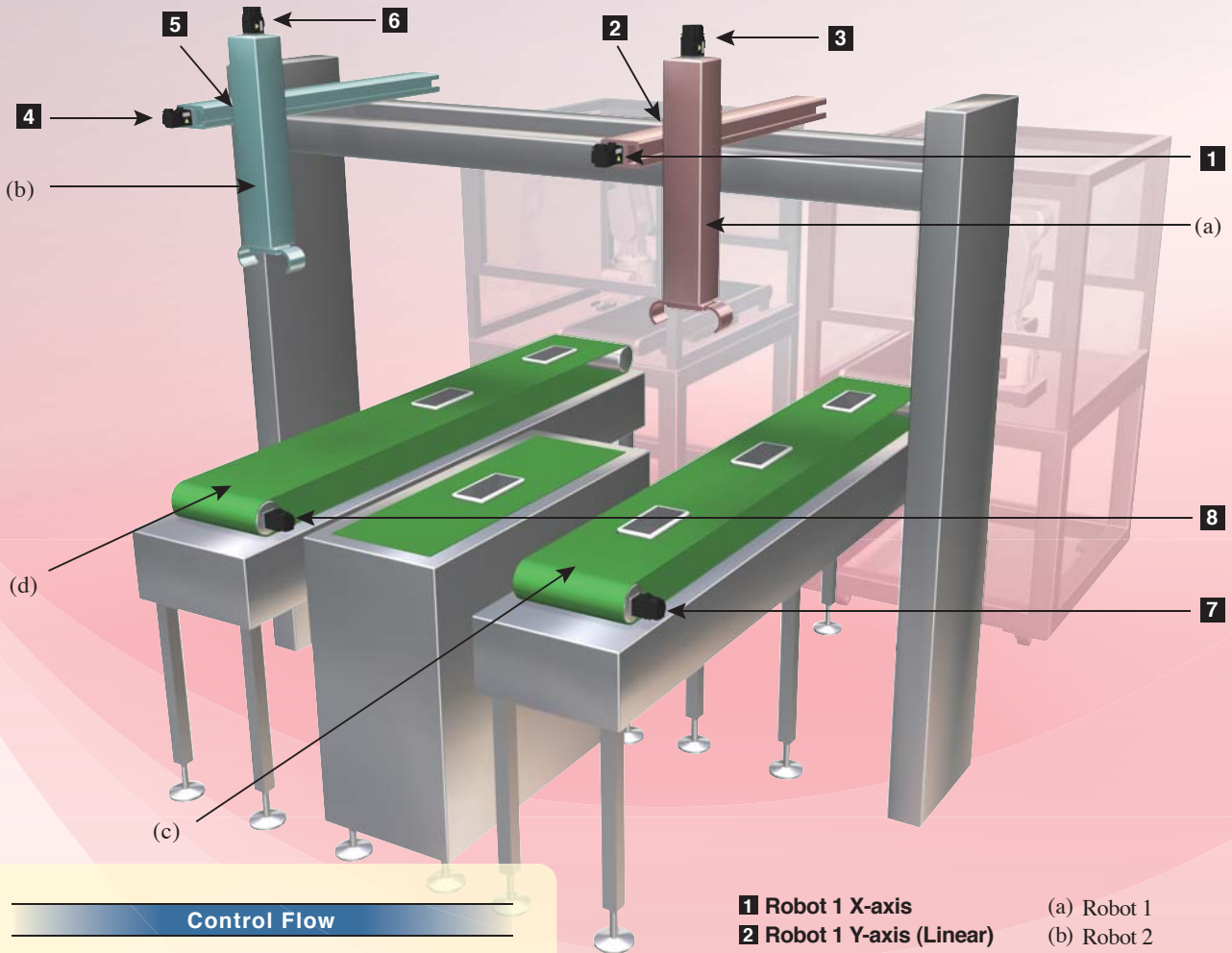
Item	Block No.1
Speed Monitoring Axis No.	1
Speed Monitoring Error Detection Time	0.10[msec]
Axis Link Setting	Quick
Number of Pulses per Motor Revolution	419430[PLS]
Movement Amount per Motor Revolution	10000.0[mm]
Motor Encoder Resolution	419430[PLS]
Number of Pulses per External Sensor	4096[PLS]
Rotation	20.0[mm]
Travel Value per External Sensor	1.00[mm/rev]
Safety Speed	1.00[mm/min]
Safety Motor Speed	1.0[mm]
Allowance Value of Position Deviation	100.0[mm]
Allowance Value of Speed Deviation	10.00[mm/min]
SSM Hysteresis Width	0.00[mm/min]
SSM Output Y Device No.	FFFF
External Sensor Input X Device No.	0210
Speed Monitoring I/O Device No.	0220

Start monitoring just by setting parameters

For conveyors, Motion alignment, packing, and robots

| CASE | 08

Eco-friendly Conveyors and Product Handling Equipment



- 1** Robot 1 X-axis
 - 2** Robot 1 Y-axis (Linear)
 - 3** Robot 1 Z-axis
 - 4** Robot 2 X-axis
 - 5** Robot 2 Y-axis (Linear)
 - 6** Robot 2 Z-axis
 - 7** Line 1 Belt Conveyor Drive Axis
 - 8** Line 2 Belt Conveyor Drive Axis
- (a) Robot 1
 - (b) Robot 2
 - (c) Line 1
 - (d) Line 2

Control Flow

All axes

Robot 1 (X, Y, Z-axis) moves to its wait position.

Robot 2 (X, Y, Z-axis) moves to its wait position.

Robot 1 (X, Y, Z-axis)

Robot 1 grabs a workpiece and place it on the pallet.

Robot 2 (X, Y, Z-axis)

Robot 2 grabs the workpiece in the pallet and move it to Line 2.

Operation is then repeated.

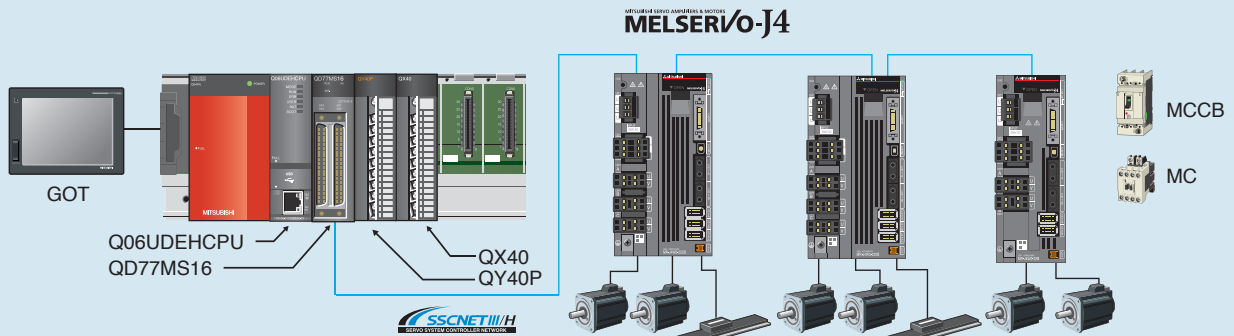


Q17nDSCPU QD77MS
Q170MSCPU QD77GF (Note-1)

Issues at production sites

- Issue 1 Managing of total power consumption
↳ **Power Monitor Function**
- Issue 2 Reduction of power consumption
↳ **Multi-axis Servo Amplifier**
- Issue 3 Minimizing waste of power
↳ **Capacity Selection Software**

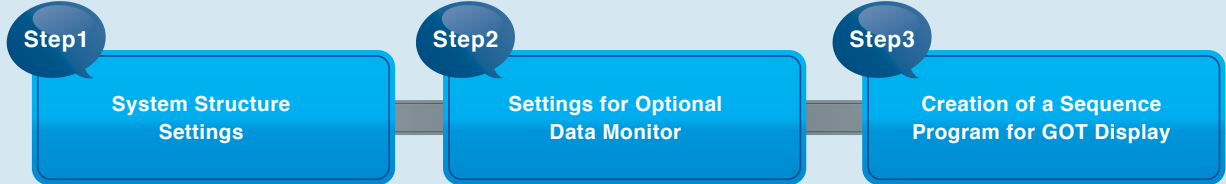
System Example



《Mitsubishi solution》

PLC CPU : Q06UDEHCPU	Simple Motion : QD77MS16	Servo amplifier : MR-J4W3-B, MR-J4W2-B
GOT : GOT 1000 series	I/O module : QX40, QY40P	Servo motor : HG-KR
Main base unit : Q35DB		Linear servo motor : LM-H3

Setup Procedure



《Applications》

- Conveyors and handling equipment
- Packing machine
- Motion alignment
- Pick and place robot

(Note-1): Create the system with one rotary servo motor when using QD77GF.

Solution 1 Power Monitor Function

Managing Power Consumption with a Visualization System

The MR-J4 series servo amplifiers can calculate power consumption itself without a power measuring instrument, and can send the data to controllers for monitoring.

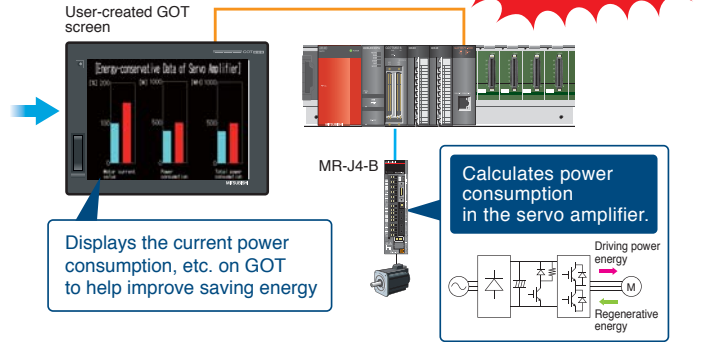
● **Parameter setting (Optional data selection)**

Data that can be Monitored		
The following are some examples of the data.		
• Effective load ratio	• Regenerative load ratio	• Peak load ratio
• Load to motor inertia ratio	• Position loop gain 1	• Equivalent disturbance torque
• Module power consumption	• Module integral power consumption	• Bus voltage

Optional data monitor:
Data type setting with GX Works2

- Module power consumption (W)
- Module integral power consumption (Wh)

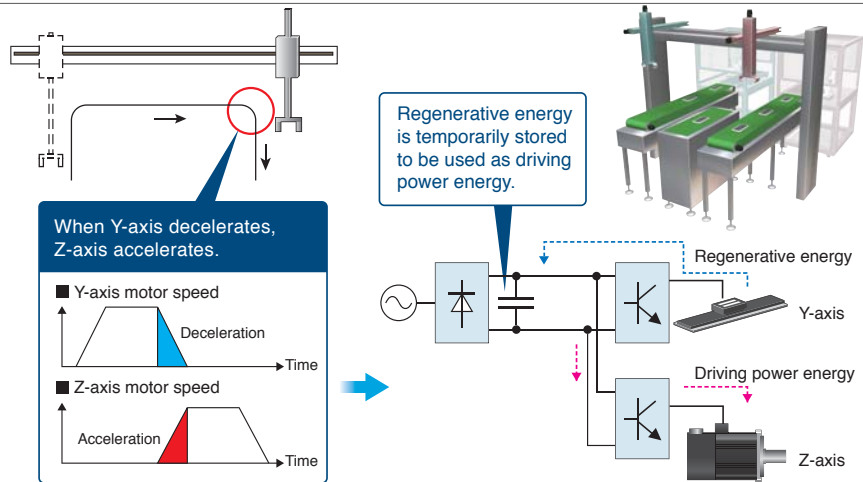
● **Displaying power consumption**



Solution 2 Multi-axis Servo Amplifier

Contributing Energy Conservation Using Regenerative Energy

The multi-axis servo amplifier can store regenerative energy when motors decelerate. Those regenerative energy is used to drive another motor, contributing to energy conservation of the machine. In this system, the regenerative energy from the Y-axis is used to accelerate the Z-axis.



Solution 3 Capacity Selection Software

Easy Selection of a Suitable Motor for Your Machine

The "Capacity selection software" (free software) selects a suitable rotary servo motor, linear servo motor, and direct drive motor for your machine using various data, such as mass of the table and the load, the operation pattern, etc. After the selection, it shows the calculation process and results.

(Note): This software is available for free download. Contact your local sales office for more details.

Setup Procedure

Step 1

System Structure Settings

Set servo amplifier.

System Structure

Amplifier Settings

Amplifier Operation Mode:
 "Standard" for the rotary motor
 "Linear" for the linear motor
 "DD motor" for the direct drive motor

Step 2

Settings for Optional Data Monitor

Set the "Optional data monitor" with the parameter. If you select "Module power consumption" or "Module integral power consumption", the amplifier power consumption is monitored.

Axis-1 parameter

Item	Axis #1	Axis #2	Axis #3
Pr. 50: Setting for the movement amount after near-point dog ON	0.0 μm	0.0 μm	0.0 μm
Pr. 51: OPR acceleration time selection	0:1000	0:1000	0:1000
Pr. 52: OPR deceleration time selection	0:1000	0:1000	0:1000
Pr. 53: OP shift amount	0.0 μm	0.0 μm	0.0 μm
Pr. 54: OPR torque limit value	300 %	300 %	300 %
Pr. 55: Operation setting for incompletion of OPR	0:Positioning Control is Not Executed	0:Positioning Control is Not Executed	0:Positioning Control is Not Executed
Pr. 56: Speed designation during OPR shift	0:OPR Speed	0:OPR Speed	0:OPR Speed
Pr. 57: Dwell time during OPR retry	0 ms	0 ms	0 ms
Pr. 86: Pulse conversion unit: OPR request setting	0:Turn OPR Request ON at Servo OFF	0:Turn OPR Request ON at Servo OFF	0:Turn OPR Request ON at Servo OFF
Pr. 87: Pulse conversion unit: Walking time after clear signal output	0 ms	0 ms	0 ms

Expansion parameters

Pr. 91: Optional data monitor: Data type setting 1

Pr. 92: Optional data monitor: Data type setting 2

Pr. 93: Optional data monitor: Data type setting 3

Pr. 94: Optional data monitor: Data type setting 4

Pr. 96: Operation cycle setting

Pr. 97: SNET Setting

Pr. 91: Optional data monitor: Data type setting 1

Pr. 92: Optional data monitor: Data type setting 2

Pr. 93: Optional data monitor: Data type setting 3

Pr. 94: Optional data monitor: Data type setting 4

Pr. 96: Operation cycle setting

Pr. 97: SNET Setting

Pr. 91: Optional data monitor: Data type setting 1

Pr. 92: Optional data monitor: Data type setting 2

Pr. 93: Optional data monitor: Data type setting 3

Pr. 94: Optional data monitor: Data type setting 4

Pr. 96: Operation cycle setting

Pr. 97: SNET Setting

Step 3

Creation of a Sequence Program for GOT Display

Create a sequence program to calculate the data to be displayed on GOT, such as, "Peak power consumption", "Peak integral power consumption", and "Peak motor current".

User-created GOT screen

[Energy-conservative Data of Servo Amplifier]

- Motor current value
- Power consumption
- Total power consumption

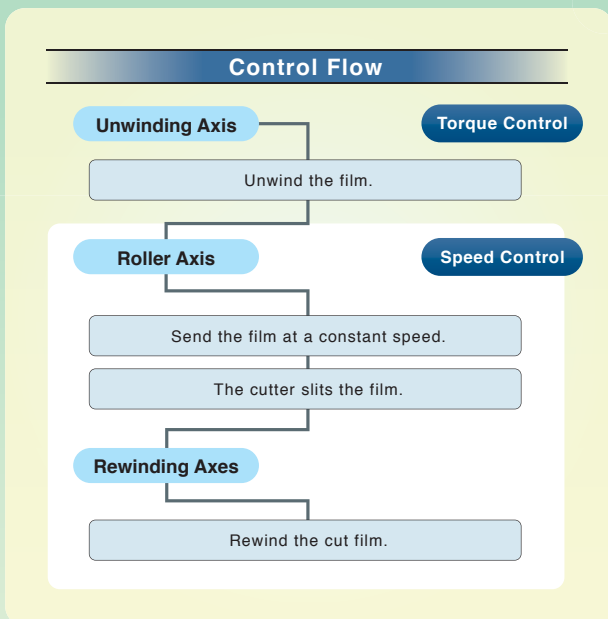
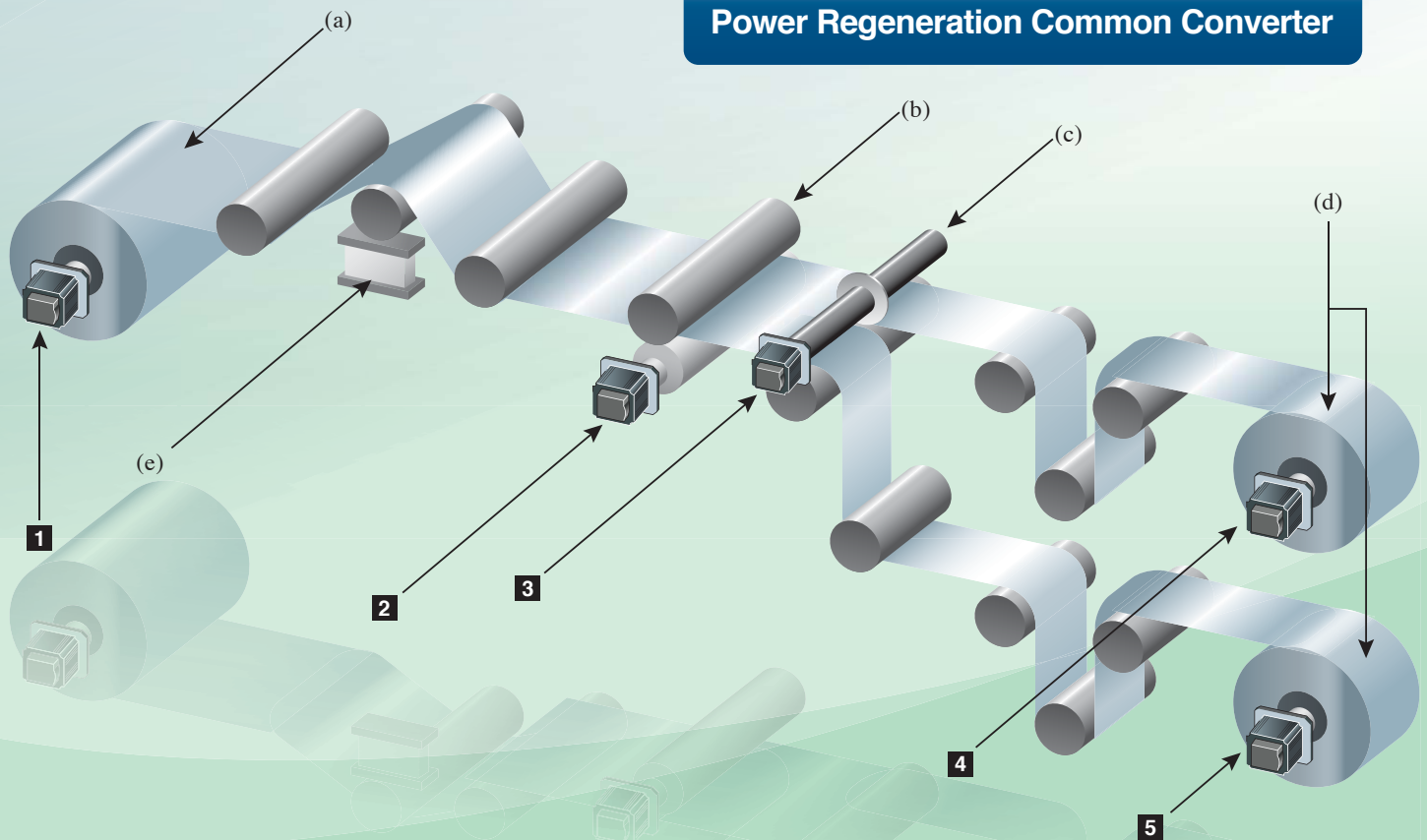
- Motor current value
- Peak motor current value
- Power consumption
- Peak power consumption
- Integral power consumption
- Peak Integral power consumption

For equipment with rollers

| CASE | 09

Film Slitting Machine

PN Bus Voltage Connection + Power Regeneration Common Converter



- 1** Unwinding Axis
- 2** Roller Axis
- 3** Cutter Axis
- 4** Rewinding Axis 1
- 5** Rewinding Axis 2

- (a) Film Unwinder
- (b) Film Sender
- (c) Cutter
- (d) Film Rewinder
- (e) Tension Detector (sensor)



Issues at production sites

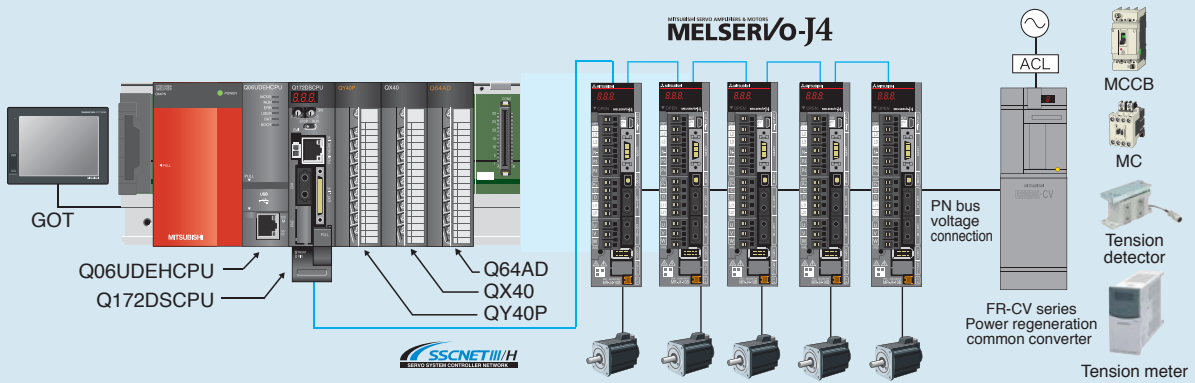
- Issue 1 Sending film with a constant speed or tension

 ↳ **Speed Control, Torque Control**
- Issue 2 Utilizing regenerative energy

 ↳ **PN Bus Voltage Connection + Power Regeneration Common Converter**

Q17nDSCPU
Q170MSCPU

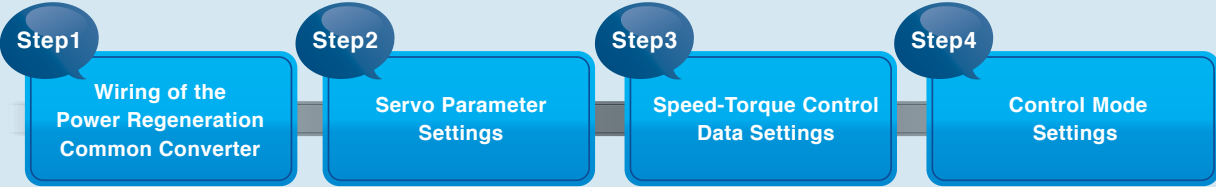
System Example



《Mitsubishi solution》

PLC CPU	: Q06UDEHCPU	Motion CPU	: Q172DSCPU	Servo amplifier	: MR-J4-B
GOT	: GOT 1000 series	I/O module	: QX40, QY40P	Servo motor	: HG-SR, HG-KR
Main base unit:	Q35DB	Analog input module:	Q64AD	Power regeneration:	FR-CV series common converter
		Tension meter	: LM-10PD	Tension detector	: LX-050TD

Setup Procedure



《Applications》

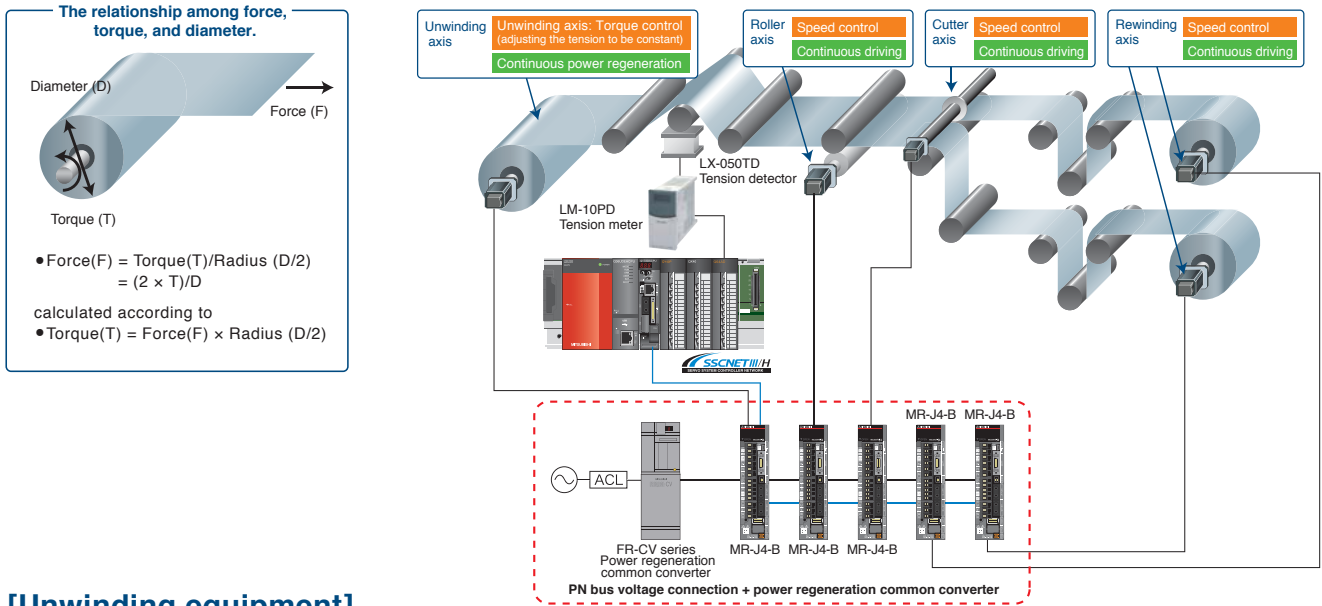
- Packing machine
- Printing machine
- Laminator
- Wire drawing machine
- Slitting machine

Solution 1
Speed Control, Torque Control

Various Controls Flexibly Applied for the Better Operation

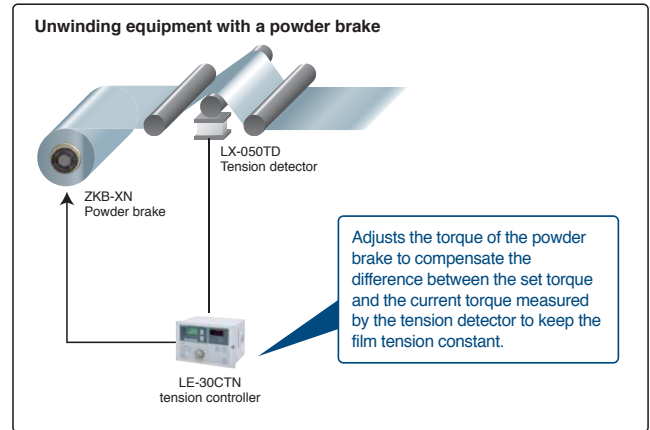
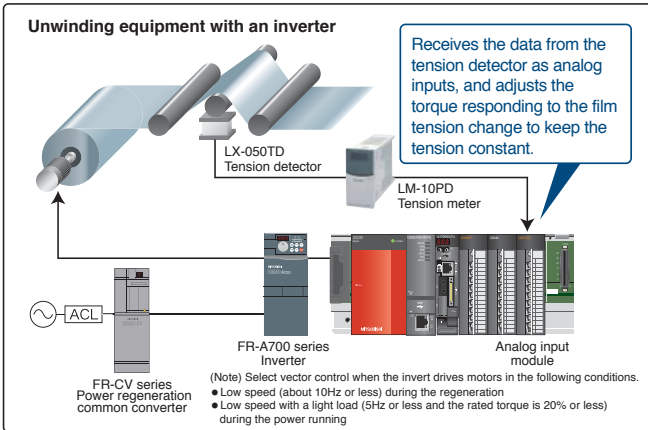
Film needs to be sent with a constant tension, preventing from stretching or shrinking. To achieve that, as the equation below shows the relationship among force, torque, and diameter, the torque has to be changed according to the unwinding roll's diameter.

The current torque of the unwinding axis, taking the diameter into account, is measured with the tension detector and is used to compensate the difference from the original torque command, and the data for compensation is sent to the amplifiers.



[Unwinding equipment]

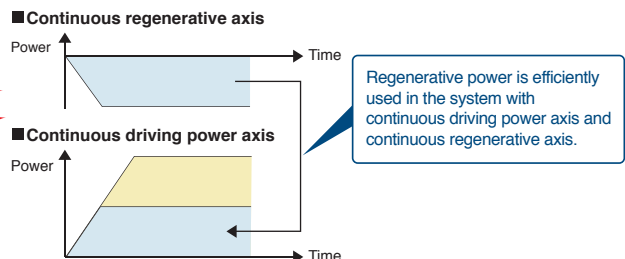
An unwinding equipment can be created with an inverter or a powder brake.



Solution 2
PN Bus Voltage Connection + Power Regeneration Common Converter

Contributing Energy Conservation by Utilizing Regenerative Energy

Regenerative energy is used efficiently when multiple servo amplifiers are connected through common PN bus to the power regeneration common converter.



Setup Procedure

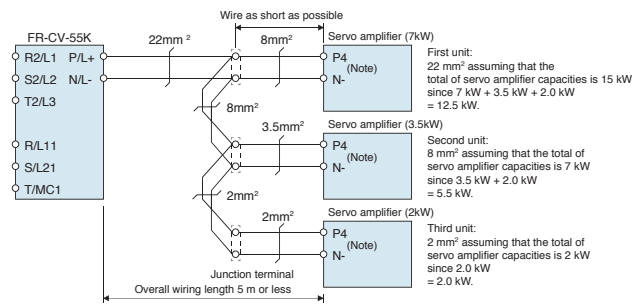
Step 1

Wiring of the Power Regeneration Common Converter

Wire the Power regeneration common converter.

A wiring example of three servo amplifiers and Power regeneration common converter

When connecting multiple servo amplifiers, always use junction terminals for wiring the servo amplifier terminals P4, N-. Also, connect the servo amplifiers in the order of larger to smaller capacities.



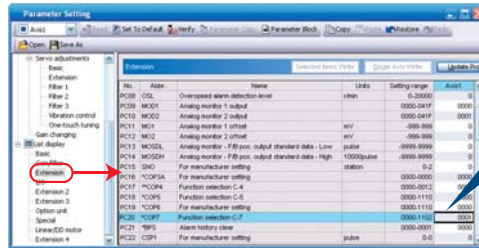
(Note) When using the servo amplifier of 7 kW or less, make sure to disconnect the wiring of built-in regenerative resistor (5 kW or less: P+ and D, 7 kW: P+ and C).

Step 2

Servo Parameter Settings

Set the PC20 parameter when using the Power regeneration common converter.

Servo Parameter



PC20

Undervoltage alarm detection method selection

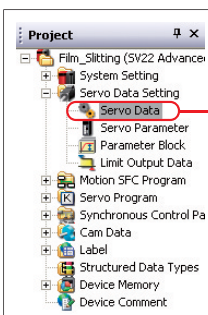
When you use FR-RC, FR-CV, or FR-BU2, select "Method 2 (_ _ _ 1)".

- 0: Method 1
- 1: Method 2

Step 3

Speed-Torque Control Data Settings

Set the parameters for the unwinding axis, rewinding axis, and all of the roller axes to perform the Speed-Torque control.



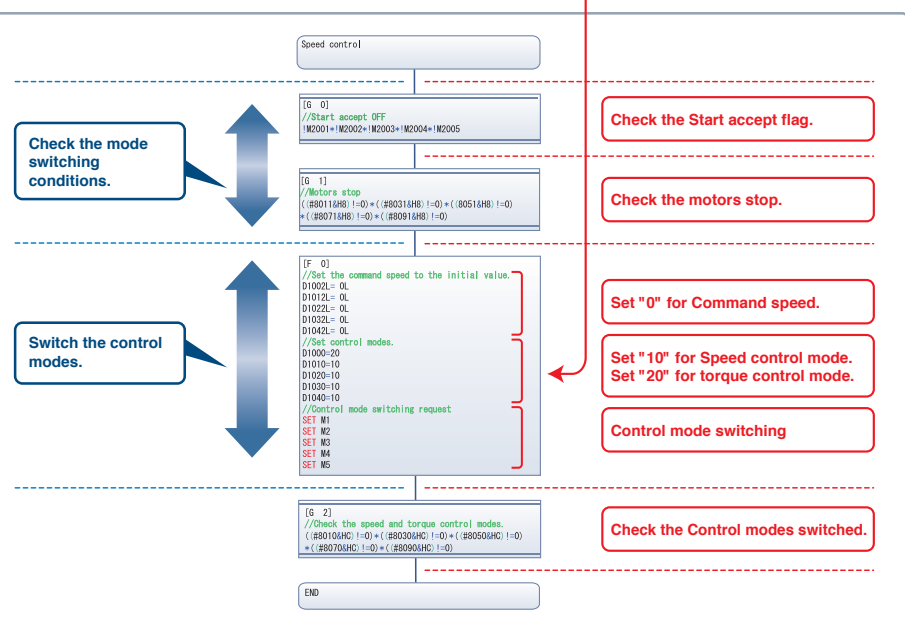
Speed-Torque control Data

Item	Axis1	Axis2	Axis3	Axis4	Axis5
Speed-Torque Control Data					
Control Mode Switching Request Device	M1	M2	M3	M4	M5
Control Mode Setting Device	D1000(1)	D1010(1)	D1020(1)	D1030(1)	D1040(1)
Speed Limit Value in Speed-Torque Control	20000[PLS/s]	20000[PLS/s]	20000[PLS/s]	20000[PLS/s]	20000[PLS/s]
Torque Limit Value in Speed-Torque Control	300.0[%]	300.0[%]	300.0[%]	300.0[%]	300.0[%]
Speed Command Device	D1002(2)	D1012(2)	D1022(2)	D1032(2)	D1042(2)
Command Speed Acceleration Time	1000[ms]	1000[ms]	1000[ms]	1000[ms]	1000[ms]
Command Speed Deceleration Time	1000[ms]	1000[ms]	1000[ms]	1000[ms]	1000[ms]
Torque Command Device	D1004(1)	D1014(1)	D1024(1)	D1034(1)	D1044(1)
Command Torque Time Constant (Positive Direction)	1000[ms]	1000[ms]	1000[ms]	1000[ms]	1000[ms]
Command Torque Time Constant (Negative Direction)	1000[ms]	1000[ms]	1000[ms]	1000[ms]	1000[ms]
Speed Initial Value Selection at Control Mode Switching	0:Command Speed	0:Command Speed	0:Command Speed	0:Command Speed	0:Command Speed
Torque Initial Value Selection at Control Mode Switching	0:Command Torque	0:Command Torque	0:Command Torque	0:Command Torque	0:Command Torque
Invalid Selection during Zero Speed at Control Mode Switching	0:Switching Condition at Switching Control ...	0:Switching Condition at Switching Control ...	0:Switching Condition at Switching Control ...	0:Switching Condition at Switching Control ...	0:Switching Condition at Switching Control ...

Step 4

Control Mode Settings

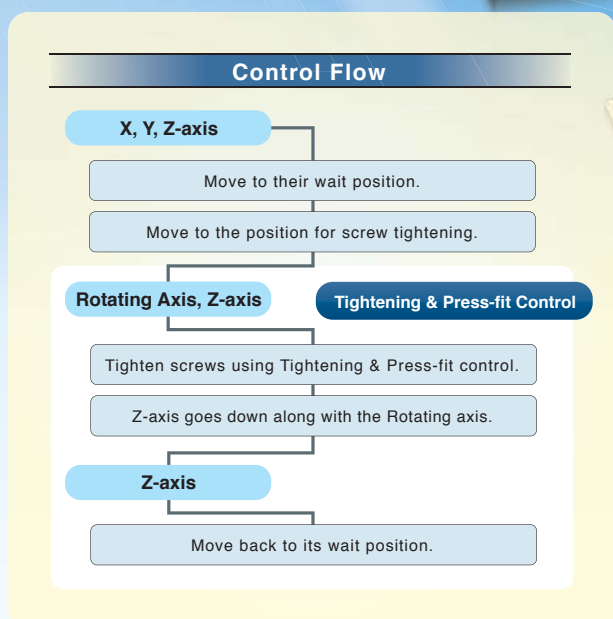
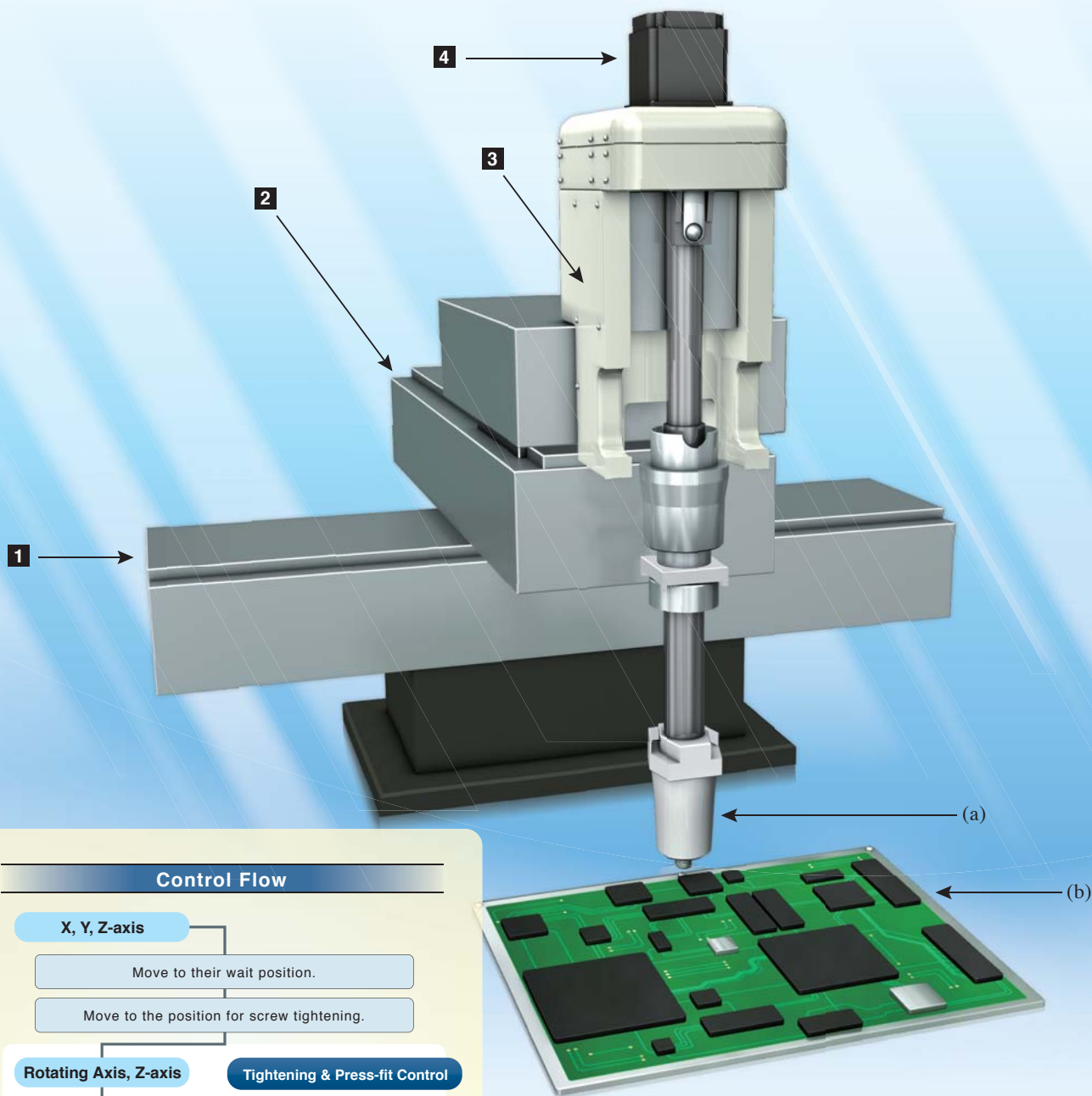
Create the Motion SFC program to switch the control mode of each axis to speed or torque control. Set each axis to "10" (Speed control) or "20" (Torque control) in the program, according to the application of each axis. The example on the right is a Motion SFC program switching the unwinding axis to torque control, and the other axes to speed control.



For tightening, pressing, and clamping

| CASE | 10

Screw Tightening Machine



- 1** X-axis
- 2** Y-axis
- 3** Vertical Axis (Z-axis)
- 4** Rotating Axis

- (a) Screw Tightener
- (b) Workpiece

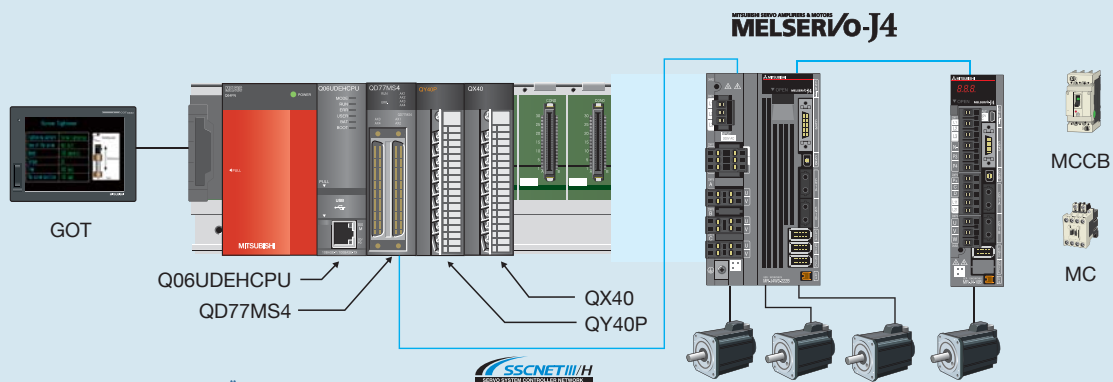


Q17nDSCPU QD77MS
Q170MSCPU

Issues at production sites

- Issue 1 Tightening screws without using a torque sensor
➔ **Tightening & Press-fit Control**
- Issue 2 Repeated accuracy in screw tightening operation
➔ **Reduced Torque Ripple During Conduction**

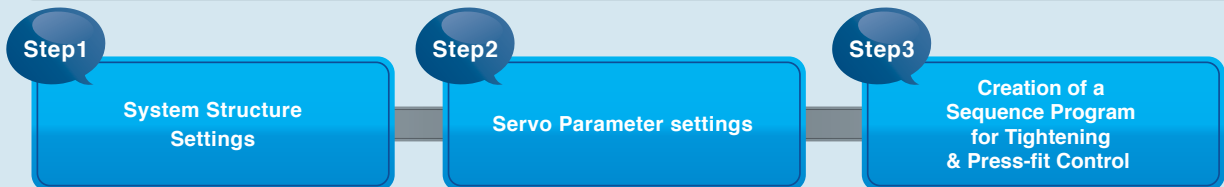
System Example



《Mitsubishi solution》

PLC CPU : Q06UDEHCPU	Simple Motion : QD77MS4	Servo amplifier : MR-J4(W3)-B
GOT : GOT 1000 series	I/O module : QX40, QY40P	Servo motor : HG-SR, HG-KR
Main base unit : Q35DB		

Setup Procedure



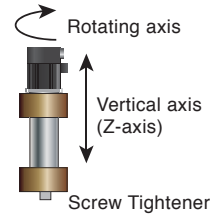
《Applications》

● Cap tightening	● Tightening machine for cylinder head	● Tightening machine for clutch tightening
● Press-fit machine	● Clamping	

Solution 1 **Tightening & Press-fit Control**

Open-Loop Control for Screw Tightening

The vertical (Z-axis) and rotating axis can be used to tighten screws by switching the control mode to "Tightening & press-fit control" which does not require a torque sensor. "Tightening & Press-fit control" is a control mode where the motor does not have to stop when the system switches to this control mode from speed or positioning control.



<Operation Sequence>

- ①→② Vertical axis : Moves from its wait position to above the workpiece.
Rotating axis : No movement (Servo ON)

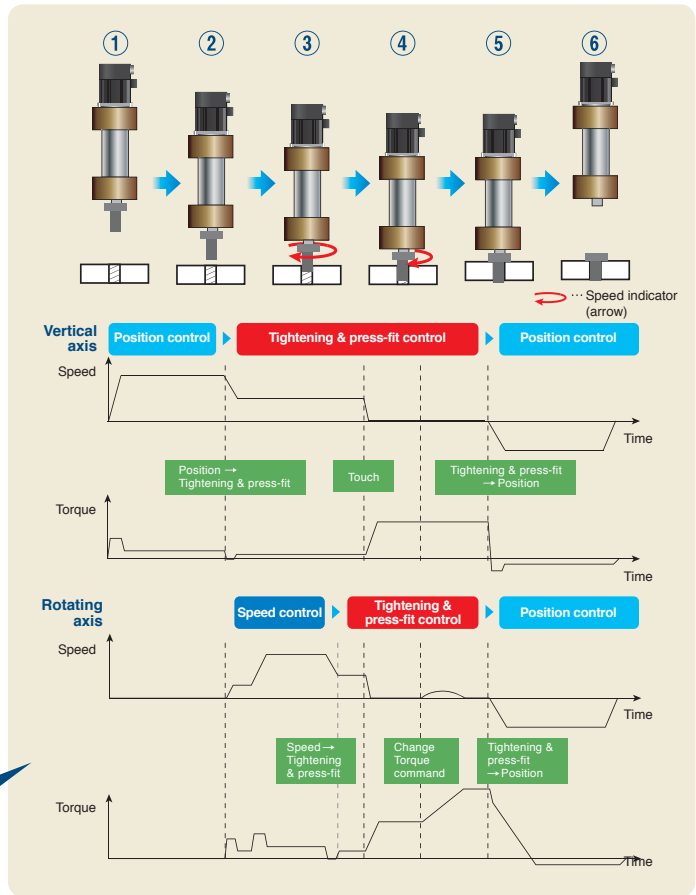
- ② Vertical axis : Switches to Tightening & press-fit control.
Rotating axis : Switches to speed control and starts operation at low speed

- ②→③ Vertical axis : Starts pushing down the screw.
Rotating axis : Starts tightening after switching to mid-range speed operation.

- ③→④ Vertical axis : Pushes down the screw with a constant torque.
Rotating axis : Switches to Tightening & press-fit control and tightens the screw.

- ④→⑤ Vertical axis : Pushes the screw to its final position with a constant torque.
Rotating axis : Tightens the screw fully with a specified torque.

- ⑤→⑥ Vertical axis : Switches back to position control and goes back to its wait position.
Rotating axis : Switches back to position control and goes back to its wait position.



<Tightening screws without a torque sensor>
Screws can be tightened without using a torque sensor (open-loop control), controlling the speed and torque of the rotating axis according to its operation sequence.

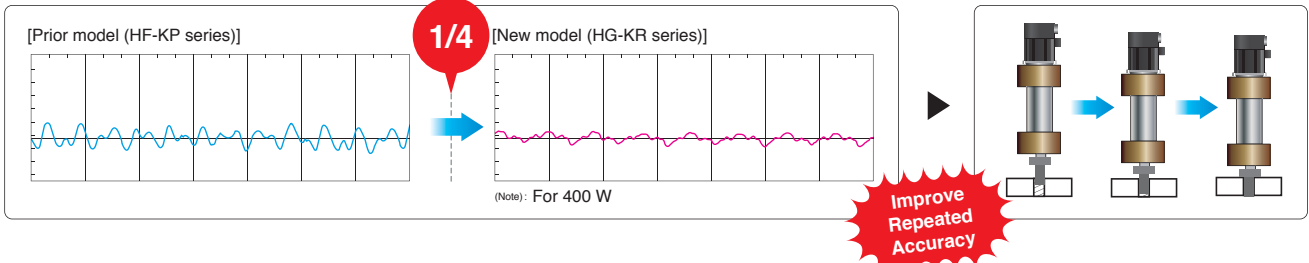
Solution 2 **Reduced Torque Ripple During Conduction**

Great Improvement in Repeated Accuracy of Screw Tightening

By optimizing the combination of the number of motor poles and the number of slots, torque ripple during conduction is greatly reduced, which helps improve the accuracy of repeated operation of tightening screws.

Torque ripple

(As compared to the prior series.)

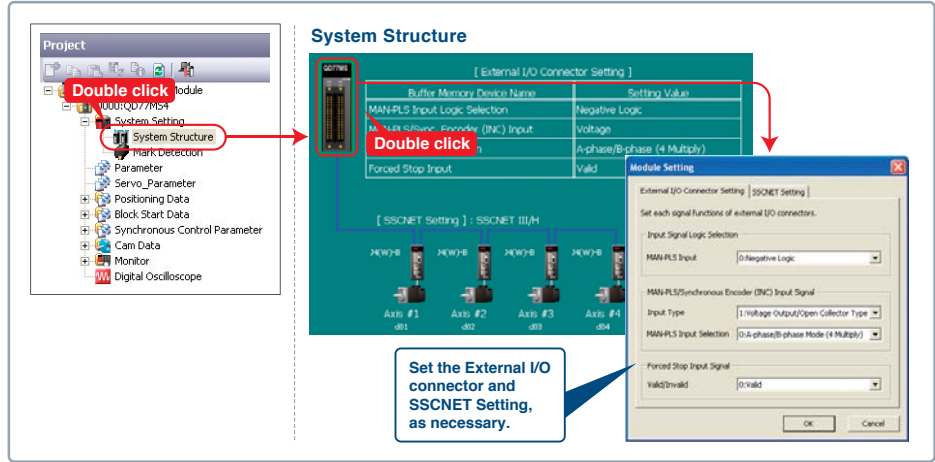


Setup Procedure

Step 1

System Structure Settings

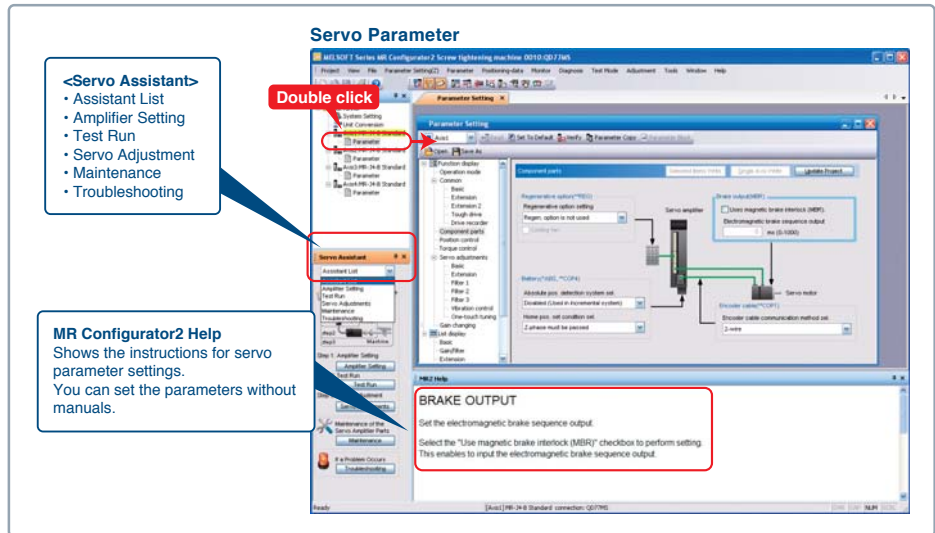
Set the servo amplifier in the System Structure.



Step 2

Servo Parameter Settings

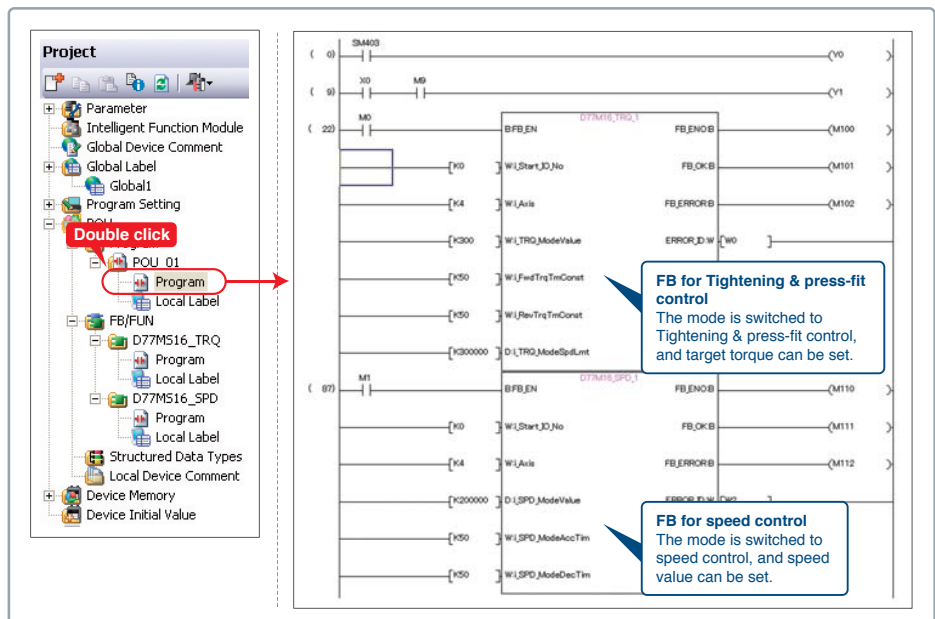
Set the servo amplifier of each axis. The parameters are easily set following the assistant function, including those set for the first time.



Step 3

Creation of a Sequence Program for Tightening & Press-fit Control

Create a sequence program for control using Function Block (FB), such as a program for control mode switching.



Lineup

Features of the Motion Controllers and the Simple Motion Modules

Harmony with a wide range of applications and controls



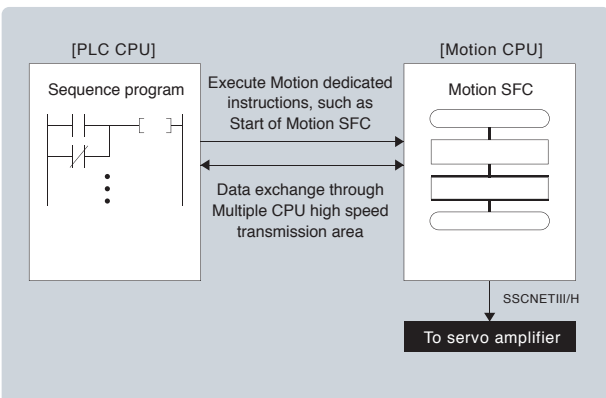
Most-advanced Motion controller

SSCNET III/H compatible Motion controller

- Q173DSCPU
- Q172DSCPU
- Q170MSCPU
- Q170MSCPU-S1

The Motion controller is a CPU module used with the PLC CPU for Motion control. Using Motion SFC program, the Motion controller separately controls I/O modules, etc., from the PLC CPUs; therefore high speed control is achieved.

The Q170MSCPU is a CPU module integrating the Motion controller function, the PLC CPU function, and power supply all in one.



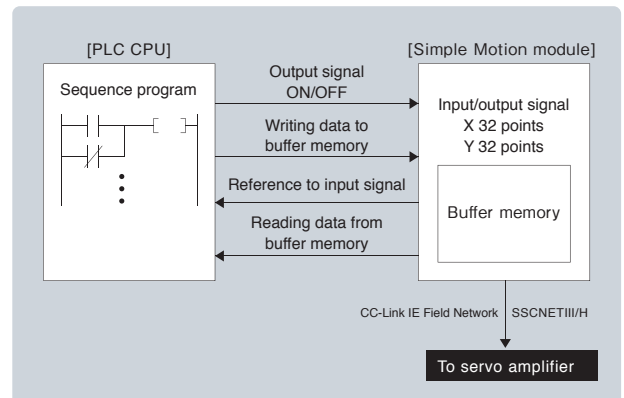
Advanced control but simple to use just like the positioning module

SSCNET III/H compatible Simple Motion module

- QD77MS16
- QD77MS4
- QD77MS2
- CC-Link IE Field Network Simple Motion Module
- QD77GF16

The Simple Motion module is an intelligent function module performing positioning control following the PLC CPU's instructions. Synchronous control that was unavailable with the previous positioning module is now available with these new Simple Motion modules, while being simple to use just like the positioning module.

The positioning function of this Simple Motion module is used in the same way as the positioning module.



Function Comparison

Comparison of Motion controller and Simple Motion module

■ Superior

	Motion controller			Simple Motion module		
	Q173DSCPU	Q172DSCPU	Q170MSCPU(-S1) NEW	QD77MS16	QD77MS4/QD77MS2	QD77GF16 NEW
Module type	CPU module			Intelligent Function Module		
Servo amplifier interface	SSCNET III/H			SSCNET III/H	CC-Link IE Field Network	
	2 systems	1 system		1 system	1 system	
Servo amplifier type	MR-J4-B			MR-J4-B	MR-J4-B-RJ010+MR-J3-T10	
Number of control axes	Up to 32 axes	Up to 16 axes		Up to 16 axes	Up to 4 axes/2 axes	Up to 16 axes
Operation cycle	0.22 ms or more			0.88ms / 1.77ms	0.88ms	0.88ms / 1.77ms
PLC CPU	MELSEC-Q series		Q03UD/Q06UDH or equivalent	MELSEC-Q series		
Engineering environment	MT Works2	MR Configurator2 <small>(Note-1)</small>		Simple Motion Module Setting Tool	MR Configurator2 <small>(Note-2)</small>	
Programming language	Motion SFC			—		
Control modes	Position control	Speed control	Torque control	Position control	Speed control <small>(Note-5)</small>	Torque control <small>(Note-4)</small>
	Tightening & Press-fit control	Synchronous control	Cam control	Tightening & Press-fit <small>(Note-4)</small>	Cam control	
	Advanced synchronous control				Synchronous control	
Positioning control	Linear interpolation	Circular interpolation	Trajectory control	Linear interpolation	Circular interpolation	Trajectory control
	Helical interpolation	Position follow-up control	Speed control with fixed position stop	Speed/position switching control (ABS)		
	High-speed oscillation control	Speed/position switching control	Speed/position switching control (INC)			Position/speed switching control
Acceleration/deceleration control	Trapezoidal acceleration/deceleration	S-curve acceleration/deceleration	Advanced S-curve acceleration/deceleration	Trapezoidal acceleration/deceleration	S-curve acceleration/deceleration	
Manual control	JOG operation	Manual pulse generator operation		JOG operation	Manual pulse generator operation	
	JOG operation simultaneous start				Inching operation	
Functions to change the control details	Current value change	Target position change	Torque limit value change	Current value change	Target position change	Torque limit value change
	Speed change	Acceleration/deceleration time change		Speed change	Override	Acceleration/deceleration time change
Home position return type	Proximity dog type 1	Proximity dog type 2	Scale home position signal detection type	Proximity dog type	Scale home position signal detection type	
	Count type 1	Count type 2	Count type 3	Count type 1	Count type 2	
	Data set type 1	Data set type 2	Dog cradle type	Data set type		
	Stopper type 1	Stopper type 2	Limit switch combined type			
	Dogless origin signal reference type					
Sub functions	Forced stop	Hardware stroke limit	Software stroke limit	Forced stop	Hardware stroke limit	Software stroke limit
	Absolute position system	Amplifier-less operation	Unlimited length feed	Absolute position system	Amplifier-less operation	Unlimited length feed
	Optional data monitor	Mark detection	ROM operation	Optional data monitor <small>(Note-4)</small>	Mark detection	Flash ROM backup
	M-code output	Error history	Digital oscilloscope	M-code output	Error history collection	Digital oscilloscope
	Safety observation <small>(Note-3)</small>	Vision system	Software security key			
	High-speed reading	Limit switch output	Cam auto-generation	Cam auto-generation		

(Note-1) : MELSOFT MR Configurator2 is included in MELSOFT MT Works2.
 (Note-2) : The Simple Motion module setting tool is included in MELSOFT GX Works2.
 (Note-3) : The safety observation function is available with the Q173DSCPU/Q172DSCPU.
 (Note-4) : Available only with the QD77MS.
 (Note-5) : The QD77GF can perform only speed control with position loop, while QD77MS can perform speed control.

Engineering Environment



Comprehensively supporting Motion controller design and maintenance

Motion Controller Engineering Software MELSOFT MT Works2

Motion SFC programming, parameter setting, digital oscilloscope function, and simulation function are available. All necessary setup steps for use of Motion controller are created with this software, from system designing, programming, debugging, to maintenance.

Supporting settings of simple Motion modules as well as sequence program creation

Programmable Controller Engineering Software MELSOFT GX Works2

This software supports sequence program creation and the necessary setup steps for use of Simple Motion modules, such as the creation, startup, debugging, and maintenance of parameters, positioning data, and cam data.

Start-up support tool for a suitable machine system, optimum control and short setup time

Servo Setup Software MELSOFT MR Configurator2

Tuning, monitor display, diagnosis, reading/writing parameters, and test operations are easily performed on a personal computer. This start-up support tool achieves a stable machine system, optimum control, and short setup time.

Easy to Use | Pursuing Easy-to-use and User-friendly Functions

System Design



◆ System design

You can easily set servo amplifiers and modules with a graphical system setting screen.



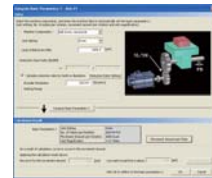
◆ Parameter settings

The one-point help is available to set parameters without the manual.



◆ Electronic gear

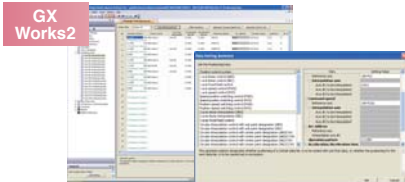
You can easily set the complicated electronic gear just by inputting the machine specifications (reduction ratio, ball screw pitch, etc.).



Programming

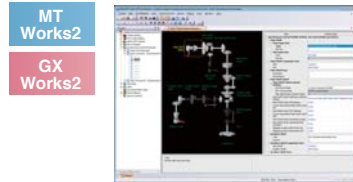
◆ Positioning data setting

The Data Setting Assistant function simplifies the setting input process of the positioning data for the Simple Motion modules.



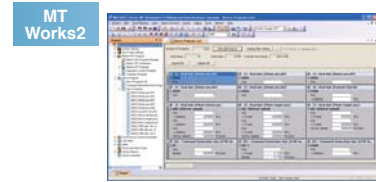
◆ Advanced synchronous control

Synchronous control data is easily created with software by placing mechanical modules on screen, such as the gear, shaft, speed change gear and cam.



◆ Programming

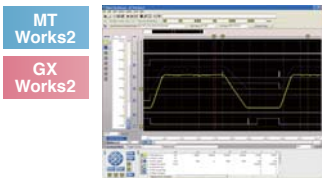
User-friendly functions are available for program development.



Monitor Function and Debugging

◆ Digital oscilloscope function

Operation check and troubleshooting are powerfully supported with data collection and wave displays which are synchronized to the Motion operation cycle.



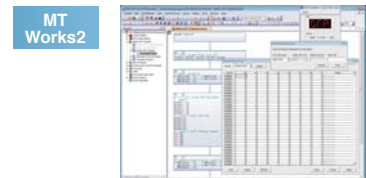
◆ Monitor function

The Motion controller operation status is easily confirmed with the various monitoring functions.



◆ Simulator

Program debugging can be executed without using Motion controller, which improves designing efficiency.

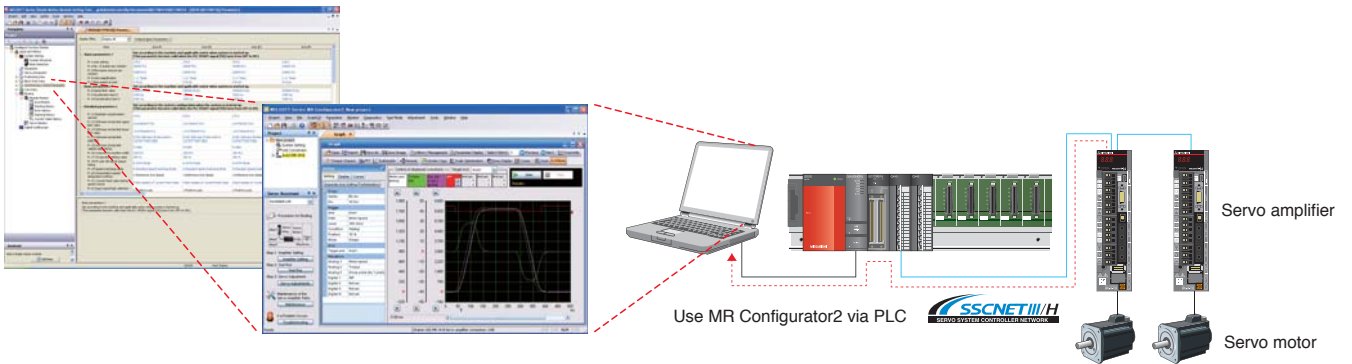


Easy to Use | User-friendly Software for Easy Setup, Tuning and Operation

◆ Adjustment of servo amplifier parameters

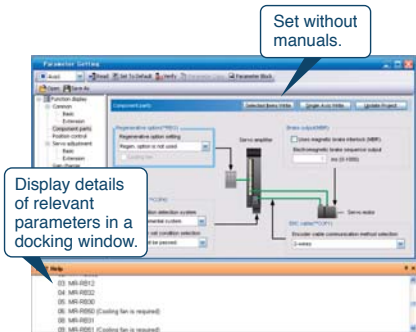
MR Configurator2

Collaboration with the MR Configurator2 increases the ease of servo installation. You can set and adjust servo amplifier parameters with the MR Configurator2, the software created with Mitsubishi servo know-how.



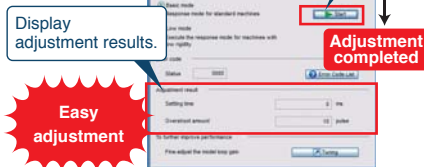
◆ Parameter Setting Function

Display parameter setting in list or visual formats, and set parameters by selecting from the drop down list.



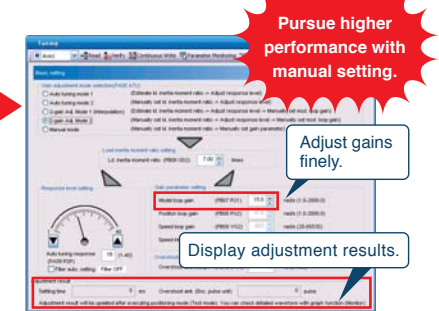
◆ One-touch Tuning Function

Adjustments including estimating load to motor inertia ratio, adjusting gain, and suppressing machine resonance are automatically performed for the maximum servo performance just by clicking the start button. Check the adjustment results of settling time and overshoot.



◆ Tuning Function

Adjust model control gain finely on [Tuning] window manually for further performance after the one-touch tuning.

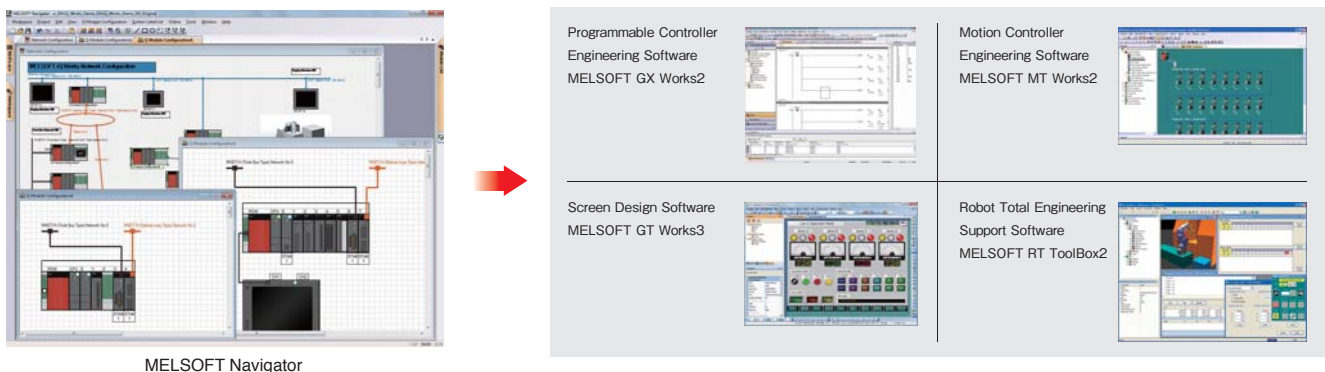


Easy to Use | Seamless Engineering Environment

MELSOFT iQ Works is an integrated engineering software product, composing of GX Works2, MT Works2, GT Works3, and RT ToolBox2. By sharing information such as system designs and programming as the entire control system, the system design and programming efficiency are improved and total cost reduction is achieved.

◆ MELSOFT Navigator

In combination with GX Works2, MT Works2, GT Works3, and RT ToolBox2, this software performs upstream system design and inter-software operation. It provides such convenient functions as system configuration design, batch setting of parameters, system labeling, and batch reading.

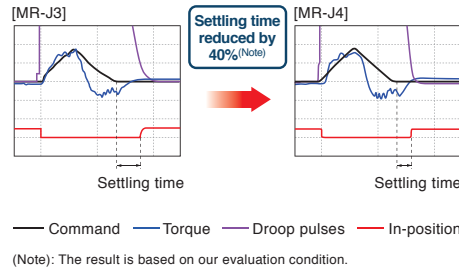


Industry-leading Basic Functions

High response | Speed Frequency Response Is Increased to 2.5 kHz

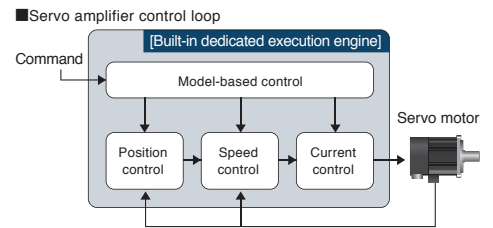
Our original servo control architecture is evolved from the conventional two-degrees-of-freedom model adaptive control and applied to the dedicated execution engine. Speed frequency response is increased to 2.5 kHz. Compatible servo motors are equipped with a high-resolution absolute encoder of 4,194,304 pulses/rev (22-bit), enabling high-speed and high-accuracy operation. The performance of the high-end machine is utilized to the fullest.

[Settling time comparison with the prior model]



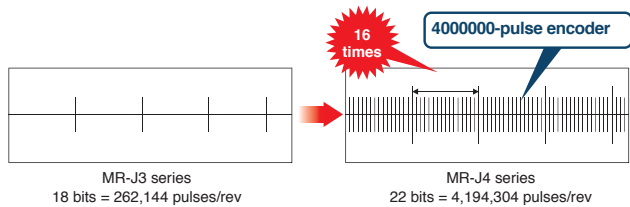
[Dedicated execution engine]

Equipped with the servo control engine with our original architecture.



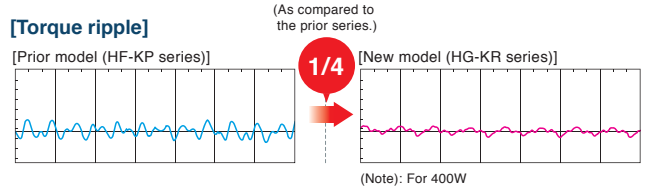
High-accuracy | Improving Machine Performance with High-performance Motors

Rotary servo motors achieve high-accuracy positioning and smooth rotation with a high-resolution encoder and improved processing speed.



High Stability | Reduced Torque Ripple During Conduction

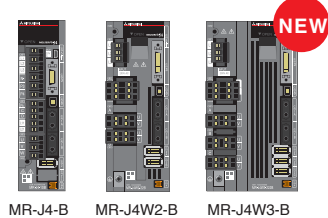
By optimizing the combination of the number of motor poles and the number of slots, torque ripple during conduction is greatly reduced. Smooth constant-velocity operation of machine is achieved.



Flexible | Applicable for Various Control and Driving Systems

◆ 1-axis/2-axis/3-axis Servo Amplifiers

For SSCNET III/H compatible servo amplifiers, 2-axis and 3-axis types are available in addition to 1-axis type, enabling flexible systems based on the number of control axes.



◆ Compatible Servo Motors

MR-J4 series servo amplifier operates rotary servo motors, linear servo motors, and direct drive motors as standard.



◆ Linear Servo Motor

Four series are available depending on applications.



LM-H3 series
(Core type)
Material handlings
Rated thrust: 70N to 960N
Max. thrust: 175N to 2400N



LM-U2 series
(Coreless type)
Screen printing systems
Scanning exposure systems
Rated thrust: 50N to 800N
Max. thrust: 150N to 3200N



LM-F series
(Core type (natural/liquid cooling))
Material handlings
Press feeders
Rated thrust:
300N to 3000N (natural cooling)
600N to 6000N (liquid cooling)
Max. thrust:
1800N to 18000N (natural/liquid cooling)

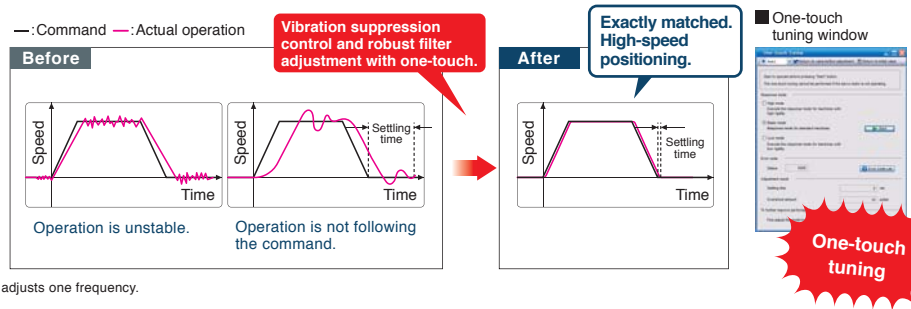


LM-K2 series
(Core type with magnetic attraction counter-force)
LCD assembly systems
Semiconductor mounting systems
Rated thrust: 120N to 2400N
Max. thrust: 300N to 6000N

Advanced Servo Gain Adjustment

Advanced One-touch Tuning Function | Quick Setting by Just One Click

Servo gains including machine resonance suppression filter, advanced vibration suppression control II (Note), and robust filter are adjusted just by turning on the one-touch tuning function. Machine performance is utilized to the fullest using the advanced vibration suppression control function.



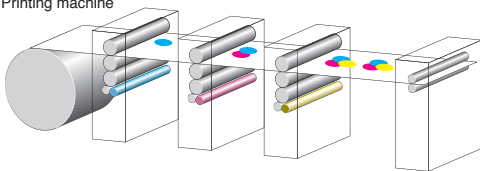
(Note): The advanced vibration suppression control II automatically adjusts one frequency.

High Stability | Robust Filter

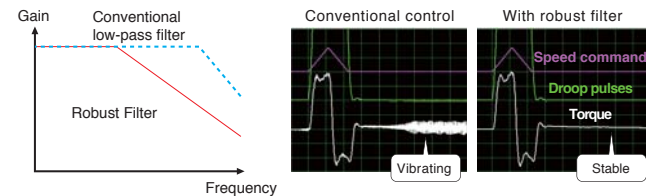
Achieving both high responsivity and stability was difficult with the conventional control in high-inertia systems with belts and gears such as printing and packaging machines. Now, this function enables the high responsivity and the stability at the same time without adjustment. The robust filter more gradually reduces the torque with wide frequency range and achieves more stability as compared to the prior model.

[Machine with a high-inertia ratio]

(Ex.) Printing machine



[Robust Filter]

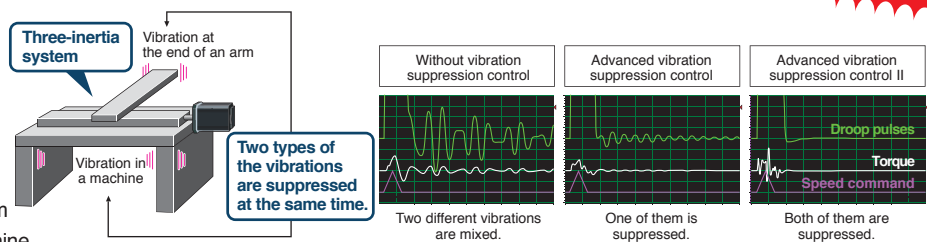


High Stability | Advanced Vibration Suppression Control II

Due to vibration suppression algorithm which supports three-inertia system, two types of low frequency vibrations are suppressed at the same time.

Adjustment is performed on MR Configurator2.

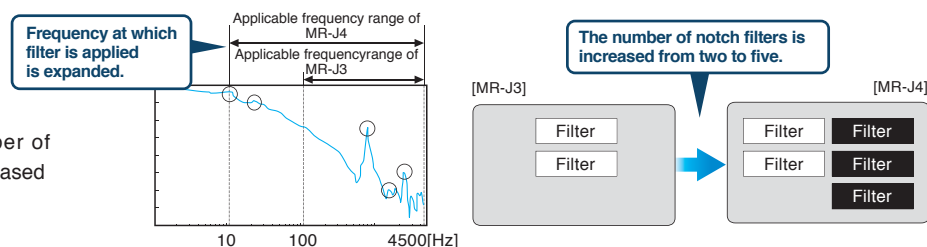
This function is effective in suppressing vibration at the end of an arm and in reducing residual vibration in a machine.



Patent Pending

High Stability | Machine Resonance Suppression Filter

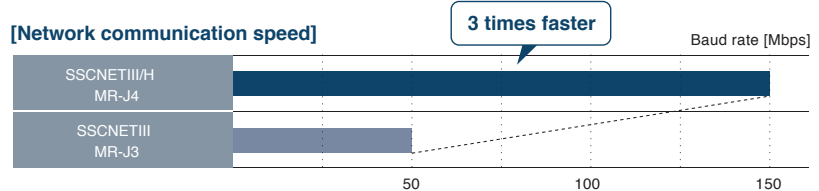
With advanced filter structure, applicable frequency range is expanded from between 100Hz and 4500Hz to between 10Hz and 4500Hz. Additionally, the number of simultaneously applicable filters is increased from two to five, improving vibration suppression performance of machine.



Achieving High-speed and High-accuracy Movement

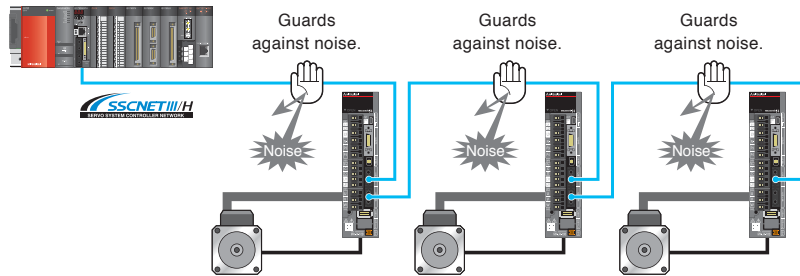
High response | Three times faster communication speed

Communication speed is increased to 150 Mbps full duplex (equivalent to 300 Mbps half duplex), three times faster than the conventional speed. System response is dramatically improved.



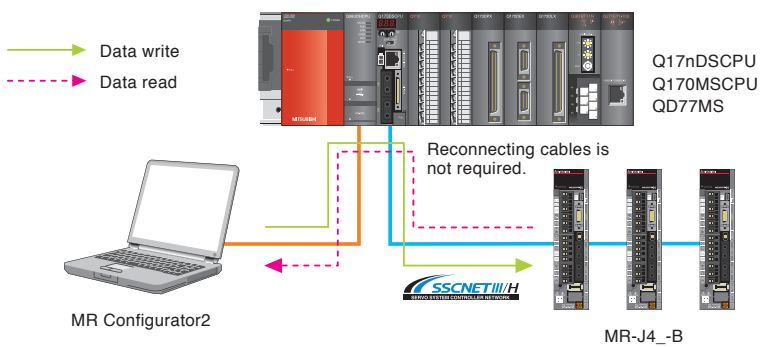
Low noise | No transmission collision

The fiber-optic cables thoroughly shut out noise that enters from the power cable or external devices. Noise immunity is dramatically improved as compared to metal cables.



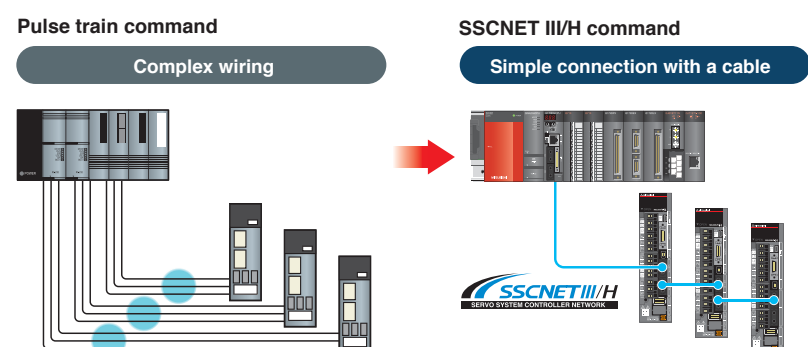
Easy to Use | Central control with network

Large amounts of servo data are exchanged in real-time between the controller and the servo amplifier. Using MR Configurator2 on a personal computer that is connected to Q17nDSCPU, Q170MSCPU, or QD77MS helps consolidate information for the multiple servo amplifiers.



SSCNET III/H | Dramatically Reduced Wiring

Simple connections with dedicated cables reduce both wiring time and chances of wiring errors. No more complicated wiring.



Compliant with Functional Safety of International Standard

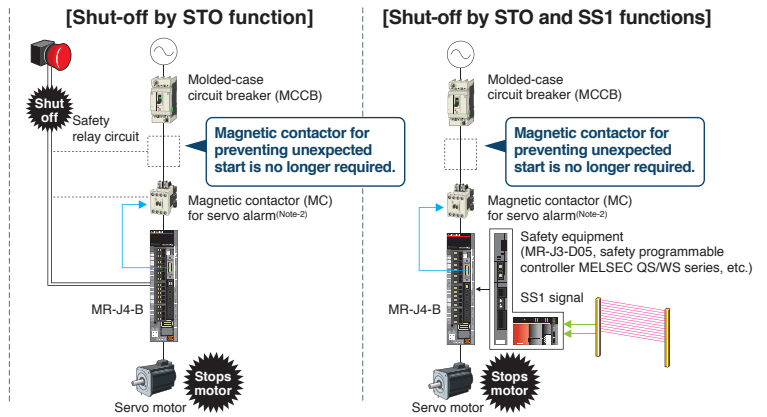
Functional Safety | Functions According to IEC/EN 61800-5-2

MELSERVO-J4 series servo amplifiers have integrated STO (Safe torque off) and SS1^(Note-1) (Safe stop 1) functions as standard. Safety system is easily configured in the machine. (SIL 2)

- Turning off the control power of servo amplifier is not required, cutting out the time for restart. Additionally, home position return is not required.
- Magnetic contactor for preventing unexpected motor start is not required.^(Note-2)

(Note-1): Safety equipment (MR-J3-D05, safety programmable controller MELSEC QS/WS series, etc.) is required.

(Note-2): STO is not the electrical safety protection function but the function to turn off the output torque by shutting off the power supply inside the servo amplifier. For MR-J4 series servo amplifier, magnetic contactors are not required to meet the STO requirements. However, install a magnetic contactor to prevent the short circuit of servo amplifier or electric shock.



Safety Standard | Advanced Features for World-class Safety

- (1) Amplifier + Motion controller "Safety Observation Function"
- (2) Amplifier only
- (3) Amplifier + Safety logic module "MR-J3-D05"

IEC61800-5-2 Safety standard	(1)	(2)	(3)
<p>Safe torque off (STO)</p> <p>The STO function shuts off power to the motor electronically using the internal circuit by responding to the input signals (EM1) from external equipment (shuts off through secondary-side output). This function corresponds to the Stop category 0 of IEC 60204-1.</p>	○	○	○
<p>Safe stop 2 (SS2)</p> <p>Responding to the input signals from external equipment (EM2), the SS2 function initiates the motor deceleration. After a required time delay for motor stop is passed, the SS2 function initiates the SOS function. This function corresponds to the Stop category 2 of IEC 60204-1</p>	○	—	—
<p>Safely-limited speed (SLS)</p> <p>This function monitors the motor not to exceed the required speed limit. If the speed exceeds the limit, the motor power is shut off by the STO or SS1 function.</p>	○	—	—
<p>Safe brake control (SBC)</p> <p>This function outputs a safety output signals for external brake control.</p>	○	—	—

IEC61800-5-2 Safety standard	(1)	(2)	(3)
<p>Safe stop 1 (SS1)</p> <p>Responding to the input signals (EM2) from external equipment, the SS1 function initiates the motor deceleration. After a required time delay for motor stop is passed, the SS1 initiates the STO function. This function corresponds to the Stop category 1 of IEC 60204-1.</p>	○	—	○
<p>Safe operating stop (SOS)</p> <p>This function monitors the position of the motor not to deviate from the specified range. Power is still supplied to the motor during the SOS function.</p>	○	—	—
<p>Safe speed monitor (SSM)</p> <p>The SSM signal is outputted when the motor speed is below the specified speed limit.</p>	○	—	—

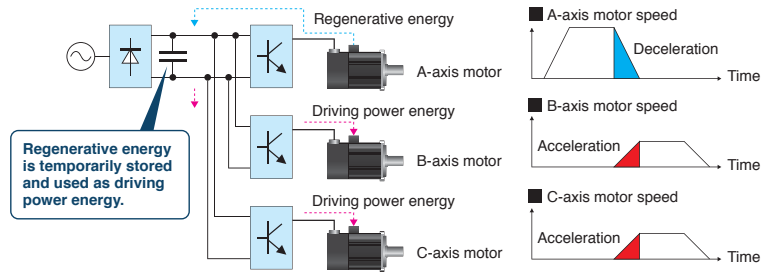
V: Speed
Vmax: User specified speed limit value
S1, S2: Specified stop position
■ Ensured safety range

A Wide Variety of Energy-conservation Functions

Energy Saving | Achieving Energy-conservative Machine Using Regenerative Energy

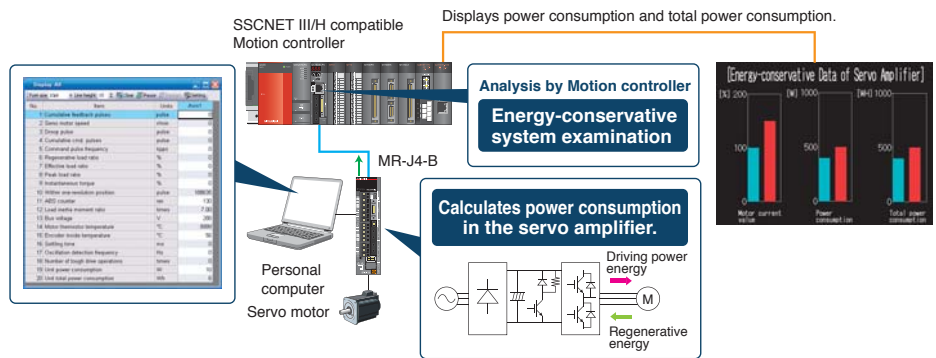
In the multi-axis servo amplifier, the regenerative energy of an axis is used as driving power energy for the other axes, contributing to energy-conservation of machine.

"Power Monitor function", which is available with the standard amplifier, enables the visualization of the power flow on screen.



Energy Saving | Power Monitor Function

Driving power and regenerative energy are calculated from the data in the servo amplifier such as speed and current. Motor current value, power consumption, and total power consumption are monitored with MR Configurator2. In SSCNET III/H system, data are transmitted to a Motion controller, and the power consumption is analyzed and displayed.



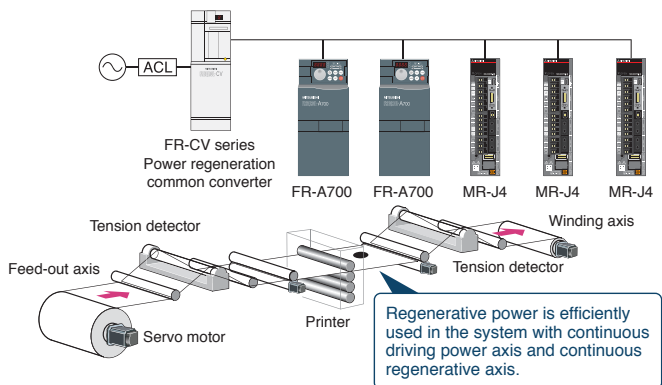
(Note): The diagram shows an example of using MR-J4-B servo amplifier.
Note that this function is available with any of MR-J4 series servo amplifiers.

Energy Saving | Optimal Energy-conservative Machine System

◆ PN Bus Voltage Connection + Power Regeneration Common Converter

Regenerative energy is used efficiently when multiple servo amplifiers and inverters are connected through common PN bus to the power regeneration common converter.

(Note): System only with common PN bus connection is also possible to be configured without using the power regeneration common converter.
However, there are restrictions depending on the system. Contact your local sales office for more details.
(Note): Refer to MR-J4-B(-R)/A(-R) Servo Amplifier Instruction Manual for selection of FR-CV series power regeneration common converter.



Resource Saving | Environment-friendly Servo Motors

The new environment-friendly HG rotary servo motor series uses 30% less permanent magnet than the prior HF series due to the optimized design of magnetic circuit.

(Note): For HG-KR43

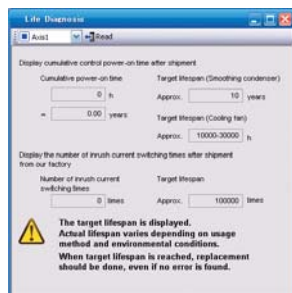


Maintenance Functions for TCO Reduction

Maintenance Function | Support the Preventive Maintenance for Safety Operation

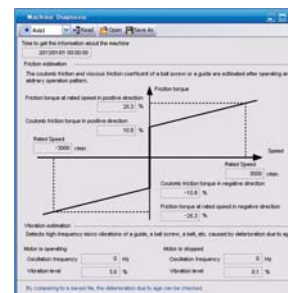
◆ Servo Amplifier Life Diagnosis Function

Check cumulative operation time and on/off times of inrush relay. This function provides an indication of replacement time for servo amplifier parts such as capacitor and relays.



◆ Machine Diagnosis Function

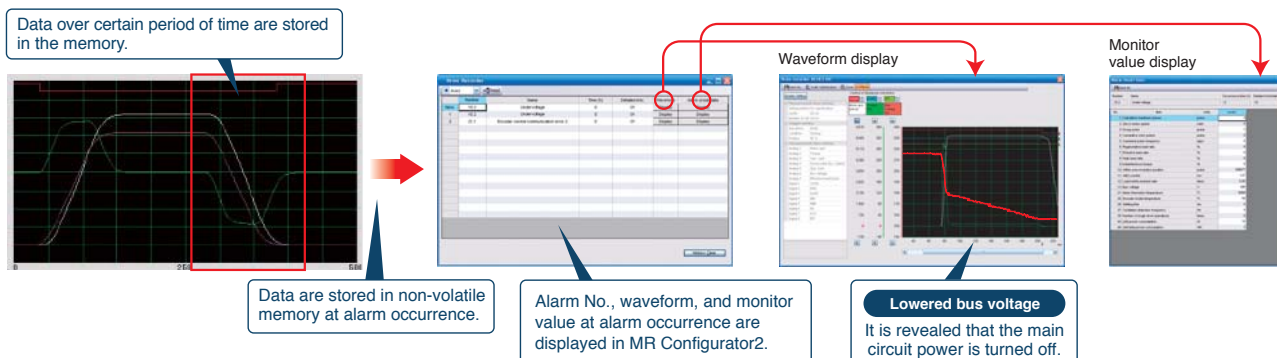
This function estimates and displays machine friction and vibration in normal operation without any special measurement. Comparing the data of the first operation and after years of operation helps to find out the aging deterioration of machine and is beneficial for preventive maintenance.



TCO Reduction | Large Capacity Drive Recorder

(Note): TCO: Total Cost Ownership

- Servo data such as motor current and position command before and after the alarm occurrence are stored in non-volatile memory of servo amplifier. The data read on MR Configurator2 during restoration are used for cause analysis.
- Check the waveform ((analog 16 bits × 7 channels + digital 8 channels) × 256 points) of 16 alarms in the alarm history and the monitor value.



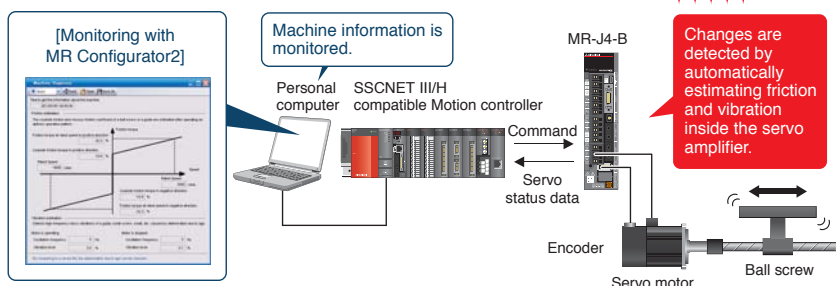
Maintenance Function | Powerful Maintenance Support with Machine Diagnosis Function

Patent pending

NEW

This function detects changes of machine parts (ball screw, guide, bearing, belt, etc.) by analyzing machine friction, load moment of inertia, unbalanced torque, and changes in vibration component from the data inside the servo amplifier, supporting timely maintenance of the driving parts.

(Note): The diagram shows an example of using MR-J4-B servo amplifier. Note that this function is available with any of MR-J4 series servo amplifiers.



Maintenance Function | Easier Troubleshooting with 3-digit Alarm Display

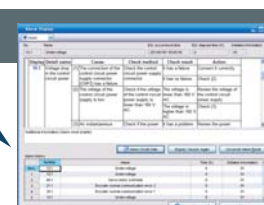
In MR-J4 series, servo alarms are displayed in 3 digits. Troubleshooting at alarm occurrence is easy.

[3-digit alarm display]



For the undervoltage alarm, whether the alarm occurred in the main or the control circuit is identified by the alarm No.

[Example of an alarm window on MR Configurator2]



FA Products

PLC

MELSEC-Q Series Universal Model



Introducing the high-speed QCPU (QnUDVCPU) for faster processing of large data volumes.

- ◎ Realize high-speed, high-accuracy machine control with various iQ Platform compatible controllers and multiple CPUs.
- ◎ Easily connect to GOTs and Programming tools using built-in Ethernet port.
- ◎ 25 models from 10 k step small capacity to 1000 k step large capacity, are available.
- ◎ Seamless communication and flexible integration at any network level.

Product Specifications

Program capacity	10k steps to 1000k steps
Number of I/O points [X/Y], number of I/O device points [X/Y]	256 points to 4096 points/8192 points
Basic instruction processing speed (LD instruction)	120ns to 1.9ns
External connection interface	USB (all models equipped), Ethernet, RS-232, memory card, extended SRAM cassette
Function module	I/O, analog, high-speed counter, positioning, simple motion, temperature input, temperature control, network module
Module extension style	Building block type
Network	Ethernet, CC-Link IE controller network, CC-Link IE field network, CC-Link, CC-Link/LT, MELSECNET/H, SSCNETIII (H), AnyWire, RS-232, RS-422

HMI

Graphic Operation Terminal GOT1000 Series GT16 Model



Full-flat face body integrating all the functions required of a HMI.

- ◎ All models are equipped with Ethernet, RS-422/485 and RS-232 interfaces enabling a diverse range of communications.
- ◎ A multimedia unit and a video/RGB unit (optional) are supported for smooth recording and playback of moving images.
- ◎ USB host and device ports are provided as a standard on the front panel. Easily connect to a personal computer for data exchange.
- ◎ Large 15MB memory capacity allows you to use optional functions and real parts, etc., without worrying about memory space.

Product Specifications

Screen size	15", 12.1", 10.4", 8.4", 5.7"
Resolution	XGA, SVGA, VGA
Intensity adjustment	8-step or 4-step adjustment
Touch panel type	Analog resistive film
Built-in interface	RS-232, RS-422/485, Ethernet, USB, CF card
Applicable software	GT Works3
Input power supply voltage	100 to 240VAC (+10%, -15%), 24VDC (+25%, -20%)

Inverter

FREQROL-A700 Series



High-function, high-performance inverter

- ◎ High-accuracy, high-response speed control using real sensor-less vector control is possible with a general-purpose inverter having no PLG (encoder) (200% torque/0.3 Hz (3.7 K or less)).
- ◎ Full-scale vector control is possible when used in combination with a motor with PLG (when using option).
- ◎ The built-in noise filter (EMC filter) helps reduce noise generated from the inverter.
- ◎ This series supports IPM motor operation. Use auto tuning to operate with the optimum motor characteristics.

Product Specifications

Inverter capacity	200V class: 0.4kW to 90kW, 400V class: 0.4kW to 500kW
Control method	IPM control, Soft-PWM control, high-carrier frequency PWM control (Select from V/F, advanced flux vector, or real sensor-less vector), vector control (when using options)
Output frequency range	0.2 to 400Hz (real sensor-less vector, upper frequency during vector control is 120Hz)
PM offline auto tuning	200V class: 0.4K to 1.5K (150%3%ED), 2.2K/3.7K (100%3%ED) When using the MM-CF Series, the motor constants, etc., are automatically measured for operation with the optimum motor characteristics (IPM motors other than the MM-CF Series, and other IPM motor brands are also supported)
Starting torque	200% 0.3Hz (3.7K or less), 150% 0.3Hz (5.5K or more) (when using real sensor-less vector, vector control)

Magnetic motor starters

MS-T Series

Collection large satisfaction in a small body.



- ◎The industry-leading smallest dimension* is achieved in a general purpose Magnetic Contactor.
 - * In general Magnetic Contactors of 10A frame class (our survey in September, 2012)
- ◎Standard terminal cover improves safety.
- ◎Wide range of operation coil ratings available. Reducing inventory types and supporting selections.
- ◎Supporting your overseas business with compliance to various International Standards.

Product Specifications

Frame	10 A to 32 A
Applicable standards	Certification to various standards including IEC, JIS, UL and CE (TÜV, CCC certification pending)
Terminal cover	Standard terminal cover improves safety, simplifies ordering, and reduces inventory, etc.
Improved wiring	Wiring and operability are improved with streamlining wiring terminal BC specifications.
Operation coil rating	Wide range of operation coil ratings reduces number of coil types from 14 (N Series) to seven types and simplifies selection.
Option units	Diverse lineup includes auxiliary contact blocks, surge absorber unit, and mechanical interlock unit.

Robot

MELFA F Series

High speed, high precision and high reliability industrial robot



- ◎Compact body and slim arm design, allowing operating area to be expanded and load capacity increased.
- ◎The fastest in its class using high performance motors and unique driver control technology.
- ◎Improved flexibility for robot layout design considerations.
- ◎Optimal motor control tuning set automatically based on operating position, posture, and load conditions.

Product Specifications

Degrees of freedom	Vertical:6 Horizontal:4
Installation	Vertical:Floor-mount, ceiling mount, wall mount (Range of motion for J1 is limited) Horizontal:Floor-mount
Maximum load capacity	Vertical:2-20 k g Horizontal:3-20kg
Maximum reach radius	Vertical:504-1503mm Horizontal:350-1,000mm

CNC

Mitsubishi Numerical Control Unit C70 Series

iQ Platform compatible CNC to provide TCO reduction effect.



- ◎A CNC structured in building block method on iQ Platform.
- ◎High performance CNC integrated with high-speed PLC offers high-speed control to reduce cycle time.
- ◎A wide variety of FA products helps construct flexible lines.

Product Specifications

Maximum number of control axes (NC axis + spindle + PLC axis)	16 axes
Maximum number of part system	Machining center system: 7 systems, Lathe system: 3 systems
Maximum number of NC axes per part system	8 axes
Maximum program capacity	2,000 kB (5,120 m)
Maximum number of files to store	124 files/252 files
Number of input/output points	4,096 points
Safety observation function	Safety signal comparison function, speed monitoring function, duplexed emergency stop

Check here for detailed information: <http://www.mitsubishielectric.co.jp/fa/index.html>

A global support network for MELSERVO users

Global FA Center

Across the globe, FA Centers provide customers with local assistance for purchasing Mitsubishi Electric products and with after-sales service. To enable national branch offices and local representatives to work together in responding to local needs, we have developed a service network throughout the world. We provide repairs, on-site engineering support, and sales of replacement parts. We also provide various services from technical consulting services by our expert engineers to practical training for equipment operations.



Ratingen, Germany
German FA Center/
Europe Development Center



Krakowska, Poland
European FA Center (Poland)



St. Petersburg, Russia
Russian FA Center



Pune/Gurgaon/Bangalore, India
India FA Center



Bangkok, Thailand
Thailand FA Center



Hatfield, U.K.
UK FA Center



Praha, Czech Republic
Czech Republic FA Center



China (including Hong Kong District)



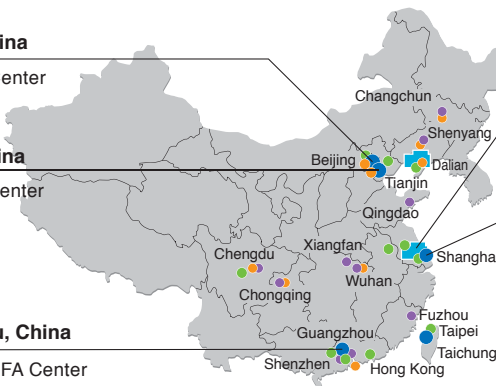
Beijing, China
Beijing FA Center



Tianjin, China
Tianjin FA Center



Guangzhou, China
Guangzhou FA Center



Changshu, China
China Local Factory
Mitsubishi Electric
Automation Manufacturing
(Changshu) Co., Ltd.



Shanghai, China
Shanghai FA Center



Complies with EN, UL, CSA (c-UL) standards, and Korea Radio Wave Law (KC).



MELSERVO-J4 series conforms to global standards.

* This product is not subject to China Compulsory Certification (CCC).
* Refer to "Servo Amplifier Instruction Manual" and "EMC Installation Guidelines" when your system needs to meet the EMC directive.
* Contact your local sales office for the corresponding models and standards.

- Global FA Center
- FA Center Satellite (China)
- Mechatronics Service Base (China)
- Mitsubishi Sales Offices
- Production Facility
- ◆ Development Center



Complies with Restriction of Hazardous Substances Directive (RoHS).

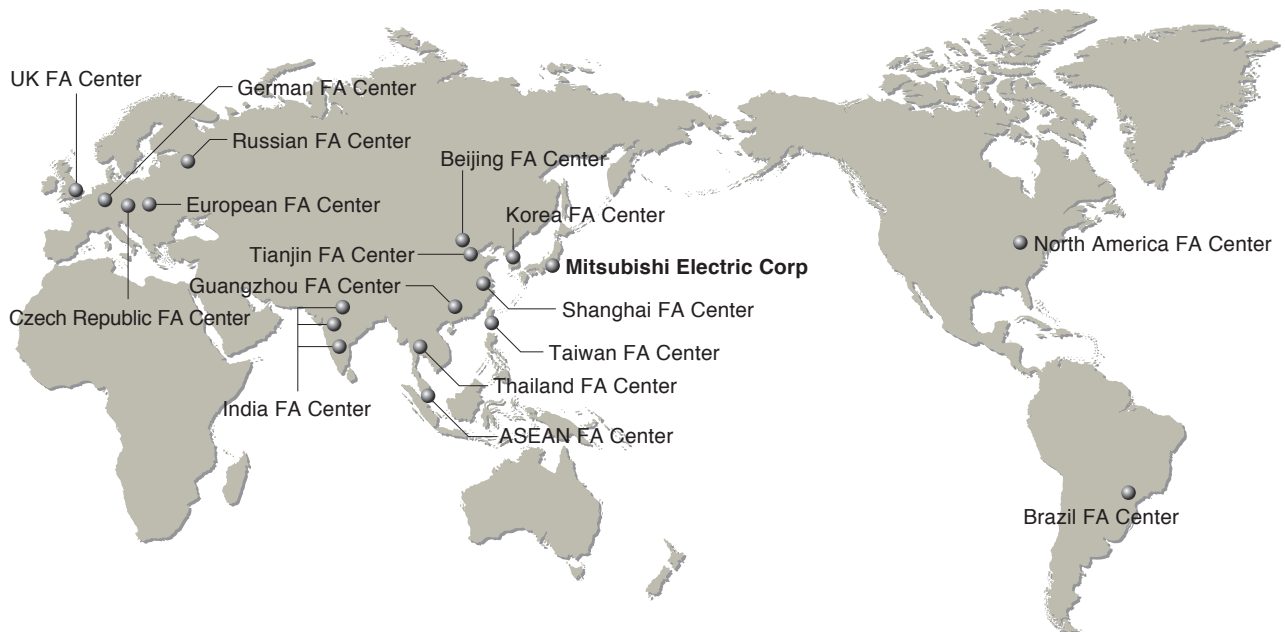
Human and environment-friendly MELSERVO-J4 series is compliant with RoHS Directive.

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.

* Refer to "Servo Amplifier Instruction Manual" and "EMC Installation Guidelines" when your system needs to meet the EMC directive.

Our optional cables and connectors comply with "Measures for Administration of the Pollution Control of Electronic Information Products" (Chinese RoHS).

Global FA Centers

**China**

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Servo Amplifiers & Motors

Servo System Controllers



Safety Warning

To ensure proper use of the products listed in this catalog, please be sure to read the instruction manual prior to use.

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