MITSUBISHI
MOTION CONTROLLERS

核心合作伙伴

日本三菱电机是全球知名的工业自动化（FA）及机电一体化（MECHATRONICS）产品及电子设备制造厂商，掌握着世界领先的自动与控制核心技术。三菱电机中国是日本三菱株式会社在中国的附属机构，三菱电机长期以来建立起的全球销售服务网络，OEM 最佳合作伙伴。

Motion Control Structured to your Specific Application

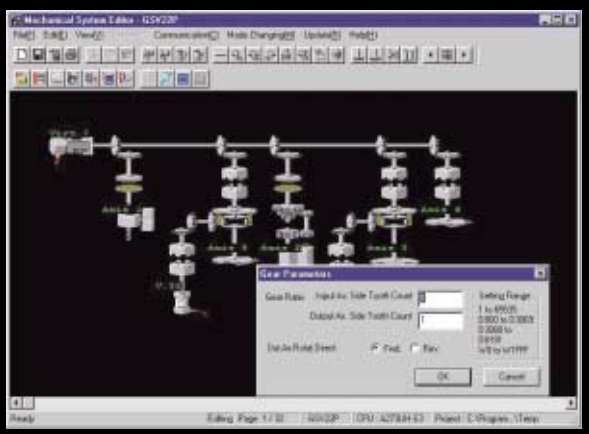
Various motion control models are available based on your specific application requirements. Models includes the A171SH(up to 4 control axes) for smaller scale applications up to the A173UH(up to 32 control axes) for larger scale applications. In addition, various motion controller operating system software packages are available. The OS with optimum control functions is selected based on your application requirements. Simple, compact and powerful motion control, custom tailored for your application needs.

High Speed Synchronous Communication Network : SSCNET

SSCNET(Servo System Controller NETwork) is a high-speed synchronous serial communication network that realized increased performance and reliability over conventional control networks. SSCNET allows for batch control of up to 32-axes thus simple one touch connection bus cabling, fast and simple connection.

Powerful Programming Environment

A powerful programming environment insures minimal system start up and programming time, as well as powerful, easy to use diagnostic and monitoring utilities. System development time is greatly reduced, saving valuable time and money.



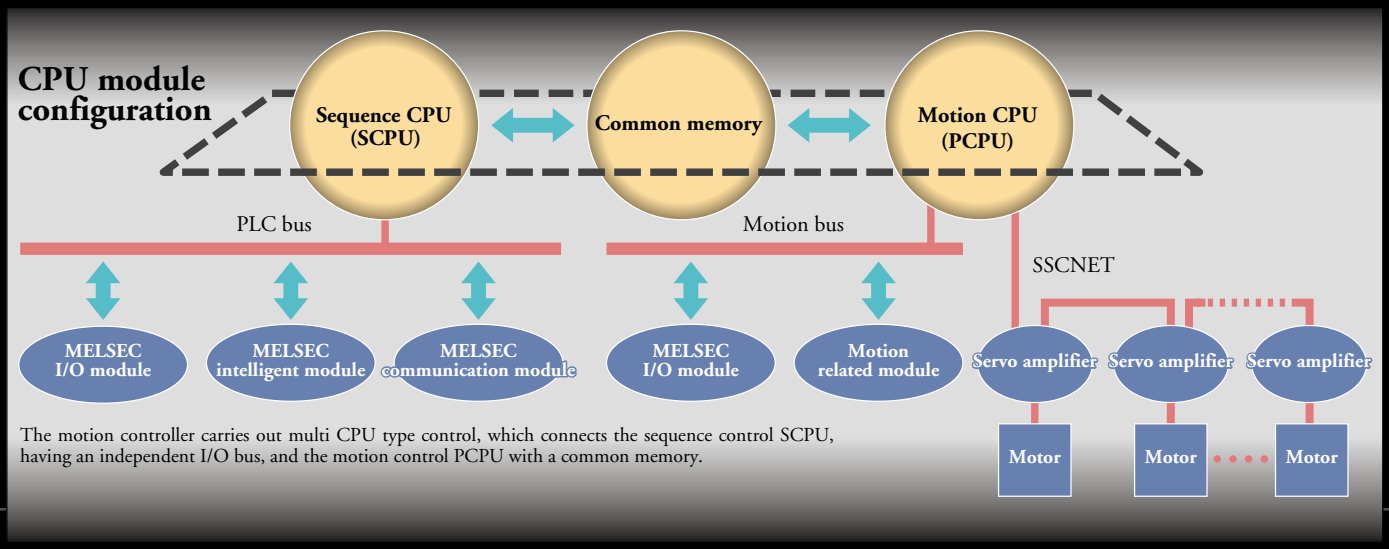
Unity and Inno

Integrated Motion and Sequence Control

The motion controller integrates motion and sequence control functions into a single compact package, thus reducing overall system size, complexity and cost. The motion controller utilities the industry leading MELSEC-A series PLC modules for networking, I/O and special function operations.

Diverse Motion Control Functions

The system is provided with diverse and innovative motion control functions including interpolation control, speed control, electronic cam and locus control, so even complicated operations can be freely controlled.



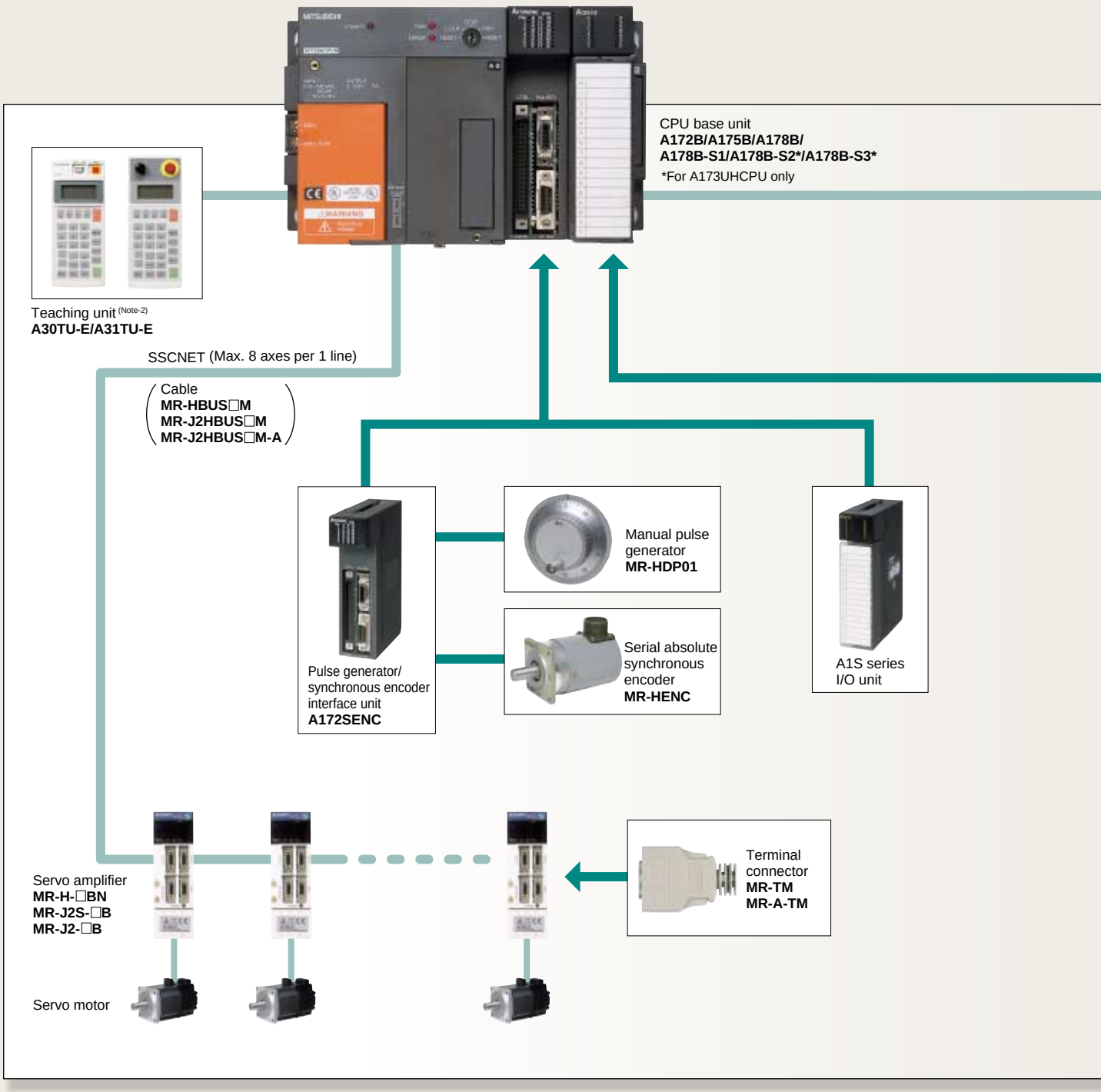
The motion controller carries out multi CPU type control, which connects the sequence control SCPU, having an independent I/O bus, and the motion control PCPU with a common memory.

ovation

CONTENTS

System Configuration

A171SH/A172SH/A173UH

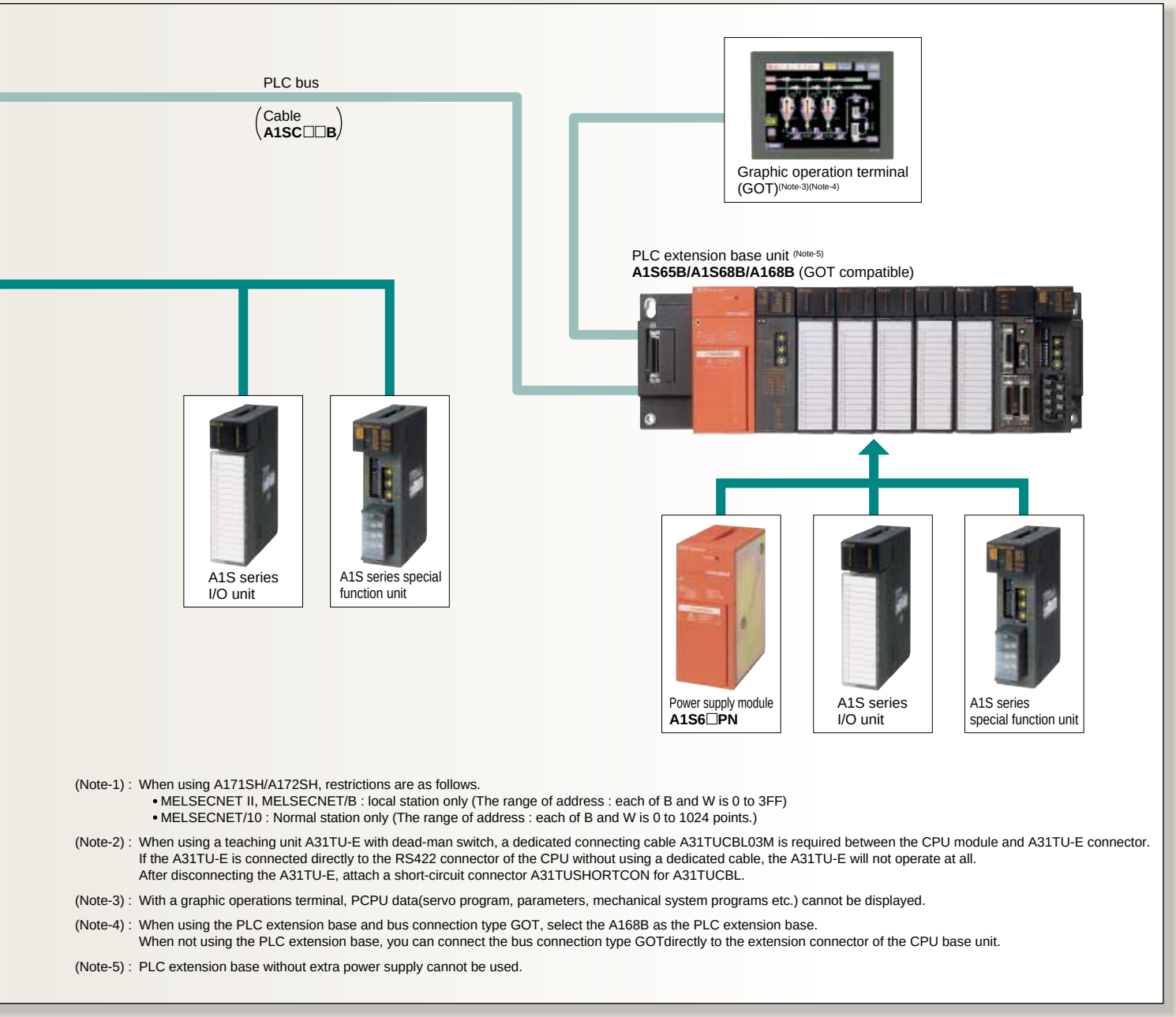


Motion controller integrates motion and sequence control into a single compact package.
(220mm wide, 130mm high and 110mm deep) (A172B CPU base use).

By connecting to a PLC extension base, I/O capabilities are expanded A171SH : max. 512 points, A172SH : max. 1024* points and A173UH : max. 2048* points. The extension base can connect to max. one step.
*The real I/O points can be used within the range of main base and one extension base.

Connects to MELSECNET II, MELSECNET/B, MELSECNET/10 and CC-Link networks (Note-1)

By connecting MR-H-BN/MR-J2S-B/MR-J2-B model servo amplifiers with the SSCNET communication network, 50W to 55kW servo motors can be batch controlled A171SH : max. 4-axes, A172SH : max. 8-axes and A173UH : max. 32-axes.



(Note-1) : When using A171SH/A172SH, restrictions are as follows.
- MELSECNET II, MELSECNET/B : local station only (The range of address : each of B and W is 0 to 3FF)
- MELSECNET/10 : Normal station only (The range of address : each of B and W is 0 to 1024 points.)

(Note-2) : When using a teaching unit A31TU-E with dead-man switch, a dedicated connecting cable A31TUCBL03M is required between the CPU module and A31TU-E connector. If the A31TU-E is connected directly to the RS422 connector of the CPU without using a dedicated cable, the A31TU-E will not operate at all. After disconnecting the A31TU-E, attach a short-circuit connector A31TUSHORTCON for A31TUCBL.

(Note-3) : With a graphic operations terminal, PCPU data(servo program, parameters, mechanical system programs etc.) cannot be displayed.

(Note-4) : When using the PLC extension base and bus connection type GOT, select the A168B as the PLC extension base. When not using the PLC extension base, you can connect the bus connection type GOTdirectly to the extension connector of the CPU base unit.

(Note-5) : PLC extension base without extra power supply cannot be used.

Product Line-Up

A171SHCPUN

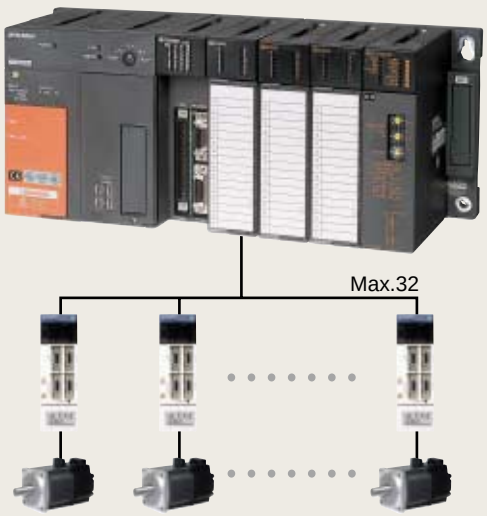
A171SHCPUN	Specifications
PLC CPU	A2SHCPU equivalent
PLC program capacity	14k steps
Real I/O points	512 points
Processing speed (sequence command)	0.25µs/step
Control axes	Max. 4
Servo program capacity	13k steps
Servo amplifier	External servo amp connected by SSCNET
Servo motor capacity	50W to 55kW
Network	MELSECNET II/B(local station only) MELSECNET/10(normal station only) CC-Link
PLC extension	Max. 1 base unit

A172SHCPUN

A172SHCPUN	Specifications
PLC CPU	A2SHCPU memory, I/O increase equivalent
PLC program capacity	30k steps
Real I/O points	1024 points (Note)
Processing speed (sequence command)	0.25µs/step
Servo program capacity	13k steps
Control axes	Max. 8
Servo amplifier	External servo amp connected by SSCNET
Servo motor capacity	50W to 55kW
Network	MELSECNET II/B(local station only) MELSECNET/10(normal station only) CC-Link
PLC extension	Max. 1 base unit

(Note) : The real I/O point can be used within the range of CPU base and one extension base.

A173UHCPU



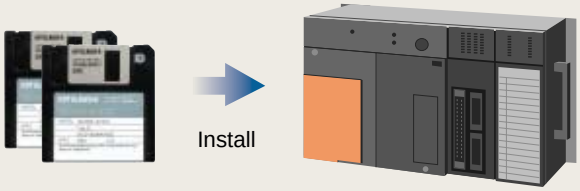
A173UHCPU(-SI)	Specifications
PLC CPU	A3UCPU equivalent
PLC program capacity	30k steps x2
Real I/O points	2048 points (Note)
Processing speed (sequence command)	0.15µs/step
Servo program capacity	14k steps
Control axes	Max. 32
Servo amplifier	External servo amp connected by SSCNET
Servo motor capacity	50W to 55kW
Network	MELSECNET II/B/10,CC-Link
PLC extension	Max. 1 base unit

(Note) : The real I/O point can be used within the range of CPU base and one extension base.

OS Software Packages

Application Tailored Software Packages

The motion controller operating system software is specifically tailored and packed with functionality specific for your application needs.
Dramatic reductions in product design costs and simpler programming environments over conventional motion controllers realized great time and money savings.

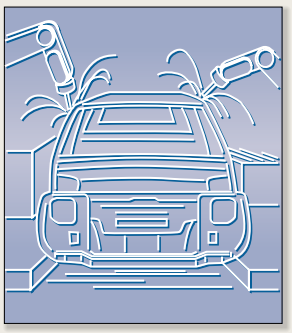


OS Software Line-up

Conveyor Assembly Use

Motion SFC
SV13

SV13



Offer constant-speed control, speed control, 1 to 4-axes linear interpolation and 2-axes circular interpolation, etc. Ideal for use in conveyors and assembly machines.

- Electronic component assembly
- Inserter
- Feeder
- Molder
- Conveying equipment
- Paint applicator
- Chip mounter
- Wafer slicer
- Loader/Unloader
- Bonding machine
- X-Y table

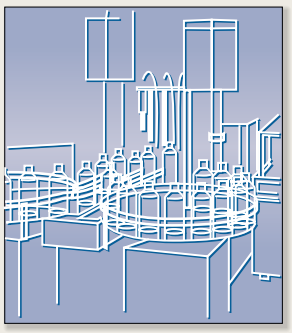
Dedicated language

- Linear interpolation(1 to 4-axes)
- Circular interpolation
- Constant-speed control
- Fixed-pitch feed
- Speed change control
- Speed control
- Speed-positionswitching
- Teaching function

Automatic Machinery Use

Motion SFC
SV22

SV22



Provides simultaneous control multiple servo motors and offers software cam control. Ideal for use in automatic machinery.

- Press feeder
- Food processing
- Food packaging
- Winding machine
- Spinning machine
- Textile machine
- Printing machine
- Book binder
- Tire molder
- Paper-making machine

Mechanical support language

- Synchronous control
- Electronic shaft
- Electronic clutch
- Electronic cam
- Draw control

Motion SFC

Greatly strengthed programming environment and event processing.

The Motion SFC function to describes the motion control program in flow chart form. By describing the program of the CPU(PCPU) which controls the motion in a suitable Motion SFC for the event processing, serial operation of the machine is controlled by PCPU, aiding the event response.

Motion SFC (Sequential Function Chart)

Easy-to-read and comprehend flow chart description.

- Programming can be carried out with an image that describes the flow chart with the machine operation procedures.
- A process control program can be created easily, and the control details can be visualized.

Controlling the series of machine operations with PCPU

- Using the Motion SFC, the servo control, operation and I/O control can be carried out in a batch with the PCPU.
- There is no need to start the servo program from the CPU (SCPU) that controls the sequence.

Multi-task processing

- The Motion SFC allows for multi-task program operation.
- By using parallel distribution in one program, multiple steps can be executed simultaneously.

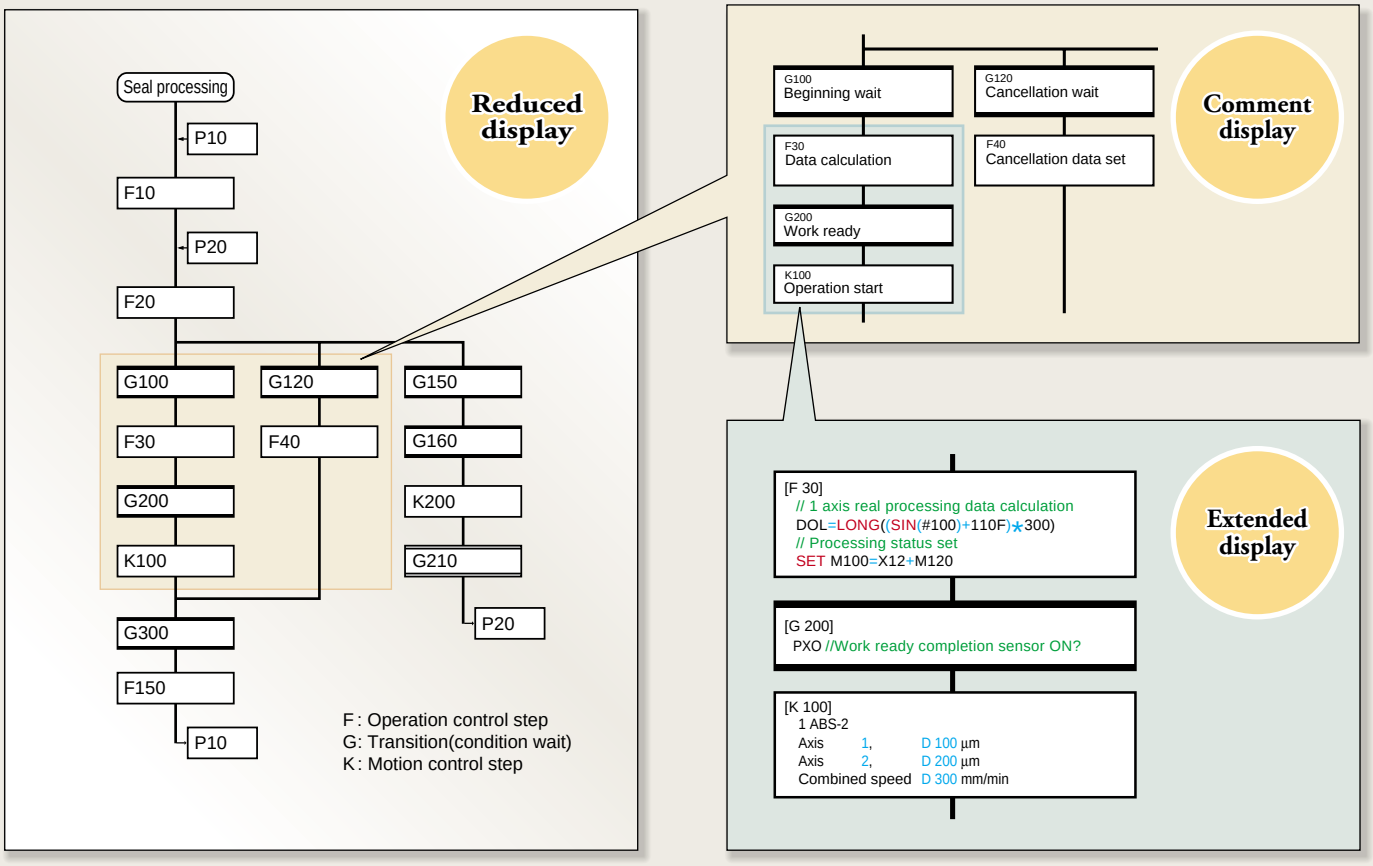
Motion SFC description

Flow chart description which easy-to-view and understand.

- As the outline operation of the process control is described as a flow chart, the entire operations can be viewed at a glance.
- The operation details can be described as a comment so an easy-to-understand program can be created.
- The program has a hierarchical structure, so detailed operations can be described for each step.

Enhanced operation function

- The operation expression can be described in the original state.
- Compatible with 64-bit floating point operation.
- Various arithmetic functions including trigonometric functions, square root and natural logarithm are provided.
- The motion registers (#0 to #8191) have been added for Motion SFC operations.



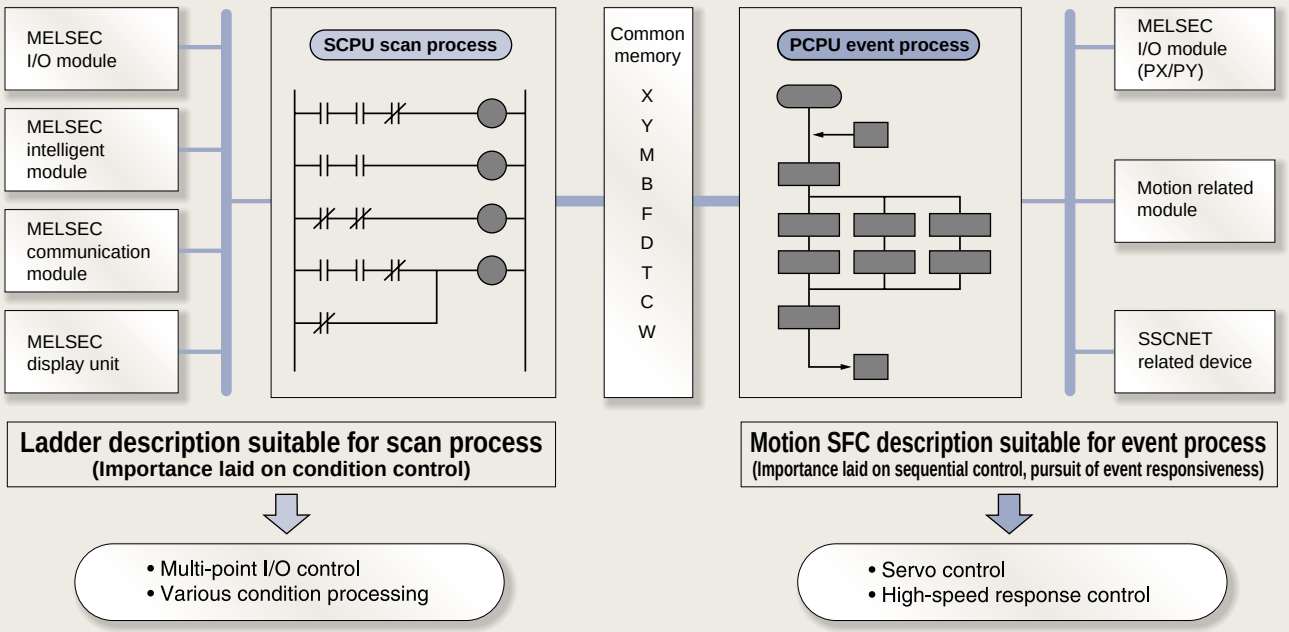
Powerful event processing functions

■Minimized variation in control response time

With the conventional SV13/SV22, the series of machine operations were controlled by the SCPU so a variation occurred in the response time per seguence scan. However, this can be minimized by the strengthened Motion SFC event processing function, so the scan time can be suppressed, and variations in product machining can be reduced.

■Multi-CPU method that strengthens event processing function

The multi-point I/O control and monitoring operations can be appointed to the SCPU by the ladder program, and the servo control and high-speed response control can be appointed to the PCPU by the Motion SFC program. This balances the scan process and event process, and further utilizes the multi-CPU configuration.



■Event process

This process waits for the conditions to be established (event to occur) with the changes in the input signal state or device value, and carries out high-speed response control (signal output control, servo motor start and speed change, etc.) when the conditions are established.

■Examples of events

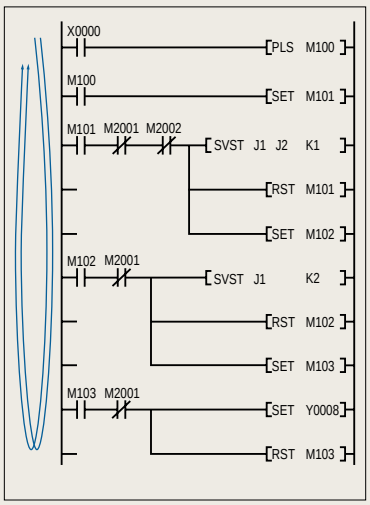
- Input signal turned ON.
- Operation results reached constant value.
- Set time elapsed.
- Positioning was completed.

Motion SFC

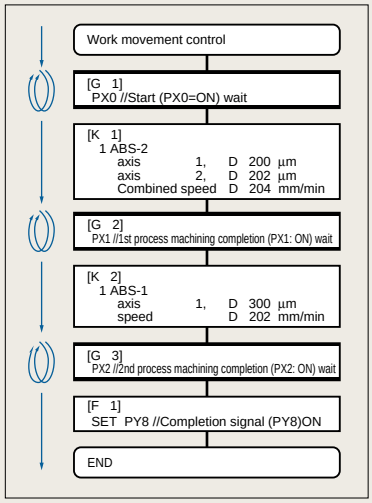
High-speed response using step execution method

- The sequence program uses a scan execution method to execute all steps with constant scanning. However, with the Motion SFC, the step execution method executes only the active steps following the shift conditions. Thus, the operation process can be reduced, and processing and response control can be realized.

Sequence program
All steps are executed with constant scan.



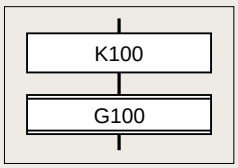
Motion SFC program
Only active steps are executed following shift conditions.



Exclusive description unique to motion control

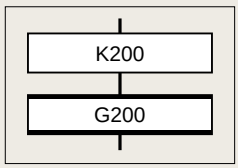
- If shift is applied immediately after the motion control step, the shift will be executed without waiting for the motion control operation to end.
- If WAIT is executed immediately after the motion control step, WAIT will be executed after waiting for the motion control operation to end.
- If WAIT ON/WAIT OFF is commanded just before the motion control step, the details of the motion control will be pre-read, and preparation for starting will be carried out. The operation will start immediately when the designated bit device turns ON/OFF.

Shift



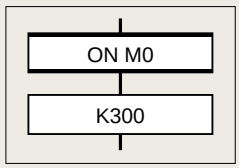
• Execute G100 without waiting for K100 operation to end

WAIT



• Execute G200 after waiting for K200 operation to end

WAIT ON/OFF

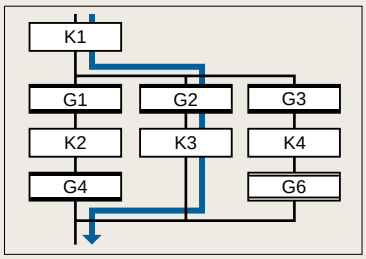


• Pre-read K300 and prepare to start
• Start immediately when designated bit (M0) turns ON

Selective branch and parallel branch

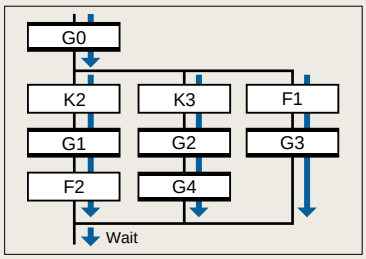
- When all routes shift after branch, or WAIT is issued for all routes, selective branch will be applied. Parallel branch is applied in all other cases.
- With selective branch, the route for which the shift conditions are established first are executed.
- With parallel branch, several routes connected in parallel are executed simultaneously. The process waits at the connection point, and shifts to the next process after execution of all routes is completed.

Selective branching



• Judge G1 to G3 conditions, and execute only established route

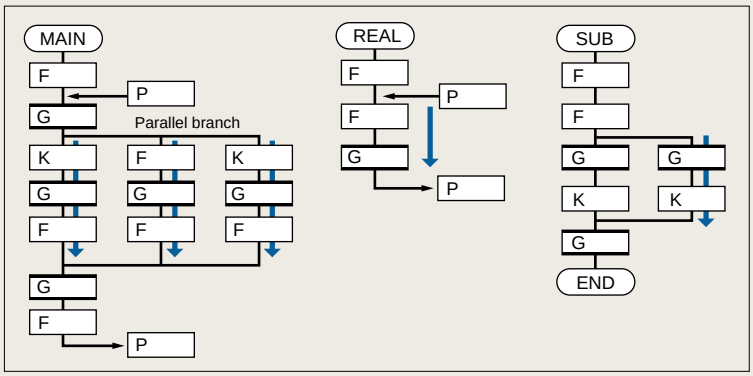
Parallel branching



• Simultaneously execute all routes for step K2 to F1 in parallel

Multi-task processing

- With the Motion SFC, when several programs are started, the process is carried out with multi-task operation.
- Multiple steps can be simultaneously executed with parallel branching even within one program.
- A program that executes multiple processes simultaneously, or a program that groups the control axis for independent movements can be created easily.
- A highly independent programming is possible according to the process details, so an easy-to-comprehend program can be created.



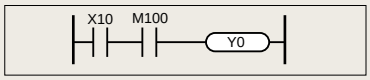
High-response to external inputs

I/O output

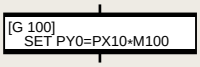
- This is used to measure the response time of the output signal in respect to the input signal from an external source.
- With the sequence program, there is a delay and variation equal to the response time 20ms and approximately the scan time.
- With the Motion SFC, the response time and variation are approximately 3ms.

S-I/O: PLC slot I/O
P-I/O: Motion slot I/O

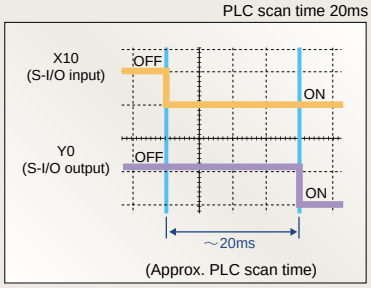
Sequence program



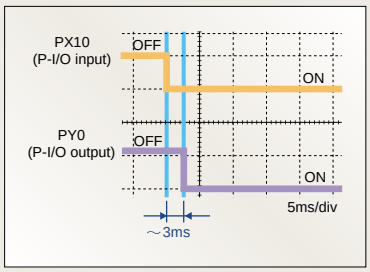
Motion SFC program



PLC scan time 20ms



(Approx. PLC scan time)



- Applicable CPU: A172SHCPUN
- Input module: A1SX40-S1 (OFF→ON response: up to 0.1ms)
- Output module: A1SY40 (OFF→ON response: up to 2ms)

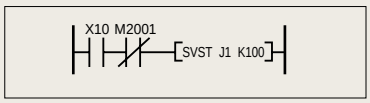
Great reduction in servo program start time

Start up of servo program

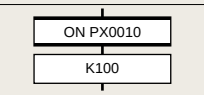
- This is an example of starting the servo program using the input signal from an external source as a trigger.
- When starting with the sequence program, a delay and variation equal to 20ms and approximately the scan time occurs from the input of the external signal to start-up of the speed command.
- With the Motion SFC, the speed command will start up with a response time of less than 10ms and variation of approximately 3ms.

S-I/O: PLC slot I/O
P-I/O: Motion slot I/O

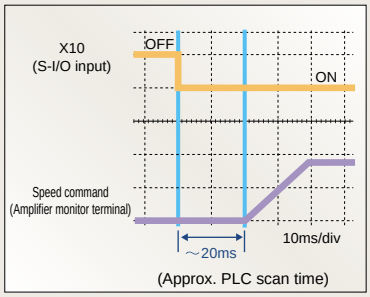
Sequence program



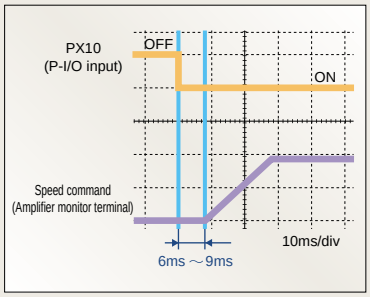
Motion SFC program



PLC scan time 20ms



(Approx. PLC scan time)

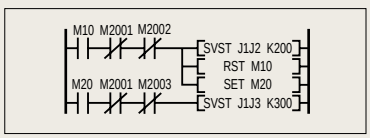


- Applicable CPU: A172SHCPUN
- Input module: A1SX40-S1 (OFF→ON response: up to 0.1ms)

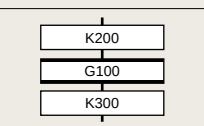
Continuous start-up of servo program

- This shows an example of starting-up the 1-axis and 3-axes linear interpolation program K300 immediately after starting-up the 1-axis and 2-axes linear interpolation program K200.
- When continuously starting-up the servo program with the sequence program, a delay and variation of approximately 30ms will occur. This is because the PLC scan time is 20ms, and the refresh cycle for the start acceptance flag M2001, which is the interlock is 10ms.
- An interlock is not required with the Motion SFC, and the start delay will be approximately 7ms.

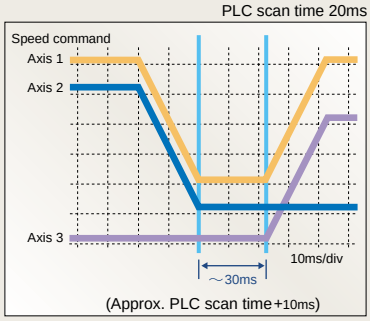
Sequence program



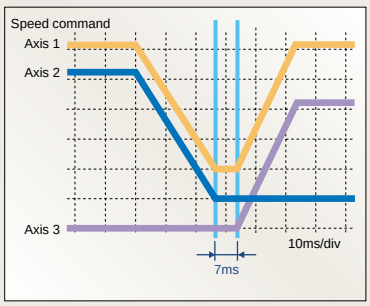
Motion SFC program



PLC scan time 20ms



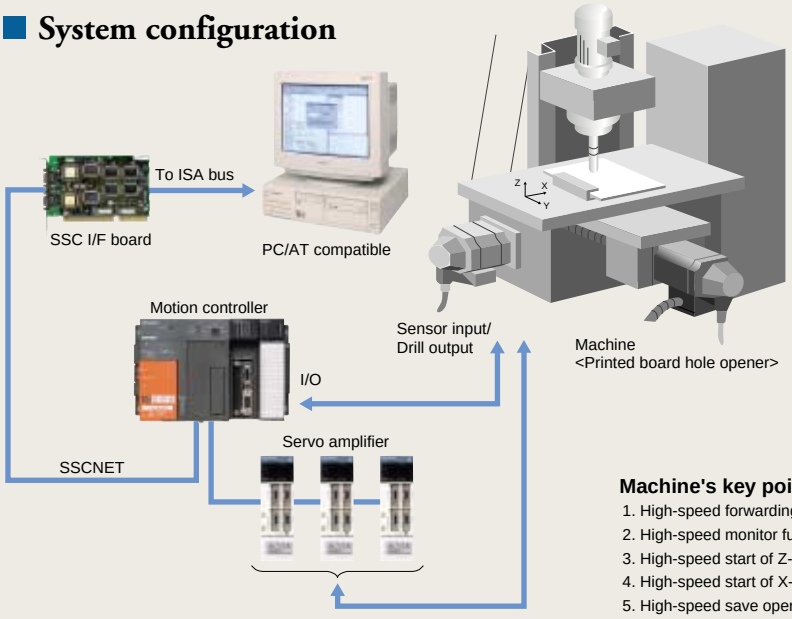
(Approx. PLC scan time+10ms)

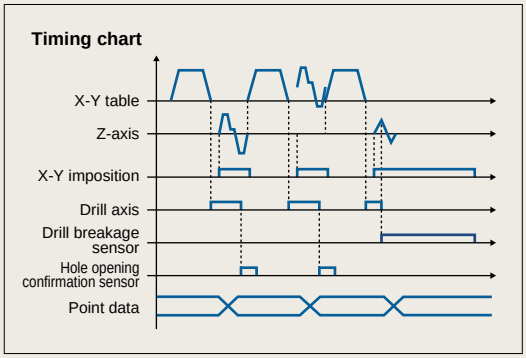


- Applicable CPU: A172SHCPUN
- Input module: A1SX40-S1 (OFF→ON response: up to 0.1ms)

Example applications

System configuration

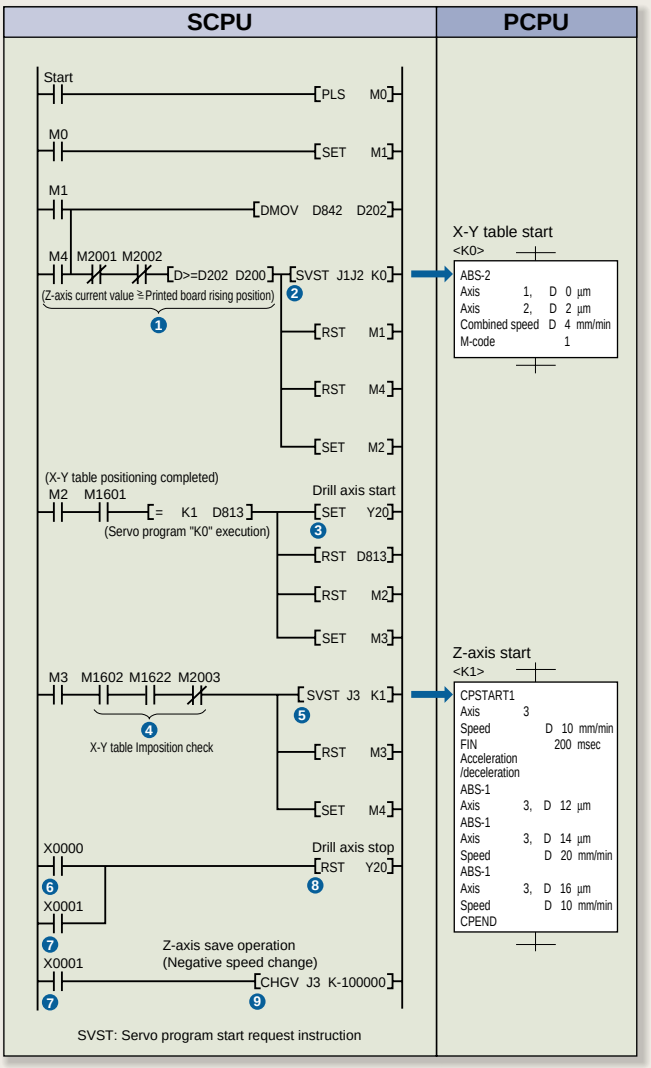




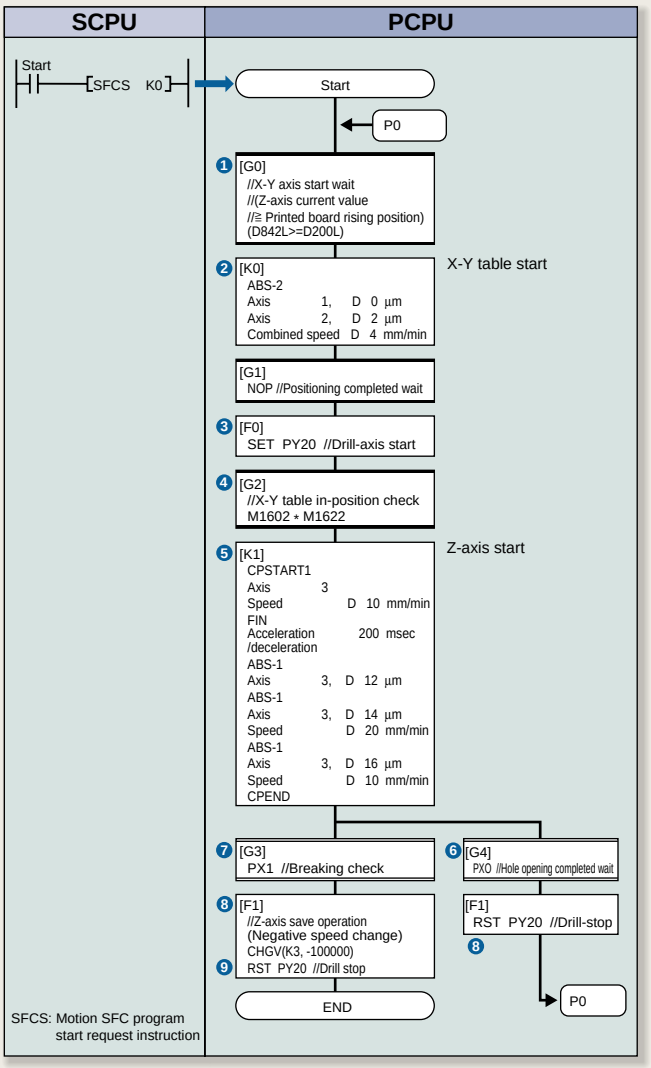
Machine's key points

1. High-speed forwarding of a hole breakage data from a personal computer.
2. High-speed monitor function in a personal computer.
3. High-speed start of Z-axis after X-Y table positioning is completed.
4. High-speed start of X-Y axis after printed a board hole opening(Z-axis rises from printed board position).
5. High-speed save operation when drill breakage.

Previous method (SV13)

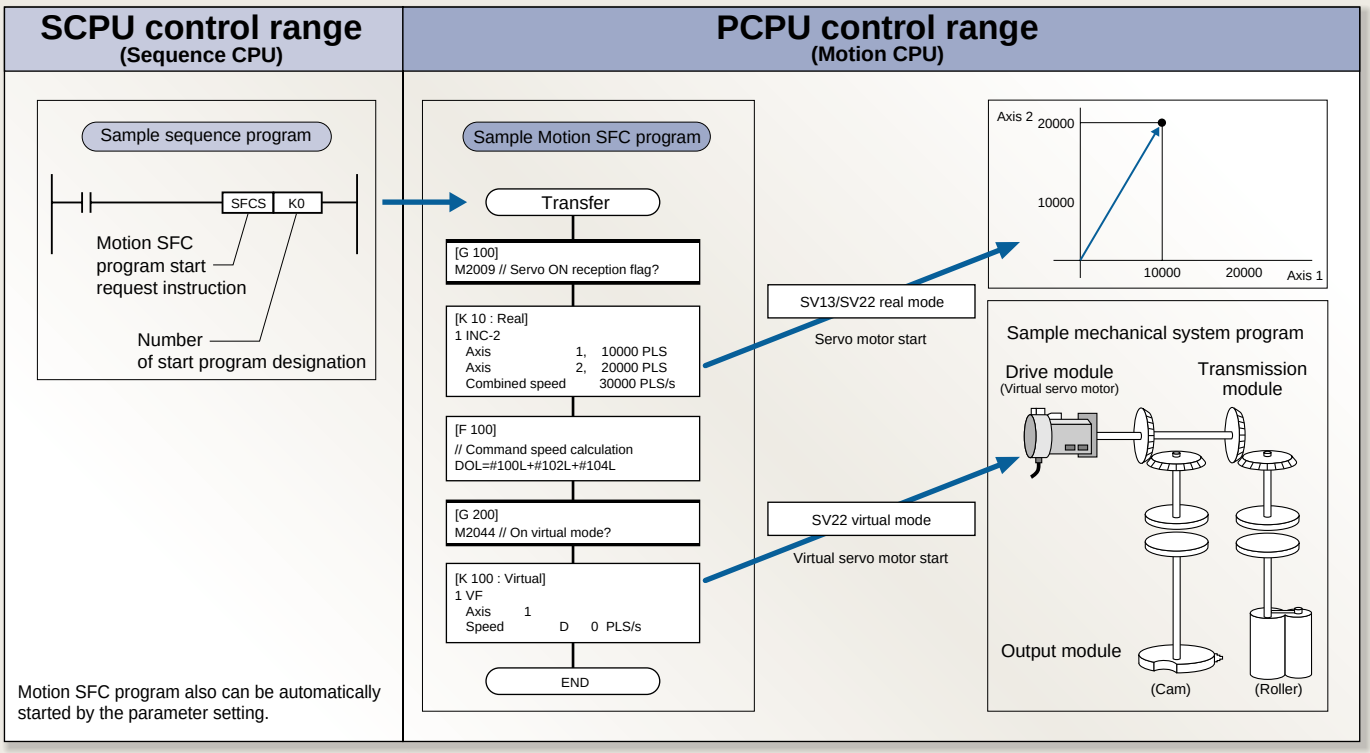


New method (Motion SFC SV13)



Processing action ❶ to ❾ of the previous method corresponds to the new method ❶ to ❾.

Control flow (Motion SFC SV13/SV22)



Please refer to P19 regarding control flow of "SV13(without Motion SFC)" and P23 regarding control flow of "SV22(without Motion SFC)".

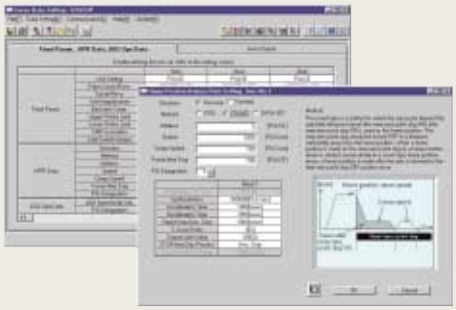
Various programming tools.

System setting

System setting

• Set the system configuration (motion module, servo amplifier, servo motor) from the menu selection

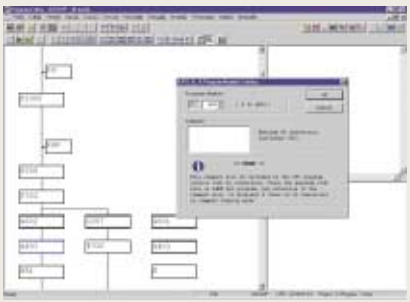
Servo data setting



• Set the servo parameter and fixed parameters, etc.
• Display explanations of parameters with one-point help

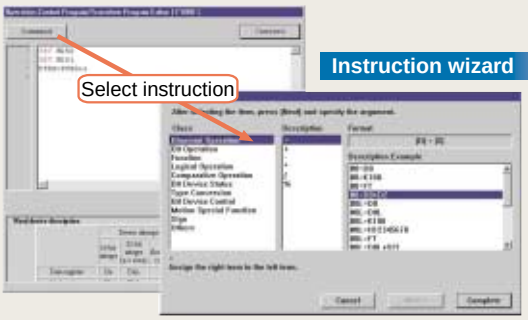
Programming

Motion SFC program editing



• Describe machine operation procedures with flow chart format
• Lay out graphic symbols by clicking mouse; connect by dragging

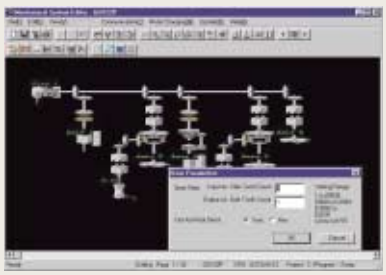
Program editing



Instruction wizard

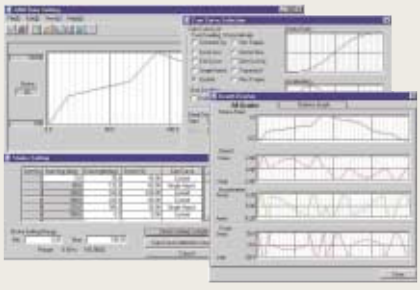
• Program for each step and transition
• Selection from menu using command wizard is also possible

Mechanical system editing



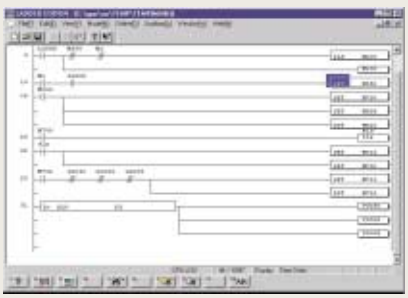
• Edit and monitor mechanics configuration program
• Lay out each module by clicking mouse to create

Cam deta setting



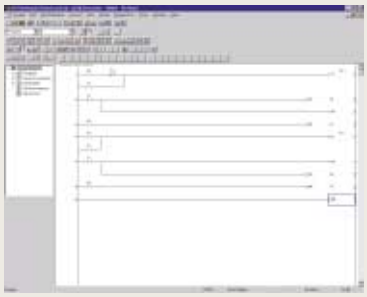
• Create cam data with cam pattern selection and free curve setting; display cam control status waveform

Ladder editing



• Ladder editing software [LADDERP] is available to edit and monitor sequence program

GX-Developer



• Highly functional windows version GPP function software [GX-Developer] can be used (optional)

Debugging

Motion SFC monitor

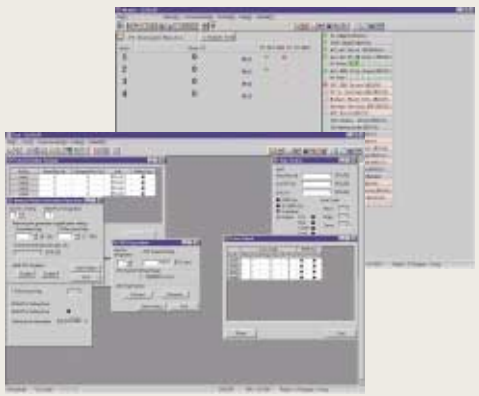
- Color display of step in execution on flow chart
- Device monitoring and testing of execution and designated step

Motion SFC debugging mode

- Greatly reduced debugging time with powerful debug function (one-step execution, forced shift, brake, forced end)

Start-up adjustment

Monitor·Test



- Current value monitor, axis monitor, error history monitor
- Various tests such as zeroing and JOG by clicking mouse

Digital oscilloscope

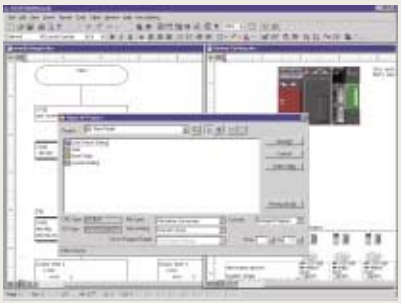
- Data sampling synchronized with motion control cycle
- Waveform display, dump display, file save, printing

Operation and maintenance

Back-up

- Back-up of motion controller programs, parameters and internal information in a batch as a file

Document printing



- Conversion of system settings, programs and parameters into Word or Excel file and printing

Motion SFC specifications

Motion SFC chart symbols

Class	Name	Symbol	Function
Program start/end	START	Program name	Indicates the start (entrance) of the program.
	END	END	Indicates the end (exit) of the program.
Step	Motion control step	K	Starts the servo program Kn. (The servo commands are the same as the conventional SV13/SV22.)
	Once execution type operation control step	F	Executes the operation control program Fn once.
	Scan execution type operation control step	FS	Repeats an operation control program FSn until the next transition condition enables.
	Subroutine call/start step	Program name	Calls or starts a subroutine.
	Clear step	CLR Program name	Cancels and ends execution of the designated program.
Transition	Shift (Pre-read transition)	G	Shifts to the next step when the transition condition enables without waiting for the previous motion control step or subroutine to end.
	WAIT	G	Shifts to the next step when the transition conditions enables after the previous motion control step or subroutine ends.
	WAIT ON	ON bit device	Prepares to start the next motion control step, and immediately outputs a command when the conditions are established.
	WAIT OFF	OFF bit device	
Jump	Jump	P	Jumps to the designated pointer Pn within its own program.
Pointer	Pointer	P	Indicates the jump destination pointer (label).

Motion SFC program parameters

• The Motion SFC program start method and execution timing are set with the program parameters.

Item	Setting range		Details
Start setting	Automatically start		• Start at rising edge of PLC READY (M2000)
	Do not start automatically		• Start with the Motion SFC program start command SFCS from PLC • Start with "Subroutine call/start" GSUB from the Motion SFC program
Executed task	Normal task		• Execute in motion main cycle (free time)
	Event task	Fixed cycle	• Execute in fixed cycle (1.7ms, 3.5ms, 7.1ms, 14.2ms)
		External interrupt	• Execute when set external interrupt unit (I0 to I15) input turns ON
		PLC interrupt	• Execute with interrupt from PLC (When PLC dedicated command ITP is executed)
	NMI task		• Execute when set external interrupt unit (I0 to I15) input turns ON

Operation control step and transition commands

Class	Symbol	Function
Binary operation	=	Substitution
	+	Addition
	–	Subtraction
	*	Multiplication
	/	Division
	%	Remainder
Bit operation	~	Bit inversion (complement)
	&	Bit logical AND
	I	Bit logical OR
	^	Bit exclusive OR
	≫	Bit right shift
	≪	Bit left shift
Sign	–	Sign inversion (complement of 2)
Type conversion	SHORT	Convert to 16-bit integer type (signed)
	USHORT	Convert to 16-bit integer type (unsigned)
	LONG	Convert to 32-bit integer type (signed)
	ULONG	Convert to 32-bit integer type (unsigned)
	FLOAT	Regarded as signed data, and convert into 64-bit floating point type
	UFLOAT	Regarded as unsigned data, and convert into 64-bit floating point type

Class	Symbol	Function
Standard function	SIN	Sine
	COS	Cosine
	TAN	Tangent
	ASIN	Arcsine
	ACOS	Arccosine
	ATAN	Arctangent
	SQRT	Square root
	LN	Natural logarithm
	EXP	Exponential operation
	ABS	Absolute value
	RND	Round off
	FIX	Round down
	FUP	Round up
	BIN	BCD → BIN conversion
	BCD	BIN → BCD conversion
Bit device status	(none)	ON (normally open contact)
	!	OFF (normally closed contact)
Bit device control	SET	Device set
	RST	Device reset
	DOUT	Device output
	DIN	Device input

Class	Symbol	Function
Logical operation	(none)	Logical acknowledge
	!	Logical negation
	*	Logical AND
	+	Logical OR
Comparison operation	==	Equal to
	! =	Not equal to
	<	Less than
	<=	Less than or equal to
	>	More than
	>=	More than or equal to
Motion dedicated function	CHGV	Speed change request
	CHGT	Torque limit value change request
Others	EI	Event task enable
	DI	Event task disable
	NOP	No operation
	BMOV	Block move
	TIME	Time to wait

Sequence dedicated commands

Sequence command	Control details
SFCS	At the rising edge (OFF → ON) of the SFCS command executed by the sequence program,start of the designated the Motion SFC program is requested.
ITP	An interrupt is issued to the motion CPU (PCPU) at the rising edge (OFF → ON) of the ITP command executed by the sequence program. The motion CPU executes the active step of the SFC program executed by the "PLC interrupt".

• The functions of the conventional SV13/22 PLC dedicated commands (DSFRP/SVST/DSFLP/CHGA/CHGV/CHGT) are described in the Motion SFC program, and cannot be described in the sequence program.

List of integrated start-up support software SW3RNC-GSVE software configuration

Software	Function	
Conveyor assembly software **SW3RN-GSV13P**	Installation	• Installation of the motion OS • Comparison of the motion OS
	Project management	• New creation, setting and reading of projects • Batch management of user files in project units
	System setting	• Setting of system configuration (motion module/servo amplifier/servo motor, etc.) • Setting of high-speed read data
	Servo data setting	• Setting of servo parameters and fixed parameters, etc. (Explanatory diagrams displayed with one-touch help) • Setting of limit switch output data (Output pattern displayed with waveform display function)
	Program editing	• Editing of the Motion SFC program, setting of the Motion SFC parameters • Reduced display of the Motion SFC diagram, display of comments, enlarged display • Monitor of the Motion SFC, debugging of the Motion SFC
Automatic machinery software **SW3RN-GSV22P**	Mechanical system editing (GSV22P only)	• Editing of mechanical system program • Monitoring of mechanical system program execution state
	Communication	• Setting of SSCNET communication CH. • Writing, reading and comparison of programs and parameters in respect to the motion controller.
	Monitoring	• Current value monitor, axis monitor, error history • Servo monitor, limit switch output monitor
	Testing	• Servo startup, servo diagnosis • Jog operation, manual pulser operation, zeroing test, program operation • Teaching, error reset, current value change
	Backup	• Backup of motion controller programs and parameters in file • Batch writing of backed up files into the motion CPU
Cam data creation software **SW3RN-CAMP**	Cam data creation	• Cam data creation with Cam pattern selection and free curve settings • Graphic display of Cam control status
Digital oscilloscope software **SW3RN-DOSCP**	Digital oscilloscope	• Data sampling synchronized to operation cycle • Waveform display, dump display and file saving of collected data
Communication system software **SW3RN-SNETP**	Communication system Communication API	• Communication task, communication manager, common memory server, SSCNET communication driver • Support of cyclic communication, transient communication, high-speed refresh communication • Communication API functions compatible with VC++/VB
Document printing software **SW3RN-DOCPRNP** (Note)	Printing	• Printing of program, parameter and system settings (Convert into Word 97 or Excel 97 document format, and print)
Ladder editing software **SW3RN-LADDERP**	Ladder editing	• Editing of sequence program • Monitoring of sequence program execution

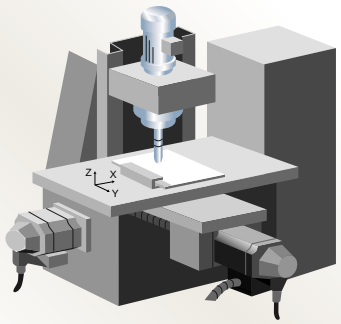
(Note) : Word 97 and Excel 97 and above are required.

Simple programming using dedicated commands.

By using easily understood dedicated servo command and sequence commands positioning and locus control can be programmed as you like.
Control which is considered difficult and complex can be carried out simply using a variety of canned motion control functions.

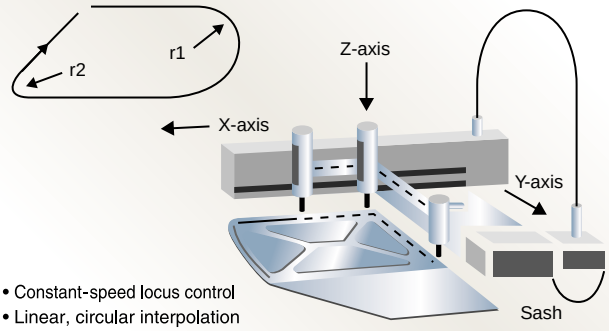
Example applications

X-Y table control



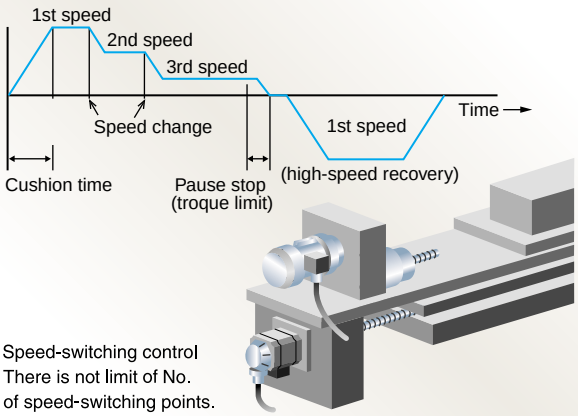
- 2-axes liner interpolation
- 3-axes liner interpolation
- 2-axes circular interpolation
- Constant-speed locus control

Sealing



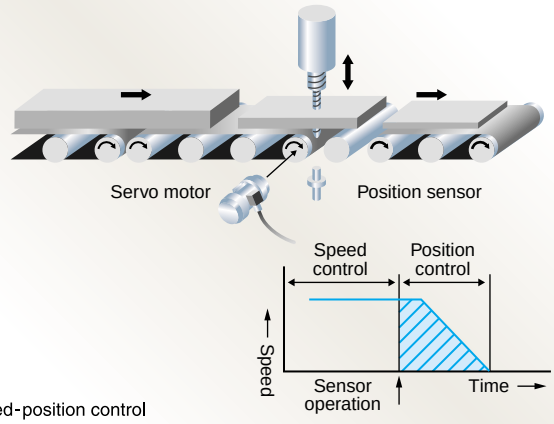
- Constant-speed locus control
- Linear, circular interpolation
- High-speed, high-precision locus operation

Feed control



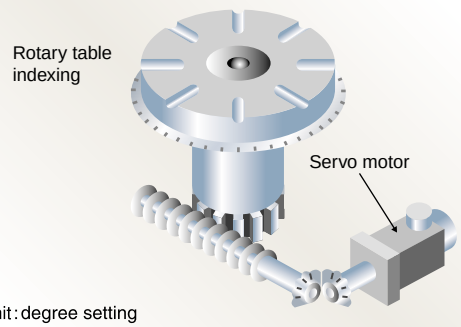
- Speed-switching control
- There is not limit of No. of speed-switching points.

Fixed-pitch hole drilling



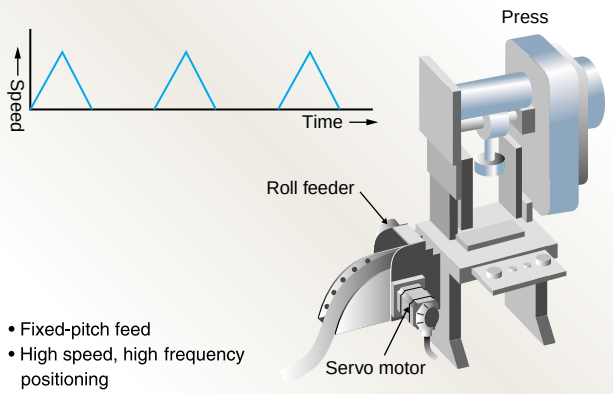
- Speed-position control

Rotary table indexing



- Control unit: degree setting
- Shorter indexing
- Rotation direction indexing

Roll feeder



- Fixed-pitch feed
- High speed, high frequency positioning
- High speed response

Example functions

Skip operation

This allows a positioning point to be made invalid during constant-speed control so that positioning moves on to the next positioning point.

Uses : Handling positioning eta.

Negative speed change

During position control, movement in the reverse direction can be made using speed change. Using the sequence command CHGV, a negative speed can be set so that the locus is retraced.

Uses : Return operations

M-code FIN waiting function

This allow a faster than normal commencement of positioning to the next point during constant-speed control.

Uses : High response positioning operation

Position follow-up control

By carrying start-up once, the setting value of the positioning point is detected in real time, and position control is carried out by tracking the changing settings.

M-code output function

During positioning, M-codes between 0 and 255 can be output at each positioning point.

Dwell time free setting

Dwell time can be set for any value between 0 and 5000ms.

Parameter block setting

Common setting items in positioning control can be set and freely selected as parameter blocks up to a maximum of 64 types.

Torque limit value change

Torque limit value change can be carried out simply during positioning and JOG operation using the sequence command CHGT.

High speed read-out function

Using a signal from the input unit as a trigger, up to 11data sets(feed current value, variation counter value, etc.) out of 16 types of data can be read simultaneously to designated devices.

Uses : Measured length, synchronized correction

Cancel/start function

This forcibly halts program processing during operation, allowing you to switch to other program.

Uses : Escape operations when errors occur

S-curve acceleration/ deceleration

Using a determined ratio S-curve acceleration/deceleration characteristics can be set. The S-curve acceleration/deceleration enables smoother start and stop, and reduces stress on machines.

Speed change/pause/restart

Positioning, speed change during JOG operation as well as pause and restart can be carried out simply using the sequence command CHGV.

2 speed controls

Two types speed controls are available using position loops or speed loops.

Limit switch output

High-speed output of ON/OFF signals for up to 8 points per axis in response to the real current value during operation can be made regardeess of the sequence program.

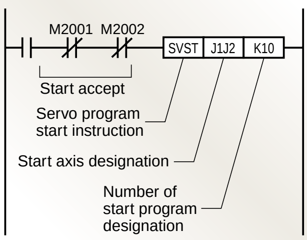
Teaching setting

Using address teach and program teach, the positioning points can be taught.

Control flow (SV13)

SCPU control range (Sequence CPU)	PCPU control range (Motion CPU)

Sample sequence program

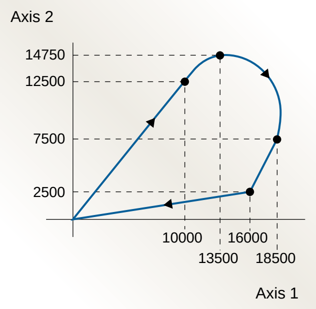


Please refer to P11 regarding control flow of "Motion SFC SV13".

Sample servo program

(2-axes constant-speed control)

```
      <K10>
point
5     CPSTART2                            ---- 2-axes constant-speed control
        Axis        1,
        Axis        2,
        Speed            1000.00  (mm/min.) -- Combined speed setting
1     ICN-2                               ---- Incremental linear interpolation
        Axis        1,  10000.0   (μm)
        Axis        2,  12500.0   (μm)
2     ABS                                 ---- Absolute auxiliary point setting
                                               Circular interpolation
        Axis        1,  18500.0   (μm)
        Axis        2,   7500.0   (μm)
        Auxiliary P 1,  13500.0   (μm)
        Auxiliary P 2,  14750.0   (μm)
        M-code               10           ---- M-code output
3     ABS-2                               ---- Absolute linear interpolation
        Axis        1,    D2000   (μm) ------- Indirect designation
        Axis        2,    D2002   (μm)
        M-code               11
4     ABS-2
        Axis        1,      0.0   (μm)
        Axis        2,      0.0   (μm)
        Speed             800.00  (mm/min.)
        M-code               12
5     CPEND
```



Positioning parameter

System setting
Servo parameters
Fixed parameter
Parameter block
JOG operation data
Limit switch output data

Please refer to P11 regarding control flow of "Motion SFC SV13"

Servo instruction

Positioning control		Instruction symbol	Processing
Linear control	1-axis	ABS-1	Absolute 1-axis positioning
		INC-1	Incremental 1-axis positioning
	2-axes	ABS-2	Absolute 2-axes linear interpolation
		INC-2	Incremental 2-axes linear interpolation
	3-axes	ABS-3	Absolute 3-axes linear interpolation
		INC-3	Incremental 3-axes linear interpolation
	4-axes	ABS-4	Absolute 4-axes linear interpolation
		INC-4	Incremental 4-axes linear interpolation
2-axes circular interpolation control	Auxiliary point designation	ABS	Absolute auxiliary point designation circular interpolation
		INC	Incremental auxiliary point designation circular interpolation
	Radius designation	ABS	Absolute radius designation circular interpolation less than CW 180°
		ABS	Absolute radius designation circular interpolation CW 180° or more
		ABS	Absolute radius designation circular interpolation less than CCW 180°
		ABS	Absolute radius designation circular interpolation CCW 180° or more
		INC	Incremental radius designation circular interpolation less than CW 180°
		INC	Incremental radius designation circular interpolation CW 180° or more
		INC	Incremental radius designation circular interpolation less than CCW 180°
		INC	Incremental radius designation circular interpolation CCW 180° or more
	Center point designation	ABS	Absolute center point designation circular interpolation CW
		ABS	Absolute center point designation circular interpolation CCW
		INC	Incremental center point designation circular interpolation CW
		INC	Incremental center point designation circular interpolation CCW

Positioning control		Instruction symbol	Processing
Fixed-pitch feed	1-axis	FEED-1	1-axis fixed-pitch feed start
	2-axes	FEED-2	2-axes linear interpolation fixed-pitch feed start
	3-axes	FEED-3	3-axes linear interpolation fixed-pitch feed start
Speed-switching control		VSTART	Speed switching control start
		VEND	Speed switching control end
		VABS	Absolute designation speed switching point
		VINC	Incremental designation speed switching point
Speed control (I)	Forward	VF	Speed control(I) forward rotation start
	Reverse	VR	Speed control(I) reverse rotation start
Speed control (II)	Forward	VVF	Speed control(II) forward rotation start
	Reverse	VVR	Speed control(II) reverse rotation start
Speed-position control	Forward	VPF	Speed-position control forward rotation start
	Reverse	VPR	Speed-position control reverse rotation start
	Restart	VPSTART	Speed-position control reverse rotation restart
Position tracking control		PFSTART	Position follow-up control start
Constant-speed control		CPSTART1	1-axis constant-speed control start
		CPSTART2	2-axes constant-speed control start
		CPSTART3	3-axes constant-speed control start
		CPSTART4	4-axes constant-speed control start
		CPEND	Constant-speed control end
Repetition of same control (Used in speed switching control and constant-speed control)		FOR-TIMES	Repeat range start setting
		FOR-ON	
		FOR-OFF	
		NEXT	Repeat range end setting
Simultaneous start		START	Simultaneous start
Zeroing		ZERO	Zeroing start
High-speed oscillation		OSC	High-speed oscillation start

Teaching functions

Portable teaching units, perfect on-site environments. In addition, they also have servo programming functions, data setting, servo monitor and servo testing functions.
Also, because the A31TU-E is fitted with a dead-man switch, error safety is assured.

Teaching unit

A30TU-E

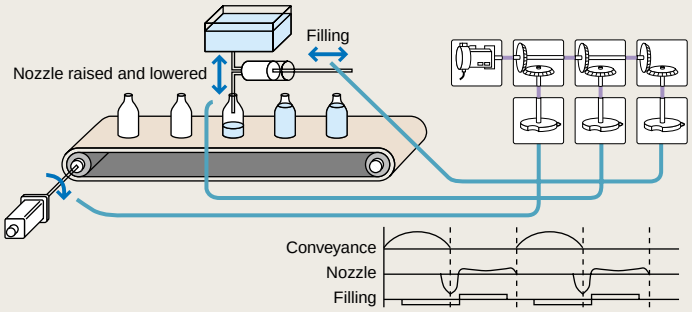
A31TU-E
(Front panel) (Rear panel)

Easy on screen programming using the mechanical support language.

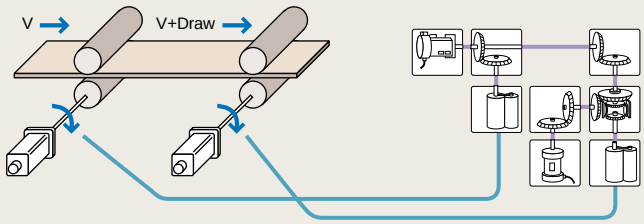
Loaded with a mechanical support language that allows easy programming of the machine mechanism. Ideal for controlling automated machines such as food machines and wrappers.
By freely combining a variety of software mechanism modules and cam patterns, complex synchronization control and coordinated control can be achieved easily and low cost.

Example applications

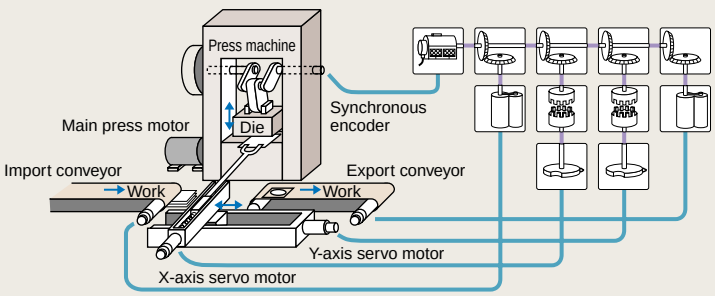
Filling machine



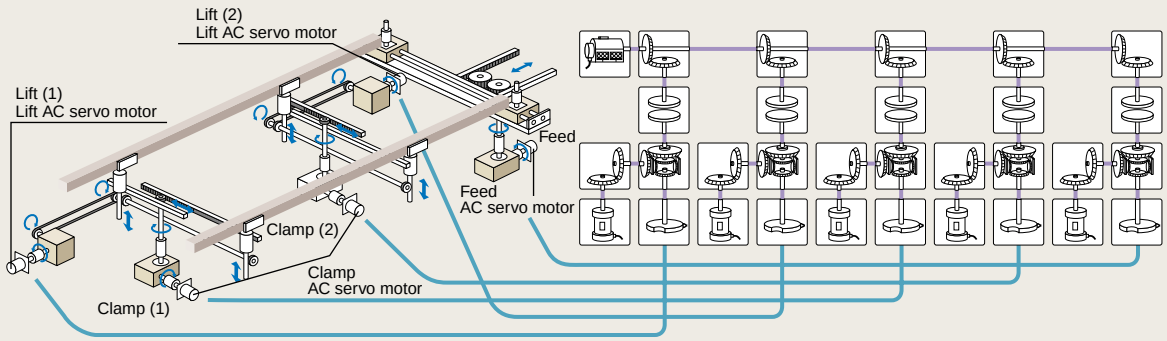
Draw control



Press conveyance

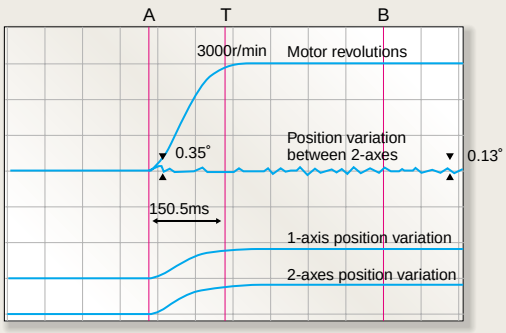


Three dimensional transfer

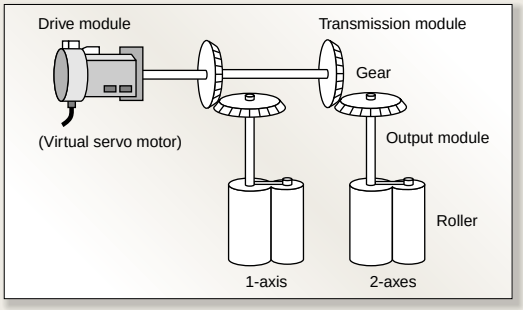


Synchronous control

The servo motor can be operated simultaneously with other motor control conditions. Using the mechanical support language, synchronous control settings can be made simply, and synchronous operation is carried out with little tracking delay.



Position variation between 2-axes during synchronous control



Synchronous control mechanical system program

Mechanical support language

Software is used for mechanism operation

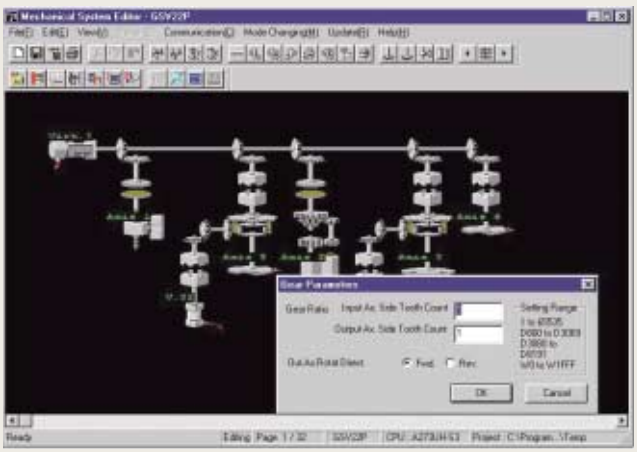
Control of hardware such as main shafts, gears, clutches and cams is handled by the software mechanical modules, conventional problems are solved.

- The machine is more compact and costs are lower.
- There no worries over friction and service life of main shafts, gear and clutches.
- Changing initial setup is simple.
- Eliminating mechanical precision errors and boosting system performance.

Control through advanced software cam

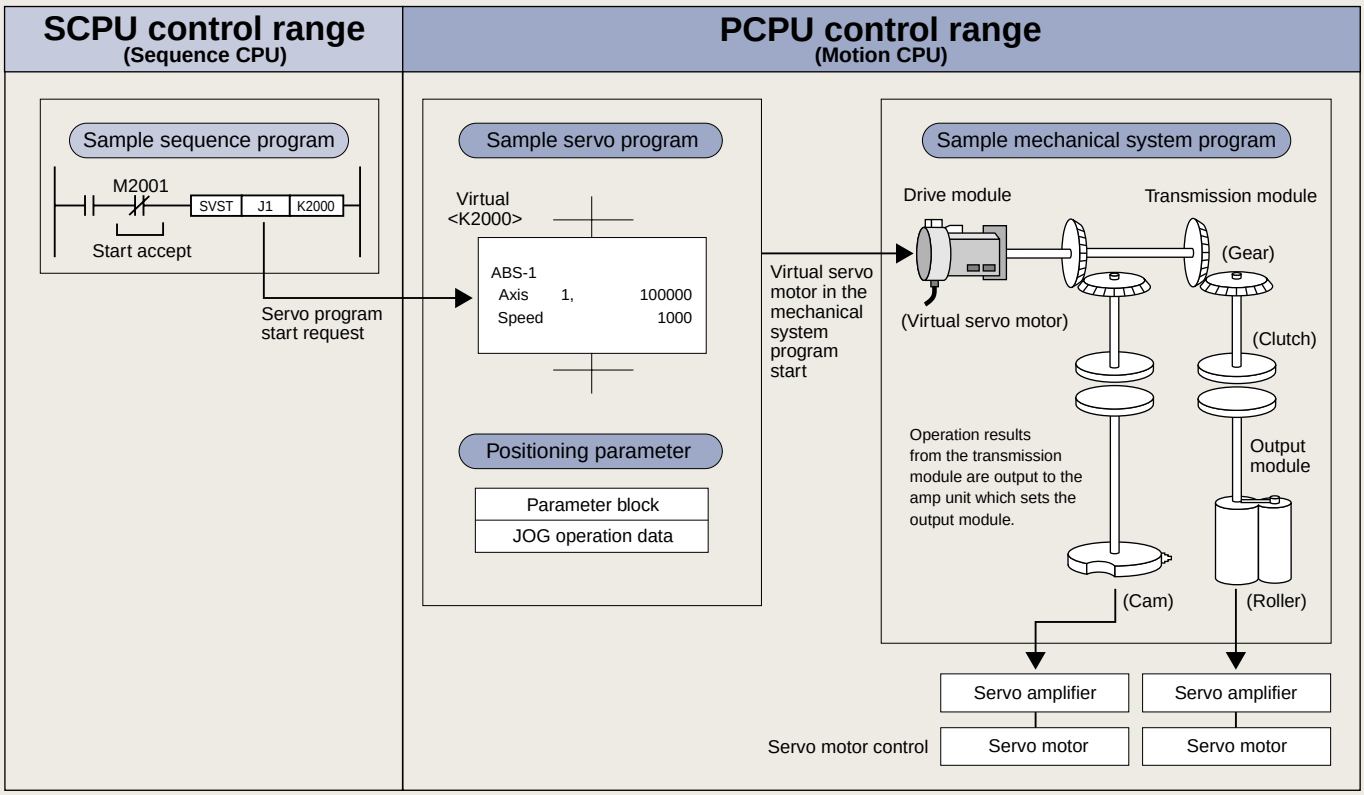
Since cam control is handled by software, there are no problems with error caused by conventional cam control. The ideal cam pattern control can be achieved. Ideal in applications such as raising or lowering control of nozzles in contact with liquid surfaces, control of amount of filler or smooth conveyance control. Changing of cams when product types alter is also easy to handle by simply adjusting the cam pattern.

Easy programming on screen using a mouse



Monitor screen with mechanical support language

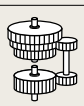
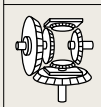
Control flow (SV22)



Please refer to P11 regarding control flow of "Motion SFC SV22"

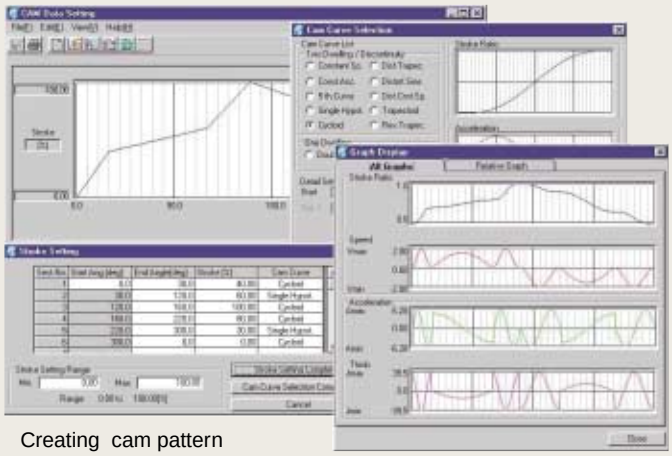
Mechanical module list

Mechanism section	Mechanical module		Function
	Name	Appearance	
Drive module	Virtual servo motor		• Used to drive the virtual axis in the mechanical system program by the servo program or JOG start.
	Synchronous encoder		• Used to drive the virtual axis by input pulse from an external synchronous encoder.
Virtual axis	Virtual main shaft	—	• This is a virtual "link shaft" . • The rotation of the drive module is transferred to the transmission module.
	Virtual auxiliary input axis	—	• This is the auxiliary input axis for input to the transmission module "differential gear". • It is automatically displayed when the differential gear and the gear are connected.
Output module	Roller		• Used when the speed control occurs at the final output.
	Ball screw		• Used when the liner positioning occurs at the final output.
	Rotary table		• Used when the angle control occurs at the final output.
	Cam		• Used when control other than those shown above occurs at the final output. Position control occurs based on the cam pattern setting data. • There are two cam control modes: the two-way cam mode and the feed cam mode.

Mechanism section	Mechanical module		Function
	Name	Appearance	
Transmission module	Gear		• Transfers the drive module rotation to the output axis. • The travel valve input from the drive module multiplied by the set gear ratio, and transferred to the output axis so that it moves in the set direction.
	Direct clutch		• Engages/disengages the output module with the drive module rotation. • When switching the clutch ON/OFF, there is a direct clutch for direct transfer and a smoothing clutch for acceleration/deceleration processing which occurs in accordance with the smoothing time constant setting.
	Smoothing clutch		• Depending on the application, ON/OFF mode, address mode or external input mode can be selected. • As the smoothing method, the time constant setting method or degree of slippage setting method can be selected.
	Speed change gear		• Used to change the speed of the output module. • The speed from the input axis side multiplied by the set speed change ratio and transferred to the output axis.
	Differential gear		• The rotation of the auxiliary input axis subtracted from the rotation of the virtual main shaft and transferred to the output axis.
			• The rotation of the auxiliary input axis subtracted from the rotation of the virtual main shaft and transferred to the output axis. (for connection to the virtual main shaft)

Software package for creating cam curves SW3RN-CAMP

This package sets the cam pattern when using software cam control through the mechanical support language. It makes it easy to freely create highly precise cam patterns to match the required control. Complex cam patterns are simple to create.



Creating cam pattern

Ten types of cam patterns provided

Select from among the ten cam patterns provided to find the one suited to your application. Combine them to create whatever cam curve you need.

<Cam patterns>

- Constant velocity
- Constant acceleration
- 5-dimensional
- Simple harmonic
- Cycloid
- Deformed trapezoid
- Deformed sine wave
- Deformed constant velocity
- Trapeculoid
- Inverse trapeculoid

Can be set with free-form curves

Cam curves can be set with free curves using spline interpolation.

Select cam precision to match application

The resolution per cycle of the cam can be set in the following four stages.

- 256
- 512
- 1024
- 2048

Graphic display of control status

Control status information such as stroke ratio, speed and bounding can be displayed in easy to understand graphics.

Overview of CPU Performance

Motion control specifications

<table>
<tr><th colspan="2"></th><th>SV13</th><th>SV22</th></tr>
<tr><td colspan="2">Number of control axes</td><td colspan="2">A173UHCPU (-S1) : Max. 32-axes
A172SHCPUN : Max. 8-axes
A171SHCPUN : Max. 4-axes</td></tr>
<tr><td colspan="2">Interpolation function</td><td colspan="2">Linear interpolation (Max. 4-axes)
Circular interpolation (2-axes)</td></tr>
<tr><td colspan="2">Control method</td><td>PTP(Point to Point), speed control, fixed-pitch feed, speed-position control, constant-speed control, speed-switching control, position follow-up control, high speed oscillation</td><td>PTP(Point to Point), speed control, synchronous control, fixed-pitch feed, speed-position control, constant-speed, speed-switching control, position follow-up control</td></tr>
<tr><td colspan="2">Control unit</td><td colspan="2">mm, inch, degree, PULSE</td></tr>
<tr><td rowspan="4">Positioning</td><td>Method</td><td colspan="2">PTP : Absolute method/select of absolute or incremental method
Constant-speed, speed-position-switching control : Absolute method/both absolute and incremental method can be used together
Fixed-pitch feed, speed-position control : Incremental method
Position follow-up control : Absolute method</td></tr>
<tr><td>Position command</td><td colspan="2"><table><tr><th>Control unit</th><th>Command unit</th><th>Address setting range</th></tr><tr><td>mm</td><td>× 10^{-1} μm</td><td>-2147483648 to 2147483647</td></tr><tr><td>inch</td><td>× 10^{-5} inch</td><td>-2147483648 to 2147483647</td></tr><tr><td>degree</td><td>× 10^{-5} degree</td><td>0 to 35999999</td></tr><tr><td>PLS</td><td>PLS</td><td>-2147483648 to 2147483647</td></tr></table></td></tr>
<tr><td>Speed command</td><td colspan="2"><table><tr><th>Control unit</th><th colspan="2">Speed Setting Rane</th></tr><tr><td>mm</td><td>0.01 to 6000000.00</td><td>(mm/min)</td></tr><tr><td>inch</td><td>0.001 to 600000.000</td><td>(inch/min)</td></tr><tr><td>degree</td><td>0.001 to 2147483.647</td><td>(degree/min)</td></tr><tr><td>PULSE</td><td>1 to 10000000</td><td>(PLS/s)</td></tr></table></td></tr>
<tr><td>Acceleration/ deceleration control</td><td>Automatic trapezoidal acceleration/deceleration</td><td><table><tr><th>Acceleration fixed acceleration/deceleration</th><th>Time fixed acceleration/deceleration</th></tr><tr><td>Acceleration time : 1 to 65535ms
Deceleration time : 1 to 65535ms</td><td>Acceleration/deceleration time : 1 to 5000ms
(only constant-speed control)</td></tr></table></td></tr>
<tr><td></td><td>S-curve acceleration/deceleration</td><td colspan="2">S-curve ratio : 0 to 100%</td></tr>
<tr><td rowspan="2">Compensation</td><td>Backlash compensation</td><td colspan="2">(0 to 65535) × Position command unit (0 to 65535PLS with unit converted into PULSE)</td></tr>
<tr><td>Electronic gear</td><td colspan="2">Function to compensate for real travel error against command value</td></tr>
<tr><td rowspan="4">Program</td><td>Language</td><td>Dedicated instructions
(Motion SFC, servo program)</td><td>Dedicated instructions
(Motion SFC, servo program, mechanical support language)</td></tr>
<tr><td>Capacity</td><td colspan="2">A173UHCPU (-S1) : 14k step (14336 steps)
A172SHCPUN : 13k step (13312 steps)
A171SHCPUN : 13k step (13312 steps)</td></tr>
<tr><td>Number of positioning point</td><td colspan="2">A173UHCPU (-S1) : 100 points/axis
A172SHCPUN : 400 points/axis
A171SHCPUN : 800 points/axis
} Positioning data can be designated indirectly</td></tr>
<tr><td>Tool</td><td colspan="2">PC/AT compatible, A30TU-E/A31TU-E (for SV13 only)</td></tr>
<tr><td colspan="2">Zeroing function</td><td colspan="2">Not absolute position system is recommended : Proximity dog type or count type can be selected.
Absolute position system is recommended : Data setting type, proximity dog type or count type can be selected.</td></tr>
<tr><td colspan="2">JOG operation function</td><td colspan="2">Available</td></tr>
<tr><td colspan="2">Manual pulse generator operation function</td><td colspan="2">A173UHCPU (-S1) : 3 units
A172SHCPUN : 1 unit
A171SHCPUN : 1 unit
} can be connected</td></tr>
<tr><td colspan="2">M-function</td><td colspan="2">M-code output function</td></tr>
<tr><td colspan="2">Limit switch output function</td><td colspan="2">ON/OFF settings can be made for each axis up to 10 points
8 output points for each axis</td></tr>
<tr><td colspan="2">Absolute position system</td><td colspan="2">Made compatible by fitting battery to servo amplifier (Absolute or incremental system can be specified per axis)</td></tr>
</table>

Mechanical system program specifications (SV22)

Item	Mechanical module		A171SH	A172SH	A173UH	A173UH-S1
Control unit	Drive module	Virtual servo motor	PLS			
		Synchronous encoder				
	Output module	Roller	mm, inch			
		Ball screw				
		Rotary table	Fixed as "degree"			
		Cam	mm, inch, PLS			
Mechanical system program	Drive module	Virtual servo motor	4	8	32	
		Synchronous encoder	1	1	4	Total 36 (Total 5 / Total 9)
	Virtual axis	Virtual main shaft	4	8	32	
		Virtual auxiliary input shaft	4	8	32	Total 64 (Total 8 / Total 16)
	Transmission module	Gear (Note-1)	8	16	64	
		Clutch (Note-1)	8	16	64	
		Speed change gear (Note-1)	8	16	64	
		Differential gear (Note-1)	4	8	32	
		Differential gear (for the virtual main shaft) (Note-2)	4	8	32	
	Output module	Cam	4	8	32	
		Roller	4	8	32	
		Ball screw	4	8	32	Total 32 (Total 4 / Total 8)
		Rotary table	4	8	32	
Cam	Types		Max. 64		Max. 64	Max. 256
	Resolution per cycle		256, 512, 1024, 2048			
	Memory capacity		32k bytes		32k bytes (Note-3)	132k bytes (Note-3)
	Stroke resolution		32767			
	Control mode		Two-way cam, feed cam			

(Note-1) : The gears, clutch, speed change gears and differential gear modules can be used only one module per one output module.

(Note-2) : The differential gears connected to the virtual main shaft can be used only one module per one module of the virtual servo motor.

(Note-3) : Strocked in block from No.10 of the expansion file resister area.

PCPU Motion SFC specifications

Item			A172SHCPUN	A173UHCPU (-S1)
Program capacity	Code total (Motion SFC chart+Operation control+Transition)		287k bytes	
	Text total(Operation control+Transition)		224k bytes	
	Motion control program (Servo program)		52k bytes	Approx. 56k bytes
Program storage area	Code·Motion control program		PCPU SRAM	
	Text		PCPU SRAM	
Motion SFC program	Number of Motion SFC programs		256 (No.0 to 255)	
	Number of Motion SFC steps/all programs (1 step+1 transition)		Max. approx. 7.5k steps (varies with the number of operation control program and transition program steps.)	
	Motion SFC program name/program		16 bytes (program name is used as a file name)	
	Motion SFC chart size/program		Max. 64k bytes(included Motion SFC chart comments)	
	Motion SFC steps/program		Max. 4094 steps	
	Motion SFC chart comments		Max. 80 characters/symbol	
Operation control program(F/FS) · Transition program(G)	Number of operation control programs	Once execution type	4096 (F0 to F4095)	4096 with F and FS combined (F/FS0 to F/FS4095)
		Scan execution type	4096 (FS0 to FS4095)	
	Number of transition programs		4096 (G0 to G4095)	
	Code-size/program		Max. approx. 64k bytes (32766 steps)	
	Text-size/program		Max. approx. 64k bytes	
	Number of blocks(lines)/program		Max. 8192 blocks(in the case of 4 steps(min)/block)	
	Number of characters/block(line)		Max. 128 characters (comment included)	
	Number of operand/block(line)		Max. 64 (operand : constants, word devices, bit devices)	
Motion control program	Number of servo programs		4096 (K0 to K4095)	
	Program steps/all programs		13312	14334
	Program steps/program		Max.13312 steps (Speed control, speed change control)	
	Positioning points		Approx. 800 points/axis	Approx. 400 points/axis
Executed specification	Number of multi executed programs		Max. 256	
	Number of multi active steps		Max. 256 steps/all programs	
	Executed task	Normal task	Executed in motion main cycle	
		Event task	Fixed cycle (1.7ms, 3.5ms, 7.1ms, 14.2ms) 16 external interrupt points(Input from interrupt input module installed in motion slot.) Excute with interrupt from PLC 1 point (When PLC dedicated instruction ITP is excuted.)	
		NMI task	16 external interrupt points(Input from interrupt input module installed in motion slot.) Add event task and NMI task 16 points(set in SFC parameter)	
Device	Number of motion register (#0)		8192 points(#0 to #8191) (#8000 to #8191 is dedicated device)	
	Number of coasting timer(FT)		1 point (FT) (888μs timer(32bit))	
	Number of motion slot I/O(PX/PY)		Total 64 points	Total 256 points

Overview of CPU Performance

Sequence control specifications

<table>
<tr><th colspan="3"></th><th>A171SH</th><th>A172SH</th><th>A173UH</th><th>A173UH-S1</th></tr>
<tr><td colspan="3">Control method</td><td colspan="4">Repeated operation using stored program</td></tr>
<tr><td colspan="3">I/O control method</td><td colspan="2">Refresh mode/direct mode
(possible to select)</td><td colspan="2">Refresh mode
(direct mode can be used partially in accordance with the instruction)</td></tr>
<tr><td colspan="3">Programming language</td><td colspan="4">Sequence control dedicated language
(relay symbol language, logic symbol language, MELSAP Ⅱ (SFC))</td></tr>
<tr><td colspan="3" rowspan="4">Number of instructions</td><td colspan="2">Sequence instructions : 26</td><td colspan="2">Sequence instructions : 22</td></tr>
<tr><td colspan="2">Basic instructions : 131</td><td colspan="2">Basic/applied instructions : 252</td></tr>
<tr><td colspan="2">Applied instructions : 106</td><td colspan="2">Instructions : 204</td></tr>
<tr><td colspan="2">Motion instructions : 4</td><td colspan="2">Motion instructions : 4</td></tr>
<tr><td rowspan="2">Processing speed
(Sequence instruction)</td><td>Direct mode</td><td colspan="2">0.25 to 1.9 μs/step</td><td colspan="2">—</td></tr>
<tr><td>Refresh mode</td><td colspan="2">0.25 μs/step</td><td colspan="2">0.15 μs/step</td></tr>
<tr><td colspan="3">I/O points (Note-1)</td><td colspan="2">2048 (X/Y0 to 7FF)</td><td colspan="2">8192 (X/Y0 to 1FFF)</td></tr>
<tr><td colspan="3">Real I/O points</td><td>512 (X/Y0 to 1FF)</td><td>1024 (X/Y0 to 3FF)</td><td colspan="2">2048 points (X/Y0 to 7FF) (within the range of one extension base.)</td></tr>
<tr><td colspan="3">Watchdog timer (WDT)</td><td colspan="2">10 to 2000ms</td><td colspan="2">200ms</td></tr>
<tr><td colspan="3">Memory capacity (built-in RAM)</td><td>64k bytes</td><td>192k bytes</td><td>192k bytes</td><td>768k bytes</td></tr>
<tr><td rowspan="3">Program capacity</td><td>Main sequence</td><td>Max. 14k steps</td><td>Max. 30k steps</td><td colspan="2">Max. 30k steps</td></tr>
<tr><td>Sub sequence</td><td>—</td><td>—</td><td colspan="2">Max. 30k steps</td></tr>
<tr><td>Microcomputer program</td><td>Max. 26k bytes</td><td>Max. 58k bytes</td><td colspan="2">—</td></tr>
<tr><td rowspan="19">Device</td><td colspan="2">Internal relay (M) (Note-1)</td><td>1000 points (M0 to M999)</td><td rowspan="3">Total 2048 points
(set in parameters)</td><td colspan="2" rowspan="3">Total 8191 points
(set in parameters)</td></tr>
<tr><td colspan="2">Latch relay (L)</td><td>1048 points (L1000 to L2047)</td></tr>
<tr><td colspan="2">Step relay (S)</td><td>0 point (none at initial)</td></tr>
<tr><td colspan="2">Link relay (B)</td><td colspan="2">1024 points (B0 to B3FF)</td><td colspan="2">8192 points (B0 to B1FFF)</td></tr>
<tr><td rowspan="3">Timer (T)</td><td>Points</td><td colspan="2">256</td><td colspan="2">2048 (default 256)</td></tr>
<tr><td rowspan="2">Specifications</td><td colspan="2"><table><tr><th></th><th>Setting time</th><th>Device</th></tr><tr><td>100ms timer</td><td>0.1 to 3276.7s</td><td>T0 to T199</td></tr><tr><td>10ms timer</td><td>0.01 to 327.67s</td><td>T200 to T255</td></tr><tr><td>100ms
retentive timer</td><td>0.1 to 3276.7s</td><td>None at initial</td></tr></table></td><td colspan="2"><table><tr><th></th><th>Setting time</th><th>Device</th></tr><tr><td>100ms timer</td><td>0.1 to 3276.7s</td><td>T0 to T199</td></tr><tr><td>10ms timer</td><td>0.01 to 327.67s</td><td>T200 to T255</td></tr><tr><td>100ms retentive timer</td><td>0.1 to 3276.7s</td><td>None at initial</td></tr><tr><td>Extension timer</td><td>Time set by word device (D,W and R)</td><td>T256 to T2047</td></tr></table></td></tr>
<tr><td colspan="2">Set in parameter</td><td colspan="2">Set in parameter</td></tr>
<tr><td rowspan="3">Counter (C)</td><td>Points</td><td colspan="2">256 points</td><td colspan="2">1024 points (default 256 points)</td></tr>
<tr><td rowspan="2">Specifications</td><td colspan="2"><table><tr><th></th><th>Setting range</th><th>Device</th></tr><tr><td>Normal counter</td><td rowspan="2">1 to 32767</td><td>C0 to C255</td></tr><tr><td>Interrupt program counter</td><td>None at initial</td></tr></table></td><td colspan="2"><table><tr><th></th><th>Setting range</th><th>Device</th></tr><tr><td>Normal counter</td><td>1 to 32767</td><td>C0 to C255</td></tr><tr><td>Interrupt counter</td><td>C224 to C225</td><td>None at initial</td></tr><tr><td>Extension counter</td><td>Count value set by word device (D,W and R)</td><td>C256 to C1023</td></tr></table></td></tr>
<tr><td colspan="2">Set in parameter</td><td colspan="2">Set in parameter</td></tr>
<tr><td colspan="2">Data register (D) (Note-1)</td><td colspan="2">1024 points (D0 to D1023)</td><td colspan="2">8192 points (D0 to D8191)</td></tr>
<tr><td colspan="2">Link register (W)</td><td colspan="2">1024 points (W0 to W3FF)</td><td colspan="2">8192 points (W0 to W1FFF)</td></tr>
<tr><td colspan="2">Annunciator (F)</td><td colspan="2">256 points (F0 to F255)</td><td colspan="2">2048 points (F0 to F2047)</td></tr>
<tr><td colspan="2">File register (R)</td><td colspan="4">Max. 8192 points (R0 to R8191) (set in parameter)</td></tr>
<tr><td colspan="2">Accumulator (A)</td><td colspan="4">2 points (A0, A1)</td></tr>
<tr><td colspan="2">Index register (V･Z)</td><td colspan="2">2 points (V, Z)</td><td colspan="2">14 points (V, V1 to V6, Z, Z1 to Z6)</td></tr>
<tr><td colspan="2">Pointer (P)</td><td colspan="4">256 points (P0 to P255)</td></tr>
<tr><td colspan="2">Interrupt pointer (I)</td><td colspan="4">32 points (I0 to I31)</td></tr>
<tr><td colspan="2">Special relay (M)</td><td colspan="4">256 points (M9000 to M9255)</td></tr>
<tr><td colspan="2">Special register (D)</td><td colspan="4">256 points (D9000 to D9255)</td></tr>
<tr><td colspan="3" rowspan="2">Extension file register blocks (Note-2)</td><td rowspan="2">– (Note-3)</td><td rowspan="2">– (Note-3)</td><td>Max. 10 blocks</td><td>Max. 46 blocks</td></tr>
<tr><td colspan="2">Depends on memory size</td></tr>
<tr><td colspan="3">Comment points</td><td colspan="4">Max. 4032 points (64k bytes), 1 point=16k bytes
(set in 64 points unit)</td></tr>
<tr><td colspan="3">Extension comment points (Note-2)</td><td colspan="4">Max. 3968 points (63k bytes), 1 point=16k bytes
(set in 64 points unit)</td></tr>
<tr><td colspan="3">Self-diagnostic function</td><td colspan="4">Operation error monitoring and detection of errors in CPU,I/O, battery etc</td></tr>
<tr><td colspan="3">Operation mode in error</td><td colspan="4">Select of stop or continue</td></tr>
<tr><td colspan="3">Output mode when switching from STOP to RUN</td><td colspan="4">Select of re-output operation status before STOP (default) or output after operation execution</td></tr>
<tr><td colspan="3">Clock function (Note-4)</td><td colspan="4">Year, month, day, hour, minute, weekday (automatic leap year adjustment)</td></tr>
<tr><td colspan="3">Program/parameter conversion to ROM</td><td colspan="4">Not available</td></tr>
</table>

(Note-1) : The positioning dedicated device range varies with the OS.
(Note-2) : This changes depending on the sequence parameter.
(Note-3) : By used to "SW0GHP-UTLP-FN1" on A6GPP or A6PHP, possible to use max.3 blocks on A171SH and max.10 blocks on A172SH.
(Note-4) : The year data by the clock element is only the lower two digits of the year. When used in sequence control,the data must be compensated for the sequence program in some applications of using the data.

Software Packages List

OS software package list

Application	Peripheral device	Model name		
		A171SHCPUN	A172HCPUN	A173UHCPU
For conveyor assembly **SV13** (Motion SFC)	PC/AT compatible	–	SW3RN-SV13D	SW3RN-SV13B
For automatic machinery **SV22** (Motion SFC)		–	SW3RN-SV22C	SW3RN-SV22A
For conveyor assembly **SV13** (without Motion SFC)		SW0SRX-SV13G	SW0SRX-SV13D	SW2SRX-SV13B
For automatic machinery **SV22** (without Motion SFC)		SW0SRX-SV22F	SW0SRX-SV22C	SW2SRX-SV22A

Programming software package list

Application	Peripheral device	Model name	Notes
For conveyor assembly **SV13** (Motion SFC / without Motion SFC)	PC/AT compatible	SW3RN-GSV13P	Included in the "Integrated start-up support software".
For automatic machinery **SV22** (Motion SFC / without Motion SFC)		SW3RN-GSV22P	

Integrated start-up support software list

Model name	Details
SW3RNC-GSVPROE	SW3RNC-GSVE (Integrated start-up support software) 1 CD-ROM •Conveyor assembly software : SW3RN-GSV13P •Automatic machinery software : SW3RN-GSV22P •Cam data creation software : SW3RN-CAMP •Digital oscilloscope software : SW3RN-DOSCP •Communication system software : SW3RN-SNETP •Document print software : SW3RN-DOCPRNP •Ladder editing software : SW3RN-LADDERP
	SW3RNC-GSVHELPE (operation manual) 1 CD-ROM
	Instllation manual
SW3RNC-GSVSETE	SW3RNC-GSVPROE
	A30CD-PCF (SSC I/F card (PCMCIA TYPEⅡ 1CH/card))
	A270CDCBL03M (cable for A30CD-PCF) 3m

System Component

Item	Model name	Description	Standard
CPU module	A171SHCPUN	Sequence program capacity : Max.14k steps Servo program capacity : Max.13k steps PLC control real I/O point : Max. 512 Internal power supply : Input : 100 to 240 VAC, output : 5 VDC 3A, 24 VDC 0.6A 5VDC internal consumption current : 1.63A	UL/cUL CE marks
	A172SHCPUN	Sequence program capacity : Max. 30k steps Servo program capacity : Max.13k steps PLC control real I/O point : Max. 1024 Internal power supply : Input : 100 to 240 VAC, output : 5 VDC 5A 5VDC internal consumption current : 1.63A	
	A173UHCPU	Sequence program capacity : Max. 60k steps Servo program capacity : Max.14k steps PLC control real I/O point : Max. 2048 Internal power supply : Input : 100 to 240 VAC, output : 5 VDC 5A 5VDC internal consumption current : 1.90A	
	A173UHCPU-S1		
CPU base unit	A172B	1 motion module slot and 1 PLC module slot can be fitted.	UL/cUL
	A175B	1 motion module slot and 4 PLC module slots can be fitted.	
	A178B	1 motion module slot and 7 PLC module slots can be fitted.	
	A178B-S1	2 motion module slots and 6 PLC module slots can be fitted.	
	A178B-S2 (Note)	4 motion module slots and 4 PLC module slots can be fitted.	
	A178B-S3 (Note)	8 motion module slots can be fitted.	
Power supply module	A1S61PN	Input : 100 to 240 VAC, output : 5 VDC 5A	UL/cUL CE marks
	A1S62PN	Input : 100 to 240 VAC, output : 3 VDC 5A, 24 VDC 0.6A	
PLC extension base uint	A1S65B	For extension power supply and 5 slots, compatible with system up to one extension stage.	
	A1S68B	For extension power supply and 8 slots, compatible with system up to one extension stage.	
	A168B	For extension power supply and 8 slots, compatible with system to bus-connected one extension stage and GOT.	
Extension cable	A1SC01B	55mm (2.17 inch)	UL/cUL
	A1SC03B	300mm (11.81 inch)	
	A1SC07B	700mm (27.56 inch)	
	A1SC12B	1200mm (47.24 inch)	
	A1SC30B	3000mm (118.11 inch)	
	A1SC60B	6000mm (236.22 inch)	
	A1S05NB	450mm (17.72 inch)	UL/cUL
	A1S07NB	700mm (27.56 inch)	
	A1SC30NB	3000mm (118.11 inch) (For A6□B)	
	A1SC50NB	5000mm (196.85 inch) (For A6□B)	
Pulse generator/ synchronous encoder interface unit	A172SENC	I/O signal 33 points (FLS, RLS, STOP, DOG/CHANGE : 8 points each tracking input : 1 point) Dynamic brake command output : 1 point Manual pulse generator/synchronous encoder interface : 1 Serial absolute synchronous encoder interface : 1	UL/cUL
Transistor output module	A1SY42	Transistor output 64 points, 12/24 VDC 0.1A	
Battery	A6BAT	Replacement battery for CPU	
Teaching unit	A30TU-E	For SV13, 5m cable, 5 VDC internal current consumption	
	A31TU-E	For SV13, with dead-man switch, 5m cable(It is necessary to both A31TUCBL03M and A31SHORTCON), 5 VDC internal current consumption 0.22A	
	A31TUCBL03M	Cable to connect CPU module to A31TU-E (for inside the control panel)	
	A31SHORTCON	Short-circuit connector for A31TUCBL (when A31TU-E is not connected)	
Manual pulse generator	MR-HDP01	5VDC 25PLS/rev, 100PLS/rev at magnification of 4	
Serial absolute synchronous encoder cable	MR-HENC	Resolution :16384PLS/rev, Permissible rotation speed : 4300r/min, absolute type	UL/cUL
Serial absolute synchronous encoder cable	MR-HSCBL□M	For connection of MR-HENC and A172SENC 2m, 5m, 10m, 20m, 30m (Same as encoder cables for HC-SF/RF/UF (2000r/min)/HA-LH series motors.)	
SSC I/F board	A30BD-PCF	ISA bus loaded type 2CH/board	
SSC I/F card	A30CD-PCF	PCMCIAI TYPEⅡ 1CH/card	
Cable for SSC I/F board	A270BDCBL03M	For A30BD-PCF 3m	
	A270BDCBL05M	For A30BD-PCF 5m	
	A270BDCBL10M	For A30BD-PCF 10m	
Cable for SSC I/F card	A270CDCBL03M	For A30CD-PCF 3m	
	A270CDCBL05M	For A30CD-PCF 5m	
	A270CDCBL10M	For A30CD-PCF 10m	

(Note) : For A173UHCPU only

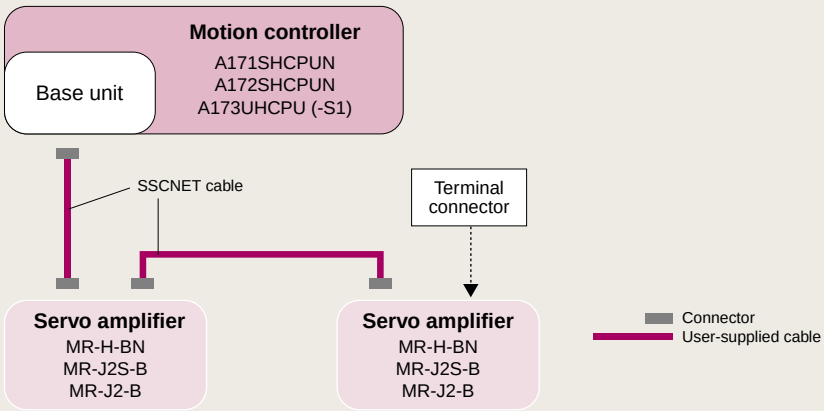
Pulse generator/synchronous encoder interface unit

A172SENC

Loaded in motion slot. One point each is built in for the various inputs on the 8 axes, and for the tracking input, manual pulse generator and synchronous encoder.

Item		Specification
Motion control signal input, tracking input	Input point	Motion signal point : 32 points (8 points each for upper limit switch, lower limit switch, STOP signal, proximity dog) Tracking input : 1 point
	Range of voltage used	10.2 to 26.4 VDC
	ON voltage/current	Min. 7V/Min. 1.0mA
	OFF voltage/current	Max. 1.8V/Max. 0.18mA
	Response time	Motion control signal input OFF → ON Max. 2ms, ON → OFF Max. 3ms Tracking input OFF → ON Max. 0.5ms, ON → OFF Max. 0.5ms
Dynamic brake command output	Output point	1 point
	Range of load voltage used	21.6 to 30 VDC
	Max. load current	0.1A
	Response time	OFF → ON max. 2ms, ON → OFF max. 2ms
Manual pulse generator/ synchronous encoder input	Usable unit	1
	Adaptive type	Voltage output type (5 VDC) / differential output type (26LS31 or equivalent) Possible to select by connector wiring
	High level voltage	3.0 to 5.25 VDC
	Low level voltage	0 to 1 VDC
	Input frequency	Max. 100k PLS/s (magnification of 4)
Synchronous encoder input	Usable unit	1
	Adaptive type	Serial absolute synchronous encoder input (MR-HENC)
5VDC internal consumption current		0.42A (Manual pulse generator/synchronous encode is contained)

Cables and connectors



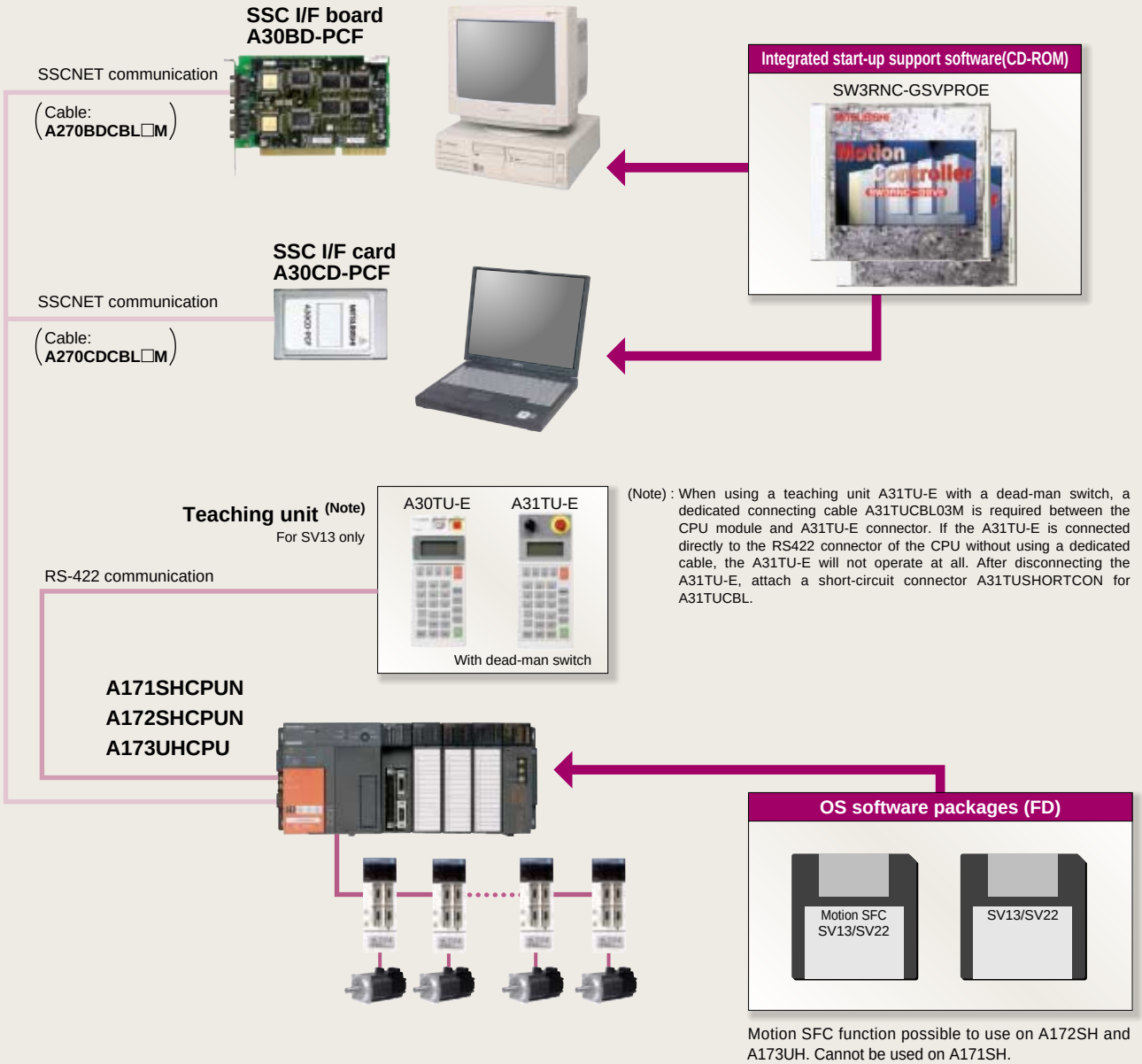
Item	Model name	Description
SSCNET cable	MR-HBUS☐M	For connection of CPU module and MR-H-BN, and for connection MR-H-BN and MR-H-BN 0.5m, 1m, 5m
	MR-J2HBUS☐M-A	For connection of CPU module and MR-J2S-B/MR-J2-B, and for connection MR-H-BN and MR-J2S-B/MR-J2-B 0.5m, 1m, 5m
	MR-J2HBUS☐M	For connection of MR-J2S-B/MR-J2-B and MR-J2S-B/MR-J2-B 0.5m. 1m, 5m
Terminal connector	MR-TM	Fitted to the last servo amplifier (MR-H-BN) by SSCNET.
	MR-A-TM	Fitted to the last servo amplifier (MR-J2S-B/MR-J2-B) by SSCNET.

- Please refer to the servo amplifier "MR-H series" catalogue for the power supply connectors of servo motor.
- Please refer to the servo amplifier "MR-H series", "MR-J2-Super series" and "MR-J2 series" catalogues for the encoder cables and the encoder connector set.

Peripheral Equipment

Full support from a wide-ranging lineup

The motion controller supports any of the personal computers on the market and an general use, so it can be used with familiar environment. The most appropriate programming environment for users is provided.



(Note) : When using a teaching unit A31TU-E with a dead-man switch, a dedicated connecting cable A31TUCBL03M is required between the CPU module and A31TU-E connector. If the A31TU-E is connected directly to the RS422 connector of the CPU without using a dedicated cable, the A31TU-E will not operate at all. After disconnecting the A31TU-E, attach a short-circuit connector A31TUSHORTCON for A31TUCBL.

Motion SFC function possible to use on A172SH and A173UH. Cannot be used on A171SH.

Operating environment

PC/AT compatible with which WindowsNT 4.0 / Windows 98 operates normally and the following use is filled.

OS		WindowsNT 4.0 / Windows 98
CPU		More than pentium 133MHz
Memory capacity		More than 32M bytes
Hard disk capacity		SW3RNC-GSVE : more than 51MB + SW3RNC-GSVHELPE : more than 108MB (possible to select installation)
Display	Resolution	More than 800 × 600 pixels
	Colors	More than 256 colors
Application software		Word 97, Excel 97 (for document printing) More than Visual C++4.0, more than Visual Basic 4.03 (32 bit) (When communication API function use.)

(When using the A30CD-PCF, the PC card driver for Windows NT / Windows 98, provided by the personal computer manufacturer must be used.)

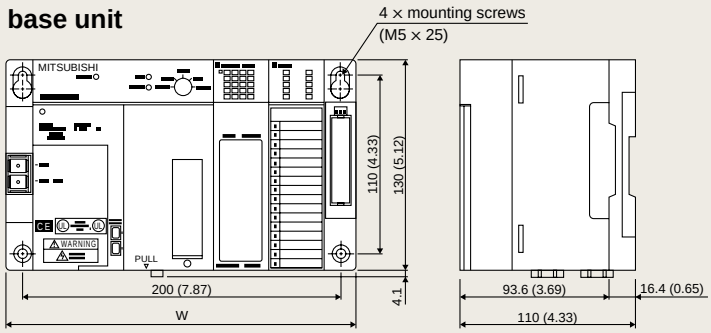
(Note) : Windows, Word, Excel, Visual C++ and Visual Basic is a trade-mark of the Microsoft Corporation.
: Before exporting the personal computer as a single unit or assembled into a device, consult with the manufacturer and check that the OS (Windows, etc.) and network browser incorporated in the personal computer comply with the foreign exchange control laws.

Exterior Dimensions

CPU module A171SH/A172SH/A173UH

unit : mm (inch)

CPU base unit

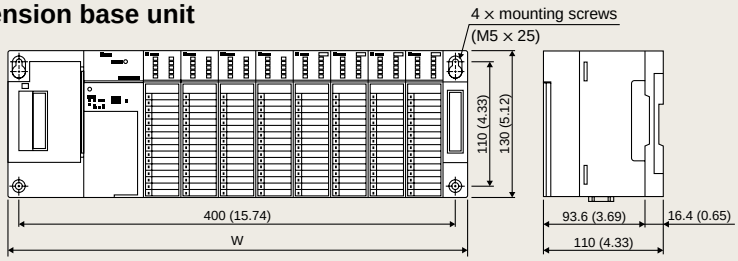


Width W

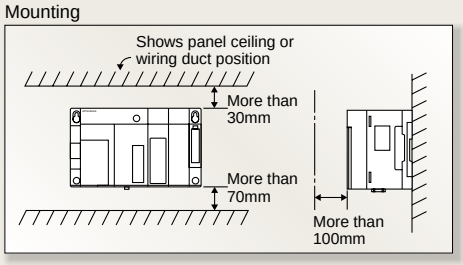
CPU base unit			Extension base unit	
A172B	A175B	A178B A178B-S1 A178B-S2* A178B-S3*	A175B	A1S68B A168B
220 (8.66)	325 (12.8)	430 (16.9)	315 (12.4)	420 (16.5)

* For A173UHCPU only

Extension base unit

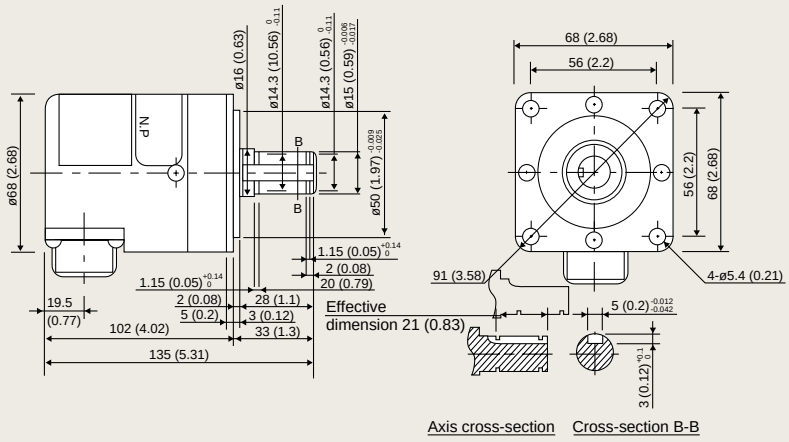


Mounting



Serial absolute synchronous encoder MR-HENC

unit : mm (inch)

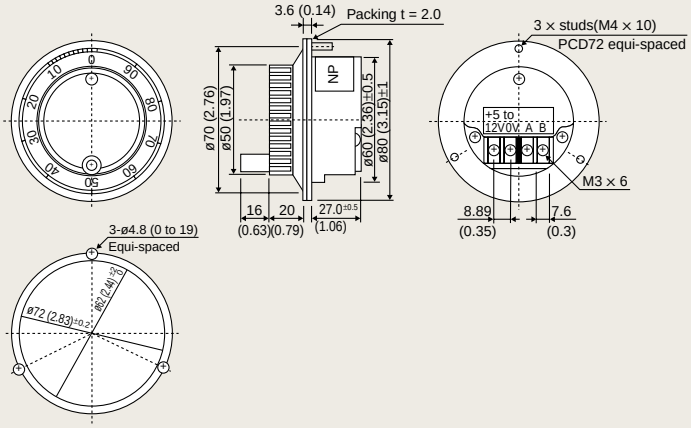


Keyway dimension diagram

Item	Specifications
Resolution	16384 PLS/rev
Direction on increase	Counter clockwise (viewed from end of axis)
Protective construction	IP52 (dust-proof, oil-proof)
Permitted axis load	Radial : Max. 98N
	Thrust : Max. 49N
Permissible rotation speed	4300 r/min
Permissible angular acceleration	4000 rad/s
Operating temperature	-5˚c to 55˚c
Weight kg (16)	1.5 (3.3)

Manual pulse generator MR-HDP01

unit : mm (inch)



Item	Specifications
Pulse resolution	25 PLS/rev (100PLS/rev at magnification of 4)
Output voltage	Input voltage > 1V (Note)
Consumption current	Max. 60mA
Life	More than 1,000,000 revolutions at 200 r/min
Permitted axis load	Radial : Max. 19.6N
	Thrust : Max. 9.8N
Operating temperature	-10˚c to -60˚c
Weight kg (16)	0.4 (0.88)

(Note) : When using an external power supply, necessary to 5V power supply.

Combinations of Servo Amplifiers and Servo Motors

		MR-J2-B servo amplifier								MR-H-BN servo amplifier									
		MR -J2 10B	MR -J2 20B	MR -J2 40B	MR -J2 60B	MR -J2 70B	MR -J2 100B	MR -J2 200B	MR -J2 350B	MR -H 10BN	MR -H 20BN	MR -H 40BN	MR -H 60BN	MR -H 100BN	MR -H 200BN	MR -H 350BN	MR -H 500BN	MR -H 700BN	MR -H 11KBN
 Small capacity HC-MF 3000r/min series	HC-MF053	●									●								
	HC-MF13	●									●								
	HC-MF23		●									●							
	HC-MF43			●									●						
	HC-MF73					●								●					
 Small capacity HC-KF 3000r/min series	HC-KF053	▲								▲									
	HC-KF13	▲								▲									
	HC-KF23		▲								▲								
	HC-KF43			▲								▲							
 Small capacity HA-FF 3000r/min series	HA-FF053	●								●									
	HA-FF13	●								●									
	HA-FF23		●								●								
	HA-FF33			●								●							
	HA-FF43			●								●							
	HA-FF63				●								●						
 Middle capacity HC-SF 1000r/min series	HC-SF81						●												
	HC-SF121							●							●				
	HC-SF201							●							●				
	HC-SF301								●							●			
Middle capacity HC-SF 2000r/min series	HC-SF52				●								●						
	HC-SF102						●							●					
	HC-SF152							●							●				
	HC-SF202							●							●				
	HC-SF352								●							●			
	HC-SF502																●		
	HC-SF702																	●	
Middle capacity HC-SF 3000r/min series	HC-SF53				●								●						
	HC-SF103						●							●					
	HC-SF153							●							●				
	HC-SF203							●							●				
	HC-SF353								●							●			
 Low inertia HC-RF 3000r/min series	HC-RF103							●							●				
	HC-RF153							●							●				
	HC-RF203								●							●			
	HC-RF353																●		
	HC-RF503																●		
 Flat HC-UF 3000r/min series	HC-UF13	●								●									
	HC-UF23		●									●							
	HC-UF43			●									●						
	HC-UF73					●								●					
Flat HC-UF 2000r/min series	HC-UF72					●								●					
	HC-UF152							●							●				
	HC-UF202								●							●			
	HC-UF352																●		
	HC-UF502																●		
 Low inertia HA-LH2000r/min series	HA-LH11K2																		●
	HA-LH15K2																		
	HA-LH22K2																		
 Large capacity HA-LF 2000r/min series	HA-LF30K24																		
	HA-LF37K24																		
	HA-LF45K24																		
	HA-LF55K24																		

		MR-J2S-B servo amplifier										Motor capacity (kW)
		MR -J2S 10B	MR -J2S 20B	MR -J2S 40B	MR -J2S 60B	MR -J2S 70B	MR -J2S 100B	MR -J2S 200B	MR -J2S 350B	MR -J2S 500B	MR -J2S 700B	
 Small capacity HC-MFS 3000r/min series	HC-MFS053	●										0.05
	HC-MFS13	●										0.1
	HC-MFS23		●									0.2
	HC-MFS43			●								0.4
	HC-MFS73					●						0.75
 Small capacity HC-KFS 3000r/min series	HC-KFS053	●										0.05
	HC-KFS13	●										0.1
	HC-KFS23		●									0.2
	HC-KFS43			●								0.4
	HC-KFS73					●						0.75
 Middle capacity HC-SFS 1000r/min series	HC-SFS81						●					0.85
	HC-SFS121							●				1.2
	HC-SFS201							●				2.0
	HC-SFS301								●			3.0
Middle capacity HC-SFS 2000r/min series	HC-SFS52				●							0.5
	HC-SFS102						●					1.0
	HC-SFS152							●				1.5
	HC-SFS202							●				2.0
	HC-SFS352								●			3.5
	HC-SFS502									●		5.0
	HC-SFS702										●	7.0
Middle capacity HC-SFS 3000r/min series	HC-SFS53				●							0.5
	HC-SFS103						●					1.0
	HC-SFS153							●				1.5
	HC-SFS203							●				2.0
	HC-SFS353								●			3.5
 Low inertia HC-RFS 3000r/min series	HC-RFS103							●				1.0
	HC-RFS153							●				1.5
	HC-RFS203								●			2.0
	HC-RFS353									●		3.5
	HC-RFS503									●		5.0
 Flat HC-UFS 3000r/min series	HC-UFS13	●										0.1
	HC-UFS23		●									0.2
	HC-UFS43			●								0.4
	HC-UFS73					●						0.75
Flat HC-UFS 2000r/min series	HC-UFS72					●						0.75
	HC-UFS152							●				1.5
	HC-UFS202								●			2.0
	HC-UFS352									●		3.5
	HC-UFS502									●		5.0

	MR -H 15KBN	MR -H 22KBN	MR -H 30KBN4	MR -H 37KBN4	MR -H 45KBN4	MR -H 55KBN4	Motor capacity (kW)
							0.05
							0.1
							0.2
							0.4
							0.75
							0.05
							0.1
							0.2
							0.4
							0.05
							0.1
							0.2
							0.3
							0.4
							0.6
							0.85
							1.2
							2.0
							3.0
							0.5
							1.0
							1.5
							2.0
							3.5
							5.0
							7.0
							0.5
							1.0
							1.5
							2.0
							3.5
							1.0
							1.5
							2.0
							3.5
							5.0
							0.1
							0.2
							0.4
							0.75
							0.75
							1.5
							2.0
							3.5
							5.0
							11.0
	●						15.0
		●					22.0
			●				30.0
				●			37.0
					●		45.0
						●	55.0

▲: Special amplifier required

⚠ 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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