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# Motion Controllers



#### 核心合作伙伴

MITSUBISHI ELECTRIC Chanaes for the Better

菱电机

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

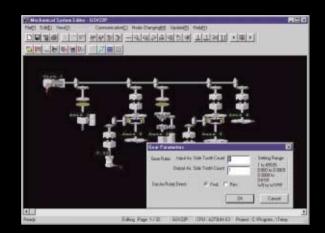
Various motion control models are available based on your specific application requirements. Models includes the A171SH(up to 4 control axes) for smaller scale applications up to the A173UH(up to 32 control axes) for larger scale applications. In addition, various motion controller operating system software 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 highspeed 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

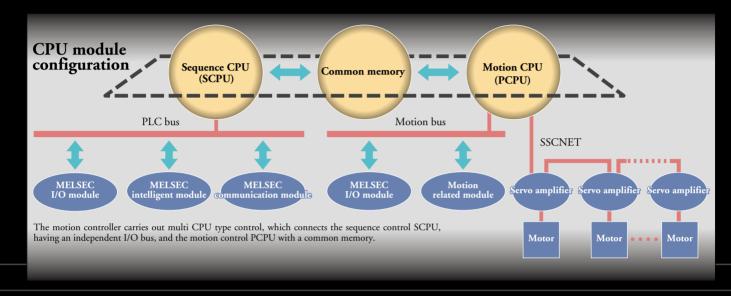
#### **Integrated Motion and Sequence Control**

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.

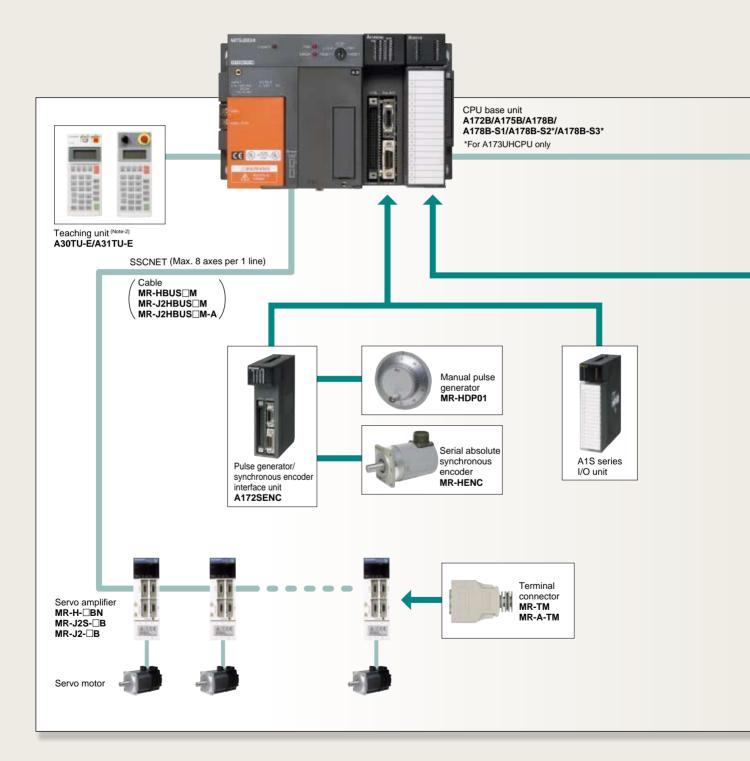
#### **Diverse Motion Control Functions**

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.



#### vation CONTENTS Main Features 3 System Configuration 5 Products Line-Up A172SENC TR AISX40 **OS Software Packages** 6 MITSUBISHI FUN O L.C.R. TOP POWER C ERROR 🔕 RESET - 🤔 - RESET Motion SFC A172SHCPUN SV13 (Conveyor Assenmbly use) 17 0 SV22 (Automatic Machinery use) 21 Overview of CPU Performance 25 Software Packages List 28 N INT N INT 29 System Components CE D address ( 31 Peripheral Equipment WARNING 32 Exterior Dimensions 0 Combinations of Servo Amplifiers and Servo Motors 33

# A171SH/A172SH/A173UH

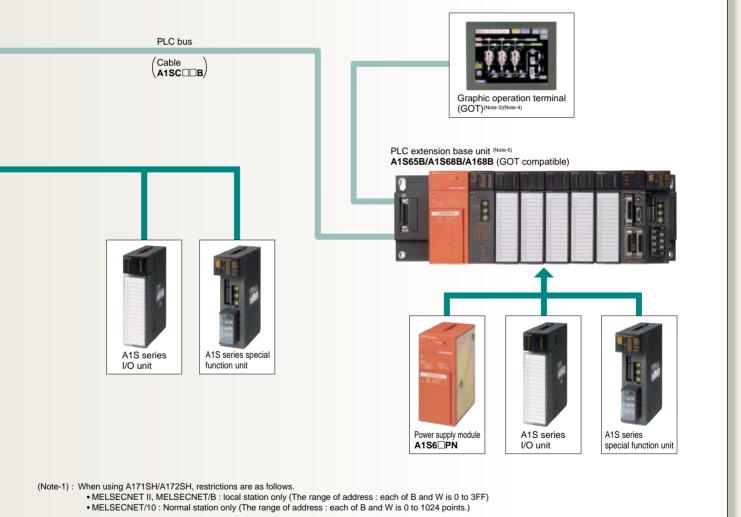


Motion controller integrates motion and sequence control into a single compact package. (220mm wide, 130mm high and 110mm deep) (A172B CPU base use).

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-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 GOT directly 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
	MELSECNET II/B(local station only)
Network	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
	MELSECNET II/B(local station only)
Network	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.



#### **Conveyor Assembly Use**



Offer constant-speed control, speed control, 1 to 4-axes linear

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

# **OS Software Line-up**



interpolation and 2-axes circular interpolation, etc. Ideal for use in conveyors and assembly machines.

#### **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

Press feeder

**Automatic Machinery Use** 

Motion SFC

cam control. Ideal for use in automatic machinery.

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

#### **Mechanical support** language

2131

- Synchronous control
- Electronic shaft

Provides simultaneous control multiple servo motors and offers software

- · 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.

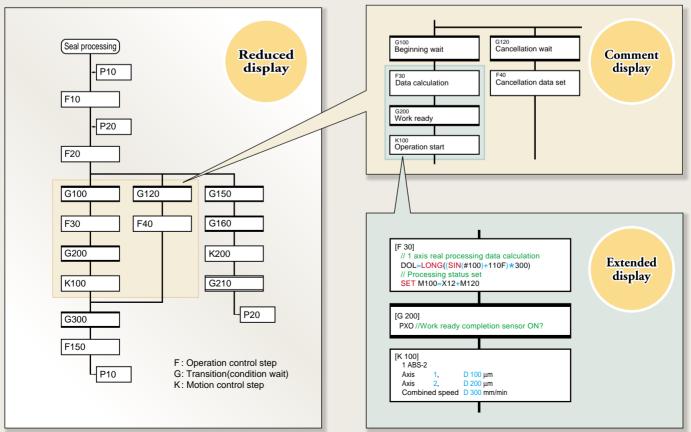
## Motion SFC description

# 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.



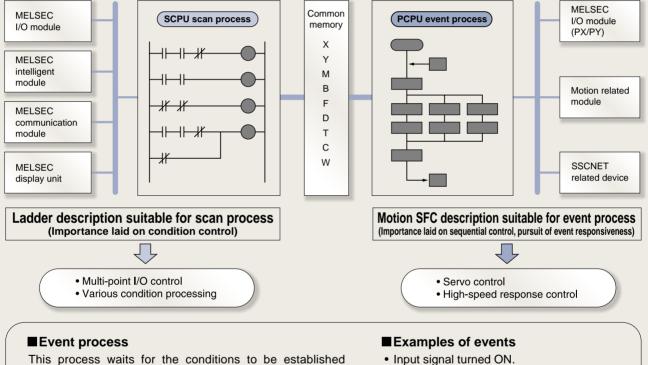
## Powerful event processing functions

#### 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.

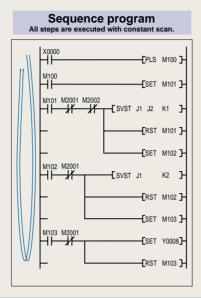


(event to occur) with the changes in the input signal state or device value, and carries out high-speed response control (signal output control, servo motor start and speed change, etc.) when the conditions are established.

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

#### 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.



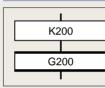
#### Motion SFC program Work movement contro [G 1] PX0 //Start (PX0=ON) wait (()[K 1] 1 ABS-2 D D D 200 µm axis 202 204 μm mm [G 2] PX1 //1st n moletion (PX1 · ON) [K 2] 1 ABS-1 D 300 μm 202 mm/mi axis spee [G 3] PX2 //2nd tion (PX2: ON) v

#### Exclusive description unique to motion control

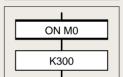
- If shift is applied immediately after the motion control step, the shift will be executed without waiting for the motion control operation to end.
- · If WAIT is executed immediately after the motion control step, WAIT will be executed after waiting for the motion control operation to end.
- · If WAIT 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.

#### 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.



WAIT



WAIT ON/OFF

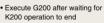
ion signal (PY8)ON

· Execute G100 without waiting for K100 operation to end

Shift

K100

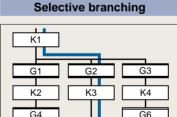
G100



[F 1] SET PY8 //C

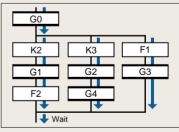
END

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



#### · Judge G1 to G3 conditions, and execute only established route

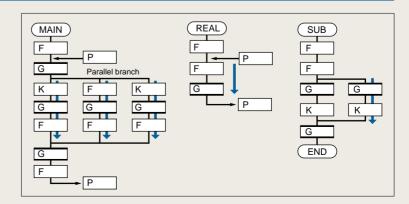
Parallel branching



 Simultaneously execute all routes for step K2 to F1 in parallel

#### Multi-task processing

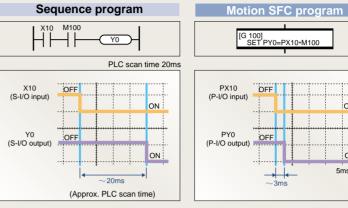
- With the Motion SFC, when several programs are started, the process is carried out with multi-task operation.
- Multiple steps can be simultaneously executed with parallel branching even within one program.
- A program that executes multiple processes simultaneously, or a program that groups the control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

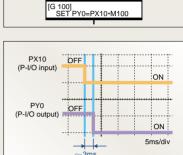


# High-response to external inputs

#### 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

Applicable CPU: A172SHCPUN

• Input module: A1SX40-S1 (OFF  $\rightarrow$  ON response: up to 0.1ms)

• Output module: A1SY40 (OFF  $\rightarrow$  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.

Sequence program Notion SFC program ON PX0010 -[SVST J1 K100]-K100 PLC scan time 20ms OFF PX10 (P-I/O input) OFF X10 (S-I/O input) ON ON Speed command Speed command (Amplifier monitor termina Amplifier monitor ter 10ms/div 10ms/div ~20ms ~ 9ms 6ms (Approx. PLC scan time)

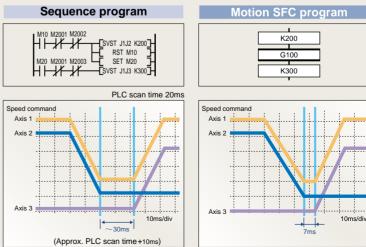
S-I/O: PLC slot I/O P-I/O: Motion slot I/O

#### 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.



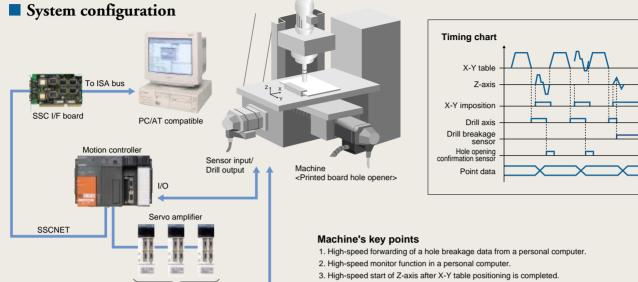
Applicable CPU: A172SHCPUN



Applicable CPU: A172SHCPUN

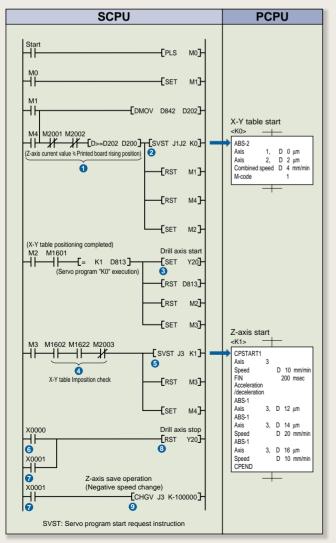
Input module: A1SX40-S1 (OFF → ON response: up to 0.1ms)

# Example applications

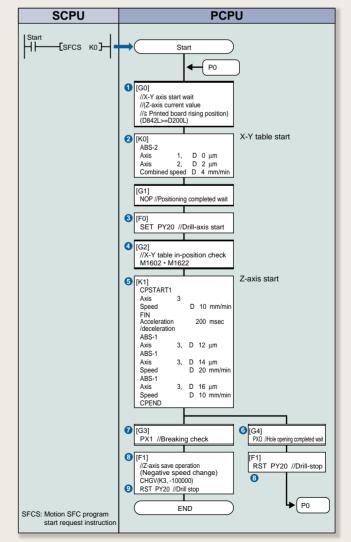


- High-speed start of Z-Y axis after printed a board hole opening(Z-axis rises from printed board position).
- 5. High-speed save operation when drill breakage.

#### Previous method (SV13)

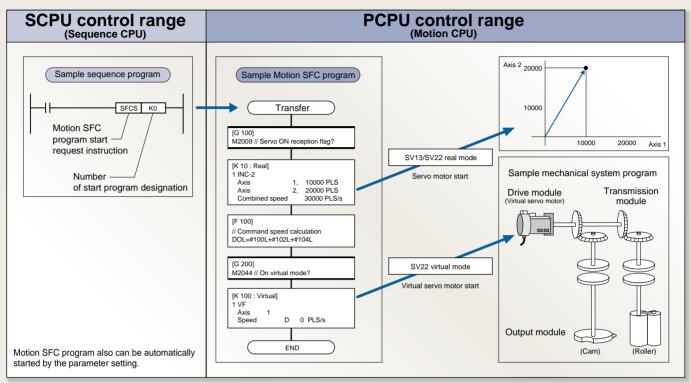


New method (Motion SFC SV13)



Processing action 1 to 9 of the previous method corresponds to the new method 1 to 9

# Control flow (Motion SFC SV13/SV22)

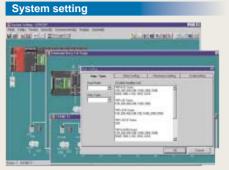


Please refer to P19 regarding control flow of "SV13(without Motion SFC)" and P23 regarding control flow of "SV22(without Motion SFC)".

# Motion SFC $\equiv$

# Various programming tools.

# System setting -



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

# Programming

# Motion SFC program editing

Describe machine operation procedures with flow chart format

Lay out graphic symbols by clicking mouse; connect by dragging



• Edit and monitor mechanics configuration program

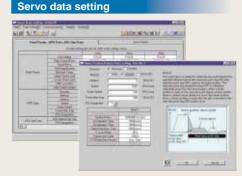
Lay out each module by clicking mouse to create

#### Ladder editing

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· Ladder editing software [LADDERP] is available to

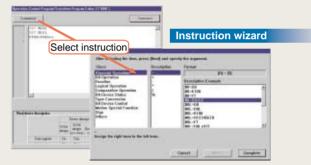
edit and monitor sequence program



Set the servo parameter and fixed parameters, etc.

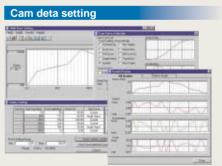
• Display explanations of parameters with one-point help

#### Program editing



Program for each step and transition

Selection from menu using command wizard is also possible



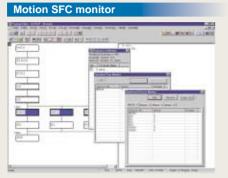
 Create cam data with cam pattern selection and free curve setting; display cam control status waveform

#### GX-Developer

1000	anin.	5	11	-12	1
15-	12				
	1.			 	4
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_	-			10.	

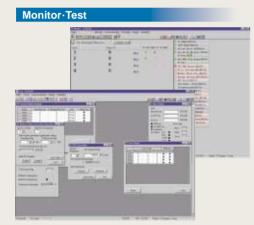
• Highly functional windows version GPP function software [GX-Developer] can be used (optional)

# Debugging



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

# Start-up adjustment



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

## **Operation and maintenance**



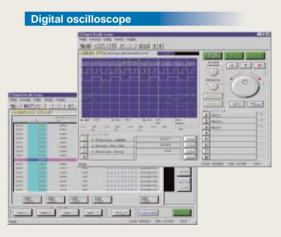
• Back-up of motion controller programs, parameters and internal information in a batch

as a file

#### Motion SFC debugging mode



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



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

#### **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	Program name	Indicates the start (entrance) of the program.
start/end	END	END	Indicates the end (exit) of the program.
	Motion control step	К	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.
Step	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.
	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.
Transition	WAIT	G	Shifts to the next step when the transition conditions enables after the previous motion control step or subroutine ends.
Transmon	WAIT ON	ON bit device	Prepares to start the next motion control step, and immediately outputs a command
	WAIT OFF	OFF bit device	when the conditions are established.
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	
	Automatically start		Start at rising edge of PLC READY (M2000)	
Start setting	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	
	Normal task		Execute in motion main cycle (free time)	
Executed	Executed Fixed cycle		Execute in fixed cycle (1.7ms, 3.5ms, 7.1ms, 14.2ms)	
task	Event task	External interrupt	Execute when set external interrupt unit (I0 to I15) input turns ON	
lask		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	Class	Symbol	Function	Class	Symbol	Function
	=	Substitution		SIN	Sine		(none)	Logical acknowledge
	+	Addition		COS	Cosine	Logical	!	Logical negation
Binary	-	Subtraction	Standard	TAN	Tangent	operation	*	Logical AND
operation	*	Multiplication		ASIN	Arcsine		+	Logical OR
	/	Division		ACOS	Arccosine		==	Equal to
	%	Remainder		ATAN	Arctangent		! =	Not equal to
	~	Bit inversion (complement)		SQRT	Square root	Comparison	<	Less than
	&	Bit logical AND	function	LN	Natural logarithm	operation	<=	Less than or equal to
Bit	I	Bit logical OR		EXP	Exponential operation		>	More than
operation	^	Bit exclusive OR		ABS	Absolute value		>=	More than or equal to
	≫	Bit right shift		RND	Round off	Motion dedicated	CHGV	Speed change request
	«	Bit left shift		FIX	Round down	function	CHGT	Torque limit value change request
Sign	-	Sign inversion (complement of 2)		FUP	Round up		EI	Event task enable
	SHORT	Convert to 16-bit integer type (signed)		BIN	$BCD \rightarrow BIN$ conversion		DI	Event task disable
	USHORT	Convert to 16-bit integer type (unsigned)		BCD	$BIN \rightarrow BCD$ conversion	Others	NOP	No operation
	LONG	Convert to 32-bit integer type (signed)	Bit device	(none)	ON (normally open contact)		BMOV	Block move
Туре	ULONG	Convert to 32-bit integer type (unsigned)	status	!	OFF (normally closed contact)		TIME	Time to wait
conversion	FLOAT	Regarded as signed data,		SET	Device set			
		and convert into 64-bit floating point type	Bit device	RST	Device reset			
	UFLOAT	Regarded as unsigned data,	control	DOUT	Device output			
		and convert into 64-bit floating point type		DIN	Device input			

#### Sequence dedicated commands

Sequence command	Control details
SFCS	At the rising edge (OFF $\rightarrow$ 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 $\rightarrow$ 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	
	Installation	Installation of the motion OS     Comparison of the motion OS	
	Project management	<ul> <li>New creation, setting and reading of projects</li> <li>Batch management of user files in project units</li> </ul>	
Conveyor assembly software SW3RN-GSV13P	System setting	<ul> <li>Setting of system configuration (motion module/servo amplifier/servo motor, etc.)</li> <li>Setting of high-speed read data</li> </ul>	
	Servo data setting	<ul> <li>Setting of servo parameters and fixed parameters, etc. (Explanatory diagrams displayed with one-touch help)</li> <li>Setting of limit switch output data (Output pattern displayed with waveform display function)</li> </ul>	
	Program editing	<ul> <li>Editing of the Motion SFC program, setting of the Motion SFC parameters</li> <li>Reduced display of the Motion SFC diagram, display of comments, enlarged display</li> <li>Monitor of the Motion SFC, debugging of the Motion SFC</li> </ul>	
	Mechanical system editing (GSV22P only)	<ul> <li>Editing of mechanical system program</li> <li>Monitoring of mechanical system program execution state</li> </ul>	
	Communication	<ul> <li>Setting of SSCNET communication CH.</li> <li>Writing, reading and comparison of programs and parameters in respect to the motion controller.</li> </ul>	
Automatic machinery software	Monitoring	Current value monitor, axis monitor, error history     Servo monitor, limit switch output monitor	
SW3RN-GSV22P	Testing	<ul> <li>Servo startup, servo diagnosis</li> <li>Jog operation, manual pulser operation, zeroing test, program operation</li> <li>Teaching, error reset, current value change</li> </ul>	
	Backup	<ul> <li>Backup of motion controller programs and parameters in file</li> <li>Batch writing of backed up files into the motion CPU</li> </ul>	
Cam data creation software SW3RN-CAMP	Cam data creation	<ul> <li>Cam data creation with Cam pattern selection and free curve settings</li> <li>Graphic display of Cam control status</li> </ul>	
Digital oscilloscope software SW3RN-DOSCP	Digital oscilloscope	<ul> <li>Data sampling synchronized to operation cycle</li> <li>Waveform display, dump display and file saving of collected data</li> </ul>	
Communication system software SW3RN-SNETP Communication API		Communication task, communication manager, common memory server, SSCNET communication drive     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 Ladder editing SW3RN-LADDERP		Editing of sequence program     Monitoring of sequence program execution	

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



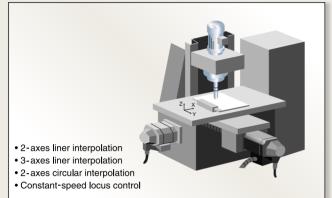
# Simple programming using dedicated commands.

By using easily understood dedicated servo command and sequence commands positioning and locus control can be programmed as you like.

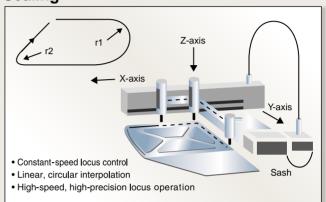
Control which is considered difficult and complex can be carried out simply using a variety of canned motion control functions.

# Example applications

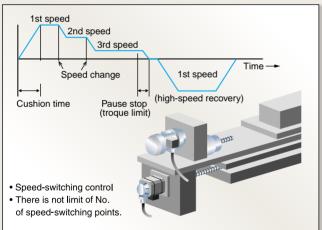
#### X-Y table control



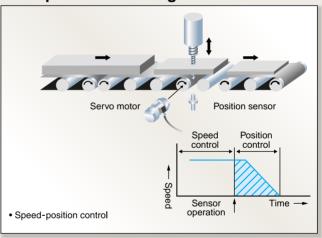
#### Sealing



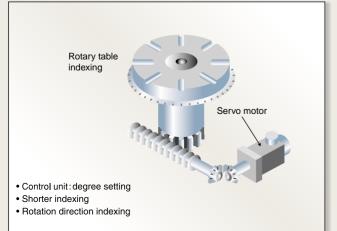
#### **Feed control**



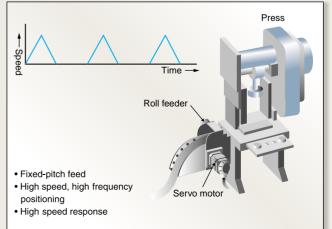
### Fixed-pitch hole drilling



#### Rotary table indexing



#### **Roll feeder**



# **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.

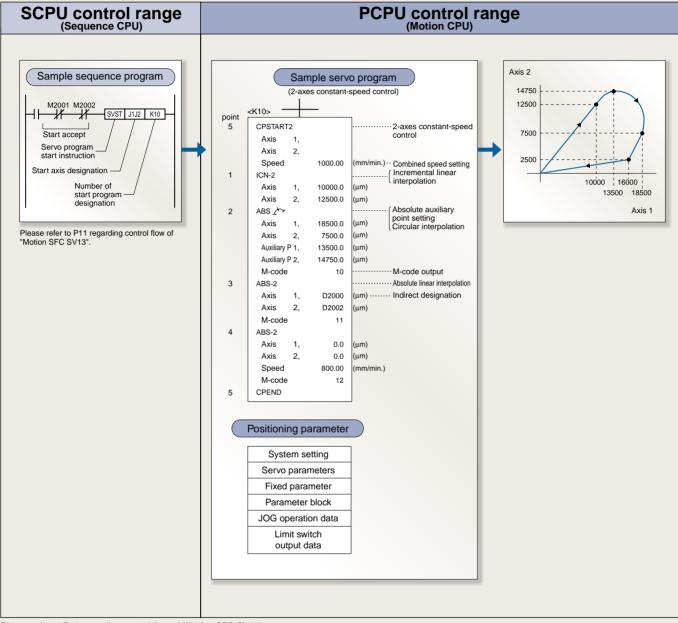
#### Limit switch output

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)



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

## Servo instruction

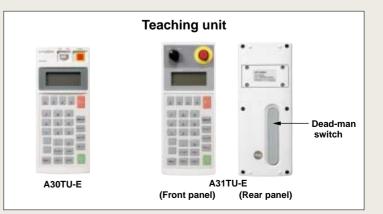
Positionir	Positioning control		Processing
	1-axis	ABS-1	Absolute 1-axis positioning
	I-axis	INC-1	Incremental 1-axis positioning
	2-axes	ABS-2	Absolute 2-axes linear interpolation
Linear	2-0,65	INC-2	Incremental 2-axes linear interpolation
control	3-axes	ABS-3	Absolute 3-axes linear interpolation
	5-4763	INC-3	Incremental 3-axes linear interpolation
	4-axes	ABS-4	Absolute 4-axes linear interpolation
	T UNOU	INC-4	Incremental 4-axes linear interpolation
	Auxiliary point	ABS 🕂	Absolute auxiliary point designation circular interpolation
	designation	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
2-axes circular		INC 🔨	Incremental radius designation circular interpolation less than CW 180°
interpolation control			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
		ABS 🔨	Absolute center point designation circular interpolation CW
	Center	ABS 😏	Absolute center point designation circular interpolation CCW
	point designation		Incremental center point designation circular interpolation CW
		INC 😏	Incremental center point designation circular interpolation CCW

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





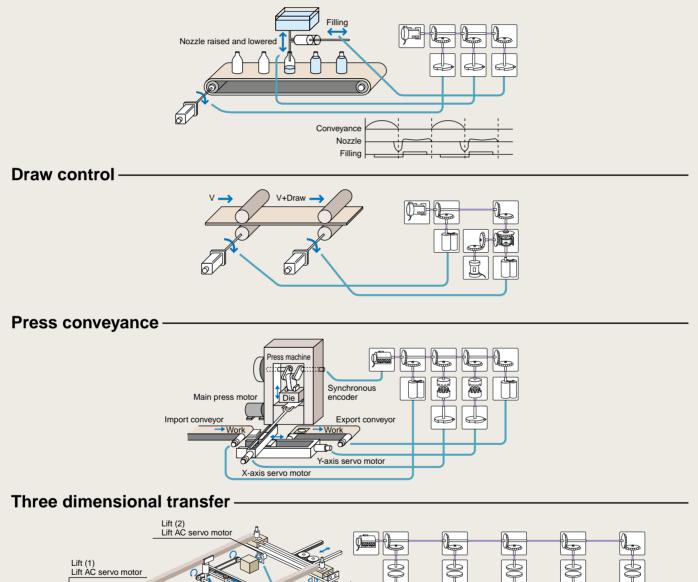
## Easy on screen programming using the mechanical support language.

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 -



Feed AC servo moto

Clamp (2

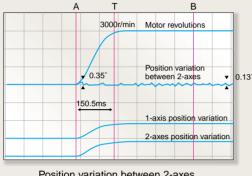
Clamp (1)

Clamp AC servo motor 皍

F

### 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



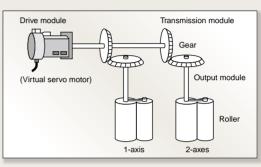
#### Software is used for mechanism operation

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.

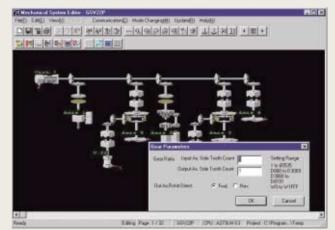
#### Control through advanced software cam

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.



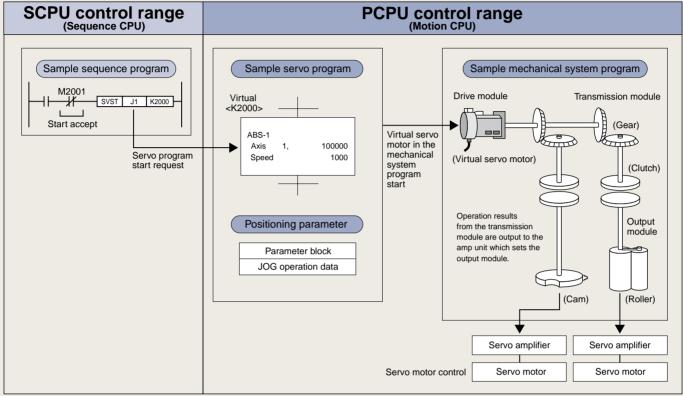
Synchronous control mechanical system program

#### Easy programming on screen using a mouse



Monitor screen with mechanical support language

# Control flow (SV22)



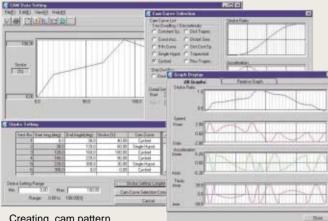
Please refer to P11 regarding control flow of "Motion SFC SV22"

# Mechanical module list

Mechanism	chanism Mechanical module		Function	Mechanism	Mechanie	cal module	Function	
section	Name	Appearance	Function	section	Name	Appearance	Function	
Drive module	Virtual servo motor	<b>Ç</b> î	Used to drive the virtual axis in the mechanical system program by the servo program or JOG start.		Gear		<ul> <li>Transfers the drive module rotation to the output axis.</li> <li>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.</li> </ul>	
	Synchronous encoder		Used to drive the virtual axis by input pulse from an external synchronous encoder.		Direct		• Engages/disengages the output module with the drive module rotation.	
Virtual	Virtual main shaft		This is a virtual "link shaft" .     The rotation of the drive module is transferred to the transmission module.		clutch		<ul> <li>When switching the clutch ON/OFF, there is a direct clutch for direct transfer and a smoothing clutch for acceleration/decelerat- ion processing which occurs in accordance with the smoothing time constant setting.</li> </ul>	
axis	Virtual auxiliary input axis		This is the auxiliary input axis for input to the transmission module "differential gear".     It is automatically displayed when the diffe- rential gear and the gear are connected.	Transmission	Smoothing	Ð	Depending on the application, ON/OI mode, address mode or external inp mode can be selected.     As the smoothing method, the time const-	
	Roller		• Used when the speed control occurs at the final output.	module			ant setting method or degree of slippage setting method can be selected.	
Output module	Ball screw	w Used when the liner positioning occurs at the final output.		Speed change gear		<ul> <li>Used to change the speed of the output module.</li> <li>The speed from the input axis side multiplied by the set speed change ratio and transferred to the output axis.</li> </ul>		
module	Rotary table		Used when the angle control occurs at the final output.		Differential		• The rotation of the auxiliary input axis subtracted from the rotation of the virtual main shaft and transferred to the output axis.	
	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.		gear		• 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     Simple harmonic     Deformed sine wave	Constant acceleration     Cycloid     Deformed constant velocity	<ul> <li>5-dimensional</li> <li>Deformed trapezoid</li> <li>Trapeculoid</li> </ul>					

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.

|--|

#### 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

			SV13			SV22		
Number of cont	trol axes		A173UHCPU (-S1) : Max. 32-axes A172SHCPUN : Max. 8-axes A171SHCPUN : Max. 4-axes					
Interpolation fu	nction				polation (Max. 4-axes) terpolation (2-axes)			
Control method	I	control, const		ed-pitch feed, speed-pos ed-switching control, pos		nt), speed control, synchronous con ition control, constant-speed, s ollow-up control		
Control unit				mm, inch,	degree, PULSE			
	Method	Fixed-pitch	peed, speed-position-swi feed, speed-position cor ow-up control	itching control : Absolute r	al method	e or incremental method d incremental method can be used to	gether	
	Position command		Control unit mm inch degree PLS	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	-2147483 -2147483	255 setting range 2648 to 2147483647 2648 to 2147483647 0 to 35999999 2648 to 2147483647	-	
Positioning			Control unit		Speed Setting R	ane	]	
	Speed command		mm inch degree PULSE	0.01 to 600 0.001 to 600 0.001 to 214 1 to 100	0000.000 47483.647	(mm/min) (inch/min) (degree/min) (PLS/s)		
	Acceleration/ deceleration control	acceler	natic trapezoidal ation/deceleration	Acceleration fixed acceleration/deceleration         Time fixed acceleration/deceleration/			to 5000ms	
Compensation	Backlash compensation	S-curve acc	eleration/deceleration (0 to 65535) ×	Position command unit (0	S-curve ratio : 0 to 65535PLS with unit co			
	Electronic gear		Funct	tion to compensate for rea	I travel error against com	mand value		
	Language		Dedicated instruct ( Motion SFC, servo		(Motion SFC,	Dedicated instructions ( Motion SFC, servo program, mechanical support language)		
Program	Capacity			A173UHCPU (-S1) A172SHCPUN A171SHCPUN	: 14k step (14336 steps : 13k step (13312 steps : 13k step (13312 steps	)		
Number of positioning point     A173UHCPU (-S1) : 100 points/axis A172SHCPUN     Positioning data can be 800 points/axis					tioning data can be designated indire	ectly		
	Tool			PC/AT compatible, A30T	U-E/A31TU-E (for SV13	only)		
Zeroing function	n		Not absolute position s Absolute position syste	system is recommended : em is recommended :		nt type can be selected. ity dog type or count type can be sele	cted.	
JOG operation function					vailable			
Manual pulse g operation functi		A173UHCPU (-S1) : 3 units A172SHCPUN : 1 unit A171SHCPUN : 1 unit						
M-function				M-code of	output function			
Limit switch out	put function				made for each axis up to points for each axis	o 10 points		
Absolute position	on system		Made compatible by fittin	g battery to servo amplifie	er (Absolute or increment	al system can be specified per axis)		

#### Mechanical system program specifications (SV22)

Item		Mechanical module	A	171SH	A1	72SH	A1	73UH	A173UH-S1	
Drive		Virtual servo motor								
	module	Synchronous encoder		PLS						
Control		Roller				<b>mm</b>	inch			
unit	Output	Ball screw					Inch			
	module	Rotary table				Fixed as	"degre	e"		
		Cam				mm, in	ch, PLS	3		
	Drive	Virtual servo motor	4	Total 5	8	Total 9	32		Total 36	
	module	Synchronous encoder	1	TOTAL 2	1	10(a) 9	4		10141 30	
	Virtual	Virtual main shaft	4	Total 8	8	Total 16	32		Total 64	
	axis	Virtual auxiliary input shaft	4	Total o	8	10121 10	32	10(8) 64		
		Gear (Note-1)		8		16		64		
Mechanical		Clutch (Note-1)		8		16		64		
system	Transmission module	Speed change gear (Note-1)		8		16		64		
program		Differential gear (Note-1)		4		8	32			
		Differential gear (for the virtual main shaft) <sup>(Note-2)</sup>		4	8		32		32	
		Cam	4	4			32			
	Output	Roller	4	Total 4	8	Tatalo	32		Total 32	
	module	Ball screw	4	101214	8	Total 8	32		10101 32	
		Rotary table	4		8	]	32			
	Types			Max	<b>.</b> 64		Ma	ax. 64	Max. 256	
	Resolution pe	er cycle	256, 512, 1024, 2048							
Cam	Memory capa	city	32k bytes 32k bytes (Note-3) 132k bytes (Note-3)					3) 132k bytes (Note-3)		
	Stroke resolut	tion				327	767			
	Control mode	1			Tw	o-way ca	m, feec	l 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**

	lt	em	A172SHCPUN	A173UHCPU (-S1)			
	Code total (Motion	SFC chart+Operation control+Transition)	287k bytes				
Program capacity	Text total(Operat	on control+Transition)	224k bytes				
	Motion control pro	ogram (Servo program)	52k bytes	Approx. 56k bytes			
Program	Code-Motion con	trol program	PCPU	SRAM			
storage area	Text		PCPU	SRAM			
	Number of Motion	n SFC programs	256 (No.	0 to 255)			
	Number of Motion (1 step+1 transition	n SFC steps/all programs on)	Max. approx (varies with the number of operation contro				
Motion SFC program	Motion SFC prog	ram name/program	16 b (program name is u				
	Motion SFC char	t size/program	Max. 64k bytes(included Mo	otion SFC chart comments)			
	Motion SFC steps	s/program	Max. 409	94 steps			
	Motion SFC char	t comments	Max. 80 chara	acters/symbol			
	Number of operation	n Once execution type	4096 (F0 to F4095)	4096 with F and FS combined			
	control programs	Scan execution type	4096 (FS0 to FS4095)	(F/FS0 to F/FS4095)			
Operation control	Number of transit	ion programs	4096 (G0	to G4095)			
program(F/FS)	Code-size/progra	m	Max. approx. 64k b	ytes (32766 steps)			
• Tana 141 a a	Text-size/program	n	Max. approx	k. 64k bytes			
Transition program(G)	Number of blocks	(lines)/program	Max. 8192 blocks(in the ca	ase of 4 steps(min)/block)			
program(C)	Number of chara	cters/block(line)	Max. 128 characters (comment included)				
	Number of opera	nd/block(line)	Max. 64 (operand : constants, word devices, bit devices)				
	Number of servo	programs	4096 (K0 to K4095)				
Motion control	Program steps/al	l programs	13312	14334			
program	Program steps/pr	ogram	Max.13312 steps (Speed control, speed change control)				
	Positioning points	3	Approx. 800 points/axis	Approx. 400 points/axis			
	Number of multi	executed programs	Max. 256				
	Number of multi a	active steps	Max. 256 steps/all programs				
Executed		Normal task	Executed in mo				
specification	Executed task	Event task	Fixed cycle (1.7ms, 3.5ms, 7.1ms, 14.2ms) 16 external interrupt points(Input from interrupt input module installed in motion slo 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)				
	Number of motion	n register (#0)	8192 points(#0 to #8191) (#8000 to #8191 is dedicated device)				
Device	Number of coasti	ng timer(FT)	1 point (FT) (88	8μs timer(32bit))			
	Number of motion	n slot I/O(PX/PY)	Total 64 points	Total 256 points			

#### Sequence control specifications

			A171SH		A1	72SH	A17:	3UH		A173UI	H-S1	
Control	l method					ated operation using stored program						
I/O con	trol method				le/direct mode to select)		Refresh mode (direct mode can be used partially in accordance with the instruction)					
Progra							juence control dedicated language uage, logic symbol language, MELSAP II (SFC))					
			Sequ	ence in	structions : 26				Sequence ins	tructions : 22		
Numbe	r of instruct	ions			uctions : 131				Basic/applied in			
					ructions : 106				Instructio			
					tructions : 4				Motion inst	ructions: 4		
Processin (Sequence	9.0000 H	Direct mode	0.		.9 μs/step				0.15	- -		
· ·	nts (Note-1)	Refresh mode	20		us/step Y0 to 7FF)				0.15 μ: 8192 (X/Y(			
	D points		512 (X/Y0 to 1FF		,	/Y0 to 3FF)	2048 point	s (X/V)		the range of one extens	ion base )	
	dog timer (N	/DT)	012 (001010111		2000ms		2040 000	5 (70 1	200	0	1011 5030.)	
		built-in RAM)	64k bytes	10 10 2		k bytes	192k	bytes		768k by	tes	
	Main a	200000	Max. 14k steps		Max	30k steps			Max. 30	k stone		
Program	m Cub aa	equence quence			iviaX. C				Max. 30	· · ·		
capacit	·y	mputer program	Max. 26k bytes		Max. 5	58k bytes				-		
		ay (M) <sup>(Note-1)</sup>	1000 points (M0 to N									
	Latch relay		1048 points (L1000 to	,		048 points			Total 819			
	Step relay	. ,	0 point (none at ini		(set in p	arameters)	(set in parameters)					
	Link relay (	B)	1024	points	(B0 to B3FF)				8192 points (E	B0 to B1FFF)		
		Points		2	56		2048 (default 256)					
				Se	tting time	Device			Set	tting time	Device	
			100ms timer		to 3276.7s	T0 to T199	100ms timer			o 3276.7s	T0 to T199	
Ti	Timer (T)	Specifications	10ms timer	0.01	to 327.67s	T200 to T255	10ms timer				T200 to T255	
			100ms retentive timer	0.1	to 3276.7s	None at initial	100ms retentive tim Extension timer	er		to 3276.7s rd device (D,W and R)	None at initial T256 to T2047	
							-		Time Set by Wor		12301012047	
		Points		- cinto		Set in parameter		1021 points (date	ault OEC painta)			
		Specifications	256 points						1024 points (defa		Device	
Device					Setting range	Device	Normal counter		Setting 1 to 3		C0 to C255	
Device	Counter (C)		Normal counter Interrupt program co	ounter	1 to 32767	C0 to C255	Interrupt counter		C224 te		None at initial	
			Interrupt program of	Junier		None at initial	Extension counter	Coun	nt value set by wo	rd device (D,W and R)	C256 to C1023	
							Set in parameter					
	Data regist	er (D) (Note-1)	1024 p	oints (E	D0 to D1023)		8192 points (D0 to D8191)					
	Link registe		1024 p	oints (V	N0 to W3FF)		8192 points (W0 to W1FFF)					
	Annunciato	or (F)	256 p	points (I	F0 to F255)		2048 points (F0 to F2047)					
	File registe	r (R)				Max. 8192	2 points (R0 to R8191) (set in parameter)					
	Accumulate	or (A)					2 points (A0, A1)					
	Index regis	· ·		2 point	s (V, Z)				4 points (V, V1 to	V6, Z, Z1 to Z6)		
	Pointer (P)						256 points (P0 to P2	,				
	Interrupt po						32 points (10 to 131					
	Special rela						256 points (M9000 to M 256 points (D9000 to D					
	Special reg	jister (D)						,		Max 16	blocks	
Extensi	on file regist	er blocks (Note-2)	_ (Note-3)		-	(Note-3)	Max. 10 blocks Max. 46 blocks Depends on memory size					
Comme	ent points					Max. 403	2 points (64k bytes), 1 p (set in 64 points un		16k bytes			
Extens	ion commer	nt points (Note-2)				Max. 396	68 points (63k bytes), 1 point=16k bytes (set in 64 points unit)					
Self-dia	agnostic fun	ction			Oper	ation error monitor	oring and detection of e	rrors ir	n CPU,I/O, batter	y etc		
Operat	ion mode in	error					Select of stop or cont	inue				
	mode wher TOP to RUN				Select of re-ou	tput operation sta	tion status before STOP (default) or output after operation execution					
Clock f	unction (Note	-4)			Year,	month, day, hour	minute, weekday (auto	matic	leap year adjustr	nent)		
Clock function (Note-4)         Year, month, day, hour, minute, weekday (automatic leap year adjustment)           Program/parameter         Not available							Not available					

(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			
Application	Periprieral device	A171SHCPUN	A172HCPUN	A173UHCPU	
For conveyor assembly <b>SV13</b> (Motion SFC)		-	SW3RN-SV13D	SW3RN-SV13B	
For automatic machinery <b>SV22</b> (Motion SFC)	PC/AT compatible	-	SW3RN-SV22C	SW3RN-SV22A	
For conveyor assembly SV13 (without Motion SFC)		SW0SRX-SV13G	SW0SRX-SV13D	SW2SRX-SV13B	
For automatic machinery <b>SV22</b> (without Motion SFC)		SW0SRX-SV22F	SW0SRX-SV22C	SW2SRX-SV22A	

#### Programming software package list

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

#### 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
	Instilation manual
	SW3RNC-GSVPROE
SW3RNC-GSVSETE	A30CD-PCF (SSC I/F card (PCMCIA TYPEII 1CH/card))
	A270CDCBL03M (cable for A30CD-PCF) 3m

# System Component

Item	Model name	Description	Standard					
	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						
CPU module	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	UL/cUL CE marks					
	A173UHCPU	Sequence program capacity       : Max. 60k steps         Servo program capacity       : Max.14k steps         PLC control real I/O point       : Max. 2048         Internet evenewater in the step						
	A173UHCPU-S1	Internal power supply         : Input : 100 to 240 VAC, output : 5 VDC 5A           5VDC internal consumption current         : 1.90A						
	A172B	1 motion module slot and 1 PLC module slot can be fitted.						
	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.	111 /-111					
CPU base unit	A178B-S1	2 motion module slots and 6 PLC module slots can be fitted.	UL/cUL					
	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.						
	A1S61PN	Input : 100 to 240 VAC, output : 5 VDC 5A	UL/cUL					
Power supply module	A1S62PN	Input : 100 to 240 VAC, output : 3 VDC 5A, 24 VDC 0.6A	CE marks					
	A1S65B	For extension power supply and 5 slots, compatible with system up to one extension stage.						
PLC extension base uint	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.						
	A1SC01B	55mm (2.17 inch)						
	A1SC01B A1SC03B	300mm (11.81 inch)						
		700mm (27.56 inch)						
	A1SC07B							
	A1SC12B	1200mm (47.24 inch)						
Extension cable	A1SC30B	3000mm (118.11 inch)						
	A1SC60B	6000mm (236.22 inch)						
	A1S05NB	450mm (17.72 inch)						
	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						
	A30TU-E	For SV13, 5m cable, 5 VDC internal current consumption						
Teaching unit	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 TYPE II 1CH/card						
	A270BDCBL03M	For A30BD-PCF 3m						
Cable for SSC I/F board	A270BDCBL05M	For A30BD-PCF 5m						
	A270BDCBL10M	For A30BD-PCF 10m						
	A270CDCBL03M	For A30CD-PCF 3m						
Cable for SSC I/F card	A270CDCBL05M	For A30CD-PCF 5m						
	A270CDCBL03M A270CDCBL10M	For A30CD-PCF 10m						
	N2100D0BL10W							

(Note) : For A173UHCPU only

#### Pulse generator/synchronous encoder interface unit -

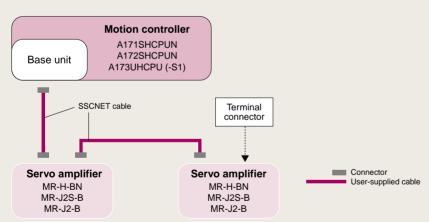
#### A172SENC

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			
	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			
Motion control signal	Range of voltage used	10.2 to 26.4 VDC			
input,	ON voltage/current	Min. 7V/Min. 1.0mA			
tracking input	OFF voltage/current	Max. 1.8V/Max. 0.18mA			
	Response time	Motion control signal input OFF $\rightarrow$ ON Max. 2ms, ON $\rightarrow$ OFF Max. 3ms Tracking input OFF $\rightarrow$ ON Max. 0.5ms, ON $\rightarrow$ OFF Max. 0.5ms			
	Output point	1 point			
Dynamic brake	Range of load voltage used	21.6 to 30 VDC			
command output	Max. load current	0.1A			
	Response time	$\text{OFF} \rightarrow \text{ON}\ \text{max.}\ \text{2ms,}\ \text{ON} \rightarrow \text{OFF}\ \text{max.}\ \text{2ms}$			
	Usable unit	1			
Manual pulse generator/ synchronous encoder	Adaptive type	Voltage output type (5 VDC) / differential output type (26LS31 or equivalent) Possible to select by connector wiring			
input	High level voltage	3.0 to 5.25 VDC			
linpat	Low level voltage	0 to 1 VDC			
	Input frequency	Max. 100k PLS/s (magnification of 4)			
Synchronous	Usable unit	1			
encoder input	Adaptive type	Serial absolute synchronous encoder input (MR-HENC)			
5VDC internal consur	mption current	0.42A (Manual pulse generator/synchronous encode is contained)			

#### Cables and connectors -



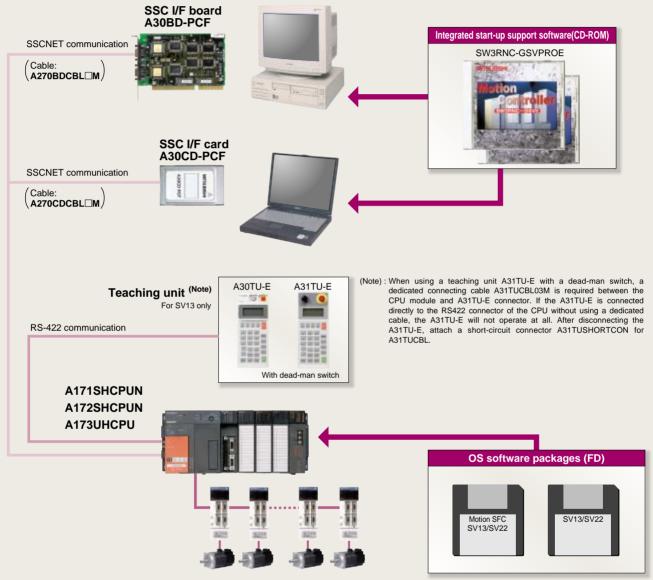
Item	Model name	Description			
	MR-HBUS⊡M	For connection of CPU module and MR-H-BN, and for connection MR-H-BN and MR-H-BN 0.5m, 1m, 5m			
SSCNET cable	MR-J2HBUS□M-A	For connection of CPU module and MR-J2S-B/MR-J2-B, and for connection MR-H-BN and MR-J2S-B/MR-J2-B 0.5m, 1m, 5m			
	MR-J2HBUS IM	For connection 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.



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.

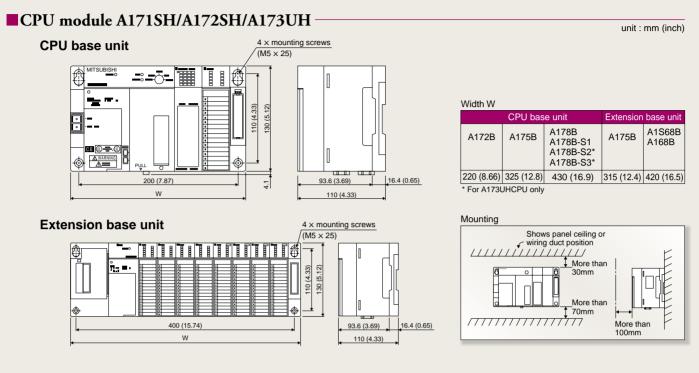
OS		WindowsNT 4.0 / Windows 98		
CPU		More than pentium 133MHz		
Memory capacity		More than 32M bytes		
Hard disk capacity		SW3RNC-GSVE : more than 51MB + SW3RNC-GSVHELPE : more than 108MB (possible to select installation		
Display	Resolution	More than $800 \times 600$ pixels		
	Colors	More than 256 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.)

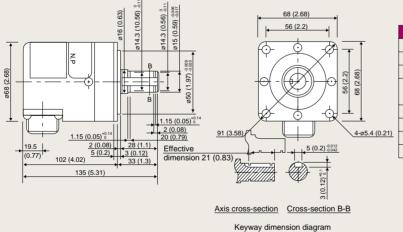
(Note) : Windows, Word, Excel, Visual C++ and Visual Basic is a trade-mark of the Microsoft Corporation

 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



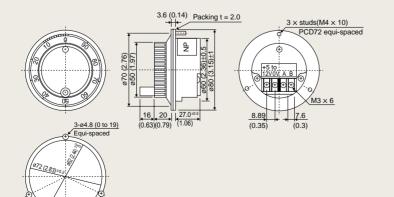
Serial absolute synchronous encoder MR-HENC



unit : mm (inch)

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			
I emilied axis load	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)			

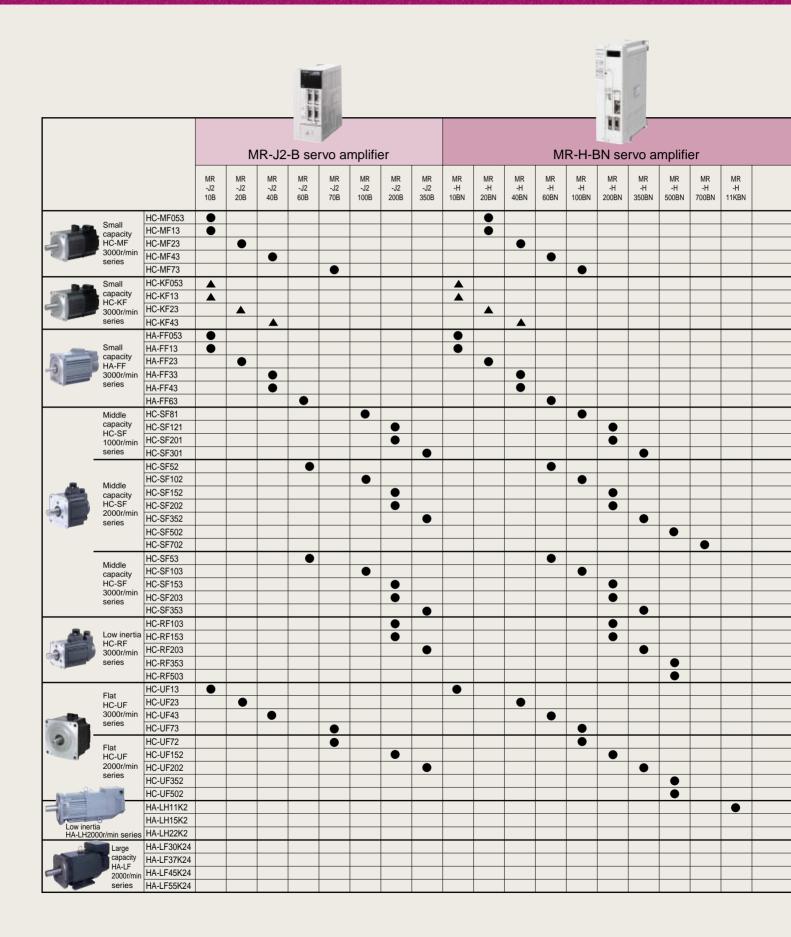
#### Manual pulse generator MR-HDP01



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			
Fermined axis load	Thrust : Max. 9.8N			
Operating temperature	-10°c to -60°c			
Weight kg (16)	0.4 (0.88)			

 $(\mbox{Note})$  : When using an external power supply, necessary to 5V power supply.

# Combinations of Servo Amplifiers and Servo Motors



		1
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_0	16	

							Motor capacity
	MR -H 15KBN	MR -H 22KBN	MR -H 30KBN4	MR -H 37KBN4	MR -H 45KBN4	MR -H 55KBN4	(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
							0.85
							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
			-				0.1
_							0.2
							0.75
							0.75
							1.5
							2.0
							3.5
							5.0
							11.0
							15.0
	-						22.0
							30.0
							37.0
							45.0

Small capacity Book series         HC-MFS03 HC-MFS13         MR HC-MFS03         MR HC-MFS13         MR HC-MFS13         M	Mater
Small capacity hC-MFS13         HC-MFS03 hC-MFS13         Image: Comparison of the comparison of	3
Small (apacity BC-MFS 3000/rmin series         HC-MFS13         HC-MFS13         HC-MFS23           HC-MFS233         <	3
Middle         HC-MFS13         Image: Constraint of the second of the se	0.05
3000/min series         HC-MFS43         Image: Constraint of the series         Imag	0.1
series         HC-MFS73         Image: Constraint of the series         Image: Constraint of the series <thimage: conseries<="" th=""> <thimage: constraint="" of="" seris<="" td="" the=""><td>0.2</td></thimage:></thimage:>	0.2
Middle capacity HC-KFS3         M-KFS33         M-KFS333         M-KFS333 <td>0.4</td>	0.4
Midle capacity HC-KFS13         HC-KFS13         HC-KFS13         HC-KFS23         HC-KFS233         HC-KFS233         HC-KFS233         HC-KFS233         HC-KFS233         HC-KFS233         HC-KFS233         HC-KFS233         HC-KFS233         HC-KFS333	0.75
Image: Construct of the construction of the construle construction of the construction of the construct	0.05
HC-KFS series         HC-KFS23 HC-KFS73         Image: Constraint of the series of the	0.1
series         HC-KF33         Image: Constraint of the series         Image: Cons	0.2
Middle capacity HC-SFS 1000r/min series         HC-SFS81         Image: Constraint of the series         Image: Constraint of the series <thimage: constraint="" of="" serie<="" td="" the=""><td>0.4</td></thimage:>	0.4
Middle capacity HC-SFS 1000/min series         HC-SFS121 HC-SFS201         HC-SFS201         Image: Comparison of the compar	0.75
HC-SFS 1000/min series         HC-SFS201         Image: Constraint of the series	0.85
Middle         HC-SFS201         Image: Constraint of the sector of the s	1.2
Middle capacity HC-SFS 2000r/min series         HC-SFS52         Image: Constraint of the series         Image: Constraint of the series <thimage: constraint="" of="" serie<="" td="" the=""><td>2.0</td></thimage:>	2.0
Middle capacity HC-SFS 2000r/min series         HC-SFS152         Image: Constraint of the series         Image: Conseries         Image: Constraint of the series	3.0
Middle capacity HC-SFS         HC-SFS152         Image: Constraint of the second	0.5
Capacity HC-SFS         HC-SFS152         Image: Comparison of the comparison o	1.0
HC-SFS 2000/min series         HC-SFS202         Image: Constraint of the series	1.5
series         Inc-sr 5332         Inc-sr 5332           HC-SFS002         Inc-sr 5702         Inc-sr 5703         Inc-sr 570	2.0
HC-SFS502         Image: Constraint of the second seco	3.5
Middle capacity HC-SFS 3000/min series         HC-SFS53         Image: Constraint of the second secon	5.0
Middle capacity HC-SFS 3000/min series         HC-SFS103         Image: Constraint of the series         Image: Constraint of the seri	7.0
capacity HC-SFS 3000/min series         HC-SFS103         Image: Comparison of the comparison of	0.5
HC-SFS 3000/min series         HC-SFS153         Image: Constraint of the series	1.0
series         HC-SFS203         Image: Constraint of the series         Image: Conseries         Image: Constraint of the se	1.5
HC-SFS353         Image: Constraint of the system of t	2.0
Low inertia HC-RFS 3000/min series         HC-RFS153         Image: Comparison of the comparison	3.5
HC-RFS 3000/min series         HC-RFS203         ●           HC-RFS353         ●         ●           HC-RFS503         ●         ●           Flat         HC-UFS13         ●	1.0
3000r/min series         HC-RFS353         Image: Constraint of the series         Im	1.5
series         HC-RFS353         Image: Constraint of the series         Image: Const	2.0
Flat HC-UFS13 •	3.5
Fial Fial Fial Fial Fial Fial Fial Fial	5.0
	0.1
HC-UFS HC-UFS23	0.2
3000r/min HC-UFS43	0.4
series HC-UFS73	0.75
HC-UFS72	0.75
Flat HC-UFS152	1.5
HC-UFS HC-UFS202	2.0
series HC-UFS352	3.5
HC-UFS502	5.0

▲ : 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.



