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(2) Main Program

Screwdriving: Program No. 1 (Task No.1)

[Application Program]

Line	Expansion	Input	Commands			Output	Comment
	AND/OR	I/O, Flag	Command	Operand1	Operand2	Output Port, Flag	
1			EXPG	2			Program 2 start
2			HOME	11			Homing
3			VEL	100			Velocity 100mm/sec
4			ACC	0.3			Acceleration 0.3 G
5			TAG	1			Restart Target
6			WTON	6			Screwdriving start Push Button
7			LET	1	1		Screw Counter Set
8			TAG	2			1 screw complete Target
9			MOVL	*1			Move
10			BTON	303			Z axis air cylinder down
11			BTON	304			Screwdriving start
12			WTON	16			Screwdriving complete
13			BTOF	303	304		Cylinder up, screwdriving stop
14			WTON	15			Z axis air cylinder upper edge check
15			ADD	1	1		Screw counter +1
16			CMPE	1	7	900	6 screws complete Compare
17		N900	GOTO	2			1 screw complete To the next screwdriving
18		N007	GOTO	1			Screwdriving To restart
19			ABPG	2			Program 2 Stop
20			BTOF	305			Parts feeder stop
21			EXIT				Program 1 end

[Position Program]

No.	X	Y
1	30	30
2	60	30
3	90	30
4	30	60
5	60	60
6	90	60

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(3) Sub Program

Screw Feeding: Program No. 2 (Task No.2)

[Application Program]

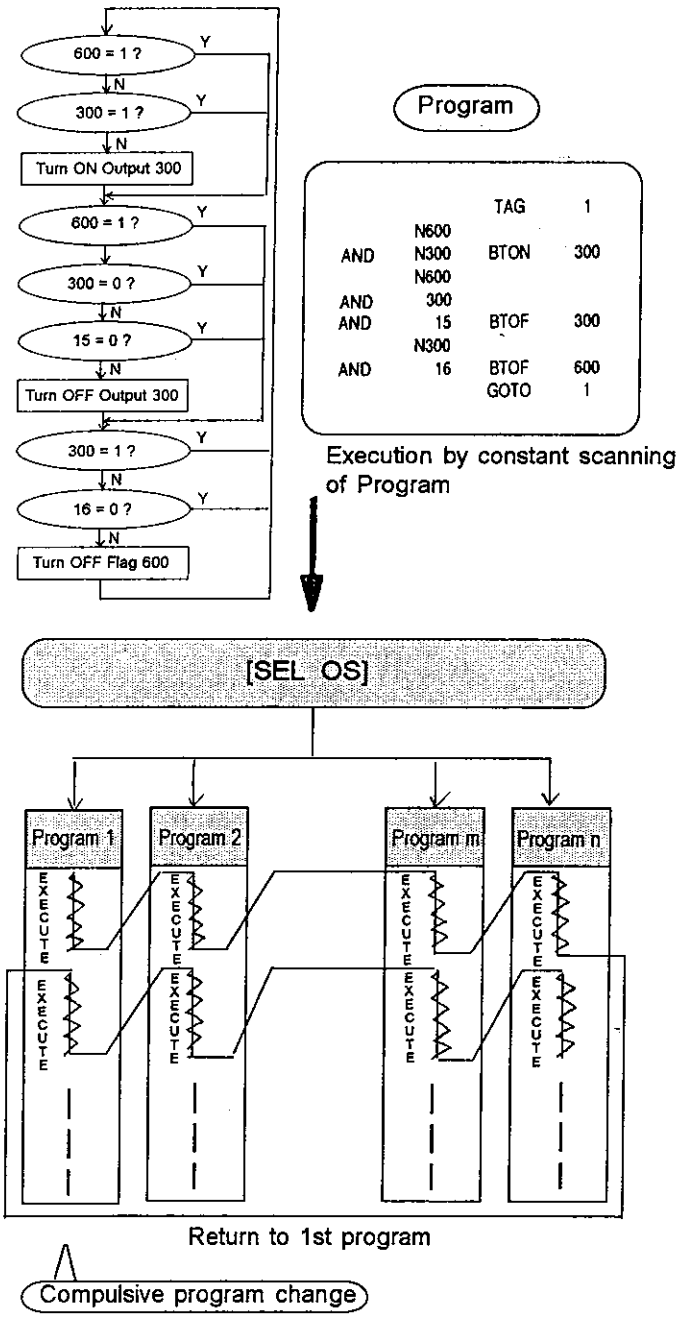
Line	Expansion	Input	Commands			Output	Comment
	AND/OR	I/O, Flag	Command	Operand1	Operand2	Output Port, flag	
1			TAG	1			Repeated jump target
2			WTOF	17			Parts feeder depleted
3			BTON	305			Parts feeder start
4			WTON	17			Parts feeder full
5			BTOF	305			Parts feeder stop
6			TIMW	5			Restart Timer 5 seconds
7			GOTO	1			Repeat

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Part 3 - Multi-Tasking Programming Tips

Although multi-tasking methods are generally expressed as "the simultaneous operation of multiple programs (multi-tasking)", the programs are not actually carried out simultaneously. They are, rather, simultaneous operation-like conditions throuth the execution of multiple programs over a very small amount of time using the free time of each program. Avoid any program combination that uses up the controller CPU for one program. The most efficient configuration, making the multi-tasking function fully useful, will be shown later.

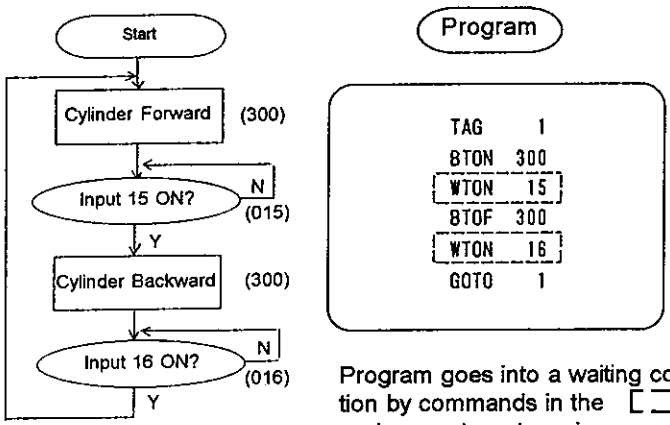
(1) Inefficient Configuration



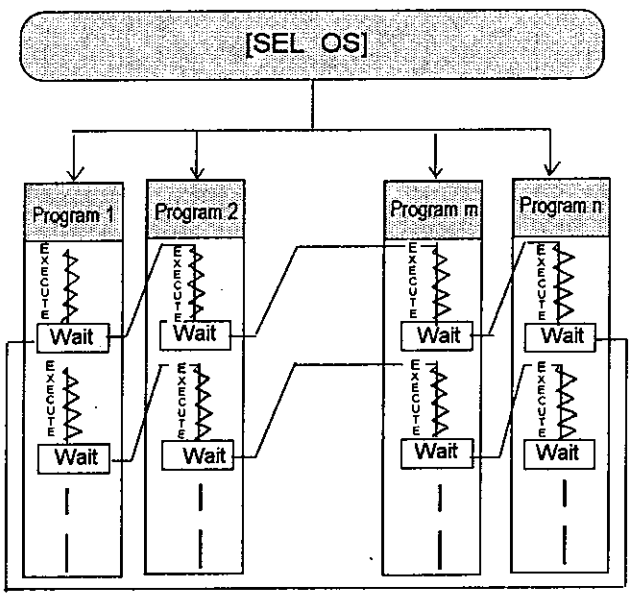
- Basically, multi-tasking operations are monitored by the controller system program [SEL OS]. The program being executed goes into a waiting condition such as input signal waiting, then the next program executes.
- As shown on the left, all of the programs are combined considering only conditions to proceed steps without any waiting period, so full time scanning is necessary.
- In this case the program being executed does not have a waiting condition, and uses up CPU. The controller system program (SEL OS) will then perform a compulsive program change.
- As explained above, programs that are always scanning use up CPU. This combination works, but not efficient. It is not a true usage of the multi-tasking function.

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(2) The Most Efficient Configuration



Program goes into a waiting condition by commands in the [ ], and executes steps in sequence without scanning.



Returning point is not necessarily the 1st program. It differs depending on the waiting condition.

Executes other programs using the waiting condition

- The most efficient configuration is to execute the next program during a waiting period such as an input signal waiting.
- As shown on the left, use the WTON comand (instead of conditional judgment) to execute steps in the sequence without full time scanning.
- The WTON command keeps the program in a waiting condition until the designated con dition turns ON.
  Commands to keep programs in waiting conditions are:
  WTON WTOF
  MOVP MOVL CIR ARC PATH
  TIMW

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Chapter 4. Programming

Unlike other complicated robotic languages, the Super SEL language is simple and easy to use. The Super SEL Language is not only simple, but can be used to develop high sophisticated programs.

Other langauges based on BASIC are in "symbolic notation" and the "interpretation" of the language can be very time consuming. As programs become more and more complicated, interpreters are no longer capable of translating the languages within the time limit allowed. In order to solve this problem, an extra step (compiler) is added. This causes MS-DOS to become extremely complex.

The new Super SEL interpreter can be used to develop highly complex programs without compilation.

Note 1: Interpreters - can operate while translation
Note 2: Compiler(s) - translate orders into computer languages beforehand.

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Chapter 4. Programming

Part 1 - Super SEL Language

1. Numerals and Symbols

The following numerals and symbols are used for super SEL programming.

Function	Numerals and Symbols	Note
Input Port	001 ~ 287 (287)	Varies ~
Output Port	300 ~ 587 (288)	Varies ~
Axis Pattern	8 7 6 5 4 3 2 1	Varies ~
Axis No.	1 ~ 8	Varies ~
Positon No.	1000 1500	Type A Type B
Program No.	48 64	Type A Type B
Program Step	2000 2500	Type A Type B
Timer	One in Each Program	
Position	+/- 9999,999	

Function	Global	Local
Flag	600 ~ 887 (288)	900 ~ 999 (100)
Variable (Integer)	200 ~ 299 (100)	1 ~ 99 (99) *
Variable (Real)	300 ~ 399 (100)	100 ~ 199 (100) **
TAG No.		1 ~ 64 (64)
Subroutine No.		1 ~ 64 (64)

Global : Visible to all programs
Local : Visible only within a program
(The local range clears at the start of a program)

* Use INB, OUTB for 99.
** Use PPUT, PGET for 199.

Note The variable 99 and 199 are the special registers for calculation. Do not use these two variables for general use.

- Battery Back-up Range

When the power is turned back ON, everything will be cleared except the area backed up by the battery. (Same as emergency stop)

Program..... Stop
Output Port..... Clear
Local Flag..... Clear
Local Variable.....Clear
Home Position.....Clear

Global Flag.....Maintained
Global Variabel.....Maintained

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2. Input/Output Port

(1) Input Port

Input ports are numbered from 001 ~ 287.

Board No.	Output No. Assignment	Type A Model	Type B Model
1	001 ~ 023	Standard	Standard
2	024 ~ 047	Option	Included
3	048 ~ 071	Option	Option
4	072 ~ 095	Option	Option
5	096 ~ 119	---	Option
6	120 ~ 143	---	Option
7	144 ~ 167	---	Option
8	168 ~ 191	---	Option
9	192 ~ 215	---	Option
10	216 ~ 239	---	Option
11	240 ~ 263	---	Option
12	264 ~ 287	---	Option

(2) Output Port

Output ports are numbered from 300 ~ 587.

Board No.	Output No. Assignment	Type A Model	Type B Model
1	300 ~ 323	Standard	Standard
2	324 ~ 347	Option	Included
3	348 ~ 371	Option	Option
4	372 ~ 395	Option	Option
5	396 ~ 419	---	Option
6	420 ~ 443	---	Option
7	444 ~ 467	---	Option
8	468 ~ 491	---	Option
9	492 ~ 515	---	Option
10	516 ~ 539	---	Option
11	540 ~ 563	---	Option
12	564 ~ 587	---	Option

Optional expansion I/O Boards are available to provide an additional 24 inputs and 24 outputs per I/O board.

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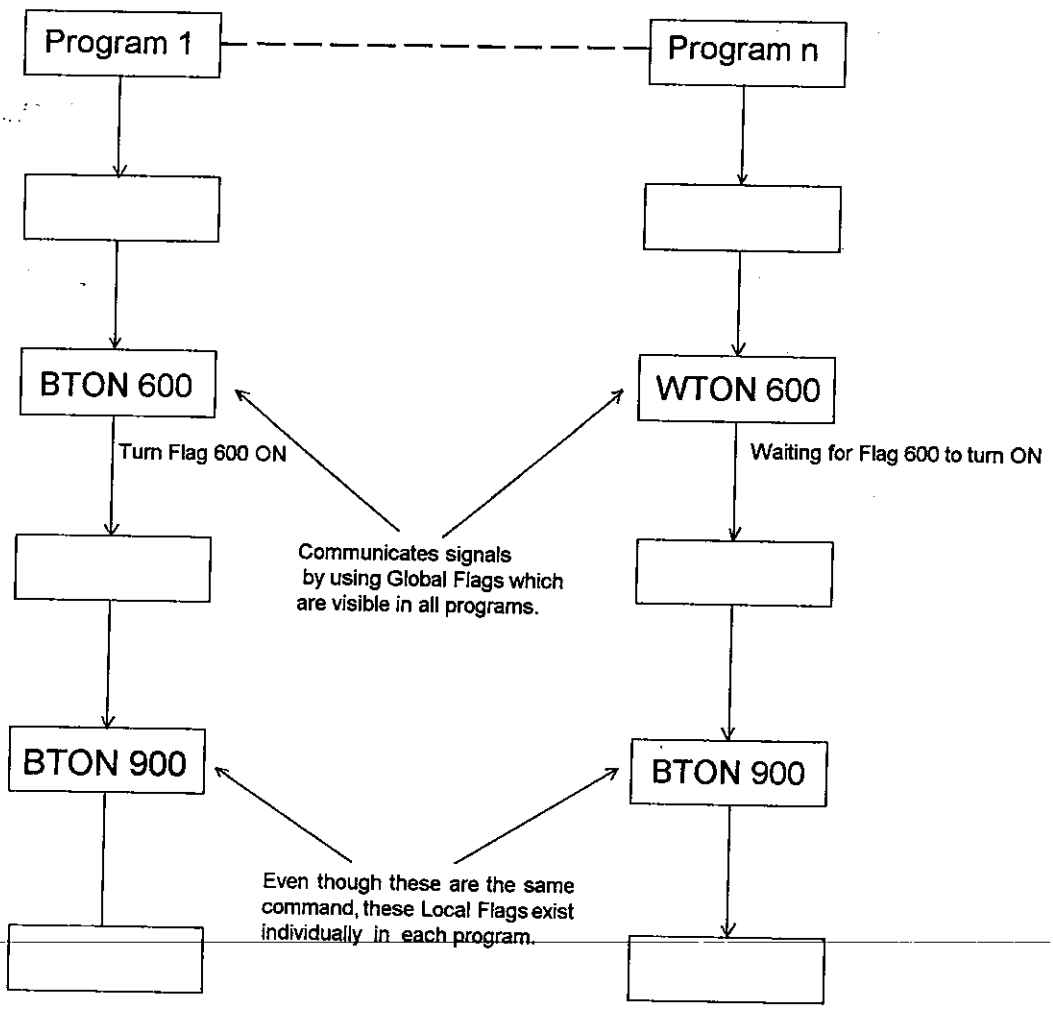
3. Flags

The function of flags is to set and reset data within "Memory". This is analagous to "internal relays" or "coils".

In general, there are two (2) types of flags: Global Flags 600 ~ 887 which can be used in all programs; and Local Flags 900 ~ 999 which can be used *only* in individual programs.

Global Flags can be saved when the power is turned OFF (battery backup). Local Flags are erased when the power is turned OFF.

Flag Number	600 ~887	Global Flag : Visible To All Program
Flag Number	900 ~ 999	Local Flag : Visible Only Within A Program

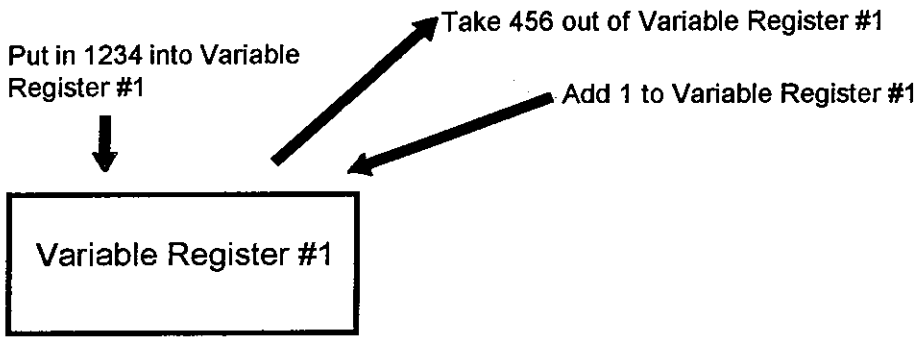


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4. Variable Register

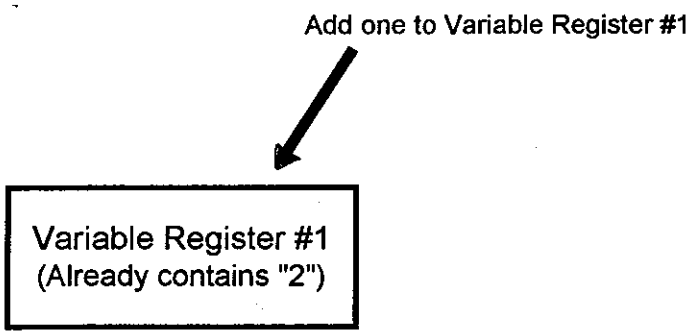
(1) What are Variables?

The term "Variable Register" is a software term. Imagine a box that holds numbers. Numbers can be put in and taken out, added, subtracted, and so on.



Command	Operand 1	Operand 2
Add	1	1

This command adds 1 to Variable Register #1. If the Register contains 2, then the variable becomes 3.



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(2) Types of Variables

2-1 Integer Variable. Whole numbers do not have decimal points. (For Example: -2, -1, 0, 1, 2, 3)

Integer Variable Register #1 (1234)

Integer Variable No.	200 ~ 299	Global Integer Variable
Integer Variable No.	1 ~ 99	Local Integer Variable

Note: The variable 99 is a special register for integer calculation.

2-2 Real Variable. For example: 1234.567

Integer Variable Register #1 (1234.567)

Real Variable No.	300 ~ 399	Global Real Variable
Real Variable No.	100 ~ 199	Local Real Variable

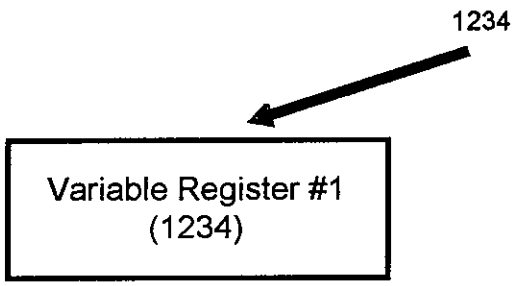
Note: The variable 199 is a special register for real number calculation.

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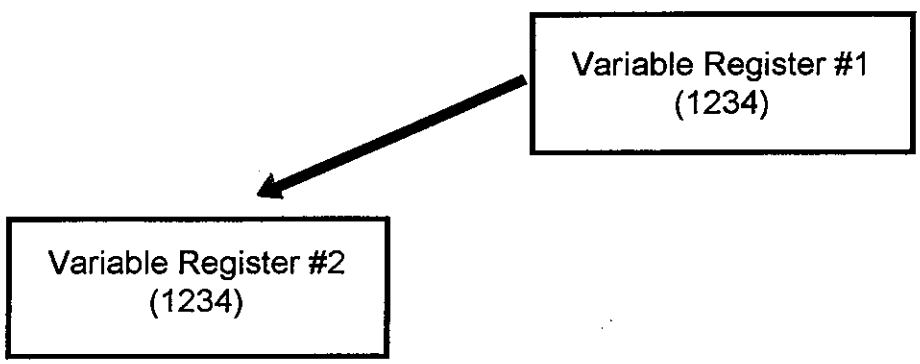
2-3 Asterisk

The Asterisk symbol (*) is used to represent contents of the Variable Register which can be data in another program.

Command	Operand 1	Operand 2
LET	1	1234



Command	Operand 1	Operand 2
LET	2	*1



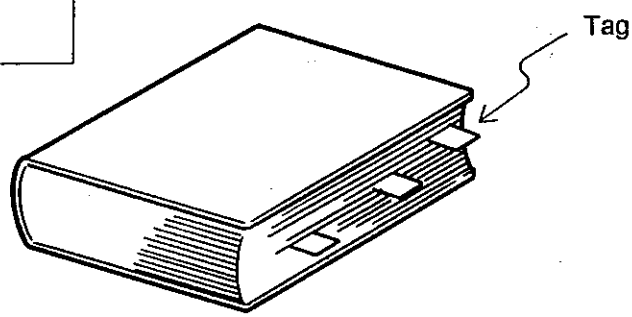
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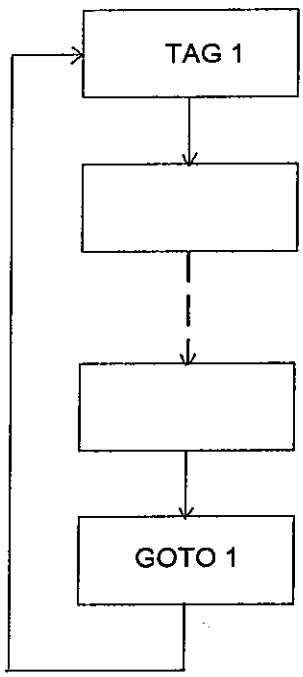
5. Tag

"Tag" means heading. A TAG can be thought of as the same as placing labels on important pages. The TAG as it is used in the Super SEL programming language is the "return to" area and is used in conjunction with the GOTO command to provide programming loops.

Command	Operand 1
TAG	TAG No. (Integers 1 ~ 99)

Local to each program.





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6. Subroutine

Frequently repeated steps in a program can be expressed as subroutines in order to simplify the entire application program. These subroutines are individually usable in each program. (Nesting: Max 15)

Command	Operand 1
EXSR	Subroutine No. (1 ~ 64 Integers, or Variables)

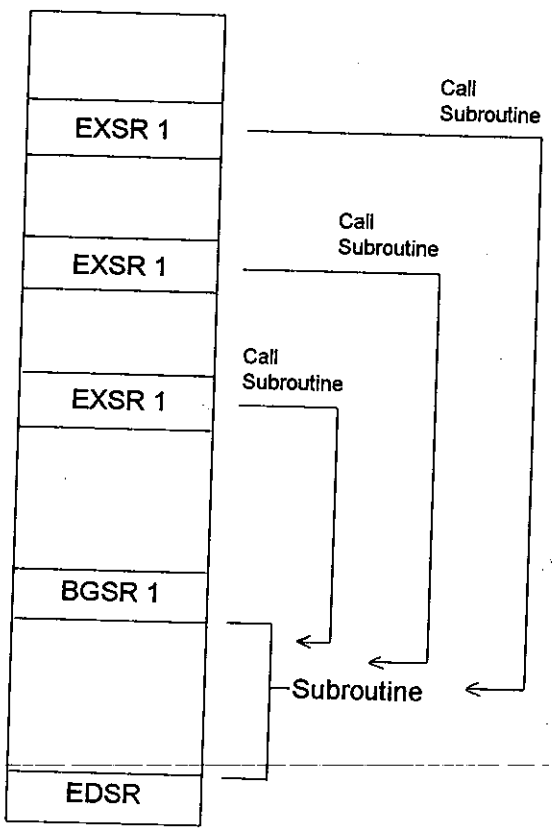
Execute subroutine command

Command	Operand 1
BGSR	Subroutine No. (1 ~ 64 Integers)

Begin subroutine command

Command	Operand 1
EDSR	--------

End subroutine command



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7. Axis Designation

(1) There are two ways to indicate more than one axis using Super SEL Controller: axis No. and axis pattern.

Type A Model

Although four (4) axes are indicated in the table, it is possible to change the figures through parameters.

Axis No.	Default Notation
1	X
2	Y
3	Z
4	θ

Type B Model

Although four (4) axes are indicated in the table, it is possible to change the figures through parameters.

Axis No.	Default Notation
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8

Axis No. is used to designate one axis out of many axes.

Commands to designate Axis No. are:
BASE, PPUT, PGET

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(2) Axis Selection

Selection of an Axis is specified by either "1" or "0"

Type A

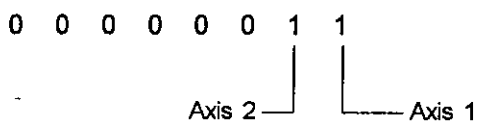
Axis No.	θ	Z	Y	X
Used	1	1	1	1
Not Used	0	0	0	0

Type B

Axis No.	8	7	6	5	4	3	2	1
Used	1	1	1	1	1	1	1	1
Not Used	0	0	0	0	0	0	0	0

For Example

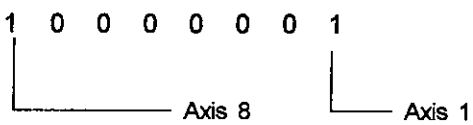
If Axis 1 and Axis 2 are in use, then this is signified by...



The zeroes before the 1 are unnecessary. The simplified form is 11, without leading zeroes.

For Example

If Axis 1 and Axis 8 are in use, then this is signified by...



In this example, the zeroes *are* necessary in order to indicate the position of Axis 8.

Axis pattern is used to designate more than one axis at the same time.

Axis pattern designation command
OFST, GRP, SVON, SVOF, HOME, JFWN, JFWF, JBWN, JBWF, STOP, PTST, PRED

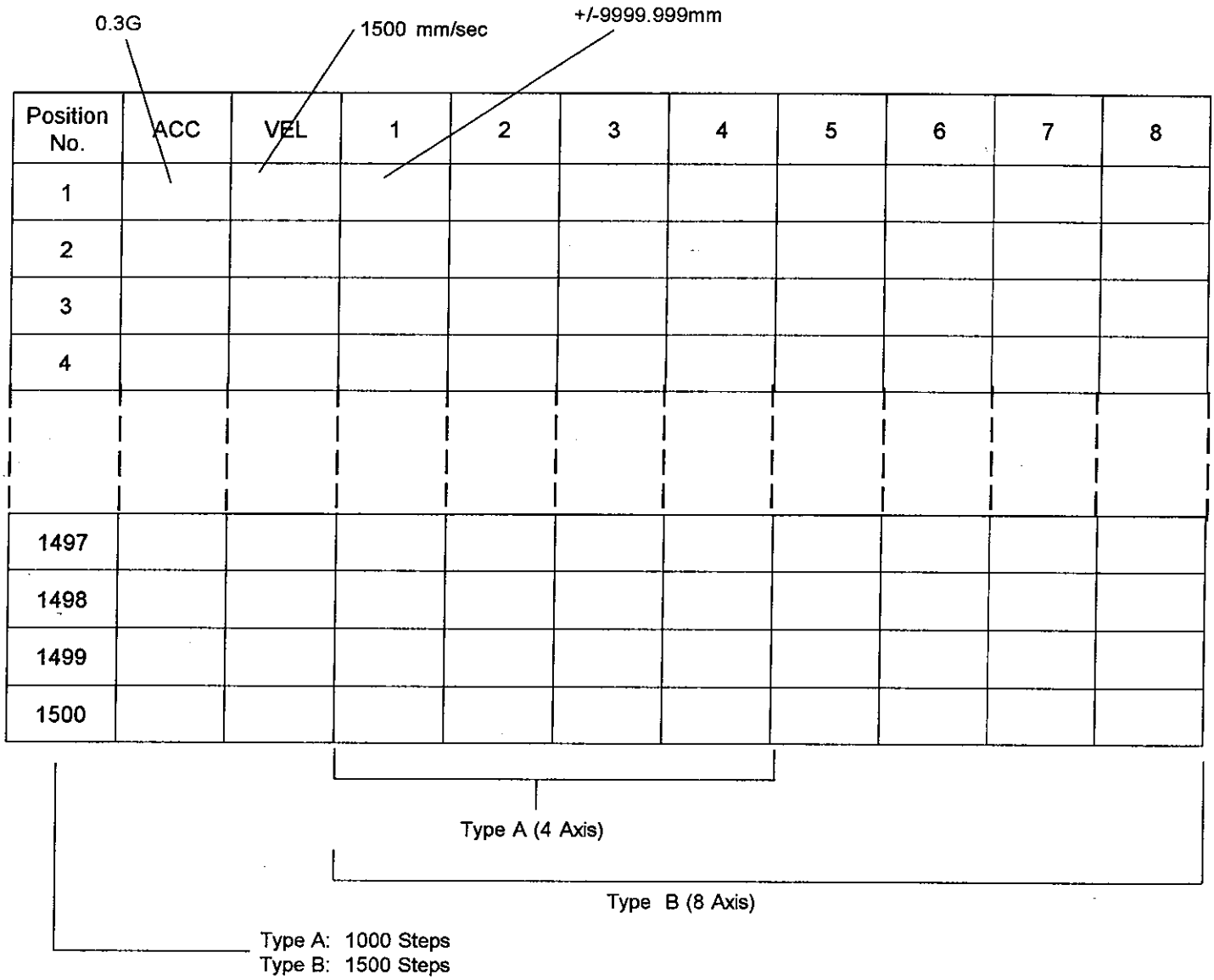
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Part 2 - Super SEL Language Structure

The Super SEL programming consists of a Position and Application Program (command) section.

1. Position Program

In the Position Section, we have Coordinates, Velocity, Acceleration, and Variables

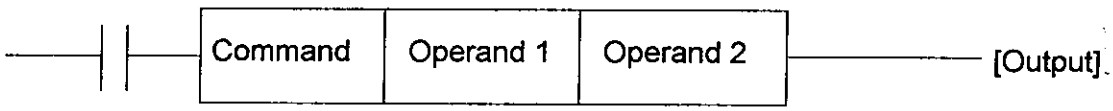


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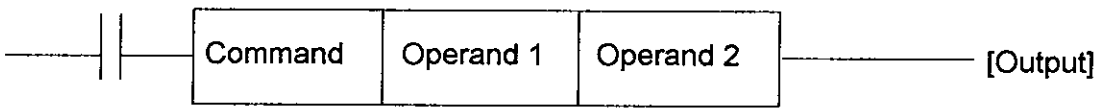
2. Application Program (Commands)

AND/OR Condition	Input Condition I/O Flag	Command	Operand 1	Operand 2	Output Port Flag, Output

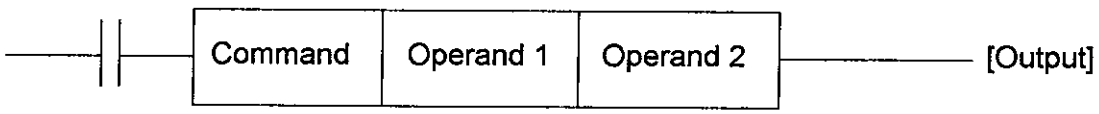
Ladder Diagram Display



The conditions before the commands are equivalent to "if ~ then" statements in BASIC language.



1. Carry out a command when an input condition is established, and turn the output port ON, if output is designated. When not established, go on to the next step regardless of the next command (ex. WTON, WTOF). The designated output port remains the same , however it needs to be monitored carefully.
2. If there is no conditioning set up, carry out command unconditionally.
3. If condition is used as "negative condition", then place an "N" (NOT).
4. Input/output port & flag can be used for condition.



Output is set based on the result of the command execution.

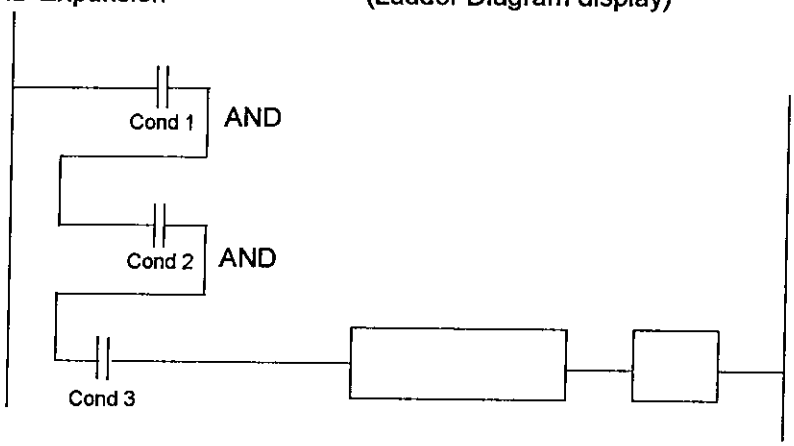
1. Actuators motion control commands: becomes OFF immediately after the command starts to be executed, and becomes ON when the command is completed.
   Computation commands: when the result becomes a certain value, it turns ON, and it stays OFF otherwise.
2. Output port and flag can be used for output section.

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Expansion Condition

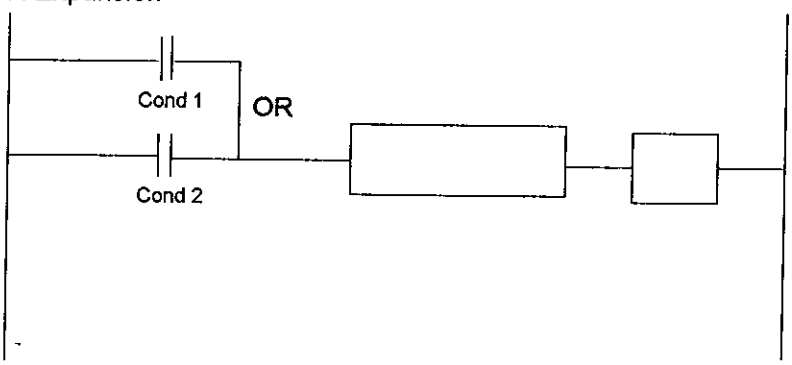
It is possible to combine conditions to make more complicated conditions as follows:

AND Expansion (Ladder Diagram display) (Super SEL Language)



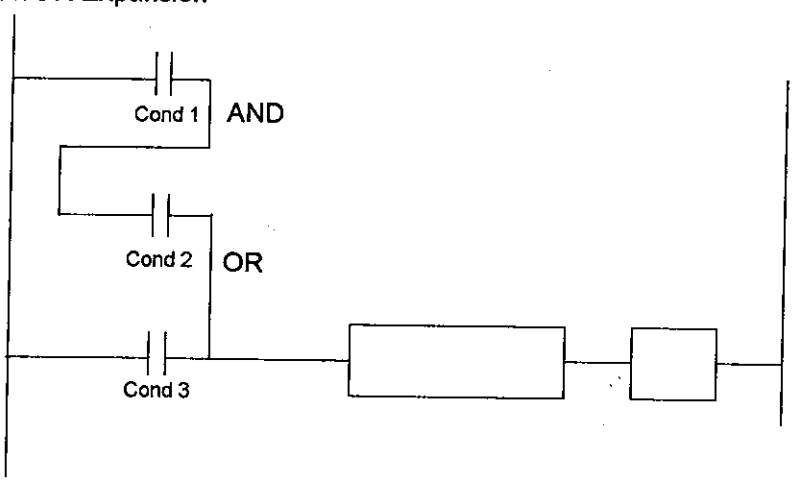
Expansion	Input	Commands			Output
		Command	Operand1	Operand2	
	Condition1				
AND	Condition 2				
AND	Condition 3	Command	Operand1	Operand2	

OR Expansion



Expansion	Input	Commands			Ouptput
		Command	Operand1	Operand2	
	Condition 1				
OR	Condition 2	Command	Operand 1	Operand 2	

AND/OR Expansion



Expansion	Input	Commands			Output
		Command	Operand1	Operand2	
	Condition1				
AND	Condition 2				
OR	Condition 3	Command	Operand1	Operand2	

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Part 3 - Command

1. Command Table

Category	Function	Command	Reference Page
Actuator Control Designation	Set Velocity	VEL	89
	Set Acceleration	ACC	89
	Velocity Scale Factor	OVRD	90
	Designate Offset	OFST	90
	Designate Axis Assignment	*GRP	91
	Set Arc Degrees	DEG	91
	Designate Axis Temp. Stop Port	HOLD	92
	Designate Axis Stop Port	CANC	93
	Designate Axis Base	*BASE	93
Actuator Control Commands	Designated Axis Servo ON	SVON	94
	Designated Axis Servo OFF	SVOF	94
	Designated Axis Execute Homing	HOME	95
	Designated Group Axes Point Move	MOVP	95
	Designated Group Axes Point Move	MOVL	96
	Circular Movement	CIR	96
	Arc Movement	ARC	97
	PATH Movement	PATH	97
	Designated Axis Jog Forward while ON	*JFWN	98
	Designated Axis Jog Forward while OFF	*JFWF	98
	Designated Axis Jog Backward while ON	*JBWN	99
	Designated Axis Jog Backward while OFF	*JBWF	99
	Stop Movement of Designated Axis	*STOP	100
	Arch Motion	ARCH	100
	Arch Motion Trigger	ATRG	101
Input/Output Flag Operation Commands	Designated Output Port Flag ON	BTON	102
	Designated Output Port Flag OFF	BTOF	102
	Designated Output Port Flag Reverse	BTNT	103
	Designated Output Port Flag ON Waiting	WTON	103
	Designated Output Port Flag OFF Waiting	WTOF	104
	Reading Binary Value	IN	104
	Read BCD Value	INB	105
	Binary Output	OUT	105
	BCD Output	OUTB	106
Timer Commands	Wait Timer (Sec)	TIMW	107
	Reset Task Timer	TIMC	107

*These commands are not supported by the tabletop type, TT-300.

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Category	Function	Command	Reference Page
Program Control Commands	Program End	EXIT	108
	Start Task	EXPG	108
	Abort Task	ABPG	109
Tag Command Designation	Jump	GOTO	110
	Designate Tag for Jump	TAG	110
Subroutine Control Designation Commands	Start Designated Subroutine	BGSR	111
	End Subroutine	EDSR	111
	Call (Execute) Subroutine	EXSR	112
Calculation Commands	Assign	LET	113
	Add	ADD	113
	Subtract	SUB	114
	Multiply	MULT	114
	Divide	DIV	115
	Module	MOD	115
	Clear Desig. Variable Range	CLR	116
Function Computation Commands	Sine	*SIN	117
	Cosine	*COS	117
	Tangent	*TAN	118
	Arctangent	*ATN	118
	Square Root	*SQR	119
Logic Commands	Bitwise AND	AND	120
	Bitwise OR	OR	120
	Bitwise EXOR	EOR	121
Comparison Commands	Equal	CMPE	122
	Greater Than	CMPG	122
	Less Than	CMPL	123
	Equal	**CPEQ	124
	Unequal	**CPNE	124
	Greater Than	**CPGT	125
	Equal or Greater Than	**CPGE	125
	Equal or Less Than	**CPLE	126
	Less Than	**CPLT	126
Point Data Operation Commands	Assign Point Data to Designated Axis	PPUT	127
	Read Point Data of Designated Axis	PGET	127
	Check For Data In Designated Axis	PTST	128
	Copy Point Data	PCPY	128
	Clear Point Data	PCLR	129
	Read Designated Point Data	PRED	129
	Point Data Range	PSIZ	130
	Assign Velocity Data	**PVEL	130
	Assign Acceleration Data	**PACC	131

*These commands are not supported by the tabletop type, TT-300.

**These commands will be supported from August, 1994.

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Commands

2-1 Actuator Control Designations

VEL (Velocity)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	VEL	Velocity		

[Function] The setup velocity of the Actuator is in mm/sec. Maximum velocity varies and depends on the model of actuator.

Note 1 Variables smaller than 1 cannot be used and would cause an error.
Note 2 The minimum velocity is 1mm/sec.

[Example] VEL 1000
1000mm/sec (Velocity Setting)

```
VEL   1000
MOVP  1
MOVP  2
VEL   500
MOVP  3
MOVP  4
```

This velocity is 1000mm/sec between these two points.

This velocity is 500mm/sec between these two points.

ACC (Acceleration)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	ACC	Acceleration		

[Function] The setup acceleration of the actuator is expressed in G (Gravity). Maximum acceleration varies and depends on the model of actuator and payload. The rated acceleration is 0.3 G. The actuator moves at the rated acceleration 0.3 G when acceleration is not set by ACC command.

[Example]

ACC 0.3
0.3G (Acceleration setting at 0.3G)

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OVRD (Override)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	OVRD	Velocity Ratio Value		

[Function] This command decreases the velocity according to the designated ratio. (Velocity coefficient setting). The range of the ratio settings is from 1 ~ 100%.

Note The minimum value for the velocity is 1mm/sec.

[Example]

```
VEL     100     100mm/sec setting
OVRD    50      100mm/sec is reduced by 50% and the actual velocity becomes 50mm/sec.
```

OFST (Offset)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	OFST	Axis Pattern	Offset Value	

[Function] During movement, this command adds an offset value to the specified Axes. Resolution is 0.001mm. Offset values can be negative numbers within the operation range.

[Example]

```
OFST    10000011        50.000
```

50mm is added to the movement amount of Axis 1, Axis 2, and Axis 8.

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GRP (Grouping of Axes)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	GFP	Axis Pattern		

[Function] This command causes movement through the position data of the designated axis pattern.

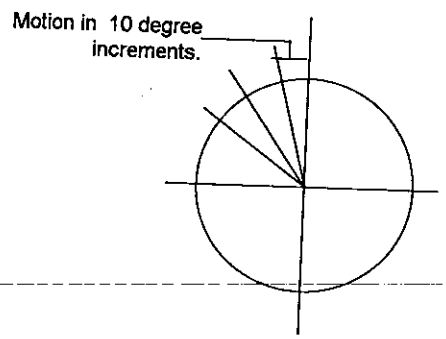
[Example] GRP 00000011
Data from axis 1 and 2 is taken out and executed.

DEG (Degree Setting)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	DEG	Angle		

[Function] This command sets up the motion increments for use with CIR (Circular Movement) and ARC (Arc Movement) commands. By performing CIR and ARC commands, passing points are calculated throuth dividing a circle by the set increment. When increments are set small, the circular movement is accurate, however, when they are too small, the speed becomes too slow. When CIR and ARC commands are performed without setting increments, the motion increments of the actuator will be 15 degrees.

[Example] DEG 10



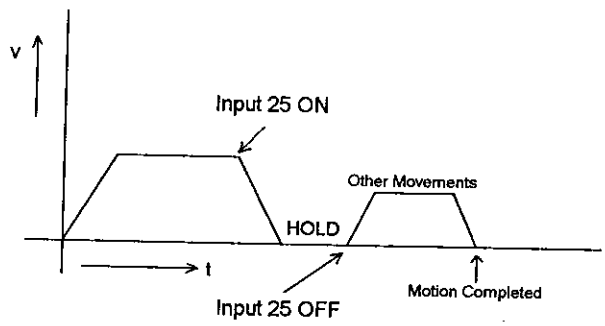
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HOLD (Hold : Axis Temporary Stop)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	HOLD	Input Port		

[Function] If the actuator is moving and the designated Input Port turns ON, then velocity decreases until all motion stop. When the Input Port turns OFF, then motion begins again. The HOLD command is only available to the axes in the designated task (program), and not available to axes in other programs.

[Example] HOLD 25 (When Input Port 25 turns ON, velocity decreases until all motion stops.)



Note 1: When HOLD designation is used during PATH motion designation, the actuator stops at the next position . During the execution of straight line motion designations such as MOVL, MOVP, and circular/arc designa tions such asCIR, ARC, it stops immediately.

Note 2: In IA system , unique PLC is used for homing. It locks the servo to detect the stroke edge at homing. If the HOLD disignation is activated at the end of homing, servo run-away = alarm could occur in the programmed motion thereafter. Therefore, HOLD designation should be designated after HOME command. If HOLD designation needs to be designated from the beginning, a home area detection switch.(an area limit switch) must be installed so that the HOLD designation will not be carried out in this area.

Note 3: HOLD and CANC can not be used in the same program. (If both are written in the same program, the latter command becomes effective.)

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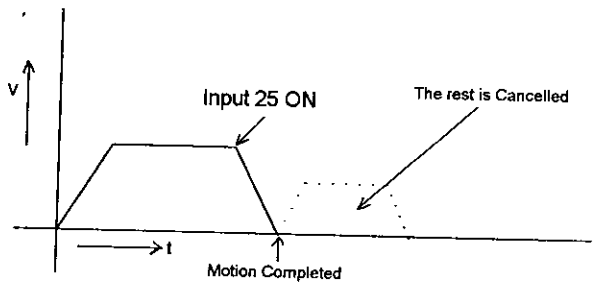
CANC (Cancel : Cancelling the next steps after axis stop motion)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CANC	Input Port		

[Function] If the actuator is moving and the designated input port turns ON, then velocity decreases until all motion stops. Any other programmed motion thereafter is cancelled and not executed.

Note 1: HOLD and CANC can not be used in the same program. (If both are written in the same program, the latter command becomes effective.)

[Example]



Note 2: During PATH motion designation, the actuator moves to the next position. Any other programmed motion thereafter is cancelled and not executed.

BASE (Axis Base Designation) (This command is not supported by the tabletop type TT-300.)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	BASE	Axis No.		

[Function] Count axes from the designated axis as the first axis.

[Example]

```
HOME  11    Axis No.1 and Axis No.2 perform homing.
BASE   3    Count Axis No.3 as the first axis
HOME  11    Axis No.3 and Axis No.4 perform homing
            After homing, Axis No.3~8 move by the designation of Axis No.1~6 (axis pattern and
            position data)
```

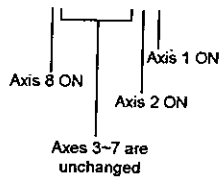

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SVON (Servo ON)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	SVON	Axis Pattern		

[Function] This commands turns ON the Servos of the designated axes.

[Example] SVON 10000011 (Type B Controller)



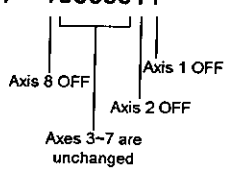
The servo already turned on by the designated axis stays ON, and will not turned OFF by 0.

SVOF (Servo OFF)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	SVOF	Axis Pattern		

[Function] This commands turns OFF the Servos of the designated axes.

[Example] SVOF 10000011 (Type B Controller)



The servo already turned off by the designated axis stays OFF, and will not turned ON by 0.

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HOME (Return Home)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	HOME	Axis Pattern		OPTIONAL

[Function] This command executes homing of the designated axes. Servos turn ON automatically.

[Example] HOME 10000011 Axis 1, 2, and 8 axes execute homing. (Type B Controller).

MOVP (Point-to-point Position Data)

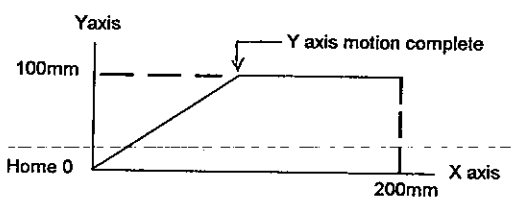
Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	MOVP	Position No.		OPTIONAL

[Function] This command moves the actuator to the designated position number from point to point without interpolation.

[Example] MOVP 100 Moves to Position No. 100 (point to point)

MOVP *1 If the variable 1 is 150, then the actuator moves to position number 150 (point to point)

Position No.	1	2	3
1			
2			
3			
thru			
100	100.00	100.00	xxx.xx
thru			
150	200.00	200.00	xxx.xx
thru			



When moving from Home position to another position (x-axis: 200mm, y-axis100mm), each axis moves at its own designated speed.

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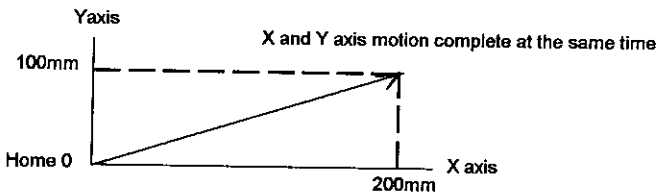
MOVL (Position Data with Interpolation)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	MOVL	Position No. Variable No.		OPTIONAL

[Function] Moves the actuator to the designated point along using interpolation (not point to point).

[Example] MOVL 100 Move to position No. 100 using interpolation.

MOVL *1 If variable 1 is 150, then the actuator moves to position 150 using interpolation.

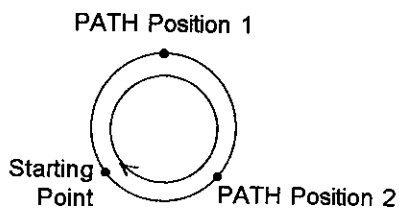


When moving from Home Position to another position (x-axis: 200mm, y-axis100mm), x-axis and y-axis motion are combined, and the tip of the combined motion moves at the designated speed. It makes a straight line.

CIR (Circular Movement)

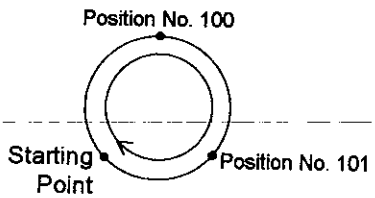
Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CIR	Passing Through Position 1	Passing Through Position 2	OPTIONAL

[Function] Three points determine circular motion. The starting point, Position 1, and Position 2. The rotation direction is determined by the position data. The following diagram shows CW (clockwise) motion but this can be changed to CCW (counterclockwise) by exchanging positions 1 and 2)



Note: This command is available for the specified orthogonal plane (Automatically selected by position data. Generally the XY plane is selected.)
When this command is used along with the OFST command, please pay extra attention. (The motion must be checked.)

[Example] CIR 100 101
The following diagram shows circular motion passing through position Numbers 100 and 101.

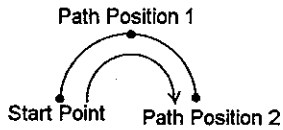


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ARC (Arc Movement)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	ARC	Passing Through Position 1	Passing Through Position 2	OPTIONAL

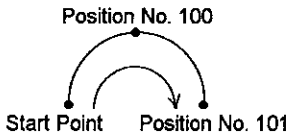
[Function] Circular motion that starts from the present point and which passes through position No. 1 and 2 is called ARC motion.



Note: This command is available for the specified orthogonal plane (Automatically selected by position data. Generally the XY plane is selected.)

[Example] ARC 100 101

The following diagram shows Arc motion passing through position numbers 100 and 101.



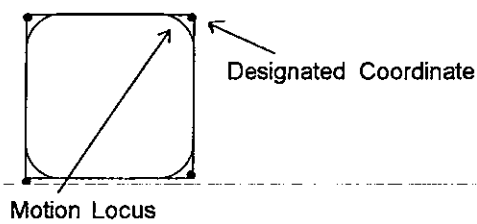
PATH (Path Movement)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	PATH	Starting Position	Ending Position	OPTIONAL

[Function] Actuator moves continuously between the designated starting point and the finishing point. the locus is a B-spline-type, free-form curve which passes through the inside of the designated coordinate. It is possible for the actuator to move close to the designated coordinate by increasing the accelera tion. However, when it exceeds the maximum acceleration, an error will occur.

Note 1: If Hold designation is entered during PATH command, actuator stops at the next position, and later it continues to perform PATH motion without any problem except less smoothness at joint section. When the distance between the position data is too long, actuator will not stop immediately. When the actuator needs to be stopped immediately by HOLD, the distances between the position data must be short. If CANC is designated during PATH execution, the actuator moves to the next position (same as HOLD), ignores the rest of the PATH positions, and moves on to the next step.

Note 2: Three dimensional motion can be performed by this command.



[Example] PATH 100 120
Moves to position 100 ~ 120, Continuously.

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JFWN (Jog Forward ON) (This command is not supported by the tabletop type, TT-300.)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	JFWN	Axis Pattern	Input Port, Flag	OPTIONAL

[Function] When designated input port or flag (global flag) is ON, then there is forward movement.

Note: HOLD is not available for this command.

[Example] JFWN 10000011 25 When input port 25 is ON, then axis 1 and axis 2 and axis 8 move forward.

JFWF (Jog Forward OFF) (This command is not supported by the tabletop type, TT-300.)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	JFWF	Axis Pattern	Input Port, Flag	OPTIONAL

[Function] When designated input port or flag (global flag)is OFF, then move forward.

Note: HOLD is not available for this command.

[Example] JFWF 10000011 25 When input 25 is OFF, then axis 1, axis 2, and axis 8 move forward.

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JBWN (Jog Backward ON) (This command is not supported by the tabletop type, TT-300.)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	JBWN	Axis Pattern	Input Port, Flag	OPTIONAL

[Function] When the designated input port or flag (global flag) is ON, then move backward.

Note: HOLD is not available for this command.

[Example] JBWN 10000011 25 When input port 25 is ON, then axis 1, axis 2 and axis 8 move backward.

JBWF (Jog Backward OFF) (This command is not supported by the tabletop type, TT-300.)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	JBWF	Axis Pattern	Input Port, Flag	OPTIONAL

[Function] When input port or flag (global flag) is OFF, then move backward.

Note: HOLD is not available for this command.

[Example] JBWF 10000011 25 When input port 25 is OFF, then axis 1, axis 2, and axis 8 move backward.

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STOP (Stop Motion) (This command is not supported by the tabletop type, TT-300.)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	STOP	Axis Pattern		

[Function] Stop motion of individual axes in main program and all tasks.

[Example] STOP 10000011 Stop motion in axis 1, axis 2, and axis 8.

ARCH (Arch Motion)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	ARCH	Start Position No.	End Position No.	OPTIONAL

[Function] In order to accomplish faster pick & place motion in the air and shorten the tact time, the actuator performes an arch motion movement by changing the position ratio of the axis movement before it reaches the intermediate position.

[Example] Refer to ATRG command.

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ATRG (Arch Motion Trigger)

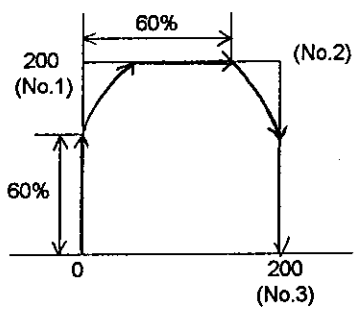
Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	ATRG	Position ratio (%)		

[Function] Set the axis movement position ratio for ARCH command execution.

Note: Set the position ratio at 50 ~ 60% or higher. This depends on the distance of movement. When the ratio is set too low, a "C2" alarm may occur.

[Example] Application program

```
HOME    11
VEL     100
ATRG    60
ACC     0.3
ARCH    1  3
```



Position Data	X Axis	Y Axis
No. 1	200.000	xxx.xxx
No. 2	xxx.xxx	200.000
No. 3	0.00	xxx.xxx

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2-3 I/O, Flag Operation Commands

BTON (Output Port, Flag ON)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	BTON	Output Port, Flag	Output Port, Flag	

[Function] Turns ON the designated output port or flag, or the range of ports or flags.

[Example]

```
BTON  300          Output Port 300 turns ON
BTON  300  310     Ouput Port 300 ~ 310 turns ON
BTON  600          Flag 600 turns ON
BTON  600  610     Flag 600 ~ 610 turns ON
```

BTOF (Output Port, Flag OFF)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	BTOF	Output Port, Flag	Output Port, Flag	

[Function] Turns OFF the designated output port or flag, or the range of ports or flags.

[Example]

```
BTOF  300          Output Port 300 turns OFF
BTOF  300  310     Output Port 300 ~ 310 turns OFF
BTOF  600          Flag 600 turns OFF
BTOF  600  610     Flag 600 ~ 610 turns OFF
```


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BTNT (Output Port, Flag Invert)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	BTNT	Output Port, Flag	Output Port, Flag	

[Function] Inverts the designated ouput port or flag, or range of ports or flags. When the command is performed, ON changes to OFF and OFF changes to ON.

[Example]

```
BTNT  300          Reverse Output Port 300
BTNT  300  310     Reverse Output Port 300 ~ 310
BTNT  600          Reverse Flag 600
BTNT  600  610     Reverse Flag 600 ~ 610
```

WTON (Waiting Input/Ouput Port, Flag ON)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Post (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	WTON	Input Port, Flag	Time Out	

[Function] Wait until the designated I/O port or flag turns ON. Do not go to the next step. I/O waiting can be cut off at the time that was set by the time out setting. The Time Out setting is in units of seconds (0.01 ~ 99 sec). When the Time Out is set, the output section turns ON. When the Time Out is not set, the output section is not available.

Note: Local Flag cannot be used for this output section.

[Example]

```
WTON  25          Wait until Input Port 25 turns ON
WTON  25   10     Wait until Input Port 25 turns ON. After 10 seconds, it becomes time out, then
                  go on to the next step.
```


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WTOF (Waiting for Input/Ouput Port, Flag OFF)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Post (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	WTOF	Input Port, Flag	Time Out	

[Function] Wait until the designated I/O port or flag turns OFF. Do not go on to the next step. I/O waiting can be cut off at the time that was set by the time out setting. The time out setting is in units of seconds (0.01 ~ 99 sec). When the Time Out is set, the output section turns ON. When the Time Out is not set, the output section is not available.

Note: Local Flag cannot be used for this output section.

[Example] WTOF 25 Wait until Input Port 25 turns OFF

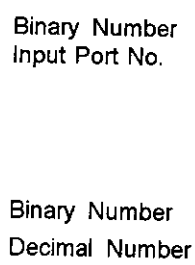
WTOF 25 10 Wait until Input Port 25 turns OFF. After 10 seconds, it becomes time out, then go on to the next step.

IN (Binary Numbers Input/Output, Read in)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	IN	Start Input/Output Port, Flag	Finish Input/Output Port, Flag	

[Function] Read the value as a binary number based on the designated I/O port or flag, then load the Variable Register 99 with the decimal value that was read.

Note: The maximum port range of an input is 32 consecutive bits.



[Example] IN 16 23

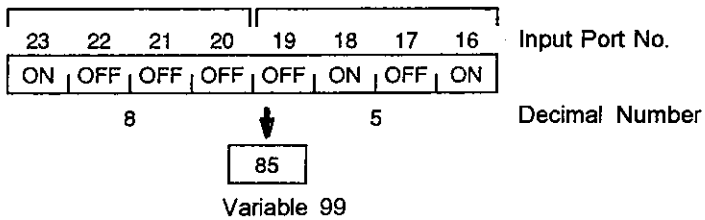
Read the binary values based on input ports 16 ~ 23. Load Variable Register 99 with the value it.

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INB (BCD Input/Ouput, Read in)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	INB	Input Port	# of BCD Decimal Characters	

[Function] Read BCD value from designated input port, then load Variable Register 99 with the BCD value read.



Note 1: The BCD value is read as 4 x n. (Every four input ports are read as one set) (n : # of the decimal characters in Operand 2)

Note 2: The maximum figure number of inputs to be read in is 8 digits, or the 32 consecutive input ports.

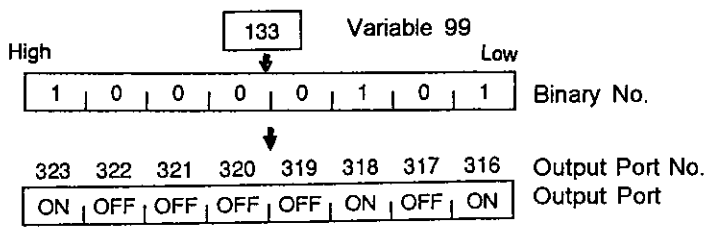
[Example] INB 16 2

Read in 2 decimal digits (of 4 inputs each) starting from Input Port #16.

OUT (Binary Number Output)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	OUT	Start Output Port, Flag	Finish Output Port, Flag	

[Function] Ouput the binary value of Variable Register 99 to the designated output port or flag (range).



Note: The maximum port range of an output is 32 consecutive bits.

[Example] OUT 316 323

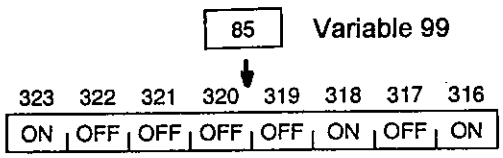
Ouput the binary value of Variable Register 99 to output ports 316 ~ 323.

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OUTB (BCD Output)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	OUTB	Start Output Port, Flag	# of BCD Decimal Characters	

[Function] Output the BCD value of the Variable Register 99 to the designated output port or flag by BCD value.



Note 1: The BCD value is read as 4 x n. (Every four output ports are read as one set.) (n : # of the decimal characters in Operand 2)

Note 2: The maximum figure number of outputs to be read is 8 digits, or the 32 consecutive output ports.

[Example] OUTB 316 2

Output 2 decimal digits (of 4 outputs each) starting from Output Port #316.

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2-4 Timer Command

TIMW (Timer Command)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	TIMW	Time		OPTIONAL

[Function] Waiting according to time set. The time set unit is expressed in seconds (0.01 ~ 9999 sec)

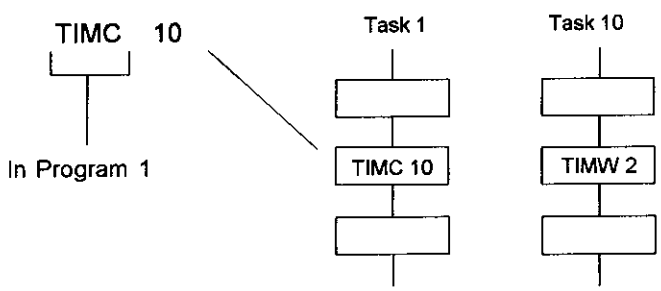
[Example] TIMW 1.5 Wait for 1.5 seconds

TIMC (Timer Cancel)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	TIMC	Program No.		

[Function] Cancel (set) the timer of the other concurrent task.

[Example]



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2-5 Program Control Commands

EXIT (Program Exit)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	EXIT			

[Function] Finish program

Note: The status at the program completion

- Output Port Valid
- Local Flag Invalid
- Local Variable Invalid
- Current Value Valid
- Global Flag Valid
- Global Variable Valid

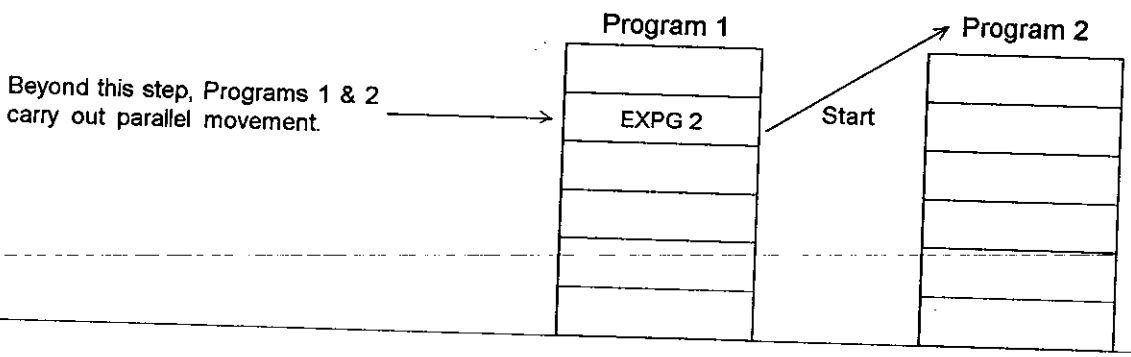
[Example] EXIT Program Finish

EXPG (Program exit and start another program)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	EXPG	Program No.		OPTIONAL

[Function] Start another program, conduct parallel processing (other programs). When the parallel processing started, output the output port, flag.

[Example] EXPG 2 Start program No. 2, then conduct parallel processing.



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ABPG (Abandon Other Program)

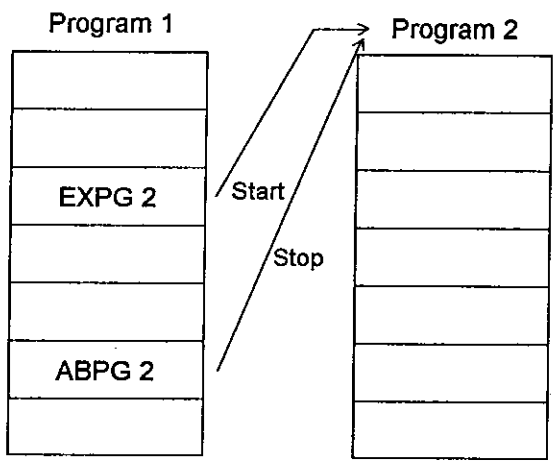
Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	ABPG	Program No.		OPTIONAL

[Function] Make the other program actually in practice end. When the program ended, output the output port, flag.

Note: When ABPG is executed during a motion command or Timer execution, the program ends after completing the movement or the Timer command.

[Example] ABPG 2

Stops Program No.2, which is actually being executed in parallel to Program 1.



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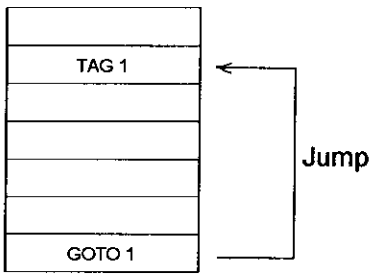
2-6 Turnout Commands

GOTO (Jump)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	GOTO	Tag No.		

[Function] Go to the designated step by Tag No.
(Within the same program only)

[Example] Go to Tag 1 Step.

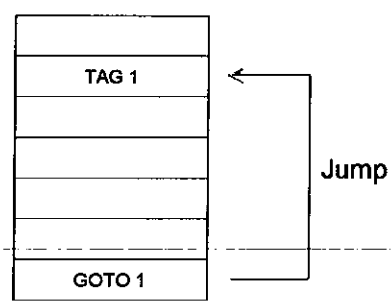


TAG (Tag Designation)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Post (Output Port, Flag)
		Commands	Operand 1	Operand 2	
		TAG	Tag No.		

[Function] Designate the jumping place of the GOTO Command via Tag No.
(Within the same program only)

[Example] Prepare Tag 1 as the jumping place for GOTO 1.



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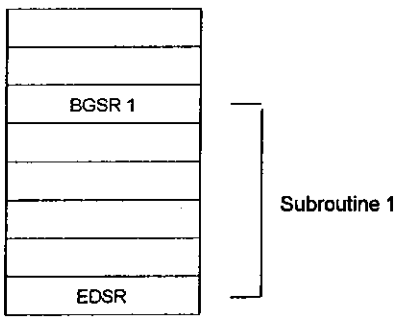
2-7 Subroutine Control Commands

BGSR (Begin Subroutine)

Expansion Condition (AND/OR)	Input Condition (I/O, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
		BGSR	Subroutine No.		

[Function] Declare subroutine starting

[Example] Declare subroutine starting

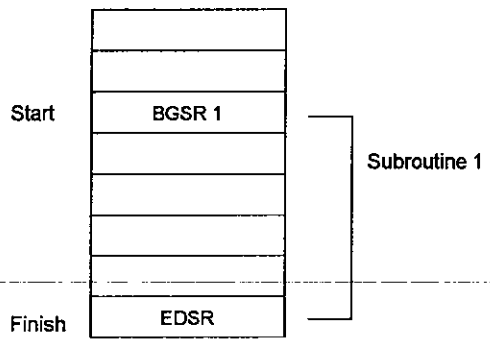


EDSR (End Subroutine)

Expansion Condition (AND/OR)	Input Condition (I/O, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
		EDSR			

[Function] Declare subroutine complete

[Example] Declare Subroutine complete. EDSR is always used as the very last step.



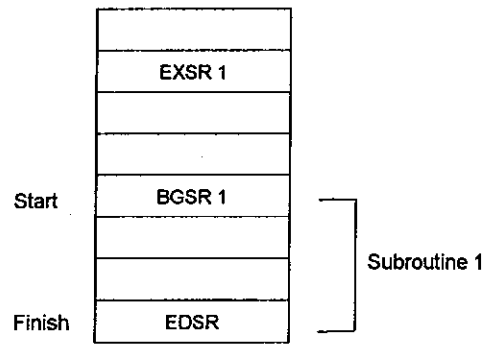
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EXSR (Execute Subroutine)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	EXSR	Subroutine No.		

[Function] Perform the designated numbered subroutine.
(Within the same program only)

[Example] Perform subroutine 1



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2-8 Calculation Commands

LET (Assignment)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	LET	Variable No.	Data, Variable No.	OPTIONAL

[Function] Substitute variable for data. When Operand 1 is 0, then the output section turns ON.

[Example] LET 1 10 Assign 10 to Variable Register 1.

LET 1 *2 Assign variable 2 to variable Register 1.

ADD (Addition)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	ADD	Variable No.	Data, Variable No.	OPTIONAL

[Function] Add the variable content in Operand 1 and the data in Operand 2, then load the Operand 1 variable with it. Add the variable content in Operand 1 and the variable content in Operand 2, then load the Operand 1 variable with it. If there is a post instruction (flag, output port), it turns ON when the computing result becomes zero.

[Example] ADD 1 10 When the variable content in Operand 1 is 10, 10 (variable 1 contents in Operand 1) + 10 (data in Operand 2) equals 20, then after performing the command, the varaible 1 becomes 20.

ADD 1 *2 When variable 1 content in Operand 1 and variable 2 content in Operand 2 are both 10, then 10 (variable 1 content in Operand 1) + 10 (variable 2 content in Operand 2) equals 20, then after performing the command, variable 1 becomes 20.

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SUB (Subtraction)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	SUB	Variable No.	Data, Variable No.	OPTIONAL

[Function] Subtract the data in Operand 2 from the variable content in Operand 1, then load the Operand 1 variable with it. Subtract the variable content in Operand 2 from the variable content in Operand 1, then load the Operand 1 variable with it. If there is a post instruction (flag, output port), it turns ON when the computing result becomes zero.

[Example] SUB 1 10 When variable 1 content in Operand 1 is 20, 20 (variable 1 content in Operand 1) -10 (data in Operand 2) equals 10. After performing the command, the variable becomes 10.

SUB 1 *2 When variable 1 content in Operand 1 is 20 and variable 2 content in Operand 2 is 10, then 20 (variable 1 content in Operand 1) - 10 (variable 2 content in Operand 2) equals 10. After performing the command, the variable 1 becomes 10.

MULT (Multiplication)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	MULT	Variable No.	Data, Variable No.	OPTIONAL

[Function] Multiply the variable content in Operand 1 by the data in Operand 2, then load the Operand 1 variable with it. Multiply the variable content in Operand 1 by the variable contents in Operand 2, then load the Operand 1 variable with it. If there is a post instruction (flag, output port), it turns ON when the computing result is zero.

[Example] MULT 1 10 When the variable 1 content in Operand 1 is 10, 10 (variable 1 content in Operand 1) x 10 (data in Operand 2) equals 100, then after performing the command, the variable 1 becomes 100.

MULT 1 *2 When variable 1 content in Operand 1 and variable 2 content in Opernad 2 are both 10, 10 (variable 1 content in Operand 1) x 10 (variable 2 content in Operand 2) = 100, then after performing the command, the variable 1 becomes 100.

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DIV (Division)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	DIV	Variable No.	Data, Variable No.	OPTIONAL

[Function] Divide the variable content in Operand 1 by the data in Operand 2, then load the Operand 1 variable with it. Divide the variable content in Operand 1 by the variable content in Operand 2, then load the Operand 1 variable with it. If there is a post instruction (flag, output port) at output area, it turns ON when the computing result becomes zero.

[Example]

DIV	1	5	When variable 1 in Operand 1 is 10, 10 (variable 1 content in Operand 1) divided by 5 (data in Operand 2) equals 2. After performing the command, the variable 1 becomes 2.
DIV	1	*2	When the variable 1 content in Operand 1 is 10 and variable 2 content in Operand 2 is 5, 10 (variable 1 content in Operand 1) divided by 5 (variable *2 content in Operand 2) equals 2. After performing the command, the variable 1 becomes 2.

MOD (Module)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	MOD	Variable No.	Data, Variable No.	OPTIONAL

[Function] Divide the variable content in Operand 1 by the data in Operand 2, then load the Operand 1 variable with the remainder. Divide the variable content in Operand 1 by the variable content in Operand 2, then load the Operand 1 variable with the remainder. If there is an instruction (flag, output port) at output area, it turns ON when the computing result becomes zero.

Note This command only applies to integers.

[Example]

MOD	1	3	When the Variable 1 content in Operand 1 is 10, 10 (variable 1 content in Operand 1) divided by 3 (data in Operand 2) = 3 and 1 over. After performing the command, the variable 1 becomes 1.
MOD	1	*2	When variable 1 in Opernad 1 is 10 and variable 2 content in Operand 2 is 3, 10 (variable 1 content in Operand 1) divded by 3 (variable 2 content in Operand 2) is 3 and 1 over. After performing the command, the variable 1 becomes 1.

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CLR (Clear Variables)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CLR	Variable No.	Variable No.	

[Function] Clear the designated range of variables to zero.
(Be sure to input a variable No. in Operand 2. When designate Variable 1, be sure to input 1 in Operand 1 and Operand 2.

[Example]

CLR	1	1	Clear the variable 1 to zero.
CLR	1	10	Clear the variables 1 ~ 10 to zero.

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2-9 Functional Commands

SIN (Sine) (This command is not supported by the tabletop type, TT-300.)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	SIN	Variable No.	Data, Variable No.	OPTIONAL

[Function] Load the variable in Operand 1 with SIN data in Operand 2. Load the variable in Operand 1 with SIN variable content in Operand 2. If there is an instruction (flag, output port) at output section, it turns ON when the computing result is zero. (Be sure to input a real number variable 100~199 in Operand 1. The same for Operand 2. Data in Operand 2 must be input in radian, instead of angle (degrees). The maximum of 7 digit floating point numbers can be input.)

[Example] SIN 100 0.988031 SIN 0.988031 (radian) is 0.5, then after performing the command, the variable 100 becomes 0.5

SIN 100 *101 When the variable*101 content in Operand 2 is 0.988031 (radian), then SIN 0.988031 (radian) becomes 0.5, then after performing the command the variable 100 becomes 0.5

*180° = Pi (rad), 90° = 1/2 Pi (rad)
Angle x Pi / 180 = radian

COS (Cosine) (This command is not supported by the tabletop type, TT-300.)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	COS	Variable No.	Data, Variable No.	OPTIONAL

[Function] Load the variable in Operand 1 with COS data in Operand 2. Load the variable in Operand 1 with COS variable content in Operand 2. If there is an instruction (flag, output port) at the output area, it turns ON when the computing result is zero. (Be sure to input a real number variable 100~199 in Operand 1. Same for Operand 2. Data in Operand 2 must be input in radian, instead of angle (degrees). The maximum of 7 digit floating point numbers can be input.)

[Example] COS 100 1.047197 COS 1.047197 (radian) is 0.5, then after performing the command, the variable 100 becomes 0.5

COS 100 *101 When the variable *101 in Opernad 2 is 1.047197 (radian), COS 1.047197 (radian) becomes 0.5, then after performing the command, the variable 100 becomes 0.5

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TAN (Tangent) (This command is not supported by the tabletop type, TT-300.)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	TAN	Variable No.	Data, Variable No.	OPTIONAL

[Function] Load the variable in Opernad 1 with TAN data in Operand 2. Load the variable in Operand 1 with TAN variable content in Operand 2. If there is an instruction (flag, output port) at the output area, it turns ON when the computing result is zero. (Be sure to input a rea number variable 100~199 in Operand 1. Same for Operand 2. Data in Operand 2 must be input in radian, instead of angle (degrees). The maximum of 7 digit floating point numbers can be input.)

[Example]

TAN	100	0.785398	TAN 0.785398 (radian) is 1, then after performing the command, the variable100 becomes 1.
TAN	100	*101	When the variable *101 in Operand 2 is 0.785398 (radian), TAN 0.785398 becomes 1, then after performing the command, the variable 100 becomes 1.

ATN (Arctangent) (This command is not supported by the tabletop type, TT-300.)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	ATN	Variable No.	Data, Variable No.	OPTIONAL

[Function] Load the variable in Operand 1 with ATN data in Operand 2. Load the variable in Operand 1 with ATN variable content in Operand 2. If there is an instruction (flag, output port) at output area, it turns ON when the computing result is zero. (Be sure to input a real number variable 100~199 in Operand 1. Same for Operand 2).

[Example]

ATN	100	1	The ATN of 1 is 0.785 radians (45 degrees). Therefore, after performing the command, variable 100becomes 0.785.
ATN	100	*101	When the variable *101 in Operand 2 contains 1, then Variable 100 becomes 45.

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SQR (Square Root) (This command is not supported by the tabletop type, TT-300.)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	SQR	Variable No.	Data, Variable No.	OPTIONAL

[Function] Load the variable in Operand 1 with SQR data in Operand 2. Load the variable in Operand 1 with SQR variable content in Operand 2. If there is an instruction (flag, output port) at the output area, it turns ON when the computing result is zero.

[Example]

SQR	1	4	The SQR (square root) of 4 is 2, then after performing the command, the variable 1 becomes 2.
SQR	1	*2	When the variable *2 in Operand 2 is 4, SQR 4 becomes 2, then after performing the command, the variable 1 becomes 2.

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2-10 Logical Operation Commands

AND (Bitwise AND)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	AND	Variable No.	Data, Variable No.	OPTIONAL

[Function] Load the variable in Operand 1 with AND result of variable content in Operand 1 and data in Operand 2. Load variable in Operand 1 with AND result of variable content in Operand 1 and variable content in Operand 2. If there is an instruction (flag, output port) at output area, it turns ON when the computing result is zero.

[Example] AND 1 3 When the variable 1 content in Operand 1 is 131 by the decimal (10000011 binary number) and the data condition in Operand 2 is 3 by the decimal (00000011 by binary number), the result of AND is 3 by decimal (00000011 by binary number) the variable 1 becomes 3.

Variable 1 (Operand 1) 10000011
Data (Operand 2) 00000011 AND
Result (Load Variable 1) 00000011 (3 by decimal, the variable 1 becomes 3)

OR (Bitwise OR)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	OR	Variable No.	Data, Variable No.	OPTIONAL

[Function] Load variable in Operand 1 with OR result of variable content in Operand 1 and data in Operand 2. Load variable in Operand 1 with OR result of variable content in Operand 1 and variable content in Operand 2. If there is an instruction (flag, output port) at output area, it turns ON when the computing result is zero.

[Example] OR 1 3 When the variable 1 content in Operand 1 is 128 by decimal (10000000 by binary number), and the data in Operand 2 is 3 by the decimal (00000011 by binary number) the result of OR is 131 by decimal (100000011 by binary number).

Variable 1 (Operand 1) 10000000
Data (Operand 2) 00000011 OR
Result (Load Variable 1) 10000011 (131 by decimal. The variable 1 becomes 131)

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EOR (Bitwise Exclusive OR)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	EOR	Variable No.	Data, Variable No.	OPTIONAL

[Function] Load variable in Operand 1 with EOR result of variable content in Operand 1 and data in Operand 2. Load variable in Operand 1 with EOR result of variable content in Operand 1 and variable content in Operand 2. If there is any instruction (flag, output port) at output area, it turns ON when the computing result is zero.

[Example] EOR 1 3 When the variable 1 content in Operand 1 is 128 by decimal (10000000 by binary number) and the data in Operand 2 is 3 by decimal (00000011 by binary number) the result of EOR is 124 by decimal (01111100 by binary number). Therefore, the variable 1 becomes 124.

Variable 1 (Operand 1) 10000000
Data (Operand 2) 00000011 EOR
Result (Load Variable 1) 01111100 (124 by decimal, the variable 1 becomes 124)

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2-11 Calculation Comparison

CMPE (Compare if Equal)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CMPE	Variable No.	Data, Variable No.	NECESSARY

[Function] If the values in Operand 1 and 2 are the same (equal), the output flag and ouput port will be turned ON. (variable values remain the same)

Note: Use CPEQ.

[Example] CMPE 1 5 600 When the variable 1 content in Operand 1 becomes 5 and if it matches the value of Operand 2 data, then it turns ON output 600.

CMPE 1 *2 600 When variable 1 content in Operand 1 matches the variable 2 content in Operand 2, then output 600 will be turned ON.

CMPG (Compare if Greater Than)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CMPG	Variable No.	Data, Variable No.	NECESSARY

[Function] When the Operand 1 value is greater than the Operand 2 value, then the output flag or output port turns ON.

Note: Use CPGT.

[Example] CMPG 1 5 600 When variable 1 content in Operand 1 is greater than the value of Operand 2 data, then the output 600 turns ON.

CMPG 1 *2 600 When the variable 1 content in Operand 1 is greater than the variable 2 content in Operand 2, then output 600 turns ON.

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CMPL (Compare if Less Than)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CMPL	Variable No.	Data, Variable No.	NECESSARY

[Function] When the value in Operand 1 is smaller than the value in Operand 2, output flag and output port will be turned ON.

Note: Use CPLT.

[Example]

CMPL	1	5	600	When variable 1 content in Operand 1 is smaller than the data value in Operand 2, then output 600 will be turned ON. When variable 1 is 5, 600 is OFF. When variable 1 is 4, 600 is ON.
CMPL	1	*2	600	When the variable 1 content in Operand 1 is smaller than the variable 2 content in Operand 2, then output 600 will be turned ON.

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CPEQ (Compare if Equal)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CPEQ	Variable No.	Data, Variable No.	NECESSARY

[Function] If the values in Operand 1 and 2 are the same (equal), the output flag and output port will turn ON. (variable values remain the same) Equivalent to CMPE. When not equal (either greater or smaller), the output section turns OFF.

Note: When real variables (100 ~ 199, 300 ~ 399) are used, it is almost impossible for the values to be equal after floating point calculations. For comparison of position data, some calculation techniques are required. (ex: divide by 100, and multiply by 1000, so that the number down to the first digit after the decimal point become an integer. Then assign the value into the integer variable for comparison.)

[Example] CPEQ 1 5 600 When the variable 1 content in Operand 1 and the content of Operand 2 are equal (5 in this case), then the output 600 turns ON. If they are not equal, the output 600 turns OFF.

CPEQ 1 *2 600 When the variable 1 content in Operand 1 and the variable 2 content in Operand 2 are equal, the output 600 turns ON.

CPNE (Compare if Not Equal)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CPNE	Variable No.	Data, Variable No.	NECESSARY

[Function] When the values in Operand 1 and Operand 2 are not equal (equivalent to CPGT and CPLT), the output flag or the output port turns ON. (Variable values do not change.) The contents in Operand 1 and Operand 2 are equal, the output section turns OFF.

[Example] CPNE 1 5 600 When the variable 1 content in Operand 1 and the content in Operand 2 are not equal (greater or smaller than 5 in this case), the output 600 turns ON. The contents in Operand 1 and Operand 2 are equal, the output section turns OFF.

CPNE 1 *2 600 When the variable 1 content in Operand 1 and the the variable content in Operand 2 are not equal, the output 600 turns ON. When they are equal, the output 600 turns OFF.

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CPGT (Compare if Greater Than)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CPGT	Variable No.	Data, Variable No.	NECESSARY

[Function] When the value in Operand 1 is greater than the value in Operand 2, the output flag or the output port turns ON. (Variable values do not change.) Equivalent to CMPG. When the condition is not met (equal or smaller), the output section turns OFF.

[Example]

CPGT 1	5	600	When the variable 1 content in Operand 1 is greater than the content in Operand 2 (greater than 5 in this case), the output 600 turns ON. When the condition is not met, 600 turns OFF.
CPGT 1	*2	600	When the variable 1 content in Operand 1 is greater than the variable content in Operand 2, the output 600 turns ON. When the condition is not met, it turns OFF.

CPGE (Compare if Equal or Greater)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CPGE	Variable No.	Data, Variable No.	NECESSARY

[Function] When the value in Operand 1 is equal to or greater than the value in Operand 2, the output flag or output port turns ON. (Variable values not change.) When the value in Operand 1 is smaller than the value in Operand 2, the output section turns OFF.

[Example]

CPGE 1	5	600	When the variable 1 content in Operand 1 is equal to or greater than the content in Operand 2 (5 or greater than 5 in this case), the output 600 turns ON. When smaller than 5, 600 turns OFF.
CPGE 1	*2	600	The variable 1 content in Operand 1 is equal to or greater than the variable content in Operand 2, the output 600 turns ON. When the condition is not met, 600 turns OFF.

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CPLE (Compare if Equal or Smaller)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CPLE	Variable No.	Data, Variable No.	NECESSARY

[Function] When the value in Operand 1 is equal to or smaller than the value in Operand 2, the output flag or the output port turns ON. (Variable values do not change.) When the condition is not met, the output section turns OFF.

Note: It is almost impossible for the values to be equal as explained under CPEQ command.

[Example] CPLE 1 5 600 When the variable 1 content in Operand 1 is equal to or smaller than the content in Operand 2 (5 or smaller than 5 in this case), the output 600 turns ON. When the variable 1 content is greater than 6, the output 600 turns OFF.

CPLE 1 *2 600 When the variable 1 content in Operand 1 is equal to or smaller than the variable content in Operand 2, the output 600 turns ON. When greater than the variable 2 content, 600 turns OFF.

CPLT (Compare if Smaller Than)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	CPLT	Variable No.	Data, Variable No.	NECESSARY

[Function] When the value in Operand 1 is smaller than the value in Operand 2, the output flag or output port turns ON. (Variable values do not change.) When equal to or greater than the value in Operand 2, the output section turns OFF.

[Example] CPLT 1 5 600 When the variable 1 in Operand 1 is smaller than the value in Operand 2 (smaller than 5 in integer variable = 4 or less), the output 600 turns ON. When the condition is not met, the output 600 turns OFF.

CPLT 1 *2 600 When the variable 1 content in Operand 1 is smaller than the variable value in Operand 2, the output 600 turns ON. When the condition is not met, 600 turns OFF.

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2-12 Position Data Operation Commands

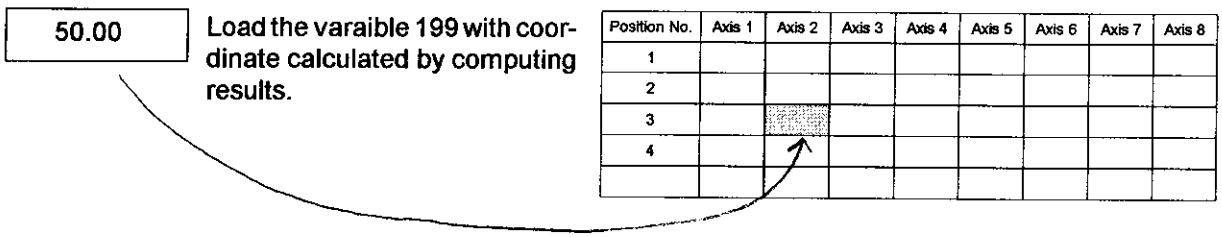
PPUT (Axis Data Assignment)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	PPUT	Axis No.	Position No. Variable No.	

[Function] Substitute the variable 199 coordinate for the designated axis position data.

[Example] PPUT 2 3 Substitute the variable 199 coordinate for the axis no. 2 position No. 3.

Variable 199 (Common Variable)



PGET (Axis Data Read)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Post (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	PGET	Axis No.	Position No. Variable No.	

[Function] Read the designated axis data of position data to the variable 199. (Opposite of PPUT) When up-take data is xxx.xx during execution, the data will not be substituted for the variable 199.

[Example] PGET 2 3 Read the data of axis No. 2, Position No. 3 at variable 199.

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PTST (Position Data Check)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	PTST	Axis No.	Position No.	NECESSARY

[Function] Check to see whether effective data exists in the designated pattern and the position No. If there is no data, it turns on a flag in the output area or output port. When all the axes specified by the axis pattern are XX.XXX, the output section turns ON. ("0" is considered as data.)

[Example] PTST 11 10 600

If there is no data in position 11 of axis 1 and 2, it turns on flag 600.

Position No.	Axis 1	Axis 2	Axis 3
1			
2			
3			
10	50.00	100.00	xx.xxx
11	xx.xxx	xx.xxx	xx.xxx

PCPY (Position Data Copy)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	PCPY	Position No.	Position No.	

[Function] Copy data in the designated position No. (copy data from Operand 2 to Operand 1).

[Example] PCPY 20 10

Copy data from position 10 in Operand 2 to position 20 in Operand 1.

Position No.	Axis 1	Axis 2	Axis 3
10	50.00	100.00	xx.xxx
20	50.00	100.00	xx.xxx

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PCLR (Position Data Clear)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	PCLR	Position No.	Position No.	

[Function] Clear the position data in the designated area from Operand 1 to Operand 2. (Becomes XX.XXX. Not 0.00.)

[Example] PCLR 10 20 Clear data from position 10 in Operand 1 through position 20 in Operand 2.

PRED (Coordinate Read)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	PRED	Axis Pattern	Position No.	

[Function] Read the present coordinate of the designated axis in Operand 1. Write it in the designated position in Operand 2.

Note 1: This command calculates up to three decimal places.
Note 2: Please be sure that there is no error in the last digit after multiplication and division.

[Example] PRED 11 10 Write the present coordinates of the designated axis 1 and axis 2 in Operand 1 into position 10.

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PSIZ (Position Data Size Check)

Expansion Condition (AND/OR)	Input Condition (Input/Ouput, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	PSIZ	Variable (Assigned To)		

[Function] Check the maximum size of the usable position data.

[Example] PSIZ 1 The maximum of position data goes in the varaible 1 (substituted number) in Operand 1.

PVEL (Velocity Data Assign)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	PVEL	Velocity	Position No.	

[Function] Assign the Operand 1 value (or variable) into the designated position data. This command is used to change the actual velocity.

Note: When a negative number is assigned after calculation, an alarm occurs at the time of data use although there is no warning at execution time.

[Example] PVEL 100 3 Assign 100mm/sec into the velocity data of the position number 3.

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PACC (Acceleration Data Assign)

Expansion Condition (AND/OR)	Input Condition (Input/Output, Flag)	Commands			Output Section (Output Port, Flag)
		Commands	Operand 1	Operand 2	
OPTIONAL	OPTIONAL	PACC	Acceleration	Position No.	

[Function} Assign the acceleration data (or variable) in Operand 1 into the position data. Please be careful not to assign a value beyond the actuator's limit (There is no system to check the value range during this command).

[Example] PACC 0.3 3 Assign 0.3 into the acceleration data of position number 3.

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Part 4 - Parameter List

The system parameters are all written in at the time of shipment. There is no need to change the parameters unless a special system is used. If parameters need to be changed for your system, please contact our technical service department. (The following tables are the initial values displayed by the Teaching Pendant. Actual parameters may differ depending on actuators in your particular system.)

1. Axis Parameters

a) Servo Control

No.	Parameter Name	Default	Contents
1	Numerater	1	Numerator
2	Denominator	1	Denominator
*3	Over Ride (%)	100	Over Ride
4	Acceler (0.01 G)	0.30	Acceleration
5	Jog Vel	30	Jog Velocity
6	Pend Band	10	Position End Band (Pulse)
7	Soft Limit Off	2.00	Software Limit Offset
8	Soft Limit (+)	9999	Software Limit (+)
9	Soft Limit (-)	0	Software Limit (-)

*At present, a common parameter is used for Over Ride. (Over Ride is no longer available.)

b) Homing

No.	Parameter Name	Default	Contents
1	Home Dir	0	Home Direction
2	Home Type	0	Home Type
3	Home Sequence	0 ~ 9	Sequence (Axis Used, Unused)
4	Home SW Pol	1	Limit Input Polarity
5	Home Z Edge	1	Z-phase detect edge
6	Home Creep Vel	100	Creep Velocity
7	Home Back Vel	10	Run-in Velocity
8	Home Z Vel	5	Z-Phase Search Velocity
9	Home Offset	0	Offset Move Amount (Length)
10	Home Deviation	667	Deviation (Pulse)
11	Home Current	60	Current Limit

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c) Motor*

No.	Parameter Name	Default	Content
1	Motor RPM Max	4000	Motor RPM Maximum
2	Encoder Pulse	400	Encoder Pulse Per Rev.
3	Screw Lead	8	Screw Lead (mm)
4	Multiple	4	Encoder Pulse Multiplier
5	Brake Time	0.1	Brake Time (sec)
6	Position Gain	60	Position Gain
7	Speed Gain	80	Speed Gain
8	F/F Gain	0	Feed/Forward Gain
9	Intergral Gain	30	Integral Gain
10	Total Gain	150	Total Gain
11	Int. Volt. Lmt.	60	Integral Voltage Limit
12	Over Speed	410	Over Speed Constant
13	Error Range	2666	Error Range
14	Motor Max Cur	90	Motor Maximum Current
15	Motor Over Load	23808	Motor Overload Lower Limit

*Motor related parameters differ depending on the actuator. The table above is only an example. Please contact our technical service department when motor related parameters must be used for your system.

d) Axis Name

No.	Parameter Name	Default	Valid Name
1	Axis 1	1	Axis Name 0 ~ 9, A - Z Setting
2	Axis 2	2	Axis Name 0 ~ 9, A - Z Setting
3	Axis 3	3	Axis Name 0 ~ 9, A - Z Setting
4	Axis 4	4	Axis Name 0 ~ 9, A - Z Setting
5	Axis 5	5	Axis Name 0 ~ 9, A - Z Setting
6	Axis 6	6	Axis Name 0 ~ 9, A - Z Setting
7	Axis 7	7	Axis Name 0 ~ 9, A - Z Setting
8	Axis 8	8	Axis Name 0 ~ 9, A - Z Setting

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2. System Parameters

a) Application Program

No.	Parameter Name	Default	Contents	8 Axis	Standard	TT-300
1	Auto Start PRG	0	Auto Start Program Number	-	-	-
2	Emergency PRG	0	Emergency Stop Program Number	-	-	-
*3	Program Size	48	Program Size	64	48	32
*4	Task Size	8	Task Size	16	8	4
*5	Step Size	2000	Program Step	2500	2000	1000
6	Time Slice	0.01	Time Slice Check	-	-	-

(*For reference only. Not changeable)

b) Position Data

No.	Parameter Name	Default	Contents	8 Axis	Standard	TT-300
*1	Point Size	1000	Point Data Number	1500	1000	500

(*For reference only. Not changeable)

c) Servo Device

No.	Parameter Name	Default	Contents
1	Axis Size	8	Axis Number
2	Numerator	1	Numerator
3	Denominator	1	Denominator
4	Over Ride (%)	100	Velocity Scale Factor
5	Acceler (0.01G)	0.30	Acceleration
6	Acc Max (0.01G)	1.00	Maximum Acceleration
7	Drive Vel	100	Drive Velocity (mm/sec)
8	Drive Vel Max	1000	Drive Velocity Max (mm/sec)

d) Communication

No.	Parameter Name	Default	Contents	
*1	Terminal ID	99	Multi-Drop Code	
*2	Time Out (sec)	0	Time Out	
*3	Baud Rate	3	Baud Rate	Note 1
*4	Char Length	0	Character Length	Note 1
*5	Parity	1	Parity	Note 1
*6	Stop Bit	0	Stop Bit	Note 1

Note 1: The actual setting is fixed: 9600 Baud, 8 Bit, N Parity, 1 Stop. (*For reference only. Not changeable)

e) Circular/Path

No.	Parameter Name	Default	Contents
*1	Circle Angle	15.0	Slice Angle (15 Degrees)
*2	Circle Delt	0	Velocity Increment (mm/sec)

(*Fixed Parameter))

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Part - 5 Error Codes

Error Code	Error Name	Explanation
A1	External Interrupt Error	1. Motor over current 2.Over regenerative current (Over negative load) 3. Driver Overheat
A2	Motor Overload Error	Mechanical overload of motor
A3	Deviation Error	Motor is unable to perform properly due to mechanical overload
A4	Software Limit Error	Exceeded software limit
B0	No Program Error	Program does not exist
B1	Program Execution Error	Execution of a currently executing program
B2	Program Over Error	Number of tasks exceeds those set as parameters
B3	Double Subroutine Number Error	Two or more of the same subroutine number are used
B4	Double Tag Number Error	Two or more of the same tag number are used
B5	Undefined Subroutine Number	Subroutine number is not defined
B6	Undefined Tag Number	Tag number is not defined
B7	Subroutine Pair Error	BGSR and EDSR are not the same quantity
B8	Step 1 BGSR Error	Step 1 is a BGSR Error
C0	No Homing Error	Homing was not performed before running actuators
C1 (F4)	Point Data Error	Attempt has been made to execute unregistered Point Data
C2	Axis Double Execution Error	Move command given to axis currently moving
C3	Software Limit Error	Software limit exceed in program
D0	Acceleration Error	Acceleration exceeds limits
D1	No Velocity Error	Velocity has not been set
D2	Override Error	Override was set outside the range of 0~100%
D3	Angle Error	Angle was set outside the range of 0.1~120 degrees
D4	Axis Pattern Error	Axis Pattern was not set correctly. Displays D4 also for C1 (Point Data Error)
D5	Axis Number Error	Axis Number was set outside the range of 1~8
D6	Axis Error	More than 3 axes are designated in circular/arc motion
D7	Program Number Errror	Program number exceeds the limit
D8	Position Number Error	Position number exceeds the limit
D9	Point Number Error	Negative number was input in the point number
DA	PIO Number Error	Input, Output, and Flag are not assigned correctly
DB	Variable Error	Variable is not assigned correctly
DC	Digits Over Error	Assigned number exceed 8 digits (binary 32 bit)
DD	Division (0) Error	Result of the division is "0"
DE	Circular Motion Computation Error	Position data that cannot perform circular motion was input
E0	Undefined Command Error	Undefined command execution attempted
E1	Subroutine Over Nesting Error	Nesting of more than 15 subroutines
E2	Subroutine Under Nesting Error	EXSR and EDSR are not making a pair
E3	Controlling Column Error	Use of condition is not correct
EG	EMG Error	Emergency (Emergency Stop) input
F0	Interrupt Error	Motor CPU and Interrupt management do not match

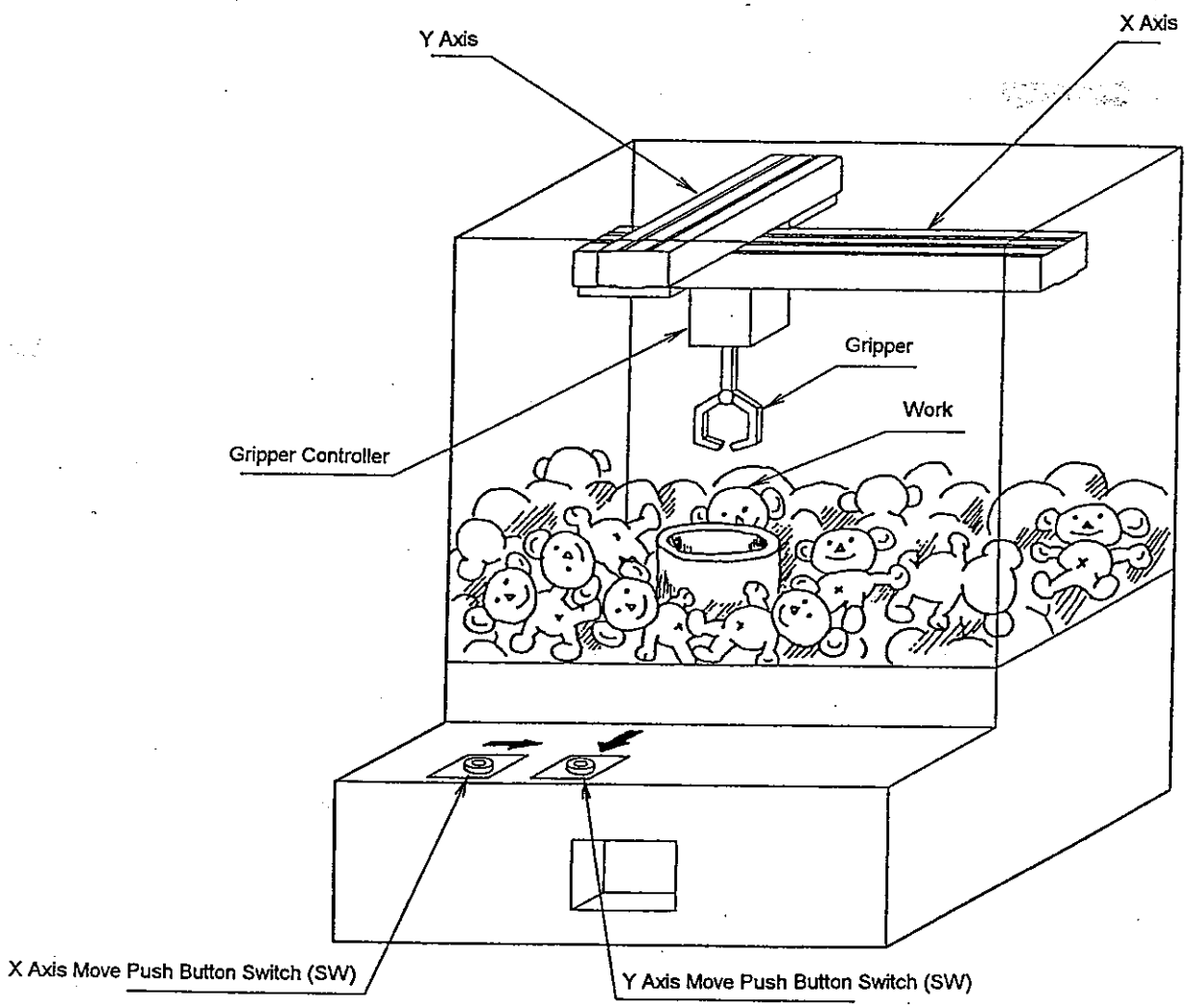
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Part 6 - Application Program Examples

1 Operation using JOG Move Command [Doll Game]

(1) System Description

The following example consists of a Z-axis, XY system. In order to position the gripper over the desired doll, use the control buttons on the control panel as shown below.



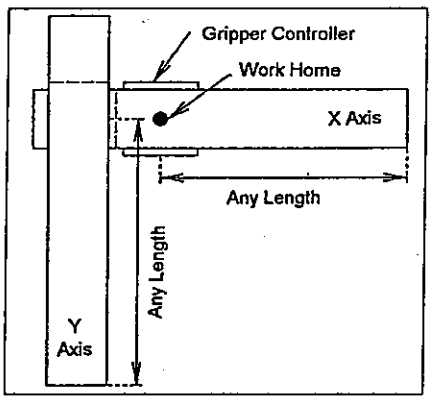
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(2) Movement Description

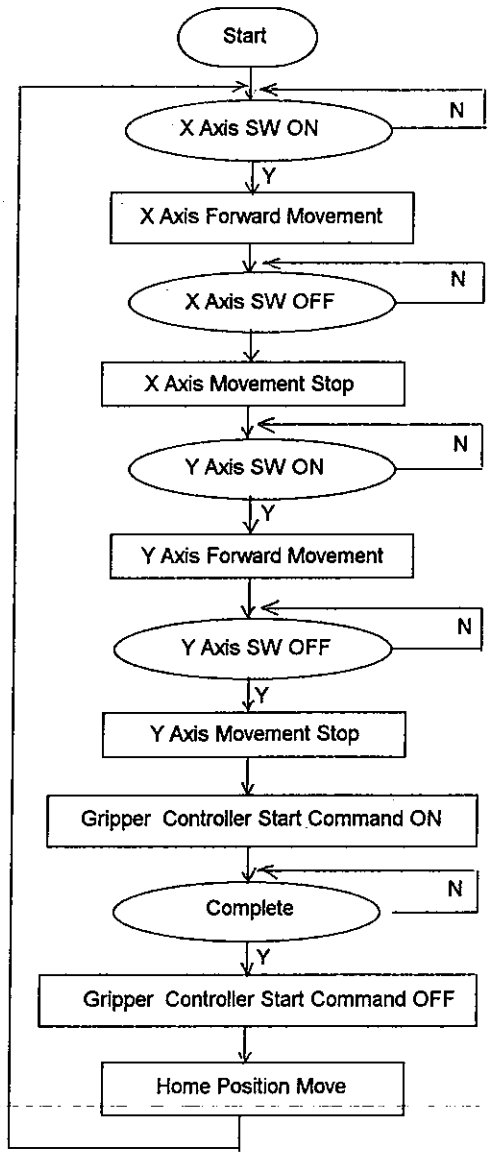
1. Waiting for the X-axis switch to turn ON.
2. While the X-axis switch is ON, the X-axis moves. When the switch is OFF, the X-axis stops moving.
3. Waiting for the Y-axis switch to turn ON.
4. While the Y-axis switch is ON, the Y-axis moves. When the switch is OFF, the Y-axis stops moving.
5. Output a start command to the gripper controller.
6. Waiting for a completion input from the gripper controller.
7. Homing after the completion input.

Repeat the same procedure as above. The operating position, external I/O assignment and flowchart are as follows:

Operating Position



Flowchart



I/O Assignment

Section		I/O #	Signals	Specifications
SuperSEL	I	020	X-Axis Move Command	Push Button SW
		021	Y-Axis Move Command	Push Button SW
		022	Gripper Move Complete	External Control Device
	O	310	Gripper Start Command	DC24V
	Flag Not in Use			

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(3) Super SEL Controller Application Program

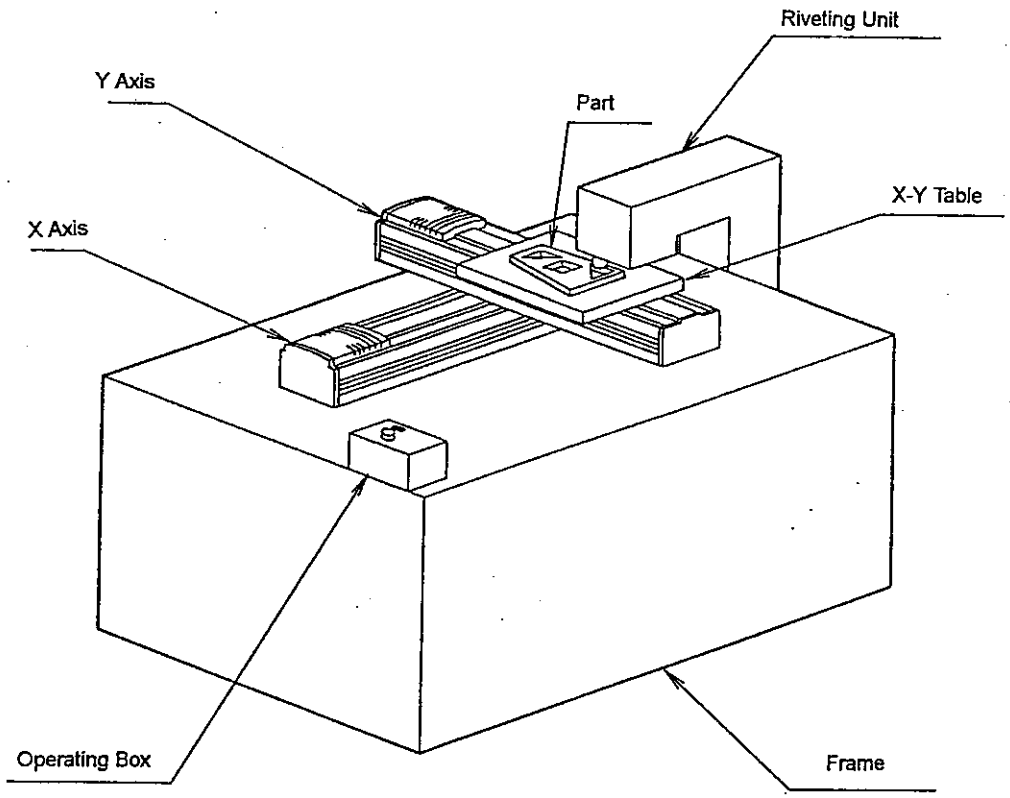
Step	A/O	N	OP-Code	Operand1	Operand2	Post	Comment
1			HOME	11			X and Y-Axis Homing (Servo ON)
2			VEL	400			Velocity 400mm/s Setting
3			TAG	1			
4			WTON	20			Waiting for X-Axis Move SW Input
5			JFWN	1	20		While X-Axis Move SW ON, Move Forward
6			WTON	21			Waiting for Y-Axis Move SW Input
7			JFWN	10	21		While Y-Axis Move SW ON, Move Forward
8			BTON	310			External Control Device Start Command ON
9			WTON	22			Waiting for External Control Device Motion Completion
10			BTOF	310			External Control Device Start Command OFF
11			JBWF	11	22		Move Backwards While X and Y-Axis 22 ON
12			GOTO	1			Jump TAG 1
13							
14							
15							
16							
17							
18							
19							
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32							

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2 Operation using Point Move Commands [Riveting Device]

(1) System Description

The riveting device is composed of an X-Y table (X and Y-actuators) and a riveting unit. Work is placed on the X-Y table. The system homes, then a start signal is given. The device shown below attaches rivets to 3 points on the part.



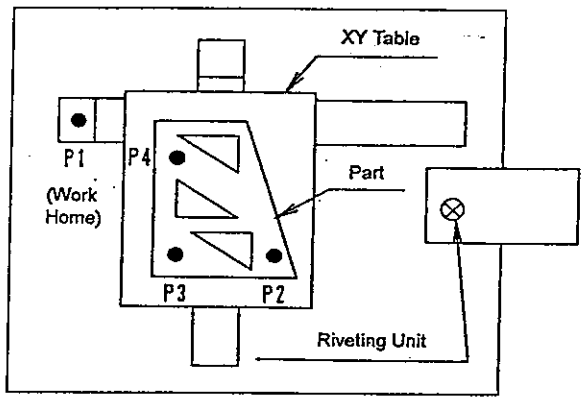
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(2) Movement Description

1. X and Y-axis return Home and wait.
2. Worker sets work on X-Y-table, then turns Start Switch (SW) ON.
3. X-Y-table moves to position No.1 then outputs riveting command to the riveting unit.
4. After riveting is completed, wait for completion signal input. Repeat the same procedure for position No.2 and position No.3.
5. After riveting at all three positions, returns Home.

Repeat the same procedure as above. The operating position, external I/O assignment and flowchart are as follows.

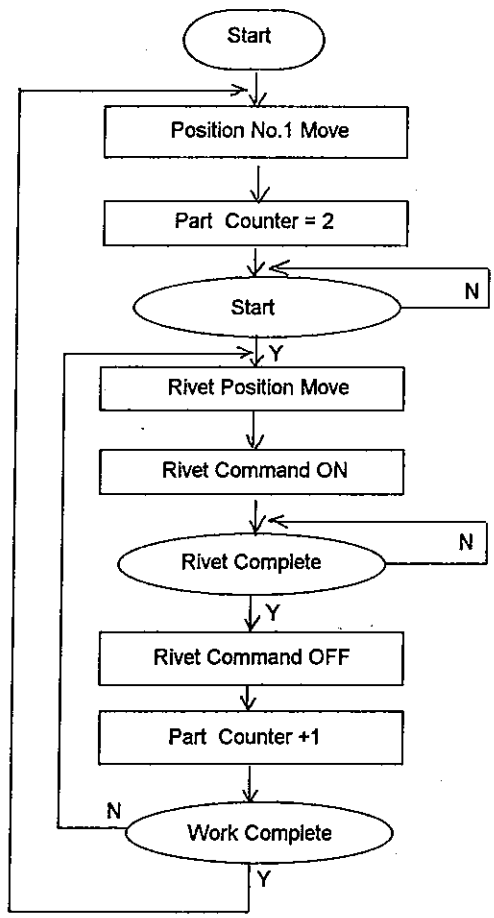
Operating Position



I/O Assignment

Section		I/O #	Signals	Specifications
SuperSEL	I	020	Start Command	Push Button SW
		021	Rivet Complete	Contact Signal
	O	310	Rivet Command	DC 24V
	Flag In Use From 600			

Flowchart



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(4) Super SEL Controller Application Program

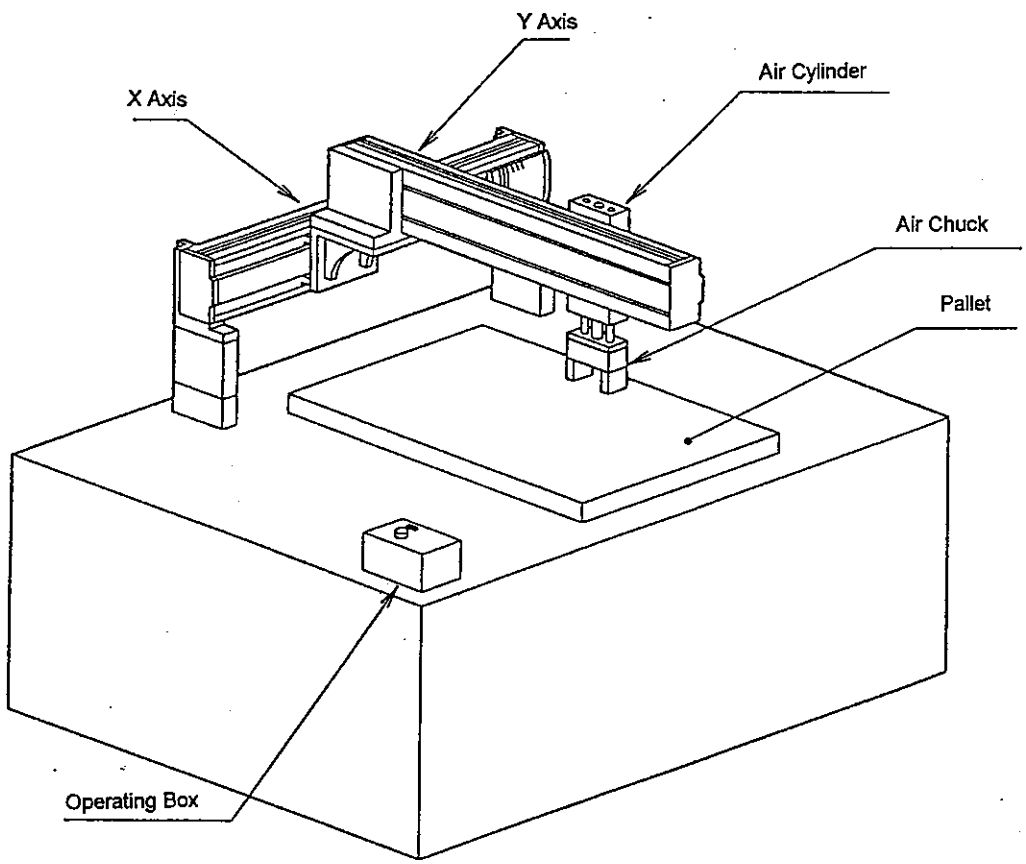
Step	A/O	N	OP-Code	Operand1	Operand2	Post	Comment
1			HOME	11			X-Y Table Homing (Servo ON)
2			VEL	400			Velocity 400mm/s Setting
3			TAG	1			
4			MOVL	1			Position No.1 Move
5			LET	1	2		Set 2 on Part Counter
6			BTOF	600			Complete Flag, Clear
7			WTON	20			Waiting for Start Command
8			TAG	2			
9			MOVL	*1			Part Counter Position Move
10			BTON	310			Rivet Command ON
11			WTON	21			Waiting for Rivet Completion
12			BTOF	310			Rivet Command OFF
13			ADD	1	1		Part Counter +1
14			CMPE	1	5	600	When Part Complete, Flag ON
15		N600	GOTO	2			When Not Complete, Jump TAG 2
16			GOTO	1			When Complete, Jump TAG1
17							
18							
19							
20							
21							
22							
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24							
25							
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27							
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32							

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3 Palletizing Operation [Palletizing Device]

(1) System Description

This system consists of an X-Y configuration with a pneumatic Z-axis. The system is used to pick up parts from a supply point, go to another point, and place the part onto a pallet in a certain sequence.



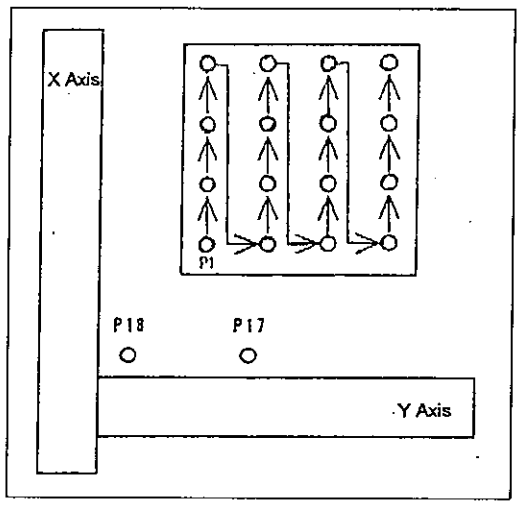
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(2) Movement Description

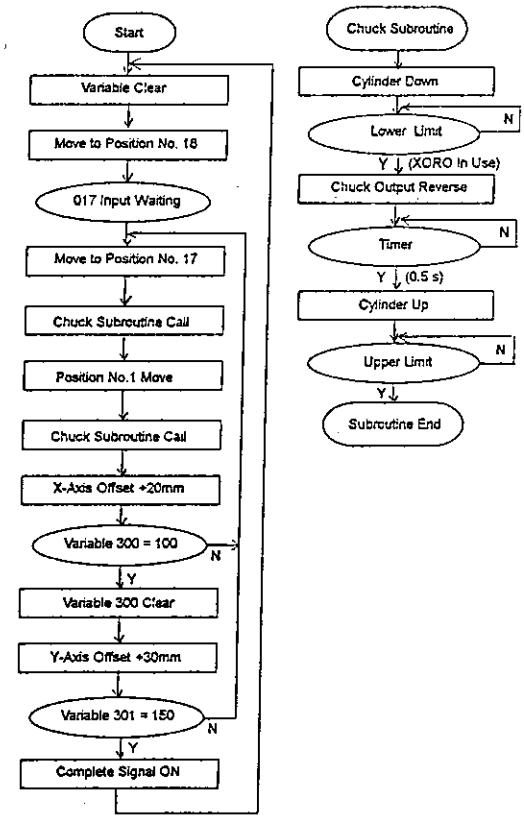
1. Move to the waiting position, and wait for Start Input.
2. Move to the part supply point, after Start Input.
3. Z-axis moves downward, and the air chuck picks up a part.
4. Z-axis moves upward and moves to another point above the pallet.
5. Z-axis moves downward, then the air chuck releases the part.
6. Z-axis moves upward and moves back to the part supply point.
7. When the pallet has been completed, moves to P18. After the pallet completion output, waits for re-start input.

Repeat the same procedure above. Operating position, external I/O assignment and flowchart are as follows.

Operating Position



Flow Chart



I/O Assignment

Section	I/O #	Signals	Specifications
Input	015	Z-Axis Cylinder Up	Adjacent SW
	016	Z-Axis Cylinder Down	Adjacent SW
	017	Start	Push Button SW
Output	310	Z-Axis Cylinder SV	DC24V
	311	Z-Axis Chuck SV	DC24V
	312	Pallet Complete	DC24V
*Flag In Use From 600			

Pallet Specifications

X Direction 20mm pitch
Y Direction 30mm pitch

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(3) Super SEL Controller Application Program

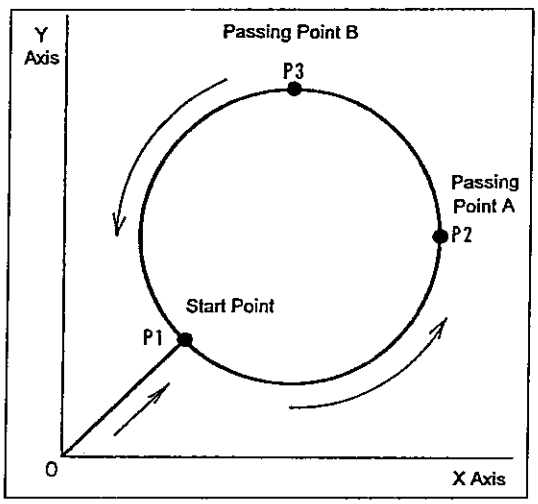
Step	A/O	N	OP-Code	Operand1	Operand2	Post	Comment
1			HOME	11			X and Y-Axis Homing
2			VEL	100			Velocity 100mm/s Setting
3			ACC	0.2			Acceleration 0.2G
4			TAG	1			
5			LET	300	0		Variable Clear
6			LET	301	0		Variable Clear
7			OFST	11	0		Offset Value Clear
8			MOVL	18			Move to Position No.18
9			WTON	17			Wait for Start Input
10			BTOF	312			Output 312 OFF
11			TAG	2			
12			OFST	11	0		Offset Value Clear
13			MOVL	17			Move to Position No.17
14			EXSR	1			Chuck Subroutine Call (Chuck)
15			OFST	1	*300		X-Axis, Variable 300 Offset
16			OFST	10	*301		Y-Axis, Variable 301 Offset
17			MOVL	1			Move to Position No.1 + Offset Value
18			EXSR	1			Chuck Subroutine Call (Unchuck)
19			ADD	300	20		Add 20 to Variable 300
20			CMPE	300	80	600	When Variable 300 = 80, Flag 600 ON
21		N600	GOTO	2			If Flag 600 is Off, Jump to TAG 2
22			LET	300	0		Variable 300 Clear
23			ADD	301	30		Add 30 to Variable 301
24			CMPE	301	120	601	When Variable 301 = 120, Flag 601 ON
25		N601	GOTO	2			If Flag 601 is OFF, Jump to TAG 2
26			BTON	312			Output 312 ON
27			GOTO	1			Jump to TAG 1
28			BGSR	1			Chuck Subroutine Start
29			BTON	310			Z-Axis Cylinder Down
30			WTON	16			Lower Limit Input Waiting
31			BTNT	311			Air Chuck Output Revert
32			TIMW	0.5			Timer 0.5 Second
33			BTOF	310			Z-Axis Cylinder Up
34			WTON	15			Upper Limit Input Waiting
35			EDSR				Chuck Subroutine End
36							
37							
38							
39							

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4 Circular Movement Command

In less sophisticated controllers it was generally understood that the changes in speed would result in changes in the motion profile. In the new Super SEL Controller, however, accurate circular motion profiles can be achieved by passing through the exact points regardless of changes in speed settings.

Locus



Programming

Circular movement only applies to two dimensional movement. A circular motion program is easily constructed by selecting a starting point and two passing points.

1. Set Position No.1 (P1) coordinate data (Starting Point).
2. Set Position No.2 (P2) and Position No.3 (P3) coordinate data (Passing Points).
3. Moves to Position No.1 by MOVL Command (Starting Point).
4. Set 1st passing point (P2) in OPRND1 and 2nd passing point (P3) in OPRND 2 by CIR Command.
   * The direction of rotation can be reversed by exchanging P2 and P3.

Program of Locus above

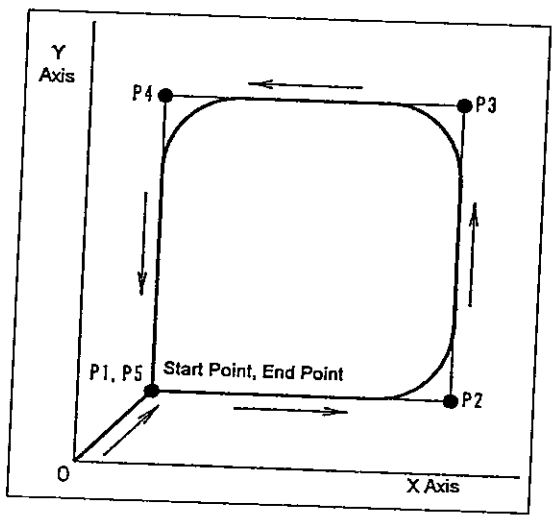
Step	A/O	N	OP-Code	Operand1	Operand2	Post	Comment
1			HOME	11			X and Y-Axis Homing
2			VEL	200			Velocity 200mm/s Setting
3			ACC	0.3			Acceleration 0.3G
4			MOVL	1			Move to Position No.1 (Starting Point)
5			TAG	1			
6			CIR	2	3		Circular Motion Passing through P2 and P3
7			GOTO	1			Jump TAG 1

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5 Path Movement Command

In the Super SEL Controller, accurate path motion profiles can be achieved by passing through the exact points regardless of changes in speed settings.

Locus



Programming

A path motion program can be constructed easily with only a starting point, and an end point. Therefore, a program takes only one line regardless of the number of passing points between the starting point and the end point.

1. Set Position No.1 (P1) coordinate data (Starting Point).
2. Set coordinate data from Position No.2 (P2) through Position No.4 (P4) (Passing Points), and Position No.5 (P5) (End Point). For continuous path movement, set the passing points in the operating position No. sequence.
3. Move to Position No.1 by MOVL Command (Starting Point).
4. Set the starting point (P1) in Operand 1 and the end point in Operand 2 by PATH Command.
   * The path direction can be reversed by exchanging the position numbers of the starting point and end point.

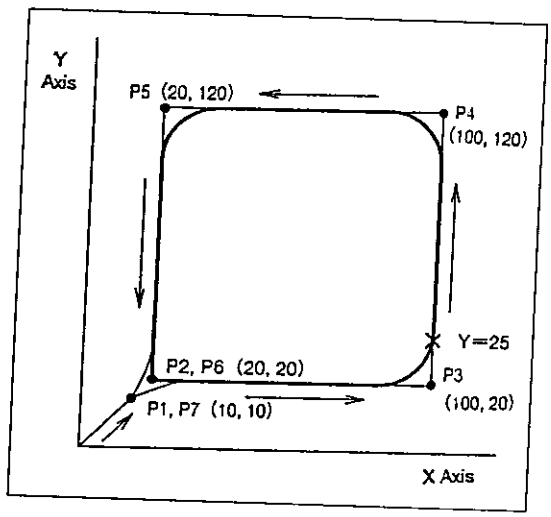
Program of Locus above

Step	A/O	N	OP-Code	Operand1	Operand2	Post	Comment
1			HOME	11			X and Y-Axes Homing (Servo ON)
2			VEL	200			Velocity 200mm/s Setting
3			ACC	0.3			Acceleration 0.3 G
4			MOVL	1			Move to Position No.1 (Starting Point)
5			TAG	1			
6			PATH	1	5		Path Motion from Position No.1 to No.5
7			GOTO	1			Jump TAG 1

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6 Dispenser Application

Locus



The Path motion is mainly applied to dispenser operations. For dispenser operations it is better to start a motion from a point outside of the path, and enter the path by moving to P2 (Starting Point), then the dispenser turns ON to start dispensing from P2 (See the Path motion shown on the left). If the motion was simply started from P2 (Starting Point), and the dispenser was turned ON at the same time, it would stop once at this point. The Super SEL multi-tasking function becomes very useful in cases like this.

Assume that the dispenser is controlled by the output 310, and the coordinate of each point is shown in the diagram above.

The main program

1. Moves to P1 (Path Starting Point), and start the Dispenser ON/OFF Program No.5.
2. Runs the path from P1 to P7.

*Selection of P1 and P7 are important for locus accuracy.

Dispenser ON/OFF Program No.5

1. Read the current position coordinate. If X is greater than 19, it turns the dispenser ON. If X is smaller than 19, it repeats this step. (The value 19 changes depending on the velocity.)
2. Read the current Y coordinate. If Y is greater than 25, it moves to the next stop. If not, it continues to loop. (The value 20 would be too small to assure a complete path motion.)
3. Continue to monitor the X coordinate. When the value becomes smaller than 20, it turns OFF the dispenser.

*Main Point: Check one condition at a time instead of two or more conditions. Do not use CPME. (It would be almost impossible to compare to see the values match in high speed motion.)

Program of Locus above

Main Program

Step	A/O	N	OP-Code	Operand1	Operand2	Post	Comment
1			HOME	11			X and Y-Axis Homing
2			VEL	200			Velocity 200mm/s Setting
3			ACC	0.3			Acceleration 0.3G
4			MOVL	1			
5			EXPG	5			
6			PATH	1	7		
7			EXIT				

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Program No. 5 (Dispenser)

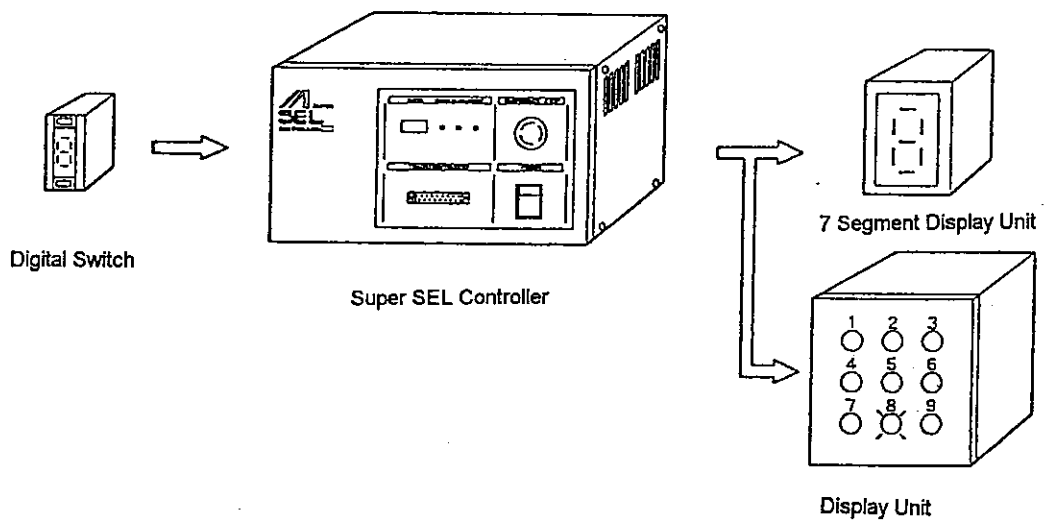
Step	A/O	N	Op-Code	Operand1	Operand2	Post	Comment
1			TAG	1			Check X Coordinate
2			PRED	1	5		Read current position of X-Axis and store in Position No.5
3			PGET	1	5		Get X coordinate of Position No.5 & store in Variable Register 199.
4		N600	CPMG	199	19	600	Is the value in Variable Register 199 greater than 19?
5			GOTO	1			If X < 19, continues to check X coordinate
6			BTOF	600			If X > 19, reset flag 600
7			BTON	310			Turn ON the dispenser
8			TAG	2			Check Y Coordinate
9			PRED	11	5		Read current position of Y-Axis and store in position No.5
10			PGET	2	5		Get Y cordinate of Position No.5 & store in Variable Register 199
11			CPMG	199	25	601	If the value in Variable Register 199 is greater than 25 (Unable to assure a complete path motion when compared with 20), set flag 601
12		N601	GOTO	2			If Y < 25, continues to check Y coordinate
13			BTOF	601			If Y > 25, reset flag 601
14			TAG	3			Check X Coordinate to turn OFF
15			PRED	1	5		Read current position of X-Axis & store in Position No.5
16			PGET	1	5		Get X coordinate of Position No.5 & store in Variable Register 199
17			CPML	199	20	602	Is the value in Variable Register 199 less than 20?
18		N602	GOTO	3			If X > 20, continues to check X coordinate
19			BTOF	602			If X < 20, reset flag 602
20			BTOF	310			Dispenser OFF

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6 BCD Code Signals Input and Output

(1) Circuit

This is a circuit that the controller verifies the BCD values input by the external digital switch, and lights the number on the display unit corresponding to the number displayed on the 7 segment display unit provided separately.



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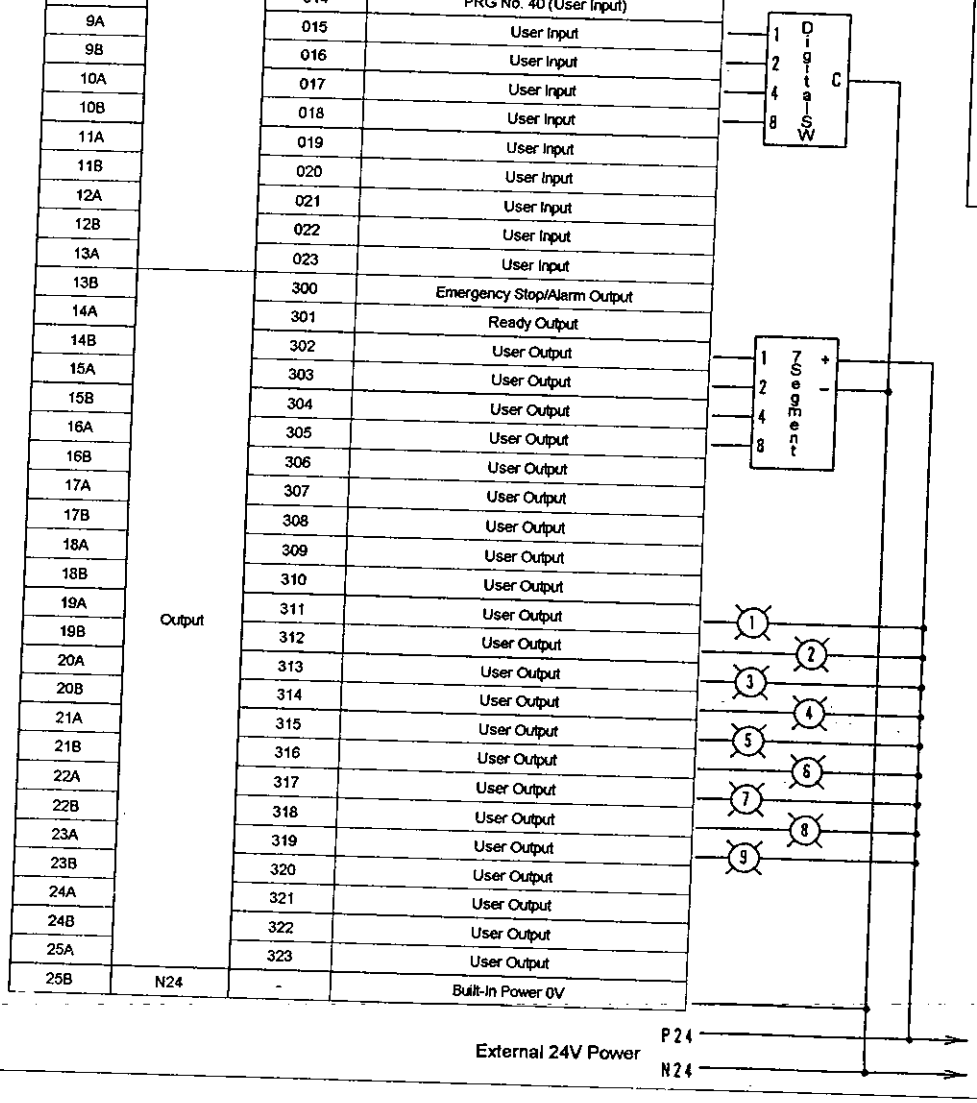
(2) I/O Connections

The following I/O connections are for external digital switches and the external display unit.

Pin No.	Category	Port No.	Function
1A	P24	-	Built-in Power +24V
1B	Input	000	External Start Input
2A		001	User Input
2B		002	Emergency Stop (Point b Input)
3A		003	Unused (NC)
3B		004	Unused (NC)
4A		005	User Input
4B		006	User Input
5A		007	User Input
5B		008	PRG No. 1 (User Input)
6A		009	PRG No. 2 (User Input)
6B		010	PRG No. 4 (User Input)
7A		011	PRG No. 8 (User Input)
7B		012	PRG No. 10 (User Input)
8A		013	PRG No. 20 (User Input)
8B		014	PRG No. 40 (User Input)
9A		015	User Input
9B		016	User Input
10A		017	User Input
10B		018	User Input
11A		019	User Input
11B		020	User Input
12A		021	User Input
12B		022	User Input
13A		023	User Input
13B	Output	300	Emergency Stop/Alarm Output
14A		301	Ready Output
14B		302	User Output
15A		303	User Output
15B		304	User Output
16A		305	User Output
16B		306	User Output
17A		307	User Output
17B		308	User Output
18A		309	User Output
18B		310	User Output
19A		311	User Output
19B		312	User Output
20A		313	User Output
20B		314	User Output
21A		315	User Output
21B		316	User Output
22A		317	User Output
22B		318	User Output
23A		319	User Output
23B		320	User Output
24A		321	User Output
24B		322	User Output
25A		323	User Output
25B	N24	-	Built-in Power 0V

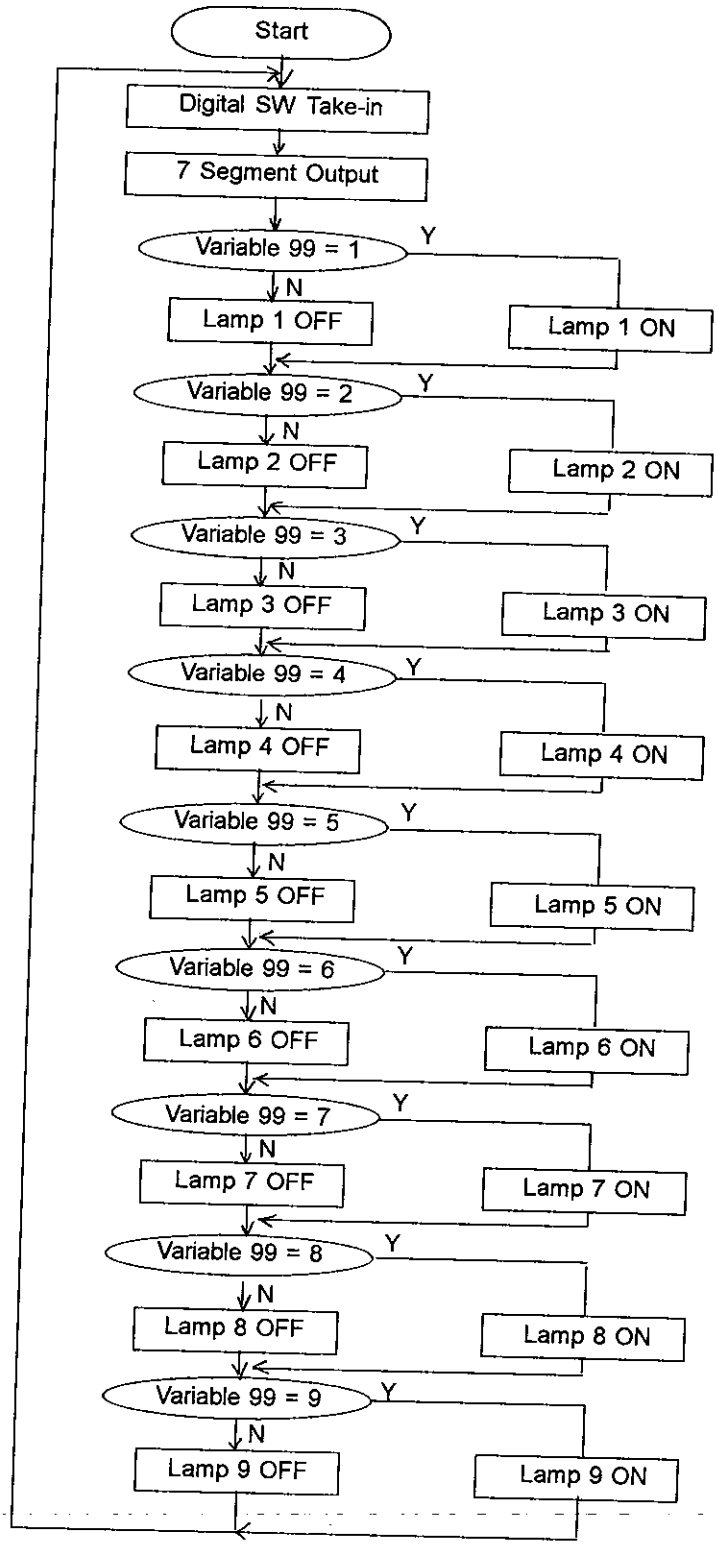
I/O Assignment

Section	I/O #	Signals
I	015	Digital Switch 1
	016	Digital Switch 2
	017	Digital Switch 4
	018	Digital Switch 8
O	302	7 Segment 1
	303	7 Segment 2
	304	7 Segment 4
	305	7 Segmetnt 8
	311	External Display Light 1
	312	External Display Light 2
	313	External Display Light 3
	314	External Display Light 4
	315	External Display Light 5
	316	External Display Light 6
	317	External Display Light 7
	318	External Display Light 8
	319	External Display Light 9



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(3) Movement Description



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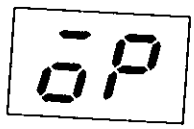
(4) Application Program

Step	A/O	N	OP-Code	Operand1	Operand2	Post	Comment
1			TAG	1			
2			INB	15	1		Digital Switch Value into Variable 99
3			OUTB	302	1		Up-Take Value 7 Segment Output
4			CMPE	99	1	601	When Up-Take Value = 1, Flag 601 ON
5		601	BTON	311			When Flag 601 ON, Lamp 1 ON
6		N601	BTOF	311			When Flag 601 OFF, Lamp 1 OFF
7			CMPE	99	2	602	When Up-Take Value = 2, Flag 602 ON
8		602	BTON	312			When Flag 602 ON, Lamp 2 ON
9		N602	BTOF	312			When Flag 602 OFF, Lamp 2 OFF
10			CMPE	99	3	603	When Up-Take Value = 3, Flag 603 ON
11		603	BTON	313			When Flag 603 ON, Lamp 3 ON
12		N603	BTOF	313			When Flag 603 OFF, Lamp 3 OFF
13			CMPE	99	4	604	When Up-Take Value = 4, Flag 604 ON
14		604	BTON	314			When Flag 604 ON, Lamp 4 ON
15		N604	BTOF	314			When Flag 604 OFF, Lamp 4 OFF
16			CMPE	99	5	605	When Up-Take Value = 5, Flag 605 ON
17		605	BTON	315			When Flag 605 ON, Lamp 5 ON
18		N605	BTOF	315			When Flag 605 OFF, Lamp 5 OFF
19			CMPE	99	6	606	When Up-Take Value = 6, Flag 606 ON
20		606	BTON	316			When Flag 606 ON, Lamp 6 ON
21		N606	BTOF	316			When Flag 606 OFF, Lamp 6 OFF
22			CMPE	99	7	607	When Up-Take Value = 7, Flag 607 ON
23		607	BTON	317			When Flag 607 ON, Lamp 7 ON
24		N607	BTOF	317			When Flag 607 OFF, Lamp 7 OFF
25			CMPE	99	8	608	When Up-Take Value = 8, Flag 608 ON
26		608	BTON	318			When Flag 608 ON, Lamp 8 ON
27		N608	BTOF	318			When Flag 608 OFF, Lamp 8 OFF
28			CMPE	99	9	609	When Up-Take Value = 9, Flag 609 ON
29		609	BTON	319			When Flag 609 ON, Lamp 9 ON
30		N609	BTOF	319			When Flag 609 OFF, Lamp 9 OFF
31			GOTO	1			Jump TAG 1
32							

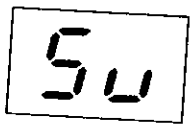
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*Supplement

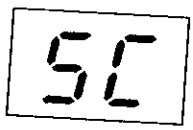
1. Super SEL Controller 7 Segment Display at the time of Power Up

(1) 

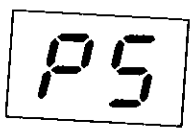
Open (Always appear at the beginning). Goes to the next step (2) after 500msec.

(2) 

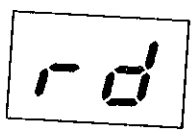
Opens SIO (Serial IO). If under EMG condition, waits till EMG is released. Goes to the next step (3) if no problem.

(3) 

Check Servo. Initializing the motor processor. Waits 500msec after initializing, then goes to the next step (4).

(4) 

Sets up the position data and program data. Waits 500msec after setting, then goes to the next step (5).

(5) 

Indicates the normal status of Power Up under stand-by condition.

Each display indicates the "progress status of the initial setting", and it is not an alarm. However, switching the controller power supply for a very short period of time could cause this process to stop at Step 3 (SC). This is a hardware related problem, and nothing unusual. This problem should be corrected by turning the power back on after 10 seconds or longer.

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2. Power required by Super SEL Controller (Manual display & caluculation)

(1) Power values written in the manual indicate Rated Power (Active Power).

The required power is calculated basing on the power consumption below.

			Power Consumption	
Controller		A Type	60W	at Maximum (4 axes)
		B Type	80W	at Maximum (8 axes)
DC Motor	Axis Output	20W Type	60W	at Rated Output
	Axis Output	30W Type	60W	at Rated Output
	Axis Output	35W Type	60W	at Rated Output
	Axis Output	60W Type	110W	at Rated Output
	Axis Output	100W Type	160W	at Rated Output
	Axis Output	200W Type	270W	at Rated Output

[Example] : Controller B, 6 axes specification, 60w x 2 + 35w + 20w + 100w x 2

$$\underset{A}{80} + \underset{B}{(110 \times 2 + 60 + 60 + 160 \times 2)} = 740W$$

The calculated value is the required active power when each axis is used at the rated power. A is Control ler Consumption, and B is Motor Consumption.

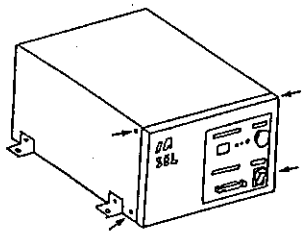
(2) For IAI power supplies, the load current cannot be calculated simply by the resistive load but also requires a power factor. Although every motor is differnt, an average power factor of 60% can be used to calculate the nominal apparent power. For the example above, when the load is 100% (full duty), the apparent power is 740W / 0.6 = 1.2K VA. Because the load varies depending upon the application, we can introduce a load factor into the calculation. For the example above, we will assume a load factor of 60%. 60% is a rough guess of how much the motor is loaded. Hence the nominal required apparent power for the example above is now (80 + 660 x 0.6) / 0.6 = 800VA.

(3) 10% of the nominal apparent power calculated in (2) above is dissipated as heat.

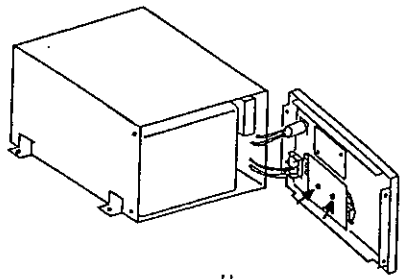
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3. How to change the Super SEL Controller Battery

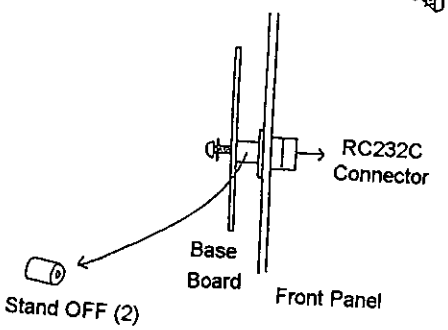
Tool: Screwdriver (+)
Environment: Minimal dust and oil



(1) Turn the Power OFF. Unplug the power cord. Unscrew the four screws to remove the front panel of the controller.

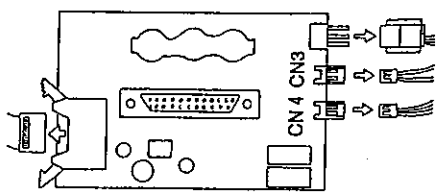


(2) There are two boards inside of the front panel. Remove the lower board. (2 screws in the drawing on the right)
Note: Please pay attention to the stopper which comes off during this process.

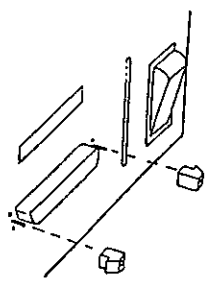


(3) RS232C Connector and a battery are mounted to the board which was removed in Step (2). Remove the RS232C Connector stand off (2) attached to the board at the same time of removing the screws.

(4) Change the board.
Note: During this process the four connectors attached to the board are removed. Please pay extra attention to CN3, CN4 when they are connected back to the connectors (They use the same type of connectors)



(5) After pluging the four connectors to the board, place the stand off (2) (Step 3) back to the original place, and attach them to the front panel.
Note: During this process, the stopper is placed back on the front side. Be sure that the direction of the stopper is correct.



(6) Place the front panel back on the body.
Note: Keep the four screws loose in order to make this process easier.

Important:
The data in the controller are stored by the super capacitor during the battery change operation. However, the data should be backed up if the operation time is expected to be more than four hours.

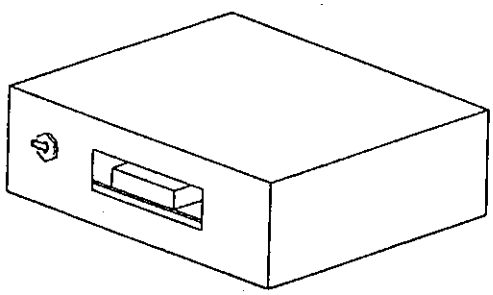
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4. Brake Specification (Option)

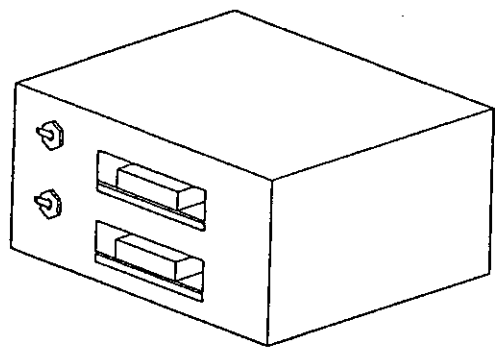
(1) Summary

When an actuator with brake specification is controlled by the Super SEL Controller, connect the option brake box to the controller. Brake boxes are devided into two categories basing on the power supply: AC117V and AC240V. There are two types of brake boxes in each category: 1 axis use and 2 axes use. Brake boxes can be used singly or combined. Connect the brake box (es) and the actuator with brake cables.

AC100V

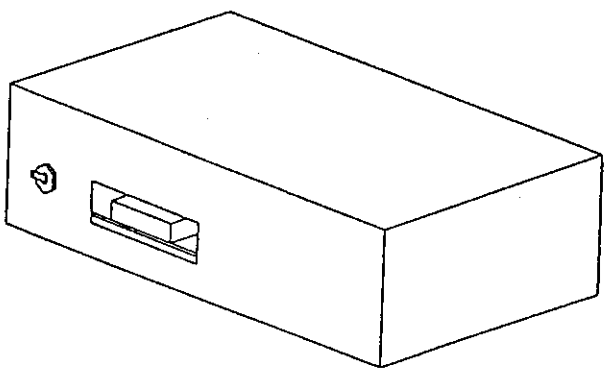


Brake Box (1 Axis)

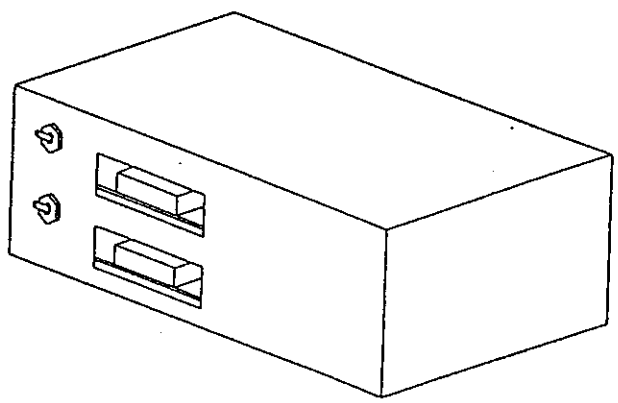


Brake Box (2 Axes)

Single Phase AC200V



Brake Box (1 Axis)



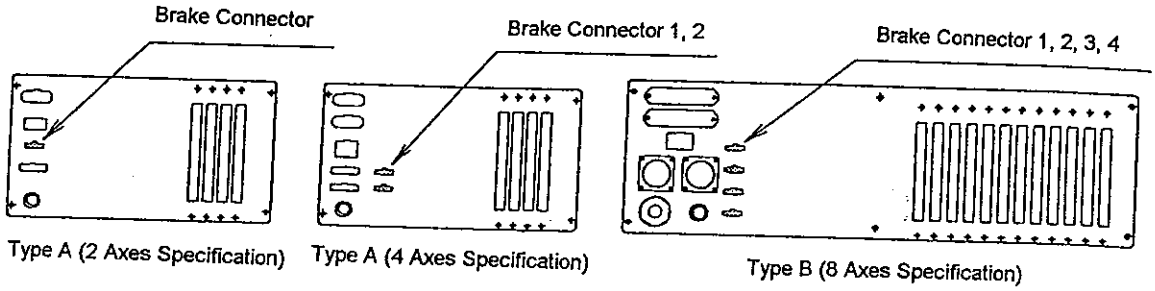
Brake Box (2 Axes)

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(2) How to connect

a. Brake Box and Controller

Controller side brake connector numbers are indicated on the cables. Connect cables according to the numbers. The placement of the brake connectors on the controller differs depending on the actuator. (See below)

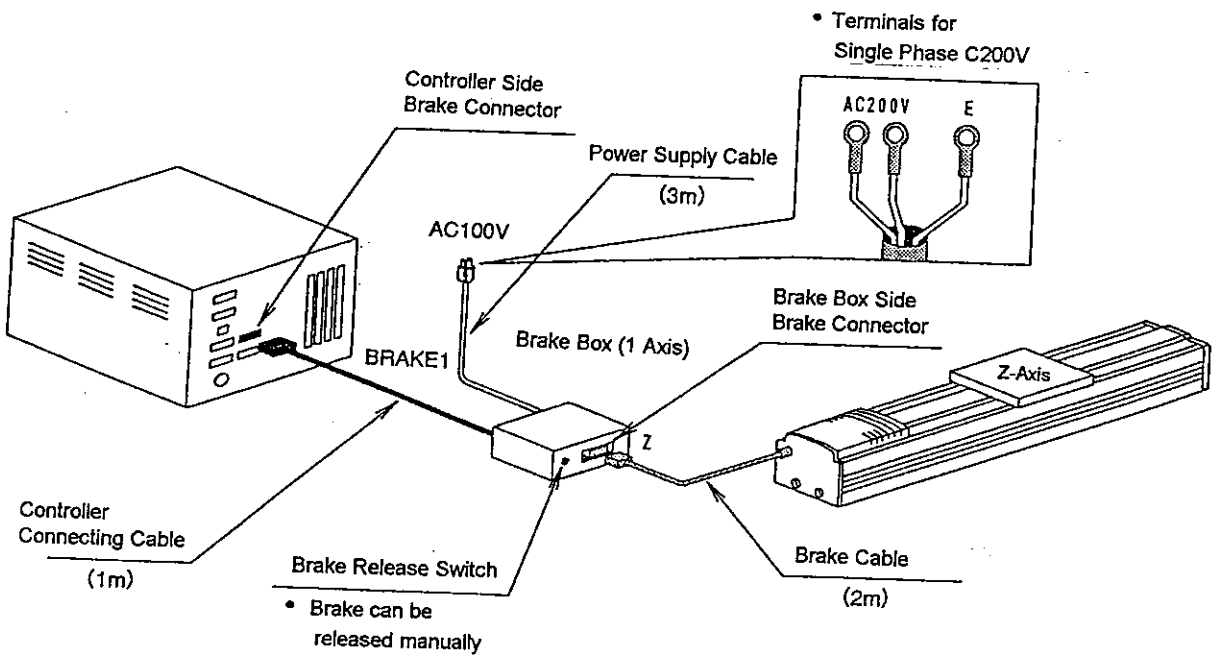


b. Brake Box and Actuator

The type of actuator to be connected is indicated on the brake connector of the brake box. Connect brake cables accordingly.

c. Brake 1 axis specification

• Brake Box (1 axis) use

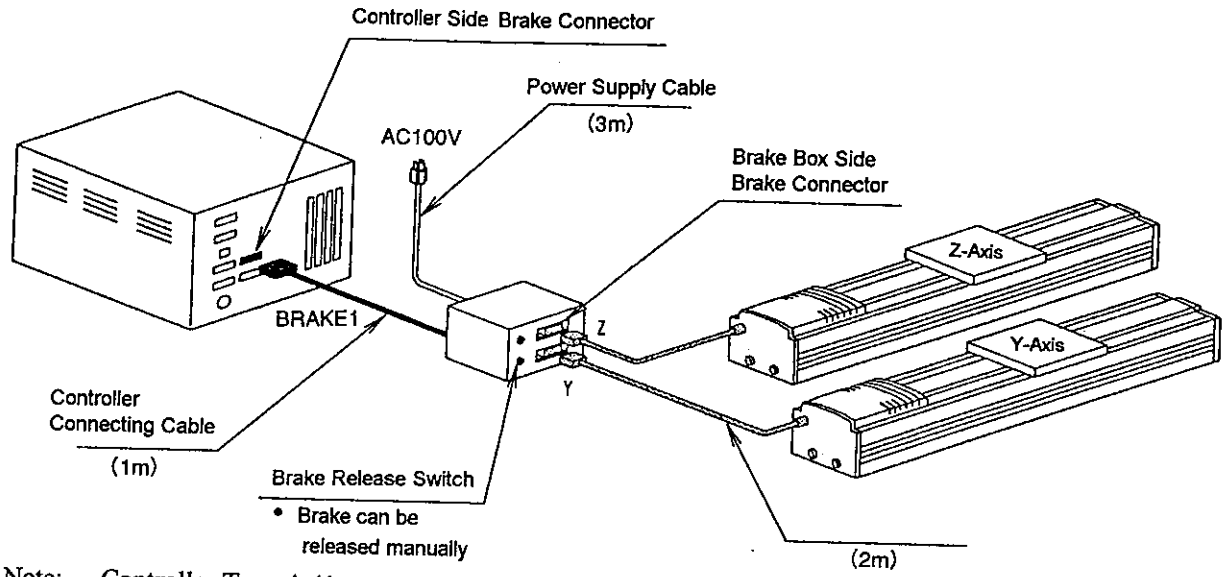


Note: Controller Type A (4 axes specification), Z-axis Actuator

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d. Brake 2 axes specification

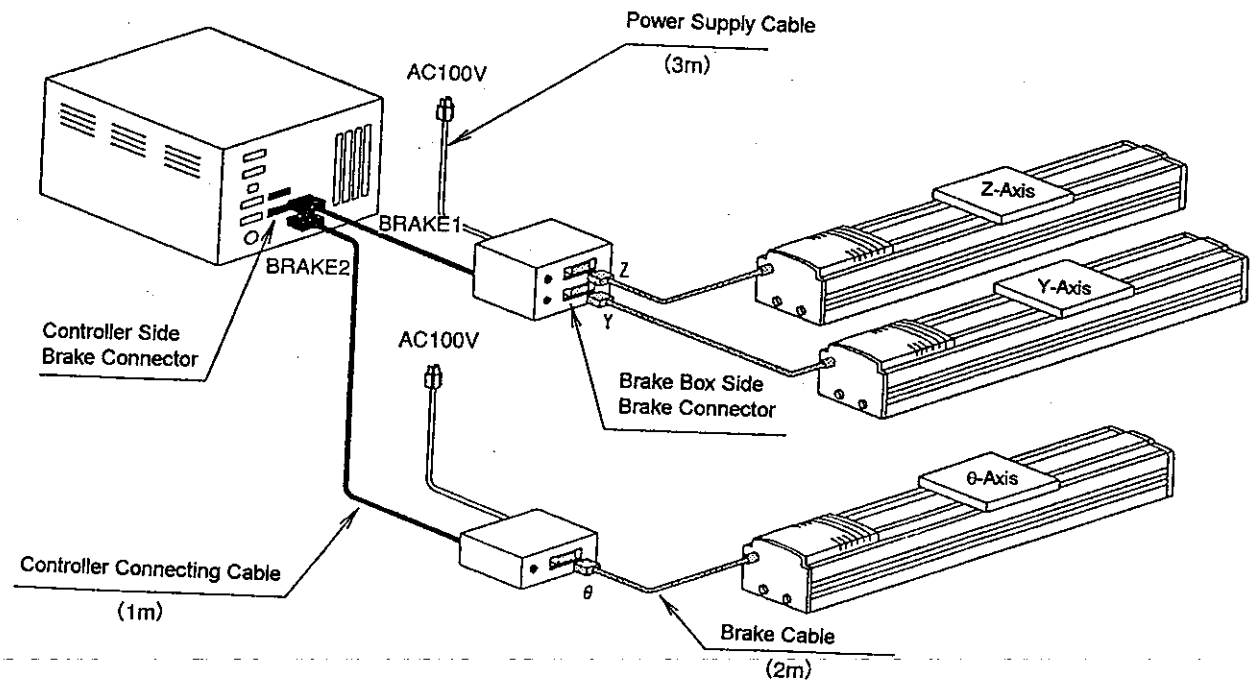
• Brake Box (2 axes) use



Note: Controller Type A (4 axes specification), Y and Z-axis actuators

e. Brake multi-axes specification

• Odd number of axes: Brake box (1 axis), (2 axes) in parallel use
• Even number of axes: Brake box (2 axes) in use

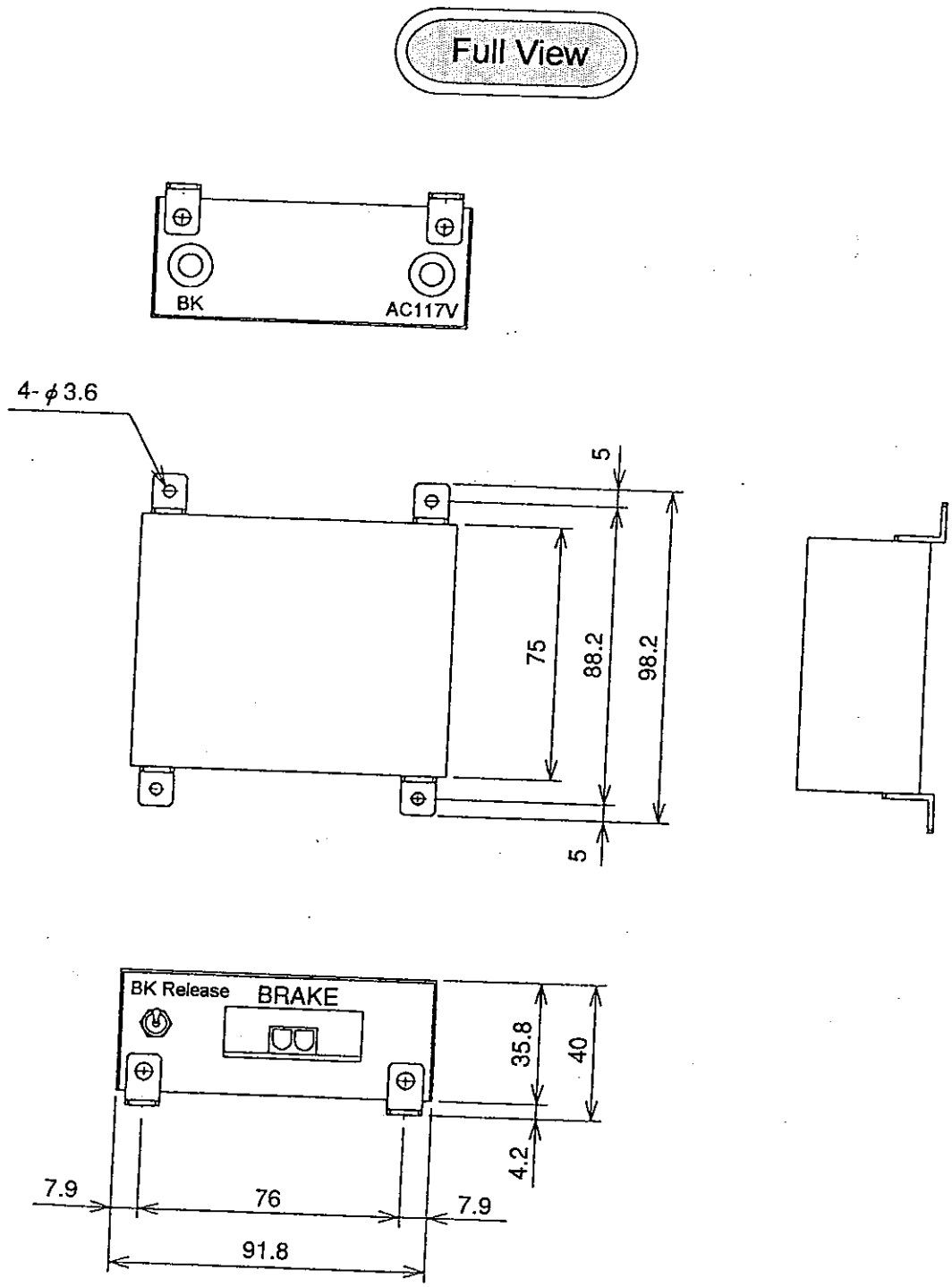


Note: Controller Type A (4 axes specification), Y, Z, and θ-axis actuator

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(3) Full View

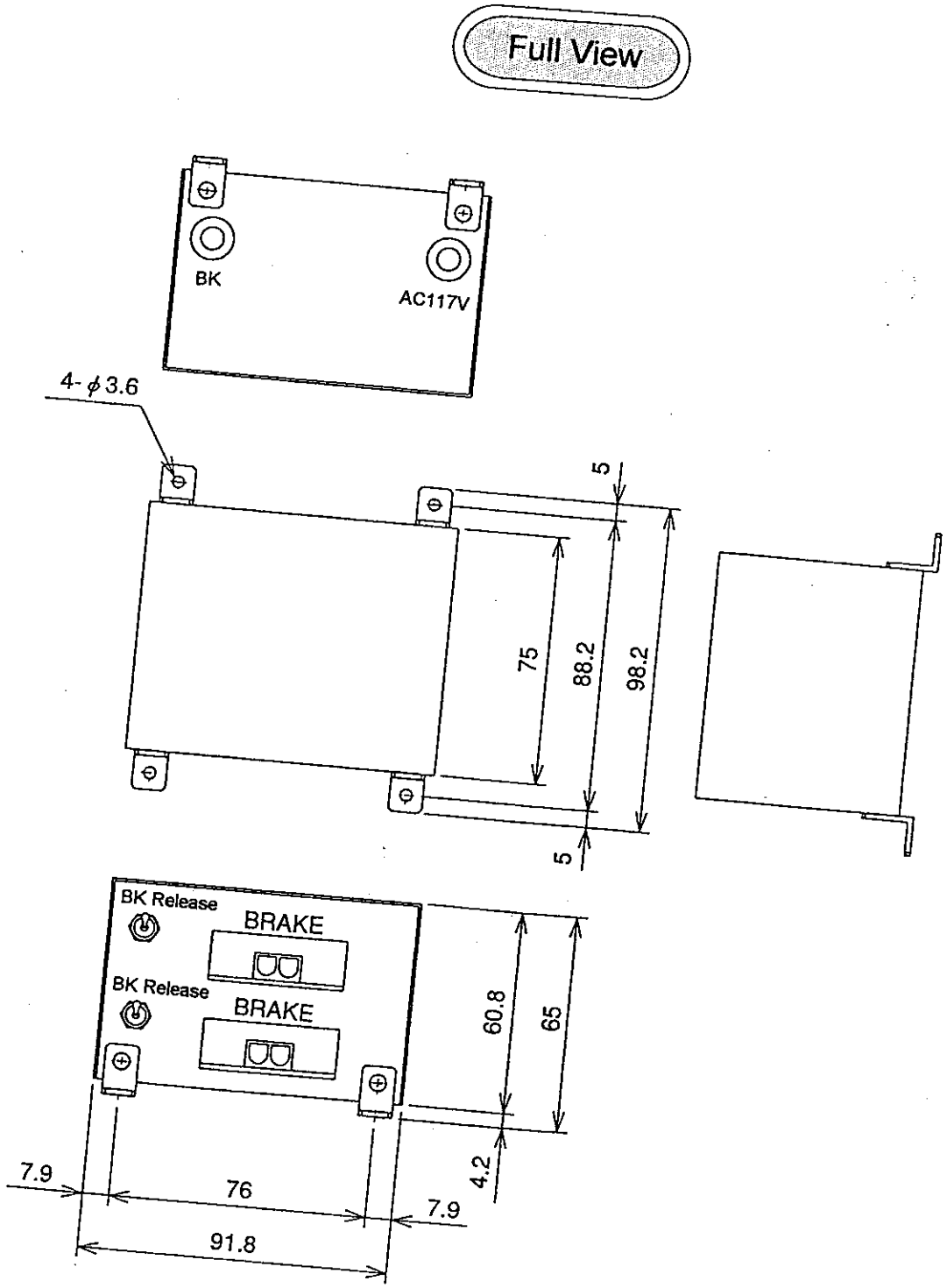
a. AC117V Brake Box (1 axis)



 For Technical Assistance Call: **1-800-736-1712**

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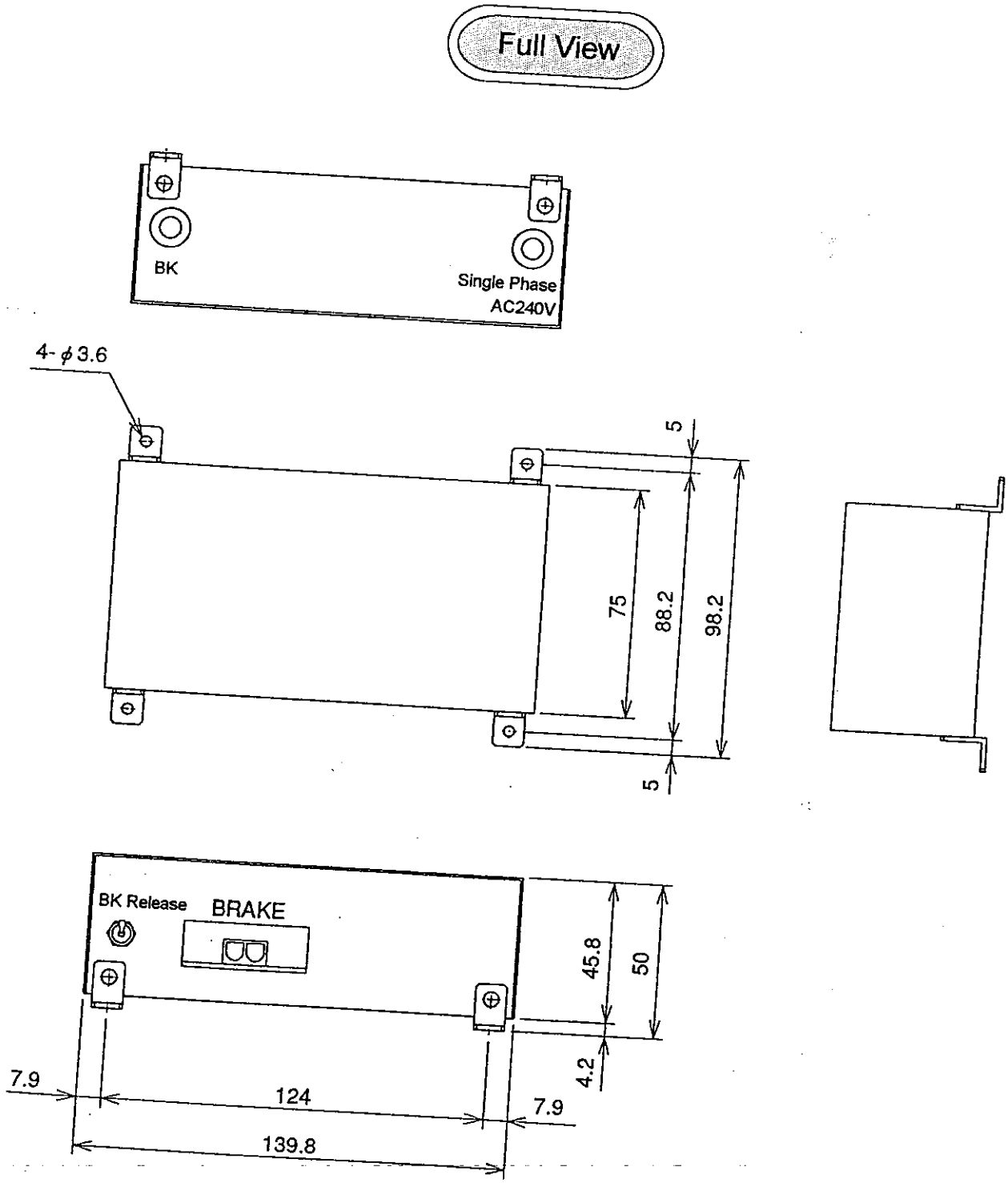
b. AC117V Brake Box (2 axes)



For Technical Assistance Call: 1-800-736-1712

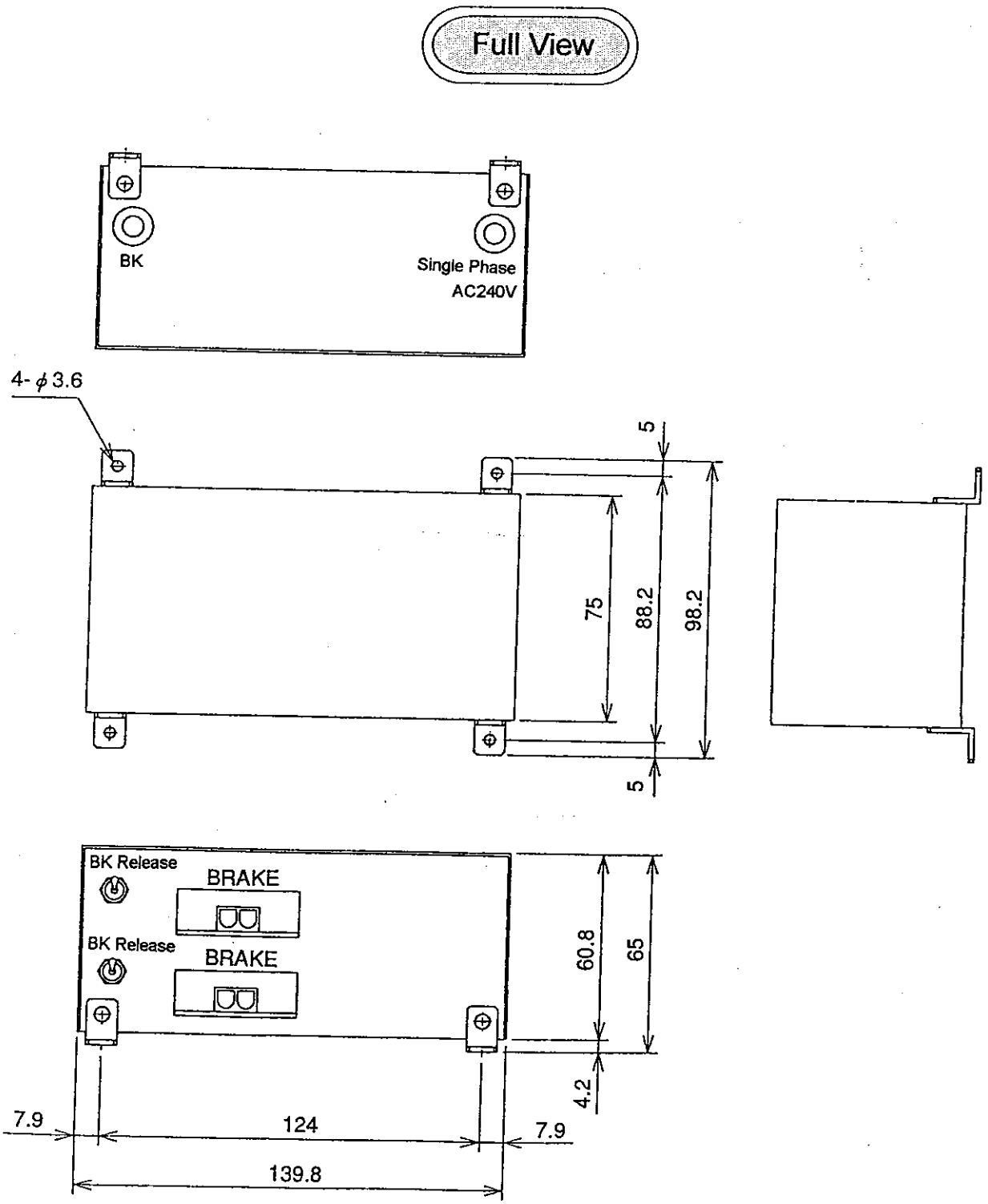
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c. Single Phase AC240V Brake Box (1 axis)



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d. Single Phase AC240V Brake Box (2 axes)



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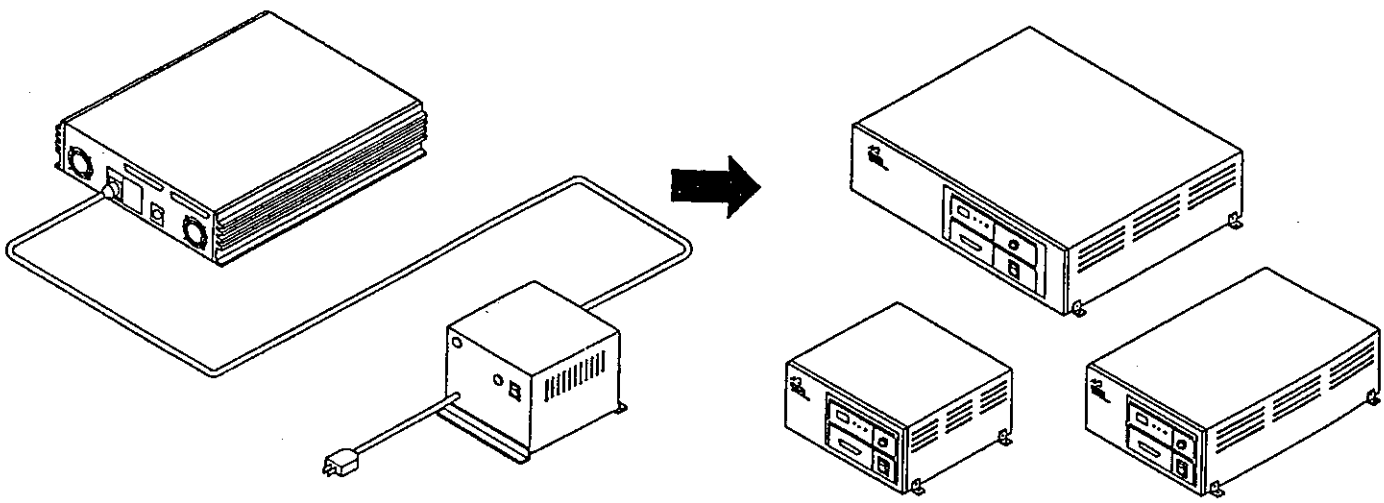
5. DC200W Specification

(1) Summary

There are two types of Super SEL Controller based on motor capacity, and they differ in regards to specification and dimension: 100W specification (DC Servo Motor 20 ~ 100W) and 200W specification (DC Servo Motor 200W). 200W specifications must be selected when DC servo motor 200W is to be used. This section will provide information on Super SEL Controller 200W specifications in detail.
For our original Multi-SEL Controller, a transformer box (total motor capacity 800W) must be installed separately from the controller when the total motor capacity is over 400W.
The 200W Super SEL Controller does not require a separate transformer because of its high efficient power switching feature.

Multi-SEL Controller

Super SEL Controller
DC Servo Motor 200W



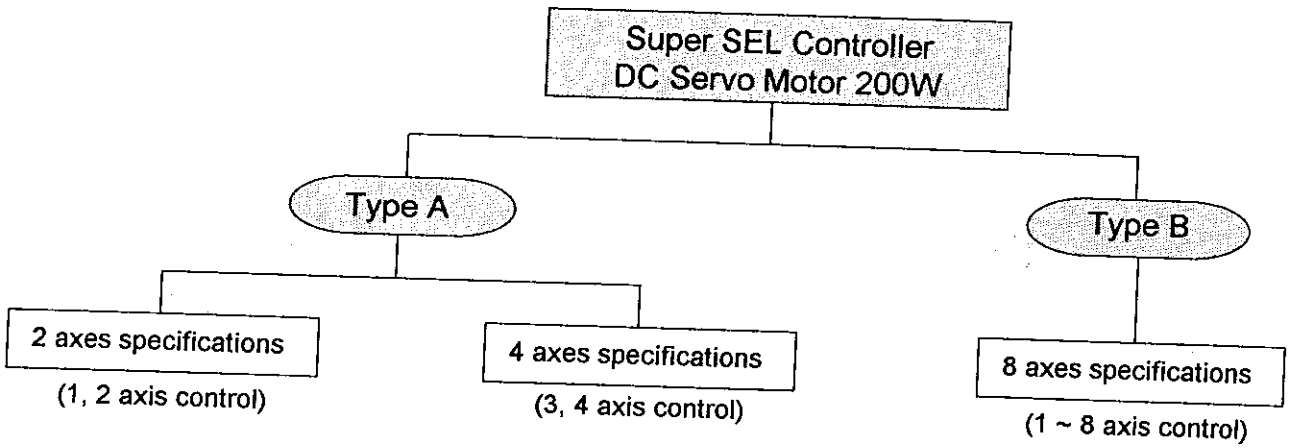
Separate Transformer Box

For Technical Assistance Call: **1-800-736-1712**

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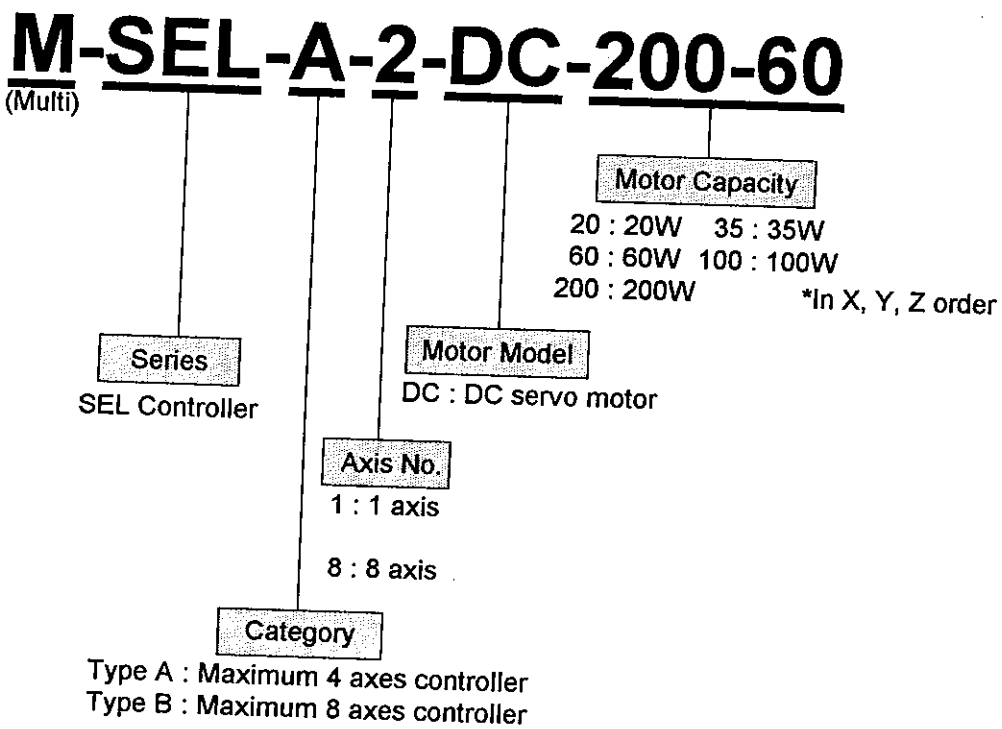
(2) Structure and Model

a. Structure



Note: When DC servo motor 200W is used for even one axis in multi-axis specifications, 200W Super SEL Controller must be used.

b. Model



*Super SEL Controller Type A, 2 axes, DC servo motor, X-axis 200W, Y-axis 60W

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(3) Specifications

2 Axis Specification	4 Axis Specification	
2 Axis (200W x 2)	3 Axis (200W x 3)	4 Axis (200W x 4)
AC117V +/- 10%		
50/60Hz		
Approximately 390W	Approximately 550W	Approximately 710W
Temperature 0 ~ 50 degrees Centigrade, Humidity less than 85%RH		
No-Corrosive Gas, Minimal Dust		
500V 10M Ω or more		
1500V 1 microsecond pulse by noise simulator		
Approximately 5kg	Approximately 6kg	Approximately 6kg
Driver Humidity Check Overload Check Software Limit Check		
DC Servo Motor 20W ~ 200W		
Approximately 2,000 Steps and 1,000 Positions Total		
48 Programs 8 Multi-Tasking Programs		
CMOS RAM Battery Backup		
Dedicated Input : Emergency Stop, Limit Switch Standard I/O : 22 Inputs, 24 Outputs (including dedicated I/O) Extended I/O : 1 Module 24 Input, 24 Output Maximum expansion up to 3 Modules Maximum Expansion : 94 Input, 96 Output DC24V 0.5A Built-in		
Teaching Pendant or RS232C Communications		
EIA RS232C Asynchronous		

Note: Controller Unit Test

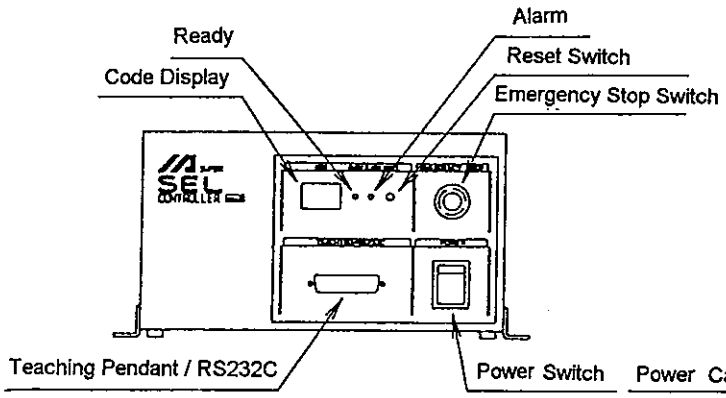
8 Axis Specification		
4-Axis (200W x 4)	6-Axis (200W x 6)	8-Axis (200W x 8)
AC117V +/-10%		
50/60 Hz		
Approximately 730W	Approximately 1060W	Approximately 1380W
Temperature 0 ~ 50 degrees Centigrade, Humidity less than 85%RH		
No-Corrosive Gas, Minimal Dust		
500V 10Ω or more		
1500V 1 microsecond pulse by noise simulator		
Approximately 11kg	Approximately 12kg	Approximately 13kg
Driver Humidity Check Overload Check Software Limit Check		
DC Servo Motor 20W ~ 200W		
Approximately 2,500 Steps and 1,500 Positions Total		
64 Programs 16 Multi-Tasking Programs		
CMOS RAM Battery Backup		
Dedicated Input : Emergency Stop, Limit Switch Standard I/O : 46 Inputs, 48 Outputs (including dedicated I/O) Extended I/O : Module 24 Input, 24 Output. Maximu extension up to 10 Modules Maximum Expansion : 286 Input, 288 Output DC24V 0.5A Built-in		
Teaching Pendant or RS232C Communications		
EIA RS232C Asynchronous		

Note: Controller Unit Test

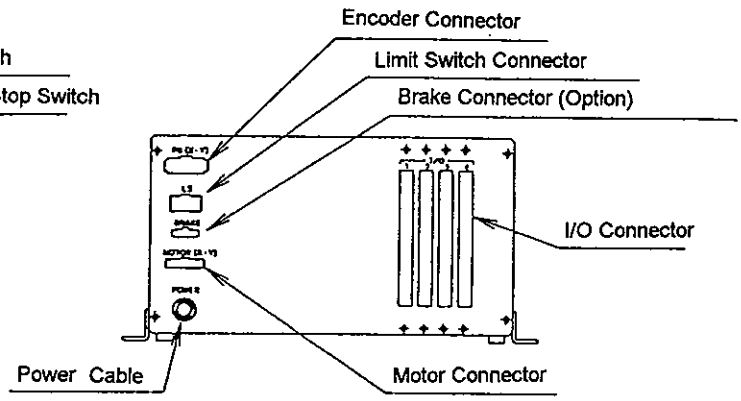
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(4) Full View

a. Type A (2 axes specification)

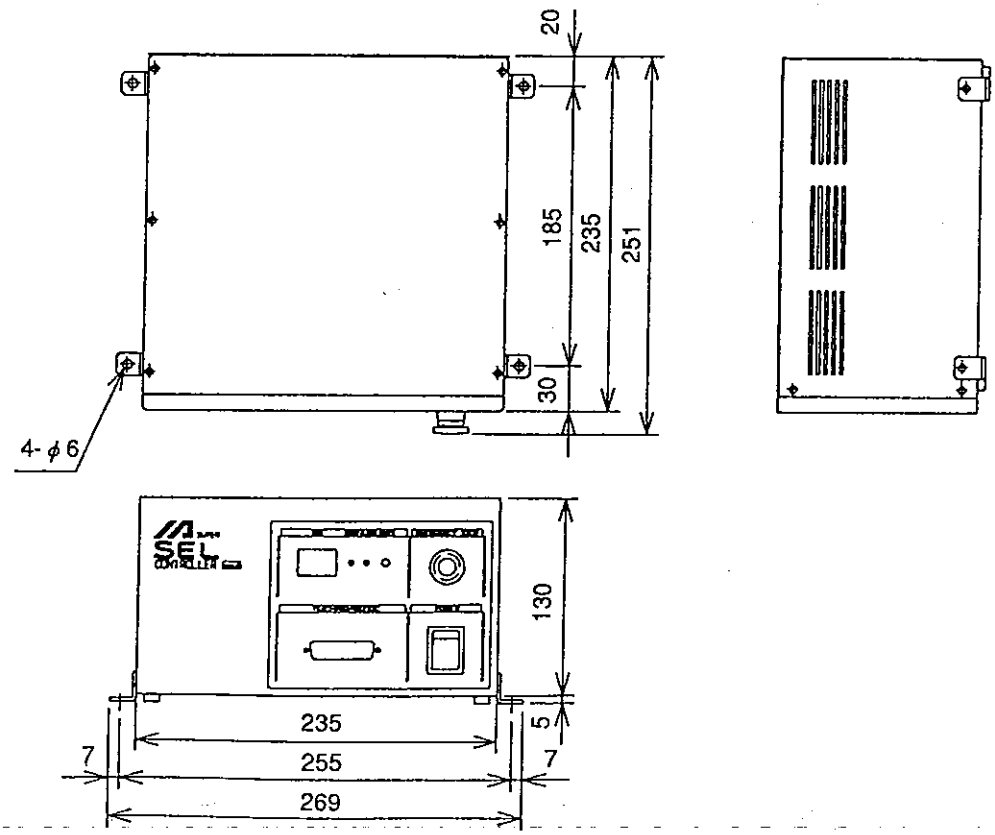


Front Panel



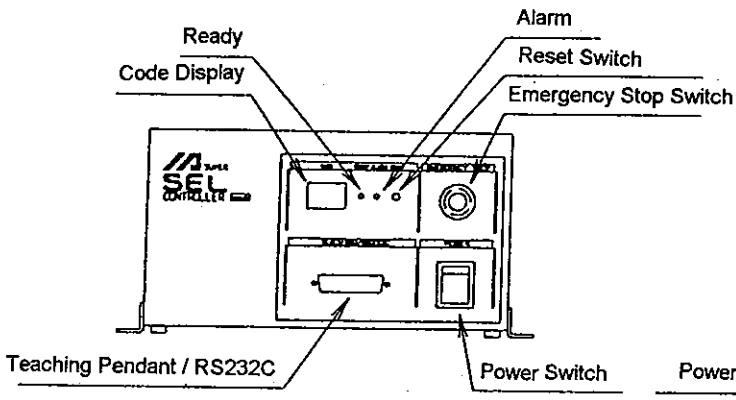
Rear Panel

Full View

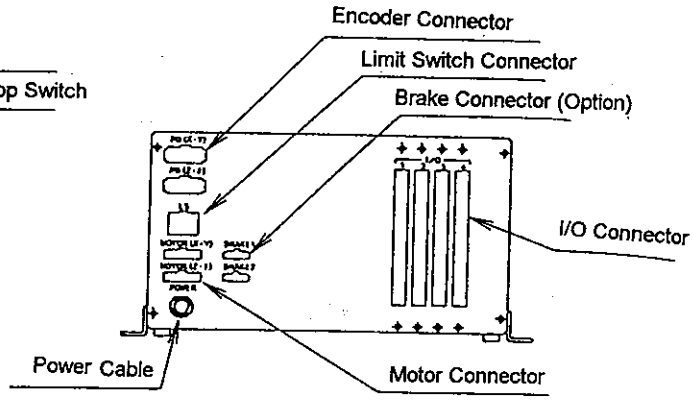


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b. Type A (4 axes specification)

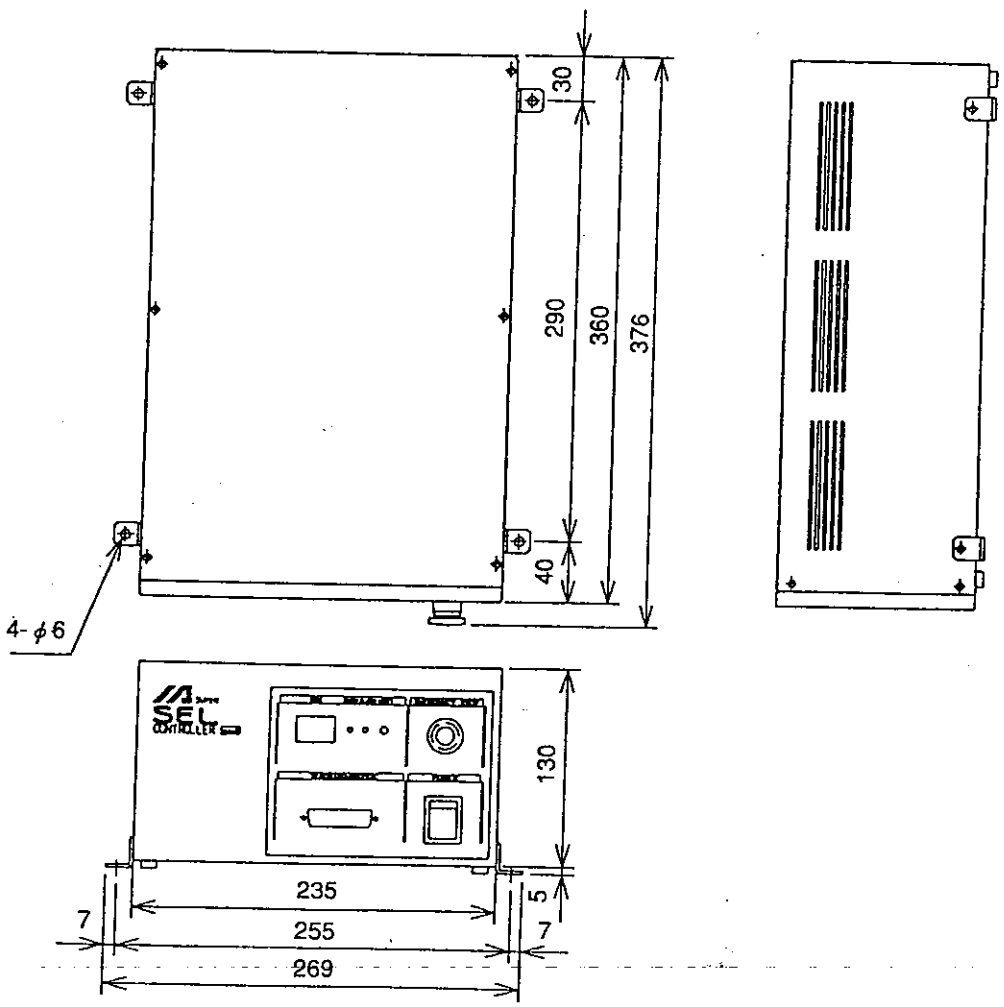


Front Panel



Rear Panel

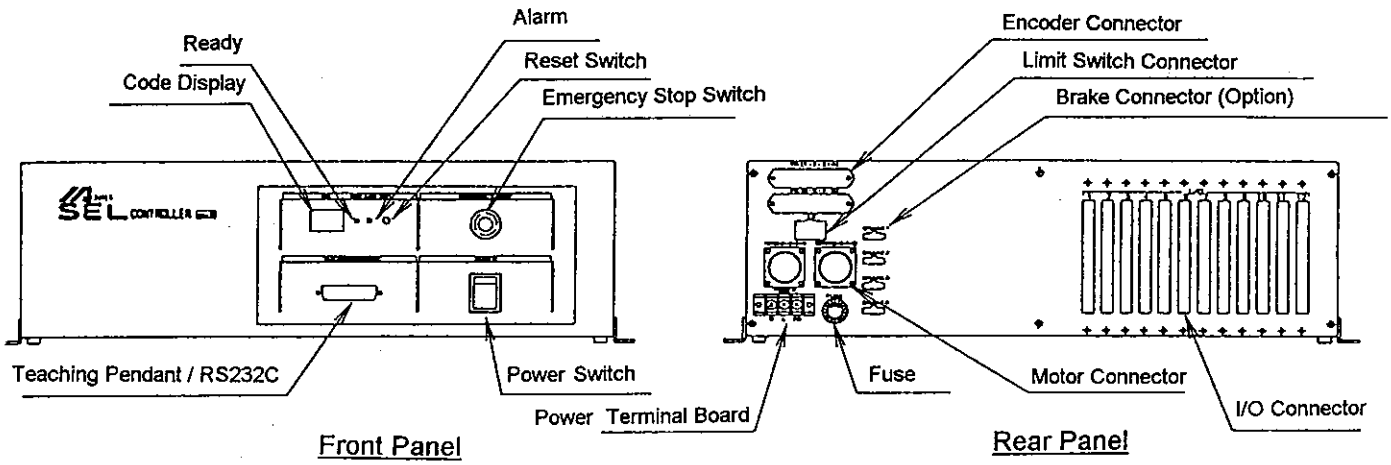
Full View



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c. Type B (8 axes specification)

The 200W Super SEL Controller Type B has a power termial board on the rear panel. Please provide your own cables that meet the rated power.

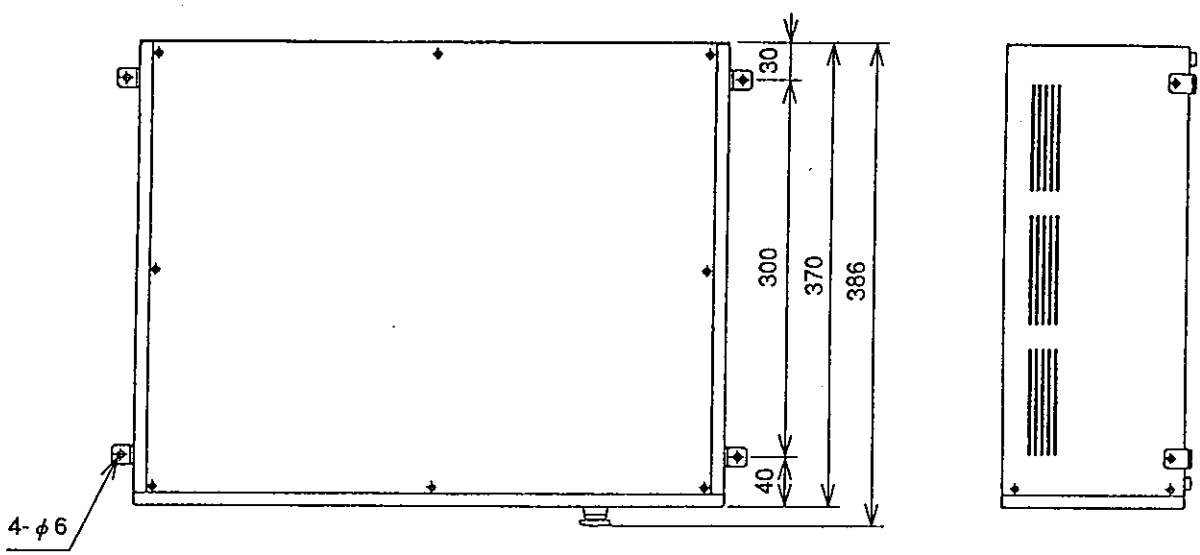


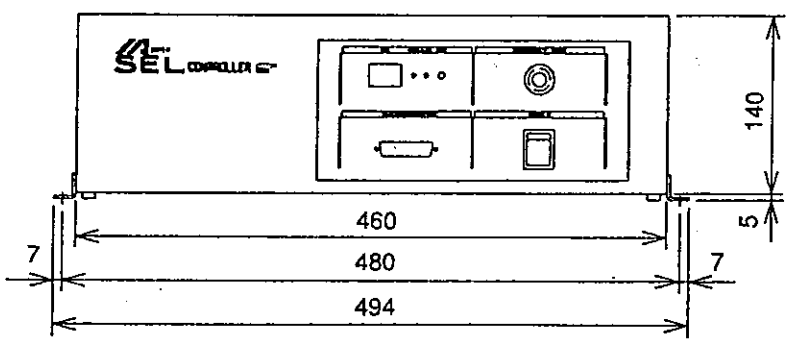
Rated Power

Number of Axis	Power Supply	Rated Power
6 axes	AC117V	15A, 125V
	AC240V	8A, 250V
8 axes	AC117V	20A, 125V
	AC240V	10A, 250V

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Full View





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Step	A/O	N	OP-CODE	OPRND1	OPRND2	POST	COMMENT
1							
2							
3							
4							
5							
6							
7							
8							
9							
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
0							

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No.	1 (x)	2 (y)	3 (z)	4	5	
1						
2						
3						ENT
4						
5						
6						
7						
8						
9						
0						
1						
2						
3						
4						
5						
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2						
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