NC ROTARY TABLE

Kitagawa own controller
MAC mini i series
MAC mini i・MAC mini iH
MAC mini iH2

## ▌ Easy operation, Full functionality

【 All Types 】

●**Absolute Encoders are adopted to all types.**
Absolute encoders of 17 bits are used on all MAC mini controllers.
This means it is not necessary to return to the zero position after each power on. The machine zero position can also be optionally set at any angle. If the cable from the rotary table is disconnected from the controller the zero position still remains.

●**LCD can display various data.**
The LCD screen is used to display various data. Programs can be displayed by each block. Parameter settings and alarm messages are displayed clearly with descriptions making setup, programming and error finding simple.

●**Max. 90 channels capacity.**
Standard 16 channels can be expanded to 90 by setting the number of blocks per channel.

●**1000 blocks per channel.**
Each program created in one channel can contain 1000 blocks.

●**Manual pulse generator.**
Manual pulse generators can be fitted as an option.

●**Extend reset function can be installed.**

【 MAC mini iH Type: CE Compliant. 】

●**Pendant type features manual operation.**
All features, programming editing, diagnostics etc can be operated from the product.

●**ENABLE switch function**
The pendant is equipped with an ENABLE switch as standard for safe operation in manual mode and automatic mode.

●**External channel number output.**
The channel number that is selected can be outputted to external equipment, this allows the selected channel number to be checked on the machine side.

●**Controller corresponding to 2 axes（MAC mini iH2 / iHT）**
2 axis controller. One controller can control 2 axis. One common M signal can also correspond to 2 axis.

●**Many outputs of function signals.**
Output of auto signals, output of manual signals etc.
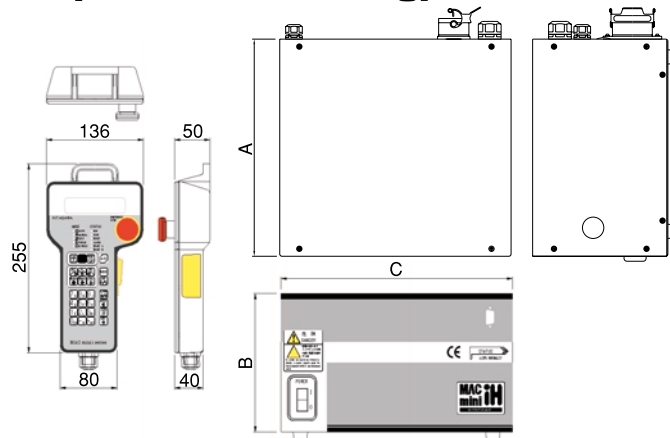
MAC mini i / iF / iDM

【Dimensional drawing】

305 / 328.7 / 190 / Max 26mm
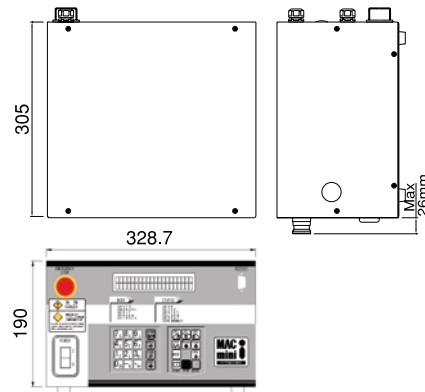
MAC mini iH / iHF / iHP

Conforms to EN standard and corresponds to EMC command.

【Dimensional drawing】

136 / 50 / 255 / 80 / 40 / A / B / C

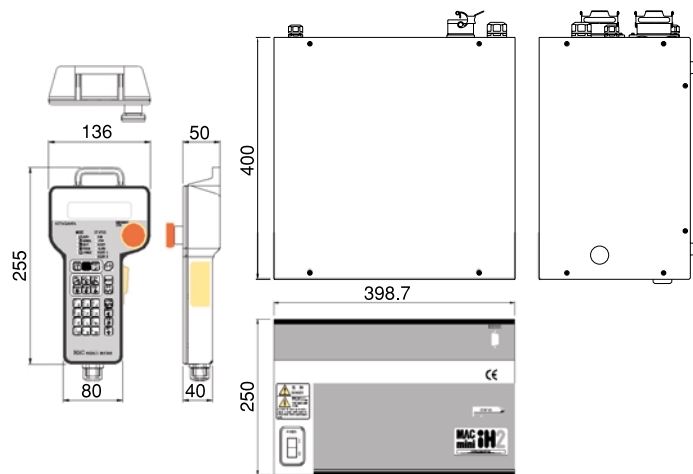■Dimensions

	A	B	C
iH / iHF	305	190	328.7
iHP	400	250	398.7

MAC mini iH2 / iHT

Two-axis controller conformed to EN standard and corresponded to EMC command.
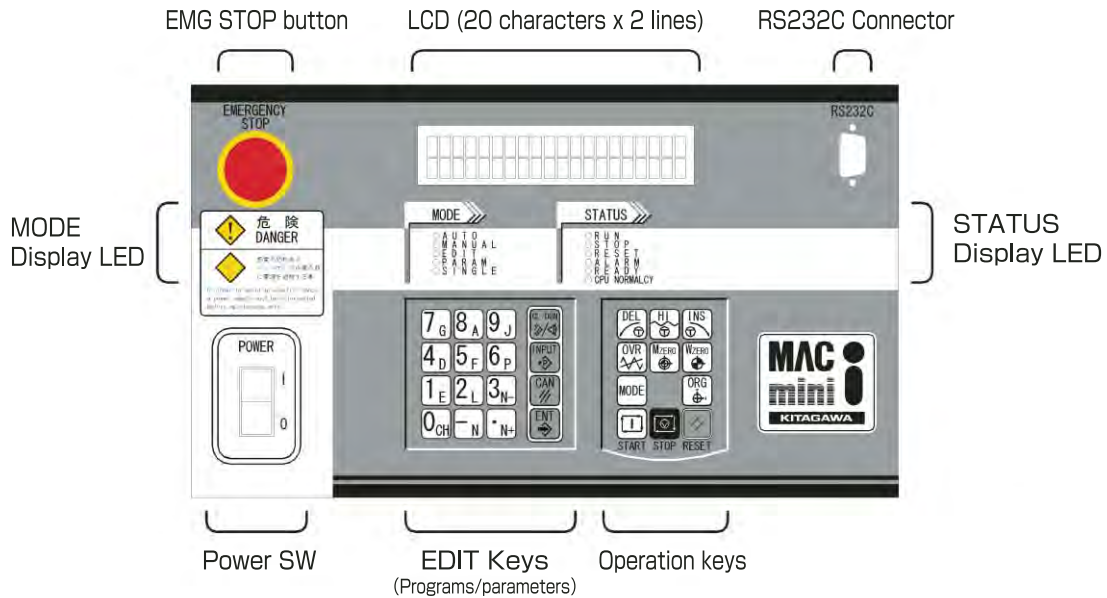
【Dimensional drawing】

136 / 50 / 255 / 80 / 40 / 400 / 398.7 / 250

NC ROTARY TABLE MAC mini i series MAC mini i·MAC mini iH·MAC mini iH2

MAC mini i Type PANEL FUNCTIONS

EMG STOP button   LCD (20 characters x 2 lines)   RS232C Connector

MODE
Display LED

STATUS
Display LED

Power SW   EDIT Keys
(Programs/parameters)   Operation keys

■ **Power SW** Turns ON/OFF controller power.

■ **EMG STOP button** Stops the table during operation in an emergency.

■ **LCD** Displays current position, program, parameter and alarm data.
【 Current position display example 】
```
CH00 A   123.456
N000            WP-R
```
【 Program display example 】
```
CH00 /A/G90A180.000
N000 F0    D    J
```
【 Parameter display example 】
```
A:110          1
PRM INPUT PURMISSION
```
【 Alarm display example 】
```
<A>Err.001
EMERGENCY STOP
```
【 Diagnosis screen display example 】
```
A 011000 CLAMP
              EA-I
```

■ **RS232C Connector** Uses this connector when data communication or remote control is performed.

■ **MODE Display LED**
AUTO : Auto operation mode
　Executes block by block as often as a start signal is inputted.
MANUAL : Manual operation mode
　Rotates the table manually.
EDIT : Program EDIT mode
　Inputs and edits programs.
PARAM : Parameter mode
　Sets and checks parameters.
SINGLE : Manual operation
　Operates the controller independently.

■ **STATUS Display LED**
RUN : During RUN
　Lamp lights during program run.
STOP : During STOP
　Lamp lights when program is not run. When the program is held, the lamp lights together with "RUN".
RESET : During RESET
　Lamp lights just after power ON, after program reset and JOG start.
ALARM : During alarm occurrence
　Lamp lights during alarm. The lamp flashes while alarms occur redundantly.
READY : Operation ready
　Lamp lights when the controller can be operated automatically.

■ **EDIT Keys** Used when program INPUT/EDIT, parameter setting and selection of diagnosis screen are performed.

■ **Operation keys**
　[MODE] Selects operation mode.
　[INS] Feeds at JOG in CW direction.
　[DEL] Feeds at JOG in CCW direction.
　[HI] Feeds at high JOG speed when pressing this button together with [INS] or [DEL].
　[MZERO] Rotates to MZRN position.
　[WZERO] Rotates to WZRN position.
　[ ] Starts the program.
　[ ] Stops the program.
　[ ] Resets the program or alarm.
　[ORG] Sets WZRN position.
　[OVR] Sets the override of feedrate.

MAC mini iH Type　PENDANT FUNCTIONS

LCD
(20 characters x 2 lines)

STATUS
Display LED

MODE
Display LED

Operation keys

EDIT keys
(Program/
parameter)

KITAGAWA

```
CH01 /A/G7 A180.000
N000 F0    D6   J0   >
```

MODE ● □ AUTO   STATUS ● RUN
● ☞ MANUAL   ● STOP
● ✎ EDIT   ● RESET
● ▷ PARAM   ● ALARM
● □ SINGLE   ● READY A
● READY B

START STOP RESET   A/B

DEL HI INS   MODE
MZERO WZERO ORG   OVR

7 G 8 A 9 J   CL/DGN
4 D 5 F 6 P   INPUT
1 E 2 L 3 N-   CAN
0 CH − N • N+   ENT

MAC mini i series

EMERGENCY
STOP

EMG STOP
button

Axis change key

ENABLE
switches

■ EMG STOP button　Stops the table during operation in an emergency.

■ ENABLE switches　Be sure to press ENABLE switches for safety operation and to prevent malfunction in auto operation start before an automatic operation is started by manual operation or pendant operation.

■ LCD　Displays current position, program, parameter and alarm data.
【 Current position display example 】
```
CH00 A   123.456
N000               WP-R
```
【 Program display example 】
```
CH00 /A/G90A180.000
N000 F0    D    J
```
【 Parameter display example 】
```
A:110            1
PRM INPUT PURMISSION
```
【 Alarm display example 】
```
<A>Err.001
EMERGENCY STOP
```
【 Diagnosis screen display example 】
```
A 011000 CLAMP
                EA-I
```

■ EDIT Keys　Used when program INPUT/EDIT, parameter setting and selection of diagnosis screen are performed.

■ MODE Display LED

AUTO : Auto operation mode
　Executes block by block as often as a start signal is inputted.
MANUAL : Manual operation mode
　Rotates the table manually.
EDIT : Program EDIT mode
　Inputs and edits programs.
PARAM : Parameter mode
　Sets and checks parameters.
SINGLE : Manual operation
　Operates the controller independently.

■ STATUS Display LED

RUN : During RUN
　Lamp lights during program run.
STOP : During STOP
　Lamp lights when program is not run. When the program is held, the lamp lights together with "RUN".
RESET : During RESET
　Lamp lights just after power ON, after program reset and JOG start.
ALARM : During alarm occurrence
　Lamp lights during alarm. The lamp flashes while alarms occur redundantly.
READY A : A-axis operation ready
　Lamp lights when A-axis can be operated automatically.
READY B : B-axis operation ready
　Lamp lights when B-axis can be operated automatically.
　When MAC mini iH2/iHT are used, B-axis is used.

■ Operation keys

MODE　Selects operation mode.
INS　Feeds at JOG in CW direction.
DEL　Feeds at JOG in CCW direction.
HI　Feeds at high JOG speed when pressing this button together with INS or DEL .
MZERO　Rotates to MZRN position.
WZERO　Rotates to WZRN position.
　Starts the program.
　Stops the program.
　Resets the program or alarm.
ORG　Sets WZRN position.
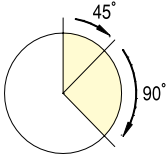OVR　Sets the override of feedrate.

■ Axis change keys

A/B　When MAC mini iH2/iHT are manually operated and programs/parameters are edited, A-axis is changed with B-axis and vise versa.

NC ROTARY TABLE

MAC mini i series   MAC mini i·MAC mini iH·MAC mini iH2
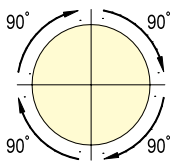
PROGRAM EXAMPLES

■ ANGLE INDEX

N000 A 45.000 F0
　　　Index angle　Rapid traverse
N001 A 90.000 J0
　　　　　　　　Jump destination

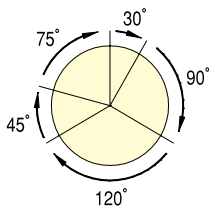Rotates 45°at rapid traverse and returns to N000 after rotating 90°.

■ EQUIPARTITION

N000 A360.000 F0　　D4　J0
　　　Partition angle　　Divided
　　　　　　　　　　　partition

Rotates with circle of 360°divided into 4-partition (every 90) at rapid traverse and returns to N000 after operating 4 times.
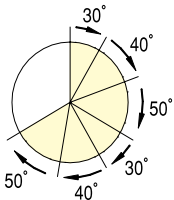
■ UNEQUAL PARTITION

N000 A 30.000 F0
N001 A 90.000
N002 A120.000
N003 A 45.000
N004 A 75.000 F500 J0
　　　　　　　　Feedrate

Rotate 45°at rapid traverse,
90°,
120°,
45°and
75°at feedrate 5.00min^{-1}
before returning to N000.

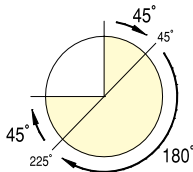### ■ REPETITION

N000 G27　　P10　　E12　　L2
　　　Repeating　Repeating　Repeating　Repeating
　　　command　start block　end block　times

N010 A 30.000
N011 A 40.000
N012 A 50.000

Command that repeats content of N010～N012

Rotate 30°,
40° and
50°.

■ ABSOLUTE / INCREMENTAL

N000 G90　　A 45.000　F0
　　　ABS　　　Index position
　　　command
N001 A225.000
　　　Index position
N002 G91　　A 45.000
　　　INC　　　Index angle
　　　command

Rotates 45°at rapid traverse under absolute mode.
Rotates 225°.

Rotates 45°under incremental mode.

■ SUBPROGRAM
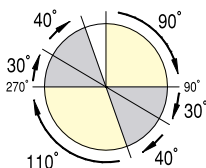
N000 A 90.000 F0 J10
　　　　　　　　　Subprogram jump destination
N001 G90 A270.000 J10
　　　　　　　　　Subprogram
　　　　　　　　　jump destination

N002 J0
N010 G91 A 30.000
N011 A40.000 J-1
　　　　　　　Return command

Rotates 90°at rapid traverse and jumps to N010.
Rotates 270°under absolute command and jumps to N010.

Returns to N000.

Rotates 30°under incremental command, rotates 40°and returns to original subprogram jump command point.

MAC mini i Series   OPTION

■ Manual Pulse Generator

【HC11DAKC11】

This pulse generator can operate the table at 0.1°,0.01°and 0.001°, and it adjusts jigs easily. One pulse generator can operate MAC mini iH2/iHT by changing the shaft.

Attached holder
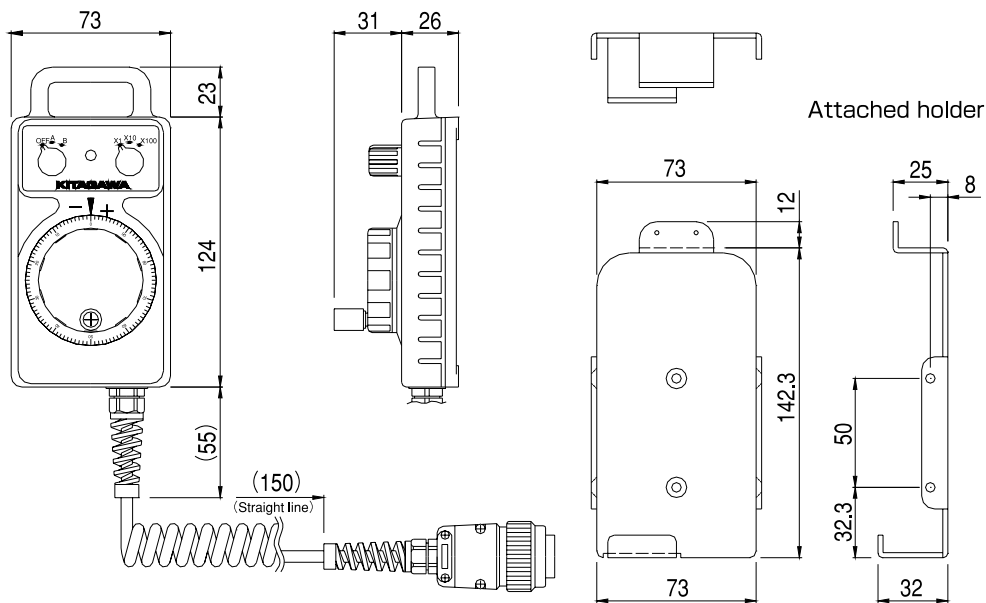
■ Manual Pulse Generator Junction cable

【HC1-IC】

To use the manual pulse generator, this junction cable (for inside panel) is required.
For HC1-IC, dust caps and mounting screws (4 pieces) are attached.
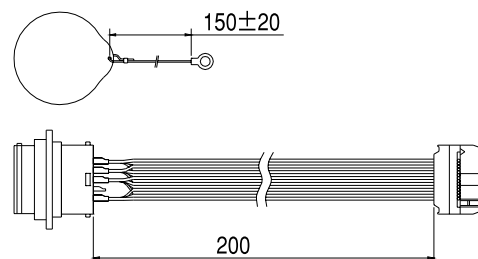
■ Dedicated software for data communication

This software can input and output the data for "Program", "Parameter" and "WZRN POS." that stores them in the controller.
This software is for Windows and it corresponds to WindowsXP, NT4.0 and 2000.
For RS232C cable, please consult our Sales Section.

【Updown Load】

MAC mini i Series   MAC mini i・MAC mini iH・MAC mini iH2

MAC mini i Series   OPTION

■ Remote Control Function

Remote Control Mode

The rotary table is controlled by programming the table movement into the machine's NC program. There is no programming required on the controller.
The movement of the rotary table is controlled by the program on the machine.

RS232C cable
Remote control function accessory

Command
(movement program)

CB3i Cable
Controller accessory

M-signal   FIN-signal

CONTROLLER

MACHINE

NC maker and Required function

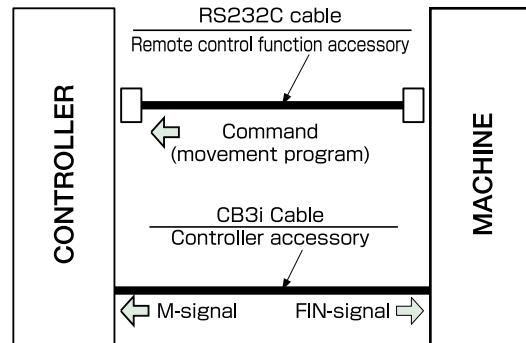| NC maker	Required Function (※1)	NC unit type
FANUC	Custom macro B (External output command)	After FS0 series After FS11 series
Mitsubishi Electric Corporation	User macro (External output command)	After MELDAS300 series
Okuma	User task II READ/WRITE・GET/PUT functions	After OSP5000
Yamazaki Mazak Corporation	External output command	Fusion 640M MATRIX ※2

※1 Since the required function may be the option of NC unit, please check that the required function exists to each maker.
※2 RS232C extension is required.

Examples of Machine Programs

● Program: FANUC (external output command)

180°

90°
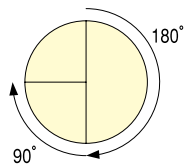
POPEN;
DPRNT [//G91A180.000F30.00/];
PCLOS;
M100;
・・・・・・・・
POPEN;
DPRNT [//G91A90.000F0.00/];
PCLOS;
M100;

Open RS232C port.
Transmit movement command to controller.
Close RS232C port.
Start positioning.
Process by movement program on the machine
Open RS232C port.
Transmit movement command to controller.
Close RS232C port.
Start positioning.

Remote Control Function Accessory

● RS232C cable for remote controlling

RS232C cable to connect between the machine and the controller.
Select the cable with appropriate connector type to match RS232C port on the machine.

【RSCB0925】(Standard)

Machine side connector with 25 pins

2000

Controller side connector with 9 pins
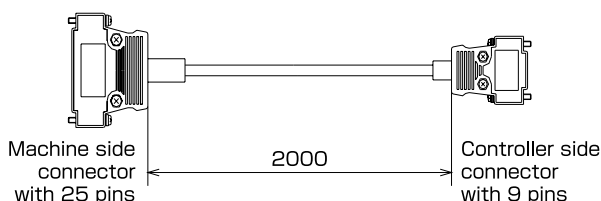
【RSCB0909】(Made to order)

Machine side connector with 9 pins

2000

Controller side connector with 9 pins

MAC mini i Series　Specification

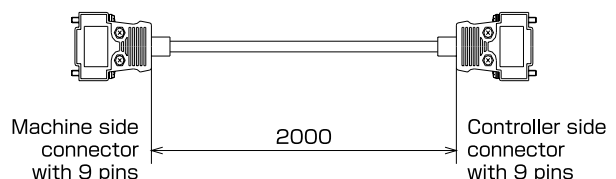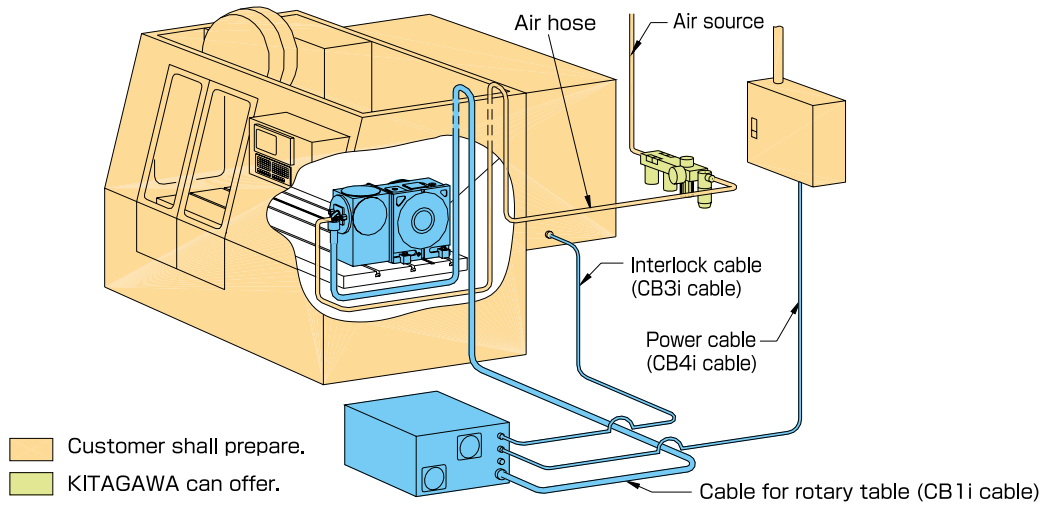| MAC mini / Item	Standard specification			CE specification				
	i	iDM	iF	iH	iHF	iHP	iH2	iHT
Controlled axes	1 axis			1 axis			2 axes	
Servomotor spec.	AC servo motor with absolute detector							
Servomotor capacity	750W	200W	400W	750W	400W	2KW	750W＋750W	400W＋750W
Setting unit	0.001°							
Max. setting angle	999-rotation +360° and 999.999°							
Equal partition	2～999 partition (dividable to sector form)							
Program capacity	2000-block (500-block x 1CH + 100-block x 15CH: Standard)							
	■ Optional channel set function is usable at max. 90-CH, max. 1000-block (1CH).							
Command method	Absolute / incremental methods (selectable at G90 / G91)							
Zero position return	MZRN and WZRN			MZRN and WZRN (commandable by external input.)				
Manual feed	Rapid traverse, slow speed feed, step feed							
Emergency stop	Emergency stop button or forced servo stop by external interlock input + master stop							
	■ When an emergency stop button is pushed, the data is outputted(EMOUT) to the external equipment.							
Halt	Halt of rotary table by key input or external SP input							
Feedrate override	Settable to 1～200% (Can be notched to 1～100%.)							
Preparatory function	DWELL, LEAD CUTTING, BUFFER FUNCTION, CLAMP PRESENCE, DEVIATION CHECK FUNCTION, INTERLOCK START, CONTINUOUS START, MZRN, WZRN, REPEATING FUNCTION, LOOP JUMP FUNCTION, ABSOLUTE/INCREMENTAL, FIN SIGNAL CONTROL COMMAND							
Jump function	Jumps to subprogram.							
Uni-directional approach	Even if rotary direction is changed, positioning from uni-direction is available.							
Software limit function	Software limit can be set from machine zero position to prevent interference with the machine by mounting jigs or workpiece.							
Over travel stop function	The hard limit mode can control the rotary range of rotary table.							
	Inputted point : 1 point			Inputted point : 2 points				
Pitch error compensation	Pitch error can be compensated per 15°. （Min. set unit : 0.001°）							
Backlash compensation	The backlash compensation of rotary table can be set. （Min. set unit : 0.001°）							
Alarm function	When error is detected, alarm No. and alarm message are automatically displayed.							
Self-diagnosis function	Machine coordinate, work coordinate (command value, encoder value), remained movement, I/O signal state, position deviation, current %, encoder electric angle							
Input power	Single-phase AC200/230V±10％ 50/60Hz （Only iHP : 3 phases, AC200/230V±10％　50/60Hz）							
Apparent power	1.0KVA	0.6KVA		1.0KVA	0.6KVA	4.3KVA	2.0KVA	1.6KVA
Weight	7.5kg			14kg		27kg	24kg	
Environment	Working temperature : 0～45℃　　Storage temperature (transportation temp.) : -10℃～60℃ Humidity: 85%RH or less (dew condensation, freezing not to be found.) Vibration proof: 0.5G or less　　Shock resistant: 1G or less							
	Ambient atmosphere : to pollution level 2							
Display	LCD 20 characters x 2 lines							
Attached cables	・Rotary table～controller　Polyamide flexible cable ・・5m ・Power cable ・・・・・・・・・・5m ・External interlock cable ・・5m			・Rotary table～controller　Polyamide flexible cable with metal blade ・・5m ・Power cable ・・・・・・・・・・5m ・External interlock cable ・・5m			・Rotary table～controller　Two polyamide flexible cables with metal blade・5m ・Power cable ・・・・・・・・・・5m ・External interlock cable ・・5m	
External input signal	START, STOP External EMG STOP, external channel selection			START, STOP, RESET External EMG STOP, external channel selection external ZRN, AUTO/MANU mode change			START, STOP, RESET External EMG STOP, external channel selection external ZRN (A-axis / B-axis) AUTO / MANU mode change	
External output signal	Block completed, 360° comp., optional completed signal, MZRN completed, EMG STOP output signal, alarm output signal (A-contact, B-contact)			Block completed, 360° comp., optional completed signal, MZRN completed, EMG STOP output signal, alarm output signal (A-contact, B-contact), channel No. output			【Common output】 Block completed, EMG STOP output signal, channel No. output, alarm output signal (A-contact, B-contact), 【A/B each axis output】 360° comp., optional completed signal, MZRN completed	
RS232C Interface	External equipment can input and output programs, parameters, etc. Interface is also used for the remote control function.							

Note) Minimum federate is at 0.03min⁻¹.

NC ROTARY TABLE MAC mini i Series   MAC mini i·MAC mini iH·MAC mini iH2

Connection

Air hose   Air source

Interlock cable
(CB3i cable)

Power cable
(CB4i cable)

Customer shall prepare.

KITAGAWA can offer.

Cable for rotary table (CB1i cable)
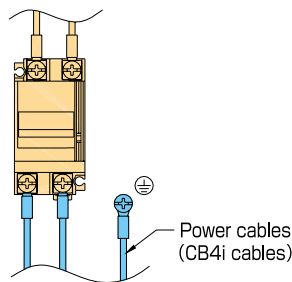
■ Power Supply

Supply power to controller.
Customer shall prepare exclusive circuit breaker.
Specifications of circuit breaker are as follows:

Type	Capacity
MAC mini iF / iHF / iDM	5A
MAC mini i / iH	10A
MAC mini iH2 / iHT	15A
MAC mini iHP	30A

Connect an earth wire of Class D (Class No. 3).
Moreover, when the earth leakage breaker is used, it is recom-
mended to use the breaker for which sensitivity current is
100mA or more, an operation time is 0.1 second or more, or a
high frequency measure is taken in order to prevent the motor
from the malfunction caused by a motor's high frequency.

Power cables
(CB4i cables)

■ Connection for external interlock

When the rotary table is interlocked with the external equipment, it is controlled
with M signals from the external equipment.
The external equipment must be equipped with the connection (terminal board)
for M-signal OUTPUT, M-signal completed INPUT, etc., by machine maker.

■ Air Supply

Air Supply

Coupler   Air hose   Coupler

Mounting side
of rotary table

AIR COMBINATION
AC25C-02CG(SMC)

DRAIN CATCHER
AMG150-02BC(SMC)
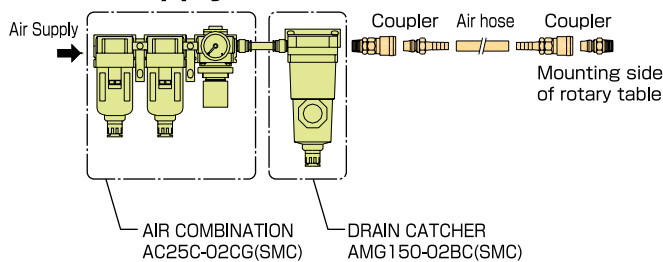
The rotary table is clamped by air.
Therefore, please prepare the following components.
・Air combination
・Drain unit
・Air hoses or air tubes (incombustibility)
・Couplers for connection

※Air-Unit should have the specification with Auto drain port

■ Air Diagram

Maximum permissible
air pressure 0.7MPa
(However, T-type X series
is 0.6MPa)

NOTICE

Four-piece air unit
(with auto drain)
AC25C-02CG(SMC)

Drain catch
(with auto drain)
AMG150-02BC(SMC)

Mutual Connection Diagram

① ※3

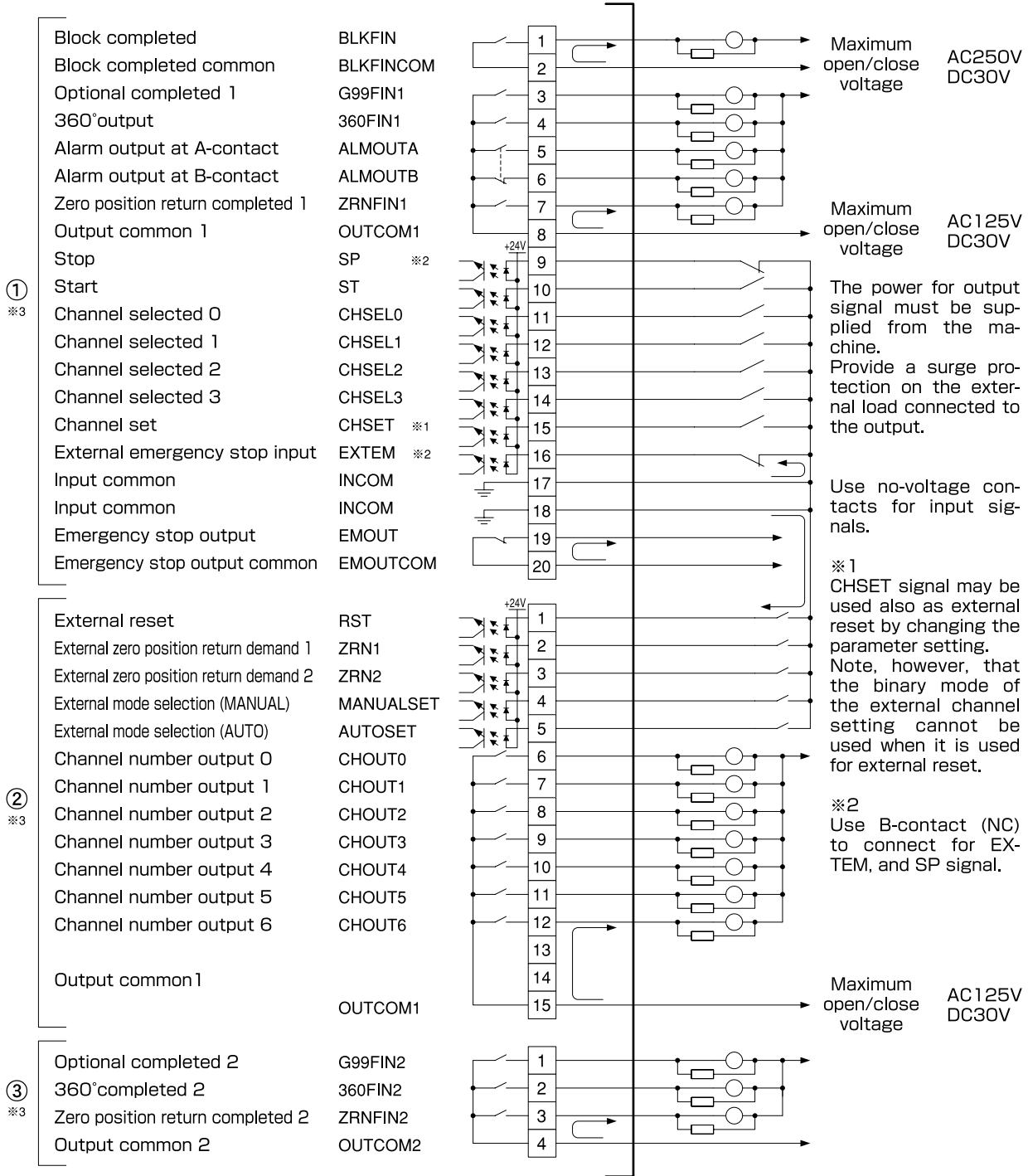| Signal name	Symbol	Terminal
Block completed	BLKFIN	1
Block completed common	BLKFINCOM	2
Optional completed 1	G99FIN1	3
360°output	360FIN1	4
Alarm output at A-contact	ALMOUTA	5
Alarm output at B-contact	ALMOUTB	6
Zero position return completed 1	ZRNFIN1	7
Output common 1	OUTCOM1	8
Stop	SP ※2	9
Start	ST	10
Channel selected 0	CHSEL0	11
Channel selected 1	CHSEL1	12
Channel selected 2	CHSEL2	13
Channel selected 3	CHSEL3	14
Channel set	CHSET ※1	15
External emergency stop input	EXTEM ※2	16
Input common	INCOM	17
Input common	INCOM	18
Emergency stop output	EMOUT	19
Emergency stop output common	EMOUTCOM	20

+24V

Maximum open/close voltage — AC250V DC30V

Maximum open/close voltage — AC125V DC30V

The power for output signal must be supplied from the machine.
Provide a surge protection on the external load connected to the output.

Use no-voltage contacts for input signals.

※1
CHSET signal may be used also as external reset by changing the parameter setting.
Note, however, that the binary mode of the external channel setting cannot be used when it is used for external reset.

② ※3

Signal name	Symbol	Terminal
External reset	RST	1
External zero position return demand 1	ZRN1	2
External zero position return demand 2	ZRN2	3
External mode selection (MANUAL)	MANUALSET	4
External mode selection (AUTO)	AUTOSET	5
Channel number output 0	CHOUT0	6
Channel number output 1	CHOUT1	7
Channel number output 2	CHOUT2	8
Channel number output 3	CHOUT3	9
Channel number output 4	CHOUT4	10
Channel number output 5	CHOUT5	11
Channel number output 6	CHOUT6	12
		13
		14
Output common1	OUTCOM1	15

+24V

※2
Use B-contact (NC) to connect for EXTEM, and SP signal.

Maximum open/close voltage — AC125V DC30V

③ ※3

Signal name	Symbol	Terminal
Optional completed 2	G99FIN2	1
360°completed 2	360FIN2	2
Zero position return completed 2	ZRNFIN2	3
Output common 2	OUTCOM2	4

※3
MAC mini i series may have different I/O signals depending on the machine types.

	I/O Signal Configurations		
	①	②	③
MAC mini i / iF / iDM	○	—	—
MAC mini iH / iHF / iHP	○	○	—
MAC mini iHT / iH2	○	○	○

Extension not available for configurations marked with "—".

NC ROTARY TABLE

MAC mini i series   MAC mini i·MAC mini iH·MAC mini iH2

Machine Connection Diagram

■ M-Signal Interlock

Input common	INCOM
Start	ST
Block completed	BLKFIN
Block completed common	BLKFINCOM

Start ST

Clamped

Table rotating

Block completed BLKFIN

Unclamped

PRM035
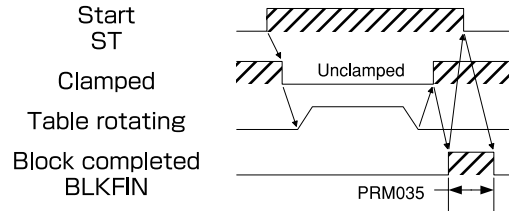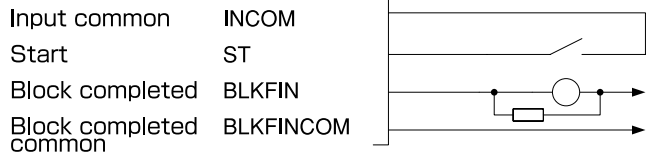
■ External Program Selection:Binary Mode

Input common	INCOM
Channel selection 0	CHSEL0
Channel selection 1	CHSEL1
Channel selection 2	CHSEL2
Channel selection 3	CHSEL3
Channel set	CHSET
Block completed	BLKFIN
Block completed common	BLKFINCOM

Selection signal CHSEL0~6

Set signal CHSET

Block completed BLKFIN
Program modification timing

fixed

PRM035

modified
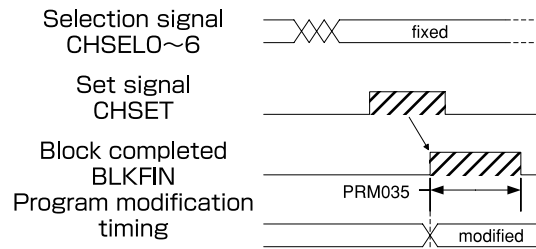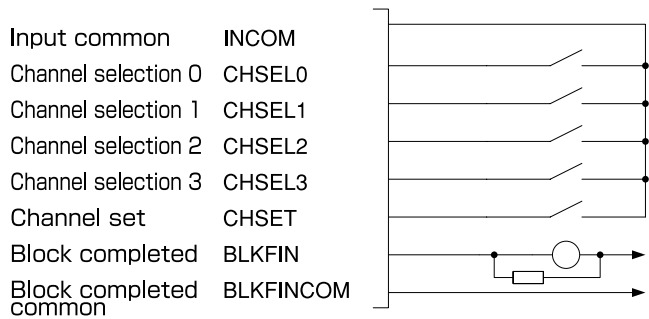
※The channels available on binary mode are CH00 through CH15.

■ External Program Selection:M-signal Mode

Input common	INCOM
ZERO signal	CHSEL0
PLUS1 signal	CHSEL1
PLUS10 signal	CHSEL2
MINUS10- signal	CHSEL3
Block completed	BLKFIN
Block completed common	BLKFINCOM

Selection signal CHSEL0~3

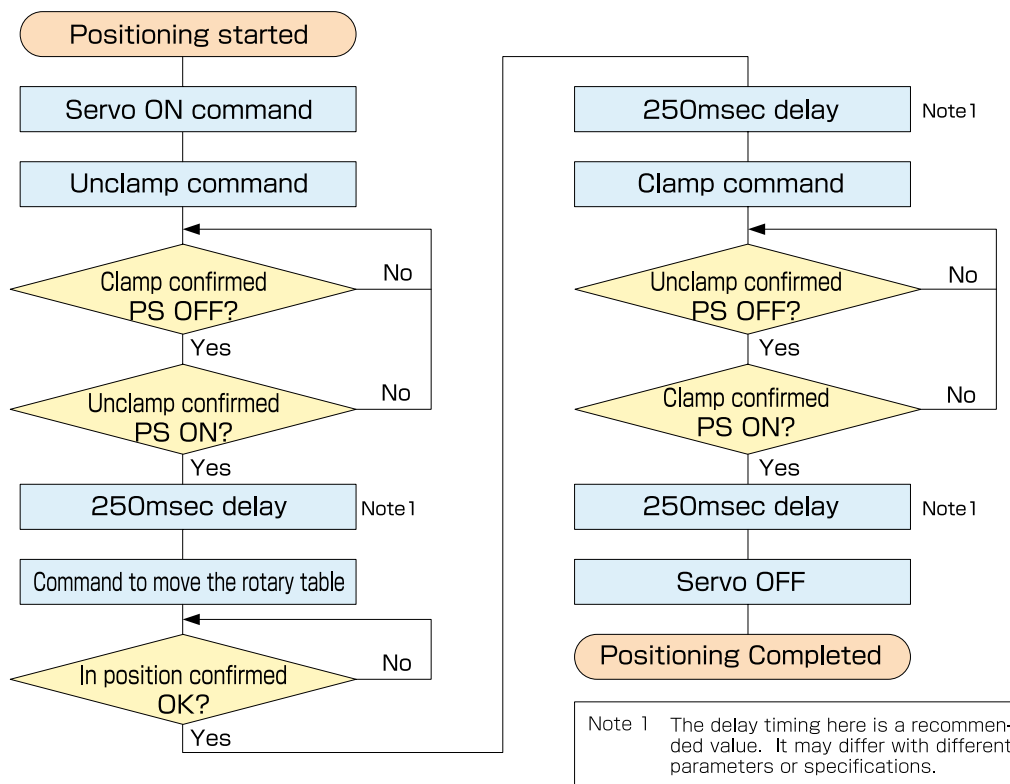Block completed BLKFIN

Program modification timing

modified   modified
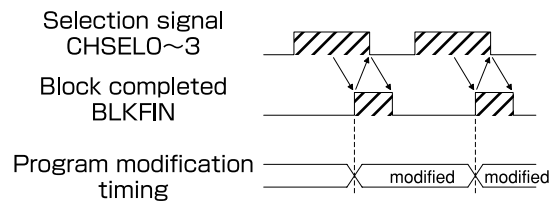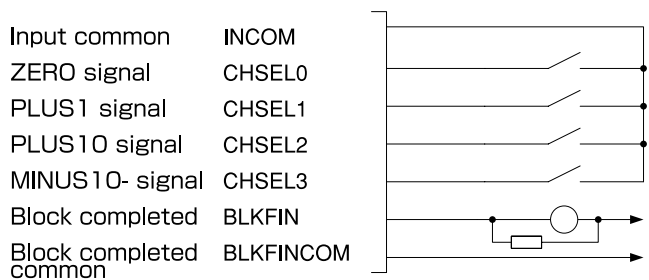
※The channels available on M-signal mode are CH00 through CH89.
For CH16 and later, extension channel setting is required.

NC ROTARY TABLE

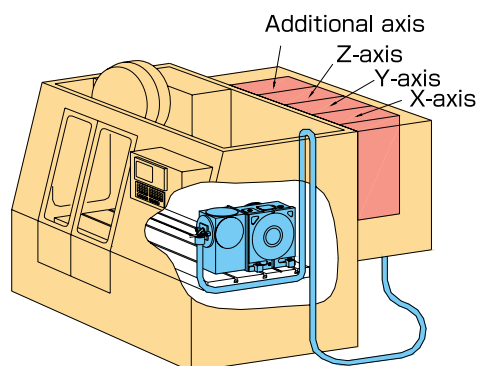# DATA   Control Detail

■ Control Flow-Chart

It is in principle recommended for Kitagawa's NC rotary table control to turn the servo OFF while clamping.

Semi-／Full-Closed Loop

```
Positioning started
        │
Servo ON command
        │
Unclamp command
        │
Clamp confirmed PS OFF?  ──No──┐
        │Yes                    │
Unclamp confirmed PS ON?  ──No──┤
        │Yes
250msec delay   Note1
        │
Command to move the rotary table
        │
In position confirmed OK?  ──No──┐
        │Yes
```

```
        ┌──────────────────────┐
250msec delay   Note1
        │
Clamp command
        │
Unclamp confirmed PS OFF?  ──No──┐
        │Yes                     │
Clamp confirmed PS ON?  ──No──────┤
        │Yes
250msec delay   Note1
        │
Servo OFF
        │
Positioning Completed
```

Note 1   The delay timing here is a recommended value. It may differ with different parameters or specifications.

■ Methods for Controlling NC Rotary Table

Additional-Axis Method

Additional axis
Z-axis
Y-axis
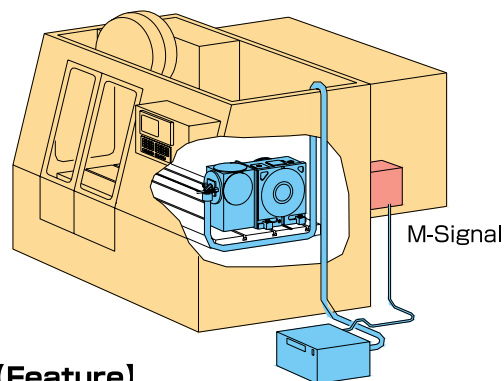X-axis

【Feature】
◆NC Rotary Table is controlled as the NC Axis of the machine.
◆Interpolation machining is possible with X- , Y- and Z-axis of the machine.
◆Program can be controlled on the machine.

M-Signal Method

M-Signal

【Feature】
◆NC Rotary Table is controlled by a separate controller, and not as the NC Axis of the machine.
◆NC Rotary Table can be fitted with machine with no compatibility for an additional axis, as long as M-signal is available.
◆NC Rotary Table can easily be transferred to another machine.