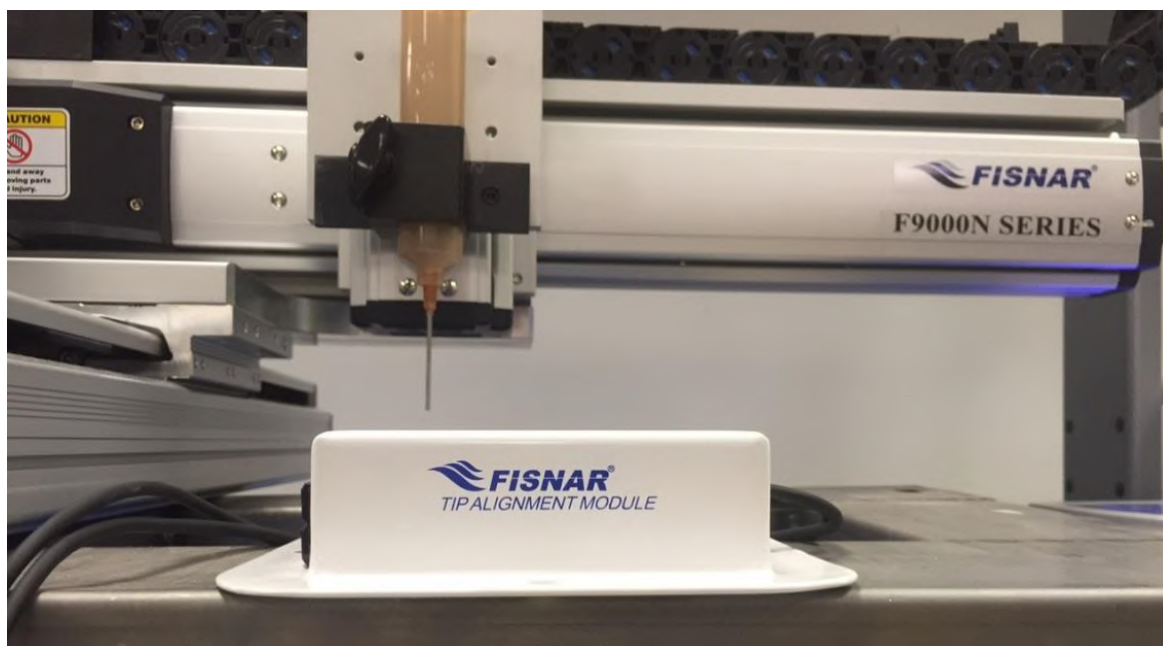


Tip Alignment Manual



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1 About Tip Alignment Module

The Tip Alignment Module use sensors to check position of the dispensing tip and will correct position if tip is changed or damaged. The Sensors are connected to the user Input port on the back of the F9000N controller.

The Sequence of Tip Alignment is

- 1) Set Tip-searching start position (only first time)
- 2) Set Sensor input, tip searching speed, Tip end position (only first time)
- 3) Run base tip alignment.
- 4) Create dispensing program.
- 5) Run program
- 6) After tip change, run Auto tip alignment.

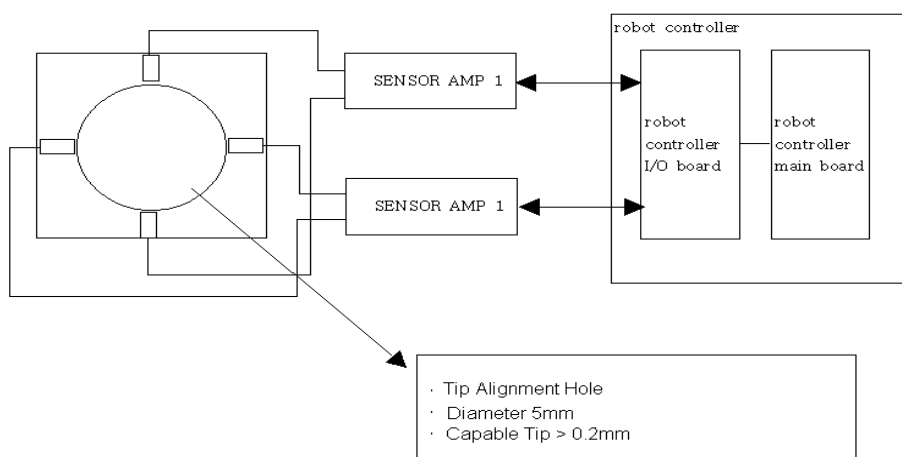
The Tip Alignment only affects the current program. So if a new program is created, Base tip alignment for the new program must be completed.

Minimum Robot Software Required for Tip Alignment Module: Version 15.3A

1.1 Hardware

`Type	Sensor Specification	Align Dimension	Sensor Number
		Fiber Optic	XYZ
Accuracy	0.1 mm		
Speed	0.3 ~1 mm/sec		
Diameter of tip	0.265 mm < Tip diameter < 10 mm		

*** Tip must be vertical. If not, the alignment device cannot be used.



Output cable of sensor must be connected to User Input port on the back of the F9000N controller.






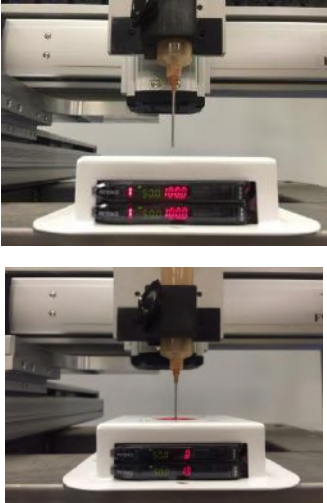
1.2 Hardware Orientation

To achieve optimal results when running the device, please position the Tip Alignment Module forward with the front sensors facing you as shown below. This will increase accuracy as well as improve ease of operation.



1.3 Setting

Please follow the following instructions to set up and run the Tip Alignment Module.

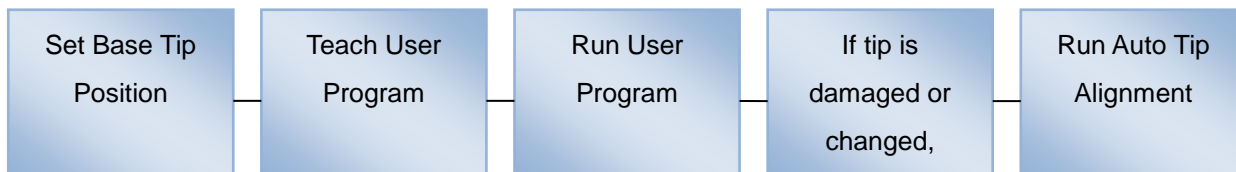
	Command	Display
1	Turn on Controller.	----- Press Home Key To Find Origin -----
2	Press the Home key  and find the robot origin.	ADDR: 0 PROG: 0 EMPTY X: 0 Y: 0 Z: 0 R: 0
3	Press the Menu 2 key  on the teach pendant.	1.Point Utility 2.Group Utility 3.Program Utility 4.Memory Utility
4	Select 2. <u>Group Utility</u> and Press PgDn key  on the teach pendant.	5.Set Tip Align 6.Auto Tip Align 7.Auto Z Align
5	5. <u>Select Set Tip Align.</u>	1.Set Tip Start Pos 2.Set Base Tip Pos 3.Seach Speed 4.I/O 5.Tip End
6	Select 1.Set Tip Start Pos. Jog Tip to Sensing hole and lower the Z Axis until the sensors give approx. a zero value reading. Press the Enter key. This position will be start position of Tip searching. Note: For better results, please try to center the tip as much as possible using the sensor readings.	

	<i>Command</i>	<i>Display</i>
8	Select 3. <u>Search Speed</u> and input search speed (1mm/sec ~ 3mm/sec). Press ESC and select 1. Yes to confirm	[Search Speed] Speed : 3.0 mm
9	Select 4. <u>I/O</u> Input User Input number of each Axis. See sensor input on the right for correct sensor setup. Press ESC and select 1. Yes to confirm.	[Set Input Mode] X Sensor In: 0 Y Sensor In : 1 Z Sensor In : 0
10	Select 6. <u>Tip End</u> Teach position which Tip will move after Tip Align process. Press the Enter key to register the position.	Set Tip End Pos
10	Select 2. <u>Set Base Tip Pos.</u> And select 1. XYZ Pos The Tip will Move to Start Position and start the Tip search. <u>It will register the Tips position of current program.</u>	1. Set XYZ Pos 2. Set Z Pos
11	Initial Tip Alignment setup is now complete. Proceed to create dispensing program.	
12	If Tip Position is damaged or changed, select Menu2>2.Group Utility> 6. <u>Auto Tip Align</u> . This will run the Auto Tip Alignment and all program positions will be adjusted to the new tip position.	

Tip Alignment will only affect the current program. For each program, Set Base Tip Position must be done.

The sequence is Set Base Tip Position. -> Teaching User Program -> Running User Program -> if Tip is exchanged, Execute Auto Tip Align.

Tip Alignment Sequence



Example. Program 0 and program 1 are using nozzle 0 with the same Set Base Tip Position.

If nozzle 0 is changed to nozzle 1,

To use program 0 => load program 0 => run Auto Tip Align.

To use program 1 => load program 1 => run Auto Tip Align.

As long as the new nozzle is activating the sensors, each program will be offset to run with nozzle 1.

If a new program is added, must use Set Base Tip Position with nozzle 1 to get the tips initial value. If the nozzle is changed again to nozzle 2, Tip alignment will offset each program and correct each position.

To use program 0 => load program 0 => run Auto Tip Align.

To use program 1 => load program 1 => run Auto Tip Align.

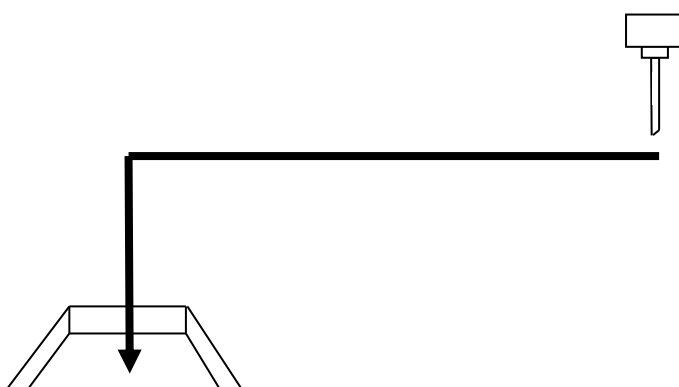
To use program 2 => load program 2 => run Auto Tip Align.

To use program 3 => load program 3 => run Auto Tip Align.

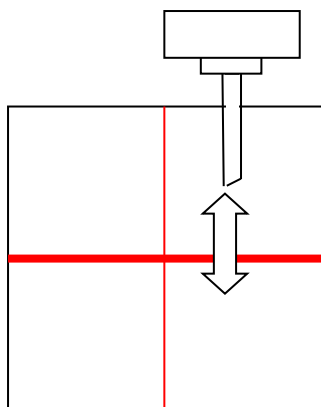
1.4 Tip Align Movement

As the tip moves, it is triggering the sensors and its position is being recorded. If the Tip Alignment fails, make sure the tip is triggering the sensor as it moves in the X and Y direction. This can be easily done by adjusting the starting position of the tip in the Set Tip Start position command. Make sure both sensors are giving low values when tip is in starting position to ensure accuracy of the Tip Alignment Module.

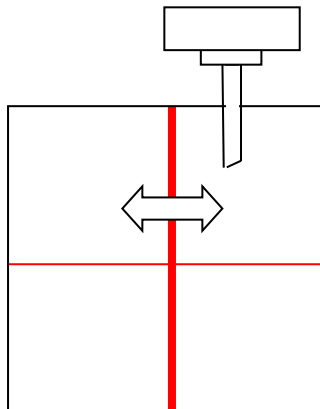
- ① Move to Start Position of Tip Searching



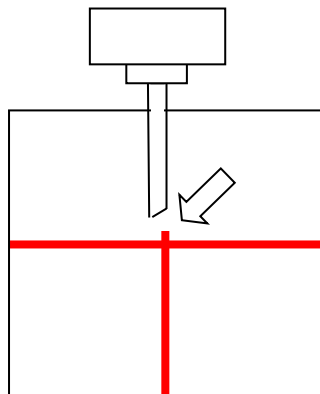
- ② Searching X Axis sensor.



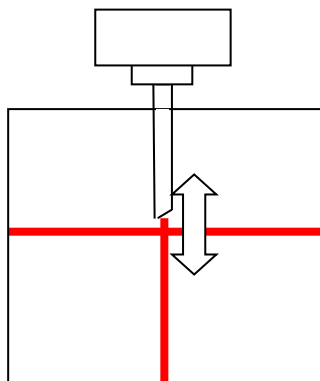
- ③ Searching Y Axis sensor.



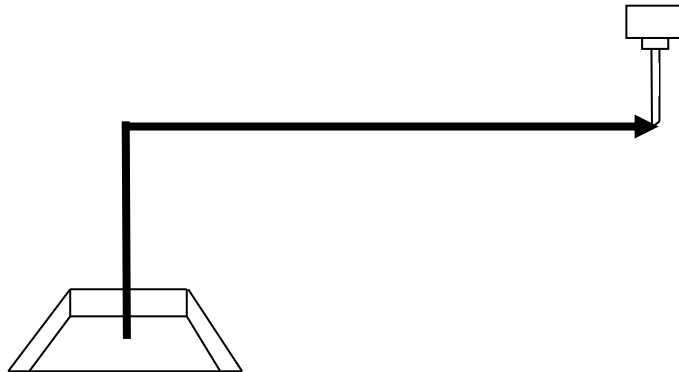
- ④ Moves to Center of Searching zone.



- ⑤ Find Z Axis Tip position,



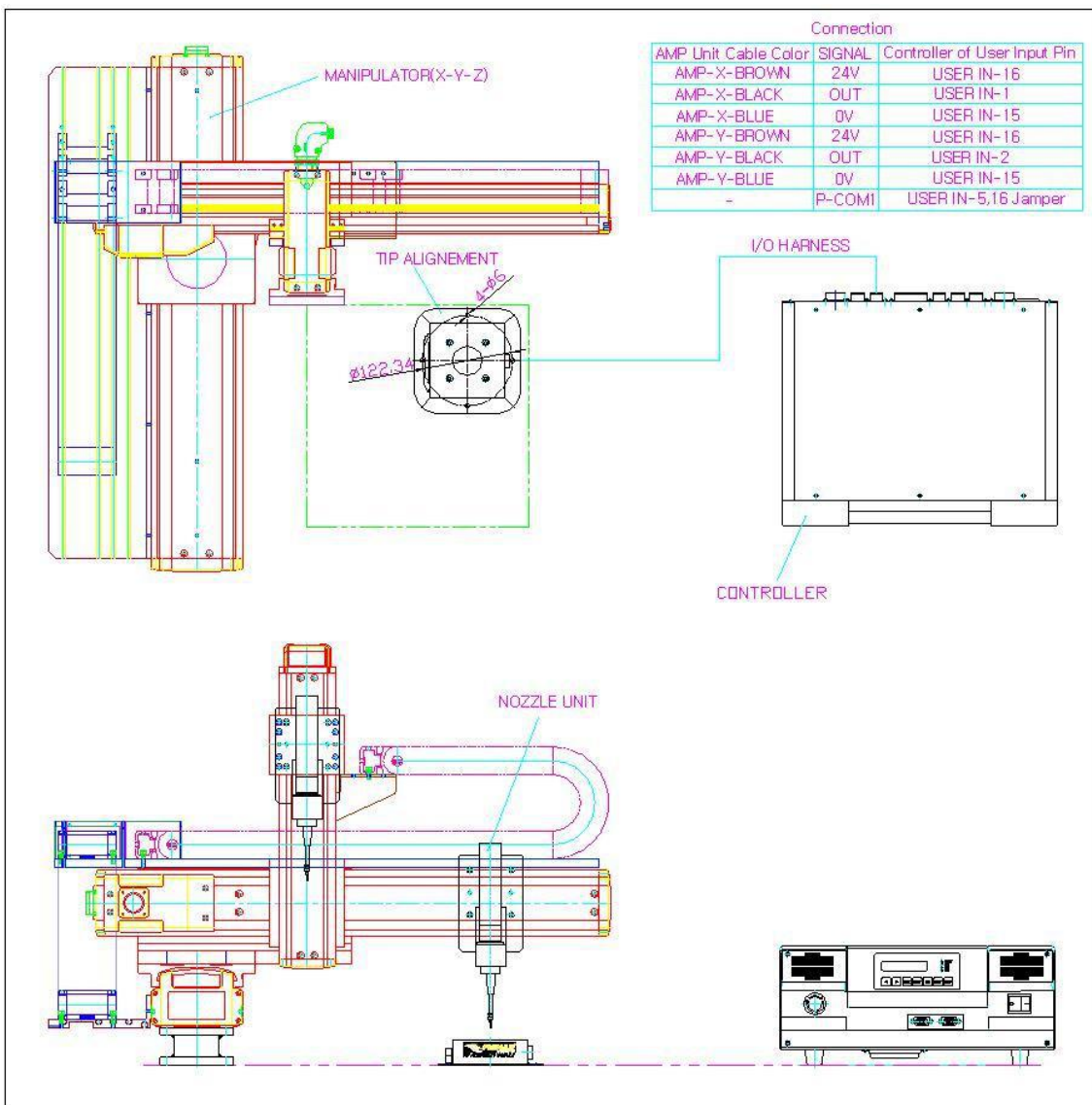
- ⑥ Move to Tip End Position.



Tip End Position is not exclusive to each program. If changing between multiple programs, it is recommended to set the Tip End Position of all programs in the same general position.

- ⑦ Tip Alignment is complete. Offset values should be applied to the current program.

1.5 Drawing of Tip Alignment system



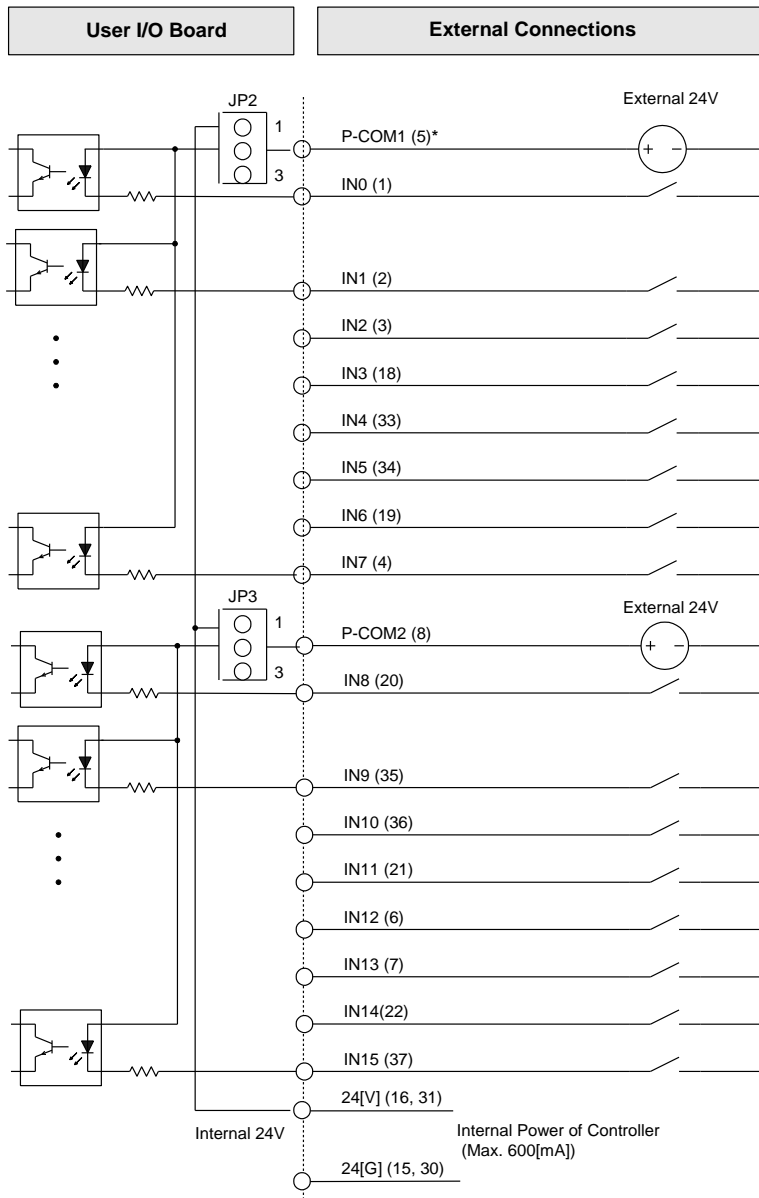
1.6 Connecting an External Device

Please refer to the following diagrams for input and pin locations.

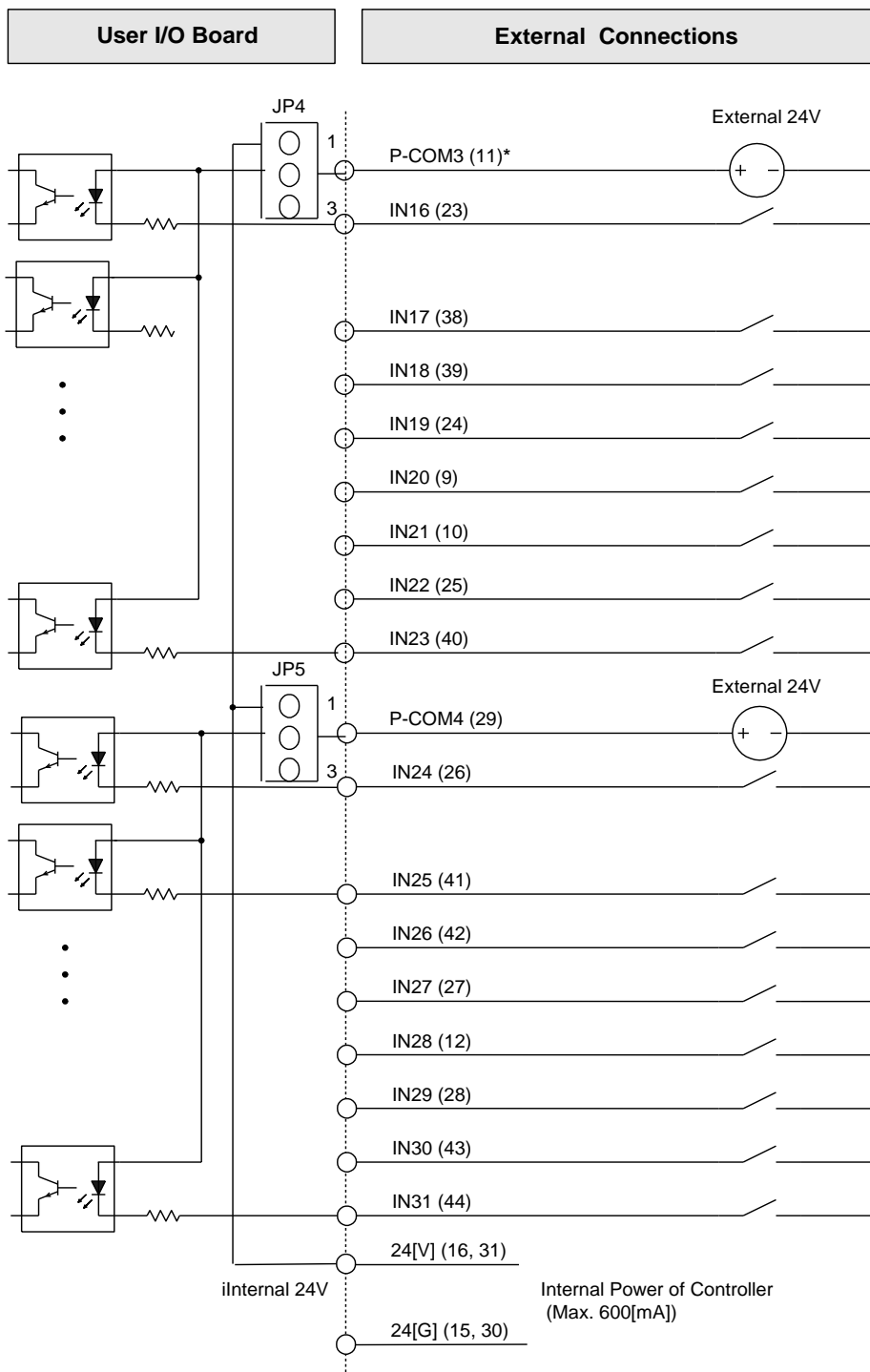
Example. Connect an external start/stop button by connecting the device to Pin 34(IN 5) and Pin 30(G) on the connector. By doing this, the Auto Tip Alignment function will check tip position whenever the button signal is sent. This will allow the Tip Alignment Tool to be better integrated into more complex systems.

Note: To activate the device, the F9000N robot must be in run mode.

Input Circuit and External Interface Circuit (1st ~16th contact): **CN2 Connector**



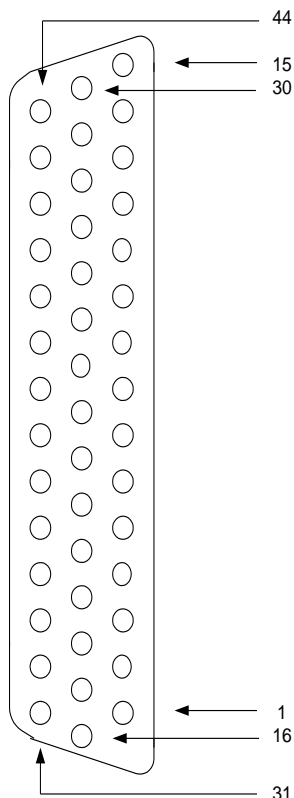
Input Circuit and External Interface Circuit (17th ~ 32nd contact): **CN2 Connector**



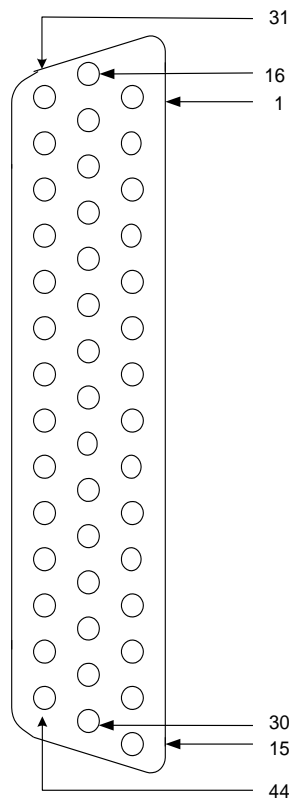
Note: () * is the Pin Number of the Connector.

Pin Arrangement and Specification of the Connector

Input Connector (CN2)



Output Connector (CN3)



Connector specification:

CN2: D-Sub, 44Pin, Female, Right Angle Type

CN3: D-Sub, 44Pin, Male, Right Angle Type

- Note 1:** When you connect the CN2 connector with external device, use D-Sub, 44Pin, Male, Solder Type.
- Note 2:** When you connect the CN3 connector with external device, use D-Sub, 44Pin, Female, Solder Type.
- Note 3:** When you wire the external power, please make sure the connection of D.C 24 [V] polarities are properly assigned.
- Note 4:** If wiring is not properly done, the internal circuit element may be damaged. Take precaution of the polarity of the common terminal.

Please refer to the F9000N robot manual for additional information.

1.7 Robot PLC Programming

Once your external device is setup, a small PLC program must be written to activate the external input. The robot will receive a signal from the external device and by manually setting Input 5 using the robot PLC, the Tip Alignment Module will run.

LD X5
OUT H52
END

To create a PLC File, following the following steps.

	<i>Instruction</i>	<i>Display Shows</i>
1	Turn On the controller and set it in Run Mode.	PROG:00 AUTO Press Move Key Cycle Counter: 0 AU/ST PLC Clear Mode
2	Select Mode by pressing the Mode/Menu 2 key.	----- Press Home Key To Find Origin -----
3	Press the Home/-/R key. The robot will move to the home position.	ADDR:0 PROG:00 EMPTY X:0 Y:0 Z:0 R:0
4	Press Menu 1 key, then press PgDn key three times, to go to page 4 of the menu. Finally, press the numeric key 1 (for: PLC File Edit).	PLC FILE NO []
5	Press any numeric key from 0 to 9, for example 1, and press the ENT key.	ADDR:0 PLC_1 i EDIT GROUP PGDEL
6	Select EDIT by pressing the F1/Setup key.	ADDR:0 PLC_1 i PROG CTRL MV DMV

	<i>Instruction</i>	<i>Display Shows</i>
7	The different commands can be accessed using the F1, F2, Menu1 and Menu2 keys.	

The following is a list of the commands found under **PROG**, **CTRL**, **MV**, **DMV**.
(Use /-1 and /+1 keys to go from one group of commands to another. Use ESC key to exit from the displayed group of commands).

PROGRAM

NAME	MEANING	FUNCTION
AND	And	Serial connection of logical operation (A contact).
OR	Or	Parallel connection of logical operation (A contact).
NOT	Negation	
LD	Load	Start operation at A (Normal open) contact.
OUT	Out	Output of the operation result.
PULS	Pulse	If input contact value changes to On status, this output will be given during 1 Scan Time.
SET	Set	If input is turned On, the output contact is maintained with On state.
RESET	Reset	If input is turned On, the output contact is maintained with Off state.

CTRL

NAME	MEANING	FUNCTION
T	Timer	This is used to control time and is On Delay Timer.
C	Counter	This is used to count the number and is Down Counter. When the enable signal is turned Off, the current value will be reset to the setting value. Input after counting is finished will be ignored.
MC		Master Control Set.
MCR	MC Reset	Master Control Reset.
D	Data	Sets Data value for counter and timer.
BK	Block	
END	End	Marks the end of the program.

MV

NAME	MEANING	FUNCTION
MOV	Move 16bit data	This is used to move data from a 16 bit register (B or D) to another 16 bit Register (B or D) ex: MOV B100 D100 (D100 = B100)
ADD	Add two 16bit data	This is used to add data of two 16 bit register (B or D) and store the result to another 16 bit Register (B or D) ex: ADD B100 D30 D40 (D40 = B100 + D30)
SUB	Subtract two 16bit data	This is used to subtract data of two 16 bit register (B or D) and store the result to another 16 bit Register (B or D) ex: SUB B100 D30 D40 (D40 = B100 - D30)
MUL	multiply two 16bit data	This is used to multiply data of two 16 bit register (B or D) and store the result to another 16 bit Register (B or D) ex: MUL B100 D30 D40 (D40 = B100 x D30)
DIV	divide two 16bit data	This is used to divide data of two 16 bit register (B or D) and store the quotient to another 16 bit Register (B or D), remainder to Next 16bit Register (B or D) ex: DIV B100 D30 D40 (D40 = B100 / D30 D41 = B100 % D30)

DMV is 32 bit operation of MV function.

Running a PLC File

	<i>Instruction</i>	<i>Display Shows</i>
1	Turn On the controller and set it in Run Mode. Press the Shift/Char + Menu2 keys.	PROG:00 AUTO Press Move Key Cycle Counter: 0 AU/ST PLC Clear Mode
2	Select PLC by pressing the F2 key.	PROG: PLC_0 [STOP] RUN
3	Use the arrow keys ▲▼ to select the program number, for example 1.	PROG: PLC_1 [STOP] RUN
4	Press F1 to execute the program. If the ESC key is pressed, it will exit from the current display and return to Program selection display. However, the current PLC program will continue running.	PROG: PLC_1 [PLAY] RUN
5	To stop the program, press the STOP button.	PROG: PLC_1 [STOP] RUN

Please refer to the F9000N robot manual for additional information.

