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Application Note of Delta HMC Take-out Robot for Injection Molding Machine

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Preface

Thank you for purchasing our product. You can find the information related to take-out arm for injection molding machine in this application note during inspection, installation, wiring, operation and examination.

The following information describes the purpose and application:

- Control System (Chapter 1)
- Operation (Chapter 2)
- Program Usage and Editing (Chapter 3)
- System Setting (Chapter 4)
- Troubleshooting (Chapter 5)
- Others (Chapter 6)
- Examples (Chapter 7)

Product Features

- Distributed fieldbus control: High precision and high speed motion, quick response and can be easily constructed.
- Built-in functions: Inhibited zone, protection in inner molding area, and protection mechanism.
- Smoothing function: Continuously smooth the interpolation.
- Ejector protection: Protect the ejector when it moves forward.
- Adaptive moving: Each axis can do adaptive moving with the setting of torque limit.
- Flexibly carry out stacking command
- Template program: 10 program templates for customized setting
- Provides huge amount of command program: With 1000 programs and up to 400 commands can be edited in one program.
- Supports dual system

Technical Support

If you have any technical question, please contact local distributers or Delta's service center.

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Table of Contents

3 Program Usage and Editing

4 System Setting

5 Troubleshooting

6 Others

7 Examples

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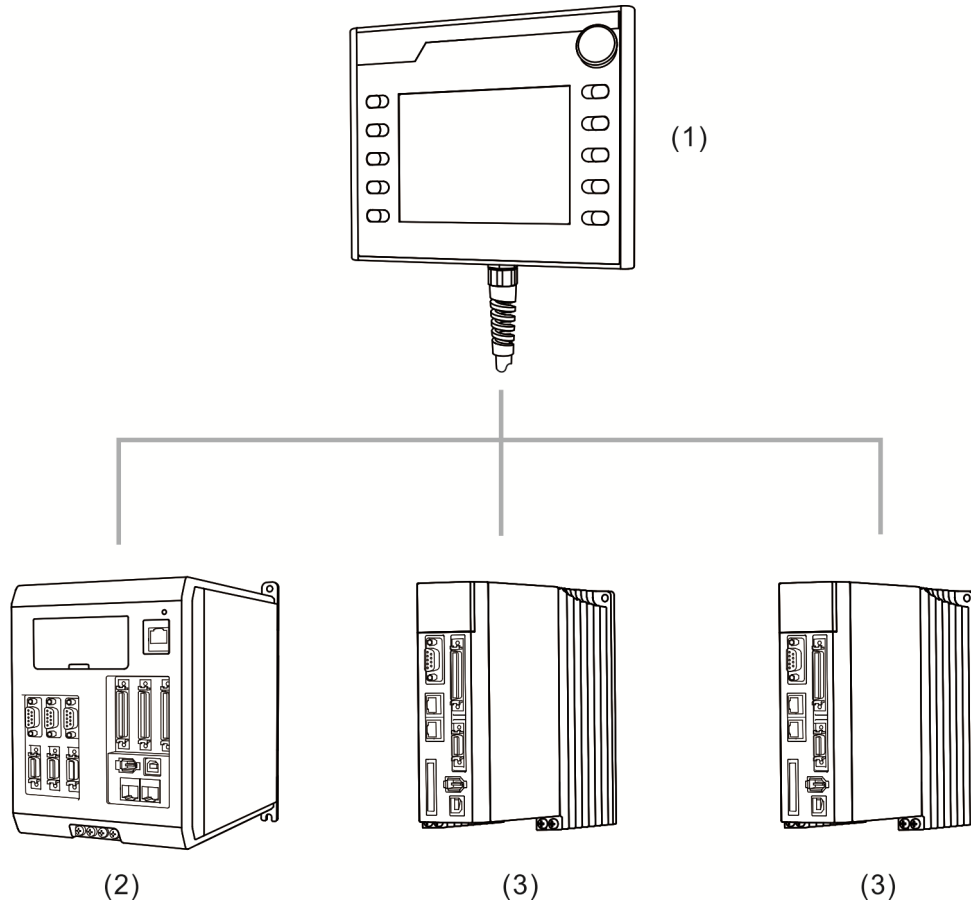# Control System

<div style="text-align: right;">**1**</div>

Please select the servo drives and motors from the list mentioned in this chapter when applying this control system. Pay attention to the safety precautions during installation, wiring, operation and examination. As for the detailed information of each product, please refer to the corresponding user manual.

1

1.1 Features

This system adopts Delta's HMC distributed motion control framework for easier and more flexible multi-axis control.

(1)

(2)   (3)   (3)

(1)   HMC; (2) ASDA-MS (for 3-axis linear, single-axis, linear, arc or helical motion);

(3)   ASDA-A2 (for single-axis linear motion)

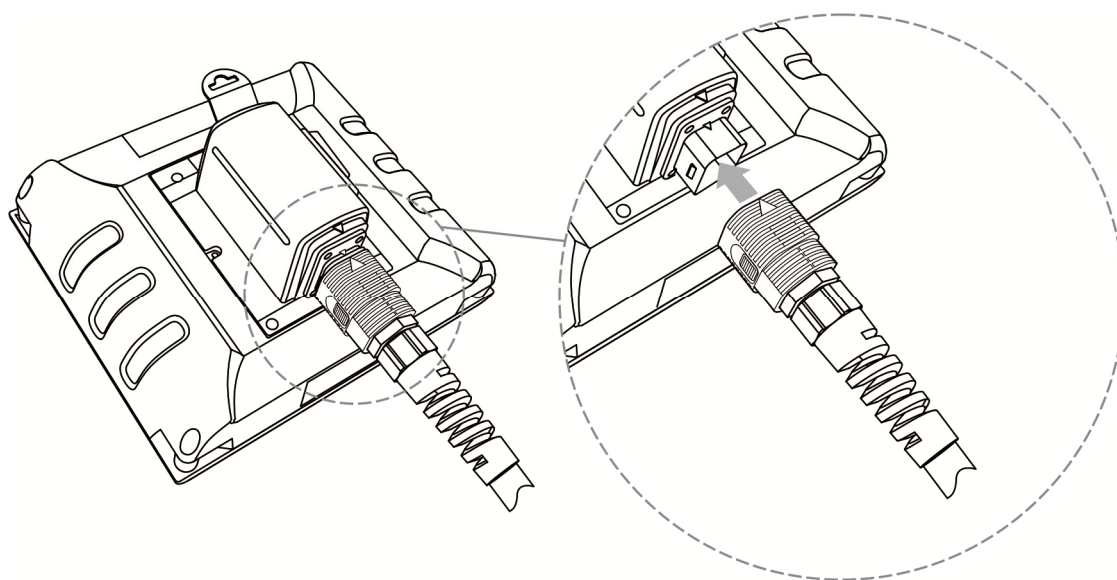# 1.2   System Specifications and Configuration

1.2.1   Controller

■   Model name of HMC controller

HMC Model	Applicable System
HMC07-N510H52	3 axes
HMC07-N511H52	12 axes and below
HMC07-N411H5C/ HMC07-N411H5A	12 axes and below

■   Controller installation and wiring

■   Definition of color thread

Part Number for Wiring
32 pin Type A: HMC-CA3203B0 (3M), HMC-CA3205B0 (5M), HMC-CA3210B0 (10M)
16 pin Type A: HMC-CA1603B0 (3M), HMC-CA1605B0 (5M), HMC-CA1610B0 (10M)
12 pin Type A: HMC-CA1203B0 (3M), HMC-CA1205B0 (5M), HMC-CA1210B0 (10M)

Color	Name	Description
White/Orange	EMG_C	Emergency switch-B contact; users can connect this contact to the safety device.
White/Orange	EMG_C	Emergency switch-B contact; users can connect this contact to the safety device.
White/Green	EMG_O	Emergency switch-A contact; users can connect this contact to the safety device.
White/Green	EMG_O	Emergency switch-A contact; users can connect this contact to the safety device.
Red	Power	System power 24V+

1

Part Number for Wiring

32 pin Type A: HMC-CA3203B0 (3M), HMC-CA3205B0 (5M), HMC-CA3210B0 (10M)

16 pin Type A: HMC-CA1603B0 (3M), HMC-CA1605B0 (5M), HMC-CA1610B0 (10M)

12 pin Type A: HMC-CA1203B0 (3M), HMC-CA1205B0 (5M), HMC-CA1210B0 (10M)

Color	Name	Description
Black	PGND	Ground for system power
White	EGND	Grounding
Yellow	422_TX+	RS-422: TX+, RS-232: TX, RS-485: T+/R+
White/Yellow	422_TX-	RS-422: TX-, RS-485: T-/R-
Black/White	CGND	Grounding for communication
Black/White	CGND	Grounding for communication
Black/White	CGND	Grounding for communication
White/Blue	ENA_O	Limit switch, A contact
White/Blue	ENA_O	Limit switch, A contact
Purple	422_RX+	RS-422: R+, RS-232: RX
White/Purple	422_RX-	RS-422: R-
Black/Orange	INT1	(Reserved)
Black/Green	INT0	(Reserved)
Red/Black	I_GND	(Reserved)
White/Red	I_PW	(Reserved)
RJ45 Blue	DMC	DMCNET. Connect to DMCNET communication port.
RJ45 Black	ETH	Ethernet. Connection is not a must.
RJ45 Green	RIO	Remote I/O. Connect to I/O module's communication port.

Note: For safety concerns, please connect contact A and B to system loop

1

■　Wiring for Peripheral Devices

(1)　Use DMCNET (RJ45-blue) to connect servo drive or DMCNET modules.
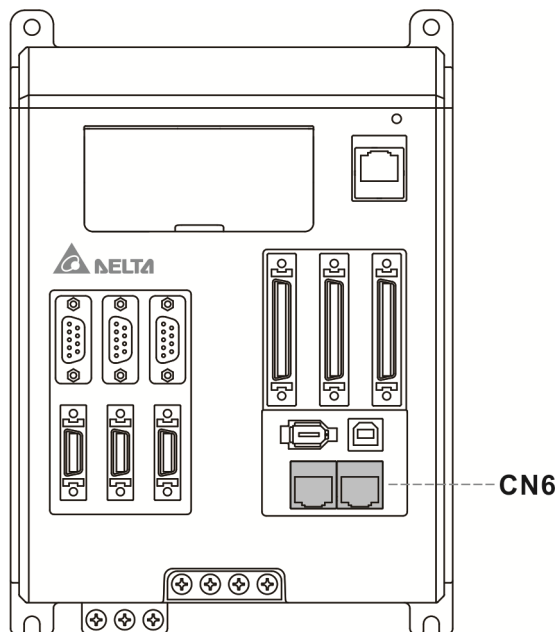
Note:

1.　Select one port for connection.
2.　DMCNET wiring is a serial communication loop. Please connect to a terminal resistor at the end of the loop.

(2)　Use Remote I/O (RJ45-green) to connect I/O module.

1.2.2   Servo System

Please refer to ASDA series user manual for further information:

Website:
http://www.deltaww.com/services/DownloadCenter2.aspx?secID=8&pid=2&tid=0&CID=06&itemID=060201&typeID=1&downloadID=,&title=--%20Select%20Product%20Series%20--&dataType=2;4;&check=1&hl=en-US
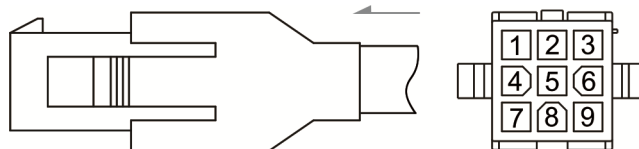
■   Model Type and Definition

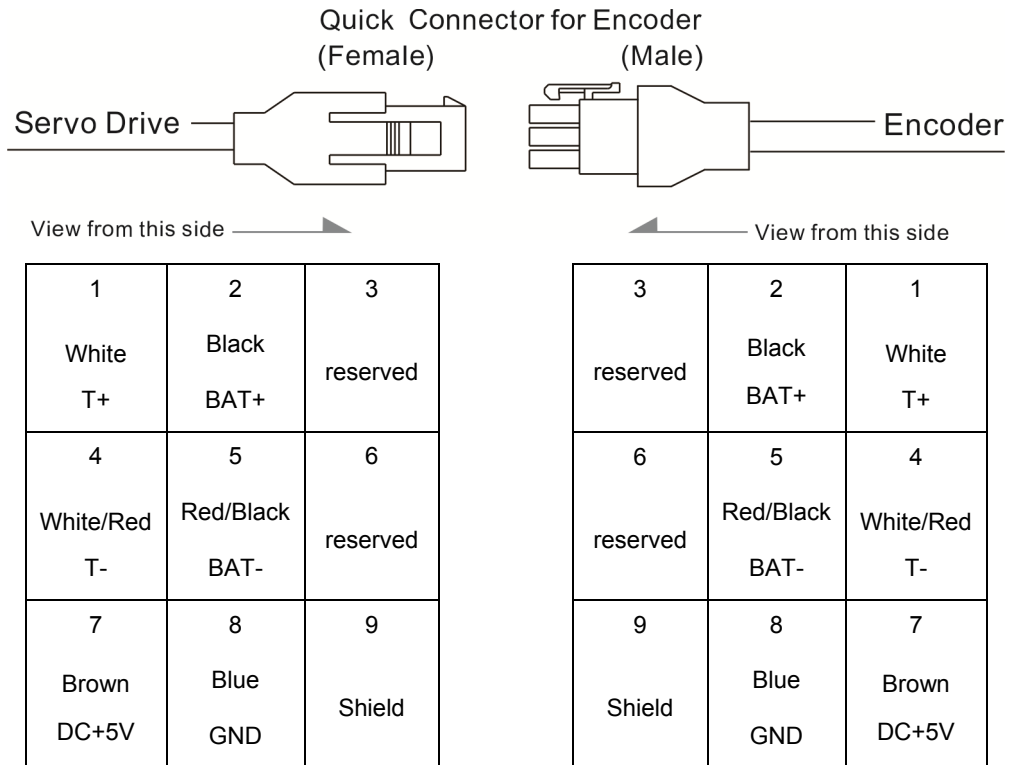| Axial Name	Station Number (P3-00)	Note
Horizontal axis of primary arm	1	ASD-M-F/ ASD-A2-F servo drive
Vertical axis of primary arm	2	ASD-M-F/ ASD-A2-F servo drive
Travel axis of primary arm	3	ASD-M-F/ ASD-A2-F servo drive
Horizontal axis of secondary arm [5-axis take-out arm]	4	ASD-M-F/ ASD-A2-F servo drive
Vertical axis of secondary arm [5-axis take-out arm]	5	ASD-M-F/ ASD-A2-F servo drive

■   Encoder Wiring
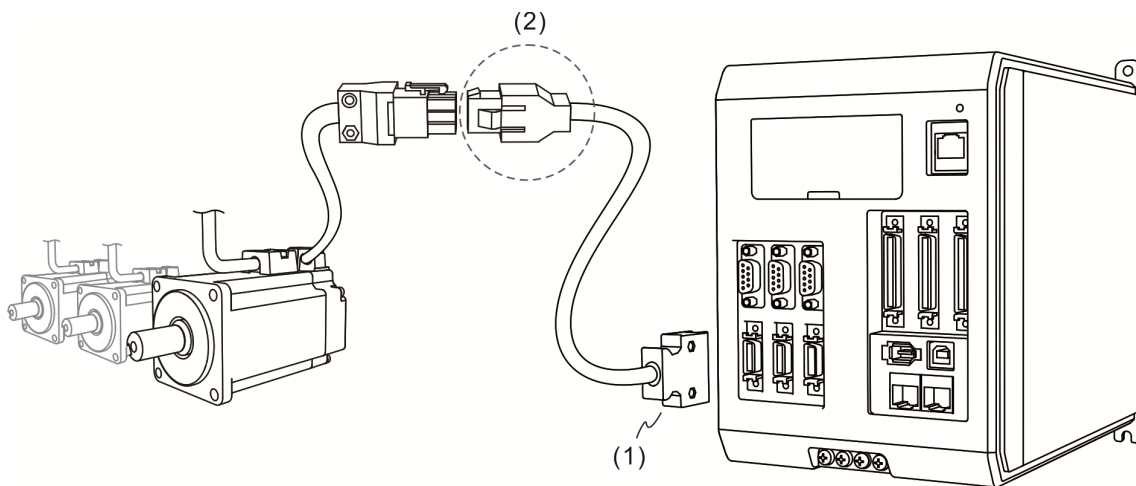
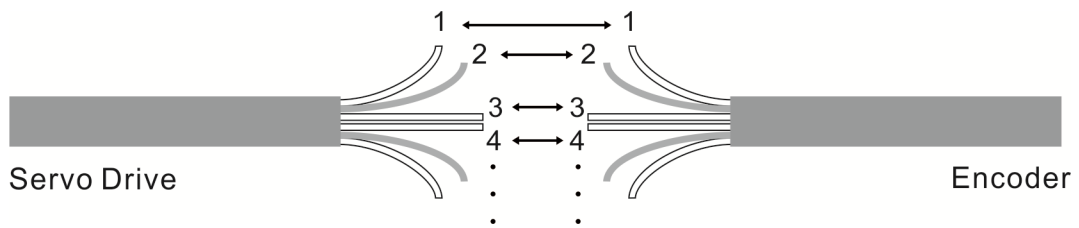(1)   CN2 connector; (2) Quick connector (Connector of encoder cable)

Quick connector (Male):

Quick connector:

Quick Connector for Encoder

1 White T+	2 Black BAT+	3 reserved
4 White/Red T-	5 Red/Black BAT-	6 reserved
7 Brown DC+5V	8 Blue GND	9 Shield

3 reserved	2 Black BAT+	1 White T+
6 reserved	5 Red/Black BAT-	4 White/Red T-
9 Shield	8 Blue GND	7 Brown DC+5V

The wire color of the servo drive is for reference only. Please refer to the real object.


To directly wire the cores without housing, please wire them according to the corresponding core number. For example, connect core No. 1 of the servo drive to No.1 of the motor encoder. Connect core No.2 of the servo drive to core No.2 of the motor encoder and so on. Please number the cores of the servo drive in sequence and then connect them to the encoder.
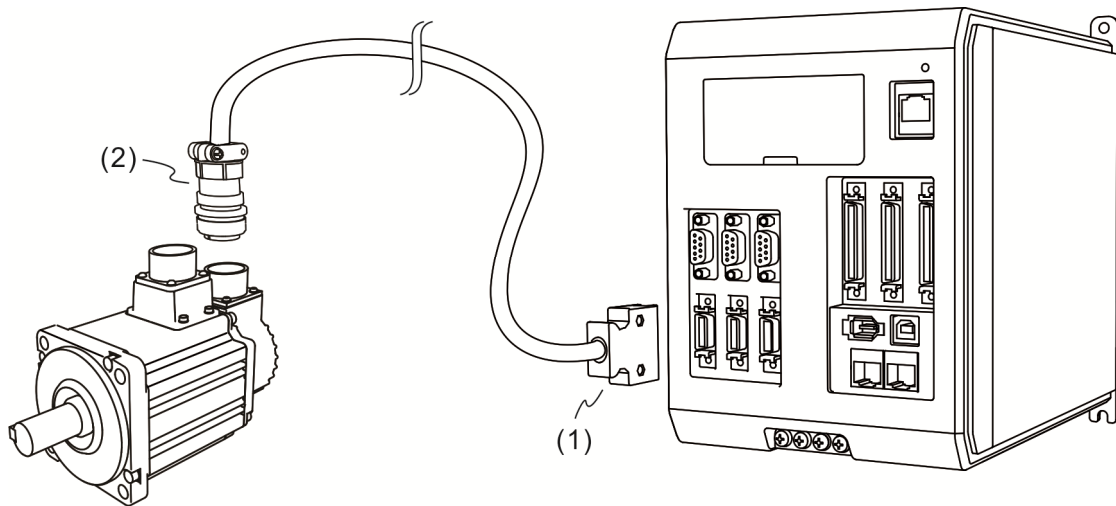
CN2 connector and 9 pins (3*3) on encoder side shall be connected as the following ways:

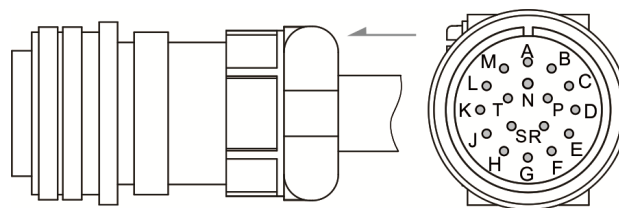CN2 Connector:

(1)   (2)
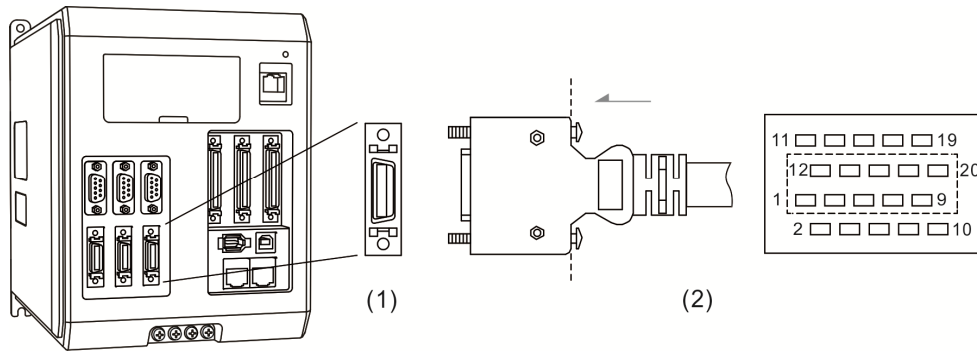
(1)   CN2 connector (female); (2) CN2 connector (male)

Encoder connection


(1)   CN2 connector; (2) Military connector

Military connector:

The definition of each signal is as follows:

| Drive Connector			Encoder Connector		
Pin No	Terminal Symbol	Function and Description	Military connector	Quick connector	Color
5	T+	Serial communication signal input/output (+)	A	1	Blue
4	T-	Serial communication signal input/output (-)	B	4	Blue & Black
-	-	Reserved	-	-	-
-	-	Reserved	-	-	-
14,16	+5V	Power +5V	S	7	Red/Red & white
13,15	GND	Power ground	R	8	Black/Black & white
Shell	Shielding	Shielding	L	9	-

■   Wiring for Motor Power Cable:
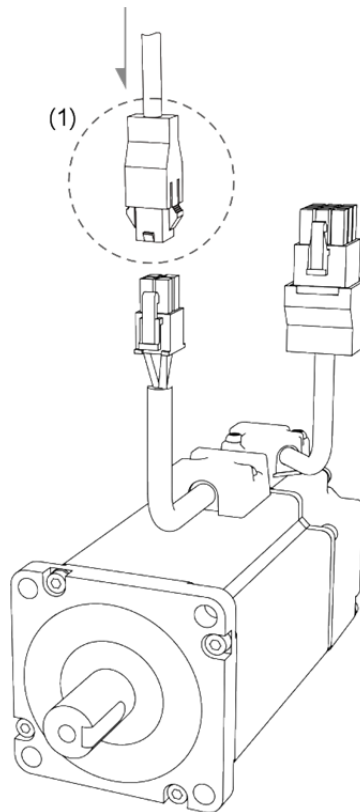
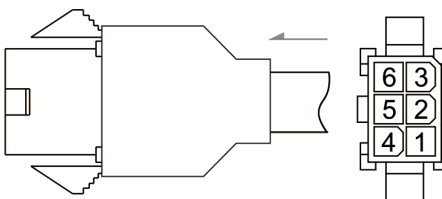(1)   UVW connectors of the servo drive

Power cable (without brake). See the terminal as below:
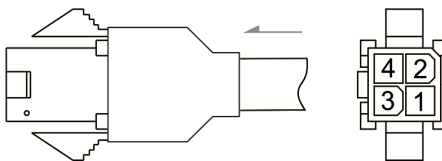
Motor Side	1	2	3	4
Drive Side	U	V	W	Grounding(GND)

Power cable (with brake). See the terminal as below:

Motor Side	1	2	3	4	5	6
Drive Side	U	V	Brake 1	W	Grounding(GND)	Brake 2

■ Homing sensor/Limit sensor/Brake wiring:

CN1 connector and its definition:
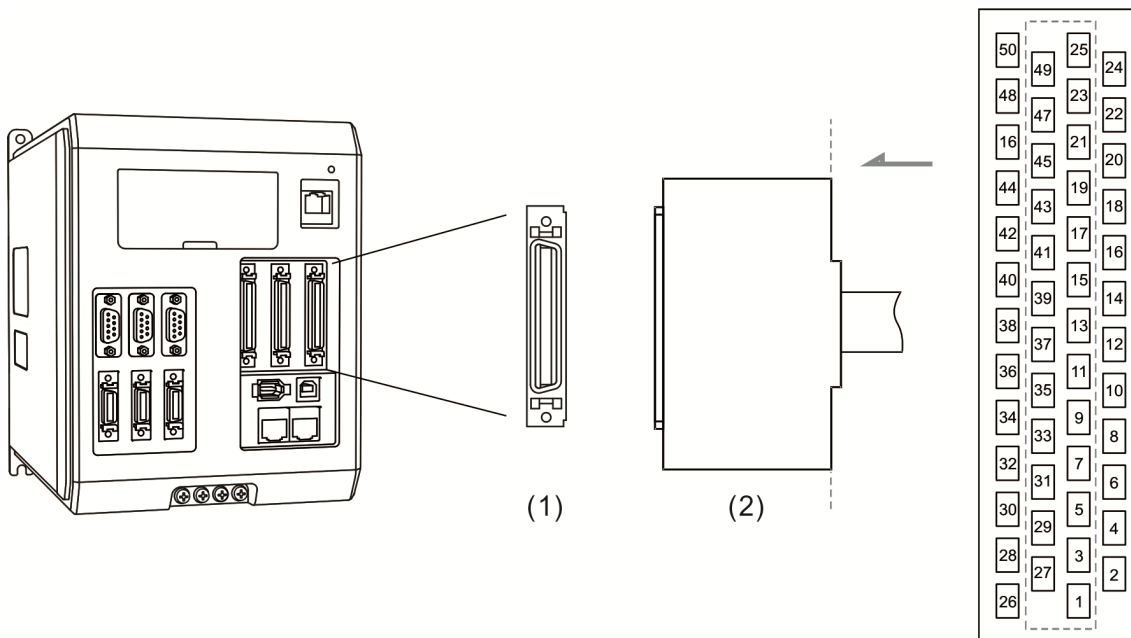
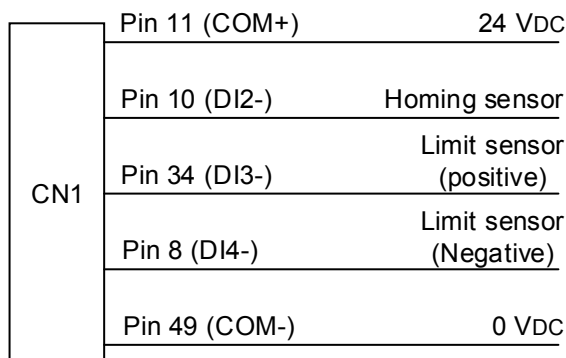(1) CN1 connector (female); (2) CN1 connector (Male)

Pin assignment:

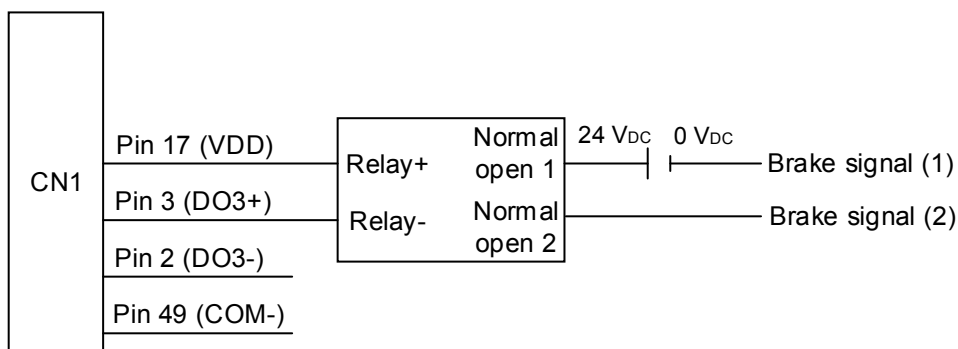| Pin	Signal	Function	Pin	Signal	Function	Pin	Signal	Function
1	NC	Not in use	18	T_REF	Analog torque input	35	PULL HI_S (Sign)	Pull-high voltage of sign
2	DO3-	Digital output	19	GND	Analog input signal ground	36	SIGN	Position sign (+)
3	DO3+	Digital output	20	VCC	+12 power output (for analog command)	37	/SIGN	Position sign (-)
4	DO2-	Digital output	21	OA	Encoder A pulse output	38	HPULSE	High-speed position command pulse (+)
5	DO2+	Digital output	22	/OA	Encoder /A pulse output	39	PULL HI_P (Pulse)	Pull-high voltage of pulse
6	DO1-	Digital output	23	/OB	Encoder /B pulse output	40	/HSIGN	High-speed position command (-)
7	DO1+	Digital output	24	/OZ	Encoder /Z pulse output	41	/PULSE	Position pulse(-)
8	DI4-	Digital input	25	OB	Encoder B pulse output	42	V_REF	Analog command input speed (+)
9	DI1-	Digital input	26	NC	Not in use	43	PULSE	Position pulse(+)
10	DI2-	Digital input	27	NC	Not in use	44	GND	Analog input signal ground
11	COM+	Power input (12 ~ 24V)	28	NC	Not in use	45	COM-	VDD (24V) power ground
12	GND	Analog input signal ground	29	/HPULSE	High-speed position command pulse (-)	46	HSIGN	High-speed position command (+)
13	GND	Analog input signal ground	30	NC	Not in use	47	COM-	VDD (24V) power ground
14	NC	Not in use	31	NC	Not in use	48	OCZ	Encoder Z pulse open-collector output
15	MON2	Analog monitor output 2	32	DI6-	Digital input	49	COM-	VDD (24V) power ground
16	MON1	Analog monitor output 1	33	DI5-	Digital input	50	OZ	Encoder Z pulse line-driver output
17	VDD	+24V power output (for external I/O)	34	DI3-	Digital input	-	-	-

(1)   Wiring diagram for homing/limit sensor
       Please refer to the followings for wiring methods of homing sensor and limit sensor on
       each axis. NPN method is applied in this example. Please refer to ASDA series user
       manual for PNP wiring method.

Servo Drive

CN1		
Pin 11 (COM+)	24 V$_{DC}$
Pin 10 (DI2-)	Homing sensor
Pin 34 (DI3-)	Limit sensor (positive)
Pin 8 (DI4-)	Limit sensor (Negative)
Pin 49 (COM-)	0 V$_{DC}$

(2)   Wiring diagram for servo motor with brake (vertical axis)

Servo Drive

CN1				
Pin 17 (VDD)	Relay+	Normal open 1	24 V$_{DC}$ 0 V$_{DC}$	Brake signal (1)
Pin 3 (DO3+)	Relay-	Normal open 2		Brake signal (2)
Pin 2 (DO3-)				
Pin 49 (COM-)				

Set parameter P2-20 of vertical axis to 2108 or 2008. 2108 is set as normally open (it is
usually set as normally open) while 2008 is normally close.

■   Parameters setting list of each axis

When it connects to ASDA-M:

Primary arm	Horizontal Axis (M)	Vertical Axis (M)	Travel Axis (M)
Original Point	P2-11 = 1124 or 1024	P2-11 = 2124 or 2024	P2-11 = 3124 or 3024
Position limit	P2-12 = 1123 or 1023	P2-12 = 2123 or 2023	P2-12 = 3123 or 3023
Negative limit	P2-13 = 1122 or 1022	P2-13 = 2122 or 2022	P2-13 = 3122 or 3022
Servo operating direction	P1-01 = B or 10B	P1-01 = B or 10B	P1-01 = B or 10B
Parameter for station number	P3-00 = 1	P3-00 = 2	P3-00 = 3
Communication Rate	P3-01 = 203	P3-01 = 203	P3-01 = 203
Brake setting in non-volatile area	P3-10 = 11	P3-10 = 11	P3-10 = 11
E-gear ratio setting in non-volatile area	P3-12 = 100	P3-12 = 100	P3-12 = 100

Primary arm	Horizontal Axis (M)	Vertical Axis (M)	Travel Axis (M)
Software limit stop	P4-25 = 11	P4-25 = 11	P4-25 = 11
No parameter is applied	P2-10 = 1100	P2-10 = 2100	P2-10 = 3100
No parameter is applied	P2-14 = 1100	P2-14 = 2100	P2-14 = 3100
No parameter is applied	P2-15 = 1100	P2-15 = 2100	P2-15 = 3100

When it connects to ASDA-A2:

Assistant Arm	Horizontal Axis (A2)	Vertical Axis (A2)
Original Point	P2-11 = 1124 or 1024	P2-11 = 2124 or 2024
Position limit	P2-12 = 1123 or 1023	P2-12 = 2123 or 2023
Negative limit	P2-13 = 1122 or 1022	P2-13 = 2122 or 2022
Servo operating direction	P1-01 = B or 10B	P1-01 = B or 10B
Parameter for station number	P3-00 = 4	P3-00 = 5
Communication Rate	P3-01 = 203	P3-01 = 203
Brake setting in non-volatile area	P3-10 = 11	P3-10 = 11
E-gear ratio setting in non-volatile area	P3-12 = 100	P3-12 = 100
Software limit stop	P4-25 = 11	P4-25 = 11
No parameter is applied	P2-10 = 1100	P2-10 = 2100
No parameter is applied	P2-14 = 1100	P2-14 = 2100
No parameter is applied	P2-15 = 1100	P2-15 = 2100

Note:
1. The above setting is for reference only. Please setup parameters according to the servo drive you applied.
2. P2-11 (for setting the original signal) is set to 1124. It means this sensor is a normal open signal and 1024 represents normally close.
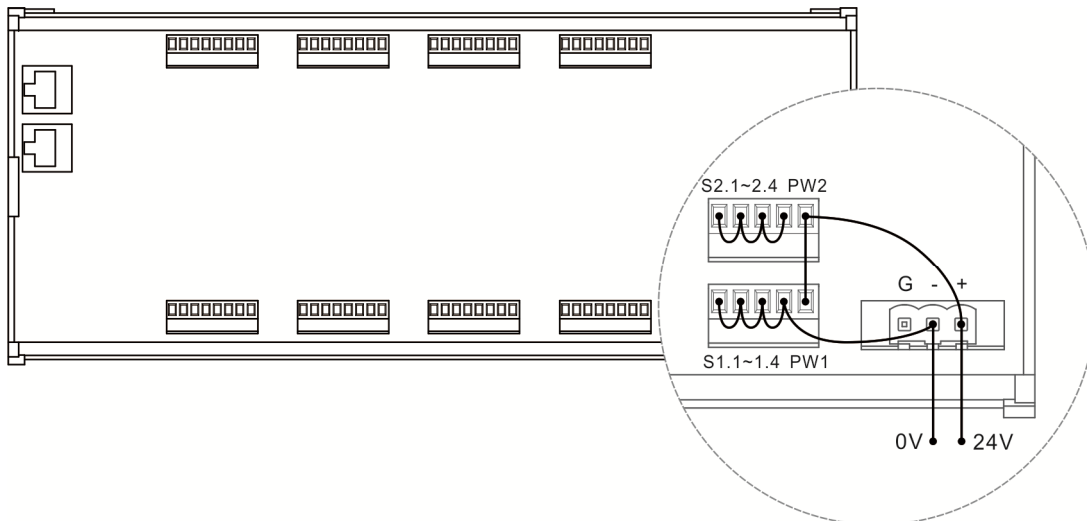
1.2.3   I/O Module

■   Applied Model

Model	Communication Interface
HM-RIO3232T12	RS-422

■   Power Supply and Wiring

(1) Power supply for I/O Module

For protecting the circuit, please short-circuit the 0 V and 24 V of each set.

(2) Input Point Wiring:
DC signal IN: Sink mode
1.   Two sets of PW shall connect to external +24V power.
2.   X0~X15's input common point of HM-RIO3232T12 has already connected to PW1; X16~X31's input common point has already connected to PW2.
3.   Use SINK mode to connect external output / contact to X intput point.

Wiring Circuit

1
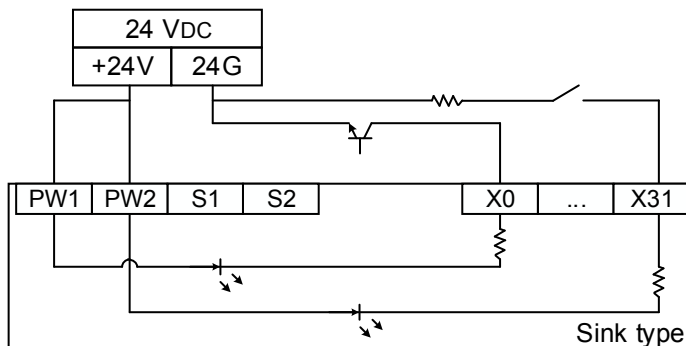
(3) Output Point Wiring

DC signal IN: NPN mode

1. Two sets of PW shall connect to external +24 V power.

2. Y0~Y15's output common point of HM-RIO3232T12 has already connected to S1; Y16~Y31's output common point has already connected to S2. S1 includes S1.1 ~ S1.4; while S2.1 ~ S2.4 are included in S2.

3. If current of the output point is less than 8 A, connect to S1.1 and S2.1 ~ 24 G will do. No need to connect S1.2 ~ S1.4 and S2.2 ~ S2.4.

4. If current of the output point is more than 8 A, please connect S1.1 ~ S1.4 and S2.1 ~ S2.4 to 24 G in parallel so as to distribute load current.

Wiring Circuit
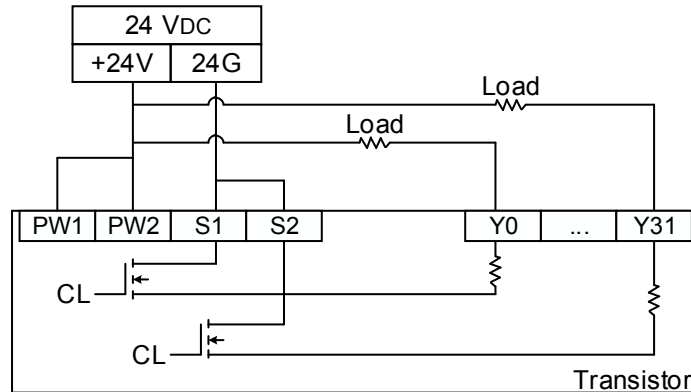
■   I/O number and defintion of each point

Output point	Function	Output point	Function
Y0	Allow mold close	X0	Mold open finish
Y1	Allow mold open	X1	Safety door
Y2	Mold area free	X2	Automatic
Y3	Allow ejector forward	X3	Ejector forward position
Y4	Allow ejector back	X4	Ejector back position
Y5	IMM emergency stop	X5	Mid-plate mold
Y6	Spray release agent	X6	Intermediate mold opening
Y7	Conveyor operation	X7	Emergency stop of IMM
Y8	PA. Horizontal	X8	PA. Horizontal Sensor
Y9	PA. Vertical	X9	PA. Vertical Sensor
Y10	Clamp/vacuum 1	X10	Clamp/vacuum 1
Y11	Clamp/vacuum 2	X11	Clamp/vacuum 2
Y12	Extend output 5	X12	Peripheral Input 3
Y13	Clamp/vacuum 4	X13	Clamp/vacuum 4

1

Output point	Function	Output point	Function
Y14	SA. Fall	X14	Reserved
Y15	Sub Clamp/vacuum	X15	Sub Clamp/vacuum
Y16	SA. Forward	X16	SA. upper safety sensor
Y17	Alarm buzzer	X17	Inside mould sensor
Y18	Clamp/vacuum 5	X18	Clamp/vacuum 5
Y19	Clamp/vacuum 6	X19	Peripheral Input 5
Y20	Extend output 1	X20	Peripheral Input 1
Y21	Extend output 2	X21	Peripheral Input 2
Y22	Operation lights	X22	Peripheral Input 3
Y23	Extend output 6	X23	Pressure Monitor
Y24	Extend output 7	X24	SP. outside mold output Allow mould close
Y25	Extend output 8	X25	Peripheral Input 6
Y26	Extend output 9	X26	Peripheral Input 7
Y27	Extend output 10	X27	Reject
Y28	Allow Core 1 In	X28	Core 1 In sensor
Y29	Allow Core 2 In	X29	Core 1 Out sensor
Y30	Allow Core 2 Out	X30	Core 2 In sensor
Y31	Allow Core 2 Out	X31	Core 2 Out sensor

1.3 Wiring Description

[Wiring diagram] in this section is for reference only. The connected peripheral devices might be different in actual situation.

■ Power of Servo Drive (ASDA-M series)

■   Encoder

1

S   R

MCCB

Noise Filter

ASDA-M Series
Servo Drive

R

S

T

L1C

L2C

X-CN2 Encoder	T+	5		blue	1	Motor Encoder
	T/	4		blue/black	4	
	5V	14	16	red	7	
	GND	13	15	red/black	8	
			shielding	SG	9	

Y-CN2 Encoder	T+	5		blue	1	Motor Encoder
	T/	4		blue/black	4	
	5V	14	16	red	7	
	GND	13	15	red/black	8	
			shielding	SG	9	

Z-CN2 Encoder	T+	5		blue	1	Motor Encoder
	T/	4		blue/black	4	
	5V	14	16	red	7	
	GND	13	15	red/black	8	
			shielding	SG	9	

■   CN1 Homing Sensor/Limit Sensor/Brake

S R

MCCB

Noise Filter

ASDA-M Series
Servo Drive

L1C

L2C

R

S

T

U-X / V-X / W-X   Motor output

U-Y / V-Y / W-Y   Motor output

U-Z / V-Z / W-Z   Motor output

X-CN1 connector

COM+	11	24 V$_{DC}$
DI2-	10	Home
DI3-	34	Positive limit
DI4-	8	Negative limit
COM-	49	0 V$_{DC}$

X-axis sensor

shielding — SG

Z-CN1 connector

COM+	11	24 V$_{DC}$
DI2-	10	Home
DI3-	34	Positive limit
DI4-	8	Negative limit
COM-	49	0 V$_{DC}$

Z-axis sensor

shielding — SG

Y-CN1 connector

VDD	17	Relay input+
DO3+	3	Relay input-
COM+	11	24 V$_{DC}$
DI2-	10	Home
DI3-	34	Positive limit
DI4-	8	Negative limit
COM-	49	0 V$_{DC}$

Y-axis sensor

24 VDC / 0V   Relay   Brake 1 / Brake 2

shielding — SG

1

■   I/O Board

Operation

2

This chapter provides the information about screen configuration, operating functions and operations of each mode.

2.1 Screen configuration

2.1.1   Main Screen

When the system is started up, the main screen will pop up which is showed as below:
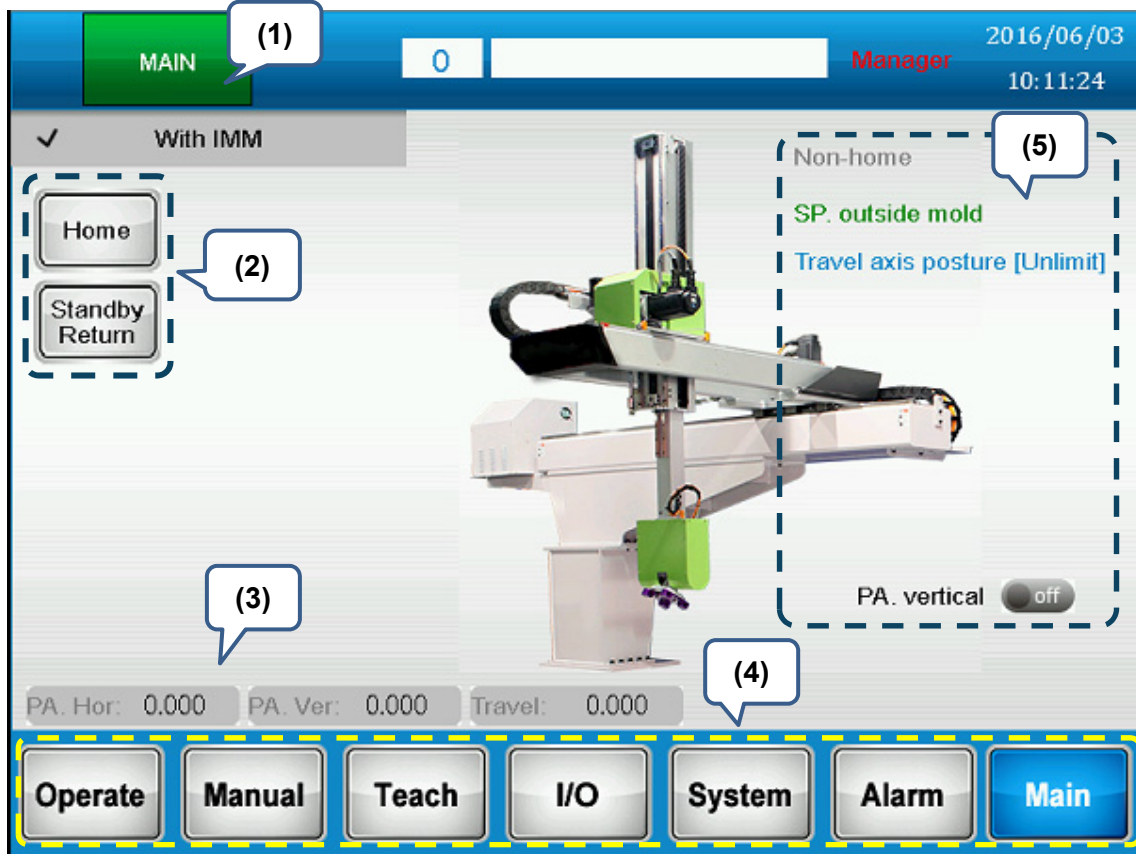
(1) **Status bar:** It shows the title of the current screen, program number, program name, current user, date and time.

(2) **Operation in main screen:** Users can do homing, status display and settings of injection molding machine.
Note: Disable the function of [Work with injection molding machine] and the system will turn on the signal of [Not to use take-out arm].

(3) **Servo position:** Display the servo's current position of each axis. Users can press this button to switch between the main system and subsystem.

(4) **Function key:** Click the button to enter the corresponding page.

(5) **System status:** It includes the arm's current posture, the arm's posture when it is in molding area and its limit setting at transverse direction. When the system is not applied to the power, the output condition of operating [Main arm returns to the original position] will be: [When it is standby in molding area, the take-out arm retrieves (signal On)] or [When it is standby in non-molding area, the take-out arm is not in molding area (signal Off)].

2.1.2 Status Bar

(1) **Screen title:** It displays the screen title that you currently use.

(2) **Current program name:** It displays current program number and program name. 1000 programs are provided to store different instructions and for users to apply. Click this button to enter the screen of [Program manager].

(3) **User level:** It displays four different user levels, operator, operator leader, engineer and administrator. Click this button to log out. Click on it again to use different user name to log in.

(4) **Date & Time:** It displays the current date and time.

2.1.3 Function Keys

Function Keys	Description
Operate	**Operate Screen** It includes the function of auto operation, single cycle and step run.
Manual	**Manual Screen** Window of jog in manual mode will pop up. Users also can control the cylinder in this window.
Teach	**Teach Screen** Edit the program that you currently choose.
I/O	**I/O Screen** Monitor and control the signal of cylinder, arm-in-position signal, handshake signal with injection molding machine and the signal from servo drive.
System	**System Screen** Users can set up motion, moving distance/safety zone, protection and servo related functions in this screen.
Alarm	**Alarm** It shows the information of current alarms and alarm history so that users can identify the alarm causes.
Main	**Main Screen** Return to the main screen.

2.2   Start-up Procedure

See the procedure below for each main function after you starting up the system:
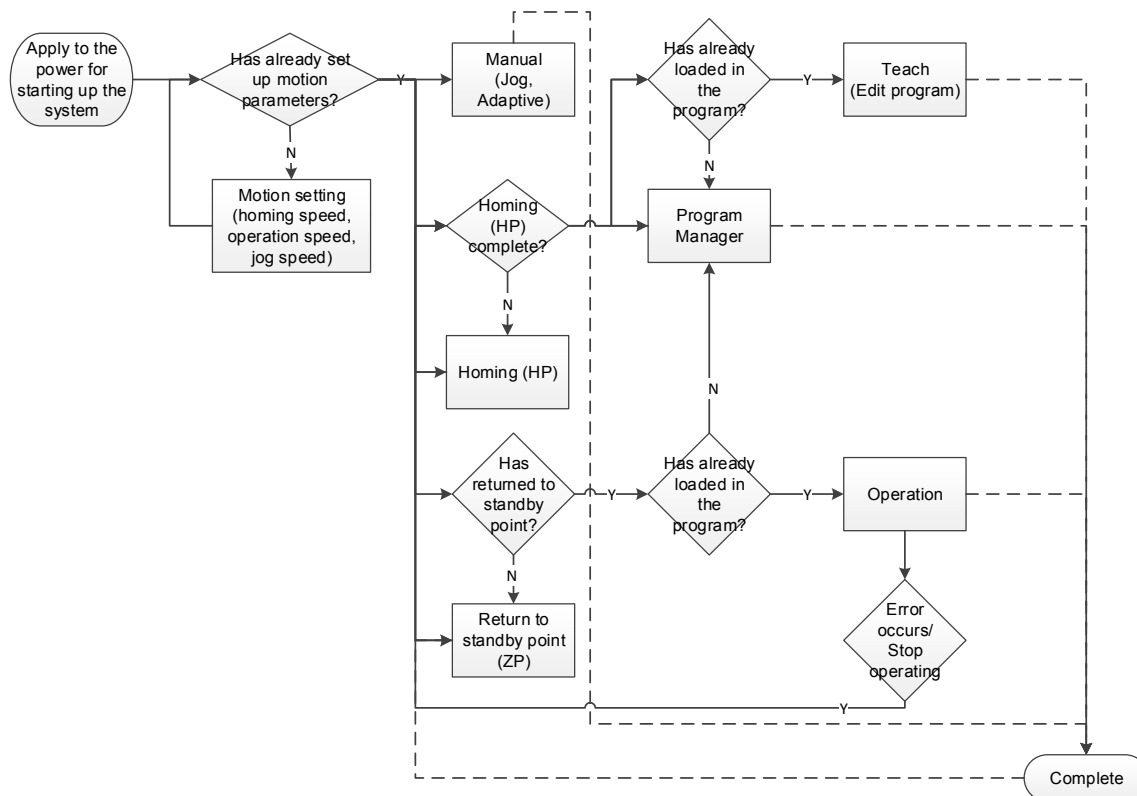
After starting up the system, please complete [Homing] first to obtain the correct position of each axis. When executing [Homing], each servo drive will be servo on simultaneously. If any alarm occurs at the moment, please clear the alarm first.

See the following for descriptions of main and sub functions:

Item	Sub-functions
Main screen	Program manager
	Log in/Log out
	Work with injection molding machine
	Homing
	Return to standby point
Alarm	Current alarm: Alarm Confirm (F10)
	Alarm history
System	Motion setting: homing offset, homing mode, motion speed and torque protection.
	Safety setting: Safety zone (inhibited zone), setting of max. moving distance of each axis, homing/return to standby point setting.
	Operation setting: motion setting and motion confirm setting
	System setting: applied mechanism, system auxiliary setting and information for operation
	Servo setting: gear ratio, acceleration/deceleration smoothing setting, max. speed limit, motor operating direction.

2

Item	Sub-functions
	Version information
I/O	Cylinder input and output signal
	Arm's input and output signal
	Output signal of injection molding machine
	Input signal of injection molding machine
	Signal from servo drive
Teach	Teaching of program instruction
	Motion setting
Manual	Jog with unlimited range
	Jog with limited range
	Jog with the set target
	Adaptive moving
Operation	Return to standby point
	Operation
	Trial operation (step run)
	Production setting

2.3   Description of User Permission

2.3.1   User Level

It has four user levels. Before logging in, users can only view the alarm information and the information on main screen. Following describes the authorization for each user level:

■   **Operator:** Operators can only use basic functions, such as homing and auto operation.

■   **Operator leader:** Apart from the basic functions, operator leaders can apply the function in manual mode and select the load-in programs.

■   **Engineer:** Except for the functions that are for Manager only, engineers have the authority to access all functions.

■   **Manager [manufacturers]:** Manager have the authority to access all functions, including setting up the mechanism and password. This authorization is usually given to system manufacturers.

See the following table for the authorization of each function:
√ means user can use the function / × means users cannot use the function

Functions	Operator (level 1~3)	Operator Leader (level 4,5)	Engineer (level 6)	Manager [Admin] (level 7)
Return to standby point/ homing point	√	√	√	√
Program operation	×	√	√	√
Program load-in selection	×	√	√	√
Manual operation	×	√	√	√
Mode switching of IMM	×	×	√	√
Program manager	×	×	√	√
Teach program	×	×	√	√
Edit template program	×	×	×	√
Semi-auto operation	×	×	√	√
Motion parameters	×	×	√	√
Homing sequence	×	×	√	√
Running setting	×	×	√	√
Motion protection and confirmation	×	×	√	√
Mechanical parameters	×	×	×	√
System setting	×	×	×	√
Password setting	×	×	×	√

2.3.2   Login / Logout

Click "User Level" on status bar. A window for login / logout will pop up. When successfully logging in, click on this button again to log out.
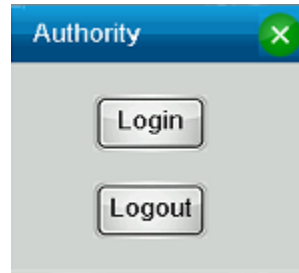
(1) **Login:** Enter the password to log in.

(2) **Logout:** After logging out, it will be in [Not logged in] status.

(3) **Automatically log out:** Users can set the function of [Auto log out time]. If there is no operation within the set up time, the system will be automatically logged out. When the value is set to 0, then it means the system is always logged on.

(4) **No authority to access:** When you have no authority to access the function, a pop-up window will appear or a red lock icon will show as the reminder.
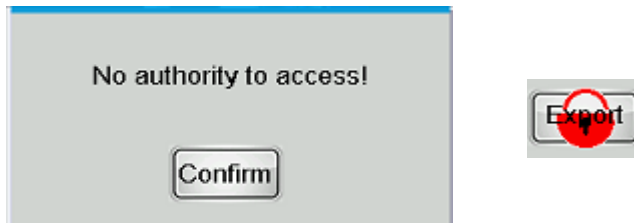
2

2.4   System Setting before Motion being Executed

Before the motion being executed, please make sure settings of the servo drive and mechanism are correct. Wrong setting might result in danger. In addition, the system needs to complete the specified speed setting first. Otherwise, the following window will pop up when executing the motion instruction.

```
Please set motion parameters first!
[Main]->[System]->[Motion Setting]

            Enter
```
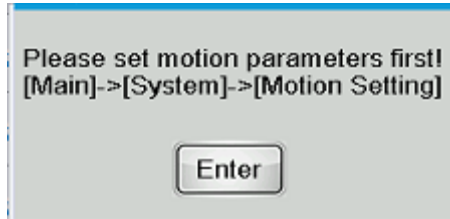
Following is the motion parameters setting window. You can start the operation after the speed setting is complete.

	Homing Offset	Homing Mode	Homing High-speed	Homing Low-speed	AutoRun speed	Jog speed	Torque protection
	(mm)		(mm/s)				(%)
PA. Hor axis	0.000	35	0.000	0.000	0.000	0.000	0.0
PA. Ver axis	0.000	35	0.000	0.000	0.000	0.000	0.0
Travel axis	0.000	35	0.000	0.000	0.000	0.000	0.0
SA. Hor axis	0.000	35	0.000	0.000	0.000	0.000	0.0
SA. Ver axis	0.000	35	0.000	0.000	0.000	0.000	0.0

2.5   Homing / Return to Standby Point

Please complete homing after the system is started up. This is for ensuring the accuracy of servo's position. Also, before starting auto-operation or trail run, the arm shall return to the starting point, which is the standby point for safety concerns. This is why the system needs to complete [Return to standby point] beforehand.

When carrying out homing or returning to standby point, for a safer operation, users can use the [Enabling switch] to immediately stop the operation when any safety worries arise. (See the figure below)

To use [Enabling switch], please go to [System] > [Safety setting] > [Homing/Return to standby point] and enable the function of [Enabling switch protection]. When the [Enabling switch] is enabled, homing/ returning to standby point can be carried out. When [Enabling switch] is disabled, it will immediately stop the action and a pop-up window will appear. When the function of [Enabling switch protection] is disabled, the operation will not be controlled by [Enabling switch].
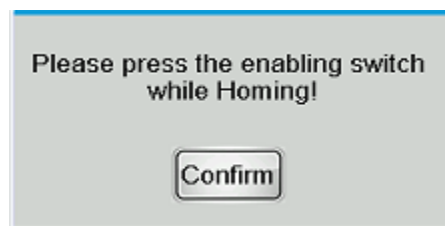
[Enabling Switch] is a 3-position operation switch. See the definitions below:
- **Not pressed:** Disabled status; Inhibit to operate in manual mode.
- **Pressed:** Enabled status; Allow users to operate in manual mode.
- **Hardly pressed:** Disabled status; Inhibit to operate in manual mode.
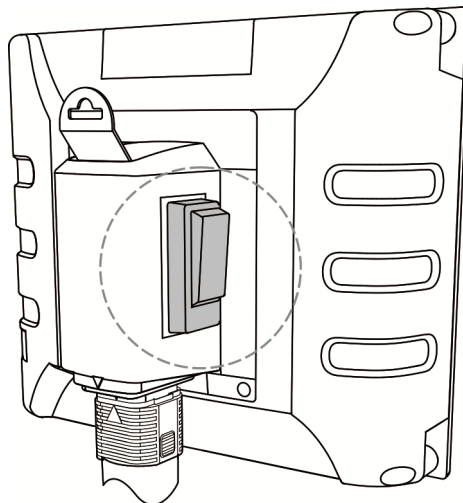
2

2.5.1   Homing

Click [Homing of Main system] on main screen. A window of motion sequence and posture will pop-up. Click on [Homing] again, the system will start homing.
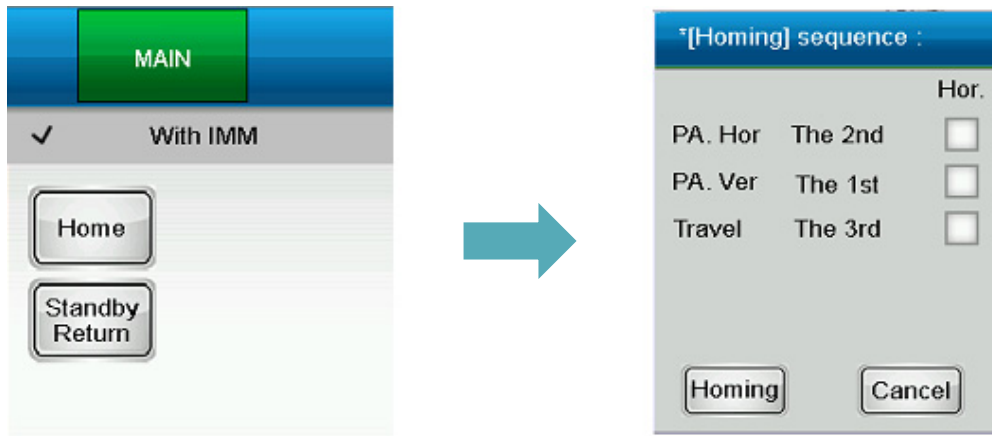
When executing the instruction, the button will be glittering and a text of [Homing…] in red color will appear on top-left corner. After the motion is complete, the button will become blue and shows instruction completed.
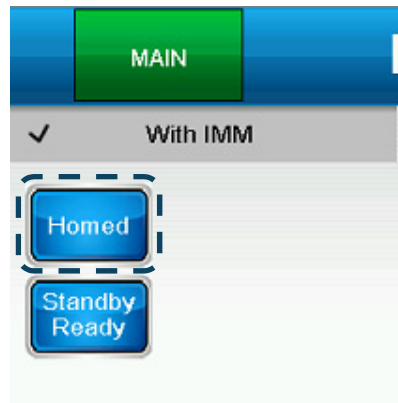
This sequence and posture can be set in [System] > [Safety setting] > [Homing / Standby].

2.5.2   Return to Standby Point

Click on [Standby Return] (Return to standby point of main system) on main screen.
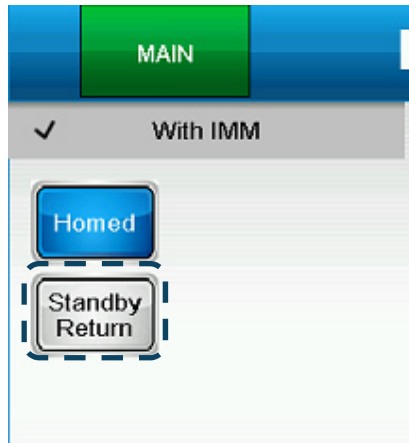
Or, users can click on [Standby] (Return to standby point) on operation screen.
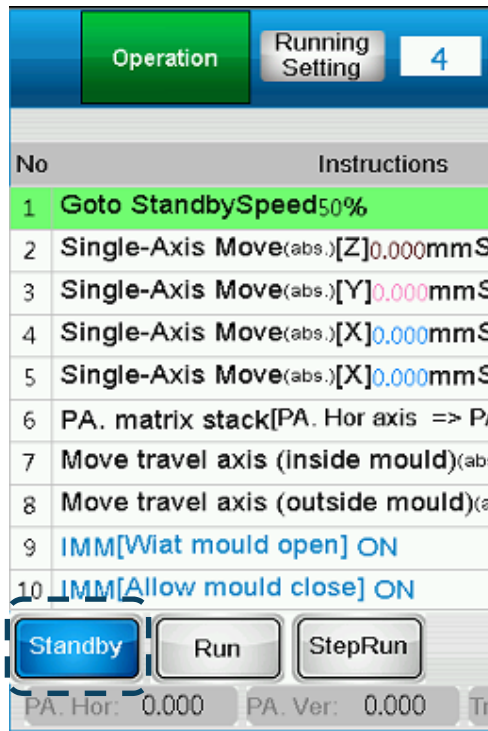
2

When executing the instruction, the button will be glittering and a text of [Homing…] in red color will appear on top-left corner. After the motion is complete, the button will become blue and shows instruction completed.

This sequence and posture can be set in [System] > [Safety setting] > [Homing / Standby].

2.6   Operate in Manual Mode

The manual mode cannot be enabled when the system is in auto operation. Other than that, manual mode can be applied in all screens. When it switches to manual mode, the window of operating function in manual mode will pop up, including jog, adaptive moving and arm's output control.
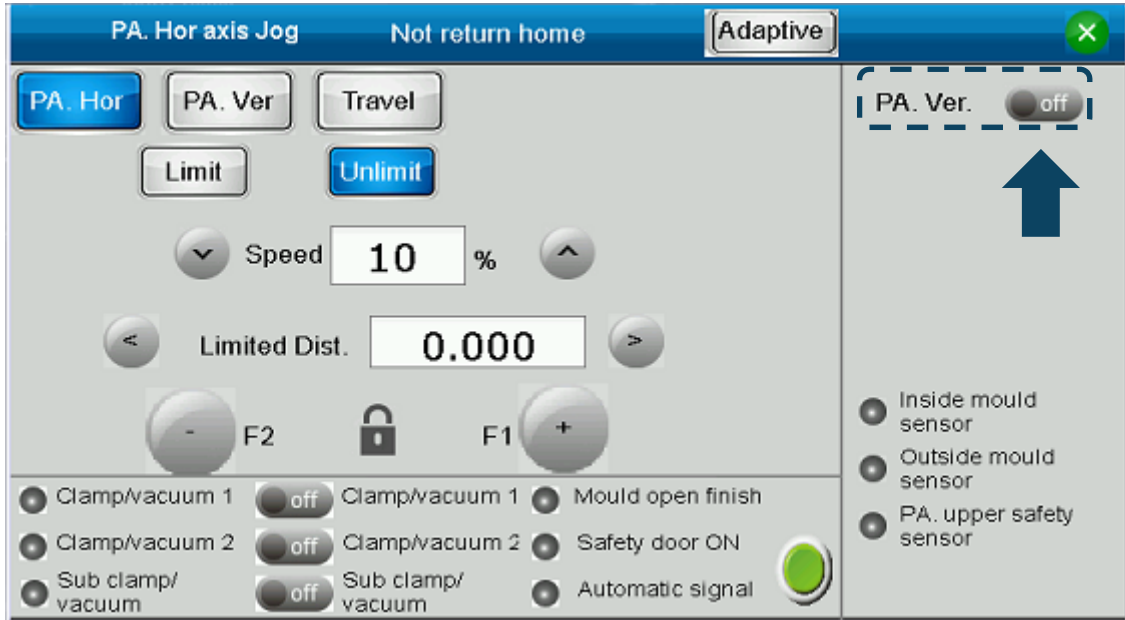
For avoiding danger resulting from wrong operation, jog function shall be used with [Enabling switch] and can work only when [Enabling switch] is enabled. See the figure below.
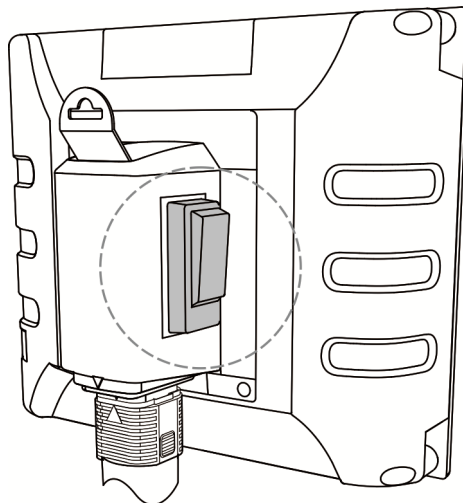
[Enabling Switch] is a 3-position operation switch. See the definitions below:
- **Not pressed:** Disabled status; Inhibit to operate in manual mode.
- **Pressed:** Enabled status; Allow users to operate in manual mode.
- **Hardly pressed:** Disabled status; Inhibit to operate in manual mode.

To control the arm's action via DI/DO, please directly click on the corresponding button. See the figure above.

2.6.1   Troubleshoot in Jog Mode

Users can use jog function to clear alarms. Please note that the position protection for each axis will be invalid when applying jog function.

(1) **Servo activated:** Servo on the drive in manual mode first before taking other actions.

(2) **Mode:** Unlimited mode only

(3) **Axis selection:** Select the axis which is going to execute instructions.

(4) **Speed:** The speed (%) in jog mode. It can only operate at 10% of speed or below in this situation.

(5) **Jog function enabled:** Jog function enabled. It should work with enabling switch. (Disable 🔒 / Enable 🔄)

(6) **Jog in reverse direction:** Jog in reverse direction. Release the button to stop the operation.

(7) **Jog in forward direction:** Jog in forward direction. Release the button to stop the operation.

2.6.2 Jog with Unlimited Range

Jog function can be used within the set distance and non-inhibited zone.
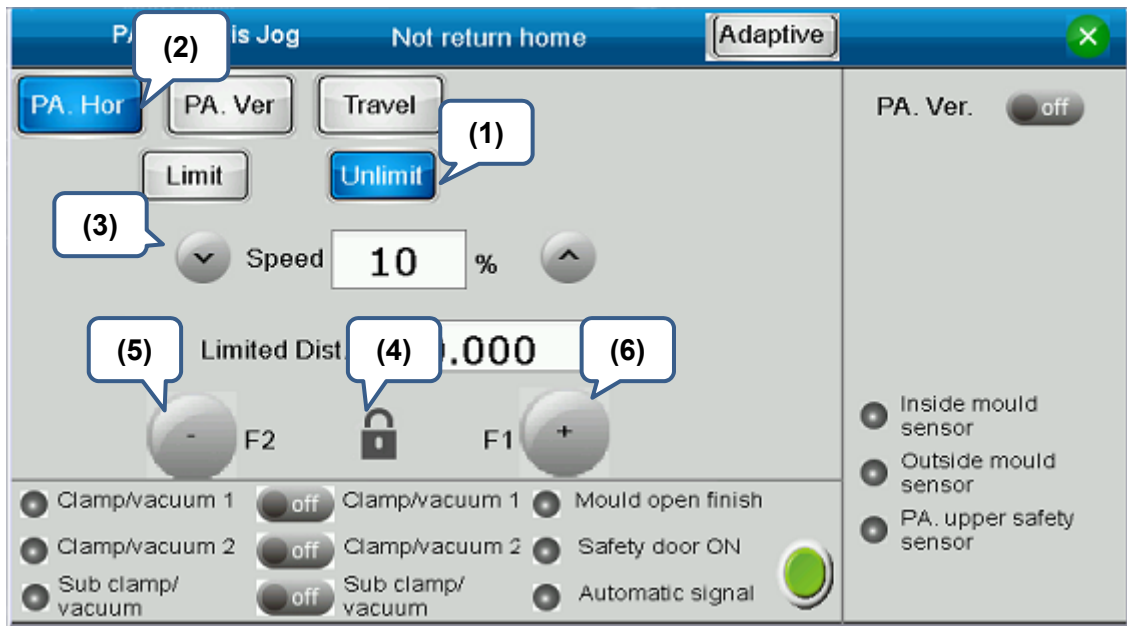
(1) **Mode:** Unlimited mode

(2) **Axis selection:** Select the axis which is going to execute instructions

(3) **Speed:** The speed (%) in jog mode, range from 1 to 100%.

(4) **Jog function enabled:** Jog function enabled. It should work with enabling switch. (Disable 🔒 / Enable 🔄)

(5) **Jog in reverse direction:** Jog in reverse direction. Release the button to stop the operation.

(6) **Jog in forward direction:** Jog in forward direction. Release the button to stop the operation.

2

2.6.3   Jog with Limited Range

Jog function can be used within the set distance and non-inhibited zone. Users can specify the max. moving distance for one operation with jog function. It can be applied for teaching the position.
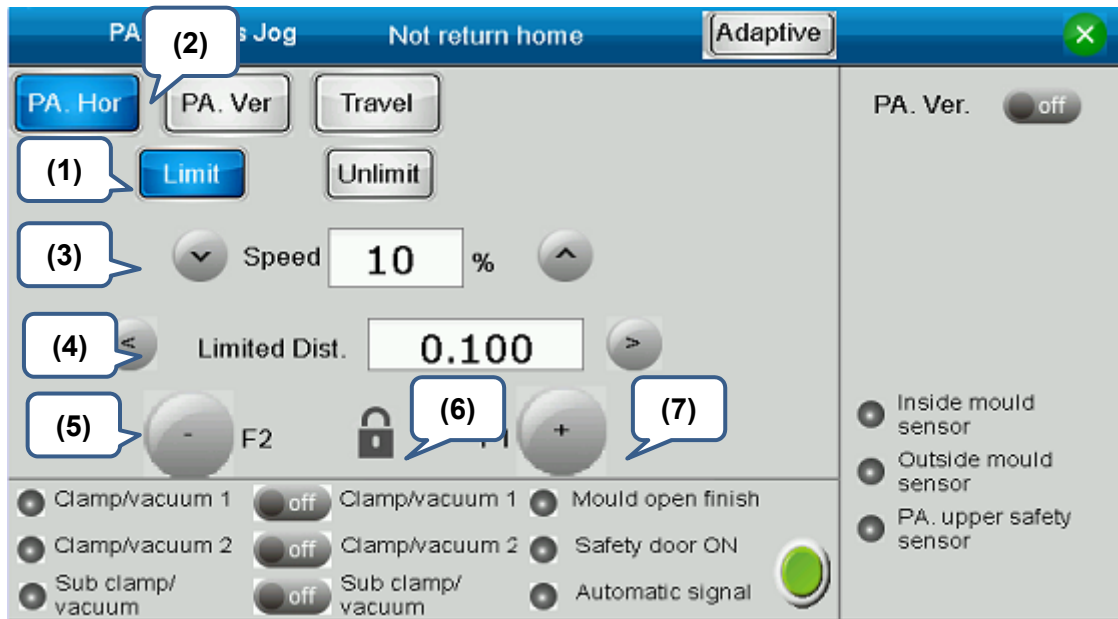
(1) **Mode:** Limited mode

(2) **Axis selection:** Select the axis which is going to execute instructions

(3) **Speed:** The speed (%) in jog mode, range from 1 to 100%.

(4) **Set the moving distance:** Set the max. moving distance in jog mode. Use **<** and **>** to change the setting. The moving distance can be set as 100, 10, 1 and 0.1 (mm).

(5) **Jog function enabled:** Jog function enabled. It should work with enabling switch. (Disable 🔒 / Enable 🔄)

(6) **Jog in reverse direction:** Jog in reverse direction. Release the button to stop the operation.

(7) **Jog in forward direction:** Jog in forward direction. Release the button to stop the operation.

2.6.4 Jog with the Set Target

This function can be applied in [Teach] only. And only when the modified instruction is [interpolation] or [position], can the user use this function to move the arm to the absolute position. This function limits the system to jog with the set direction and distance. For example, if the current position is 100, when the target position is 200, the system only can move in forward direction. Also, when its position is at 200, it cannot move further. Users can apply this function to quickly move the arm to the target position and do fine tuning afterwards.
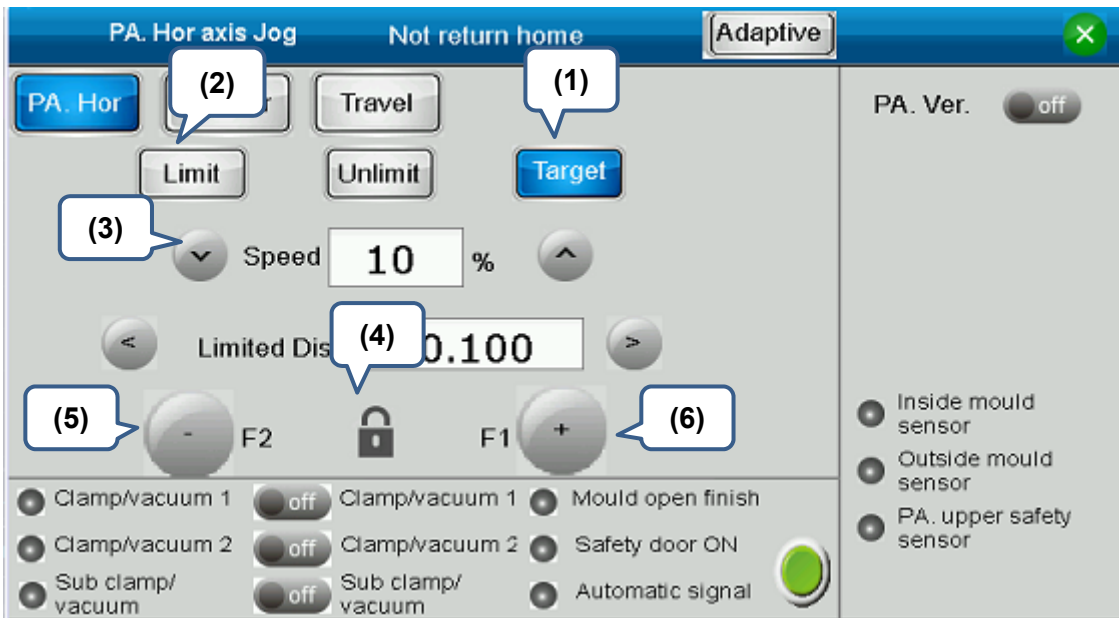
(1) **Mode:** Target mode

(2) **Axis selection:** Select the axis which is going to execute instructions

(3) **Speed:** The speed (%) in jog mode, range from 1 to 100%.

(4) **Jog function enabled:** Jog function enabled. It should work with enabling switch. (Disable / Enable)

(5) **Jog in reverse direction:** Jog in reverse direction. Release the button to stop the operation.

(6) **Jog in forward direction:** Jog in forward direction. Release the button to stop the operation.

2.6.5 Adaptive Moving

With the function of adaptive moving, users can complete position teach by hand movement. When this funtion is enabled, the servo motor will limit the arm's action by the limited torque output. The arm will move by the external force. It will be easier to move the arm when the torque setting is smaller. Please note that when the vertical axis applies this function, the arm might slip if the torque is set to small. Only one axis can apply the function of adaptive moving at a time. Leave the page of adaptive teach to disable this function.

Click on [Adaptive] to enter [Teach] screen:
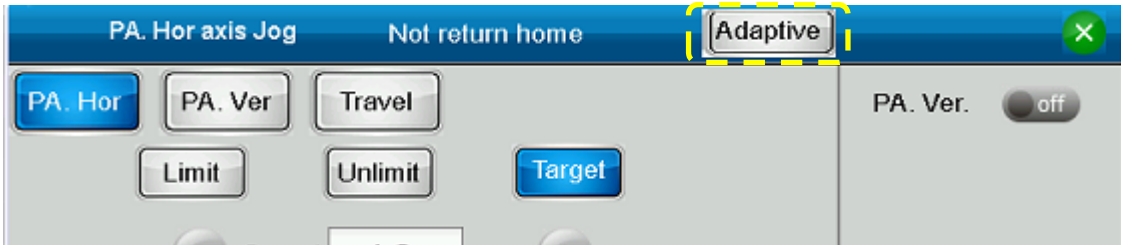
Go to adaptive screen.
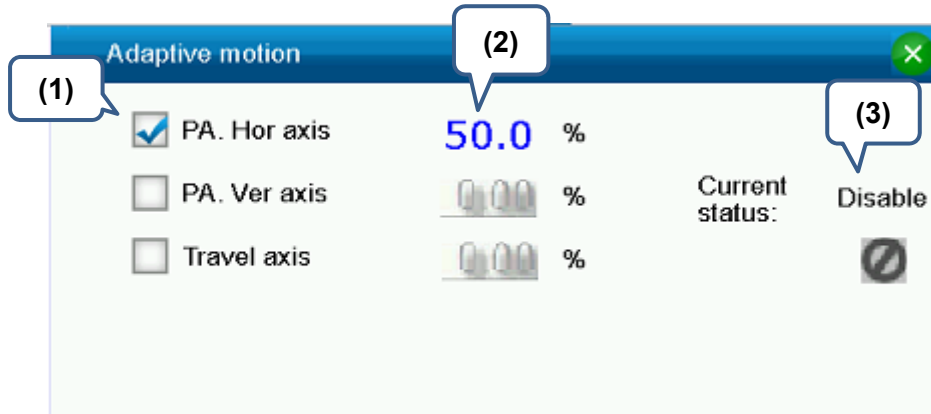
(1) **Axis selection:** Select the axis that is going to do adaptive moving.

(2) **Torque output:** Output setting to limit the torque. Range for vertical axis is from 50 to 100% and 1 to 100% for other axes.

(3) **Switch:** Click on the button to enable or disable adaptive functio006E. (Enable ✓ / Disable ∅)

2.7 Trail Run Operation

When loading in a new program or editing the instruction, trail run operation can be used to ensure the accuracy of the action. Through this function, users also can adjust the target position.
Go to [Operation] screen, return to start point (= standby point) of the arm before proceeding trail run. Then, click on [StepRun].
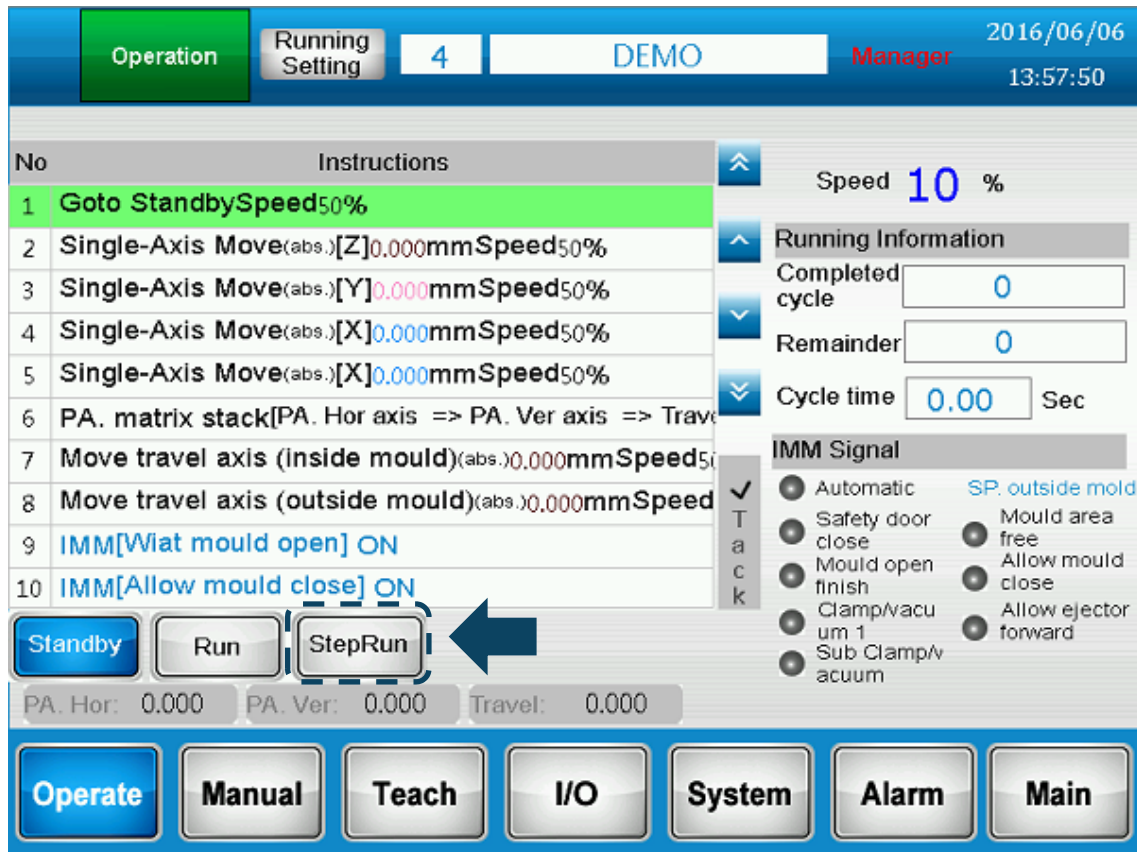
2

See the screen of [Trail run operation] below:

(1) **Speed:** Adjust the percentage to change the speed of trail run.

(2) **Program instruction:** It displays the instruction of current program. Target instruction will be highlighted. When this function is disabled, you can directly click on the instruction that you wish to see or modify. The instruction editing window will pop up.

(3) **Instruction tracking:** When this function is enabled, the target instruction is the current instruction. When it is disabled, users can select the target instruction and set up the parameters of the instruction.

(4) **Instruction display:** When tracking function is disabled, clicking on this button can check the content of previous, next instruction, and instruction content on previous or next page.

(5) **Single cycle:** Click on this button to start trail run in single cycle. If the enabling switch is enabled, it will start to execute the instruction in sequence. If not, the trail run will stop until all instructions are complete. Then, a pop-up window will appear. Please note that it is necessary to return to standby point before you start to do trail run.
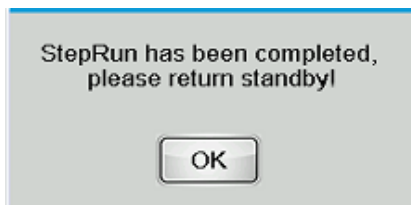
(6) **Previous step:** The system will set the previous instruction as the target instruction. Thus, when clicking on this button, the system will go to the end position from previous instruction.

(7) **Next step:** Clicking on this button, the cursor will move to the next instruction after completing the current instruction. The next instruction will be set as the target instruction. When the instruction is complete, a pop-up message will appear.

StepRun has been completed, please return standby!

OK
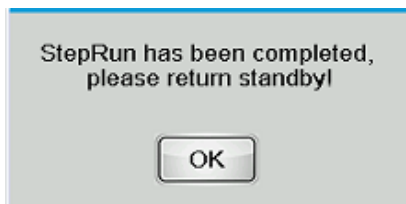
(8) **Stop:** Click on this button to cancel the trail run of single cycle.

2.8 Auto Operation

With this function, the current selected program will be in auto operation. Go to [Operation] screen. Before starting auto operation, the arm has to be returned to the start position, which is the standby point. Then, click [Run].
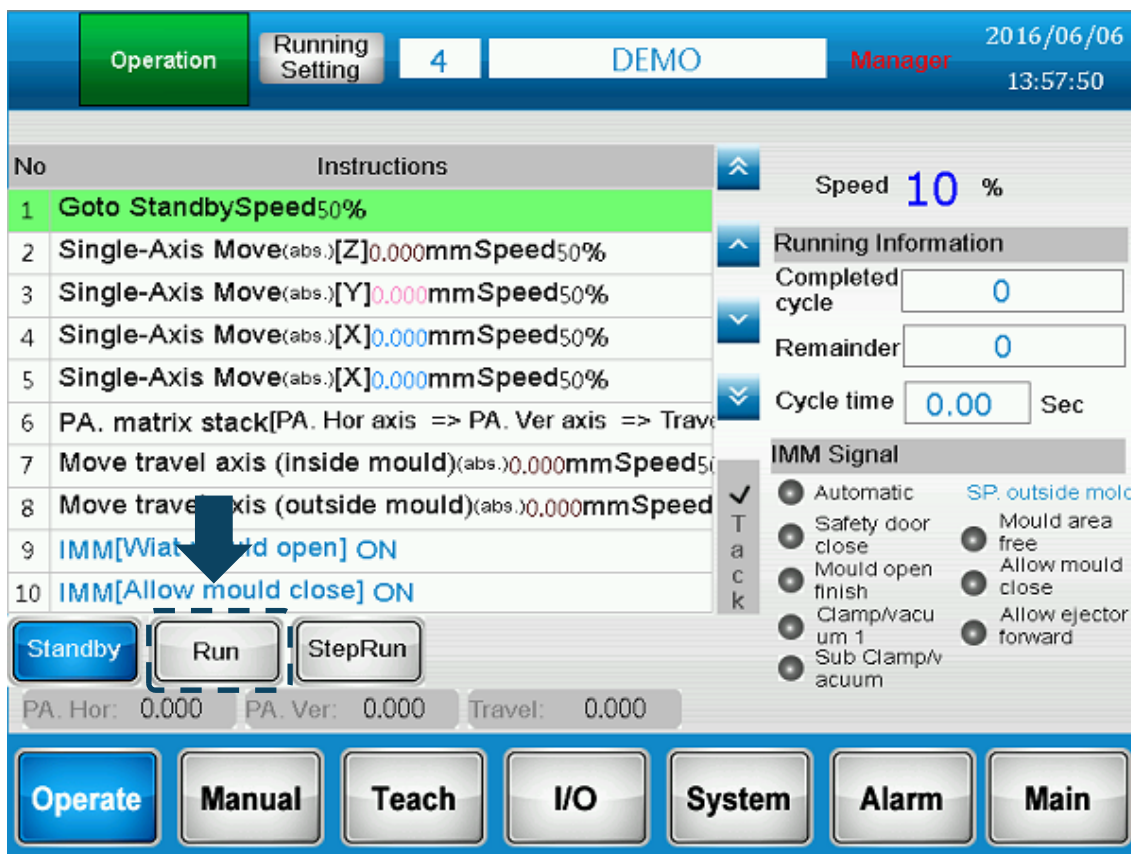
See the screen of [Auto operation] below:

(1) **Speed:** Adjust the percentage to change the speed of trail run.

(2) **Program instruction:** It displays the instruction of current program. Target instruction will be highlighted. When this function is disabled, you can directly click on the instruction that you wish to see or modify. The instruction editing window will pop up.

(3) **Instruction tracking:** When this function is enabled, the target instruction is the current instruction. When it is disabled, users can select the target instruction and set up the parameters of the instruction.

(4) **Instruction display:** When tracking function is disabled, clicking on this button can check the content of previous, next instruction, and instruction content on previous or next page.

(5) **Pause:** Click on [Pause], the system will temporarily stop. Button of [Operating] will glitter. Double click the [Pause] button to resume the operation.

(6) **Stop:** Click on [Stop], the system will stop operating after completing the current instruction. If the current instruction has not been completed, click on [Stop] again to resume the operation.

(7) **Cycle stop:** Click on [Cycle stop], the system will stop operating when the current cycle ends. Then, a window will pop up. Click on [Cycle stop] again to resume the operation.

> This cycle has been completed,
> Auto Run finished!
>
> Confirm
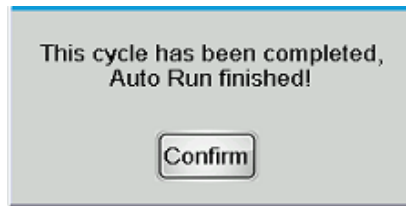
To immediately stop the operation, please click on [Pause] when the cycle stops. A pop-up window will appear then. Users also can directly click [EMS] button.

> Cycle is stopped...
> Auto Run is canceled!
>
> Confirm
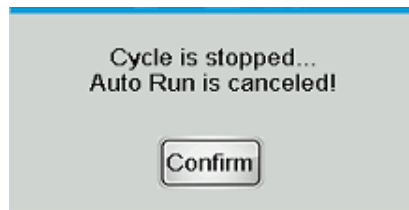
(8) **Completed cycle:** The complete cycle number in one auto operation.

(9) **Remainder**: Users can set up the total number of the product in [Production setting]. The residual number is the result that deducts [Number of the complete cycle] from [Total number of production]. If there is no need to set up the number of production, then set this value to 0.

(10) **Cycle time:** The time it takes for the last cycle

(11) **Signal from IMM:** It displays the input/output signal of the injection molding machine and the current status of the system.

(12) **Running setting:** This window shows production setting and the related information.
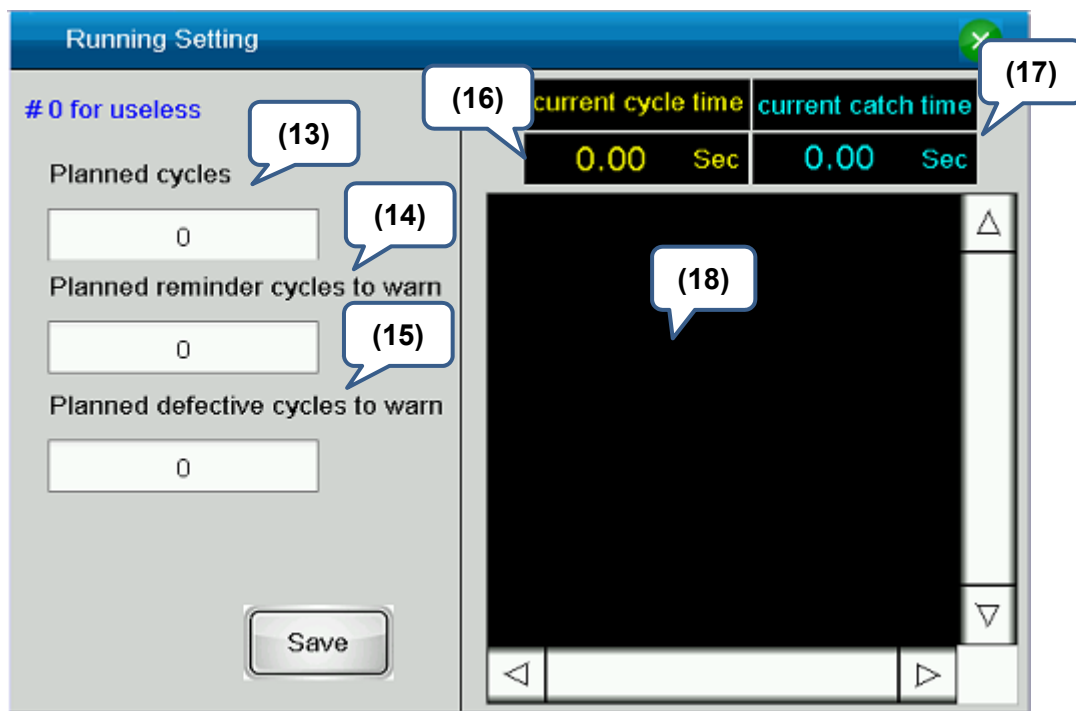
(13) **Total number of the product:** When the number of completed product reaches this setting value, a window will pop-up as the reminder and stop auto operation. Set it to 0 means to disable this function.

Planned running cycles arrive!

OK
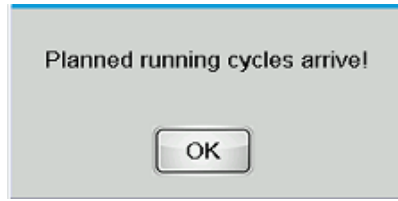
(14) **Planned cycles:** When the number of completed product reaches this setting value, a window will pop-up. Set it to 0 means to disable this function.

Planned running cycles
will be arrived!

Confirm
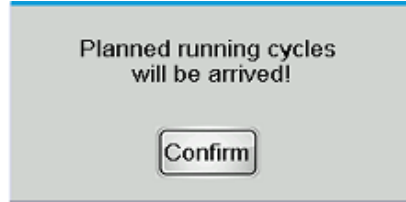
(15) **Planned reminder cycles to warn:** When the number of defective goods exceeds the setting value, an alarm will occur as a reminder. Set it to 0 means to disable this function.

(16) **Current cycle time:** It shows the duration time for the current cycle.

(17) **Current catch time:** The product take-out time of the current cycle

(18) **Record for the cycle time:** Records for the last ten cycle time and product take-out time.

2.9 Signal Monitoring

It can monitor the signal of take-out arm and injection molding machine. Click on [I/O] on main screen to go to I/O monitoring screen, you can monitor and control signals of cylinder and take-out arm, input/output signals of injection molding machine and signals of servo drive.
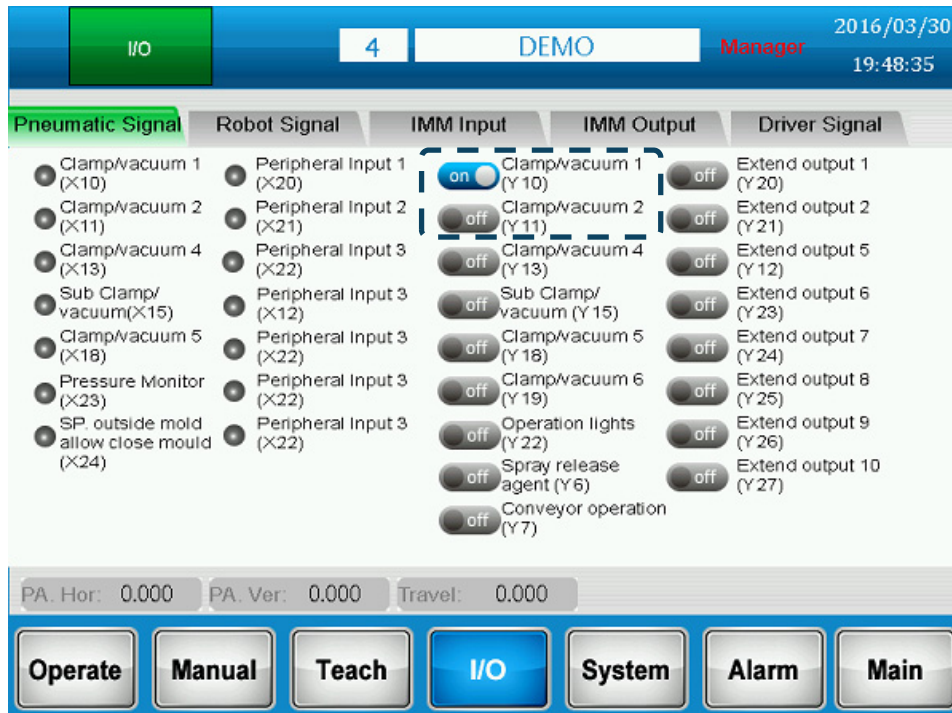
Click on the button of [On/Off] to enable or disable the function of the corresponding terminal. See the figure above.

Note: Function of each terminal can be flexibly defined. Screen that shows above is for reference only.

Program Usage and Editing 3

This chapter describes the method to manage and edit the program and the related functions.

3

The take-out arm needs different motions to handle different types of production line. The combination of different motions is called [Program]. This system provides 1000 programs for users. Each program contains 400 motion commands.
Another 10 program templates are provided for administrators to pre-edit the commonly used motions and stores these motions in different program templates. When loading the program template, users can quickly download each created motion that they had defined beforehand. In addition, to import and export the program via USB disk or SD card is also supported so that the program can be shared among different take-out arm systems.

3.1 Program Manager

Click on the program name on status bar to enter the screen of [Program manage]. See the following figure for the screen of [Program manage]:
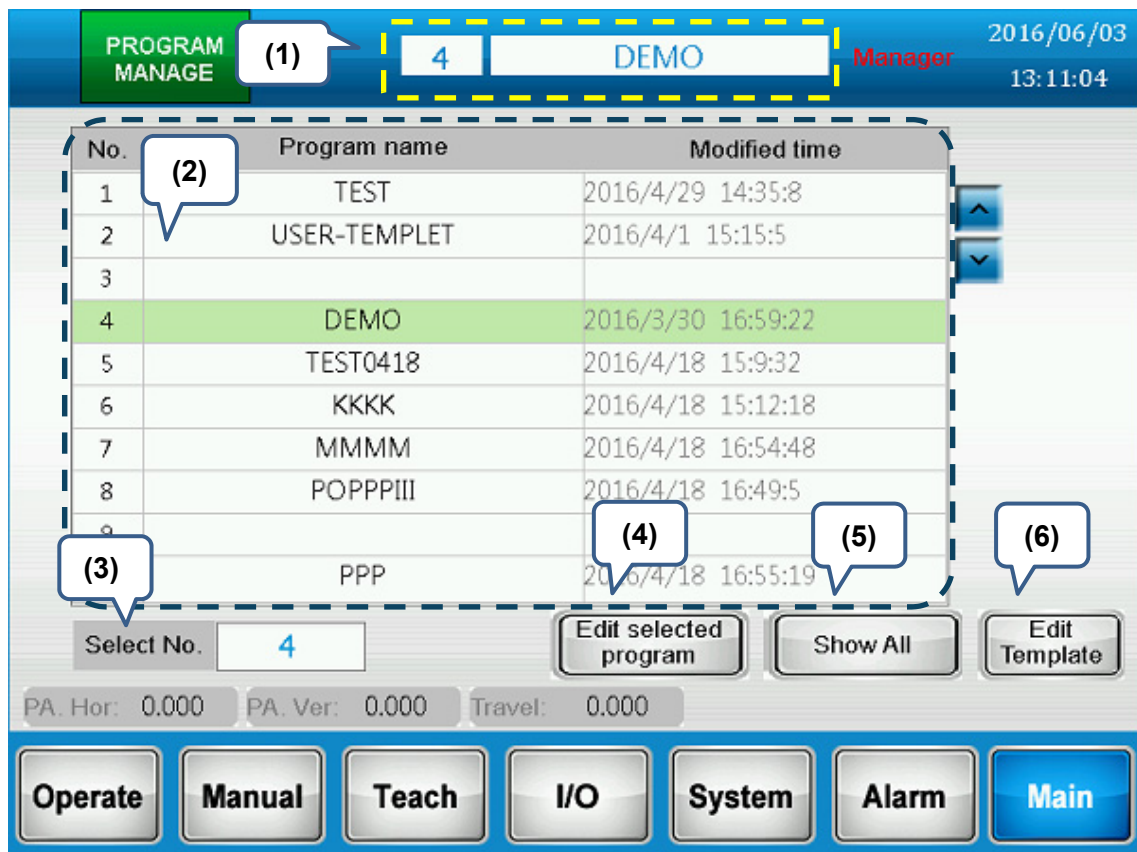
(1) **Currently used program:** Display the program number and program name that currently used.

(2) **Program list:** Display all program names and the modified time. Directly click on it to select the program.

(3) **Select the program:** Select the program number that you wish to operate.

(4) **Edit selected program:** Edit selected program. Click on this button, the following screen will show up. Users can edit or load the program.
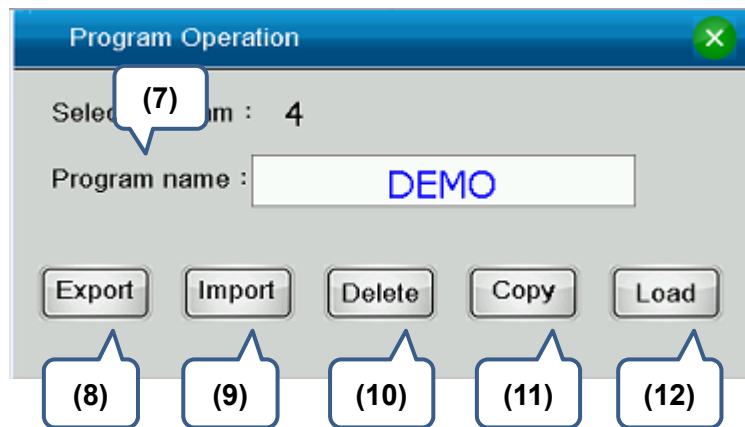
(5) **Show All / Only display the selected ones:** Users can switch the displayed list. [Display all] means to display the list of 1000 programs; [Only display the selected ones] means it only displays the program which has file name.

(6) **Edit template:** Select the program template for editing. This function only can be used by administrators. The following screen will show up after clicking on the icon:

Select the template to enter [Teach] screen. 10 templates are provided, 1001 ~ 1010.
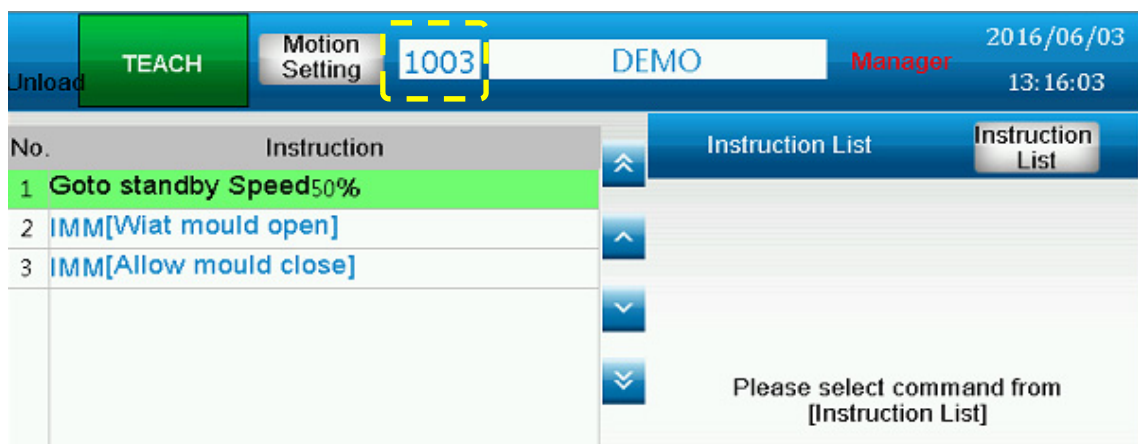
3

(7) **Program name:** Edit the program name that you selected.

(8) **Export:** Export the selected program to external device.

(9) **Import: Import the selected program from external device.**

(10) **Delete:** Delete the content from the selected program. A window will pop up.
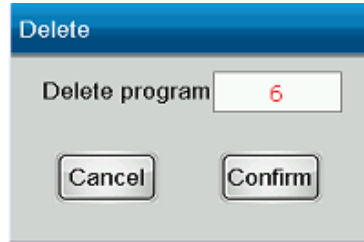
(11) **Copy:** Copy the selected program to other programs. A window of the selected program will pop up after clicking on it.
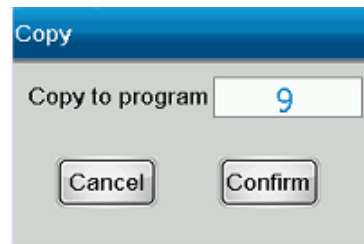
(12) **Load:** Load the selected program and enter teach editing screen.

3.2 Loading and Editing a Program

After loading a program, it will enter [Teach] screen for instruction editing. Users also can directly click on [Teach] to edit the current program when you have already downloaded the program.

3.3 Description of Edit Function in Teach Mode

Apart from instructions editing, parameters from the program can also be edited in teach mode. See the figure below for [Teach] screen:

(1) **Content of the instruction:** It is the instruction content of the current program. Click on it, a window of parameters will pop up so that users can modify the setting.

(2) **Operate the instruction displaying area:** Users can scroll the displayed page of instruction content and change the target instruction. The related parameters will not be displayed here.

(3) **Cut/Delete:** Cut the target instruction.

(4) **Clear:** Long press the button for three seconds to clear all instructions.

(5) **Copy:** Copy the target instruction.

(6) **Paste:** Long press the button for three seconds to paste the [Cut] or [Copy] instruction on the target instruction.

(7) **Insert:** Insert the current editing instruction to the target instruction.

(8) **New:** Add the current editing instruction to the position placed after the target instruction.

(9) **Change:** Change the current editing instruction to the target instruction.

(10) **Store:** Store the current editing program. If the program is not stored after being edited or modified, a prompt message will pop up and ask for confirmation.

(11) **Instruction list:** Call the instruction list and to select the instruction that you wish to join.

(13) **Edit the instruction: It displays the related parameters of current instruction.**

(14) **Template:** Select the template to download to the current program.

(12) **Motion setting:** It includes the setting of current program, such as postures of homing, injection protection and standby mode. When you click on it, its setting window will pop up.

3.4 Description of Program Setting

Each program can save its own settings, such as standby position, posture or standby mode, including parameters setting. Click on [Motion setting], a window for program setting will pop up.
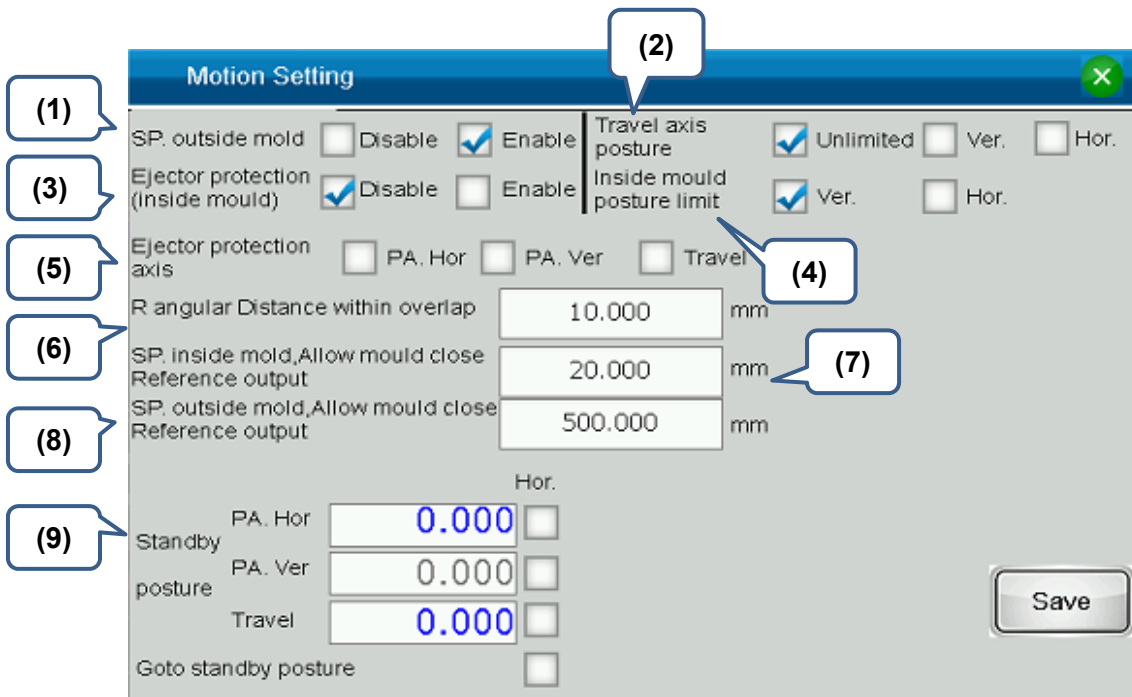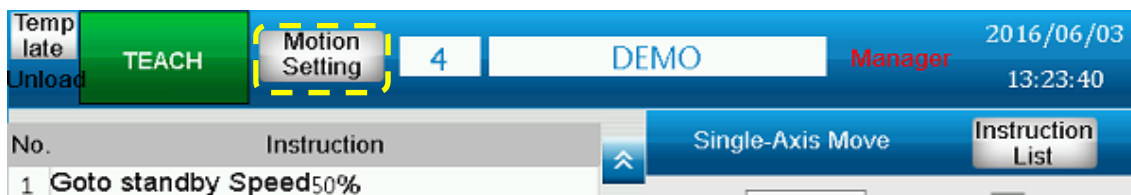
(1) **SP. Outside mold (Standby point outside mold):** It can determine if the system is going to stand by in non-molding area.

(2) **Travel axis posture:** When travel axis is moving, the primary arm's posture can be set via this function. If the primary arm's posture is different from the setting, an alarm will occur.

(3) **Ejector protection axis:** When executing the instruction of [Ejector is allowed to proceed], axes that were used to protect the ejector will be switched to torque protection mode to protect the mechanism of take-out arm and ejector of injection molding machine.

(4) **Inside mold posture limit:** When the take-out arm is in inner molding area, its posture is limited either in manual or auto mode.

(5) **Ejector protection axis:** This function is used with [Ejector protection axis]. When it is executing the instruction of [Ejector is allowed to proceed] while this function is enabled, the ejector can push forward the arm. Protection output of axes that were used to protect the ejector can be set in [Motion setting] > [Torque protection].

3

(6) **R angular Distance within overlap:** When [Interp. Move] instruction enables overlap function, more than one linear motions will use smoothing function automatically. This function is for setting up the radius of the round angle. Bigger setting value brings smoother angle. Please bear in mind that if the value is set too big, it might collide with the peripheral equipment.
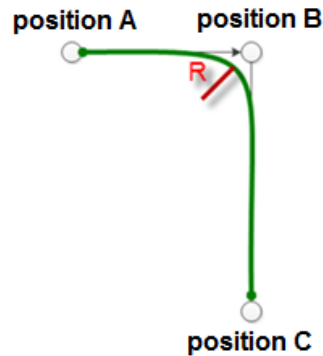
(7) **SP. inside mold,Allow mould close Reference output:** When standby in molding area, if the instruction of [Molding close] is issued beforehand, [Molding closure] signal will be on as soon as the arm is within the allowable range. This is for time saving.

(8) **SP. Outside mold,Allow mould close Reference output:** When standby in non-molding area, if the instruction of [Molding close] is issued beforehand, [Molding closure] signal will be on as soon as the arm is within the allowable range.

(9) **Goto standby posture:** It can set up the position and posture of each axis when standby.

3.5 Description of Program Instruction

Click on [Instruction list] on [Teach] screen, a window of instruction list will pop up for selection. Select the instruction that you are going to use. And the selected instructions will be displayed in instruction area. See further information below:
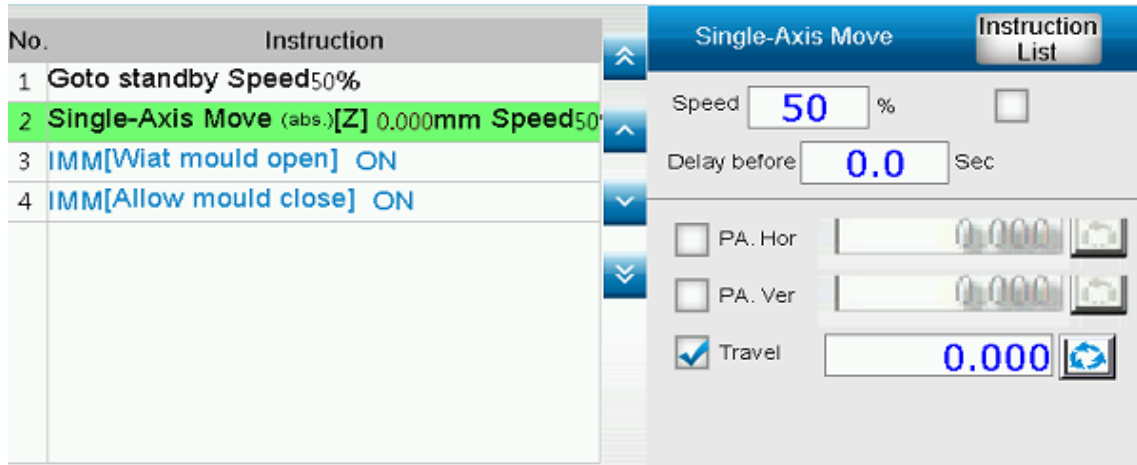
3

3.5.1 Motion for Each Axis

■ **Interp. Move:** Linear motion of multi-axis (interpolation). Users can select single axis or multi-axis to do linear interpolation.
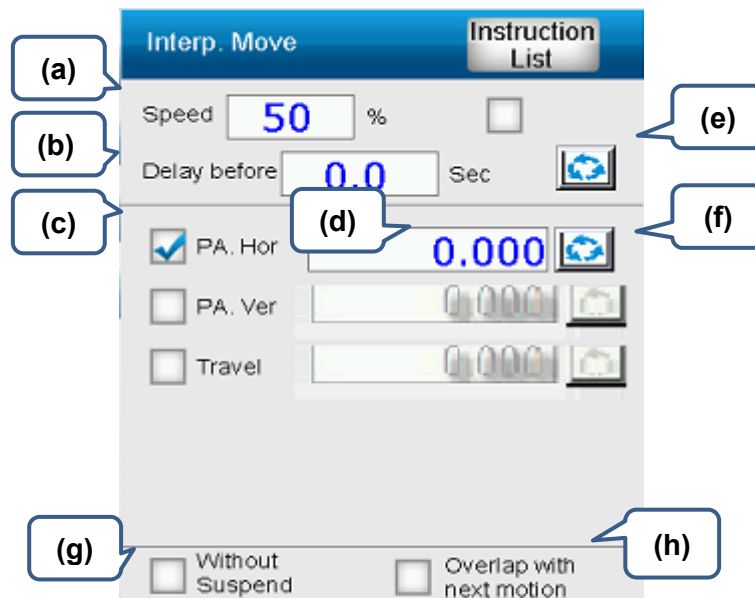
(a) The is the setting for motion speed

(b) It is for setting up the time interval before you carry out the motion instruction.

(c) Select the motion instruction for axis.

(d) Execute the instruction according to the setting value. When executing relative motion instruction, it moves to the relative position. When executing absolute instruction, it moves to the absolute position.

(e) Update the position for multiple axes. Regard the current position of each axis as the teach position point.

(f) Update the position for single axis. Regard the current position of corresponded axis as the teach position point.

(g) Check [Without suspend], it means after current motion instruction is complete, it will execute the next instruction right away. Thus, multiple axes can work individually and simultaneously.

(h) Check [Overlap], it means the current instruction will smoothly connect to the next instruction. Please bear in mind that the motion type and axis of the current and next

instruction shall be the same but the target position shall be different. See the following figure as the example. If the current position is A and current instruction is [interpolation[XYZ]..B], the next instruction shall be [interpolation [XYZ]..C]. And the sequence to complete the instruction will be (A > B > C).
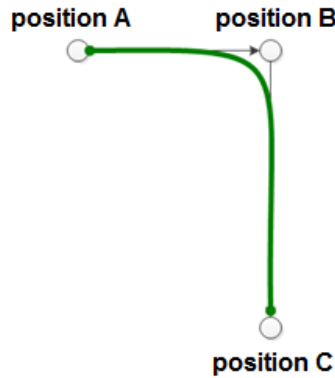
■   **Single-Axis Move:** Single axis moves along the straight line. Only one axis can be used at a time.

Please refer to instruction of [Interpolation] for parameters.

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■   **Goto standby:** It is the moving instruction to ask the system moving to the standby position.
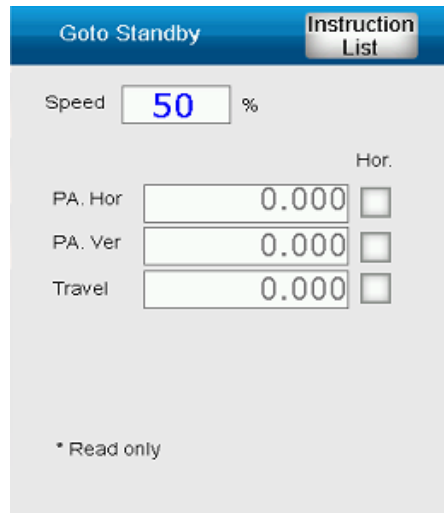
This is read-only parameter. If you wish to change its setting value, please go to [Teach > [Motion setting]. For safety concerns, the standby position of vertical axis of main/secondary arm can only be 0.

■   **PA. matrix stack:** It is also called stacking. Users only need to set up the start point for stacking. The system will automatically calculate the position of each point in accordance with the offset value, number and sequence. This instruction contains a series motion of stacking; It determines whether the machine shall move in transverse direction and then place the object right above the target position and if it shall pass the entry point then move downwards to the placing point.
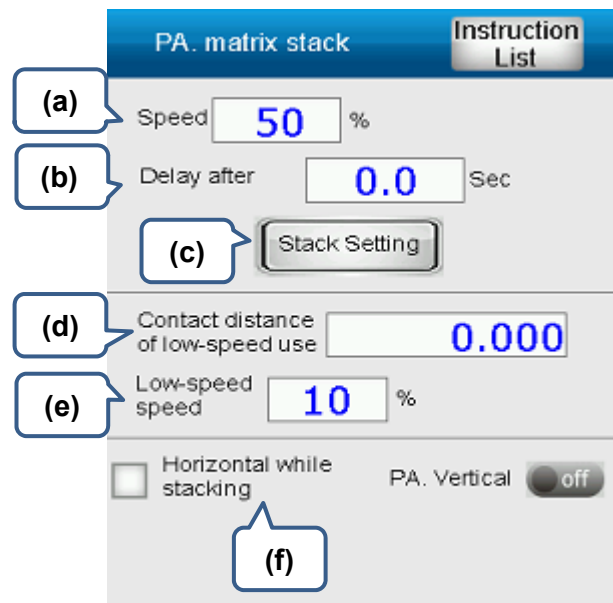
(a)   It is the speed of motion.

(b)   It is for setting up the time interval before you execute the next motion instruction.

(c)   [Stack Setting]: Click on this button to enter the setting window of array positioning.

(d)   Starts to move at low speed with the set distance when it is above the target point.

(e)   Set up low-speed motion

(f)   It can change the setting of primary arm's posture before it starts to carry out the instruction of array positioning.
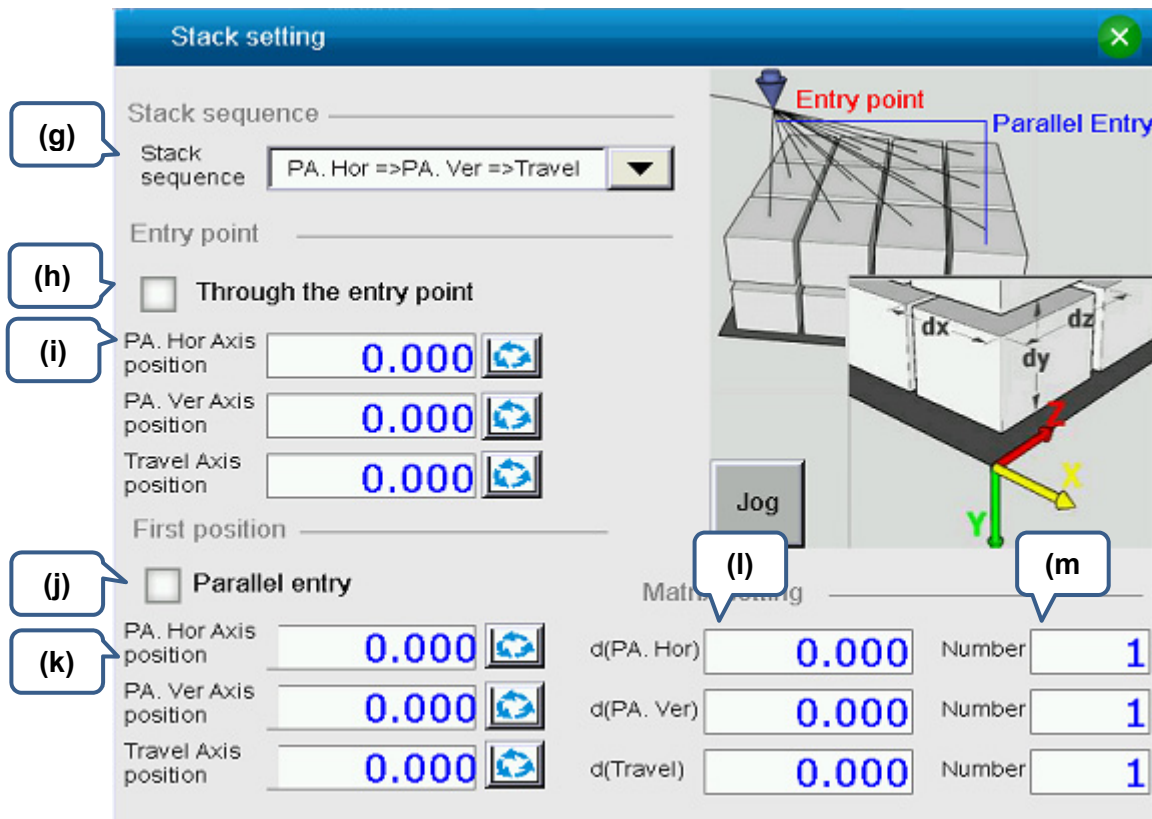
(g) The sequence setting of stack: X represents horizontal axis; Y represents vertical axis; Z represents transverse axis. If the sequence is X > Y > Z and the stacking number of X, Z and Y shall be 4, 3 and 2 respectively, the arrangement is showed as below:
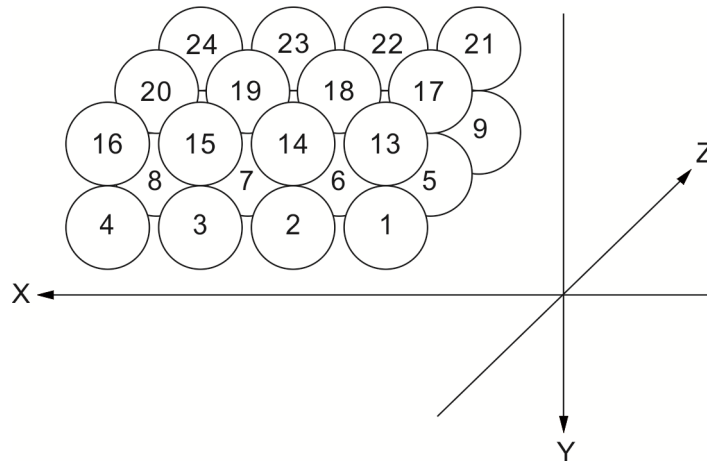
(h) Check [Through the entry point]. The arm will move to the entry point first. Then, it moves toward the stacking position.

(i) Coordinate of the entry point

(j) Check [Parallel entry]. Before the arm goes to stacking position, it moves horizontally right above the placing point first. Then, move downward to the stacking point.

(k) Coordinate of the first stacking point

(l) Offset setting of the distance between two stacking positions.

(m) Setting of stacking number

3

■ **Move Ver axis**: It is the positioning function of single vertical axis. Functions like motion instruction executed by main/secondary arm, motion instruction simultaneously executed by main/secondary arm and limit the target position of each axis within each distance are all included. If 5 axes are servo drives, please see the following parameters setting for vertical axis:

If three axes are servo drives and another two are cylinders, please see the following parameters setting for vertical axis:

3

- ■ **Move Hor axis:** It is the positioning function of single horizontal axis. Functions like motion instruction executed by main/secondary arm, motion instruction simultaneously executed by main/secondary arm and limit the target position of each axis within each distance are all included. If 5 axes are servo drives, please see the following parameters setting for horizontal axis:

If three axes are servo drives and the other two are cylinders, please see the following parameters setting for horizontal axis:

3

- **Move travel axis (inside mould):** Single-axis positioning function of horizontal axis. Its target position is limited within the inner molding area and at transverse direction.

- **Move travel axis (outside mould)**: Single-axis positioning function of horizontal axis. Its target position is limited within the outer molding area and at transverse direction.

3.5.2　Progam Motion

■　**IMM Operation:** The system sends the signal to injection molding machine for handshaking.
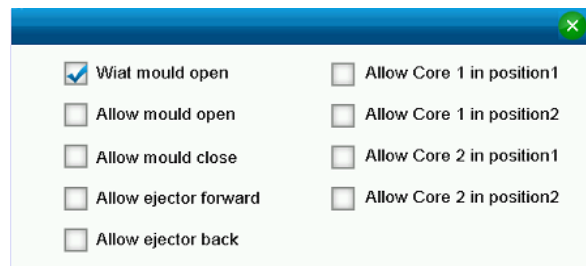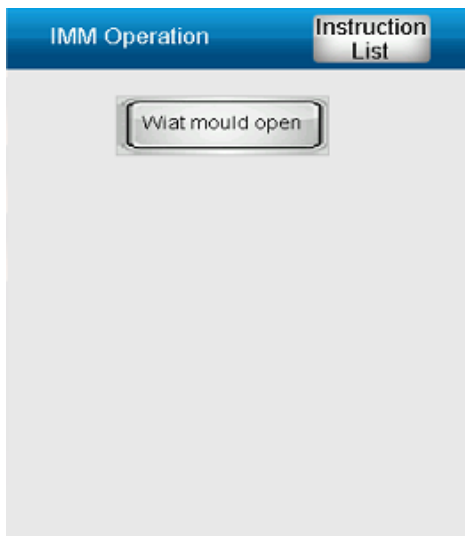
■　**Wait IMM:** The system waits for the handshaking signals from injection molding machine. After receiving the signal, it continues to carry out the instruction.
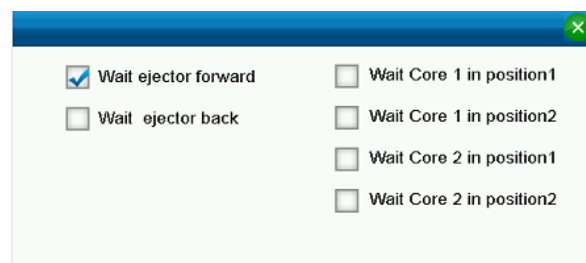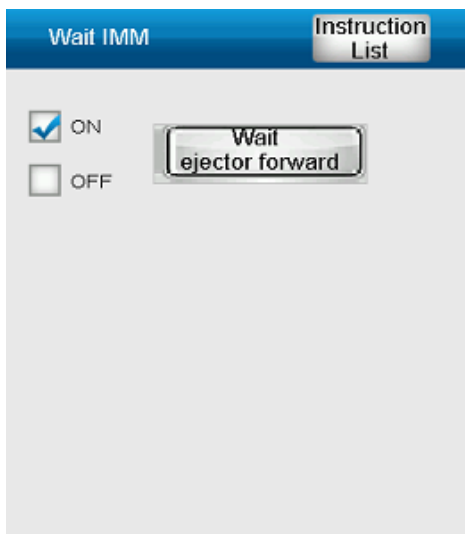
3

■   **Delay:** Delay time
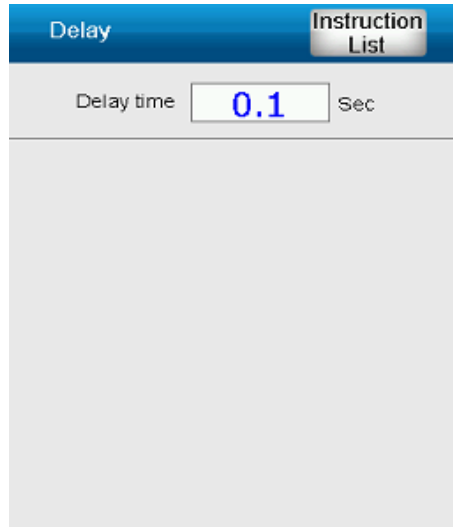
■   **PA. Pneumatic:** It is the instruction used to control the primary arm's posture. When the arm is in inner molding area, its posture is set based on the parameters.
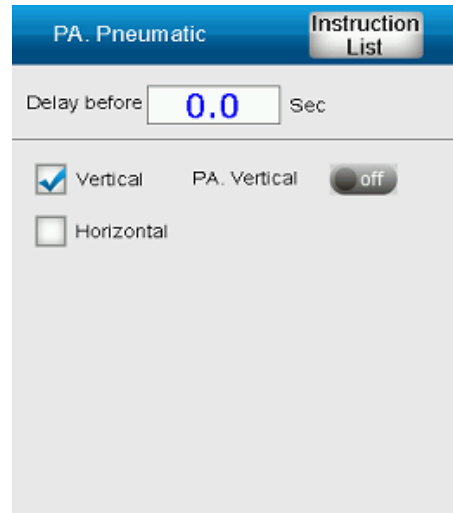
■ **SA. Pneumatic:** It is the instruction used to control the secondary arm's posture, including moving up and down (vertical axis) and forward and backward (transverse axis). When the arm is in inner molding area, its posture is set based on the parameters.
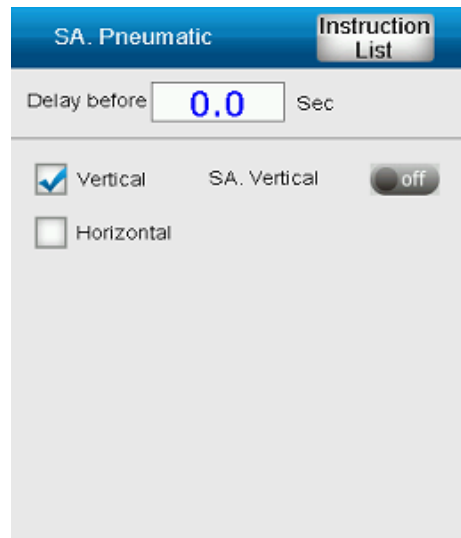
■ **Output:** It is the signal to control the clamp/vacuum valve and output instruction from peripheral device.
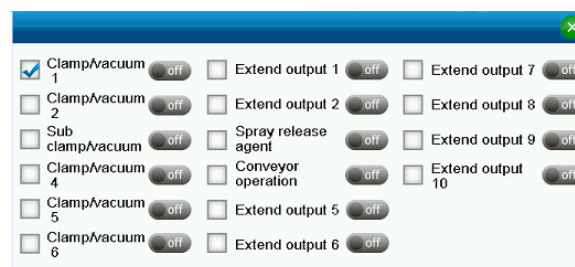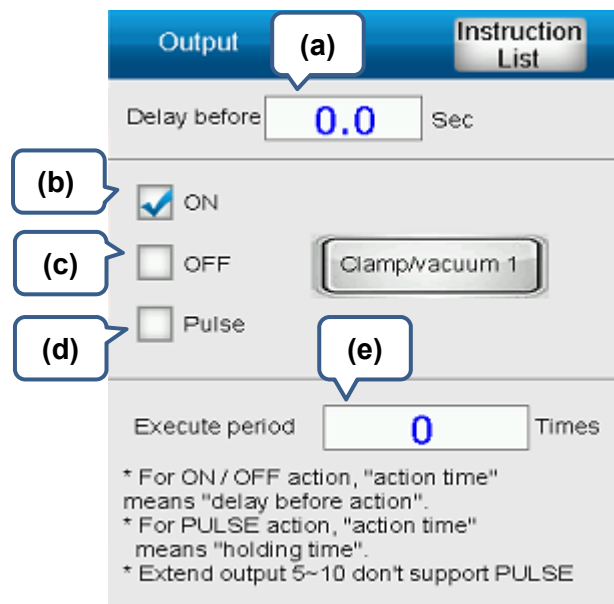
(a) Time for executing the instruction

(b) Turn on the signal.

(c) Turn off the signal.

(d) Select pulse output and turn on the signal. When the instruction is complete, the signal is off. When pulse output is selected, the next instruction will be executed before the

3

whole process is complete (Off > On > Off). Please note that pulse output will not influence the cycle. Thus, it is usually applied to the application of conveyor controlling.

(e) Interval for executing instructions. It indicates the interval among each instruction. If the interval number is 2, it means the instruction will be executed once every three cycles.

■ **Wait:** Wait for the input instruction from clamp/vacuum valve or peripheral device.
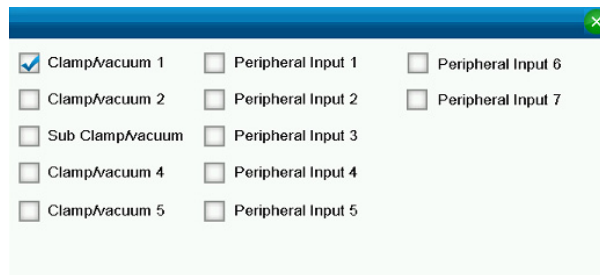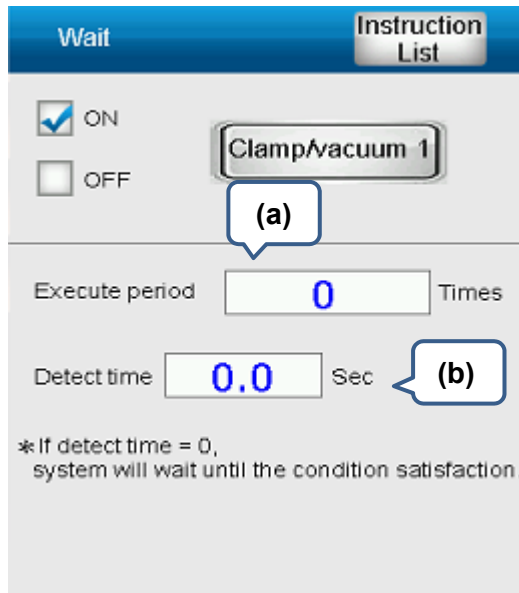
(a) Interval for executing instructions. It indicates the interval among each instruction. If the interval number is 2, it means the instruction will be executed once every three cycles.

(b) Detect time: When the system does not receive the signal within the setting time, an alarm will occur. When the detection time is not set to 0, a window of time delay will pop up and an alarm will occur.
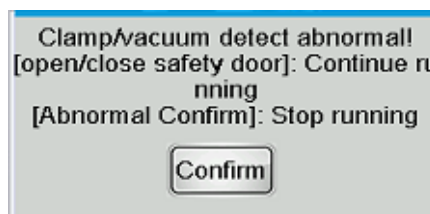
To open and close the safety door again will clear the alarm and resume the operation. Press [Alarm Confirm] ([F10]) to stop the operation.

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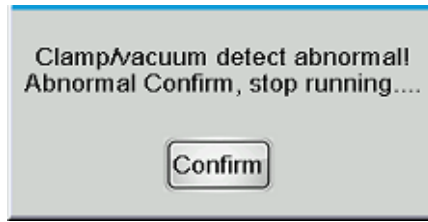
3.5.3   Procedure

■   **Starts:** Apart from the first cycle, each cycle starts from this instruction when it is in auto operation. <u>Instructions before [Starts] will be regarded as the initial instructions for auto operation.</u>

■   **End:** When executing this instruction, the cycle is over.

■   **Cycle Start \ Cycle End:** Instructions between [Cycle Start] and [I Cycle End] will not be executed every cycle. They will be carried out according to the Execute period setting. For example, if the Execute period is set to 1, instructions within the range will be executed every two cycles.
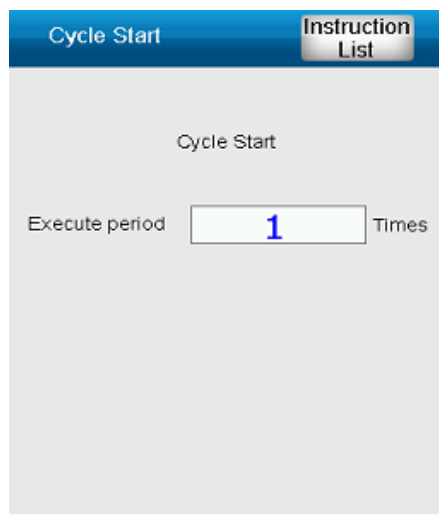
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■ **IF\ELSEIF\ELSE\ENDIF:** As long as the condition of IF is established, can the procedure of IF…ELSEIF of IF…ENDIF be executed. The applying method is similar to program language. Please note that nested loop is not supported. It only supports one layer of IF.

■ **FOR\BREAK\NEXT:** The executing time of instructions in FOR….NEXT can be set in accordance with the set constant or variables. Please note that, nested loop is not supported.

3.5.4   Others
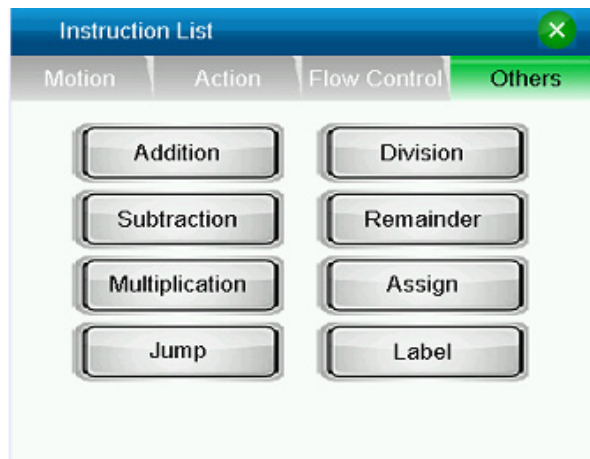
- ■ **Addition\Subtraction\Multiplication\Division\Remainder\Assign:** It is the operation instruction for system variables. 32 system variables for instructions are in total, U1 ~ U32, which can be used by procedure instructions.
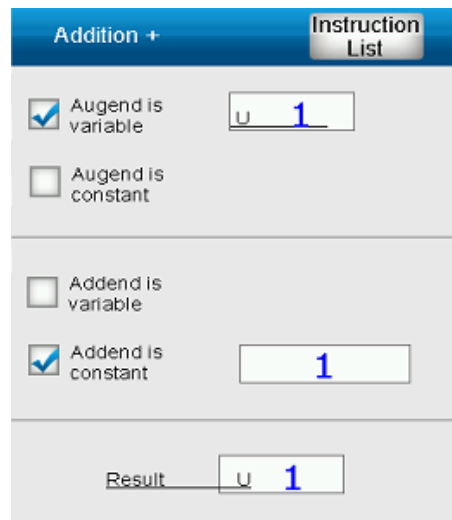
- ■ **Label:** It works with [Jump].

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■ Jump: It looks for the specified label and directly goes to the instruction. If the specified label cannot be found, the cycle is over.
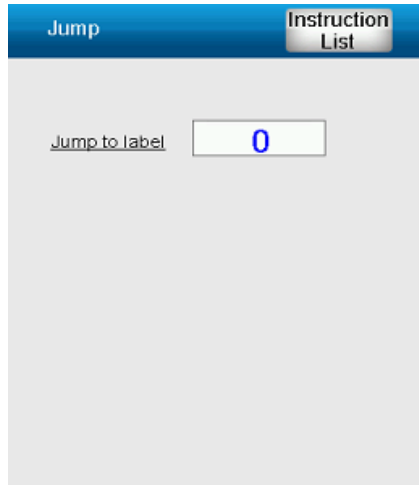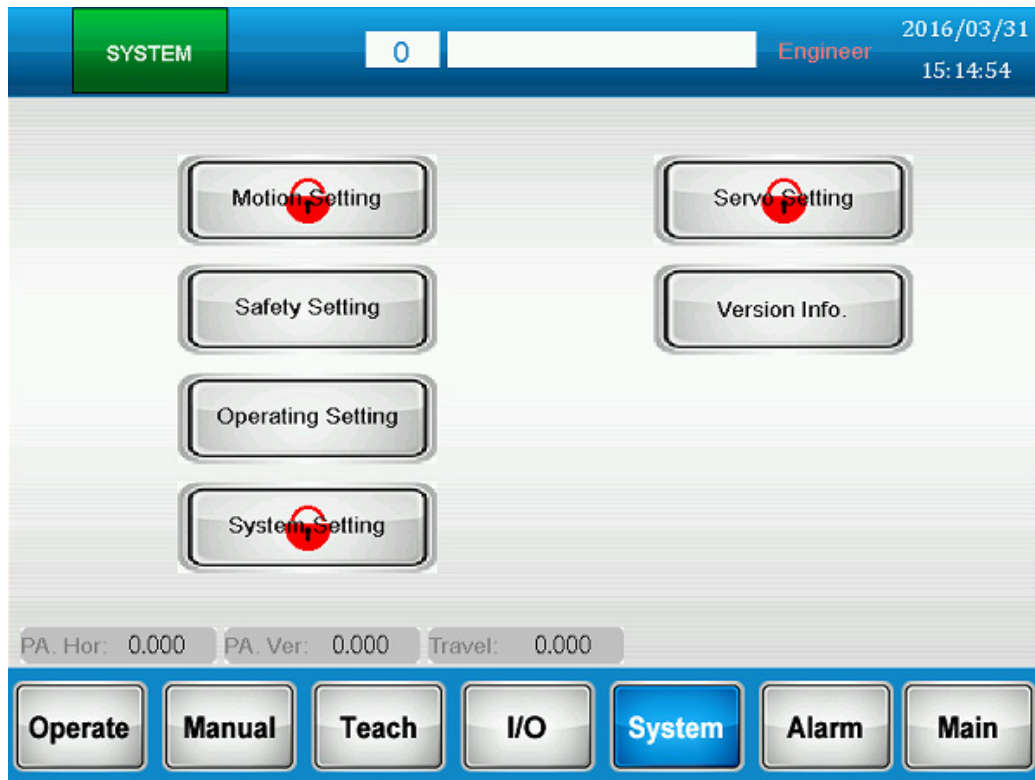
System Setting

<div style="text-align: right; font-size: 3em;">4</div>

This chapter illustrates the operation about system setting and the related information for safety setting.

4

Click [System] on main screen to enter the system setting page.

When entering the system page, different levels of users can access different contents.

Screen	Limit of Authority	Description
Motion setting	Administrator	LEVEL 7
Safety setting	Engineer	LEVEL 6
Operation setting	Engineer	LEVEL 6
System setting	Administrator	LEVEL 7
Servo setting	Administrator	LEVEL 7
Version	Engineer	LEVEL 6

4.1 Status Display about Motion Setting

Speed and torque settings of servo axis:

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	Homing Offset (mm)	Homing Mode	Homing High-speed	Homing Low-speed	AutoRun speed	Jog speed	Torque protection (%)
			(mm/s)				
PA. Hor axis	0.000	1	100.000	50.000	100.000	60.000	50.0
PA. Ver axis	0.000	2	100.000	50.000	100.000	60.000	50.0
Travel axis	0.000	2	100.000	50.000	100.000	60.000	50.0

(header labels (1)-(7) above columns: (1) Homing Offset, (2) Homing Mode, (3) Homing High-speed, (4) Homing Low-speed, (5) AutoRun speed, (6) Jog speed, (7) Torque protection)

PA. Hor: 0.000   PA. Ver: 0.000   Travel: 0.000

Operate | Manual | Teach | I/O | System | Alarm | Main

(1) **Homing offse:** When not regarding the sensor as the zero point, this function allows users to set any position as zero point.

(2) **Homing mode:** Various homing modes are provided. Please refer to HMC Controller User Manual for further information.

(3) **Homing high-speed:** It is the speed before the servo axis is detected by the homing sensor during homing.

(4) **Homing lower-speed:** It is the speed after the servo axis is detected by the homing sensor, which is the speed to look for Z phase during homing.

(5) **Auto Run speed:** The max. speed during auto-operation.

(6) **Jog speed:** The max. jog speed when it is manually controlled.

(7) **Torque protection:** This function is for protecting the ejector during auto operation. The servo drive will limit the torque output according the setting value so that the arm will be thrust by the ejector. Please note that the value beyond setting range will lead to invalid function (the ejector is unable to push the arm forward); while smaller value might cause arm slippage. Please setup the value according to the actual situation.

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4.2 Servo Setting

This system needs to work with Delta's ASDA-A2-F and ASDA-M-F series servo drive. This screen is for setting up motion parameters of servo axis and servo performance.

	Gear ratio (Mol.)	Gear ratio (Den.)	S-curve	Acc. time	Dec. time	Homing acc./dec.	Max. speed		Dire.
					(ms)		mm/s	RPM	
PA. Hor axis	367	11	50	100	100	200	350.000	4000	C.W
PA. Ver axis	367	11	50	100	100	200	350.000	4000	C.C.W
Travel axis	367	11	50	100	100	200	350.000	4000	C.C.W

PA. Hor: 0.000   PA. Ver: 0.000   Travel: 0.000

Operate | Manual | Teach | I/O | **System** | Alarm | Main

(1) **Gear ratio:** Electronic gear ratio plays a vital role when converting the unit of controlling system with the unit of real machine.
  N represents numerator and M represents denominator; 1:a is the gear ratio from motor side to final output terminal.
  N = 1280000
  M = gear number*tooth spacing/a   Note: the unit of pitch is millimeter (mm).
  Example: a gear reducer with 1:5 of gear ratio, the gear number of belt pulley is 20 and the pitch is 5 mm. Then, N = 1280000, M = 20000
  (20000 is acquired when the unit converts from mm to um)
  N/M = 1280000/20000 = 64/1

(2) **S-curve:** It is for setting the acceleration curve when motion starts and deceleration curve when motion stops. Bigger value brings smoother motion. However, it brings longer response time.

(3) **Acc. time(Acceleration time):** The required time when the motor runs from 0 rpm to 3000 rpm. Increase the value can smoother the operation. But the excessive value might bring a longer response time.

(4) **Dec. time(Deceleration time):** The required time when the motor runs from 3000 rpm to 0 rpm. Increase the value can smoother the operation. But the excessive value might bring a longer response time.

(5) **Acc./dec. time of homing**: Acceleration and deceleration time when homing.

(6) **Max. speed:** RPM = (rotation/minute); mm/s = (millimeter/second). When setting the E-gear ratio, rpm and mm/s is in linear relation. RPM is equals to mm/s.

(7) **Dire.(Forward direction):**
  This system follow the rules that listed below:
  a. Horizontal axis: to leave the mold represents forward direction; to move toward the mold

represents backward direction

b. Transverse axis: to leave the mold represents forward direction; to move toward the mold represents backward direction

c. Vertical axis: downward represents forward direction while upward represent backward direction.

When it is in forward direction, it means the coordinate value is increasing while backward direction means the value is decreasing. If the direction is incorrect, press this button and re-servo on can change the direction.

4.3 Moving Distance and Safety Zone Setting

4.3.1 Moving Distance

It is the motion setting range for each axis. When it is in jog operation or position teaching, the setting value will be limited within the setting range for safety concerns.
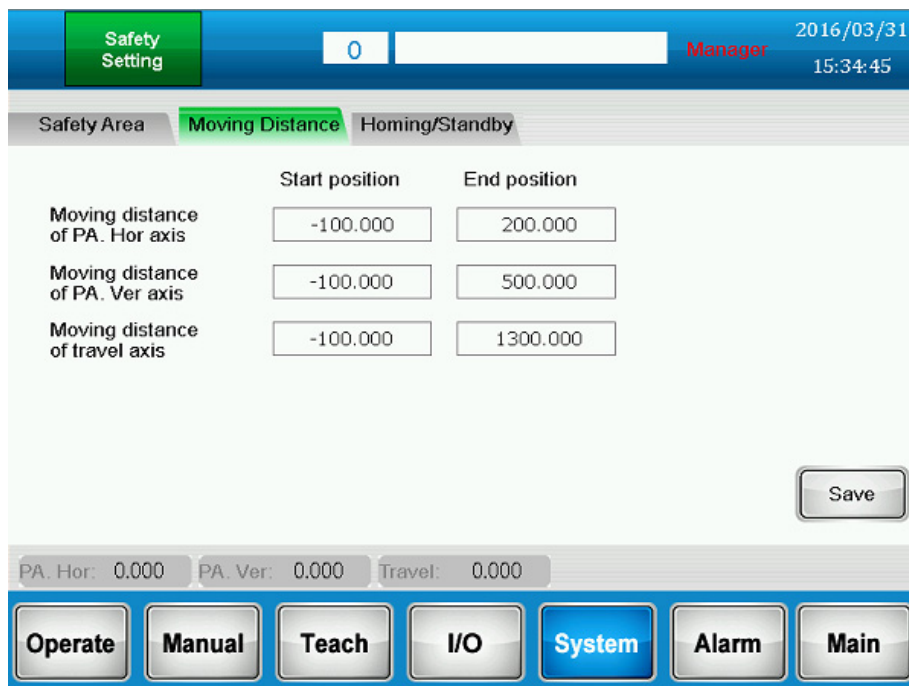
4

4.3.2   Safety Zone

The setting for safety zone means [Inhibited zone setting]. When the take-out arm is in inner molding area, its moving distance will be limited by the inhibited zone. This shall be set in accordance with the setting of injection molding machine for safety concerns.

Safety Setting	0		Manager	2016/03/31 15:37:05

Safety Area   Moving Distance   Homing/Standby

	Start position	End position	
Inside mould PA. Ver axis safety area		80.000	
Inside mould PA. Hor axis safety area	-100.000	100.000	
Inside mould travel axis safety area	-100.000	200.000	SP. outside mold all ow close mould
Outside mould travel axis safety area	500.000	1300.000	0.000

Save

PA. Hor: 0.000   PA. Ver: 0.000   Travel: 0.000

Operate	Manual	Teach	I/O	System	Alarm	Main

4.4 Setting for System Operation

4.4.1   Operating Setting

(1) **Alarm time of IMM Signal:** Time-out setting for signal handshake time when the ejector moves forward and backward and when the core moves forward and backward. When this alarm occurs, open the safety door and then close the door again can clear the alarm (It means the personnel enters to troubleshoot the problem).

(2) **Safety door action (outside mould):** The arm is in outer molding area. Users can determine if the arm shall **Pause** or **Non Pause** when the safety door is opened.

(3) **Safety door action (inside mould):** The arm is in inner molding area. Users can determine if the arm shall **Stop** or **Pause** when the safety door is opened.

(4) **Monitor alarm of Mid-plate mould:** It can be set to detect [Mid-plate mould] when the mould is opened.

(5) **Detecting midway judgment:** To detect the items dropped in the midway from the sensor.

(6) **Adjust the distance in auto operation:** When the arm is in auto operation, click on [Not tracking] to select the instruction for slightly adjusting the moving distance. Users can setup the maximum distance that can be adjusted via this function.

4.4.2   Action Confirm

(1)   **PA. posture confirm:** Determine if the primary arm's posture needs to be confirmed by the sensor. Default setting is [Yes].

(2)   **Posture abnormal time:** Within the setting time, if the posture is not identical to the setting one, an alarm will occur. Set the value to 0 to disable this function.

(3)   **Timeout of SA. Fall:** It is for setting the time when the secondary arm moves downward. However, if the retract signal is On in the setting time, an alarm will occur. Set the value to 0 to disable this function.

(4)   **Timeout of SA. Rise:** It is for setting the time when the secondary arm arises. However, if the retract signal is Off in the setting time, an alarm will occur. Set the value to 0 to disable this function.

(5)   **SA. Forward/backward abnormal time:** It is for setting the time when the secondary arm pulls out the item. However, if the signal is off within the setting time, an alarm will occur. Set the value to 0 to disable this function.

4.5 System Setting

4.5.1   Mechanism

(1) **Using pressure detect:** When you check [Yes], this function is enabled. Please note that when you enable this function, you need to connect to the air cylinder. If not, an alarm will occur. If you check [No], then this function will be disabled.

(2) **SA. within cylinder rotate:** Determine if the secondary arm is controlled by air cylinder. Controlling by air cylinder is not an usual type. The default setting is [No].

(3) **SA. Hor axis within cylinder mechanism:** Determine if the horizontal axis of secondary arm is controlled by air cylinder. If yes, please check [Yes].

(4) **SA. Ver axis within cylinder mechanism:** Determine if the vertical axis of secondary arm is controlled by air cylinder. If yes, please check [Yes].
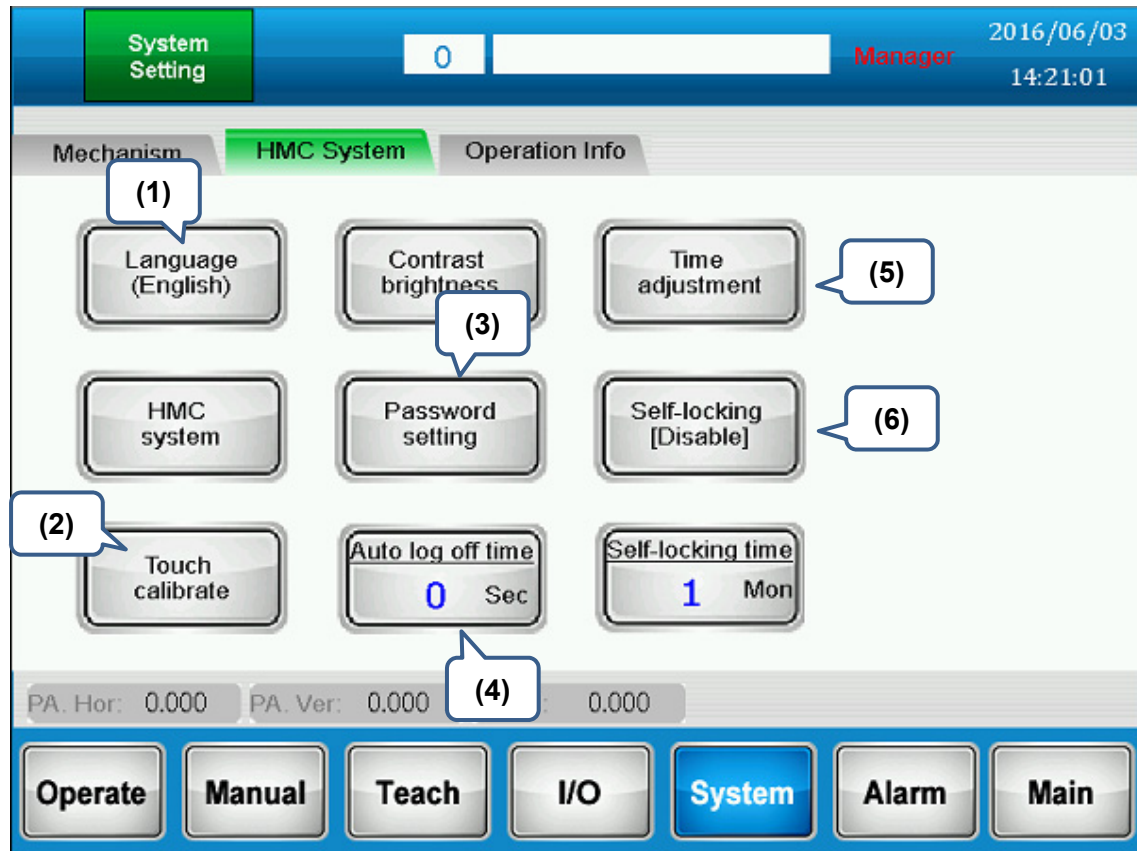
4.5.2　Operating Information

It records the system's total operation time. Administrator can long press this button to clear the accumulative value.
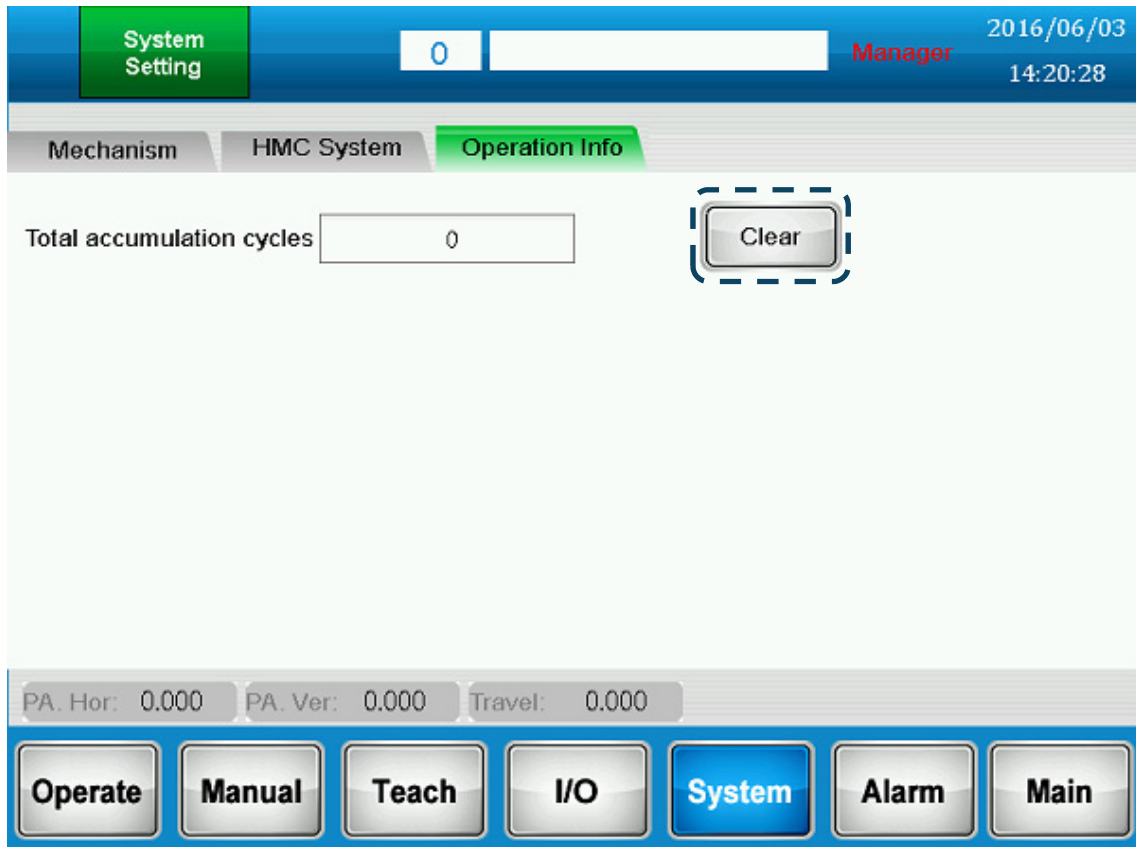
4.5.3   HMC System Setting

HMC system setting includes [Touch calibrate], [Password setting] and [Auto log off time].

(1) **Language:** Users can change system language via this function. Traditional Chinese, Simplified Chinese and English are available now.

(2) **Touch calibrate:** Press this button to calibrate the system.

(3) **Password setting:** Users can change the password.

(4) **Auto log off time:** If there is no operation within the setting time, the system will log out automatically. [Log on] will show on the screen.

(5) **Time adjustment:** Modify the system time.

(6) **Self-locking:** When this function is enabled, if the using time exceeds the setting time of [Auto lock time], users will be unable to use the system.

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4

Troubleshooting 5

Users can find the related information about alarm screens, causes and corrective actions in this chapter.

5.1 Screen of Alarm

Apart from the scrolling text shown in the bottom of the screen, the screen also display the information about current alarms and alarm history. Click on [Alarm Confirm] or F10 to clear the alarm.
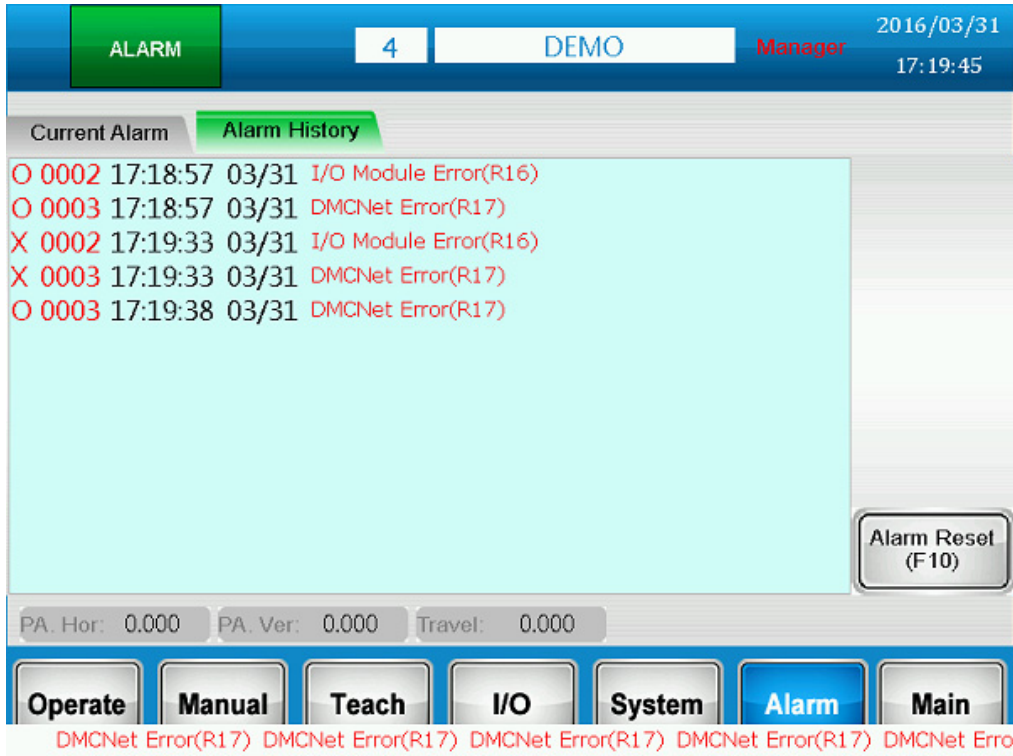
5.2 Servo Alarms and Troubleshooting

When alarm occurs, the system will display the alarm content and related information. Please refer to the following for alarms:

Alarm Code	Corrective Actions
ALE002 Overvoltage	Connect to external regenerative resistor
ALE003 Under voltage	Check if the wiring of RST is correct
AL006 Overload	1. Value of the servo gain is in correct 2. Overload
ALE009 Excessive position error	1. The setting of the gain value is too small. 2. UVW connector is not properly connected. 3. Motor's loading is too heavy.
ALE11 Encoder error	Check if CN2 connector is correct.
ALE13 Emergency stop	Check if the emergency stop button is enabled.
ALE14/15 Sensor limit warning	Check if the limit switch is enabled.
ALE283/285 Software limit warning	Software limit warning. Please check if the motor's current position is within the setting range.

5

5.3 System Alarm and Troubleshooting

| Alarms	Corrective Actions
I/O communication error	1. Check if the I/O communication cable is securely connected or broken. If it is broken, please replace a new one. 2. Make sure the cable is connected to the INPUT terminal on I/O board.
Servo communication [DMCNET] error	1. Make sure DMCNET cable is securely connected or broken. If it is broken, please replace a new one. 2. Make sure the servo drive is connected to terminal resistor.
EMS button is activated	EMS button is activated.
Air pressure detection error	Please check if the signal of [Air pressure detection] on I/O board is effective. If it is ineffective, this alarm will occur.
When the arm is in inner molding area, mold opened signal is in error	When the arm is in inner molding area, the mold opened signal is off.
When it is in transverse position during operation, the assistant arm stretches out.	If the assistant arm is in transverse position and not in the safety area during operation, please check if the sensor is effective.
When it is in transverse position, the assistant arm stretches out.	If the assistant arm is in transverse position and not in the safety area, please check if the sensor is effective.
When it is in transverse position during operation, the main arm stretches out.	During operation, the main arm is not in the safety area when it is in transverse position. Please make sure the main arm is in the safety area.
When it is in transverse position, the main arm stretches out.	The main arm is not in the safety area when it is in transverse position. Please make sure the main arm is in the safety area.
When the arm is in transverse direction and within the setting safety area, sensor is in error	When the transverse axis returns to homing position, check if the sensor works properly.
When the arm is in vertical direction and within the setting safety area, sensor is in error	When the vertical axis returns to homing position, check if the sensor works properly.
When the arm is in inner molding area, [Safety Equipment] signal is in error	When the arm is in inner molding area, please check if the safety door is opened.
When the arm is in inner molding area, [Mold opened] signal is in error	When the arm is in inner molding area, [Mold opened] signal is off.
When the arm is in inner molding area, the main arm's posture is incorrect.	When the arm is in inner molding area, the main arm's posture is different from the setting.
When it is in transverse direction, the main arm's posture is incorrect.	Please check the posture required by [Teach] > [Motion Setting]
Clamp/Vacuum detection time-out	Clamp/vacuum signal time-out. To open and close the safety door again can clear this alarm. Click alarm reset will do, but it will stop auto-operation.
Inhibited zone interference	Please check if the guided axis motion interferes with the motion in safety zone.

Others

6

Users can learn how to use external device (e.g. USB) to update the system and share the program from this chapter.
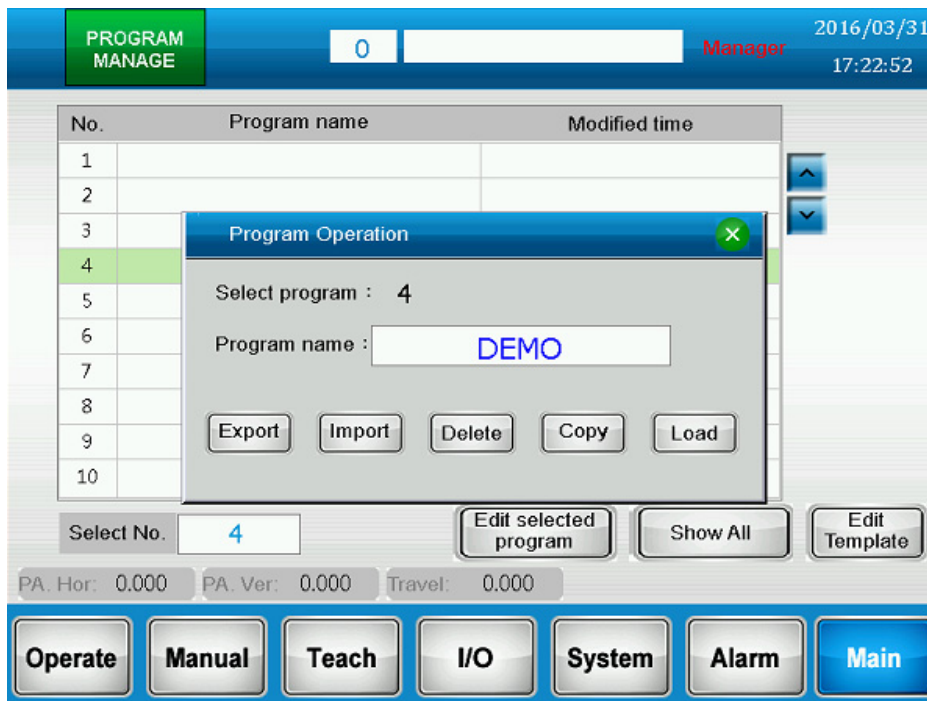
6

6.1 Procedures of using USB disk to [Export]/[Import]

Step 1: Go to the screen of [Program Manage]. Then, select the program that you wish to store in USB disk.
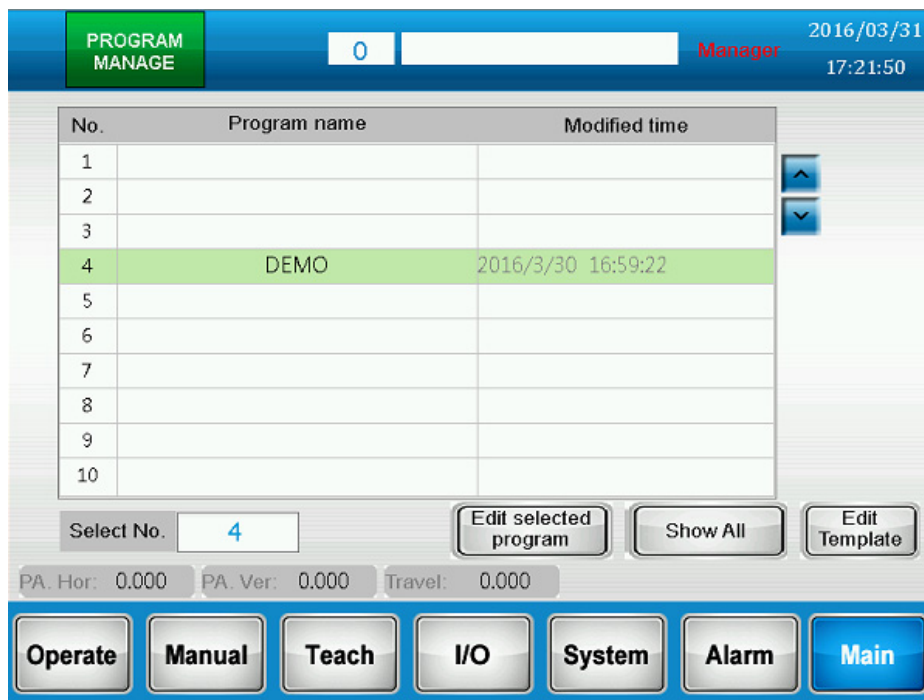
Step 2: Click [Edit selected program] and the screen will show as below.

Step 3: Click [Export]. Then, click USB disk. If the file is from external device, please select [import].
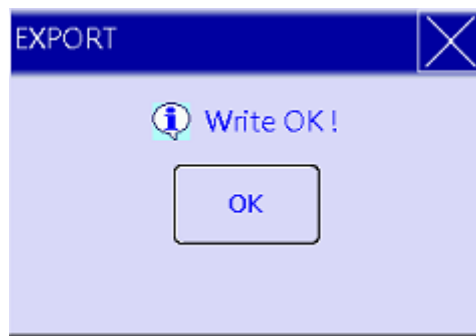

Step 4: Name the file that you wish to store in USB Disk in the blank of D:\. If the file is from external device, please select the file name from USB disk.
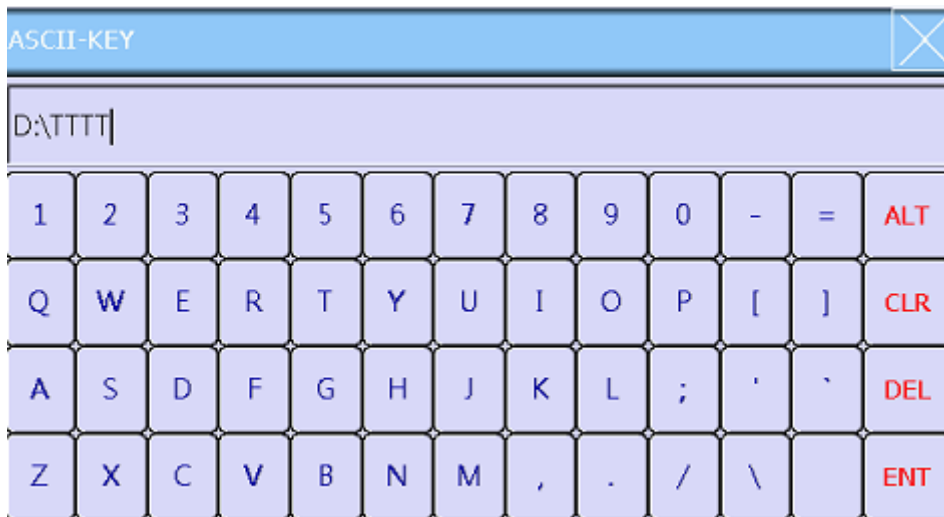
Step 5: Click [OK] after you name the file. Then, the following window will pop up to inform you that the file is successfully saved.
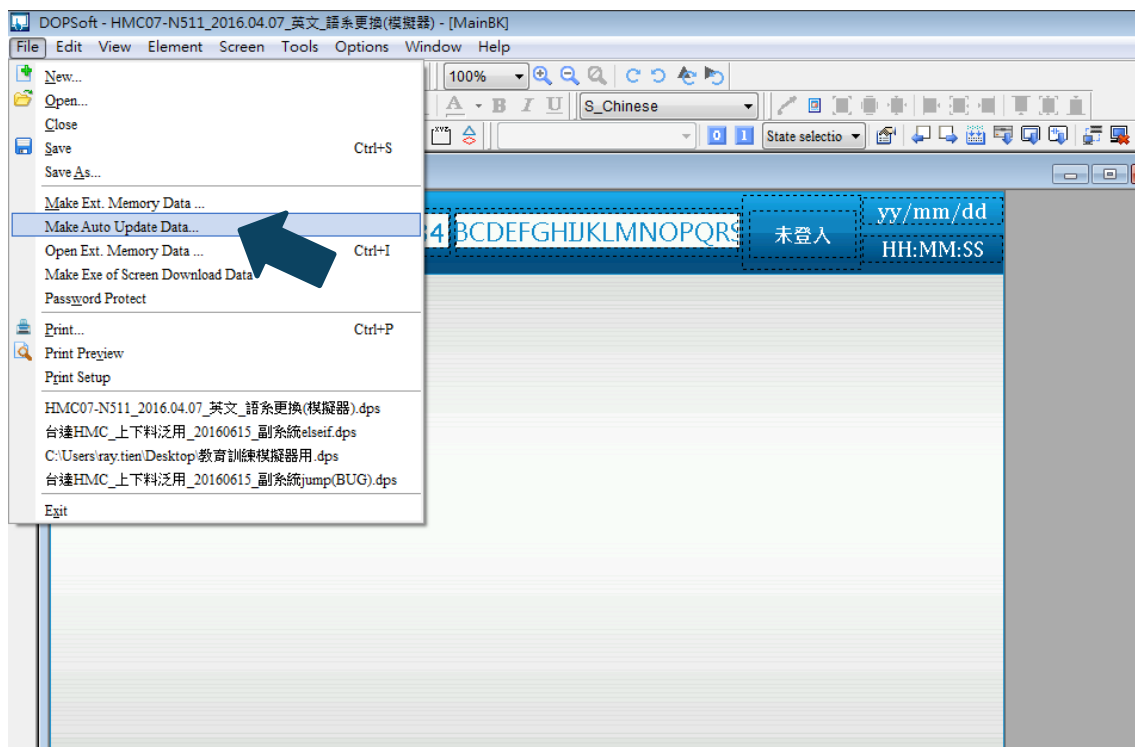

6.2 Update the System Screen via USB Disk

The HMC controller editing software also supports USB disk. Users can update system screen with a USB disk without computer.

Step 1: Edit screen file
Select [File] > [Make Aito Update Data]

Step 2: Store the screen to USB disk without changing the file name. Its default file name is [HMI_AutoUp] and can only be stored in root directory. The format of USB disk must be FAT32.

Step 3: Insert the USB Disk to HMC and restart the HMC.

Step 4: See below for the start-up screen of HMC.

USB: ☒

ⓘ **Enter Auto Update Procedure?**

YES   NO
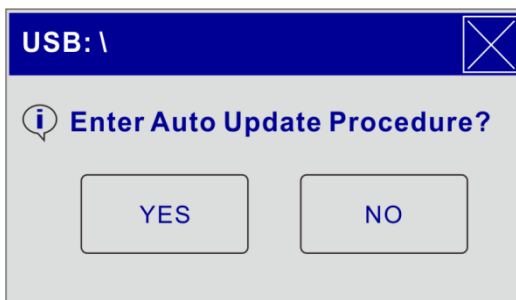
Click [YES] and the system will start upgrading. Then, restart the system and unplug the USB Disk after the procedure is completed.

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6

Examples

7

This chapter introduces the way to create a new program and to use program template to start the production.

7.1 Applying New Program

Here introduces the procedure of starting up the system, creating new program and auto-operating the system.
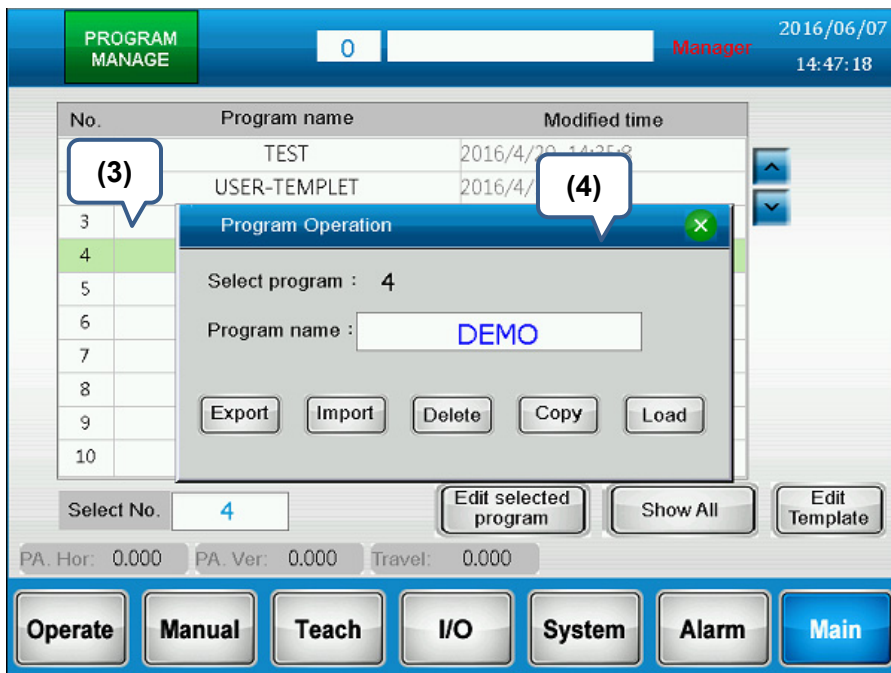
Step 1: When the system is started up, please execute homing first to identify a correct coordinate system.

Step 2: Log in and enter the screen of [Program Manage].

Step 3: Select program No.4 and open to edit it.

Step 4: Enter [DEMO] as [Program Name] and load in this program for teaching and editing.

Step 5: When creating a new program, the essential commands list will be automatically generated on the screen. Click the instruction list to select the instruction that you wish to edit. Then, complete the program editing by following the procedures.

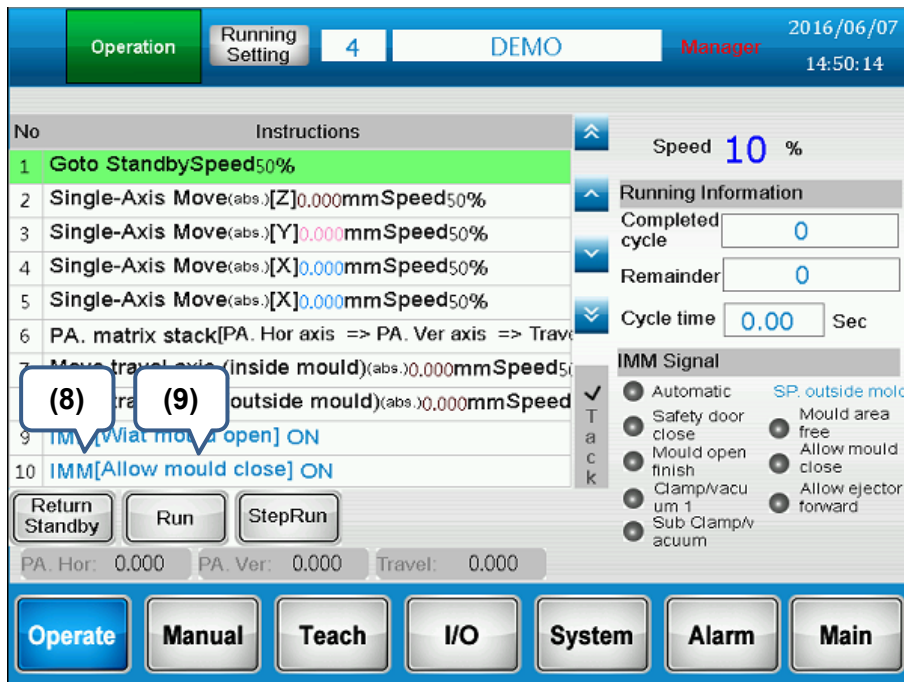Step 6: After editing the motion commands, please store its teaching content.

Step 7: Then, switch the screen to Operation for auto-operating the system.

7

Step 8: For safety operation, please return to the standby point of the main system before carrying out auto-operation.

Step 9: Click [Run] to start auto-operating.

Step 10: Auto-operating

7.2 Applying Program Template

This section introduces the process from starting up the system, and how to save the editing time

by applying program template to auto-operate the system.
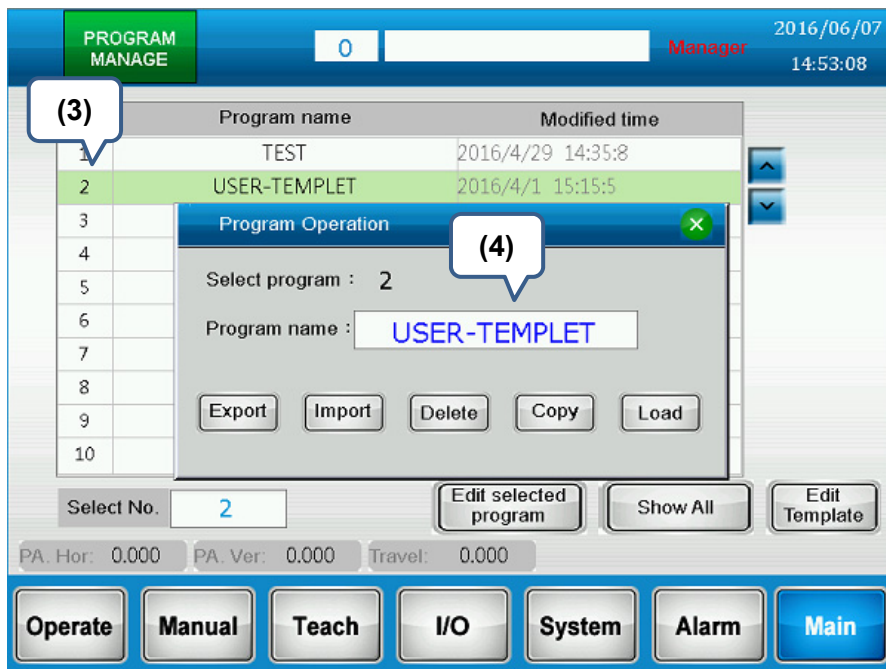
Step 1: When the system is started up, please execute homing first to create a correct coordinate
        system.

Step 2: Log in and enter the screen of [Program Manage].

Step 3: Select program No.2 and open to edit it.

Step 4: Enter [USE-TEMPLET] as [Program Name] and load in this program for teaching and
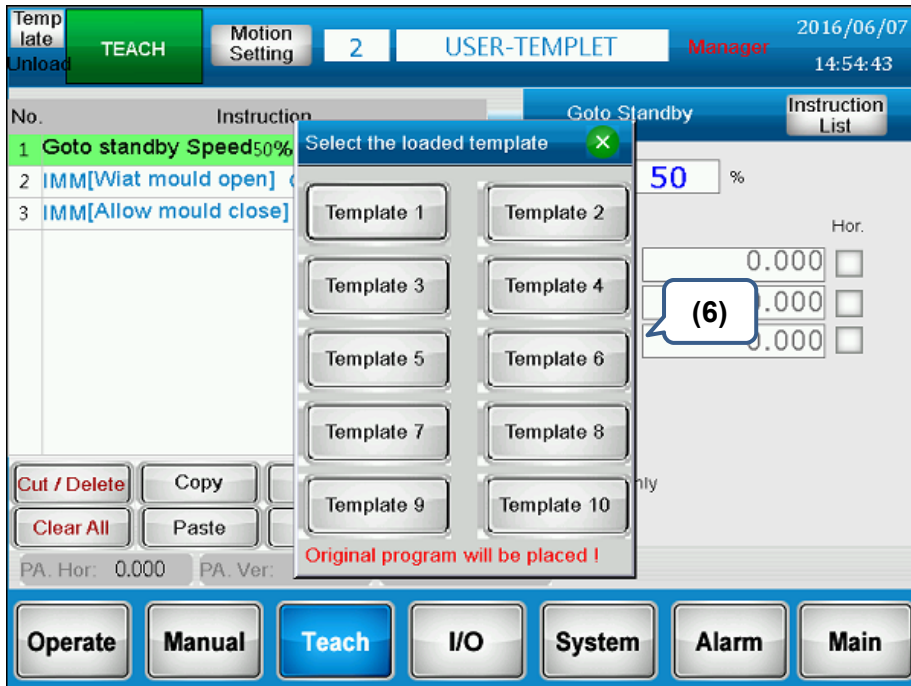
        editing.

Step 5: When creating a new program, the essential instruction list will be automatically generated on the screen. Click [Template] to select the template screen.
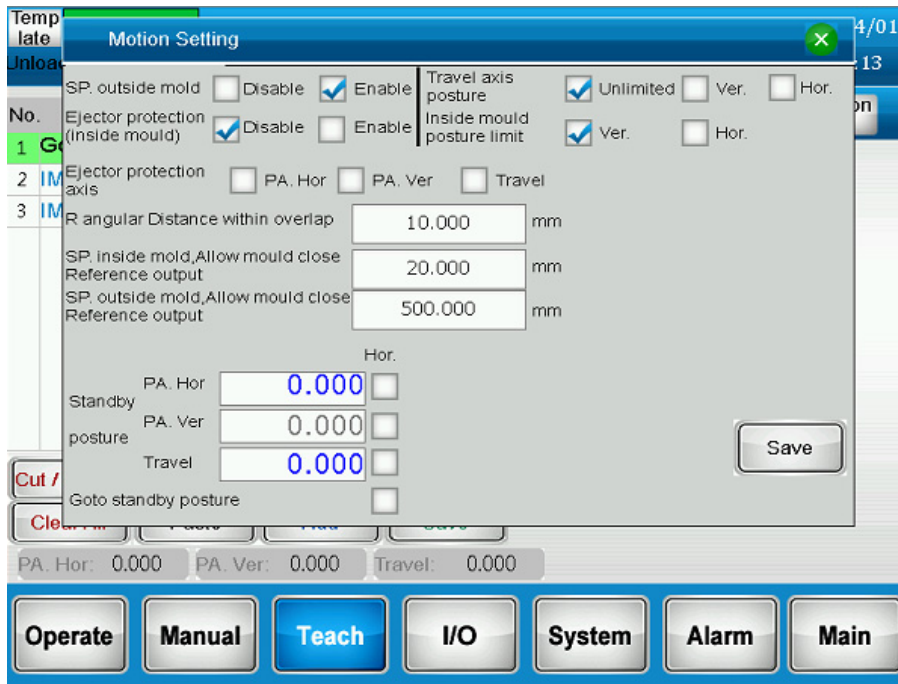

Step 6: Click on the program template.

Step 7: After loading in the program template, all commands and motions from target template will be loaded into the current program. Users only need to modify or adjust part of the commands. Then, store the setting and switch the screen to run for auto-operating.

7

Step 8: Please return to the standby point of the main system before carrying out auto-operation.
Click [Run] to auto-operate the system.

No	Instructions
1	Goto Standby Speed50%
2	IMM[Wiat mould open] ON
3	Single-Axis Move(absolute)[X]250.000mmSpeed50%
4	Single-Axis Move(absolute)[Y]350.000mmSpeed50%
5	Single-Axis Move(absolute)[Z]900.000mmSpeed50%
6	Output[Clamp/vacuum 1]ON
7	IMM[Allow mould close] ON
8	Single-Axis Move(absolute)[Z]100.000mmSpeed50%
9	Single-Axis Move(absolute)[Y]0.000mmSpeed50%
10	Single-Axis Move(absolute)[X]250.000mmSpeed50%

Operation | Running Setting | 2 | USER-TEMPLET | Manager | 2016/04/01 15:15:51

Speed 10 %

Running Information
Completed cycle: 0
Remainder: 0
Cycle time: 0.00 Sec

IMM Signal
- Automatic
- Safety door close
- Mould open finish
- Clamp/vacuum 1
- Sub Clamp/vacuum
- SP. outside mold
- Mould area free
- Allow mould close
- Allow ejector forward

Return Standby | Running | Pause | Stop | CycleStop
PA. Hor: 0.000   PA. Ver: 0.000   Travel: 0.000

Operate | Manual | Teach | I/O | System | Alarm | Main

更新履歷

Date of Release	Version	Chapter	Revision
June, 2016	V1.0 (First version)		

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