HYUNDAI ROBOTICS

WARNING

INSTALLATION SHOULD ONLY BE PERFORMED BY QUALIFIED INSTALLATION PERSONNEL AND MUST CONFORM TO ALL NATIONAL AND LOCAL CODES

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Hi5aPNT230626FMEN4

Hi5a Controller Function Manual

Painting Application

HD HYUNDAI ROBOTICS

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1 Overview

1.1. Terms and definitions

■ Explosion-proofing

This system features functions for pressure, withstanding pressure, and essential safety explosion-proofing for preventing explosion from electric causes created by parts that drive the robot during painting. The robot's body is designed to have a pressure explosion-proof structure to prevent explosive gas from penetrating into the body. Also, perform air purging operation when starting the controller.

■ Air purging

To prevent the flow of flammable materials into the robot's body, the robot is injected with a higher air pressure than atmospheric pressure to release explosive gases and prevent explosions. This function is automatically activated as soon as the controller main power is applied.

■ PAINT Command

This is the robot command that switches on/off the paint supply output signal

■ Atom(Atomize)/Spray ON/OFF

This is the output signal for the paint supply. It switches on/off the paint ejection pressure valve (atom) and the spray vale, and adjusts the output timing according to the painting sequence.

■ GUN key/LED

This is the condition key for executing the PAINT command. The PAINT command of the work program will be executed, and the "Atom/Spray" output signal will only be activated when the LED is turned on.

■ Painting section

This means the section in which the robot moves between the ON and OFF state of the PAINT command.

1.2. Basic requirements

To understand this manual, you should learn the following basic requirements:

■ Basic method for operating Hyundai Hi5a robot controller (Hi5a controller operation manual)

■ General understanding of robot painting

1.3. Painting application functions

The painting application functions of the Hi5a controller is carried out as the output of the “Atomize on” and the “Spray on” signals according to the PAINT command.

To ensure the painting quality, a painting device with the appropriate values of painting quality parameters (atomization, pressure, high voltage, ejection volume, etc.) should be selected and used to meet the painted object and the painting pattern, which are realized by utilizing the process PLC, the HMI, and the Hi5a controller.

Figure 1.1 shows the general block diagram of the painting process robot system. Table 1-1 describes the factors that determine the painting quality relating to the robot and the painting device.

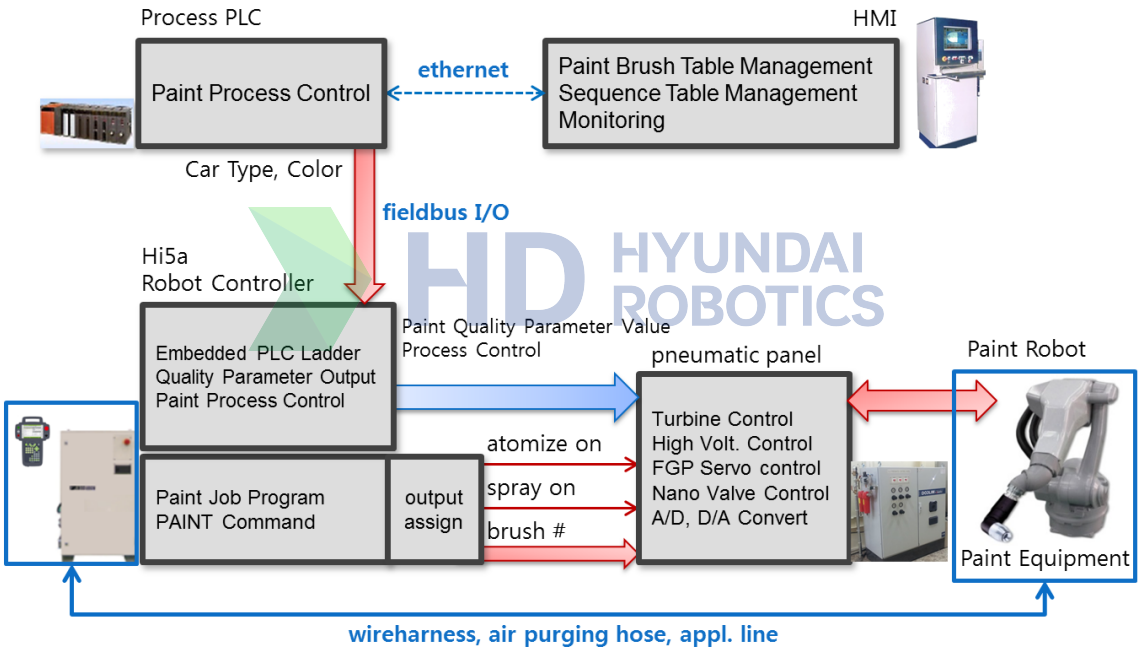

Figure 1.1 System block diagram

Table 1-1 Parameters determining painting quality

classification	parameter	unit	quality effect	index
Robot	Tip speed	mm/sec	Speed increased, adhesion-efficiency decreased, difficult to maintain pattern	1300 ↓
	Path pitch	mm	pitch is determined by pattern size and required number of overlap. If the number of overlap increases, flow amount decreases, paint-thickness uniformity improved, stain decreases, and the paint-time increases.	150 ↓
	Target distance	mm	If the distance of paint-gun is short, atom speed increases, adhesion-efficiency increases, but the danger of high voltage and rebounding pollution occurs.	180~250
Paint equipment	High Voltage	kV	As high voltage increases, adhesion-efficiency increases, but stability decreases by increment of current. Efficiency improvement is slight.	40~90
	Turbine speed	kPRM	As RPM increases, atomization is accelerated, but adhesion-efficiency decreases, the color difference by change is large.	15-70
	Shaping air	LPM(bar)	A factor determining pattern size, but in vortex type it affects the atom speed and pattern tendency orientation.	700 ↓
	Flow rate	cc/min	A factor determining the paint-thickness. If flow is large, atomization decreases, adhesion-efficiency decreases, quality problem occurs because of adhesion NV(non-volatility) decrement.	700 ↓

2
Air purging

2.1. Air purging

1) Explosion accidents are highly likely to occur in the vicinity of the operating space of the painting robot because of the presence of paint and air, which are flammable substances, and motors, which are ignition sources. Therefore, the painting robot has an explosion-proofing procedure for preventing explosion accidents.

2) The Hyundai painting robot features a pressure explosion-proof structure for preventing flammable gas from penetrating into the robot body. This structure maintains the inside pressure of the robot body higher than the atmospheric pressure. Air purging refers to a series of procedures for preventing gas penetration by maintaining a constant pressure inside the robot body upon the initial application of power supply to the robot.

3) After the power is switched on, the Hyundai robot controller automatically carries out air purging while the power supply to the motor of the painting robot is blocked. During air purging, the motor cannot be switched on even when you press the “Motor on” button. Do not manipulate it, and wait until the air purging is completed.

2.2. Purging system

1) The purging system of the painting robot controller is as shown in Figure 2.1. The modules include a purging condition display part, a purging control unit, a pneumatic unit, air hoses, and a pressure sensor.

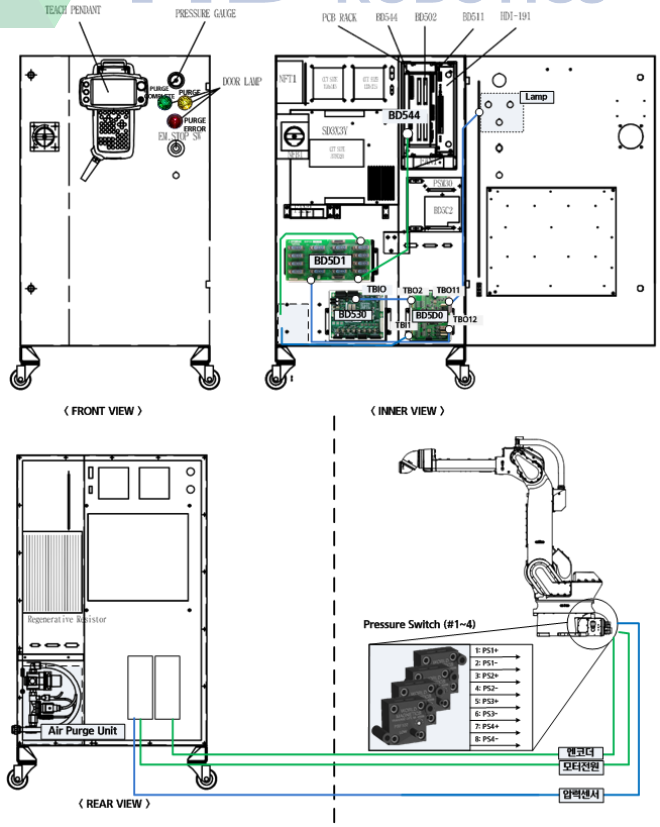

Figure 2.1 Air purging system of the painting robot controller

2) The setup of the pressure gauge for air purging, the operating condition lamp, and the pneumatic device is shown in Figure 2.2

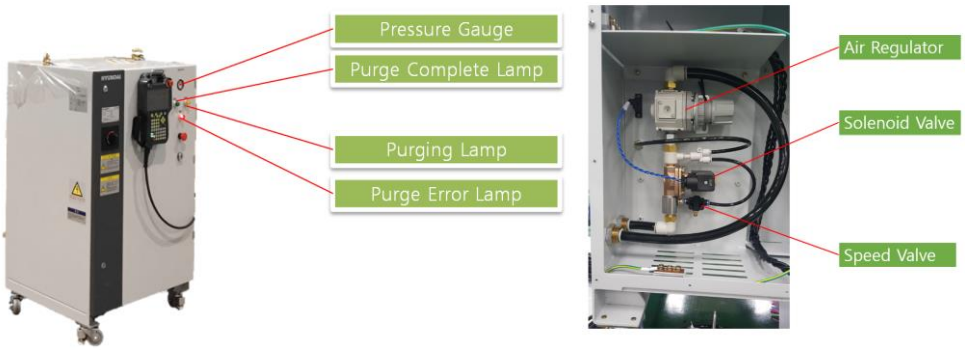

Figure 2.2 Setup and operating condition display of the air-purging pneumatic devices

3) Table 2-1 describes the pressure criteria, display, and operating condition lamps needed for air purging.

Table 2-1 Pressure setting and operating condition display for air purging

PRESSURE GAUGE & Regulator	This indicates the pneumatic pressure input to the purging control pneumatic circuit. The input pressure should be set at 0.2–0.3 Mpa with the regulator on the pneumatic device as shown in Figure 2.2.
PURGE COMPLETE LAMP	This is switched on after air purging.
PURGING LAMP	This is switched on during air purging.
PURGE ERROR LAMP	This is switched on in case of errors during air purging.

4) Figure 2.3 shows the BD5D0 board used for air purging control. It carries out air purging for a given time after the main power is switched on. The air purging time setting is fixed when the controller is delivered. If you need to change the setting, refer to the maintenance manual of the controller.

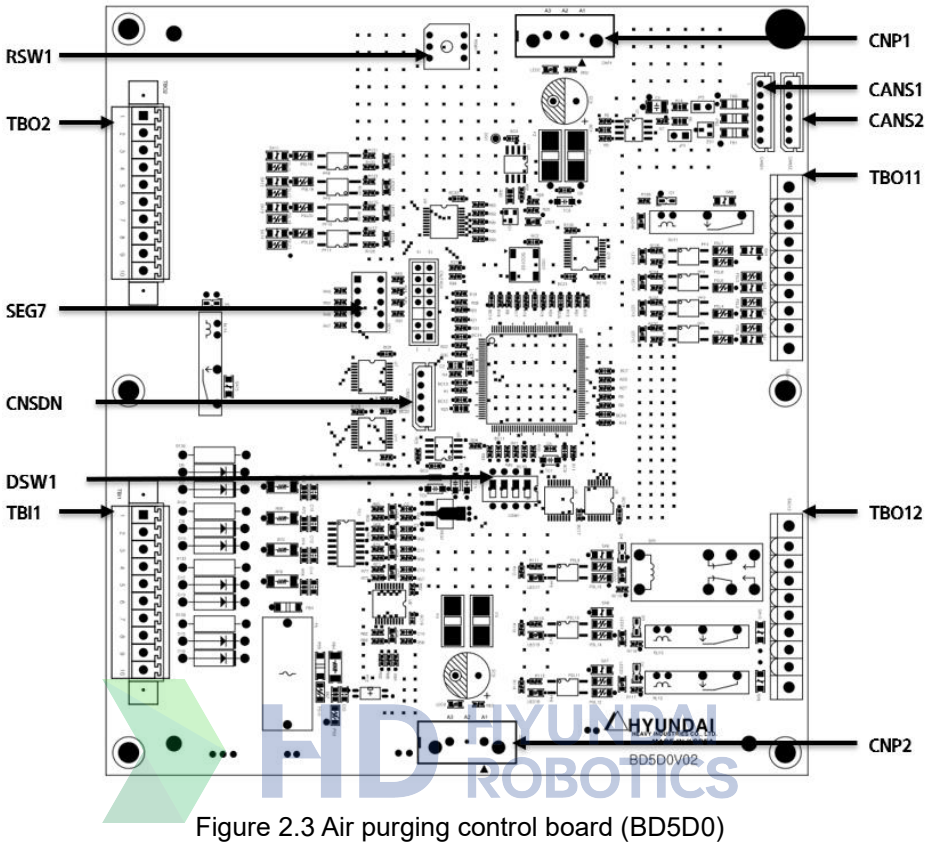

Figure 2.3 Air purging control board (BD5D0)

Table 2-2 **BD5D0 connector type and purpose**

Name	Use	Spec
CNP1	Power supply for control	5V
CNP2	24V I/O power supply	24V/5A SMPS
TBI1	Pressure switch connection	24V IO Power
TBO11	Connecting the status indication lamp	24V IO Power
TBO12	Signal control for the air-purging valve	24V IO Power
TBO2	Signal of the purging status	BD530 TBIO

For the connection of each signal, you may refer to the Purging Control Connection (R63-012227-0.0) drawing among the electrical drawings.

Monitor the pressure switch to check the pressure condition inside the robot's body. The operating condition of the switch can be visually checked with the LED placed next to the TBI1 connector.

Table 2-3 **Description of the pressure sensor (TBI1) connector**

Terminal No.	Signal name (TBI 1)	setting pressure	Signal Description
1, 2	PS1+, PS1-	180Pa	Low Pressure Sensor 1
3, 4	PS2+, PS2-	200Pa	Low Pressure Sensor 2
5, 6	PS3+, PS3-	5.2kPa	High Pressure & Flow Sensor 1
7, 8	PS4+, PS4-	4.4kPa	High Pressure & Flow Sensor 2
9, 10	-	-	Not Used

The purging sequence can be checked by the controller front door lamp.

Table 2-4 **Description of the lamp output (TBO11) connector signals**

Terminal No.	Signal name	Signal Description
TBO11, 3	P/Error	Red: Error during the purging operation
TBO11, 5	Purging	Yellow: Purging operation in progress
TBO11, 6	P/Complete	Green: Purging operation completed normally

It controls the pneumatic output through the solenoid valve according to the purging sequence and electrically connects the encoder and the servo board by actuating the encoder relay board when the purging is completed normally.

Table 2-5 **Description of the signals of the valve and relay control (TBO12) connector**

Terminal No.	Signal name	Signal Description
TBO12, 3	EVP1-	Solenoid Valve On/Off
TBO12, 5	EnRLY_PWR	Encoder Barrier Relay On/Off

It transmits the current status to BD530 through the I/O.

Table 2-6 **Description of the status output (TBO2) connector signals**

Terminal No.	Signal name (TBO2)	Signal name (TBIO)	Signal Description
TBO2, 6	M_DI 1	DI 1	Low Pressure Error
TBO2, 7	M_DI 2	DI 2	High Pressure Error
TBO2, 8	M_DI 3	DI 3	Low Flow Error
TBO2, 9	M_DI 4	DI 4	Purge Complete
TBO2, 2	M_DO 1	DO 1	Board reset

Reference

- The air purging function will work normally if the application of the robot controller is set at “Painting.” See the method for application setting described in Section 3.1 Basic (application) setting.
- For the details of errors and how to troubleshoot the errors that may occur during the air purging, see Section 5.1 Error messages.
- Ensure that the air pressure needed for the air purging will be maintained within the specified range.

2.3. Air purging process

1) If you turn on the main power of the Hyundai Robot Controller, the air-purging process will be actuated, and high-pressure air will flow into the robot's body through the purging valve for 3 min to prevent pressure explosion. At this time, inspect whether the controller stops booting until the air-purging operation is completed. Furthermore, check whether an error would occur in the sensor that detects the air-pressure condition while the controller is on standby for purging completion. Figure 2.4 shows the flowchart of the air-purging sequence.

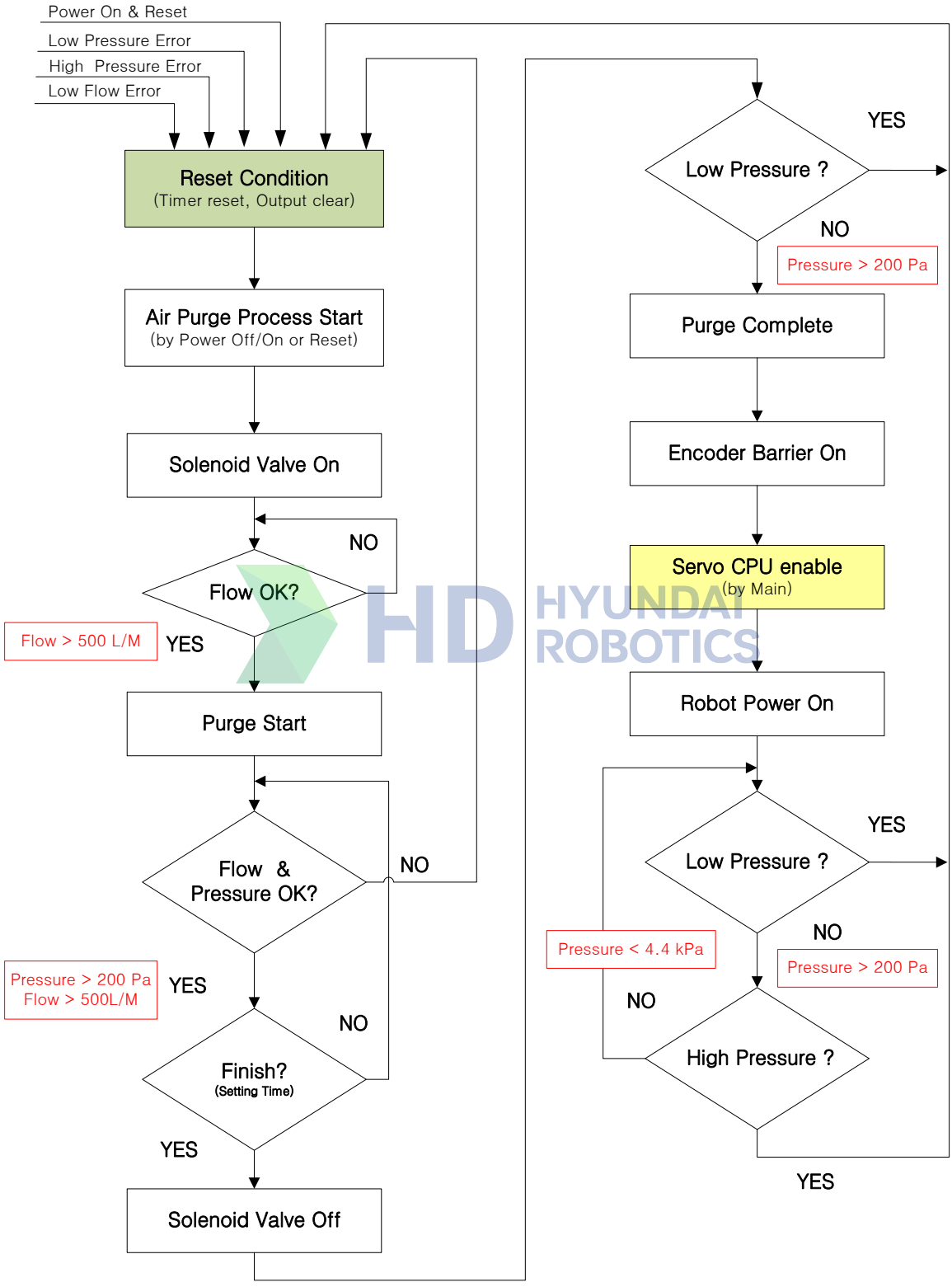

Figure 2.4 Air Purge Sequence Flow Chart

2) Figure 2.5 shows the timings at which the explosion-prevention sensors are actuated and the error conditions that occur during the air-purging process.

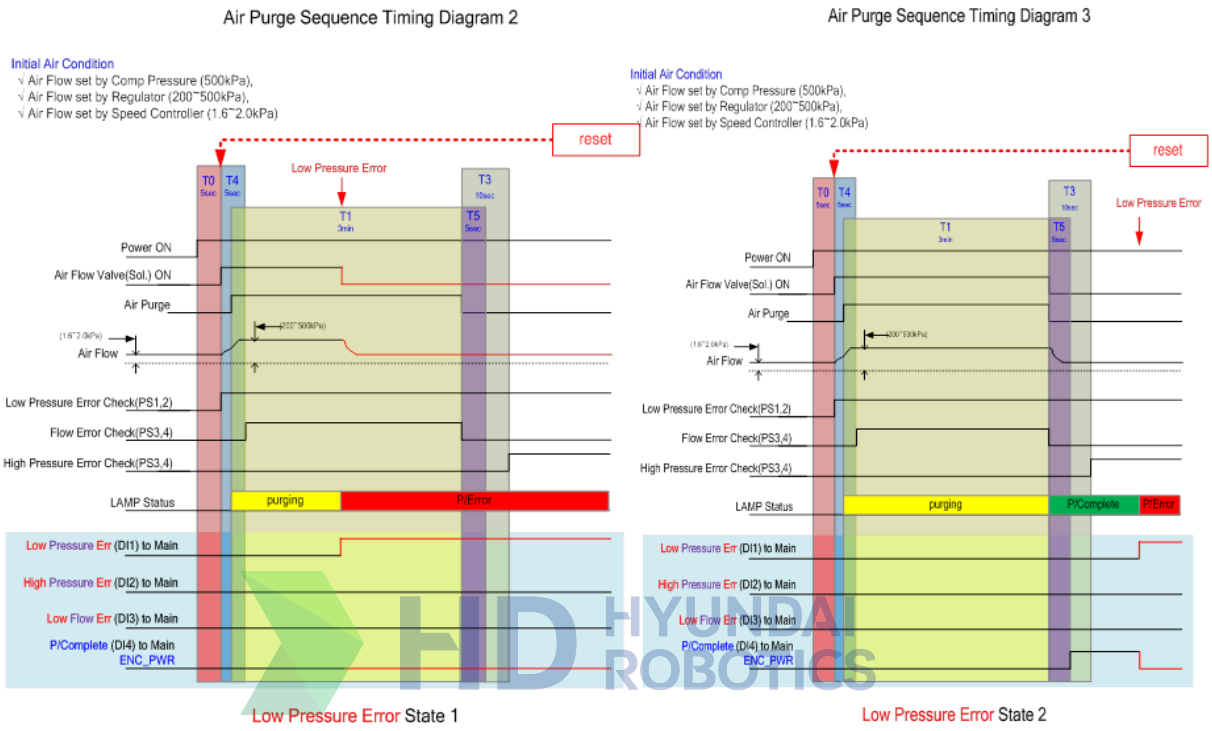

Figure 2.5 Air purging process and detailed timing diagram

3) During air purging, no manipulation should be made. “Air purging in progress” will be displayed at the lower right part of the teach pendant window at this time.

4) When air purging is completed, the controller will start booting and enter the self-diagnosis mode to enable inspection and operation of the system.

5) If air pressure error occurs during air purging, “Purging Error!!!” will be displayed at the lower right part of the teach pendant window even though the controller will start booting and enter the operating state. You will not be able to apply motor driving power to the robot before the error is corrected.

6) After the error is corrected, click [RESET] on the teach pendant window without turning off and on the controller power. This will simultaneously start the air purging process and reboot the controller.

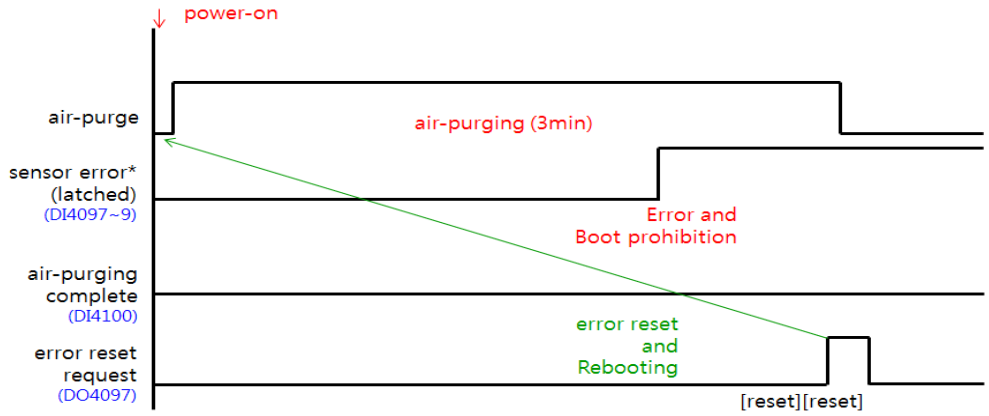

Figure 2.6 Reboot process in case of an error while booting

- The sensor error will be activated if either the “air pressure low,” “air pressure high,” or “flow rate abnormal” error is input to Ports 1–3 (DI4097–DI4099) of the BD530 TBI0 connector.
- After air purging is completed, the “air purging complete” signal will be input in Port 4 (DI4100) of the BD530 TBI0 connector, and the signal will be activated under normal condition.
- The errors and input signals of the “purging complete” sensor can be checked if you click “[F1]: Service” → “1: Monitoring” → “2: I/O Signal” → “1: Dedicated Input Signal” in the conditions of the painting application. Then, the monitoring window will open, allowing you to view the input state of “Pressure Sensor (low)” or “Pressure Sensor (high)” at the lower part of the window.
- After an air purging error has occurred, click [RESET][RESET] to reset the error. Then, the signal will be output to Port 1 (D04097) of the BD530 TBI0 connector, and the air purging controller will also be reset.
- The reset signal can be checked if you click “[F1]: Service” → “1: Monitoring” → “2: I/O Signal” → “1: Dedicated Input Signal” in the conditions of the painting application. Then, the monitoring window will open, allowing you to view the “Purge Reboot” output state at the lower part of the window.

3 Usage Methods

3.1. Basic (application) setting

1) For using the functions related to air purging and the painting application, you should set the application of the controller to “Painting.” For the setting, engineer authority is needed.

2) In the manual mode, click “[F2]: System” → “5: Reset” → “3: Application Setting”. Then, the window for setting the robot application, resetting the user keys, and the I/O signal assignment will open as shown in Figure 3.1.

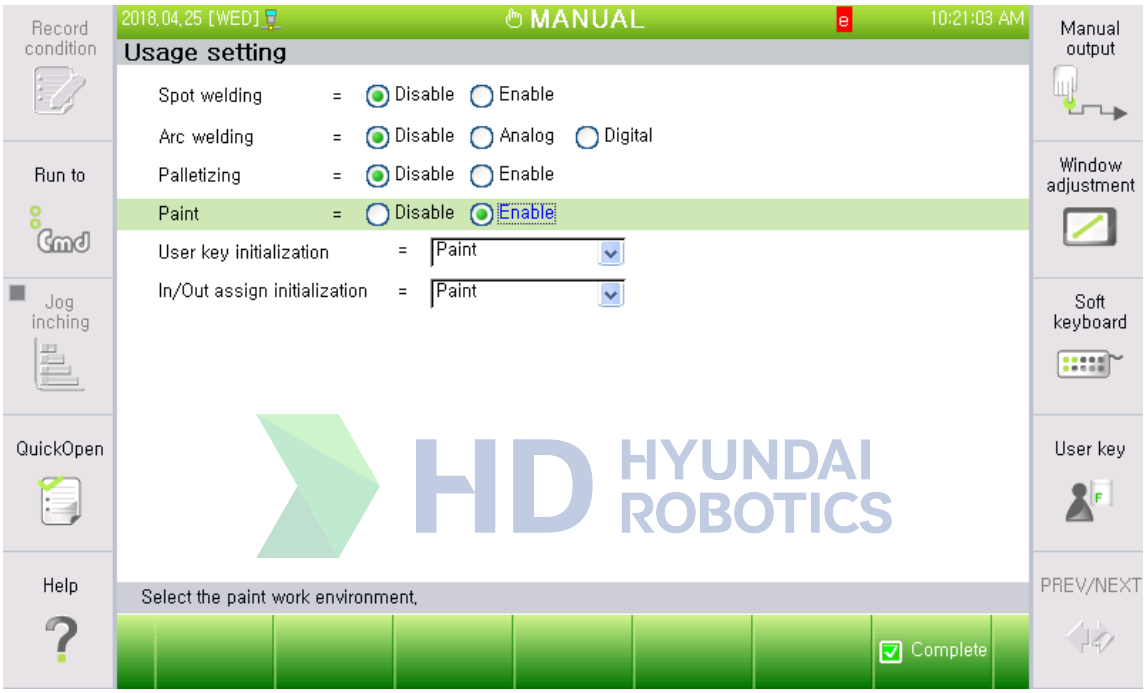

Figure 3.1 Application-setting dialog box

3) Select “Valid” among the “Painting” radio buttons. Then, set both the “Reset User Key” and the “Reset I/O Assignment” to “Painting.”

4) After completing the selections, click “[F7]: Complete.”

3.2. Painting commands

PAINT syntax

Description	This controls the painting gun output signal used for supplying paint. (It will turn on/off the Atom/Spray output signal.)	
Grammar	▪ PAINT <Gun_number>=<Gun_On/Off> ▪ PAINT <Gun_number>=<Gun_On/Off>, ANT=<Advance/Delay>	
Parameters	Gun number	G1: Gun 1 G2: Gun 2
	Gun_On/Off	1: On 0: Off
	Advance/Delay	'<0': Advanced by the absolute value '>0': Delayed by the absolute value
Example	▪ PAINT G2=1, ANT=-0.5 ▪ PAINT G2=0	

SELBRUSH syntax

Description	This outputs the number designated as a “Brush number” assignment signal group. Also, it indicates the number of brushes to be applied to the painting device. By adding an OX, OY, or OZ factor, you can designate the correct position in the absolute coordinate at which the brush should be replaced	
Grammar	▪ SELBRUSH <Brush_no> ▪ SELBRUSH <Brush_no>, OX=<Cartesian_X_coordinate> ▪ SELBRUSH <Brush_no>, OY=<Cartesian_Y_coordinate> ▪ SELBRUSH <Brush_no>, OZ=<Cartesian_Z_coordinate>	
Parameters	Brush_no	0–255
	OX	X, Y, or Z value in absolute coordinate at which the brush should be replaced with another. (-3,000 mm – 3,000 mm)
Example	▪ SELBRUSH13, OY=500 'Replace the brush with Brush 13 when the Y position of the tool tip is at 500 mm. ▪ SELBRUSH8 'Replace the brush with Brush 8.	

< Example of the painting work program >

```
        SELBRUSH 1 'Apply Brush 1.
S1      MOVE P,S=80%,A=3,T=0
S2      MOVE P,S=60%,A=1,T=0
        PAINT G1=1,ANT=-0.5 'Gun_1 ON (start) (0.5 second advanced)
S3      MOVE L,S=300mm/s,A=1,T=0
S4      MOVE L,S=300mm/s,A=1,T=0
S5      MOVE L,S=300mm/s,A=1,T=0
        SELBRUSH 9 'Apply Brush 9 (painting finishing stage)
S6      MOVE L,S=300mm/s,A=1,T=0
        PAINT G1=0,ANT=-0.5 'Gun_1 Off (finish) (0.5 second advanced)
S7      MOVE P,S=60%,A=1,T=0
```

1) In the above program sample, the painting output signal (Atom/Spray) will be turned on when the robot tool tip passes through Position S2, and the signal will be turned off when the tool tip passes through Position S6.

2) As a short time is taken after the execution of the PAINT command and before the actual ejection of the paint, the painting output signal should be advanced or delayed, taking into consideration the appropriate position of the painting gun for setting the correct position of the paint film formation. You can advance or delay the signal by setting a negative or a positive value in the ANT parameter.

Reference

When executing the PAINT command, the following conditions should be met for outputting signals relating to painting:

- The PAINT command can only be executed in the automatic mode or the remote automatic mode.
- For executing the PAINT command, the gun key state LED should be switched on. See Section 4.1 Conditions of automatic operation.
- This sets the Atom/Spray output signal and its sequence. For the sequence and assignment of the output signal, see Section 3.4.

3.3. Input assignment signal

1) The Hyundai robot controller provides one input assignment signal relating to painting application.

- [GUN] key setting: Input signal for external control of the same function as the [GUN] key of the teach pendant window.

This is the input assignment signal that enables the external on/off control of the [GUN] key of the teach pendant. You can set it in “[F2]: System” → “4: Application Parameter” → “13 Painting” → “3: Input Signal Assignment” window (Figure 3.2.)

2) If a valid signal number other than 0 is set in the “[GUN] key setting,” the input assignment signal, the teach pendant cannot operate the device because the on/off control of the [GUN] key of the teach pendant is taken by this assignment signal. This is useful in preventing the operator from unintentionally pressing the [GUN] key of the teach pendant, which may affect the painting work.

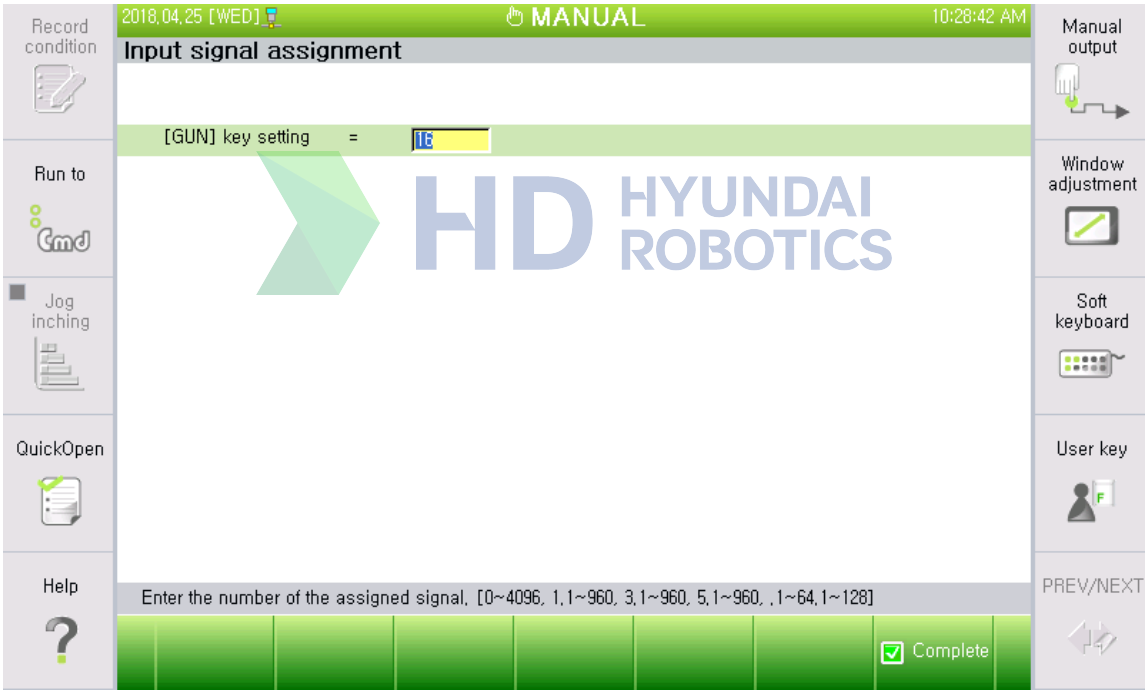

Figure 3.2 Input signal-assignment dialog box

3.4. Output assignment signal

1) The Hyundai robot controller provides four output assignment signals relating to the painting application.

   - Atom On/Off: Output signal for controlling air pressure in supplying paint
   - Spray On/Off: Output signal for controlling paint valve
   - [GUN] key state: Output signal for indicating on/off state of the [GUN] key on the teach pendant
   - Brush number : Signal outputting the selected brush number with the SELBRUSH command

2) Atom On and Spray On directly affect the painting quality. Atom On refers to the supply of the atomizer air that atomizes paint and forms paint patterns, while Spray On refers to the opening of the solenoid valve for paint spray. Between these two signals, timing adjustment is needed for ensuring painting quality, and these signals are sent in the sequence shown in Figure 3.3 according to the on/off state of the PAINT command.

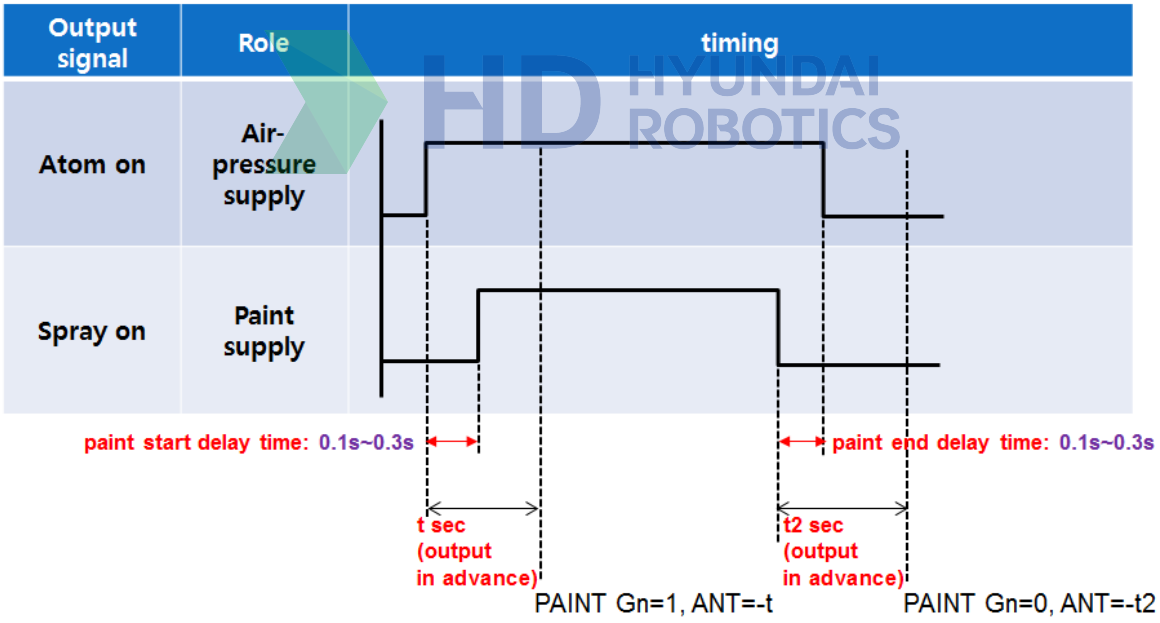

Figure 3.3 Atom/Spray output signal timing for the on/off switch of the PAINT command

3) In timing the Atom/Spray signal, the sequence should first supply air pressure because a constant pressure should be supplied for normal paint supply. The timing should be adjusted at the site in consideration of the time lag caused by the electric solenoid valve and the hose length. You can set the timing sequence in “[F2: System]” → “4: Application Parameter” → “13: Painting” → “1: Painting Sequence” window (Figure 3.4). Carefully set the timing sequence because the adjustment of the timing for supplying or shutting off paint may either improve or degrade the quality.

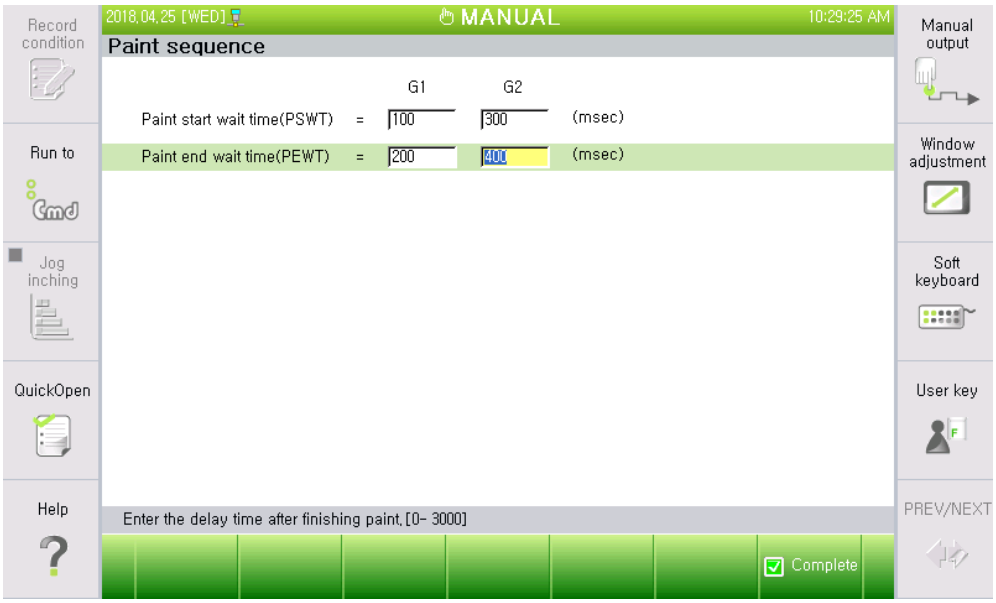

Figure 3.4 Atom/Spray (painting sequence) output signal-timing dialog box

4) The GUN key state signal is an output signal indicating that the Atom and Spray output signals can be controlled by the PAINT command. This key can be activated in the automatic mode by the [GUN] key of the teach pendant. This key can also be controlled by an external input signal. If control is transferred to the outside, it cannot be activated by the [GUN] key of the teach pendant. (See 3.3 “Input Assignment Signal”.)

5) You can set each output assignment signal in “[F2: System]” → “4: Application Parameter” → “13: Painting” → “2: Output Signal Assignment” dialog box (Figure 3.5).

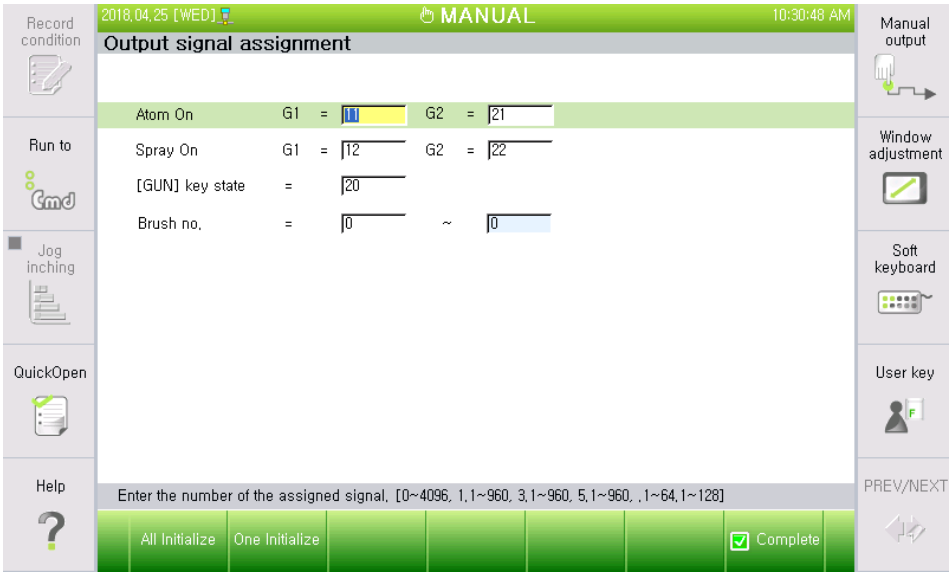

Figure 3.5 Painting application output signal-assignment dialog box

6) When the operation has been stopped and restarted in the painting section where the PAINT command is on, the Atom/Spray output signals of the gun are switched on (activated) or off (deactivated) to meet the sequence timing. When operation is stopped, the Spray output signal is switched off first, and the Atom output signal is switched off after the sequence timing. When operation is restarted, the Atom output signal is switched on first, and the Spray output signal is switched on after the sequence timing.

7) When the SELBRUSH command is executed, the brush number set as an argument is output as the 8-bit signal set in the Brush number

8) In assigning output signals, when no user DI0 board or field bus is available, you may use the TBI0 port of the BD530 system bus as shown in Figure 10. The TBI0 connector has four hardwired output signal ports. Among them, as Ports 1 and 3 are used for other application purposes, Ports 2 and 4 may be used for Atom output (Port 2 - D04098) and Spray output (Port 4 - D04100) for the painting application. (Ports 1 through 4 are mapped to D04097 through D04100.)

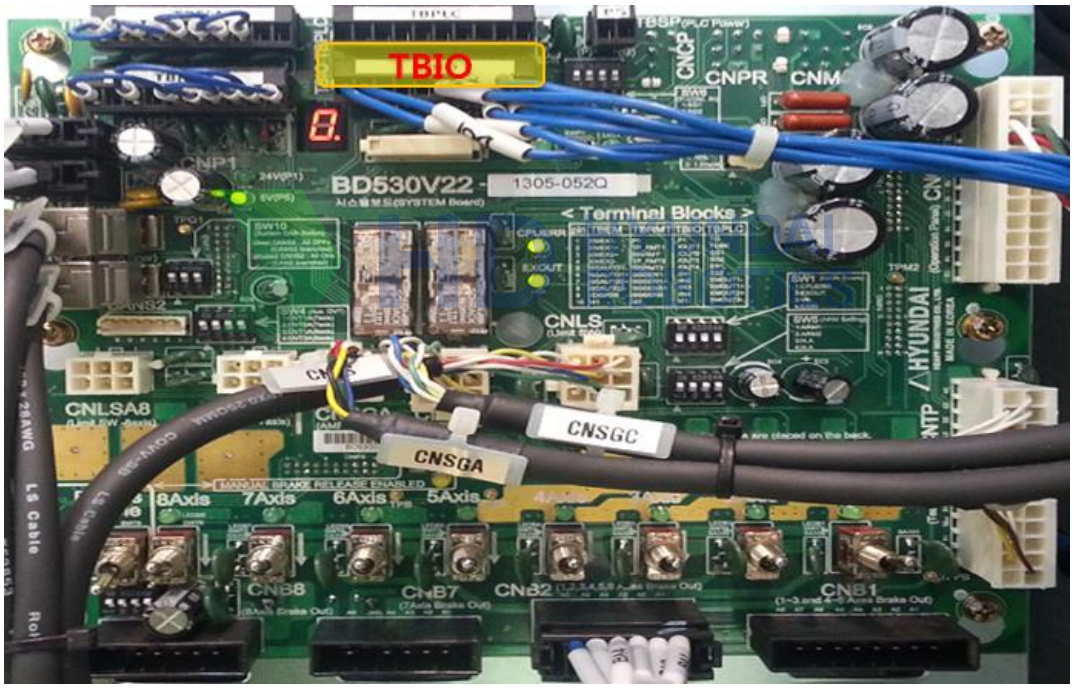

Figure 3.6 BD530 system board

9) AS shown in Figure 3.7, you may assign the desired output signals by the field bus communications.

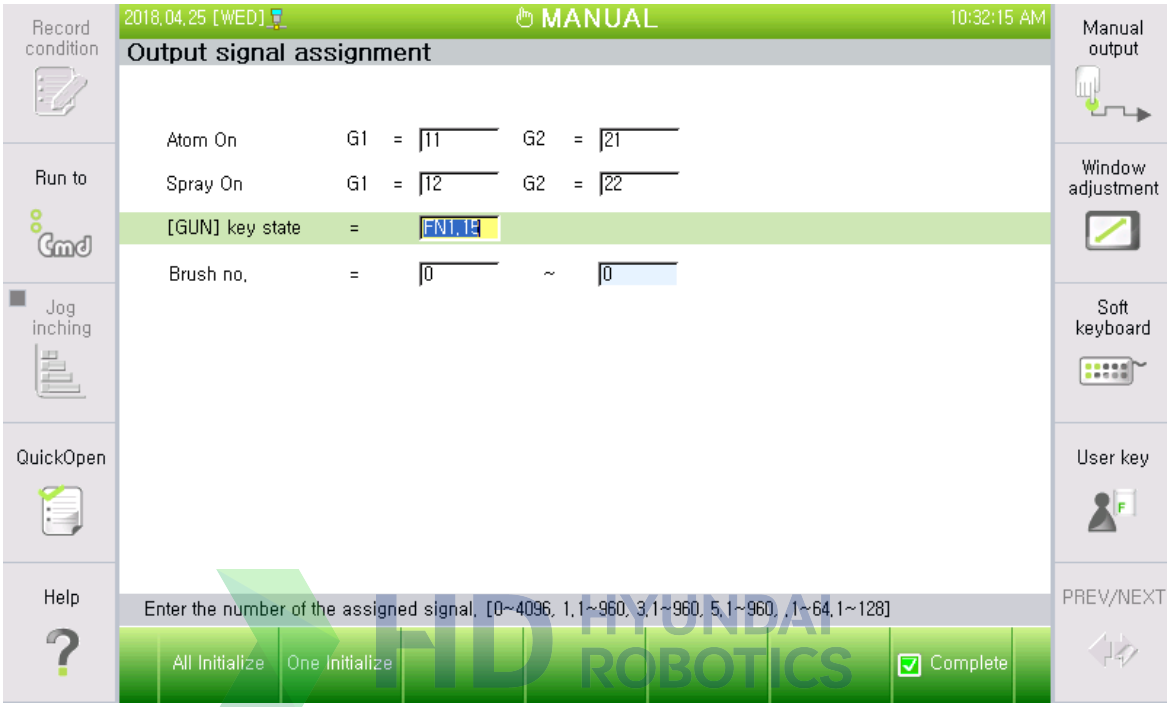

Figure 3.7 Example of assigning field-bus output signals

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4 Automatic operation

4.1. Conditions of automatic operation

1) This is a sample structure of the PAINT command. It will be convenient to set the painting section in mm/s or sec, which enables speed estimation.

```
        SELBRUSH 1 'Apply Brush 1.
S1      MOVE P,S=80%,A=3,T=0
S2      MOVE P,S=60%,A=1,T=0
        PAINT G1=1,ANT=-0.5 'Gun_1 ON (start) (0.5 second advanced)
S3      MOVE L,S=300mm/s,A=1,T=0
S4      MOVE L,S=300mm/s,A=1,T=0
S5      MOVE L,S=300mm/s,A=1,T=0
        SELBRUSH 9 'Apply Brush 9 (painting finishing stage)
S6      MOVE L,S=300mm/s,A=1,T=0
        PAINT G1=0,ANT=-0.5 'Gun_1 Off (finish) (0.5 second advanced)
S7      MOVE P,S=60%,A=1,T=0
```


2) In the manual mode, check the robot path in advance by carrying out step forward/reverse. As mentioned in the PAINT command section, the PAINT command is not executed in the manual mode. In the manual mode, you may check the path at the recorded speed if you press the [SHIFT] key and the step forward/reverse key at the same time.

3) Select a desired movement cycle. In “[F7]: Condition Setting” → “1: Movement Cycle,” select either “1 cycle” or “Repeat.” For checking operation, the optimal setting is “1 cycle.”

4) If you have selected “Repeat” as the movement cycle, execute the END command, and set again the time delay between Step 0 and the execution. Set the delay time in “[F2]: System” → “2: Control Parameter” → “1: Control Configuration” → “2: END Relay Output Time.”

5) The mode switch of the teach pendant should be set to “Automatic” or “Remote.” In the remote mode, you should set the automatic mode from outside. Set the input assignment signal in "[F2]: System → "2: Control Parameter" → "2: I/O Signal Assignment" → "3: Input Signal Assignment" to enable switching on of the assignment signals from the outside.

6) If you use an embedded PLC, you should set RUN at “3: Embedded PLC Mode” in “[F7]: Condition Setting” → “[F1]: Application Condition.”

7) Check the Atom/Spray output signals, sequence setting, and electric solenoid valve for paint output.

8) For outputting paint through execution of the PAINT command, the GUN LED on the teach pendant should be switched on. If you want to control the GUN LED from the outside, set the “[GUN] key setting” input assignment signal by referring to Section 3.3.

9) The GUN key of the teach pendant can only be switched on/off in the automatic mode. The GUN LED is automatically switched off when the manual mode is selected, and on when the automatic mode is selected.

10) During automatic operation, the GUN key of the teach pendant cannot be manipulated in the painting section. In addition, even when an external GUN key input signal is given, it is applied outside the painting section.

4.2. Automatic operation

1) When the conditions of automatic operation are met, 1-cycle operation will be executed.

Reference

- In automatic operation, the playback speed ratio in “[F7]: Condition Setting” will not apply. Note that the robot will only move at the speed of the recorded step.
- In the painting section, the Atom/Spray outputs will be switched off when the robot stops, and on when the robot restarts. In this case, signal on/off will comply with the sequence timing. See Section 3.4 Output assignment signal.
- Note that the paint may not be sprayed normally at the stop point due to time delay when the robot stops and restarts in the painting section.
- Note that the paint spraying may start at an incorrect position when the robot stops and restarts just before the painting section.
- When the robot is stopped and the step is changed in the painting section, the painting section state will be cleared, the PAINT command state will be off, and the Atom/Spray output signals for paint supply will not switch on again.
- When the PAINT OFF command is given before the END command in the program as shown in Figure 4.1, paint quality may be degraded as the robot moves to Step 1 immediately before the output signal is switched off to match the sequence. In this case, set delay between the END command and Step 1. See Section 4.1 Conditions of automatic operation.

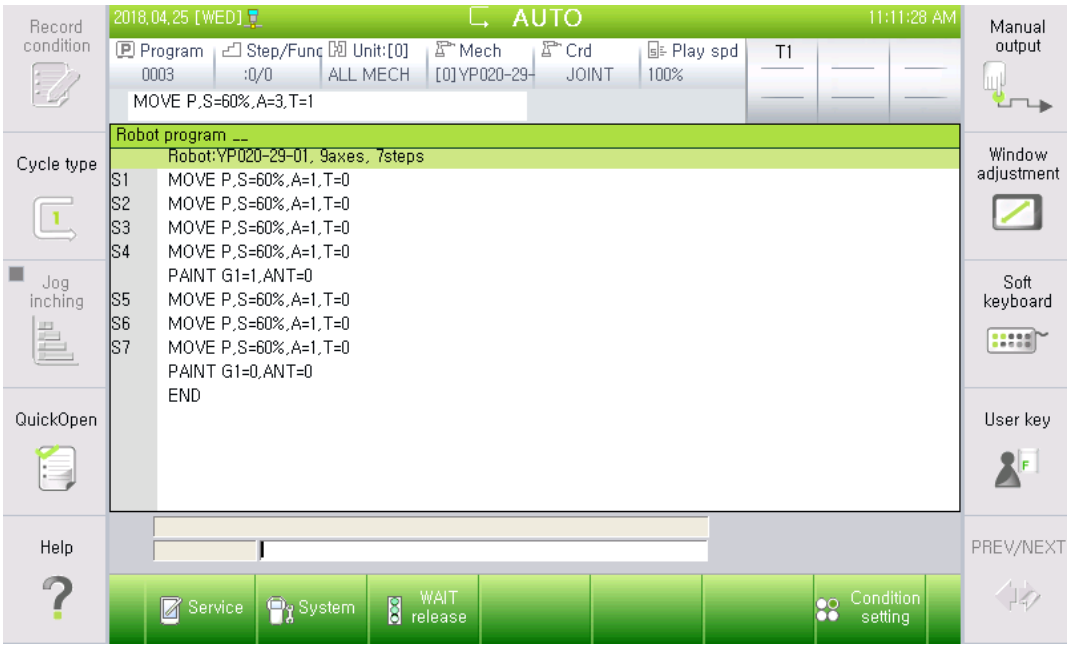

Figure 4.1 Executing the PAINT command before shutting off the program

- Pay attention in setting step positions and sequence data as specified sequence may become invalid if the moving distance of the PAINT command on/off section of the GUN is too short.

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5
Errors and alarms

5.1. Error messages

■ **Code:** E36000 explosion-proof: Error in the air purging completion sensor

■ **Description:** The sensor signal is not received after the air purging duration.

■ **Action:** Check the air purging completion sensor or the air pressure sensor.

■ **Code:** E36001 explosion-proof: Air pressure low-sensor signal is input.

■ **Description:** The air pressure is low, or there is an error in the low sensor.

■ **Action:** Check the air pressure or the low sensor.

■ **Code:** E36002 explosion-proof: Air pressure high-sensor signal is input.

■ **Description:** The air pressure is high, or there is an error in the high sensor.

■ **Action:** Check the air pressure or the high sensor.

■ **Code:** E36003 explosion-proof: Air pressure high-sensor and low-sensor signals are input.

■ **Description:** There are errors in the two air pressure sensors (low and high).

■ **Action:** Check the two air pressure sensors or the signal lines.

■ **Code:** E36004 explosion-proof: Airflow rate sensor signal is input.

■ **Description:** There is an error in the airflow condition or the sensor.

■ **Action:** Check the air flow condition or the sensor.

■ **Code:** E36005 explosion-proof: The air pressure low-sensor and the airflow rate sensor signals are input.

■ **Description:** There are errors in the air pressure or the two sensors (low, flow rate).

■ **Action:** Check the two air pressure sensors and the signal lines.

■ **Code:**	E36006 explosion-proof: The air pressure high-sensor and the air flow rate sensor signals are input.
■ **Description:**	There are errors in the air pressure or the two sensors (high, flow rate).
■ **Action:**	Check the two air pressure sensors and the signal lines.

■ **Code:**	E36007 explosion-proof: Signals from all air pressure sensors are input.
■ **Description:**	There is an error in the air pressure sensors.
■ **Action:**	Check the air pressure sensors and the signal lines.

■ **Code:**	E36020: "G1=" range of the PAINT command has been exceeded.
■ **Description:**	The on/off (1/0) range of the PAINT command has been exceeded.
■ **Action:**	Enter ON=1 and OFF=0.

■ **Code:**	E36021: "ANT=" range of the PAINT command has been exceeded.
■ **Description:**	The ANT value range (-60.0–60.0) of the PAINT command has been exceeded.
■ **Action:**	Enter a value between -60.0 and 60.0.

■ **Code:**	W36000: GUN LED control signal (external input for painting) is off.
■ **Description:**	This error occurs when the GUN LED control signal is off.
■ **Action:**	Check the GUN LED control signal.

■ **Code:**	W36001: No Atom/Spray output signal is assigned for painting.
■ **Description:**	This error occurs when no Atom/Spray output signal is assigned for painting.
■ **Action:**	Check the setting in “System” → “Application Parameter” → “Painting” → “Output Signal Assignment.”

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