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HEAVY INDUSTRIES CO.,LTD.

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THE INSTALLATION SHALL BE MADE BY QUALIFIED INSTALLATION PERSONNEL AND SHOULD CONFORM TO ALL NATIONAL AND LOCAL CODES

Hyundai Robot

Hi5RH130301FMEN1

Hi5 Controller Function Manual

Roller Hemming Squeeze Control

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Contents

List of Figures

1 Overview

1.1. Introduction

The roller hemming squeeze control function is used in a way that users measure the contact force (squeeze) between the roller and the work targeted for hemming, by using the load cells that are attached to the hemming tool, and then control the contact force to meet the value that is set by the users. Using this function, users can ① adjust the robot teaching point slightly for the hemming squeeze to meet the set level and ② control the robot in real time while the hemming operation is in progress.

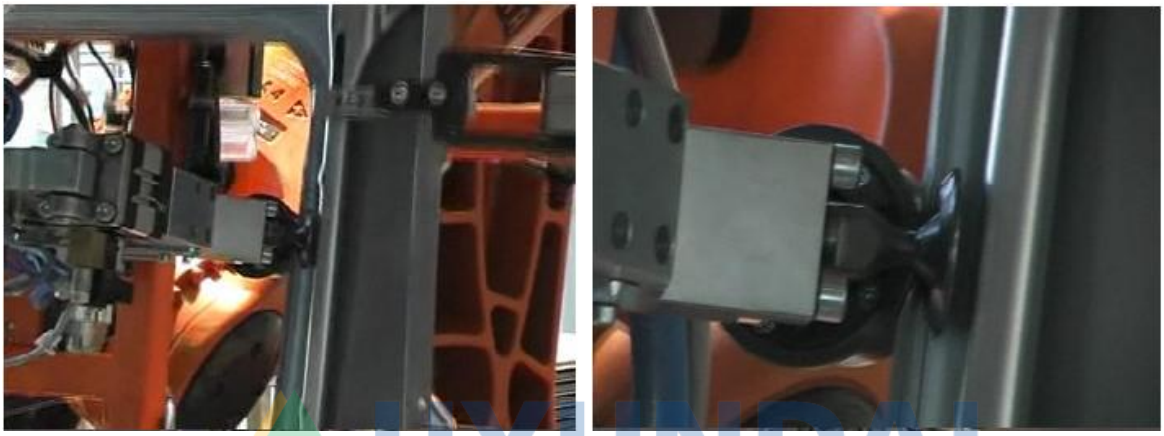


Figure 1.1 Robot roller hemming operation

1.2. Summary of the function

- Can control the robot along the z axis of the tool coordinates to adjust the hemming squeeze to meet the value set by the user.
- Through the T/P and G/P, it is possible to monitor the squeeze and the function activation state.
- For the sake of safety, it is only possible to move -10mm~+10mm from the function activation point along the z axis direction of the tool coordinates.
- In auto mode, a warning or an error will be generated depending on the tolerance of the squeeze control (Tolerance to be set by the user)
- Load cells that are supported: 8532-6005 with In-Line Amp (Manufactured by burster)
- Software version: Main V32.10-00 or higher, DSP V5.72 or higher

2
Use Methods

2.1. Summary

In order to use the roller hemming squeeze control function, the RHemming command will be used. The users need to enter their desired squeeze and control gain as well as the tolerance that is necessary for handling warnings and errors that could occur due to errors with the squeeze. It is needed to use RHemming ON for activating the function and RHemming OFF for deactivating the function.

2.2. Roller hemming squeeze control (RHemming)

Explanation	For setting the variables for the roller hemming squeeze control function, and turning the function ON or OFF.		
Input method	『[F6]: Command Input』 → 『[F1]: Motion,I/O』 → 『RHemming』		
Grammar	RHemming ON, Fd=_,K=_,V=_,TOL_W=_,TOL_E=_,CTRL=_ RHemming OFF		
Parameter	Fd	Desired squeeze [KN]	-
	K	Control gain	Default : K=4
	V	Max. speed limit [mm/s]	Default: V=10
	TOL_W	Tolerance for generating a warning [KN]	A warning will be generated if the squeeze exceeds Fd-TOL_W~Fd+TOL_W (In auto mode)
	TOL_E	Tolerance for generating an error [KN]	An error will be generated if the squeeze exceeds Fd-TOL_E~Fd+TOL_E (In auto mode)
	CTRL	Squeeze control On or Off (1: On, 0: Off)	Just shift to CTRL=0 if not performing the squeeze control after correcting teaching points

2.3. Roller hemming squeeze control setting sequence

(1) Select 'Enable' for the function usage item at the screen of [『[F2]: System』 → 『4: Application Parameter』 → 『12: Roller Hemming Squeeze Control』 → 『Function Usage』]

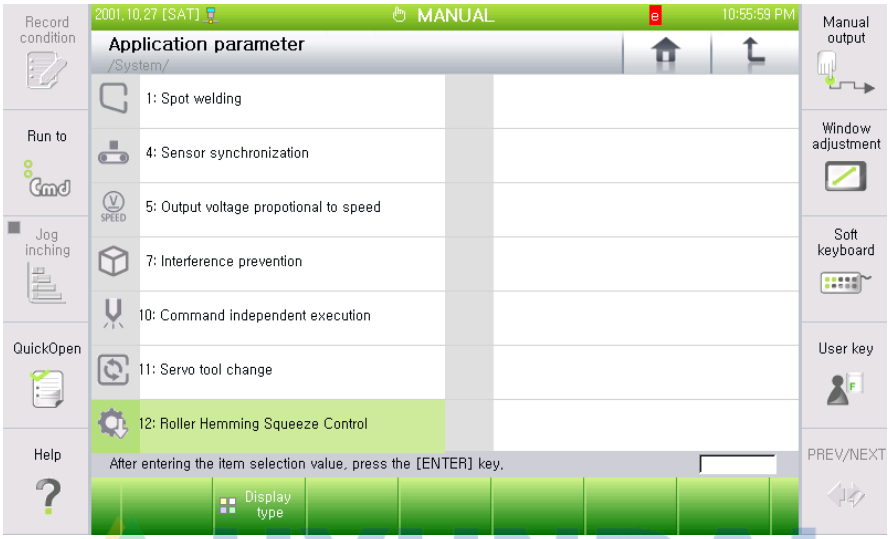


Figure 2.1 Roller hemming squeeze control menu

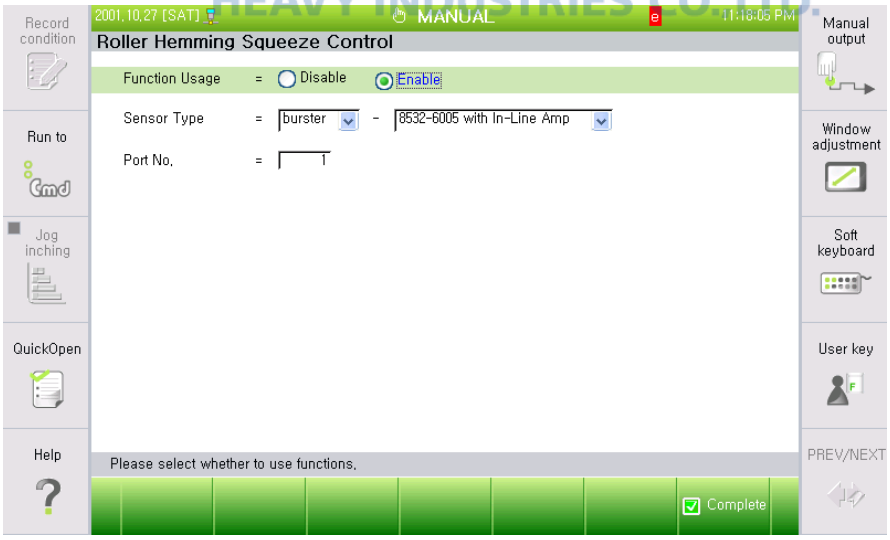


Figure 2.2 Roller hemming squeeze control screen set as 'Enable'

(2) It is required to check whether the load cells attached to the roller hemming tool is '8532-6005 with an amplifier' manufactured by burster. It is required to select the same sensor at the screen of [『[F2]: System』 → 『4: Application Parameter』 → 『12: Roller Hemming Squeeze Control』 → 『Sensor Type』]

(3) In order to control the analogue output signal of the load cells, an analogue board (Arc board, BD584V30) is used. Required to check whether the load cell output is connected to the analogue input port 1. It is also required to set '1' for the input port at the screen of [『[F2]: System』 → 『4: Application Parameter』 → 『12: Roller Hemming Squeeze Control』 → 『Port No.』].

(4) When the load cells are powered up and connected to the analogue input port of the controller, the squeeze information can be received from the controller. It is required to check whether there is any problem with the values displayed at T/P while changing the force that is applied onto the load cells.

(5) In order to control the squeeze, the robot will move in the z axis direction of the tool coordinate currently activated. That is why it is required to check whether the tool coordinates of individual rollers are defined correctly.

(6) As a last step, the sensor of a roller hemming tool needs to be initialized while having no contact with outside. For the initialization, it is required first to select [『[F1]: Service』 → 『1: Monitoring』 → 『22: Roller Hemming Data』] (when the roller hemming data monitoring window has focus), and then press the [F5: Initialize] to bring up a dialogue box. The sensor initialization screen will be displayed as below.

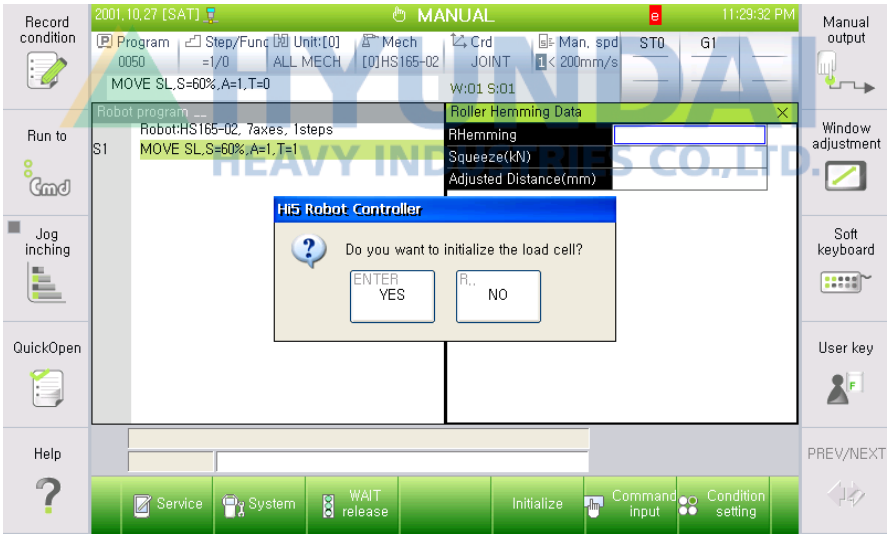


Figure 2.3 Load cell initialization screen

(7) In order to display the roller hemming squeeze on G/P(Graphic Panel) in real time, it needs to be defined as SW195 for the use (Unit: [N])

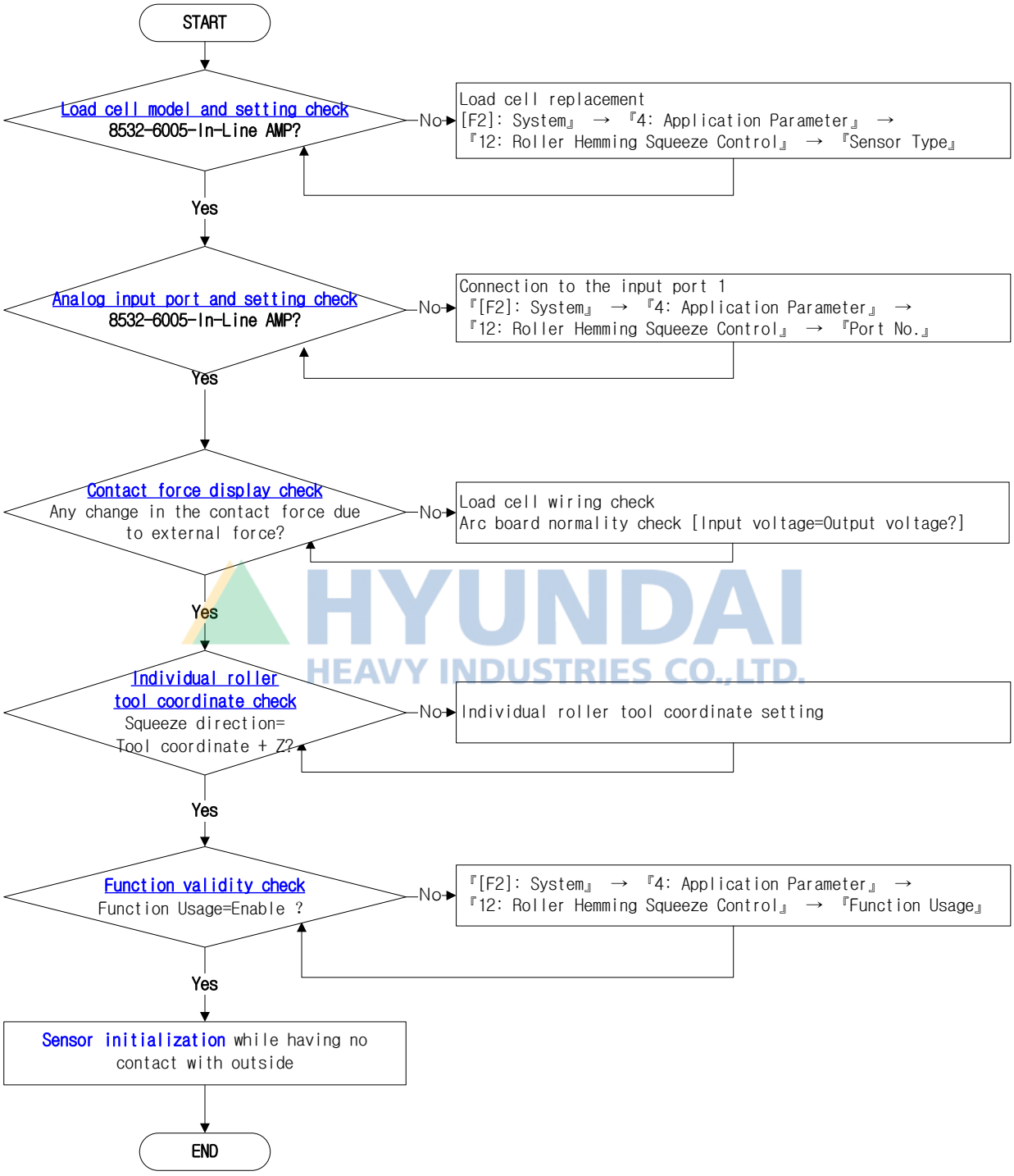


Figure 2.4 Setting sequence before using the function

2.4. Roller hemming squeeze control applying sequence

(1) It is required to enter RHemming ON and RHemming OFF at the hemming start and end sections individually of the robot teaching program that is secured through OLP.
For example, the desired squeeze is 0.8KN and the tolerance values for a warning and an error are 0.2KN and 0.5KN individually, it is required to enter as shown below.

RHemming ON, Fd=0.8,K=4,V=10,TOL_W=0.2,TOL_E=0.5,CTRL=1

※ K=4, V=10 need to be entered as initial values. If vibration occurs, it is recommended to lower the K and V values.

(2) While the function is activated, the squeeze control can be performed through manual operation in a way that desired squeezes can be applied onto individual teaching points. It is required to check by monitoring whether desired squeezes are reached and perform “position correction”.

(3) Carry out hemming operation after completing the ‘position correction’ for all the teaching points.

(4) Through the monitoring function, it is required to check whether the quality of the squeeze, applied while the robot is moving, is satisfactory.

(5) If the quality is not satisfactory, it is required to change to CTRL=0 in the RHemming command. This is for turning off the squeeze function while the robot is moving.

3 Others

3.1. System configuration

The load cell output is fed to the controller through an arc board. In addition, the load cell power is supplied (24V) from the controller

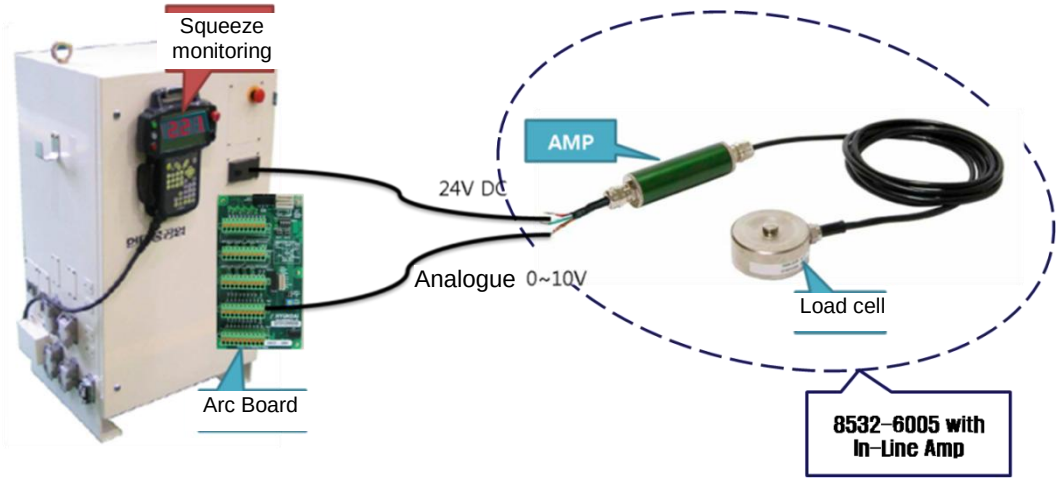


Figure 3.1 System configuration

3.2. Technical Data

Load cell (8532-6005 with In-Line Amp, made by burster)

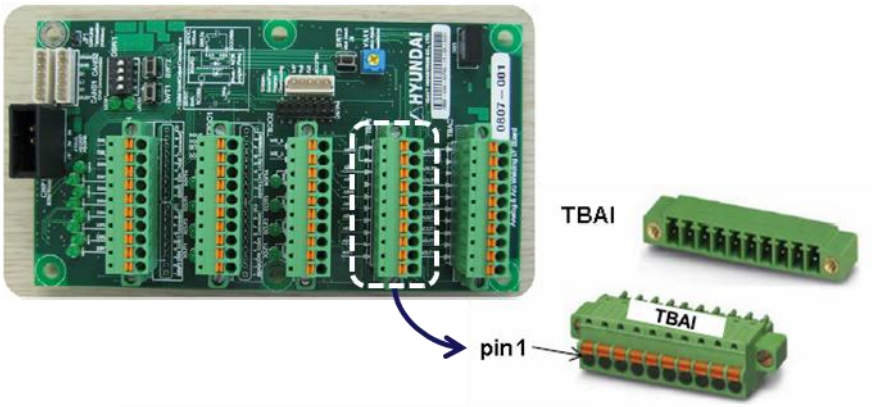
- Output voltage is 0~10V, which is equivalent to a squeeze of 0~5KN
- Needs DC voltage of 15~30V for activating sensors

Order Code	Measurement Range
8532-5500	0 ... 500 N
8532-6001	0 ... 1 kN
8532-6002	0 ... 2 kN
8532-6005	0 ... 5 kN
8532-6010	0 ... 10 kN
8532-6020	0 ... 20 kN

Electrical values

Excitation voltage:		15 ... 30 V DC
Output voltage:		0 ... 10 V
Wiring code of the IN-LINE amplifier:		
red	excitation	positive
black	excitation	negative
white	signal output	positive
green	signal output	negative
Wiring code of the load cell cable:		
red	excitation	positive
black	excitation	negative
white	measurement signal	negative
green	measurement signal	positive

Analogue board (Arc board, BD584V30)



Number	Name	Usage
1	AIN1	Analog Input Channel 1
2	AIN 2	Analog Input Channel 2
3	AIN 3	Analog Input Channel 3
4	AIN 4	Analog Input Channel 4
5	AIN 5	Analog Input Channel 5
6	AIN 6	Analog Input Channel 6
7	AIN 7	Analog Input Channel 7
8	AIN 8	Analog Input Channel 8
9	AING	Analog Input Ground
10	AING	Analog Input Ground

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