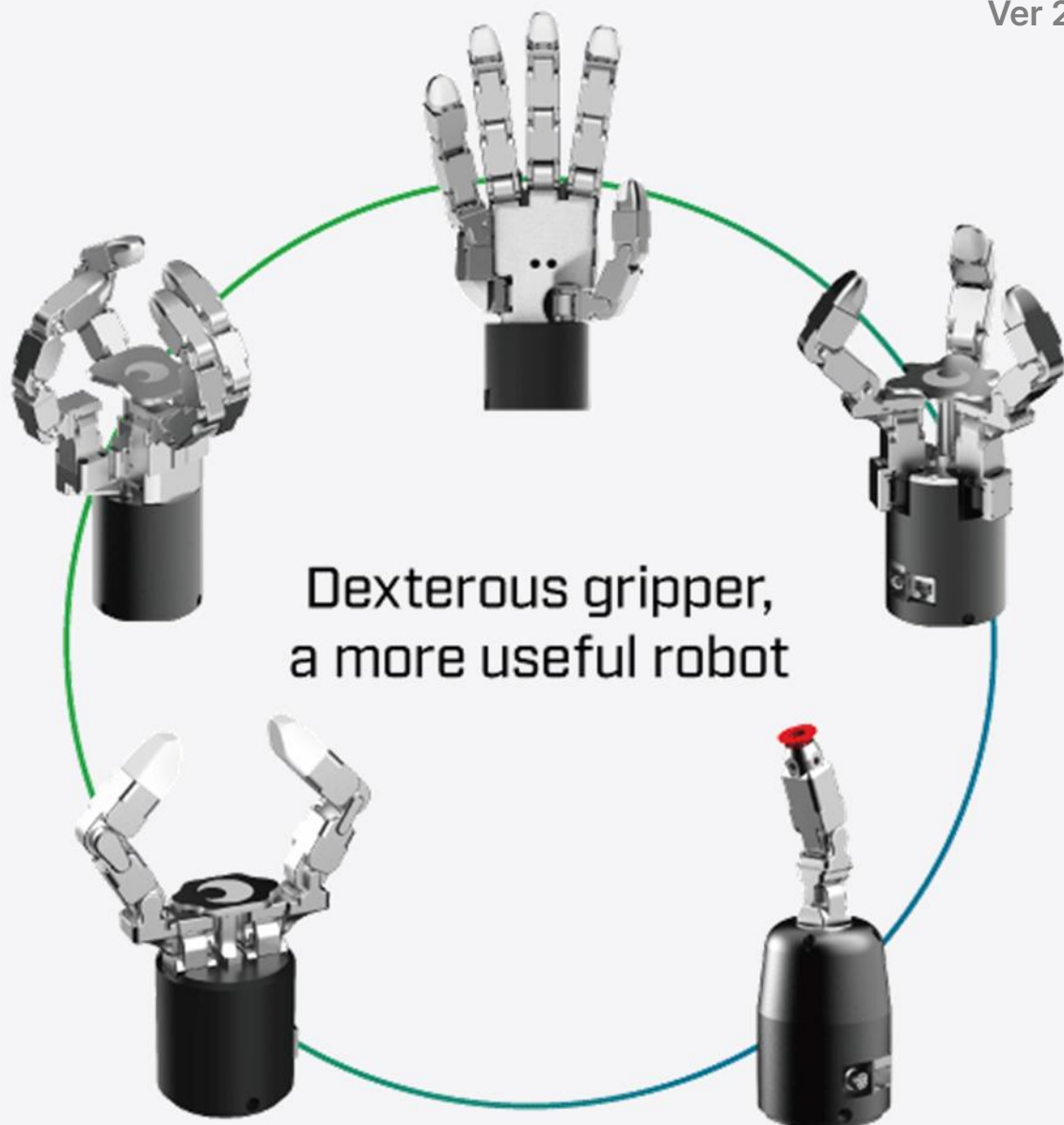


Delto Gripper Series

Control Manual

English

Ver 2.0.0



INFORMATION

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Notice of revisions to the user guide

This documentation is subject to revision for technical improvements.

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Tesollo Corporation

Headquarters: 26F, 165, Convensia-daero, Yeonsu-gu, Incheon, Republic of Korea

Office: 26F, A-Building, 43, Iljik-ro, Gwangmyeong-si, Gyeonggi-do, Republic of Korea

Support T: +82 2 6914 6620

E: support@tesollo.com

H: <http://en.tesollo.com/>

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Chapter 1. Developer Mode

Developer Mode is a mode in which the user operates the system using a custom-developed controller. This mode allows direct control of each joint of the robot hand by receiving joint information.

Developer Mode supports communication via Ethernet (TCP/IP). This chapter introduces the protocol required for using Developer Mode.

Caution!!

Using 'Torque Limit Mode' off in Operator Mode or using stall torque in Developer Mode may cause a rapid increase in product temperature and potential product damage. Please note that repairs (A/S) may be difficult in case of failure.

The DG-5F-S model does not support 'Torque Limit Mode'.

1.1 Basic Connection Information

1.1.1 Connection Type Classification

Type	Applicable Model	Remarks
Type A	DG-1F-M DG-2F-M DG-3F-M DG-4F-M	Uses a single IP address 1.1.2 Connection Type A: Single-IP Model ref.
Type B	DG-5F-M DG-5F-M(Short Wrist) DG-5F-S	IP address differs by right-hand/left-hand model 1.1.3 Connection Type B: Left/Right-Hand IP Model ref.

1.1.2 Connection Type A: Single-IP Model

IP address ⁽¹⁾	169.254.186.72
Subnet mask	255.255.255.0
Gateway	0.0.0.0
Port number ⁽¹⁾	502
(1) It can be changed through the 1.3.4 Set IP & PORT (0x07)	

1.1.3 Connection Type B: Left/Right-Hand IP Model

	Left Hand	Right Hand
IP address ⁽¹⁾	169.254.186.73	169.254.186.72
Subnet mask	255.255.255.0	
Gateway	0.0.0.0	
Port number ⁽¹⁾	502	
(2) It can be changed through the 1.3.4 Set IP & PORT (0x07)		

1.2 Data Structure

1.2.1 Developer Mode Commands

Command	Name	Description
0x01	Get Data	Receive data from each joint
0x05	Set Duty	Sending Duty for each joint
0x06	Set GPIO	Transmit GPIO Output
0x07	Set IP & PORT	Gripper IP & PORT Settings
0x08	Get Gripper Information	Receive Gripper Information
0x09	Get Module Communication Error	Receive the ID of the module with a communication error
0x0A	Set Boot Mode	Enter boot mode
0x0B	Set F/T Sensor Offset	F/T Sensor Offset Setting

1.2.2 Types of incoming data

Code	Name	Data size (Byte)	Remarks
0x01	Position	2	Unit: 0.02 Degree Digits: 2 decimal place → Data x 100 representation Byte order: Big Endian
0x02	Current	2	Unit: 1 mA Byte order: Big Endian
0x03	Temperature	2	Unit: 0.1 C° Digits: 1 decimal place → Data x 10 representation Byte order: Big Endian
0x04	RPM	1	Unit: 1 RPM
0x05	Sensor	-	1.2.2.1 Data Format by Sensor Type ref
0x06	GPIO	4	Output Ports: GPIO Output 1 - 3 Input Port: GPIO Input 1 I/O levels: 0 = 0V, 1 = 24V / 24mA - Not supported by the DG-5F-M(Short Wrist), DG-5F-S model
0x07	Error Code	2	400 + Motor number with error
0x08	Control Cycle	2	Internal control cycle

1.2.2.1 Data Format by Sensor Type

Code	Sensor Type	Output Data	Remarks
1	6-Axis F/T Sensor	DG-1F-M DG-2F-M DG-3F-M DG-4F-M DG-5F-M DG-5F-M(Short Wrist)	- Data configurations : Fx, Fy, Fz, Tx, Ty, Tz - Unit : Force [0.1N], Torque[1mNm] - Data size : 2 Byte per axis - Byte order : Big Endian
2	3-Axis Force Sensor		- Data configurations: Fx, Fy, Fz - Unit : Force [0.1N] - Data size : 2 Byte per axis - Byte order : Big Endian
3	DG-M Tactile Sensor		- Array size: 3 x 5 - Cell value range: 0 - 255 - Data size: 1 Byte per cell - Data order: Top-Left → Bottom-Right
5	DG-S Tactile Sensor	DG-5F-S	- Array size : 3 x 6 - Cell value range : 0 - 4095 - Data size : 2 Byte per cell - Data order : Top-Left → Bottom-Right - Byte order : Big Endian

1.3 Protocol Structure

1.3.1 Get Data(0x01)

Outgoing packets

- Send a command by including the data you want to receive in the Data area.

Length	CMD	Data 1	Data 2	Data 3	...
2 Byte	1 Byte	1 Byte	1 Byte	1 Byte	...

* **Length:** The total number of bytes in the packet, including the Length byte.
 * **CMD:** 0x01 = Command to receive data from each joint
 * **Data:** [1.2.2 Types of incoming data](#) ref
 * **Example:** Receive position, current, and Sensor data → 00 06 01 01 02 05

Return Packets

- Receive data according to the type of transmitted data.

Length	CMD	ID 1	Data 1 to n	...	Sensor	GPIO
2 Byte	1 Byte	1 Byte	1-2 Byte	...	n Byte x m	4 Byte

* **Length:** The total number of bytes in the packet, including the Length byte.
 * **CMD:** 0x01 = Command to receive data from each joint
 * **ID + Data 1-n:** ID and Data for each joint (up to 20 = number of joints)

- ID: ID of each joint
- Data 1 through n: Sends user-specified data of position, current, temperature, or velocity
- Data is received in the structure of [ID 1 + Data 1 + ... + Data n] for each joint

 * **Sensor:** The total received data size depends on the type and number of sensors mounted on the product, and is n × m bytes.

- n : Data size per sensor (Byte)
- m : Number of fingers
- [1.2.2.1 Data Format by Sensor Type](#) ref

 * **GPIO:** When the user selects a GPIO, it sends data in the following order

- Receive data in the order: GPIO Output 1 – 3, then GPIO Input 1
- GPIO Output: Returns the status value set by [1.3.3 Set GPIO \(0x06\)](#)
- GPIO Input: Output the input level
- The DG-5F-M(Short Wrist) and DG-5F-S models do not support the GPIO function.
- [1.2.2 Types of incoming data](#) → GPIO Reference

1.3.2 Set Duty (0x05)

This command sends a Duty value to each joint to directly control each joint.

Outgoing packets

Length	CMD	ID 1	Data 1	ID 2	Data 2	...
2 Byte	1 Byte	1 Byte	2 Byte	1 Byte	2 Byte	...

* **Length:** The total number of bytes in the packet, including the Length byte.

* **CMD:** 0x05 = Duty send command for each joint

* **ID + Data 1-n:** ID and Data for each joint (n : Maximum number of joints)

- ID: ID of each joint
- Data: Duty value for each joint, from -1000 to +1000
(1 decimal place → represented as Data × 10)
- Data byte order: Big Endian
- Received for each joint in the structure [ID (1 Byte) + Data (2 Byte)]

* **Example:** All joints Duty 50% → 00 3F 05 01 01 F4 02 01 F4 ... 14 01 F4

1.3.3 Set GPIO (0x06)

This command sets the GPIO output states of the gripper.

The DG-5F-M(Short Wrist) and DG-5F-S models do not support the GPIO function.

Outgoing packets

Length	CMD	Data 1	Data 2	Data 3
2 Byte	1 Byte	1 Byte	1 Byte	1 Byte

* **Length:** The total number of bytes in the packet, including the Length byte.

* **CMD:** 0x06 = GPIO Output command

* **Data 1-3:** GPIO Output 1 - GPIO Output 3 Output Level Setting

- Output Level: 0 = 0V, 1 = 24V / 24mA

* **Example:** GPIO Output 2 to 24V output → 00 06 06 00 01 00

1.3.4 Set IP & PORT (0x07)

This command sets the IP address and PORT of the gripper.

Outgoing packets

Length	CMD	Data 1	Data 2
2 Byte	1 Byte	4 Byte	2 Byte
* Length: The total number of bytes in the packet, including the Length byte. * CMD: 0x07 = Gripper IP & PORT Setup Command * Data 1: Gripper IP address - Byte order: First through fourth digits of the IP * Data 2: Gripper PORT - Byte order: Big Endian * Example: IP = 169.254.186.72, PORT = 502 → 00 09 07 A9 FE BA 48 01 F6			

1.3.5 Get Gripper Information (0x08)

This command receives the Product ID, firmware version, and option code of the gripper.

Outgoing packets

Length	CMD
2 Byte	1 Byte
* Length: The total number of bytes in the packet, including the Length byte. * CMD: 0x08 = Command to receive gripper Product ID & firmware version * Example: 00 03 08	

Return Packets

Length	CMD	Data 1	Data 2	Data 3
2 Byte	1 Byte	2 Byte	2 Byte	2 Byte
* Length: The total number of bytes in the packet, including the Length byte. * CMD: 0x08 = Command to receive gripper Product ID & firmware version * Data 1: Product ID (2.4 Product ID by Model ref) - Byte order: Series, Model * Data 2: Firmware Version - Byte order: Major, Minor * Data 3: Option code - [AA] [BB] - AA : Sensor code (1.2.2.1 Data Format by Sensor Type ref) - BB : Number of sensors * Example: DG-5F-S (20-DoF) left, firmware version 3.0 → 00 09 08 5F 14 03 00 05 02				

1.3.6 Get Module Communication Error (0x09)

This command detects communication errors for each joint.

Outgoing packets

Length	CMD
2 Byte	1 Byte
* Length: The total number of bytes in the packet, including the Length byte. * CMD: 0x09 = Command to receive communication anomaly module ID * Example: 00 03 09	

Return Packets

Length	CMD	Data
2 Byte	1 Byte	1 Byte
* Length: The total number of bytes in the packet, including the Length byte. * CMD: 0x09 = Command to receive communication anomaly module ID * Data: ID of the joint where the communication error occurred * Example: - Communication error on joint 2 → 00 04 09 02 - No error → 00 04 09 00		

1.3.7 Set Boot Mode (0x0A)

The command to enter boot mode for firmware download.

Outgoing packets

Length	CMD	Data
2 Byte	1 Byte	1 Byte
* Length: The total number of bytes in the packet, including the Length byte. * CMD: 0x0A = Command to enter boot mode * Data: Verification code = 0xAF * Example: 00 04 0A AF		

1.3.8 Set F/T Sensor Offset (0x0B)

This command sets the offset of the F/T sensor.

Outgoing packets

Length	CMD
2 Byte	1 Byte
* Length: The total number of bytes in the packet, including the Length byte. * CMD: 0x0B = F/T Sensor Offset Setting Command * Example: 00 03 0B	

Chapter 2. Operator Mode

This mode is controlled using the controller inside the product. It supports the Modbus Protocol and allows you to easily control the robot hand by simply changing the register map or by using the UI operations provided.

Caution!!

Using 'Torque Limit Mode' off in Operator Mode or using stall torque in Developer Mode may cause a rapid increase in product temperature and potential product damage. Please note that repairs (A/S) may be difficult in case of failure.

The DG-5F-S model does not support 'Torque Limit Mode'.

2.1 Modbus basics

Supported Function	Read Holding Register (FC 03) Read Input Register (FC 04) Write Single Register (FC 06) Diagnostics (FC 08) Write Multiple Register (FC 16)
Slave ID⁽¹⁾	1
Start Address	0
(1) Can be changed via Modbus Write (Holding Register 371) function	

2.1.1 Modbus RTU

The DG-5F-M (Short Wrist) and DG-5F-S models do not support Modbus RTU.

Physical Interface	RS-485
Baudrate	115,200 bps
Data bits	8 bit
Parity bits	None
Stop bits	1 bit
Flow control	None
CRC	CRC-16 (Modbus)

2.1.2 Connection Type Classification

Type	Applicable Model	Remarks
Type A	DG-1F-M DG-2F-M DG-3F-M DG-4F-M	Uses a single IP address 2.1.3 Connection Type A: Single-IP Model ref.
Type B	DG-5F-M DG-5F-M(Short Wrist) DG-5F-S	IP address differs by right-hand/left-hand model 2.1.4 Connection Type B: Left/Right-Hand IP Model ref.

2.1.3 Connection Type A: Single-IP Model

IP address⁽¹⁾	169.254.186.72
Subnet mask	255.255.255.0
Gateway	0.0.0.0
Port number⁽¹⁾	502
(1) Can be changed via Modbus Write (Holding Register 372,376,380,384) function	

2.1.4 Connection Type B: Left/Right-Hand IP Model

	Left Hand	Right Hand
IP address ⁽¹⁾	169.254.186.73	169.254.186.72
Subnet mask	255.255.255.0	
Gateway	0.0.0.0	
Port number ⁽¹⁾	502	
(1) Can be changed via Modbus Write (Holding Register 372,376,380,384) function		

2.2 Modbus Registers

*(x10, x100, x1000): Write/Read data multiplied by 10, 100, 1000 to apply decimalization

* Shade of green: EEPROM area (Holding Register 1)

2.2.1 Holding Register (Read / Write)

Address	Description.	Scale	Initial values
DEC			DEC
0	System Behavior [0 to 1] 0: Stop 1: Start	-	0
1	EEPROM Write [1] 1: Store data in EEPROM memory	-	0
2	Motion Teach Mode [0 to 1] 0: Teach Mode Off 1: Teach Mode On - Ability to physically shape the gripper yourself	-	0
3	Load Pose Recipe [1 to 100] Importing a saved pose recipe	-	1
5	Save Current Position Recipe [1 to 100] Store the current position value in slot n of the recipe	-	0
6	Save Target Position Recipe [1 to 100] Store the target position value in slot n of the recipe	-	0
7	Motor 1 Position Target Value [-1800 to 1800] Unit: 0.1°	x10	0
8	Motor 2 Position Target Value [-1800 to 1800]	x10	0
9	Motor 3 Position Target Value [-1800 to 1800]	x10	0
10	Motor 4 Position Target Value [-1800 to 1800]	x10	0
11	Motor 5 Position Target Value [-1800 to 1800]	x10	0
12	Motor 6 Position Target Value [-1800 to 1800]	x10	0
13	Motor 7 Position Target Value [-1800 to 1800]	x10	0
14	Motor 8 Position Target Value [-1800 to 1800]	x10	0

15	Motor 9 Position Target Value [-1800 to 1800]	x10	0
16	Motor 10 Position Target Value [-1800 to 1800]	x10	0
17	Motor 11 Position Target Value [-1800 to 1800]	x10	0
18	Motor 12 Position Target Value [-1800 to 1800]	x10	0
19	Motor 13 Position Target Value [-1800 to 1800]	x10	0
20	Motor 14 Position Target Value [-1800 to 1800]	x10	0
21	Motor 15 Position Target Value [-1800 to 1800]	x10	0
22	Motor 16 Position Target Value [-1800 to 1800]	x10	0
23	Motor 17 Position Target Value [-1800 to 1800]	x10	0
24	Motor 18 Position Target Value [-1800 to 1800]	x10	0
25	Motor 19 Position Target Value [-1800 to 1800]	x10	0
26	Motor 20 Position Target Value [-1800 to 1800]	x10	0
27	Motor 1 Target Position Reach Time [0 to 30000] • Unit: 1 ms • Arrive at the target position on time	-	300
28	Motor 2 Target Position Reach Time [0 to 30000]	-	300
29	Motor 3 Target Position Reach Time [0 to 30000]	-	300
30	Motor 4 Target Position Reach Time [0 to 30000]	-	300
31	Motor 5 Target Position Reach Time [0 to 30000]	-	300
32	Motor 6 Target Position Reach Time [0 to 30000]	-	300
33	Motor 7 Target Position Reach Time [0 to 30000]	-	300
34	Motor 8 Target Position Reach Time [0 to 30000]	-	300
35	Motor 9 Target Position Reach Time [0 to 30000]	-	300
36	Motor 10 Target Position Reach Time [0 to 30000]	-	300
37	Motor 11 Target Position Reach Time [0 to 30000]	-	300
38	Motor 12 Target Position Reach Time [0 to 30000]	-	300
39	Motor 13 Target Position Reach Time [0 to 30000]	-	300
40	Motor 14 Target Position Reach Time [0 to 30000]	-	300
41	Motor 15 Target Position Reach Time [0 to 30000]	-	300
42	Motor 16 Target Position Reach Time [0 to 30000]	-	300
43	Motor 17 Target Position Reach Time [0 to 30000]	-	300
44	Motor 18 Target Position Reach Time [0 to 30000]	-	300
45	Motor 19 Target Position Reach Time [0 to 30000]	-	300
46	Motor 20 Target Position Reach Time [0 to 30000]	-	300

82	Load Gain Recipes [1 to 20] - Importing a saved gain recipe - See Holding Register 83 for storing gain recipes.	-	1
83	Save Gain Recipe [1 to 20] Save the P Gain, D Gain, I Gain, I Limit, and Gain Mode settings to slot n.	-	0
85	Gain Mode [0 to 1] 0: PD control 1: PID Control	-	0
86	Motor 1 P Gain [0 to 30000] Unit: 0.1	x10	10
87	Motor 2 P Gain [0 to 30000]	x10	10
88	Motor 3 P Gain [0 to 30000]	x10	10
89	Motor 4 P Gain [0 to 30000]	x10	10
90	Motor 5 P Gain [0 to 30000]	x10	10
91	Motor 6 P Gain [0 to 30000]	x10	10
92	Motor 7 P Gain [0 to 30000]	x10	10
93	Motor 8 P Gain [0 to 30000]	x10	10
94	Motor 9 P Gain [0 to 30000]	x10	10
95	Motor 10 P Gain [0 to 30000]	x10	10
96	Motor 11 P Gain [0 to 30000]	x10	10
97	Motor 12 P Gain [0 to 30000]	x10	10
98	Motor 13 P Gain [0 to 30000]	x10	10
99	Motor 14 P Gain [0 to 30000]	x10	10
100	Motor 15 P Gain [0 to 30000]	x10	10
101	Motor 16 P Gain [0 to 30000]	x10	10
102	Motor 17 P Gain [0 to 30000]	x10	10
103	Motor 18 P Gain [0 to 30000]	x10	10
104	Motor 19 P Gain [0 to 30000]	x10	10
105	Motor 20 P Gain [0 to 30000]	x10	10
106	Motor 1 D Gain [0 to 30000] Unit: 0.1	x10	30
107	Motor 2 D Gain [0 to 30000]	x10	30
108	Motor 3 D Gain [0 to 30000]	x10	30
109	Motor 4 D Gain [0 to 30000]	x10	30

110	Motor 5 D Gain [0 to 30000]	x10	30
111	Motor 6 D Gain [0 to 30000]	x10	30
112	Motor 7 D Gain [0 to 30000]	x10	30
113	Motor 8 D Gain [0 to 30000]	x10	30
114	Motor 9 D Gain [0 to 30000]	x10	30
115	Motor 10 D Gain [0 to 30000]	x10	30
116	Motor 11 D Gain [0 to 30000]	x10	30
117	Motor 12 D Gain [0 to 30000]	x10	30
118	Motor 13 D Gain [0 to 30000]	x10	30
119	Motor 14 D Gain [0 to 30000]	x10	30
120	Motor 15 D Gain [0 to 30000]	x10	30
121	Motor 16 D Gain [0 to 30000]	x10	30
122	Motor 17 D Gain [0 to 30000]	x10	30
123	Motor 18 D Gain [0 to 30000]	x10	30
124	Motor 19 D Gain [0 to 30000]	x10	30
125	Motor 20 D Gain [0 to 30000]	x10	30
126	Motor 1 I Gain [0 to 30000] • Unit: 0.001	x1000	0
127	Motor 2 I Gain [0 to 30000]	x1000	0
128	Motor 3 I Gain [0 to 30000]	x1000	0
129	Motor 4 I Gain [0 to 30000]	x1000	0
130	Motor 5 I Gain [0 to 30000]	x1000	0
131	Motor 6 I Gain [0 to 30000]	x1000	0
132	Motor 7 I Gain [0 to 30000]	x1000	0
133	Motor 8 I Gain [0 to 30000]	x1000	0
134	Motor 9 I Gain [0 to 30000]	x1000	0
135	Motor 10 I Gain [0 to 30000]	x1000	0
136	Motor 11 I Gain [0 to 30000]	x1000	0
137	Motor 12 I Gain [0 to 30000]	x1000	0
138	Motor 13 I Gain [0 to 30000]	x1000	0
139	Motor 14 I Gain [0 to 30000]	x1000	0
140	Motor 15 I Gain [0 to 30000]	x1000	0
141	Motor 16 I Gain [0 to 30000]	x1000	0
142	Motor 17 I Gain [0 to 30000]	x1000	0
143	Motor 18 I Gain [0 to 30000]	x1000	0

144	Motor 19 I Gain [0 to 30000]	x1000	0
145	Motor 20 I Gain [0 to 30000]	x1000	0
146	Motor 1 I Limit [0 to 30000] • Unit: 0.01	x100	0
147	Motor 2 I Limit [0 to 30000]	x100	0
148	Motor 3 I Limit [0 to 30000]	x100	0
149	Motor 4 I Limit [0 to 30000]	x100	0
150	Motor 5 I Limit [0 to 30000]	x100	0
151	Motor 6 I Limit [0 to 30000]	x100	0
152	Motor 7 I Limit [0 to 30000]	x100	0
153	Motor 8 I Limit [0 to 30000]	x100	0
154	Motor 9 I Limit [0 to 30000]	x100	0
155	Motor 10 I Limit [0 to 30000]	x100	0
156	Motor 11 I Limit [0 to 30000]	x100	0
157	Motor 12 I Limit [0 to 30000]	x100	0
158	Motor 13 I Limit [0 to 30000]	x100	0
159	Motor 14 I Limit [0 to 30000]	x100	0
160	Motor 15 I Limit [0 to 30000]	x100	0
161	Motor 16 I Limit [0 to 30000]	x100	0
162	Motor 17 I Limit [0 to 30000]	x100	0
163	Motor 18 I Limit [0 to 30000]	x100	0
164	Motor 19 I Limit [0 to 30000]	x100	0
165	Motor 20 I Limit [0 to 30000]	x100	0
286	Start Blend Joint [0 to 10] • 0: Stop • 1-10: Start the Blend Joint saved in n. • Execute the recipes stored in the blend list sequentially.	-	0
287	Save The Current Blend List [1 to 10] Save the Blend List to slot n	-	0
288	Add and Delete Blend Lists [0 to 2] • Add Pose Recipes, Gain Recipes, and Latency to the Blend List (up to 50) • 0: default • 1: Add to list • 2: Initialize the list	-	0

289	Select a Blend Pose Recipe [1 to 100] Choose from your saved pose recipes	-	1
290	Select a Blend Gain Recipe [1 to 20] Choose from your saved gain recipes	-	1
291	Blend Target Position Wait Time[0 to 30000] - Unit: 1 ms - Setting the wait time between each action during Blend actions	-	0
292	Grasp Action [0 to 1] 0: RELEASE 1: GRASP	-	0
293	Load the Grasp Recipe [1 to 20] Recalling saved grasping settings	-	1
294	Save the Grasp Recipe [1 to 20] Save "Grasp Mode", "Grasp Force", "Hold Position" to slot n	-	0
295	Grasp Mode [Varies by Model] 2.3 Grasp Mode ref	-	21
296	Grasp Force [0 to 200] Unit: 0.1 N	-	30
299	Motor 1 Hold Position During Grasping [0 to 1] 0: Off 1: Lock position	-	0
300	Motor 2 Hold Position During Grasping [0 to 1]	-	0
301	Motor 3 Hold Position During Grasping [0 to 1]	-	0
302	Motor 4 Hold Position During Grasping [0 to 1]	-	0
303	Motor 5 Hold Position During Grasping [0 to 1]	-	0
304	Motor 6 Hold Position During Grasping [0 to 1]	-	0
305	Motor 7 Hold Position During Grasping [0 to 1]	-	0
306	Motor 8 Hold Position During Grasping [0 to 1]	-	0
307	Motor 9 Hold Position During Grasping [0 to 1]	-	0
308	Motor 10 Hold Position During Grasping [0 to 1]	-	0

309	Motor 11 Hold Position During Grasping [0 to 1]	-	0
310	Motor 12 Hold Position During Grasping [0 to 1]	-	0
311	Motor 13 Hold Position During Grasping [0 to 1]	-	0
312	Motor 14 Hold Position During Grasping [0 to 1]	-	0
313	Motor 15 Hold Position During Grasping [0 to 1]	-	0
314	Motor 16 Hold Position During Grasping [0 to 1]	-	0
315	Motor 17 Hold Position During Grasping [0 to 1]	-	0
316	Motor 18 Hold Position During Grasping [0 to 1]	-	0
317	Motor 19 Hold Position During Grasping [0 to 1]	-	0
318	Motor 20 Hold Position During Grasping [0 to 1]	-	0
319	Motor 1 Offset [-1800 to 1800] - Unit: 0.1° - Setting Offsets for Joint Angle Values	x10	0
320	Motor 2 Offset [-1800 to 1800]	x10	0
321	Motor 3 Offset [-1800 to 1800]	x10	0
322	Motor 4 Offset [-1800 to 1800]	x10	0
323	Motor 5 Offset [-1800 to 1800]	x10	0
324	Motor 6 Offset [-1800 to 1800]	x10	0
325	Motor 7 Offset [-1800 to 1800]	x10	0
326	Motor 8 Offset [-1800 to 1800]	x10	0
327	Motor 9 Offset [-1800 to 1800]	x10	0
328	Motor 10 Offset [-1800 to 1800]	x10	0
329	Motor 11 Offset [-1800 to 1800]	x10	0
330	Motor 12 Offset [-1800 to 1800]	x10	0
331	Motor 13 Offset [-1800 to 1800]	x10	0
332	Motor 14 Offset [-1800 to 1800]	x10	0
333	Motor 15 Offset [-1800 to 1800]	x10	0
334	Motor 16 Offset [-1800 to 1800]	x10	0
335	Motor 17 Offset [-1800 to 1800]	x10	0
336	Motor 18 Offset [-1800 to 1800]	x10	0

337	Motor 19 Offset [-1800 to 1800]	x10	0
338	Motor 20 Offset [-1800 to 1800]	x10	0
339	Motor 1 Inpose [0 to 1800] - Unit: 0.1° - Range for determining if the target position has been reached - Input Register 3 ref	x10	100
340	Motor 2 In Position [0 to 1800]	x10	100
341	Motor 3 In Position [0 to 1800]	x10	100
342	Motor 4 In Position [0 to 1800]	x10	100
343	Motor 5 In Position [0 to 1800]	x10	100
344	Motor 6 In Position [0 to 1800]	x10	100
345	Motor 7 In Position [0 to 1800]	x10	100
346	Motor 8 In Position [0 to 1800]	x10	100
347	Motor 9 In Position [0 to 1800]	x10	100
348	Motor 10 In Position [0 to 1800]	x10	100
349	Motor 11 In Position [0 to 1800]	x10	100
350	Motor 12 In Position [0 to 1800]	x10	100
351	Motor 13 In Position [0 to 1800]	x10	100
352	Motor 14 In Position [0 to 1800]	x10	100
353	Motor 15 In Position [0 to 1800]	x10	100
354	Motor 16 In Position [0 to 1800]	x10	100
355	Motor 17 In Position [0 to 1800]	x10	100
356	Motor 18 In Position [0 to 1800]	x10	100
357	Motor 19 In Position [0 to 1800]	x10	100
358	Motor 20 In Position [0 to 1800]	x10	100
369	Moving In Position [0 to 1800] - Range of whether to determine gripper movement - Unit: 0.1° - Input Register 2 ref	x10	3
371	Modbus Slave ID [1 to 255]	-	1
372	Ethernet IP 1 [1 to 255]	-	169
373	Ethernet IP 2 [0 to 255]	-	254
374	Ethernet IP 3 [0 to 255]	-	186
375	Ethernet IP 4 [0 to 255]	-	72or73

376	Ethernet subnet 1 [0 to 255]	-	255
377	Ethernet subnet 2 [0 to 255]	-	255
378	Ethernet subnet 3 [0 to 255]	-	255
379	Ethernet subnet 4 [0 to 255]	-	0
380	Ethernet Gateway 1 [0 to 255]	-	0
381	Ethernet Gateway 2 [0 to 255]	-	0
382	Ethernet Gateway 3 [0 to 255]	-	0
383	Ethernet Gateway 4 [0 to 255]	-	0
384	Ethernet Port [1 to 30000] • The value 2607 cannot be entered.	-	502
385	Set the initial Pose Recipe [1 to 100] • Set which of your saved pose recipes to apply on first launch	-	1
386	Set the initial Gain Recipe [1 to 20] • Set the gain to apply on first startup from a saved gain recipe	-	1
387	Set the initial Grasp Recipe [1 to 20] • Which of your saved grasp settings to apply on first startup	-	1
388	Set the Low Pass Filter Alpha Value [0 to 99] • Apply a Low Pass Filter to the Joint Current Position Value • 0: Off • 1 to 99: Set the Alpha value (%)	-	0
389	Set Current Control Mode [0 to 1] • 0: Off • 1: On • P, I, and D gain values cannot be set in current control mode.	-	0
390	Motor 1 Current Target Value [-360 to 360] • Unit: 1 mA	-	0
391	Motor 2 Current Target Value [-360 to 360]	-	0
392	Motor 3 Current Target Value [-360 to 360]	-	0
393	Motor 4 Current Target Value [-360 to 360]	-	0
394	Motor 5 Current Target Value [-360 to 360]	-	0
395	Motor 6 Current Target Value [-360 to 360]	-	0
396	Motor 7 Current Target Value [-360 to 360]	-	0
397	Motor 8 Current Target Value [-360 to 360]	-	0

398	Motor 9 Current Target Value [-360 to 360]	-	0
399	Motor 10 Current Target Value [-360 to 360]	-	0
400	Motor 11 Current Target Value [-360 to 360]	-	0
401	Motor 12 Current Target Value [-360 to 360]	-	0
402	Motor 13 Current Target Value [-360 to 360]	-	0
403	Motor 14 Current Target Value [-360 to 360]	-	0
404	Motor 15 Current Target Value [-360 to 360]	-	0
405	Motor 16 Current Target Value [-360 to 360]	-	0
406	Motor 17 Current Target Value [-360 to 360]	-	0
407	Motor 18 Current Target Value [-360 to 360]	-	0
408	Motor 19 Current Target Value [-360 to 360]	-	0
409	Motor 20 Current Target Value [-360 to 360]	-	0
439	GPIO Output 1 Level [0 to 1] - The DG-5F-M(Short Wrist) and DG-5F-S models do not support the GPIO function. 0: 0 V 1: 24 V / 24mA	-	0
440	GPIO Output 2 Level [0 to 1]	-	0
441	GPIO Output 3 Level [0 to 1]	-	0
442	Enter Boot Mode [2607] Enter boot mode for firmware update	-	0
443	Torque Limit Mode [0 to 1] - The DG-5F-S model does not support the Torque Limit Mode function. 0: Torque Limit off 1: Torque Limit on	-	1
597	FT Sensor Offset Setting [1] 1: Offset Setting	-	0

2.2.2 Input Register (Read Only)

Address DEC	Description.	Scale
0	Product ID	-
1	Firmware version	-
2	Whether the gripper joint moves Holding Register 369 ref 0: Stop 1: Movement	-
3	Arrive Joint Target Value Verify Target Value Arrival for All Joints See Holding Register 339 to 358 0: Not reached 1: Arrival	-
4	Currently Active Blend Number Indicates the Execution Order of the Currently Active Blend	-
5	Blend Status - Displaying Status Based on Blend Behavior 0: Stop 1: In Progress 2: Done	-
6	Motor 1 Current Position Value Unit: 0.1°	x10
7	Motor 2 Current Position Value	x10
8	Motor 3 Current Position Value	x10
9	Motor 4 Current Position Value	x10
10	Motor 5 Current Position Value	x10
11	Motor 6 Current Position Value	x10
12	Motor 7 Current Position Value	x10
13	Motor 8 Current Position Value	x10
14	Motor 9 Current Position Value	x10
15	Motor 10 Current Position Value	x10

16	Motor 11 Current Position Value	x10
17	Motor 12 Current Position Value	x10
18	Motor 13 Current Position Value	x10
19	Motor 14 Current Position Value	x10
20	Motor 15 Current Position Value	x10
21	Motor 16 Current Position Value	x10
22	Motor 17 Current Position Value	x10
23	Motor 18 Current Position Value	x10
24	Motor 19 Current Position Value	x10
25	Motor 20 Current Position Value	x10
26	Motor 1 Current Value • Unit: 1 mA	-
27	Motor 2 Current Value	-
28	Motor 3 Current Value	-
29	Motor 4 Current Value	-
30	Motor 5 Current Value	-
31	Motor 6 Current Value	-
32	Motor 7 Current Value	-
33	Motor 8 Current Value	-
34	Motor 9 Current Value	-
35	Motor 10 Current Value	-
36	Motor 11 Current Value	-
37	Motor 12 Current Value	-
38	Motor 13 Current Value	-
39	Motor 14 Current Value	-
40	Motor 15 Current Value	-
41	Motor 16 Current Value	-
42	Motor 17 Current Value	-
43	Motor 18 Current Value	-
44	Motor 19 Current Value	-
45	Motor 20 Current Value	-
46	Motor 1 Current Speed Value • Unit: 1 RPM	-
47	Motor 2 Current Speed Value	-

48	Motor 3 Current Speed Value	-
49	Motor 4 Current Speed Value	-
50	Motor 5 Current Speed Value	-
51	Motor 6 Current Speed Value	-
52	Motor 7 Current Speed Value	-
53	Motor 8 Current Speed Value	-
54	Motor 9 Current Speed Value	-
55	Motor 10 Current Speed Value	-
56	Motor 11 Current Speed Value	-
57	Motor 12 Current Speed Value	-
58	Motor 13 Current Speed Value	-
59	Motor 14 Current Speed Value	-
60	Motor 15 Current Speed Value	-
61	Motor 16 Current Speed Value	-
62	Motor 17 Current Speed Value	-
63	Motor 18 Current Speed Value	-
64	Motor 19 Current Speed Value	-
65	Motor 20 Current Speed Value	-
66	Motor 1 Current Temperature Value • Unit: 0.1 C°	x10
67	Motor 2 Current Temperature Value	x10
68	Motor 3 Current Temperature Value	x10
69	Motor 4 Current Temperature Value	x10
70	Motor 5 Current Temperature Value	x10
71	Motor 6 Current Temperature Value	x10
72	Motor 7 Current Temperature Value	x10
73	Motor 8 Current Temperature Value	x10
74	Motor 9 Current Temperature Value	x10
75	Motor 10 Current Temperature Value	x10
76	Motor 11 Current Temperature Value	x10
77	Motor 12 Current Temperature Value	x10
78	Motor 13 Current Temperature Value	x10
79	Motor 14 Current Temperature Value	x10

80	Motor 15 Current Temperature Value	x10
81	Motor 16 Current Temperature Value	x10
82	Motor 17 Current Temperature Value	x10
83	Motor 18 Current Temperature Value	x10
84	Motor 19 Current Temperature Value	x10
85	Motor 20 Current Temperature Value	x10
86	Option Code [0xAABB] - AA : Option code (1.2.2.1 Data Format by Sensor Type ref) - BB : Number of sensors	-
115	Control Cycle Displays the current control cycle of the product.	
116	Error Code - Displays the error code. 400 + Motor number with error.	
127	GPIO Input1 Status - The DG-5F-M(Short Wrist) and DG-5F-S models do not support the GPIO function. 0: 0 V 1: 24 V	-
128	Sensor Data 1	-
129	Sensor Data 2	-
130	Sensor Data 3	-
131	Sensor Data 4	-
132	Sensor Data 5	-
133	Sensor Data 6	-
134	Sensor Data 7	-
135	Sensor Data 8	-
136	Sensor Data 9	-
137	Sensor Data 10	-
138	Sensor Data 11	-
139	Sensor Data 12	-
140	Sensor Data 13	-
141	Sensor Data 14	-
142	Sensor Data 15	-
143	Sensor Data 16	-

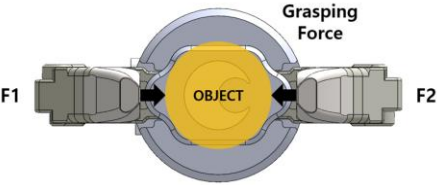
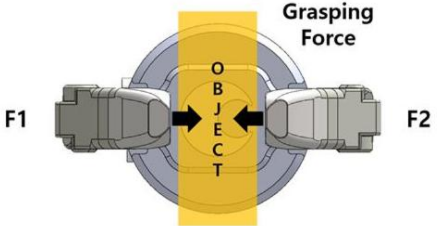
144	Sensor Data 17	-
145	Sensor Data 18	-
146	Sensor Data 19	-
147	Sensor Data 20	-
148	Sensor Data 21	-
149	Sensor Data 22	-
150	Sensor Data 23	-
151	Sensor Data 24	-
152	Sensor Data 25	-
153	Sensor Data 26	-
154	Sensor Data 27	-
155	Sensor Data 28	-
156	Sensor Data 29	-
157	Sensor Data 30	-

* The allocation of the sensor data area (Input Register 128 and above) may differ depending on the type of sensor mounted on the product. Detailed mapping information will be added to this document once finalized.

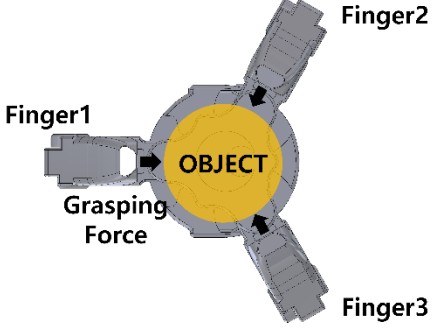
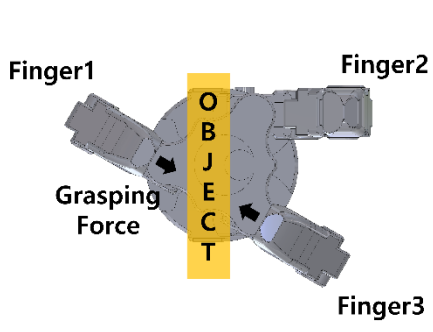
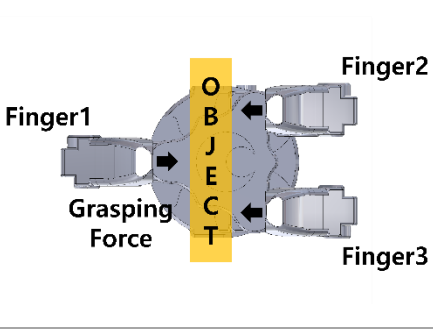
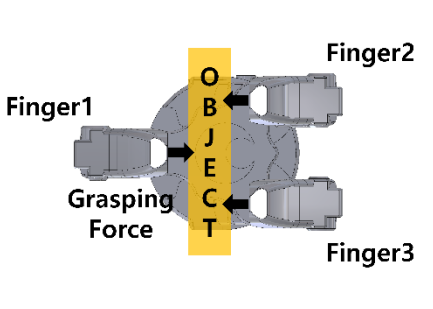
2.3 Grasp Mode

Each number is a mode code entered when setting Grasp Mode, and the supported values vary by model.

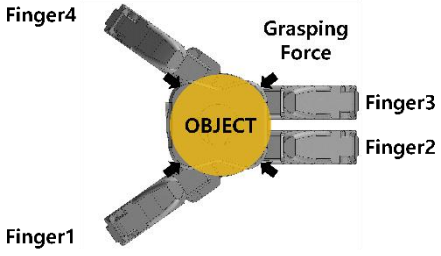
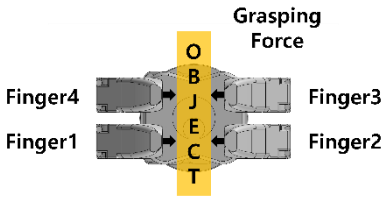
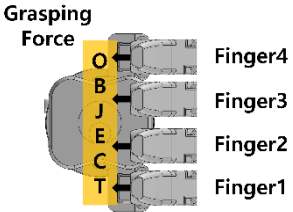
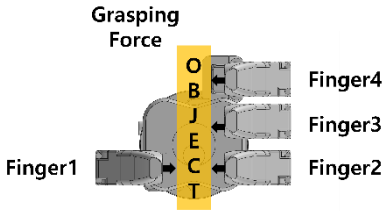
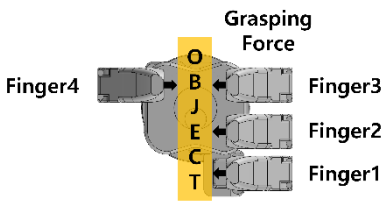
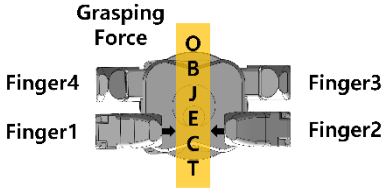
2.3.1 DG-2F-M Grasp Mode

51		A grasping algorithm that tracks the center point of two fingers based on force
52		A force-based grasping algorithm that enables two fingers to enclose and hold an object

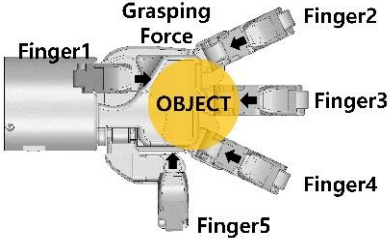
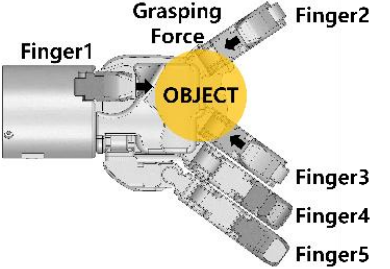
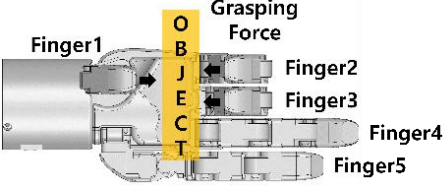
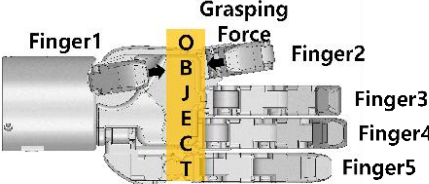
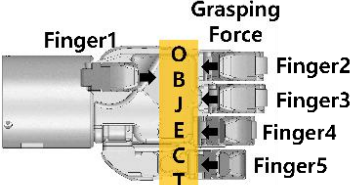
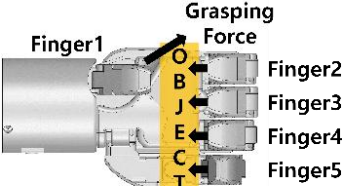
2.3.2 DG-3F-M Grasp Mode

1		A grasping algorithm implemented so that the force of the three fingertips is centered on the center of the gripped object.
2 3 4		A grasping algorithm implemented so that the force of the two fingertips is centered on the center of the gripped object. (F1 and F2, F1 and F3, F2 and F3)
5		Implemented grasping algorithm so that the force on the fingertips of fingers 2 and 3 is parallel to the grip
6		A grasping algorithm where all three fingers operate to wrap around the target object based on force

2.3.3 DG-4F-M Grasp Mode

31		A grasping algorithm that tracks the center point of four fingers based on force
32		A force-based grasping algorithm that ensures Finger 1 and Finger 4, as well as Finger 2 and Finger 3, move in parallel
33		A force-based grasping algorithm that enables four fingers to enclose and hold an object
34		A force-based grasping algorithm that enables the three fingers opposing Finger 1 to move in parallel with it
35		A force-based grasping algorithm that enables the three fingers opposing Finger 4 to move in parallel with it
36 37 38		A force-based grasping algorithm that tracks the central point between one finger and its opposing finger (Finger 1 and Finger 2) (Finger 1 and Finger 4) (Finger 3 and Finger 4)

2.3.4 DG-5F-M, DG-5F-M(Short Wrist), DG-5F-S Grasp Mode

21		A grasping algorithm that follows the center point where the five fingers cross, based on force
22		A grasping algorithm that follows the center point where three fingers cross, based on force (Finger 1 and Finger 2 and Finger 3)
23		A grasping algorithm that follows the force-based tracking, where one finger and its corresponding two fingers are driven in parallel (Finger 1 and Finger 2 and Finger 3)
24 25 26 27		A grasping algorithm that follows the center point where two fingers cross, based on force (Finger 1 and Finger 2 – Finger 5)
28		A grasping algorithm that follows the force-based tracking, where one finger and its corresponding four fingers are driven in parallel.
29		A grasping algorithm where all five fingers operate to wrap around the target object based on force

2.4 Product ID by Model

The Product ID is an identification value used to distinguish the model and specifications. Please refer to the table below for details.

Model	Product ID
DG-1F-M	0x1F02
DG-2F-M	0x2F02
DF-3F-M	0x3F02
DG-4F-M	0x4F02
DG-5F-M-Left DG-5F-M(Short Wrist)-Left	0x5F12
DG-5F-M-Right DG-5F-M(Short Wrist)-Right	0x5F22
DG-5F-S(20-DoF)-Left	0x5F14
DG-5F-S(20-DoF)-Right	0x5F24
DG-5F-S(15-DoF)-Left	0x5F34
DG-5F-S(15-DoF)-Right	0x5F44

