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Warning

All installation works must be performed by a qualified installer and must comply with applicable laws and regulations.

HD
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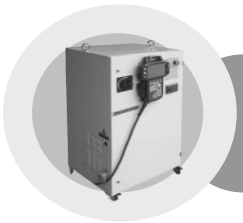
Hyundai Robot

Hi5aVSM230630FMEN3



Hi5a Controller Function Manual

Vacuum Robot Sensor Monitoring System

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1 Overview

1.1. Vacuum Robot Sensor Monitoring Function

The vacuum robot sensor monitoring function is used to monitor and control the states of the following sensors through Ethernet/IP communication: internal temperature sensor (hereinafter “temperature sensor”), cooling airflow sensor (hereinafter “flow sensor”), and glass detection sensor (hereinafter “fiber sensor”).

In this regard, there are functions to set individual sensors’ specifications and display their state information.

The quantities, upper/lower limits, and modes of the individual sensors can be indicated when setting their specifications.

Sensor state monitoring indicates the current state and abnormalities (using a color) of a sensor.

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Product Information

2.1. Components and Functions

2.1.1. Components

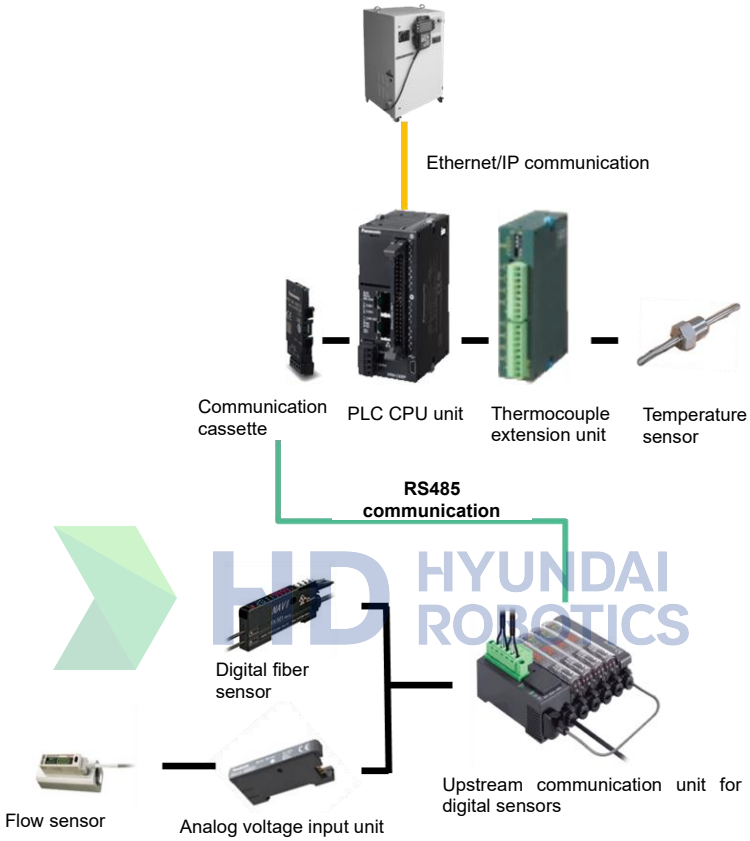

Figure 2.1 Components of Monitoring System

2.1.2. Functional Information

Table 2-1 Names and Functions of Monitoring System Components

Name	Function
PLC CPU unit	Control unit
RS485 communication cassette	Communication with the SC-GU1-485 unit
Thermocouple extension unit	Conversion of the temperature sensor data to digital values
Upstream communication unit for digital sensors	Integrated management of digital and analog units
Digital fiber sensor	Input of light measurement
Analog voltage input unit	Conversion of voltage data from the flow sensor to digital values
Flow sensor	Measurement of the cooling airflow
Temperature sensor	Measurement of the robot's internal temperature

2.2. PLC Layout

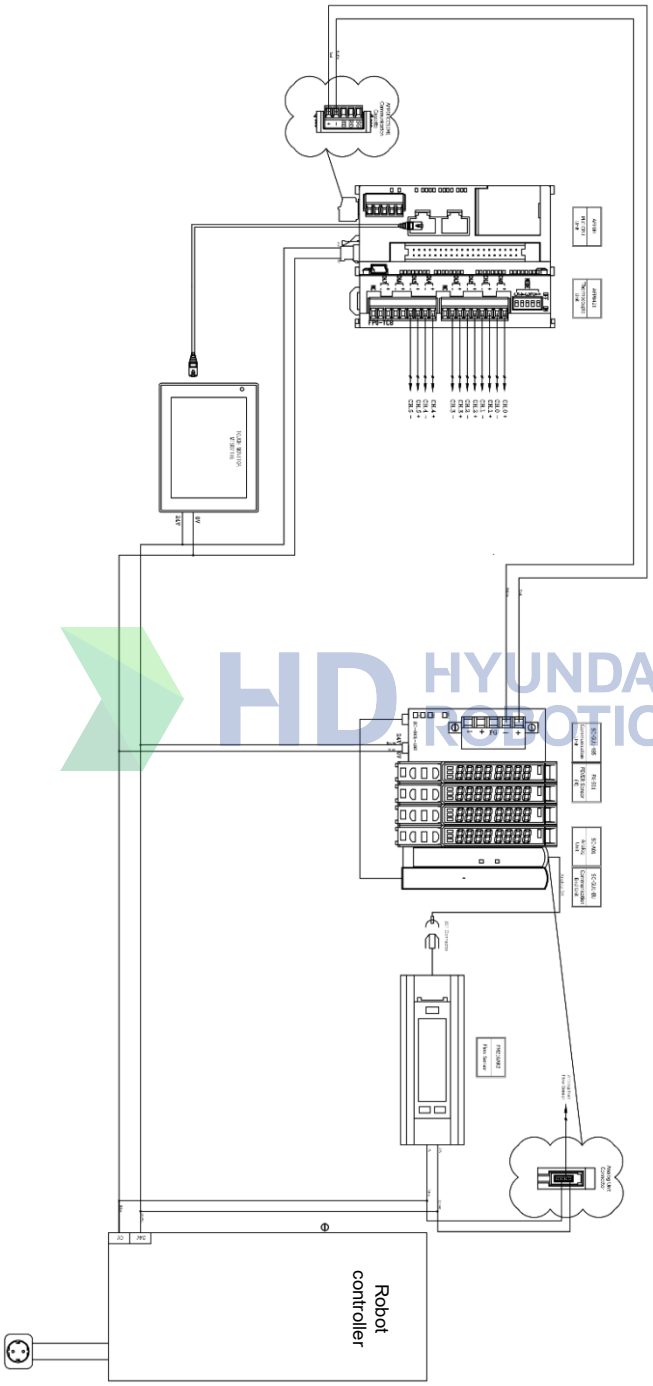

Figure 2.2 Monitoring System Layout

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How to Use

3.1. Communication Connection

- Ethernet/IP connection with the BD525 board
  (PLC: Master; BD525: Slave)
- Input/output IO size: 120-byte set

* For more details, refer to the Ethernet/IP manual.

Figure 3.1 Ethernet/IP Communication Connection Dialog

3.2. Sensor Specifications Setting

1. **Access Path**
   - Accessible only with the engineer or high mode
   - F2.System → 3: Robot Parameters → 12: System Maintenance → 4: Vacuum Robot Sensor Setting

2. **Settings Screen**

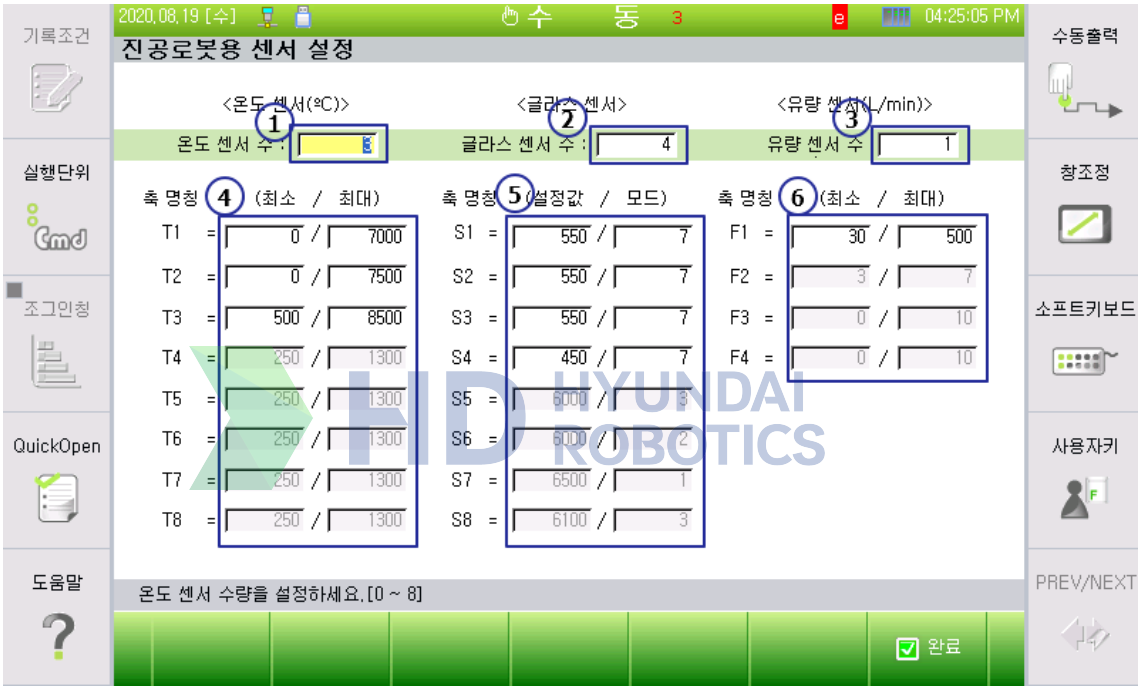

Figure 3.2 Sensor Setting Dialog

3. Descriptions and Setting Ranges of Items

① Quantity of temperature sensors

➔ Setting range: 0–8

② Quantity of fiber sensors

➔ Setting range: 0–8

③ Quantity of flow sensors

➔ Setting range: 0–4

④ Upper/lower limits of temperature sensors

- Depends on the type of temperature sensor

Table 3-1 Ranges by Types of Temperature Sensors

Type of Temperature Sensor	Temperature Range (° C)
K, J	-100° C–500° C
T	-100° C–400° C
R	0° C–1500° C

⑤ Setting range and sensing mode of fiber sensor

- Depending on sensing modes

Table 3-2 Ranges by Types of Fiber Sensors

Sensing Mode	Description	Setting Range
1	High-Speed(H-SP)	50–4,000
2	Fast (FAST)	50–4,000
3	Reduce	Not used
4	Standard (STD)	50–4,000
5	Standard Fine	Not used
6	Long (LONG)	50–8,000
7	Ultralong (U-LG)	50–9,999
8	Hyper (HYPR)	50–9,999

⑥ Upper/lower limits of flow sensors

➔ Setting range: -1,100–1,100 (l/min)

3.3. Monitoring

1. **Access Path**

   - F1.Service → 1: Monitoring → 16: System Property Data → 13: Vacuum Robot Sensor Data

2. **Settings Screen**

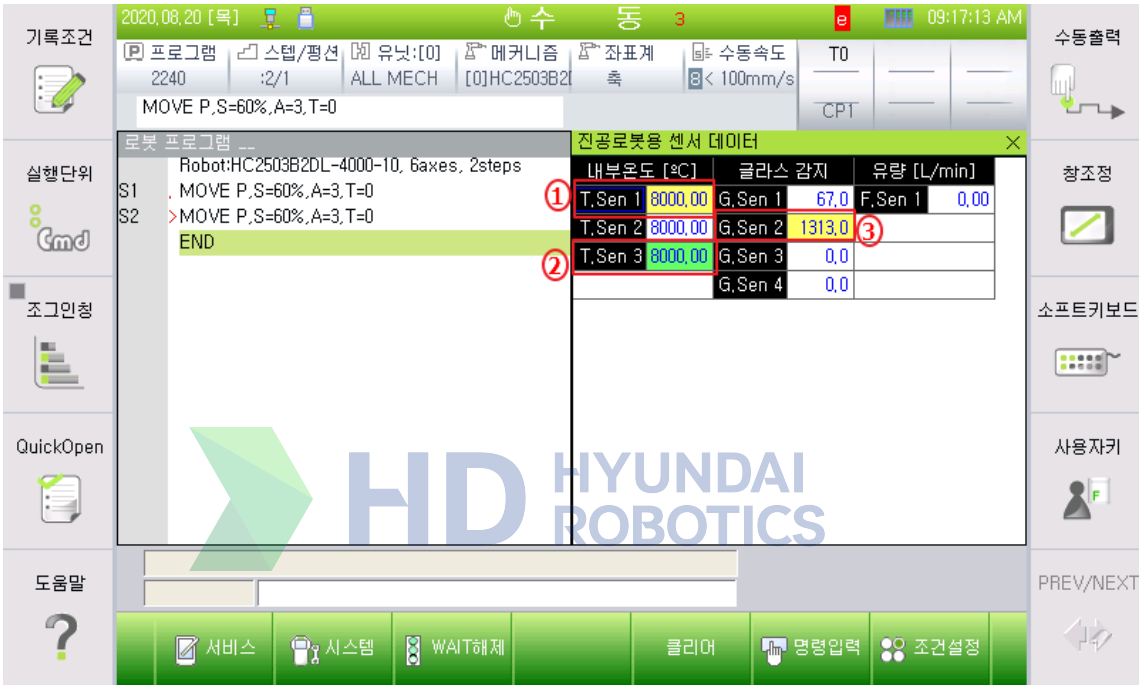

Figure 3.3 Sensor Monitoring Dialog

3. **Item Descriptions**

   ① Yellow background for an internal temperature/flow item

   ➔ A measured value is smaller than the setting value (below the reference value).

   ② Green background for an internal temperature/flow item

   ➔ A measured value is larger than the setting value (over the reference value).

   ③ Yellow background for a glass detection item

   ➔ Glass detection state

3.4. Ethernet/IP Communication Format

1. Input Area (Robot Controller to Monitor PLC; PLC → Robot Controller)

<table>
<tr><th>Classification</th><th colspan="8">Data Description</th><th rowspan="2">Remarks</th></tr>
<tr><th>Byte Address</th><th>Bit 1</th><th>Bit 2</th><th>Bit 3</th><th>Bit 4</th><th>Bit 5</th><th>Bit 6</th><th>Bit 7</th><th>Bit 8</th></tr>
<tr><td>0</td><td colspan="8" rowspan="2">To check communication</td><td rowspan="2">The value of this area is refreshed cyclically from 1 through 5.</td></tr>
<tr><td>1</td></tr>
<tr><td>2</td><td colspan="8" rowspan="2">Current value of temperature 1Ch</td><td rowspan="15">Monitoring of each channel's current temperature (in 0.1° C increments)
Ex.: “20.5° C” → “205”</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td><td colspan="8" rowspan="2">Temperature 2Ch current value display</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td><td colspan="8" rowspan="2">Temperature 3Ch current value display</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td><td colspan="8" rowspan="2">Temperature 4Ch current value display</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td><td colspan="8" rowspan="2">Temperature 5Ch current value display</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td><td colspan="8" rowspan="2">Temperature 6Ch current value display</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td><td colspan="8" rowspan="2">Temperature 7Ch current value display (reserved)</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td colspan="8" rowspan="2">Temperature 8Ch current value display (reserved)</td></tr>
<tr><td>17</td></tr>
<tr><td>18</td><td>Temperature 1Ch upper limit</td><td>Temperature 1Ch lower limit</td><td>Temperature 2Ch upper limit</td><td>Temperature 2Ch lower limit</td><td>Temperature 3Ch upper limit</td><td>Temperature 3Ch lower limit</td><td>Temperature 4Ch upper limit</td><td>Temperature 4Ch lower limit</td><td rowspan="2">Monitoring of each temperature channel's upper/lower temperature limit lamp
True: Alert ON; False: Alert OFF</td></tr>
<tr><td>19</td><td>Temperature 5Ch upper limit</td><td>Temperature 5Ch lower limit</td><td>Temperature 6Ch upper limit</td><td>Temperature 6Ch lower limit</td><td>Temperature 7Ch upper limit</td><td>Temperature 7Ch lower limit</td><td>Temperature 8Ch upper limit</td><td>Temperature 8Ch lower limit</td></tr>
</table>

<table>
<tr><td>20</td><td colspan="5" rowspan="2">Flow 1Ch current value display</td><td rowspan="4">Monitoring of each channel's current flow (in l/min)
Ex.: "100 l/min" → "100"</td></tr>
<tr><td>21</td></tr>
<tr><td>22</td><td colspan="5" rowspan="2">Flow 2Ch current value display (reserved)</td></tr>
<tr><td>23</td></tr>
<tr><td>24</td><td>Flow 1Ch upper limit</td><td>Flow 1Ch lower limit</td><td>Flow 2Ch upper limit</td><td>Flow 2Ch lower limit</td><td>Not used</td><td rowspan="2">Monitoring of each flow channel's upper/lower flow limit lamp
True: Alert ON; False: Alert OFF</td></tr>
<tr><td>25</td><td colspan="5">Not used</td></tr>
<tr><td>26</td><td colspan="5" rowspan="2">Temperature 1Ch upper limit value display</td><td rowspan="22">Monitoring of each channel's upper/lower temperature limit value with the "Byte 18–19" temperature alert lamp working (in 0.1° C increments)

Ex.: Upper limit of temperature 1Ch, "30.5° C" → "305"</td></tr>
<tr><td>27</td></tr>
<tr><td>28</td><td colspan="5" rowspan="2">Temperature 1Ch lower limit value display</td></tr>
<tr><td>29</td></tr>
<tr><td>30</td><td colspan="5" rowspan="2">Temperature 2Ch upper limit value display</td></tr>
<tr><td>31</td></tr>
<tr><td>32</td><td colspan="5" rowspan="2">Temperature 2Ch lower limit value display</td></tr>
<tr><td>33</td></tr>
<tr><td>34</td><td colspan="5" rowspan="2">Temperature 3Ch upper limit value display</td></tr>
<tr><td>35</td></tr>
<tr><td>36</td><td colspan="5" rowspan="2">Temperature 3Ch lower limit value display</td></tr>
<tr><td>37</td></tr>
<tr><td>38</td><td colspan="5" rowspan="2">Temperature 4Ch upper limit value display</td></tr>
<tr><td>39</td></tr>
<tr><td>40</td><td colspan="5" rowspan="2">Temperature 4Ch lower limit value display</td></tr>
<tr><td>41</td></tr>
<tr><td>42</td><td colspan="5" rowspan="2">Temperature 5Ch upper limit value display</td></tr>
<tr><td>43</td></tr>
<tr><td>44</td><td colspan="5" rowspan="2">Temperature 5Ch lower limit value display</td></tr>
<tr><td>45</td></tr>
<tr><td>46</td><td colspan="5">Temperature 6Ch upper limit value display</td></tr>
</table>

47		
48	Temperature 6Ch lower limit value display	
49		
50	Temperature 7Ch upper limit value display (reserved)	
51		
52	Temperature 7Ch lower limit value display (reserved)	
53		
54	Temperature 8Ch upper limit value display (reserved)	
55		
56	Temperature 8Ch lower limit value display (reserved)	
57		
58	Flow 1Ch upper limit value display	Monitoring of each channel's upper/lower flow limit value with the "Byte 28–29" flow alert lamp working (in l/min) Ex.: Upper limit value of flow 1Ch, "200 l/min" → "200"
59		
60	Flow 1Ch lower limit value display	
61		
62	Flow 2Ch upper limit value display (reserved)	
63		
64	Flow 2Ch lower limit value display (reserved)	
65		
66	Quantity of sensors installed	Displays the number of installed sensors. Ex.: 4 = 4 sensors are installed
67		

<table>
<tr><td>68</td><td>Sensor setting complete</td><td>Processing sensor setting</td><td colspan="5">Not used</td><td rowspan="2">Light input of current sensor; Mode settings are the same with the sensor settings (output area) from the robot.
Bit 1 – True: Sensor setting complete; False: Sensor setting incomplete

Bit 2 – True: Processing sensor setting (if incorrect values are written); False: Sensor setting complete</td></tr>
<tr><td>69</td><td colspan="7">Not used</td></tr>
<tr><td>70</td><td>Sensor 1Ch output L1</td><td>Sensor 2Ch output L2</td><td>Sensor 3Ch output R1</td><td>Sensor 4Ch output R2</td><td>Sensor 5Ch output</td><td>Sensor 6Ch output</td><td>Sensor 7Ch output</td><td>Sensor 8Ch output</td><td rowspan="2">Monitoring the output state of each sensor
True: Sensor output ON; False: Sensor output OFF</td></tr>
<tr><td>71</td><td colspan="8">Not used</td></tr>
<tr><td>72</td><td colspan="8" rowspan="2">Sensor 1Ch light input display (LGS1)</td><td rowspan="9">Monitoring of each sensor’s light input

Display range by sensing mode
H-SP/FAST/STD: 0–4,000; LONG: 0–</td></tr>
<tr><td>73</td></tr>
<tr><td>74</td><td colspan="8" rowspan="2">Sensor 2Ch light input display (LGS2)</td></tr>
<tr><td>75</td></tr>
<tr><td>76</td><td colspan="8" rowspan="2">Sensor 3Ch light input display (RGS1)</td></tr>
<tr><td>77</td></tr>
<tr><td>78</td><td colspan="8" rowspan="2">Sensor 4Ch light input display (RGS2)</td></tr>
<tr><td>79</td></tr>
<tr><td>80</td><td colspan="8">Sensor 5Ch light input display (reserved)</td></tr>
</table>

81		8,000; U-LG/HYPR: 0–9,999
82	Sensor 6Ch light input display (reserved)	
83		
84	Sensor 7Ch light input display (reserved)	
85		
86	Sensor 8Ch light input display (reserved)	
87		
88	Sensor 1Ch setting value display (LGS1)	Monitoring of each sensor's setting value (threshold) Display range by sensing mode H-SP/FAST/STD: 0–4,000; LONG: 0–8,000; U-LG/HYPR: 0–9,999
89		
90	Sensor 2Ch setting value display (LGS2)	
91		
92	Sensor 3Ch setting value display (RGS1)	
93		
94	Sensor 4Ch setting value display (RGS2)	
95		
96	Sensor 5Ch setting value display (reserved)	
97		
98	Sensor 6Ch setting value display (reserved)	
99		
100	Sensor 7Ch setting value display (reserved)	
101		
102	Sensor 8Ch setting value display (reserved)	
103		
104	Sensor 1Ch sensing mode display (LGS1)	Monitoring of each sensor's set sensing mode (response time) Separation value by sensing mode 1: H-SP (150 us)
105		
106	Sensor 2Ch sensing mode display (LGS2)	
107		
108	Sensor 3Ch sensing mode display (RGS1)	
109		
110	Sensor 4Ch sensing mode display (RGS2)	
111		

112 113	Sensor 5Ch sensing mode display (reserved) [Needs to extend the input area for sensor 5Ch or higher]	2: FAST (500 μs) 4: STD (5 ms) 6: LONG (50 ms) 7: U-LG (100 ms) 8: HYPR (500 ms)
114 115	Sensor 6Ch sensing mode display (reserved) [Needs to extend the input area for sensor 6Ch or higher]	
116 117	Sensor 7Ch sensing mode display (reserved) [Needs to extend the input area for sensor 7Ch or higher]	
118 119	Sensor 8Ch sensing mode display (reserved) [Needs to extend the input area for sensor 8Ch or higher]	

2. Output Area (Robot Controller to Control PLC; Robot Controller → PLC)

Classification	Data Description								Remarks
Byte Address	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 7	
0	Write flag	Not used							All-channel upper/lower temperature limit value write bit
1	Not used								
2 3	Temperature 1Ch upper limit value input								Set by inputting the upper/lower temperature limit value of each channel How to set: Input a setting value in the input area of the temperature channel, and set the write bit to “True.” Ex.: If “12.3° C” is
4 5	Temperature 1Ch lower limit value input								
6 7	Temperature 2Ch upper limit value input								
8 9	Temperature 2Ch lower limit value input								
10 11	Temperature 3Ch upper limit value input								
12 13	Temperature 3Ch lower limit value input								

14 15	Temperature 4Ch upper limit value input		set as the upper limit value of temperature 1Ch, input “12.3” in the temperature 1Ch upper limit value input (“Byte 2–3”). Then, set the all-channel upper/lower limit value write bit (“Bit 1 of Byte 0”) to “True.”
16 17	Temperature 4Ch lower limit value input		
18 19	Temperature 5Ch upper limit value input		
20 21	Temperature 5Ch lower limit value input		
22 23	Temperature 6Ch upper limit value input		
24 25	Temperature 6Ch lower limit value input		
26 27	Temperature 7Ch upper limit value input (reserved)		
28 29	Temperature 7Ch lower limit value input (reserved)		
30 31	Temperature 8Ch upper limit value input (reserved)		
32 33	Temperature 8Ch lower limit value input (reserved)		
34	Write flag	Not used	All-channel upper/lower flow limit value write bit
35	Not used		
36 37	Flow 1Ch upper limit value input		Set by inputting the upper/lower flow limit value of each channel How to set: Input a setting value in the input area of the flow channel, and set the bit 1 of the upper/lower flow limit write
38	Flow 1Ch lower limit value input		

39			bit (“Byte 34”) to “True.” Ex.: If “200 l/min” is set as the upper limit value of flow 1Ch, input “200” in the flow 1Ch upper limit value input (“Byte 36–37”). Then, set the all-channel upper flow limit value write bit (“Bit 1 of Byte 34”) to “True.”
40	Flow 2Ch upper limit value input (reserved)		
41			
42	Flow 2Ch lower limit value input (reserved)		
43			
44	(Reserved)		
45			
46	(Reserved)		
47			
48	(Reserved)		
49			
50	(Reserved)		
51			
52	Write flag	Not used	Setting value (threshold) for all sensors; sensing mode write bit
53	Not used		
54	Sensor 1Ch setting value input (LGS1)		Set by inputting the setting value (threshold) of each sensor How to set: Input a setting value in the input area of the
55			
56	Sensor 2Ch setting value input (LGS2)		

57		sensor channel, and set the bit 1 of the setting value write bit (“Byte 52”) to “True.” Ex.: If the 1Ch (LGS1) setting value is set to “1234,” input “1234” in the sensor 1Ch setting value input (“Byte 54–55”). Then, set the all-sensor setting value write bit (“Bit 1 of Byte 52”) to “True.” Input range by sensing mode H-SP/FAST/STD: 0–4,000; LONG: 0–8,000; U-LG/HYPR: 0–9,999
58	Sensor 3Ch setting value input (RGS1)	
59		
60	Sensor 4Ch setting value input (RGS2)	
61		
62	Sensor 5Ch setting value input (reserved)	
63		
64	Sensor 6Ch setting value input (reserved)	
65		
66	Sensor 7Ch setting value input (reserved)	
67		
68	Sensor 8Ch setting value input (reserved)	
69		
70	(Reserved)	
71		
72	Sensor 1Ch sensing mode input (LGS1)	Set by inputting the sensing mode of

73		each sensor How to set: Input a setting value in the input area of the sensor channel, and set the bit 1 of the sensing mode write bit (“Byte 52”) to “True.” Input value of sensing mode 1: H-SP; 2: FAST; 4: STD; 6: LONG; 7: U-LG; 8: HYPR Ex.: If the sensor 1Ch (LGS1) sensing mode is set to “H-SP,” input “1” in the sensor 1Ch sensing mode input (“Byte 72–73”). Then, set the all-channel sensing mode write bit (“Bit 1 of Byte 52”) to “True.”
74 75	Sensor 2Ch sensing mode input (LGS2)	
76 77	Sensor 3Ch sensing mode input (RGS1)	
78 79	Sensor 4Ch sensing mode input (RGS2)	
80 81	Sensor 5Ch sensing mode input (reserved)	
82 83	Sensor 6Ch sensing mode input (reserved)	
84 85	Sensor 7Ch sensing mode input (reserved)	
86 87	Sensor 8Ch sensing mode input (reserved)	
88	(Reserved)	

89		
90 91	Quantity of temperature sensors installed	Input the quantity of installed temperature sensors Ex.: 3 channels used → “3”
From 92 To 119	(Reserved)	Available area in future update

4 Errors and Warnings

4.1. Error Messages

■ **Code:** E21031

■ **Description:** A measured value from the vacuum robot temperature sensor is smaller than the reference value.

■ **Cause:** The measured temperature value from the vacuum robot temperature sensor is smaller than the min. setting value.

■ **Action:** Check the setting in the vacuum robot sensor setting dialog, and fix any issues.

■ **Code:** E21032

■ **Description:** A measured value from the vacuum robot temperature sensor is larger than the reference value.

■ **Cause:** The measured temperature value from the vacuum robot temperature sensor is larger than the max. setting value.

■ **Action:** Check the setting in the vacuum robot sensor setting dialog, and fix any issues.

■ **Code:** E21033

■ **Description:** A measured value from the vacuum robot flow sensor is smaller than the reference value.

■ **Cause:** The measured flow value from the vacuum robot flow sensor is smaller than the min. setting value.

■ **Action:** Check the setting in the vacuum robot sensor setting dialog, and fix any issues.

■ **Code:** E21034

■ **Description:** A measured value from the vacuum robot flow sensor is larger than the reference value.

■ **Cause:** The measured flow value from the vacuum robot flow sensor is larger than the max. setting value.

■ **Action:** Check the setting in the vacuum robot sensor setting dialog, and fix any issues.

■ **Code:** E21036

■ **Description:** The number of flow sensors for the vacuum robot does not match.

■ **Cause:** The number of flow sensors recognized for the vacuum robot does not match with the number of sensors set for the vacuum robot.

■ **Action:** 1) Check whether the number of flow sensors is normal in the sensor setting dialog box for a vacuum robot, and take corrective action if any abnormality is found.

2) Check whether there is a flow sensor disconnected.

■ **Code:** E21037

■ **Description:** The number of fiber sensors for the vacuum robot does not match.

■ **Cause:** The number of fiber sensors recognized for the vacuum robot does not match with the number of sensors set for the vacuum robot..

■ **Action:** 1) Check whether the number of fiber sensors is normal in the sensor setting dialog box for the vacuum robot, and take corrective action if any abnormality is found.

2) Check whether there is a fiber sensor disconnected.

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