1. OUTLINE

Features of Z-1151:
- Autotuning (AT) can be conducted for Cascade control.
- Ramp/Soak stabilizer (RSS) function is added.
- The following parameters are added for Autotuning (AT):
  - Input 1_AT differential gap (\( I_1 \cdot \hat{\Gamma}_{PH} \))/Input 2_AT differential gap (\( I_2 \cdot \hat{\Gamma}_{PH} \))
  - Input 1_proportional band adjusting factor (\( I_1 \cdot \hat{PR}_{J} \))/Input 2_proportional band adjusting factor (\( I_2 \cdot \hat{PR}_{J} \))
  - Input 1_integral time adjusting factor (\( I_1 \cdot \hat{RU}_{J} \))/Input 2_integral time adjusting factor (\( I_2 \cdot \hat{RU}_{J} \))
  - Input 1_derivative time adjusting factor (\( I_1 \cdot \hat{dRU}_{J} \))/Input 2_derivative time adjusting factor (\( I_2 \cdot \hat{dRU}_{J} \))
- Data range and factory set value is changed for Input 1_AT differential gap time (\( I_1 \cdot \hat{RF}_{H} \)) and Input 2_AT differential gap time (\( I_2 \cdot \hat{RF}_{H} \)).
- DeviceNet communication, PROFIBUS communication, CC-Link communication and Infrared communication cannot be used for Communication function.

2. MODEL CODE

Z-1151 is added to end of model codes. In addition, specification of Communication 2 is different between Z-1151 specification and Standard specifications. Infrared function cannot be selected.

High-speed AT type:

\[
\begin{array}{c}
\text{HA400} \\
\text{HA900} \\
\hline
\text{□ □ ♦ □ * □ ♦ ♦ ♦ ♦ ♦} \\
\text{(1) (2) (3) (4) (5) (6) (7) (8) (9)(10)(11) (12) (13) (14)} \\
\end{array}
\]

(11) Communication 2 (optional)
N: None
1: RS-232C (RKC communication)
4: RS-422A (RKC communication)
5: RS-485 (RKC communication)
6: RS-485 (Modbus)
7: RS-422A (Modbus)
8: RS-232C (Modbus)

(14) Instrument version
YN: Version symbol (Without Infrared function)
3. DESCRIPTION OF THE RAMP/SOAK STABILIZER (RSS) FUNCTION

Overshoot occurring during the transition from ramp segment to soak segment can be suppressed by Ramp/Soak stabilizer (RSS) function.

When setting a smaller value to Ramp/Soak stabilizer (RSS)

- PV when RSS is OFF.
- PV when a smaller value is set to RSS

When setting 0.5 to Ramp/Soak stabilizer (RSS)

- PV when RSS is OFF.
- Set value (SV)
- PV when RSS is set to 0.5

When setting a larger value to Ramp/Soak stabilizer (RSS)

- PV when RSS is OFF.
- Set value (SV)
- PV when a larger value is set to RSS

To achieve better follow-up, activate Ramp/Soak stabilizer (RSS) and set the Control response parameter to “Fast.”

PV when RSS is set to 0.5

- PV when Control response parameter is set to “Fast”
- Set value (SV)
- PV when Control response parameter is set to “Medium”
- PV when Control response parameter is set to “Slow”

Condition of action:
- Intensity factor of Ramp/Soak stabilizer is set to larger value of “0.1.”
- Ramp state and Soak state is set by Setting change rate limiter function (or Link function).
- PI or PID control is used. (Excluding the Position proportioning PID control)
- Auto mode is selected and the operation is in RUN state.

When the following setting is set to Input 2_use selection (E95), RSS function may not be operative:
- Remote input: RSS function is not operative for Input 1 side.
- Cascade control: RSS function is not operative for Input 2 (slave) side.
4. DESCRIPTION OF THE PARAMETER

4.1 Additional Parameters

The following parameters are added for Z-1151 specification:

- Input 1: intensity factor of Ramp/Soak stabilizer ($I_{r55}$)
- Input 1: AT differential gap ($I_{rPPh}$)
- Input 1: proportional band adjusting factor ($I_{PAJ}$)
- Input 1: integral time adjusting factor ($I_{IAJ}$)
- Input 1: derivative time adjusting factor ($I_{DAJ}$)
- Input 2: intensity factor of Ramp/Soak stabilizer ($2. r55$)
- Input 2: AT differential gap ($2. rPPh$)
- Input 2: proportional band adjusting factor ($2. PAJ$)
- Input 2: integral time adjusting factor ($2. IAJ$)
- Input 2: derivative time adjusting factor ($2. DAJ$)

4.2 Description of Each Parameters

- **Intensity factor of Ramp/Soak stabilizer** ($I_{r55}, 2. r55$) [Engineering mode F51, F52]
  
  Set Intensity factor of Ramp/Soak stabilizer. Input 1 and Input 2 can be set individually.
  
  **Data range:**
  - Temperature input: 0.0 to 1.0 (0.0: Unused)
  
  **Factory set value:**
  - Input 1: intensity factor of Ramp/Soak stabilizer ($I_{r55}$): 0.5
  - Input 2: intensity factor of Ramp/Soak stabilizer ($2. r55$): 0.5

- **AT differential gap** ($I_{rPPh}, 2. rPPh$) [Engineering mode F53, F54]
  
  Use to set an ON/OFF action differential gap for Autotuning (AT). This function prevents the AT function from malfunctioning caused by noise.
  
  **Data range:**
  - Temperature input: 0 (0.0) to 100 (100.0) °C [°F]
  - Voltage/Current input: 0.0 to 10.0 % of Input span
  
  **Factory set value:**
  - Input 1: AT differential gap ($I_{rPPh}$): Temperature input: 1.0
  - Voltage/Current input: 0.1 of Input span
  - Input 2: AT differential gap ($2. rPPh$): Temperature input: 1.0
  - Voltage/Current input: 0.1 of Input span

  - **Do not use “AT differential gap” and “AT differential gap time” at the same time.**

  **Functional description:**
  
  Output may chatter due to the fluctuation of the Measured value (PV) caused by noise during Autotuning (AT). The differential gap of AT differential gap prevents the output from chattering during Autotuning (AT).

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![Diagram](attachment:Diagram.png)

*Example of action when setting AT differential gap to 1 °C (factory set value)*
■ Proportional band adjusting factor (1. PRJ, 2. PRJ) [Engineering mode F53, F54]

This is a factor which is multiplied by the Proportional band computed by executing the Autotuning (AT) function. Input 1 and Input 2 can be set individually.

Data range: 0.01 to 10.00 times

Factory set value: Input 1_proportional band adjusting factor (1. PRJ): 1.00
Input 2_proportional band adjusting factor (2. PRJ): 1.00

■ Integral time adjusting factor (1. IAJ, 2. IAJ) [Engineering mode F53, F54]

This is a factor which is multiplied by the Integral time computed by executing the Autotuning (AT) function. Input 1 and Input 2 can be set individually.

Data range: 0.01 to 10.00 times

Factory set value: Input 1_integral time adjusting factor (1. IAJ): 1.00
Input 2_integral time adjusting factor (2. IAJ): 1.00

■ Derivative time adjusting factor (1. DAJ, 2. DAJ) [Engineering mode F53, F54]

This is a factor which is multiplied by the Derivative time computed by executing the Autotuning (AT) function. Input 1 and Input 2 can be set individually.

Data range: 0.01 to 10.00 times

Factory set value: Input 1_derivative time adjusting factor (1. DAJ): 1.00
Input 1_derivative time adjusting factor (2. DAJ): 1.00

4.3 Parameter with Specific Data Range

Data range and Factory set value of the parameter below is changed.

■ AT differential gap time (1. ATH, 2. ATH) [Engineering mode F53, F54]

Use to set an ON/OFF action differential gap time for Autotuning (AT). This function prevents the AT function from malfunctioning caused by noise.

Data range: 0.00 to 100.00 seconds

Factory set value: Input 1_AT differential gap time (1. ATH): 0.00
Input 2_AT differential gap time (2. ATH): 0.00

⚠️ Do not use “AT differential gap time” and “AT differential gap” at the same time.
5. KEY OPERATION FOR Z-1151 SPECIFICATION

Set parameters related to Z-1151 in the Engineering mode.

![WARNING]

Parameters in the Engineering mode should be set according to the application before setting any parameter related to operation. Once the Parameters in the Engineering mode are set correctly, no further changes need to be made to parameters for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. RKC will not bear any responsibility for malfunction or failure as a result of improper changes in the Engineering mode.

- Parameters in Engineering mode are settable only when the controller is in STOP mode.
- All parameters of the engineering mode are displayed regardless of the instrument specification.
- This instrument returns to the PV1/SV1 monitor screen if no key operation is performed within 1 minute.

### Input 1_intensity factor of Ramp/Soak stabilizer (1_rSS)

Input 1_intensity factor of Ramp/Soak stabilizer (1_rSS) is added after Input 1_power feed forward gain (1_PFFS) at the Function block F51.

**SV setting & Monitor mode, Parameter setting mode, or Setup setting mode**

- Press the shift key for 2 seconds while pressing the SET key.

**Engineering mode**
**Function block F10**

**F 10.**

- Press the DOWN key until F51 is displayed.

**Engineering mode**
**Function block F51**

- Input 1_control action type selection
- Input 1_integral/derivative decimal point position
- Input 1_derivative gain
- Input 1_ON/OFF action differential gap (upper)
- Input 1_ON/OFF action differential gap (lower)
- Input 1_action at input error (high)
- Input 1_action at input error (low)
- Input 1_manipulated output value at input error
- Input 1_output change rate limiter (up)
- Input 1_output change rate limiter (down)
- Input 1_output limiter high
- Input 1_output limiter low
- Input 1_power feed forward selection
- Input 1_power feed forward gain
- Input 1_intensity factor of Ramp/Soak stabilizer

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IMR01N27-E1 5
### Input 2_intensity factor of Ramp/Soak stabilizer (2. r55)

Input 2_intensity factor of Ramp/Soak stabilizer (2. r55) is added after Input 2_power feed forward gain (2. PFF5) at the Function block F52.

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**SV setting & Monitor mode, Parameter setting mode, or Setup setting mode**

1. Press the shift key for 2 seconds while pressing the SET key.
2. Press the DOWN key until F52 is displayed.

#### Engineering mode
- Function block F10

#### Input 2_control action type selection
- SET key

#### Input 2_integral/derivative decimal point position
- SET key

#### Input 2_derivative gain
- SET key

#### Input 2_ON/OFF action differential gap (upper)
- SET key

#### Input 2_ON/OFF action differential gap (lower)
- SET key

#### Input 2_action at input error (high)
- SET key

#### Input 2_action at input error (low)
- SET key

#### Input 2_manipulated output value at input error
- SET key

#### Input 2_output change rate limiter (up)
- SET key

#### Input 2_output change rate limiter (down)
- SET key

#### Input 2_output limiter high
- SET key

#### Input 2_output limiter low
- SET key

#### Input 2_power feed forward selection
- SET key

#### Input 2_power feed forward gain
- SET key

#### Input 2_intensity factor of Ramp/Soak stabilizer
- SET key
- Input 1_AT differential gap (1.8PH), Input 1_proportional band adjusting factor (1.8AJ), Input 1_integral time adjusting factor (1.8IJ) and Input 1_derivative time adjusting factor (1.8dAJ)

Setting display of each parameter above is added after Input 1_AT differential gap time (1.8PH) at Function block F53.

SV setting & Monitor mode, Parameter setting mode, or Setup setting mode

Press the shift key for 2 seconds while pressing the SET key.

Engineering mode
Function block F10

Press the DOWN key until F53 is displayed.

Input 1_AT bias
 SET key

Input 1_AT cycle
 SET key

Input 1_AT differential gap time
 SET key

Input 1_AT differential gap
 SET key

Input 1_proportional band adjusting factor
 SET key

Input 1_integral time adjusting factor
 SET key

Input 1_derivative time adjusting factor
 SET key

- Input 2_AT differential gap (2.8PH), Input 2_proportional band adjusting factor (2.8AJ), Input 2_integral time adjusting factor (2.8IJ) and Input 1_derivative time adjusting factor (2.8dAJ)

Setting display of each parameter above is added after Input 2_AT differential gap time (2.8PH) at Function block F54.

SV setting & Monitor mode, Parameter setting mode, or Setup setting mode

Press the shift key for 2 seconds while pressing the SET key.

Engineering mode
Function block F10

Press the DOWN key until F54 is displayed.

Input 2_AT bias
 SET key

Input 2_AT cycle
 SET key

Input 2_AT differential gap time
 SET key

Input 2_AT differential gap
 SET key

Input 2_proportional band adjusting factor
 SET key

Input 2_integral time adjusting factor
 SET key

Input 1_derivative time adjusting factor
 SET key
6. AUTOTUNING (AT) AT CASCADE CONTROL

For HA400/900 standard version, PID values cannot be computed by Autotuning (AT) for either Input 1 or Input 2 when selecting “2: Cascade control (Slave)” at Input 2_use selection (CAM).

When specifying Z-1151 specification, Autotuning (AT) can be conducted for Cascade control and Autotuning (AT) is operative for both Input 1 and Input 2.

- For Autotuning (AT), refer to HA400/HA900/HA401/HA901 Operation Manual (IMR01N02-E).

### Operation for Autotuning (AT)

#### To conduct Autotuning (AT) for Input 1

1. **SV setting & Monitor mode Input 1_PV1/SV1 monitor**
   - Press the R/S key to switch to RUN mode.

2. **SV setting & Monitor mode Input 1_PV1/SV1 monitor**
   - Press and hold the shift key for 1 second.
   - Operation mode PID/AT transfer 1
   - Press the UP key to turn ON AT.

   - **AT lamp will go out when AT is completed.**

3. **SV setting & Monitor mode Input 1_PV1/SV1 monitor**
   - This instrument returns to the SV setting & Monitor mode if no key operation is performed within 1 minute.

4. **Operation mode PID/AT transfer 1**
   - AT lamp flashes when AT starts.

#### To conduct Autotuning (AT) for Input 2

1. **SV setting & Monitor mode Input 1_PV1/SV1 monitor**
   - Press the R/S key to switch to RUN mode.

2. **SV setting & Monitor mode Input 1_PV1/SV1 monitor**
   - Press and hold the shift key for 1 second.
   - Operation mode PID/AT transfer 1
   - Press the shift key and display PID/AT transfer 2.

3. **Operation mode PID/AT transfer 2**
   - AT lamp flashes when AT starts.

4. **SV setting & Monitor mode Input 1_PV1/SV1 monitor**
   - This instrument returns to the SV setting & Monitor mode if no key operation is performed within 1 minute.

5. **Operation mode PID/AT transfer 2**
   - Press the UP key to turn ON AT.
   - AT lamp flashes when AT starts.

6. **SV setting & Monitor mode Input 1_PV1/SV1 monitor**
   - AT lamp will go out when AT is completed.

For 2-input specification, both Input 1 and 2 are in Run state or Stop state when pressing the R/S key. RUN/STOP cannot be switched for each input.
7. COMMUNICATION DATA

7.1 RKC Communication

The communication data related to Autotuning (AT) is added. As the data is added after the NZ identifier, polling/selecting by ACK (Acknowledgment) is available. Additionally, confirm the communication data with changed setting ranges. Data is in 7 digits.

For details of communication protocol, refer to the HA400/HA900/HA401/HA901 Communication Instruction Manual (IMR01N03-E†).

Communication Item List

- Additional communication data

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Identifier</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>233</td>
<td>Input 1_proportional band adjusting factor</td>
<td>JC</td>
<td>R/W*</td>
<td>0.01 to 10.00 times</td>
<td>1.00</td>
</tr>
<tr>
<td>234</td>
<td>Input 1_integral time adjusting factor</td>
<td>JD</td>
<td>R/W*</td>
<td>0.01 to 10.00 times</td>
<td>1.00</td>
</tr>
<tr>
<td>235</td>
<td>Input 1_derivative time adjusting factor</td>
<td>JE</td>
<td>R/W*</td>
<td>0.01 to 10.00 times</td>
<td>1.00</td>
</tr>
<tr>
<td>236</td>
<td>Input 2_proportional band adjusting factor</td>
<td>JF</td>
<td>R/W*</td>
<td>0.01 to 10.00 times</td>
<td>1.00</td>
</tr>
<tr>
<td>237</td>
<td>Input 2_integral time adjusting factor</td>
<td>JG</td>
<td>R/W*</td>
<td>0.01 to 10.00 times</td>
<td>1.00</td>
</tr>
<tr>
<td>238</td>
<td>Input 2_derivative time adjusting factor</td>
<td>JH</td>
<td>R/W*</td>
<td>0.01 to 10.00 times</td>
<td>1.00</td>
</tr>
<tr>
<td>239</td>
<td>Input 1_intensity factor of Ramp/Soak stabilizer</td>
<td>CC</td>
<td>R/W*</td>
<td>0.0 to 1.0 (0.0: Unused)</td>
<td>0.5</td>
</tr>
<tr>
<td>240</td>
<td>Input 2_intensity factor of Ramp/Soak stabilizer</td>
<td>CD</td>
<td>R/W*</td>
<td>0.0 to 1.0 (0.0: Unused)</td>
<td>0.5</td>
</tr>
<tr>
<td>241</td>
<td>Input 1_AT differential gap</td>
<td>GU</td>
<td>R/W*</td>
<td>Temperature input: 0 (0.0) to 100 (100.0) °C [°F] Voltage/Current input: 0.0 to 10.0 % of Input span</td>
<td>Temperature input: 1.0 Voltage/Current input: 0.1 of Input span</td>
</tr>
<tr>
<td>242</td>
<td>Input 2_AT differential gap</td>
<td>GV</td>
<td>R/W*</td>
<td>Temperature input: 0 (0.0) to 100 (100.0) °C [°F] Voltage/Current input: 0.0 to 10.0 % of Input span</td>
<td>Temperature input: 1.0 Voltage/Current input: 0.1 of Input span</td>
</tr>
</tbody>
</table>

* The attribute for the communication data is RO (Read only) when the instrument is in RUN state.

Parameter with specific data range

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Identifier</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>185</td>
<td>Input 1_AT differential gap time</td>
<td>GH</td>
<td>R/W*</td>
<td>0.00 to 100.0 seconds</td>
<td>0.00</td>
</tr>
<tr>
<td>188</td>
<td>Input 2_AT differential gap time</td>
<td>GG</td>
<td>R/W*</td>
<td>0.00 to 100.0 seconds</td>
<td>0.00</td>
</tr>
</tbody>
</table>

* The attribute for the communication data is RO (Read only) when the instrument is in RUN state.
## 7.2 Modbus Communication

The communication data related to Autotuning (AT) is added. Additionally, confirm the communication data with changed setting ranges.

For details of communication protocol, refer to the HA400/HA900/HA401/HA901 Communication Instruction Manual (IMR01N03-E).

### Data Map List

- Additional communication data

<table>
<thead>
<tr>
<th>Name</th>
<th>Register address</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hexadecimal</td>
<td>Decimal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low-order</td>
<td>High-order</td>
<td>Low-order</td>
<td>High-order</td>
</tr>
<tr>
<td>Input 1_proportional band adjusting factor</td>
<td>0326</td>
<td>0327</td>
<td>806</td>
<td>807</td>
</tr>
<tr>
<td>Input 1_integral time adjusting factor</td>
<td>0328</td>
<td>0329</td>
<td>808</td>
<td>809</td>
</tr>
<tr>
<td>Input 1_derivative time adjusting factor</td>
<td>032A</td>
<td>032B</td>
<td>810</td>
<td>811</td>
</tr>
<tr>
<td>Input 2_proportional band adjusting factor</td>
<td>032C</td>
<td>032D</td>
<td>812</td>
<td>813</td>
</tr>
<tr>
<td>Input 2_integral time adjusting factor</td>
<td>032E</td>
<td>032F</td>
<td>814</td>
<td>815</td>
</tr>
<tr>
<td>Input 2_derivative time adjusting factor</td>
<td>0330</td>
<td>0331</td>
<td>816</td>
<td>817</td>
</tr>
<tr>
<td>Input 1_intensity factor of Ramp/Soak stabilizer</td>
<td>0332</td>
<td>0333</td>
<td>818</td>
<td>819</td>
</tr>
<tr>
<td>Input 2_intensity factor of Ramp/Soak stabilizer</td>
<td>0334</td>
<td>0335</td>
<td>820</td>
<td>821</td>
</tr>
<tr>
<td>Input 1_AT differential gap</td>
<td>0336</td>
<td>0337</td>
<td>822</td>
<td>823</td>
</tr>
<tr>
<td>Input 2_AT differential gap</td>
<td>0338</td>
<td>0339</td>
<td>824</td>
<td>825</td>
</tr>
</tbody>
</table>

* The attribute for the communication data is RO (Read only) when the instrument is in RUN state.

### Parameter with specific data range

<table>
<thead>
<tr>
<th>Name</th>
<th>Register address</th>
<th>Attribute</th>
<th>Data range</th>
<th>Factory set value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hexadecimal</td>
<td>Decimal</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Low-order</td>
<td>High-order</td>
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<td>High-order</td>
</tr>
<tr>
<td>Input 1_AT differential gap time</td>
<td>02C6</td>
<td>02C7</td>
<td>710</td>
<td>711</td>
</tr>
<tr>
<td>Input 2_AT differential gap time</td>
<td>02CC</td>
<td>02CD</td>
<td>716</td>
<td>717</td>
</tr>
</tbody>
</table>

* The attribute for the communication data is RO (Read only) when the instrument is in RUN state.