

# mitsubishi

Mitsubishi AC Servo  
MDS-A-SVJ Series

## Servo Parameter Manual

BNP-B3882B-ENG

This manual pertains to the following system:

MDS-A-SVJ Series

BND-511W000-C1

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## 1. Introduction

This manual describes servo parameters and alarms pertaining to the MDS-A-SVJ Series. Any parameter not covered in this manual must be set to zero. Any parameters added, changed, or deleted due to software revisions are marked accordingly in this manual.

The following documents are also provided for reference and should be used in conjunction with this manual:

|                                         |           |
|-----------------------------------------|-----------|
| Mitsubishi Personal Machine Controller  |           |
| Servo Selection Manual                  | BNP-B3783 |
| Mitsubishi Personal Machine Controller  |           |
| Servo Maintenance and Adjustment Manual | BNP-B2057 |

## 2. Functions and Related Parameters

By software (hereafter abbreviated to "S/W") version, functions have been added or revised as shown below.

| S/W version | Date of revision | Addition/revision                                                                                           | Related parameter |       |       |
|-------------|------------------|-------------------------------------------------------------------------------------------------------------|-------------------|-------|-------|
| AO          | '93-12-27        | New                                                                                                         |                   |       |       |
| BO          | '94- 4-11        | Absolute position control enabled                                                                           | SVo17             |       |       |
|             |                  | Made compatible with HA93N-E30-, HA-FH**-Y-, and HA-ME-series motors                                        | SV019             | SV020 | SV025 |
|             |                  | HA**N-E33- and HA**N-A33- series (high-speed serial detector-type) added                                    | SV025             |       |       |
|             |                  | New overload detection method utilized. Servo monitor overload display now shows current actual load level. | SVo21             | SVo22 |       |
|             |                  | Alarm 1F detection added                                                                                    |                   |       |       |
| B1          | '94- 7-11        | D/A output amplification rate settings changed                                                              | SV063             |       |       |
|             |                  | Alarm 28 (absolute position overspeed) detection deleted                                                    |                   |       |       |
| B2          | '94-10-24        | Regeneration resistors (MR-RB064, MR-RB34) added                                                            | SV036             |       |       |
| B3          | '94-12-12        | Made compatible with 100V units. 100V and 200V units operable using same S/W.                               |                   |       |       |
|             |                  | Regeneration resistors (MR-RB063, MR-RB064, two series) added                                               | SV036             |       |       |
|             |                  | Alarm 10 (insufficient amp voltage) added                                                                   |                   |       |       |
| B4          | '95- 2-27        | HA**N-E33 and HA**N-E30 parameters made common                                                              | SV025             |       |       |
| co          | '95- 6-23        | Acceleration feedforward control added                                                                      | SV015             |       |       |
|             |                  | Induced voltage correction added (compatible with HA**N motors only)                                        | SVo47             |       |       |
|             |                  | Emergency-stop ready maintenance control (thrust axis drop prevention control) added                        | SV048             |       |       |
| C1          | '95- 7-26        | None                                                                                                        |                   |       |       |

### 3, Servo Parameters

Servo parameter settings and display methods differ according to the controller used. For details, please refer to the relevant instruction manual.

| Name  | Abbreviation | Description                                 | Setting screen | Type of change | Setting unit          | Minimum value | Maximum value | Type                  |                     |            |
|-------|--------------|---------------------------------------------|----------------|----------------|-----------------------|---------------|---------------|-----------------------|---------------------|------------|
|       |              |                                             |                |                |                       |               |               | Machine configuration | Servo configuration | Adjustment |
| SV001 | PC1          | Motor-side gear ratio                       | Configuration  | Initial        |                       | 1             | 32767         | ○                     |                     |            |
| SV002 | PC2          | Machine-side gear ratio                     | Configuration  | Initial        |                       | 1             | 32767         | ○                     |                     |            |
| SV003 | PGN1         | Position loop gain 1                        | Configuration  |                | 1/Sec                 | 1             | 200           |                       | ○                   |            |
| SV004 | PGN2         | Position loop gain 2                        | Adjustment     |                | 1/Sec                 | 0             | 999           |                       |                     | ○          |
| SV005 | VGN1         | Velocity loop gain 1                        | Adjustment     |                |                       | 1             | 999           |                       |                     | ○          |
| SV006 |              |                                             |                |                |                       |               |               |                       |                     |            |
| SV007 |              |                                             |                |                |                       |               |               |                       |                     |            |
| SV008 | VIA          | Speed loop lead compensation                | Adjustment     |                |                       | 1             | 9999          |                       |                     | ○          |
| SV009 | IQA          | Current loop q-axis lead compensation       |                |                |                       | 1             | 20480         |                       | ○                   |            |
| SV010 | IDA          | Current loop d-axis lead compensation       |                |                |                       | 1             | 20480         |                       | ○                   |            |
| SV011 | IQG          | Current loop q-axis gain                    |                |                |                       | 1             | 2560          |                       | ○                   |            |
| SV012 | IDG          | Current loop d-axis gain                    |                |                |                       | 1             | 2560          |                       | ○                   |            |
| SV013 | ILMT         | Current limit                               |                |                | % of rated current    | 0             | 999           |                       |                     | ○          |
| SV014 | ILMTsp       | Special operation current limit             |                |                | % of rated current    | 0             | 999           |                       |                     | ○          |
| SV015 | FFC          | Acceleration feedforward gain               | Adjustment     |                | %                     | 0             | 999           |                       |                     | ○          |
| SV016 | LMC1         | Lost motion correction 1                    | Adjustment     |                | %, % of rated current | -1            | 200           |                       |                     | ○          |
| SV017 | SPEC         | Servo configuration                         | Configuration  | Initial        | HEX setting           | *             | *             | ○                     | ○                   |            |
| SV018 | PIT          | Ball screw lead                             | Configuration  | Initial        | mm                    | 1             | 32767         | ○                     |                     |            |
| SV019 | RNG1         | Position detector resolution                | Configuration  | Initial        | kp/rev                | 1             | 9999          |                       | ○                   |            |
| SV020 | RNG2         | Speed detector resolution                   | Configuration  | Initial        | kp/rev                | 1             | 9999          |                       | ○                   |            |
| SV021 | OLT          | Overload detection time constant            |                |                | sec                   | 1             | 80            |                       | ○                   |            |
| SV022 | OLL          | Overload detection level                    |                |                | % of rated current    | 32            | 180           |                       | ○                   |            |
| SV023 | OD1          | Servo ON * excessive error detection range  |                |                | mm                    | 0             | 32767         | ○                     |                     |            |
| SV024 | INP          | In-position detection range                 |                |                | μm                    | 0             | 32767         | ○                     |                     |            |
| SV025 | MTYP         | Motor/detector type                         | Configuration  | Initial        | HEX setting           | *             | *             |                       | ○                   |            |
| SV026 | OD2          | Servo OFF * excessive error detection range |                |                | mm                    | 0             | 32767         | ○                     |                     |            |
| SV027 | SSF1         | Special servo function selection 1          | Configuration  |                | HEX setting           | *             | *             |                       |                     | ○          |

| Name  | Abbreviation | Description                                              | Setting screen | Type of change | Setting unit          | Minimum value | Maximum value | Type                  |                     | Adjustment |
|-------|--------------|----------------------------------------------------------|----------------|----------------|-----------------------|---------------|---------------|-----------------------|---------------------|------------|
|       |              |                                                          |                |                |                       |               |               | Machine configuration | Servo configuration |            |
| SV028 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV029 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV030 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV031 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV032 | TOF          | Torque offset                                            | Adjustment     |                | % of rated current    | -100          | 100           |                       |                     | ○          |
| SV033 | SSF2         | Special servo function selection 2                       | Configuration  |                | HEX setting           | *             | *             |                       | ○                   |            |
| SV034 | SSF3         | Special servo function selection 3                       |                | Initial        | HEX setting           | *             | *             |                       | ○                   |            |
| SV035 | SSF4         | Special servo function selection 4                       |                |                | HEX setting           | *             | *             |                       | ○                   |            |
| SV036 | PTYP         | Regeneration resistor type                               | Configuration  | Initial        | HEX setting           | *             | *             |                       | ○                   |            |
| SV037 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV038 | FHz          | Mechanical resonance suppression filter centre frequency | Adjustment     |                | Hz                    | 0             | 3000          |                       |                     | ○          |
| SV039 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV040 | LMCT         | Lost motion correction dead zone                         | Adjustment     |                | μm                    | 0             | 100           |                       |                     | ○          |
| SV041 | LMC2         | Lost motion correction 2                                 | Adjustment     |                | %, % of rated current | -1            | 200           |                       |                     | ○          |
| SV042 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV043 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV044 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV045 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV046 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV047 | EC           | Induced voltage correction                               | Adjustment     |                | %                     | 0             | 200           |                       |                     | ○          |
| SV048 | EMGrt        | Emergency stop ready maintenance time                    | Adjustment     |                | msec                  | 0             | 1000          |                       |                     | ○          |
| SV049 | PGN1sp       | Special operation • position loop gain 1                 |                |                | 1/sec                 | 1             | 200           |                       |                     | ○          |
| SV050 | PGN2sp       | Special operation • position loop gain 2                 |                |                | 1/sec                 | 0             | 999           |                       |                     | ○          |
| SV051 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV052 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV053 | OD3          | Special operation • excessive error detection range      |                |                | mm                    | 0             | 32767         |                       |                     | ○          |
| SV054 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV055 | EMGdt        | Maximum deceleration control delay time                  |                |                | msec                  | 0             | 5000          | ○                     |                     |            |
| SV056 | EMGt         | Deceleration control time constant                       |                |                | msec                  | 0             | 5000          | ○                     |                     |            |
| SV057 | SHGC         | SHG control gain                                         |                |                | 1/sec                 | 0             | 999           |                       |                     | ○          |
| SV058 | SHGCsp       | Special operation • SHG control gain                     |                |                | 1/sec                 | 0             | 999           |                       |                     | ○          |
| SV059 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV060 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV061 | DA1NO        | D/A output channel data                                  |                |                |                       | 0             | 7             |                       |                     |            |
| SV062 |              |                                                          |                |                |                       |               |               |                       |                     |            |
| SV063 | DA1MPY       | D/A output channel amplification rate                    |                |                | 1/256                 | -32768        | 32767         |                       |                     |            |
| SV064 |              |                                                          |                |                |                       |               |               |                       |                     |            |

## 3.1 Parameter Descriptions

| Name | Abbreviation | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Setting range |         |
|------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------|
|      |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Minimum       | Maximum |
| V001 | PC1          | Sets motor-side gear ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1             | 32767   |
| V002 | PC2          | Sets machine-side gear ratio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1             | 32767   |
| V003 | PGN1         | Sets position loop gain.<br>Normally set to 33                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1             | 200     |
| V004 | PGN2         | Set together with SV057:SHGC when SHG control is used.<br>Set to zero when not in use.                                                                                                                                                                                                                                                                                                                                                                                                                                | 0             | 999     |
| V005 | VGN1         | Sets speed loop gain.<br>Can be increased to up to 5 times the standard value in steps of 20-30% of the standard value.<br>Higher settings provide increased response but cause greater vibration and noise.                                                                                                                                                                                                                                                                                                          | 1             | 999     |
| V006 |              | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |         |
| V007 |              | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |         |
| V008 | VIA          | Sets speed loop lead compensation.<br>Setting is fixed according to motor type used (see Standard Parameters by Motor Type table).                                                                                                                                                                                                                                                                                                                                                                                    | 1             | 9999    |
| V009 | IQA          | Internal current loop compensation.<br>Setting is fixed according to motor type used (see Standard Parameters by Motor Type table).                                                                                                                                                                                                                                                                                                                                                                                   | 1             | 20480   |
| V010 | IDA          | Internal current loop compensation.<br>Setting is fixed according to motor type used (see Standard Parameters by Motor Type table).                                                                                                                                                                                                                                                                                                                                                                                   | 1             | 20480   |
| V011 | IQG          | Internal current loop compensation.<br>Setting is fixed according to motor type used (see Standard Parameters by Motor Type table).                                                                                                                                                                                                                                                                                                                                                                                   | 1             | 2560    |
| V012 | IDG          | Internal current loop compensation.<br>Setting is fixed according to motor type used (see Standard Parameters by Motor Type table).                                                                                                                                                                                                                                                                                                                                                                                   | 1             | 2560    |
| V013 | ILMT         | Sets current limit.<br>Setting is a percentage of rated current.<br>Set to standard value if motor is used to maximum torque (may be limited by amp specifications). Limit applies in + and - directions.                                                                                                                                                                                                                                                                                                             | 0             | 999     |
| V014 | ILMTsp       | Sets special operation (e.g., absolute position initial setting or at machine end stopper method) current limit.<br>Setting is a % of rated current.<br>Set to standard value if motor is used to maximum torque (may be limited by amp specifications). Limit applies in + and - directions.                                                                                                                                                                                                                         | 0             | 999     |
| V015 | FFC          | Set when overshoot is significant under feedforward control or when relative error is significant under synchronous control. Set to zero when not in use.                                                                                                                                                                                                                                                                                                                                                             | 0             | 999     |
| V016 | LMC1         | Set when arc quadrant changeover projections are large (occurs when friction, torsion, or backlash causes a dead zone).<br>Effective only when lost motion correction (SV027:lmc1, lmc2) is selected.                                                                                                                                                                                                                                                                                                                 | -1            | 200     |
|      |              | Type 1 SV027:SSF1/lmc1=1, lmc2=0<br>This type of correction eliminates projections with low-speed interpolation.<br>A setting of zero gives no correction gain; a setting of 100 gives 100% correction.                                                                                                                                                                                                                                                                                                               | 0             | 200     |
|      |              | Type 2 SV027:SSF1/lmc1=0, lmc2=1<br>This type is standard with the MDS-A-SVJ series.<br>Use when type-1 correction is insufficient, e.g., with high-speed, high-precision interpolation.<br>Set as a % of rated current.                                                                                                                                                                                                                                                                                              | 0             | 100     |
|      |              | For setting different correction gain (type-1) or correction amount (type-2) for each command direction.<br>Set together with SV041:LMC2 when a different value setting is desired for each command direction.<br>To change the command speed from - to + (with clockwise command direction), set value to SV016:LMC1.<br>To change the command speed from + to - (with clockwise command direction), set value to SV041:LMC2.<br>If -1 is set, correction is not carried out during command speed direction changes. |               |         |

| Name | Breviation | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Setting range |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------|----|--------------------------------|----|------|------|---|---|---|---|---|---|---|---|---|------|--|--|--|--|--|--|--|------|------|--|--|--|--|--|--|-----|------|-------------|---------------------------|--|--|--|------------------------|--|--|--|--|--|--|--|--|---|------|------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|---|--|--|---|--|--|--|--|--|--|--|--|--|---|------|--------------------------------|---|--|--|--------------------------------|--|--|--|---|--|--|--|--|--|--|--|--|---|---|-----|-----------------------------|--|--|--|-----------------------------|--|--|--|---|--|--|--|--|---|--|--|--|--|---|--|--|--|--|--|--|--|--|--|----|---|--|--|--|--|--|--|--|--|----|--|--|--|--|--|--|---|--|--|----|--|--|--|--|--|--|--|--|--|----|--|--|---|------|------------------------------------------------|--|--|--|--|----|--|--|--|--|--|--|--|--|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|----|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|      |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Minimum       | Maximum |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| V017 | PEC        | <p>Servo configuration</p> <table border="1"> <tr> <td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td colspan="8"></td> <td>abs</td> <td colspan="4">vdir</td> <td colspan="4"></td> </tr> <tr> <th>bit</th> <th>Name</th> <th colspan="4">Function when set to zero</th> <th colspan="4">Function when set to 1</th> </tr> <tr><td> </td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td> </td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td> </td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td> </td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td>4</td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td>5</td><td>vdir</td><td colspan="4">Detector mounting direction AC</td><td colspan="4">Detector mounting direction BD</td></tr> <tr><td>6</td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td>7</td><td>abs</td><td colspan="4">Relative position detection</td><td colspan="4">Absolute position detection</td></tr> <tr><td>8</td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td>9</td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td>10</td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td>11</td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td>12</td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td>13</td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> <tr><td>14</td><td> </td><td colspan="4"> </td><td colspan="4"> </td></tr> </table> | 15            | 14      | 13 | 12                             | 11 | 10   | 9    | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |      |  |  |  |  |  |  |  | abs  | vdir |  |  |  |  |  |  |     | bit  | Name        | Function when set to zero |  |  |  | Function when set to 1 |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  | 4 |  |  |  |  |  |  |  |  |  | 5 | vdir | Detector mounting direction AC |   |  |  | Detector mounting direction BD |  |  |  | 6 |  |  |  |  |  |  |  |  |   | 7 | abs | Relative position detection |  |  |  | Absolute position detection |  |  |  | 8 |  |  |  |  |   |  |  |  |  | 9 |  |  |  |  |  |  |  |  |  | 10 |   |  |  |  |  |  |  |  |  | 11 |  |  |  |  |  |  |   |  |  | 12 |  |  |  |  |  |  |  |  |  | 13 |  |  |   |      |                                                |  |  |  |  | 14 |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15   | 14         | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 12            | 11      | 10 | 9                              | 8  | 7    | 6    | 5 | 4 | 3 | 2 | 1 | 0 |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|      |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    | abs  | vdir |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| bit  | Name       | Function when set to zero                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |         |    | Function when set to 1         |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|      |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|      |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|      |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|      |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5    | vdir       | Detector mounting direction AC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |         |    | Detector mounting direction BD |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7    | abs        | Relative position detection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |         |    | Absolute position detection    |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 9    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 11   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| V018 | PIT        | Sets ball screw lead. Normally set to 360 for rotating axis. Setting is made in mm, so not compatible with imperial ball screws.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1             | 3276    |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| V019 | UNG1       | Sets number of pulses per one revolution of motor-end detector in units of 1,000 pulses.<br>Set SV019:RNG1 and SV020:RNG2 to same value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1             | 999     |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| V020 | UNG2       | Sets number of pulses per one revolution of motor-end detector in units of 1,000 pulses.<br>Set SV019:RNG1 and SV020:RNG2 to same value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1             | 999     |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| V021 | OLT        | Sets overload detection time constant.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1             | 81      |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| V022 | OLL        | Sets overload current detection level as a % of rated current. Determines the amp load. The motor load is determined by the motor/detector type (SV025:MTYP). The servo monitor load is displayed on the basis that the amp load or motor load, whichever is greater, is the rated continuous output level (alarm level), i.e., 100%.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 32            | 181     |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| V023 | 001        | <p>Sets excessive error detection range when servo is ON. With a setting of zero, excessive error detection does not take place.</p> <p>Standard setting formula:<br/> <math>SV023:OD1 = SV026:OD2 = SV053:OD3 = F / (60 \times PGN1) \times 0.5,</math><br/>                     where<br/>                     F = Maximum rapid traverse speed (mm/mm);<br/>                     PGN1 = Position loop gain 1 (1/sec).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0             | 3276    |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| V024 | INP        | Sets in-position detection range.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0             | 3276    |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| V025 | 4TYP       | <p>Motor/detector type</p> <table border="1"> <tr> <td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td colspan="8">etyp</td> <td colspan="8">mtyp</td> </tr> <tr> <th>bit</th> <th>Name</th> <th colspan="14">Description</th> </tr> <tr> <td>0</td> <td>mtyp</td> <td colspan="14">Sets motor type (see Motor Types table).</td> </tr> <tr><td>1</td><td> </td><td colspan="14"> </td></tr> <tr><td>2</td><td> </td><td colspan="14"> </td></tr> <tr><td>3</td><td> </td><td colspan="14"> </td></tr> <tr><td>4</td><td> </td><td colspan="14"> </td></tr> <tr><td>5</td><td> </td><td colspan="14"> </td></tr> <tr><td>6</td><td> </td><td colspan="14"> </td></tr> <tr><td>7</td><td> </td><td colspan="14"> </td></tr> <tr> <td>8</td> <td>etyp</td> <td colspan="14">Sets detector type (see Detector Types table).</td> </tr> <tr><td>9</td><td> </td><td colspan="14"> </td></tr> <tr><td>10</td><td> </td><td colspan="14"> </td></tr> <tr><td>11</td><td> </td><td colspan="14"> </td></tr> <tr><td>12</td><td> </td><td colspan="14"> </td></tr> <tr><td>13</td><td> </td><td colspan="14"> </td></tr> <tr><td>14</td><td> </td><td colspan="14"> </td></tr> <tr><td>15</td><td> </td><td colspan="14"> </td></tr> </table>                                                                                                                                                                                                                                                                                                                                                                               | 15            | 14      | 13 | 12                             | 11 | 10   | 9    | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | etyp |  |  |  |  |  |  |  | mtyp |      |  |  |  |  |  |  | bit | Name | Description |                           |  |  |  |                        |  |  |  |  |  |  |  |  | 0 | mtyp | Sets motor type (see Motor Types table). |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 2 |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                | 3 |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  | 4 |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  | 5 |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    | 6 |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  | 7 |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  | 8 | etyp | Sets detector type (see Detector Types table). |  |  |  |  |    |  |  |  |  |  |  |  |  | 9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 11 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 12 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 14 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15   | 14         | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 12            | 11      | 10 | 9                              | 8  | 7    | 6    | 5 | 4 | 3 | 2 | 1 | 0 |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| etyp |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    | mtyp |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| bit  | Name       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0    | mtyp       | Sets motor type (see Motor Types table).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8    | etyp       | Sets detector type (see Detector Types table).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 9    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 11   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |         |    |                                |    |      |      |   |   |   |   |   |   |   |   |   |      |  |  |  |  |  |  |  |      |      |  |  |  |  |  |  |     |      |             |                           |  |  |  |                        |  |  |  |  |  |  |  |  |   |      |                                          |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |  |  |   |  |  |  |  |  |  |  |  |  |   |      |                                |   |  |  |                                |  |  |  |   |  |  |  |  |  |  |  |  |   |   |     |                             |  |  |  |                             |  |  |  |   |  |  |  |  |   |  |  |  |  |   |  |  |  |  |  |  |  |  |  |    |   |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |   |  |  |    |  |  |  |  |  |  |  |  |  |    |  |  |   |      |                                                |  |  |  |  |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



| Name | Breviation | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Setting range                     |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
|------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------|---------------------------|------------------------|---|--|--|--|---|--|--|--|---|--|--|--|---|--|--|--|---|-------|--------------------------------|-------------------------------|---|-------|-------------------------------|-------------------------------|---|--|--|--|---|--|--|--|---|------|-------------------------------------|-----------------------------------|---|------|-----------------------------------|----------------|----|--|--|--|----|--|--|--|----|--|--|--|----|--|--|--|----|------|-------------------------------|-------------------------------|----|--|--|--|--|--|
|      |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Minimum                           | Maximum |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| V026 | DD2        | sets excessive error detection range when servo is OFF. With a setting of zero, excessive error detection does not take place. Normally set to same value as SV023:OD1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0                                 | 32767   |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| V027 | SF1        | <p>Special servo function selection 1</p> <p>15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0</p> <p>zrn2           lmc2   lmc1                    </p> <table border="1"> <thead> <tr> <th>bit</th> <th>Name</th> <th>Function when set to zero</th> <th>Function when set to 1</th> </tr> </thead> <tbody> <tr><td>0</td><td></td><td></td><td></td></tr> <tr><td>1</td><td></td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td></tr> <tr><td>4</td><td>vfct1</td><td>00: Jitter correction disabled</td><td>10: Jitter correction 2 pulse</td></tr> <tr><td>5</td><td>vfct2</td><td>01: Jitter correction 1 pulse</td><td>11: Jitter correction 3 pulse</td></tr> <tr><td>6</td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td></tr> <tr><td>8</td><td>lmc1</td><td>00: Lost motion correction disabled</td><td>10: Lost motion correction type 2</td></tr> <tr><td>9</td><td>lmc2</td><td>01: Lost motion correction type 1</td><td>11: Prohibited</td></tr> <tr><td>10</td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td></tr> <tr><td>12</td><td></td><td></td><td></td></tr> <tr><td>13</td><td></td><td></td><td></td></tr> <tr><td>14</td><td>zrn2</td><td>Reference point return type 1</td><td>Reference point return type 2</td></tr> <tr><td>15</td><td></td><td></td><td></td></tr> </tbody> </table> | bit                               | Name    | Function when set to zero | Function when set to 1 | 0 |  |  |  | 1 |  |  |  | 2 |  |  |  | 3 |  |  |  | 4 | vfct1 | 00: Jitter correction disabled | 10: Jitter correction 2 pulse | 5 | vfct2 | 01: Jitter correction 1 pulse | 11: Jitter correction 3 pulse | 6 |  |  |  | 7 |  |  |  | 8 | lmc1 | 00: Lost motion correction disabled | 10: Lost motion correction type 2 | 9 | lmc2 | 01: Lost motion correction type 1 | 11: Prohibited | 10 |  |  |  | 11 |  |  |  | 12 |  |  |  | 13 |  |  |  | 14 | zrn2 | Reference point return type 1 | Reference point return type 2 | 15 |  |  |  |  |  |
| bit  | Name       | Function when set to zero                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Function when set to 1            |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 0    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 1    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 2    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 3    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 4    | vfct1      | 00: Jitter correction disabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 10: Jitter correction 2 pulse     |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 5    | vfct2      | 01: Jitter correction 1 pulse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 11: Jitter correction 3 pulse     |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 6    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 7    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 8    | lmc1       | 00: Lost motion correction disabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10: Lost motion correction type 2 |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 9    | lmc2       | 01: Lost motion correction type 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 11: Prohibited                    |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 10   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 11   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 12   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 13   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 14   | zrn2       | Reference point return type 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Reference point return type 2     |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 15   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| V028 |            | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| V029 |            | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| V030 |            | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| V031 |            | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| V032 | TOP        | sets unbalance torque for vertical axes and other axes with unbalance torque as a % of rated current. Used when SV027:SSF1/lmc1, lmc2 are set.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | -100                              | 100     |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| V033 | SSF2       | <p>Special servo function selection 2</p> <p>15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0</p> <p>                               </p> <table border="1"> <thead> <tr> <th>bit</th> <th>Name</th> <th>Function when set to zero</th> <th>Function when set to 1</th> </tr> </thead> <tbody> <tr><td>0</td><td></td><td></td><td></td></tr> <tr><td>1</td><td></td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td></tr> <tr><td>12</td><td></td><td></td><td></td></tr> <tr><td>13</td><td></td><td></td><td></td></tr> <tr><td>14</td><td></td><td></td><td></td></tr> <tr><td>15</td><td></td><td></td><td></td></tr> </tbody> </table> <p>1000h must be set.</p>                                                                                                                                                                                                                                                                                                              | bit                               | Name    | Function when set to zero | Function when set to 1 | 0 |  |  |  | 1 |  |  |  | 2 |  |  |  | 3 |  |  |  | 4 |       |                                |                               | 5 |       |                               |                               | 6 |  |  |  | 7 |  |  |  | 8 |      |                                     |                                   | 9 |      |                                   |                | 10 |  |  |  | 11 |  |  |  | 12 |  |  |  | 13 |  |  |  | 14 |      |                               |                               | 15 |  |  |  |  |  |
| bit  | Name       | Function when set to zero                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Function when set to 1            |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 0    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 1    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 2    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 3    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 4    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 5    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 6    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 7    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 8    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 9    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 10   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 11   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 12   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 13   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 14   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |
| 15   |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |         |                           |                        |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |       |                                |                               |   |       |                               |                               |   |  |  |  |   |  |  |  |   |      |                                     |                                   |   |      |                                   |                |    |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |    |      |                               |                               |    |  |  |  |  |  |

| Name  | Abbreviation | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Setting range |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
|-------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------|--------------------------------------------------------------------|-------------------------------|------|--|--|--|--|--|--|--|--|--|--|------|------|---------------------------|---------------------------|------------------------|---|------|------------------------------|-------------------------------|---|--|--|---|---|--|--|---|---|--|--|---|---|--|--|---|---|--|--|---|---|--|--|---|---|--|--|---|------|--------------------------------------------------------------------|--|---|---|--|--|----|----|--|--|----|----|--|--|----|-----|------------------------|--|----|----|--|--|----|----|--|--|----|----|--|--|--|--|--|
|       |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Minimum       | Maximum |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
| :V034 | SSF3         | Special servo function selection 3<br>15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0<br><table border="1" style="width:100%; text-align:center;"> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table> <table border="1" style="width:100%; text-align:center;"> <thead> <tr> <th>bit</th> <th>Name</th> <th>Function when set to zero</th> <th>Function when set to 1</th> </tr> </thead> <tbody> <tr><td>0</td><td></td><td></td><td></td></tr> <tr><td>1</td><td></td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td></tr> <tr><td>12</td><td></td><td></td><td></td></tr> <tr><td>13</td><td></td><td></td><td></td></tr> <tr><td>14</td><td></td><td></td><td></td></tr> <tr><td>15</td><td></td><td></td><td></td></tr> </tbody> </table> 0000h must be set.                                                                   |               |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      | bit  | Name                      | Function when set to zero | Function when set to 1 | 0 |      |                              |                               | 1 |  |  |   | 2 |  |  |   | 3 |  |  |   | 4 |  |  |   | 5 |  |  |   | 6 |  |  |   | 7 |  |  |   | 8    |                                                                    |  |   | 9 |  |  |    | 10 |  |  |    | 11 |  |  |    | 12  |                        |  |    | 13 |  |  |    | 14 |  |  |    | 15 |  |  |  |  |  |
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| :V035 | SSF4         | Special servo function selection 4<br>15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0<br><table border="1" style="width:100%; text-align:center;"> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td>imon</td></tr> </table> <table border="1" style="width:100%; text-align:center;"> <thead> <tr> <th>bit</th> <th>Name</th> <th>Function when set to zero</th> <th>Function when set to 1</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>imon</td> <td>Command current peak display</td> <td>Feedback current peak display</td> </tr> <tr><td>1</td><td></td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td></tr> <tr><td>11</td><td></td><td></td><td></td></tr> <tr><td>12</td><td></td><td></td><td></td></tr> <tr><td>13</td><td></td><td></td><td></td></tr> <tr><td>14</td><td></td><td></td><td></td></tr> <tr><td>15</td><td></td><td></td><td></td></tr> </tbody> </table>                 |               |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  | imon | bit  | Name                      | Function when set to zero | Function when set to 1 | 0 | imon | Command current peak display | Feedback current peak display | 1 |  |  |   | 2 |  |  |   | 3 |  |  |   | 4 |  |  |   | 5 |  |  |   | 6 |  |  |   | 7 |  |  |   | 8    |                                                                    |  |   | 9 |  |  |    | 10 |  |  |    | 11 |  |  |    | 12  |                        |  |    | 13 |  |  |    | 14 |  |  |    | 15 |  |  |  |  |  |
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|       |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 11            |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
| 12    |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
| 13    |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
| 14    |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
| 15    |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
| :V036 | PTYP         | Regeneration resistor type<br>15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0<br><table border="1" style="width:100%; text-align:center;"> <tr> <td colspan="4">amp</td> <td colspan="4">rtyp</td> <td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td> </tr> </table> <table border="1" style="width:100%; text-align:center;"> <thead> <tr> <th>bit</th> <th>Name</th> <th>Function when set to zero</th> <th>Function when set to 1</th> </tr> </thead> <tbody> <tr><td>0</td><td></td><td></td><td></td></tr> <tr><td>1</td><td></td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td></tr> <tr> <td>8</td> <td>rtyp</td> <td colspan="2">Regeneration resistor type (see Regeneration Resistor Types table)</td> </tr> <tr> <td>9</td> <td></td> <td colspan="2"></td> </tr> <tr> <td>10</td> <td></td> <td colspan="2"></td> </tr> <tr> <td>11</td> <td></td> <td colspan="2"></td> </tr> <tr> <td>12</td> <td>amp</td> <td colspan="2">Sets amp type number 1</td> </tr> <tr><td>13</td><td></td><td></td><td></td></tr> <tr><td>14</td><td></td><td></td><td></td></tr> <tr><td>15</td><td></td><td></td><td></td></tr> </tbody> </table> | amp           |         |                                                                    |                               | rtyp |  |  |  |  |  |  |  |  |  |  | bit  | Name | Function when set to zero | Function when set to 1    | 0                      |   |      |                              | 1                             |   |  |  | 2 |   |  |  | 3 |   |  |  | 4 |   |  |  | 5 |   |  |  | 6 |   |  |  | 7 |   |  |  | 8 | rtyp | Regeneration resistor type (see Regeneration Resistor Types table) |  | 9 |   |  |  | 10 |    |  |  | 11 |    |  |  | 12 | amp | Sets amp type number 1 |  | 13 |    |  |  | 14 |    |  |  | 15 |    |  |  |  |  |  |
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|       |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 8             | rtyp    | Regeneration resistor type (see Regeneration Resistor Types table) |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
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|       |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 11            |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
| 12    | amp          | Sets amp type number 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
| 13    |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
| 14    |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |
| 15    |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |         |                                                                    |                               |      |  |  |  |  |  |  |  |  |  |  |      |      |                           |                           |                        |   |      |                              |                               |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |   |  |  |   |      |                                                                    |  |   |   |  |  |    |    |  |  |    |    |  |  |    |     |                        |  |    |    |  |  |    |    |  |  |    |    |  |  |  |  |  |

## Parameter Descriptions

| Name  | Abbreviation | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Setting range |         |
|-------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------|
|       |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Minimum       | Maximum |
| svo37 |              | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |         |
| SV038 | FHz          | Sets mechanical vibration suppression frequency if mechanical vibration suppression is required. Must be set over 100Hz. Set to zero when not in use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0             | 3000    |
| svo39 |              | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |         |
| SV040 | LMCT         | Sets lost motion correction dead zone.<br>Normally set to zero.<br>Set only if lost motion correction timing is incorrect when feed-forward control is used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0             | 100     |
| svo41 | LMC2         | Normally set to zero.<br>Set together with SV016:LMC1 only when different setting values are desired for lost motion correction gain (type 1) or correction amount (type 2) according to the command direction.<br>To change the command speed from - to + (with clockwise command direction), set value to SV016:LMC1.<br>To change the command speed from + to - (with clockwise command direction), set value to SV041:LMC2.<br>If -1 is set, correction is not carried out during command speed direction changes.<br>Only effective when lost motion correction (SV027:lmcl, lmc2) is selected.                                                                                 | -1            | 200     |
| SV042 |              | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |         |
| svo43 |              | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |         |
| svo44 |              | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |         |
| svo45 |              | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |         |
| SV046 |              | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |         |
| svo47 | EC           | Sets effective gain for induced voltage correction. Compatible only with HA**N HA053, and HA13 motors.<br>Using this function, the feedback current's ability to follow the command current can be increased and the deceleration torque increased.<br>The standard setting is 100, but the following adjustments must be made:<br>Set bit 0 of SV035:SSF4 to 1 and thus display the command current peak in the MAX current 1 display on the servo monitor and the feedback current peak in the MAX current 2 display.<br>Next, carry out acceleration/deceleration and set adjust the setting such that the feedback current peak is 5-10% smaller, than the command current peak. | 0             | 200     |
| SV048 | EMGrT        | Sets time between an emergency stop (caused by an external emergency stop input, insufficient voltage, or alarm) and ready ON. Used to prevent vertical axes from dropping after an emergency stop.<br>Note that the time set by this parameter becomes ready-ON even if a deceleration-controllable alarm occurs. Generally, this parameter should be set to the minimum value that enables the electromagnetic brake to operate for the required time. This parameter's time setting must be smaller than that of SV055:EMGdt.                                                                                                                                                     | 0             | 1000    |

| Name  | bbreviation | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Setting range |         |
|-------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------|
|       |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Minimum       | Maximum |
| SV049 | PGN1sp      | Sets position loop gain during special operation, e.g., with synchronous tap, main axis C-axis interpolation.<br>Normally sets main axis position loop gain.                                                                                                                                                                                                                                                                                                                                                          | 1             | 200     |
| SV050 | PGN2sp      | Set together with SV058:SHGCsp if SHG control is carried out during special operation, e.g., with synchronous tap, main axis C-axis interpolation.<br>Set to zero when not in use.                                                                                                                                                                                                                                                                                                                                    | 0             | 999     |
| SV051 |             | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |         |
| SV052 |             | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |         |
| SV053 | OD3         | Sets excessive error detection range for special operation. e.g., absolute position initial setting or at machine end stopper method.<br>With a setting of zero, excessive error detection does not take place when the servo is ON during special operation.                                                                                                                                                                                                                                                         |               | 32767   |
| sv054 |             | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |         |
| SV055 | EMGdt       | Sets time in ms from start of deceleration control to application of dynamic braking.<br>Normally set to same value as SV056:EMGt.<br>A setting of zero is taken as an input of 2,000 ms.<br>Set to 1 if dynamic braking is selected without deceleration control.<br>Dynamic braking selection takes precedence over position loop step stopping.<br>For axes with brakes, select position loop step stopping or dynamic braking.<br>This parameter's time setting must be larger than that of SV048:EMGrt.          | 0             | 5000    |
| SV056 | EMGt        | Sets time taken to stop from maximum rapid traversing speed (RAPID: axis configuration parameter) following an emergency stop (caused by an external emergency stop input, insufficient voltage, or alarm).<br>From other speeds, deceleration control takes place in direct proportion to the parameter setting.<br>Normally set to same value as rapid traverse time constant.<br>A setting of zero sets position loop step stopping.<br>Reset NC power supply after changing RAPID (axis configuration parameter). | 0             | 5000    |
| SV057 | SHGC        | Set together with SV004:PGN2 when SHG control is used.<br>Set to zero when not in use.                                                                                                                                                                                                                                                                                                                                                                                                                                | 0             | 999     |
| SV058 |             | Set together with SV050:PGN2sp if SHG control is used during special operation, e.g., with synchronous tap, main axis C-axis interpolation.                                                                                                                                                                                                                                                                                                                                                                           |               |         |
| SV059 |             | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |         |
| SV060 |             | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |         |
| SV061 | DA1NO       | Sets output data number of D/A output channel.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0             | 7       |
| SV062 |             | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |         |
| SV063 | DA1MPY      | Sets output amplification rate of D/A output channel.<br>Output amplification rate = setting value / 256.<br>A setting of zero is taken as a setting value of 256 (output amplification rate = 1).                                                                                                                                                                                                                                                                                                                    | -32768        | 32767   |
| SV064 |             | Must be set to zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |         |

## 3.2 Motor Types

Set the mtyp value for SV025:MTYP in accordance with the following tables.

| Motor series | NC motor<br>2,000 rpm<br>(standard) |    |    |    |    |    | NC motor<br>3,000 rpm<br>(special) | General-<br>purpose,<br>low-capac-<br>ity, low-<br>inertia |
|--------------|-------------------------------------|----|----|----|----|----|------------------------------------|------------------------------------------------------------|
| Number       | 0x                                  | 1x | 2x | 3x | 4x | 5x | 6x                                 | 7x                                                         |
| x0           | HA40N                               |    |    |    |    |    |                                    | HA-FE/<br>FH43                                             |
| x1           | HA80N                               |    |    |    |    |    |                                    | HA-FE/<br>FH63                                             |
| x2           | HA100N                              |    |    |    |    |    |                                    |                                                            |
| x3           |                                     |    |    |    |    |    |                                    |                                                            |
| x4           |                                     |    |    |    |    |    |                                    |                                                            |
| x5           |                                     |    |    |    |    |    |                                    |                                                            |
| x6           |                                     |    |    |    |    |    |                                    |                                                            |
| x7           |                                     |    |    |    |    |    |                                    |                                                            |
| x8           |                                     |    |    |    |    |    |                                    |                                                            |
| x9           |                                     |    |    |    |    |    |                                    |                                                            |
| xA           |                                     |    |    |    |    |    |                                    |                                                            |
| xB           |                                     |    |    |    |    |    |                                    |                                                            |
| xC           |                                     |    |    |    |    |    |                                    | HA-FE/<br>FE053                                            |
| xD           |                                     |    |    |    |    |    |                                    | HA-FE/<br>FH13                                             |
| xE           |                                     |    |    |    |    |    | HA23N                              | HA-FE/<br>FH23                                             |
| xF           |                                     |    |    |    |    |    | HA33N                              | HA-FE/<br>FH33                                             |

  

| Motor series | NC motor<br>3,000 rpm<br>(standard) | General-<br>purpose,<br>low-capac-<br>ity,<br>extra-low-<br>inertia |    |    |    |    |    |    |
|--------------|-------------------------------------|---------------------------------------------------------------------|----|----|----|----|----|----|
| Number       | 8x                                  | 9x                                                                  | Ax | Bx | Cx | Dx | Ex | Fx |
| x0           | HA43N                               | HA-ME43                                                             |    |    |    |    |    |    |
| x1           | HA83N                               | HA-ME73                                                             |    |    |    |    |    |    |
| x2           |                                     |                                                                     |    |    |    |    |    |    |
| x3           |                                     |                                                                     |    |    |    |    |    |    |
| x4           |                                     |                                                                     |    |    |    |    |    |    |
| x5           |                                     |                                                                     |    |    |    |    |    |    |
| x6           |                                     |                                                                     |    |    |    |    |    |    |
| x7           |                                     |                                                                     |    |    |    |    |    |    |
| x8           |                                     |                                                                     |    |    |    |    |    |    |
| x9           |                                     |                                                                     |    |    |    |    |    |    |
| xA           | HA93N                               |                                                                     |    |    |    |    |    |    |
| xB           |                                     |                                                                     |    |    |    |    |    |    |
| xC           | HA053                               | HA-ME053                                                            |    |    |    |    |    |    |
| xD           | HA13                                | HA-ME13                                                             |    |    |    |    |    |    |
| xE           |                                     | HA-ME23                                                             |    |    |    |    |    |    |
| xF           |                                     |                                                                     |    |    |    |    |    |    |

### 3.3 Detector Types

Set the etyp value for SV025:MTYP in accordance with the following table.

| Number | Detector system           | Motor type<br>(detector type) | Detector<br>resolution | RNG1/2<br>setting | Remarks |
|--------|---------------------------|-------------------------------|------------------------|-------------------|---------|
| 00     | ABZ + WW (with OHM)       | HA**N-E30                     | 25000                  | 25                |         |
|        | High-speed serial         | HA**N-E33                     | 25000                  | 25                |         |
| 11     | No setting                |                               |                        |                   |         |
| 22     | High-speed serial         | HA**N-E33                     | 25000                  | 25                |         |
|        |                           | HA**N-A33                     | 25000                  | 25                |         |
|        |                           | HA-FH                         | 8000                   | 8                 |         |
| 33     | ABZ + ww (without<br>OHM) | HA053/13-E30                  | 10000                  | 10                |         |
|        |                           | HA-FE                         | 4000                   | 4                 |         |
|        |                           | HA-ME                         | 4000                   | 4                 |         |

### 3.4 Regeneration Resistors Types

Connectable regeneration resistor combinations depend on the servo amp capacity, as shown in the following table. Set SV036:PTYP to the number corresponding to the regeneration resistor combination that is connected.

| Regenera-<br>tion<br>resistor<br>type | Connec-<br>tion<br>arrange-<br>ment | Total<br>resis-<br>tance | Regen-<br>erative<br>capac-<br>ity | SV036 | MDS-<br>A-SVJ-01 | MDS-<br>A-SVJ-03 | MDS-<br>A-SVJ-06 | MDS-<br>A-SVJ-10 | MDS-<br>A-SVJ-20 |
|---------------------------------------|-------------------------------------|--------------------------|------------------------------------|-------|------------------|------------------|------------------|------------------|------------------|
| No resis-<br>tor                      |                                     |                          |                                    | 1000  | ⊙                |                  |                  |                  |                  |
| MR-RB013                              | 1                                   | 52 Ω                     | 18 W                               | 1100  | ○                | ⊙                | ⊙                |                  |                  |
| MR-RB033                              | 1                                   | 52 Ω                     | 36 W                               | 1200  | ○                | ○                | ○                |                  |                  |
|                                       | 2 x<br>paral-<br>lel                | 26 Ω                     | 72 W                               | 1200  |                  |                  |                  | ⊙                | ⊙                |
|                                       | 4 x<br>paral-<br>lel                | 13 Ω                     | 144 W                              | 1200  |                  |                  |                  |                  | ○                |
| MR-RB064                              | 1                                   | 26 Ω                     | 72 W                               | 1300  |                  |                  |                  | ○                | ○                |
|                                       | 2 x<br>paral-<br>lel                | 13 Ω                     | 144 W                              | 1300  |                  |                  |                  |                  | ○                |
|                                       | 2 x<br>serial                       | 52 Ω                     | 144 W                              | 1F00  | ○                | ○                | ○                |                  |                  |
| MR-RB34                               | 1                                   | 26 Ω                     | 300 W                              | 1400  |                  |                  |                  | ○                | ○                |
|                                       | 2 x<br>paral-<br>lel                | 13 Ω                     | 600 W                              | 1400  |                  |                  |                  |                  | ○                |
| MR-RB063                              | 1                                   | 52 Ω                     | 72 W                               | 1500  | ○                | ○                | ○                |                  |                  |
|                                       | 2 x<br>paral-<br>lel                | 26 Ω                     | 144 W                              | 1500  |                  |                  |                  | ○                | ○                |
|                                       | 4 x<br>paral-<br>lel                | 13 Ω                     | 288 W                              | 1500  |                  |                  |                  |                  | ○                |

(NOTE) ⊙ : Standard resistor selection; ○ : Possible resistor selection.

\* Resistor selection: If the servo is used on a vertical axis, select resistors of one or two grades higher than the standard selection.

### 3.5 D/A Output Channel

The servo amp has one monitor output channel for servo adjustment purposes. This output is provided via a special connector at the top of the amp's front panel.

D/A output specifications are as follows:

Number of channels : 1  
 Resolution : 7 bits (full-scale 128 resolution)  
 Output voltage range : 0 to 10 V  
 Sampling cycle : 3.55 ms

Set SV061:DA1N0 in accordance with the following table.

| Number | Description                      | Unit        | Number | Description            | Unit               |
|--------|----------------------------------|-------------|--------|------------------------|--------------------|
| 0      | Speed feedback                   | rpm         | 4      | Speed feedback         | rpm                |
| 1      | Current command (torque command) | % of rating | 5      | 0 output               |                    |
| 2      | Current command (torque command) | % of rating | 6      | Position droop (lower) | interpolation unit |
| 3      | Current feedback (actual torque) | % of rating | 7      | Position droop (upper) |                    |

The output voltage is determined according to the formula below. To alter the output voltage, adjust the output amplification rate. Note that if SV063 is zero, the output is determined on the assumption that this parameter is set to 256.

$$\text{Data} \times \frac{\text{SV063}}{256} \times \frac{10}{256} + 5.00 = \text{output voltage [V]}$$

Example: With settings of SV061 = 0 and SV063 = 8 and a motor speed of 3,000 rpm, the output voltage is as follows:

$$3000 \times \frac{8}{256} \times \frac{10}{256} + 5.00 = 8.66 \text{ [V]}$$

### 3.6 Electronic Gearing

By correctly setting the ball screw lead, step-down ratio, step-up ratio, and detector resolution, it is possible to make amounts of machine movement consistent with those required by commands. The matching of these two amounts of movement is termed electronic gearing and determined by the following parameters:

Parameters Related to Electronic Gearing:

SV001 : PC1      SV018: PIT  
 svoo2 : PC2      SV019 : RNG1  
                   SV020 : RNG2

Set the machine constant such that the reduced numerator and denominator are less than 32767. If this condition is not satisfied, an alarm 37, abnormal parameter number 2301 (101 with M500-type NCs) will be output.

$ELG1 < 32767, ELG2 < 32767$

$\frac{ELG1}{ELG2}$  is a reduction of  $\frac{PC2 \times RANG}{PC1 \times PIT \times IUNIT}$ .

Note that  $RANG = RNG1 = RNG2$ .

IUNIT is related to the interpolation unit as follows:

0.5  $\mu\text{m}$  : IUNIT = 2,      0.05  $\mu\text{m}$ : IUNIT = 20



### 3.7 Parameter Changes

For safety, parameters must be changed with the system in an emergency stop condition. The time at which parameter changes become effective depends on the parameter. For details, refer to the Servo Parameters table. Changes to parameters marked "Initial" in the Servo Parameters table are effective the next time the controller power is switched ON. Changes to parameters with no "Initial" entry are effective immediately.

### 3.8 Command Polarity

With commands executed in the + direction, the motor direction (and thus the command direction) is termed

CW if the motor turns clockwise and

CCW if the motor turns counter-clockwise,

as seen from the load side.

The direction of rotation can be changed using the controller parameters. Note that with some parameters, the +/- motor direction relationship is reversed. Servo parameters that are affected by the CW/CCW direction are as follows:

SV016:LMC1    SV041:LMC2

(assuming different values other than zero are set for SV016 and SV041)

3.9 Standard Parameters by Motor Type

| Motor<br>Amp<br>capacity | HA40N<br>06 | HA80N<br>10 | HA100N<br>20 | HA053<br>01 | HA13<br>01 | HA23N<br>03 | HA33N<br>03 | HA43N<br>06 | HA83N<br>10 | HA93N<br>20 |
|--------------------------|-------------|-------------|--------------|-------------|------------|-------------|-------------|-------------|-------------|-------------|
| SV001                    | -           | -           | -            | -           | -          | -           | -           | -           | -           | -           |
| SV002                    | -           | -           | -            | -           | -          | -           | -           | -           | -           | -           |
| SV003                    | 33          | 33          | 33           | 33          | 33         | 33          | 33          | 33          | 33          | 33          |
| SV004                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV005                    | 100         | 100         | 150          | 70          | 70         | 70          | 70          | 100         | 100         | 150         |
| SV006                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV007                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV008                    | 1364        | 1364        | 1364         | 1364        | 1364       | 1364        | 1364        | 1364        | 1364        | 1364        |
| SV009                    | 2048        | 2048        | 2048         | 2048        | 2048       | 2048        | 2048        | 2048        | 2048        | 2048        |
| SV010                    | 2048        | 2048        | 2048         | 2048        | 2048       | 2048        | 2048        | 2048        | 2048        | 2048        |
| SV011                    | 512         | 512         | 256          | 256         | 256        | 256         | 256         | 256         | 256         | 256         |
| SV012                    | 512         | 512         | 512          | 256         | 256        | 256         | 256         | 512         | 512         | 512         |
| SV013                    | 500         | 500         | 500          | 500         | 500        | 500         | 500         | 500         | 500         | 500         |
| SV014                    | 500         | 500         | 500          | 500         | 500        | 500         | 500         | 500         | 500         | 500         |
| SV015                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV016                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV017                    | 0000        | 0000        | 0000         | 0000        | 0000       | 0000        | 0000        | 0000        | 0000        | 0000        |
| SV018                    | -           | -           | -            | -           | -          | -           | -           | -           | -           | -           |
| SV019                    | 25          | 25          | 25           | 10          | 10         | 25          | 25          | 25          | 25          | 25          |
| SV020                    | 25          | 25          | 25           | 10          | 10         | 25          | 25          | 25          | 25          | 25          |
| SV021                    | 60          | 60          | 60           | 60          | 60         | 60          | 60          | 60          | 60          | 60          |
| SV022                    | 150         | 150         | 150          | 150         | 150        | 150         | 150         | 150         | 150         | 150         |
| SV023                    | -           | -           | -            | -           | -          | -           | -           | -           | -           | -           |
| SV024                    | 50          | 50          | 50           | 50          | 50         | 50          | 50          | 50          | 50          | 50          |
| SV025                    | xx00        | xx01        | xx02         | 338C        | 338D       | xx6E        | xx6F        | xx80        | xx81        | xx8A        |
| SV026                    | -           | -           | -            | -           | -          | -           | -           | -           | -           | -           |
| SV027                    | 4000        | 4000        | 4000         | 4000        | 4000       | 4000        | 4000        | 4000        | 4000        | 4000        |
| SV028                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV029                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV030                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV031                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV032                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV033                    | 0000        | 0000        | 0000         | 0000        | 0000       | 0000        | 0000        | 0000        | 0000        | 0000        |
| SV034                    | 0000        | 0000        | 0000         | 0000        | 0000       | 0000        | 0000        | 0000        | 0000        | 0000        |
| SV035                    | 0000        | 0000        | 0000         | 0000        | 0000       | 0000        | 0000        | 0000        | 0000        | 0000        |
| SV036                    | 1100        | 1200        | 1200         | 1000        | 1000       | 1100        | 1100        | 1100        | 1200        | 1200        |
| SV037                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV038                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV039                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV040                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV041                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV042                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV043                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV044                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV045                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV046                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV047                    | 100         | 100         | 100          | 100         | 100        | 100         | 100         | 100         | 100         | 100         |
| SV048                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV049                    | 15          | 15          | 15           | 15          | 15         | 15          | 15          | 15          | 15          | 15          |
| SV050                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV051                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV052                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV053                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV054                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV055                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV056                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV057                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV058                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV059                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV060                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV061                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV062                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV063                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |
| SV064                    | 0           | 0           | 0            | 0           | 0          | 0           | 0           | 0           | 0           | 0           |

(NOTE) Parameters marked "--" are determined according to the machine configuration.

|                     |
|---------------------|
| MDS-A-SVJ           |
| Standard Parameters |

| Motor        | HA-FE053<br>(HA-FH053) | HA-FE13<br>(HA-FH13) | HA-FE23<br>(HA-FH23) | HA-FE33<br>(HA-FH33) | HA-FE43<br>(HA-FH43) | HA-FE63<br>(HA-FH63) |  |  |  |  |
|--------------|------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--|--|--|--|
| Amp capacity | 01                     | 01                   | 03                   | 03                   | 06                   | 06                   |  |  |  |  |
| SV001        | -                      | -                    | -                    | -                    | -                    | -                    |  |  |  |  |
| SV002        | -                      | -                    | -                    | -                    | -                    | -                    |  |  |  |  |
| SV003        | 33                     | 33                   | 33                   | 33                   | 33                   | 33                   |  |  |  |  |
| SV004        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV005        | 15                     | 15                   | 15                   | 15                   | 15                   | 15                   |  |  |  |  |
| SV006        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV007        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV008        | 1364                   | 1364                 | 1364                 | 1364                 | 1364                 | 1364                 |  |  |  |  |
| SV009        | 2048                   | 2048                 | 2048                 | 2048                 | 2048                 | 2048                 |  |  |  |  |
| SV010        | 2048                   | 2048                 | 2048                 | 2048                 | 2048                 | 2048                 |  |  |  |  |
| SV011        | 256                    | 256                  | 512                  | 512                  | 768                  | 768                  |  |  |  |  |
| SV012        | 256                    | 256                  | 512                  | 512                  | 768                  | 768                  |  |  |  |  |
| SV013        | 500                    | 500                  | 500                  | 500                  | 500                  | 500                  |  |  |  |  |
| SV014        | 500                    | 500                  | 500                  | 500                  | 500                  | 500                  |  |  |  |  |
| SV015        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV016        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV017        | 0000                   | 0000                 | 0000                 | 0000                 | 0000                 | 0000                 |  |  |  |  |
| SV018        | -                      | -                    | -                    | -                    | -                    | -                    |  |  |  |  |
| SV019        | 4(8)                   | 4(8)                 | 4(8)                 | 4(8)                 | 4(8)                 | 4(8)                 |  |  |  |  |
| SV020        | 4(8)                   | 4(8)                 | 4(8)                 | 4(8)                 | 4(8)                 | 4(8)                 |  |  |  |  |
| SV021        | 60                     | 60                   | 60                   | 60                   | 60                   | 60                   |  |  |  |  |
| SV022        | 150                    | 150                  | 150                  | 150                  | 150                  | 150                  |  |  |  |  |
| SV023        | -                      | -                    | -                    | -                    | -                    | -                    |  |  |  |  |
| SV024        | 50                     | 50                   | 50                   | 50                   | 50                   | 50                   |  |  |  |  |
| SV025        | 337C<br>(227C)         | 337D<br>(227D)       | 337E<br>(227E)       | 337F<br>(227F)       | 337G<br>(227G)       | 337H<br>(227H)       |  |  |  |  |
| SV026        | -                      | -                    | -                    | -                    | -                    | -                    |  |  |  |  |
| SV027        | 4000                   | 4000                 | 4000                 | 4000                 | 4000                 | 4000                 |  |  |  |  |
| SV028        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV029        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV030        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV031        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV032        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV033        | 0000                   | 0000                 | 0000                 | 0000                 | 0000                 | 0000                 |  |  |  |  |
| SV034        | 0000                   | 0000                 | 0000                 | 0000                 | 0000                 | 0000                 |  |  |  |  |
| SV035        | 0000                   | 0000                 | 0000                 | 0000                 | 0000                 | 0000                 |  |  |  |  |
| SV036        | 1000                   | 1000                 | 1100                 | 1100                 | 1100                 | 1100                 |  |  |  |  |
| SV037        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV038        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV039        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV040        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV041        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV042        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV043        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV044        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV045        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV046        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV047        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV048        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV049        | 15                     | 15                   | 15                   | 15                   | 15                   | 15                   |  |  |  |  |
| SV050        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV051        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV052        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV053        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV054        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV055        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV056        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV057        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV058        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV059        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV060        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV061        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV062        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV063        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |
| SV064        | 0                      | 0                    | 0                    | 0                    | 0                    | 0                    |  |  |  |  |

(NOTE) Parameters marked "-" are determined according to the machine configuration.

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|---------------------|
| MDS-A-SVJ           |
| standard Parameters |

| Motor<br>Amp<br>capacity | HA-ME053<br>01 | HA-ME13<br>01 | HA-ME23<br>03 | HA-ME43<br>03 | HA-ME73<br>06 |  |  |  |  |  |
|--------------------------|----------------|---------------|---------------|---------------|---------------|--|--|--|--|--|
| SV001                    | -              | -             | -             | -             | -             |  |  |  |  |  |
| SV002                    | -              | -             | -             | -             | -             |  |  |  |  |  |
| SV003                    | 33             | 33            | 33            | 33            | 33            |  |  |  |  |  |
| SV004                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV005                    | 8              | 8             | 8             | 8             | 8             |  |  |  |  |  |
| SV006                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV007                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV008                    | 1364           | 1364          | 1364          | 1364          | 1364          |  |  |  |  |  |
| SV009                    | 2048           | 2048          | 2048          | 2048          | 2048          |  |  |  |  |  |
| SV010                    | 2048           | 2048          | 2048          | 2048          | 2048          |  |  |  |  |  |
| SV011                    | 256            | 256           | 512           | 512           | 512           |  |  |  |  |  |
| SV012                    | 256            | 256           | 512           | 512           | 512           |  |  |  |  |  |
| SV013                    | 500            | 500           | 500           | 500           | 500           |  |  |  |  |  |
| SV014                    | 500            | 500           | 500           | 500           | 500           |  |  |  |  |  |
| SV015                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV016                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV017                    | 0000           | 0000          | 0000          | 0000          | 0000          |  |  |  |  |  |
| SV018                    | -              | -             | -             | -             | -             |  |  |  |  |  |
| SV019                    | 4              | 4             | 4             | 4             | 4             |  |  |  |  |  |
| SV020                    | 4              | 4             | 4             | 4             | 4             |  |  |  |  |  |
| SV021                    | 60             | 60            | 60            | 60            | 60            |  |  |  |  |  |
| SV022                    | 150            | 150           | 150           | 150           | 150           |  |  |  |  |  |
| SV023                    | -              | -             | -             | -             | -             |  |  |  |  |  |
| SV024                    | 50             | 50            | 50            | 50            | 50            |  |  |  |  |  |
| SV025                    | 339C           | 339D          | 339E          | 3390          | 3391          |  |  |  |  |  |
| SV026                    | -              | -             | -             | -             | -             |  |  |  |  |  |
| SV027                    | 4000           | 4000          | 4000          | 4000          | 4000          |  |  |  |  |  |
| SV028                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV029                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV030                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV031                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV032                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV033                    | 0000           | 0000          | 0000          | 0000          | 0000          |  |  |  |  |  |
| SV034                    | 0000           | 0000          | 0000          | 0000          | 0000          |  |  |  |  |  |
| SV035                    | 0000           | 0000          | 0000          | 0000          | 0000          |  |  |  |  |  |
| SV036                    | 1000           | 1000          | 1100          | 1100          | 1100          |  |  |  |  |  |
| SV037                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV038                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV039                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV040                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV041                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV042                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV043                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV044                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV045                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV046                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV047                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV048                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV049                    | 15             | 15            | 15            | 15            | 15            |  |  |  |  |  |
| SV050                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV051                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV052                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV053                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV054                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV055                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV056                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV057                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV058                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV059                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV060                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV061                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV062                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV063                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |
| SV064                    | 0              | 0             | 0             | 0             | 0             |  |  |  |  |  |

(NOTE) Parameters marked "-" are determined according to the machine configuration.

## 4. Servo Alarms and Warnings

| Number | Abbreviation | Name                                          | Stopping method      | Reset | Number | Abbreviation | Name                          | Stopping method      | Reset |
|--------|--------------|-----------------------------------------------|----------------------|-------|--------|--------------|-------------------------------|----------------------|-------|
| 10     | UV           | Amp insufficient voltage                      | Deceleration control | PR    | 40     |              |                               |                      |       |
|        |              |                                               |                      |       | 41     |              |                               |                      |       |
|        |              |                                               |                      |       | 42     | FE1          | Feedback error                | Deceleration control | PR    |
| 11     |              |                                               |                      |       |        |              |                               |                      |       |
| 12     | ME           | Memory error                                  | Initial error        | AR    | 43     |              |                               |                      |       |
| 13     | SWE          | S/W error                                     | Dynamic              | PR    | 44     |              |                               |                      |       |
| 14     |              |                                               |                      |       | 45     |              |                               |                      |       |
| 15     |              |                                               |                      |       | 46     | OHM          | Motor overheat                | Deceleration control | NR    |
| 16     | RD1          | Magnetic pole position detection error        | Deceleration control | PR    | 47     |              |                               |                      |       |
| 17     | ADE          | A/D converter error                           | Dynamic              | PR    | 48     |              |                               |                      |       |
| 18     | RD2          | Serial detector • initial communication error | Initial error        | PR    | 49     |              |                               |                      |       |
|        |              |                                               |                      |       | 4A     |              |                               |                      |       |
|        |              |                                               |                      |       | 4B     |              |                               |                      |       |
| 19     |              |                                               |                      |       | 4C     |              |                               |                      |       |
| 1A     |              |                                               |                      |       | 4D     |              |                               |                      |       |
| 1B     |              |                                               |                      |       | 4E     |              |                               |                      |       |
| 1C     |              |                                               |                      |       | 4F     |              |                               |                      |       |
| 1D     |              |                                               |                      |       | 50     | OL1          | Overload detection 1          | Deceleration control | NR    |
| 1E     |              |                                               |                      |       |        |              |                               |                      |       |
| 1F     | PIDE         | Power P board ID error                        | Initial error        | AR    | 51     | OL2          | Overload detection 2          | Dynamic              | NR    |
| 20     | NS1          | No feedback signal                            | Dynamic              | PR    | 52     | OD1          | Excessive error 1 (servo ON)  | Dynamic              | NR    |
| 21     |              |                                               |                      |       |        |              |                               |                      |       |
| 22     |              |                                               |                      |       | 53     | OD2          | Excessive error 2 (servo OFF) | Dynamic              | NR    |
| 23     |              |                                               |                      |       |        |              |                               |                      |       |
| 24     |              |                                               |                      |       | 54     |              |                               |                      |       |
| 25     |              |                                               |                      |       | 55     |              |                               |                      |       |
| 26     | ABSE         | Absolute position lost                        | Initial error        | AR    | 56     |              |                               |                      |       |
| 27     |              |                                               |                      |       | 57     |              |                               |                      |       |
| 28     |              |                                               |                      |       | 58     |              |                               |                      |       |
| 29     |              |                                               |                      |       | 59     |              |                               |                      |       |
| 2A     |              |                                               |                      |       | 5A     |              |                               |                      |       |
| 2B     | SMEN         | Serial detector • CPU error                   | Initial error        | AR    | 5B     |              |                               |                      |       |
| 2c     | SDAT         | Serial detector • data error                  | Dynamic              | PR    | 5D     |              |                               |                      |       |
|        |              |                                               |                      |       | 5E     |              |                               |                      |       |
|        |              |                                               |                      |       | 60     |              |                               |                      |       |
| 2D     | SLED         | Serial detector • data error                  | Dynamic              | PR    | 61     |              |                               |                      |       |
| 2E     |              |                                               |                      |       | 62     |              |                               |                      |       |
|        |              |                                               |                      |       | 63     |              |                               |                      |       |
| 2F     | STRE         | Serial detector • communication error         | Dynamic              | PR    | 64     |              |                               |                      |       |
|        |              |                                               |                      |       | 65     |              |                               |                      |       |
| 30     | OR           | Over-regeneration                             | Deceleration control | PR    | 66     |              |                               |                      |       |
|        |              |                                               |                      |       | 67     |              |                               |                      |       |
|        |              |                                               |                      |       | 68     |              |                               |                      |       |
| 31     | OS           | Overspeed                                     | Deceleration control | PR    | 69     |              |                               |                      |       |
|        |              |                                               |                      |       | 6A     |              |                               |                      |       |
|        |              |                                               |                      |       | 6B     |              |                               |                      |       |
| 32     | PMOC         | Power module error (excessive current)        | Dynamic              | PR    | 6C     |              |                               |                      |       |
|        |              |                                               |                      |       | 6D     |              |                               |                      |       |
| 33     | OV           | Excessive voltage                             | Dynamic              | PR    | 6E     |              |                               |                      |       |
| 34     | DP           | CRC error                                     | Deceleration control | PR    | 6F     |              |                               |                      |       |
|        |              |                                               |                      |       | 70     |              |                               |                      |       |
|        |              |                                               |                      |       | 71     |              |                               |                      |       |
| 35     | DE           | Data error                                    | Deceleration control | PR    | 72     |              |                               |                      |       |
|        |              |                                               |                      |       | 73     |              |                               |                      |       |
|        |              |                                               |                      |       | 74     |              |                               |                      |       |
| 36     | TE           | Communication error                           | Deceleration control | PR    | 75     |              |                               |                      |       |
|        |              |                                               |                      |       | 76     |              |                               |                      |       |
|        |              |                                               |                      |       | 77     |              |                               |                      |       |
| 37     | PE           | Initial parameter error                       | Initial error        | PR    | 78     |              |                               |                      |       |
|        |              |                                               |                      |       | 79     |              |                               |                      |       |
| 38     | TP1          | Protocol error 1                              | Deceleration control | PR    | 7A     |              |                               |                      |       |
|        |              |                                               |                      |       | 7B     |              |                               |                      |       |
|        |              |                                               |                      |       | 7C     |              |                               |                      |       |
| 39     | TP2          | Protocol error 2                              | Deceleration control | PR    | 7D     |              |                               |                      |       |
|        |              |                                               |                      |       | 7E     |              |                               |                      |       |
|        |              |                                               |                      |       | 7F     |              |                               |                      |       |
| 3A     | OC           | Excessive current                             | Dynamic              | PR    | 80     |              |                               |                      |       |
| 3B     | PMOH         | Power module error (overheat)                 | Dynamic              | PR    | 81     |              |                               |                      |       |
|        |              |                                               |                      |       | 82     |              |                               |                      |       |
| 3C     |              |                                               |                      |       | 83     |              |                               |                      |       |
| 3D     |              |                                               |                      |       | 84     |              |                               |                      |       |
| 3E     |              |                                               |                      |       | 85     |              |                               |                      |       |
| 3F     |              |                                               |                      |       | 86     |              |                               |                      |       |

| Num-ber | Abbrevi-ation | Name     | Stopping method | Reset | Num-ber | Abbrevi-ation | Name | Stopping method | Reset |
|---------|---------------|----------|-----------------|-------|---------|---------------|------|-----------------|-------|
| 87      |               |          |                 |       |         |               |      |                 |       |
| 88      | WD            | Watchdog | Dynamic         | AR    |         |               |      |                 |       |
| 89      |               |          |                 |       |         |               |      |                 |       |
| 8A      |               |          |                 |       |         |               |      |                 |       |
| 8B      |               |          |                 |       |         |               |      |                 |       |
| 8C      |               |          |                 |       |         |               |      |                 |       |
| 8D      |               |          |                 |       |         |               |      |                 |       |
| 8E      |               |          |                 |       |         |               |      |                 |       |
| 8F      |               |          |                 |       |         |               |      |                 |       |



#### 4.1 Alarm Descriptions

| Num-ber | Abbrevi-ation | Name                                          | Description                                                                                                                                                 | stop-ping method      | Reset |
|---------|---------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------|
| 10      | UV            | Amp insufficient voltage                      | Servo amp's internal PN power supply voltage is too low. Servo amp waits for initial controller communication. No record is kept of this alarm.             | Decel-eration control | PR    |
| 12      | ME            | Memory error                                  | Error detected in memory IC/FB IC during self-diagnostic checks after servo amp power ON. No record is kept of this alarm.                                  | Initial error         | AR    |
| 13      | SWE           | S/W error                                     | Software data processing not completed within designated time.                                                                                              | Dynamic               | PR    |
| 16      | RD1           | Magnetic pole position detection error        | Abnormality detected in UVW phase of magnetic pole position detection signal (with HA**N-E30, HA053, HA13, HA-FE, or HA-ME).                                | Decel-eration control | PR    |
| 17      | ADE           | A/D converter error                           | Abnormality found in current detection A/D converter during self-diagnostic checks after servo amp power ON.                                                | Dynamic               | PR    |
| 18      | RD2           | Serial detector . initial communication error | Initial communication with detector cannot take place (with HA**N-E33, HA**N-A33, or HA-FH).                                                                | Initial error         | PR    |
| 1F      | PIDE          | Power P board ID error                        | Servo amp internal power unit is SVJ-type.                                                                                                                  | Initial error         | AR    |
| 20      | NS1           | No feedback signal                            | Feedback signal lost (with HA**N-E30, HA053, HA13, HA-FE; or HA-ME).                                                                                        | Dynamic               | PR    |
| 25      | ABSE          | Absolute position lost                        | Low voltage on absolute position detector's internal backup battery. can't guarantee accuracy of absolute position.                                         | Initial error         | AR    |
| 2B      | SMEN          | Serial detector . CPU error                   | Error detected in data in detector's internal EEPROM (with HA**N-E33, HA**N-A33).                                                                           | Initial error         | AR    |
| 2C      | SLED          | Serial detector . LED error                   | Deterioration sensed in detector LED (with HA**N-E33 or HA**N-A33).                                                                                         | Dynamic               | PR    |
| 2D      | SDAT          | Serial detector . data error                  | Abnormality sensed in detector's internal position control in one revolution (with HA**N-E33 or HA**N-A33).                                                 | Dynamic               | PR    |
| 2F      | STRE          | Serial detector . communication error         | Communication with detector interrupted (with HA**N-E33, HA**N-A33, or HA-FH).                                                                              | Dynamic               | PR    |
| 30      | OR            | Over-regeneration                             | Overheating in regeneration resistors detected. Cannot be reset if regeneration load is over 40%. Do not force-reset by turning servo amp power OFF and ON. | Decel-eration control | PR    |
| 31      | OS            | Overspeed                                     | Motor speed detected in excess of motor's permissible speed (1.2 X maximum motor speed).                                                                    | Decel-eration control | PR    |
| 32      | PMOC          | Power module error (excessive current)        | Excessive current detected by IPM used with inverter.                                                                                                       | Dynamic               | PR    |
| 33      | OV            | Excessive voltage                             | Excessive voltage detected on servo amp's internal PN power supply.                                                                                         | Dynamic               | PR    |
| 34      | DP            | CRC error                                     | Error detected in data sent from controller to servo amp.                                                                                                   | Decel-eration control | PR    |



| Number | Abbreviation | Name                          | Description                                                                                                                                                                  | Stopping method      | Reset |
|--------|--------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------|
| 35     | DE           | Data error                    | Error detected in movement command data sent from controller.                                                                                                                | Deceleration control | PR    |
| 36     | TE           | Communication error           | Communication from controller interrupted.                                                                                                                                   | Deceleration control | PR    |
| 37     | PE           | Initial parameter error       | Illegal parameter detected in parameters sent following controller power ON.                                                                                                 | Initial error        | PR    |
| 38     | TP1          | Protocol error 1              | Error detected in communication frame sent from controller.                                                                                                                  | Deceleration control | PR    |
| 39     | TP2          | Protocol error 2              | Error detected in axis status data sent from controller.                                                                                                                     | Deceleration control | PR    |
| 3A     | OC           | Excessive current             | Excessive level detected in motor drive current.                                                                                                                             | Dynamic              | PR    |
| 3B     | PMOH         | Power module error (overheat) | Overheating detected in IPM used with inverter.                                                                                                                              | Dynamic              | PR    |
| 42     | FE1          | Feedback error                | Missing feedback pulse or abnormality in Z phase detected (with HA**N-E30, HA053, HA13, HA-FE, or HA-ME).                                                                    | Deceleration control | PR    |
| 46     | OHM          | Motor overheat                | Thermal protector operated in motor or detector.                                                                                                                             | Deceleration control | NR    |
| 50     | OL1          | Overload detection 1          | Overload detection level current (SV022:OLL) flowed for overload time constant period (SV021:OLT), or load exceeded motor rating. Cannot be reset if load level is over 40%. | Deceleration control | NR    |
| 51     | OL2          | Overload detection 2          | Current command of more than 95% of servo amp's maximum capacity continued for over 1 second.                                                                                | Dynamic              | NR    |
| 52     | OD1          | Excessive error 1 (servo ON)  | With servo ON, discrepancy between ideal position and actual position exceeded parameter SV023:OD1 (or SV053:OD3).                                                           | Dynamic              | NR    |
| 53     | OD2          | Excessive error 1 (servo OFF) | With servo OFF, discrepancy between ideal position and actual position exceeded parameter SV026:OD2.                                                                         | Dynamic              | NR    |
| 88     | WD           | Watchdog                      | Servo system not functioning normally.                                                                                                                                       | Dynamic              | AR    |

#### 4.2 Warning Descriptions

| Number | Abbreviation | Name                                             | Description                                                                                                          | Reset |
|--------|--------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------|
| 93     | WAM          | Initial absolute position fluctuation            | Position moved by more than permissible amount from absolute position detected at controller power ON.               | PR    |
| 9E     | WAR          | Serial detector • multi-revolution counter error | Abnormality detected in multi-revolution counter; can't guarantee accuracy of absolute position (with HA**N-A33).    | .     |
| 9F     | WAB          | Low battery voltage                              | Low voltage detected on absolute position detector battery.                                                          | .     |
| E0     | WOR          | Over-regeneration warning                        | Regeneration of 80% of over-regeneration alarm level detected.                                                       | .     |
| E1     | WOL          | Overload warning                                 | Loading of 80% of overload alarm level detected.                                                                     | *     |
| E3     | WAC          | Absolute position counter warning                | Discrepancy detected between absolute position and relative position; can't guarantee accuracy of absolute position. | .     |
| E4     | WPE          | Parameter error warning                          | Parameter setting detected outside permissible range.                                                                | *     |
| E6     | AXE          | Controlled axis removed warning                  | Controlled axis removed.                                                                                             | *     |
| E1     | NCE          | External emergency stop                          | External emergency stop input received.                                                                              | *     |

## 4.3 Initial Parameter Error Numbers

Whenever an initial parameter error (alarm 37) occurs, the parameter causing the error is identified on the controller's diagnostic screen. Note that the format in which erroneous parameters are displayed differs according to the controller. For details, please refer to the relevant instruction manual. Parameter numbers are as follows:

## Parameter Numbers

M500-type CNC : 1 to 64  
 MS0-type CNC, machine controller model N : 2201 to 2264

If and when an initial parameter error occurs, first check the parameter setting range. If the setting is within the permissible range, the cause of the error is probably as shown below.

| Number |      | Probable cause                                                                                                                                                                                                                                                   |
|--------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| M500   | M50  |                                                                                                                                                                                                                                                                  |
| 19     | 2219 | Detector resolution setting does not match currently connected detector. (If detector is incremental type, also check SV025.)                                                                                                                                    |
| 20     | 2220 | SV020 setting value does not match SV019.                                                                                                                                                                                                                        |
| 25     | 2225 | Motor type setting is for motor type that is not recognized.<br>Detector type designation is incorrect.<br>Absolute position system is set with detector type setting of 00.<br>Motor type HA053 or HA13 is set with detector type setting of 00 (should be 33). |
| 27     | 2227 | Lost motion correction types 1 and 2 are enabled simultaneously.                                                                                                                                                                                                 |
| 36     | 2236 | Regeneration resistor type setting is for regeneration resistor that is not recognized.                                                                                                                                                                          |
| 55     | 2255 | SV055 setting value (input of 0 is taken as 2000) is smaller than SV048 setting value.                                                                                                                                                                           |

Parameter errors with the numbers shown below are caused by more than one parameter.

| Number |      | Probable cause                                                                                                                                                                                                                       | Related parameters                                        |
|--------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| M500   | M50  |                                                                                                                                                                                                                                      |                                                           |
| 101    | 2301 | Electronic gearing constant is greater than machine constant.<br>Check that all related parameters are set correctly.                                                                                                                | SV001:PC1, SV002:PC2, SV018:PIT<br>SV019:RNG1, SV020:RNG2 |
| 102    | 2302 | Absolute position detection parameter is ON with HA*N-E33 connected.<br><br>Turn absolute position detection parameter OFF. To carry out absolute position detection, replace incremental-type detector with absolute position-type. | SV017:SPEC, SV025:MTYP                                    |

#### 4.4 100V Servo Amps

A low power supply voltage can limit maximum operating capacity.

The MDS-A-SVJ-OIW (100W) and MDS-A-SVJ-03W (300W) normally have an instantaneous operating capacity of 300% of the rated motor output (excluding HA\*\*N motors). If the power supply voltage is below 90V, however, the MDS-A-SVJ-03W's maximum instantaneous operating capacity is limited to 4.75A (250% of the HA-FE33's rated output). With this limitation, excessive error 1 (OD1) alarms are liable to occur. To prevent excessive error 1 alarms, increase the excessive error detection range settings (SV023 and SV053).

Note that the MDS-A-SVJ-01W (100W) is not thus affected.

<<NOTE>> The MDS-A-SVJ-01W and MDS-A-SVJ-03W are designed for use with a single-phase, 100V power supply. Never apply a 200V power supply. Use of a 200V power supply would damage the amp.

| Revision number | Date of revision (S/W) | Details of revision                                                                                                                                                                                                                 |
|-----------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 | '95- 2-27 (B4)         | First edition of manual released.                                                                                                                                                                                                   |
| A               | '95- 6-23 (C0)         | Servo parameters added.<br>Regeneration Resistor Types table created.<br>D/A output specifications and output voltage calculation formula added.<br>Causes of initial parameter errors grouped according to error parameter number. |
| B               | '95- 1-26 (C1)         | Electronic Gearing notes (section 3.6) revised.<br>Front cover title changed from "Mitsubishi Personal Machine Controller" to Mitsubishi AC Servo.                                                                                  |
|                 |                        |                                                                                                                                                                                                                                     |