DOOSAN AC SERVO MOTOR/DRIVE
VISION
DVSC – TM Series

MODEL: 0.8KW/1.5KW/1.7KW/2.0KW/2.3KW/3.0KW/4.0KW

Operation Manual

REV. B
### Version History

<table>
<thead>
<tr>
<th>Ver.</th>
<th>Changed Contents</th>
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</thead>
<tbody>
<tr>
<td>Ver. B</td>
<td>--------------------- Servo drive for Turret/Magazine ---------------------</td>
</tr>
<tr>
<td></td>
<td>Modification of Servo motor in 1.1 Formal type designation (Page 1)</td>
</tr>
<tr>
<td></td>
<td>Modification of 1.6 Outside circuit connection diagram (Page 15)</td>
</tr>
<tr>
<td></td>
<td>Modification of 1.7 Layout of connector terminal CN1, CN2 (Page 18)</td>
</tr>
<tr>
<td></td>
<td>Modification of contents in 2.1 Automatic operation (Page 22)</td>
</tr>
<tr>
<td></td>
<td>Add 2.7 Switch of display mode, parameter and position compensation value setting method at the time an alarm occurs (Page 31)</td>
</tr>
<tr>
<td></td>
<td>Add 2.8 S-shaped acceleration/deceleration setting method (Page 33)</td>
</tr>
<tr>
<td></td>
<td>Add 2.9 Backlash compensation setting method (Page 34)</td>
</tr>
<tr>
<td></td>
<td>Add 2.10 Teaching function setting method (Page 36)</td>
</tr>
<tr>
<td></td>
<td>Add 2.11 Position signal output selection function (Page 39)</td>
</tr>
<tr>
<td></td>
<td>Modification of 3.2.2 Display Flowchart (Page 45)</td>
</tr>
<tr>
<td></td>
<td>Add 3.4.6 Teaching function setting (Page 52)</td>
</tr>
<tr>
<td></td>
<td>Add 3.4.7 Position signal output whole zone setting (Page 52)</td>
</tr>
<tr>
<td></td>
<td>Add 3.4.8 Angle setting by position signal section (Page 53)</td>
</tr>
<tr>
<td></td>
<td>Modification of 3.4.9 Drive itself JOG operation (Page 53)</td>
</tr>
<tr>
<td></td>
<td>Modification of 3.5.2 Drive operation at alarm occurrence (Page 58)</td>
</tr>
<tr>
<td></td>
<td>Modification of 3.6.2 User parameter list (Page 63)</td>
</tr>
<tr>
<td></td>
<td>Modification of parameter 0 contents in 3.6.3 Detailed explanation of user parameter (Page 64)</td>
</tr>
<tr>
<td></td>
<td>Modification of parameter 5 contents in 3.6.3 Detailed explanation of user parameter (Page 65)</td>
</tr>
<tr>
<td></td>
<td>Modification of parameter 31 contents in 3.6.3 Detailed explanation of user parameter (Page 68)</td>
</tr>
<tr>
<td></td>
<td>Modification of parameter 48 contents in 3.6.3 Detailed explanation of user parameter (Page 70)</td>
</tr>
<tr>
<td></td>
<td>Modification of parameter 50 contents in 3.6.3 Detailed explanation of user parameter (Page 70)</td>
</tr>
<tr>
<td></td>
<td>Modification of parameter 56 contents in 3.6.3 Detailed explanation of user parameter (Page 71)</td>
</tr>
<tr>
<td></td>
<td>--------------------- Servo drive for ATC ---------------------</td>
</tr>
<tr>
<td></td>
<td>Modification of 1.6 Outside circuit connection diagram (Page 78)</td>
</tr>
<tr>
<td></td>
<td>Modification of contents in 2.1 Automatic operation (Page 83)</td>
</tr>
<tr>
<td>Ver.</td>
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<tr>
<td></td>
<td>Add 2.5 Switch of display mode, parameter and position compensation value setting method at the time an alarm occurs (Page 90)</td>
</tr>
<tr>
<td></td>
<td>Add 2.6 S-shaped acceleration/deceleration setting method (Page 92)</td>
</tr>
<tr>
<td></td>
<td>Modification of 3.2.2 Display Flowchart (Page 95)</td>
</tr>
<tr>
<td></td>
<td>Modification of 3.4.6 Maker management items (Page 102)</td>
</tr>
<tr>
<td></td>
<td>Modification of 3.4.7 Drive itself JOG operation (Page 102)</td>
</tr>
<tr>
<td></td>
<td>Modification of 3.5.2 Drive operation at alarm occurrence (Page 106)</td>
</tr>
<tr>
<td></td>
<td>Modification of 3.6.2 User parameter list (Page 111)</td>
</tr>
<tr>
<td></td>
<td>Modification of parameter 0 contents in 3.6.3 Detailed explanation of user parameter (Page 113)</td>
</tr>
</tbody>
</table>
3.7. Position compensation value setting ................................................................. 72
Servo drive for ATC........................................................................................................... 74
1. Installation and wiring ................................................................................................. 74
  1.1. Designations ........................................................................................................... 74
  1.2. Environmental conditions ...................................................................................... 75
  1.3. Installation method ................................................................................................ 75
  1.4. Wiring ..................................................................................................................... 77
  1.5. Noise treatment ..................................................................................................... 77
  1.6. Outside circuit connection diagram(example) ......................................................... 78
  1.7. Layout of drive connector terminal ....................................................................... 79
  1.8. Signals for connector CN1 and their meanings ..................................................... 80
  1.9. Signals for connector CN2 and their meanings ..................................................... 81
  1.10. Structure of drive I/O circuit ............................................................................... 82
2. Operation ..................................................................................................................... 83
  2.1. Automatic operation .............................................................................................. 83
  2.2. Parameter and Machine Origin setting method after replacement of the servo drive ......................................................... 84
  2.3. Operation of servo drive in JOG mode by external signal ...................................... 88
  2.4. Machine Origin setting method by external signal ............................................... 89
  2.5. Switch of display mode, parameter and position compensation value setting .......... 90
  2.6. S-shaped acceleration/deceleration setting method ............................................... 92
3. Display/Setting part ..................................................................................................... 93
  3.1. Functions ................................................................................................................ 93
  3.2. Operating of the Display/Setting part and display flowchart .................................. 94
  3.3. State display .......................................................................................................... 96
  3.4. Diagnosis display .................................................................................................. 99
  3.5. Alarm history display ............................................................................................ 106
  3.6. User Parameter setting and Detailed explanation .................................................. 109
WARNING

I. Definition of Symbols for Warning

1) Warning : This symbol means that there is possible of danger such as electric shock, if not handled properly.

2) Caution : This symbol means that there is possible of danger such as receiving a slight or serious injuries or machine damages, if not handled properly.

II. Warning

1) Do not use in areas near corrosive, inflammable or explosive gas.

2) Take appropriate measures of protection while the servo motor is in operation.

3) While installing and wiring, turn the power switch off, in order to prevent electric shock.

4) Ground the PE terminal block of the front panel terminal block L1(R), L2(S), L3(T) to one-point with the class 3 (below 100Ω) ground circuit, in order to prevent electric shock or other malfunctions. For PE terminal block, use wire 40mm² thicker than the electric wire of the terminal L1, L2, L3.

5) Connect the PE terminal block of the servo motor to the PE terminal block U, V, W of the servo drive in order to prevent electric shock. To connect the wire, use wire 40mm² thicker than the power line of U, V, W.

6) Take precautions while mounting, dismantling, uninstalling and transferring the servo motor.

7) Cover the terminal block while using the servo drive in order to prevent electric shock.

8) Use the reinforcement wire SELV for maintenance brake power switch, input and output power switch and input and output signal in order to prevent electric shock.

9) Do not dismantle the servo drive within 5 minutes after shutting off the main power. – Charged voltage may still remain inside the drive.

10) This product uses batteries. Take the following precautions while using the battery. If used inappropriately, explosion or fire may occur. The contents of the battery are harmful to the eye.

   ① Do not heat above 100℃ and do not open when there is fire.
   ② Do not take it apart. (The contents are harmful to the eye.)
③ Do not recharge it.

11) During emergency shutdown, stop the servo motor before shutting down the servo drive (terminal L1, L2, L3).

III. Caution

1) To avoid burns, do not touch the heat protecting board or the regenerative resistor of the servo motor and drive while the servo motor is in operation or right after turning off the power switch. Take appropriate measures of protection.

2) Avoid the following to prevent damages to the servo motor and servo drive.
   ① Do not connect the power directly to the U, V, W terminal block of the servo motor. The servo motor will be damaged.
   ② Avoid external impact such as hammering to the servo motor. The encoder inside the servo motor will be damaged.
   ③ Do not connect the power to the U, V, W terminal block of the servo drive.
   ④ While doing the resisting pressure test or insulation voltage test, disconnect the terminal of the servo drive terminal block or all the connectors and avoid the test voltage from affecting the servo drive. Also avoid the test voltage from affecting the encoder connector terminal of the servo motor.
   ⑤ Do not install the servo motor and the servo drive differently than it should.
   ⑥ Prevent water or oil from directly touching the servo motor. Use in areas free of water or oil to prevent it from touching the main wire of the servo motor.
   ⑦ Do not use the servo motor and drive differently other than stated in this manual.
COMMON SUBJECT

1. Specifications and Composition

1.1. Formal type designation

◆ Servo Motor

<table>
<thead>
<tr>
<th>TYPE</th>
<th>RH SERIES</th>
<th>RG SERIES</th>
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<table>
<thead>
<tr>
<th>OUTPUT</th>
<th>08 : 0.8KW</th>
<th>15 : 1.5KW</th>
<th>17 : 1.7KW</th>
<th>20 : 2.0KW</th>
<th>23 : 2.3KW</th>
<th>28 : 2.8KW</th>
<th>30 : 3.0KW</th>
<th>40 : 4.0KW</th>
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<thead>
<tr>
<th>ENCODER</th>
<th>17BIT ABS</th>
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|------------------------|----------------------------------|----------------------------------|-------------------------------|-------------------------------|------------|

◆ Servo Drive

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<thead>
<tr>
<th>COMPACT DRIVE SERIES</th>
<th>TYPE</th>
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<tr>
<td>TT : TURRET/MAG.</td>
<td>TA : ATC</td>
</tr>
<tr>
<td>TX : 2 AXIS</td>
<td>TM: TURRET/MAG./ATC</td>
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<tr>
<th>S/W VERSION NO.</th>
<th>0 ~ 9</th>
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<tbody>
<tr>
<td>H/W VERSION NO.</td>
<td>A ~ Z</td>
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- Rated Current Capacity
  - 14 : 14A (Bellow 2.0KW Motor)
  - 28 : 28A (Bellow 4.0KW Motor)
1.2. Specifications for Servo Motor

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<thead>
<tr>
<th>Items</th>
<th>Specifications</th>
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<tr>
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<td>F Class</td>
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<td>Multi-turn Absolute Encoder</td>
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<td>(17bits/1 rotation, rotation count :16bits)</td>
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<td>Protection, Cooling method</td>
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<tr>
<td>Ambient temperature</td>
<td>0 ~ 40°C</td>
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<td>Ambient humidity</td>
<td>20 ~ 80%</td>
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<td>Mounting structure</td>
<td>Flange type</td>
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<td>Insulation resistance</td>
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<td>Insulation voltage</td>
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1.3. Torque–Speed Characteristics of Servo Motor(2.0KW)

※ Refer to Motor Specifications for details.
# 1.4. Specifications for Servo Drive

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Applied motor capacity</th>
<th>Rated current</th>
<th>Maximum current</th>
<th>Rotation speed</th>
<th>Main input voltage</th>
<th>Control period</th>
<th>Braking type</th>
<th>Control mode</th>
<th>Control circuit</th>
<th>Encoder Spec.</th>
<th>I/O Terminal block</th>
<th>Protection Functions</th>
<th>Other Functions</th>
<th>Ambient temperature</th>
<th>Ambient humidity</th>
<th>Preservation temperature</th>
<th>Altitude</th>
<th>Vibrations</th>
<th>Mounting</th>
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<tr>
<td><strong>Applied motor capacity</strong></td>
<td>0.8KW / 1.5KW 1.7KW/ 2.0KW / 2.3KW</td>
<td>2.8KW / 3.0KW / 4.0KW</td>
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<td>Absolute Encoder</td>
<td>Input electric power (R, S, T), Output electric power (U, V, W), Ground (E)</td>
<td>Over voltage, under voltage, over current, over speed, over load, encoder error and etc.</td>
<td>Parameter setting, Diagnosis, Alarm Display and State Display by Display/Setting parts</td>
<td>0 ~ 50°C</td>
<td>Below 90%RH (don't be covered with dew)</td>
<td>-20 ~ 85°C</td>
<td>Below 1,000m</td>
<td>Below 0.5G</td>
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<td>28A rms</td>
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<td><strong>Maximum current</strong></td>
<td>40A peak</td>
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<td>80A peak</td>
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<td>Position/ speed/ torque control</td>
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<td>Absolute Encoder</td>
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<td><strong>Protection Functions</strong></td>
<td>Over voltage, under voltage, over current, over speed, over load, encoder error and etc.</td>
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<tr>
<td><strong>Other Functions</strong></td>
<td>Parameter setting, Diagnosis, Alarm Display and State Display by Display/Setting parts</td>
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<tr>
<td><strong>Ambient temperature</strong></td>
<td>0 ~ 50°C</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Ambient humidity</strong></td>
<td>Below 90%RH (don't be covered with dew)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Preservation temperature</strong></td>
<td>-20 ~ 85°C</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Altitude</strong></td>
<td>Below 1,000m</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Vibrations</strong></td>
<td>Below 0.5G</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Mounting</strong></td>
<td>Rack Mount</td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
1.5. Coupling of the Servo Motor / Drive

1.6. Inner structure of Servo Drive
1.7. Rotation direction of the servo motor

▶ ⚠️ Caution: The encoder of the servo motor is made of glass.
   Take precautions in order to avoid damages to the encoder shaft of the servo motor.

▶ ⚠️ Caution: Make sure the rotation direction is correct when the servo motor rotates.

◆ The correct rotation direction is shown in the following picture.

Forward direction (CCW)
2. Dimensions of the servo motor / drive
2.1. Dimensions of the servo motor

- **800W**
DOOSAN TM SERVO OPERATION MANUAL

■ 3.0kW

<table>
<thead>
<tr>
<th>구분</th>
<th>모델</th>
<th>출력 (kW)</th>
<th>Dim. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PH307A - 180</td>
<td>3.0</td>
<td>331</td>
</tr>
<tr>
<td></td>
<td>PH307A - 300</td>
<td>3.0</td>
<td>331</td>
</tr>
<tr>
<td>without brake</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RH307A - 180</td>
<td>3.0</td>
<td>380</td>
</tr>
<tr>
<td></td>
<td>RH307A - 300</td>
<td>3.0</td>
<td>380</td>
</tr>
<tr>
<td>with brake</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.2. Dimensions of the servo drive

- 14A: for 0.8/1.5/1.7/2.0/2.3kW motors

- 28A: for 2.8/3.0/4.0kW motors
Servo drive for Turret and Magazine

1. Installation and wiring

1.1. Designations

Designations of DOOSAN AC Servo Motor and Drive are as follows.
Please refer to this section for system installation and after service.

1) Encoder Connector  2) Power Connector  3) Name Plate  4) Shaft  5) Flange  6) Frame  7) Encoder

1) Encoder 2) Power 3) Name Plate 4) Shaft 5) Flange 6) Frame 7) Encoder
1.2. Environmental conditions
This product was designed for indoor usage.

⚠️ Caution: If used in different circumstances and environment other than stated below, damages may occur.
Please use under the following conditions.

<table>
<thead>
<tr>
<th>Environmental Conditions</th>
<th>SERVO MOTOR</th>
<th>SERVO DRIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>–</td>
<td>3 phase AC 200V ~ 220V +10 ~ -15%, 50/60Hz</td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>0 ~ +40℃</td>
<td>0 ~ +50℃</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-25 ~ +80℃</td>
<td>-25 ~ +65℃</td>
</tr>
<tr>
<td>Humidity</td>
<td>Below 80% RH</td>
<td>Below 90% RH</td>
</tr>
<tr>
<td>(1) Use in areas free of corrosive and explosive gas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Use in areas that are well ventilated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Nearby vibrations or tremors may be the cause of loose contact of the connector, electronic connector device and relay.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.3. Installation method

1.3.1. Assembling of the servo motor

⚠️ Warning: While assembling the servo motor, avoid dropping it.

⚠️ Caution: While mounting the servo motor horizontally, the connector should be assembled facing downward.

The servo motor can be mounted horizontally or vertically.

To prevent vibrations and extend the life of coupling and bearing, the motor shaft and the loading shaft should be precisely aligned. Use flexible coupling when connecting directly to the load.

① The outer part of the coupling should be measured at four equidistant points each 90° apart, and the gap between the maximum and the minimum readings should not exceed 0.03㎜.

② The center point of the motor and the loading shaft should be precisely aligned.

Avoid excessive radial and thrust load to the motor shaft and also avoid impact that is more than 10G when mounting the gear, coupling, pulley and etc. at the same time.

A minus load means continuous operation in the regenerative braking state, when the motor is rotated by load. The regenerative braking capacity of the servo drive is short term rated specification equivalent to stop time of the motor. Thus, it should not be used in minus load that generates continuous regenerative braking.

ex) Servo system for descending objects (without counterweight)

12
The admissible load inertia into the motor shaft is within 5 times than the inertia of applied servo motor. If it exceeds this, during deceleration it may cause regenerative malfunction. The following steps should be taken if the load inertia exceeds more than 5 times the inertia of the servo motor.
- Reduce the current limit.
- Decelerate slowly. (Slow Down)
- Lower the maximum speed in use.

1.3.2. Mounting of the servo drive

⚠️ Warning: To prevent electric shock, turn off the power while mounting or uninstalling.
- While installing the panel, the size of the panel, cooling and wiring should be considered in order to maintain a difference of temperature below 5°C between the panel temperature and the surrounding temperature in accordance with heat value of the equipment and box size.
- If a heating element is placed nearby, the surrounding temperature of the servo drive should be maintained below 55°C at all cases despite temperature rise by convection and radiation. Use a fan to ventilate sealed inner air, and proper ventilation should be used for convection of the air.
- If a vibrating element is placed nearby, the drive should be mounted on shock absorbing surface.
- If the servo drive be exposed to corrosive gas for a long time, may cause damages to connecting devices such as relay and circuit breaker, thus it should be avoided.
- Environmental conditions such as high temperature, high humidity, excessive dust and metal particles should be avoided.

◆ Mounting method
- There should be a space wider than 100mm below and above the servo drive.
- There should be a space wider than 30mm on both sides of the servo drive.
- Mount the servo drive vertically. Do not use if it is mounted horizontally.
1.4. Wiring

- For signal lines and encoder lines, use twisted lines or multi-core shielded twisted-pair lines. The length for command input lines should be maximum 3m, and the encoder line should be maximum 10m or less.
- Wiring must be done in shortest distance and the remaining length should be cut.
- The ground circuit should be a thick line. Usage of third-class grounding or above (ground resistance 100Ω or less) is recommended. Also, make sure to ground at one-point grounding.
- The following precautions should be taken to avoid malfunction due to noise.
  - The noise filter should be placed as near as possible.
  - Mount a surge absorber to the coil of the relay, electromagnetic contacts, solenoids and etc.
  - The power line (AC input, motor input line) and the signal line should be placed 30cm apart or more. Do not put them into the same duct or tie them in a bundle.
  - If the power source of the servo drive is used in common with an electric welder or electrical discharge machine, or a high-frequency noise source is present, attach noise filter to the power or the input circuits.
  - Since the core wire of the signal line cable is as thin as only 0.2 ~ 0.3㎟, excessive force to the line should be avoided to prevent damages.

1.5. Noise treatment

For wiring and grounding of the servo drive, the effect of switching noise which is generated by the built-in IPM should be reduced as much as possible. Unexpected effect by outside noise should be reduced as much as possible.

- Grounding method
  The servo drive supplies power to the motor according to the switching of the IPM device. Thus the Cf dv/dt current flows from the power component to the floating capacity of the motor. To prevent the effect of the switching noise, the motor frame terminal should be connected to the PE terminal of the servo drive terminal block and the PE terminal of the servo drive should be directly grounded to standard ground panel.

- Noise filter
  Noise filter is used in order to prevent noise from the power line. Please refer to the following conditions while installing.
  (a) Separate the input and output wiring and do not tie them together or put them into the same duct.
  (b) Do not put the ground wire into the same duct with the filter output line or other signal lines. And do not tie them together.
  (c) The ground wire should be wired singly to the ground panel.
  (d) If the unit contains the filter, connect the filter and the equipment ground to the base of the unit.
1.6. Outside circuit connection diagram (example)

- **NC CONTROLLER**
  - SEQUENCE INPUT
  - POSITION INPUT
  - OVERRIDE INPUT

- **AC SERVO DRIVE**
  - A1, A2, B1, B2, B3, B4, B5, B6, B7, B8, B9, B10, A10

- **AC SERVO MOTOR**
  - A1, B1, B2, A2, B3, B4, B5, B6

**NOTE**
1. TWISTED PAIR SHIELDED CABLE
2. USE FOR BUILT-IN BRAKE TYPE MOTOR
3. CONNECTOR SPECIFICATION
   - MAKE: TYCO ELECTRONICS AMP
   - PCN1: 1318107-1, 1318118-9
   - PCN2: 1318107-1, 1318118-9
   - PCN3: 1318107-6, 1318118-6
   - PCN1: 1-917807-2, 316040-6(14D), 316041-6(26B)
   - PCN2: 3-917807-2, 316040-6(14D), 316041-6(26B)
NOTE
1. TWISTED PAIR SHIELDED CABLE
2. USE FOR BUILT-IN BRAKE TYPE MOTOR
3. CONNECTOR SPECIFICATION
   MAKER : TYCO ELECTRONICS AMP

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>RECEPTACLE HOUSING</th>
<th>RECEPTACLE AMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN1</td>
<td>1–1318118-9</td>
<td>1318107-1</td>
</tr>
<tr>
<td>CN2</td>
<td>2–1318118-9</td>
<td>1318107-1</td>
</tr>
<tr>
<td>CN3</td>
<td>1–1318118-6</td>
<td>1318107-1</td>
</tr>
<tr>
<td>PCN1</td>
<td>1–917807-2</td>
<td>316040-6(14D)</td>
</tr>
<tr>
<td>PCN2</td>
<td>3–917807-2</td>
<td>316040-6(14D)</td>
</tr>
</tbody>
</table>
1.7. Layout of drive connector terminal

1.7.1. Layout of connector terminal CN1

<table>
<thead>
<tr>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
<th>B7</th>
<th>B8</th>
<th>B9</th>
<th>B10</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM2</td>
<td>POSI6/</td>
<td>POSI4/</td>
<td>POSI2/</td>
<td>POSI0/</td>
<td>SPARE</td>
<td>JOG−/</td>
<td>SVON/</td>
<td>OVR3/</td>
<td>OVR1/</td>
</tr>
<tr>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5</td>
<td>A6</td>
<td>A7</td>
<td>A8</td>
<td>A9</td>
<td>A10</td>
</tr>
<tr>
<td>START/</td>
<td>POSI5/</td>
<td>POSI3/</td>
<td>POSI1/</td>
<td>COM1</td>
<td>STOP/</td>
<td>JOG+/</td>
<td>SPARE</td>
<td>OVR2/</td>
<td>OVR0/</td>
</tr>
</tbody>
</table>

1.7.2. Layout of connector terminal CN2

<table>
<thead>
<tr>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
<th>B7</th>
<th>B8</th>
<th>B9</th>
<th>B10</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM4</td>
<td>POSO1/</td>
<td>POSO3/</td>
<td>POSO5/</td>
<td>VPF/</td>
<td>BAT_L/</td>
<td>SVRDY/</td>
<td>AUX_OUT1/</td>
<td>BRAKE+/</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5</td>
<td>A6</td>
<td>A7</td>
<td>A8</td>
<td>A9</td>
<td>A10</td>
</tr>
<tr>
<td>POSO0/</td>
<td>POSO2/</td>
<td>POSO4/</td>
<td>POSO6/</td>
<td>COM3</td>
<td>ALM/</td>
<td>AUX_OUT0/</td>
<td>POSO7/</td>
<td>BRAKE−/</td>
<td></td>
</tr>
</tbody>
</table>

1.7.3. Layout of connector terminal CN3

<table>
<thead>
<tr>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
</tr>
</thead>
<tbody>
<tr>
<td>+6</td>
<td>+6</td>
<td>RX</td>
<td>RX/</td>
<td>BAT+</td>
<td>BAT−</td>
</tr>
<tr>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5</td>
<td>A6</td>
</tr>
<tr>
<td>+6</td>
<td>GND</td>
<td>GND</td>
<td>GND</td>
<td>BAT+</td>
<td>FG</td>
</tr>
</tbody>
</table>

1.7.4. Layout of connector terminal

Maker: TYCO ELECTRONICS AMP

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>RECEPTACLE HOUSING</th>
<th>RECEPTACLE CONTACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN1</td>
<td>1-1318118-9</td>
<td>1318107-1</td>
</tr>
<tr>
<td>CN2</td>
<td>2-1318118-9</td>
<td>1318107-1</td>
</tr>
<tr>
<td>CN3</td>
<td>1-1318118-6</td>
<td>1318107-1</td>
</tr>
<tr>
<td>PCN1</td>
<td>1-917807-2</td>
<td>316040-6(14D)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>316041-6(28B)</td>
</tr>
<tr>
<td>PCN2</td>
<td>3-917807-2</td>
<td>316040-6(14D)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>316041-6(28B)</td>
</tr>
</tbody>
</table>
### 1.8. Signals for connector CN1 and their meanings

<table>
<thead>
<tr>
<th>Signal</th>
<th>No.</th>
<th>Description</th>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVON</td>
<td>B8</td>
<td>When this signal is ON, the motor generates torque as energized state and will be ready to run. When this signal is off, the motor state is changed as free–run. (In case there is an inner brake, the brake operates.)</td>
<td>Input</td>
</tr>
<tr>
<td>JOG+(CCW)</td>
<td>A7</td>
<td>These signals are used as two different modes, depending on the setting value of the parameter 3.</td>
<td>Input</td>
</tr>
<tr>
<td>JOG– (CW)</td>
<td>B7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Direction fixing signal (when set the value of the parameter 3 as 0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>At the time of positioning move, the rotation direction can be fixed to one side.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCW, CW signals = OFF : The rotation direction is automatically set as the short distance side.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCW signal = ON : The rotation direction is fixed counterclockwise.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CW signal = ON : The rotation direction is fixed clockwise.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCW, CW signals = ON : Cannot be defined.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- JOG Operation signal (when set the value of the parameter 3 as 1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Used as manual jog operation signal.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>JOG+ signal = ON : The motor rotates counterclockwise while this signal is on.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>And when it turns off, the motor stops at the nearest POST of rotation direction.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>JOG– signal = ON : The motor rotates clockwise while this signal is on.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>And when it turns off, the motor stops at the nearest POST of rotation direction.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rotation speed and acceleration/deceleration time is the same as when it is operated automatically. When it is operated automatically and motor is running, these signals are ignored.</td>
<td></td>
</tr>
<tr>
<td>STOP</td>
<td>A6</td>
<td>When this signal is ON, the motor stops abruptly. The motor moves the rest of the distance according to the START signal input.</td>
<td>Input</td>
</tr>
<tr>
<td>SPARE</td>
<td>B6</td>
<td>Spare signal</td>
<td>Input</td>
</tr>
<tr>
<td>COM1</td>
<td>A5</td>
<td>COMMON terminal for sequence input signals (When the DC 24V is inputted between this terminal and the certain input signal, the signal turns ON.)</td>
<td>Input</td>
</tr>
<tr>
<td>START</td>
<td>A1</td>
<td>When this signal turns ON while the SVON signal is ON, it moves towards input value of the position data (binary code). Maintain the ON time at minimum 100 msec.</td>
<td>Input</td>
</tr>
<tr>
<td>POSI0, POSI1</td>
<td>B5</td>
<td>Input signals of the position data</td>
<td>Input</td>
</tr>
<tr>
<td>POSI2, POSI3</td>
<td>A4</td>
<td>The POST number is entered to these signals as 7 bits binary code.</td>
<td></td>
</tr>
<tr>
<td>POSI4, POSI5</td>
<td>B4</td>
<td>Input data should be entered before the START signal more than 10 msec. (Minimum input data is 1.)</td>
<td></td>
</tr>
<tr>
<td>POSI6</td>
<td>A3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COM2</td>
<td>B1</td>
<td>COMMON terminal for START, POSI0–POS16 signals (When the DC 24V is inputted between this terminal and the certain input signal, the signal turns ON.)</td>
<td>Input</td>
</tr>
<tr>
<td>OVR0</td>
<td>OVR1</td>
<td>Input signals of the position data</td>
<td>Input</td>
</tr>
<tr>
<td>OVR2</td>
<td>OVR3</td>
<td>The POST number is entered to these signals as 7 bits binary code.</td>
<td></td>
</tr>
<tr>
<td>OVR0</td>
<td>POSI7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OVR1</td>
<td>A10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OVR2</td>
<td>B10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OVR3</td>
<td>A9</td>
<td>When the parameter 46 is set as 1, these signals are used as OVERRIDE inputs. (4 bits binary code input (OVR0–OVR3))</td>
<td>Input</td>
</tr>
<tr>
<td></td>
<td>B9</td>
<td>When the parameter 2 is set as 1 or the parameter 46 is enabled as 2, these signals are used as option function signal.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>When the parameter 46 is set as 3, OVR0 is changed as POSI7 signal and used as command of 128 TOOL.</td>
<td></td>
</tr>
</tbody>
</table>
1.9. Signals for connector CN2 and their meanings

<table>
<thead>
<tr>
<th>Signal</th>
<th>No.</th>
<th>Description</th>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALM</td>
<td>A6</td>
<td>When a drive alarm occurs, this signal is OFF and the normal case, this signal turns ON.</td>
<td>Output</td>
</tr>
<tr>
<td>SVRDY</td>
<td>B7</td>
<td>Servo ready complete signal. When the SVON signal is ON, this signal turns ON after the setting time in the parameter 13 unless there’s anything wrong with the drive. When the SVON signal is OFF, this signal turns OFF after the setting time in the parameter 15.</td>
<td>Output</td>
</tr>
<tr>
<td>BAT_L</td>
<td>B6</td>
<td>When the battery voltage falls below 3.2V, this signal (Active Low) turns ON.</td>
<td>Output</td>
</tr>
<tr>
<td>COM3</td>
<td>A5</td>
<td>COMMON terminal for sequence signals (ALM, SVRDY, etc.)</td>
<td>Output</td>
</tr>
<tr>
<td>COM4</td>
<td>B1</td>
<td>COMMON terminal for sequence signals (POSO0, VPF, etc.)</td>
<td>Output</td>
</tr>
<tr>
<td>BRAKE+</td>
<td>B10</td>
<td>In case there is an inner brake in the motor, this signal controls the brake power. (The current flow capacity is within 30mA due to photo coupler contact point, thus a different relay contact point must be used for the actual brake power ON/OFF control. Design the circuit so that when output contact point is ON, the brake is free, when output contact point is OFF, the brake operates.)</td>
<td></td>
</tr>
<tr>
<td>BRAKE−</td>
<td>A10</td>
<td></td>
<td>Output</td>
</tr>
<tr>
<td>VPF</td>
<td>B5</td>
<td>Positioning completion signal output. If the pulse error readings while the motor is moving is within the setting value in the parameter 18, this signal turns ON. (This signal turns ON even when the SVON signal turns OFF.)</td>
<td>Output</td>
</tr>
<tr>
<td>POSO0, POSO1, POSO2, POSO3, POSO4, POSO5, POSO6</td>
<td>A1,B2, A2,B3, A3,B4, A4</td>
<td>As the position data output signal, these signals output currently located POST number as 7 bits binary code. While the motor rotates, these signals will not be outputted. These signals will be outputted just before the VPF signal turns ON. When the SVON signal is OFF, the nearest POST number will be outputted.</td>
<td></td>
</tr>
<tr>
<td>AUX_OUT0</td>
<td>A7</td>
<td>If the option function is enabled, while the parameter 2 is set as 1 or the parameter 46 is set as 2, this signal outputs the signal reception state. When the parameter 46 is set as 3, AUX_OUT0 is changed as POSO7 signal and used as command of 128 TOOL.</td>
<td></td>
</tr>
<tr>
<td>AUX_OUT1</td>
<td>B8</td>
<td></td>
<td>Output</td>
</tr>
</tbody>
</table>
1.10. Structure of drive I/O circuit

① Input
There are ALMRST, SVON, JOG+, JOG-, STOP, SPARE, START, POS10~POS16 signals and two types of input circuits are provided. (The current is limited to 5mA due to inner resistance.)

![AC SERVO DRIVE](image1)

Using VCC(+24V) COMMON

Using GND COMMON

② Output
There are SVRDY, ALM, BAT_L, VPF, POS00~POS06 signals. They are photo coupler output, thus design the output circuit so that the output current is limited to 50mA.

![AC SERVO DRIVE](image2)

+24V
COM3 or COM4
50mA max
R
2. Operation

2.1. Automatic operation

① If the drive maintains a normal state (takes 5 sec) after the POWER turns on, it outputs the initial position data and the positioning completion signal (VPF) after it detects the initial position by the absolute encoder.

② When the SVON signal is ON, the SVRDY signal turns ON after the inner GATE turns ON.

③ When the START signal is ON, the servo motor will rotate according to the position data. (Maintain ON state of the START signal for about 100 ~ 200 msec.)

④ When the position movement starts, the position data 0 will be outputted with turning OFF the VPF (Positioning Completion) signal.

⑤ When the position movement is complete, the VPF signal turns ON after the position input data is outputted.

⑥ The host controller must turn OFF the SVON signal only after the VPF signal turns ON. (Move to the next position after the SVRDY signal turns OFF.)

⑦ After the SVRDY and the SVON signals are turned OFF, the current position data is outputted.
2.2. Jog operation and Usage of BRAKE Signal (Magazine Port move by the jog signal)

① Turn ON the Jog Switch.
② The PLC outputs the SERVO ON signal to the servo drive.
③ When the SERVO ON signal turns ON, the BRAKE release signal is outputted after the time value in the parameter 14.
④ After the time value in the parameter 13, the SERVO READY signal is outputted.
⑤ After the SERVO READY signal is outputted, the PLC must input the JOG+ signal to the servo drive.
⑥ When the position movement is complete, the positioning completion signal (VPF) turns ON after the position data that is increased by more than one from the previous position is outputted.
⑦ When the positioning completion signal (VPF) turns ON, the PLC turns OFF the SERVO ON signal. Then, the servo drive turns ON the BRAKE signal and turns OFF the SERVO READY signal after the time value in the parameter 15.

The servo drive outputs the current position data after the SERVO ON signal turns OFF.

※ In the jog mode, the motor cannot rotate over 4,000 revolutions continuously. If there is an input over 4,000 revolutions, the motor will stop and it will not rotate. In this case, turn off the JOG+ or JOG− signal and then turn it on again.
2.3. Parameter and Machine Origin setting method after replacement of the servo drive

At the time of the first machine assembly, it should be set the absolute encoder zero–point to the Machine Origin. The setting method is as follows. (These steps should be done when the external SERVO ON signal is OFF.)

2.3.1. Parameter and Machine Origin setting method of Turret/Magazine

1) Turn on the drive power.

2) Clamp the Turret.

3) Set value of the parameter 45, servo drive function selection parameter, as 0. Please change the parameter 45 as 1 only when it needs to set as ATC because default value is 0, Turret/Magazine. Turn the drive power OFF and then turn ON again after setting the value.

4) Initialize the parameter value. Press the MODE key to change the display to diagnosis mode, and then press the DOWN key three times to change the display to parameter initialize mode.

![Display modes](image)

- State display mode
- Diagnosis display mode
- Parameter initialize display

: Press the SET key to save the parameter.

: Parameters from No. 0 to 99 are saved automatically.

: Return to the original display after saving the parameter up to 99 automatically.
5) Initialize the position compensation value.
   After parameter initialization, press the UP key once to change the display to position compensation value initialize mode.

   ![Parameter initialize display]
   ![Position compensation value initialize display]

   : Press the SET key to initialize the position compensation value.

   ![Parameters from 0 to 127 are saved automatically.]

   : Return to the original display after saving the parameter up to 127 automatically.

6) Turn the drive power OFF and then turn ON again.

7) Set the parameter by reference the parameter sheet of the equipment. At this time, set the parameter 8 to the number of Turret/Magazine.
   ① Press the MODE key twice to change the display to parameter setting mode.

   ![State display mode]
   ![Parameter setting mode]

   : Press the UP key 8 times to change the two-digit address of the beginning as 08.
③ The rightmost number will blink on and off after pressing the SET key once. (Each time the SET key is pressed, the blinking number will shift to the left and after 5 times the setting value will be applied with stopping blinking.)

④ In this state, if the currently located POST number is 22, press the UP key once to change the rightmost number as 2. And, press the SET key once to shift the blinking number to the left so the second number of the right is blinked. Then, press the UP key twice to change the second number as 2 so the two digits are changed as 22.

⑤ In this state, the setting value will be applied with stopping blinking after pressing the SET key 3 times.

※ All settings can be set under OFF state of the SVON signal, and if the parameter setting is completed, the drive power must be turned OFF and ON again to apply the changed parameter value.

8) Turn the servo drive power OFF and ON again.

9) Set the origin at the origin setting display of the diagnosis mode.
① Press the MODE key to change the display to diagnosis mode, and then press the DOWN key once to change the display to origin setting display mode.
Press the SET key for 3 seconds or more to save the origin-related parameter.

Parameters from No. 34 to 46 are saved automatically.

Return to the original display after saving the parameter up to 46 automatically.

10) Turn the servo drive power OFF and ON again to complete the origin setting.
2.4. Selective application of the position compensation value by external signal

When the parameter 46 is set to 2, the offset value that is set at the drive can be applied by outside contact signal (OVR0) optionally.

1) Set the first-axis parameter 46 as 2.
   ① Change the operating display as the parameter setting mode by pressing the MODE key twice.

   ![State display mode](image1) \(\Rightarrow\) ![Parameter setting mode](image2)
   Twice

   ② Press the DOWN key 15 times to change the left two digits of address as 46.

   ![15 times](image3)

   ③ After pressing the SET key once, the rightmost number will blink on and off.

   ![Once](image4)

   ④ In this state, press the UP key twice to change the rightmost number as 2. And the setting value will be applied with stopping blinking after pressing the SET key four times.

   ![Twice](image5) \(\Rightarrow\) ![4 times](image6)

2) If the servo drive input contact point OVR0 is turned ON by NC, the drive applies the offset value at the time of moving to the commanded tool number after outputs ON of the output contact point AUX_OUT0 to the NC.

※ OVR0 and AUX_OUT0 contact points between NC and servo drive must be connected to use this function.
2.5. Operation of servo drive in JOG mode by external signal

When the parameter 2 is set to 1, the servo drive can be operated in JOG mode by outside contact signal (OVR1).

1) Set the first-axis parameter 2 as 1.
   ① Change the operating display as the parameter setting mode by pressing the MODE key twice.

   ![State display mode](null)  ➔  ![Parameter setting mode](null)

   State display mode  ➔  Parameter setting mode

   Twice

   ② Press the UP key twice to change display of first two segments as 2.

   ![Parameter setting mode](null)  ➔  ![Parameter setting mode](null)

   Parameter setting mode

   Twice

   ③ After pressing the SET key once, the rightmost number will blink on and off.

   ![Parameter setting mode](null)  ➔  ![Parameter setting mode](null)

   Parameter setting mode

   Once

   ④ In this state, press the UP key once to change the rightmost number as 1. And the setting value will be applied with stopping blinking after pressing the SET key four times.

   ![Parameter setting mode](null)  ➔  ![Parameter setting mode](null)  ➔  ![Parameter setting mode](null)

   Parameter setting mode

   Once  ➔  Four times

2) If the servo drive input contact point OVR1 is turned ON by NC, the drive outputs ON of the output contact point AUX_OUT1 to the NC. And the servo drive can be operated in JOG mode.

3) The servo motor rotates at the setting speed in parameter 27 while the NC enables JOG+ or JOG− signal.

※ OVR1 and AUX_OUT1 contact points between NC and servo drive must be connected to use this function.
2.6. Machine Origin setting method by external signal

When the parameter 2 is set to 1, it’s possible to set the machine origin by outside contact signals (OVR0, OVR1).

1) Set the parameter 2 as 1.
   ① Change the operating display as parameter setting mode by pressing the MODE key twice.
   
   ![State display mode](state_display_mode.png)  
   ![Parameter setting mode](parameter_setting_mode.png)

   ② Press the UP key twice to change display of first two segments as 2.
   
   ![Twice](twice.png)

   ③ After pressing the SET key once, the rightmost number will blink on and off.
   
   ![Once](once.png)

   ④ In this state, press the UP key once to change the rightmost number as 1. And the setting value will be applied with stopping the blinking after pressing the SET key four times.
   
   ![4 times](four_times.png)

2) If the servo drive input contact points OVR0 and OVR1 are turned ON by NC at once, the drive outputs ON of the output contact points AUX_OUT0 and AUX_OUT1 to the NC at once after completion of origin setting.

   ![ON to OFF](on_to_off.png)

3) Turn the servo drive power OFF and ON again to complete the origin setting.

※ OVR0, OVR1, AUX_OUT0 and AUX_OUT1 contact points between NC and servo drive must be connected to use this function.
2.7. Switch of display mode, parameter and position compensation value setting method at the time an alarm occurs

When an alarm occurs, for existing version, it’s impossible to use any function or switch the front display of the servo drive with displaying current alarm in the front display. But, it’s possible to set the parameter or switch display since version DVSC–TM–14D–02.

1) Switch of diagnosis display at the time an encoder alarm occurs

When an alarm occurs, the alarm type is displayed in front display of the servo drive. In this state, it’s possible to switch to the necessary diagnosis mode display by pressing the direction key after switching of the display as diagnosis mode by pressing the MODE key once.

- AL1-CO $\rightarrow$ rd-off $\rightarrow$ AL1.000

- Direction key: Sequence input contact points display
- Direction key: Sequence output contact points display
- Direction key: Position data input contact points display
- Direction key: Position data output contact points display

2) Switch of parameter setting display at the time an encoder alarm occurs

When an alarm occurs, the alarm type is displayed in front display of the servo drive. In this state, it’s possible to confirm or change the necessary parameter value by pressing the direction key after switching of the display as parameter setting mode by pressing the MODE key twice.

- AL1-CO $\rightarrow$ 000020 $\rightarrow$ AL1.000

- Direction key: No. 0 Motor output capacity setting parameter
- Direction key: No. 1 Motor rotation direction setting parameter
3) Switch of position compensation value setting display at the time an encoder alarm occurs

When an alarm occurs, the alarm type is displayed in front display of the servo drive. In this state, it’s possible to confirm or change the necessary position compensation value by pressing the direction key after switching of the display as position compensation value setting mode by pressing the MODE key three times.

- Position compensation value initial display
- No. 1 POST position compensation value
- No. 2 POST position compensation value
- No. 127 POST position compensation value
2.8. S–shaped acceleration/deceleration setting method

When applying a straight speed profile, apply S–shaped speed profile to reduce vibration that occurs in the acceleration/deceleration section. To set the time constant of S–shaped acceleration/deceleration, change the front display as parameter setting mode by pressing the MODE key twice and set as the necessary value after setting the left two digits of address as 21 by pressing the UP key 21 times. It’s possible to apply this function since version DVSC–TM–14D–02.

1) S–shaped acceleration/deceleration time constant setting
   ① Change the operating display as parameter setting mode by pressing the MODE key twice.

   ![State display mode](image1)
   ![Parameter setting mode](image2)
   Twice

   ② Set as the necessary value after setting the left two digits of address as 21 by pressing the UP key 21 times.

   ![21 times](image3)

2) S–shaped acceleration/deceleration time calculation
   : S–shaped acceleration/deceleration section is set as much as the setting value of parameter 21 unless it is 0.

   ![Straight speed profile](image4)
   ![S-shaped speed profile](image5)

   \[
   \text{total accel. time(msec)} = \text{accel. time(parameter 29)} + \text{S–shaped time constant(parameter 21)}
   \]

   \[
   \text{total decel. time(msec)} = \text{decel. time(parameter 30)} + \text{S–shaped time constant(parameter 21)}
   \]
2.9. Backlash compensation setting method

When moving the mechanical system, it’s possible to reduce the position error by compensating the Backlash that occurs by gear. It’s possible to set the compensation value according to the Backlash compensation sign (parameter 48), Backlash scale (parameter 49) and tool number increase/decrease direction (parameter 50, 51).

It’s possible to apply this function since version DVSC-TM-14D-02.

1) Backlash compensation sign setting
   ① Change the operating display as parameter setting mode by pressing the MODE key twice.

   ![State display mode](image1)
   ![Parameter setting mode](image2)
   Twice

   ② Set as the necessary value after setting the left two digits of address as 48 by pressing the DOWN key 13 times.

   ![13 times](image3)

   ※ Refer the following chart for the Backlash compensation sign setting value.

<table>
<thead>
<tr>
<th>Value</th>
<th>Parameter 50 (tool number increase direction)</th>
<th>Parameter 51 (tool number decrease direction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>1</td>
<td>−</td>
<td>−</td>
</tr>
</tbody>
</table>

2) Backlash scale setting
   ① Change the operating display as parameter setting mode by pressing the MODE key twice.

   ![State display mode](image4)
   ![Parameter setting mode](image5)
   Twice

   ② Set as the necessary value after setting the left two digits of address as 49 by pressing the DOWN key 12 times.

   ![12 times](image6)
3) Backlash compensation value setting in tool number increase direction
   ① Change the operating display as parameter setting mode by pressing the MODE key twice.

   - 0000
   State display mode
   MODE
   000020
   Parameter setting mode
   Twice

   ② Set as the necessary value after setting the left two digits of address as 50 by pressing the DOWN key 11 times.

   000020
   DOWN
   11 times
   500000

4) Backlash compensation value setting in tool number decrease direction
   ① Change the operating display as parameter setting mode by pressing the MODE key twice.

   - 0000
   State display mode
   MODE
   000020
   Parameter setting mode
   Twice

   ② Set as the necessary value after setting the left two digits of address as 49 by pressing the DOWN key 10 times.

   000020
   DOWN
   10 times
   510000

5) Backlash compensation value calculation

   \[
   \text{1 port movement pulse[pulse]} = \frac{\text{Motor side gear ratio}}{\text{Machine side gear ratio}} \times 8192[\text{pulse}] \\
   = \frac{\text{value of parameter 6}}{\text{value of parameter 7}} \times 8192[\text{pulse}] \\
   \text{Backlash setting pulse[pulse]} = \frac{\text{1 port movement pulse[pulse]}}{\text{1 port movement distance[mm]}} \times \text{Backlash value[mm]}
   \]

   Set the calculated Backlash setting pulse into the parameter 50 or 51.
2.10. Teaching function setting method

When using the Teaching function by setting the parameter 31 as 1, it’s possible to set the movement distance unequally because it’s possible to set the specific position as tool number. This function is applicable when the machinery side rotation angle is within 0 and 360 degrees. It’s possible to apply this function since version DVSC–TM–14D–04.

1) Teaching function setting
   ① Change the operating display as parameter setting mode by pressing the MODE key twice.

   \[ \begin{array}{c}
   \text{State display mode} \\
   \text{Parameter setting mode}
   \end{array} \]

   \[ \begin{array}{c}
   \text{Twice}
   \end{array} \]

   ② Press the UP key 31 times to change display of first two segments as 31.

   \[ \begin{array}{c}
   \text{31 times}
   \end{array} \]

   ③ After pressing the SET key once, the rightmost number will blink on and off. In this state, press the UP key once to change the rightmost number as 1. (Each time the SET key is pressed, the blinking number will shift to the left and after 5 times the setting value will be applied with stopping blinking.)

   \[ \begin{array}{c}
   \text{Once}
   \end{array} \]

   ④ Change the leftmost number as 0 by pressing the SET key 3 times and DOWN key 3 times. And the setting value will be applied with stopping blinking after pressing the SET key once.

   \[ \begin{array}{c}
   \text{3 times}
   \end{array} \]

   ⑤ Turn the servo drive power OFF and ON again to enable the Teaching function.
⑥ Change the operating display as parameter setting mode by pressing the MODE key twice to set the parameter 5 as the maximum tool number at Teaching mode.

![State display mode](image1)  \(\Rightarrow\)  ![Parameter setting mode](image2)

⑦ Press the UP key 5 times to change display of first two segments as 5.

![5 times](image3)

⑧ After pressing the SET key once, the rightmost number will blink on and off. (Each time the SET key is pressed, the blinking number will shift to the left and after 5 times the setting value will be applied with stopping blinking.)

![Once](image4)

⑨ In this state, if the maximum position number is 12, press the UP key twice to change the rightmost number as 2. And, press the SET key once to shift the blinking number to the left so the second number of the right is blinked. Then, press the UP key once to change the second number as 1 so the two digits are changed as 12.

![3 times](image5)  \(\Rightarrow\)  ![Once](image6)  \(\Rightarrow\)  ![Once](image7)

⑩ In this state, the setting value will be applied with stopping blinking after pressing the SET key 3 times.

![3 times](image8)

⑪ Turn the servo drive power OFF and ON again to apply the changed parameter.

⑫ Move the machinery to the setting position as 1. (When moving the machinery using servo drive itself JOG function, refer this manual 3.4.7. Drive itself JOG operation.)
⑬ Change the operating display as Teaching mode to set number 1 position after moving the machinery to the number 1 position.

```
⑭ Change the operating display as number 1 position value setting mode by pressing the SET key once.
```

```
⑮ If pressing the SET key for 2 seconds, the number 1 will be set as current machinery position value with displaying SetEnd. And after 400 msec, the display will be changed as number 1 position value setting mode.
```

○ ⑭ Repeat ⑫ ～ ⑮ process to save the next position value.

⑯ Because parameter 5 is set as 12, it’s possible to set the position value up to maximum number 12. Change display as Teaching mode by pressing the MODE key once after position value setting is end.

⑰ Turn the servo drive power OFF and ON again to apply the changed position value.
2.11. Position signal output selection function

If the parameter 56 is set as 1, it’s possible to output the position signal using the existing tool number output contact point at the specific position(angle) that is set by user. It’s possible to set to 1 place of decimals. This function is applicable since version DVSC-TM-14D-04 and available only if the NC is ready for this feature. Setting range : 1.0–360.0 degrees

1) Position signal output function setting
   ① Change the operating display as parameter setting mode by pressing the MODE key twice.

   ![State display mode](image1) ➜ ![Parameter setting mode](image2)

   Twice

   ② Press the DOWN key 5 times to change display of first two segments as 56.

   ![5 times](image3)

   ③ After pressing the SET key once, the rightmost number will blink on and off. (Each time the SET key is pressed, the blinking number will shift to the left and after 5 times the setting value will be applied with stopping blinking.)

   ![Once](image4)

   ④ In this state, press the UP key once to change the rightmost number as 1. And the setting value will be applied with stopping the blinking after pressing the SET key four times.

   ![Once](image5) ➜ ![4 times](image6)

   ⑤ Turn the servo drive power OFF and ON again to enable the position signal output function.
⑥ Change the operating display as position signal output whole section setting mode to set the entire zone in which the signal is outputted.

- MODE
- ID-OFF
- PdST1

Once
6 times

⑦ Change the operating display as number 1 position value setting mode by pressing the SET key once.

PdST1

SET

Once

⑧ After pressing the SET key once, the rightmost number will blink on and off.
(Each time the SET key is pressed, the blinking number will shift to the left and after 3 times the setting value will be applied with stopping blinking.)

STEP1000

SET

Once

⑨ In this state, if start zone number is 1, press the UP key once to change the rightmost number as 1. And the setting value will be applied with stopping the blinking after pressing the SET key twice.

STEP1000

△

Once

STEP10

SET

Twice

⑩ Change the operating display as the last zone number setting mode by pressing the UP key once.

STEP10

△

Once
⑪ After pressing the SET key once, the rightmost number will blink on and off.

⑫ In this state, if the last zone number is 12, press the UP key twice to change the rightmost number as 2. And, press the SET key once to shift the blinking number to the left so the second number of the right is blinked. Then, press the UP key once to change the second number as 1 so the two digits are changed as 12.

⑬ In this state, the setting value will be applied with stopping blinking after pressing the SET key once.

⑭ Change the operating display as position signal output zone setting mode by pressing the MODE key once because the setting of the start and last number of position signal output is completed.

⑮ Change the display as output section setting mode by position signal by pressing the UP key once.
Change the display as number 1 output position setting mode by pressing the SET key once.

Set
Once

After pressing the SET key once, the rightmost number will blink on and off.

Set
Once

In this state, if number 1 output position value is 34.5 degrees, press the UP key 5 times to change the rightmost number as 5. And, press the SET key once to shift the blinking number to the left so the second number of the right is blinked. Then, press the UP key 4 times to change the second number as 4 and press the SET key once again to shift the blinking number to the left so the third number of the right is blinked. Then, press the UP key 3 times to change the third number as 3 and the setting value will be applied with stopping the blinking after pressing the SET key once.

Set
Once

Repeat ~ process to save the next position value after move to desired number using the UP or DOWN key.

It’s possible to save the output position value by maximum 25. Change the display as output section setting mode by position signal by pressing the MODE key once after all settings are completed.

Set
Once

Turn the servo drive power OFF and ON again to apply changed settings.
3. Display/Setting part

3.1. Functions

The 6 digits 7 segment display in front of the drive indicates parameter setting, position compensation value setting, diagnosis and alarm. And drive setting and various operating can be done by the 4 keys below the display.

▶ Even if the power turns OFF, values set by key operation is stored in drive.
▶ Even if the power turns OFF after the alarm occur, the contents of the alarm is stored in drive. And the contents can be verified after turning ON the power again.
3.2. Operating of the Display/Setting part and display flowchart

3.2.1. Overview

Soon after turning on the power, the 7 segment is in the state display mode and the mode selection can be done by the MODE key.

- Designated series display (CT series)
- Capacity display (2.0KW) ※0.8KW(Pro.800), 1.5KW(Pro.150), 2.3KW(Pro.230)
- Control Mode display (Position / Speed / Current)
- State display mode
- Diagnosis display mode
- Parameter setting mode
- Position compensation value setting mode
- Alarm history display mode
3.2.2. Display Flowchart

- **State display**
  - Motor rotation speed
  - Alarm
  - Reserved
  - Accumulated remaining pulse
  - Maximum load factor
  - Effective load factor
  - Absolute encoder value within 1 rotation
  - Current position number

- **Diagnosis display**
  - Servo ready state
  - Machine origin setting
  - Reserved
  - JOG operation
  - Output section setting by position signal
  - Position signal output whole section setting
  - Teaching section setting
  - Contact output test

- **Parameter setting**
  - Parameter 0
  - Parameter 1
  - Parameter 2
  - Parameter 3
  - Parameter 60

- **Position compensation value setting**
  - Position compensation value 1
  - Position compensation value 2
  - Position compensation value 100
  - Position compensation value 110
  - Position compensation value 127

- **Alarm history**
  - Initial display
  - Alarm history 1
  - Alarm history 2
  - Alarm history 3
  - Alarm history 10
  - Alarm history 20

- **Sequence outputs**
  - Sequence output
  - Sequence input

- **Position data outputs**
  - Position data output
  - Position data input
3.3. State display

The state display mode is the function that verifies the state of the drive during operation.

- The front panel displays the state of the drive, and its contents and usage are as follows.
- All position related calculations are executed according to pulse unit inside the drive. Therefore the state display of the pulse unit is displayed according to the pulse standard of the encoder. (8,192 pulses per rotation)

3.3.1. Motor rotation speed
The rotation speed of the motor is displayed as RPM unit. The rapid change of the speed cannot be seen due to inner filtering process.
If the motor rotates in a clockwise, ‘-’ will be displayed.    Display range [-3000 ~ 3000]

- - 1000 : Positive(1000rpm)  - - 1000 : Negative (-1000rpm)

3.3.2. Alarm display
Current occurred alarm state is displayed and it’s possible to change the display even if an alarm occurred.

AL: Ex) overload alarm  AL:OL

◆ Sequence of display conversions

- - 1000  AL:AL:AL:AL:AL:

Once

3.3.3. Remaining pulses
The error between position command and position feedback(actual position) is displayed as accumulated pulse unit. If the error exceeds the setting value of the parameter 19, position deviation excess alarm will be occurred. If the motor rotates in a clockwise, ‘-’ will be displayed and the display will be changed as 0 after the SVON signal is turned OFF.

E 10000 : Remaining pulses  E - 10000 : Negative (-1000)

◆ Sequence of display conversions

- - 1000  E 10000

4 times
3.3.4. Maximum load factor
The maximum value of load is displayed in %. While the SVON signal is ON, the display is always updated as the maximum value and it will be 0 when the signal is OFF.
If the value is in the minus, ‘-‘ will be displayed. Display range [−300 ~ 300]

- 000  \(\Rightarrow\) 4 000

3.3.5. Effective load factor
The effective value of load is displayed in %. (The rated value is 100%.) If the motor rotates in a clockwise, ‘-‘ will be displayed.
When the SVON signal is OFF, the display will be 0. Display range [−300 ~ 300]

L 000

3.3.6. Position value within 1 rotation of motor
This mode will display the pulse count within 1 rotation of the absolute encoder in the motor. (2,048 count per rotation) When the count exceeds 2048, it will resume to 0. Display range [0 ~ 2,047]

A 1403

3 times
3.3.7. Rotation count of motor
This mode will display the rotation pulse count of the absolute encoder in the motor. (1 count per rotation) When the count exceeds 65,535, it will resume to 0. Display range [0 ~ 65,535]

\[ d \ 10224 \]

◆ Sequence of display conversions

\[ - \ 0000 \ \Rightarrow \ d \ 10224 \]

Twice

3.3.8. Current POST number
This mode displays the current located POST number. The number will be updated only when the motor has stopped or the SVON signal is OFF.

\[ n \ 0018 \]

◆ Sequence of display conversions

\[ - \ 0000 \ \Rightarrow \ n \ 0018 \]

Once
3.4. Diagnosis display

- In this mode, it will be possible to verify the external sequence state and the condition of the system.
- It will be displayed in the LED display as shown below, and its contents and usage are as follows.

3.4.1. Servo ready state

- **Sequence of display conversions**

3.4.2. Sequence I/O signal

1) Sequence input signal: ON/OFF state of external input signals is displayed in 7 segments.

- **Sequence of display conversions**

2) Sequence output signal: ON/OFF state of external output signals is displayed in 7 segments.

- **Sequence of display conversions**
Sequence of display conversions

The state of I/O signals is verified by blinking of the 7 segments LED. When the signal is ON, LED turns ON. And it turns OFF when the signal is OFF.

3.4.3. Position data I/O signal

1) Position data input signal: ON/OFF state of position data input signal is displayed in 7 segments.

2) Position data output signal: ON/OFF state of position data output signal is displayed in 7 segments.

3.4.4. Override Input signal
3.4.5. Output signal test

In this mode, it is possible to verify the connection by outputting the output signals by force to external.

- Set desired output using SET key
- POSO0 signal ON
- POSO1 signal ON
- POSO2 signal ON
- POSO3 signal ON
- POSO4 signal ON
- POSO5 signal ON
- POSO6 signal ON
- VPF signal ON
- BAT_LOW signal ON
- ALM signal ON
- SVRDY signal ON
- AUX_OUT0 signal ON
- AUX_OUT1 signal ON
- Unused
- Unused
- BRAKE signal ON
- Return to the original display
3.4.6. Teaching function setting

When using the Teaching function by setting the parameter 31 as 1, it’s possible to set the movement distance unequally because it’s possible to set the specific position as tool number. This function is applicable when the machinery side rotation angle is within 0 and 360 degrees.

◆ Sequence of display conversions

3.4.7. Position signal output whole zone setting

If the whole zone of position output signal is set as number, it’s possible to output the position signal using the existing tool number output contact point at the specific position(angle) that is set by user.
Setting range : tool number 1 ~ 99

◆ Sequence of display conversions
Sequence of setting

- Press the SET key once:
  - Start zone setting:
    - The display will be changed as start zone after pressing the SET key once.
  - Last zone setting:
    - The display will be changed as last zone after pressing the UP key once.

3.4.8. Angle setting by position signal section

- If the angle of position signal is set by each zone, it’s possible to output the position signal using the existing tool number output contact point at the specific position (angle) that is set by user. It’s possible to set to 1 place of decimals.
- Setting range: 1.0 ~ 360.0 degrees

Sequence of display conversions

- Press the MODE key once:
  - ON/OFF

Sequence of setting

- Press the SET key once:
  - Angle setting mode:
    - The display will be changed as number 1 zone angle setting mode after pressing the SET key once.

3.4.9. Drive itself JOG operation

- When setting the origin regardless of external signals autonomously, this mode can be used to move to home position of the selected POST. While the UP or DOWN key is pressed, the servo motor rotates at the setting speed in parameter 27.
- From upper version than DVSC–TM–14D–04, the oscillation will be suppressed at the time of acceleration or deceleration.

Sequence of display conversions

- Press the MODE key once:
  - ON/OFF

Ex) Drive itself JOG operation at 200 rpm

: After pressing the SET key, the SVON signal automatically turns ON, and it will be changed to JOG operation mode.

: JOG operation mode

: Resume to initial display mode

3.4.10. Parameter Initialization

: In this mode, all parameters except parameter 45 are initialized as default value and stored in FRAM by pressing the SET key for 2 seconds or more.

: Press the SET key to save the parameter.

: Parameters from No. 0 to 99 are saved automatically.

: Return to the original display after saving the parameter up to 99 automatically.
3.4.11. Position compensation value Initialization
In this mode, all of the position compensation values are initialized as 0 and stored in FRAM by pressing the SET key for 2 seconds or more.

- 0000 \(\Rightarrow\) rd-off \(\Rightarrow\) OFFSET

Once \(\Rightarrow\) Twice

OFFSET : Press the SET key to save the offset value.

OFFSET : Offset values from No. 0 to 127 are saved automatically.

OFFSET : Return to the original display after saving the offset values up to 127 automatically.

3.4.12. Machine Origin setting
In this mode, current position can be set as machine origin. In the origin setting mode, after pressing the SET key more than 3 seconds, the parameter related with origin-point will be automatically set. After setting the origin-point, turn the power OFF and turn ON again in other to complete the setting.

1. Press the MODE key twice to change operating display to parameter setting mode.

- 0000 \(\Rightarrow\) 000020

Twice

2. Press the UP key 8 times to change the two-digit address of the beginning as 08.

000020 \(\Rightarrow\) \(\Rightarrow\) 080001

8 times
③ The rightmost number will blink on and off after pressing the SET key once. 
(Each time the SET key is pressed, the blinking number will shift to the left and after 5 times the setting value will be applied with stopping blinking.)

④ In this state, if the currently located POST number is 22, press the UP key once to change the rightmost number as 2. And, press the SET key once to shift the blinking number to the left so the second number of the right is blinked. Then, press the UP key twice to change the second number as 2 so the two digits are changed as 22.

⑤ In this state, the setting value will be applied with stopping blinking after pressing the SET key 3 times.

※ All settings can be set under OFF state of the SVON signal, and if the parameter setting is completed, the drive power must be turned OFF and ON again to apply the changed parameter value.

⑥ Turn the servo drive power OFF and ON again.

⑦ Set the origin at the origin setting display of the diagnosis mode.

: Press the MODE key to change the display to diagnosis mode, and then press the DOWN key once to change the display to origin setting display mode.
Set

Press the SET key for 3 seconds or more to save the origin-related parameter.

Parameters from No. 34 to 46 are saved automatically.

Return to the original display after saving the parameter up to 46 automatically.

⑧ Turn the servo drive power OFF and ON again to complete the origin setting.

※ After completion of the origin setting, check carefully that current POST number on the display and the machinery side number match exactly before using the drive.
3.5. Alarm history display

3.5.1. Alarm history display

The recent alarm records will be stored and displayed up to 20 times. The records can be verified by pressing UP or DOWN key. All records of the alarm will be cleared by pressing the SET key.

- Alarm history mode
- One time alarm display  ex) in case of battery alarm
- Second time alarm display  ex) in case of parameter error alarm
- Third time alarm display
- 20th time alarm display

◆ All records will be cleared when the SET key is pressed at the alarm record display mode.

3.5.2. Drive operation at alarm occurrence

When an alarm occurs, the photo coupler contact points between ALM and COM2 terminals of the CN2 connector will be OFF. Then, SVRDY and BRAKE terminal will be OFF as well, and the motor will be on free run state. The detected alarm item will be displayed on drive 7 segments display. Also the alarm number as binary code will be outputted to the NC through the position data output terminals.
Even if an alarm occurs, it’s possible to change the display as state display mode, diagnosis display mode, parameter setting mode, origin setting mode and alarm history display mode since version DVSC–TM–14D–02. Also, even at alarm state, parameter or offset value setting is possible since that version.

▶ Method of releasing the alarm state
  : Once the cause of the alarm is resolved, it is possible to operate the drive by turning the power OFF and ON again.

▶ Detection time of over load
  : The operation time of the over load alarm detect circuit is as listed below.

- 300% ~ : 5.5sec
- 275% ~ : 6.5sec
- 225% ~ : 8sec
- 200% ~ : 10sec
- 170% ~ : 14sec
- 150% ~ : 17.5sec
- 140% ~ : 20sec
- 130% ~ : 25sec
- 120% ~ : 30sec
Display and contents of the drive alarm is as following.

<table>
<thead>
<tr>
<th>NO</th>
<th>LED display</th>
<th>Alarm type</th>
<th>Corrective actions</th>
</tr>
</thead>
</table>
| 1  | ALI-UV      | Under voltage : occurs when the inside DC link voltage is below the standard value. | - check if the input power is low.  
       |             |            | - check if the motor power cable is open. |
| 2  | ALI-OV      | Over voltage : occurs when the inside DC link voltage is above the standard value. | - check if the input power is high.  
       |             |            | - check if the operation frequency is above standard value.  
       |             |            | - check if regenerative resistor is damaged. |
| 3  | ALI-OX      | Main circuit error : occurs when the IPM malfunctions. | - check if the heat sinking panel is over 100 degrees Celsius.  
       |             |            | - check if the operation frequency is above the standard value. |
| 4  | ALI-OC      | Encoder signal error : occurs when encoder signal malfunctions. | - check if the encoder connection is correctly assembled.  
       |             |            | - check if the encoder line is cut. |
| 5  | ALI-OS      | Over speed : occurs when the motor speed exceeds the maximum rotating count. | - check if the encoder cable is missing or if correctly assembled. |
| 6  | ALI-OL      | Over load : occurs when the over load state continuous for a long time exceeding the standard time. | - check if there is connection error in the motor power cable.  
       |             |            | - check if the parameter is set correctly. |
| 7  | ALI-CE      | CPU error : occurs when the CPU malfunctions or there is fault with the board. | - turn OFF the power and ON again.  
       |             |            | - check if the parameter is set correctly. |
| 8  | ALI-PC      | Parameter error : occurs when the set parameter is not within the range. | - check if the parameter is set correctly. |
| 9  | ALI-PF      | Excessive position deviation : occurs when the remaining pulse exceeds the setting value of parameter 19 during position control. | - check if the value of parameter 19 is set too low.  
       |             |            | - check the encoder cable and the motor. |
| 10 | ALI-OP      | Over current : occurs when the over current flows into the motor. | - check if the accel./decel. parameter is set on too low value.  
       |             |            | - check if the insulation resistor of the motor is correctly displayed. |
| 11 | ALI-EP      | Encoder battery error : occurs when the backup battery of the encoder is discharged or disconnected. | - check if the encoder connection is correctly assembled.  
       |             |            | - change the battery. |

※ For detail contents, please refer to the maintenance documentation.

When an alarm occurs, the alarm number as binary code will be outputted to the NC through the position data output terminals.

Example) AL1–UV(under voltage) alarm

<table>
<thead>
<tr>
<th>Input number at NC : 1</th>
<th>POSO3</th>
<th>POSO2</th>
<th>POSO1</th>
<th>POSO0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>
3.6. User Parameter setting and Detailed explanation

Some parameters must be set depending on driving and system configuration before the operation. And the setting method is as following.

3.6.1. Parameter setting method

Ex) Change value of the parameter 8 from 1 to 22.

① Press the MODE key twice to change operating display to parameter setting mode.

```
State display mode  MODE  Parameter setting mode
Twice
```

② Press the UP key 8 times to change the two-digit address of the beginning as 08.

```
000020  UP  00001
8 times
```

③ The rightmost number will blink on and off after pressing the SET key once. (Each time the SET key is pressed, the blinking number will shift to the left and after 5 times the setting value will be applied with stopping blinking.)

```
080001  SET
Once
```

④ In this state, press the UP key once to change the rightmost number as 2, and press the SET key once to shift the blinking number to the left so the second number of the right is blinked. Then, press the UP key twice to change the second number as 2 so the two digits are changed as 22.

```
080001  UP  080002  SET  08002  UP  080022
Once  Once  Twice
```
5. In this state, the setting value will be applied with stopping the blinking after pressing the SET key 3 times.

All settings can be set under OFF state of the SVON signal, and if the parameter setting is completed, the drive power must be turned OFF and ON again to apply the changed parameter value.
### 3.6.2. User Parameter list (Refer to the attached parameter sheet at the machine.)

<table>
<thead>
<tr>
<th>NO.</th>
<th>Name</th>
<th>Range</th>
<th>Initial value</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Motor output capacity</td>
<td>0~40</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>Motor rotation direction</td>
<td>0~1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>Option function</td>
<td>0~1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Direction signal output function</td>
<td>0~1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>Encoder pulse per 1 rotation</td>
<td>2048</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>Maximum POST number</td>
<td>2~127</td>
<td>12</td>
<td>POST</td>
<td>If parameter 46 is set as 3, maximum value is 255,</td>
</tr>
<tr>
<td>06</td>
<td>Gear ratio – motor side</td>
<td>1~9999</td>
<td>3075</td>
<td>rotation</td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>Gear ratio – machine side</td>
<td>1~9999</td>
<td>1200</td>
<td>POST</td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>POST number of origin</td>
<td>1~127</td>
<td>1</td>
<td></td>
<td>If parameter 46 is set as 3, maximum value is 255,</td>
</tr>
<tr>
<td>09</td>
<td>24 angle alternate angle</td>
<td>0~1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Position loop proportional gain</td>
<td>0~9999</td>
<td>600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Speed loop proportional gain</td>
<td>0~9999</td>
<td>400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Speed loop integral gain</td>
<td>0~9999</td>
<td>400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>SERVO READY ON delay time</td>
<td>0~1000</td>
<td>0</td>
<td>10msec</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>BRAKE OFF control delay time</td>
<td>0~1000</td>
<td>0</td>
<td>10msec</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>BRAKE ON delay time</td>
<td>0~1500</td>
<td>0</td>
<td>10msec</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Reserved</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Reserved</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Positioning complete range</td>
<td>1~9999</td>
<td>100</td>
<td>Pulse</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Remaining pulse allowable range</td>
<td>1~6000</td>
<td>6000</td>
<td>100Pulse</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Deceleration time after stop signal</td>
<td>0~5000</td>
<td>0</td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>S-shaped acceleration/deceleration time constant</td>
<td>0~400</td>
<td>0</td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Negative torque limit 1</td>
<td>0~300</td>
<td>250</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Positive torque limit 1</td>
<td>0~300</td>
<td>250</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Negative torque limit 2</td>
<td>0~300</td>
<td>100</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Positive torque limit 2</td>
<td>0~300</td>
<td>100</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Speed limit</td>
<td>0~3000</td>
<td>2050</td>
<td>rpm</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Jog speed at origin setting</td>
<td>1~3000</td>
<td>100</td>
<td>rpm</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Operation speed</td>
<td>10~3000</td>
<td>2000</td>
<td>rpm</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Acceleration</td>
<td>0~9999</td>
<td>92</td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Deceleration time</td>
<td>0~9999</td>
<td>120</td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Teaching function</td>
<td>0~3000</td>
<td>3000</td>
<td>1 : Teaching function</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>High torque IPM motor</td>
<td>0~5000</td>
<td>1500</td>
<td>1 : High torque IPM motor</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Initial state display</td>
<td>0~10</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Encoder coordinates compensation value(lower)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Encoder coordinates compensation value(upper)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Machine origin setting value (lower)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Machine origin setting value (upper)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Current loop proportional gain</td>
<td>0~2048</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Current loop integral gain</td>
<td>0~2048</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Feedback pulse (lower)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Feedback pulse (upper)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Remaining value of deceleration ratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Compensation value for deceleration ratio remaining(lower)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Compensation value for deceleration ratio remaining(upper)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Servo drive function selection</td>
<td>0~1</td>
<td>0</td>
<td></td>
<td>0 : Turret/Magazine  1: ATC</td>
</tr>
<tr>
<td>46</td>
<td>Option function</td>
<td>0~3</td>
<td>0</td>
<td></td>
<td>1 : Override 2 :Selective application of offset 3 : 255 tool</td>
</tr>
<tr>
<td>47</td>
<td>Reserved</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Backlash compensation sign</td>
<td>0~1</td>
<td>0</td>
<td></td>
<td>0 : + 1 : -</td>
</tr>
<tr>
<td>49</td>
<td>Backlash Scale</td>
<td>0~1000</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Tool number increase direction Backlash</td>
<td>0~9999</td>
<td>0</td>
<td>Pulse</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Tool number decrease direction Backlash</td>
<td>0~9999</td>
<td>0</td>
<td>Pulse</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Speed Command Filter</td>
<td>0~9999</td>
<td>9000</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Speed Feedback Filter</td>
<td>0~9999</td>
<td>9000</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Current Command Filter</td>
<td>0~9999</td>
<td>500</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Current Feedback Filter</td>
<td>0~9999</td>
<td>9000</td>
<td>Hz</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Position signal output function</td>
<td>0~3</td>
<td>0</td>
<td></td>
<td>1 : Position signal output</td>
</tr>
<tr>
<td>57</td>
<td>Reserved</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Reserved</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Reserved</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Reserved</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.6.3. Detailed explanation of user parameter

0 Motor output capacity

As selection parameter of the applied motor capacity, it’s possible to select 0.8, 1.5, 1.7, 2.0, 2.3, 3.0 and 4.0kW.

0 : 1.5kW  8 : 0.8kW  17 : 1.7kW  20 : 2.0kW  23 : 2.3kW  30 : 3.0kW  40 : 4.0kW

※ Use 14A drive for motors under 3.0kW and 28A drive for motors more than 3.0kW. If not applied properly, it may cause malfunction of the motor.

1 Motor rotation direction

This parameter sets the rotation direction of the motor. Please select according to the structure of the equipment.

0 : Selects when the rotation direction of the motor and the equipment is the same.
1 : Selects when the rotation direction of the motor and the equipment is different.

2 Option function

This parameter is used when the NC uses the drive itself JOG mode or sets the origin position. For use this function, OVR0 and OVR1 contact points must be connected between the drive and the NC, and the NC program should support this feature.

0 : Option disable  1 : Option enable

<table>
<thead>
<tr>
<th>OVR0</th>
<th>OVR1</th>
<th>function</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>ON</td>
<td>The operation mode will be changed as the drive itself JOG, and the motor rotates by JOG+, JOG− signals.</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>Machine origin setting will be executed.</td>
</tr>
</tbody>
</table>

3 Direction fixing, JOG function selection

This parameter defines the function of JOG+(no.20) and JOG−(no.23) signals of CN1 connector.

0 : Defined as direction fixing signal.

1 : Magazine JOG operation signal (This is used when it need to move the tool post by the JOG signal at the Magazine.)

<table>
<thead>
<tr>
<th>JOG+</th>
<th>JOG−</th>
<th>Rotation direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>Detects the shortest distance and rotates.</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
<td>The motor always rotates in clockwise.</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>The motor always rotates in counterclockwise.</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>The motor always rotates in counterclockwise.</td>
</tr>
</tbody>
</table>

※ The above statement is applicable if the parameter 1 is set as 0. If the parameter is set as 1, the motor rotates the opposite way.

<table>
<thead>
<tr>
<th>JOG+</th>
<th>JOG−</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>Only operates by position data input.</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
<td>Step JOG operates towards the direction the POST number decreases.</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>Step JOG operates towards the direction the POST number increases.</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>Cannot be defined.</td>
</tr>
</tbody>
</table>

※ The above statement is applicable if the parameter 1 is set as 0. If the parameter is set as 1, the motor rotates the opposite way. And, the position data input will be ignored if JOG+ and JOG− signals are ON.

※ For more detailed explanation, refer to ‘JOG operation’ section.
4 Encoder pulse per 1 rotation
This parameter displays 1/4 value of encoder pulse count per rotation.

5 Maximum POST number
This parameter sets the maximum POST number. If parameter 46 is set as 3, it’s possible to set as maximum 255. At the Teaching mode, it’s available up to 99. The position data input exceeding the setting number will be ignored.

Setting range : 2 ~ 127 or 255  Teaching function : 2 ~ 99

6 Gear ratio of motor side
This parameter sets the motor rotation counts until the machine moves up to the POST set in the parameter 7.

Setting range : 1 ~ 9999

7 Gear ratio of machine side
This parameter sets the POST number variation until the motor rotates up to the setting data in the parameter 6.

Setting range : 1 ~ 9999

Example)

1. At the TC model, the turret has 10 POST(10 angle) and makes 1 revolutions until the motor makes 30.75 revolutions. In case the reduction gear ratio is determined like this, the parameter will be set as follow, because 1 revolution of turret corresponds with 10 POST move.
   - Maximum POST number : 10
   - Gear ratio of motor side : 3075
   - Gear ratio of machine side : 1000

2. At the MC model, the Magazine has 41 POST(41 POT) and moves 9 POSTs until the motor makes 101 revolutions. In case the reduction gear ratio is determined like this, the parameter will be set as follows.
   - Maximum POST number : 41
   - Gear ratio of motor side : 101
   - Gear ratio of machine side : 9

8 POST number of origin
When setting the origin of machine, input the POST number that will be set as origin into this parameter. If parameter 46 is set as 3, it’s possible to set as maximum 255.
Please refer to ‘Machine origin setting’ for more detailed explanation.

Setting range : 1 ~ 127 or 255

9 24 angle alternate angle function selection
This parameter sets the 24 angle alternate angle function of the Turret.

0 : Alternate angle function disable
1 : Alternate angle function enable
Position loop proportional gain

The proportional gain of the position loop is the parameter which determines the response of position control loop. If the value increases, the mechanical response gets better. However, mechanical impact on the machine may occur when the motor starts or stops. If the value decreases, the mechanical response will get worse and position error increases by remaining pulse. This also relates with the speed loop gain.

Setting range: 0 ~ 9999

Speed loop proportional gain

The proportional gain of speed loop is the parameter which determines the response of the speed control loop. As external characteristics, it determines the degree of rigidity. If the value of the proportional gain increases, the rigidity becomes better. Thus the larger the setting value is the better, but too large setting may cause oscillations and hunting. The value should be set as large as possible under a stable condition.

Setting range: 0 ~ 9999

Speed loop integral gain

The integral gain of the speed loop is a compensatory factor which reduces normal state error and increases rigidity. If the value of integral gain is increased, the rigidity will get better. But too large setting may cause oscillations and the system may become unstable.

Setting range: 0 ~ 9999

SERVO READY ON delay time

This parameter sets the Servo Ready signal delay time to change as ON.

Setting range: 0 ~ 1000 [x 10msec]

Brake OFF control delay time

In case the motor has an inner brake, this parameter sets brake release delay time.

Setting range: 0 ~ 1000 [x 10msec]

Brake ON delay time

In case the motor has an inner brake, this parameter sets the time it takes for braking. Set the value higher than actual time it takes for braking.

Setting range: 0 ~ 1000 [x 10msec]

Positioning complete range

At position control, this parameter sets the positioning completion range. If the deviation between the targeted position and the current position is within the setting range, the VPF terminal (no. 16 of the CN1 connector) will be turned ON. The numerical value unit means the encoder pulse and it is 8192 pulse per rotation of the motor.

Setting range: 1 ~ 9999[Pulse]
**Remainder pulse allowable range**

In position control, in each position control loop the difference between position command and position feedback is accumulated. If this difference value exceeds the setting value, the position deviation excess alarm will be occurred. The numerical value unit means the encoder pulse and presently it is 8192 pulse per 1 rotation.

Setting range: 1 ~ 6000 [x 100 pulse]

**Deceleration time after stop signal**

This parameter sets the deceleration time from rotation state until the motor stops. When the setting value is 0 as default, the motor under 3kW capacity will be stopped as 100 msec deceleration time. And the motor more than 3kW will be stopped as 340 msec.

Setting range: 0 ~ 5000 [msec]

**S-shaped acceleration/deceleration time constant**

This parameter sets the time constant to reduce the impact at the time of acceleration or deceleration.

Total acceleration time: acceleration time (parameter 29) + S-shape acceleration/deceleration time constant

Total deceleration time: deceleration time (parameter 30) + S-shape acceleration/deceleration time constant

Setting range: 0 ~ 400 [msec]

**Positive torque limit 1**

This parameter limits the torque output of the positive (+) polarity in areas except of positioning complete range. If the value is set at 0%, positive torque will not occur. If the value is set too low, hunting may occur when the motor starts or stops.

Setting range: 0 ~ 300 [%]

**Negative torque limit 1**

This parameter limits the torque output of the negative (−) polarity in areas except of positioning complete range. If the value is set at 0%, negative torque will not occur. If the value is set too low, hunting may occur when the motor starts or stops.

Setting range: 0 ~ 300 [%]

**Positive torque limit 2**

This parameter limits the torque output of the positive (+) polarity in areas within positioning complete range. In purpose of applying continuous load with ON state of SVON signal after positioning completion, the overstrain on the equipment or the motor can be avoided by setting a low value.

Setting range: 0 ~ 300 [%]
**Negative torque limit 2**
This parameter limits the torque output of the negative (−) polarity in areas within positioning complete range. In purpose of applying continuous load with ON state of SVON signal after positioning completion, the overstrain on the equipment or the motor can be avoided by setting a low value.

Setting range: 0 ~ 300 [%]

**Speed limit**
This parameter limits the maximum rotation speed. Even when overshooting and such cases occur while accelerating, the rotation speed will be limited within the setting value. Set the value at least 50rpm more than the setting value of parameter 28(rotation speed).

Setting range: 0 ~ 3000 [rpm]

**Jog speed at origin setting**
This parameter sets the motor speed of the internal jog operation. (At Magazine, the speed of the jog operation will be applied as the setting speed of parameter 28.)

Setting range: 1 ~ 3000 [rpm]

**Operation speed**
This parameter sets the motor rotation speed for automatic operation or jog operation speed of the Magazine.

Setting range: 10 ~ 3000 [rpm]

**Acceleration time**
This parameter sets the time that takes to get to the setting speed of parameter 28 from 0 speed. If the value is set too low, speed overshooting may occur when accelerating.

Setting range: 0 ~ 9999 [msec]

**Deceleration time**
This parameter sets the time that takes to get to 0 speed from the setting speed of parameter 28. If the value is set too low, positioning completion time may be delayed due to hunting when the motor stops.

Setting range: 0 ~ 9999 [msec]

**Teaching function**
To use the Teaching function, set this parameter as 1. It's possible to set the movement distance unequally unlike existing gear ratio setting method.

3000: gear ratio setting method
1: Teaching function enabled
**High torque IPM motor selection**

If the high torque IPM motor is applied, set the value of this parameter as 1.

- 1500 : Normal SPM motor
- 1 : High torque IPM motor

**Initial state display**

This parameter sets the initial display mode just after the power is ON.

<table>
<thead>
<tr>
<th>Set value</th>
<th>Initial display contents</th>
<th>Set value</th>
<th>Initial display contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Motor rotation speed</td>
<td>06</td>
<td>Accumulated value of remaining pulse</td>
</tr>
<tr>
<td>01</td>
<td>Current POST number</td>
<td>07</td>
<td>Reserved</td>
</tr>
<tr>
<td>02</td>
<td>Absolute encoder rotation count</td>
<td>08</td>
<td>Reserved</td>
</tr>
<tr>
<td>03</td>
<td>Absolute encoder—one rotation</td>
<td>09</td>
<td>Alarm display</td>
</tr>
<tr>
<td>04</td>
<td>Effective load factor</td>
<td>10</td>
<td>Motor rotation speed</td>
</tr>
<tr>
<td>05</td>
<td>Maximum load factor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Automatic setting parameters or maker parameters for management**

These parameters are maker parameters for management or will be set automatically while setting the machine origin–point.

Please do not set according to the user’s purpose. It may cause malfunction of the servo drive.

**Servo drive function selection**

Please set this parameter first before parameter initialization or parameter setting, because this parameter sets the servo drive function as Turret/Magazine or ATC.

<table>
<thead>
<tr>
<th>Set value</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Turret/Magazine</td>
</tr>
<tr>
<td>1</td>
<td>ATC</td>
</tr>
</tbody>
</table>

※ For normal operation of the servo drive, the drive power must be turned OFF and ON again, after setting parameter 45.

**Option function**

This parameter sets up OVERRIDE, selective application of offset and 255 TOOL function.

For use the OVERRIDE function OVR0, OVR1, OVR2 and OVR3 contact points must be connected between the drive and the NC, and the NC program should support this feature.

For use the function of selective application of offset value, OVR0 and AUX_OUT0 contact points must be connected between the drive and the NC, and the NC program should support this feature.

For use of 255 TOOL function, OVR0 and AUX_OUT0 contact points must be connected between the drive and the NC, and the NC program should support this feature.

- 0 : Option function disabled
- 1 : OVERRIDE function enabled
- 2 : Selective application of offset value
- 3 : 255 TOOL function enabled
Reserved

48 Backlash compensation sign
This parameter sets the sign of the Backlash compensation value.

<table>
<thead>
<tr>
<th>Value</th>
<th>Parameter 50 (tool number increase direction)</th>
<th>Parameter 51 (tool number decrease direction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Setting range: 0 ~ 1

49 Backlash Scale
This parameter sets the scale of Backlash compensation value. If this parameter is set as 0, Backlash scale is not applied.

Example of Backlash Scale setting)
Value of parameter 49 : 10, Value of parameter 50 : 750 [Pulse]
Total Backlash = Backlash Scale(parameter 49) X Backlash [Pulse](parameter 50 or 51)
= 10 X 750 = 7500 [Pulse]

Setting range: 0 ~ 1000

50 Tool number increase direction Backlash
This parameter sets the Backlash compensation value for tool number increase direction. If this parameter is set as 0, Backlash compensation value is not applied.

Example of Backlash compensation value setting)
Value of parameter 6 : 676, Value of parameter 7 : 24
1 port movement distance : 220.86mm, Gear Backlash : 0.75mm

\[
\text{1 port movement pulse[pulse]} = \frac{\text{Motor side gear ratio}}{\text{Machine side gear ratio}} \times 8192[\text{pulse}]
\]
\[
= \frac{\text{value of parameter 6}}{\text{value of parameter 7}} \times 8192[\text{pulse}]
\]
\[
= \frac{676}{24} \times 8192[\text{pulse}] = 230,741[\text{pulse}]
\]

Backlash setting pulse[pulse] = \(\frac{1}{\text{1 port movement distance[mm]}}\) \times \text{Backlash value[mm]}
\[
= \frac{230,741[\text{pulse}]}{220.86[\text{mm}]} \times 0.75[\text{mm}] = 784[\text{pulse}]
\]

Value of parameter 50 will be 784.

Setting range: 0 ~ 9999[PULSE]
**51 Tool number decrease direction Backlash**
This parameter sets the Backlash compensation value for tool number decrease direction. If this parameter is set as 0, Backlash compensation value is not applied. The numerical value unit means the encoder pulse and presently it is 8192 pulse per 1 rotation. Please refer to ‘Example of tool number increase direction Backlash compensation value setting’ for more detailed setting method.

Setting range: 0 ~ 9999[PULSE]

**52 Speed Command Filter**
This parameter sets Speed Command Filter value. If this parameter is set as 0, Speed Command Filter value is not applied.

Setting range: 0 ~ 9999[Hz]

**53 Speed Feedback Filter**
This parameter sets Speed Feedback Filter value. If this parameter is set as 0, Speed Feedback Filter value is not applied.

Setting range: 0 ~ 9999[Hz]

**54 Current Command Filter**
This parameter sets Current Command Filter value. If this parameter is set as 0, Current Command Filter value is not applied.

Setting range: 0 ~ 9999[Hz]

**55 Current Feedback Filter**
This parameter sets Current Feedback Filter value. If this parameter is set as 0, Current Feedback Filter value is not applied.

Setting range: 0 ~ 9999[Hz]

**56 Position Signal Output Function**
Set this parameter as 1 to use position signal output function. Use this function when it needs to output the position signal using the existing tool number output contact point at the specific position(angle) that is set by user. And this function is available only if the NC is ready for this feature.

0 : disabled
1 : Position signal output function enabled

**57 ~ 60 Reserved**
3.7. Position compensation value setting
In this section, it’s possible to set the position compensation value for each POST. The unit is encoder pulse (8192 pulse per 1 rotation) and the setting range will be from -9999 to 9999. The setting method is as follows.

① Press the MODE key 3 times to change the operating display as position compensation value setting mode.

② Press the UP key once to change the left two digits of address as 01.

③ After pressing the SET key once, the rightmost number will blink on and off.

④ In this state, set the right four numbers as desired value by pressing the UP or DOWN key.

▶ In case of setting the compensation value of the number 1 as 1234

▶ In case of setting the compensation value of the number 1 as -4321
  : Blinking of the dot at the right lower side in the four numbers indicates the negative value.
5. In this state, the setting value will be applied with stopping the blinking after pressing the SET key once.

※ All settings can be set under OFF state of the SVON signal, and the setting value will be effective right after the setting.
Servo drive for ATC

1. Installation and wiring

1.1. Designations

Designations of DOOSAN AC Servo Motor and Drive are as follows. Please refer to this section for system installation and after service.

1) Encoder Connector 2) Power Connector 3) Name Plate 4) Shaft 5) Flange 6) Frame 7) Encoder
1.2. Environmental conditions
This product was designed for indoor usage.
⚠️ Caution : If used in different circumstances and environment other than stated below, damages may occur.
Please use under the following conditions.

<table>
<thead>
<tr>
<th>Environmental Conditions</th>
<th>SERVO MOTOR</th>
<th>SERVO DRIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>–</td>
<td>3 phase AC 200V ~ 220V +10 ~ -15%, 50/60Hz</td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>0 ~ +40℃</td>
<td>0 ~ +50℃</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-25 ~ +80℃</td>
<td>-25 ~ +65℃</td>
</tr>
<tr>
<td>Humidity</td>
<td>Below 80% RH</td>
<td>Below 90% RH</td>
</tr>
</tbody>
</table>

- (4) Use in areas free of corrosive and explosive gas.
- (5) Use in areas that are well ventilated.
- (6) Nearby vibrations or tremors may be the cause of loose contact of the connector, electronic connector device and relay.

| Waterproof / Oil proof   | (3) The protection level of the servo motor is IP-54. Please lay a cover in areas where there is massive water and oil. (4) When installing the servo motor, the connector should be assembled as downward direction. |
| Other                    | Please refer to chapter 2 while assembling and handling the wires. |

1.3. Installation method

1.3.1. Assembling of the servo motor

⚠️ Warning: While assembling the servo motor, avoid dropping it.

⚠️ Caution: While mounting the servo motor horizontally, the connector should be assembled facing downward.

- The servo motor can be mounted horizontally or vertically.
- To prevent vibrations and extend the life of coupling and bearing, the motor shaft and the loading shaft should be precisely aligned. Use flexible coupling when connecting directly to the load.
  ① The outer part of the coupling should be measured at four equidistant points each 90° apart, and the gap between the maximum and the minimum readings should not exceed 0.03mm.
  ② The center point of the motor and the loading shaft should be precisely aligned.
- Avoid excessive radial and thrust load to the motor shaft and also avoid impact that is more than 10G when mounting the gear, coupling, pulley and etc. at the same time.
- A minus load means continuous operation in the regenerative braking state, when the motor is rotated by load. The regenerative braking capacity of the servo drive is short term rated specification equivalent to stop time of the motor. Thus, it should not be used in minus load that generates continuous regenerative braking.
  ex) Servo system for descending objects(without counterweight)
The admissible load inertia into the motor shaft is within 5 times than the inertia of applied servo motor. If it exceeds this, during deceleration it may cause regenerative malfunction. The following steps should be taken if the load inertia exceeds more than 5 times the inertia of the servo motor.
- Reduce the current limit.
- Decelerate slowly. (Slow Down)
- Lower the maximum speed in use.

1.3.2. Mounting of the servo drive

Warning: To prevent electric shock, turn off the power while mounting or uninstalling.

While installing the panel, the size of the panel, cooling and wiring should be considered in order to maintain a difference of temperature below 5°C between the panel temperature and the surrounding temperature in accordance with heat value of the equipment and box size.

If a heating element is placed nearby, the surrounding temperature of the servo drive should be maintained below 55°C at all cases despite temperature rise by convection and radiation. Use a fan to ventilate sealed inner air, and proper ventilation should be used for convection of the air.

If a vibrating element is placed nearby, the drive should be mounted on shock absorbing surface.

If the servo drive be exposed to corrosive gas for a long time, may cause damages to connecting devices such as relay and circuit breaker, thus it should be avoided.

Environmental conditions such as high temperature, high humidity, excessive dust and metal particles should be avoided.

Mounting method

- There should be a space wider than 100mm below and above the servo drive.
- There should be a space wider than 30mm on both sides of the servo drive.
- Mount the servo drive vertically. Do not use if it is mounted horizontally.
1.4. Wiring

▶ For signal lines and encoder lines, use twisted lines or multi-core shielded twisted-pair lines. The length for command input lines should be maximum 3m, and the encoder line should be maximum 10m or less.

Wiring must be done in shortest distance and the remaining length should be cut.

▶ The ground circuit should be a thick line. Usage of third-class grounding or above (ground resistance 100Ω or less) is recommended. Also, make sure to ground at one-point grounding.

▶ The following precautions should be taken to avoid malfunction due to noise.
  - The noise filter should be placed as near as possible.
  - Mount a surge absorber to the coil of the relay, electromagnetic contacts, solenoids and etc.
  - The power line (AC input, motor input line) and the signal line should be placed 30cm apart or more. Do not put them into the same duct or tie them in a bundle.
  - If the power source of the servo drive is used in common with an electric welder or electrical discharge machine, or a high-frequency noise source is present, attach noise filter to the power or the input circuits.
  - Since the core wire of the signal line cable is as thin as only 0.2 ~ 0.3㎟, excessive force to the line should be avoided to prevent damages.

1.5. Noise treatment

For wiring and grounding of the servo drive, the effect of switching noise which is generated by the built-in IPM should be reduced as much as possible. Unexpected effect by outside noise should be reduced as much as possible.

▶ Grounding method

The servo drive supplies power to the motor according to the switching of the IPM device. Thus the Cf dv/dt current flows from the power component to the floating capacity of the motor. To prevent the effect of the switching noise, the motor frame terminal should be connected to the PE terminal of the servo drive terminal block and the PE terminal of the servo drive should be directly grounded to standard ground panel.

▶ Noise filter

Noise filter is used in order to prevent noise from the power line. Please refer to the following conditions while installing.

(a) Separate the input and output wiring and do not tie them together or put them into the same duct.

(b) Do not put the ground wire into the same duct with the filter output line or other signal lines.

(c) The ground wire should be wired singly to the ground panel.

(d) If the unit contains the filter, connect the filter and the equipment ground to the base of the unit.
1.6. Outside circuit connection diagram (example)

**NOTE**
1. TWISTED PAIR SHIELDED CABLE
2. USE FOR BUILT-IN BRAKE TYPE MOTOR
3. CONNECTOR SPECIFICATION

**MAKER:** TYCO ELECTRONICS AMP

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>RECEPTACLE HOUSING</th>
<th>RECEPTACLE CONTACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN1</td>
<td>1-1318118-9</td>
<td>1318107-1</td>
</tr>
<tr>
<td>CN2</td>
<td>2-1318118-9</td>
<td>1318107-1</td>
</tr>
<tr>
<td>CN3</td>
<td>1-1318123-6</td>
<td>1318107-1</td>
</tr>
<tr>
<td>PCN1</td>
<td>1-917807-2</td>
<td>316040-6(142)</td>
</tr>
<tr>
<td>PCN2</td>
<td>3-917803-2</td>
<td>316040-6(142)</td>
</tr>
</tbody>
</table>
### 1.7. Layout of drive connector terminal

#### 1.7.1. Layout of connector terminal CN1

<table>
<thead>
<tr>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
<th>B7</th>
<th>B8</th>
<th>B9</th>
<th>B10</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM2</td>
<td>SJOG_MODE/</td>
<td>S_JOG+/</td>
<td>H_TOOL0/</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SVON/</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5</td>
<td>A6</td>
<td>A7</td>
<td>A8</td>
<td>A9</td>
<td>A10</td>
</tr>
<tr>
<td>START/</td>
<td>S_JOG+/</td>
<td>H_TOOL1/</td>
<td>COM1</td>
<td></td>
<td>STOP/</td>
<td></td>
<td></td>
<td>SPARE</td>
<td></td>
</tr>
</tbody>
</table>

#### 1.7.2. Layout of connector terminal CN2

<table>
<thead>
<tr>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
<th>B7</th>
<th>B8</th>
<th>B9</th>
<th>B10</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM4</td>
<td></td>
<td>UNCLAMP/</td>
<td>VPF/</td>
<td>BAT_L/</td>
<td>SVRDY/</td>
<td></td>
<td></td>
<td>BRAKE+/</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5</td>
<td>A6</td>
<td>A7</td>
<td>A8</td>
<td>A9</td>
<td>A10</td>
</tr>
<tr>
<td>ORIGIN_OUT/</td>
<td>CLAMP/</td>
<td>COM3</td>
<td>ALM/+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BRAKE-/</td>
<td></td>
</tr>
</tbody>
</table>

#### 1.7.3. Layout of connector terminal CN3

<table>
<thead>
<tr>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
</tr>
</thead>
</table>
| +6 | +6 | RX | RX/ | BAT/ | BAT+
| A1 | A2 | A3 | A4 | A5 | A6 |
| +6 | GND | GND | GND | BAT/ | FG |

#### 1.7.4. Layout of connector terminal

Maker: TYCO ELECTRONICS AMP

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>RECEPTACLE HOUSING</th>
<th>RECEPTACLE CONTACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN1</td>
<td>1–1318118–9</td>
<td>1318107–1</td>
</tr>
<tr>
<td>CN2</td>
<td>2–1318118–9</td>
<td>1318107–1</td>
</tr>
<tr>
<td>CN3</td>
<td>1–1318118–6</td>
<td>1318107–1</td>
</tr>
<tr>
<td>PCN1</td>
<td>1–917807–2</td>
<td>316040–6(14D)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>316041–6(28B)</td>
</tr>
<tr>
<td>PCN2</td>
<td>3–917807–2</td>
<td>316040–6(14D)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>316041–6(28B)</td>
</tr>
</tbody>
</table>
### 1.8. Signals for connector CN1 and their meanings

<table>
<thead>
<tr>
<th>Signal</th>
<th>No.</th>
<th>Description</th>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVON</td>
<td>B8</td>
<td>When this signal is ON, the motor generates torque as energized state and will be ready to run. When this signal is off, the motor state is changed as free–run. (In case there is an inner brake, the brake operates.)</td>
<td>Input</td>
</tr>
<tr>
<td>S_JOG+(Forward)</td>
<td>A2</td>
<td>STEP JOG Operation signal (when the SJOG_MODE signal is ON)</td>
<td>Input</td>
</tr>
<tr>
<td>S_JOG–(Reverse)</td>
<td>B3</td>
<td>Used for step jog operation signal. S_JOG+ signal = ON : The ARM rotates forward. S_JOG– signal = ON : The ARM rotates reverse.</td>
<td>Input</td>
</tr>
<tr>
<td>STOP/</td>
<td>A6</td>
<td>When this signal is ON, the motor stops abruptly.</td>
<td>Input</td>
</tr>
<tr>
<td>H_TOOL0</td>
<td>B4</td>
<td>Heavy tool input signal</td>
<td>Input</td>
</tr>
<tr>
<td>H_TOOL1</td>
<td>A3</td>
<td></td>
<td>Input</td>
</tr>
<tr>
<td>COM1</td>
<td>A5</td>
<td>COMMON terminal of sequence input signals. When the DC 24V is inputted between this terminal and the certain input signal, the signal turns ON.</td>
<td>Input</td>
</tr>
<tr>
<td>START/</td>
<td>A1</td>
<td>When this signal is ON while the SVON signal is ON, the motor rotates. Maintain the ON time at minimum 100 msec.</td>
<td>Input</td>
</tr>
<tr>
<td>COM2</td>
<td>B1</td>
<td>COMMON terminal for START, SJOG_MODE, S_JOG+, S_JOG–, H_TOOL0 and H_TOOL1 signals. When the DC 24V is inputted between this terminal and the certain input signal, the signal turns ON.</td>
<td>Input</td>
</tr>
<tr>
<td>SJOG_MODE</td>
<td>B2</td>
<td>STEP JOG state input signal</td>
<td>Input</td>
</tr>
</tbody>
</table>
### 1.9. Signals for connector CN2 and their meanings

<table>
<thead>
<tr>
<th>Signal</th>
<th>No.</th>
<th>Description</th>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALM</td>
<td>A6</td>
<td>When a drive alarm occurs, this signal is OFF and the normal case, this signal turns ON.</td>
<td>Output</td>
</tr>
<tr>
<td>SVRDY</td>
<td>B7</td>
<td>Servo ready complete signal                                                                ーション</td>
<td>Output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When the SVON signal is ON, this signal turns ON after the setting time in the parameter 13 unless there’s anything wrong with the drive. When the SVON signal is OFF, this signal turns OFF after the setting time in the parameter 15.</td>
<td></td>
</tr>
<tr>
<td>BAT_L</td>
<td>B6</td>
<td>When the battery voltage falls below 3.2V, this signal(Active Low) turns ON.</td>
<td>Output</td>
</tr>
<tr>
<td>COM3</td>
<td>A5</td>
<td>COMMON terminal for sequence signals(ALM, SVRDY, etc.)</td>
<td>Output</td>
</tr>
<tr>
<td>CLAMP</td>
<td>A4</td>
<td>This signal outputs the CLAMP signal.</td>
<td>Output</td>
</tr>
<tr>
<td>BRAKE+</td>
<td>B10</td>
<td>In case there is an inner brake in the motor, this signal controls the brake power. (The current flow capacity is within 30mA due to photo coupler contact point, thus a different relay contact point must be used for the actual brake power ON/OFF control. Design the circuit so that when output contact point is ON, the brake is free, when output contact point is OFF, the brake operates.) When the SVON signal is ON, this signal turns ON after the setting time in the parameter 14 and then SVRDY signal turns ON after the setting time in the parameter 13. When the SVON signal is OFF, this signal turns OFF after the setting time in the parameter 14.</td>
<td>Output</td>
</tr>
<tr>
<td>BRAKE_-</td>
<td>A10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VPF</td>
<td>B5</td>
<td>Positioning completion signal output</td>
<td>Output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If the pulse error readings while the motor is moving is within the setting value in the parameter 18, this signal turns ON. (This signal turns ON even when the SVON signal turns OFF.)</td>
<td></td>
</tr>
<tr>
<td>UNCLAMP</td>
<td>B4</td>
<td>This signal outputs the UNCLAMP signal.</td>
<td>Output</td>
</tr>
<tr>
<td>ORIGIN_OUT</td>
<td>A3</td>
<td>This signal outputs the HOME(ORIGIN) POSITION signal.</td>
<td>Output</td>
</tr>
</tbody>
</table>
1.10. Structure of drive I/O circuit

① Input
There are SVON, JOG+, JOG-, STOP, H_TOOL0, H_TOOL1, START and SJOG_MODE signals and two types of input circuits are provided. (The current is limited to 5mA due to inner resistance.)

![Input diagram]

② Output
There are SVRDY, ALM, VPF, BAT_L, CLAMP, UNCLAMP and ORIGIN_OUT signals. They are photo coupler output, thus design the output circuit so that the output current is limited to 50mA.

![Output diagram]
2. Operation

2.1. Automatic operation

① If the drive maintains a normal state (takes 5 sec) after the POWER turns on, it detects the initial position by the absolute encoder. If the initial position corresponds to the HOME POSITION, the drive outputs ORIGIN_OUT signal.

② When the SVON signal is ON, the SVRDY signal turns ON after the inner GATE turns ON.

③ When the START signal is ON, the servo motor will start to rotate. (Maintain ON state of the START signal for about 100 ~ 200 msec.)

④ When the position movement starts, ORIGIN_OUT(HOME POSITION) signal will be turned OFF.

⑤ When the position movement is complete, ORIGIN_OUT(HOME POSITION) signal turns ON.

⑥ The host controller must turn OFF the SVON signal only after the ORIGIN_OUT(HOME POSITION) signal turns ON. (Move to the next position after the SVRDY signal turns OFF.)
2.2. Parameter and Machine Origin setting method after replacement of the servo drive

At the time of the first machine assembly, should be set the absolute encoder zero-point to the Machine Origin. The setting method is as follows.
(These steps should be done when the external SERVO ON signal is OFF.)

2.2.1. Parameter and Machine Origin setting method of ATC

1) Turn on the drive power.

2) Set value of the parameter 45, servo drive function selection parameter, as 1.
   Please change the parameter 45 as 1 only when it needs to set as ATC because default value is 0, Turret/Magazine. Turn the drive power OFF and then turn ON again after setting the value.

3) After power turns ON, if AL I- PE alarm, namely, parameter error alarm occurred, turn the drive power OFF and ON again to release the alarm.

4) Initialize the parameter value.
   Press the MODE key to change the display to diagnosis mode, and then press the DOWN key 3 times to change the display to parameter initialize mode.

   

   

   

   : Press the SET key to save the parameter.

   : Parameters from No. 0 to 99 are saved automatically.

   : Return to the original display after saving the parameter up to 99 automatically.
5) Initialize the position compensation value.
   After parameter initialization, press the UP key once to change the display to position
   compensation value initialize mode.

   : Press the SET key to initialize the position compensation value.

   : Parameters from No. 0 to 127 are saved automatically.

   : Return to the original display after saving the parameter
   up to 127 automatically.

6) Turn the drive power OFF and then turn ON again.

7) Set the parameter by reference the parameter sheet of the equipment.
   Ex) Change the value of parameter 6 from 10 to 43.
   ① Press the MODE key twice to change the display to parameter setting mode.

   ② Press the UP key 6 times to change the two-digit address of the beginning as 06.
③ The rightmost number will blink on and off after pressing the SET key once. (Each time the SET key is pressed, the blinking number will shift to the left and after 5 times the setting value will be applied with stopping blinking.)

④ In this state, if the value is 43, press the UP key 3 times to change the rightmost number as 3. And, press the SET key once to shift the blinking number to the left so the second number of the right is blinked. Then, press the UP key 3 times to change the second number as 4 so the two digits are changed as 43.

⑤ In this state, the setting value will be applied with stopping blinking after pressing the SET key 3 times.

※ All settings can be set under OFF state of the SVON signal, and if the parameter setting is completed, the drive power must be turned OFF and ON again to apply the changed parameter value.

8) Turn the servo drive power OFF and ON again.

9) Set the origin at the origin setting display of the diagnosis mode.
① Press the MODE key to change the display to diagnosis mode, and then press the DOWN key once to change the display to origin setting display mode.
Set

Press the SET key for 3 seconds or more to save the origin-related parameter.

Parameters from No. 34 to 46 are saved automatically.

Return to the original display after saving the parameter up to 46 automatically.

10) Turn the servo drive power OFF and ON again to complete the origin setting.
2.3. Operation of servo drive in JOG mode by external signal

When the parameter 2 is set to 1, the servo drive can be operated in JOG mode by outside contact signal(OVR1).

1) Set the parameter 2 as 1.
   ① Change the operating display as the parameter setting mode by pressing the MODE key twice.

   ![State display mode](image1) ➔ ![Parameter setting mode](image2)
   State display mode ➔ Parameter setting mode

   Twice

   ② Press the UP key twice to change display of first two segments as 2.

   ![Twice](image3)

   Twice

   ③ After pressing the SET key once, the rightmost number will blink on and off.

   ![Once](image4)

   Once

   ④ In this state, press the UP key once to change the rightmost number as 1. And the setting value will be applied with stopping blinking after pressing the SET key four times.

   ![4 times](image5)

   4 times

2) If the servo drive input contact point OVR1 is turned ON by NC, the drive outputs ON of the output contact point AUX_OUT1 to the NC. And the servo drive can be operated in JOG mode.

3) The servo motor rotates at the setting speed in parameter 27 while the NC enables JOG+ or JOG- signal.

※ OVR1 and AUX_OUT1 contact points between NC and servo drive must be connected to use this function.
2.4. Machine Origin setting method by external signal

When the parameter 2 is set to 1, it’s possible to set the machine origin by outside contact signals(OVR0, OVR1).

1) Set the parameter 2 as 1.
   ① Change the operating display as parameter setting mode by pressing the MODE key twice.

   ![Mode display](image)

   State display mode  ➔  Parameter setting mode

   Twice

   ② Press the UP key twice to change display of first two segments as 2.

   ![Up display](image)

   Twice

   ③ After pressing the SET key once, the rightmost number will blink on and off.

   ![Set display](image)

   Once

   ④ In this state, press the UP key once to change the rightmost number as 1. And the setting value will be applied with stopping the blinking after pressing the SET key four times.

   ![Set display](image)

   Once  ➔  4 times

2) If the servo drive input contact points OVR0 and OVR1 are turned ON by NC at once, the drive outputs ON of the output contact points AUX_OUT0 and AUX_OUT1 to the NC at once after completion of origin setting.

   ![Contact display](image)

3) Turn the servo drive power OFF and ON again to complete the origin setting.

※ OVR0, OVR1, AUX_OUT0 and AUX_OUT1 contact points between NC and servo drive must be connected to use this function.
2.5. Switch of display mode, parameter and position compensation value setting method at the time an alarm occurs

When an alarm occurs, for existing version, it’s impossible to use any function or switch the front display of the servo drive with displaying current alarm in the front display. But, it’s possible to set the parameter or switch display since version DVSC–TM–14D–02.

1) Switch of diagnosis display at the time an encoder alarm occurs
   When an alarm occurs, the alarm type is displayed in front display of the servo drive. In this state, it’s possible to switch to the necessary diagnosis mode display by pressing the direction key after switching of the display as diagnosis mode by pressing the MODE key once.

2) Switch of parameter setting display at the time an encoder alarm occurs
   When an alarm occurs, the alarm type is displayed in front display of the servo drive. In this state, it’s possible to confirm or change the necessary parameter value by pressing the direction key after switching of the display as parameter setting mode by pressing the MODE key twice.
3) Switch of position compensation value setting display at the time an encoder alarm occurs

When an alarm occurs, the alarm type is displayed in front display of the servo drive. In this state, it’s possible to confirm or change the necessary position compensation value by pressing the direction key after switching of the display as position compensation value setting mode by pressing the MODE key three times.

![Diagram]

- Position compensation value initial display
- No. 1 POST position compensation value
- No. 2 POST position compensation value
- No. 127 POST position compensation value
2.6. S-shaped acceleration/deceleration setting method

When applying a straight speed profile, apply S-shaped speed profile to reduce vibration that occurs in the acceleration/deceleration section. To set the time constant of S-shaped acceleration/deceleration, change the front display as parameter setting mode by pressing the MODE key twice and set as the necessary value after setting the left two digits of address as 21 by pressing the UP key 21 times. It’s possible to apply this function since version DVSC-TM-14D-02.

1) S-shaped acceleration/deceleration time constant setting
   ① Change the operating display as parameter setting mode by pressing the MODE key twice.

   ![State display mode](image1)
   ![Parameter setting mode](image2)
   Twice

   ② Set as the necessary value after setting the left two digits of address as 21 by pressing the UP key 21 times.

   ![000020](image3)
   ![210000](image4)
   21 times

2) S-shaped acceleration/deceleration time calculation
   : S-shaped acceleration/deceleration section is set as much as the setting value of parameter 21 unless it is 0.

   ![Straight speed profile](image5)
   ![S-shaped speed profile](image6)

   total accel. time(msec) = accel. time(parameter 29) + S-shaped time constant(parameter 21)
   total decel. time(msec) = decel. time(parameter 30) + S-shaped time constant(parameter 21)
3. Display/Setting part

3.1. Functions

The 6 digits 7 segment display in front of the drive indicates parameter setting, position compensation value setting, diagnosis and alarm. And drive setting and various operating can be done by the 4 keys below the display.

- Even if the power turns OFF, values set by key operation is stored in drive.
- Even if the power turns OFF after the alarm occur, the contents of the alarm is stored in drive. And the contents can be verified after turning ON the power again.
3.2. Operating of the Display/Setting part and display flowchart

3.2.1. Overview

Soon after turning on the power, the 7 segment is in the state display mode and the mode selection can be done by the MODE key.

- Designated series display (CT series)
- Capacity display (2.0KW)
  ※0.8KW (Pro.800), 1.5KW (Pro.150), 2.3KW (Pro.230)
- Control Mode display (Position / Speed / Current)
- State display mode
- Diagnosis display mode
- Parameter setting mode
- Position compensation value setting mode
- Alarm history display mode
3.2.2. Display Flowchart

- **State display**
  - Motor rotation speed
  - Alarm
  - Reserved
  - Accumulated remaining pulse
  - Maximum load factor
  - Effective load factor
  - Absolute encoder value within 1 rotation
  - Current position number

- **Diagnosis display**
  - Servo ready state
  - Machine origin setting
  - Position compensation value setting
  - Reserved
  - JOG operation
  - Output section setting by position signal
  - Position signal output whole section setting
  - Teaching section setting
  - Contact output test
  - Override input signal
  - Function data output
  - Function data input
  - Sequence output
  - Sequence input

- **Parameter setting**
  - Parameter 0
  - Parameter 1
  - Parameter 2
  - Parameter 3
  - Parameter 73

- **Position compensation setting**
  - Position compensation value 1
  - Reserved
  - Position compensation value 2
  - Alarm history 1
  - Alarm history 2
  - Alarm history 3
  - Position compensation value 100
  - Position compensation value 110
  - Alarm history 20
  - Position compensation value 127
3.3. State display

The state display mode is the function that verifies the state of the drive during operation.

- The front panel displays the state of the drive, and its contents and usage are as follows.
- All position related calculations are executed according to pulse unit inside the drive. Therefore the state display of the pulse unit is displayed according to the pulse standard of the encoder.
  (8,192 pulses per rotation)

3.3.1. Motor rotation speed

The rotation speed of the motor is displayed as RPM unit. The rapid change of the speed cannot be seen due to inner filtering process.
If the motor rotates in a clockwise, ‘-’ will be displayed. Display range \([-3000 \sim 3000]\)

\[
\begin{align*}
\text{Positive(1000rpm)} & : \quad \text{Positive(1000rpm)} \\
\text{Negative (-1000rpm)} & : \quad \text{Negative (-1000rpm)}
\end{align*}
\]

3.3.2. Alarm display

Current occurred alarm state is displayed and it’s possible to change the display even if an alarm is occurred.

\[
\begin{align*}
\text{Ex) overload alarm} & : \quad \text{Ex) overload alarm} \\
\text{ALI-OL} & : \quad \text{ALI-OL}
\end{align*}
\]

\[\text{Sequence of display conversions}\]

\[
\begin{align*}
\text{-10000} & \quad \text{ALI---} \\
\text{ALI-} & \quad \text{ALI-} \\
\text{-10000} & \quad \text{-10000}
\end{align*}
\]

3.3.3. Remaining pulses

The error between position command and position feedback(actual position) is displayed as accumulated pulse unit. If the error exceeds the setting value of the parameter 19, position deviation excess alarm will be occurred. If the motor rotates in a clockwise, ‘-‘ will be displayed and the display will be changed as 0 after the SVON signal is turned OFF.

\[
\begin{align*}
\text{Remaining pulses} & : \quad \text{Remaining pulses} \\
\text{E0000} & : \quad \text{E0000} \\
\text{E-1000} & : \quad \text{E-1000}
\end{align*}
\]

\[\text{Sequence of display conversions}\]

\[
\begin{align*}
\text{-10000} & \quad \text{E0000} \\
\text{E0000} & \quad -10000
\end{align*}
\]

4 times
3.3.4. Maximum load factor
The maximum value of load is displayed in %. While the SVON signal is ON, the display is always updated as the maximum value and it will be 0 when the signal is OFF. If the value is in the minus, ‘-‘ will be displayed. Display range [-300 ~ 300]

◆ Sequence of display conversions

3.3.5. Effective load factor
The effective value of load is displayed in %. (The rated value is 100%.) If the motor rotates in a clockwise, ‘-‘ will be displayed. When the SVON signal is OFF, the display will be 0. Display range [-300 ~ 300]

◆ Sequence of screen conversions

3.3.6. Position value within 1 rotation of motor
This mode will display the pulse count within 1 rotation of the absolute encoder in the motor. (2,048 count per rotation) When the count exceeds 2048, it will resume to 0. Display range [0 ~ 2,047]

◆ Sequence of display conversions
3.3.7. Rotation count of motor
This mode will display the rotation pulse count of the absolute encoder in the motor. (1 count per rotation) When the count exceeds 65,535, it will resume to 0. Display range [0 ~ 65,535]

\[ d \, 0 \, 0 \, 2 \, 2 \, 4 \]

◆ Sequence of display conversions

\[-0000 \Rightarrow d \, 0 \, 0 \, 2 \, 2 \, 4\]

Twice

3.3.8. Usage for maker management

\[ a \, 0 \, 0 \, 0 \, 1 \, 1 \, 0 \, 0 \, 6 \, 4 \]
3.4. Diagnosis display

▶ In this mode, it will be possible to verify the external sequence state and the condition of the system.
▶ It will be displayed in the LED display as shown below, and its contents and usage are as follows.

3.4.1. Servo ready state

- **PD-Off**: SVON signal is OFF  
  - **PD-on**: SVON signal is ON

◆ Sequence of display conversions

- 0000

3.4.2. Sequence I/O signal

1) Sequence input signal: ON/OFF state of external input signals is displayed in 7 segments.

- START  
- STOP  
- JOG-  
- JOG+  
- SVON

◆ Sequence of display conversions

- 0000

2) Sequence output signal: ON/OFF state of external output signals is displayed in 7 segments.

- BRAKE  
- BAT_LOW  
- ALM  
- AUX_OUT1  
- SVRDY

◆ Sequence of display conversions

- 0000
3.4.3. Function data I/O signal
1) Function data input signal: ON/OFF state of function data input signal is displayed in 7 segments.

2) Function data output signal: ON/OFF state of function data output signal is displayed in 7 segments.

3.4.4. Option Input signal
Sequence of display conversions

3.4.5. Output signal test
In this mode, it is possible to verify the connection by outputting the output signals by force to external.

- Set desired output using SET key
- POSO0 signal ON
- POSO1 signal ON
- POSO2 signal ON
- POSO3 signal ON
- ... signal ON
- AUX_OUT0 signal ON
- AUX_OUT1 signal ON
- BRAKE signal ON
- Return to the original display

Once
5 times
◆ Sequence of display conversions

- 0000  $\Rightarrow$  rpm-off  $\Rightarrow$  dti--  

Once  $\Rightarrow$  6 times

3.4.6. Maker management items

[Search]: Unused

3.4.7. Drive itself JOG operation

: When setting the origin regardless of external signals autonomously, this mode can be used to move to home position of the selected POST. While the UP or DOWN key is pressed, the servo motor rotates at the setting speed in parameter 27. From upper version than DVSC-TM-14D-04, the oscillation will be suppressed at the time of acceleration or deceleration.

◆ Sequence of display conversions

- 0000  $\Rightarrow$  rpm-off  $\Rightarrow$  jog-wa

Once  $\Rightarrow$  4 times

Ex) Drive itself JOG operation at 200 rpm

: After pressing the SET key, the SVON signal automatically turns ON, and it will be changed to JOG operation mode.

: JOG operation mode

: Resume to initial display mode
3.4.8. Parameter Initialization
: In this mode, all parameters except parameter 45 are initialized as default value and stored in FRAM by pressing the SET key for 2 seconds or more.

![Diagram showing parameter initialization process]

3.4.9. Position compensation value Initialization
: In this mode, all of the position compensation values are initialized as 0 and stored in FRAM by pressing the SET key for 2 seconds or more.

![Diagram showing position compensation value initialization process]
3.4.10. Machine Origin setting

In this mode, current position can be set as machine origin. In the origin setting mode, after pressing the SET key more than 3 seconds, the parameter related with origin-point will be automatically set. After setting the origin-point, turn the power OFF and turn ON again in other to complete the setting.

1) Set the parameter by reference the parameter sheet of the equipment.

Ex) Change the value of parameter 6 from 10 to 43.

① Press the MODE key twice to change the display to parameter setting mode.

![State display mode](image1) ➔ ![Parameter setting mode](image2)

② Press the UP key 6 times to change the two-digit address of the beginning as 06.

![6 times](image3)

③ The rightmost number will blink on and off after pressing the SET key once. (Each time the SET key is pressed, the blinking number will shift to the left and after 5 times the setting value will be applied with stopping blinking.)

![Once](image4)

④ In this state, if the value is 43, press the UP key 3 times to change the rightmost number as 3. And, press the SET key once to shift the blinking number to the left so the second number of the right is blink. Then, press the UP key 3 times to change the second number as 4 so the two digits are changed as 43.

![3 times](image5) ➔ ![Once](image6) ➔ ![3 times](image7)
5) In this state, the setting value will be applied with stopping blinking after pressing the SET key 3 times.

![Diagram showing SET key pressed 3 times]

※ All settings can be set under OFF state of the SVON signal, and if the parameter setting is completed, the drive power must be turned OFF and ON again to apply the changed parameter value.

2) Turn the servo drive power OFF and ON again.

3) Set the origin at the origin setting display of the diagnosis mode.
   ① Press the MODE key to change the display to diagnosis mode, and then press the DOWN key once to change the display to origin setting display mode.

![Diagram showing transition from state display mode to diagnosis display mode to origin setting display mode]

: Press the SET key for 3 seconds or more to save the origin-related parameter.

: Parameters from No. 34 to 46 are saved automatically.

: Return to the original display after saving the parameter up to 46 automatically.

4) Turn the servo drive power OFF and ON again to complete the origin setting.
3.5. Alarm history display

3.5.1. Alarm history display

The recent alarm records will be stored and displayed up to 20 times. The records can be verified by pressing UP or DOWN key. All records of the alarm will be cleared by pressing the SET key.

- [Image of alarm history display]

- **Alarm history mode**
- **One time alarm display** ex) in case of battery alarm
- **Second time alarm display** ex) in case of parameter error alarm
- **Third time alarm display**
- **20th time alarm display**

- All records will be cleared when the SET key is pressed at the alarm record display mode.

- [Image of alarm cleared]

3.5.2. Drive operation at alarm occurrence

When an alarm occurs, the photo coupler contact points between ALM and COM2 terminals of the CN2 connector will be OFF. Then, SVRDY and BRAKE terminal will be OFF as well, and the motor will be on free run state.

The detected alarm item will be displayed on drive 7 segments display. Also the alarm number as binary code will be outputted to the NC through the position data output terminals.
Even if an alarm occurs, it’s possible to change the display as state display mode, diagnosis display mode, parameter setting mode, origin setting mode and alarm history display mode since version DVSC-TM-14D-02. Also, even at alarm state, parameter or offset value setting is possible since that version.

▶ Method of releasing the alarm state
  : Once the cause of the alarm is resolved, it is possible to operate the drive by turning the power OFF and ON again.

▶ Detection time of over load
  : The operation time of the over load alarm detect circuit is as listed below.

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300% ~</td>
<td>5.5 sec</td>
</tr>
<tr>
<td>275% ~</td>
<td>6.5 sec</td>
</tr>
<tr>
<td>225% ~</td>
<td>8 sec</td>
</tr>
<tr>
<td>200% ~</td>
<td>10 sec</td>
</tr>
<tr>
<td>170% ~</td>
<td>14 sec</td>
</tr>
<tr>
<td>150% ~</td>
<td>17.5 sec</td>
</tr>
<tr>
<td>140% ~</td>
<td>20 sec</td>
</tr>
<tr>
<td>130% ~</td>
<td>25 sec</td>
</tr>
<tr>
<td>120% ~</td>
<td>30 sec</td>
</tr>
</tbody>
</table>
Display and contents of the drive alarm is as following.

<table>
<thead>
<tr>
<th>NO</th>
<th>LED display</th>
<th>Alarm type</th>
<th>Corrective actions</th>
</tr>
</thead>
</table>
| 1  | AL1-UV      | Under voltage : occurs when the inside DC link voltage is below the standard value. | - check if the input power is low.  
- check if the motor power cable is open. |
| 2  | AL1-OV      | Over voltage : occurs when the inside DC link voltage is above the standard value.       | - check if the input power is high.  
- check if the operation frequency is above standard value.  
- check if regenerative resistor is damaged. |
| 3  | AL1-OK      | Main circuit error : occurs when the IPM malfunctions.                                     | - check if the heat sinking panel is over 100 degrees Celsius.  
- check if the operation frequency is above the standard value. |
| 4  | AL1-CD      | Encoder signal error : occurs when encoder signal malfunctions.                             | - check if the encoder connection is correctly assembled.  
- check if the encoder line is cut. |
| 5  | AL1-OS      | Over speed : occurs when the motor speed exceeds the maximum rotating count.               | - check if the encoder cable is missing or if correctly assembled. |
| 6  | AL1-OL      | Over load : occurs when the over load state continuous for a long time exceeding the standard time. | - check if there is connection error in the motor power cable.  
- check if the parameter is set correctly. |
| 7  | AL1-CE      | CPU error : occurs when the CPU malfunctions or there is fault with the board.              | - turn OFF the power and ON again.  
- check if the parameter is set correctly. |
| 8  | AL1-PC      | Parameter error : occurs when the set parameter is not within the range.                    | - check if the parameter is set correctly. |
| 9  | AL1-PE      | Excessive position deviation : occurs when the remaining pulse exceeds the setting value of parameter 19 during position control. | - check if the value of parameter 19 is set too low.  
- check the encoder cable and the motor. |
| 10 | AL1-CP      | Over current : occurs when the over current flows into the motor.                           | - check if the accel./decel. parameter is set on too low value.  
- check if the insulation resistor of the motor is correctly displayed. |
| 11 | AL1-EP      | Encoder battery error : occurs when the backup battery of the encoder is discharged or disconnected. | - check if the encoder connection is correctly assembled.  
- change the battery. |

※ For detail contents, please refer to the maintenance documentation.

When an alarm occurs, the alarm number as binary code will be outputted to the NC through the position data output terminals.

Example) AL1–UV(under voltage) alarm

<table>
<thead>
<tr>
<th>Input number at NC : 1</th>
<th>POSO3</th>
<th>POSO2</th>
<th>POSO1</th>
<th>POSO0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>
3.6. User Parameter setting and Detailed explanation

Some parameters must be set depending on driving and system configuration before the operation. And the setting method is as following.

3.6.1. Parameter setting method

Ex) Change value of the parameter 6 from 10 to 43.

① Press the MODE key twice to change the display to parameter setting mode.

![State display mode](image1) ➞ ![Parameter setting mode](image2)

② Press the UP key 6 times to change the two-digit address of the beginning as 06.

![6 times](image3)

③ The rightmost number will blink on and off after pressing the SET key once.
(Each time the SET key is pressed, the blinking number will shift to the left and after 5 times the setting value will be applied with stopping blinking.)

![Once](image4)

④ In this state, if the value is 43, press the UP key 3 times to change the rightmost number as 3.
And, press the SET key once to shift the blinking number to the left so the second number of the right is blinked. Then, press the UP key 3 times to change the second number as 4 so the two digits are changed as 43.

![3 times](image5) ➞ ![Once](image6) ➞ ![3 times](image7)
5 In this state, the setting value will be applied with stopping blinking after pressing the SET key 3 times.

All settings can be set under OFF state of the SVON signal, and if the parameter setting is completed, the drive power must be turned OFF and ON again to apply the changed parameter value.
3.6.2. User Parameter list (Refer to the attached parameter sheet at the machine.)

<table>
<thead>
<tr>
<th>NO.</th>
<th>Name</th>
<th>Range</th>
<th>Initial value</th>
<th>Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Motor output capacity</td>
<td>0~40</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>Motor rotation direction</td>
<td>0~1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>Reserved</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Reserved</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>Encoder pulse per 1 rotation</td>
<td></td>
<td>2048</td>
<td></td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>Reserved</td>
<td>126</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>Gear ratio – motor side</td>
<td>1~9999</td>
<td>10</td>
<td>Rotation</td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>Reserved</td>
<td>126</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>Reserved</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09</td>
<td>Reserved</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Position loop proportional gain</td>
<td>0~9999</td>
<td>450</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Speed loop proportional gain</td>
<td>0~9999</td>
<td>400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Speed loop integral gain</td>
<td>0~9999</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>SERVO READY ON delay time</td>
<td>0~1000</td>
<td>0</td>
<td>10 msec</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>BRAKE OFF control delay time</td>
<td>0~1000</td>
<td>0</td>
<td>10 msec</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>BRAKE ON delay time</td>
<td>0~1000</td>
<td>0</td>
<td>10 msec</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Reserved</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Reserved</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Positioning complete range</td>
<td>1~9999</td>
<td>200</td>
<td>PULSE</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Remaining pulse allowable range</td>
<td>1~6000</td>
<td>6000</td>
<td>100 PULSE</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Deceleration time after stop signal</td>
<td>0~5000</td>
<td>0</td>
<td>mses</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>S-shaped acceleration/deceleration time constant</td>
<td>0~100</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Positive torque limit 1</td>
<td>0~300</td>
<td>290</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Negative torque limit 1</td>
<td>0~300</td>
<td>290</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Positive torque limit 2</td>
<td>0~300</td>
<td>290</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Negative torque limit 2</td>
<td>0~300</td>
<td>290</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Speed limit</td>
<td>0~3000</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Jog speed at origin setting</td>
<td>1~3000</td>
<td>20</td>
<td>rpm</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Reserved</td>
<td>800</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Acceleration time</td>
<td>0~9999</td>
<td>80</td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Deceleration time</td>
<td>0~9999</td>
<td>100</td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Reserved</td>
<td>3000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Reserved</td>
<td>1500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Initial state display</td>
<td>0~10</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Encoder coordinates compensation value (lower)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Encoder coordinates compensation value (upper)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Machine origin setting value (lower)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Machine origin setting value (upper)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Current loop proportional gain</td>
<td>0~2048</td>
<td>750</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Current loop integral gain</td>
<td>0~2048</td>
<td>510</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Feedback pulse (lower)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Feedback pulse (upper)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Remaining value of deceleration ratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Compensation value for deceleration ratio remaining (lower)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Compensation value for deceleration ratio remaining (upper)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Servo drive function selection</td>
<td>0~1</td>
<td>1</td>
<td>0:Turret/Magazine 1:ATC</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Speed table selection</td>
<td>0~2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO.</td>
<td>Name</td>
<td>Range</td>
<td>Initial value</td>
<td>Unit</td>
<td>Remarks</td>
</tr>
<tr>
<td>-----</td>
<td>----------------</td>
<td>--------</td>
<td>---------------</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>47</td>
<td>Speed of section 1</td>
<td>10~3000</td>
<td>1050 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Speed of section 2</td>
<td>10~3000</td>
<td>950 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Speed of section 3</td>
<td>10~3000</td>
<td>600 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Speed of section 4</td>
<td>10~3000</td>
<td>1200 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Speed of section 5</td>
<td>10~3000</td>
<td>1200 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Speed of section 6</td>
<td>10~3000</td>
<td>1200 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Speed of section 7</td>
<td>10~3000</td>
<td>1200 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Speed of section 8</td>
<td>10~3000</td>
<td>1200 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Speed of section 9</td>
<td>10~3000</td>
<td>1200 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Speed of section 10</td>
<td>10~3000</td>
<td>1200 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>Speed of section 11</td>
<td>10~3000</td>
<td>1200 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Speed of section 12</td>
<td>10~3000</td>
<td>1050 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Speed of section 13</td>
<td>10~3000</td>
<td>400 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Speed of section 14</td>
<td>10~3000</td>
<td>300 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Speed of section 15</td>
<td>10~3000</td>
<td>600 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>Speed of section 16</td>
<td>10~3000</td>
<td>300 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>Speed of section 17</td>
<td>10~3000</td>
<td>450 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Speed of section 18</td>
<td>10~3000</td>
<td>600 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Speed of section 19</td>
<td>10~3000</td>
<td>600 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Speed of section 20</td>
<td>10~3000</td>
<td>450 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>CLAMP signal</td>
<td>1~360</td>
<td>277 angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>UNCLAMP signal</td>
<td>1~360</td>
<td>25 angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>HEAVY TOOL CLAMP</td>
<td>1~360</td>
<td>284 angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>HEAVY TOOL UNCLAMP</td>
<td>1~360</td>
<td>39 angle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>STEP JOG speed</td>
<td>10~200</td>
<td>130 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>Proportion gain of STEP JOG speed</td>
<td>0~1500</td>
<td>800 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>Reserved</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.6.3. Detailed explanation of user parameter

**0 Motor output capacity**
This parameter sets the applied motor capacity.

0 : 1.5kW   8 : 0.8kW   17 : 1.7kW   20 : 2.0kW   23 : 2.3kW   30 : 3.0kW   40 : 4.0kW

* Use 14A drive for motors under 3.0kW and 28A drive for motors more than 3.0kW. If not applied properly, it may cause malfunction of the motor.

**1 Motor rotation direction**
This parameter sets the rotation direction of the motor. Please select according to the structure of the equipment.

0 : Selects when the rotation direction of the motor and the equipment is the same.
1 : Selects when the rotation direction of the motor and the equipment is different.

**2 ~ 3 Reserved**

**4 Encoder pulse per 1 rotation**
This parameter displays 1/4 value of encoder pulse count per rotation.

**5 Reserved**

**6 Gear ratio of motor side**
This parameter sets the motor rotation counts per 1 rotation of machine.

Setting range : 1 ~ 9999

**7 ~ 9 Reserved**

**10 Position loop proportional gain**
The proportional gain of the position loop is the parameter which determines the response of position control loop. If the value increases, the mechanical response gets better. However, mechanical impact on the machine may occur when the motor starts or stops. If the value decreases, the mechanical response will get worse and position error increases by remaining pulse. This also relates with the speed loop gain.

Setting range : 0 ~ 9999

**11 Speed loop proportional gain**
The proportional gain of speed loop is the parameter which determines the response of the speed control loop. As external characteristics, it determines the degree of rigidity. If the value of the proportional gain increases, the rigidity becomes better. Thus the larger the setting value is the better, but too large setting may cause oscillations and hunting. The value should be set as large as possible under a stable condition.

Setting range : 0 ~ 9999
12 Speed loop integral gain
The integral gain of the speed loop is a compensatory factor which reduces normal state error and increases rigidity. If the value of integral gain is increased, the rigidity will get better. But too large setting may cause oscillations and the system may become unstable.

Setting range: 0 ~ 9999

13 SERVO READY ON delay time
This parameter sets the Servo Ready signal delay time to change as ON.

Setting range: 0 ~ 1000 [x 10msec]

14 Brake OFF control delay time
In case the motor has an inner brake, this parameter sets brake release delay time.

Setting range: 0 ~ 1000 [x 10msec]

15 Brake ON delay time
In case the motor has an inner brake, this parameter sets the time it takes for braking. Set the value higher than actual time it takes for braking.

Setting range: 0 ~ 1000 [x 10msec]

16 ~ 17 Reserved

18 Positioning complete range
At position control, this parameter sets the positioning completion range. If the deviation between the targeted position and the current position is within the setting range, the VPF terminal (no. 16 of the CN1 connector) will be turned ON. The numerical value unit means the encoder pulse and it is 8192 pulse per rotation of the motor.

Setting range: 1 ~ 9999[Pulse]

19 Remaining pulse allowable range
In position control, in each position control loop the difference between position command and position feedback is accumulated. If this difference value exceeds the setting value, the position deviation excess alarm will be occurred. The numerical value unit means the encoder pulse and presently it is 8192 pulse per 1 rotation.

Setting range: 1 ~ 6000 [x 100pulse]

20 Deceleration time after stop signal
This parameter sets the deceleration time from rotation state until the motor stops. When the setting value is 0 as default, the motor under 3kW capacity will be stopped as 100 msec deceleration time. And the motor more than 3kW will be stopped as 340 msec.

Setting range: 0 ~ 5000 [msec]
S-shaped acceleration/deceleration time constant
This parameter sets the time constant to reduce the impact at the time of acceleration or deceleration.

Total acceleration time : acceleration time(parameter 29) + S-shaped acceleration/deceleration time constant
Total deceleration time : deceleration time(parameter 30) + S-shaped acceleration/deceleration time constant

Setting range : 0 ~ 100 [msec]

Positive torque limit 1
This parameter limits the torque output of the positive (+) polarity in areas except of positioning complete range. If the value is set at 0%, positive torque will not occur. If the value is set too low, hunting may occur when the motor starts or stops.

Setting range : 0 ~ 300 [%]

Negative torque limit 1
This parameter limits the torque output of the negative (−) polarity in areas except of positioning complete range. If the value is set at 0%, negative torque will not occur. If the value is set too low, hunting may occur when the motor starts or stops.

Setting range : 0 ~ 300 [%]

Positive torque limit 2
This parameter limits the torque output of the positive (+) polarity in areas within positioning complete range. In purpose of applying continuous load with ON state of SVON signal after positioning completion, the overstrain on the equipment or the motor can be avoided by setting a low value.

Setting range : 0 ~ 300 [%]

Negative torque limit 2
This parameter limits the torque output of the negative (−) polarity in areas within positioning complete range. In purpose of applying continuous load with ON state of SVON signal after positioning completion, the overstrain on the equipment or the motor can be avoided by setting a low value.

Setting range : 0 ~ 300 [%]

Speed limit
This parameter limits the maximum rotation speed. Even when overshooting and such cases occur while accelerating, the rotation speed will be limited within the setting value.

Setting range : 0 ~ 3000 [rpm]
27 Jog speed at origin setting
This parameter sets the motor speed of the internal jog operation. And this parameter is different from the step jog speed.

Setting range : 1 ~ 3000 [rpm]

28 Reserved

29 Acceleration time
This parameter sets the time that takes to get to the setting speed of parameter 47 from 0 speed. If the value is set too low, speed overshooting may occur when accelerating.

Setting range : 0 ~ 9999 [msec], Default value : 80

30 Deceleration time
This parameter sets the time that takes to get to 0 speed from the setting speed of parameter 66. If the value is set too low, positioning completion time may be delayed due to hunting when the motor stops.

Setting range : 0 ~ 9999 [msec], Default value : 100

31 ~ 32 Reserved

33 Initial state display
This parameter sets the initial display mode just after the power is ON.

<table>
<thead>
<tr>
<th>Set value</th>
<th>Initial display contents</th>
<th>Set value</th>
<th>Initial display contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Motor rotation speed</td>
<td>06</td>
<td>Accumulated value of remaining pulse</td>
</tr>
<tr>
<td>01</td>
<td>Current POST number</td>
<td>07</td>
<td>Reserved</td>
</tr>
<tr>
<td>02</td>
<td>Absolute encoder rotation count</td>
<td>08</td>
<td>Reserved</td>
</tr>
<tr>
<td>03</td>
<td>Absolute encoder—one rotation</td>
<td>09</td>
<td>Alarm display</td>
</tr>
<tr>
<td>04</td>
<td>Effective load factor</td>
<td>10</td>
<td>Motor rotation speed</td>
</tr>
<tr>
<td>05</td>
<td>Maximum load factor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

34 ~ 44 Automatic setting parameters or maker parameters for management
These parameters are maker parameters for management or will be set automatically while setting the machine zero-point. Please do not set according to user’s purpose. It may cause malfunction of the motor.

45 Servo drive function selection
Please set this parameter first before parameter initialization or parameter setting, because this parameter sets the servo drive function as Turret/Magazine or ATC.

<table>
<thead>
<tr>
<th>Set value</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Turret/Magazine</td>
</tr>
<tr>
<td>1</td>
<td>ATC</td>
</tr>
</tbody>
</table>

※ For normal operation of the servo drive, the drive power must be turned OFF and ON again, after setting parameter 45.
46 Speed table selection
Select speed table for 20 section.
0 : The speed table from the number 47 to 66 can be set up by users.
1 : The speed table from the number 47 to 66 will be set up automatically.

Setting range : 0 ~ 2

47 ～ 56 Speed parameter of 20 sections.
These parameters set the motor rotation speed for each section while automatic operation.

Setting range : 10 ~ 3000 [rpm]

67 CLAMP signal
The CLAMP signal will be outputted when the ATC is positioned in the setting angle of this parameter.

Setting range : 1 ~ 360

68 UNCLAMP signal
The UNCLAMP signal will be outputted when the ATC is positioned in the setting angle of this parameter.

Setting range : 1 ~ 360

69 HEAVY TOOL CLAMP signal
In heavy tool applied state, the CLAMP signal will be outputted when the ATC is positioned in the setting angle of this parameter.

Setting range : 1 ~ 360

70 HEAVY TOOL UNCLAMP signal
In heavy tool applied state, the UNCLAMP signal will be outputted when the ATC is positioned in the setting angle of this parameter.

Setting range : 1 ~ 360

71 STEP JOG speed
At the time of STEP JOG operation, this parameter sets the motor rotation speed.

Setting range : 10 ~ 200

72 Proportion gain of STEP JOG speed
The proportion gain of speed loop is the parameter which determines the respond of speed control loop.

Setting range : 0 ~ 1500

73 Reserved
● Unauthorized copy of this book is prohibited.

● The appearance and specification of this equipment can be changed to improve.
DOOSAN AC SERVO MOTOR & TM SERIES SERVO DRIVE OPERATION MANUAL

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※ The contents of this operation manual can be changed as modify of specifications.