Before operating the industrial robot, read through and completely understand the instruction manual.

The contents included in this catalog are subject to change without prior notice to reflect improvements.
**Performance**

**Short cycle time**
Operates at the maximum of 1000 mm/s. (Note 1)

**Servo motor**
A servo motor for a compact axis to allow high-speed operation, quick acceleration and deceleration, and high payload.

**Absolute position system**
No need for return-to-home routines.

**Compact controller**
Uncompromised downsizing and cost reduction.

(Note 1: For limited stroke and payload, contact our sales representative for details.)

---

**Axis features**
- Resolver as a motor sensor
  A brushless resolver serves as a motor sensor.
  It has excellent environmental durability (against high and low temperatures, vibrations, and physical shocks).
- Compact and high-power servo motor
  A compact servo motor allows high-speed operation, quick acceleration and deceleration, and high payload.
- Absolute position system
  No need for time-consuming return-to-home routines; equipment start-up time can be shortened.
- 3D model types
  Slider, table, and rod type axes are available.

**Controller features**
- Compact
  It is as compact as 31 (H) x 146 (W) x 89 (D) mm (excluding screw heads).
- DC24V power supply
  Both the control and drive power supplies are DC24V.
- Brake release switch as standard equipment
  A brake release switch is provided on the front side of the controller.

**Master controller**
- Exclusive for a single axis
  A controller and driver designed exclusively for a single axis.
- No programming required
  Only parameter and table settings are required for execution of a desired operation.
- Torque control function as a standard feature
  Perfect for workplace pushing operation.
  A robot can replace an air cylinder for workplace pushing operations.
- Area entry signal output function as a standard feature
  The output signal can be turned on or off while the path is in motion.
- Acceleration and deceleration settings
  Acceleration and deceleration can be set separately.

**Slave controller**
- A driver for controlling multiple axes; to be used in combination with a BA series product
  Connect to a BA series product for controlling multiple axes.

---

**Easy-to-select sets**
This catalog introduces sets of products including an axis, controller, and controller cable. Products can also be selected individually from corresponding pages.
The BA-C series has the answer!

**CHECK**
- Do you want a faster and smoother operating air cylinder that can position multiple points?
- Do you want to quickly change air cylinder force?
- Do you want to control peripheral devices during robot operation?
- Do you want to save energy (by switching from an air cylinder to an electric cylinder)?
- Do you want to improve the stop position accuracy?
- Do you want to use the previous model (BAI) with this model?

**Performance 1**
Higher accuracy, increased energy saving, and longer lifetime than an air cylinder!

** performanced 2**
More features and easier-to-use than the BA-II series!

- **Perfect replacement of an air cylinder**
  - 6 models from 3 types to choose from
- **Advantages**
  - Easy installation and connection
  - Flexible control with an air cylinder

**Performance 3**
More scalable and easier to use when used in combination with a BA II series product!

- **Improved scalability when used with a BA series product**
- **Improved connectivity** to various controllers such as CA20-S10 and BAII-S10

---

**CA20-M00**
**CA20-S10**
**CA20-S10**
**CAI5-958**
**BA10C (air cylinder)**
**BB10C (100W)**

---

*For limited stroke and payload.*
### Specifications

#### Slider Type

<table>
<thead>
<tr>
<th>Model</th>
<th>Photo</th>
<th>Stroke (mm)</th>
<th>Lead (mm)</th>
<th>Maximum speed (mm/s)</th>
<th>Maximum payload (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAC5D</td>
<td><img src="image" alt="BAC5D" /></td>
<td>50~500 (50 to 500 in 50 mm increments)</td>
<td>12</td>
<td>800</td>
<td>1.5, 3.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>700</td>
<td>6</td>
<td>400</td>
<td>3.0</td>
</tr>
</tbody>
</table>

#### Table Type

<table>
<thead>
<tr>
<th>Model</th>
<th>Photo</th>
<th>Stroke (mm)</th>
<th>Lead (mm)</th>
<th>Maximum speed (mm/s)</th>
<th>Maximum payload (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAC5D</td>
<td><img src="image" alt="BAC5D" /></td>
<td>50~100 (50 to 100 in 50 mm increments)</td>
<td>12</td>
<td>800</td>
<td>3.0, 6.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 to 500</td>
<td>6</td>
<td>400</td>
<td>2.5</td>
</tr>
</tbody>
</table>

#### Rod Type

<table>
<thead>
<tr>
<th>Model</th>
<th>Photo</th>
<th>Stroke (mm)</th>
<th>Lead (mm)</th>
<th>Maximum speed (mm/s)</th>
<th>Maximum payload (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAC3D</td>
<td><img src="image" alt="BAC3D" /></td>
<td>50~150 (50 to 150 in 50 mm increments)</td>
<td>12</td>
<td>600</td>
<td>1.5, 3.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 to 200</td>
<td></td>
<td></td>
<td>2.2</td>
</tr>
</tbody>
</table>

**Notes:**
- P10, P11, P12, P13, P14, P15 indicate page numbers or sections.
- *1: Stroke is 50 mm or shorter*  
  *2: Stroke is from 51 mm to 100 mm*  
  *3: Stroke is from 101 mm to 150 mm*
### Specifications

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motor output</strong></td>
<td>SOW, AC servo motor (resolver)</td>
</tr>
<tr>
<td><strong>Drive system</strong></td>
<td>Rolled ball screw (class 7 equivalent); outside diameter: 8 mm</td>
</tr>
<tr>
<td><strong>Stroke (mm)</strong></td>
<td>Ø100</td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td>Ø5</td>
</tr>
<tr>
<td><strong>Lead (mm)</strong></td>
<td>6</td>
</tr>
<tr>
<td><strong>Maximum speed (mm/s)</strong></td>
<td>400</td>
</tr>
<tr>
<td><strong>Positioning repeatability (mm)</strong></td>
<td>±0.02</td>
</tr>
<tr>
<td><strong>Resolution (mm)</strong></td>
<td>Lead / 2048</td>
</tr>
<tr>
<td><strong>Allowable static moment (N⋅m)</strong></td>
<td>Stroke: 50 mm</td>
</tr>
<tr>
<td><strong>Travel</strong></td>
<td>Table: MR: 4.4, MP: 1.9, MY: 1.9</td>
</tr>
<tr>
<td><strong>Brake</strong></td>
<td>Brake applied when the system is de-energized; Voltage: DC24V</td>
</tr>
</tbody>
</table>

**Note:***Select a product with a brake if it is to be used as a vertical axis.*

**Maximum payload is the value measured when a load is applied directly above the stepper.*

**The values noted in the maximum payload table when a representative discharging unit (5A-04-00) is used.*

**The acceleration / deceleration time means the time required to reach a programmed speed.*

---

![Axis model](image)
BAC - 3D - ST - C12N - 50 - 13 - M

Specifications

Motor output: 50W AC servo motor (resolver)

Drive system: Rolled ball screw (class 7 equivalent); outside diameter: 8 mm

Stroke (mm) in 50 mm increments
- Cylinder: 50 - 150
- Type: 0.5 - 15

Maximum speed (mm/s): 12 mm lead, 6000

Maximum payload (kg): When used horizontally: 4.5; when used vertically: 2.5
- Acceleration / deceleration time: 0.15s or longer

Positioning repeatability (mm): ±0.02

Resolution (mm): Lead / 2048

Allowable static moment (N·m): Load moment cannot be applied to a rod

Brake: Brake applied when the system is de-energized; Voltage: DC24V

Master controller: CA01-M05

Note:
- Select the product with a brake if it is to be used as a vertical axis.
- The maximum payload is the value measured when a load is directly applied to the slider.
- The values include the weight of the maximum payload when a representative suspended load (GAWK0050 or GAVLNG05) is used.
- The acceleration / deceleration time means the time required to reach a programmed speed.
- For further information, please refer to the technical drawings or product catalog.

BAC 3D - ST - C12N - 50 - M

Dimensions in mm:
- Slide 1: 960, 1000, 1100
- Slide 2: 215, 245, 275
- End of Slide 2: 215, 245, 275
- Length of the Slide: 1300, 1400, 1500

40-40-40, depth 12

BAC - 4D - ST - C12N - 50 - 13 - M

Specifications

Motor output: 50W AC servo motor (resolver)

Drive system: Rolled ball screw (class 7 equivalent); outside diameter: 8 mm

Stroke (mm) in 50 mm increments
- Cylinder: 50 - 200
- Type: 0.5 - 20

Maximum speed (mm/s): 12 mm lead, 6000

Maximum payload (kg): When used horizontally: 5.2; when used vertically: 2.2
- Acceleration / deceleration time: 0.15s or longer

Positioning repeatability (mm): ±0.02

Resolution (mm): Lead / 2048

Allowable static moment (N·m): Load moment cannot be applied to a rod

Brake: Brake applied when the system is de-energized; Voltage: DC24V

Master controller: CA01-M05

Note:
- Select the product with a brake if it is to be used as a vertical axis.
- The maximum payload is the value measured when a load is directly applied to the slider.
- The values include the weight of the maximum payload when a representative suspended load (GAWK0050 or GAVLNG05) is used.
- The acceleration / deceleration time means the time required to reach a programmed speed.
- For further information, please refer to the technical drawings or product catalog.
<table>
<thead>
<tr>
<th>Control System Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller</td>
</tr>
<tr>
<td>Master controller</td>
</tr>
<tr>
<td>Slave controller</td>
</tr>
<tr>
<td>Parts</td>
</tr>
<tr>
<td>Controller Cable</td>
</tr>
<tr>
<td>Optional Parts</td>
</tr>
<tr>
<td>Table Unit</td>
</tr>
<tr>
<td>Axis with a Motor Cover</td>
</tr>
<tr>
<td>Regenerative Resistor</td>
</tr>
<tr>
<td>Teach Pendant</td>
</tr>
<tr>
<td>PC Software</td>
</tr>
<tr>
<td>Communication Cable (RS-232C)</td>
</tr>
<tr>
<td>Input / Output Cable</td>
</tr>
<tr>
<td>Resolver ABS Backup (for Maintenance)</td>
</tr>
</tbody>
</table>
**General specifications**

- **Applicable robot**: COMPO MM 8-A/C Series
- **Controller model**: COMPO A01-M05
- **Number of axes supported to control 1 axis**: 4
- **Motor capacity**: 50W
- **Control method**: Servo-controlled loop control
- **Teaching method**: Remote teaching, Direct teaching, or M0
- **Speed setting**: B-1 or B-2 (table)
- **Acceleration/deceleration setting**: B-1 or B-2 (table)
- **Number of power tables**: 15 tables
- **Storage method**: EEROM (can be rewritten 1 million times)
- **Transfer mode**: Point mode
- **Special function**: Torque control function
- **Emergency stop mode**: Yes
- **Position detection sensor input**: Yes
- **Repetitive function**: Yes (external repetitive function)
- **Dynamic brake function**: NA
- **Mechanical brake drive output**: DC24V/0.1A or larger for holding brake applied when the system is disengaged
- **Protection function**: Hardware error, servo drive power supply error, EEROM error, and so on
- **Software error**: Over-speed, overload, position error, and so on
- **Warning**: Drive power disconnection
- **Dimensions**: 31 (W) x 146 (D) x 49 (H) mm (excluding screwheads)

**System specifications**

- **Display on the status LED (Q1)**: Status display
- **System input**: 24V, 7mA, 10 points
- **System output**: 24V, 20mA, 8 points
- **Communication function**: RS232C + 1 channel (MODEM) for PC software SP-903
- **Controller supply voltage (primary)**: DC24V ±10%
- **Drive power supply voltage**: DC24V ±15%
- **Control power supply**: 24V
- **Drive power supply**: Single-ended analog or digital output (0-30mA or 0-10V)
- **Ambient conditions**: 0~40°C, RH 5%~95% (non-condensing)
- **Weight**: Approximately 0.25 kg

---

**Input and output specifications**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Input No.</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>+COM</td>
<td>Positive common mode</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>-COM</td>
<td>Positive common mode</td>
</tr>
<tr>
<td>3</td>
<td>3 - 8</td>
<td>N1-NF</td>
<td>START, 1N, 1NF</td>
</tr>
<tr>
<td>4</td>
<td>9 - 15</td>
<td>N11-N15</td>
<td>Jogging</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>STOP</td>
<td>Stop input</td>
</tr>
<tr>
<td>6</td>
<td>17</td>
<td>0-1</td>
<td>Jogging</td>
</tr>
<tr>
<td>7</td>
<td>18</td>
<td>N-1</td>
<td>Stop input</td>
</tr>
<tr>
<td>8</td>
<td>19</td>
<td>N7</td>
<td>Jogging</td>
</tr>
<tr>
<td>9</td>
<td>20</td>
<td>N8</td>
<td>Jogging</td>
</tr>
<tr>
<td>10</td>
<td>21</td>
<td>N9</td>
<td>Jogging</td>
</tr>
<tr>
<td>11</td>
<td>22</td>
<td>N10</td>
<td>Jogging</td>
</tr>
<tr>
<td>12</td>
<td>23</td>
<td>N11</td>
<td>Jogging</td>
</tr>
<tr>
<td>13</td>
<td>24</td>
<td>N12</td>
<td>Jogging</td>
</tr>
<tr>
<td>14</td>
<td>25</td>
<td>N13</td>
<td>Jogging</td>
</tr>
<tr>
<td>15</td>
<td>26</td>
<td>N14</td>
<td>Jogging</td>
</tr>
</tbody>
</table>

**Output specifications**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Input No.</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OUT1</td>
<td>RUN</td>
<td>Run in operation</td>
</tr>
<tr>
<td>2</td>
<td>OUT2</td>
<td>ERR</td>
<td>Error detected</td>
</tr>
<tr>
<td>3</td>
<td>OUT3</td>
<td>EN</td>
<td>Enable input</td>
</tr>
<tr>
<td>4</td>
<td>OUT4</td>
<td>Area</td>
<td>Area input</td>
</tr>
<tr>
<td>5</td>
<td>OUT5</td>
<td>POUT1</td>
<td>Completion point number</td>
</tr>
<tr>
<td>6</td>
<td>OUT6</td>
<td>POUT2</td>
<td>Completion point number</td>
</tr>
<tr>
<td>7</td>
<td>OUT7</td>
<td>TQLOAD</td>
<td>Torque load</td>
</tr>
<tr>
<td>8</td>
<td>OUT8</td>
<td>POUT3</td>
<td>Completion point number</td>
</tr>
<tr>
<td>9</td>
<td>OUT9</td>
<td>TQLIM</td>
<td>Torque limit</td>
</tr>
<tr>
<td>10</td>
<td>OUT10</td>
<td>POUT4</td>
<td>Completion point number</td>
</tr>
<tr>
<td>11</td>
<td>OUT11</td>
<td>POUT5</td>
<td>Completion point number</td>
</tr>
<tr>
<td>12</td>
<td>OUT12</td>
<td>POUT6</td>
<td>Completion point number</td>
</tr>
<tr>
<td>13</td>
<td>OUT13</td>
<td>N, C</td>
<td>Neutral, current mode</td>
</tr>
<tr>
<td>14</td>
<td>OUT14</td>
<td>2D</td>
<td>2D input</td>
</tr>
<tr>
<td>15</td>
<td>OUT15</td>
<td>2M</td>
<td>2M input</td>
</tr>
<tr>
<td>16</td>
<td>OUT16</td>
<td>Emergency stop input</td>
<td></td>
</tr>
</tbody>
</table>

---

**Input / output pin numbers and signal names**

- **Pin 1 to 15** shows the signal for normal operation and teaching, and the bottom line shows the signal during data reading.
- **Pin 16 to 25** also shows the signal for data reading.

---

**System configuration**

- **Main features**
  - This is a single-axis controller designed exclusively for the BA-A series.
  - Specify a point table using 4 input signals and turn on a start signal to start operation.
  - The point table consists of 12 types of data such as coordinates, speed table number, acceleration / deceleration table number, and torque-controlled operation table number.
  - Parameter setting such as gain adjustment is automatic. Just input the robot type.
  - Input signal can trigger jog moves (coordinates can be changed using this signal).
  - An LED uses 3 colors to indicate different error statuses.
  - A brake release switch is now on the controller for safety reasons.

---

**Master controller and a single axis**

- **Controller model**: A01-M05
- **Teach pendant**: TP-140

---

**Model**

- **CA01-M05**

---

**Note:**

- Do not use the same power supply as the control power supply. Do not use the same power supply as the drive power supply. Follow the instruction may result in product failure.
- Page 3 of 3 for a cross-referenced connection method.
Slave controller

Main features

- It can be connected to a BA-II series controller.
- It can be easily added to the configuration as a cylinder for a currently used axis.

System Configuration

●When using the CA20-M00 or M01

Basic unit

Expansion unit

●When using the CA20-M10 or M40

Model CA01-S05
General specifications

<table>
<thead>
<tr>
<th>Applicable robot</th>
<th>COMPO ARM 3/3C Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller model</td>
<td>CA01-V0E</td>
</tr>
<tr>
<td>Number of axes to control</td>
<td>1 (axis 1 connected to the master controller)</td>
</tr>
</tbody>
</table>

Motor capacity: 30W

Error indication: An error lamp (front panel) will be on when an error has occurred. (The system is in an emergency state.)

Ambient conditions:
- Operating temperature range: 0 to 40°C
- Storage temperature range: -25 to 60°C
- Humidity: 85% or less (no condensation)

Protective functions:
- Overload, over-heat, over-current, and protection against overvoltage.
- Over-speed, overload, over-current, and protection against overvoltage.
- Low battery voltage

Dimensions:
- 310 (W) x 146 (D) x 89 (H) mm (excluding screw heads)

Weight:
- Approx. 0.27 kg

Note 1: Do not use the same power supply as the control power supply and the drive power supply. Failure to follow this instruction may result in product failure. See page 38 for a connection example.

Slave controller

Parts

- CN6: Battery connector
- LED1: Status LED
- SW1: Mode setting switch
- CN2: Sensor connector
- CN4: RS485 / CAN connector
- CN5: RS485 / CAN connector
- SW2: Terminal resistor setting switch

- CN6: Battery connector
- LED1: Status LED
- SW1: Mode setting switch
- CN2: Sensor connector
- CN4: RS485 / CAN connector
- CN5: RS485 / CAN connector
- SW2: Terminal resistor setting switch

- SW2 comes with a plug and a connection lever.
Controller Cables

The controller cables are a set of two flexible cables that connect an axis to a controller. The set consists of a motor line and a resolver signal line.

These cables are designed exclusively for use with an axis.

Model

BAC - CC - M **

- Controller cable
  - Cable length: 30-5000 m
  - 45-10000 m
  - 50-5000 m

*The controller cable set consists of a motor line and a resolver signal line.
*Contact our sales representative if you need a cable longer than 5 m.

Dimensions

- Resolver cable
  - Cable housing diameter: 8.9 mm

- Motor cable
  - Cable housing diameter: 8.7 mm

Table Unit

Attach this table unit to the slider of a slider type axis BAC5D or BAC7D to use it as a table type axis. This product does not include an axis.

Model

BAC5 - TU - M **

- Combined axis
  - 5 BAC5D-ST-M
  - 7 BAC7D-ST-M

- Task unit
  - Motor

- Stroke
  - 0 - 90 mm
  - 10 - 180 mm
  - 15 - 150 mm

Note 1: There is no BAC5-TU-M15.
*The product comes with bolts and knock-pins. Use them when attaching the product to a slider.
*See the page describing the single axis unit specifications for table type unit specifications.

Dimensions

- BAC5-TU-M**

- BAC7-TU-M**
**Regenerative Resistor**

The regenerative resistor absorbs energy generated during deceleration of an axis motor. Use it when the load inertia exceeds its allowable value or when a heavy load is brought down by the Z-axis in a long stroke (resulting in high power generation). The regenerative resistor prevents generation of an excessive voltage in the controller.

- It is available with (CAR-UN50) or without (CAR-0500) a cover.
- All discharged energy is converted into heat.
- A contact output (NO) occurs when the resistor generates an unusual amount of heat.
- This unit supports one axis only.

**Model**

CAR-UN50 (regenerative discharging unit)
CAR-0500 (regenerative discharging resistor)

**Dimensions**

---

**Connection Example**

**CAR-UN50**

- The CAR-UN50 has a built-in temperature relay which will be activated at 150°C. When this temperature relay is activated, its output becomes an open circuit.
- When including this temperature relay in the system configuration, create a sequence in which the controller drive power supply is normally off.

**CAR-0500**

- The CAR-0500 has a built-in temperature relay which will be activated at 135°C. When this temperature relay is activated, its output becomes an open circuit.
- When including this temperature relay in the system configuration, create a sequence in which the controller drive power supply is normally off.
Teach Pendant

The teach pendant connected to a controller serves as a program or parameter input device. In addition, it issues commands to find the home position, start robot operation, stop robot operation, execute jog move, and activate an emergency stop. It also shows an abnormal or error status, and can cancel F afterwards.

**Model**

TPH - 4C

- Supports a robot version 2.25 or later.

PC Software

The PC software SP-98D uses a PC as a host computer and supports programming for the COMPO ARM BA-C and BA 8 series. It sends robot controller program data to or receives such data from the PC, and also edits or saves the program data. In addition, it can control monitoring of I/O and coordinates as well as execution of jog move and return-to-home operation.

**Model**

SF - 98D

- Supports a robot version 3.0.0 or later.

### Specifications

<table>
<thead>
<tr>
<th>Package content</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD-ROM x 1 and Installation Manual x 1 (communication cable PCBL-31 is sold separately)</td>
<td></td>
</tr>
</tbody>
</table>

**Required system**

- PC: An PC, PC/AT compatible with a serial communication port (25-pin type) and a CD-ROM drive. Requires available memory of 128MB or more and available hard disk space of 194MB or more.
- Display: SVGA or higher (resolution of 800 x 600 pixels or higher)
- Printer: A printer that can be connected to a PC and can print out from a Windows OS.
- Communication cable: A communication cable that connects a PC and the controller. Use the PCBL-31.

*Microsoft, Windows, Windows NT, and Windows logos are registered trademarks or trademarks of Microsoft Corporation in the United States of America.

### Features

- Its multi-window screen editor facilitates editing of a table or a parameter.
- Sends / receives table or parameter data to / from the controller. It can also save the data as a file.
- Controls teaching / programing such as teaching and programming.
- It can add titles or comments to tables or parameters upon output to the printer to facilitate debugging or checking.

---

Communication Cable (RS-232C)

This communication cable connects the controller to a PC (IBM / PC compatible). Use this cable when using the PC software.

**Model**

PCBL - 31

**Dimensions**

- Length: Approx. 1500mm
- Weight: Approx. 150g

---

Input / Output Cable

Connected to the input / output port of the master controller, it transfers signals to / from an external operation panel or control device. The plug on one of the cable ends allows direct connection to the controller. To connect to an external device, use the cable on the core wire and the symbol chart as guides. Crimp the terminal in advance.

**Model**

CA01 - IC - A 30

**Dimensions**

<table>
<thead>
<tr>
<th>Model</th>
<th>Number of core wires</th>
<th>Core wire size</th>
<th>Cable housing diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA01-IC-A</td>
<td>26</td>
<td>0.13sq</td>
<td>9.1mm</td>
</tr>
</tbody>
</table>
Resolver ABS Backup Battery (for Maintenance Work)

This battery is used in the controller as a resolver (ABS) backup battery. The master controller CA01-M05 and the slave controller CA01-S05 each comes with one.

Model CA10 - EB - 05

Lithium battery specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Detail</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parts</td>
<td>Lithium battery</td>
<td>Thionyl chloride battery</td>
</tr>
<tr>
<td>Model</td>
<td>ER17500V C</td>
<td>Made by Toshiba</td>
</tr>
<tr>
<td>Nominal voltage and capacity</td>
<td>3.6V, 2700mAh</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>17 x 47 mm (excluding the protrusion)</td>
<td>50 x 56 mm (excluding the connector)</td>
</tr>
<tr>
<td>Weight</td>
<td>Approximately 20g</td>
<td></td>
</tr>
<tr>
<td>Duration of the backup function (Note 1)</td>
<td>Approximately 1 year (Note 2)</td>
<td>25°C, backup current 260 μA</td>
</tr>
</tbody>
</table>

(Note 1) Cumulative time the controller is off.
(Note 2) Battery duration varies with the temperature. The figure is provided as a guide.
Product Lifetime

The maximum payload and the allowable moment that appear in this catalog have been calculated based on the guide and ball screw lifetimes. The same maximum payload and the allowable moment apply to the slider, table, and rod types.

Allowable Moment

The moment caused by the load on the robot axis has a great impact on the axle bearing of the slider. Therefore, follow the instructions below:

- Do not put on a load that exceeds the maximum payload.
- The maximum payload value is obtained using the servo motor capacity. It changes with acceleration / deceleration time.
- Do not let the moment exceed the allowable static moment.
- The allowable static moment is the moment generated when the robot is not moving. It is necessary to plan carefully the reactive force generated during movement insertion using a cylinder attached to the slider.
- Do not give a shock load to the axis.
- Do not let the moment exceed the allowable dynamic moment.
- The allowable dynamic moment is the moment generated due to acceleration or deceleration. It changes with the size of load, arm length, and arm direction; therefore, it needs to be calculated in each case.

The chart below is provided as a guide.

1. Allowable static moment
   - MR: rolling moment
   - MP: pitching moment
   - MY: yawing moment

   ★ Slider type: center of the slider
   ★ Table type: positive stroke limit at the center of the table end

<table>
<thead>
<tr>
<th>Slider type</th>
<th>31</th>
<th>12</th>
<th>12</th>
<th>12</th>
<th>12</th>
<th>25.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke: 50 mm</td>
<td>4.4</td>
<td>4.4</td>
<td>4.4</td>
<td>4.4</td>
<td>4.4</td>
<td>11.7</td>
</tr>
<tr>
<td>Stroke: 100 mm</td>
<td>1.9</td>
<td>1.9</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>11.7</td>
</tr>
<tr>
<td>Stroke: 150 mm</td>
<td>- 1.9</td>
<td>- 1.9</td>
<td>- 1.7</td>
<td>- 1.7</td>
<td>- 1.7</td>
<td>- 1.7</td>
</tr>
</tbody>
</table>

2. Allowable dynamic moment

The dynamic moment of the axis has a great impact on the lifetime and performance of the product. It is therefore necessary to plan carefully the acceleration load, arm length, arm direction, arm speed, and arm stroke. This section provides the allowable dynamic moment tables. They represent the relationship between the weight and allowable moment to allow quick calculation of the allowable dynamic moment. The tables show the load weight (kg) and the arm length to the center of gravity of the load (note that the values shown are not allowable moment values).

[Allowable dynamic moment tables] BAC5, 7: slider type

The tables show the load weight (kg) and the arm length to the center of gravity of the load (note that the values shown are not allowable moment values).
[Vertically mounted axis] BAC5.7 table type

The tables show the load weight (kg) and the arm length to the center of gravity of the load (note that the values shown are not allowable moment values).

[Horizontally mounted axis]

![Stroke 10.0 mm]

<table>
<thead>
<tr>
<th>Load [N]</th>
<th>Stroke [mm]</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>6600</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>12000</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

![Stroke 5.0 mm]

<table>
<thead>
<tr>
<th>Load [N]</th>
<th>Stroke [mm]</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>6600</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>12000</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

![Stroke 3.0 mm]

<table>
<thead>
<tr>
<th>Load [N]</th>
<th>Stroke [mm]</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>6600</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>12000</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

[Horizontally mounted axis mounted on the wall]

![Stroke 10.0 mm]

<table>
<thead>
<tr>
<th>Load [N]</th>
<th>Stroke [mm]</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>6600</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>12000</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

![Stroke 5.0 mm]

<table>
<thead>
<tr>
<th>Load [N]</th>
<th>Stroke [mm]</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>6600</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>12000</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

![Stroke 3.0 mm]

<table>
<thead>
<tr>
<th>Load [N]</th>
<th>Stroke [mm]</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>6600</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>12000</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

[Horizontally mounted axis]

![Stroke 10.0 mm]

<table>
<thead>
<tr>
<th>Load [N]</th>
<th>Stroke [mm]</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>6600</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>12000</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

![Stroke 5.0 mm]

<table>
<thead>
<tr>
<th>Load [N]</th>
<th>Stroke [mm]</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>6600</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>12000</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

![Stroke 3.0 mm]

<table>
<thead>
<tr>
<th>Load [N]</th>
<th>Stroke [mm]</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
<th>4.5</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>6600</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>12000</td>
<td>400</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

When S = 30 mm
Controller CA01-M05

Connection

System Input and Output

System Input

<table>
<thead>
<tr>
<th>Input No.</th>
<th>Signal</th>
<th>Description</th>
<th>Noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN1</td>
<td>START</td>
<td>Axis start. An input for starting axis operation.</td>
<td>The signal is detected at the rising edge.</td>
</tr>
<tr>
<td></td>
<td>+JOG</td>
<td>+JOG move. An input for starting a JOG move into the positive direction.</td>
<td></td>
</tr>
<tr>
<td>IN2</td>
<td>STOP</td>
<td>Stop input. An input for terminating travel.</td>
<td>Signal level is detected.</td>
</tr>
<tr>
<td></td>
<td>-JOG</td>
<td>-JOG move. An input for starting a JOG move into the negative direction.</td>
<td>The robot moves when the signal is on and stops when it is off.</td>
</tr>
<tr>
<td>IN3</td>
<td>SVON</td>
<td>Servo ON. An input for enabling servo locking.</td>
<td>Servo locking is enabled at the rising edge. The servo is released at the falling edge.</td>
</tr>
<tr>
<td>IN4</td>
<td>WRITE</td>
<td>Write. An input for writing coordinates in the point table [T01].</td>
<td></td>
</tr>
<tr>
<td>IN5</td>
<td>ALRST</td>
<td>Error reset. An input for cancelling the error state.</td>
<td></td>
</tr>
<tr>
<td>IN6</td>
<td>RTSEL</td>
<td>Switch between operation / teaching. An input for switching between operation mode and teaching mode.</td>
<td>The signal is detected at the rising edge.</td>
</tr>
<tr>
<td>IN7</td>
<td>PRN1</td>
<td>Command point number.</td>
<td></td>
</tr>
<tr>
<td>IN8</td>
<td>PRN2</td>
<td>An input for specifying a point table [T01] number. Turn on the start signal while signals from IN7 to IN10 are all set to ON to execute return-to-home operation. Operation mode is active when the signal is off, and teaching mode is active when it is on.</td>
<td></td>
</tr>
<tr>
<td>IN9</td>
<td>PRN4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN10</td>
<td>PRN8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*1) There is no wiring to the connector if a motor without a holding brake is used.
(*2) This connection is required when there is a large amount of regenerative energy.
### System Output

<table>
<thead>
<tr>
<th>Output No.</th>
<th>Signal</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT1</td>
<td>RUN</td>
<td>Robot in operation. This signal turns on while the robot is in operation.</td>
<td>It also turns on during return-to-home operation and JOG move.</td>
</tr>
<tr>
<td>OUT2</td>
<td>ERIROH</td>
<td>Error detected. This signal turns on when an error occurs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RDY/ERR</td>
<td>System in the READY state or an error detected. This signal turns on when</td>
<td>The signal turns on when an error occurs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the controller power is turned on and then controller initialization is</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>complete. The signal turns off when an error occurs.</td>
<td></td>
</tr>
<tr>
<td>OUT3</td>
<td>POSI</td>
<td>Positioning complete. The signal indicates that the robot is at the target</td>
<td>The signal stays off until return-to-home operation is complete. While the robot</td>
</tr>
<tr>
<td></td>
<td></td>
<td>position finished positioning.</td>
<td>travels, and while the servo is free.</td>
</tr>
<tr>
<td>OUT4</td>
<td>AREA</td>
<td>Slider in designated area. A specified output limit signal is outputted while</td>
<td>This output signal is disabled until return-to-home operation is complete.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the axis slider is within the specified coordinates.</td>
<td></td>
</tr>
</tbody>
</table>

#### Normal operation

<table>
<thead>
<tr>
<th>Output No.</th>
<th>Signal</th>
<th>Description</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUT5</td>
<td>POUT1</td>
<td>Completion point number. After robot travel is complete, a point table number</td>
<td>F Ins[1111] is outputted if the robot decelerates and stops due to a step signal or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>specified by K17 to K10 is outputted.</td>
<td>if it stops due to an emergency stop signal.</td>
</tr>
<tr>
<td>OUT6</td>
<td>POUT/2</td>
<td>Torque limit. The signal turns on when the output torque exceeds the load</td>
<td>The value 0 (0FFFFFF) is outputted during return-to-home operation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>output reference value for torque limit judgment time.</td>
<td></td>
</tr>
<tr>
<td>OUT7</td>
<td>POVL</td>
<td>Torque lock. The signal turns on when the system detects that the slider is</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>locked.</td>
<td></td>
</tr>
<tr>
<td>OUT8</td>
<td>TQLOCK</td>
<td>Torque lock. The signal turns on when the system detects that the slider is</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>locked.</td>
<td></td>
</tr>
</tbody>
</table>

#### Torque-controlled operation

- **OUT5** TQCON: Torque-controlled operation in process. The signal turns on while torque-controlled operation is in progress.
- **OUT6** TLOAD: Torque load. The signal turns on when the output torque exceeds the load output reference value for torque limit judgment time.
- **OUT7** TQLM: Torque limit. The signal turns on when torque-controlled operation continues for torque limit judgment time or longer.
- **OUT8** TQLOCK: Torque lock. The signal turns on when the system detects that the slider is locked.

### Example of Input and Output Signal Connection

- **Emergency Stop Input**
  - This input signal activates an emergency stop for the controller. The controller remains in the emergency stop state if the emergency stop circuit is not connected.
  - **Note 1:** Do not use the same power supply as the control power supply and the drive power supply. Failure to follow this instruction may result in product failure.
  - **Note 2:** This controller does not support outputting of an emergency stop signal. The emergency stop signal input status can be checked with the master controller. Use a 24V-contact emergency stop switch and connect one of the switch contacts to the master controller.
Operations

This section describes system input-based robot operation. The description applies to the robot operation and system outputs using the teach pendant and the PC software (SF-382).

Overview

This controller requires no programming. Only parameter and table settings are required for execution of a desired operation.

There are two types of operation: normal operation and torque-controlled operation.

In normal operation, the robot moves to the target position with no torque control.

In torque-controlled operation, the robot moves to a tentative target position with no torque control and then moves to the target position with its torque controlled in that direction. The torque-controlled operation is applied when a workpiece needs to be pushed or inserted without excessive force.

Normal operation

When the robot stops at the target position

1. Input the command point number (IN7 to IN10) to specify a point table.
2. Turn on the start signal (IN1) after 10 msec.
3. The robot starts travelling.
4. The robot stops at the target position.

When making the moving robot decelerate and stop

When the stop signal (IN2) is turned on while the robot is moving, the robot decelerates and then stops.

- Input the command point number (IN7 to IN10) to specify a point table.
- Turn on the start signal (IN1) after 10 msec.
- The robot starts travelling.
- Turn on the stop signal (IN2).
- The robot decelerates and then stops.

Graphical representation of operation sequence.
Using an external signal to end torque-controlled operation

Torque-controlled operation can be terminated using the master controller. Turn on the stop (IN2) signal. Receiving the status output from a controller, the master controller determines whether or not the torque-controlled operation can end. The master controller can also use its own internal information in the decision making, allowing for a more flexible process. Determine whether or not a workpiece is present based on the positioning complete (OUT3), torque limit (OUT7), and slider locked (OUT8) signal status. If necessary, the area entry signal output function can also be used to determine whether or not a workpiece is present.

When there is a workpiece

The robot comes in contact with the workpiece and starts moving.

The workpiece is locked in place.

Turn on the start signal (IN1) after 10 msec.

The robot starts travelling.

Torque-controlled operation starts when the robot reaches a tentative target position.

The travel speed is specified in point data (P0). The travel speed after the robot reaches the tentative target position is stored in point data (P1) amount of torque-controlled travel.

When there is no workpiece

The robot arrives at the target position.

Turn on the stop signal (IN2).

Robot in operation signal (OUT1) turns off. (+1)

(●1) When a workpiece is present, the robot position control continues with the target position as the final destination. Meanwhile, torque-controlled operation also continues. Output torque control continues until the output torque is at the same level as the torque limit or lower in order to avoid physical shock to the workpiece.

When there is no workpiece

Command point number (IN7 to IN10) to specify a point table.

10 msec or longer

Start (IN1)

Stop (IN2)

Operation in process (OUT1)

Positioning complete (OUT3)

Torque-controlled operation (OUT5)

Torque limit (OUT7)

Slider locked (OUT8)

Speed

● In torque-controlled operation, the robot moves to a tentative target position with no torque control and then moves to the target position with its torque controlled in that direction. The torque-controlled operation is applied when a workpiece needs to be pushed or inserted without excessive force.
When there is a workpiece

![Diagram showing workpiece-related operations and their timing](image)

- In torque-controlled operation, the robot moves to a tentative target position with no torque control and then moves to the target position with its torque controlled in that direction. The torque-controlled operation is applied when a workpiece needs to be pushed or inserted without excessive force.

---

**Automatic termination of torque-controlled operation**

A controller can terminate torque-controlled operation automatically. Turn off the robot in operation (OUT1) so that the master controller recognizes that the torque-controlled operation finished. Determine whether or not a workpiece is present based on the positioning complete (OUT3), torque limit (OUT7), and slider locked (OUT8) signal status. If necessary, the area entry signal output function can also be used to determine whether or not a workpiece is present.

1. Input the command point number (IN7 to IN10) to specify a point table.
2. Turn on the start signal (IN1) after 10 msec.
3. The robot starts travelling.
4. When there is a workpiece
   - The robot comes in contact with the workpiece and stops.
5. The workpiece is locked in place and the robot stops. (+1)
6. The master controller determines whether or not a workpiece is present based on the positioning complete (OUT3), torque limit (OUT7), and slider locked (OUT8) signal status (if necessary, use the area entry signal output function to check the location of the workpiece).

(*1) The robot position control continues with the target position as the final destination, meanwhile, torque-controlled operation also continues, until the output torque is at the same level as the torque limit or lower in order to avoid physical shock to the workpiece.
When there is no workpiece

- Command point number (IN7 to IN10)
- Start (IN1)
- Operation in process (OUT1)
- Positioning complete (OUT3)
- Torque-controlled operation (OUT5)
- Torque limit (OUT7)
- Slider locked (OUT8)

*In torque-controlled operation, the robot moves to a tentative target position with no torque control and then moves to the target position with its torque controlled in that direction. The torque-controlled operation is applied when a workpiece needs to be pushed or inserted without excessive force.*

When there is a workpiece

- Command point number (IN7 to IN10)
- Start (IN1)
- Operation in process (OUT1)
- Positioning complete (OUT3)
- Torque-controlled operation (OUT5)
- Torque limit (OUT7)
- Slider locked (OUT8)

*In torque-controlled operation, the robot moves to a tentative target position with no torque control and then moves to the target position with its torque controlled in that direction. The torque-controlled operation is applied when a workpiece needs to be pushed or inserted without excessive force.*
**Return-to-Home Operation**

Turn all command point number signals (IN7 to IN10) on (1111), and turn on the start signal (IN1). The robot begins to return to the home position.

1. Turn all command point number signals (IN7 to IN10) on (1111).
2. Wait for 10 msec or longer. Turn on the start signal (IN1).
3. The robot starts to return to the home position.
4. The robot stops and completes return-to-home operation.

**Area Entry Signal Output**

The slider in designated area signal (OUT4) changes when a robot slider enters the specified coordinates.

1. Input the command point number (IN7 to IN10) to specify a point table.
2. Turn on the start signal (IN1) after 10 msec.
3. The robot starts travelling.
4. The slider in the designated area signal turns on or off depending on the robot slider position. [*1]
5. The robot stops.

[*1] The slider in designated area signal (OUT4) also turns on or off in manual operation.

---

**Graphs:**

- **Return-to-Home Operation Graph:**
  - Command point number (IN7 to IN10)
  - Completion point number (OUT5 to OUT8)
  - Start (IN1)
  - Operation in progress (OUT1)
  - Positioning complete (OUT3)
  - Return-to-home operation in progress

- **Area Entry Signal Output Graph:**
  - Command point number (IN7 to IN10)
  - Completion point number (OUT5 to OUT8)
  - Start (IN1)
  - Operation in progress (OUT1)
  - Positioning complete (OUT3)
  - Designated area signal (OUT4)
  - Current position

---

50

51
Cycle Time Calculation

The cycle time of a robot controlled by the G801-MOS can be obtained as described below. The calculation result however will be slightly different from the actual value; therefore, use the result only as a guide. There are two types of calculation: one is the case where there is a constant speed (example 1), and the other one is the case where deceleration starts during acceleration (example 2). Select one depending on the travel distance, specified speed, and specified acceleration / deceleration time.

1. When Travel distance (L) > 2 x maximum set speed (Vmax)
   example 1
   \[
   \text{set speed} \times (\text{set speed} / \text{set speed}) \times \text{set acceleration time} = \text{set deceleration time (DEC)}
   \]

2. When Travel distance (L) = 2 x maximum set speed (Vmax)
   example 2
   \[
   \text{set speed} \times (\text{set speed} / \text{set speed}) \times \text{set acceleration time} = \text{set deceleration time (DEC)}
   \]

Refer to the relationship between Acceleration / Deceleration and Load on the next page for rough estimates of acceleration and deceleration time, referring to the specifications of the subject model for acceleration time, deceleration time, and maximum speed for the maximum payload.

Example 1

Operating conditions:
- Maximum set speed: Vmax = 400 mm/s
- Specified speed: V = 600 mm/s
- Specified acceleration: ACC = 0.2s
- Specified deceleration: DEC = 0.3s
- Travel distance: L = 100 mm

Example 2

Operating conditions:
- Maximum set speed: Vmax = 400 mm/s
- Specified speed: V = 600 mm/s
- Specified acceleration: ACC = 0.2s
- Specified deceleration: DEC = 0.3s
- Travel distance: L = 100 mm

Relationship between Acceleration / Deceleration and Load

<table>
<thead>
<tr>
<th>Type</th>
<th>Payload (kg)</th>
<th>Slider</th>
<th>0.05sec</th>
<th>0.1sec</th>
<th>0.15sec</th>
<th>0.2sec</th>
<th>0.25sec</th>
<th>0.3sec</th>
<th>0.35sec</th>
<th>0.4sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>BACSO</td>
<td>800</td>
<td>12</td>
<td>1.2</td>
<td>1.3</td>
<td>1.4</td>
<td>1.5</td>
<td>1.6</td>
<td>1.7</td>
<td>1.9</td>
<td>2.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>800</td>
<td>12</td>
<td>1.2</td>
<td>1.3</td>
<td>1.4</td>
<td>1.5</td>
<td>1.6</td>
<td>1.7</td>
<td>1.9</td>
<td>2.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>500</td>
<td>6</td>
<td>0.7</td>
<td>1.0</td>
<td>1.6</td>
<td>1.9</td>
<td>2.5</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>100mm</td>
<td>6</td>
<td>0.1</td>
<td>0.7</td>
<td>1.4</td>
<td>2.1</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>100mm</td>
<td>12</td>
<td>2.1</td>
<td>4.5</td>
<td>8.5</td>
<td>16</td>
<td>31</td>
<td>56</td>
<td>99</td>
<td>188</td>
</tr>
<tr>
<td>BACTO</td>
<td>150mm</td>
<td>12</td>
<td>3.8</td>
<td>7.6</td>
<td>15.8</td>
<td>31.5</td>
<td>63.8</td>
<td>127.6</td>
<td>255.2</td>
<td>510.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>500</td>
<td>6</td>
<td>0.3</td>
<td>0.8</td>
<td>1.4</td>
<td>2.1</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>100mm</td>
<td>6</td>
<td>0.3</td>
<td>0.8</td>
<td>1.4</td>
<td>2.1</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>100mm</td>
<td>12</td>
<td>1.0</td>
<td>1.6</td>
<td>2.5</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
<td>13.5</td>
<td>25.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>150mm</td>
<td>12</td>
<td>1.0</td>
<td>1.6</td>
<td>2.5</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
<td>13.5</td>
<td>25.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Payload (kg)</th>
<th>Table</th>
<th>0.05sec</th>
<th>0.1sec</th>
<th>0.15sec</th>
<th>0.2sec</th>
<th>0.25sec</th>
<th>0.3sec</th>
<th>0.35sec</th>
<th>0.4sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>BACSO</td>
<td>800</td>
<td>12</td>
<td>1.2</td>
<td>1.3</td>
<td>1.4</td>
<td>1.5</td>
<td>1.6</td>
<td>1.7</td>
<td>1.9</td>
<td>2.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>800</td>
<td>12</td>
<td>1.2</td>
<td>1.3</td>
<td>1.4</td>
<td>1.5</td>
<td>1.6</td>
<td>1.7</td>
<td>1.9</td>
<td>2.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>500</td>
<td>6</td>
<td>0.7</td>
<td>1.0</td>
<td>1.6</td>
<td>1.9</td>
<td>2.5</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>100mm</td>
<td>6</td>
<td>0.1</td>
<td>0.7</td>
<td>1.4</td>
<td>2.1</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>100mm</td>
<td>12</td>
<td>2.1</td>
<td>4.5</td>
<td>8.5</td>
<td>16</td>
<td>31</td>
<td>56</td>
<td>99</td>
<td>188</td>
</tr>
<tr>
<td>BACTO</td>
<td>150mm</td>
<td>12</td>
<td>3.8</td>
<td>7.6</td>
<td>15.8</td>
<td>31.5</td>
<td>63.8</td>
<td>127.6</td>
<td>255.2</td>
<td>510.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>500</td>
<td>6</td>
<td>0.3</td>
<td>0.8</td>
<td>1.4</td>
<td>2.1</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>100mm</td>
<td>6</td>
<td>0.3</td>
<td>0.8</td>
<td>1.4</td>
<td>2.1</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>100mm</td>
<td>12</td>
<td>1.0</td>
<td>1.6</td>
<td>2.5</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
<td>13.5</td>
<td>25.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>150mm</td>
<td>12</td>
<td>1.0</td>
<td>1.6</td>
<td>2.5</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
<td>13.5</td>
<td>25.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Payload (kg)</th>
<th>Rod</th>
<th>0.05sec</th>
<th>0.1sec</th>
<th>0.15sec</th>
<th>0.2sec</th>
<th>0.25sec</th>
<th>0.3sec</th>
<th>0.35sec</th>
<th>0.4sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>BACSO</td>
<td>800</td>
<td>12</td>
<td>1.2</td>
<td>1.3</td>
<td>1.4</td>
<td>1.5</td>
<td>1.6</td>
<td>1.7</td>
<td>1.9</td>
<td>2.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>800</td>
<td>12</td>
<td>1.2</td>
<td>1.3</td>
<td>1.4</td>
<td>1.5</td>
<td>1.6</td>
<td>1.7</td>
<td>1.9</td>
<td>2.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>500</td>
<td>6</td>
<td>0.7</td>
<td>1.0</td>
<td>1.6</td>
<td>1.9</td>
<td>2.5</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>100mm</td>
<td>6</td>
<td>0.1</td>
<td>0.7</td>
<td>1.4</td>
<td>2.1</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>100mm</td>
<td>12</td>
<td>2.1</td>
<td>4.5</td>
<td>8.5</td>
<td>16</td>
<td>31</td>
<td>56</td>
<td>99</td>
<td>188</td>
</tr>
<tr>
<td>BACTO</td>
<td>150mm</td>
<td>12</td>
<td>3.8</td>
<td>7.6</td>
<td>15.8</td>
<td>31.5</td>
<td>63.8</td>
<td>127.6</td>
<td>255.2</td>
<td>510.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>500</td>
<td>6</td>
<td>0.3</td>
<td>0.8</td>
<td>1.4</td>
<td>2.1</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>100mm</td>
<td>6</td>
<td>0.3</td>
<td>0.8</td>
<td>1.4</td>
<td>2.1</td>
<td>2.8</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
</tr>
<tr>
<td>BACSO</td>
<td>100mm</td>
<td>12</td>
<td>1.0</td>
<td>1.6</td>
<td>2.5</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
<td>13.5</td>
<td>25.5</td>
</tr>
<tr>
<td>BACTO</td>
<td>150mm</td>
<td>12</td>
<td>1.0</td>
<td>1.6</td>
<td>2.5</td>
<td>3.5</td>
<td>5.5</td>
<td>8.5</td>
<td>13.5</td>
<td>25.5</td>
</tr>
<tr>
<td>No.</td>
<td>Unit</td>
<td>Single axis model</td>
<td>Amount</td>
<td>2- or 3-axis model</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------</td>
<td>-------------------</td>
<td>--------</td>
<td>--------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Axis</td>
<td>BAC D - ST -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Controller cable</td>
<td>BAC - COM -</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Master cable</td>
<td>CA01 - 0S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Regenerative discharging unit</td>
<td>CAR - UNS0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Regenerative discharging resistor</td>
<td>CAR - 0500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Teach pendant</td>
<td>TPH - 4C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>PC software</td>
<td>SF - 98D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Communication cables</td>
<td>PCBL - 31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Input / output cable</td>
<td>CA01 - IC - A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Battery ABS backup battery</td>
<td>CA10 - EB - 0S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Contact your distributor for details (see the other side of this sheet)*