Brings overwhelming competitiveness to your production site

VERTICAL ARTICULATED ROBOT  TVL/TV Series

A vertical articulated robot allows flexible and three-dimensional motion similar to that of a human being. Based on advanced technologies cultivated with industrial machinery and plenty of expertise gained through a lot of experience of production sites, Shibaura Machine provides high-quality vertical articulated robots for improvement in customer productivity that attain high-speed capability, complete weight saving, and a lot of functionalities, and realize durability and expandability capable of being applied to a wide range of production environments.

Our articulated robots contribute to process automation, labor-saving, and cost reduction in a wide range of the fields including assembly of electronic equipment and inspection/carrying of food and medicinal products.
Application examples of TVL/TV Series

Application examples in our manufacturing sites
Examples of automation in our manufacturing sites using cell production robots

Soldering process
The robot enables stable soldering that produces high quality products efficiently.

Screw tightening process
Sensorless compliance control technologies is utilized in screw tightening.

Examples of injection molding machine systems
Shibaura Machine has accumulated many automation system examples and considerable understanding of corporation between injection molding machines and robots.

Supply of metal nut parts for insert molding

Thickness measurement and appearance inspection of a 10.1-inch thin light guide plate

Sprue cutting of a CFRTP molded item

Picking up of a (G)FRTP hybrid molded item

Inserting of a semifinished laminated lens product

Print decorating in a decoration system

Vertical articulated robot TVL Series

Low-cost robot with top-class performance
Highly cost-effective compact model

The TVL Series robot achieves high productivity in assembling and transfer processes in small spaces, combining top-class performance with low cost for superior cost effectiveness. A variety of options for convenience and the enhancement of workability, plus suitability for a wide range of work environments, are available.

World-class performance
(standard cycle time of 0.3 seconds level)

Special features
Tap holes
Tool fixture tap holes are provided at four locations on the arm, upper and lower positions. They are useful for fixing external cabling and peripheral devices.

Alternative installations
Tap holes on the side of the base unit allow for the robot to be installed sideways. This reduces the installation space.

Variety of options
I/O panel options
The I/O panel can be selected from three options. An optional elbow type plug is available on the hand-side connection.

Robot controller cable options
In addition to the standard cabling at the back, cabling can be routed through the base. This eliminates the need for installation space at the rear, and increases flexibility relating to the application and the space available.

Built-in three-way solenoid valve option
The three-way solenoid valve is built in the robot arm.

IP65 option
Dust-proof and drip-proof protection is available.

Cleanroom option
(ISO Class 3)

Compact controller
Controller TSL3100 specifically designed for the vertical articulated robot.

For details, refer to page 15.
World-class performance (standard cycle time of 0.3 seconds level)

**TVL500**

- Arm length 500 mm
- Maximum payload mass 3 kg
- Standard cycle time 0.3 sec level
- IP65 option
- Cleanroom design (optional)
- 3 pcs solenoid valves inside robot arm option

**Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>TVL500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of controlled axis</td>
<td>6 axes</td>
</tr>
<tr>
<td>Arm length</td>
<td>500 mm</td>
</tr>
<tr>
<td>Reach</td>
<td>260 mm</td>
</tr>
<tr>
<td>payload capacity</td>
<td>3 kg</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>7.5 m/sec</td>
</tr>
</tbody>
</table>

- **Dimensions**
  - Ø40 h8
  - Ø20 H7

- **Other features**
  - 3 pcs solenoid valves inside
  - Cleanroom design (optional)
  - IP65 option
  - 3 pcs solenoid valves inside robot arm option

Dealing with a wide range of needs in assembling and transfer processes while realizing high cost effectiveness.

**TVL700**

- Arm length 700 mm
- Maximum payload mass 4 kg
- Standard cycle time 0.4 sec level
- IP65 option
- Cleanroom design (optional)
- 3 pcs solenoid valves inside robot arm option

**Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>TVL700</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of controlled axis</td>
<td>6 axes</td>
</tr>
<tr>
<td>Arm length</td>
<td>700 mm</td>
</tr>
<tr>
<td>Reach</td>
<td>801 mm</td>
</tr>
<tr>
<td>payload capacity</td>
<td>4 kg</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>173 m/sec</td>
</tr>
</tbody>
</table>

- **Dimensions**
  - Ø40 h8
  - Ø20 H7

- **Other features**
  - 3 pcs solenoid valves inside
  - Cleanroom design (optional)
  - IP65 option
  - 3 pcs solenoid valves inside robot arm option

---

*1: Acceleration values are limited depending on motion patterns, payload mass, and offset value.
*2: Continuous operation of standard cycle motion pattern is not possible beyond the effective load ratio.
*3: Allowable moment of inertia is limited depending on motion patterns, payload mass, and offset value.
*4: Color and surface treatment of the robot body may vary slightly for each production batch.
High-end robot with high speed and high rigidity

**Vertical articulated robot TV Series**

- Excellent rigidity, durability, and expandability.
- Superior operability with easy-to-use software.
- Compliance control using no force sensor.
- Elimination of necessity for external sensors allows force control at a low cost.
- Compliance control using no force sensor.
- Superior operability with easy-to-use software.
- Excellent rigidity, durability, and expandability.
- Excellent rigidity
- Excellent durability
- Excellent expandability

**Capable of inserting and achieving compliance actions without force sensor (sensorless compliance control)**

Automation of processes that require force control can be realized without force sensors.

**What is the sensorless compliance control?**

The TV Series robot attains compliance control without using force sensors. Misalignment is absorbed by the flexible hand with the control that can adjust the force. As a result, stable work processes with less temporary stops can be realized.

**Examples of work process**

1. **Inserting process**
   Smooth insertion is realized by loosening horizontal force while pushing vertically with constant insertion force.

2. **Pin hole searching process**
   Even when a hole position cannot be figured out exactly, the robot can find it by turning the wrist while pushing vertically.

3. **Screwing process**
   Synchronization with the screw feed rate is unnecessary. Stable screwing without sticking or failure of a screw can be performed by screwing while pushing vertically with constant force.

**High-performance controller**

Controller TS100 specifically designed for the vertical articulated robot.

For details, refer to page 12.

Compact and lightweight robot that can be introduced into production facilities with ease. Suitable for assembling work such as fitting processes due to the flexible hand control.

**TV600**

- Arm length 572 mm
- Maximum payload mass 3 kg
- Compact and lightweight
- User friendly software

**Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>TV600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Vertically articulated robot</td>
</tr>
<tr>
<td>Number of controlled axis</td>
<td>6 axis</td>
</tr>
<tr>
<td>Reach</td>
<td>580 mm</td>
</tr>
<tr>
<td>Axis 1 (J1)</td>
<td>±160°</td>
</tr>
<tr>
<td>Axis 2 (J2)</td>
<td>±120°</td>
</tr>
<tr>
<td>Axis 3 (J3)</td>
<td>±110°</td>
</tr>
<tr>
<td>Axis 4 (J4)</td>
<td>±160°</td>
</tr>
<tr>
<td>Axis 5 (J5)</td>
<td>±120°</td>
</tr>
<tr>
<td>Axis 6 (J6)</td>
<td>±110°</td>
</tr>
<tr>
<td>Maximum speed*</td>
<td></td>
</tr>
<tr>
<td>Axis 1 (J1)</td>
<td>250/4</td>
</tr>
<tr>
<td>Axis 2 (J2)</td>
<td>250/4</td>
</tr>
<tr>
<td>Axis 3 (J3)</td>
<td>250/4</td>
</tr>
<tr>
<td>Axis 4 (J4)</td>
<td>320/4</td>
</tr>
<tr>
<td>Axis 5 (J5)</td>
<td>320/4</td>
</tr>
<tr>
<td>Axis 6 (J6)</td>
<td>320/4</td>
</tr>
<tr>
<td>Maximum payload mass*</td>
<td>2 kg (rated: 1 kg)</td>
</tr>
<tr>
<td>Standard cycle time</td>
<td>0.5 sec level</td>
</tr>
<tr>
<td>Allowable moment of inertia</td>
<td>0.03 kg m²</td>
</tr>
<tr>
<td>Positioning repeatability (X-Y-Z)</td>
<td>±0.02 mm (input motion)</td>
</tr>
<tr>
<td>Positioning accuracy</td>
<td>±0.02 mm (teaching operation)</td>
</tr>
<tr>
<td>Hand control signals</td>
<td>4 inputs and 4 outputs</td>
</tr>
<tr>
<td>Power inputs</td>
<td>1.0 kVA</td>
</tr>
<tr>
<td>Robot body Mass</td>
<td>75 kg</td>
</tr>
</tbody>
</table>

*1: Various drive axes: articulate movement on a circular path between a point and offset value.
*2: Continuous operation of the standard cycle pattern to the load ratio beyond the effective load ratio.
*3: 420°/s, 320°/s, 250°/s, without 120° (60°-120°-60°), 400°/s, 300°/s, 250°/s, without 120° (60°-120°-60°).
*4: Color and surface treatment of the robot body may vary slightly for each production batch.
*5: This covers no problem with the product quality.
**TV800**

- **Arm length**: 800 mm
- **Maximum payload**: 5 kg
- **Standard cycle time**: 0.4 sec level

**Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>TV800</th>
<th>TV800H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of controlled axes</td>
<td>6 axes</td>
<td>6 axes</td>
</tr>
<tr>
<td>Arm length</td>
<td>Total length</td>
<td>1,000 mm</td>
</tr>
<tr>
<td>Axis 1</td>
<td>1st arm</td>
<td>180 mm</td>
</tr>
<tr>
<td>Axis 2</td>
<td>2nd arm</td>
<td>480 mm</td>
</tr>
<tr>
<td>Reach</td>
<td>892 mm</td>
<td>1,092 mm</td>
</tr>
<tr>
<td>Working envelope</td>
<td>Axis 2 (22)</td>
<td>-10°~+158°</td>
</tr>
<tr>
<td>Axis 3 (22)</td>
<td>+10°~+158°</td>
<td></td>
</tr>
<tr>
<td>Axis 4 (4)</td>
<td>+15°~+158°</td>
<td></td>
</tr>
<tr>
<td>Axis 5 (6)</td>
<td>-15°~+158°</td>
<td></td>
</tr>
<tr>
<td>Axis 6 (6)</td>
<td>+15°~+158°</td>
<td></td>
</tr>
<tr>
<td>Maximum speed *1</td>
<td>350°/s</td>
<td>576°/s</td>
</tr>
<tr>
<td>Maximum payload mass *1</td>
<td>5 kg (rated: 2 kg)</td>
<td>10 kg (rated: 2 kg)</td>
</tr>
<tr>
<td>Standard cycle time *2</td>
<td>0.4 sec level</td>
<td>0.6 sec level</td>
</tr>
<tr>
<td>Allowable moment of inertia</td>
<td>Axis 1</td>
<td>0.3 kg m²</td>
</tr>
<tr>
<td>Axis 2</td>
<td>0.6 kg m²</td>
<td></td>
</tr>
<tr>
<td>Positioning repeatability (X-Y-Z) *3</td>
<td>±0.02 mm (each axis)</td>
<td></td>
</tr>
<tr>
<td>Driving system</td>
<td>AC servo motors</td>
<td></td>
</tr>
<tr>
<td>Hand control signals</td>
<td>8 inputs and 8 outputs (per robot arm HAND I/O panel)</td>
<td></td>
</tr>
<tr>
<td>8 inputs and 8 outputs (per controller front panel)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>AC 200 V/3A</td>
<td></td>
</tr>
<tr>
<td>Robot body</td>
<td>Max. Weight: 47 kg</td>
<td></td>
</tr>
<tr>
<td>Color *4</td>
<td>White/Light gray</td>
<td></td>
</tr>
</tbody>
</table>

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**TV1000/TV1000H**

- **Arm length**: 1,000 mm
- **Maximum payload**: 5 kg
- **Standard cycle time**: 0.6 sec level

**Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>TV1000</th>
<th>TV1000H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of controlled axes</td>
<td>6 axes</td>
<td>6 axes</td>
</tr>
<tr>
<td>Arm length</td>
<td>Total length</td>
<td>1,000 mm</td>
</tr>
<tr>
<td>Axis 1</td>
<td>1st arm</td>
<td>180 mm</td>
</tr>
<tr>
<td>Axis 2</td>
<td>2nd arm</td>
<td>480 mm</td>
</tr>
<tr>
<td>Reach</td>
<td>1,092 mm</td>
<td></td>
</tr>
<tr>
<td>Working envelope</td>
<td>Axis 2 (22)</td>
<td>-10°~+158°</td>
</tr>
<tr>
<td>Axis 3 (22)</td>
<td>+10°~+158°</td>
<td></td>
</tr>
<tr>
<td>Axis 4 (4)</td>
<td>+15°~+158°</td>
<td></td>
</tr>
<tr>
<td>Axis 5 (6)</td>
<td>-15°~+158°</td>
<td></td>
</tr>
<tr>
<td>Axis 6 (6)</td>
<td>+15°~+158°</td>
<td></td>
</tr>
<tr>
<td>Maximum speed *1</td>
<td>600°/s</td>
<td>576°/s</td>
</tr>
<tr>
<td>Maximum payload mass *1</td>
<td>5 kg (rated: 2 kg)</td>
<td>10 kg (rated: 2 kg)</td>
</tr>
<tr>
<td>Standard cycle time *2</td>
<td>0.6 sec level</td>
<td>0.9 sec level</td>
</tr>
<tr>
<td>Allowable moment of inertia</td>
<td>Axis 1</td>
<td>0.3 kg m²</td>
</tr>
<tr>
<td>Axis 2</td>
<td>0.6 kg m²</td>
<td></td>
</tr>
<tr>
<td>Positioning repeatability (X-Y-Z) *3</td>
<td>±0.02 mm (each axis)</td>
<td></td>
</tr>
<tr>
<td>Driving system</td>
<td>AC servo motors</td>
<td></td>
</tr>
<tr>
<td>Hand control signals</td>
<td>8 inputs and 8 outputs (per robot arm HAND I/O panel)</td>
<td></td>
</tr>
<tr>
<td>8 inputs and 8 outputs (per controller front panel)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>AC 200 V/3A</td>
<td></td>
</tr>
<tr>
<td>Robot body</td>
<td>Max. Weight: 47 kg</td>
<td></td>
</tr>
<tr>
<td>Color *4</td>
<td>White/Light gray</td>
<td></td>
</tr>
</tbody>
</table>

---

**Optional**

- Dust and drip proof (IP65)
- Cleanroom design
- Safety category 3
- Cabling mount
- 3 pcs solenoid valves inside robot arm

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**Plenty of options available for various environments.**

Applicable to a wide range of needs including production lines and assembly processes.

- Lightest robot in class.
- Plenty of options available for various environments.
Controllers and teach pendants specifically designed for the vertical articulated robot

**For TVL Series**

**TSL3100**
Cost effective compact controller

**TSL3100E**
Low-cost and compact CE compliant controller

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### Specifications

<table>
<thead>
<tr>
<th>Teach pendant</th>
<th>Optional</th>
<th>Teach pendant equipped with graphic operation keys</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP1000-6ax</td>
<td></td>
<td>TP3000</td>
</tr>
</tbody>
</table>

**For all TVL Series robots**

**TSL3100**
Standard teach pendant

**TSL3100E**
Teach pendant equipped with graphic operation keys

---

### Options

- Teach pendant (optional)
- TP3000
- TP1000-6ax
- Teach pendant TP3000 and TP1000-6ax (Program can also be written on PC)

---

### External view

**TSL3100**

Front view

Right-side view

Rear view

**TSL3100E**

Front view

Right-side view

Rear view

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**For TV Series**

**TS3100V2**
Controller for vertical articulated robot TV600 with up to six axes simultaneous control.

**TS3100**
High performance controller with up to six axes simultaneous control.

---

### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Number of control axes</th>
<th>Maximum 2 axes</th>
<th>Maximum 6 axes</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSL3100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Number of registerable programs

- TSL3100: Maximum 256
- TSL3100E: Maximum 256

### Power supply

- Single phase AC 190 V to 240 V, 50/60 Hz

### Communication ports

- RS232C: 2 ports, Ethernet* 1: 1 port, USB

### Storage capacity

- Approx. Total: 12,800 point + 25,600 steps
- 1 program: 2,000 point + 3,000 steps

### Motion modes

- PTP, CP (Continuous Path; Linear, Circular), Short-Cut

---

### External view

**TS3100V2**

Front view

Right-side view

Rear view

**TS3100**

Front view

Right-side view

Rear view

---

Footnotes:

1. EtherCAT is a registered trademark of Beckhoff Automation GmbH, Germany.

2. Category 3 safety circuit unit TS3SFB is necessary for CE compliance. Also, it is necessary to implement safety systems.
Various functions to support the operation

Options and functions that maximize the robot performance and PC software for efficient robot system building.

Support for Sample Projects

Sample Projects are a collaborative system between Shibaura Machine Co., Ltd. and Digital Electronics Corporation. They enable users to check the status of the robot on the touch panel display device.

[Features and Advantages]
- When an error occurs in the robot, the error information or details can be checked on the Alarm Monitor Screen (see the below figure).
- Additionally, various other screens for functions including Robot I/O Monitor, Current Position Monitor, I/O Time Chart and Connected Device Data Transfer are provided.
- The above robot screens can be downloaded from the website of Digital Electronics Corporation free of charge. There is no need to create these screens and they can be used immediately after product purchase.

- The status of the robot can be checked even by people who cannot operate the teach pendant.
- Because the information about both the robot and the system is displayed on the same display device, troubleshooting is much easier.

Built-in PLC

The robot controller has a built-in PLC (TCmini).

Input and output signals can be controlled by a ladder program, independent from robot motions.

[Features and Advantages]
- TCmini controls input/output signals of standard I/O, extension I/O and touch-sensitive panel by a ladder program and exchanges data with the robot program.
- By changing the ladder program, system I/O signals can be used as standard I/O signals, and system I/O signals can be assigned as expansion I/O signals and field network I/O signals.
- Flexible system design and control of peripheral equipment are possible without the added cost of an outside host PLC.
- Creation, monitoring and debugging of a ladder program are possible with powerful programming support software “TC-WORX” (optional).
- The scan time is 5ms per 1 K-Word (guideline for TSL3100). Connection is possible with various programmable controllers and display units etc.
- The above robot screens can be downloaded from the website of Digital Electronics Corporation free of charge. There is no need to create these screens and they can be used immediately after product purchase.

Robot Programming Assist Tool

TSAssist

POWERSFUL ASSISTANCE TO ALL PHASES OF AUTOMATION FACILITIES, FROM PLANNING, INSTALLATION TO ENHANCEMENT

1 High Performance 3D Simulation

Accurate simulation with interference check, locus display, timer (cycle time measurement), placing simple workpieces and model shapes, loading 3D CAD data, saving 3D simulation to a video file, and multi-angle view.

These functions enable highly-accurate and a high-quality estimation of robot-automation processes. From simple outline simulation to “get the picture” in accurate simulation closer to actual machine implementation, TSAssist powerfully assists all phases of robot-automation system life cycle, from initial “sketch,” planning, proposal, designing and installation, to improvement and re-purposing of existing facilities.

2 Highly Functional Program Editor

Robot language input support (keyword suggestions), Outline display, Split display.

Point data (taught position information) editor with, sort, search, filter functions. And in 3D Editor Mode, robot can be guided by mouse dragging and by clicking on object model surface. No complex position calculation is necessary. With these functions, programming can be done efficiently and with minimum mistakes.

3 Easy Operation

Easy-to-understand, intuitive screen design, ribbon interface, window-deck function for customizeable operator panels.

Beginners will find it easy to understand and can quickly learn robot programming skills. For experienced robot users, TSAssist helps making robot programs efficiently by customization.