DENSO ROBOT

Vertical articulated

VP-G-T SERIES

GENERAL INFORMATION ABOUT ROBOT (T03)

Preface

Thank you for purchasing this high-speed, high-accuracy assembly robot.

Before operating your robot, read this manual carefully to safely get the maximum benefit from your robot in your assembling operations.

Robot series and/or models covered by this manual

Series	Model
Mini-sized, vertical articulated VP-G-T	VP-6242G-T03 (6-axis type) VP-5243G-T03 (5-axis type)

Important

To ensure operator safety, be sure to read the precautions and instructions in "SAFETY PRECAUTIONS".

How this book is organized

This book is just one part of the robot documentation set. This book consists of SAFETY PRECAUTIONS, chapters one through five, and appendix.

Chapter 1 Packing List of the Robot

Lists the standard components contained in the product package and optional components.

Chapter 2 Configuration of the Robot System

Illustrates the configuration of the robot system and describes the component names of the robot unit and controller.

Chapter 3 Specifications of the Robot Unit

Describes the specifications, motion space, robot positioning time, air piping and signal wiring, and engineering-design notes for robot hands.

Chapter 4 Specifications of the Robot Controller

Lists the specifications of the robot controller and controller setting table (SETPRM LIST).

Chapter 5 Warranty

Describes the warranty period and coverage.

Contents

Chapter 1 Packing List of the Robot

1.1   Standard Components

The components listed below are contained in the product package.

Standard Components

No.	Item	Q'ty
(1)	Robot unit	1
(2)	Robot controller	1
(3)	Power cable (5 m)	1
(4)	Motor & encoder cable **(Note 1)** **(Option)**	1
(5)	Manuals (T03) ("Manual Pack CD" and "Safety Precautions")	1 set
(6)	WINCAPSIII INSTALL CD (T03 TRIAL VERSION)	1
(7)	Spare fuses for robot controller	3
(8)	Connector set for hand control signals (for CN20 and CN21)	1 set
(9)	Direction indicator label **(Note 2)**	1
(10)	Warning label **(Note 3)**	1
(11)	Spare output IC for robot controller	1
(12)	Dowel pins (internally threaded positioning pin and diamond-shaped pin)	1 set

Note 1: Choose a motor & encoder cable from the table below. The internal cable bending radius shall at least be 200 mm. Excessively bending will result in broken lead wires.

Item		Part No.
Standard cable	2 m	410141-4400
Standard cable	4 m	410141-3611
Standard cable	6 m	410141-3621
Standard cable	12 m	410141-3631
Standard cable	20 m	410141-4440

Note 2: After installation, attach the direction indicator label in a position on the robot unit that can be easily seen.

Note 3: Attach the warning label on the robot safety fence or other location where workers will easily notice it. If necessary, prepare a plate for attaching the seal.

NOTE: When placing an order for robot systems, be sure to order the optional teach pendant and operation panel also which are essential in using a robot system.
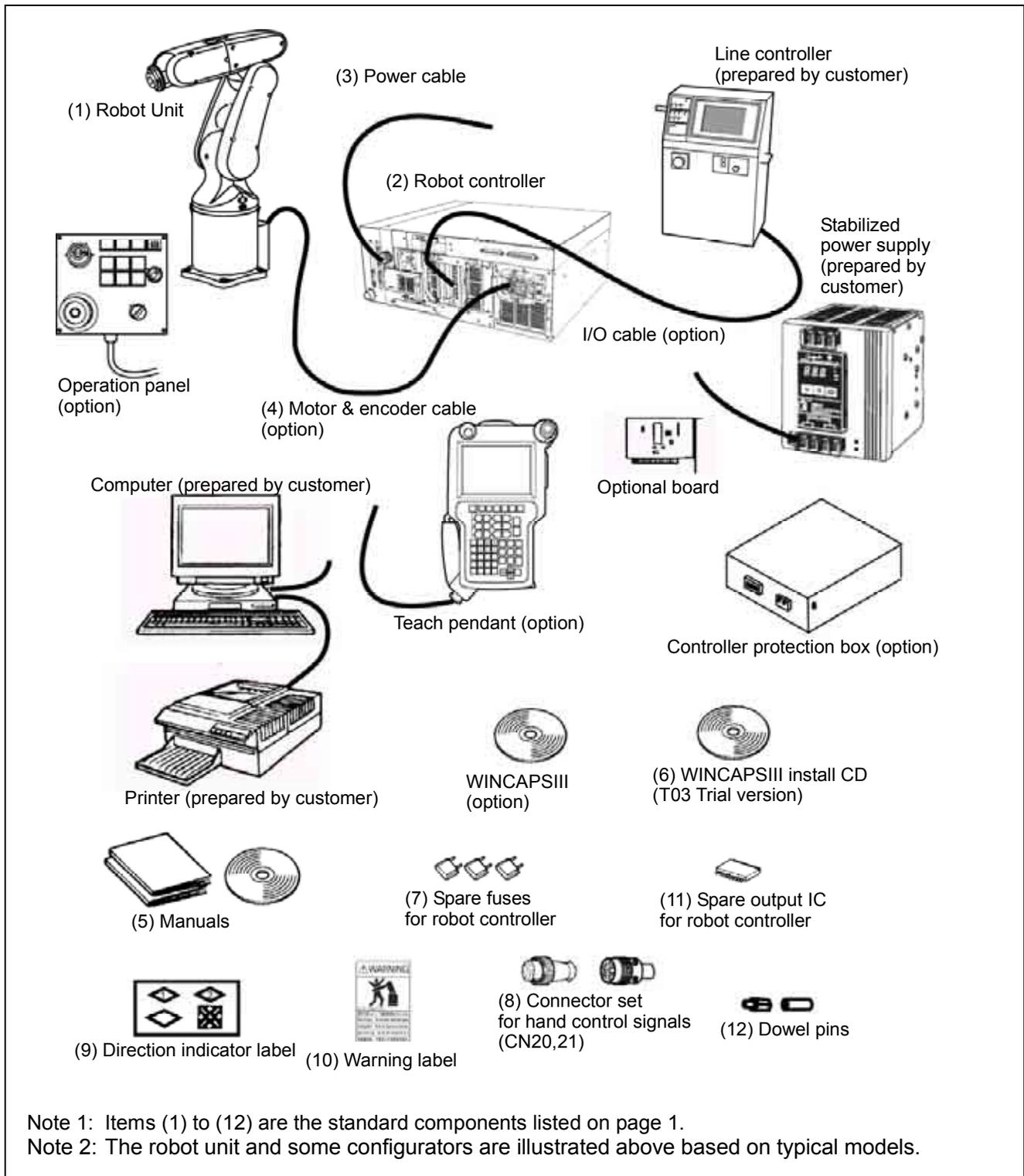
1.2   Optional Components

Please purchase the optional components if necessary referring to OPTIONAL COMPONENTS LISTS (T03) in the Manual Pack CD..

Chapter 2 Configuration of the Robot System

2.1 Configurators

The figure below shows configurators of the typical robot system.

(3) Power cable

(1) Robot Unit

Line controller
(prepared by customer)

(2) Robot controller

Stabilized
power supply
(prepared by
customer)

Operation panel
(option)

I/O cable (option)

(4) Motor & encoder cable
(option)

Computer (prepared by customer)

Optional board

Teach pendant (option)

Controller protection box (option)

Printer (prepared by customer)

WINCAPSIII
(option)

(6) WINCAPSIII install CD
(T03 Trial version)

(5) Manuals

(7) Spare fuses
for robot controller

(11) Spare output IC
for robot controller

(9) Direction indicator label

(10) Warning label

(8) Connector set
for hand control signals
(CN20,21)

(12) Dowel pins

Note 1: Items (1) to (12) are the standard components listed on page 1.
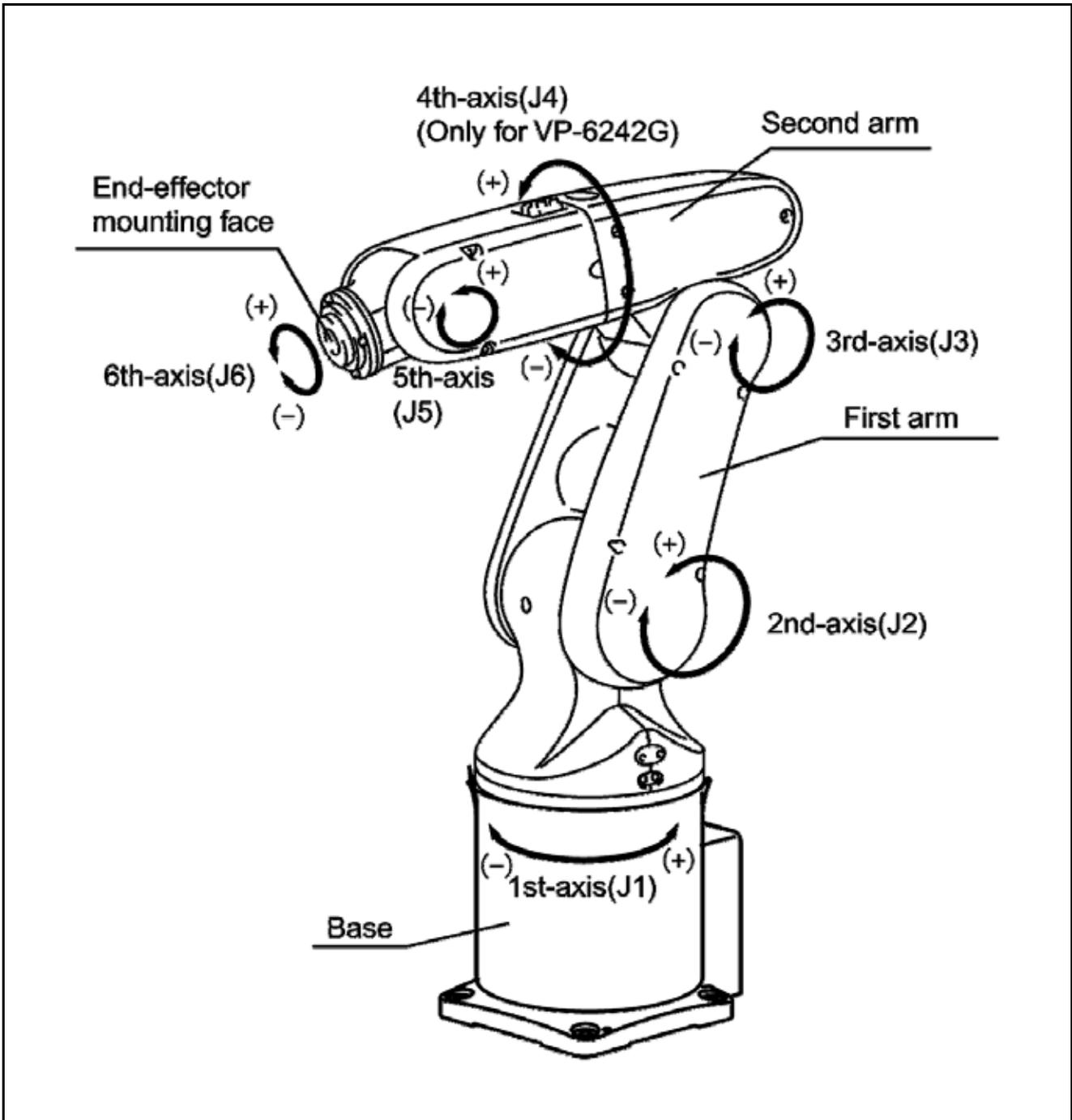Note 2: The robot unit and some configurators are illustrated above based on typical models.

Configurators of the Robot System (VP-G-T series)

2.2   Names of Robot Unit Components

2.2.1   Robot Unit Components and Rotation Direction

The figure below shows the names of the components of the robot unit and the rotation direction of each axis.
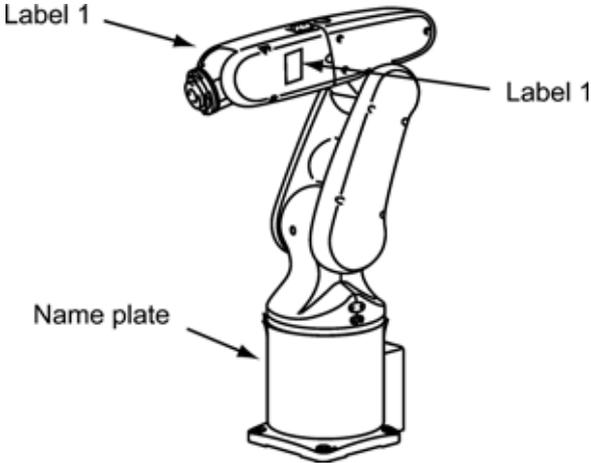

Names of Components (VP-G-T series)

3

2.2.2   Name Plate

The robot unit has a name plate pasted on the base. The serial number printed on the name plate, which is the same as that printed on the controller's name label, identifies an individual robot.

```
                                    Name plate sample (VP-6242G)

Robot unit model name  ——►   Model          : VP - 6242GM
Robot unit part number ——►   Part No.       : 411100 - 0510
        Serial number  ——►   Serial No.     : 09H 0020
     Manufacture date  ——►   Manufactured   : 09 / 2006
        Motor capacity ——►   Motor Power  : AXIS 1:  80W     AXIS 2: 80W
                                            AXIS 3:  50W     AXIS 4: 30W
                                            AXIS 5:  30W     AXIS 6: 30W
                 Mass  ——►   Weight        : 34 kg / 74 lb
    Maximum payload   ——►   Max. payload : 5 kg / 11 lb
    Air pressure             Air Pressure
    Regular operation ——►      Operation  : 0.1 - 0.39 MPa / 15-56 PSI
            Maximum   ——►      Max.       : 0.49 MPa / 71 PSI
                             Manufacturer : DENSO WAVE INCORPORATED
                             Address       : 4-2-12, Toranomon,
                                             Minato-ku, Tokyo, Japan

                                                          (QR code)
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Name Plate Sample (VP-G-T series)

2.2.3   Warning and Caution Labels

The robot unit has warning and caution labels pasted as shown below. They alert the user to the dangers of the areas on which they are pasted. Be sure to observe the instructions printed on those labels.

Warning and Caution Labels on the Robot Unit

Location of labels

Warning and caution labels on the robot unit	Additional description
Label 1	Contact with the robot unit which is in motion can cause serious injuries. Observe the following: (1) Never enter the robot's restricted space when the robot is in motion or the motor power is on. (2) When you need to enter the robot's restricted space for recovery from robot failures, be sure to cut the power to the robot motors by activating an emergency stop device or the like.

2.3 Names of the Robot Controller Components

The figure below shows the names of the robot controller components.

Note: For warning and caution labels pasted on the controller, refer to the RC7M CONTROLLER MANUAL (T03).

Rear panel (Air exhaust side)

Front panel

Air intake filters
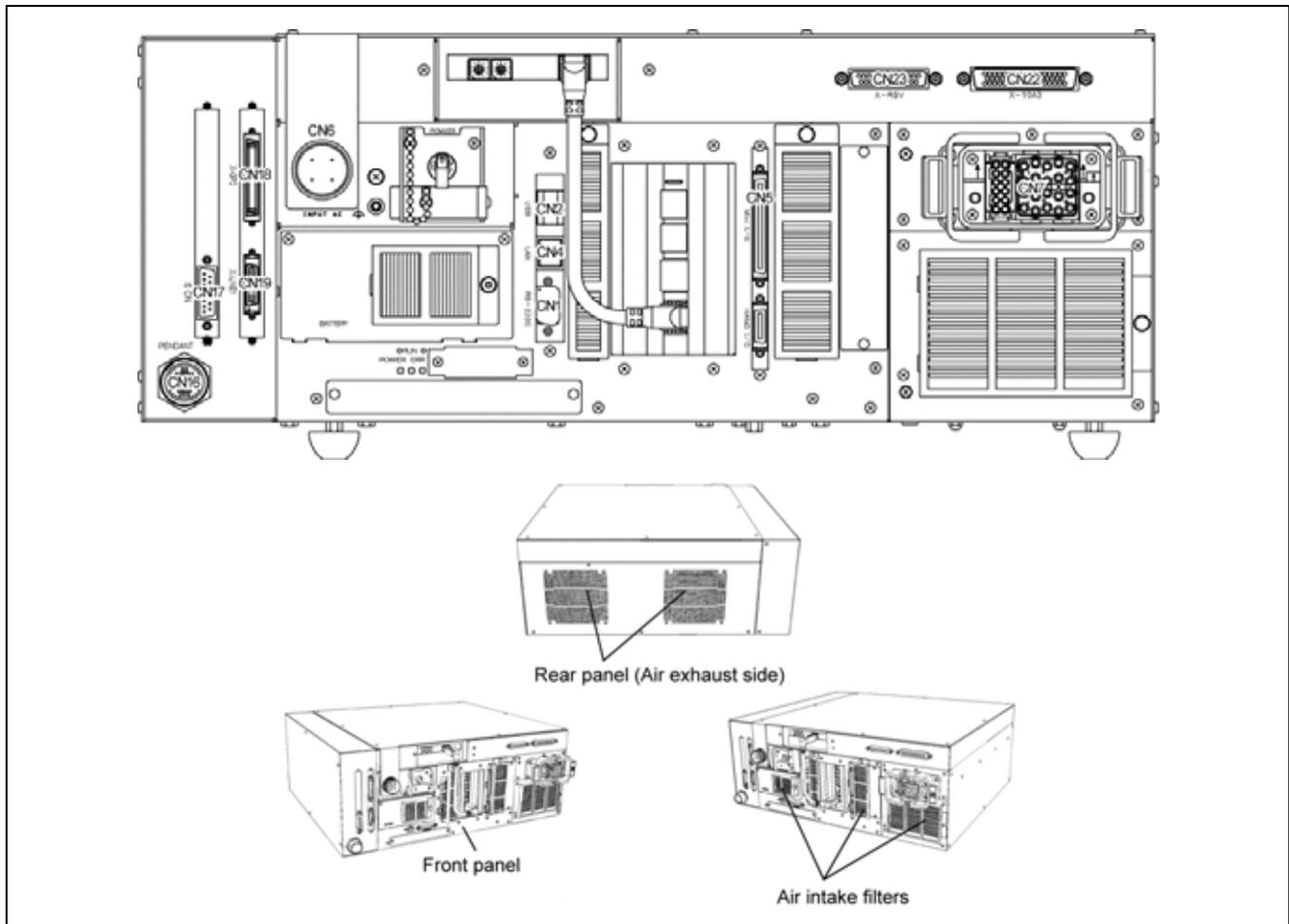
Connectors for the VP-G-T series (Encoders connected via bus)

Connector No.	Marking	Name
CN1	RS-232C	Serial interface connector
CN2	USB	USB connector (2 lines)
CN4	LAN	Ethernet connector
CN5	Mini I/O	I/O connector
CN6	INPUT AC	Power supply connector
CN7	MOTOR	Motor/encoder connector
CN9	HAND I/O	HAND I/O connector
CN12	—	FL-net connector (X-FL) for line controller
CN13	—	USB connector for PLC
CN14	—	USB connector for PLC
CN16	PENDANT	Teach pendant connector
CN17	S ON	Servo ON output & user power input connector
CN18	X-OP2	Operation panel connector
CN19	X-LNE1	Line controller wiring connector
CN22	X-10A3	User wiring connector for robot unit
CN23	X-RSV	User wiring connector (Reserved.)

Names of Robot Controller Components

Chapter 3 Specifications of the Robot Unit
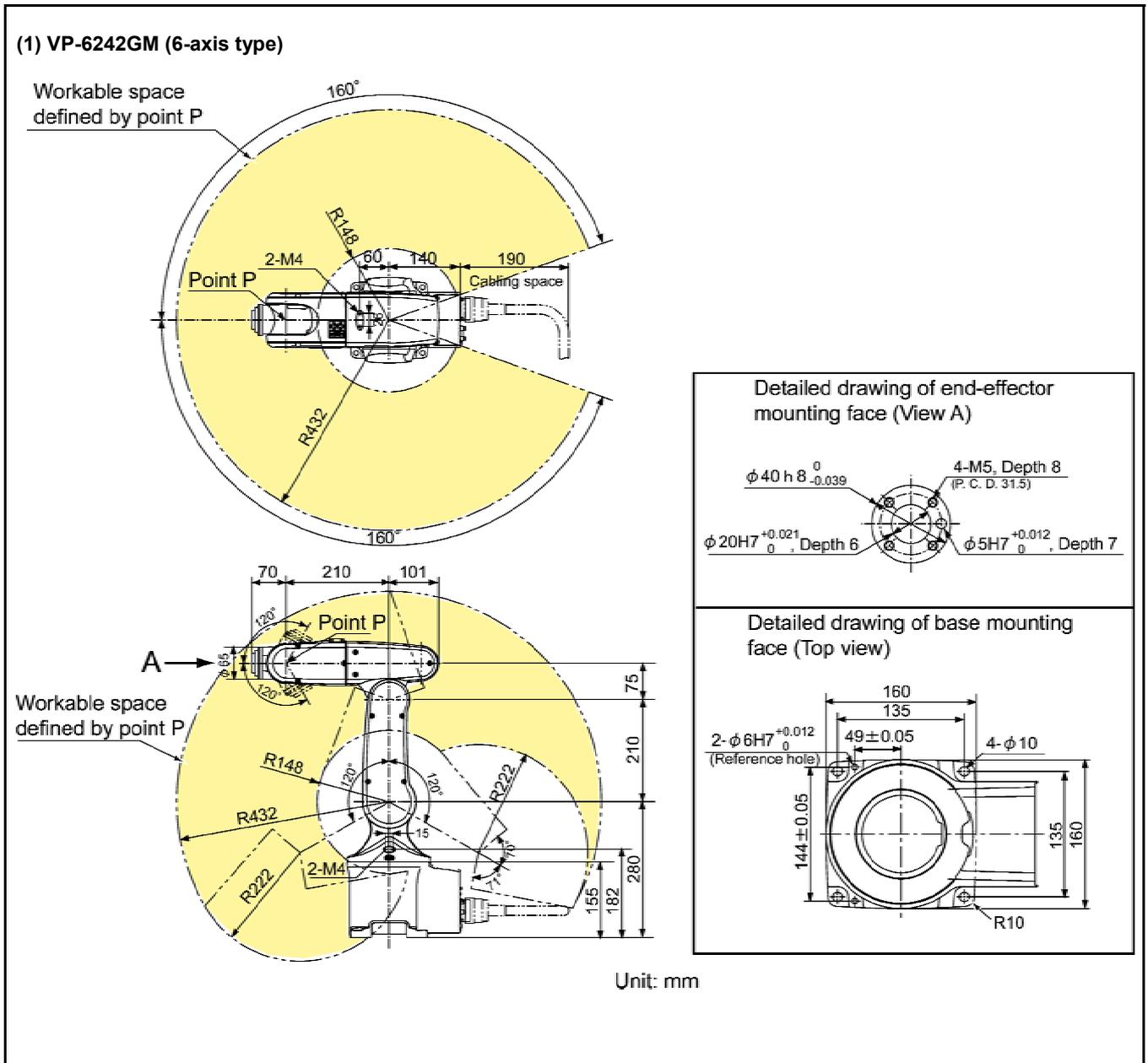
3.1   Robot Specifications (VP-G-T series)

Following table lists the robot unit specifications of the VP-G-T series.

VP-GM Series Robot Unit

Item	Specifications	
	6-axis type	5-axis type **(Note 1)**
Model name of robot set **(Note 2)**	VP-6242G-T03	VP-5243G-T03
Model name of robot unit	VP-6242GM	VP-5243GM
Overall arm length	210 (first arm) + 210 (second arm) = 420 mm	210 (first arm) + 220 (second arm) = 430 mm
Arm offset	J3 (front arm): 75 mm	-
Maximum motion area	R = 502 mm (end-effector mounting face) R = 432 mm (Point P: J4, J5, J6 center)	R = 500 mm (end-effector mounting face) R = 430 mm (Point P: J5, J6 center)
Motion range	J1 : ±160° J2 : ±120° J3 : +160°, +19° J4 : ±160° J5 : ±120° J6 : ±360°	J1 : ±160° J2 : ±120° J3 : +136°, -128° J4 : none J5 : ±120° J6 : ±360°
Maximum payload	2 kg (2.5 kg at wrist direction downward)	2.5 kg (3 kg at wrist direction downward)
Maximum composite speed	3900 mm/s (at the center of an end-effector mounting face)	
Position repeatability **(Note 3)**	In each of X, Y and Z directions: ±0.02 mm	
Maximum allowable inertia moment	Around J4 and J5: 0.030 kgm^2 Around J6: 0.007 kgm^2	Around J5: 0.040 kgm^2 Around J6: 0.010 kgm^2
Position detection	Absolute encoder	
Drive motor and brake	AC servomotors for all joints, Brakes for all joints	
User air piping	4 systems (ϕ4x4)	
User signal line	9 (for proximity sensor signals, etc.)	
Air source — Operating pressure	0.10MPa～0.39MPa	
Air source — Maximum allowable pressure	0.49MPa	
Airborne noise (A-weighted equivalent continuous sound pressure level)	80 dB or less	
Degree of protection	IP30	
Weight	Approx. 15 kg (32 lbs)	Approx. 13 kg (29 lbs)

Note 1: The 5-axis type robot has not the 4th axis (J4).

Note 2: The model name of robot set refers to the model name of a complete set including a robot unit and robot controller.

Note 3: Position repeatability is the value at constant ambient temperature.

3.2   Outer Dimensions and Workable Space of the Robot Unit (VP-G-T series)

The outer dimensions and workable space of the VP-G-T series are shown on the following pages.

(1) VP-6242GM (6-axis type)

Workable space defined by point P

160°

R148

2-M4

Point P

60   140   190

Cabling space

R432

160°

Detailed drawing of end-effector mounting face (View A)

$\phi 40 h 8 {}^{0}_{-0.039}$

4-M5, Depth 8
(P. C. D. 31.5)

$\phi 20 H7 {}^{+0.021}_{0}$, Depth 6

$\phi 5H7 {}^{+0.012}_{0}$, Depth 7

70   210   101

120°

Point P

A →

Workable space defined by point P

R148

R432

R222

120°

120°

15

70

R222

2-M4

75

210

280

155

182

Detailed drawing of base mounting face (Top view)

160

135

2-ϕ6H7 ${}^{+0.012}_{0}$
(Reference hole)

49±0.05

4-ϕ10

144±0.05

135

160

R10

Unit: mm

Outer Dimensions and Workable Space [VP-6242GM]

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(2) VP-5243GM (5-axis type)

Workable space defined by point P

160°

R162

2-M4

Point P

60 140 190
Cabling space

R430

160°

Workable space defined by point P

Point P

70 220

A→

Φ65

R430

128°

120°

R189

130°

128°

R162

136°

R220

2-M4

128°

R220

210

280

155 182

Unit: mm

Detailed drawing of end-effector mounting face (View A)

Φ40h8 $^{0}_{-0.039}$

4-M5, Depth 8
(P. C. D. 31.5)

Φ20H7 $^{+0.021}_{0}$, Depth 6

Φ5H7 $^{+0.012}_{0}$, Depth 7

Detailed drawing of base mounting face (Top view)

160
135

2-Φ6H7 $^{+0.012}_{0}$
(Reference hole)

49±0.05

4-Φ10

144±0.05

135
160

R10

Outer Dimensions and Workable Space [VP-5243GM]

3.3 Robot Positioning Time (VP-G-T series)

1. Positioning time means the time from the start of robot operation to the arrival at the target positioning point.

2. After the robot moves to and passes the target positioning point, vibration will be dampened and the robot positioned at the target positioning point as shown in Figure below. This vibration dampening time is not considered in the graph.

Caution (1) **The vibration dampening time depends on factors such as the weight of the end-effector. If the robot is to be used in such a way that it overshoots or if the vibration damping time is of great concern, test the robot carefully beforehand.**

(2) **If acceleration begins before residual vibration of the robot stops, an overcurrent error (code starts from ERROR6120; the first digit represents the axis number) may be displayed. In this case, take one of the following measures:**
· **Lower the deceleration of the preceding operation with a DECEL command to reduce residual vibration.**
· **Keep the robot in stand-by with a DELAY command until residual vibration stops.**
· **Lower acceleration with an ACCEL command.**

(3) **Operate the robot with the optimum load setting in accordance with the end-effector weight and workpiece weight. If not, a robot failure may result.**
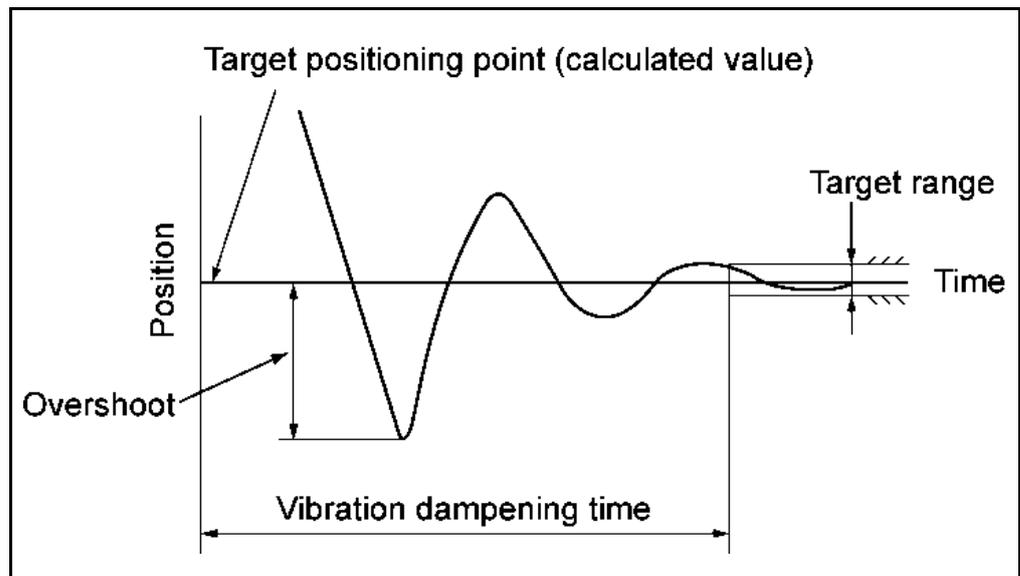
Vibration Dampening Time

(1) VP-6242G-T series robot positioning time
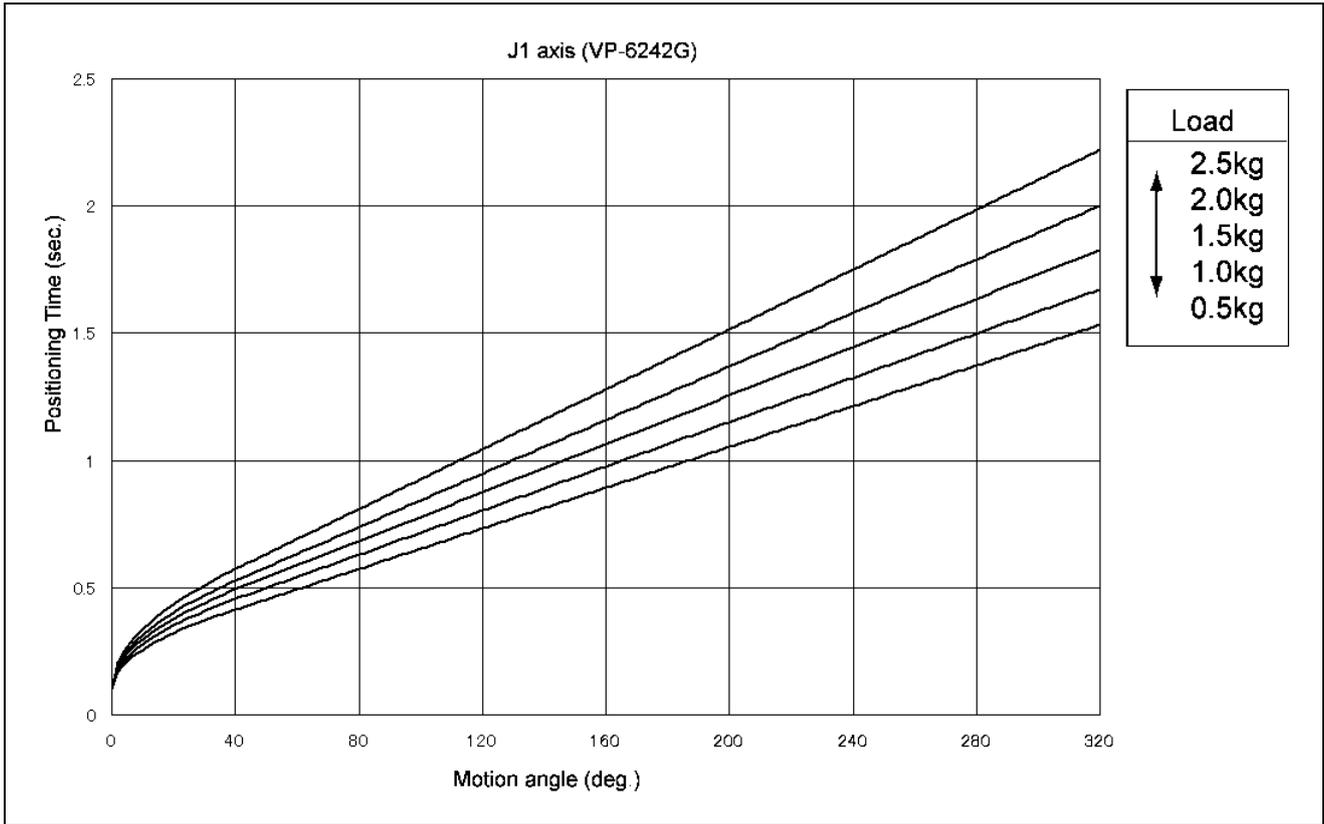
J1 Axis [VP-6242G]

J2 Axis [VP-6242G]

11
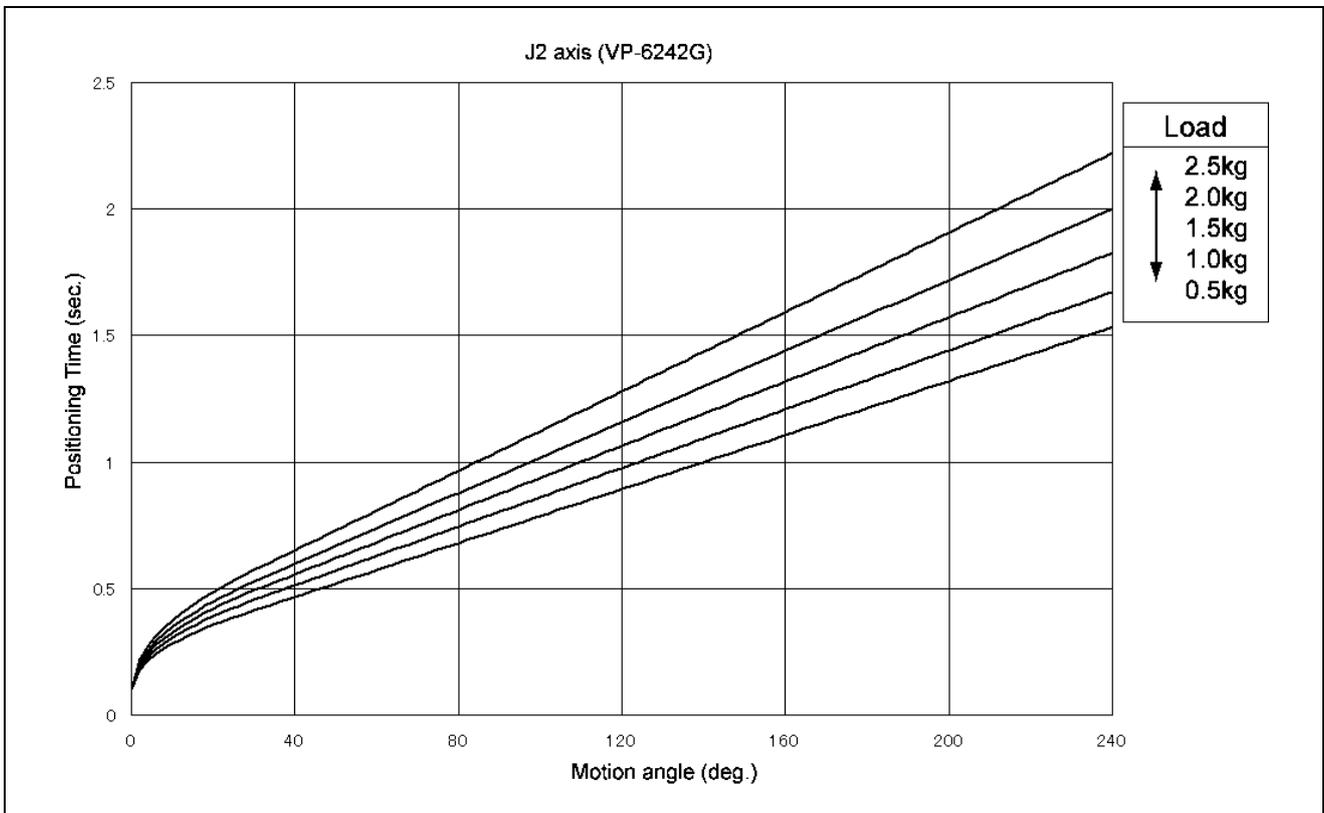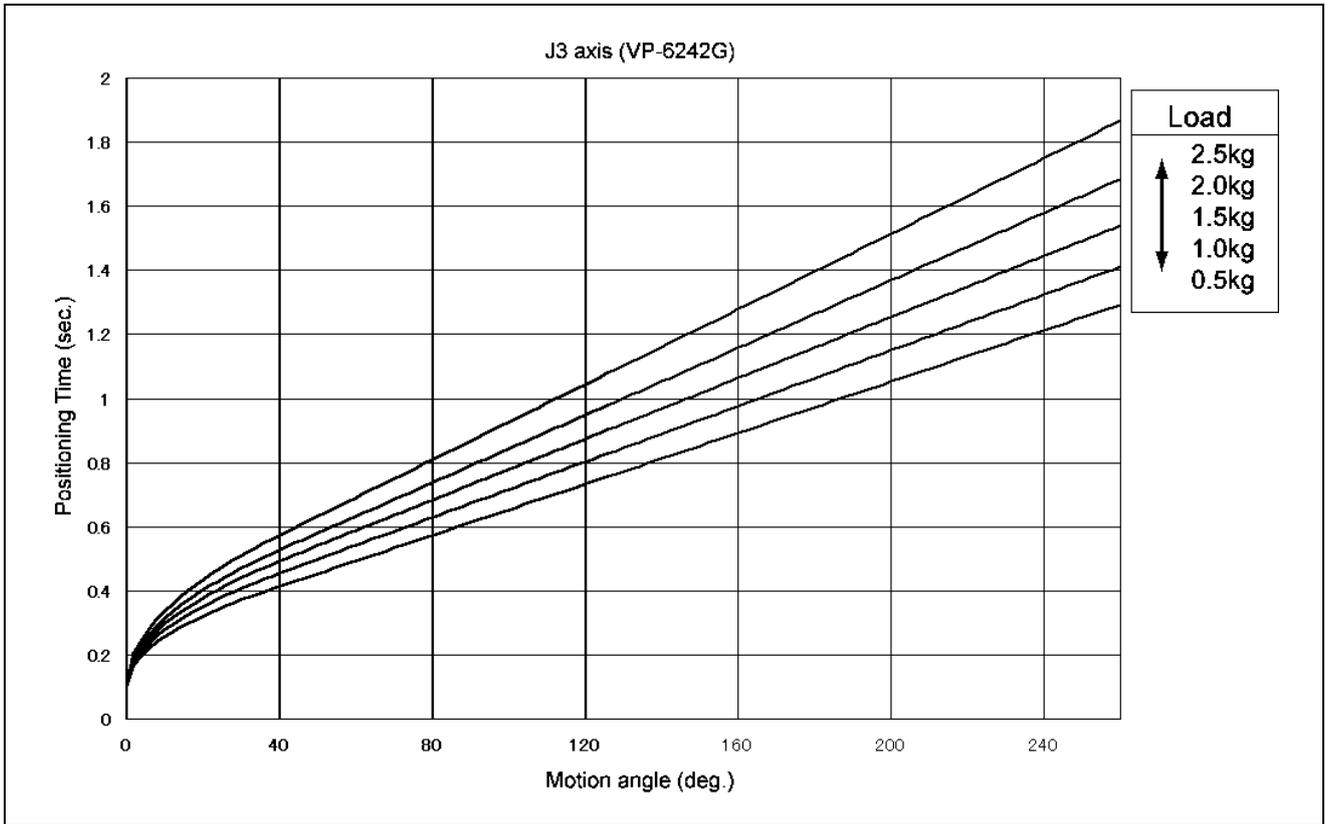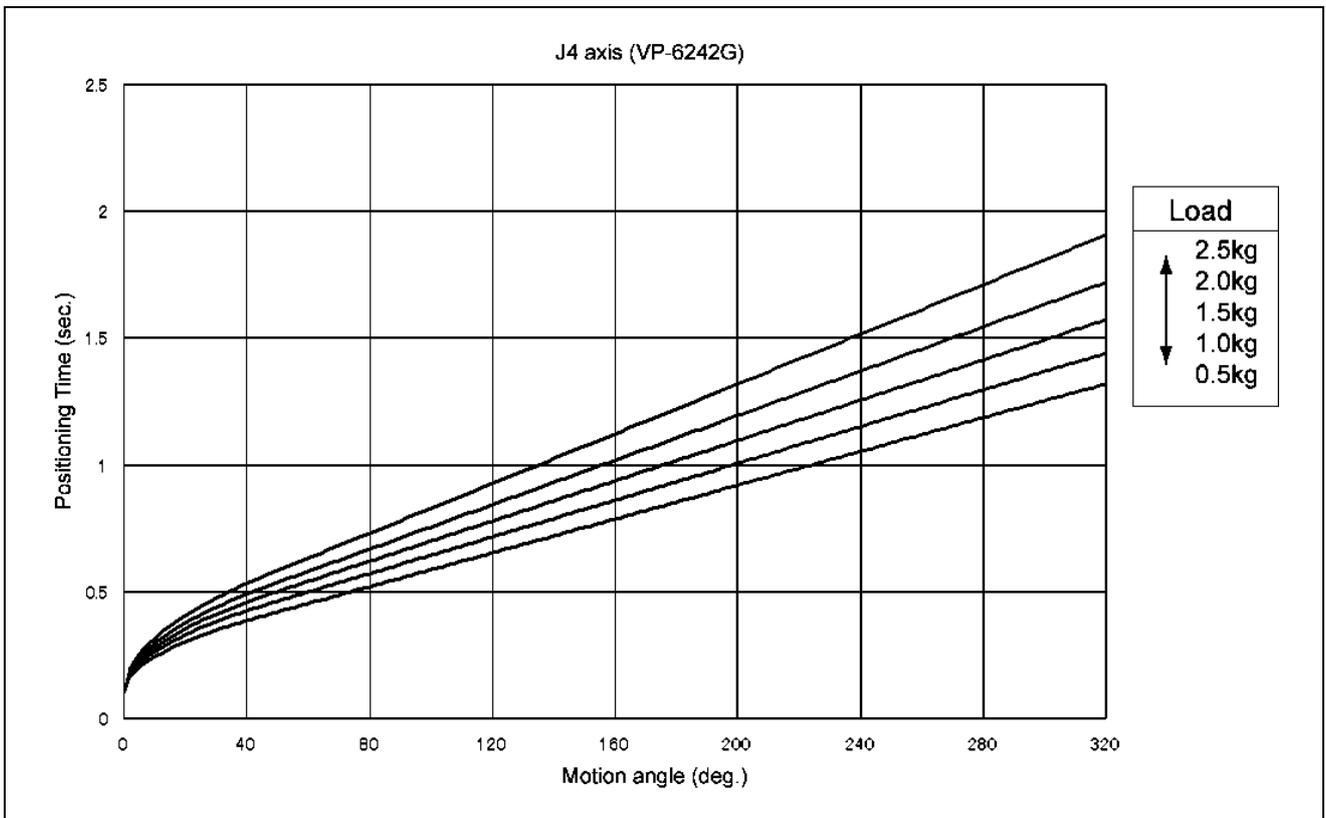
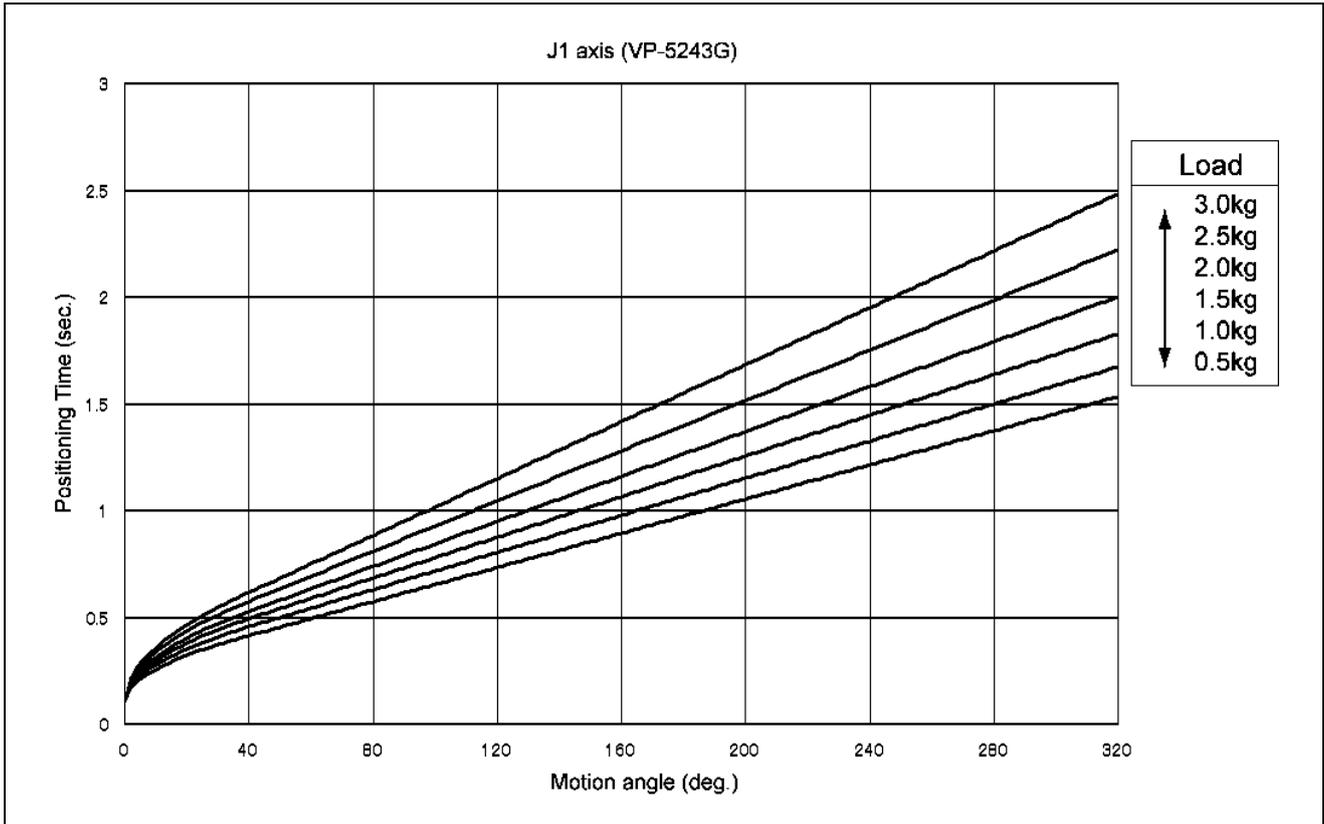J3 Axis [VP-6242G]

J4 Axis [VP-6242G]
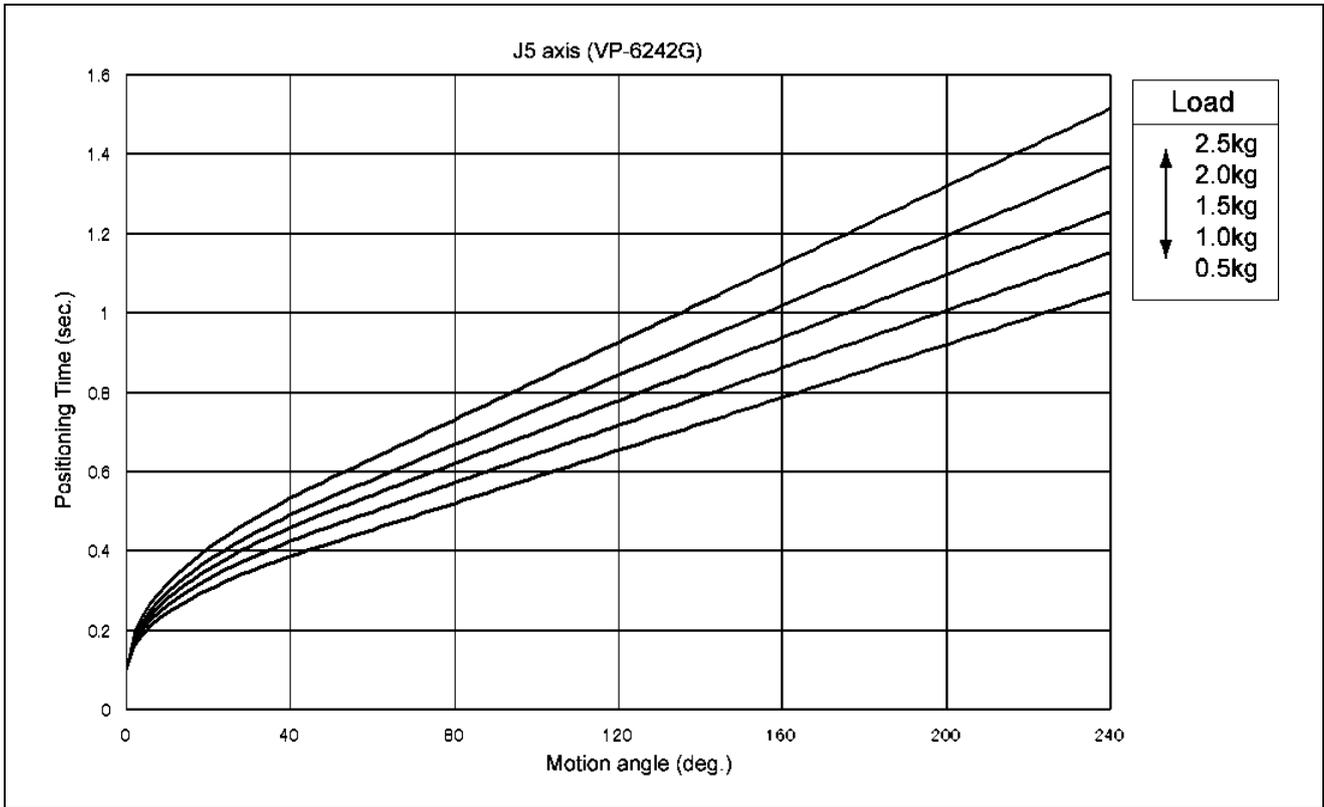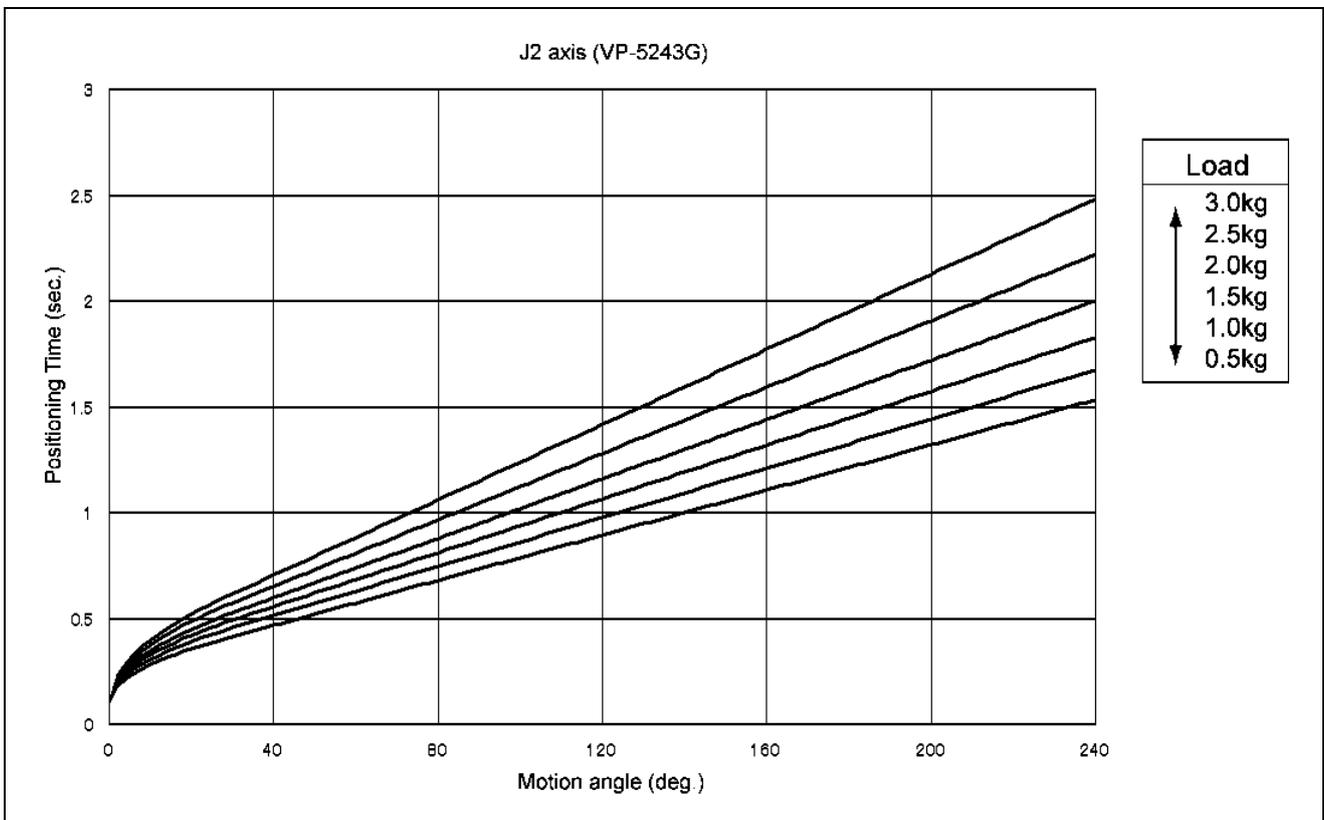
J5 Axis [VP-6242G]
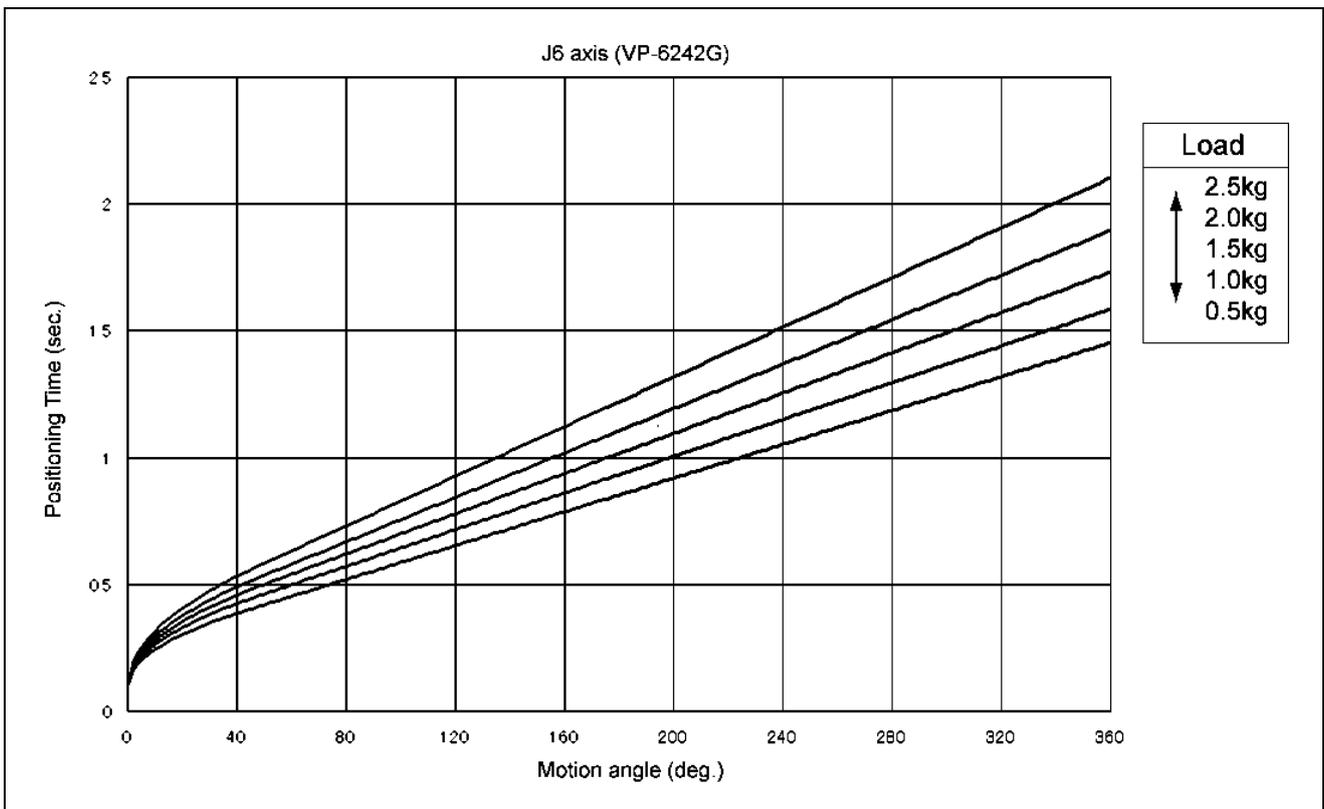
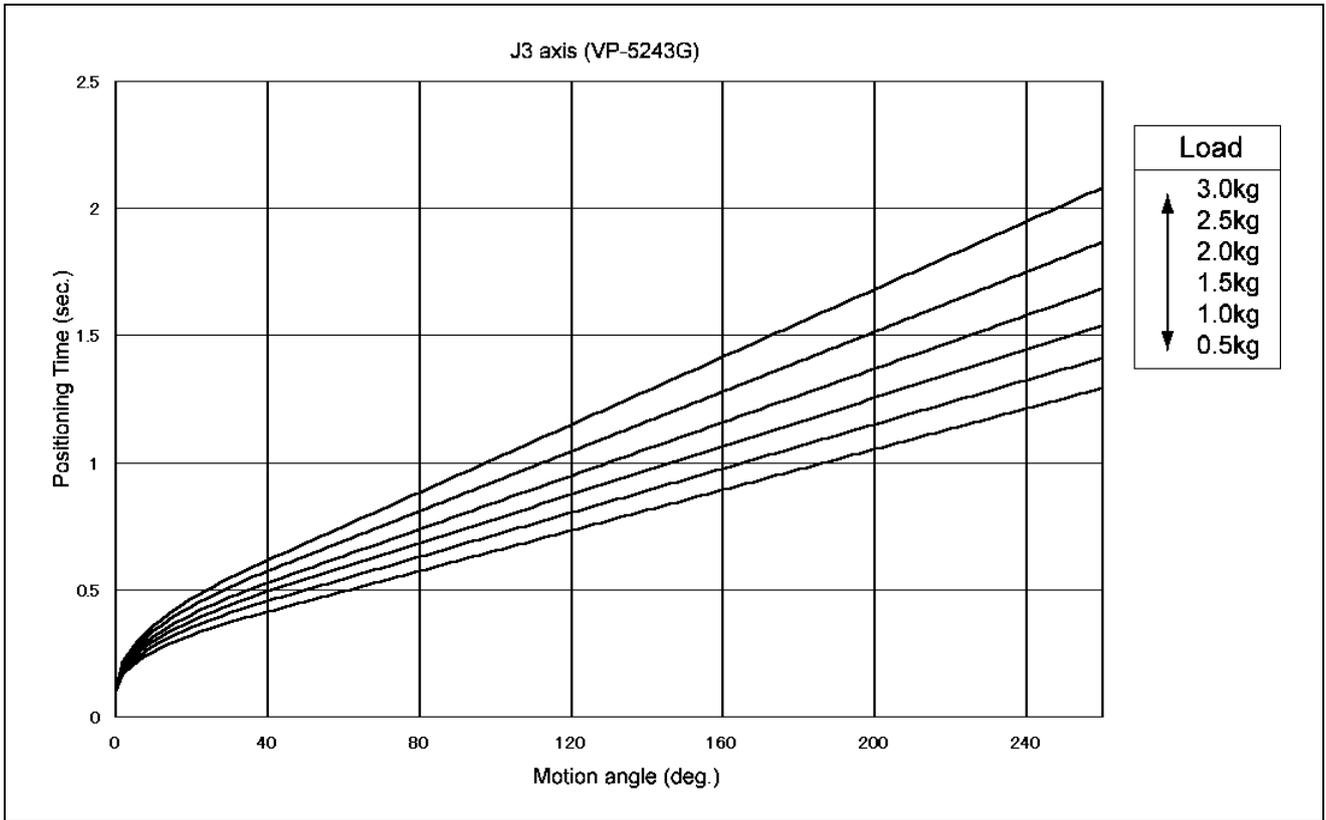J6 Axis [VP-6242G]
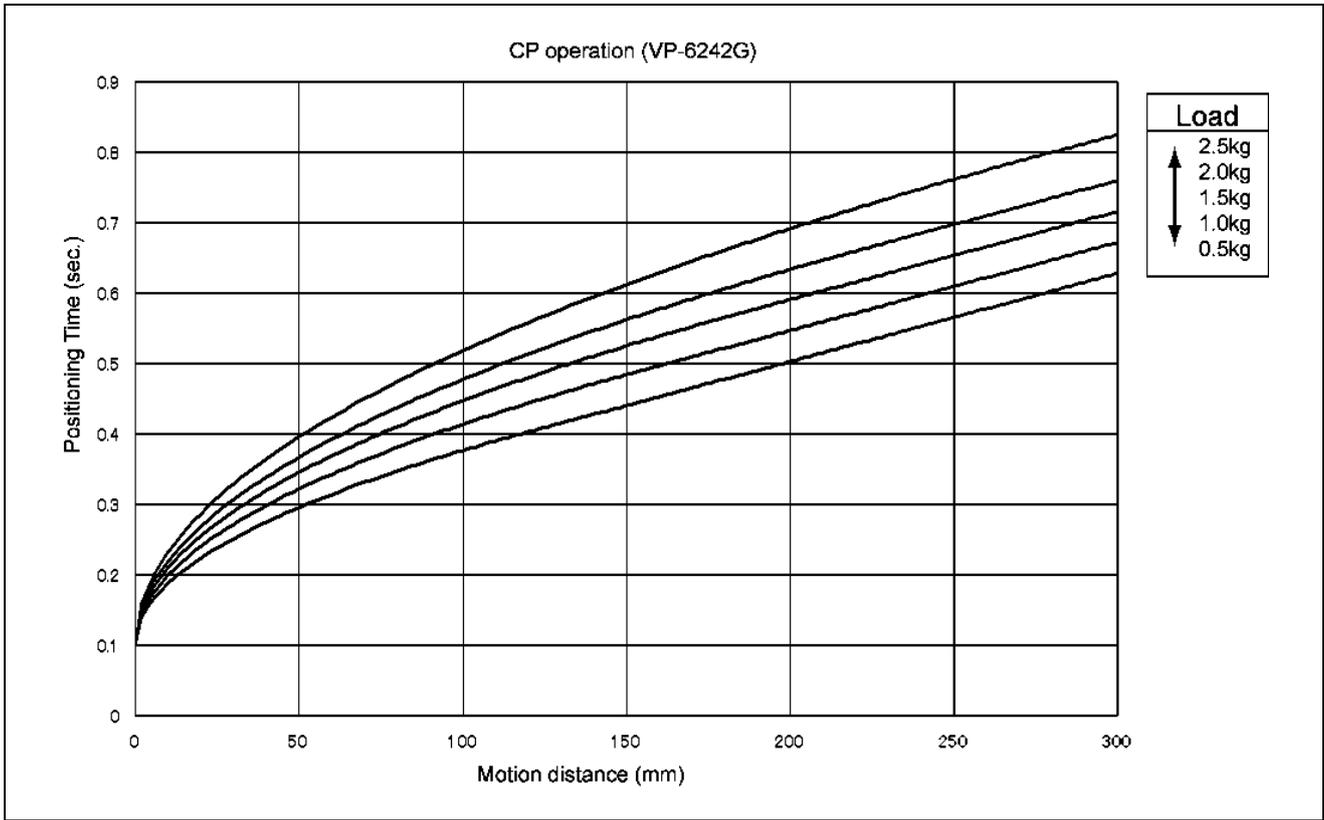
CP Operation [VP-6242G]

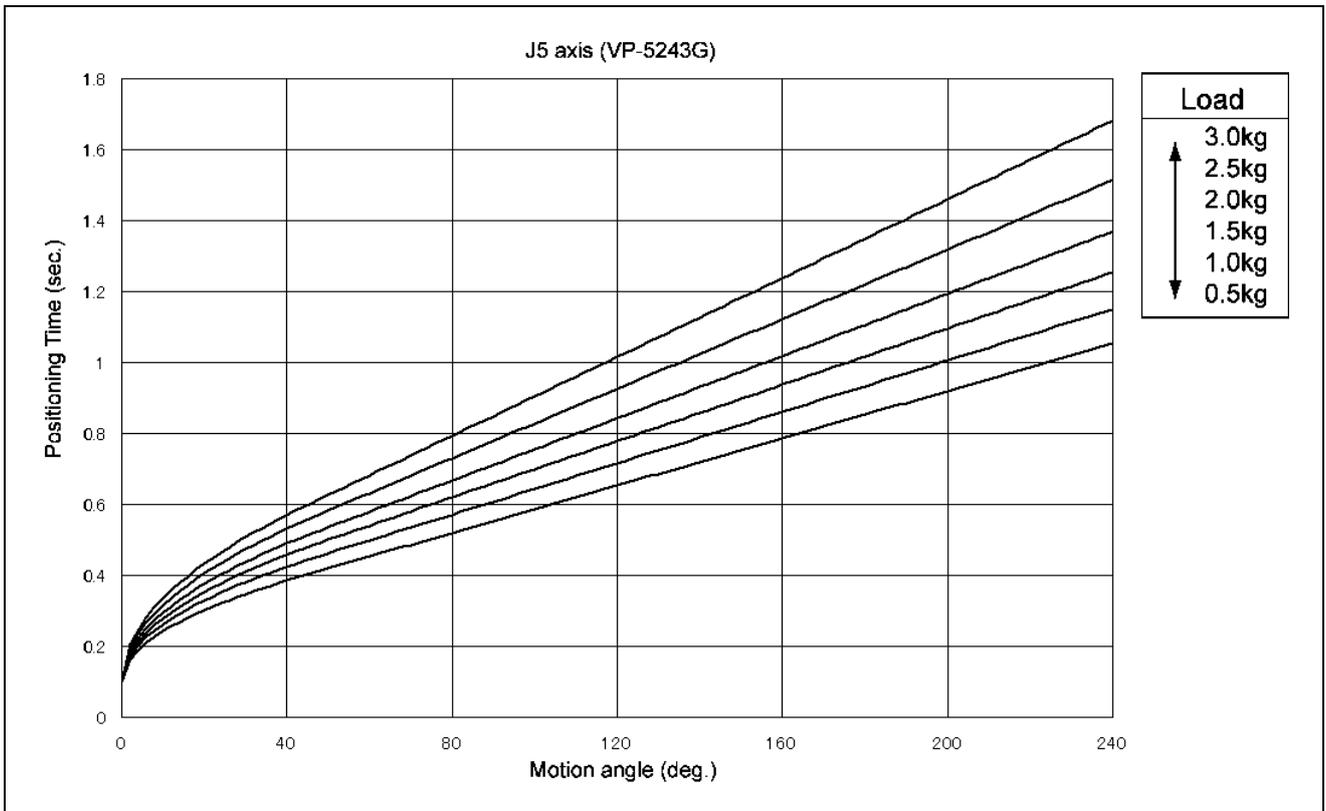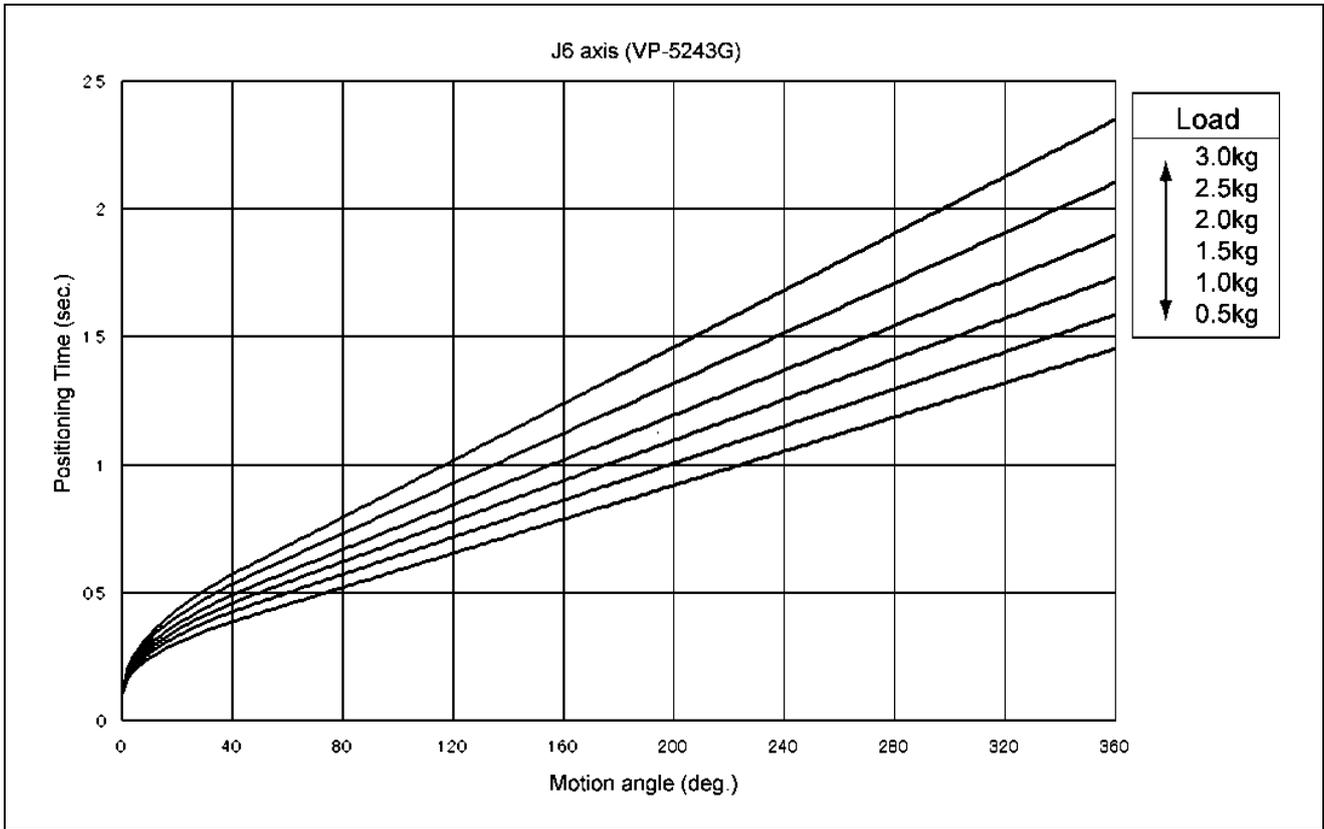## (2) VP-5243G-T series robot positioning time
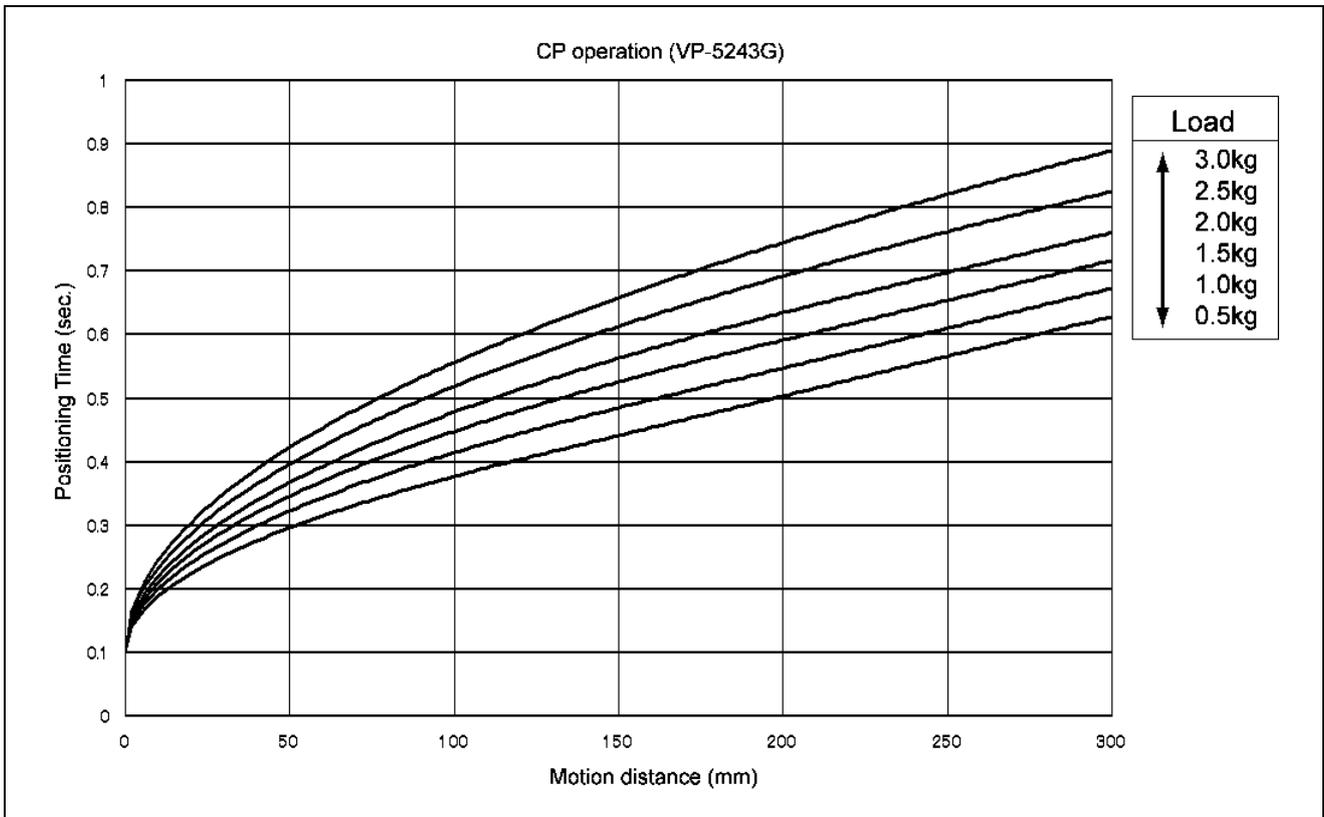

J1 Axis [VP-5243G]

J2 Axis [VP-5243G]
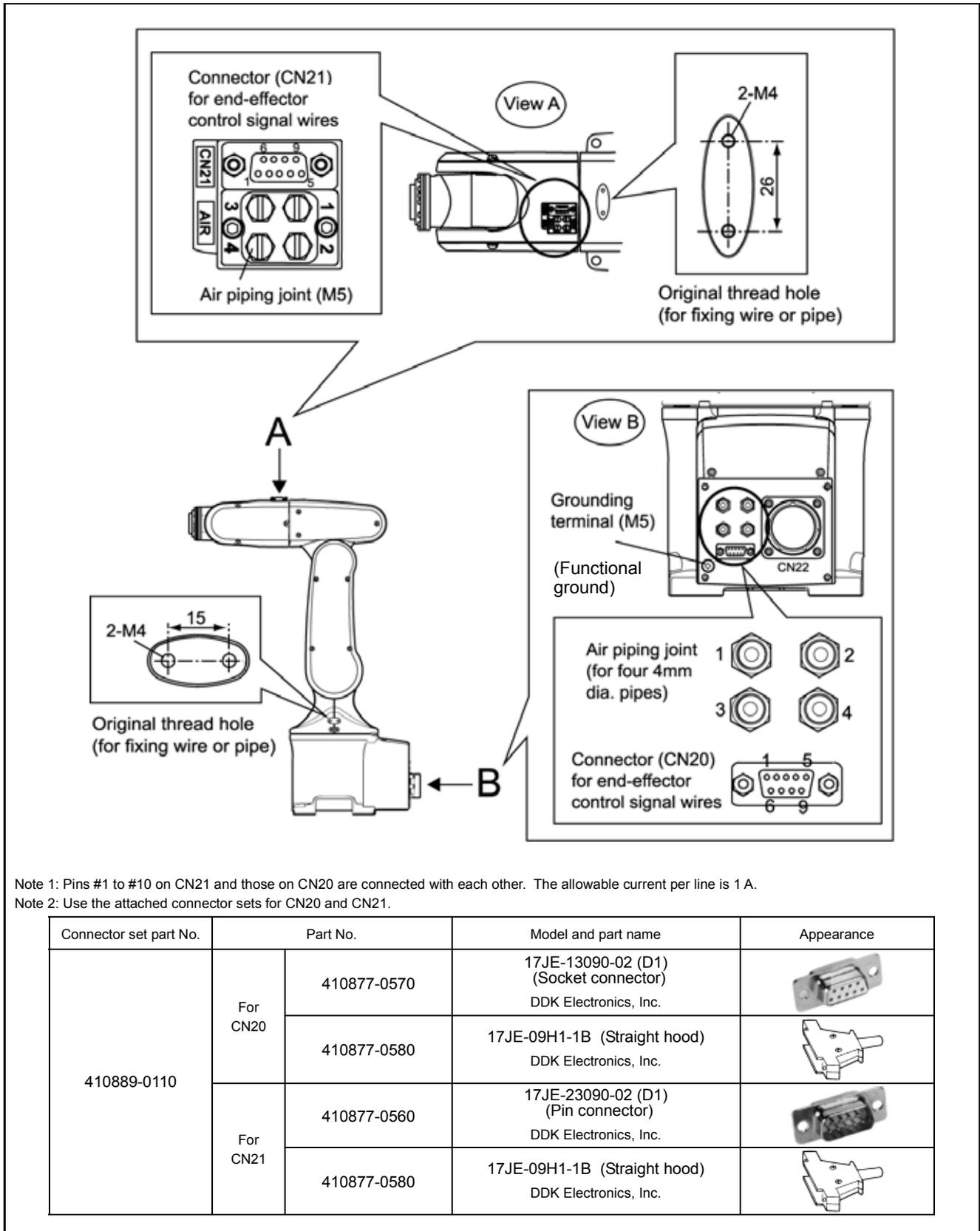
J3 Axis [VP-5243G]

J5 Axis [VP-5243G]

J6 Axis [VP-5243G]

CP Operation [VP-5243G]

3.4 Air Piping and Signal Wiring (VP-G-T series)

The VP-G-T series is equipped with 4 air pipes for air chuck and 9 signal lines. The air piping and signal wiring of the VP-G-T series are shown in the figure below.

Note 1: Pins #1 to #10 on CN21 and those on CN20 are connected with each other. The allowable current per line is 1 A.
Note 2: Use the attached connector sets for CN20 and CN21.

Connector set part No.	Part No.		Model and part name	Appearance
410889-0110	For CN20	410877-0570	17JE-13090-02 (D1) (Socket connector) DDK Electronics, Inc.	
		410877-0580	17JE-09H1-1B (Straight hood) DDK Electronics, Inc.	
	For CN21	410877-0560	17JE-23090-02 (D1) (Pin connector) DDK Electronics, Inc.	
		410877-0580	17JE-09H1-1B (Straight hood) DDK Electronics, Inc.	

Air Piping and Signal Wiring [VP-G-T series]

3.5   Precautions When Designing the End-effectors (VP-G-T series)

Design an end-effector such that it is in compliance with items (1) to (3) described below.

> ⚠ **CAUTION**   **If the end-effector design precautions are not observed, the clamped parts of the robot unit may become loose, rattle or be out of position. In the worst case, the mechanical parts of the robot and robot controller may become damaged.**
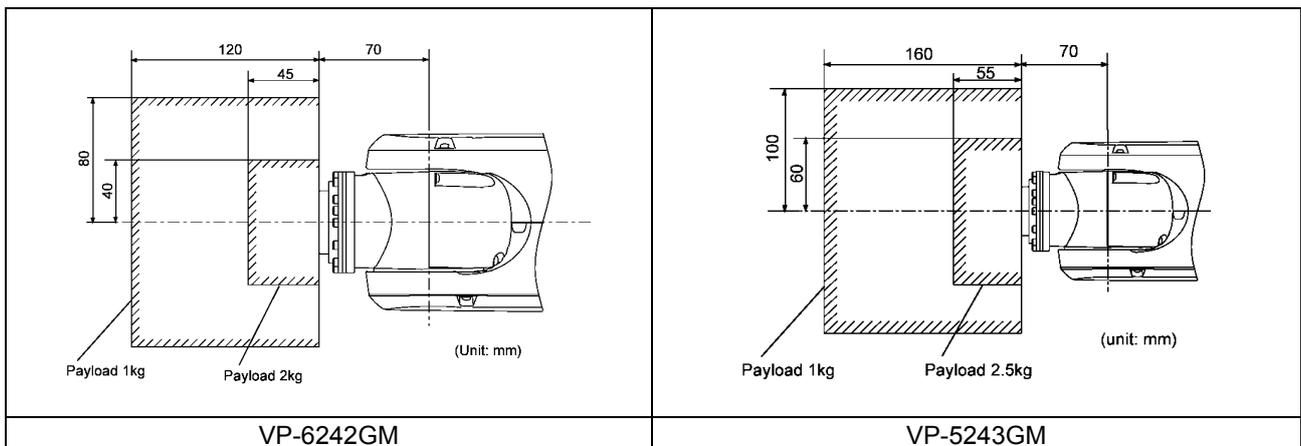
(1) Mass of end-effector

Design the end-effector so that the total mass of the end-effector (including workpiece) will be lighter than the maximum payload capacity of the robot. The total mass includes the wiring, piping, etc.

Max. total mass of end-effector (inc. workpiece) ≤ Max. payload capacity

(2) Center of gravity position of end-effector

Design an end-effector so that the center of gravity position of the end-effector (including workpiece) is within the specified range.

| VP-6242GM | VP-5243GM |

Allowable Range of Center of Gravity Position of End-effector

(3) Moment of inertia around J4, J5 and J6

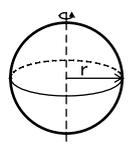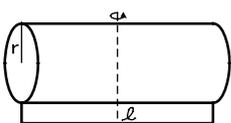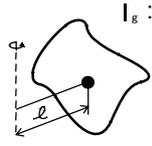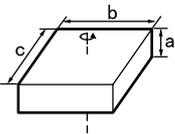Design an end-effector so that its moments of inertia around J4, J5 and J6 (including workpiece) do not exceed the maximum allowable moment of inertia of the robot.

Moment of inertia around J4, J5 and J6 of end-effector (incl. mass of workpiece) ≤ Max. allowable moment of inertia

Robot model	Around axis	Maximum allowable moment
VP-6242G	Around J4 or J5	0.030kgm^2
	Around J6	0.007kgm^2
VP-5243G	Around J5	0.040kgm^2
	Around J6	0.010kgm^2

When calculating the moment of inertia around J4, J5 and J6 of the end-effector, use the formulas given in Following Table and Figure.

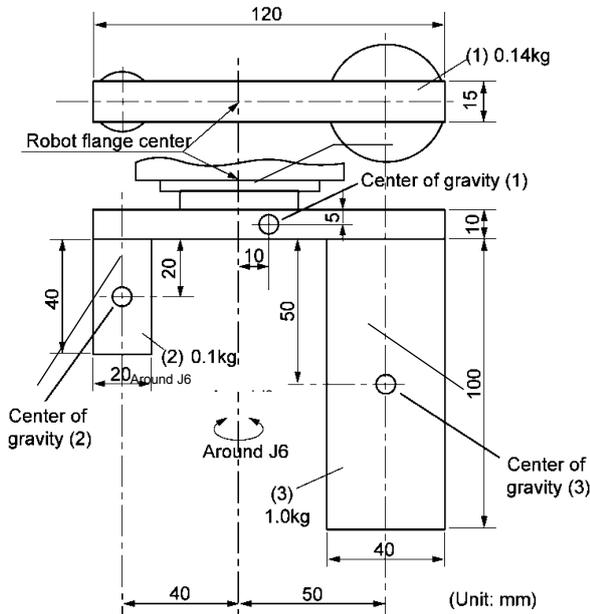**Moment-of-Inertia Formulas**

1. Cylinder (1) (Axis of rotation = Center axis) $I = \dfrac{mr^2}{2}$	4. Sphere (Axis of rotation = Center axis) $I = \dfrac{2mr^2}{5}$
2. Cylinder (2) (The axis of rotation passes through the center of gravity.) $I = \dfrac{m}{4}\left(r^2 + \dfrac{\ell^2}{3}\right)$	5. Center of gravity not on the axis of rotation I_g : Inertia moment around center of gravity 〔kgm^2〕 $I = I_g + m\ell^2$
3. Rectangular parallelepiped (The axis of rotation passes through the center of gravity.) $I = \dfrac{m}{12}(b^2 + c^2)$	I: Moment of inertia kgm^2 m: Mass kg r: Radius m b, c, ℓ : Length m
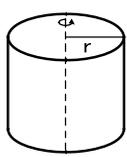
Calculation example : When calculating the moment of inertia of a complicated shape, divide it into simple parts as much as possible for easier calculations.

As shown in the figure below, divide the end-effector into three parts (①, ②, ③).

(1) Moment of inertia around J6

Moment of inertia around J6 of (1): I_1 (from 3 and 5 in the above table)

$$I_1 = \frac{0.14}{12}(0.12^2 + 0.015^2) + 0.14 \times 0.01^2 = 1.85 \times 10^{-4} \ [kgm^2]$$

Moment of inertia around J6 of (2): I_2 (from 1 and 5 in the above table)

$$I_2 = \frac{0.1 \times 0.01^2}{2} + 0.1 \times 0.04^2 = 1.65 \times 10^{-4} \quad [kgm^2]$$

Moment of inertia around J6 of (3): I_3 (from 1 and 5 in the above table)
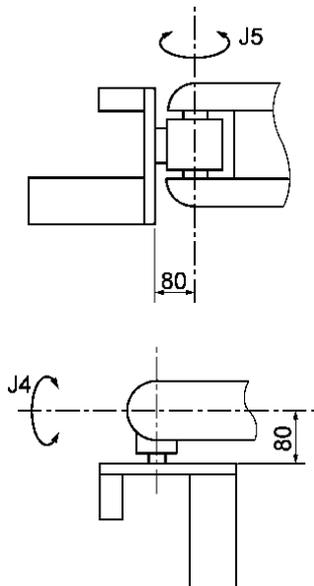
$$I_3 = \frac{1.0 \times 0.02^2}{2} + 1.0 \times 0.05^2 = 2.7 \times 10^{-3} \quad [kgm^2]$$

Moment of inertia around J6 of entire hand: I_{J6}

$$I_{J6} = I_1 + I_2 + I_3 = 0.003 \quad [kgm^2]$$

(2) Moment of inertia around J4 and J5

For the end-effector shown below, the moment of inertia around J4 and J5 can be calculated according to the same formula.

Moment of inertia around J4 and J5 of (1): I_1 (from 3 and 5 in the above table)

$$I_1 = \frac{0.14}{12}(0.015^2 + 0.01^2) + 0.14 \times (0.08 + 0.005)^2 = 1.02 \times 10^{-3} \quad [kgm^2]$$

Moment of inertia around J4 and J5 of (2): I_2 (from 2 and 5 in the above table)

$$I_2 = \frac{0.1}{4}(0.01^2 + \frac{0.04^2}{3}) + 0.1 \times (0.08 + 0.01 + 0.02)^2 = 1.23 \times 10^{-3} \ [kgm^2]$$

Moment of inertia around J4 and J5 of (3): I_3 (from 2 and 5 in the above table)

$$I_3 = \frac{1.0}{4}(0.02^2 + \frac{0.1^2}{3}) + 1.0 \times (0.08 + 0.01 + 0.05)^2 = 2.0 \times 10^{-2} \quad [kgm^2]$$

Moment of inertia around J4 and J5 of entire end-effector: I_{J4}, I_{J5}

$$I_{J4} = I_{J5} = I_1 + I_2 + I_3 = 2.22 \times 10^{-2} \quad [kgm^2]$$

**End-effector Moment of Inertia Calculation Example**

3.6　Stopping Time and Distance (Angle) at an Emergency Stop

Pressing the emergency stop button when the robot is in motion stops the robot. The stopping time required from activation of a stop signal and the distance (angle) for major three joints vary with the robot speed as shown in the graphs below. The measuring conditions are: Robot arm extended, 33%, 66% and 100% of the maximum payload.
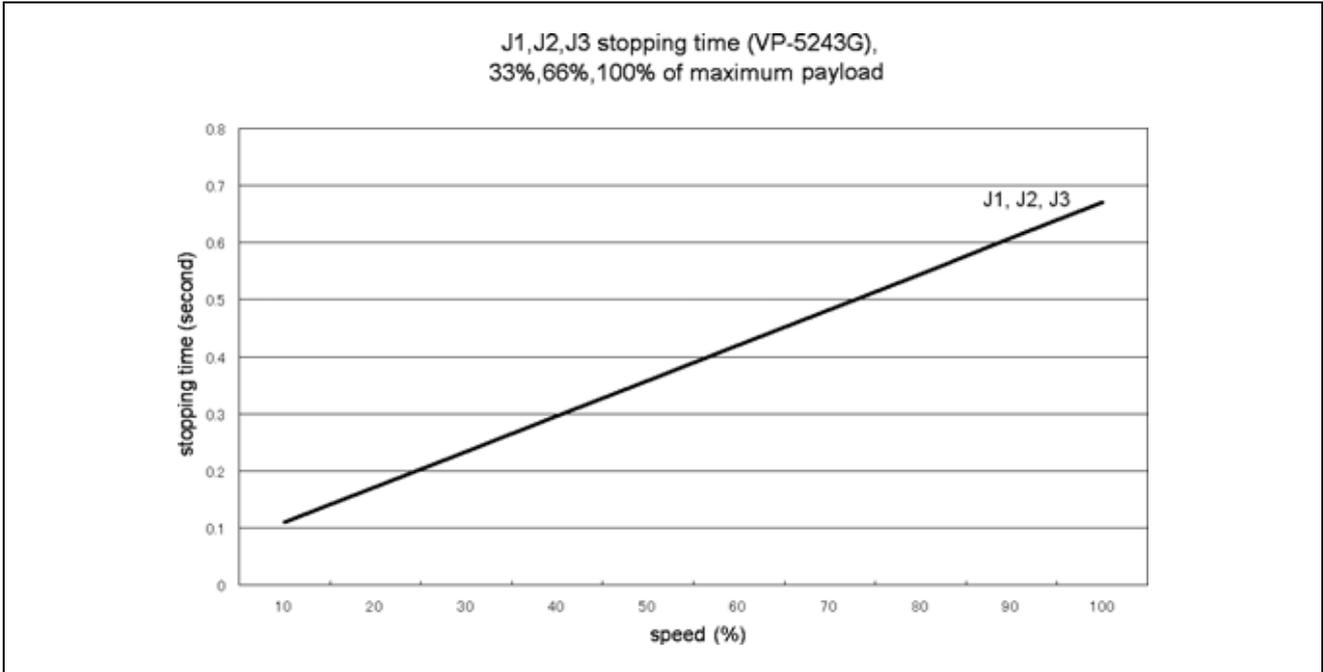
(1) VP-6242G series
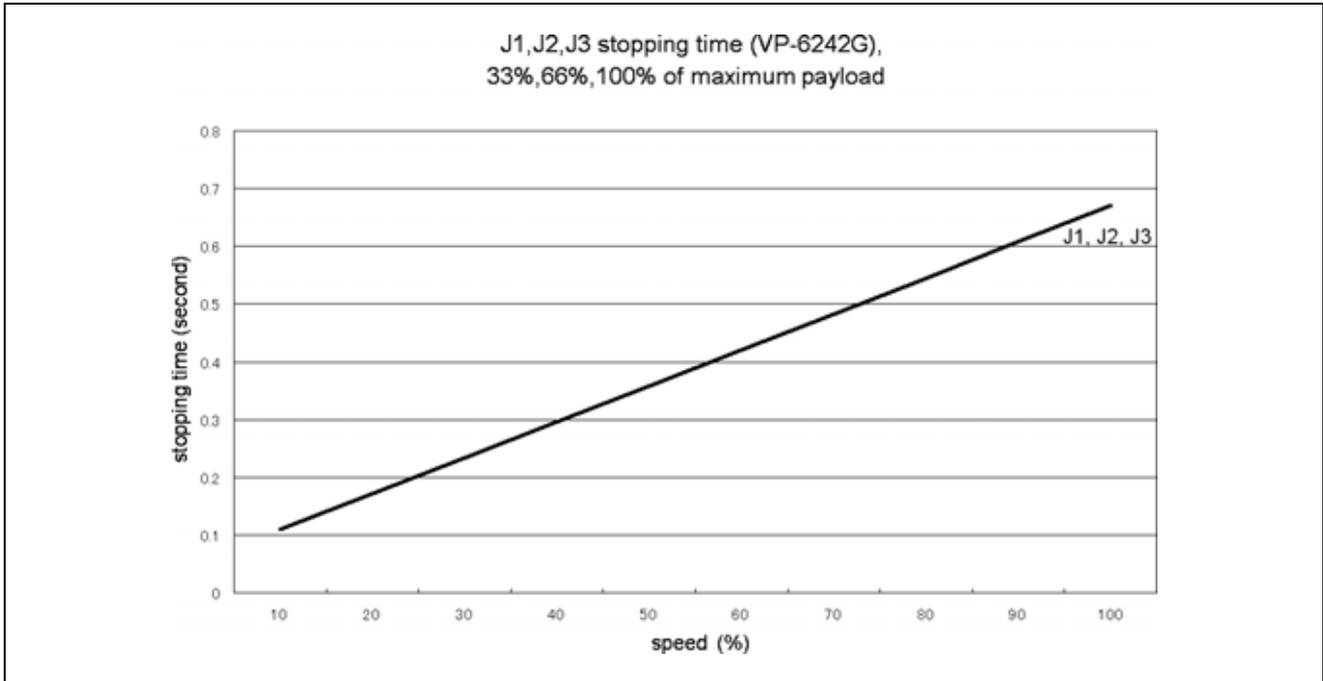
J1, J2, J3 stopping time vs. speed at an emergency stop (VP-6242G)
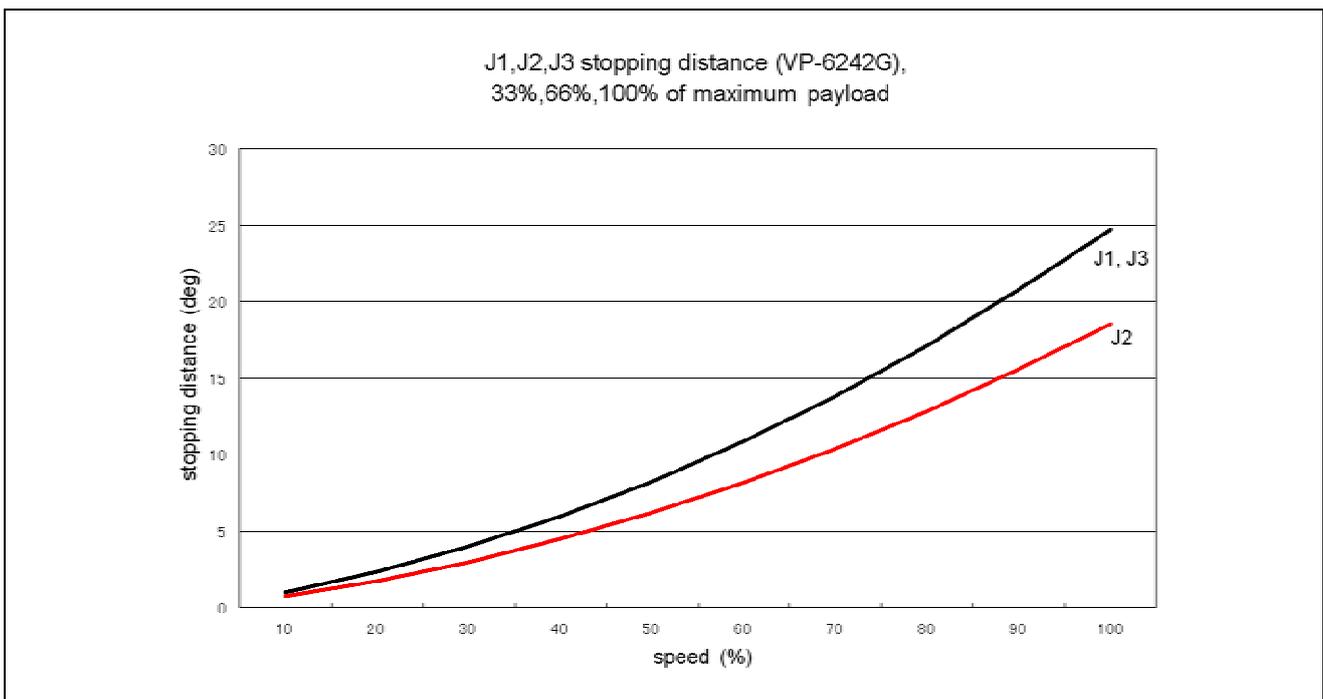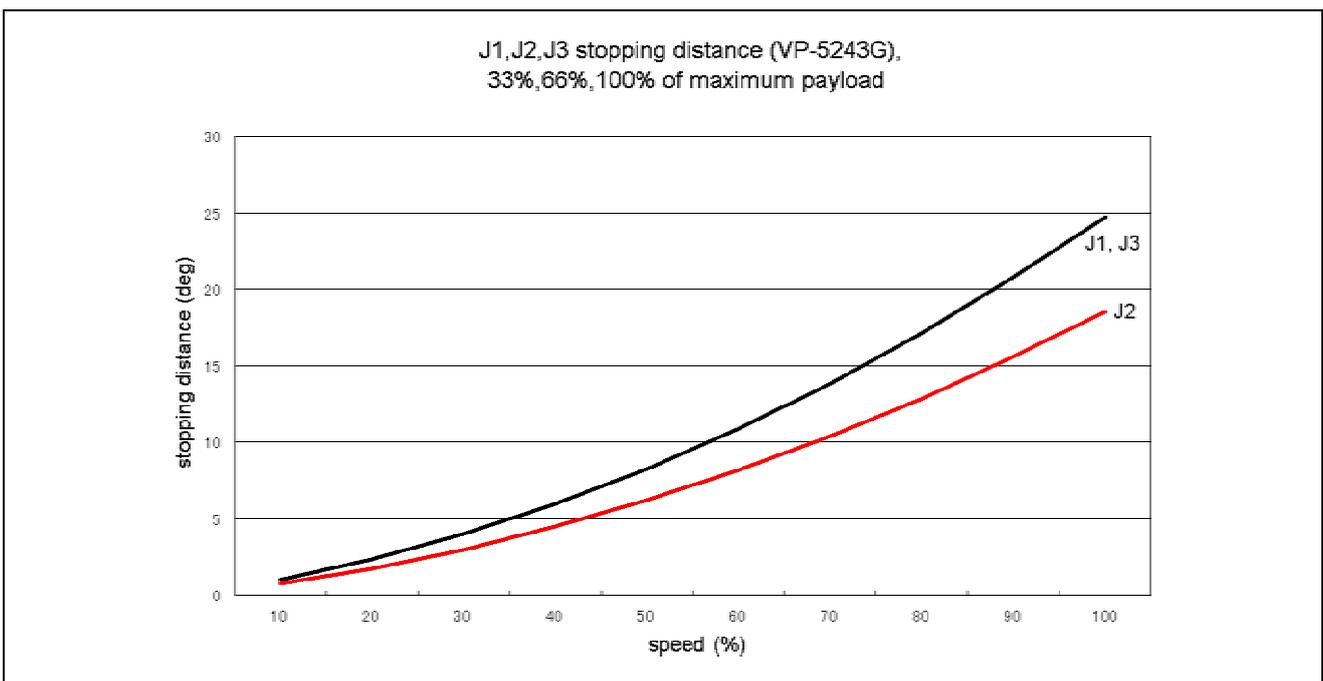

J1, J2, J3 stopping distance vs. speed at an emergency stop (VP-6242G)

(2) VP-5243G series

J1, J2, J3 stopping time vs. speed at an emergency stop (VP-5243G)

J1, J2, J3 stopping distance vs. speed at an emergency stop (VP-5243G)

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Chapter 4
Specifications of the Robot Controller

4.1   Specifications

Table below lists the robot controller specifications.

RC7M Controller Specifications (VP-G-T series)

Item			Specifications
Applicable robot			Mini-sized, vertical articulated type (VP-G-T series)
Model			RC7M-VPG5/6CA-FP
Control system			PTP, CP 3-dimensional linear, 3-dimensional circular
No. of controllable axes			Five or six axes
Drive system			All axes: Full-digital AC servo
Language used			TOYOTA robot language DENSO robot language PAC (conforming to SLIM)
Memory capacity			3.25 MB (equivalent to 10,000 steps, 30,000 points)
Teaching system			1) Remote teaching 2) Numerical input (MDI)
External signals (I/O)	Standard I/O	Mini I/O	Input signals: 8 user open points (PNP) Output signals: 8 user open points (PNP)
		HAND I/O	Input signals: 8 user open points (PNP) Output signals: 8 user open points (PNP)
	PLC	PLC I/O	Available with FL remote I/O
		DLNK-M2	Available with extension unit
		FL-net	Built in TOYOPUC PC10P
		CMP-LNK	Available with extension unit
External communication			RS-232C: 1 line Ethernet: 1 line USB: 2 lines
Extension slot			1 (Two out of three extension slots have been occupied)
Safety circuit			Safety controller in safety category 4
Self-diagnosis function			Overrun, servo error, memory error, input error, etc.
Timer function			0.02 to 10 sec. (in units of 1/60 sec.)
Error display			Error codes will be outputted on the external I/O. Error messages will be displayed in English on the teach pendant.
Cables	Motor & encoder cable (option)		2 m, 4 m, 6 m, 12 m, 20 m (Standard)
	I/O cable (option)		8 m, 15 m (For Mini I/O, HAND I/O, X-LNE1, S ON and X-10A3)
	Power cable		5 m
Environmental conditions (in operation)			Temperature: 0 to 40°C Humidity: 90% RH or less (no condensation allowed)
Power source			Three-phase, 200 VAC-10% to 230 VAC+10%, 50/60 Hz, 1.0 kVA Single-phase, 230 VAC-10% to 230 VAC+10%, 50/60 Hz, 1.0 kVA
I/O power source	External power source to be used		Supply 24 DVC ±10% power externally
Degree of protection			IP20
Weight			Approx. 26 kg (57 lbs)

⚠**WARNING**

- **DO NOT touch fins. Their hot surfaces may cause severe burns.**
- **DO NOT insert fingers or foreign objects into openings. Doing so may cause bodily injury.**
- **Before opening the controller cover and accessing the inside of the controller for maintenance, be sure to turn off the power switch, disconnect the power cable, and wait 3 minutes or more. This is for protecting you from electric shock.**
- **DO NOT connect or disconnect connector to/from the controller while the power switch is on. Doing so may cause electric shock or controller failure.**
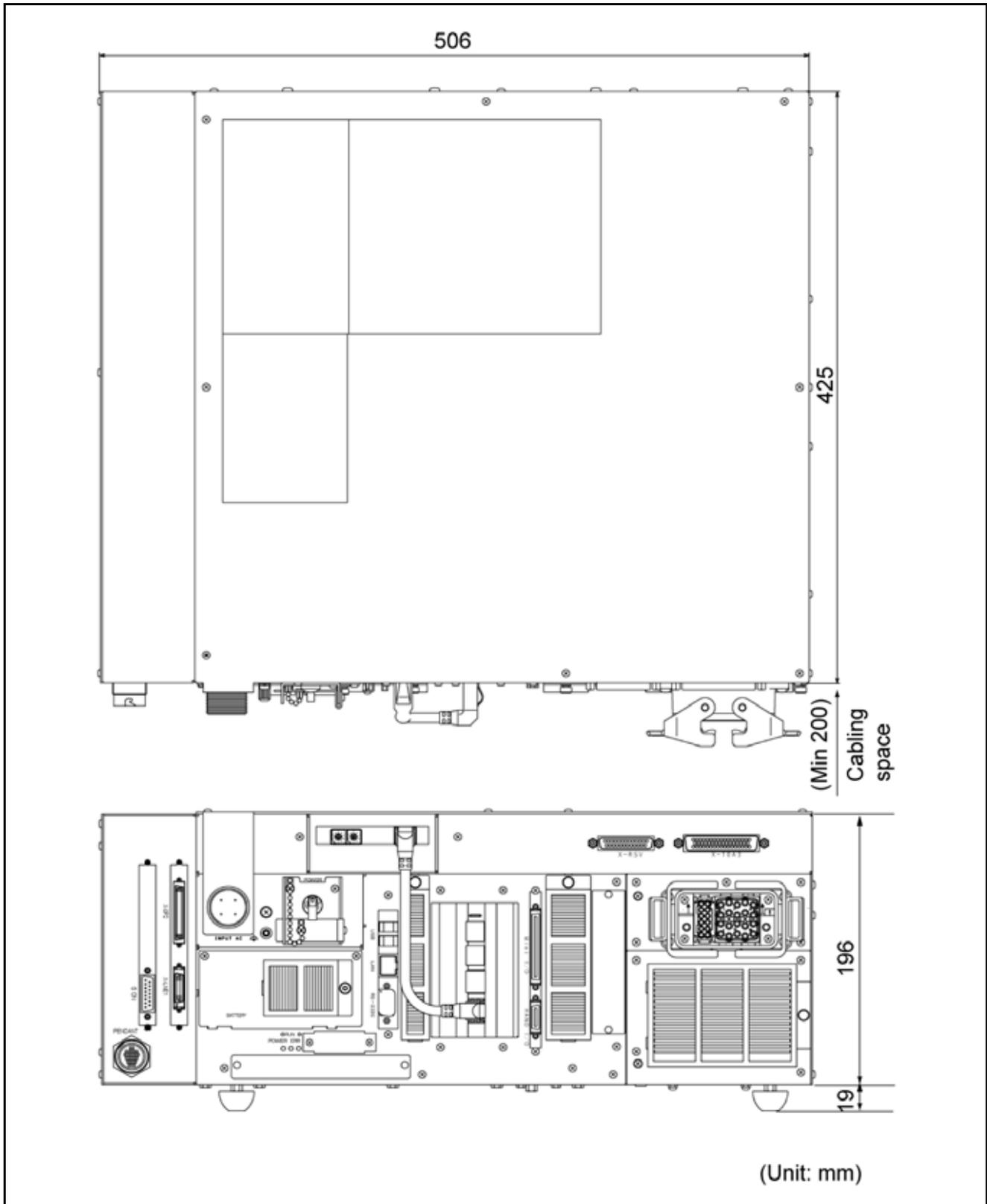
⚠ **CAUTION IN INSTALLATION**

- **This controller is not designed to be dust-proof, splash-proof, or explosion-proof.**
- **Read operation-manuals before installation.**
- **Do not place anything on the controller.**

4.2 Outer Dimensions

Figure below shows the outer dimensions of the robot controller.

Outer Dimensions of Robot Controller (VP-G-T series)

Outer Dimensions of RC7M Robot Controller

4.3   Controller Setting Table

The controller setting table given in Figure below is attached to the controller. It shows the software version, the next replacement dates of the memory backup battery and encoder backup battery, etc.
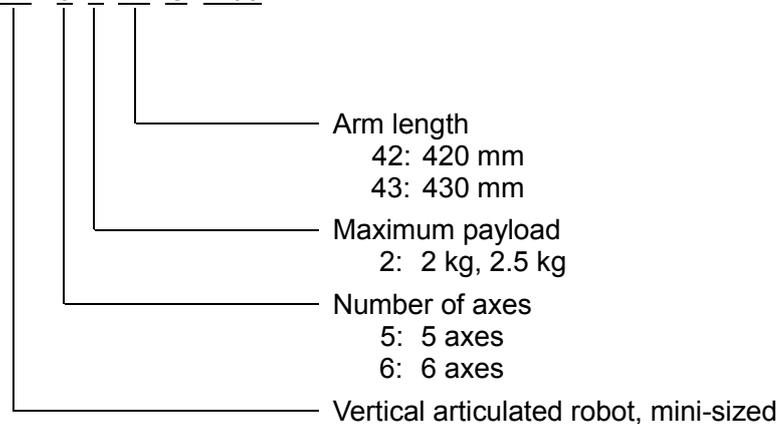
```
コントローラ設定表／THE SETPRM LIST
①パラメータ／PARAMETER
┌─────────────────────────────┐
│ソフトウェアVer.             │
│SOFTWARE Ver.               │
├─────────────────────────────┤
│電池交換日                   │
│DATE OF RENEWING BAT.       │
├─────────────────────────────┤
│TYPE                         │
└─────────────────────────────┘
②サブアッセンブリ／SUBASSEMBLY

 IPM   │SLOT5│  │SLOT6│  │
BOARD  │SLOT3│  │SLOT4│  │
       │SLOT1│  │SLOT2│  │

③その他変更点／OTHER MODIFICATIONS



Robot Controller
MODEL NO.    _____
PART NO.     _____
POWER

CAPACITY     _____
TYP OUTPUT   _____
WEIGHT       _____
CONDITION    _____
SERIAL NO.   _____
YEAR OF PRODUCTION
DENSO WAVE INCORPORATED
4-2-12, TORANOMON MINATO-KU, TOKYO, JAPAN
```

<Content THE SETPRM LIST>

SOFTWARE Ver.	The version of the main software for the controller is entered.
DATE OF RENEWING BAT.	The next replacement dates of the memory backup battery and encoder backup battery are entered.
TYPE	The model of the robot system is entered.
	The coding of the set model is described below:
SUBASSEMBLY	The type and position of the controller IPM board are described.

The coding of the set model (VP-G-T series)

VP - 6 2 42 G -T03

Arm length
        42: 420 mm
        43: 430 mm

Maximum payload
        2: 2 kg, 2.5 kg

Number of axes
        5: 5 axes
        6: 6 axes

Vertical articulated robot, mini-sized

Chapter 5 Warranty

DENSO robots are manufactured under strict quality control. In case of failure, we warranty the robot under the following conditions:

Warranty Period

The warranty shall be effective for one year from the date of purchase.

Warranty Coverage

DENSO WAVE shall repair the robot free of charge when a failure occurs and is attributable to the design, manufacture or material of the robot within the warranty period in spite of proper use.

Items Not Covered

Failures, which arise from one of the following, shall not be covered by the warranty even if the robot is under warranty:

(1) Failures caused by improper repair, modification, transfer or handling by you or a third party;

(2) Failures caused by the use of a part or oil/fat other than those specified in the related manuals;

(3) Failures caused by a fire, salt damage, earthquake, storm/flood or other acts of God;

(4) Failures caused by the use of the robot in an environment other than the environment specified in the related manuals, such as dust and water ingress;

(5) Failures caused by a worn-out consumable, such as a fan filter;

(6) Failures caused by improper performance or non-performance of lubrication, maintenance or inspections stated in this owner's manual; and

(7) Damages other than the robot repair costs.

Vertical Articulated Robot
VP-G-T SERIES

GENERAL INFORMATION ABOUT ROBOT (T03)

The purpose of this manual is to provide accurate information in the handling and operating of the robot. Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual.