DENSO ROBOT

Vertical articulated

VM-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		Remarks (Max. reach nickname)
	Floor-mount	Overhead-mount	
VM-G-T (Medium-sized, vertical articulated)	VM-6083G-W-T03 VM-60B1G-W-T03	Same as left. Same as left.	(VM1000) (VM1300)

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

Note 1: Choose and order 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.
Splash-proof cable	2 m	410141-4420
Splash-proof cable	4 m	410141-3681
Splash-proof cable	6 m	410141-3691
Splash-proof cable	12 m	410141-3701
Splash-proof cable	20 m	410141-4460

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.

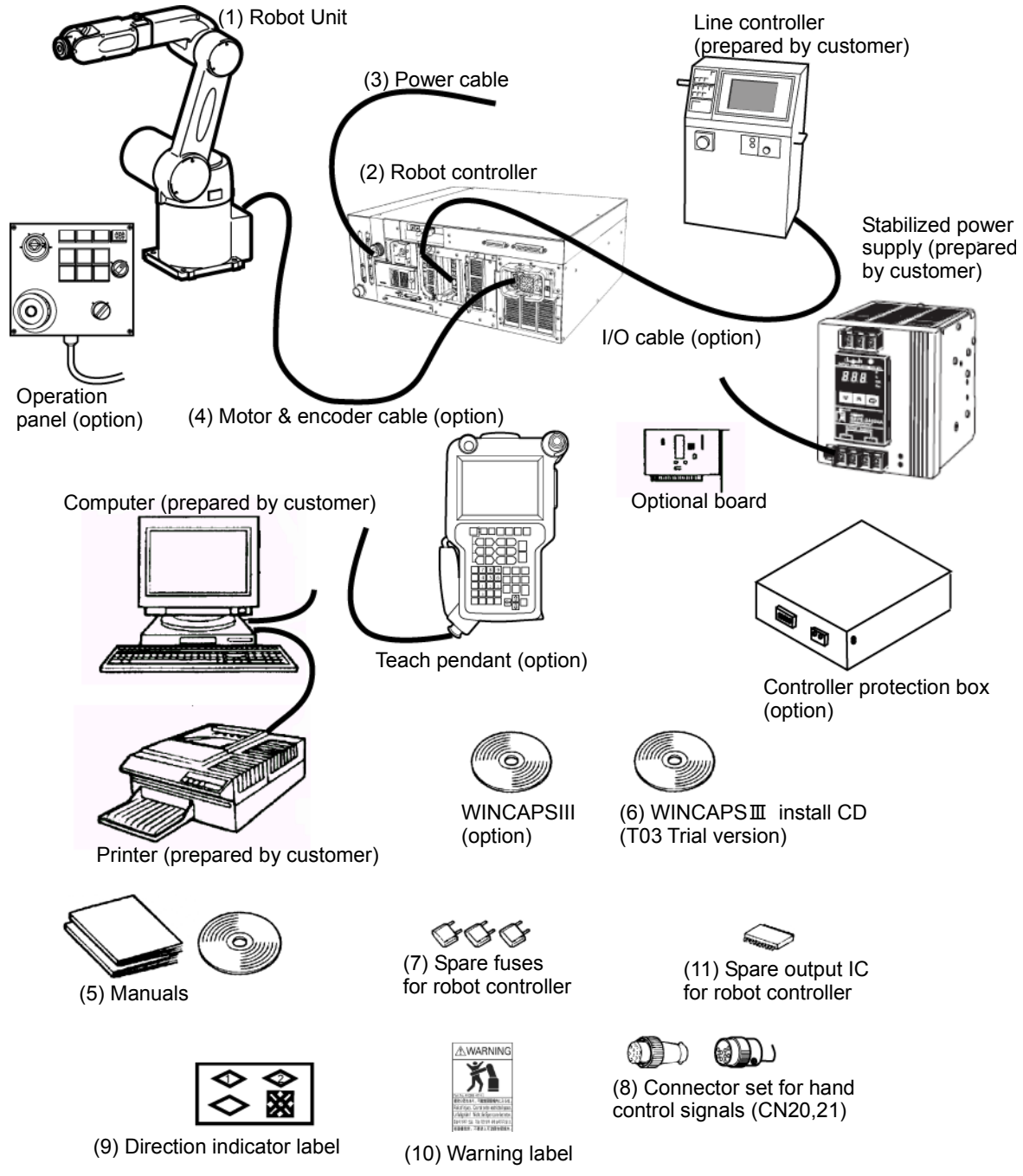
1.2 Optional Components

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.



Note 1: Items (1) to (11) are the standard components listed on page 1.
Note 2: The robot unit and some configurators are illustrated above based on typical models.

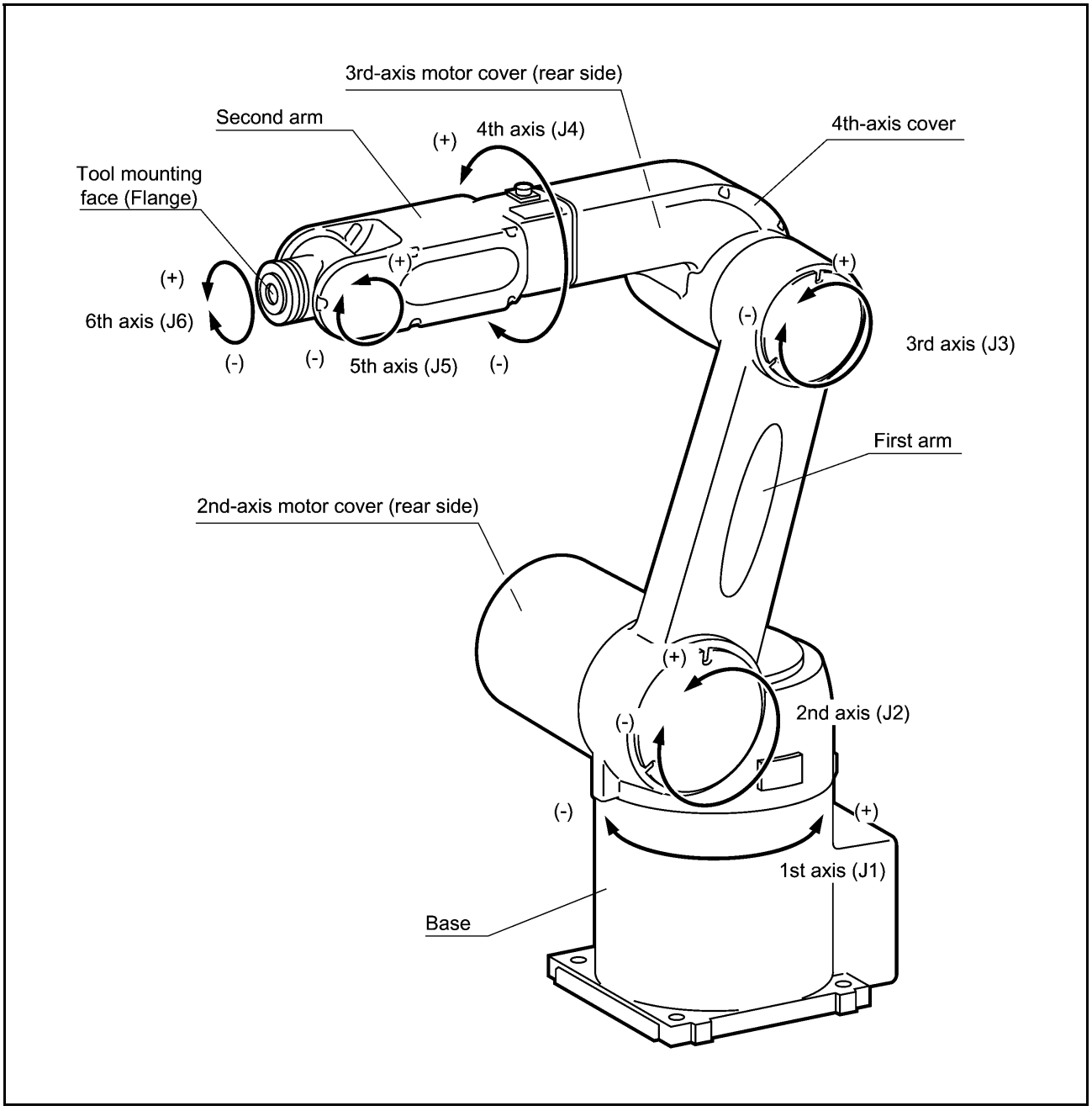
Configurators of the Robot System (VM-G-T series)

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.

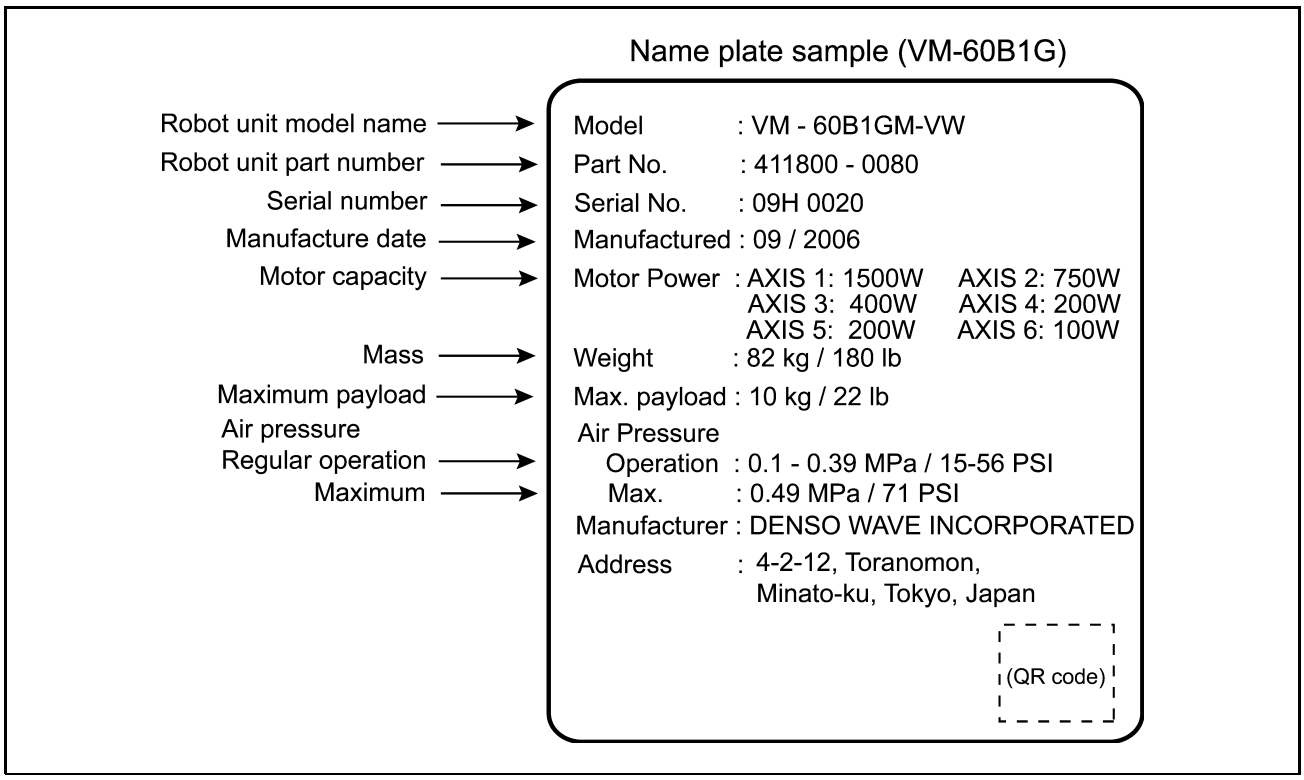
[VM-6083G/VM-60B1G]



Robot Unit Components and Rotation Direction [VM-6083G/VM-60B1G]

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.



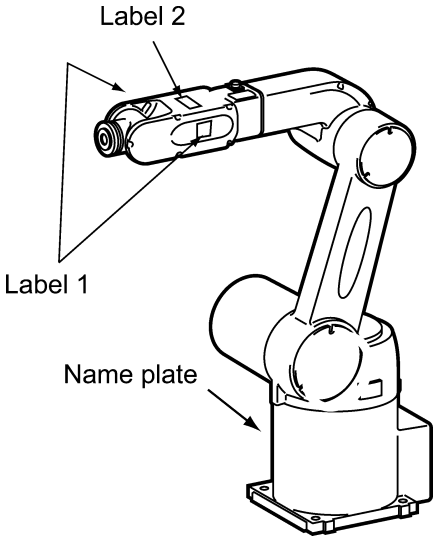
Name Plate Sample (VM-G-T series)

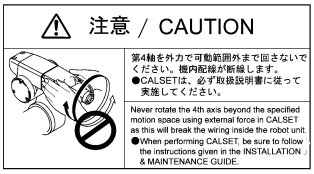
2.2.3 Warning and Caution Labels

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

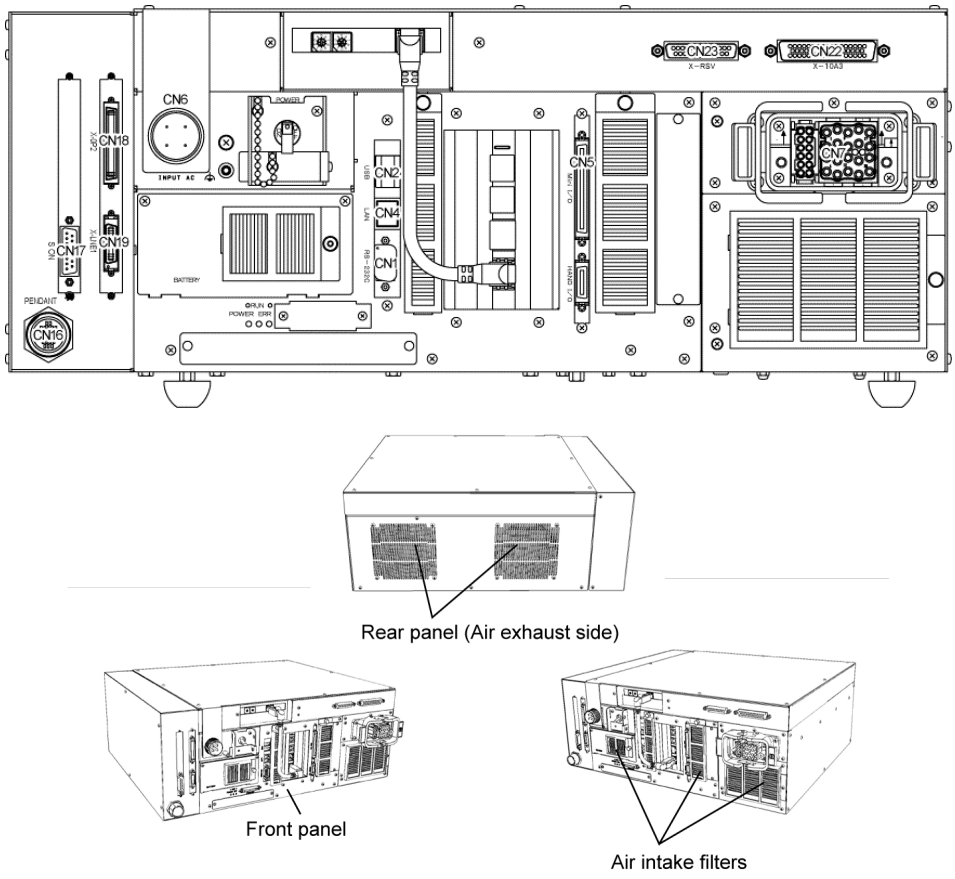


Warning and caution labels on the robot unit	Additional description
Label 1  	Contact with the robot unit which is in motion can cause serious injuries. Observe the following: (1) Never enter the robot's restricted space when the robot is in motion or the motor power is on. (2) When you need to enter 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.
Label 2  	Cautions when performing CALSET. For details, refer to the INSTALLATION & MAINTENANCE GUIDE.

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).



Names of Robot Controller Components

Connectors for the VM-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.)

Chapter 3 Specifications of the Robot Unit

3.1 Robot Specifications (VM-G-T series)

The tables below list the specifications of the VM-G-T series of robot units.

(1) VM-6083GM-VW Robot Unit (Nickname: VM1000)

Item		Specifications
		Dust- & splash-proof type (VM-W)
Model name of robot set **(Note 1)**		VM-6083G-W-T03
Model name of robot unit		VM-6083GM-VW
Overall arm length		385 (first arm) + 445 (second arm) = 830 mm
Arm offset		J1 (swing): 180 mm, J3 (front arm): 100 mm
Maximum workable space		R = 1,111 mm (end-effector mounting face) R = 1,021 mm (Point P: J4, J5, J6 center)
Motion range		J1: ±170°, J2: +135°, -90°, J3: +165°, -80° J4: ±185°, J5: ±120°, J6: ±360°
Maximum payload		10 kg
Maximum composite speed		8300 mm/s (at the center of an end-effector mounting face)
Position repeatability **(Note 2)**		In each of X, Y and Z directions: ±0.05 mm (at the center of an end-effector mounting face)
Maximum allowable inertia moment		Around J4 and J5: 0.36 kgm^2 Around J6: 0.064 kgm^2
Position detection		Absolute encoder
Drive motor and brake		AC servomotors for all joints, Brakes for joints J2 to J6
User air piping **(Note 3)**		7 systems (ϕ4x6, ϕ6x1), 3 solenoid valves(2-position, double solenoid) contained.
User signal line		10 (for proximity sensor signals, etc.)
Air source	Operating pressure	0.10 × MPa to 0.39 × MPa
	Maximum allowable pressure	0.49 × MPa
Airborne noise (A-weighted equivalent continuous sound pressure level)		80 dB or less
Degree of protection		IP54 (Wrist: IP65)
Weight		Approx. 86 kg (189 lbs)

Note 1: The model name of robot set refers to the model name of a complete set including a robot unit and robot controller.

Note 2: Position repeatability is the value at constant ambient temperature.

Note 3: Only the ϕ4x6 air piping system may be controlled by built-in solenoid valves.

(2) VM-60B1GM-VW Robot Unit (Nickname: VM1300)

Item		Specifications
		Dust- & splash-proof type (VM-W)
Model name of robot set **(Note 1)**		VM-60B1G-W-T03
Model name of robot unit		VM-60B1GM-VW
Overall arm length		520 (first arm) + 590 (second arm) = 1,110 mm
Arm offset		J1 (swing): 180 mm, J3 (front arm): 100 mm
Maximum workable space		R = 1,388 mm (end-effector mounting face) R = 1,298 mm (Point P: J4, J5, J6 center)
Motion range		J1: ±170°, J2: +135°, -90°, J3: +165°, -80° J4: ±185°, J5: ±120°, J6: ±360°
Maximum payload		10 kg
Maximum composite speed		8300 mm/s (at the center of an end-effector mounting face)
Position repeatability **(Note 2)**		In each of X, Y and Z directions: ±0.07 mm (at the center of an end-effector mounting face)
Maximum allowable inertia moment		Around J4 and J5: 0.36 kgm^2 Around J6: 0.064 kgm^2
Position detection		Absolute encoder
Drive motor and brake		AC servomotors for all joints, Brakes for joints J2 to J6
User air piping **(Note 3)**		7 systems (φ4x6, φ6x1), 3 solenoid valves(2-position, double solenoid) contained.
User signal line		10 (for proximity sensor signals, etc.)
Air source	Operating pressure	0.10 × MPa to 0.39 × MPa
	Maximum allowable pressure	0.49 × MPa
Degree of protection		IP54 (Wrist: IP65)
Weight		Approx. 88 kg (193 lbs)

Note 1: The model name of robot set refers to the model name of a complete set including a robot unit and robot controller.

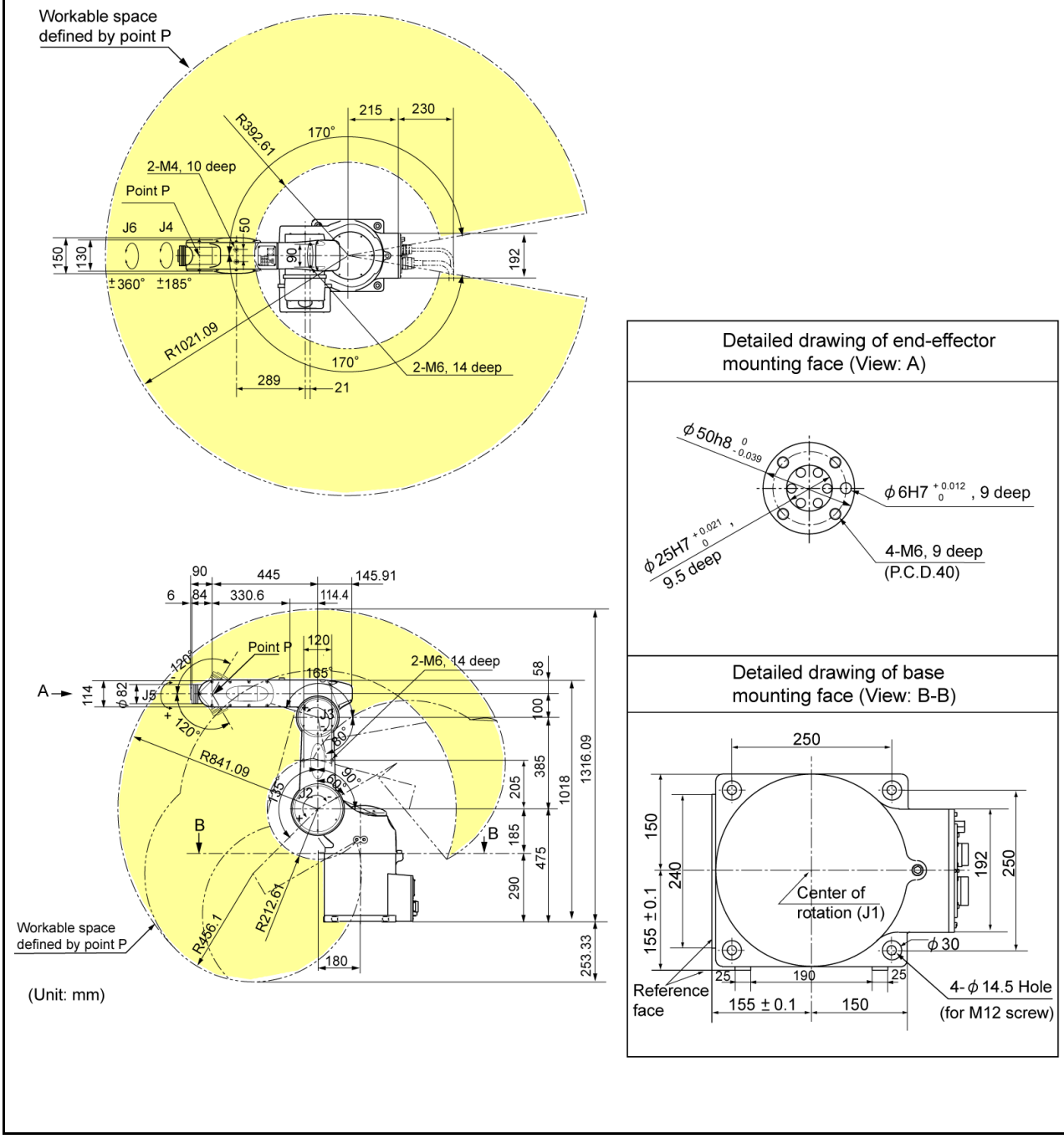
Note 2: Position repeatability is the value at constant ambient temperature.

Note 3: Only the φ4x6 air piping system may be controlled by built-in solenoid valves.

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

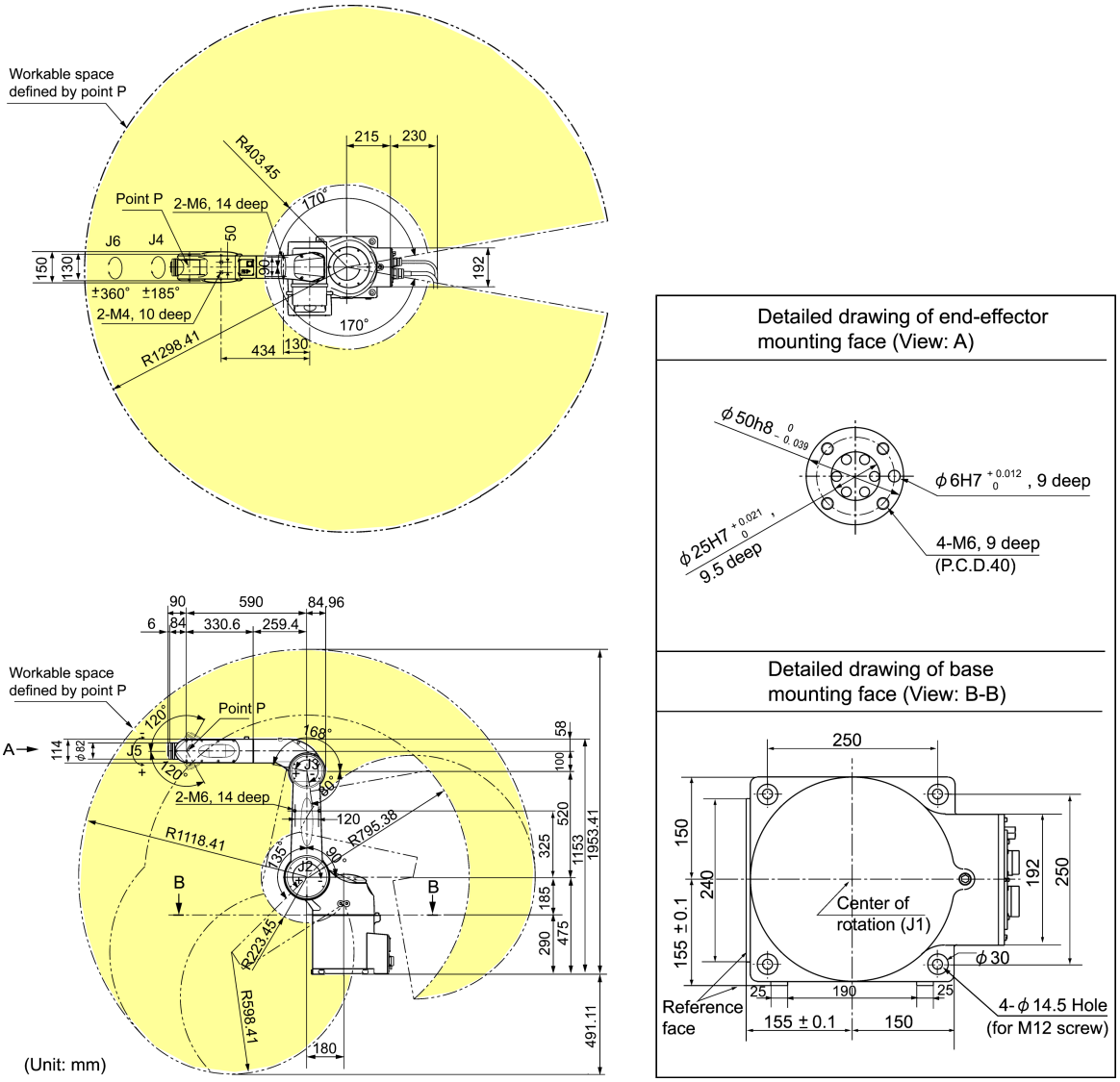
The outer dimensions and workable space of the VM-G-T series are shown on this and the following pages.

(1) VM-6083GM-VW (Dust- & splash-proof type)



Outer Dimensions and Workable Space [VM-6083GM-VW]

(2) VM-60B1GM-VW (Dust- & splash-proof type)



Outer Dimensions and Workable Space [VM-60B1GM-VW]

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

VM-G-T series robot positioning time

1. Following figures show the positioning times used to calculate the cycle time.
2. Positioning time means the time from the start of robot operation to the arrival at the target positioning point.
3. 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.

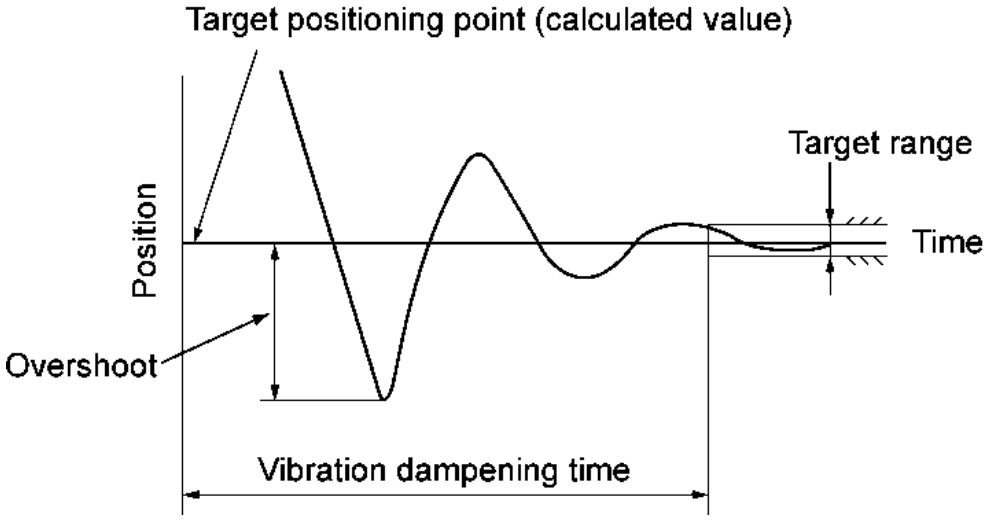
Caution (1) The vibration dampening time depends on factors such as the weight of the end-effector. If the robot is to be used in such a way that it overshoots or if the vibration damping time is of great concern, test the robot carefully beforehand.

(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.**

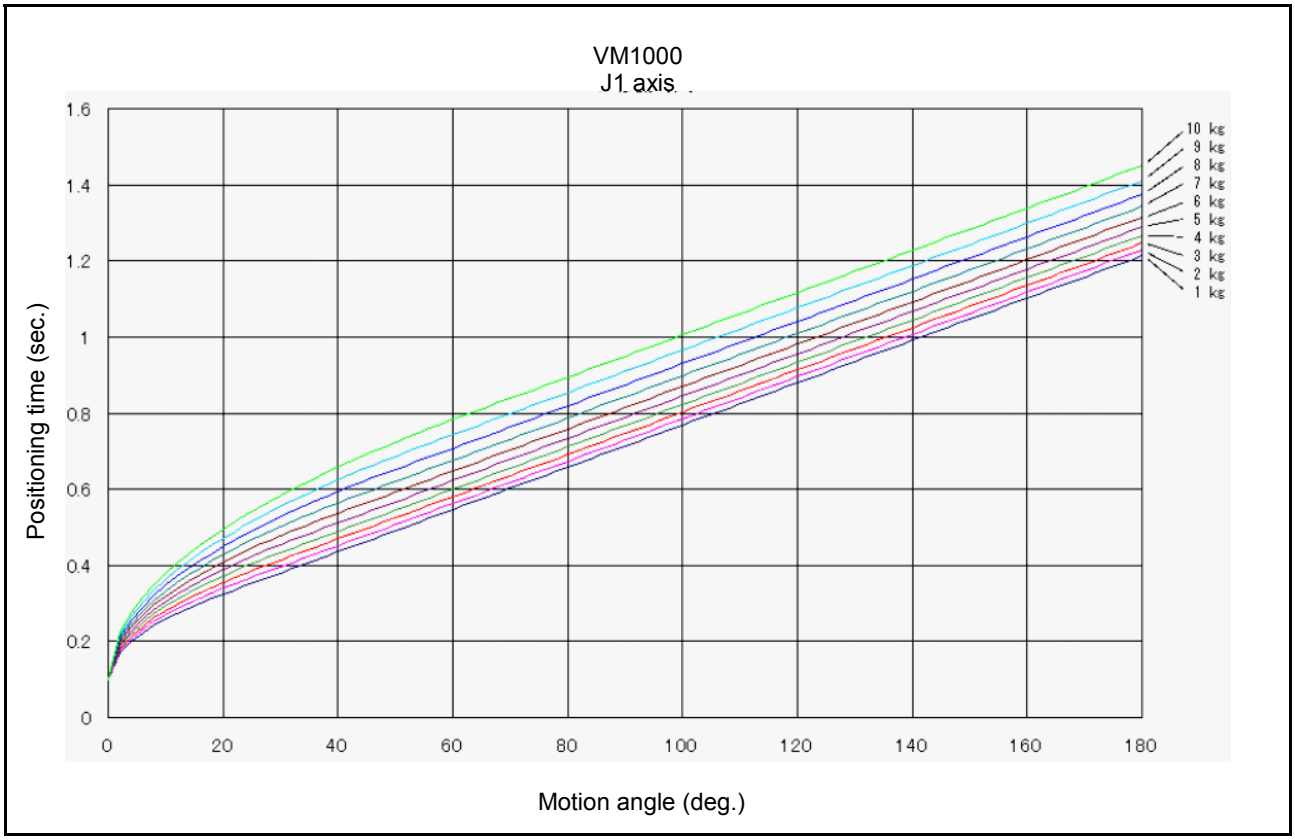
(3) Operate the robot with the optimum load setting in accordance with the end-effector weight and workpiece weight. If not, a robot failure may result.

(4) Whenever the payload is heavier than 7 kg, use the robot with the flanged side of the 6th axis facing down. If the flanged side is not facing down, an over-deviation error (code starts from ERROR6100; the first digit represents the axis number), overcurrent error (code starts from ERROR6120; the first digit represents the axis number) or overload error (code starts from ERROR6170; the first digit represents the axis number) may be displayed.

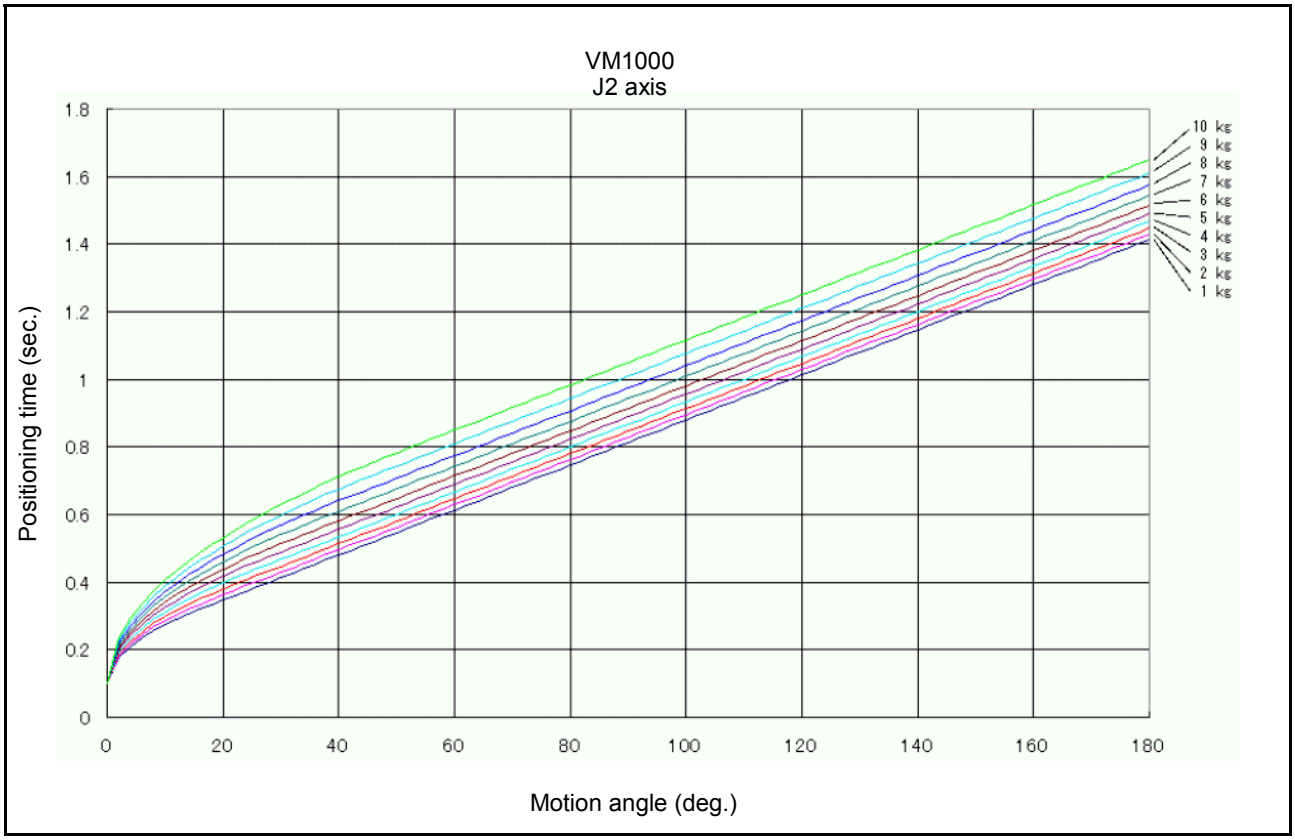


Vibration Dampening Time

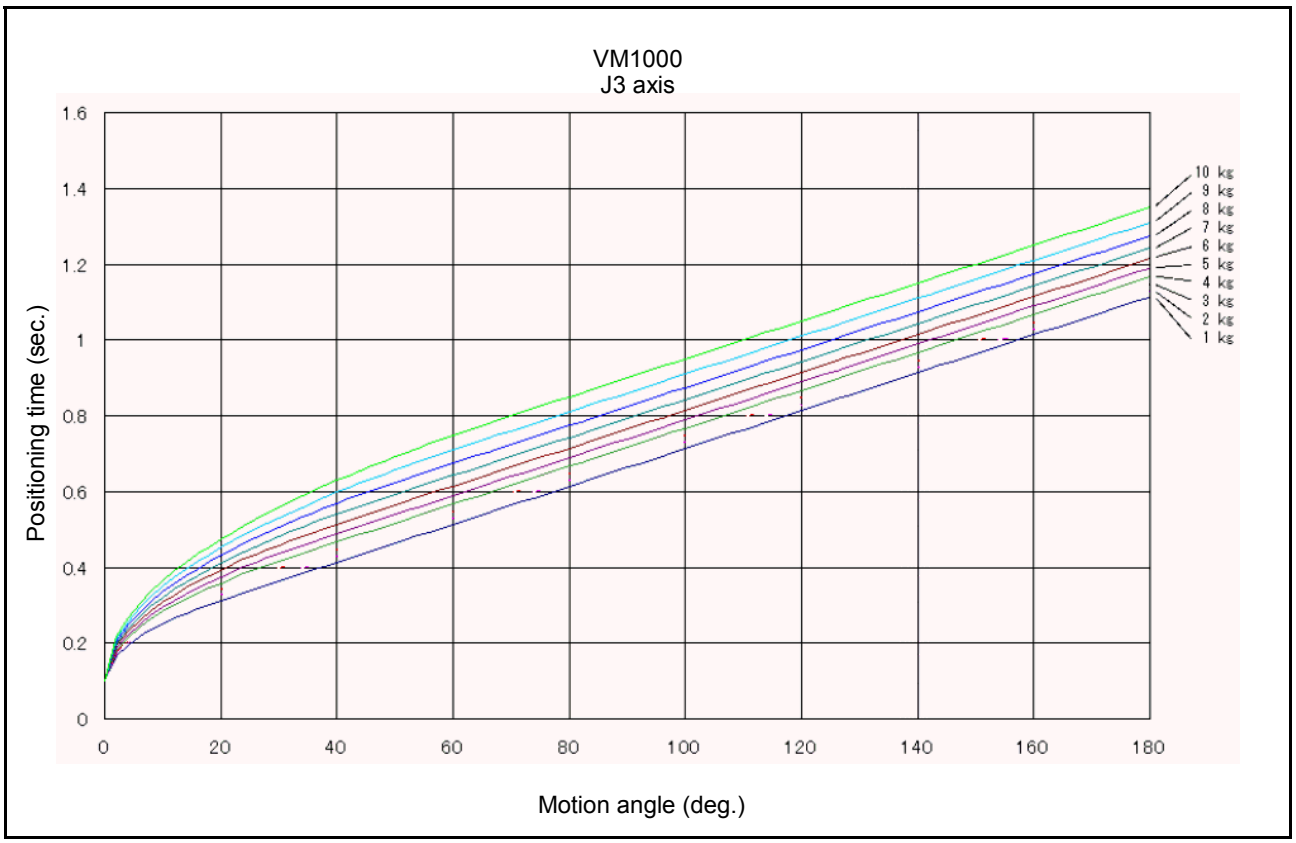
(1) VM-6083G robot positioning time



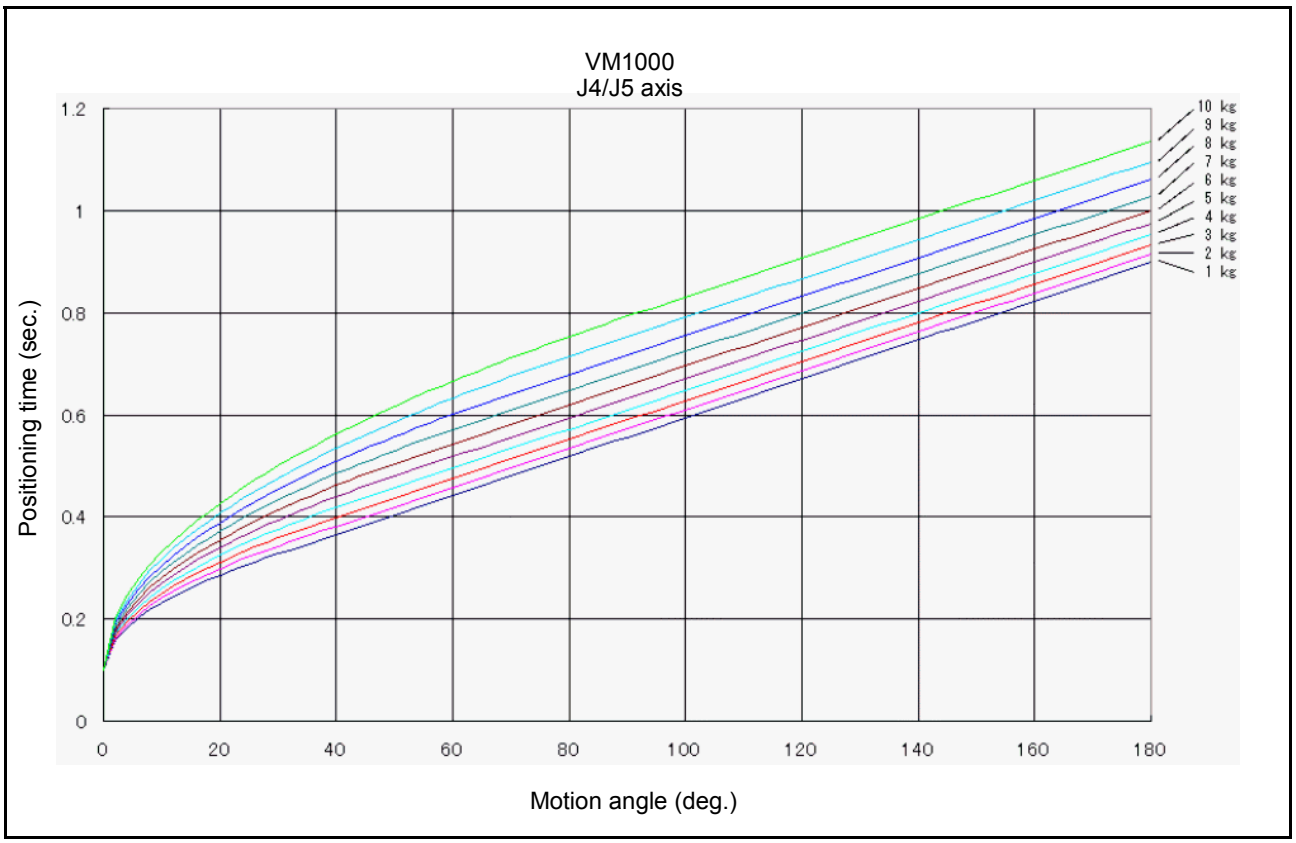
J1 Axis [VM-6083G]



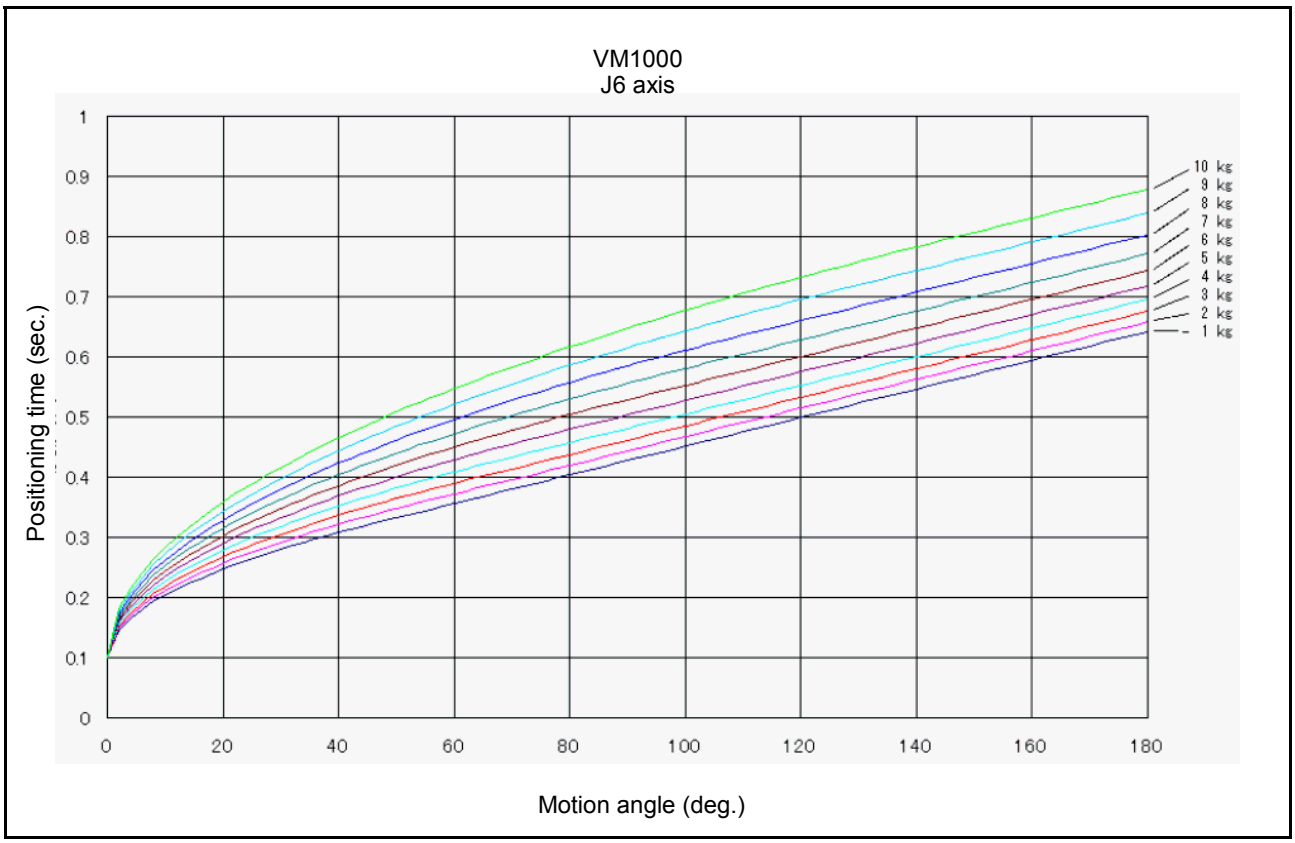
J2 Axis [VM-6083G]



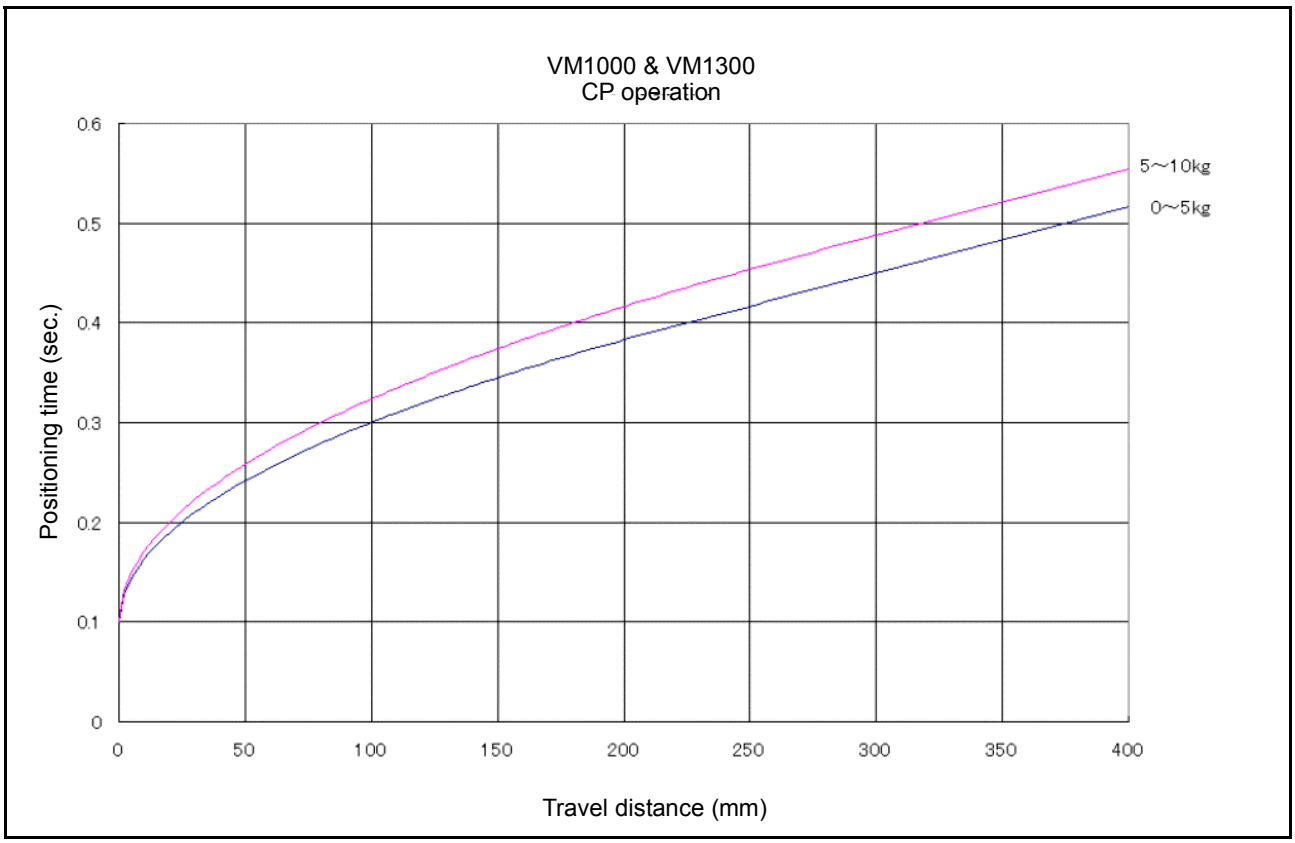
J3 Axis [VM-6083G]



J4/J5 Axis [VM-6083G]

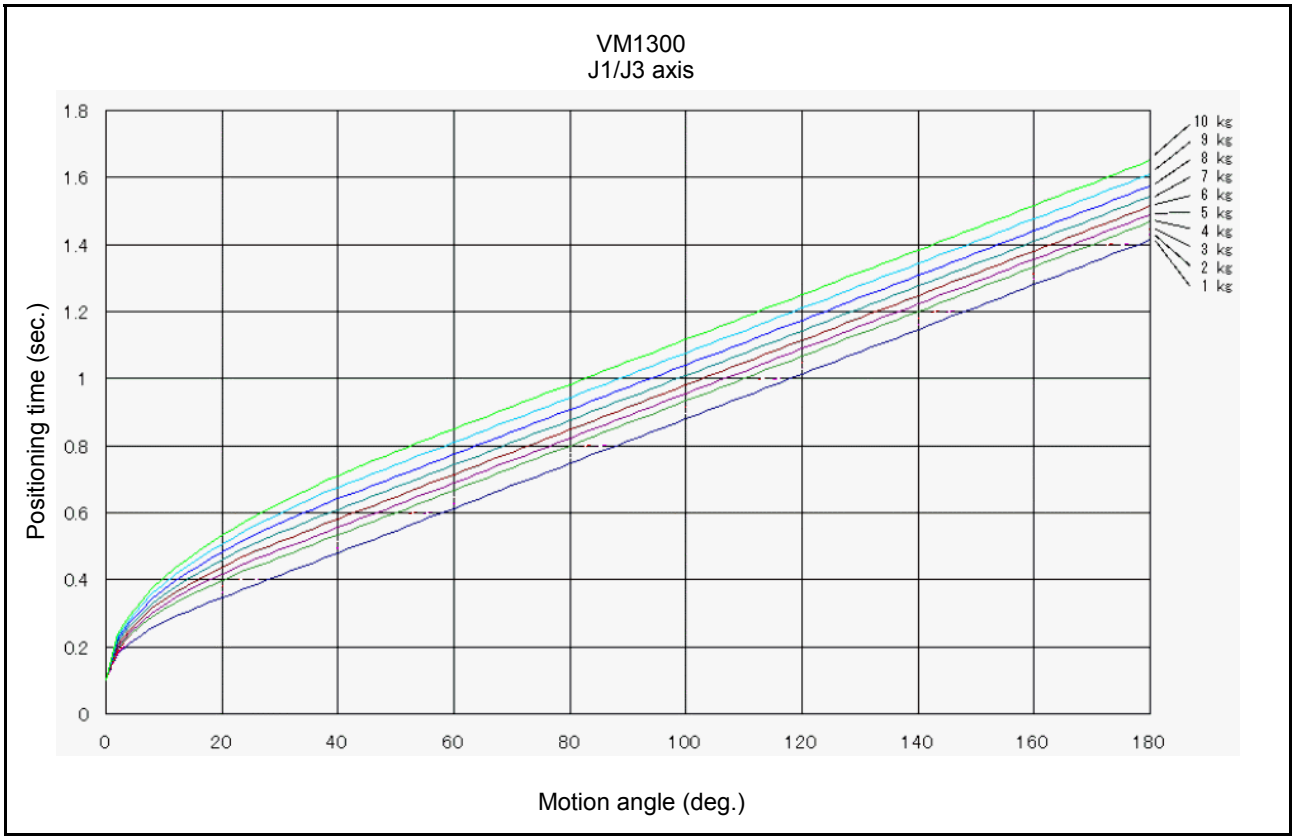


J6 Axis [VM-6083G]

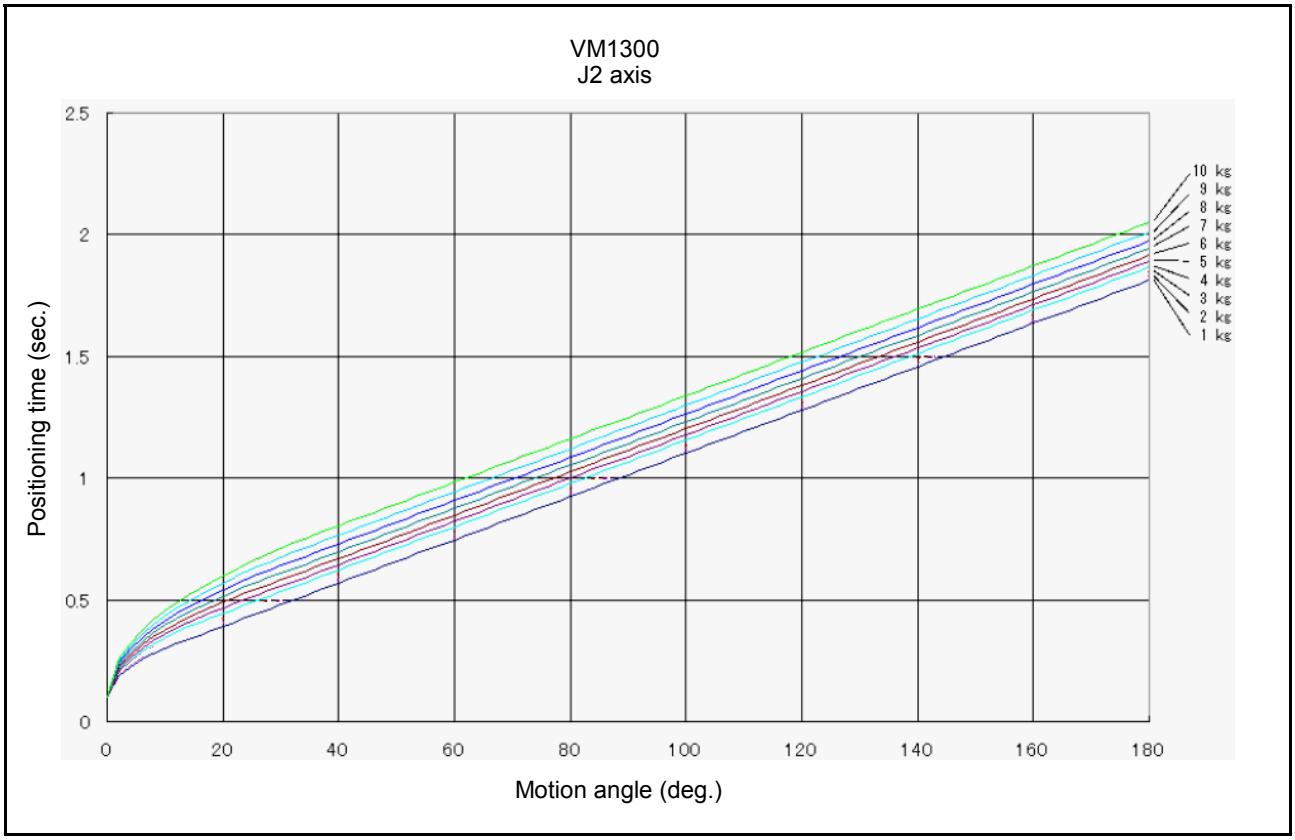


CP Operation [VM-6083G]

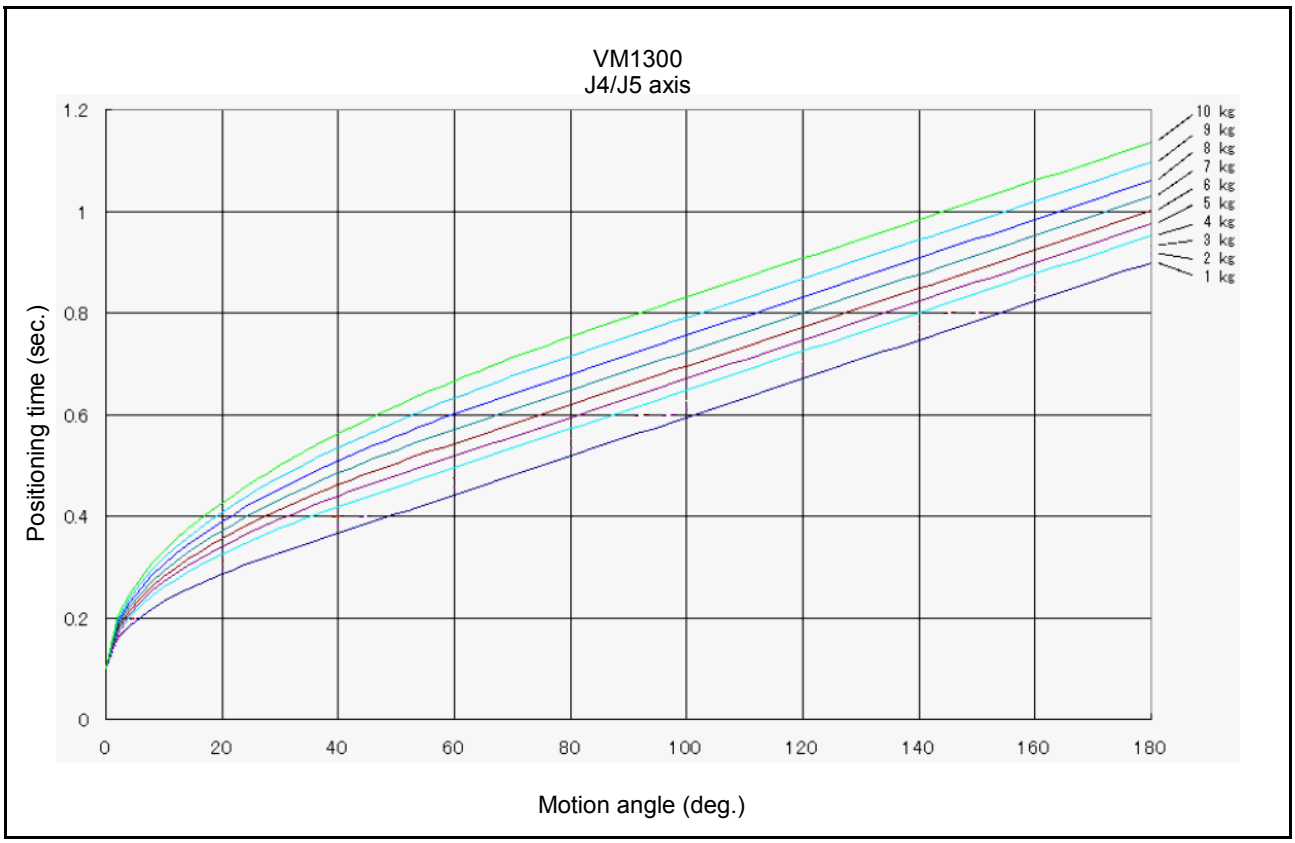
(2) VM-60B1G robot positioning time



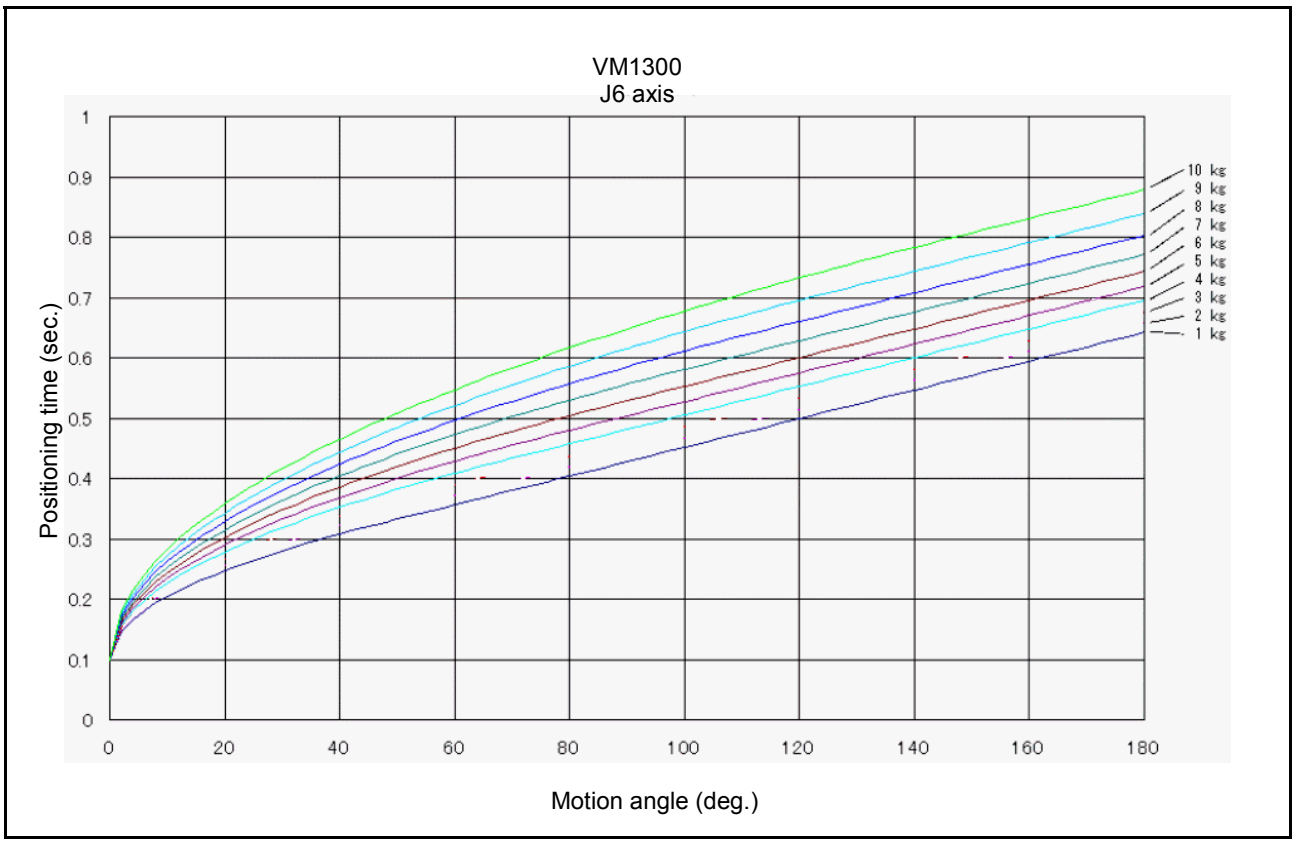
J1/J3 Axis [VM-60B1G]



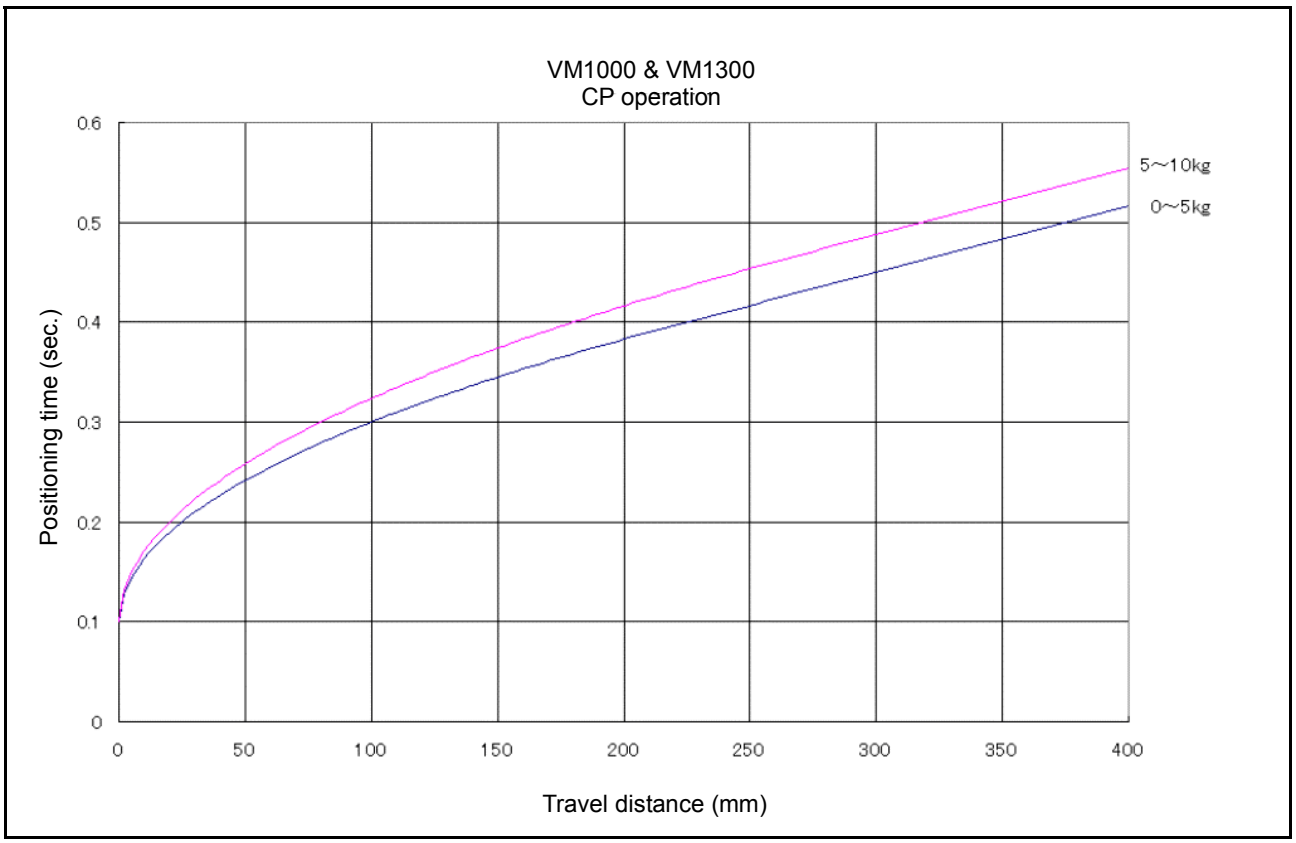
J2 Axis [VM-60B1G]



J4/J5 Axis [VM-60B1G]



J6 Axis [VM-60B1G]

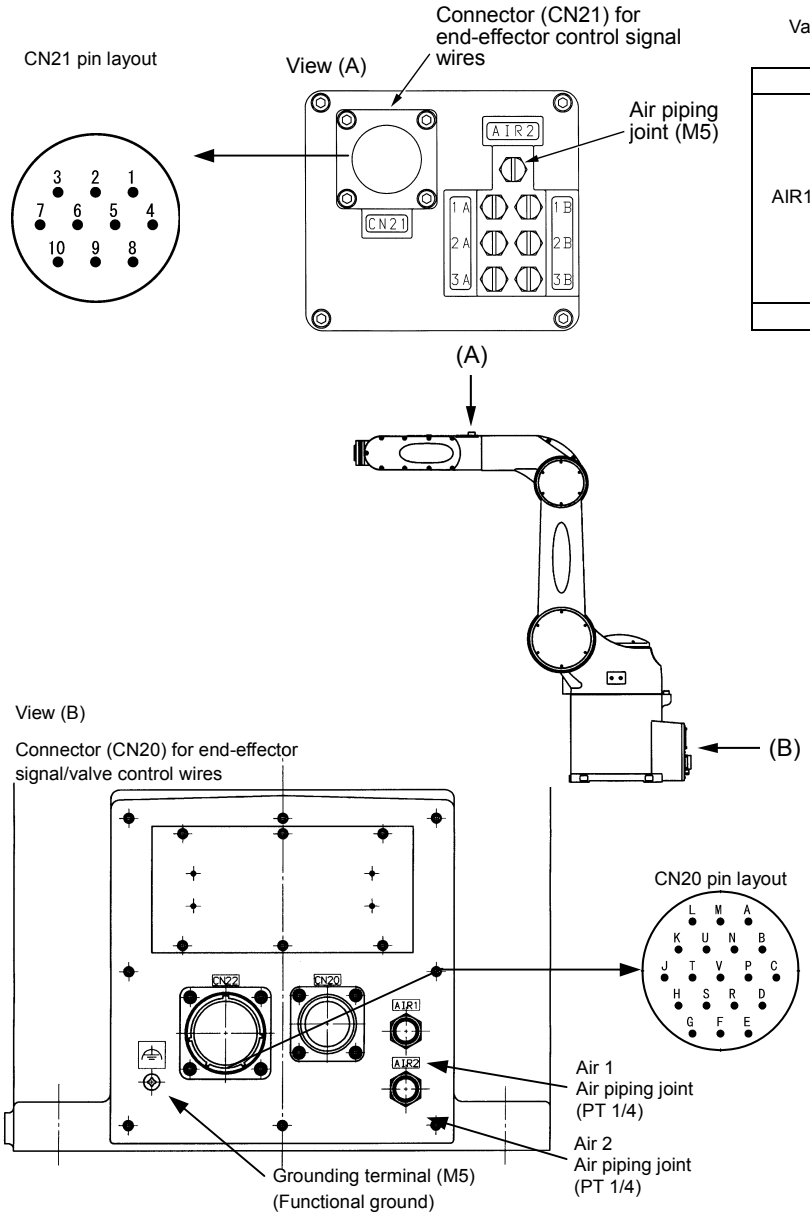


CP Operation [VM-60B1G]

3.4 Air Piping, Signal Wiring, and Solenoid Valve Specifications (VM-G-T series)

The VM-G-T series is equipped with seven air pipes for air chuck, 10 signal lines, and 3 solenoid valves in it. The air piping and signal wiring of the VM-G-T series are shown on this and the following figures.

VM-6083G-W-T03/VM-60B1G-W-T03



Valve Symbols and Air Intake and Exhaust States
(1A and 1B are piping joint symbols.)

Air piping joint			Valve signal		
	Air intake	Exhaust	Solenoid valve	Solenoid	
				A	B
AIR1	1A	1B	1	ON	OFF
	1B	1A	1	OFF	ON
	2A	2B	2	ON	OFF
	2B	2A	2	OFF	ON
	3A	3B	3	ON	OFF
	3B	3A	3	OFF	ON
AIR2					

CN20 Pin Assignment

For controller I/O unit, NPN type (source IN, sink OUT)

CN20 pin No.	Used for:
M	+24V
N	Solenoid 1A (solenoid valve 1)
P	Solenoid 1B (solenoid valve 1)
R	Solenoid 2A (solenoid valve 2)
S	Solenoid 2B (solenoid valve 2)
T	Solenoid 3A (solenoid valve 3)
U	Solenoid 3B (solenoid valve 3)

For controller I/O unit, PNP type (sink IN, source OUT)

CN20 pin No.	Used for:
M	0V
N	Solenoid 1A (solenoid valve 1)
P	Solenoid 1B (solenoid valve 1)
R	Solenoid 2A (solenoid valve 2)
S	Solenoid 2B (solenoid valve 2)
T	Solenoid 3A (solenoid valve 3)
U	Solenoid 3B (solenoid valve 3)

Note 1: Pins A to K on CN21 and pins #1 to #10 on CN20 are connected with each other as shown below. The allowable current per line is 1 A.

CN20	A	B	C	D	E	F	G	H	J	K
CN21	1	2	3	4	5	6	7	8	9	10

Note 2: Use the attached connector sets for CN20 and CN21.

Connector set part No.	Part No.	Model and part name	Appearance
410889-0010	410877-0120 (for CN20)	H/M3106A22-14S (straight plug) HIROSE ELECTRIC CO., LTD.	
	410877-0130 (for CN20)	H/MS3057-12A (cord clamp) HIROSE ELECTRIC CO., LTD.	Applicable wire dia. ϕ11.4-15.9 
	410877-0140 (for CN20)	H/MS3057-12A1 (cord clamp) HIROSE ELECTRIC CO., LTD.	Applicable wire dia. ϕ8-11.6
	410877-0070 (for CN21)	EBLP1610M (L type plug connector) DDK Electronics, Inc.	

Air Piping and Signal Wiring [VM-6083G-W-T03/VM-60B1G-W-T03]

3.4.1 Instructions for Using Splash-proof Connector Sets

The splash-proof connector sets for CN20 and CN21 assure the splash-proofness as long as they are properly assembled and connected.

When using those connector sets, be sure to observe the following notes.

(1) The degree of protection of the splash-proof robot unit, which is specified in Section 3.1 "Robot Specifications," is assured as long as the splash-proof connectors are joined with connectors CN20 and CN21 on the robot unit. If there is no connection on CN20 and CN21, the splash-proof rating is not assured.

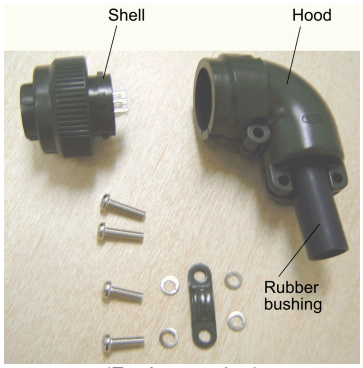
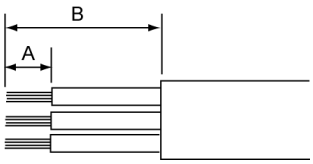
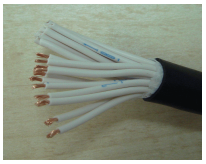
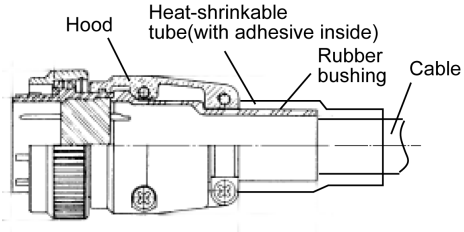
(2) Use a sheathed cable for a splash-proof connector. Using an unsheathed cable cannot assure the splash-proof rating.

(3) Each connector set contains two types of cord clamps for CN20. Use the one that matches the cable diameter.

(4) Each connector set should be assembled according to the instructions specified by the connector manufacturer.

The table below shows an assembly procedure example of a connector set for CN20, 21 The actual assembly procedure should be in accordance with the instructions specified by the connector manufacturer.

Overview of assembly procedure example of connector set for CN20, 21

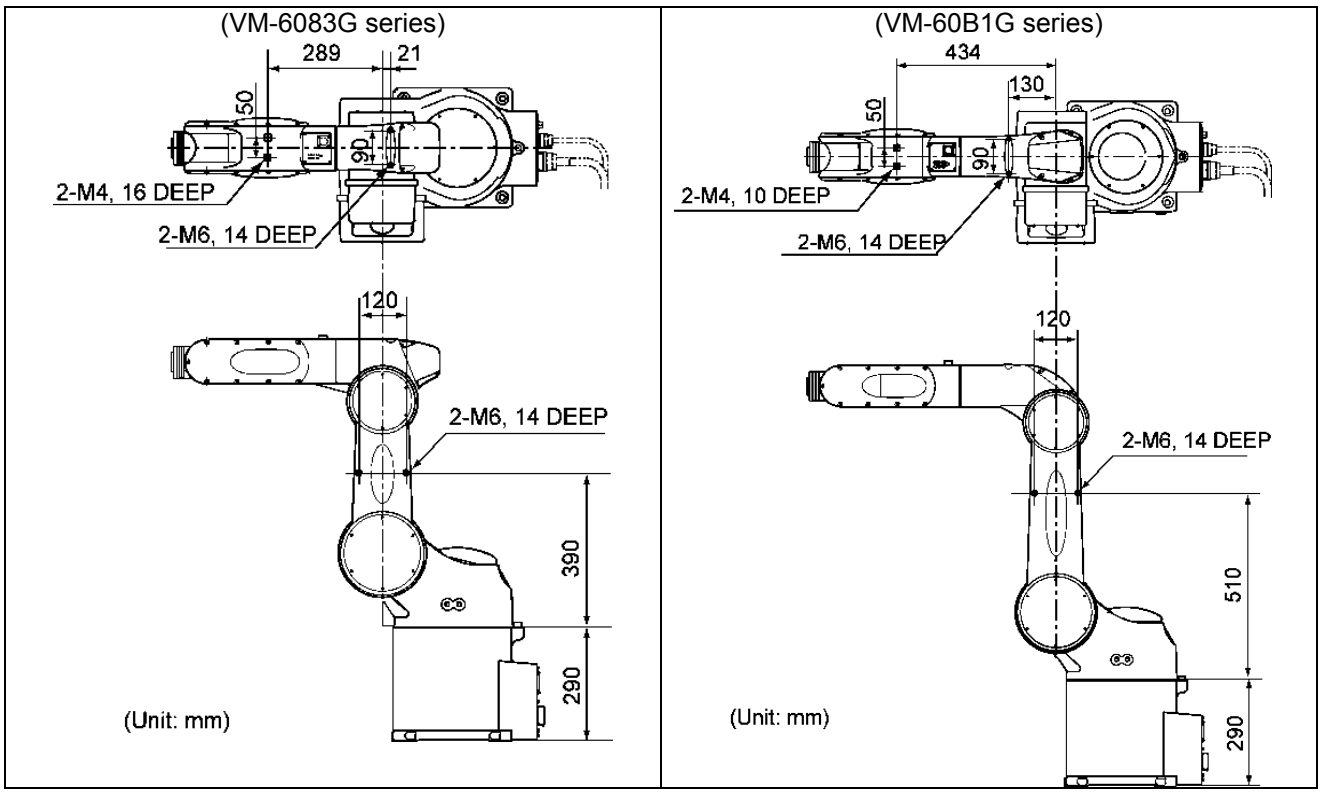
Components of connector set for CN20, 21	Assembly procedure example
 (For straight plug)  (For L type plug)	(1) Treatment of wire ends: Strip the wire ends of the cable (prepared by the customer). The cable diameter and the lengths "A" and "B" should be in accordance with the instructions given by the connector manufacturer.    (2) Tinning: Tin both the core wires and the connector contacts. (3) Pass the cable through the heat-shrinkable tube for splash-proof purpose (with adhesive inside, prepared by the customer) and the rubber bushing. (4) Solder the core wires onto the connector contacts to connect them each other. (5) Press the rubber bushing against the shell to fit the hood. Then cover the rubber bushing with the heat-shrinkable tube and apply heat to shrink the tube.  

3.4.2 Solenoid Valve Specifications

Note: Do not cover the valve exhaust port behind the second arm.

	Item	Specifications
Valve	Switching system	2-position double
	Applicable fluid	Air
	Operating system	Pilot type
	Effective cross section (Cv value)	P→A/B : 1.98mm^2(0.11) A/B→R : 1.80mm^2(0.10)
	Lubrication	Oilless
	Operating pressure range	0.1 to 0.7 MPa (Note 1)
	Response time	10 ms or less (at 0.5 MPa)
	Maximum operating frequency	10 Hz
	Ambient temperature	-5 to 50°C (No dew condensation allowed. When dry air is used)
Solenoid	Operating voltage	24 V ±10%
	Power consumption (current)	0.65 W (27 mA)
	Surge voltage protection circuit	Diode
Note 1: The air source connected to the robot unit must be used within the operating pressure range from 0.05 to 0.35 MPa (specified in Chapter 3 "Specifications of the Robot Unit").		

3.4.3 Original Thread Holes for Wiring and Piping



Existing Internal Threads for Wiring and Piping (VM-G-T series)

3.5 Precautions When Designing the End-effectors (VM-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.**

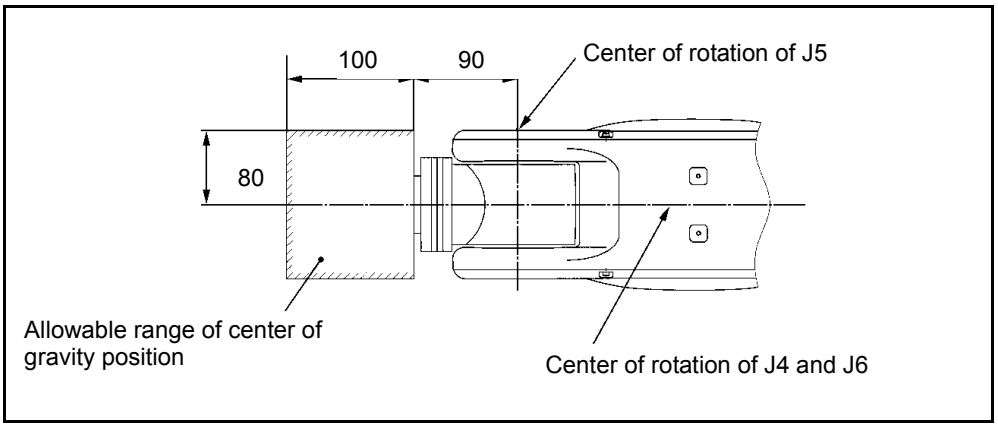
(1) Mass of end-effector

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

Maximum total mass of end-effector (including workpiece) ≤ Maximum payload capacity (10 kg)

(2) Center of gravity position of end-effector

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



Allowable Range of Center of Gravity Position [VM-G-T series]

(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

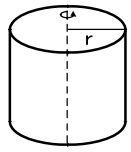
Mass of payload (kg)	Max allowable moment of inartia (kgm^2)	
	Around J4 & J5	Around J6
～1	0.04	0.006
～2	0.07	0.013
～3	0.11	0.019
～4	0.14	0.026
～5	0.18	0.032
～6	0.22	0.038
～7	0.25	0.045
～8	0.29	0.051
～9	0.32	0.058
～10	0.36	0.064

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 (VM-G-T series)

1. Cylinder (1)

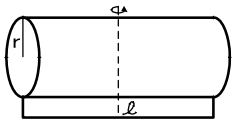
(Axis of rotation = Center axis)



$$I = \frac{mr^2}{2}$$

2. Cylinder (2)

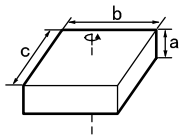
(The axis of rotation passes through the center of gravity.)



$$I = \frac{m}{4}\left(r^2 + \frac{\ell^2}{3}\right)$$

3. Rectangular parallelepiped

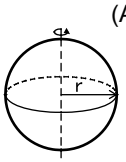
(The axis of rotation passes through the center of gravity.)



$$I = \frac{m}{12}(b^2 + c^2)$$

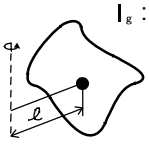
4. Sphere

(Axis of rotation = Center axis)



$$I = \frac{2mr^2}{5}$$

5. Center of gravity not on the axis of rotation



I_g : Inertia moment around center of gravity [kgm^2]

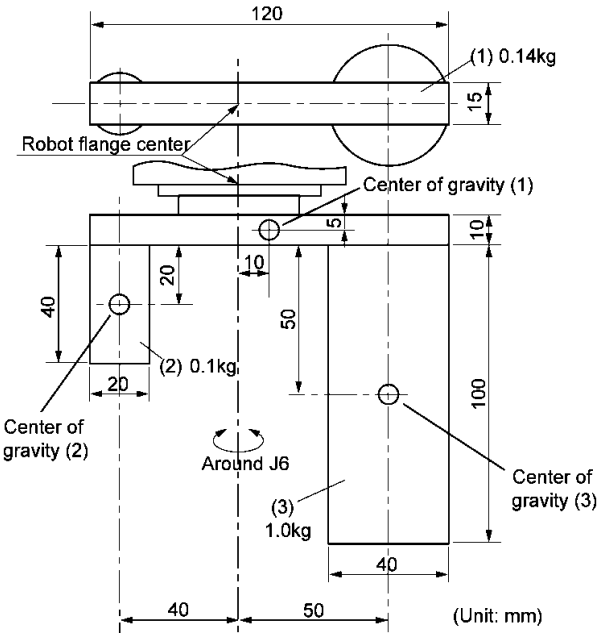
$$I = I_g + m\ell^2$$

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)

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

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)

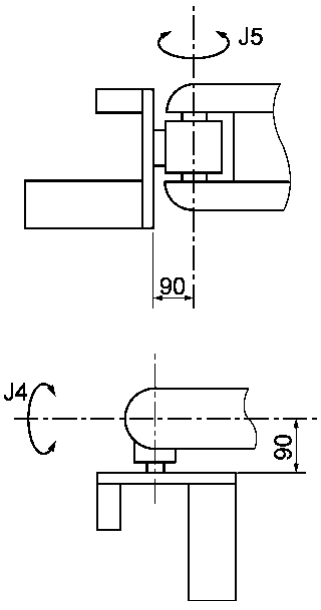
$$I_3 = \frac{1.0 \times 0.02^2}{2} + 1.0 \times 0.05^2 = 2.7 \times 10^{-3} \quad [kgm^2]$$

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 following figure, 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)

$$I_1 = \frac{0.14}{12}(0.015^2 + 0.01^2) + 0.14 \times (0.09 + 0.005)^2 = 1.3 \times 10^{-3} \quad [kgm^2]$$

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

$$I_2 = \frac{0.1}{4}\left(0.01^2 + \frac{0.04^2}{3}\right) + 0.1 \times (0.09 + 0.01 + 0.02)^2 = 1.46 \times 10^{-3} \quad [kgm^2]$$

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

$$I_3 = \frac{1.0}{4}\left(0.02^2 + \frac{0.1^2}{3}\right) + 1.0 \times (0.09 + 0.01 + 0.02)^2 = 2.3 \times 10^{-2} \quad [kgm^2]$$

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

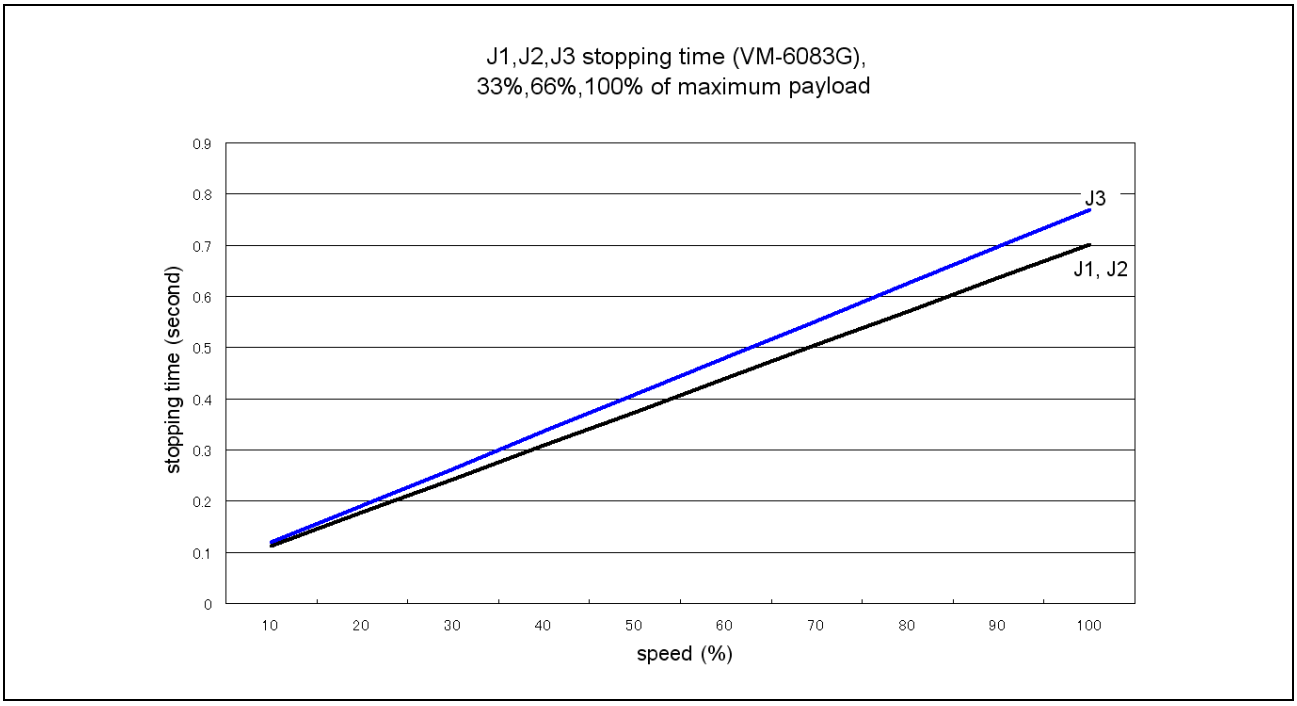
$$I_{J4} = I_{J5} = I_1 + I_2 + I_3 = 2.6 \times 10^{-2} \quad [kgm^2]$$

End-effector Moment of Inertia Calculation Example (VM-G-T series)

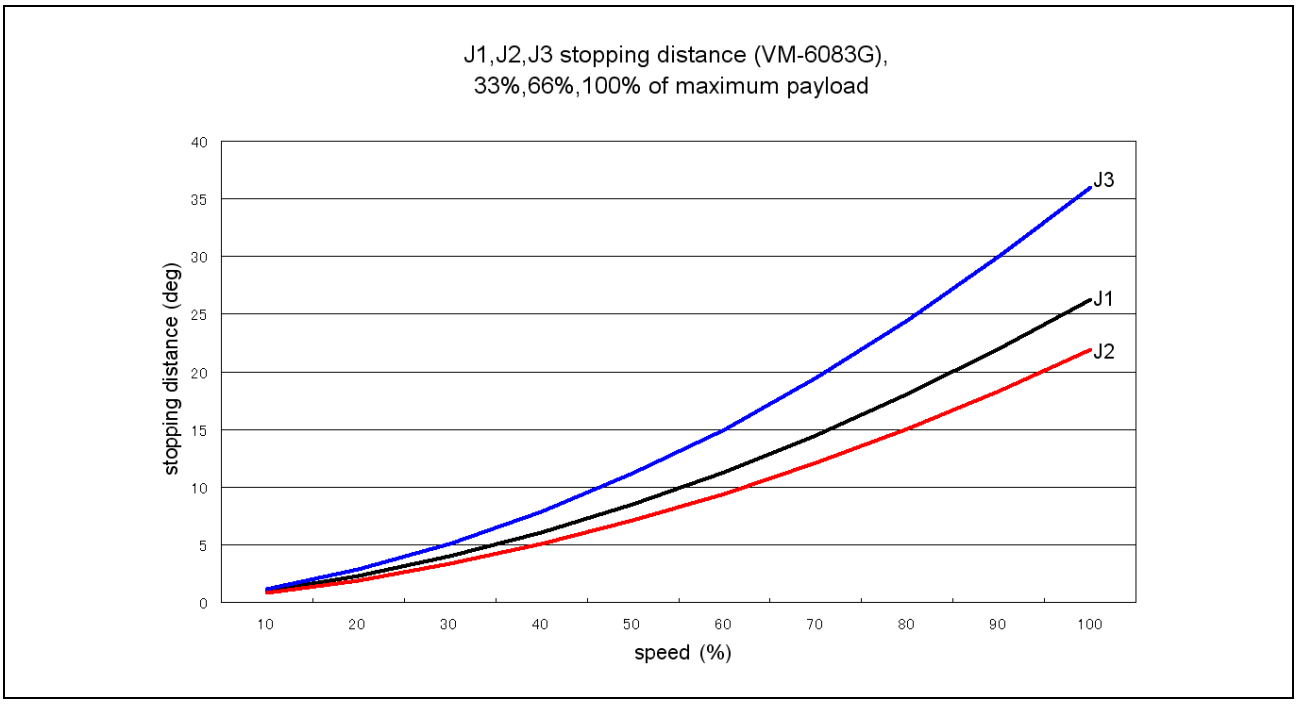
3.6 Stopping Time and Distance (Angle) at an Emergency Stop

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) VM-6083G-T series

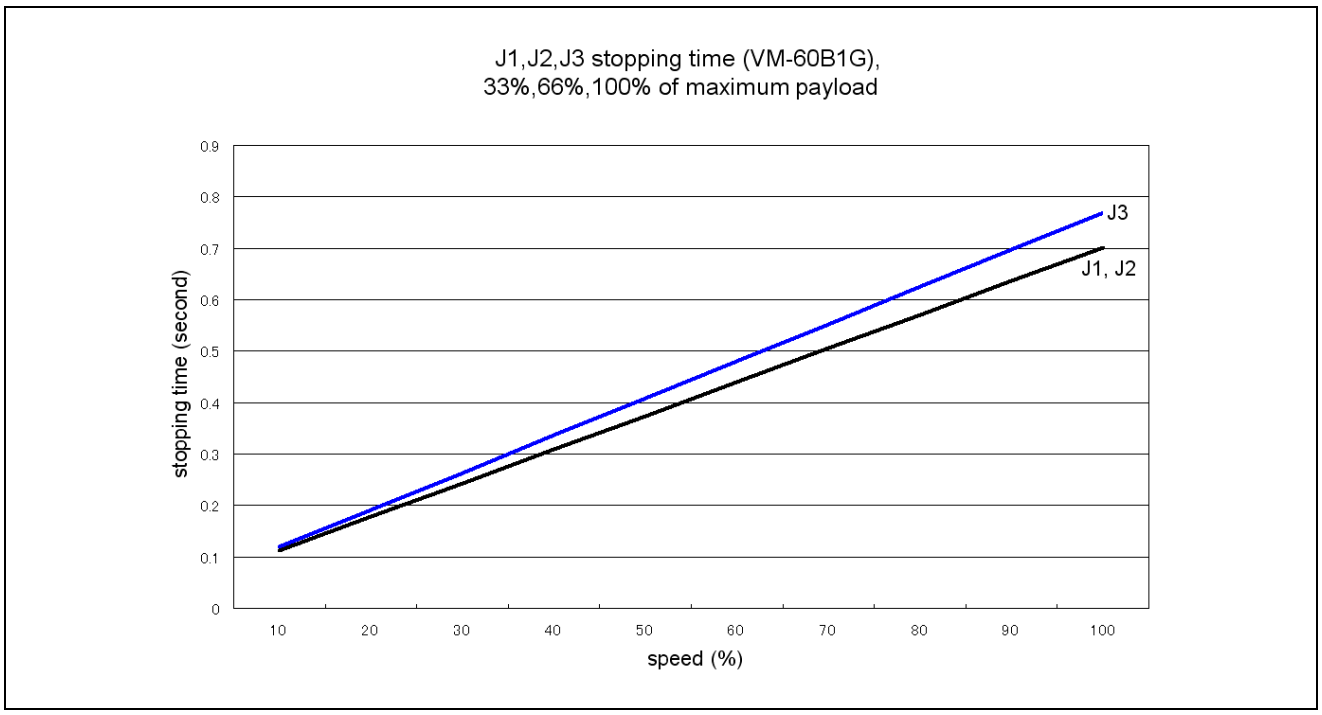


J1, J2, J3 stopping time vs. speed at an emergency stop (VM-6083G)

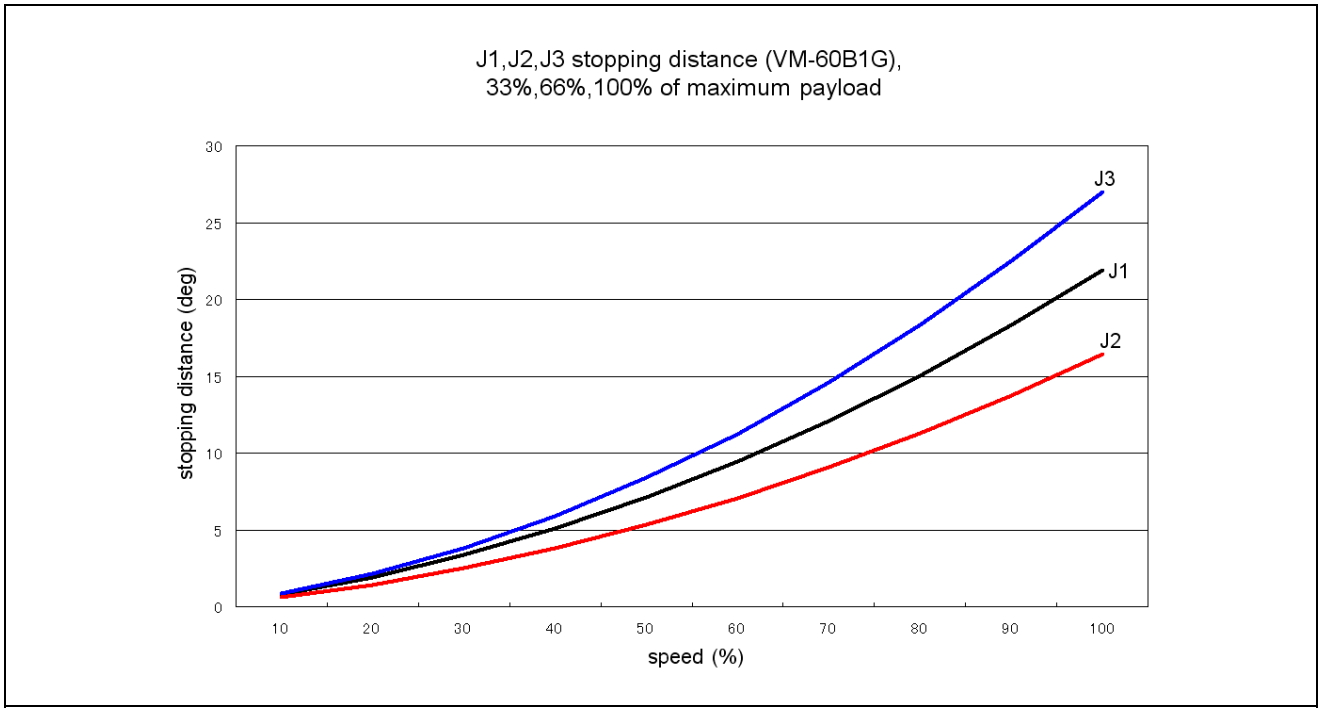


J1, J2, J3 stopping distance vs. speed at an emergency stop (VM-6083G)

(2) VM-60B1G-T series



J1, J2, J3 stopping time vs. speed at an emergency stop (VM-60B1G)



J1, J2, J3 stopping distance vs. speed at an emergency stop (VM-60B1G)

Chapter 4
Specifications of the Robot Controller

4.1 Specifications

The table below lists the specifications of the robot controller.

RC7M Controller Specifications (VM-G-T series)

Item			Specifications
Applicable robot			Medium-sized, vertical articulated type (VM-G-T series)
Model			RC7M-VMG6BA-FP-3AD
Control system			PTP, CP 3-dimensional linear, 3-dimensional circular
No. of controllable axes			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 (Splash-proof)
	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, 3.3 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)

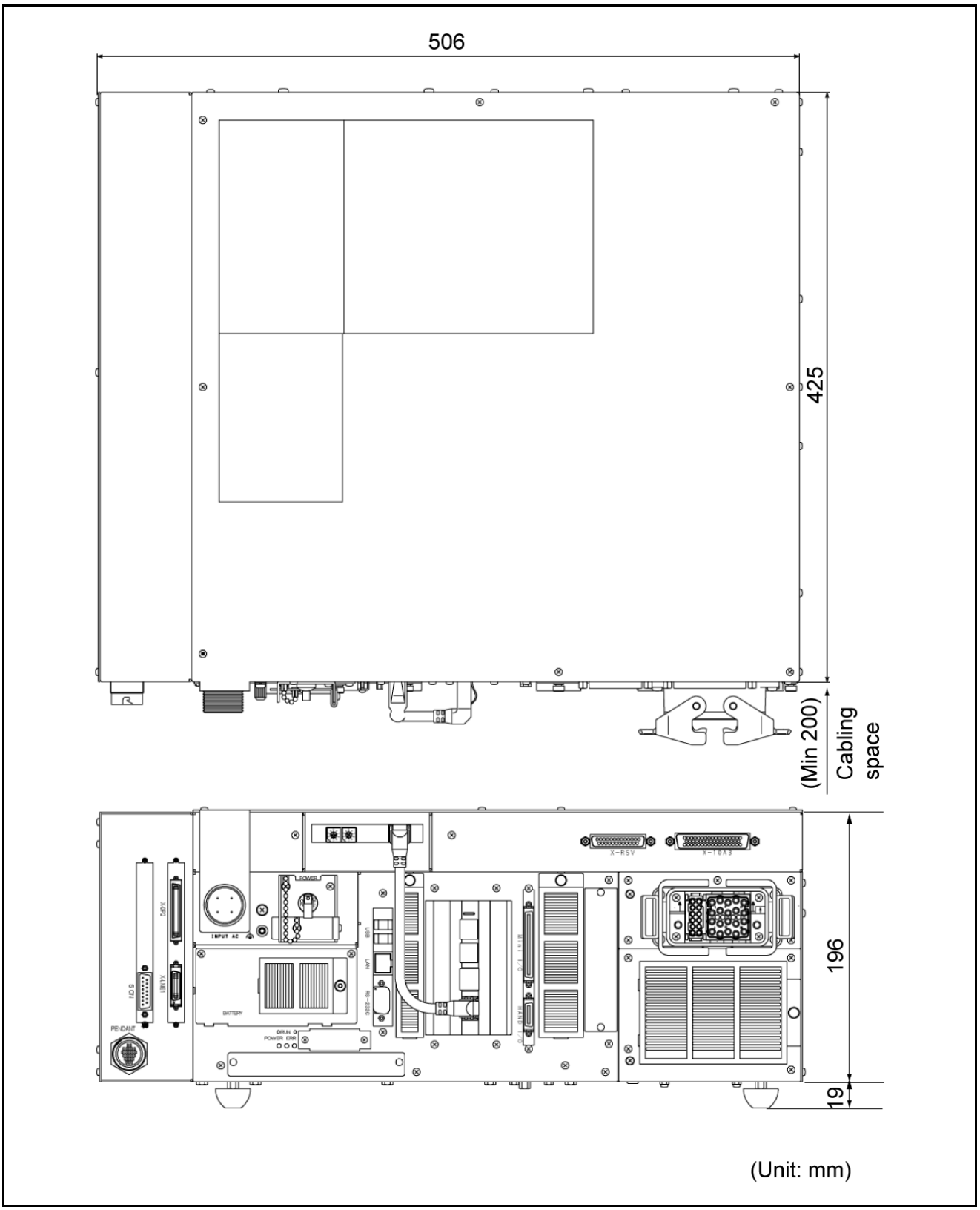
- **DO NOT touch fins. Their hot surfaces may cause severe burns.**
- **DO NOT insert fingers or foreign objects into openings. Doing so may cause bodily injury.**
- **Before opening the controller cover and accessing the inside of the controller for maintenance, be sure to turn off the power switch, 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

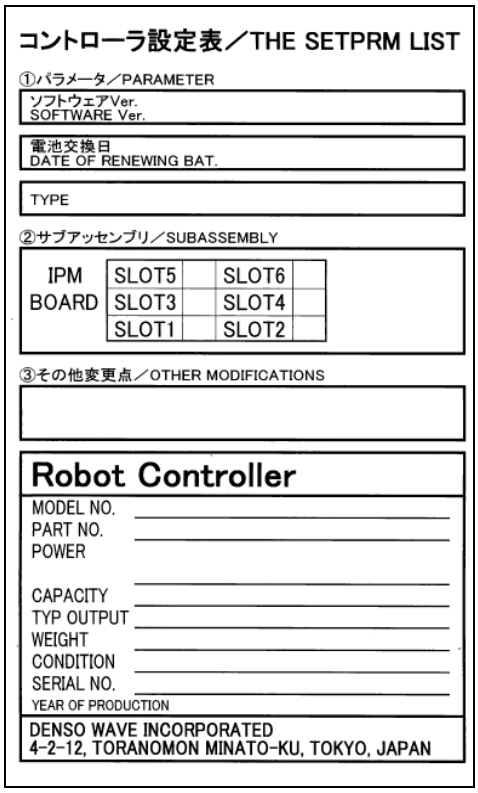
Figure below shows the outer dimensions of the robot controller.



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

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 BOARD	SLOT5		SLOT6	
	SLOT3		SLOT4	
	SLOT1		SLOT2	

③その他変更点／OTHER MODIFICATIONS

Robot Controller

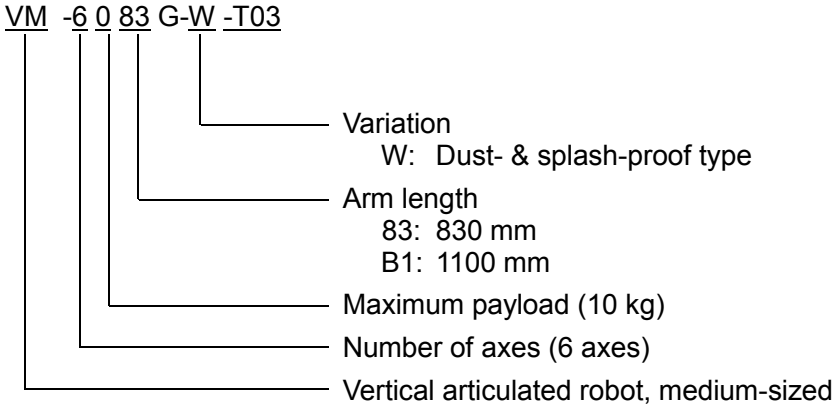
MODEL NO.
PART NO.
POWER
CAPACITY
TYP OUTPUT
WEIGHT
CONDITION
SERIAL NO.
YEAR OF PRODUCTION

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.

Medium-sized, vertical articulated type (VM-G-T series)



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
VM-G-T SERIES

GENERAL INFORMATION ABOUT ROBOT (T03)

First Edition May 2007
Third Edition September 2010
Fourth Edition August 2011

DENSO WAVE INCORPORATED 8N**C

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.

In no event will DENSO WAVE INCORPORATED be liable for any direct or indirect damages resulting from the application of the information in this manual.