It is user RESPONSIBILITY to check that this "Quick guide" refers to product model and version that will be used.

In any case, regarding installation, use and maintenance, the complete Sanyo Denki instruction manual TAKES PRIORITY. The complete Sanyo Denki instruction manual is included, in PDF format, in the Starter Kit CD-Rom and the printed version is available on demand.

R.T.A. srl

MOTION CONTROL SYSTEMS

Sanyo Denki Brushless AC Servo Systems "R" Series

Quick Guide

R.T.A. s.r.l.

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Warning !

Mounting, in accordance with instructions, has to be executed by professional builder who knows problems and rules about servo amplifiers. R.T.A. does not take any responsibility regarding wrong executions and wrong knowledge or understanding about the rules related the brushless servosystems. This quick guide is a document to ease the user that already knows instruction manual contents. The complete reading of Sanyo Denki Instruction Manual Rel. M0006890K is in any case strongly required.

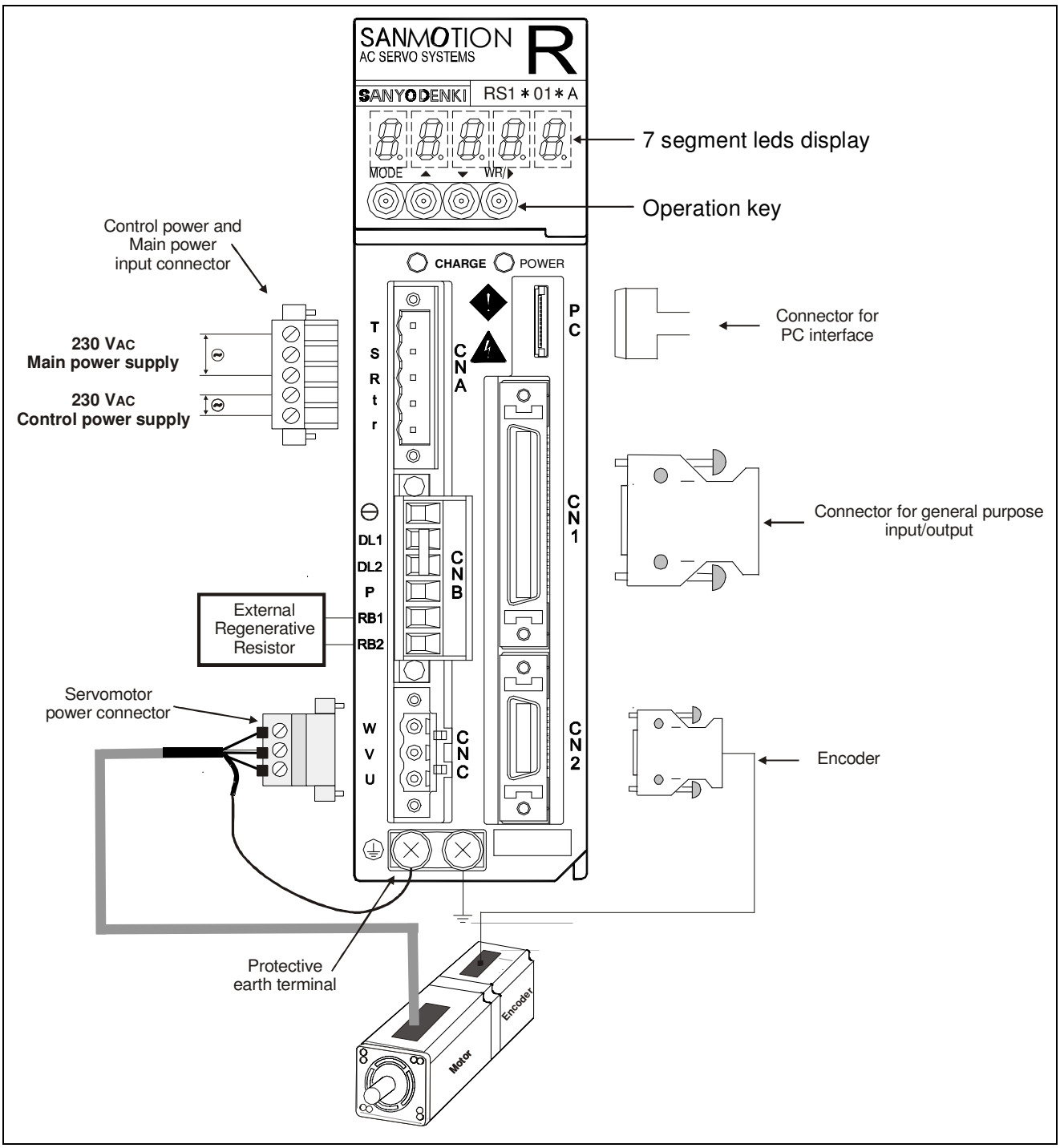
Contents

STEP A

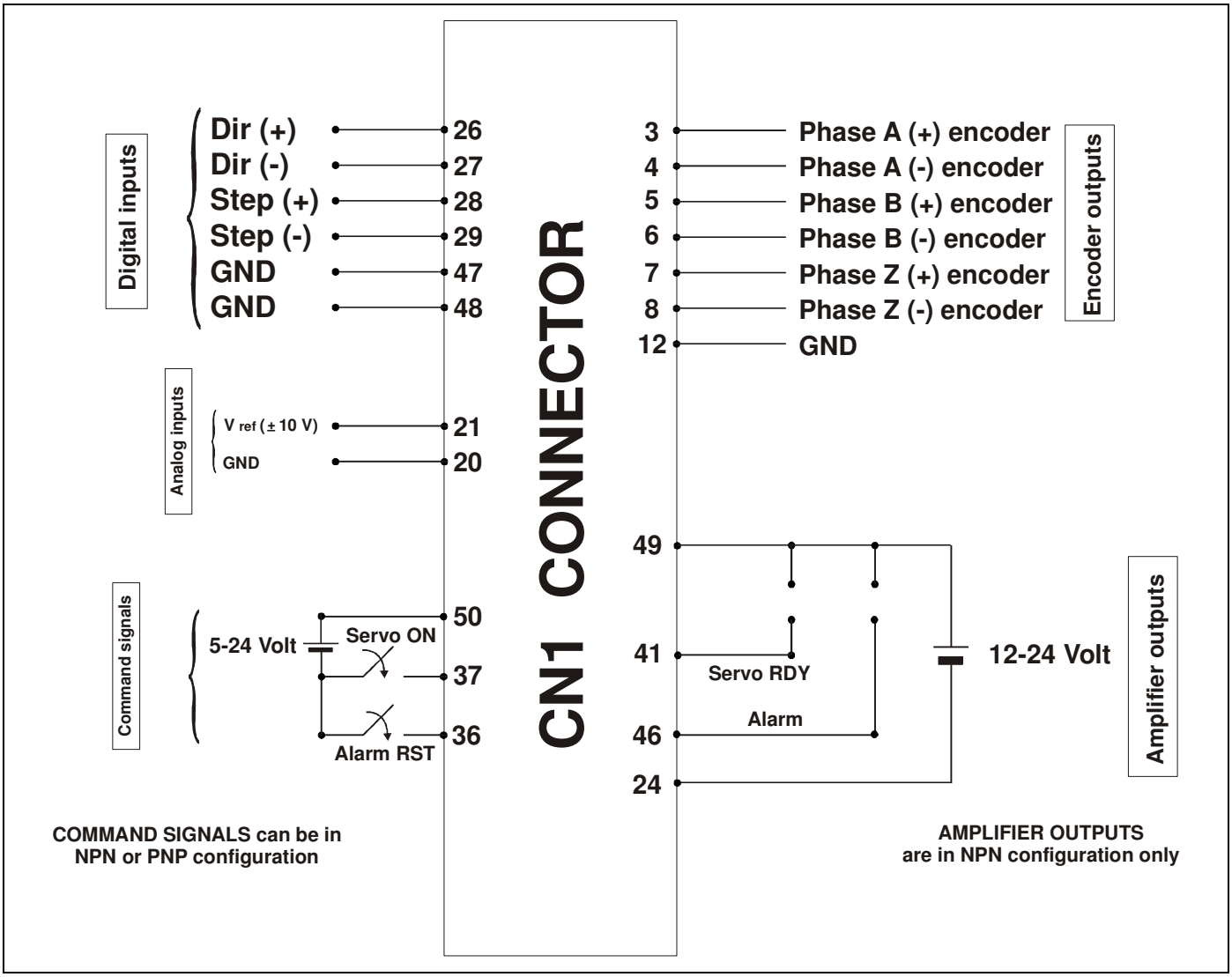
HARDWARE CONNECTIONS

HARDWARE CONNECTIONS FOR SANYO DENKI

AC SERVO SYSTEMS "R" SERIES



SIMPLIFIED WIRING SCHEME - CN1 CONNECTOR



STEP B

SOFTWARE INSTALLATION

SOFTWARE INSTALLATION

1) In this CD-ROM, open the folder: "AC_SERVOSYSTEMS".

2) Execute the file: RSetup-V10C-1130-Complete.exe

3) To the request: "Please select the language that you would like to use", select English.
Press "OK" button to continue.

4) Press "Next" button.

5) Select an installation folder, if it is different from the one indicated as default.
Press "Next" button to continue.

6) Select "Complete Installation" (default).

7) Press "Next" button to continue (recommended choice).
Otherwise select a group of programs different from "AC_SERVO_SYSTEM" (default).

8) To the request: "Please input key word", press "OK" button (standard products).

9) The program will be installed in the destination folder.
The "R-SETUP" link to the program will be shown on the Desktop.

CONNECTION OF THE SERIAL LINE

1) Connect the serial line cable between personal computer and the R Series amplifier.

2) Connect motor and encoder cables between amplifier and motor. **Remember to connect the earth cable to one of the earth screw terminals of the amplifier.**

3) Supply logic section AC 230V (inputs "t" and "r") on CNA connector of the amplifier. **Remember to connect the earth cable to one of the earth screws terminals of the amplifier.**

4) Launch R-Setup program already installed.

5) Select "Communication", then "Communication Setting" from Menu property bar to define communication port (COM1, COM2,....). Select the port from scroll menu and press "OK" button.

6) Select "Communication" and then "Offline → Online" from Menu property bar to start communication. **WARNING: DO NOT CHANGE** the communication baud rate, use the default value: 38400 bps.

7) Window "Communication Status" will be shown. Press "Check" and be sure that become shown the wording "Connected". Press "Exit" button to exit.

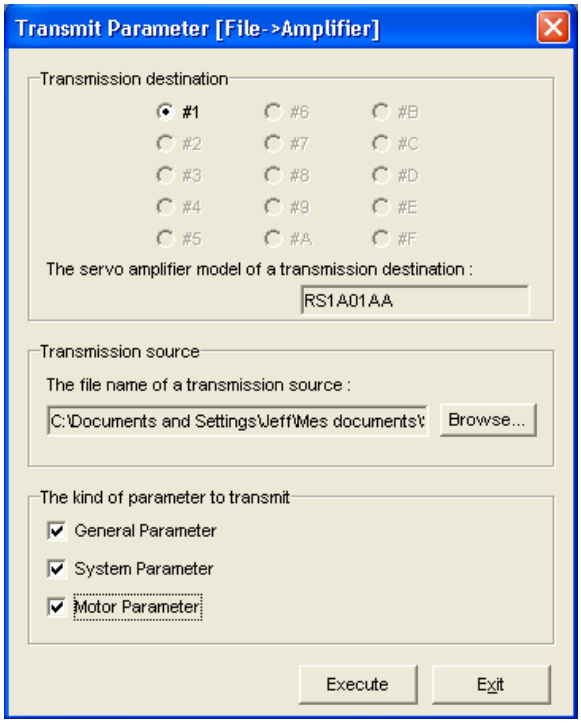
DEFAULT PARAMETERS SETTINGS

1) Start the serial communication by selecting "Offline → Online". (The "ONLINE" indication will be shown on bottom-left part of the screen).

2) Select "Parameter" and then "Transmit Parameter [File → Amplifier]" from Menu property bar.

3) Window "Transmit Parameter [File → Amplifier]" will be shown. Press "Browse..." button.
Configuration files have extension "*.ap0".
File's name contains motor and related amplifier part number.
All configuration files are included in the folder "AC_SERVOSYSTEMS/DEFAULT_PARAMETERS" of this CD-ROM.
The files are listed in sub-folders according the motor series.
Select file "*.ap0" pertinent to the connected motor and press "Open" button.

4) In "The kind of parameter to transmit" box, select ALL the following three options:
*** General Parameter (already selected as default) * System Parameter * Motor Parameter**



5) Press "Execute" button, then "OK".

6) Press "Exit".

7) Switch off the power supply of the control logic section.

8) Switch on again control logic section and main power supply section (T and R terminals of CNA connector of the amplifier). **Remember to connect the earth cable to one of the earth screws of the amplifier.**

The amplifier is now set for the used motor and default parameters are installed.
The amplifier is totally supplied but, for security reasons, disabled (motor is not in torque).
The enabling (SERVO ON) can be set through S-ON signal, assigned to the CONT1 input as default (pin 37).

The setting of the amplifier follows this default configuration:
-SINGLE-PHASE power supply (r,t and R,T) (System Parameter Settings - Page 00 "Main Power input type: 01_AC_Single_Phase").
-POSITION Control (System Parameter Settings – Page 08 "Control Mode: 02_Position").
-CODE + PULSE TRAIN inputs (General Parameter Settings - Group 8 – Page 11 "Position command pulse, form selection: 02_Code_PC").
-Resolution:

P2, P3, P5, P6, Q1, Q2 servo motors: 8000 steps/rev revolution (General Parameter Settings - Group 8 – Page 15 "Electronic Gear Ratio 1: 1/1").

R2 servo motors: 8192 steps/rev revolution (General Parameter Settings - Group 8 – Page 15 "Electronic Gear Ratio 1: 1/1").

-Medium setting of low-pass filter for frequency inputs (General Parameter Settings - Group 8 – Page 13 "Position Command Pulse Digital Filter: 00_834nsec").
-Disabled over-travel inputs (General Parameter Settings - Group 9 – Page 00 "Positive Over-travel function: 00_always_disable" and Page 01 "Negative Over-travel function: 00_always_disable").

Warning: When you open the "General Parameter Settings" for the first time, remember to change the "Display Level Settings" from "Basic Mode" to "Advanced Mode". Using this settings, you can have the access to all the parameters and all the features of the brushless servo-systems.

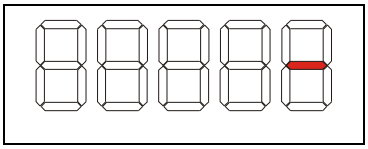
STEP C

QUICK GUIDE

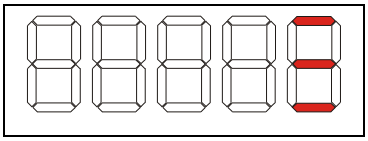
BASIC CHARACTERISTICS

Main power charge LED: Indicates that the smoothing capacitor of the main power supply is charged.

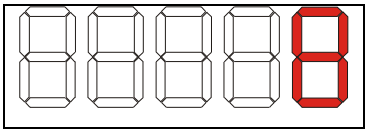
Control power supply LED: Indicates that the control power (r,t) is supplied and the internal control power supply (+5V) is set up.



Indicates that control power (r,t) is supplied at **230VAC.**

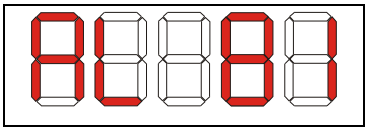


Indicates that control power (r,t) and main power (R,T) are supplied at **230VAC.**



When the seven segment led draws a "8" **rotating figure**, the "servo ON" signal is ON. The servo motor is in torque.

Remember to read the complete Sanyo Denki Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom at chapter 4 – [Digital Operator] for a complete description of the digital operator.



When an alarm occurs, the 7-segments led displays a blinking alarm code. This is an example of alarm.

Remember to read the complete Sanyo Denki Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom at chapter 8 – [Maintenance] for a complete description of alarms and warnings.

You can configure your servo system in speed control **or** position control using the Sanyo Denki R-Setup software included in the Starter Kit CD-Rom. To change the control setting, modify Page 08 – [Control Mode] in the System Parameter Settings. Remember to switch the control power off after the change.

POSITION CONTROL (Code + Pulse Train)

Basic control signals (CN1 Connector)

Warning: refer to the complete Sanyo Denki Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom to verify the compatibility between the servo amplifier input signals and your system command output signals.

Position Command Pulse INPUTS

Pin 26: Direction digital input (Dir+) Line Driver 0-5V

Pin 27: Direction digital input (Dir-) Line Driver 5V-0

Pin 28: Pulse Train digital input (Step+) Line Driver 0-5V

Pin 29: Pulse Train digital input (Step-) Line Driver 5V-0

Pin 47: Signal Ground (GND)

Pin 48: Signal Ground (GND)

RTA recommends to use *Line Driver* digital signals. If the digital outputs of your control system are only in *Open Collector* configuration, you must use the interface card BRINT.A sold separately by RTA S.r.l. This interface card converts open collector signals (both PNP or NPN) to line driver signals. BRINT.A was specially designed to connect a generic control system to Sanyo Denki servo systems "QS1A" and "RS1A" series.

General Purpose INPUTS

Pin 50: Set by default to positive or negative terminal of the power supply for general purpose input signals (5-24VDC). The general purpose inputs can be set in NPN or PNP configuration.

Pin 37: Set by default as *"Servo On Function"* – With this configuration, the input enables the servo system to receive a pulse train.

Pin 36: Set by default as *"Alarm Reset Function"*. Be sure to restore the normal conditions before clearing the alarm. Use a monostable contact.

Pin 35: Using R-Setup software [General Parameter Settings – Group 9 – Page 11], you can configure this input as *"Position Command Pulse Inhibit Function & Velocity Command Zero Clamp Function"* .

Warning: Please refer to the complete Sanyo Denki Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom for all other possible settings of general purpose inputs.

General Purpose OUTPUTS

Pin 49: Positive terminal of power supply for output signals (12-24VDC). The General Purpose Outputs are in NPN configuration only.

Pin 24: Negative terminal of power supply for output signals.

Pin 25: Negative terminal of power supply for output signals.

Pin 41: Set by default as *"Servo Ready Function"* – with this configuration, you can verify if the servo amplifier is ready to receive the "Servo On" command .

Pin 46: Set by default as *"Alarm Function"* – with this configuration, you can verify when an alarm occures.

Warning: The output transistor can tolerate a current of 50 mA max (refer to the complete Sanyo Denki Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom pag. 3-19)

Encoder OUTPUTS

Pin 3: Phase A+ encoder output (Line driver configuration)

Pin 4: Phase A- encoder output (Line driver configuration)

Pin 5: Phase B+ encoder output (Line driver configuration)

Pin 6: Phase B- encoder output (Line driver configuration)

Pin 7: Phase Z+ encoder output (Line driver configuration)

Pin 8: Phase Z- encoder output (Line driver configuration)

Pin 12: Signal Ground (GND)

The following schemes are just as an indication and represent only some features of the Sanyo Denki Servo Systems "R" series. For further information please read the complete Sanyo Denki

Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom. The following schemes are made according to this default configuration:

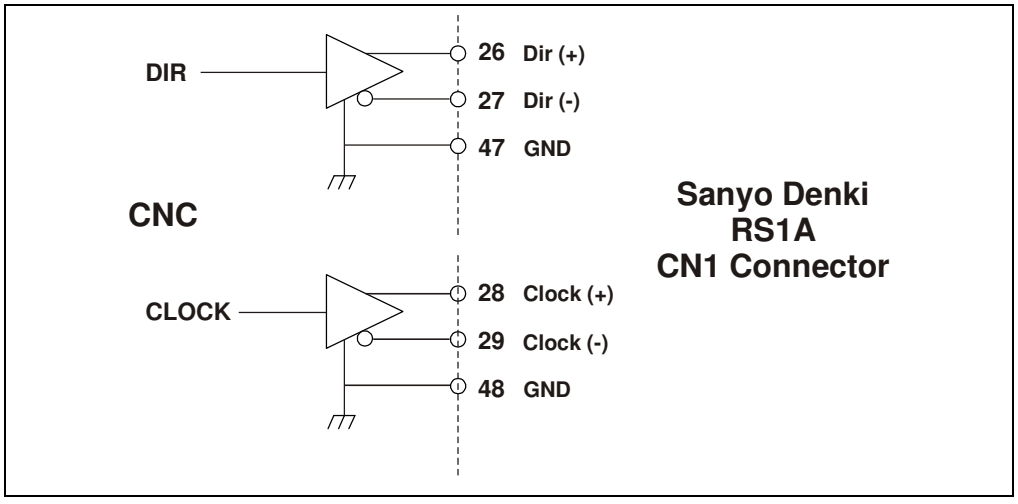
-SINGLE-PHASE power supply (r,t and R,T) (System Parameter Settings - Page 00 "Main Power input type: 01_AC_Single_Phase").

-POSITION Control (System Parameter Settings – Page 08 “Control Mode: 02_Position”)

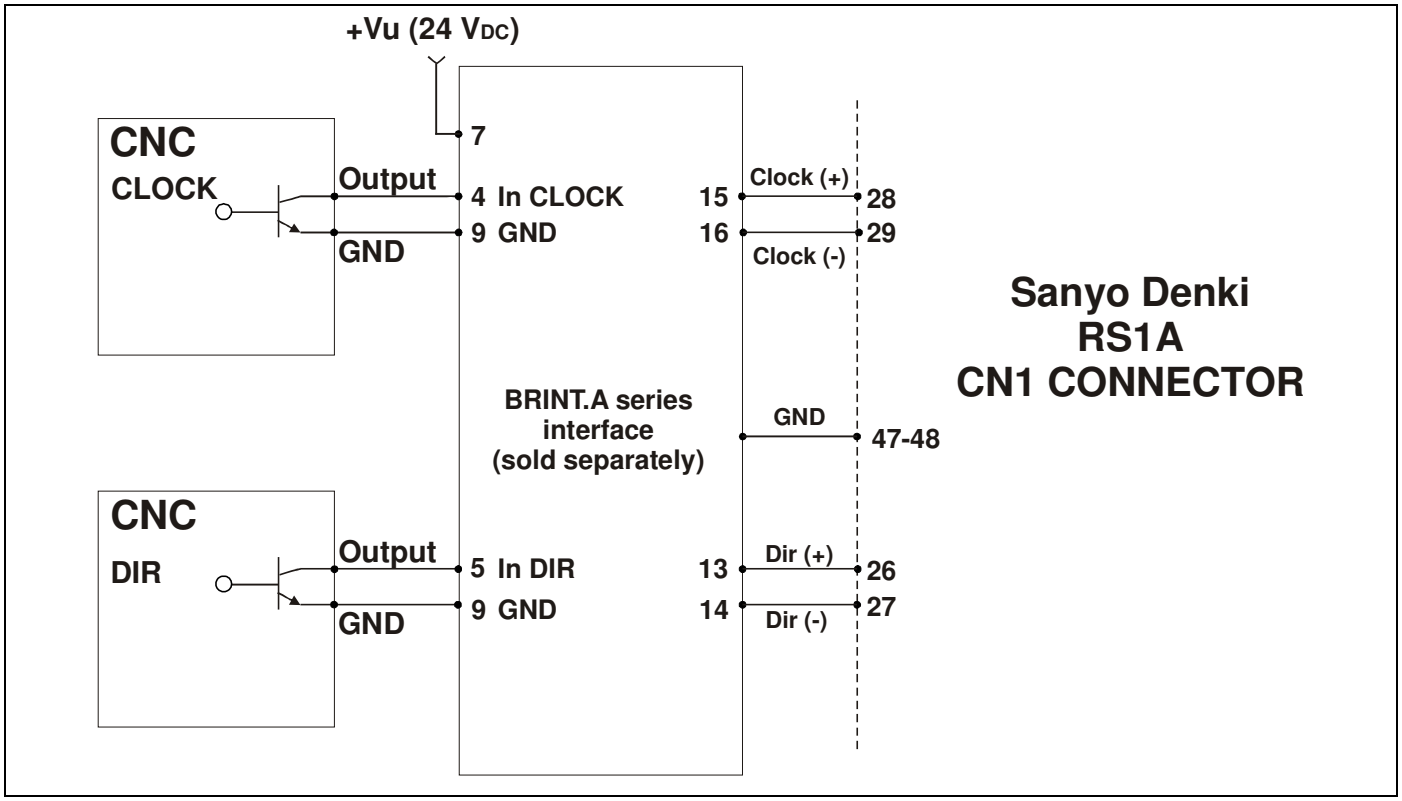
-CODE + PULSE TRAIN inputs (General Parameter Settings - Group 8 – Page 11 “Position Command Pulse Form Selection: 02_Code_PC”).

-Disabled over-travel inputs (General Parameter Settings - Group 9 – Page 00 "Positive Over-travel function: 00_always_disable" e Page 01 "Negative Over-travel function: 00_always_disable").

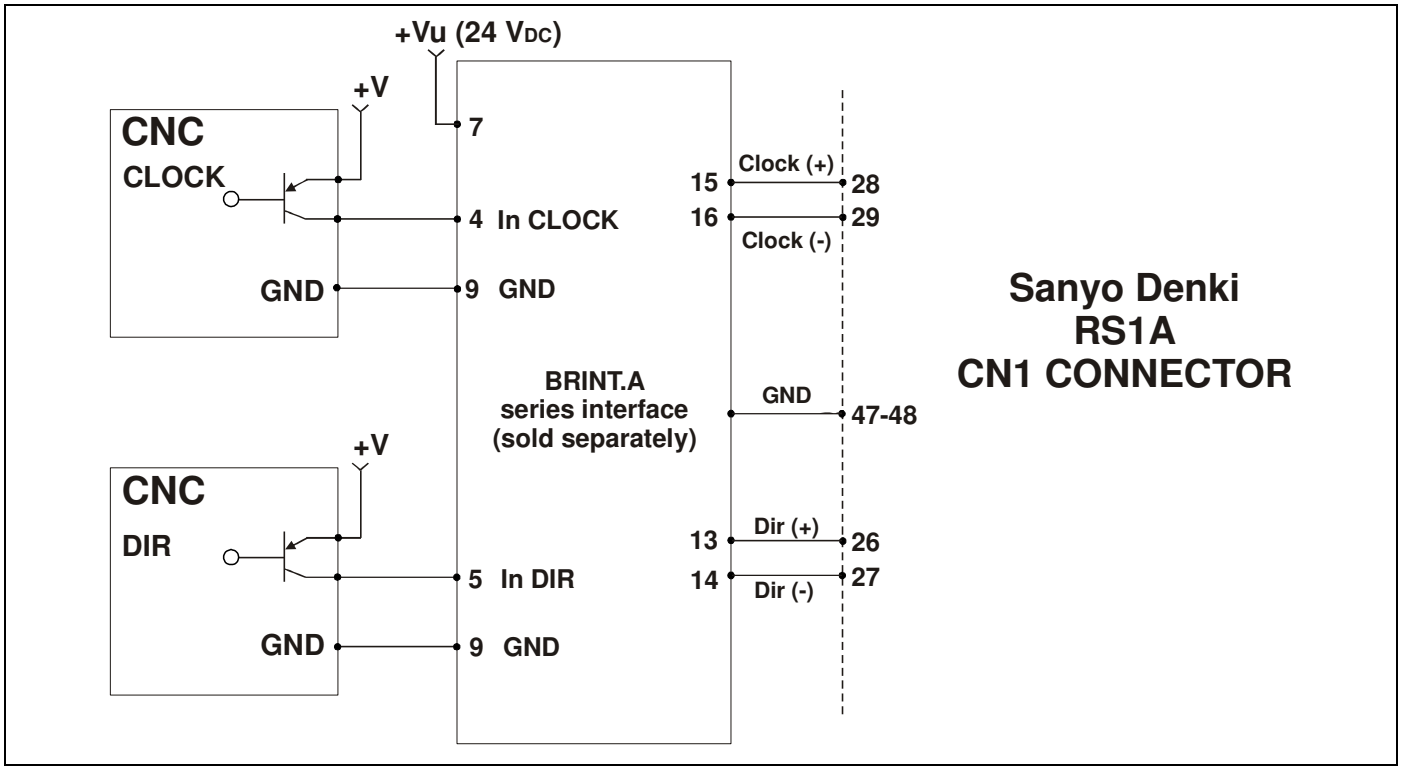
The following figure represents the wiring of digital inputs in LINE DRIVER configuration



The following figure represents the wiring of digital inputs in OPEN COLLECTOR configuration (NPN transistor)

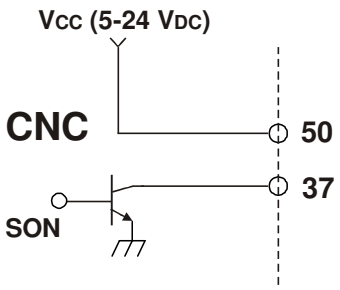


The following figure represents the wiring of digital inputs in OPEN COLLECTOR configuration (PNP transistor)



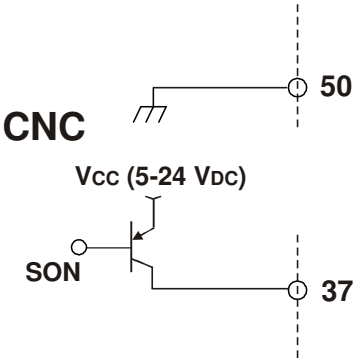
The following figure represents the wiring of a general purpose input

(i. e. Servo On)



Sanyo Denki
RS1A
CN1 CONNECTOR

NPN TRANSISTOR



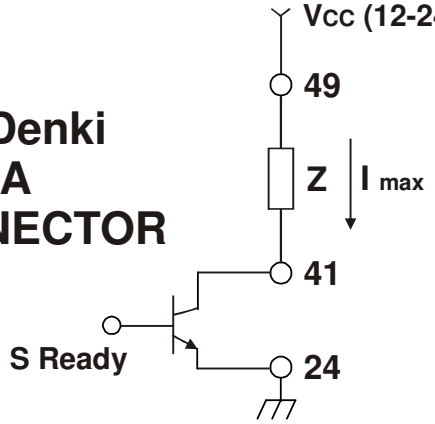
Sanyo Denki
RS1A
CN1 CONNECTOR

PNP TRANSISTOR

The following figure represents the wiring of a general purpose outputs

(i. e. Servo Ready)

Sanyo Denki
RS1A
CN1 CONNECTOR



I_{max} = 50 mA

$V_{cc\ max}$ = 24 V_{DC}

Z_{min} = 1 KΩ

Z represents the pull-up impedance to open collector output

Most numeric controllers or PLC input stages are already provided with pull-up resistor. Please check that this input impedance is compatible with RS1A output requirements

VELOCITY / TORQUE CONTROL

Basic control signals (CN1 Connector)

Warning: refer to the complete Sanyo Denki Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom to verify the compatibility between the servo amplifier input signals and your system command output signals.

Analog INPUTS

Pin 20: Signal Ground (GND)

Pin 21: Velocity / Torque Command Input (± 10V)

General purpose INPUTS

Pin 50: Set by default to positive or negative terminal of the power supply for general purpose input signals (5-24VDC). The general purpose inputs can be set in NPN or PNP configuration.

Pin 37: Set by default as *"Servo On Function"* – With this configuration, the input enables the servo system to receive an analog command.

Pin 36: Set by default as "*Alarm Reset Function"*. Be sure to restore the normal conditions before clearing the alarm. Use a monostable contact.

Pin 35: Using R-Setup software [General Parameter Settings – Group 9 – Page 11], you can configure this input as *"Position Command Pulse Inhibit Function & Velocity Command Zero Clamp Function"* .

General purpose OUTPUTS

Pin 49: Positive terminal of power supply for output signals (12-24VDC). The General Purpose Outputs are in NPN configuration only.

Pin 24: Negative terminal of power supply for output signals.

Pin 25: Negative terminal of power supply for output signals.

Pin 41: Set by default as *"Servo Ready Function"* – with this configuration, you can verify if the servo amplifier is ready to receive the "Servo On" command.

Pin 46: Set by default as *"Alarm Function"* – with this configuration, you can verify when an alarm occures.

Warning: The output transistor can tolerate a current of 50 mA max (refer to the complete Sanyo Denki Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom pag. 3-19)

Encoder OUTPUTS

Pin 3: Phase A+ encoder output (Line driver configuration)

Pin 4: Phase A- encoder output (Line driver configuration)

Pin 5: Phase B+ encoder output (Line driver configuration)

Pin 6: Phase B- encoder output (Line driver configuration)

Pin 7: Phase Z+ encoder output (Line driver configuration)

Pin 8: Phase Z- encoder output (Line driver configuration)

Pin 12: Signal Ground (GND)

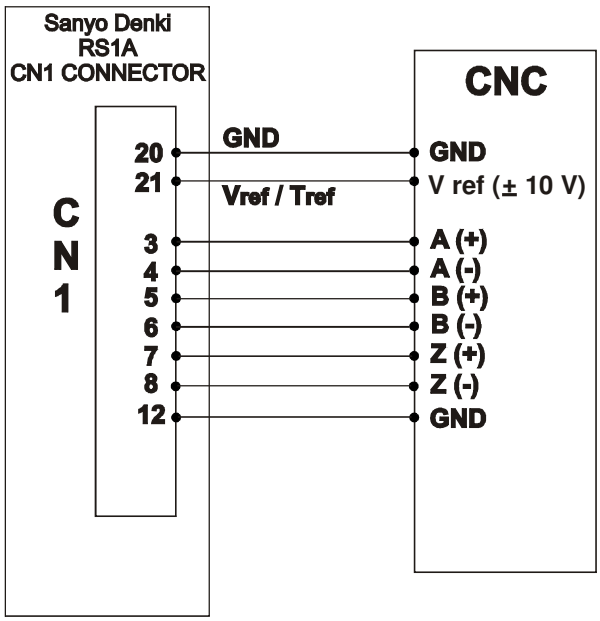
The following schemes are just as an indication and represent only some features of the Sanyo Denki Servo Systems "R" series. For further information please read the complete Sanyo Denki Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom. The following schemes are made according to this configuration:

-SINGLE-PHASE power supply (r,t and R,T) (System Parameter Settings - Page 00 "Main Power input type: 01_AC_Single_Phase").

-Control VELOCITY (System Parameter Settings – Page 08 "Control Mode: 01_Velocity").

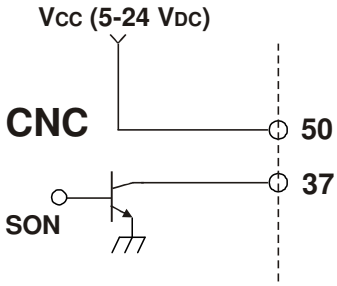
-Disabled over-travel inputs (General Parameter Settings - Group 9 – Page 00 "Positive Over-travel function: 00_always_disable" e Page 01 "Negative Over-travel function: 00_always_disable").

The following figure represents the wiring of analog inputs and the encoder feedback



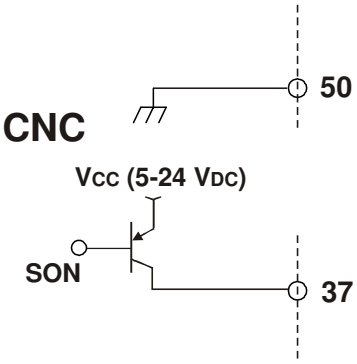
Close the position loop by connecting the encoder outputs feedback to the CNC.

The following figure represents the wiring of a general purpose input (i. e. Servo On)



Sanyo Denki RS1A CN1 CONNECTOR

NPN TRANSISTOR

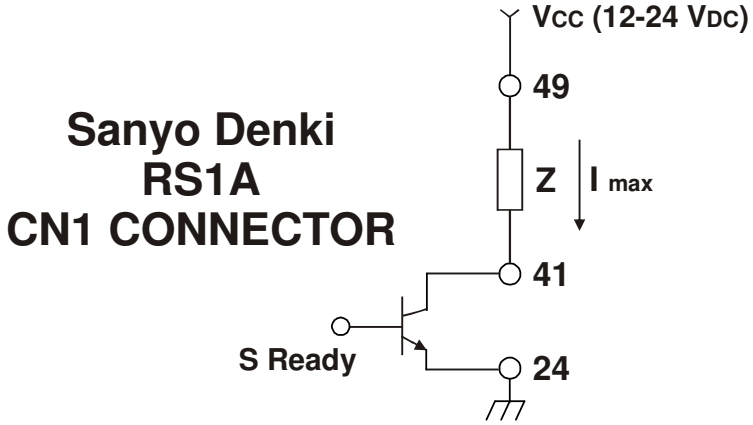


Sanyo Denki RS1A CN1 CONNECTOR

PNP TRANSISTOR

The following figure represents the wiring of a general purpose outputs

(i. e. Servo Ready)



I_{max} = 50 mA

$V_{cc\ max}$ = 24 V_{DC}

Z_{min} = 1 KΩ

Z represents the pull-up impedance to open collector output

Most numeric controllers or PLC input stages are already provided with pull-up resistor. Please check that this input impedance is compatible with RS1A output requirements.

POWER SUPPLY SEQUENCE

The Sanyo Denki brushless servo-amplifier needs two separated power supplies: the control power supply for logic circuit **(230 VAC Single Phase)** and the main power supply **(230 VAC)**. You can use single phase **(230 VAC)** or three phase electric supply **(230 VAC)** for the **main** power supply. RTA suggests to separate and protect the control and main power supply using transformers and fuses; please refer to the complete Sanyo Denki manual Rel. M0006890K included in the Starter Kit CD-Rom chapter 9 – [Specification].

The right power supply sequence is:

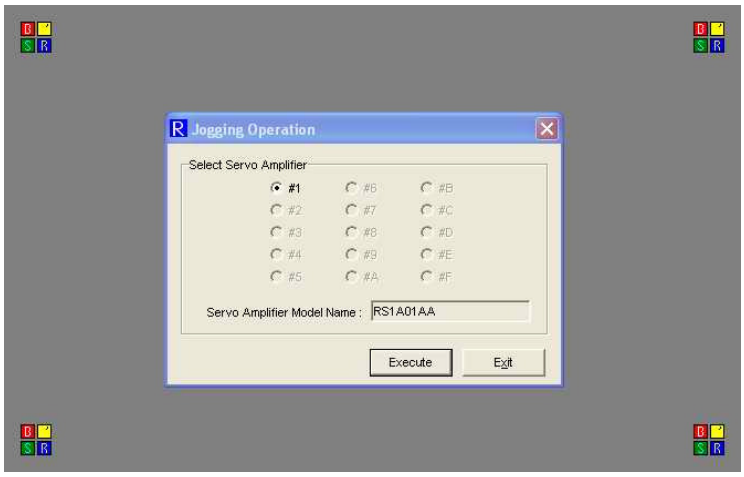
1) Power ON the logical circuit (CNA connector, *"r"* and *"t"*).
2) Be sure to see a single segment lighten in the seven segment display.
3) Power ON the main circuit (CNA connector, *"R"* and *"T"*).
4) Be sure to see three segments lighten in the seven segment display.
5) Enable the "servo ON" function (pin 37 - CN1 connector).
6) Be sure that the seven segment led draws an "8" rotating figure.
7) The servo-amplifier is ready to receive the command pulses or the velocity control.

JOGGING OPERATION

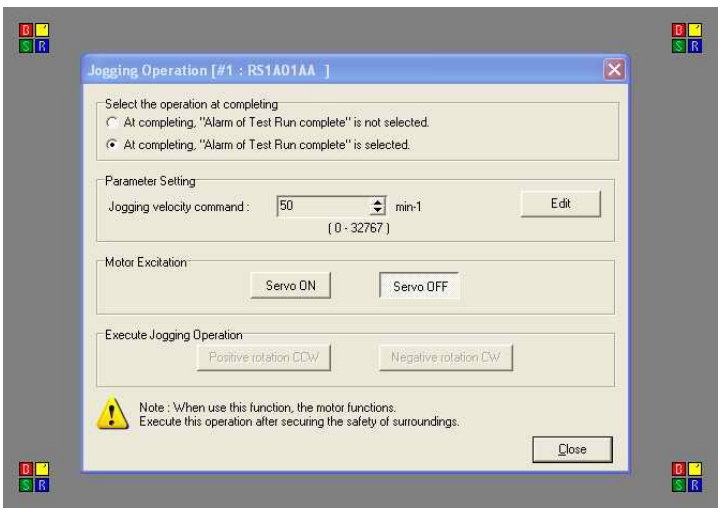
Using the Jogging Operation function, you can easily test the servo amplifier and the servo motor together. This function moves the servo motor. Execute this operation after securing the safety of surrounding.

When an alarm generates during Jogging Operation, motor excitation becomes OFF. To execute Jogging Operation it is necessary to supply the control circuit (r and t) and the main circuits (R and T).

When select *"Test Run and Adjustment – Jogging Operation"* from the menu bar, the following mask appears:



Select the axis number (the default value is Axis Number 1), afterwards press the *"Execute"* button and then click *"Ok"*. The following mask appears:



Select the choice *"At completing of Test Run complete is not selected"*; in this way no alarm occurs at the end of the Jogging Operation function. Optionally modify the Jogging velocity command using the *"Edit"* button and then press enter to write the value.
Afterwards press the *"Servo On"* button to put the motor in torque. Click and hold down the *"Positive Move"* or *"Negative Move"* button to start the rotation of the motor.
At the end of the test, click on *"Close"* to exit from the Jogging Operation function.

BASIC CONFIGURATION PARAMETERS

The basic configuration parameters can be set using the R-Setup Software. You can find the R-Setup Software in the Starter Kit CD-Rom. The following examples are just as an indications and represent only some features of the Sanyo Denki AC-Servo Systems "R" Series. For further information please read the complete Sanyo Denki Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom.

Electric Gear Ratio 1 for P2, P3, P5, P6, Q1, Q2 series servo motors. [General parameter settings – Group 8 – Page 15]. Use this parameter only in case of Position Control. This parameter sets the resolution of the system, that is the number of the "steps / revolution". The default value is 8000 "steps / revolution". To modify this one, input "*8000*" at the numerator of the ratio and input the number of "steps / revolution" needed at the denominator of the ratio. Example: if you want to reduce the resolution to 400 "steps / revolution", write "*8000*" in the numerator and "*400*" in the denominator of the ratio: [*8000/400*].

Electric Gear Ratio 1 for R2 series servo motors. [General parameter settings – Group 8 – Page 15]. Use this parameter only in case of Position Control. This parameter sets the resolution of the system, that is the number of the "steps / revolution". The default value is 8192 "steps / revolution". To modify this one, input "*8192*" at the numerator of the ratio and input the number of "steps / revolution" needed at the denominator of the ratio. Example: if you want to reduce the resolution to 400 "steps / revolution", write "*8192*" in the numerator and "*400*" in the denominator of the ratio: [*8192/400*]. Modifying the Position Command Pulse Multiplier [General Parameter Settings – Group 8 – Page 14] it is possible to increase the resolution of the system up to 131072 "steps / revolution".

Analog Velocity Command Reference for P2, P3, P5, P6, Q1, Q2 series servo motors. [General parameter settings – Group 8 – Page 25]. Use this parameter only in case of Velocity Control. This parameter sets the analog speed input scale. The default value is 500 "rpm / Volt". To modify this value, input the number of "rpm / Volt" needed. Example: if you want to work at 3200 rpm max, with an input command of 10 Volts, set this parameter at "*320*" rpm / Volt.

Analog Velocity Command Reference for R2 series servo motors. [General parameter settings – Group 8 – Page 25]. Use this parameter only in case of Velocity Control. This parameter sets the analog speed input scale. The default value is 650 "rpm / Volt". To modify this value, input the number of "rpm / Volt" needed. Example: if you want to work at 3200 rpm max, with an input command of 10 Volts, set this parameter at "*320*" rpm / Volt.

Command Input Polarity. [General parameter settings – Group 8 – Page 00]. Check that the polarity of the command sent by the host device matches the servo motor rotation direction. If the direction of the rotation does not match with your positive command, use this parameter to modify the direction of the movement. Do not modify this parameter during motor operation. Examples: in case of Position Control, setting this parameter to 04, 05, 06, 07 you can get the opposite direction of the movement. In case of Velocity Control, setting this parameter to 02, 03, 06, 07 you can get the opposite direction of the movement.

Encoder Pulse Division Output Polarity. [General parameter settings – Group C – Page 06]. Use this parameter to modify the polarity of encoder pulse frequency. Changing this parameter you can set the phase displacement between the "A phase" and the "B phase" of the encoder output.

Encoder Output Pulse Divide Ratio for P2, P3, P5, P6, Q1, Q2 series servo motors. [General parameter settings – Group C – Page 05]. The encoder signals (pin 3, 4, 5, 6, 7, 8, of the CN1 connector) can be output to the host device according to a ratio formula. Remember that this parameter sets just the resolution of the A and B phase **output** signals calculated by the amplifier. **Motor encoder resolution is not modified by this parameter**. By default, the servo amplifier provides 8000 steps / revolution (incremental encoder with 2000 pulses / revolution). If you need to reduce the resolution, remember that not any ratio is possible and the output of the "Z phase" is not divided. Use the following guide lines to input the right value:
When the numerator of the ratio is "1", the denominator can be "1 to 64" or "1 to 8192".
When the numerator of the ratio is "2", the denominator can be "3 to 64" or "3 to 8192".

When the denominator of the ratio is “8192”, the numerator can be “1 to 8191”.
Refer to the complete Sanyo Denki Instruction Manual Rel. M0006890K included in the Starter Kit CD-Rom pag. 5-17.
Example: to calculate the numerator of the ratio having “8192” at the denominator, use the following easy formula:

$$Numerator = \frac{8192}{2000\left[N°steps\,/\,revolution\ encoder\right]} \bullet N°steps\,/\,revolution\ needed$$

Encoder Output Pulse Divide Ratio for R2 series servo motors. [General parameter settings – Group C – Page 05]. The encoder signals (pin 3, 4, 5, 6, 7, 8, of the CN1 connector) can be output to the host device according to a ratio formula. Remember that this parameter sets just the resolution of the A and B phase **output** signals calculated by the amplifier. **Motor encoder resolution is not modified by this parameter**. By default, the servo amplifier provides 8192 steps / revolution. If you need to reduce the resolution, input “*8192*” at the denominator of the ratio and input the number of “steps / revolution” needed at the numerator of the ratio. Example: if you want to reduce the resolution to 2000 “steps / revolution”, write “*8192*” in the denominator and “*2000*” in the numerator of the ratio: [*2000/8192*]. The output of the “Z phase” is not divided.

Position Command Pulse Form Selection. [General parameter settings – Group 8 – Page 11]. Use this parameter to set the form of the command pulse. Three kind of command pulse form are available: [00] – Positive move pulse & Negative move pulse, [01] – Two phase pulse train of 90 degrees phase difference, [02] – Code + Pulse Train. **This setting is enabled after turning On the control power again**.

Gain Switching Function Select Input 1. [General parameter settings – Group 9 – Page 13]. This parameter defines the condition that enables the second series of the loop parameters (KP2, TPI2, KVP2,TVI2, JRAT2, TCFIL2) present in the [General parameter settings – Group 3]. Any general purpose input can enable the switchover condition, otherwise it could be enabled under other specific conditions, for example you can switch to the second series of loop parameters if the motor speed is under or over a certain value.

Gain Switching Function Select Input 2. [General parameter settings – Group 9 – Page 14]. This parameter defines the condition that enables the third or the fourth series of the loop parameters (KP3, TPI3, KVP3, TVI3, JRAT3, TCFIL3, KP4, TPI4, KVP4, TVI4, JRAT4, TCFIL4) present in the [General parameter settings – Group 3]. Any general purpose input can enable the switchover condition, otherwise it could be enabled under other specific conditions, for example you can switch to the third or the fourth series of loop parameters if the motor speed is under or over a certain value.

The following table shows the values [0 1] of the two parameters GC1 [General parameter settings – Group 9 – Page 13] and GC2 [General parameter settings – Group 9 – Page 14] suitable for enabling the four sets of the parameters (KP,TPI, KVP, TVI, …):

GC1	**GC2**	**Parameter Set**
0	0	**Set 1**
1	0	**Set 2**
0	1	**Set 3**
1	1	**Set 4**

DYNAMIC AUTOMATIC TUNING

One of the most important feature of the Sanyo Denki brushless AC servo systems "RS1A" series, is the dynamic automatic tuning function. This feature allows to self tune the system in real time. The servo amplifier reacts to variations or changes of inertial load, modifying continuously position and speed loop parameters. When the function is active, it is possible to avoid any further closed-loop setting process. **By default the dynamic automatic tuning is enabled**.

The Sanyo Denki brushless AC servo systems "RS1A" series are equipped with five types of dynamic automatic tuning functions. What "kind" of automatic tuning is suitable for your application depends on different factors: performance, mechanical elements, system inertia and so on… You can choose which kind of automatic tuning to use, changing the value of [General Parameter Settings – Group 0 – Page 01]. The choices available are:

00_Positioning 1 — Automatic tuning suitable for general purpose point to point application. You can use this kind of tuning for both horizontal and vertical axis.

01_Positioning 2 — Automatic tuning suitable for general purpose point to point application, when you look for high performance in positioning, but you don't need to follow a trajectory. You can use this kind of tuning for both horizontal and vertical axis.

02_Positioning 3 — This automatic tuning is equal to the 01_Positioning, but specifically designed for horizontal axis. Do **NOT** use this kind of automatic tuning for vertical axis.

03_Trajectory 1 — Automatic tuning specifically designed to follow a trajectory in the space. You can use this kind of tuning for both horizontal and vertical axis.

04_Trajectory 2 — Automatic tuning function specifically optimized to follow a trajectory in the space. This kind of automatic tuning is similar to the 03_Trajectory 1, but in this case you can change the value of the KP1 position loop proportional gain [General Parameter Settings – Group 1 – Page 02]. The automatic tuning modifies only the speed loop parameters; the position loop is in your hands.

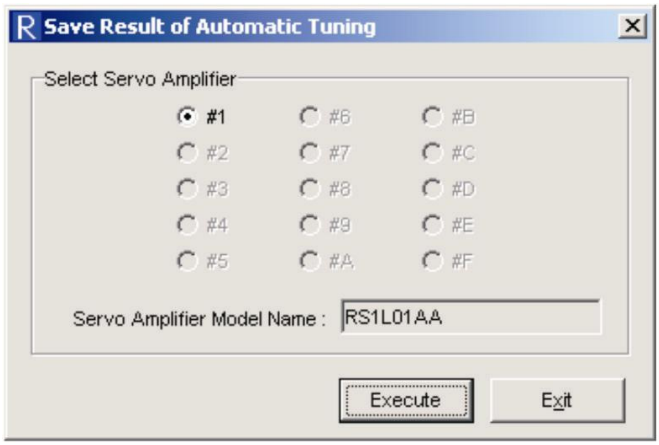
Changing the [General parameter settings – Group 0 – Page 02], the customer can choose between 30 different values of response time settings. Responsiveness increases with an increase of this value.

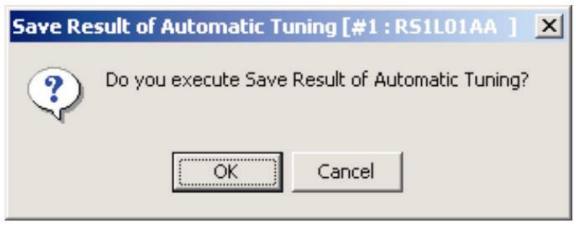
Using the *"Save Result of Automatic Tuning"* function, it is possible to freeze the parameters calculated by the Automatic Tuning Function. In this way it is possible to store control gains and load inertia value in the amplifier. When an appropriate tuning characteristic and an appropriate value of responsiveness are found, it is possible to save the parameters in the amplifier, afterwards switch to *"Manual Tuning"* and manually refine, if it is necessary, control parameters.
Warning: Execute the *"Save Result of Automatic Tuning"* only when the motor is stopped and the *"Servo On"* function is switched OFF.

Five kinds of parameters are saved:

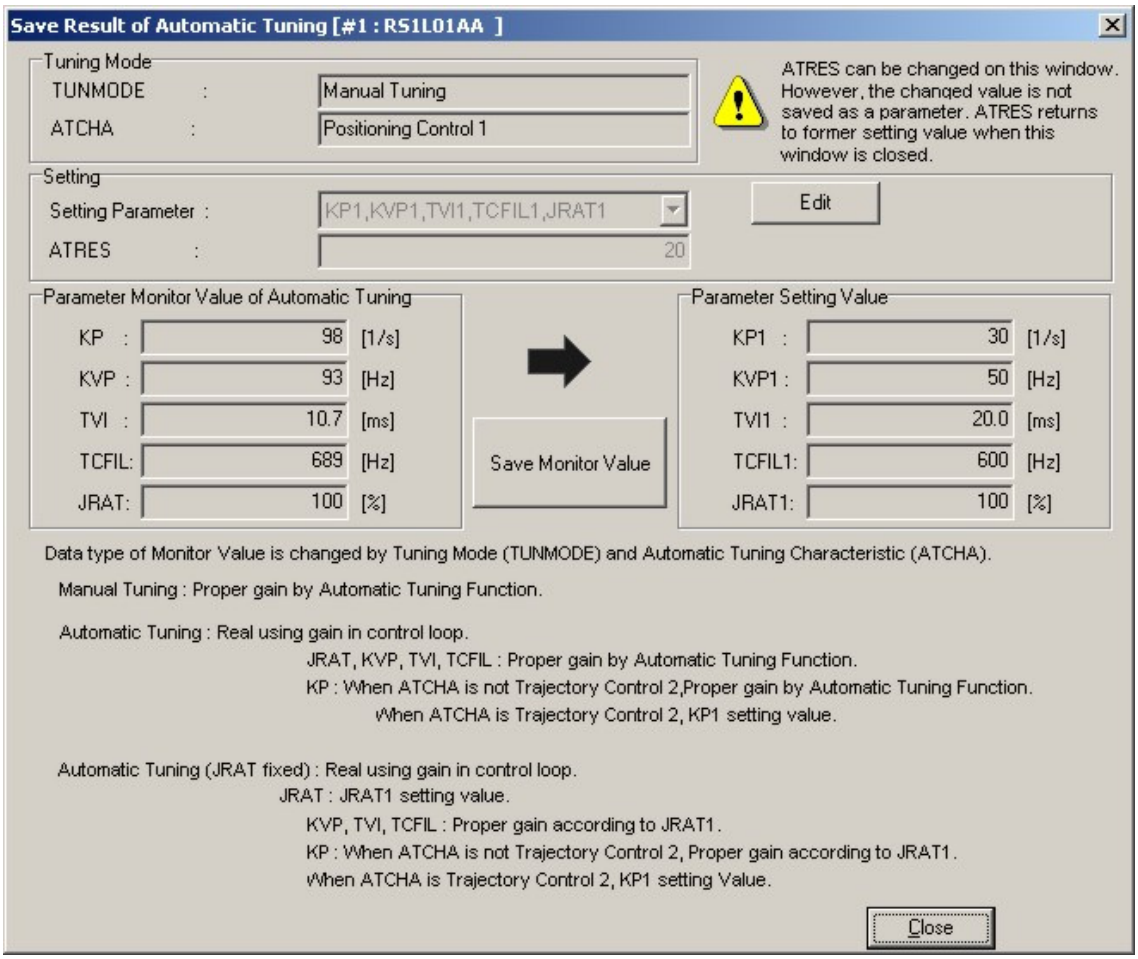
- KP1 - Position loop proportional gain 1
- KVP1 – Velocity loop proportional gain 1
- TVI1 – Velocity loop integral time constant 1
- TCFIL1 – Torque command filter 1
- JRAT1 – Load inertia ratio 1

Select *"Test Run and Adjustment"* – *"Save Result of Automatic Tuning"* from the main menu bar, click on the "Execute" button then press "OK"





It will be displayed the following mask and the parameters will be ready to be stored in the amplifier.

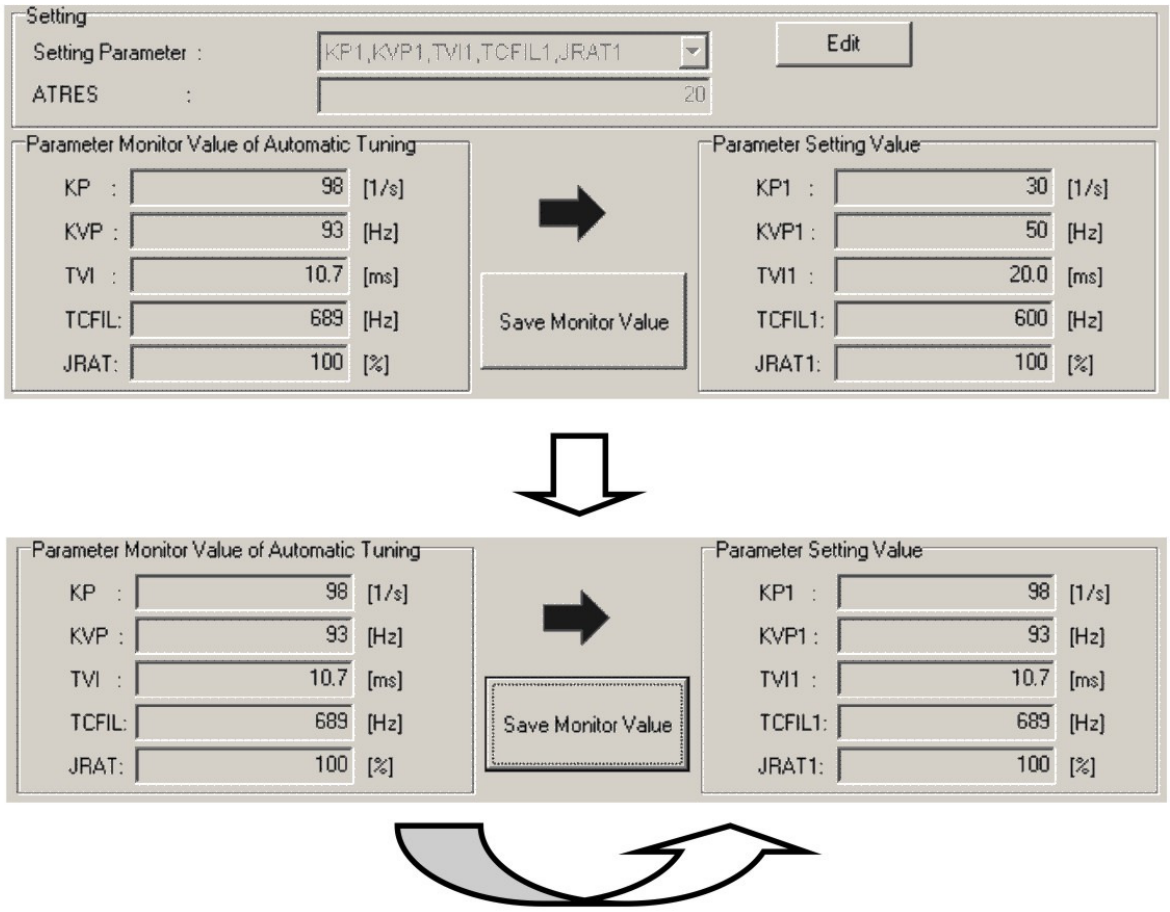


The *"Save Result of Automatic Tuning"* mask contains the following informations:

- Automatic Tuning Characteristics (Positioning 1, Positioning 2… Trajectory 1…)
- Automatic Tuning Response Value (1-30)
- Parameter Monitor Value of Automatic Tuning (KP, KVP, TVI, TCFIL, JRAT)

Press the "Save Monitor Value" button in the middle of the mask to freeze and store the calculated parameters.

The gains and the inertia value are written in the related parameters in *"General Parameter Settings" – "Group 1"*.



After saving, click on the *"Close"* button. Modify the *"Tuning Mode"* in *"General Parameter Settings"* - *"Group 1"* – *"Page 00"*. Set it to *"02_Manual Tune"*.
Now it is possible to make some adjustments; if it necessary modify the control loop parameters and set a suitable value for the feed forward gain [General Parameter Settings – Group 1 – Page 05].

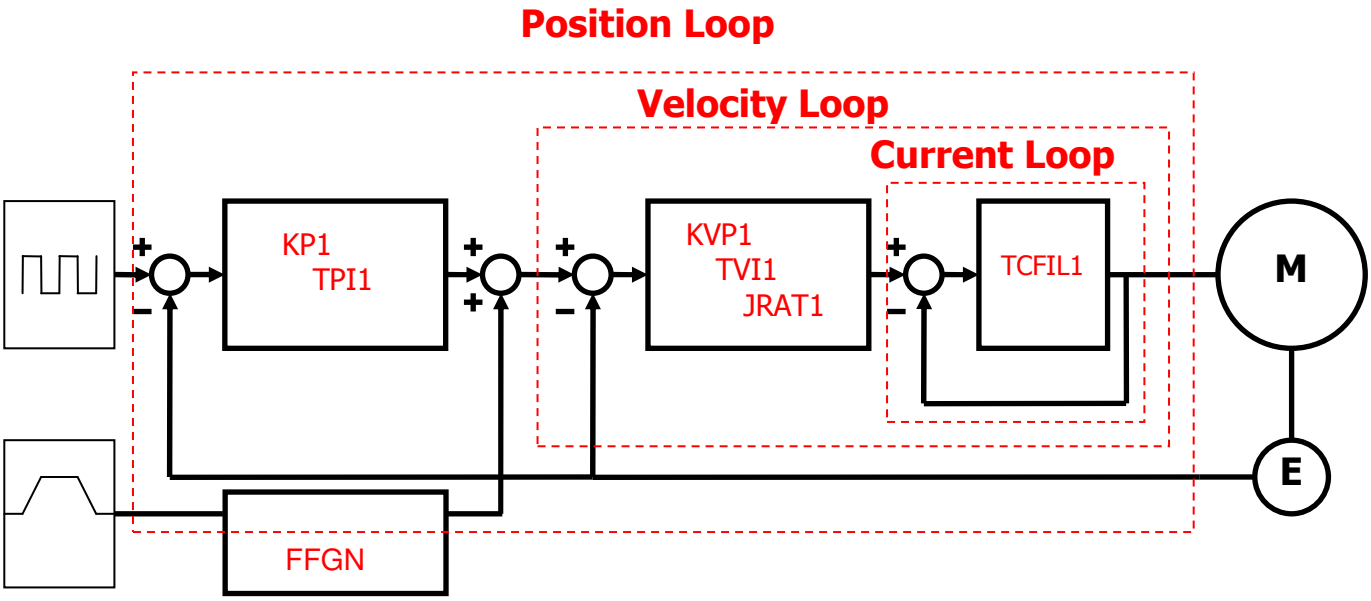
For further information please read carefully chapter 7 – [Adjustment Functions] of the complete Sanyo Denki Instructions Manual Rel. M0006890K and paragraph 3.21 [Save Result of Automatic Tuning] of the Sanyo Denki R-SetUp Software Manual Rel. M0006935G included in the Starter Kit CD-Rom.

BASIC CONTROL LOOP PARAMETERS

The servo system close-loop structure includes three sub-systems:

1. the position loop
2. the velocity loop
3. the current loop

The relationship between these three sub-systems is shown in the following figure:



If this structure is compromised, it could result in instability, low responsiveness, vibration and oscillation. Please remember to read **CAREFULLY** chapter 7 [Adjustment and Functions] of the complete Sanyo Denki Instruction Manual Rel. M0006890K.

It is possible to modify the control loop parameters by the R-Setup Software included in the Starter Kit CD-Rom.

The basic control loop parameters are:

- **KP1** Position loop proportional gain [General parameter settings – Group 1 – Page 02].
- **TP1** Position loop integral time constant [General parameter settings – Group 1 – Page 03].
- **KVP1** Velocity loop proportional gain [General parameter settings – Group 1 – Page 04].
- **TVI1** Velocity loop integral time constant [General parameter settings – Group 1 – Page 05].

- **FFGN** Feed forward gain [General parameter settings – Group 1 – Page 05].
- **TCFIL1** Torque command filter [General parameter settings – Group 1 – Page 20l].

- **KP1** By setting the position loop proportional gain to a higher value, the responsiveness increases and the setting time shortens. However, if the device mechanism has low rigidity, higher settings may result in vibration or oscillation. If you wish to set the position loop gain to a higher value, consider the rigidity of the device mechanism before raising this value.

- **TPI1** By setting the position loop integral time constant to a lower value, the position deviation decreases to zero and the setting time shortens. If you wish to set the position loop integral time constant too low, may result in vibration and oscillation. This parameter effects mainly the position deviation at constant speed.

- **KVP1** By setting the velocity loop proportional gain to a higher value, the responsiveness increases and the servo motor follows faithfulness the speed set point. It is recommended to increase this value to have a good response; it is useful to set a value that does not cause overshooting. In case of position control, the speed set point is the output of the position loop, the value of KVP1 should be higher than KP1.

- **TVI1** Since the integration time constant is a delay attribute to the servo amplifier, higher values for this parameter mean decreased responsiveness and an increase of setting time. Conversely, if the integration time constant is set too low, the servo system may become instable, and the mechanism could vibrate or oscillate, therefore it is useful to set a value that does not cause vibration or oscillation in the device mechanism.

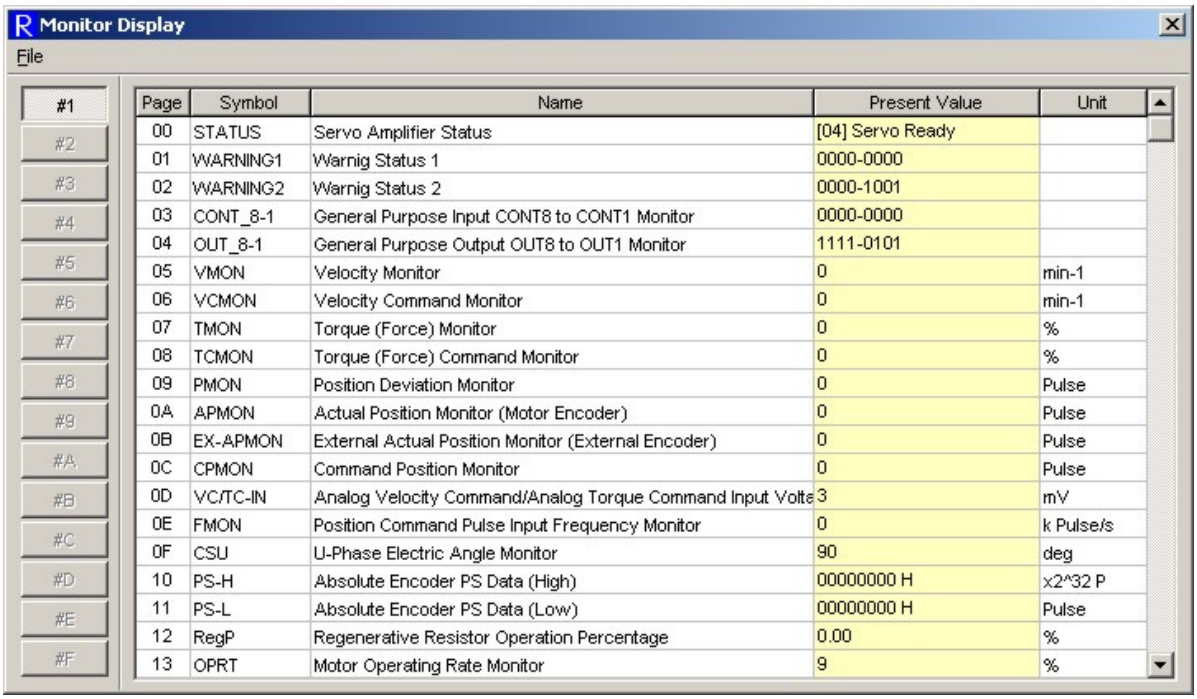
NOTE: control loop parameter modifications described are valid only in case of manual tuning setting [General Parameter Settings – Group 0 – Page 00].
When dynamic automatic tuning is enabled, the amplifier controls the majority of [Group 1] parameters.

- **FFGN** This parameter reduces position fluctuation and decreases the position loop response time on position control loop. Do not set the feed forward gain too high, because it may result in vibration and oscillation. This parameter is recommended to be set at high value (even equal to 100%) on high performance interpolation applications. In these cases, other parameters must be adequately set in order to avoid vibrations and oscillations.

- **TCFIL1** This parameter sets the cut off frequency of the primary low-pass filter for the torque command inside the current loop. The filter eliminates resonance, vibration and irregular noise. The torque command filter is a delay attribute to the servo system; excessively low settings will lead to decrease responsiveness.

MONITOR DISPLAY

A very simple and useful function included in the R-SetUp software is the possibility to display, in real time, the status of the most important parameters of the servo system. From the main menu bar, select *"Monitor"* and then *"Monitor Display"*, the following mask appears.



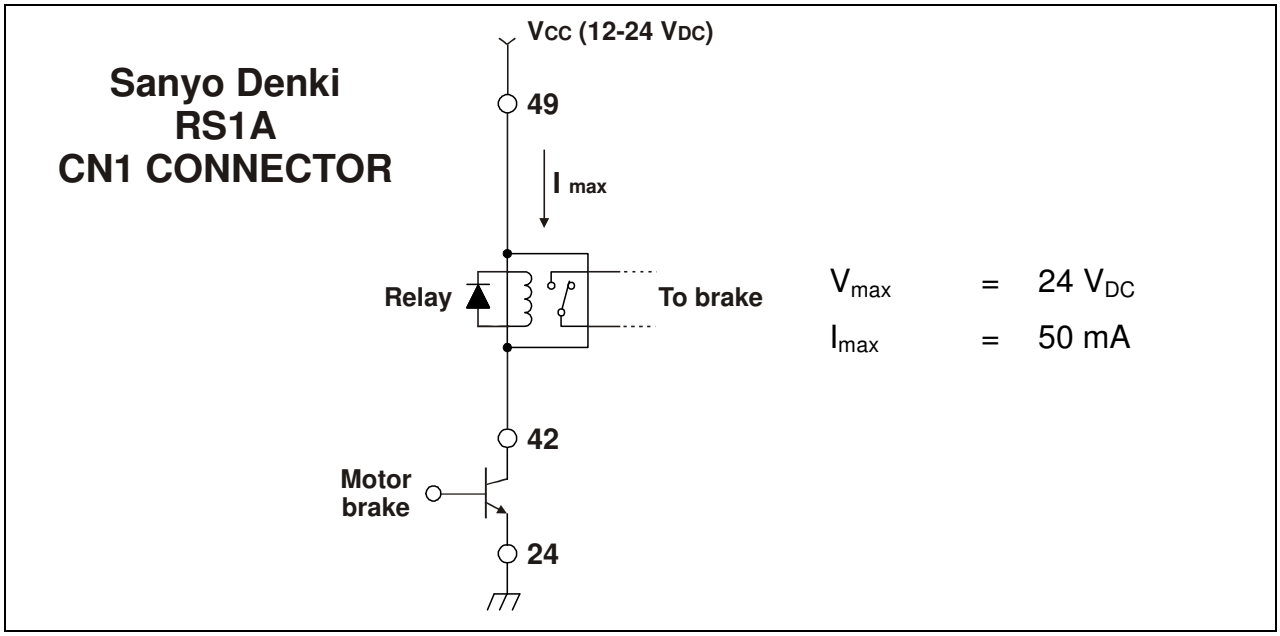
Page	Symbol	Name	Present Value	Unit
00	STATUS	Servo Amplifier Status	[04] Servo Ready	
01	WARNING1	Warnig Status 1	0000-0000	
02	WARNING2	Warnig Status 2	0000-1001	
03	CONT_8-1	General Purpose Input CONT8 to CONT1 Monitor	0000-0000	
04	OUT_8-1	General Purpose Output OUT8 to OUT1 Monitor	1111-0101	
05	VMON	Velocity Monitor	0	min-1
06	VCMON	Velocity Command Monitor	0	min-1
07	TMON	Torque (Force) Monitor	0	%
08	TCMON	Torque (Force) Command Monitor	0	%
09	PMON	Position Deviation Monitor	0	Pulse
0A	APMON	Actual Position Monitor (Motor Encoder)	0	Pulse
0B	EX-APMON	External Actual Position Monitor (External Encoder)	0	Pulse
0C	CPMON	Command Position Monitor	0	Pulse
0D	VC/TC-IN	Analog Velocity Command/Analog Torque Command Input Volta	3	mV
0E	FMON	Position Command Pulse Input Frequency Monitor	0	k Pulse/s
0F	CSU	U-Phase Electric Angle Monitor	90	deg
10	PS-H	Absolute Encoder PS Data (High)	00000000 H	x2^32 P
11	PS-L	Absolute Encoder PS Data (Low)	00000000 H	Pulse
12	RegP	Regenerative Resistor Operation Percentage	0.00	%
13	OPRT	Motor Operating Rate Monitor	9	%

For example, the status of the General Purpose Inputs and Outputs is shown in "Page 03" and "Page 04". The speed of the motor is displayed in "Page 05" and the value of the instantaneous torque in "Page 07". If the "Automatic Dynamic Tuning" is enabled, the value of the "Load Inertia Ratio" is shown in "Page 15".

Another useful function is the "Trace Operation", please read carefully paragraph 3.25 of the Sanyo Denki R-SetUp Software Manual Rel. M0006935G included in the Starter Kit CD-Rom.

HOLDING BRAKE

All the motors can be supplied, **ON DEMAND**, in the version with 24VDC holding brake. The codes of motors with brake are characterized by the last letters ("CS") – e.g. the code of the P5 1000W motor equipped with 24VDC brake is P50B08100HCS. It is important to have the servo motor equipped with the holding brake in case of hanging load. The delay of engaging and releasing emergency brake is about 100 – 200 msec, for this reason the servo amplifier keeps the motor in torque and does not accept any command movement for 300 msec. There are two parameters that define the delay of engaging and releasing the holding brake: BONDLY [General parameter settings – Group B – Page 13] and BOFFDLY [General parameter settings – Group B – Page 14]. If the motor **IS EQUIPPED** with holding brake, **DO NOT MODIFY** these parameters to prevent mechanical damages. If the motor **IS NOT** equipped with holding brake, you can decrease the BOFFDLY value to reduce the delay between the Servo ON signal and the rotation of the motor shaft. By default, the general purpose output OUT 4 (pin 42 – CN1 Connector) is set to provide a command signal to engage and release the holding brake. You could use the general purpose output OUT 4 + a relay to drive the 24VDC power supply. Follow the next scheme:



Otherwise, if you don't want to command the 24VDC for the holding brake by the servo amplifier, you could output the general purpose OUT 4 (pin 42 – CN1 Connector) to an appropriate host device; to do that, use the same scheme described on page 18 of this quick guide.

In case of no alarm conditions, the general purpose OUT 4 follows the Servo ON transitions: when the Servo On function is enabled, the general purpose OUT 4 is ON and the holding brake is released, when the Servo On function is disabled, the general purpose OUT 4 is OFF and the holding brake is engaged. The Sanyo Denki brushless AC servo systems are equipped with a servo brake system and a dynamic brake circuit; these features help to stop the motor movement in case of abnormal conditions. Please read **CAREFULLY** chapter 6 [Operation] of the complete Sanyo Denki Instruction Manual Rel. M0006890K for a complete description.

PASSWORD FUNCTION

The password function allows protection against unauthorized parameter changes (**lock function**). When setting the password, be sure to make a note of it for further reference. **WARNING:** it is **NOT POSSIBLE** to release the lock function without password. The permitted values for the password is a combination of 4 digits: from "0 to 9" and "A to F"; "0 0 0 0" and "F F F F" **ARE NOT** valid combinations. The password function is enabled or disabled by turning OFF the control power and then once again switching it ON. You can input the alphanumeric string only by the servo amplifier digital operator. If a password has been stored, it is not possible to make parameter changes via "R-Setup Software".

Lock function

1. Switch the control power on.
2. Press the "*UP*" key. If the message "*-PAS-*" is blinking, this indicates that a password has not yet been set.
3. Press and hold the "*WR*" key for more than one second.
4. The "*0 0 0 0*" message is displayed.
5. Enter the desired password using the "*Up*" key or the "*Down*" key.
6. To switch between the digits, press the "*WR*" key.
7. When you have input the password, press and hold the "*WR*" key for more than one second.
8. The display will blink three times for confirmation.
9. Turn OFF the control power supply and switch it ON again to enable the lock function.

When the password has been set, pressing the "*MODE*" key, the digital operator will show only the status and the monitor display. Obviously if a password has been set, it is not possible make parameter changes. **WARNING: if you try to change any parameters by R-Setup software, the communication will be disconnected**.

Unlock Function

If you need to modify any parameters, you have to reset the password function to factory default: "*0 0 0 0*".

1. Switch the control power on.
2. Press the "*UP*" key. If the message "-*PAS*-" is not blinking, this indicates that a password has yet been set.
3. Press and hold the "*WR*" key for more than one second.
4. Enter the stored password using the "*Up*" key or the "*Down*" key.
5. To switch between the digits, press the "*WR*" key.
6. When you have input the stored password, press and hold the "*WR*" key for more than one second.
7. The display will blink the "*0 0 0 0*" message three times for confirmation.
8. If the entered password does not match, the display will blink the "-*ERR*-" message. Try to enter it again.
9. Turn OFF the control power supply and switch it ON again to enable the unlock function.

When the password has been cleared, pressing the "*MODE*" key, the digital operator will show all the available menus. For any other information, please refer to the complete Sanyo Denki Instruction Manual Rel. M0006890K included in the Starter Kit CD-Rom.

Warning

Sanyo Denki Co. and R.T.A. S.r.l. have NOT any tools to remove the stored password, therefore if you need to repair any Brushless AC Servo Systems "R" Series, please reset the password to factory default.

AUTO OFFSET FUNCTION

In velocity control mode (±10V), sometimes the servo motor may rotate at low speed even if the analog command voltage is 0V: **this is fully normal in any analog command type servo-systems**. In this case you can use the analog speed command auto offset function. Before to start, remember to open the loop with your host device and disconnect the serial line cable from the servo amplifier. It is recommended that you perform the auto offset function only by the servo amplifier digital operator: this ensure the best results.

1. Switch the control power On.
2. Be sure to see a single segment lighten in the seven segment display.
3. Switch the main power On.
4. Be sure to see three segments lighten in the seven segment display.
5. Enable the Servo On Function.
6. Be sure that the seven segment display, draws a "8" rotating figure.
7. Open the PID loop with your host device.
8. Provide an analog command voltage of 0V.
9. Press the "*MODE*" key three times.
10. The seven segment display, shows the "*Au 00*" message; the numeric value blinks.
11. Press the "*UP*" key two times.
12. The seven segment display shows the "*Au 02*" message, now you are ready to start the "*Auto Offeset function*".
13. Press and hold the "*WR*" key for more than one second.
14. The seven segment display, shows the "*_y___n_*" message.
15. Press the "*UP*" key.
16. The seven segment display, shows the "*rdy*" message.
17. Press and hold the "*WR*" key for more than one second to start the automatic offset function.
18. At the end of the process, the seven segment display shows the message "*-End-*".
19. Press the "*MODE*" key six times to return the seven segment display to the initial condition.

For any other information, please refer to the complete Sanyo Denki Instruction Manual Rel. M0006890K included in the Starter Kit CD-Rom pag. 4-11.

POWER CAPACITY

The following table shows input power capacity for the rated output under load for the Sanyo Denki AC Servo-Systems "RS1A" series. RTA suggests to separate and protect the control and main power supply using transformers and fuses; please refer to the complete Sanyo Denki manual Rel. M0006890K included in the Starter Kit CD-Rom pag. 9-2.

POWER CAPACITY					
Input Voltage	**Servo Amplifier**	**Motor Model Number**	**Rated Output [W]**	**Main Circuit Power Supply [KVA]**	**Control Power Supply [VA]**
230V AC	**RS1A01**	P30B04005D	50	0.2	40
		P30B04010D	100	0.3	
		P30B06020D	200	0.5	
		P50B04010D	100	0.4	
		P50B05020D	200	0.8	
		R2AA04010F	100	0.4	
		R2AA06020F	200	0.8	
	RS1A03	P30B06040D	400	1.0	40
		P30B08075D	750	1.7	
		P50B07040D	400	1.3	
		P50B08100H	1000	2.2	
		R2AA06040F	400	1.0	
		R2AA08075F	750	1.7	
		R2AAB8100H	1000	2.2	
		Q2AA10150B	1500	3.0	
	RS1A05	P20B10150D	1500	3.0	40
		P60B13150H	1500	3.9	
		Q1AA10150D	1500	3.0	
		Q2AA13150H	1500	3.9	
	RS1A10	Q1AA13300D	3000	5.0	40

MOTOR DATA SHEETS

The following tables show the various constants for each motor and the motor torques provided according to speed variation (rpm). Regarding the Q1 and Q2 motor series refer to the complete Sanyo Denki Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom.
For each diagram two zones are indicated:

- **Continuous zone**: torque delivered by the motor continuously with a 100% duty cycle
- **Instantaneous zone**: torque delivered by the motor with a duty cycle below 100%.

The maximum duty cycle that can be obtained in the instantaneous zone depends on different factors, such as the system inertia. Read carefully the complete Sanyo Denki Instructions Manual Rel. M0006890K included in the Starter Kit CD-Rom or contact RTA engineers for a correct dimensioning of the system.

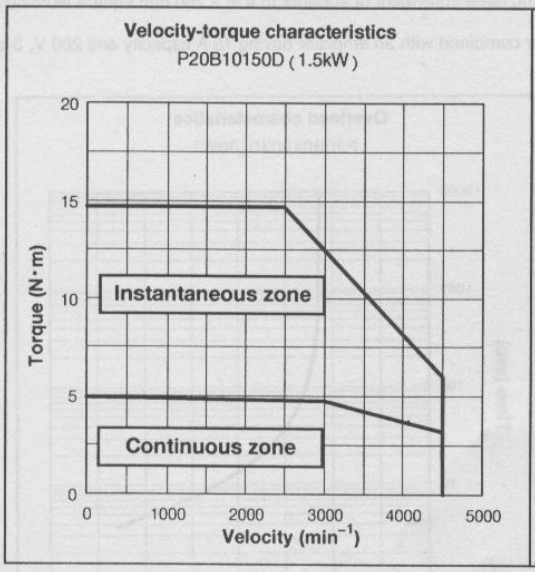
P20B10150D

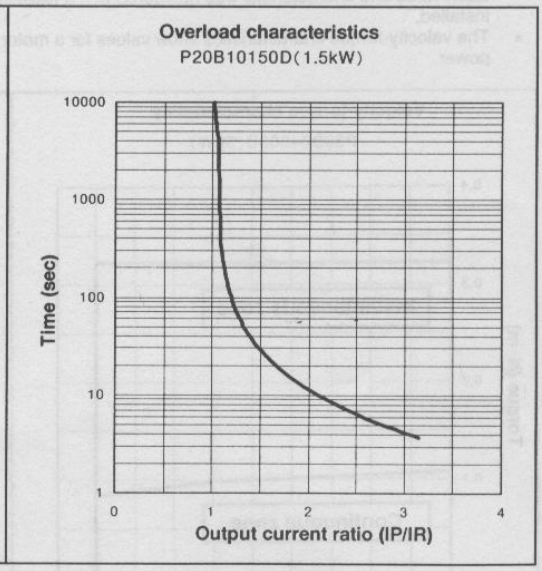
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	1500	W	1500	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	4.79	N·m	48.8	kg·cm
* Continuous stall torque	T_S	4.90	N·m	50	kg·cm
* Instantaneous maximum stall torque	T_P	14.7	N·m	150	kg·cm
* Rated armature current	I_R	8.4	Arms	8.4	Arms
* Continuous stall armature current	I_S	8.1	Arms	8.1	Arms
* Instantaneous maximum stall armature current	I_P	26.5	Arms	26.5	Arms
Torque constant	K_T	0.65	N·m/Arms	6.6	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	22.6	mV/min^{-1}	22.6	V/krpm
Phase armature resistance	R_ϕ	0.42	Ω	0.42	Ω
Electrical time constant	t_e	13	msec	13	msec
Mechanical time constant (not including sensor)	t_m	0.59	msec	0.59	msec
Inertia (including wiring-saved INC)	J_M	2.04×10^{-4}	$kg \cdot m^2 (GD^2/4)$	2.08	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	2.06×10^{-4}	$kg \cdot m^2 (GD^2/4)$	2.1	$g \cdot cm \cdot s^2$
Inertia (including ABS-RII)	J_M	2.04×10^{-4}	$kg \cdot m^2 (GD^2/4)$	2.08	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	20.4×10^{-4}	$kg \cdot m^2 (GD^2/4)$	20.8	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	6.5	kg	6.5	kg
Weight (including ABS-E)	W_E	6.4	kg	6.4	kg
Weight (including ABS-RII)	W_E	6.6	kg	6.6	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	7.84 or more	N·m	80 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.83/0.22	A(DC)	0.83/0.22	A(DC)
Inertia	J_B	0.40×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.39	$g \cdot cm \cdot s^2$
Weight	W	1.5	kg	1.5	kg

- The mark * denotes the value after a temperature rise. The others are values at 20°C. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50 A capacity and 200 V, 3-phase power.





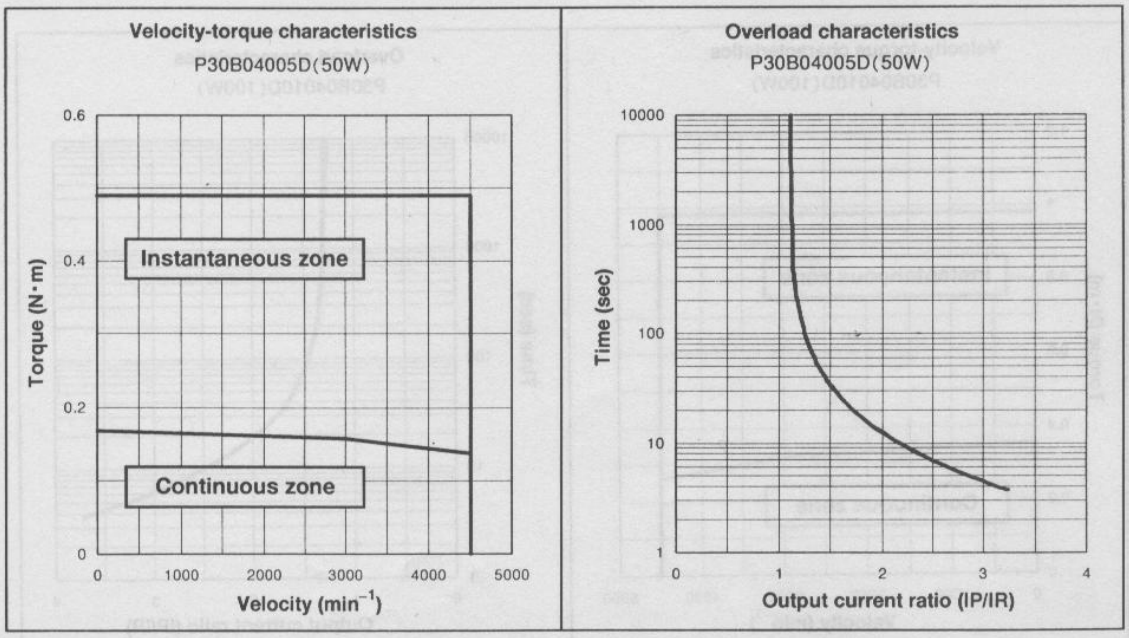
P30B04005D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	50	W	50	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.157	N·m	1.6	kg·cm
* Continuous stall torque	T_S	0.167	N·m	1.7	kg·cm
* Instantaneous maximum stall torque	T_P	0.49	N·m	5.0	kg·cm
* Rated armature current	I_R	0.74	Arms	0.74	Arms
* Continuous stall armature current	I_S	0.75	Arms	0.75	Arms
* Instantaneous maximum stall armature current	I_P	2.4	Arms	2.4	Arms
Torque constant	K_T	0.235	N·m/Arms	2.4	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	8.2	mV/min^{-1}	8.2	V/krpm
Phase armature resistance	R_ϕ	9.1	Ω	9.1	Ω
Electrical time constant	t_e	1.2	msec	1.2	msec
Mechanical time constant (not including sensor)	t_m	1.3	msec	1.3	msec
Inertia (including wiring-saved INC)	J_M	0.031×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.032	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	0.056×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.057	$g \cdot cm \cdot s^2$
Inertia (including ABS-RII)	J_M	0.028×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.029	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	0.31×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.32	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	0.35	kg	0.35	kg
Weight (including ABS-E)	W_E	0.68	kg	0.68	kg
Weight (including ABS-RII)	W_E	0.44	kg	0.44	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	0.157 or more	N·m	1.6 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.26/0.07	A(DC)	0.26/0.07	A(DC)
Inertia	J_B	0.0078×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.008	$g \cdot cm \cdot s^2$
Weight	W	0.24	kg	0.24	kg

- The mark * denotes the value after a temperature rise. The others are values at 20°C. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15 A capacity and 200 V, 3-phase power.



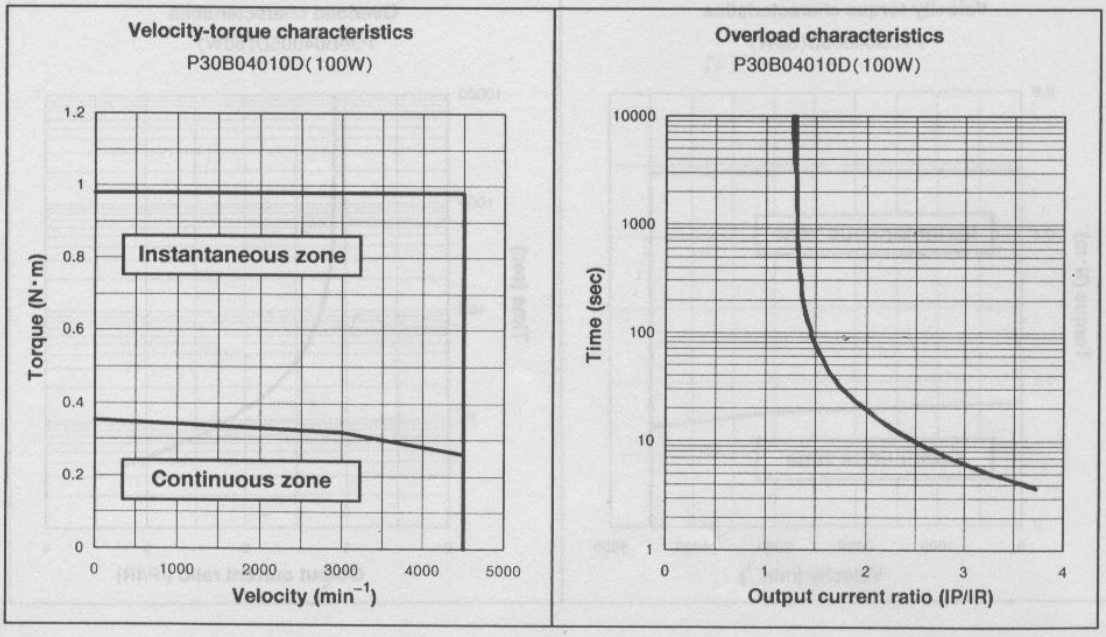
P30B04010D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	100	W	100	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.32	N·m	3.25	kg·cm
* Continuous stall torque	T_S	0.353	N·m	3.6	kg·cm
* Instantaneous maximum stall torque	T_P	0.98	N·m	10	kg·cm
* Rated armature current	I_R	1.1	Arms	1.1	Arms
* Continuous stall armature current	I_S	1.3	Arms	1.3	Arms
* Instantaneous maximum stall armature current	I_P	4.1	Arms	4.1	Arms
Torque constant	K_T	0.292	N·m/Arms	2.98	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	10.2	mV/min^{-1}	10.2	V/krpm
Phase armature resistance	R_ϕ	4.3	Ω	4.3	Ω
Electrical time constant	t_e	1.4	msec	1.4	msec
Mechanical time constant (not including sensor)	t_m	0.7	msec	0.7	msec
Inertia (including wiring-saved INC)	J_M	0.051×10^{-4}	$kg·m^2(GD^2/4)$	0.052	$g·cm·s^2$
Inertia (including ABS-E)	J_M	0.076×10^{-4}	$kg·m^2(GD^2/4)$	0.077	$g·cm·s^2$
Inertia (including ABS-RII)	J_M	0.048×10^{-4}	$kg·m^2(GD^2/4)$	0.049	$g·cm·s^2$
Applicable load inertia	J_L	0.51×10^{-4}	$kg·m^2(GD^2/4)$	0.52	$g·cm·s^2$
Weight (including wiring-saved INC)	W_E	0.5	kg	0.5	kg
Weight (including ABS-E)	W_E	0.83	kg	0.83	kg
Weight (including ABS-RII)	W_E	0.59	kg	0.59	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	0.32 or more	N·m	3.25 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.26/0.07	A(DC)	0.26/0.07	A(DC)
Inertia	J_B	0.0078×10^{-4}	$kg·m^2(GD^2/4)$	0.008	$g·cm·s^2$
Weight	W	0.24	kg	0.24	kg

- The mark * denotes the value after a temperature rise. The others are values at 20°C. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15 A capacity and 200 V, 3-phase power.



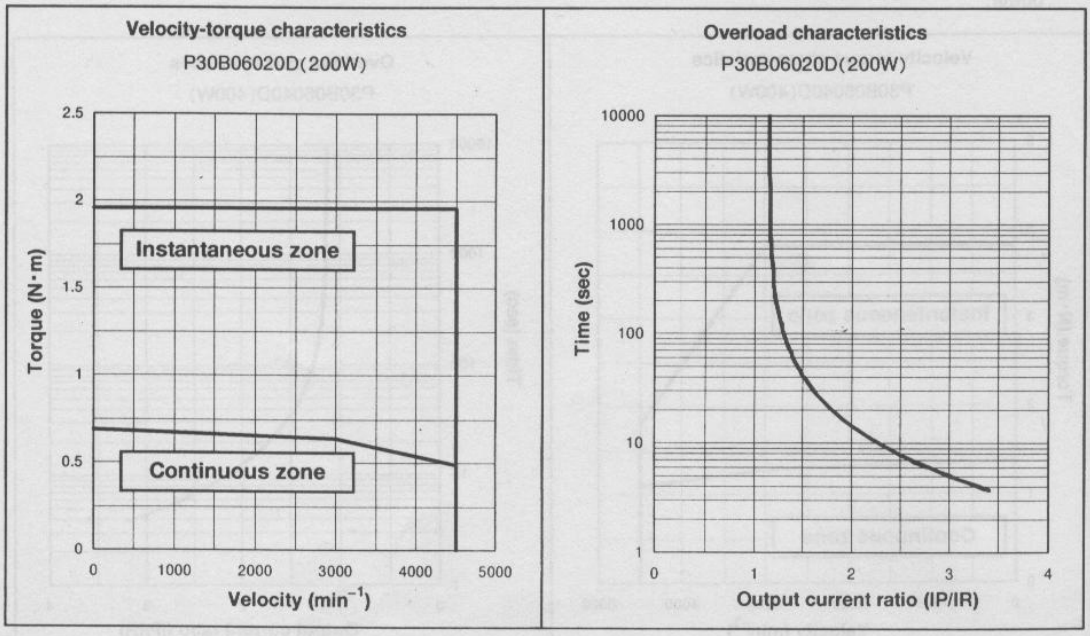
P30B06020D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	200	W	200	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.637	N·m	6.5	kg·cm
* Continuous stall torque	T_S	0.686	N·m	7	kg·cm
* Instantaneous maximum stall torque	T_P	1.96	N·m	20	kg·cm
* Rated armature current	I_R	2.2	Arms	2.2	Arms
* Continuous stall armature current	I_S	2.3	Arms	2.3	Arms
* Instantaneous maximum stall armature current	I_P	7.5	Arms	7.5	Arms
Torque constant	K_T	0.316	N·m/Arms	3.22	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	11.0	mV/min^{-1}	11.0	V/krpm
Phase armature resistance	R_ϕ	1.5	Ω	1.5	Ω
Electrical time constant	t_e	3.8	msec	3.8	msec
Mechanical time constant (not including sensor)	t_m	0.63	msec	0.63	msec
Inertia (including wiring-saved INC)	J_M	0.144×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.147	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	0.169×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.172	$g \cdot cm \cdot s^2$
Inertia (including ABS-RII)	J_M	0.141×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.144	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	1.44×10^{-4}	$kg \cdot m^2 (GD^2/4)$	1.47	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	1.15	kg	1.15	kg
Weight (including ABS-E)	W_E	1.37	kg	1.37	kg
Weight (including ABS-RII)	W_E	1.35	kg	1.35	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	0.637 or more	N·m	6.5 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.31/0.07	A(DC)	0.31/0.07	A(DC)
Inertia	J_B	0.06×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.061	$g \cdot cm \cdot s^2$
Weight	W	0.44	kg	0.44	kg

- The mark * denotes the value after a temperature rise. The others are values at 20°C. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15 A capacity and 200 V, 3-phase power.



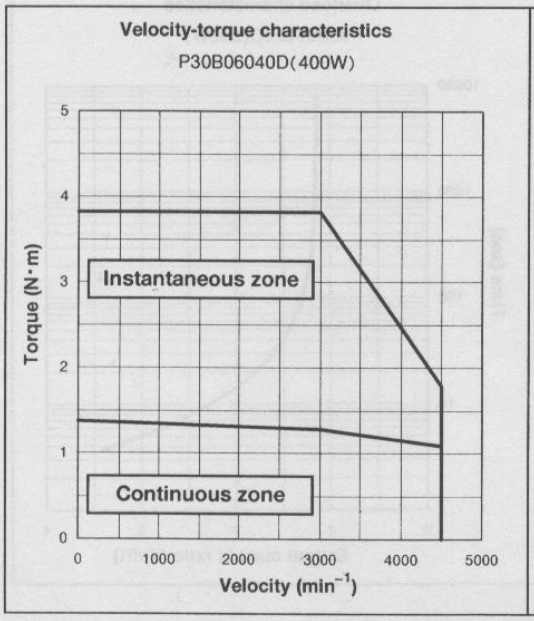
P30B06040D

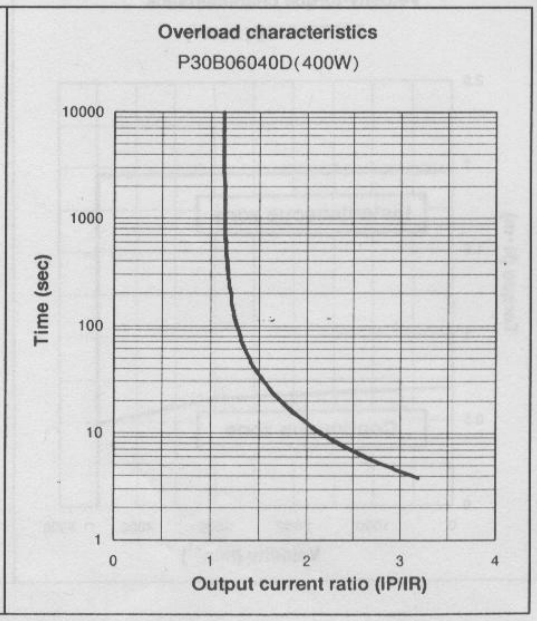
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	400	W	400	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	1.274	N·m	13	kg·cm
* Continuous stall torque	T_S	1.372	N·m	14	kg·cm
* Instantaneous maximum stall torque	T_P	3.82	N·m	39	kg·cm
* Rated armature current	I_R	2.7	Arms	2.7	Arms
* Continuous stall armature current	I_S	2.8	Arms	2.8	Arms
* Instantaneous maximum stall armature current	I_P	8.6	Arms	8.6	Arms
Torque constant	K_T	0.533	N·m/Arms	5.44	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	18.6	mV/min^{-1}	18.6	V/krpm
Phase armature resistance	R_ϕ	1.4	Ω	1.4	Ω
Electrical time constant	t_e	4.6	msec	4.6	msec
Mechanical time constant (not including sensor)	t_m	0.38	msec	0.38	msec
Inertia (including wiring-saved INC)	J_M	0.255×10^{-4}	$kg·m^2(GD^2/4)$	0.265	$g·cm·s^2$
Inertia (including ABS-E)	J_M	0.280×10^{-4}	$kg·m^2(GD^2/4)$	0.290	$g·cm·s^2$
Inertia (including ABS-RII)	J_M	0.252×10^{-4}	$kg·m^2(GD^2/4)$	0.262	$g·cm·s^2$
Applicable load inertia	J_L	2.55×10^{-4}	$kg·m^2(GD^2/4)$	2.65	$g·cm·s^2$
Weight (including wiring-saved INC)	W_E	1.7	kg	1.7	kg
Weight (including ABS-E)	W_E	1.92	kg	1.92	kg
Weight (including ABS-RII)	W_E	1.90	kg	1.90	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	1.274 or more	N·m	13 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.31/0.07	A(DC)	0.31/0.07	A(DC)
Inertia	J_B	0.06×10^{-4}	$kg·m^2(GD^2/4)$	0.061	$g·cm·s^2$
Weight	W	0.44	kg	0.44	kg

- The mark * denotes the value after a temperature rise. The others are values at 20°C. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30 A capacity and 200 V, 3-phase power.





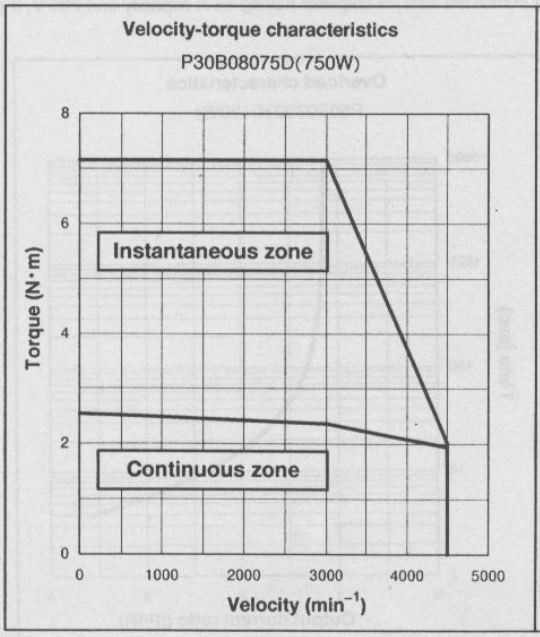
P30B08075D

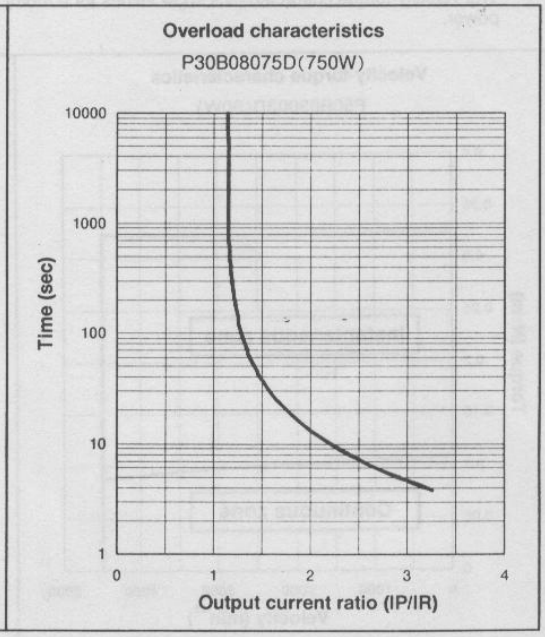
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	750	W	750	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	2.38	N·m	24.3	kg·cm
* Continuous stall torque	T_S	2.55	N·m	26	kg·cm
* Instantaneous maximum stall torque	T_P	7.15	N·m	73	kg·cm
* Rated armature current	I_R	4.6	Arms	4.6	Arms
* Continuous stall armature current	I_S	4.8	Arms	4.8	Arms
* Instantaneous maximum stall armature current	I_P	15.0	Arms	15.0	Arms
Torque constant	K_T	0.565	N·m/Arms	5.77	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	19.74	mV/min^{-1}	19.74	V/krpm
Phase armature resistance	R_ϕ	0.52	Ω	0.52	Ω
Electrical time constant	t_e	8.3	msec	8.3	msec
Mechanical time constant (not including sensor)	t_m	0.3	msec	0.3	msec
Inertia (including wiring-saved INC)	J_M	0.635×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.645	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	0.78×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.79	$g \cdot cm \cdot s^2$
Inertia (including ABS-RII)	J_M	0.647×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.657	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	6.35×10^{-4}	$kg \cdot m^2 (GD^2/4)$	6.45	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	3.3	kg	3.3	kg
Weight (including ABS-E)	W_E	3.71	kg	3.71	kg
Weight (including ABS-RII)	W_E	3.49	kg	3.49	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	2.38 or more	N·m	24.3 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.37/0.08	A(DC)	0.37/0.08	A(DC)
Inertia	J_B	0.343×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.35	$g \cdot cm \cdot s^2$
Weight	W	0.8	kg	0.8	kg

- The mark * denotes the value after a temperature rise. The others are values at 20°C. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30 A capacity and 200 V, 3-phase power.





P50B04010D

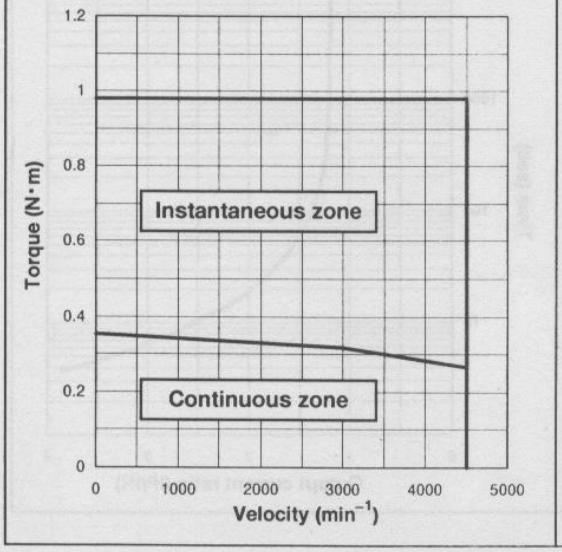
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	100	W	100	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.319	N·m	3.25	kg·cm
* Continuous stall torque	T_S	0.353	N·m	3.6	kg·cm
* Instantaneous maximum stall torque	T_P	0.98	N·m	10	kg·cm
* Rated armature current	I_R	1.0	Arms	1.0	Arms
* Continuous stall armature current	I_S	1.2	Arms	1.2	Arms
* Instantaneous maximum stall armature current	I_P	3.6	Arms	3.6	Arms
Torque constant	K_T	0.333	N·m/Arms	3.4	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	11.6	mV/min^{-1}	11.6	V/krpm
Phase armature resistance	R_ϕ	7.0	Ω	7.0	Ω
Electrical time constant	t_e	1.5	msec	1.5	msec
Mechanical time constant (not including sensor)	t_m	1.4	msec	1.4	msec
Inertia (including wiring-saved INC)	J_M	0.079×10^{-4}	$kg·m^2(GD^2/4)$	0.08	$g·cm·s^2$
Inertia (including ABS-E)	J_M	0.104×10^{-4}	$kg·m^2(GD^2/4)$	0.105	$g·cm·s^2$
Inertia (including ABS-RII)	J_M	0.0760×10^{-4}	$kg·m^2(GD^2/4)$	0.077	$g·cm·s^2$
Applicable load inertia	J_L	0.79×10^{-4}	$kg·m^2(GD^2/4)$	0.8	$g·cm·s^2$
Weight (including wiring-saved INC)	W_E	0.59	kg	0.59	kg
Weight (including ABS-E)	W_E	0.89	kg	0.89	kg
Weight (including ABS-RII)	W_E	0.65	kg	0.65	kg

Holding Brake Data Sheet (Option)

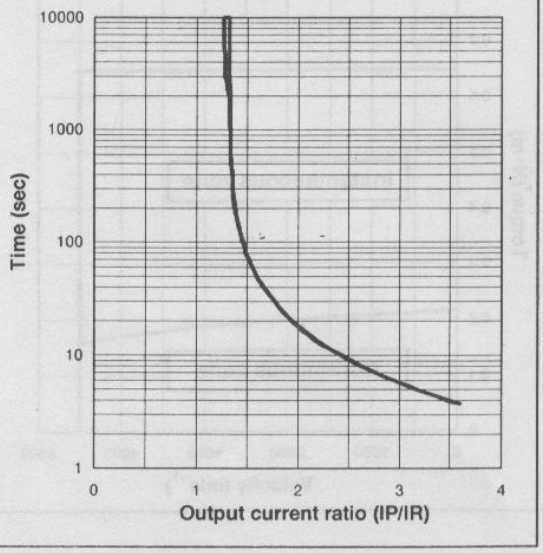
Holding torque	T_B	0.319 or more	N·m	3.25 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.26/0.07	A(DC)	0.26/0.07	A(DC)
Inertia	J_B	0.0078×10^{-4}	$kg·m^2(GD^2/4)$	0.008	$g·cm·s^2$
Weight	W	0.24	kg	0.24	kg

- The mark * denotes the value after a temperature rise. The others are values at 20°C. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t6 × 250 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15 A capacity and 200 V, 3-phase power.

Velocity-torque characteristics
P50B04010D(100W)



Overload characteristics
P50B04010D(100W)



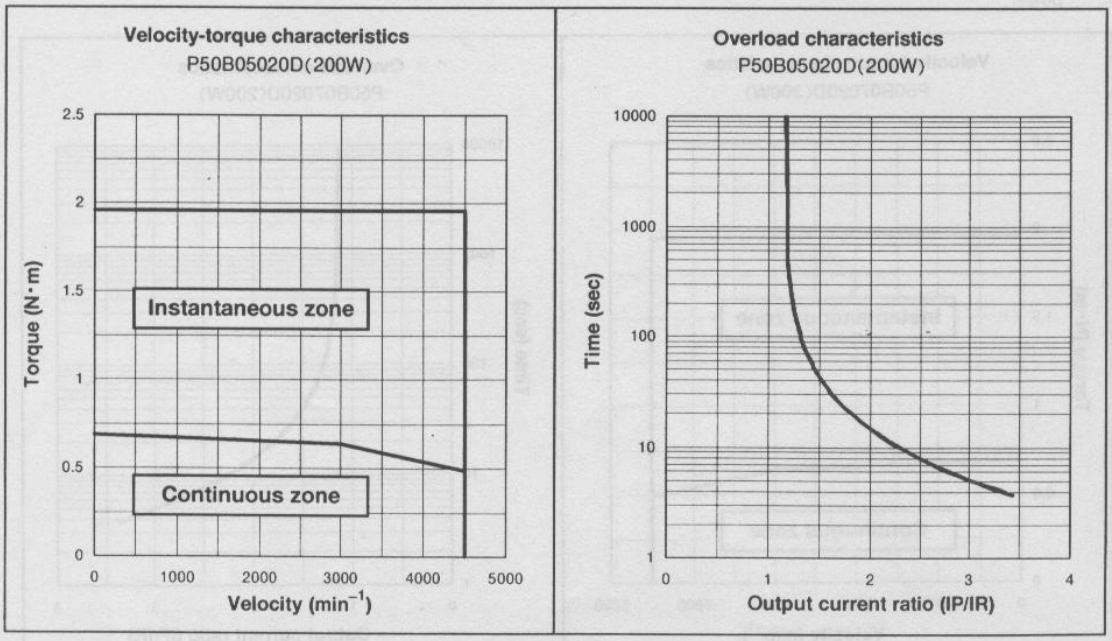
P50B05020D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	200	W	200	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	0.637	N·m	6.5	kg·cm
* Continuous stall torque	T_S	0.686	N·m	7	kg·cm
* Instantaneous maximum stall torque	T_P	1.96	N·m	20	kg·cm
* Rated armature current	I_R	1.6	Arms	1.6	Arms
* Continuous stall armature current	I_S	1.7	Arms	1.7	Arms
* Instantaneous maximum stall armature current	I_P	5.5	Arms	5.5	Arms
Torque constant	K_T	0.436	N·m/Arms	4.45	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	15.2	mV/min^{-1}	15.2	V/krpm
Phase armature resistance	R_ϕ	3.4	Ω	3.4	Ω
Electrical time constant	t_e	2.9	msec	2.9	msec
Mechanical time constant (not including sensor)	t_m	0.9	msec	0.9	msec
Inertia (including wiring-saved INC)	J_M	0.173×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.176	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	0.198×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.201	$g \cdot cm \cdot s^2$
Inertia (including ABS-RII)	J_M	0.170×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.173	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	1.73×10^{-4}	$kg \cdot m^2 (GD^2/4)$	1.76	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	1.07	kg	1.07	kg
Weight (including ABS-E)	W_E	1.34	kg	1.34	kg
Weight (including ABS-RII)	W_E	1.20	kg	1.20	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	0.353 or more	N·m	3.6 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.40/0.11	A(DC)	0.40/0.11	A(DC)
Inertia	J_B	0.029×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.03	$g \cdot cm \cdot s^2$
Weight	W	0.3	kg	0.3	kg

- The mark * denotes the value after a temperature rise. The others are values at 20°C. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 15 A capacity and 200 V, 3-phase power.



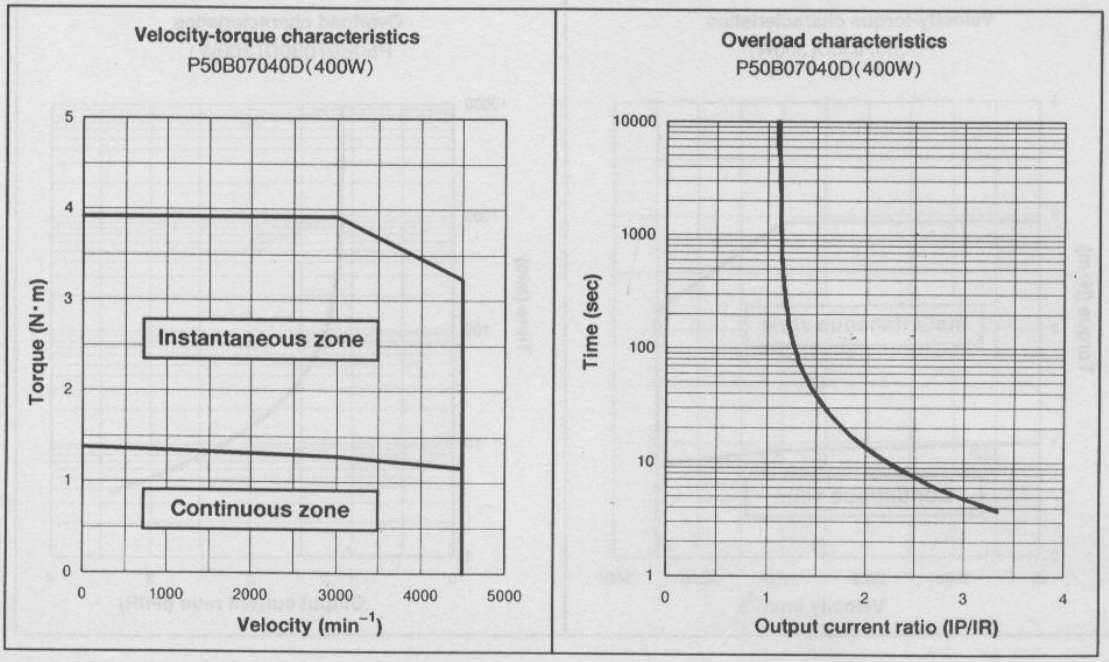
P50B07040D

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	400	W	400	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	4500	min^{-1}	4500	rpm
* Rated torque	T_R	1.274	N·m	13	kg·cm
* Continuous stall torque	T_S	1.372	N·m	14	kg·cm
* Instantaneous maximum stall torque	T_P	3.92	N·m	40	kg·cm
* Rated armature current	I_R	3.0	Arms	3.0	Arms
* Continuous stall armature current	I_S	3.1	Arms	3.1	Arms
* Instantaneous maximum stall armature current	I_P	10	Arms	10	Arms
Torque constant	K_T	0.481	N·m/Arms	4.91	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	16.8	mV/min^{-1}	16.8	V/krpm
Phase armature resistance	R_ϕ	1.65	Ω	1.65	Ω
Electrical time constant	t_e	4	msec	4	msec
Mechanical time constant (not including sensor)	t_m	1.6	msec	1.6	msec
Inertia (including wiring-saved INC)	J_M	0.74×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.755	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	0.885×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.9	$g \cdot cm \cdot s^2$
Inertia (including ABS-RII)	J_M	0.752×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.767	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	7.4×10^{-4}	$kg \cdot m^2 (GD^2/4)$	7.55	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	2.1	kg	2.1	kg
Weight (including ABS-E)	W_E	2.4	kg	2.4	kg
Weight (including ABS-RII)	W_E	2.10	kg	2.10	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	0.98 or more	N·m	10 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.30/0.08	A(DC)	0.30/0.08	A(DC)
Inertia	J_B	0.245×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.25	$g \cdot cm \cdot s^2$
Weight	W	0.57	kg	0.57	kg

- The mark * denotes the value after a temperature rise. The others are values at 20°C. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30 A capacity and 200 V, 3-phase power.



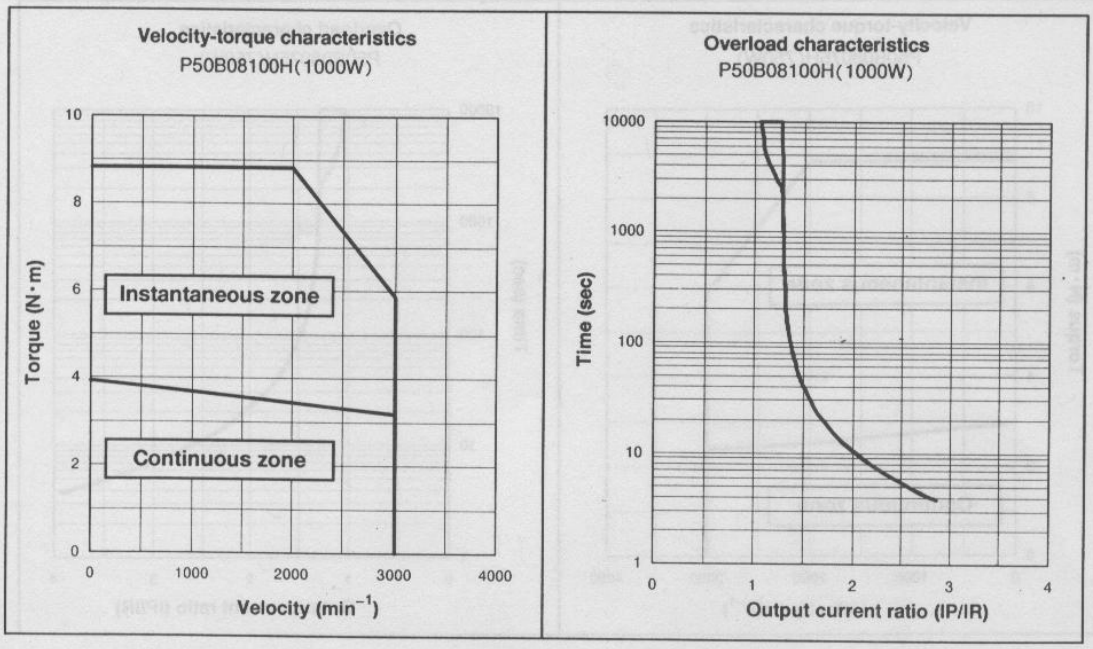
P50B08100H

Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	1000	W	1000	W
Rated revolution speed	N_R	3000	min^{-1}	3000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
* Rated torque	T_R	3.185	N·m	32.5	kg·cm
* Continuous stall torque	T_S	3.92	N·m	40	kg·cm
* Instantaneous maximum stall torque	T_P	8.82	N·m	90	kg·cm
* Rated armature current	I_R	4.3	Arms	4.3	Arms
* Continuous stall armature current	I_S	5.0	Arms	5.0	Arms
* Instantaneous maximum stall armature current	I_P	12.3	Arms	12.3	Arms
Torque constant	K_T	0.860	N·m/Arms	8.78	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	30.02	mV/min^{-1}	30.02	V/krpm
Phase armature resistance	R_ϕ	1.0	Ω	1.0	Ω
Electrical time constant	t_e	5.9	msec	5.9	msec
Mechanical time constant (not including sensor)	t_m	1.1	msec	1.1	msec
Inertia (including wiring-saved INC)	J_M	2.651×10^{-4}	$kg·m^2(GD^2/4)$	2.705	$g·cm·s^2$
Inertia (including ABS-E)	J_M	2.796×10^{-4}	$kg·m^2(GD^2/4)$	2.85	$g·cm·s^2$
Inertia (including ABS-RII)	J_M	2.663×10^{-4}	$kg·m^2(GD^2/4)$	2.717	$g·cm·s^2$
Applicable load inertia	J_L	26.5×10^{-4}	$kg·m^2(GD^2/4)$	27.1	$g·cm·s^2$
Weight (including wiring-saved INC)	W_E	5.05	kg	5.05	kg
Weight (including ABS-E)	W_E	5.31	kg	5.31	kg
Weight (including ABS-RII)	W_E	5.1	kg	5.1	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	2.94 or more	N·m	30 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.33/0.08	A(DC)	0.33/0.08	A(DC)
Inertia	J_B	0.343×10^{-4}	$kg·m^2(GD^2/4)$	0.35	$g·cm·s^2$
Weight	W	0.8	kg	0.8	kg

- The mark * denotes the value after a temperature rise. The others are values at 20°C. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t12 × 305 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 30 A capacity and 200 V, 3-phase power.



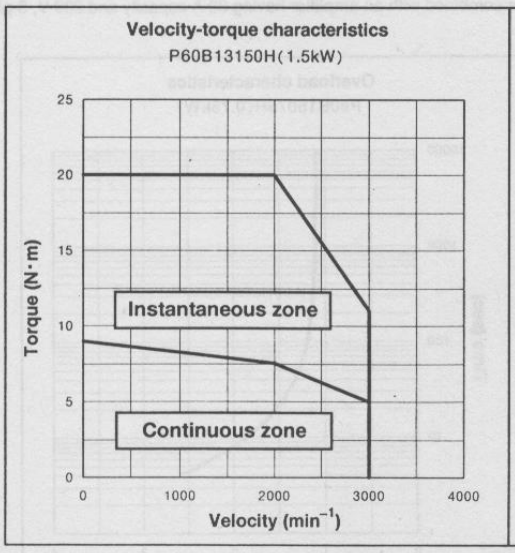
P60B13150H

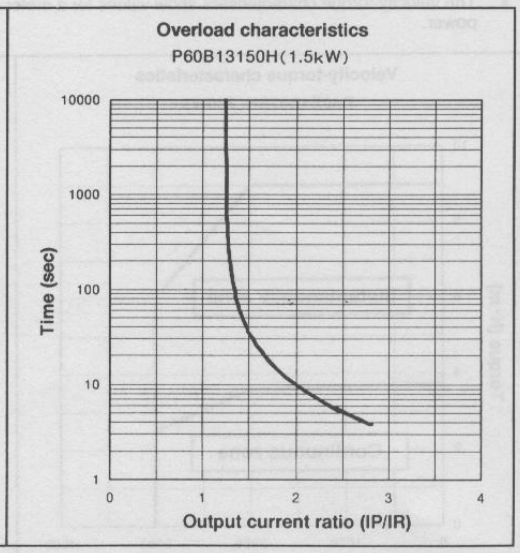
Name	Symbol	Data	Unit	Data	Unit
* Rated output	P_R	1500	W	1500	W
Rated revolution speed	N_R	2000	min^{-1}	2000	rpm
Maximum revolution speed	N_{max}	3000	min^{-1}	3000	rpm
* Rated torque	T_R	7.5	N·m	76	kg·cm
* Continuous stall torque	T_S	9.0	N·m	92	kg·cm
* Instantaneous maximum stall torque	T_P	20.0	N·m	204	kg·cm
* Rated armature current	I_R	9.4	Arms	9.4	Arms
* Continuous stall armature current	I_S	10.7	Arms	10.7	Arms
* Instantaneous maximum stall armature current	I_P	26.5	Arms	26.5	Arms
Torque constant	K_T	0.90	N·m/Arms	9.2	kg·cm/Arms
Induced voltage constant	$K_{E\phi}$	31.4	mV/min^{-1}	31.4	V/krpm
Phase armature resistance	R_ϕ	0.27	Ω	0.27	Ω
Electrical time constant	t_e	10	msec	10	msec
Mechanical time constant (not including sensor)	t_m	0.82	msec	0.82	msec
Inertia (including wiring-saved INC)	J_M	8.28×10^{-4}	$kg \cdot m^2 (GD^2/4)$	8.48	$g \cdot cm \cdot s^2$
Inertia (including ABS-E)	J_M	8.35×10^{-4}	$kg \cdot m^2 (GD^2/4)$	8.55	$g \cdot cm \cdot s^2$
Inertia (including ABS-RII)	J_M	8.280×10^{-4}	$kg \cdot m^2 (GD^2/4)$	8.443	$g \cdot cm \cdot s^2$
Applicable load inertia	J_L	82.8×10^{-4}	$kg \cdot m^2 (GD^2/4)$	84.8	$g \cdot cm \cdot s^2$
Weight (including wiring-saved INC)	W_E	7.8	kg	7.8	kg
Weight (including ABS-E)	W_E	7.8	kg	7.8	kg
Weight (including ABS-RII)	W_E	8.9	kg	8.9	kg

Holding Brake Data Sheet (Option)

Holding torque	T_B	9.0 or more	N·m	92 or more	kg·cm
Exciting voltage	V_B	24/90	V(DC)±10%	24/90	V(DC)±10%
Exciting current	I_B	0.86/0.25	A(DC)	0.86/0.25	A(DC)
Inertia	J_B	0.5×10^{-4}	$kg \cdot m^2 (GD^2/4)$	0.5	$g \cdot cm \cdot s^2$
Weight	W	1.5	kg	1.5	kg

- The mark * denotes the value after a temperature rise. The others are values at 20°C. Each value is a typical one.
- Each value and characteristic was measured with a radiating plate equivalent or superior to a t20 × 400 mm square aluminum plate installed.
- The velocity-torque characteristics show values for a motor combined with an amplifier having 50 A capacity and 200 V, 3-phase power.





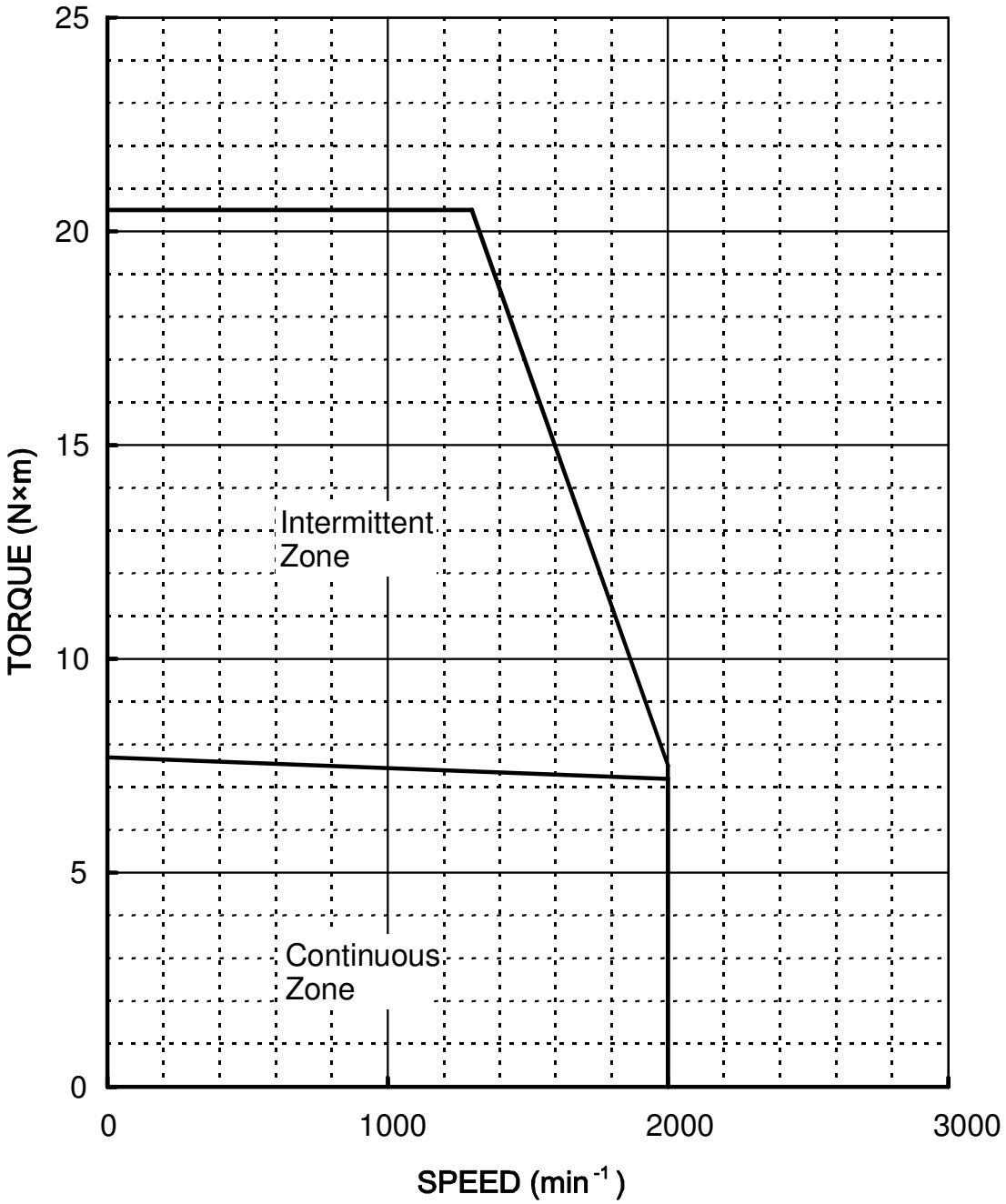
Q2AA10150B
Operating Characteristics

Applicable amplifier model: QS1A03A/RS1A03A

Rated current 5.2Arms

Peak current 15.5Arms

Motor temperature rise saturation point combined with amplifier at AC200V

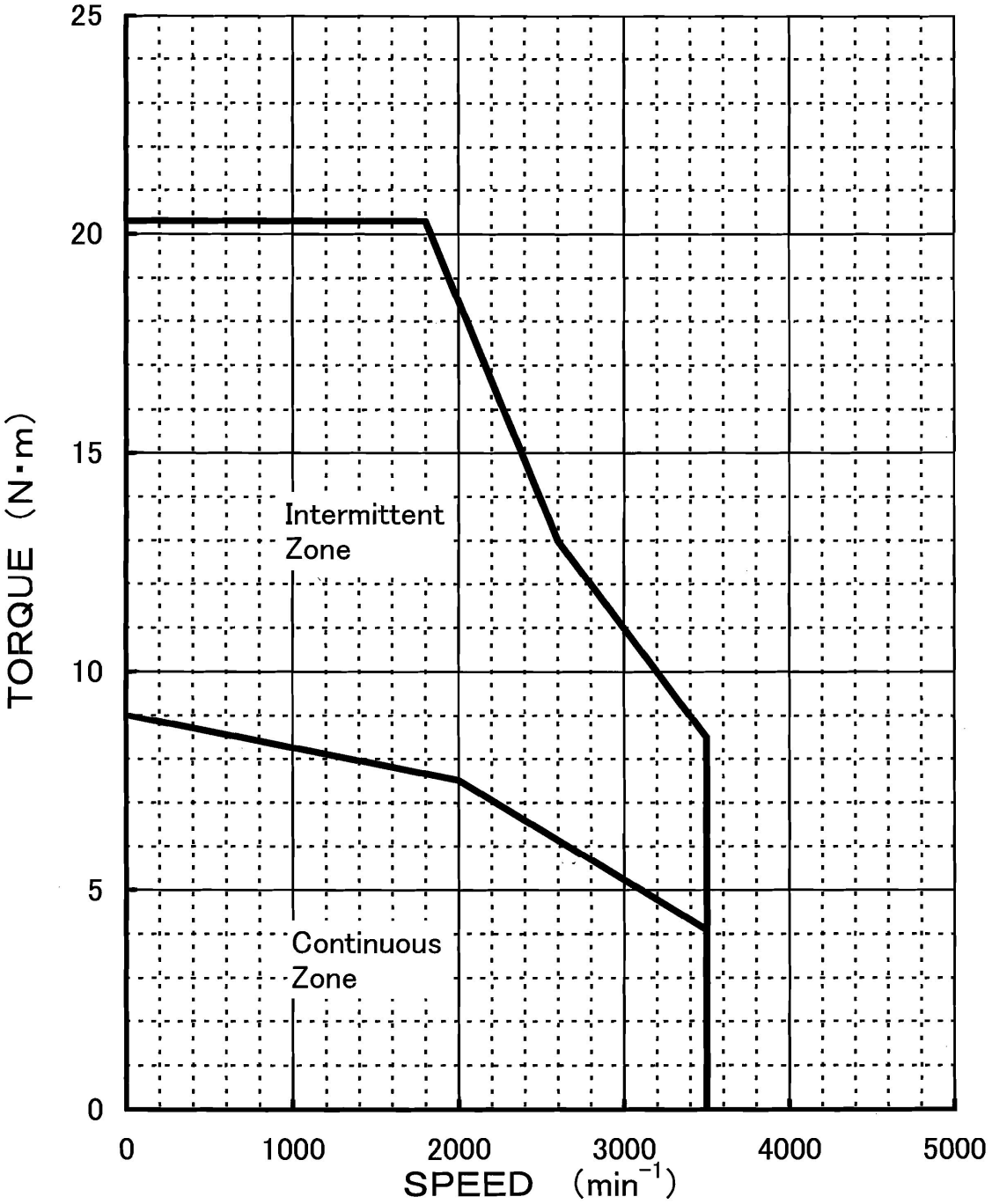


Q2AA13150H

Operating Characteristics

Applicable amplifier model: RS1A05A
Rated current 8.7Arms
Peak current 26.5Arms

Motor temperature rise saturation point
combined with Amplifire
at AC200V-single-phase

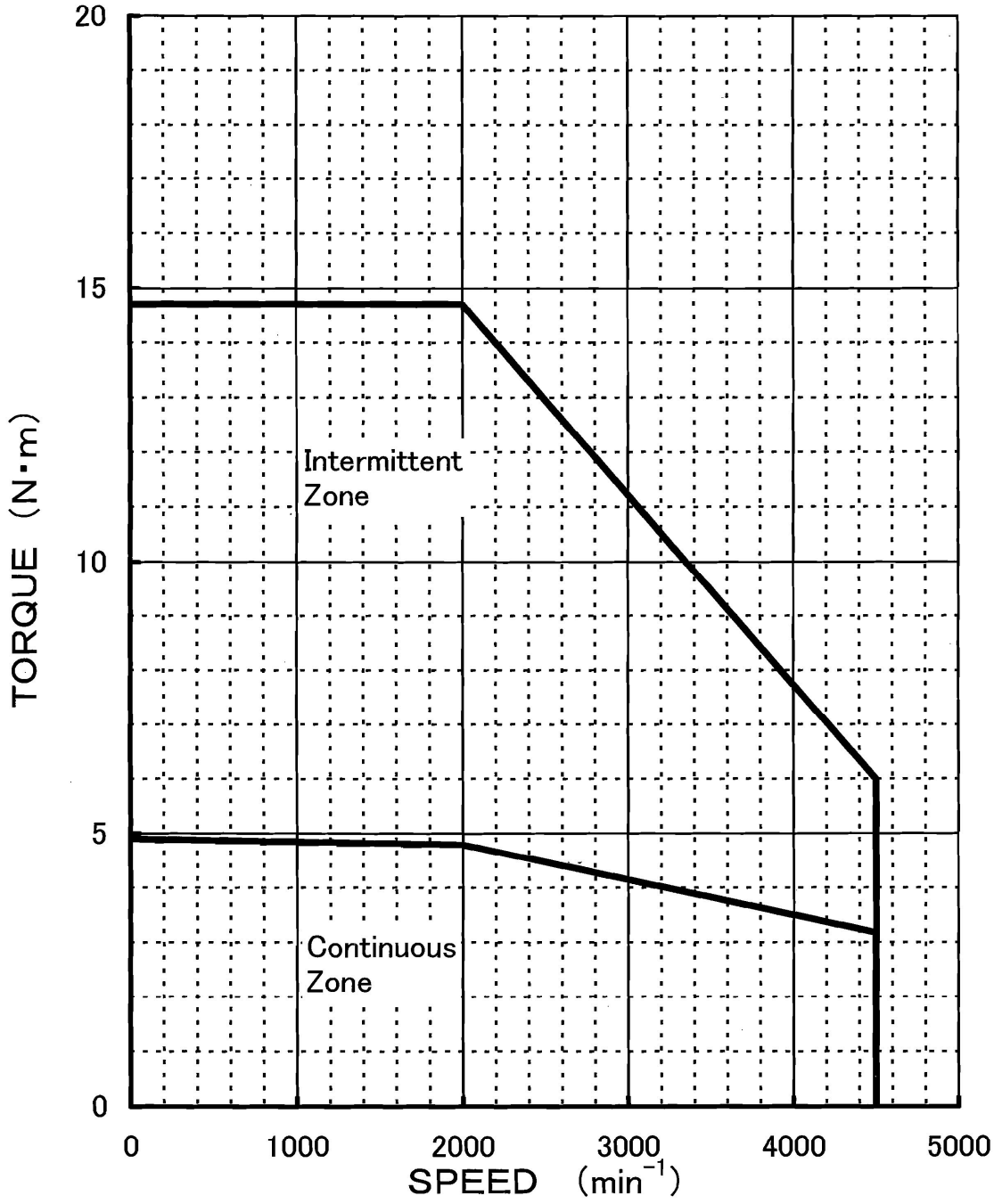


Q1AA10150D

Operating Characteristics

Applicable amplifier model: RS1A05A
Rated current 8.2Arms
Peak current 26.5Arms

Motor temperature rise saturation point
combined with Amplifire
at AC200V-single-phase



R2AAB8100H*

Operating Characteristics

Applicable amplifier model: RS1A03A
Rated current 4.6Arms
Peak current 15.5Arms

Motor temperature rise saturation point
combined with Amplifire at 200VAC