#### YASKAWA

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## $\Sigma$ Series SGM/SGMP/DR2 USER'S MANUAL

AC Servomotors and Driver

SGM/SGMP Servomotors DR2 Servopack



MANUAL NO. TSE-S800-17D

#### PREFACE

The rapid progress being made in today's automation and information technologies is resulting in a growing need for even more-advanced motion control for future high-tech equipment. The end result is a need for devices that can provide more-precise and quicker motion at higher speeds. Servo control technology makes this possible. Launched by Yaskawa in 1993, the  $\Sigma$  Series consists of innovative AC Servos that were developed using leading-edge servo control technology.

This manual covers all products information on the  $\Sigma$  Series SGM $\square$ /DR2, which feature superior functions and performance. This manual was designed to provide comprehensible information for users who are about to use a servo for the first time as well as for users who already have experience in using servos. This manual enables users to understand what  $\Sigma$ -Series AC Servos are all about and how to design, install, operate, and maintain a servo system. Keep this manual in a convenient location and refer to it whenever necessary in operating and maintaining the servo system.

#### YASKAWA ELECTRIC CORPORATION

#### **General Precautions**

- Some drawings in this manual are shown with the protective cover or shields removed, in order to describe the detail with more clarity. Make sure all covers and shields are replaced before operating this product.
- Some drawings in this manual are shown as typical example and may differ from the shipped product.
- This manual may be modified when necessary because of improvement of the product, modification or changes in specifications.
   Such modification is made as a revision by renewing the manual No.
- To order a copy of this manual, if your copy has been damaged or lost, contact your YASKAWA representative listed on the last page stating the manual No. on the front cover.
- YASKAWA is not responsible for accidents or damages due to any modification of the product made by the user since that will void our guarantee.

## NOTES FOR SAFE OPERATION

Read this manual thoroughly before installation, operation, maintenance or inspection of the AC Servo Drives. In this manual, the NOTES FOR SAFE OPERATION are classified as "WARNING" or "CAUTION".



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious personal injury.

## 

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate personal injury and/or damage to the equipment.

In some instances, items described in A CAUTION may also result in a serious accident. In either case, follow these important items.

## A WARNING

#### (INSTALLATION)

 After voltage resistance test, wait at least five minutes before servicing the product.

Failure to observe this warning may result in electric shock.

#### (WIRING)

 Grounding must be in accordance with the national code and consistent with sound local practices.

Failure to observe this warning may lead to electric shock or fire.

#### (OPERATION)

• Never touch any rotating motor parts during operation. Failure to observe this warning may result in personal injury.

#### (INSPECTION AND MAINTENANCE)

- Be sure to turn OFF power before inspection or maintenance. Otherwise, electric shock may result.
- After turning OFF power, wait at least five minutes before servicing the product.

Otherwise, residual electric charges may result in electric shock.

## 

#### (RECEIVING)

• Use the specified combination of SERVOMOTOR and SERVOPACK. Failure to observe this caution may lead to fire or failure.

#### (INSTALLATION)

• Never use the equipment where it may be exposed to splashes of water, corrosive or flammable gases, or near flammable materials. Failure to observe this caution may lead to electric shock or fire.

#### (WIRING)

- Do not connect three–phase power supply to output terminals  $\bigcirc$   $\bigcirc$  and  $\bigodot$  .

Failure to observe this caution may lead to personal injury or fire.

• Securely tighten screws on the power supply and motor output terminals. Failure to observe this caution can result in a fire.

## 

#### (OPERATION)

• To avoid inadvertent accidents, run the SERVOMOTOR only in test run (without load).

Failure to observe this caution may result in personal injury.

• Before starting operation with a load connected, set up user constants suitable for the machine.

Starting operation without setting up user constants may lead to overrun failure.

 Before starting operation with a load connected, make sure emergencystop procedures are in place.

Failure to observe this caution may result in personal injury.

• During operation, do not touch the heat sink. Failure to observe this caution may result in burns.

(INSPECTION AND MAINTENANCE)

- Do not disassemble the SERVOMOTOR. Failure to observe this caution may result in electric shock or personal injury.
- Never change wiring while power is ON. Failure to observe this caution may result in electric shock or personal injury.

### Manual Contents

This manual provides Σ-Series users with information on the following:

- An overview of servo systems for first-time users.
- Checking the product on delivery and basic applications of the servo.
- · Servo applications.
- Selecting an appropriate servo for your needs and placing an order.
- Inspection and maintenance.

### Manual Structure

All chapters in this manual are classified into one or more of three areas according to their contents: **A**, **B**, and **C**. Refer to the applicable chapters for the information you require.

- A: Chapters explaining how to select a servo: For users who wish to gain a basic understanding of  $\Sigma$  Series products or who need to select an appropriate servo.
- **B:** Chapters explaining how to design a servo system: For users who are about to design, install, and operate a  $\Sigma$ -Series Servo Control System.
- **C:** Chapters explaining maintenance: For users who are going to maintain and troubleshoot  $\Sigma$ -Series products.

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CHAPTER 1	For First-time Users of AC Servos	1	A, B
	Provides an overview of servos and the $\Sigma$ Series	N3.9	
CHAPTER 2	Basic Uses of $\Sigma$ -series Products	15	В
N.IGBOUT	Describes steps to take when product is received, plus basi wiring and application methods.	c ulo	W. GDaute
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1 dbaut	Describes operating procedures for $\Sigma$ -Series servos, turnin features ON and OFF, setting control constants, etc.	g undbautor	10000
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ý.	Describes selection methods for $\Sigma$ -Series servos and peripherals and provides servo specifications.		
CHAPTER 6	Inspection, Maintenance, and Troubleshooting	387	С
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	Provides the measures to conform to the EMC Directive.		

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### **Basic Terms**

Unless otherwise specified, the following definitions are used:

5	Servomotor:	Σ-Series SGM/SGMP Servomotor
	Servopack:	An amplifier (Trademark of Yaskawa servo amplifier "DR2 Servopack")
	Servodrive:	A SGM/SGMP Servomotor and an amplifier (DR2 Servopack)
	Servo system:	A complete servo control system consisting of servodrive, host controller, and peripheral devices

### <u>Visual Aids</u>

The following aids are used to indicate certain types of information for easier reference.



Indicates references for additional information.

Technical terms placed in bold in the text are briefly explained in a "TERMS" section at the bottom of the page. The following kinds of technical terms are explained: Technical terms that need to be explained to users who are not very familiar with servo systems or electronic devices and technical terms specific to  $\Sigma$  Series Servos that need to be explained in descriptions of functions.



The text indicated by this icon is applicable only to Servopack in speed/torque control mode.



The text indicated by this icon is applicable only to Servopack in position control mode.



The text indicated by this icon explains the operating procedure using hand-held type digital operator (Type: JUSP-OP02A-1).

JUSP-OP02A-1

**NOTE** A  $\Sigma$ -Series Servodrive alone cannot ensure the functionality and performance of the entire machine control system. It must be combined with an appropriate machine and host controller so that the entire control system works properly. Therefore, carefully read the instruction manuals for the machine to be used before attempting to operate the servodrive.

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This chapter is intended for first-time users of AC servos. It describes the basic configuration of a servo mechanism and basic technical terms relating to servos.

Users who already have experience in using a servo should also take a look at this chapter to understand the features of  $\Sigma$ -Series AC Servos.

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1.1.1 Servo Mechanisms

### 1.1 Basic Understanding of AC Servos

This section describes the basic configuration of a servo mechanism and technical terms relating to servos and also explains the features of  $\Sigma$ -Series AC Servos.

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#### 1.1.1 Servo Mechanisms

You may be familiar with the following terms:

- Servo
- Servo mechanism
- Servo control system

In fact, these terms are synonymous. They have the following meaning:

A control mechanism that monitors physical quantities such as specified positions.

In short, a servo mechanism is like a servant who does tasks faithfully and quickly according to his master's instructions. In fact, "servo" originally derives from the word "servant."

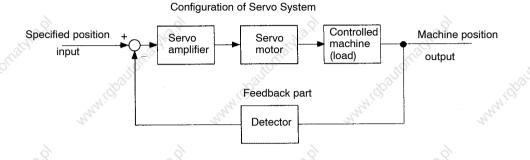


#### Servo mechanism

According to Japanese Industrial Standard (JIS) terminology, a "servo mechanism" is defined as a mechanism that uses the position, direction, or orientation of an object as a process variable to control a system to follow any changes in a target value (set point). More simply, a servo mechanism is a control mechanism that monitors physical quantities such as specified positions. Feedback control is normally performed by a servo mechanism. (Source: JIS B0181) Servo system could be defined in more detail as a mechanism that:

- · Moves at a specified speed and
- · Locates an object in a specified position

To develop such a servo system, an automatic control system involving **feedback control** must be designed. This automatic control system can be illustrated in the following block diagram:



This servo system is an automatic control system that detects the machine position (output data), feeds back the data to the input side, compares it with the specified position (input data), and moves the machine by the difference between the compared data.

In other words, the servo system is a system to control the output data to match the specified input data.

If, for example, the specified position changes, the servo system will reflect the changes.

In the above example, input data is defined as a position, but input data can be any physical quantities such as orientation (angle), water pressure, or voltage.

Position, speed, force (torque), electric current, and so on are typical controlled values for a servo system.

#### The main technical terms used in this manual are as follows:

- 1) Servo mechanism
- 2) Servo

Normally, servo is synonymous with servo mechanism. However, because "mechanism" is omitted, the meaning becomes somewhat ambiguous. Servo may refer to the entire servo mechanism but may also refer to an integral part of a servo mechanism such as a servomotor or a servo amplifier. This manual also follows this convention in the use of the term "servo".



#### Feedback control

A control that returns process variables to the input side and forms a closed loop. It is also called closed-loop control.

1.1.1 Servo Mechanisms cont.

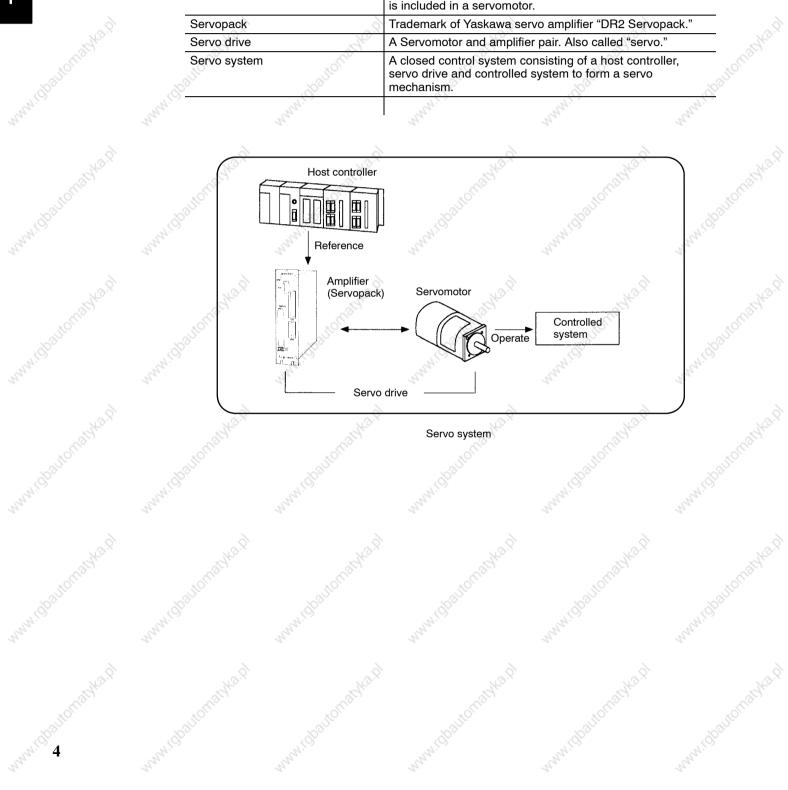
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3) Servo control system

Servo control system is almost synonymous with servo mechanism but places the focus on system control. In this manual, the term "servo system" is also used as a synonym of servo control system.

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Related Terms Servomotor	Meaning General servomotors or Yaskawa SGM/SGMP
14	Servomotors. In some cases, a position detector (encoder) is included in a servomotor.
Servopack	Trademark of Yaskawa servo amplifier "DR2 Servopack."
Servo drive	A Servomotor and amplifier pair. Also called "servo."
Servo system	A closed control system consisting of a host controller, servo drive and controlled system to form a servo mechanism.



#### 1.1.2 Servo Configuration 1) Configuration of Servo System The following diagram illustrates a servo system in detail: Host controller (5) Position or speed reference Servo amplifier (4) Power Comparator amplifier (Output) Position Motor drive (Input) circuit Speed (1)Movable Gear table Position or <del>(</del>} speed feedback Ball screw Controlled 3 system Drive system **Detector Servomotor** (1) Controlled system: Mechanical system for which the position or speed is to be controlled. This includes a drive system that transmits torque from a servomotor. (2) Servomotor: A main actuator that moves a controlled system. Two types are available: AC servomotor and DC servomotor. (3) Detector: A position or speed detector. Normally, an encoder mounted on a motor is used as a position detector. (4) Servo amplifier: An amplifier that processes an error signal to correct the difference between a reference and feedback data and operates the servomotor accordingly. A servo amplifier consists of a comparator, which processes error signals, and a power amplifier, which operates the servomotor. (5) Host controller: A device that controls a servo amplifier by specifying a position or speed as a set point.

1.1.2 Servo Configuration cont.

Servo components (1) to (5) are outlined below:

(1) Controlled system

In the previous figure, the controlled system is a movable table for which the position or speed is controlled. The movable table is driven by a ball screw and is connected to the servomotor via gears.

So, the drive system consists of:

#### Gears + Ball Screw

This drive system is most commonly used because the power transmission ratio (gear ratio) can be freely set to ensure high positioning accuracy. However, play in the gears must be minimized.

The following drive system is also possible when the controlled system is a movable table:

#### Coupling + Ball Screw

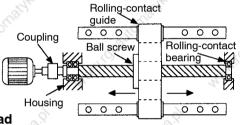
When the power transmission ratio is 1 : 1, a coupling is useful because it has no play.

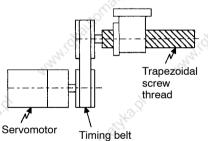
This drive system is widely used for machining tools.



A timing belt is a coupling device that allows the power transmission ratio to be set freely and that has no play.

A trapezoidal screw thread does not provide excellent positioning accuracy, so can be treated as a minor coupling device.





To develop an excellent servo system, it is important to select a rigid drive system that has no play.

Configure the controlled system by using an appropriate drive system for the control purpose.



#### Drive system

Also called a drive mechanism.

A drive system connects an actuator (such as a servomotor) to a controlled system and serves as a mechanical control component that transmits torque to the controlled system, orientates the controlled system, and converts motion from rotation to linear motion and vice versa.

(2) Servomotor

(a) DC Servomotor and AC Servomotor

Servomotors are divided into two types: DC servomotors and AC servomotors.

DC servomotors are driven by direct current (DC). They have a long history. Up until the 1980s, the term "servomotor" used to imply a DC servomotor.

From 1984, AC servomotors were emerging as a result of rapid progress in microprocessor technology. Driven by alternating current (AC), AC servomotors are now widely used because of the following advantages:

- Easy maintenance: No brush
- High speed:
- No limitation in rectification rate

Note however that servomotors and Servopacks use some parts that are subject to mechanical wear or aging. For preventive maintenance, inspect and replace parts at regular intervals.

For details, refer to Chapter 6 Inspection, Maintenance, and Troubleshooting.

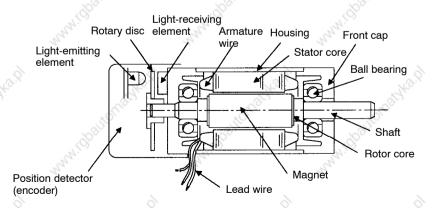
(b) AC Servomotor

AC servomotors are divided into two types: synchronous type and induction type. The synchronous type is more commonly used.

For a synchronous type servomotor, motor speed is controlled by changing the frequency of alternating current.

A synchronous type servomotor provides strong holding torque when stopped, so this type is ideal when precise positioning is required. Use this type for a servo mechanism for position control.

The following figure illustrates the structure of a synchronous type servomotor:



Yaskawa SGM and SGMP Servomotors are of the synchronous type.

1.1.2 Servo Configuration cont.

(c) Performance of Servomotor

A servomotor must have "instantaneous power" so that it can start as soon as a start reference is received.

The term "power rating (kW/s)" is used to represent instantaneous power. It refers to the electric power (kW) that a servomotor generates per second. The greater the power rating, the more powerful the servomotor.

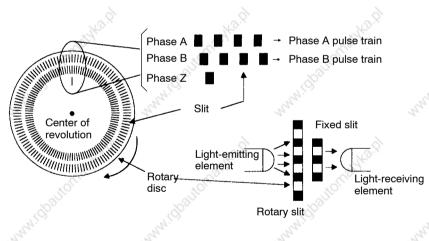
#### (3) Detector

A servo system requires a position or speed detector. It uses an encoder mounted on a servomotor. Optical and magnetic detection methods are both available. Encoders are divided into the following two types:

#### (a) Incremental Encoder

An incremental encoder is a pulse generator, which generates a certain number of pulses per revolution (e.g., 2,000 pulses per revolution). If this encoder is connected to the mechanical system and one pulse is defined as a certain length (e.g., 0.001 mm), it can be used as a position detector.

However, this encoder does not detect an absolute position and merely outputs a pulse train. Hence zero return operation must be performed before positioning. The following figure illustrates the operation principle of a pulse generator (Optical method):



#### (b) Absolute Encoder

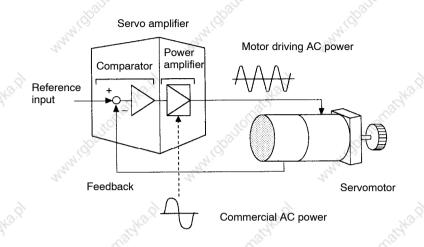
An absolute encoder is designed to detect an absolute angle of rotation as well as to perform the general functions of an incremental encoder. With an absolute encoder, therefore, it is possible to create a system that does not require zero return operation at the beginning of each operation.

- Difference between an <u>absolute</u> and <u>incremental</u> encoder:
- An <u>absolute</u> encoder will keep track of the motor shaft position even if system power is lost and some motion occurs during that period of time. The <u>incremental</u> encoder is incapable of the above.

(4) Servo amplifier

A servo amplifier is required to operate an AC servomotor.

The following figure illustrates the configuration of a servo amplifier:



A servo amplifier consists of the following two sections:

(a) Comparator

A comparator consists of a comparison function and a control function. The comparison function compares reference input (position or speed) with a feedback signal and generates a differential signal.

The control function amplifies and transforms the differential signal. In other words, it performs proportional (P) control or **proportional/integral (PI) control**. (It is not important if you do not understand these control terms completely at this point.)

(b) Power Amplifier

A power amplifier runs the servomotor at a speed or torque proportional to the output of the comparator. In other words, from the commercial power supply of 50/60 Hz, it generates alternating current with a frequency proportional to the reference speed and runs the servomotor with this current.



#### Proportional/integral (PI) control

PI control provides more accurate position or speed control than proportional control, which is more commonly used.

1.1.2 Servo Configuration cont.

(5) Host Controller

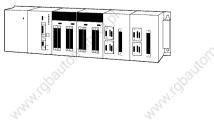
A host controller controls a servo amplifier by specifying a position or speed as a set point.

For speed reference, a position control loop may be formed in the host controller when a position feedback signal is received. Yaskawa **PROGIC-8** is a typical host controller.



#### PROGIC-8

A programmable machine controller. If combined with a servo amplifier for speed control (maximum eight axis control), the PROGIC-8 can provide position control. The PROGIC-8 also provides programmable controller functions.



SGM type

#### **1.1.3** Features of Σ-Series Servos

1) Σ-Series SGM/SGMP Servomotors are synchronous type servomotors and have the following features:

• Size and weight reduced to one-third those of our conventional models. Compact Servomotor for saving installation space.

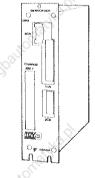
- Servo performance (power rating) enhanced to three times that of our conventional models.
   Enhanced **power rating (kW/s)** to satisfy every need.
- A wide product range covering rated output of 30 W to 750 W.

 Supply Voltage
 Rated Output
 SGMP type

 100 VAC:
 30 W, 50 W, 100 W, 200 W, 300 W
 SGMP type

 (0.04 HP, 0.07 HP, 0.13 HP, 0.27 HP, 0.40 HP)
 30 W, 50 W, 100 W, 200 W, 400 W, 750 W
 (0.04 HP, 0.07 HP, 0.13 HP, 0.27 HP, 0.53 HP, 1.01 HP)

- DR2 Servopacks can perform speed/torque or position control. Select the control mode by setting of the user constant Cn-02 (memory switch).
  - Speed/Torque Control Mode: User constant Cn-02 (memory switch) Bit B = 0 This mode uses speed or torque reference input. Reference input is by analog voltage.
  - Position Control Mode: User constant Cn-02 (memory switch) Bit B = 1 This mode uses position reference input. Reference input is by pulse train.



DR2 Servopack



#### Power rating (kW/s)

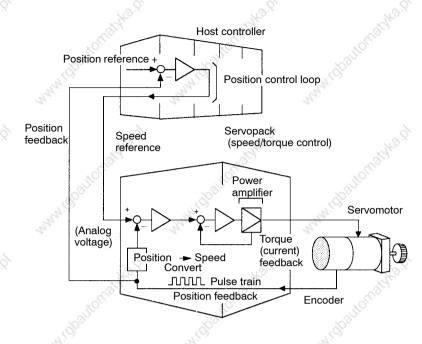
A constant that represents response performance of a servomotor. It can be determined by dividing squared rated torque by motor inertia. Power rating is the electric power (kW) that a servomotor can generate per second.

The greater the power rating, the more powerful the servomotor.

1.1.3 Features of  $\Sigma$ -Series Servos cont.

3) The most common usage of a speed/torque control Servopack is shown below:

Using Servopack in Speed/Torque Control Mode (Speed Control)



As shown in the figure above, a position control loop is formed in the host controller. The host controller compares a position reference with a position feedback signal and sends processing results to the Servopack as a speed reference.

In this way, the host controller can freely perform the control required for the servo mechanism.

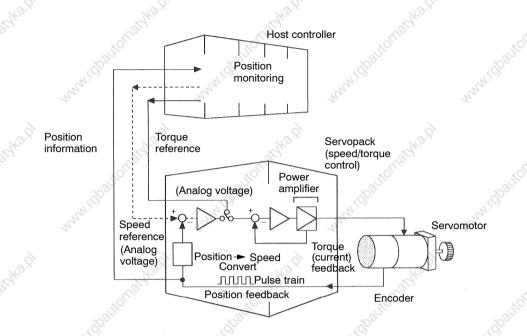
The Servopack undertakes the speed control loop and subsequent control processing.

Yaskawa programmable machine controller PROGIC-8 is available as a typical host controller.

í

4) Speed/torque control Servopack can also provide torque control as shown below.

Using Servopack in Speed/Torque Control Mode (Torque Control)



Set the user constants for Servopack to switch between the following torque control modes:

(1) Controlling servomotor torque by torque reference

(Torque control I)

(2) Operating servomotor by switching between torque reference and speed reference

(Torque control II)

13

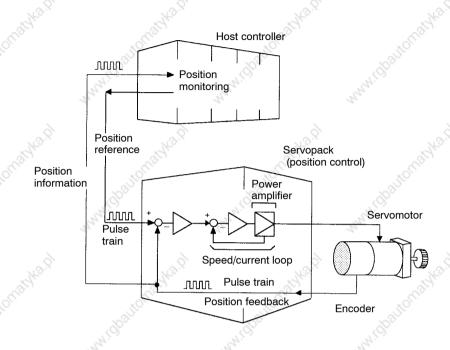
The host controller outputs a torque reference or speed reference to control the Servopack.

It also receives a pulse train (position information) from the Servopack and uses it to monitor the position.

1.1.3 Features of  $\Sigma$ -Series Servos cont.

5) Position control Servopack can be used as below.

Using Servopack in Position Control Mode



The host controller can send a position reference (pulse train) to the Servopack to perform positioning or interpolation.

This type of Servopack contains a position control loop.

User constants can be used to select either of the following pulse trains:

- (1) Code and pulse train
- (2) Two-phase pulse train with 90° phase difference
- (3) Forward and reverse pulse trains

The host controller receives a pulse train (position information) from the Servopack and uses it to monitor the position.

6) A Digital Operator can be used to set user constants for a Servopack as follows:

- (1) Setting user constants to enable or disable each function
- (2) Setting user constants required for functions to be used

Set user constants according to the servo system to be set up.

## BASIC USES OF Σ-SERIES PRODUCTS

This chapter describes the first things to do when  $\Sigma$ -Series products are delivered. It also explains the most fundamental ways of connecting and operating  $\Sigma$ -Series products. Both first-time and experienced servo users **must read** this chapter.

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#### BASIC USES OF $\Sigma$ -SERIES PRODUCTS

2.1.1 Notes on Use

#### 2.1 **Precautions**

This section provides notes on using  $\Sigma$ -Series products.

2.1.1 Notes on Use

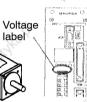
#### 2.1.1 Notes on Use

**NOTE** Always note the following to ensure safe use.

#### Two types of supply voltage are available, 100 V and 200 V.

Both  $\Sigma$ -Series Servomotor and Servopack have 100 V and 200 V types. Be sure to use the correct type.

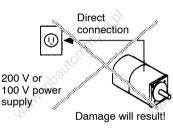
Vo Ia SGM-0 (12 A : 200 V B : 100 V



#### Always use the SGM/SGMP Servomotor and DR2 Servopack in pairs.

The SGM/SGMP Servomotor cannot run without the DR2 Servopack.

Do not plug the SGM Servomotor directly into the commercial power supply. (Direct connection to the commercial power supply will damage the Servomotor.)



#### Do not change wiring when power is ON.

Always turn the power OFF before connecting or disconnecting a connector. (Except for Digital Operator (Type: JUSP-OP02A-1))



CHARGE Lamp Extinguished

Always turn the power OFF before connecting or disconnecting a connector.

### Note that residual voltage still remains in the Servopack even after the power is turned OFF.

Even after the power is turned OFF, residual voltage still remains in the capacitor inside the Servopack. Before inspection is to be performed, make sure if CHARGE lamp is extinguished.



Careful! Residual voltage remains in capacitor

Check if CHARGE lamp goes OFF.

2.1 Precautions

#### Always follow the specified installation method.

The Servopack generates heat. Install the Servopack so that it can radiate heat freely. Note also that the Servopack must be in an environment free from condensation, vibration and shock.

#### Perform noise reduction and grounding properly.

If the signal line is noisy, vibration or malfunction will result.

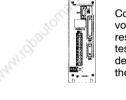
- Separate high-voltage cables from low-voltage cables.
- Use cables as short as possible.
- Use at least class 3 grounding (ground resistance 100 $\Omega$  or below) for the Servomotor and Servopack.
- Never use a line filter for the power supply in the motor circuit.

#### Conduct a voltage resistance test under the following conditions.

- Voltage: 1500 Vrms AC, one minute
- Braking current: 30 mA
- Frequency: 50/60 Hz
- Voltage applied point: Between L1, L2, L, N, +, -, Y3, Y4, U, V, W terminals and ground terminal 🕀 (connect between terminals securely.)

#### Use a fast-response type ground-fault detector.

For a ground-fault detector, always use a fast-response type or one designed for PWM inverters. Do not use a time-delay type.



Provide sufficient clearance 10 mm

Casing

Servopack Signal

line

Ambient temperature: 0 to 55°C



Servomotor

resistance test as described on the left.

_	Ground	d-fault detecto	or	
•	GOOD	GOOD	POOR	ŝ
	Fast-response type	For PWM inverter	Time-delay type	
	. She		State State	

#### Do not perform continuous operation under overhanging load.

Continuous operation cannot be performed by rotating the motor from the load and applying regenerative braking. Regenerative braking by the Servopack can be applied only for a short period, such as the motor deceleration time.

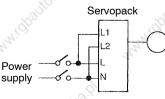


Servomotor

Regenerative braking continuously applied

#### The Servomotor cannot be operated by turning the power ON and OFF.

Frequently turning the power ON and OFF causes the internal circuit elements to deteriorate. Always start or stop the servomotor by using reference pulses.



Starting and stopping by turning power ON and OFF

#### BASIC USES OF $\Sigma$ -SERIES PRODUCTS

2.2.1 Checking on Delivery

#### 2.2 Installation

This section describes how to check  $\Sigma$ -Series products on delivery and how to install them.

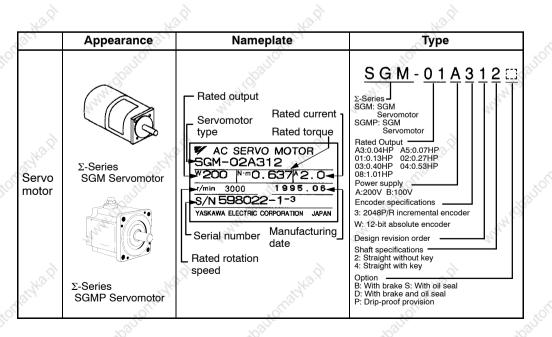
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#### 2.2.1 Checking on Delivery

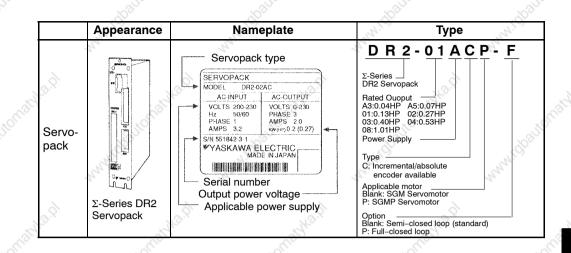
1) When  $\Sigma$ -Series products are delivered, check the following items:

Check Items	Remarks
Check if the delivered products are the ones you ordered.	Check the types marked on the nameplates of Servomotor and Servopack (see the table below).
Check if the motor shaft rotates smoothly.	If the motor shaft is smoothly turned by hand, it is normal. However, if the motor has brakes, it cannot be turned manually.
Check for damage.	Check the overall appearance, and check for damage or scratches resulting from transportation.
Check screws for looseness.	Check for looseness by using a screwdriver as necessary.

If any of the above items are faulty or incorrect, contact the dealer from which you purchased the products or your nearest local sales representative.



2.2 Installation



#### 2.2.2 Installing the Servomotor

Servomotor SGM and SGMP types can be installed either horizontally or vertically. However, if the Servomotor is installed incorrectly or in an inappropriate location, the service life will be shortened or unexpected problems will occur. To prevent this, always observe the installation instructions described below.

#### Before installation:

Anticorrosive paint is coated on the edge of the motor shaft. Clean off the anticorrosive paint thoroughly using a cloth moistened with thinner.

Anticorrosive paint is coated here

NOTE

E Avoid getting thinner on other parts of the Servomotor when cleaning the shaft.

#### Storage:

When the Servomotor is to be stored with the power cable disconnected, store it in the following temperature range:

Between –20°C and 60°C

2

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#### BASIC USES OF $\Sigma$ -SERIES PRODUCTS

2.2.2 Installing the Servomotor cont.

#### Installation sites:

The Servomotor SGM and SGMP types are designed for indoor use. Install Servomotor in an environment which meets the following conditions:

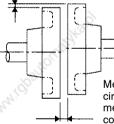
- a) Free from corrosive and explosive gases
- b) Well-ventilated and free from dust and moisture
- c) Ambient temperature of 0 to 40°C
- d) Relative humidity of 20% to 80% (non-condensing)
- e) Inspection and cleaning can be performed easily

If the Servomotor is used in a location subject to water or oil mist, install a shield cover over the Servomotor.

#### Alignment:

Align the shaft of the Servomotor with that of the equipment to be controlled, then connect the shafts with couplings. Install the Servomotor so that alignment accuracy falls within the range shown below.

Measure this distance at four different positions in the circumference. The difference between the maximum and minimum measurements must be 0.03 mm or less. (Turn together with couplings)



Measure this distance at four different positions in the circumference. The difference between the maximum and minimum measurements must be 0.03 mm or less. (Turn together with couplings)

**NOTE** If the shafts are not aligned properly, vibration will occur, resulting in damage to the bearings.

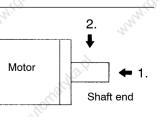
Mechanical shock to the shaft end must be less than  $98m/s^2$  (10G) and must be applied no more than twice.

Design the mechanical system so that **thrust load and radial load** applied to the servomotor shaft end during operation falls within the range shown in the following table.



#### Thrust load and radial load

- 1. Thrust load: Shaft-end load applied parallel to the centerline of a shaft
- 2. Radial load: Shaft-end load applied perpendicular to the centerline of a shaft



2.2 Installation

· Servomotor with incremental encoder

WAR. R

30

Motor Type	Allowable Radial Load Fr [N(lb)]	Allowable Thrust Load Fs [N(lb)]	LR mm (in.)	Reference Drawing
SGM-A3	68 (15)	54 (12)	20 (0.82)	- Aller - Aller
SGM-A5	68 (15)	54 (12)	20 (0.82)	
SGM-01	78 (17)	54 (12)	20 (0.82)	3 19
SGM-02	245 (55)	74 (16)	25 (1.02)	
SGM-03	245 (55)	74 (16)	25 (1.02)	
SGM-04	245 (55)	74 (16)	25 (1.02)	
SGM-08	392 (88)	147 (33)	35 (1.43)	
SGMP-01	78 (17)	49 (11)	20 (0.82)	
SGMP-02	245 (55)	68 (15)	25 (1.02)	11 <sup>0</sup> U 13 <sup>0</sup>
SGMP-03	245 (55)	68 (15)	25 (1.02)	\$°
SGMP-04	245 (55)	69 (15)	25 (1.02)	South Market Boot
SGMP-08	392 (88)	147 (33)	35 (1.43)	17

	A DION IL	encoder		autoni
Motor Type	Allowable Radial Load Fr [N(lb)]	Allowable Thrust Load Fs [N(lb)]	LR mm (in.)	Reference Drawing
SGM-A3	49 (11)	19 (4)	20 (0.82)	
SGM-A5	68 (15)	19 (4)	20 (0.82)	222
SGM-01	68 (15)	19 (4)	20 (0.82)	and the
SGM-02	196 (44)	49 (11)	25 (1.02)	
SGM-03	196 (44)	49 (11)	25 (1.02)	
SGM-04	196 (44)	68 (15)	25 (1.02)	
SGM-08	343 (77)	98 (22)	35 (1.43)	
SGMP-01	78 (17)	49 (11)	20 (0.82)	
SGMP-02	245 (55)	68 (15)	25 (1.02)	2 LU
SGMP-03	245 (55)	68 (15)	25 (1.02)	Stor.
SGMP-04	245 (55)	69 (15)	25 (1.02)	- Store
SGMP-08	392 (88)	147 (33)	35 (1.43)	ALC AND

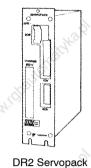
Note The radial load and thrust load values shown above are the maximum allowed values for the sum of the load generated by motor torque and the load externally applied to the shaft.

Annal 100 21 2.2.3 Installing the Servopack

#### 2.2.3 Installing the Servopack

 $\Sigma$ -Series DR2 Servopack is a rack–mounted type servo controller.

Incorrect installation will cause problems. Always observe the installation instructions described in the next page.



#### Storage:

When the Servopack is to be stored with the power cable disconnected, store it in the following temperature range:

Between -20°C and 85°C

#### Installation sites:

Situation	Notes on Installation
When installed in a control panel	Design the control panel size, unit layout, and cooling method so that the temperature around the periphery of the Servopack does not exceed 55°C.
When installed near a heating unit	Suppress radiation heat from the heating unit and a temperature rise caused by convection so that the temperature around the periphery of the Servopack does not exceed 55°C.
When installed near a source of vibration	Install a vibration isolator underneath the Servopack to prevent it from receiving vibration.
When installed in a place receiving corrosive gases	Corrosive gases do not immediately affect the Servopack but will eventually cause contactor-related devices to malfunction. Take appropriate action to prevent corrosive gases.
Others	Avoid installation in a hot and humid place or where excessive dust or iron powder is present in the air.

#### Orientation:

Install the Servopack perpendicularly as shown in the figure.

The Servopack must be orientated as shown in the figure because it is designed to be cooled by natural convection.

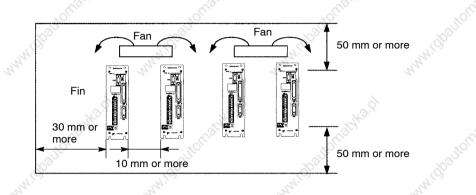
• Firmly secure the Servopack through three or four mounting holes.



Ventilation

#### Installation method:

When installing multiple Servopacks side by side in a control panel, observe the following installation method:



- a) Install Servopack perpendicularly so that the front panel (containing connectors) faces outward.
- b) Provide sufficient space around each Servopack to allow cooling by natural convection.

2.2.3 Installing the Servopack cont.

2

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c) When installing Servopacks side by side, provide at least 10 mm space between them and at least 50 mm space above and below them as shown in the figure above. Install cooling fans above the Servopacks to prevent the temperature around each Servopack from increasing excessively and also to maintain the temperature inside the control panel evenly.

d) Maintain the following conditions inside the control panel:

- Ambient temperature for Servopack: 0 to 55°C
- Humidity: 90%RH or less
- Vibration: 0.5G (4.9 m/s<sup>2</sup>)
- Condensation and freezing: None
- Ambient temperature to ensure long-term reliability: 45°C or less

# 2.3 Connection and Wiring

This section describes how to connect  $\Sigma$ -Series products to peripheral devices and explains a typical example of wiring the main circuit. It also describes an example of connecting to main host controllers.

2.3.1	Connecting to Peripheral Devices	25
2.3.2	Main Circuit Wiring and Power ON Sequence	28
2.3.3	Examples of Connecting I/O Signal Terminals	30

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### 2.3.1 Connecting to Peripheral Devices

This section shows a standard example of connecting  $\Sigma$ -Series products to peripheral devices and briefly explains how to connect to each peripheral device.

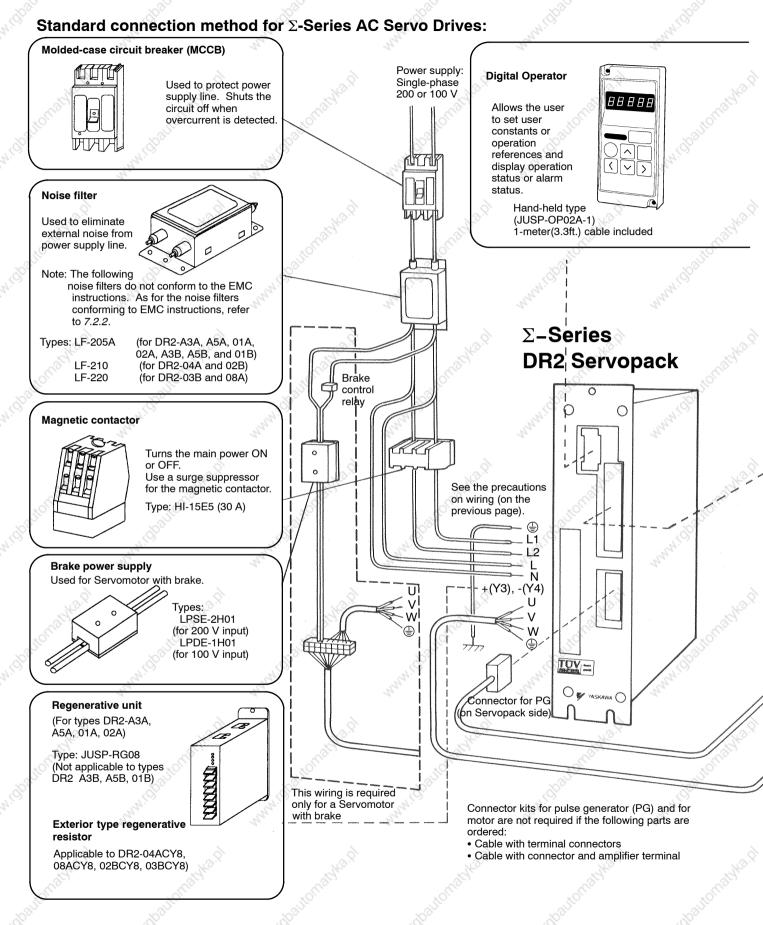
**NOTE** Read the following notes before wiring:

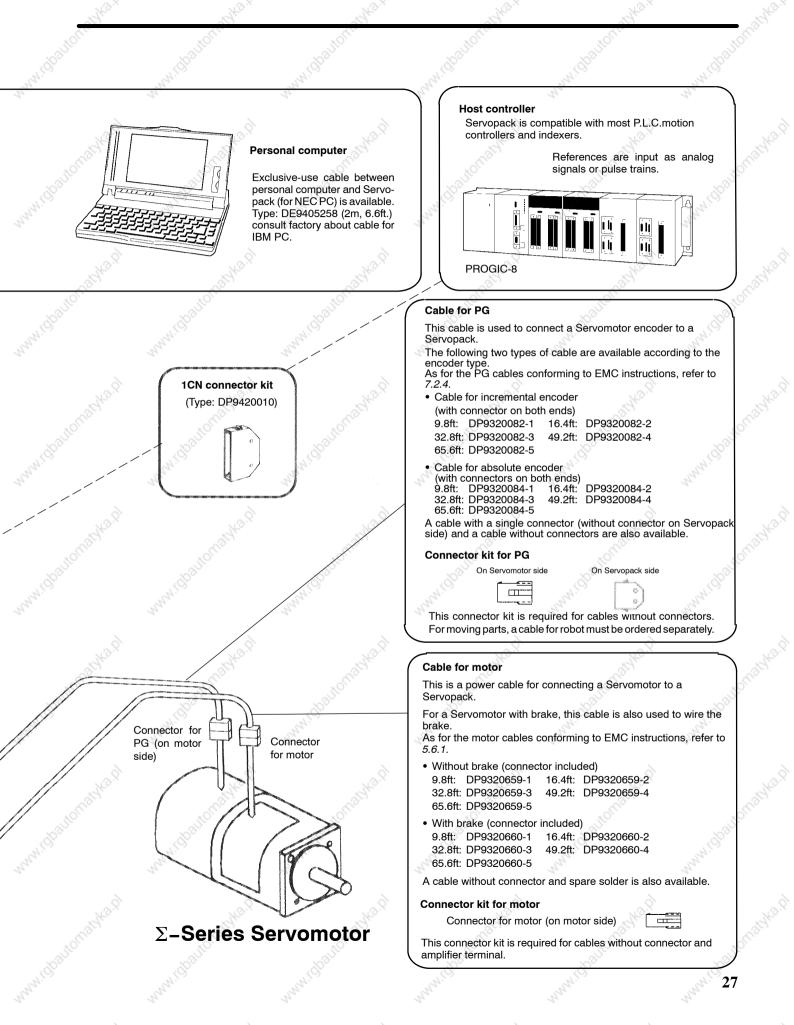
· Connect only one cable to one terminal. Never connect two cables to one terminal.

• Do not solder the cable.

- Peel back the cable shield by about 10mm (0.39in.) min. Then insert the cable into the terminal securely and tighten the screw. Never leave the bare wires outside of the termianl.
- When the cable is inserted into the flat terminal, use the following ferrules. Non-insulated ferrules, 2.5mm<sup>2</sup> or less (Made by PHOENIX CONTACT)

<Reference> Terminal block type: FRONT 2.5H/SA5 (Made by PHOENIX CONTACT)

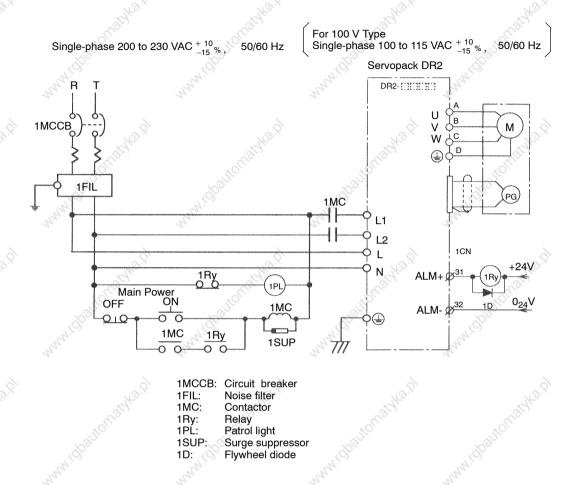




2.3.2 Main Circuit Wiring and Power ON Sequence

## 2.3.2 Main Circuit Wiring and Power ON Sequence

1) The following diagram shows a typical example of wiring the main circuit for  $\Sigma$ -Series products:

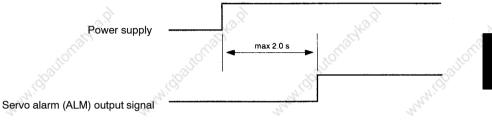


The following table shows the name and description of each main circuit terminal:

No.	"No"	No. No.	
Terminal Symbol	Name	Description	310F
L1, L2	Main circuit AC input	Single-phase 200 to 230 VAC $^{+10}_{-15}$ % , 50/60Hz*1	
L, N	Control power supply input	Single-phase 200 to 230 VAC $^{+10}_{-15}$ , 50/60Hz*1	
U, V, W	Motor connection	Connects terminal U to motor terminal (red), V to (white) and W to (blue).	
⊕ ×2	Ground terminal	Connects to ground and motor terminal (for ground and motor grounding)	305
Y3, Y4	Regenerative resistor connection	Regenerative resistor connection (External connection is not normally required.)*2	
+, -	Regenerative unit connection	Regenerative unit connection terminal (Connection is not normally required.)*3	

- \*1 For 100 V power supply: Single-phase 100 to 115 VAC + 10 % , 50/60Hz
- Provided only for types 400W, 750W (200VAC) and 200W, 300W (100VAC). \*2 www.idoautor
- \*3 Provided only for types 30W to 200W (200VAC).

- 3) Form a power ON sequence as follows:
  - a) Form a power ON sequence so that the main power is turned OFF when a servo alarm signal is output. (See the circuit diagram shown on the previous page.)
  - b) Hold down the power ON push-button for at least two seconds. The Servopack outputs a servo alarm signal for approximately two seconds or less when the power is turned ON. This operation is required to initialize the Servopack.



- After turning the power OFF, do not touch the power terminals for 5 minutes. High voltage may remain in the Servopack.
  - Avoid frequently turning the power ON and OFF. Since the Servopack has a capacitor in the power supply, a high charging current flows (for 0.2 second) when the power is turned ON. Therefore, frequently turning the power ON and OFF causes the main power devices (such as capacitors and fuses) to deteriorate, resulting in unexpected problems.

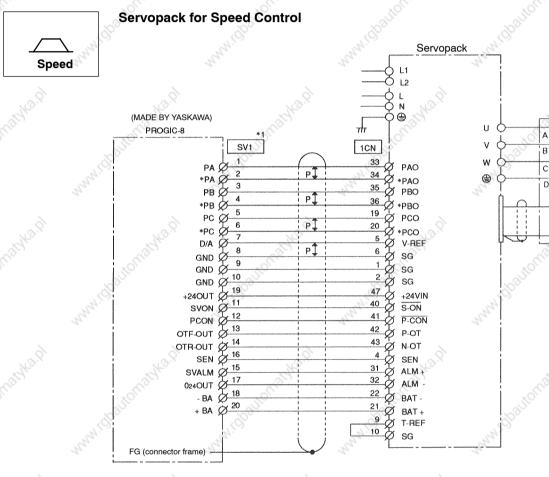
2.3.3 Examples of Connecting I/O Signal Terminals

# 2.3.3 Examples of Connecting I/O Signal Terminals

 This sub-section provides typical examples of connecting to main host controllers. Connection to other host controllers is also possible. Connect to the host controller according to the connection examples shown below by referring to technical documentation for the host controller.

**NOTE** This sub-section describes signals related to the DR2 Servopack only. For other signals, refer to the relevant technical documentation.

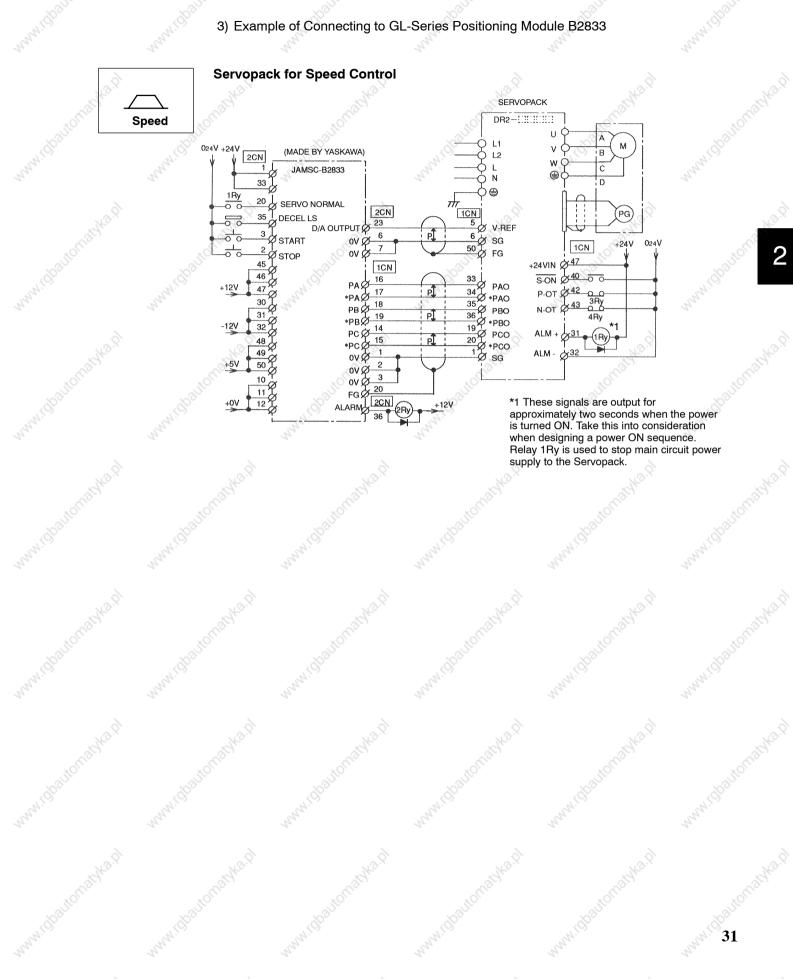
2) Example of Connecting to PROGIC-8



\*1 These pin numbers are also applicable to SV2 to SV4.\*2 Do not change the standard settings of user constants for the Servopack.

PG

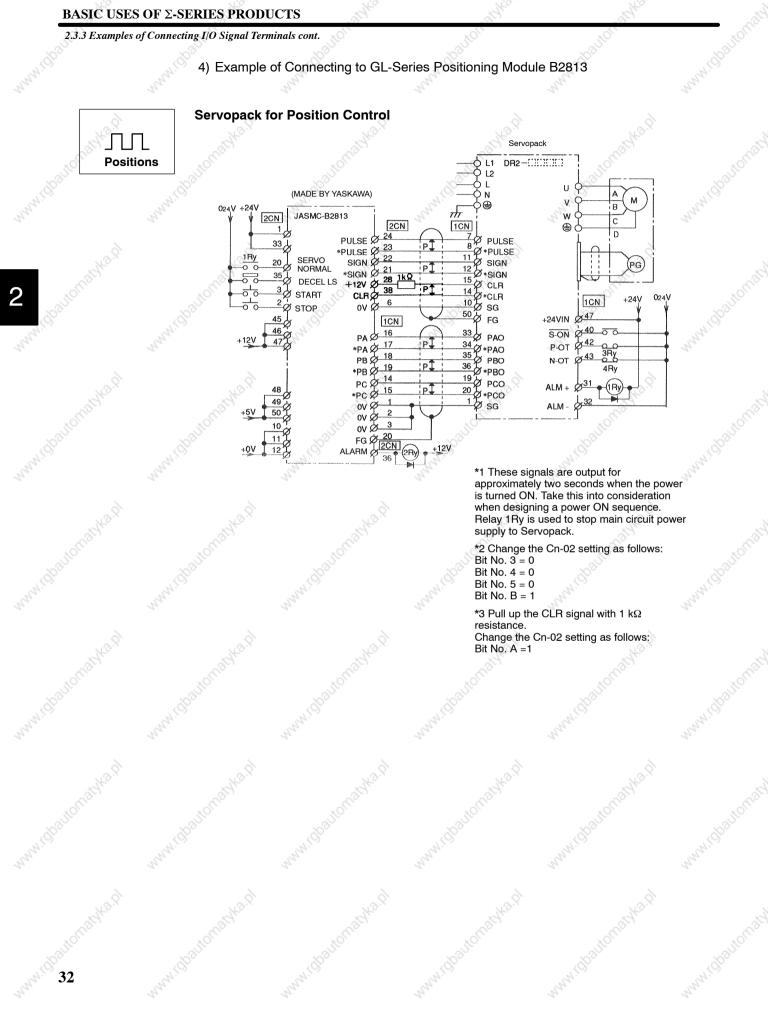
Cable between PROGIC-8 and DR2 Servopack Type JEPMC - W5521 - 05 (1.6ft.) JEPMC - W5521 - 10 (3.3ft.) JEPMC - W5521 - 30 (9.8ft.)

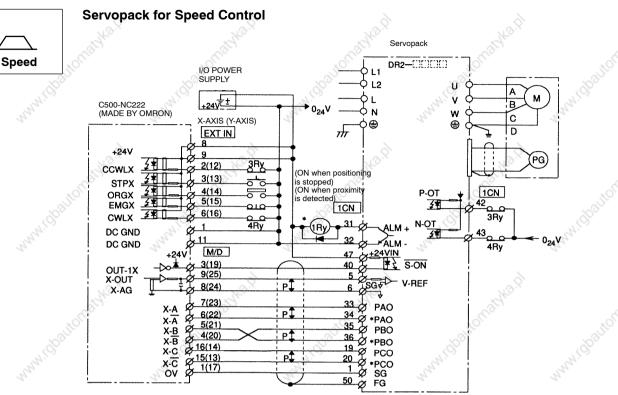


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2.3.3 Examples of Connecting I/O Signal Terminals cont.

Example of Connecting to GL-Series Positioning Module B2813





5) Example of Connecting to OMRON Position Control Unit C500-NC222

\* These signals are output for approximately two seconds when the power is turned ON. Take this into consideration when designing a power ON sequence. Relay 1Ry is used to stop main circuit power supply to Servopack.

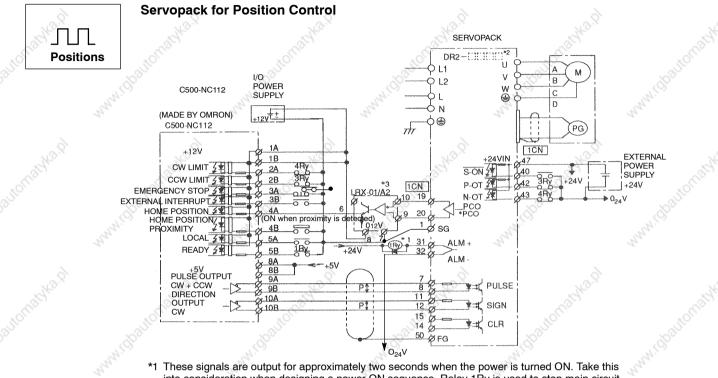
Note The signals shown here are applicable only to OMRON Sequencer C500-NC222 and Yaskawa Servopack DR2-□□□□.

30<sup>3</sup>0<sup>3</sup>33

2.3.3 Examples of Connecting I/O Signal Terminals cont.

6) Example of Connecting to OMRON Position Control Unit C500-NC112

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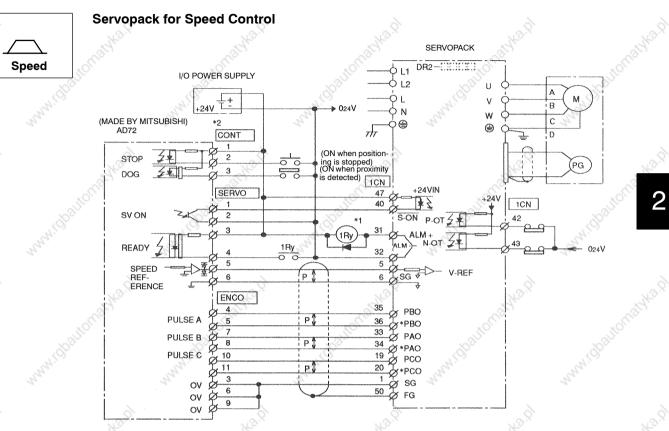


into consideration when designing a power ON sequence. Relay 1Ry is used to stop main circuit power supply to Servopack.

- \*2 Change the Cn-02 setting as follows: Bit No. 3 = 1 Bit No. 4 = 0 Bit No. 5 = 0
- \*3 Manufactured by Yaskawa Controls Co., Ltd.
- Note The signals shown here are applicable only to OMRON Sequencer C500-NC112 and Yaskawa Servopack DR2-DDDD.

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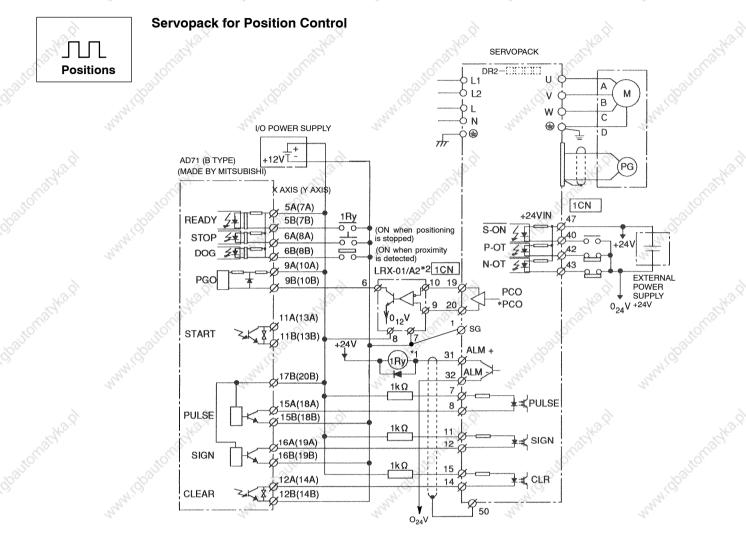


7) Example of Connecting to MITSUBISHI Positioning Unit AD72

- \*1 These signals are output for approximately two seconds when the power is turned ON. Take this into consideration when designing a power ON sequence. Relay 1Ry is used to stop main circuit power supply to Servopack.
- \*2 These pin numbers are the same for both X and Y axes.
- Note The signals shown here are applicable only to MITSUBISHI Sequencer AD72 and Yaskawa Servopack DR2-DDDD.

2.3.3 Examples of Connecting I/O Signal Terminals cont.

8) Example of Connecting to MITSUBISHI Positioning Unit AD71 (B Type)



\*1 These signals are output for approximately two seconds when the power is turned ON. Take this into consideration when designing a power ON sequence. Relay 1Ry is used to stop main circuit power supply to Servopack.

\*2 Manufactured by Yaskawa Controls Co., Ltd.

**Note** The signals shown here are applicable only to MITSUBISHI Sequencer AD71 (B Type) and Yaskawa Servopack DR2-DDD.

2

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# 2.4 Conducting a Test Run

This section describes how to conduct a full test run. The test run is divided into two steps. Complete a test run in step 1 first, then proceed to step 2.

2.4.1	Test Run in Two Steps	37
2.4.2	Step 1: Conducting a Test Run for Motor without Load	39
2.4.3	Step 2: Conducting a Test Run with the Motor Connected to the Machine	43
2.4.4	Supplementary Information on Test Run	45
2.4.5	Minimum User Constants Required and Input Signals	47

## 2.4.1 Test Run in Two Steps

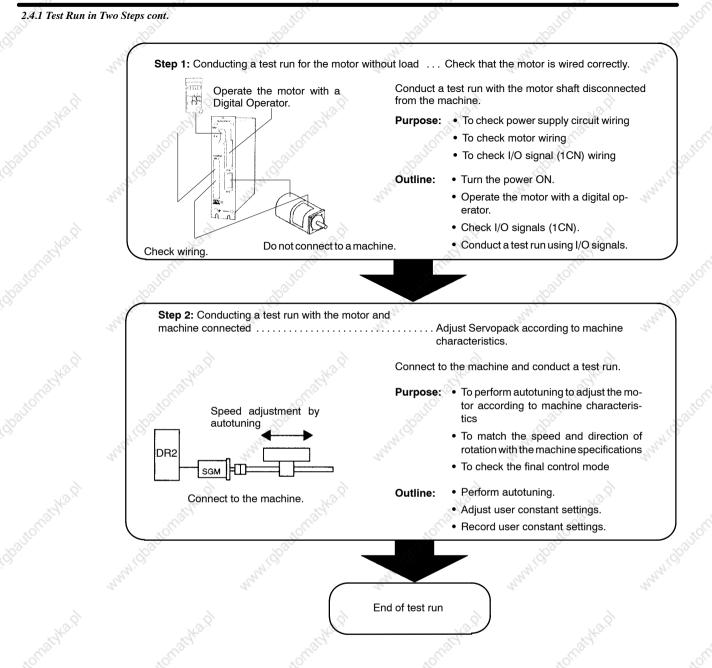
Conduct the test run when wiring is complete.

Generally, conducting a test run for servo drives can be difficult. However, by following the two steps described below, the test run can be performed safely and correctly.

**NOTE** To prevent accidents, initially conduct a test run only for a servomotor under no load (i.e., with all couplings and belts disconnected). Do not run the servomotor while it is connected to a machine.

The test run is divided here into steps 1 and 2.

Complete the test run in step 1 first, then proceed to step 2. The purposes of each step are described on the next page.



For customers who use a servomotor with a brake, refer to *Section 2.4.4 Supplementary Information on Test Run* before starting a test run.

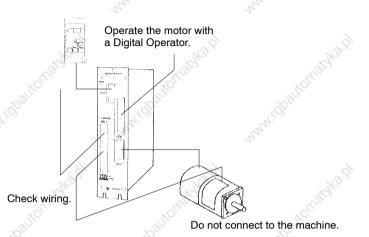
The following pages describe the test run procedure in detail.

# 2.4.2 Step 1: Conducting a Test Run for Motor without Load

Check that the motor is wired correctly.

If the motor fails to rotate properly during a servo drive test run, the cause most frequently lies in incorrect wiring.

Conduct a test run for the motor without load according to the procedure described below. For customers who use a servomotor with brake, refer to *Section 2.4.4 Supplemental Information on Test Run* before starting a test run.



(1) Secure the servomotor.

Secure the servomotor to mounting holes to prevent it from moving during operation. Alternatively, install the servomotor on the machine and disconnect couplings and belts.

(2) Disconnect connector 1CN, then check the motor wiring in the power supply circuit.

(When incremental encoder is used) I/O signals (1CN) are not to be used so leave connector 1CN disconnected.

#### (When absolute encoder is used)

Connect the battery to the battery terminals 1CN-21, -22.

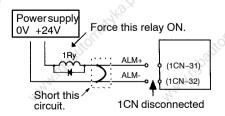
(3) Short the alarm signal circuit. Because connector 1CN is disconnected, the alarm signal prevents the power supply circuit from being turned ON. Therefore, temporarily short the alarm signal circuit. Secure servomotor to mounting holes.



Do not connect anything to the motor shaft (no-load status).



Disconnect connector 1CN



2.4.2 Step 1: Conducting a Test Run for Motor without Load cont.

(4) Turn the power ON.

Turn the Servopack power ON. If the Servopack is turned ON normally, the LED on the Digital Operator lights up as shown in the figure.

Power is not supplied to the servomotor because the servo is OFF.

If an alarm display appears on the LED as shown in the figure above, the power supply circuit, motor wiring or encoder wiring is incorrect. In this case, turn the power OFF, then correct the problem.

(5) Operate using the Digital Operator

Operate the motor with the Digital Operator. Check that the motor runs normally.

Refer to 4.2.2 Operating Using the Digital Operator.

(6) Connect signal lines.

Connect connector 1CN as follows:

(1) Turn the power OFF.

(2) Return the alarm signal circuit shorted in the above step (3) to its original state.

- (3) Connect connector 1CN.
- (4) Turn the power ON again.

(7) Check input signals.

Check the input signal wiring in monitor mode. For the checking method, refer to *4.1.6 Operation in Monitor Mode*.

Checking method

Turn each connected signal line ON and OFF to check that the monitor bit display changes accordingly.

Input Signal	ON/OFF	Monitor Bit Display
High level or open	OFF	Extinguished
0 V level	ON	S Lit





Operation by Digital Operator

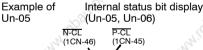


If an alarm occurs, the power supply circuit, motor wiring, or encoder wiring is incorrect.

After turning the power OFF, remove the short circuit.







Sec.	(1011-4	ŞIN- <del>1</del> 5)	3
1	-	I	1
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		P	
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·	-	 	· · ·

S-ON P-CON P-OT N-OT (1CN-40) (1CN-41) (1CN-42) (1CN-43)

> The memory switch can be used to eliminate the need for external short-circuits in wiring (Refer to 3.1.2).

Servomotor

If the signal lines below are not wired correctly, the motor fails to rotate. Always wire them correctly. (If signal lines are not to be used, short them as necessary.)

2	P-OT	1CN-42	Motor can rotate in forward direction when this input signal is at 0 V.
	N-OT	1CN-43	Motor can reverse when this input signal is at 0 V.
	S-ON	1CN-40	Servo is turned ON when this input signal is at 0 V. However, leave the servo in OFF status.

(8) Turn servo (motor) ON.

Turn the servo ON as follows:

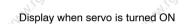
(1) Check that no reference has been input.

Speed/torque control mode : V-REF (1CN-5) and T-REF (1CN-9) are at 0 V.

Position control mode: PULS (1CN-7) and SIGN (1CN-11) are fixed.

(2) Turn the servo ON signal ON.

Set S-ON (1CN-40) to 0 V. If normal, the motor is turned ON and the Digital Operator displays the data as shown in the figure. If an alarm display appears, take appropriate action as described in *Appendix E List of Alarm Displays*.

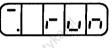


Servopack

(1CN-40)

Turn the servo ON

S-ON



(9) Operate by reference input.

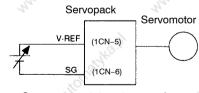
The operating procedure differs according to the Servopack control mode used.

# Speed/Torque

#### Speed/Torque Control Mode

(This section describes the standard speed control setting.)

 Gradually increase the speed reference input (V-REF, 1CN-5) voltage. The motor will rotate.



Servomotor rotates at a speed proportional to the reference voltage.

When a host controller such as a programmable controller performs position control, it may be difficult to directly input the speed reference voltage. In this case, constant voltage reference should be input once to ensure correct operation.

2.4.2 Step 1: Conducting a Test Run for Motor without Load cont.

(2) Check the following items in monitor mode (Refer to 4.6.1.):

- (1) Has a reference speed been input?
- (2) Is the motor speed as designed?
- (3) Does the reference speed match the actual motor speed?
- (4) Does the motor stop when no reference is input?

1.1	1011		
3	Un-00	Actual motor speed	E.
	Un-01	Reference speed	J.C.

- (3) If the motor rotates at an extremely slow speed when 0 V is specified as the reference voltage, correct the reference offset value as described in *Section 4.2.4 Reference Offset Automatic Adjustment*
- (4) To change motor speed or the direction of rotation, reset the user constants shown below.

Cn-03	Speed reference gain (Refer to 3.2.7.)	and the second
Cn-02 bit 0	Reverse rotation mode (Refer to 3.1.1.)	~

#### **Position Control Mode**

ЛЛ

Positions

(1) Set user constant Cn-02 so that the reference pulse form matches the host controller output form. (Refer to 4.1.5 for details on how to set user constants.)

#### Selecting reference pulse form (Refer to 3.2.2.)

Bit 3	. A
Bit 4	.S.
Bit 5	200
	Bit 4

(2) Input a slow speed pulses from the host con- troller and execute low-speed operation.

Host controlle	r <sup>g</sup>	Servopack	servomotor
Refer-	PULS	(1CN-7)	$\frown$
ence	*PULS	(1CN-8)	
pulse	SIGN	(1CN-11)	
	*SIGN	(1CN-12)	1.0
	and a		

- (3) Check the following items in monitor mode (Refer to 4.6.1.):
  - (1) Has a reference pulse been input?
  - (2) Is the motor speed as set?
  - (3) Does the reference speed match the actual motor speed?
  - (4) Does the motor stop when no reference is input?

	S1'0' S1'0'
Un-00	Actual motor speed
Un-07	Reference pulse speed display
Un-08	Position error

(4) To change motor speed or the direction of rotation, reset the user constants shown below.

Cn-24,Cn-25	Electronic gear ratio (Refer to 3.2.5.)	Carlos Carlos
Cn-02 bit 0	Reverse rotation mode (Refer to 3.1.1	)°. ""

If an alarm occurs or the motor fails to rotate during the above operation, connector 1CN wiring is incorrect or the user constant settings do not match the host controller specifications.

In this case, check the wiring and review the user constant settings, then repeat step 1.

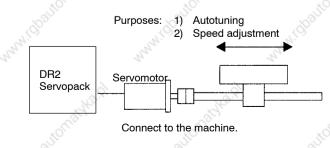
Refer to Appendix E List of Alarm Displays and Appendix D List of User Constants.

This is all that is required to complete step 1 (conducting a test run for motor without load). Whenever possible, perform tuning associated with the host controller and other necessary adjustments in step 1 (before installing the motor on the machine).

# 2.4.3 Step 2: Conducting a Test Run with the Motor Connected to the Machine

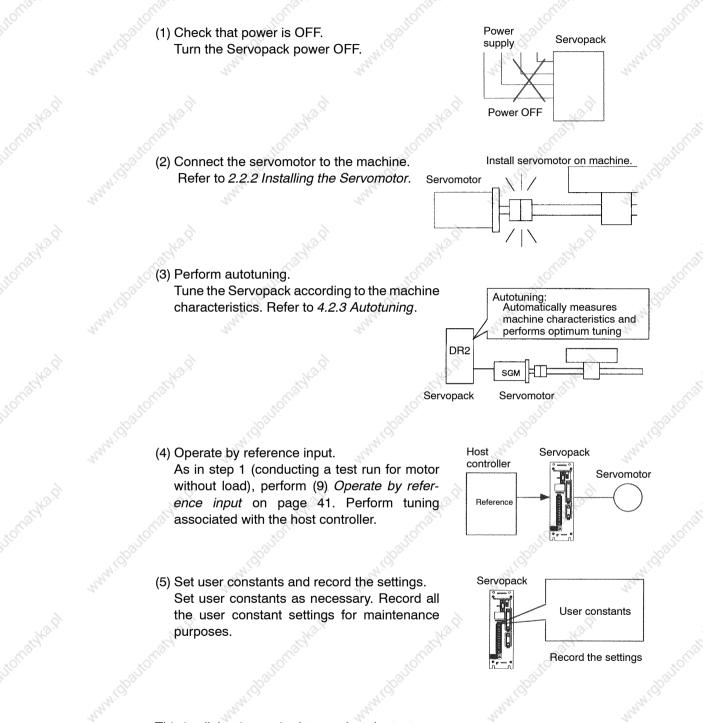
After step 1 is complete, proceed to step 2 in which a test run is conducted with the motor connected to the machine. The purpose of step 2 is to adjust the Servopack according to the machine characteristics.

Conduct a test run according to the procedure described below.



2.4.3 Step 2: Conducting a Test Run with the Motor Connected to the Machine cont.

**NOTE** Before proceeding to step 2, repeat step 1 (conducting a test run for the motor without load) until you are fully satisfied that the test has been completed successfully. Operation faults that arise after the motor is connected to the machine not only damage the machine but may also cause an accident resulting in injury or death. Therefore, all items including user constants setting and wiring should be tested as conclusively as possible before step 1 is complete.



This is all that is required to conduct the test run.

Normally, the machine may cause much friction because of an insufficient running-in period. After a test run is complete, perform adequate running-in.

# 2.4.4 Supplementary Information on Test Run

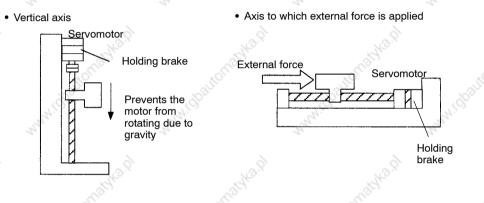
In the following cases, always refer to the information described below before starting a test run:

- When using a servomotor with a brake
- When performing position control from the host controller

#### 1) When using a servomotor with brake

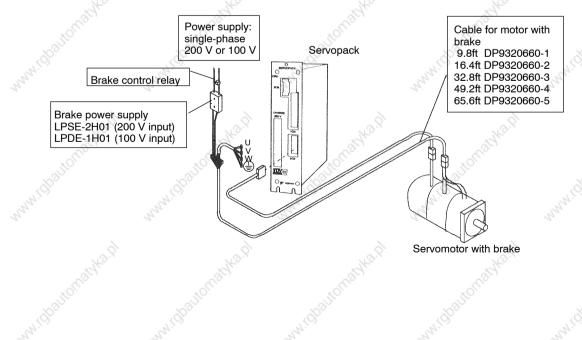
The brake prevents the motor shaft from rotating due to a backdriving torque. Such a torque may be created by an external force or the force of gravity acting on the load and may result in undesired motion or the load, should motor power be lost.

Servopack uses the brake interlock output (BK) signal to control holding brake operation for a servomotor with brake.



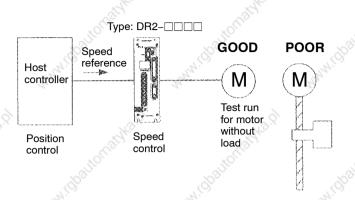
**NOTE** To prevent faulty operation caused by gravity (or external force), first check that the motor and holding brake operate normally with the motor disconnected from the machine. Then, connect the motor to the machine and conduct a test run.

For wiring of a servomotor with a brake, refer to 3.4.4 Using Holding Brake.



2.4.4 Supplementary Information on Test Run cont.

#### 2) When performing position control from the host controller Check motor operation first and then conduct a test run as described in the table below.



**NOTE** Check the motor operation with the motor disconnected from the machine. If the host controller does not perform position control correctly, the motor may run out of control.

Reference from Host Controller	Check Items	Check Method	Review Items
ster.	. 8 <sup>13</sup> <sup>1</sup> <sup>10</sup> . <sup>9</sup>	Check the motor speed as follows:	adro.g.
Jogging (constant-speed reference input from host controller)	Motor speed	<ul> <li>Use the speed monitor (Un-00) of the digital operator.</li> <li>Run the motor at low speed. For example, input a speed reference of 60 r/min and check that the motor makes one revolution per one second.</li> </ul>	Check whether the speed reference gain value (user constant Cn-03) is correct.
Simple positioning	Number of motor revolutions	<ul> <li>Input a reference equivalent to one motor revolution and visually check that the motor shaft makes one revolution.</li> </ul>	Check whether the dividing ratio count (user constant Cn-0A) is correct.
Overtravel (when P-OT and N-OT signals are used)	Whether the motor stops rotating when P-OT and N-OT signals are input	<ul> <li>Check that the motor stops when P-OT and N-OT signals are input during continuous motor operation.</li> </ul>	If the motor does not stop, review the P-OT and N-OT wiring.
WWW (BB).			. www.t

# 2.4.5 Minimum User Constants Required and Input Signals

- 1) This section describes the minimum user constants that must be set to conduct a test run. For details on how to set each user constant, refer to *4.1.5 Operation in User Constant Setting Mode*.
  - a) Servopack in speed/torque control mode

	12	54	200	22
	Cn-03	Speed reference gain	Pr.	32
2	Cn-0A	Dividing ratio setting	2	~
$\sim$				. V

b) Servopack in torque control mode

Cn-13	Torque reference adjustment gain	1. <sup>1</sup> 60	180
Cn-0A	Dividing ratio setting	1 and a start	A. C.

c) Servopack in position control mode

0.517	05° / 05° /	
Cn-02 bits 3, 4 and 5	Reference pulse form selection	20
Cn-24	Electronic gear ratio (numerator)	Bar
Cn-25	Electronic gear ratio (denominator)	and in

After changing the Cn-02 setting, always turn the power OFF, then ON. This makes the new setting valid.

2) If the specified direction of rotation differs from the actual direction of rotation, the wiring may be incorrect. In this case, recheck the wiring and correct it accordingly. Then, if the direction of rotation is to be reversed, set the following user constant:

Cn-02 (bit 0)	Reverse ro	otation mode	8	
Ko.	Nº.	Nº.	"Mari	

After changing the Cn-02 setting, always turn the power OFF, then ON. This makes the new setting valid.

3) The following table lists the minimum input signals required to conduct a test run. For details of each input signal, refer to the relevant page.

0.5		0.5	
Signal Name		Pin Number	Function
S-ON	(servo ON)	1CN-40	Switching between motor ON and OFF status.The memory switch can be used to eliminate the need for external short-circuit wiring (see page 132).
P-OT	(forward rotation prohibited)	1CN-42	Overtravel limit switch
N-OT	(revere rotation prohibited)	1CN-43	The memory switch can be used to eliminate the need for external short-circuit wiring (see page 54).
	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		

# **APPLICATIONS OF \Sigma-SERIES PRODUCTS**

This chapter is prepared for readers who wish to learn more about the applications of  $\Sigma$ -series products after fully understanding *Chapter 2 Basic Uses of*  $\Sigma$ -series *Products*. It explains how to set user constants for each purpose and how to use each function. Read the applicable sections according to your requirements.

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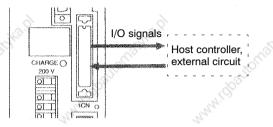
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# Before Reading this Chapter

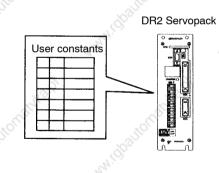
- 1) This chapter describes how to use each 1CN connector I/O signal for the DR2 Servopack and how to set the corresponding user constant.
- For a list of I/O signals of 1CN connecor, refer to Appendix C List of I/O Signals. For terminal arrangement for I/O signals of 1CN connecor, refer to 3.8.8 Connector Terminal Layouts.



3) For a list of user constants, refer to Appendix D List of User Constants.

4) User constants are divided into the following two types.

1)	Memory switch Cn-01 and Cn-02	Set each bit to ON or OFF to select a function.
2)	Constant setting Cn-03 and later	Set a numerical value such as a torque limit value or speed loop gain.



5) For details on how to set user constants, refer to 4.1.5 Operation in User Constant Setting Mode.

#### APPLICATIONS OF $\Sigma$ -SERIES PRODUCTS

3.1.1 Changing the Direction of Motor Rotation

# 3.1 Setting User Constants According to Machine Characteristics

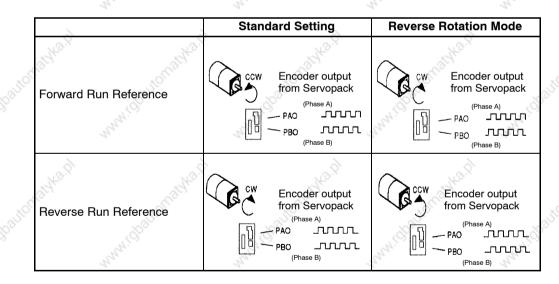
This section describes how to set user constants according to the dimensions and performance of the machine to be used.

3.1.1	Changing the Direction of Motor Rotation	52
3.1.2	Setting the Overtravel Limit Function	54
3.1.3	Restricting Torque	57

## **3.1.1 Changing the Direction of Motor Rotation**

1) This Servopack provides a reverse rotation mode in which the direction of rotation can be reversed without altering the servomotor wiring. With the standard setting, forward rotation is defined as counterclockwise (CCW) rotation when viewed from the drive end.

2) If reverse rotation mode is used, the direction of motor rotation can be reversed without other items being changed. The direction (+/-) of axial motion is reversed.



#### 3) Setting Reverse Rotation Mode:

Reverse rotation mode can be set in either of the following two ways. Normally, method 1 is easier to use.

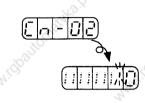
#### a) Method 1: Setting Memory Switch

Set bit 0 of memory switch Cn-02 to select reverse rotation mode.

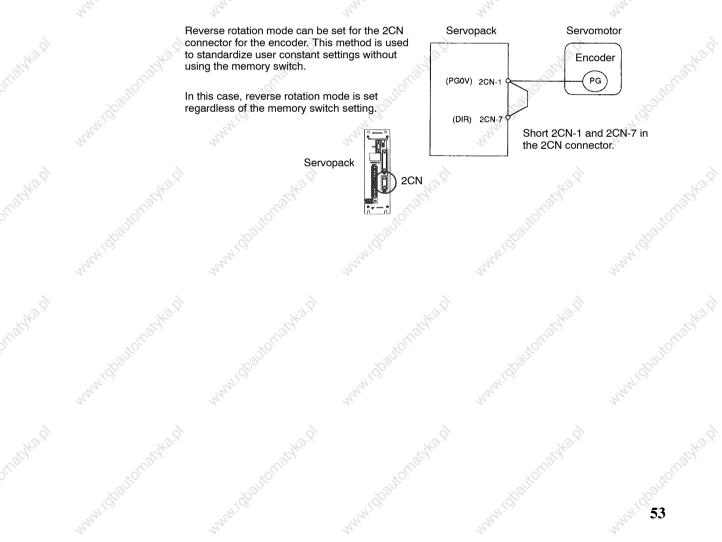
Cn-02 Bit 0	Rotation Direction	Factory	For Speed/Torque Control
a a a	Selection	Setting: 0	and Position Control

Set the direction of rotation.

Setting	🔊 Meaning	30
0	Forward rotation is defined as counterclockwise rotation when viewed from the drive end.	(Standard setting)
1	Forward rotation is defined as clockwise rotation when viewed from the drive end.	(Reverse rotation mode)



b) Method 2: Shorting the Wiring in the 2CN Connector



3.1.2 Setting the Overtravel Limit Function

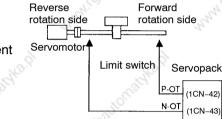
# 3.1.2 Setting the Overtravel Limit Function

1) The overtravel limit function forces the moving part of the machine to stop when it exceeds the movable range.

2) To use the overtravel limit function, connect the following input signal terminals correctly.

$\rightarrow$ Input P-OT 1CN-42	Forward Rotation Prohibited (Forward Overtravel)	For Speed/Torque Control and Position Control
$\rightarrow$ Input N-OT 1CN-43	Reverse Rotation Prohibited (Reverse Overtravel)	For Speed/Torque Control and Position Control
	20	b.

Inputs terminals for overtravel limit switch.



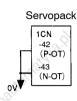
For linear motion, connect a limit switch to prevent damage to the machine.

P-OT	ON: 1CN-42 is at low level.	Forward rotation allowed. Normal operation status.	2
1340.9	OFF: 1CN-42 is at high level.	Forward rotation prohibited (reverse rotation allowed).	
N-OT	ON: 1CN-43 is at low level.	Reverse rotation allowed. Normal operation status.	
	OFF: 1CN-43 is at high level.	Reverse rotation prohibited (forward rotation allowed).	Stall O

3) Use the following user constants (memory switch) to specify whether input signals for overtravel are to be used.

Cn-01 Bit 2	Use of P-OT Input Signal	Factory Setting: 0	For Speed/Torque Control and Position Control
Cn-01 Bit 3	Use of N-OT Input Signal	Factory Setting: 0	For Speed/Torque Control and Position Control
~	2		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Specifies whether the P-OT input signal for prohibiting forward rotation at overtravel (1CN-42) is to be used and whether the N-OT input signal for prohibiting reverse rotation at overtravel (1CN-43) is to be used.



Specifies "1" when external short-circuit wiring is to be omitted.

The short-circuit wiring shown in the figure can be omitted when P-OT and N-OT are not used.

Bit	Setting	Meaning
D# 0	0	Uses the P-OT input signal for prohibiting forward rotation. (Forward rotation is prohibited when 1CN-16 is open. Forward rotation is allowed when 1CN-42 is at 0 V.)
Bit 2	A. M.	Does not use the P-OT input signal for prohibiting forward rotation. (Forward rotation is always allowed. This has the same effect as shorting 1CN-42 to 0 V.)
3.R.	0	Uses the N-OT input signal for prohibiting reverse rotation. (Reverse rotation is prohibited when 1CN-17 is open. Reverse rotation is allowed when 1CN-43 is at 0 V.)
Bit 3	1	Does not use the N-OT input signal for prohibiting reverse rotation. (Reverse rotation is always allowed. This has the same effect as shorting 1CN-43 to 0 V.)

4) If the P-OT and N-OT input signals are used, set the following user constants to specify how to stop the motor.

Cn-01 Bit 8	How to Stop Motor at Overtravel	Factory Setting: 0	For Speed Control and Position Control
Cn-01 Bit 9	Operation to be Performed when Motor Stops after Overtravel	Factory Setting: 0	For Speed Control and Position Control

- Inputs signal for prohibiting forward rotation (P-OT, 1CN-42)
- Inputs signal for prohibiting reverse rotation (N-OT, 1CN-43)

Specify how to stop the motor when either of the above signals is input.

Overtravel Stop mode After stop O Stop by dynamic brake Bit 6 Coasting to a stop Deceleration Stop Leceleration 1 Zero-clamp

#### APPLICATIONS OF $\Sigma$ -SERIES PRODUCTS

3.1.2 Setting the Overtravel Limit Function cont.

	Setting	Meaning
Cn-01 bit 8	24	Stops the motor in the same way as when the servo is turned OFF.
	0	The motor is stopped by dynamic brake or coasts to a stop. Either of these stop modes can be selected by setting bit 6 of Cn-01.
	1	Stops the motor by decelerating it with the preset torque.
		Preset value: Cn-06 (EMGTRQ) emergency stop torque

If deceleration stop mode is selected, specify the operation to be done after the motor stops.

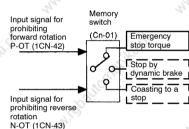
10.2	Setting	Meaning
S.	0	Turns the servo OFF when the motor stops in deceleration stop mode.
Cn-01 bit 9	1	Causes the motor to enter zero-clamp status after it stops in deceleration stop mode.

If torque control mode is selected, the motor stops in the same way as when the servo is turned OFF, regardless of the setting of Cn-01 bit 8.

	10	-1°0''		N'0''		J1011
Ś	Cn-06	EMGTRQ Emergency Stop	Unit: %	Setting Range: 0 to	Setting:	For Speed/Torque Control and Position
		lorque		Maximum Torque	Maximum Torque	Control

Specifies the stop torque to be applied at overtravel when the input signal for prohibiting forward or reverse rotation is to be used.

Specifies a torque value in terms of a percentage of the rated torque.



54					
Cn-01 Bit 6	How to Stop Motor at Servo OFF	Factory Setting: 0	For Speed/Torque Control and Position Control		
Cn-01 Bit 7	Operation to Be Performed when Motor Stops after Servo OFF	Factory Setting: 1	For Speed/Torque Control and Position Control		

The Servopack enters servo OFF status when:

- Servo ON input signal (S-ON, 1CN-40) is turned OFF.
- Servo alarm arises.
- Main power is turned OFF.

Specify how to stop the motor when one of the above events occurs during operation.

Servo OFF Stop mode Stop by dynamic brake Bit 6 Coasting to a stop

Dynamic brake is a function that electrically applies brakes by using a resistor to consume motor rotation energy

			chorgy.
		Setting	Meaning
	- 2	0	Stops the motor by dynamic brake.
	Cn-01 bit 6	- 1	Causes the motor to coast to a stop.
3	bit o	I	The motor power is OFF and stops due to machine friction.
ò,			The motor power is OFF and stops due to machine friction.

If dynamic brake stop mode is selected, specify the operation to be performed when the motor stops.

~	Setting	Meaning
Cn-01	0	Releases dynamic brake after the motor stops.
bit 7	1	Does not release dynamic brake even after the motor stops.

## 3.1.3 Restricting Torque

1) The Servopack can provide the following torque control:

Torque restriction

Level 1: To restrict the maximum output torque to protect the machine or workpiece

Level 2: To restrict torque after the motor moves the machine to a specified position

3

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Torque control

Level 3: To always control output torque, not speed

Level 4: To alternately use speed control and torque control

This section describes how to use levels 1 and 2 of the torque restriction function.

2) How to Set Level 1: Internal Torque Limit

The maximum torque is restricted to the values set in the following user constants.

		-1-4		-1-2	
Cn-08	TLMTF Forward Rotation Torque Limit	Unit: %	Setting Range: 0 to Maximum Torque	Factory Setting: Maximum Torque	For Speed/Torque Control and Position Control
Cn-09	TLMTR Reverse Rotation Torque Limit	Unit: %	Setting Range: 0 to Maximum Torque	Factory Setting: Maximum Torque	For Speed/Torque Control and Position Control
	S	2		n la	La.

#### APPLICATIONS OF $\Sigma$ -SERIES PRODUCTS

3.1.3 Restricting Torque cont.

Sets the maximum torque values for forward rotation and reverse rotation, respectively.

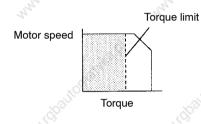
Sets these user constants when torque must be restricted according to machine conditions.

This torque restriction function always monitors torque, and outputs the signal shown on the right when the limit value is reached.

Specifies a torque limit value in terms of a percentage of the rated torque.



Example of Use: Machine Protection



Output Signal for Torque Restriction Function

• CLT+ (1CN-25), CLT- (1CN-26)

• Status indication mode bit data

Monitor mode (Un-05) bit 4

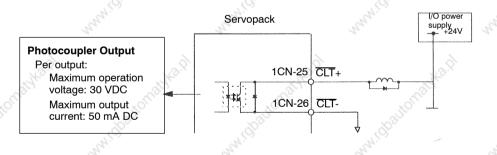
User Constant Setting:

Memory switch (Cn-01) bit 4 = 0

Note that too small a torque limit value will result in torque shortage at acceleration or deceleration.

• Using CLT+, CLT- Signals

This section describes how to use contact output signals  $\overline{\text{CLT}}$ +,  $\overline{\text{CLT}}$ - as a torque limit output signal.



Output $\rightarrow$ CLT+ 1CN-25	Torque Limit Output (Running Output)	For Speed/Torque Control
Output → CLT- 1CN-26	Output)	Control

This signal indicates whether motor output torque (current) is being restricted.

ON status: The circuit between 1CN-25 and 1CN-26 is closed. 1CN-25 is at low level.	Motor output torque is being restricted. (Internal torque reference is greater than the preset value.)
OFF status: The circuit between 1CN-25 and 1-CN26 is open. 1CN-25 is at high level,	Motor output torque is not being restricted. (Internal torque reference is equal to or below the preset value.)

#### Preset Value: Cn-08 (TLMTF) Cn-09 (TLMTR) Cn-18 (CLMIF) : P-CL input only Cn-19 (CLMIR) : N-CL input only

**Note** This function is changed to another function depending on the setting of bit 4 of memory switch Cn-01.

To use output signals  $\overline{\text{CLT}}$ +,  $\overline{\text{CLT}}$ - as a torque limit output signal, set the following memory switch to 0.

This memory switch can also be used to set level 2 torque restriction (described in the next subsection).

			<u> </u>
Cn-01 Bit 4	CLT+, CLT- Output Signals Selection	Factory Setting: 0	For Speed/Torque Control

Sets the output conditions for output signals  $\overline{\text{CLT}}$ + (1CN-25) and  $\overline{\text{CLT}}$ - (1CN-26).

Setting	Mear	ning	8°°
	Uses CLT+, CLT- output limit output signal.	signals as a torque	Bit 4 of memory switch Cn-01
à	Compares the DR2 Servopack internal torque (current) reference with the preset value.		
0	Preset Value: Cn-08 (TLMTF) Cn-09 (TLMTR) Cn-18 (CLMIF): P-CL input only Cn-19 (CLMIR): N-CL input only		Torque limit detection Speed coincide 1 CLT+ CLT- (1CN-25) (1CN-26)
	Internal torque (current) reference ≧ preset value	Opens the circuit between 1CN-25 and 1CN-26	When CLT+, CLT- output signals are changed, the
10.9	Internal torque (current) reference < preset value	Closes the circuit between 1CN-25 and 1CN-26	following bit data are also changed: • Status indication mode bit
	NON NON	J.C.	data
1	Uses CLT+, CLT- output s coincide output signal. For details, refer to 3.7.4.	Monitor mode Un-05 bit 4	

3

3.1.3 Restricting Torque cont.

#### 3) How to Set Level 2: External Torque Limit

First, use a contact input signal to make the torque (current) limit value set in the user constant valid. Torque limit can be set separately for forward and reverse rotation.

To use this function, always set bit 2 of memory switch Cn-02 to 0 (standard setting). The contact input speed control function cannot be used.

	Servopack				
P-CL	Forward rotation	Without torque limit Speed	Torque		
1CN-45	MICH 2	With torque limit Speed	Cn-18 Torque		
N-CL	Reverse rotation	Without torque limit Speed	Torque		
1CN-46	MIGD2	With torque limit Speed	Cn-19 Torque		

P-CL	ON: 1CN-45 is at low level.	Torque restriction applies during forward rotation.	Limit value: Cn-18
F-OL	OFF: 1CN-45 is at high level.	Torque restriction does not apply during forward rotation.	
	ON: 1CN-46 is at low level.	Torque restriction applies during reverse rotation.	Limit value: Cn-19
N-CL	OFF: 1CN-46 is at high level.	Torque restriction does not apply during reverse rotation.	

This torque restriction function outputs the signal shown on the right.

# Output Signal for Torque Restriction Function

- CLT+ (1CN-25), CLT- (1CN-26)
  Status indication mode bit data
- Monitor mode Un-05 bit 4
- User Constant Setting:

Memory switch Cn-01 bit 4 = 0

- Examples of Use:
- Forced stopping
- Holding workpiece by robot

3.1 Setting User Constants According to Machine Characteristics

_				· · · · · · · · · · · · · · · · · · ·	
Cn-18	CLMIF Forward External Torque Limit	Unit: %	Setting Range: 0 to Maximum Torque	Factory Setting: 100	For Speed/Torque Control and Position Control
Cn-19	CLMIR Reverse External Torque Limit	Unit: %	Setting Range: 0 to Maximum Torque	Factory Setting: 100	For Speed/Torque Control and Position Control

Sets a torque limit value when torque is restricted by external contact input.

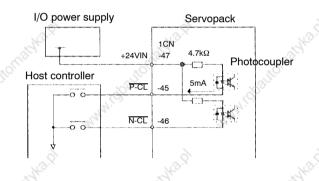
This function is valid when bit 2 of memory switch Cn-02 is set to 0.

When P-CL (1CN-45) is input	Applies torque restriction as specified in Cn-18	,
When $\overline{\text{N-CL}}$ (1CN-46) is input	Applies torque restriction as specified in Cn-19	

For torque restriction by analog voltage reference, refer to *3.2.9 Using Torque Restriction* by Analog Voltage Reference.

## Using P-CL and N-CL Signals

This section describes how to use input signals P-CL and N-CL as torque limit input signals.



→ Input P-CL 1CN-45	Forward External Torque Limit Input (Speed Selection 1)	For Speed/Torque Control and Position Control
→ Input N-CL 1CN-46	Reverse External Torque Limit Input (Speed Selection 2)	For Speed/Torque Control and Position Control

These signals are for forward and reverse external torque (current) limit input.

This function is useful in forced stopping.

#### Output Signal for Torque Restriction Function

- CLT+ (1CN-25), CLT- (1CN-26)
- Status indication mode bit data
  Monitor mode Un-05 bit 4
- User Constant Setting: Memory switch Cn-01 bit 4 = 0

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3.1.3 Restricting Torque cont.

-			.07	
P-C	<u>т</u>	ON: 1CN-45 is at low level.	Torque restriction applies during forward rotation.	Limit value: Cn-18
F-0	0L	OFF: 1CN-45 is at high level.	Torque restriction does not apply during forward rotation. Normal operation status.	
A C	3 <sup>-7</sup>	ON: 1CN-46 is at low level.	Torque restriction applies during reverse rotation.	Limit value: Cn-19
ON-C	N-CL	OFF: 1CN-46 is at high level.	Torque restriction does not apply during reverse rotation. Normal operation status.	
		AV		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

The signal shown on the right is output while torque is being restricted.

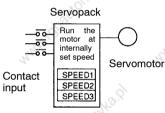
**Note** This function is changed to another function depending on the setting of bit 2 of memory switch Cn-02 (see below).

To use input signals  $\overline{P-CL}$  and  $\overline{N-CL}$  as torque limit input signals, set the following memory switch to 0.

Cn-02 Bit 2	Contact Input Speed Control Selection	 For Speed/Torque Control and Position Control

Prohibits the contact input speed control function.

If the contact input speed control function is used, the contents of the input signals shown below will change.



After this memory switch is reset, the meanings of the following signals will also change:

Monitor mode (Un-05) bit 7 and bit 8

Setting	Meaning	Input Signal				
610/40	Does not use the contact	P-CON (1CN-41) P-CON (1CN-41) B of Cn- signal.)		control. r speed/ f Cn-01 1	peed/torque control, bits A and n-01 take precedence over this	
0	input speed control function.				ward external torque limit	
WAR!	NOR NOR	N-CL (1CN-46)	) Use inp		verse external torque limit	
ġ.,	, of ar '	Da	5°'-		0: OFF, 1: ON	
	10 <sup>2011</sup>	P-CON	P-CL	N-CL	Speed Setting	
	Uses the contact input speed	Direction of rotation	0	0	Normal speed/torque or position control	
1		1 input speed control function.	0: Forward 1: Reverse	0	1	Cn-1F (SPEED1)
à	control function.		1_3	1	Cn-20 (SPEED2)	
the star			N.	0	Cn-21 (SPEED3)	
6	-Cio		6	•	all'a	

• Handling of the CLT+, CLT- signals are the same as for level 1 (internal torque limit). Refer to Using CLT+, CLT- Signals on page 58.

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3.2.1 Inputting Speed Reference

# 3.2 Setting User Constants According to Host Controller

This section describes how to connect a  $\Sigma$ -series Servo to a host controller and how to set user constants.

3.2.1	Inputting Speed Reference	64
3.2.2	Inputting Position Reference	69
3.2.3	Using Encoder Output	76
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3.2.10	Using the Reference Pulse Inhibit Function (INHIBIT)	100
3.2.11	Using the Reference Pulse Input Filter Selection Function	101
3.2.12	Using the Analog Monitor	102

# 3.2.1 Inputting Speed Reference

1) Using the following memory switch, select the speed/torque control.

14	1 <sup>1</sup>	19 Pla
Cn-02 Bit B		For Speed/Torque Control and Position Control
· · · · · · · · · · · · · · · · · · ·		

Select the control mode (speed/torque control or position control) by bit B of memory switch Cn-02.

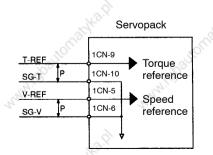
Setting	Meaning	219
0	Selects speed or torque control. Select the control form by bits A and B of memory switch Cn-01.	N. N
1	Selects position control.	8

**Note** For the memory switch Cn-02, always turn the power OFF and then ON after changing the setting. This makes the new setting valid.

 Input a speed reference by using the following input signal "speed reference input." Since this signal can be used in different ways, set the optimum reference input for the system to be created.

> Torque reference input (analog voltage input)

Speed reference input (analog voltage input)



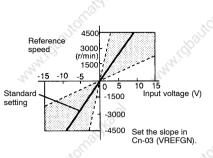
\$P: Represents twisted-pair cables

$\rightarrow$ Input V-REF	1CN-5	Speed Reference Input	For Speed/Torque Control Only
$\rightarrow$ Input SG-V	1CN-6	Signal Ground for Speed Reference Input	For Speed/Torque Control Only
		10×	1.9.2

Use these signals when speed control is selected (memory switch Cn-02 bit B = 0).

For ordinary speed control, always wire the V-REF and SG-V terminals.

Motor speed is controlled in proportion to the input voltage between V-REF and SG-V.



Standard Setting:

Cn-03 = 500: This setting means that 6 V is equivalent to rated speed (3,000 r/min)

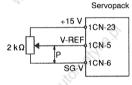
Examples:

- +6 V input  $\rightarrow$  3000 r/min in forward direction
- +1 V input  $\rightarrow$  500 r/min in forward direction
- -3 V input  $\rightarrow$  1500 r/min in reverse direction

User constant Cn-03 can be used to change the voltage input range.

Example of Input Circuit

(See the figure on the right)

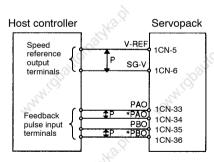


For noise control, always use twisted-pair cables.

Recommended Variable Resistor for Speed Setting: Type 25HP-10B manufactured by Sakae Tsushin Kogyo Co., Ltd.

When position control is performed by a host controller such as a programmable controller.

Connect V-REF and SG-V to speed reference output terminals on the host controller. In this case, adjust Cn-03 according to output voltage specifications.



\$P: Represents twisted-pair cables

Output → +15V 1CN-23	+15V power supply for speed/torque control	For Speed/Torque Control Only
Output → -15V 1CN-24	-15V power supply for speed/torque control	For Speed/Torque Control Only

Power output for speed/torque control. Max. output current is 30mADC.

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3.2.1 Inputting Speed Reference cont.

3) Use the memory switch and input signal P-CON to specify one of the four modes shown below.

Cn-01 Bit A	Control Mode Selection	Factory Setting: 0	For Speed/Torque Control Only
Cn-01 Bit B	Control Mode Selection	Factory Setting: 0	For Speed/Torque Control Only
	N <sup>1</sup> IO		and Charles and Charles

The Servopack for speed/torque control provides four different control modes.

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JOSULOTIC	-toaltonn	toautorne	,03 <sup>110</sup> m	108110mm	1021
and and	Cn-01 Setting Bit B Bit	al a	Control	Mode	Arnen!?
and obaitomatika.ol	Ligballonation and and	(1CN-5).	beed control. ce is input from V-REF I1) signal is used to sw	Speed reference V- (1C P/P) changeover P-C (1CN	R2 Servopack REF N-5) CON (-41)
and obaltonables, of and and	undbailtomativa.io	between P con 1CN-41 is open 1CN-41 is at 0 V	PI control P control ce input T-REF (1CN-9		al anna toball
and oballonable.pl	ugbautomanikani w	function to be set	0	p Speed reference Zero-clamp (	R2 Servopack
www.chautomatyka.pl	Arobautomania.pl		I1) signal is used to tur ction ON or OFF. Turns zero-clamp	n the the following are met: Condition 1: P ON.	performed when two conditions -CON is turned lotor speed he preset value. Cn-29 (ZCLVL)
Multipationalyka.pl	ubautomatuka.pl	1CN-41 is at 0 V	function OFF Turns zero-clamp function ON	www.edautomatika	p) www.cobau
-att a.P.	and a lit		ce input T-REF (1CN-9 d.	)	2

For torque control, refer to 3.2.7 Using Torque Control. www.gauonayka.pl 3

Arran 100

3.2.1 Inputting Speed Reference cont.

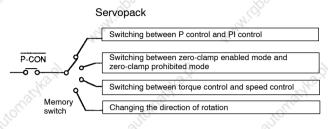
• Using P-CON Signal:

## → Input P-CON 1CN-41

Proportional Control, etc.

For Speed/Torque Control and Position Control

## The function of input signal P-CON changes with the memory switch setting.



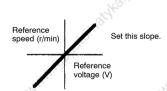
	Me	Memory Switch		Memory Switch		all all all
	Cn-02 Bit 2	Cn-01 Bit B	Cn-01 Bit A	Meaning of P-CON Signal		
	N.O.	0	0	Switching between proportional (P) control and proportional/integral (PI) control		
C	0	0	, <sub>or</sub> q	Switching between zero-clamp enabled/prohibited mode Speed control with zero-clamp function		
	0	1 _%	0	Torque control I (P-CON is not used.)		
	0	A. A.	1	Switching between torque control and speed control (Torque control II)		
	1	-	- 2	Changing the direction of rotation during contact input speed control		

4) Adjust the speed reference gain using the following user constant.

	and the second sec		N		all'
Cn-03	VREFGN Speed Reference Gain	Unit: (r/min)/V	Setting Range: 10 to 2162	Factory Setting: 500	For Speed/Torque Control Only

This user constant is for speed/torque control only. Sets the voltage range for speed reference input V-REF (1CN-5). Sets this user constant according to the output form of the host controller or external circuit.

The factory setting is as follows: Rated speed (3000 r/min)/6 V = 500





#### Zero-clamp function

This function is used for a system in which the host controller does not form a position loop. In this case, the stopping position may shift even if a speed reference is set to 0. If the zeroclamp function is turned ON, a position loop is internally formed so that the stopping position is firmly "clamped."

3.2 Setting User Constants According to Host Controller

# 3.2.2 Inputting Position Reference

1) Using the following memory switch, select the position control.

C	1 Mar	No.	1100
Cn-02 Bit B		•	For Speed/Torque Control and Position Control
	Q. Q.		Q. Q.

Select the control mode (speed/torque control or position control) by bit B of memory switch Cn-02.

Setting	A.C.	Meaning	20	
0	Selects speed or torque of Select the control form by		witch Cn-01.	50 <sup>23</sup>
1	Selects position control.	1.0	6	10

Note For the memory switch Cn-02, always turn the power OFF and then ON after changing the setting. This makes the new setting valid.

2) Input a position reference by using the following input signal "reference pulse input." Since there are several specifications for input signal, select reference input for the system to be created.

input

input

Reference sign

Error counter clear input

Inputs a move reference by pulse input.

Position reference can correspond to the following three types of output form:

- Line driver output
- +12V Open collector output
- +5V Open collector output

**Connection Example 1: Line Dri** 

Line Driver Used:

SN75174 manufactured by Texas Instruments Inc., or MC3487 or equivalent.

ver Output	Margari Ch	. Sand
Host controller	14	Servopack
Line driver	PULS	Photocoupler
indianal 2	P *PULS	1CN-8
│ _ <b>〉</b> ─	SIGN	
	P *SIGN	
	CLR P *CLR	1CN-15
waller .	"	

ΠП Positions

> Servopack PHOTOCOUPLER PUIS CN.7 Reference pulse \*PULS 1CN-8 1CN-11 SIGN p \*SIGN 1CN-12 1CN-1 CLR 1CN-14 \*CLR

1P: Represents twisted-pair cables

3.2.2 Inputting Position Reference cont.

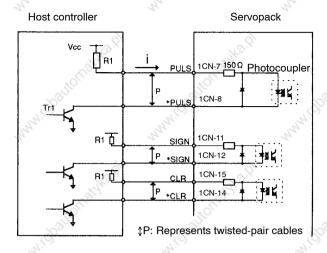
#### **Connection Example 2: Open Collector Output**

Sets the value of limiting resistor R1 so that input current i falls within the following range:

Input Current i: 7 to 15 mA

Examples:

- When Vcc is 12 V, R1 = 1 k $\Omega$
- When Vcc is 5 V, R1 = 180 Ω



**Note** The signal logic for open collector output is as follows.

When Tr1 is ON	Equivalent to high level input
When Tr1 is OFF	Equivalent to low level input
	-10

autos	( <sup>1</sup> <sup>1</sup> <sup>1</sup> )	omain	automa	OTTO
W. OC	Output $\rightarrow$ PL1	1CN-3	Power for Open Collector Reference	For Position Control Only
19	$Output \rightarrow PL2$	1CN-13	nelelelice	Control Only
	$Output \rightarrow PL3$	1CN-18	0	8

For details, refer to the Connection Example 3 (When Power for Open Collector Reference is Used) shown below:

www.dbaltor

#### Connection Example 3: When Power for Open Collector Reference is Used

When power for open collector reference (PL1, PL2, PL3) is used, connect between PL1 and PULS, PL2 and SIGN, PL3 and CLR as follows:

		-1. ·
Host controller		Servopack
Cathan!	PL1 PULS *PULS	$\begin{array}{c} 1 CN & +15 V Photo-3 & 1 k\Omega & coupler \\ \hline 7 & 150 \Omega & coupler \\ \hline 8 & \bullet 0 & \bullet = 1 \end{array}$
Tr1	PL2 SIGN	$4.7 \text{ k}\Omega$ $13 1 \text{ k}\Omega \longrightarrow +15 \text{ V}$ $11 150 \Omega$
	*SIGN	12 4.7 kΩ +15 V
Nat	PL3 CLR	18 ΚΩ 15 150 Ω • Γ <b>x</b> = L
- Ç	+CLR SG	$\begin{array}{c c} 14 & & & \\ \hline \\ 1 & & 4.7 \text{ k}\Omega \end{array}$
N. 200	\$P: Represents	s twisted-pair cables

Note The signal logic for open collector output is as follows.

When Tr1 is ON	Equivalent to high level input
When Tr1 is OFF	Equivalent to low level input

#### 3) Use the following memory switch to select the reference pulse form to be used:

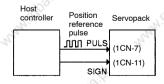
		0.5	0.2
$\rightarrow$ Input PULS	1CN-7	Reference Pulse Input	For Position Control Only
→ Input <b>★</b> PULS	1CN-8	Reference Pulse Input	For Position Control Only
→ Input SIGN	1CN-11	Reference Sign Input	For Position Control Only
$\rightarrow$ Input <b>*</b> SIGN	1CN-12	Reference Sign Input	For Position Control Only

The motor only rotates at an angle proportional to the input pulse.

Cn-02 Bit 3	Reference Pulse Form Selection	Factory Setting: 0	For Position Control Only
Cn-02 Bit 4	Reference Pulse Form Selection	Factory Setting: 0	For Position Control Only
Cn-02 Bit 5	Reference Pulse Form Selection	Factory Setting: 0	For Position Control Only

Sets the form of a reference pulse that is externally output to the Servopack.

Sets the pulse form according to the host controller specifications.



Set also the input pulse logic in bit D of Cn-02.

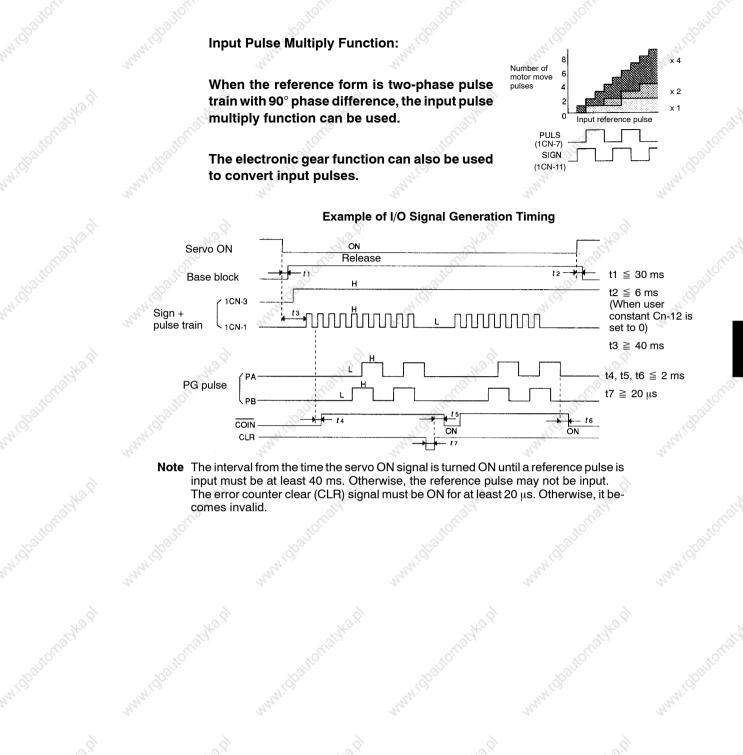
3.2.2 Inputting Position Reference cont.

			1000	-	, xé	a <sup>nt</sup>	Jahr Mo	
	Cn-02	2		Input Pulse	Refer- ence	Motor Forward	Motor Reverse	
Bit D	Bit 5	Bit 4	Bit 3	Multipli-	Pulse Form	Run Reference	Run Reference	
onable	0	0	0		Sign + pulse train	PULS (1CN-7) SIGNH'	PULS	autorna
0 (Posi-	0	un -	0	×1	Two- phase pulse train with	PULS (1CN-7) SIGN (1CN-11)	-++- <sup>90°</sup> PULS (1CN-7) SIGN (1CN-11)	
`tive logic etting)	0	1	1,5	×2	90° phase differ-			autorn
	1	0	0	×4	ence	(1CN-7)	(1CN-7) SIGN (1CN-11)	
omatyka	0	0	1		CW <sup>*1</sup> pulse + CCW pulse	PULS <u>"L"</u> (1CN-7) SIGN (1CN-11)	PULS (1CN-7) SIGNL (1CN-11)	autorn'
	0	0	0		Sign + pulse train	PULS (1CN-7) SIGNL* (1CN-11)	PULS (1CN-7) SIGN"H"	
1 Nega-	0	1	0	omanika ×1	Two- phase pulse train with	PULS (ICN-7) SIGN (ICN-11)	PULS (1CN-7) sign (1CN-11)	autorna
tive logic etting)	0	Pro-	1	×2	90° phase differ-			
- Cable	1	0	0	×4	ence	(1CN-7)	(1CN-7)	6
	0	0	3990 1		CW <sup>*2</sup> pulse + CCW pulse	РULS (1CN-7)	PULS	AUTO.

\*1 When CW pulse + CCW pulse and positive logic setting, make sure to set each of the signals (the one not being input the pulse) to Low level.

www.goautomat \*2 When CW pulse + CCW pulse and negative logic setting, make sure to set each of the signals (the one not being input the pulse) to High level.

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3.2.2 Inputting Position Reference cont.

<b>Reference Pulse Form</b>	Electrical Specifications	Remarks
Sign + pulse train input (SIGN + PULS signal) Maximum reference frequency: 450 kpps	SIGN $t_1 t_2$ PULS $t_4$ $t_5$ $t_6$ $\oplus$ reference	The signs for each reference pulse are as follows: ⊕: High level ⊖: Low level
143.Pl	$t_1, t_2 \leq 0.1 \mu s \qquad r \geq 1.1 \mu s$ $t_3, t_7 \leq 0.1 \mu s$ $t_4, t_5, t_6 > 3 \mu s$	-Walt
90° different two-phase pulse train (phase A + phase B)	PULS	User constant Cn-02 (bits 3, 4 and 5) is used to switch the input pulse
Maximum reference frequency x 1 multiplier: 450 kpps x 2 multiplier: 400 kpps x 4 multiplier:	SIGN $(r)$ Phase B is 90° forward from phase B $t_1, t_2 \le 01 \mu s$ $\frac{r}{T} \times 100 \le 50\%$	multiplier mode.
200 kpps CCW pulse + CW pulse	and the second sec	and the second s
Maximum reference frequency: 450 kpps		Ser www.to
63/4 <sup>0,01</sup>	SIGN $\bigcirc$ reference $\bigcirc$ reference $t_{1, t_{2} \leq 0.1  \mu s}$ $t_{2} \geq 1.1  \mu s$	Matthand
ADDING TO THE ADDING	$r_3 > 3 \mu s$ $\frac{r}{T} \times 100 \leq 50\%$	xo <sup>ator</sup>

## Allowable Voltage Level and Timing for Reference Pulse Input

4) The following describes how to clear the error counter.

- St		A.		-Str
→ Input	CLR	1CN-15	Error Counter Clear Input	For Position Control Only
→ Input	* CLR	1CN-14	Error Counter Clear Input	For Position Control Only
	24		A1	St.

Setting the CLR signal to high level does the following:

- Sets the error counter inside the Servopack to 0.
- Prohibits position loop control.

Use this signal to clear the error counter from the host controller.

CLR Clar Clear Position loop error counter

Bit A of memory switch Cn-02 can be set so that the error counter is cleared only once when the leading edge of an input pulse rises.

3

Dautonatykan 3.2 Setting User Constants According to Host Controller

0		utornato	99	-autornaty .	
ĺ	Cn-02 Bit A	Error Counter Clear Signal Selection	Factory Setting: 0	For Position Control	Only

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www.dautor

	Cn-02	Bit A	Error Counter Cle Selection	ar Signal	Factory Setting: 0	For Position Control Only	
a al	Selects th	ne puls	e form of error co	unter clear	signal CLR (1	CN-15).	
100 <sup>110</sup>	Setting	20	Meaning	1001		101 101	2011
	0	signal do not	the error counter w is set at high level. accumulate while t is at high level.	Error pulses	; CL	R "H" N-15) Cleared state	
automati	1		the error counter on a edge of the CLF		s. <sup>c</sup>	LR "H" N-15) $\Delta$ Cleared only once at this point	3000
		Jan 1. So		1441 BBC	A.A.	So, while	_
	Cn-01 I	Bit A	Error Counter Pro	cessing at	Factory Setting: 0	For Position Control Only	1

24		14	19
Cn-01 Bit A	Error Counter Processing at Servo OFF	Factory Setting: 0	For Position Control Only
		Setting. 0	
the state	- 3 <sup>3</sup>	3th	- Bar
Select the error	counter processing at Servo	OFF.	torn.
	er aller		. 50 <sup>0</sup> . 50 <sup>0</sup>
Setting	14	looping A	14. N

		N. S.		1.00
Setting	24	Meaning	19 <sup>19</sup>	and the second s
0	Error counter is clear	ed at Servo OFF.	1	
<u>1</u>	Error counter is not c	leared at servo OFF.	~	
atox	"Har	Stor.	No.x	
	offer	SC COL	office	. 5

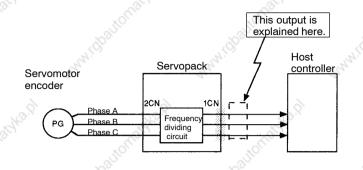
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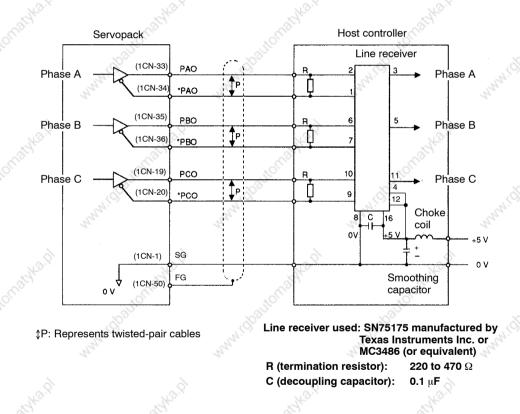
3.2.3 Using Encoder Output

# 3.2.3 Using Encoder Output

1) Encoder output signals **divided** inside the Servopack can be output externally. These signals can be used to form a position control loop in the host controller.



The output circuit is for line driver output. Connect each signal line according to the following circuit diagram.





#### Divided (or dividing)

"Dividing" means converting an input pulse train from the encoder mounted on the motor according to the preset pulse density and outputting the converted pulse. The unit is pulses per revolution.

3.2 Setting User Constants According to Host Controller

2) I/O signals are described below.

Output $\rightarrow$ PAO 1CN-33	Encoder Output Phase-A	For Speed/Torque Control and Position Control
Output $\rightarrow$ * PAO 1CN-34	Encoder Output Phase-A	For Speed/Torque Control and Position Control
Output → PBO 1CN-35	Encoder Output Phase-B	For Speed/Torque Control and Position Control
Output $\rightarrow$ * PBO 1CN-36	Encoder Output Phase-B	For Speed/Torque Control and Position Control
Output → PCO 1CN-19	Encoder Output Phase-C	For Speed/Torque Control and Position Control
Output → <b>*</b> PCO 1CN-20	Encoder Output Phase-C	For Speed/Torque Control and Position Control

Divided encoder signals are output.

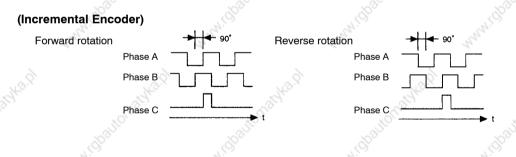
Always connect these signal terminals when a position loop is formed in the host controller to perform position control.

Set a dividing ratio in the following user constant.

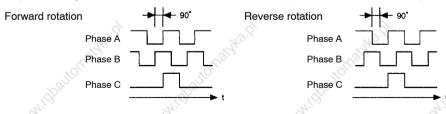
Dividing ratio setting Cn-0A PGRAT

The dividing ratio setting is not relevant to the gear ratio setting (Cn-24, 25) for the electronic gear function of the Servopack for position control.

#### **Output Phase Form**



#### (Absolute Encoder)



3.2.3 Using Encoder Output cont.

. N		
→ Input SEN 1CN-4	SEN Signal Input	For Speed/Torque Control and Position Control
→ Input 0SEN 1CN-2	SEN Signal Input	For Speed/Torque Control and Position Control
Output → PSO 1CN-48	Encoder Output Phase-S	For Speed/Torque Control and Position Control
Output $\rightarrow \star PSO 1CN-49$	Encoder Output Phase-S	For Speed/Torque Control and Position Control
→ Input BAT $\oplus$ 1CN-21	Battery (+)	For Speed/Torque Control and Position Control
$\rightarrow$ Input BAT $\ominus$ 1CN-22	Battery (-)	For Speed/Torque Control and Position Control

Use these signals (SEN to BAT $\ominus$ ) for absolute encoders. For details, refer to 3.8.5 Using an Absolute Encoder.

Output → SG 1CN-1	Signal Ground for Encoder Output	For Speed/Torque Control and Position Control
Output $\rightarrow$ FG 1CN-50	Frame Ground	For Speed/Torque Control and Position Control

SG: Connect to 0 V on the host controller.

FG: Connect to the cable shielded wire.

3) Use the following memory switch to specify the type of the encoder to be used.

Cn-02 Bit 9	Encoder Type Selection	Factory Setting: 0	For Speed/Torque Control and Position Control

Sets the encoder type according to the servomotor type as shown in the table.

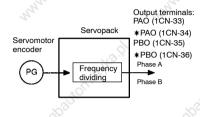
#### After changing the memory switch setting, always turn the power OFF, then ON.

Motor Type	Encoder Type		Setting
SGM-00310 SGMP-00310	Incremental encoder	WK2.P	0
SGM-00W10 SGMP-00W10	Absolute encoder	automon	1

4) Set the pulse dividing ratio in the following user constant.

Cn-0A to No. Encod Pulse	der Andrea State
--------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Sets the number of output pulses for PG output signals (PAO,  $\star$ PAO, PBO and  $\star$ PBO).



Pulses from motor encoder (PG) are divided by the preset number of pulses before being output.

The number of output pulses per revolution is set in this user constant. Set this value according to the reference unit of the machine or controller to be used.

The setting range varies according to the encoder used.

Setting example:

 3

79

1 revolution

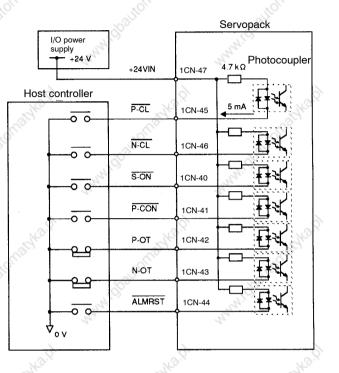
Motor Type	Number of Encoder Pulses Per Revolution	Setting Range
SGM31_ SGMP31_	Incremental encoder: 2048 pulses per revolution	16 to 2048
SGM-□□□W1□ SGMP-□□□W1□	Absolute encoder: 1024 pulses per revolution	16 to 1024
	SGM-00310 SGMP-00310 SGM-00W10	SGM31       Incremental encoder: 2048 pulses per revolution         SGMP31       Absolute encoder: 1024 pulses per revolution

For the user constant Cn-0A, always turn the power OFF and then ON after changing the setting. This makes the new setting valid. 3.2.4 Using Contact I/O Signals

# 3.2.4 Using Contact I/O Signals

#### 1) Contact Input Signal Terminal Connections

These signals are used to control DR2 Servopack operation. Connect these signal terminals as necessary.

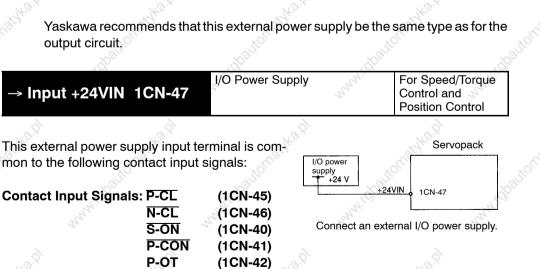


**Note** Provide an external I/O power supply separately. There are no power terminals to which the DR2 Servopack outputs signals externally.

External Power Supply:  $24 \pm 1$  VDC 50 mA or more

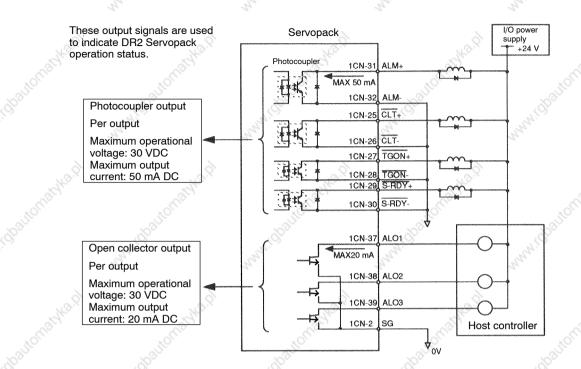
N-OT

ALMRST



(1CN-43)

(1CN-44)



#### 2) Contact Output Signal Terminal Connections

**Note** Provide an external I/O power supply separately. There are no power terminals to which the DR2 Servopack outputs signals externally.

Yaskawa recommends that this external power supply be the same type as for the input circuit.

Output → SG	1 <b>CN-</b> 2	Signal Ground for Alarm Code Output Signal	For Speed/Torque Control and Position Control
	~		

This signal ground is used for the following output signals. Connect to 0 V on the external power supply.

Contact Output Signals:	ALO1	(1CN-37)
3 <sup>10</sup>	ALO2	(1CN-38)
	ALO3	(1CN-39)

3.2.5 Using Electronic Gear

# 3.2.5 Using Electronic Gear

1) Outline

For position control only.

# Positions

The electronic gear function enables the motor travel distance per input reference pulse to be set to any value. It allows the host controller to perform control without having to consider the machine gear ratio and the number of encoder pulses.

When Electronic Gear Function is Not Used

Workpiece

Ball screw

pitch: 6 mm

Number of encoder pulses: 2048

To move a workpiece 10 mm,

One revolution is equivalent to 6 mm, so  $10 \div 6 = 1.6666$  (revolutions)

2048 x 4 (pulses) is equivalent to one revolution, so 1.6666 x 2048 x 4 = 13653 (pulses) A total of 13653 pulses must be input as a reference.

the host controller needs to make this calculation.

When Electronic Gear Function is Used Workpiece Reference unit: 1 µm Number of Ball screw encoder pitch: 6 mm pulses: 2048

Machine conditions and reference unit must be defined for the electronic gear function beforehand.

To move a workpiece 10 mm:

Reference unit is 1  $\mu$ m, so 10 mm  $\div$  1  $\mu$ m = 10000 pulses

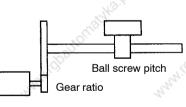
#### 2) Setting the Electronic Gear

Calculate the electronic gear ratio (B/A) according to the procedure below and set the value in Cn-24 and Cn-25.

a) Check the machine specifications.

Items related to electronic gear:

- Gear ratio
- Ball screw pitch
- Pulley diameter



b) Check the number of encoder pulses for the SGM Servomotor.

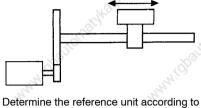
		- B		
Motor Type	Encoder Type	Number of Encoder Pulses Per Revolution		
SGM31_ SGMP31_	Incremental encoder	2048		
SGMW1_ SGMPW1_	Absolute encoder	1024	34	

Same as user constant Cn-11 settings.

c) Determine the reference unit to be used.

Reference unit is the minimum unit of position data used for moving the load. (Minimum unit of reference from host controller)

Examples: 0.01 mm, 0.001 mm, 0.1°, 0.01 inch To move a table in 0.001 mm units Reference unit: 0.001 mm



machine specifications and positioning

 $\times \frac{m}{n}$ 

Reference input of one pulse moves the load by one reference unit.

Example: When reference unit is 1  $\mu$ m If a reference of 50,000 pulses is input, the load moves 50 mm (50,000 x 1  $\mu$ m).

d) Determine the load travel distance per revolution of load shaft in reference units.

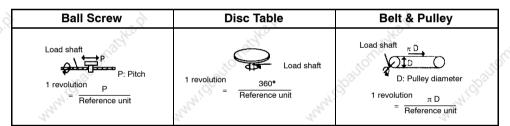
Load travel distance per revolution of load shaft (in reference units)

Load travel distance per revolution of load shaft (in unit of distance)

accuracy.

Reference unit

# Example: When ball screw pitch is 5 mm and reference unit is 0.001 mm 5/0.001 = 5,000 (reference units)



) Determine the electronic gear ratio  $\left(\frac{B}{A}\right)$ 

If the load shaft makes "n" revolutions when the motor shaft makes "m" revolutions, the gear ratio of motor shaft and load shaft is  $\frac{n}{m}$ .

Electronic gear ratio

Number of encoder pulses x 4 Travel distance per revolution of load shaft (in reference units)

#### NOTE Make sure that the electronic gear ratio meets the following condition:

0.01  $\leq$  Electronic gear ratio  $\left(\frac{B}{A}\right) \leq$  100

If the electronic gear ratio is outside this range, the Servopack does not work properly. In this case, modify the load configuration or reference unit.

3.2.5 Using Electronic Gear cont.

f) Set the electronic gear ratio in the user constants below.

Reduce the electronic gear ratio  $\left(\frac{B}{A}\right)$  to their lowest terms so that both A and B are an integer smaller than 65535, then set A and B in the following user constants.

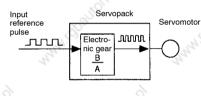
$(\underline{B})$	Cn-24	RATB Electronic gear ratio (numerator)
$(A) \longrightarrow$	Cn-25	RATA Electronic gear ratio (denominator)

This is all that is required to set the electronic gear.

Cn-24RATB Electronic Gear Ratio (Numerator)Unit: NoneSetting Range: 1 to 65535Factory Setting: 4For Position Control OnlyCn-25RATA Electronic Gear Ratio (Denominator)Unit: NoneSetting Range: 1 to 65535Factory Setting: 4For Position Control Only							
Cn-25 Electronic Gear Ratio None Range: 1 Setting: 1 Control Only	Cn-24	Electronic Gear Ratio	-	Range: 1	,	S.	and C
	Cn-25	Electronic Gear Ratio		Range: 1	,		1

These user constants are for position control only.

Set the electronic gear ratio according to machine specifications.

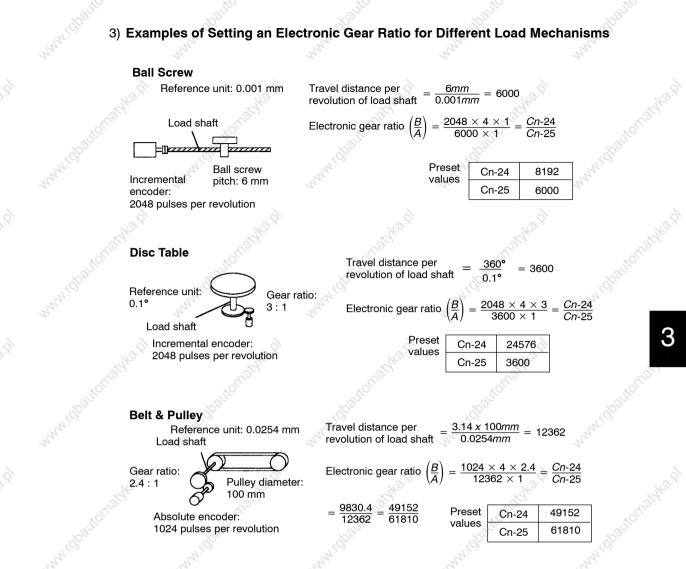


Electronic gear ratio  $\left(\frac{B}{A}\right) = \frac{\text{Cn-24}}{\text{Cn-25}}$ 

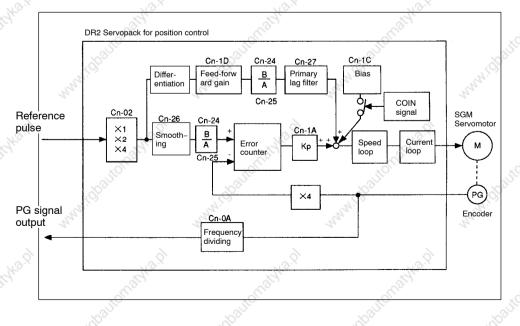
- B = [(Number of encoder pulses) x 4] x [Motor shaft rotating speed]
- A = [Load travel distance per revolution of load shaft (Reference unit)] x [Load shaft rotating speed]

Note that the user constant settings must meet the following condition:

 $0.01 \leq \left(\frac{B}{A}\right) \leq 100$ 



#### 4) Control Block Diagram for Servopack for Position Control

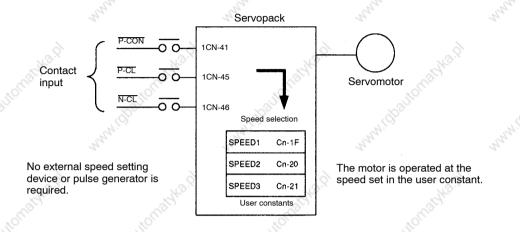


3.2.6 Using Contact Input Speed Control

# 3.2.6 Using Contact Input Speed Control

1) The contact input speed control function provides easy-to-use speed control. It allows the user to initially set three different motor speeds in user constants, select one of the speeds externally by contact input and run the motor.

This function can be used for both speed/torque control and position control.



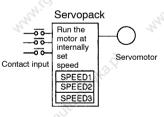
2) To use the contact input speed control function, perform Steps a) to c).

a) Set the following memory switch to 1.

ç.	Cn-02 Bit 2	Contact Input Speed Control Selection	Factory Setting: 0	For Speed/Torque Control and Position Control	
			1		6

Enables the contact input speed control function.

If the contact input speed control function is used, the contents of the input signals shown below will change.



When this memory switch is reset, the meanings of the following signals will also change:

Monitor mode (Un-05) bit 7 and bit 8

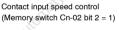
		200			. N°	
Setting	Meaning	Chi.		Inj	out Signal	- Chill
-	1	19			20	34
8	Does not use the contact input	P-CON(1CN-41)		Used t contro	o switch between I.	P control and PI
ి 0	speed control	P-CL(1CN-4	5) 📈	Used f	or forward externa	al torque limit input
	function.	N-CE(1CN-4	6)	Used f	or reverse externa	al torque limit input
	JLON.	3	Q.,	L	.3 <sup>0</sup>	
	Uses the contact input	JANI GOL			WH. ODC	0: OFF, 1: ON
	speed control function.	P-CON	P-CL	N-CL	Speed Setting	N.
2.2	Note In the case of the posi-	Direction of rotation	0	0	Stop (or pulse	reference)
1	tion control type, the re-	0: Forward 1: Reverse	SC <sup>O</sup>	1	Cn-1F, SPEED1	
	ferrence pulse inhibit	WIGDON	1	1	Cn-20, SPEED2	HI-COC
	function (INHIBIT)	AN AN	1	0	Cn-21, SPEED3	the second
2.2	cannot be used.		N	2		20.9
-	Br.		23		8	3

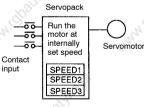
b) Set three motor speeds in the following user constants.

Cn-1F	SPEED1 1st Speed (Contact Input Speed Control)	Unit: r/min	Setting Range: 0 to Maximum Speed	Factory Setting: 100	For Speed/Torque Control and Position Control
Cn-20	SPEED2 2nd Speed (Contact Input Speed Control)	Unit: r/min	Setting Range: 0 to Maximum Speed	Factory Setting: 200	For Speed/Torque Control and Position Control
Cn-21	SPEED3 3rd Speed (Contact Input Speed Control)	Unit: r/min	Setting Range: 0 to Maximum Speed	Factory Setting: 300	For Speed/Torque Control and Position Control

Use these user constants to set motor speeds when the contact input speed control function is used (set bit 2 of memory switch Cn-02).

Speed selection input signals  $\overline{P-CL}$  (1CN-45) and  $\overline{N-CL}$  (1CN-46), and rotation direction selection signal  $\overline{P-CON}$  (1CN-41) enable the motor to run at the preset speeds.





c) Set the soft start time (for speed/torque control only).

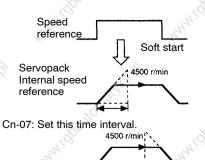
Cn-07	SFSACC Soft Start Time (Acceleration)	Unit: ms	Setting Range: 0 to 10000	Factory Setting: 0	For Speed/Torque Control and Position Control
Cn-23	SFSDEC Soft Start Time (Deceleration)	Unit: ms	Setting Range: 0 to 10000	Factory Setting: 0	For Speed/Torque Control and Position Control

3.2.6 Using Contact Input Speed Control cont.

In the Servopack, a speed reference is multiplied by the preset acceleration or deceleration value to provide speed control.

When a progressive speed reference is input or contact input speed control is used, smooth speed control can be performed. (For normal speed control, set "0" in each user constant.)

Set the following value in each user constant.



Cn-23: Set this time interval.

• Cn-07: Time interval from the time the motor starts until it reaches the maximum speed (4,500 r/min)

- $\bullet$  Cn-23: Time interval from the time the motor is running at the maximum speed (4500 r/min) until it stops
- **Note** For position control type, the soft start function is available only when the contact input speed control function is used.

3) Contact input speed control performs the following operation.

The following input signals are used to start and stop the motor.

· O <sub>x</sub>	1× · · · · · · · · · · · · · · · · · · ·	).
→ Input P-CL 1CN-45	Speed Selection 1 (Forward External Torque Limit Input)	For Speed/Torque Control and Position Control
$\rightarrow$ Input N-CL 1CN-46	Speed Selection 2 (Reverse External Torque Limit Input)	For Speed/Torque Control and Position Control

## a) Contact Input Speed Control when Cn-02 bit 2 = 1

• For Speed/Torque Control:

0: OFF, 1: ON

Conta	Contact Signal			r Const	ant							
			Cn-02	Cn	-01 2		Selected Speed					
P-CON	P-CL	N-CL	Bit 2	Bit A	Bit B	Cald!						
	Baute			300 <sup>310</sup>	0	Char	Stopped by speed ref- erence 0					
3	a a c		444	1	0	Stop	Stopped by zero-clamp (Refer to 3.4.3.)					
12.Q	0	0	N.a.P	NO.R					0	10		g speed reference F) input
and a second	1	Catol	1	1	<sup>265</sup> 1		With zero-clamp func- tion					
Direction of	0	1		S		SPEE	D1 (Cn-1F)					
rotation	s <sup>-1</sup>	1	494			SPEE	D2 (Cn-20)					
0: Forward 1: Reverse	1	0			6	SPEE	ED3 (Cn-21)					

Preset values (0 or 1) and input signal status in the portions indicated by horizontal bars (–) are optional.

3.2 Setting User Constants According to Host Controller

• For Position Control:

0: OFF, 1: ON

Contact Signal			User Constant		2
P-CON	P-CE	N-CL	Cn-02	Cn-01	Selected Speed
		N-CL	Bit 2	Bit F	- Hoffin
, Č	<u> </u>	•	S.	0	Stop
al and	0	0	And and	1	Pulse reference input
Direction of rotation	0	/0	1	6	SPEED (Cn-1F)
0: Forward rotation	1	<u>1</u>		and they are	SPEED (Cn-20)
1: Reverse rotation	900	0	6.	Jtol'	SPEED (Cn-21)

Preset values (0 or 1) and input signal status in the portions indicated by horizontal bars (–) are optional.

**Note** When the contact input speed control function is used, the reference pulse inhibit function is not available.

b) Standard Setting when Cn-02 bit 2 = 0
 Input signals are used as external torque limit input.

Input signal P-CON is used to specify the direction of motor rotation.

→ Input P-CON 1CN-41

Proportional Control, etc.

For Speed/Torque Control and Position Control

#### a) Contact Input Speed Control when Cn-02 bit 2 = 1

Use input signal P-CON to specify the direction of motor rotation.

P-CON	Meaning 🔊
1 ്	Reverse rotation
0	Forward rotation

0: OFF (high level), 1: ON (low level)

#### b) Standard Setting when Cn-02 bit 2 = 0

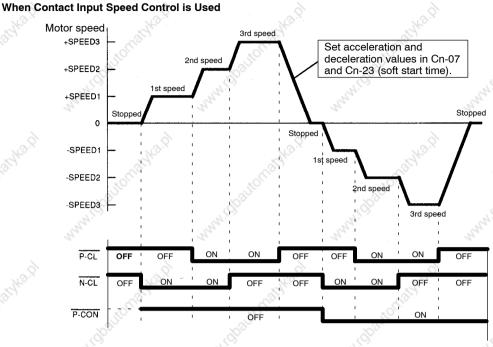
P-CON signal is used for proportional control, zero-clamp and torque/speed control changeover.

**Note** For the speed/torque control, control by external reference (voltage reference) is possible when the contact input speed control function is used by setting bits A and B of user constant Cn-01.

For the position control, control by external reference (pulse reference) is possible when the contact input speed control function is used by setting bit F of user constant Cn-01.

3.2.6 Using Contact Input Speed Control cont.

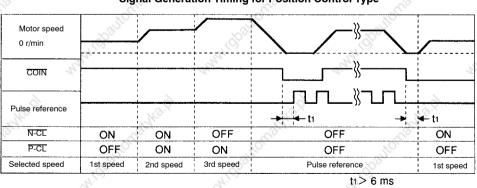
 The figure below illustrates an example of operation in contact input speed control mode. Using the soft start function reduces physical shock at speed changeover.



**Note** For the position control, the soft start function is available only when contact input speed control is used. The soft start function is not available when pulse reference input is used.

For the position control type, if contact input speed control mode is switched to pulse reference input mode when the motor is running at the 1st, 2nd or 3rd speed, the Servopack does not receive a pulse reference until positioning complete signal  $\overline{\text{COIN}}$  is output.

Always start outputting a pulse reference from the host controller after a positioning complete signal is output from the Servopack.



Signal Generation Timing for Position Control Type

The above figure illustrates signal generation timing when the soft start function is used.

The value of  $t_1$  is not influenced by use of the soft start function. A maximum of 6 ms delay occurs when  $\overline{P-CL}$  or  $\overline{N-CL}$  signal is read.

# 3.2.7 Using Torque Control

1) The Servopack can provide the following torque control:

Speed

Torque restriction

Level 1: To restrict the maximum output torque to protect the machine or workpiece

Level 2: To restrict torque after the motor moves the machine to a specified position

Torque control

Level 3: To always control output torque, not speed

Level 4: To switch between speed control and torque control

This section describes how to use levels 3 and 4 of the torque control function.

2) Use the following memory switch to select level 3 (torque control I) or level 4 (torque control II).

		14-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	
Cn-01 Bit A	Control Mode Selection	Factory Setting: 0	For Speed/Torque Control Only
Cn-01 Bit B	Control Mode Selection	Factory Setting: 0	For Speed/Torque Control Only

This is dedicated torque control.

A motor torque reference value is externally input into the Servopack to control torque.

## Examples of Use: Tension control Pressure control

	-01 ting	Control Mode	ANN ANN
Bit B	Bit A		à
8.	hand	<ul> <li>Torque Control I</li> <li>This is a dedicated torque control mode.</li> <li>A torque reference is input from T-REF (1CN-9).</li> </ul>	Torque reference T-REF (1CN-9)
19. 1	0	<ul> <li>P-CON is not used.</li> <li>Speed reference input V-REF (1CN-5) cannot be used.</li> <li>User constant Cn-14 can be used for</li> </ul>	dautonatika.pl
(Q. 4)	in the second se	Oser constant Ch-14 can be used for maximum speed control. Example of Use: Tension control Tension Control Tension	an www.

3.2.7 Using Torque Control cont.			auton	auton	- auto
and and a start and a start	Cn-0 Settin	ng 💒	Control Mode	WWW.HD	-scaral.C
~	Bit B E	Bit A	Torque Control II	~	
automatykait	at Karr		Torque control and speed control can be switched.		vopack
and and a start of the start of		h.	• A speed reference or speed limit value is input from V-REF (1CN-5).	Speed reference V-REF Torque reference T-REF Switching (1CN-9)	N. N
automatika pi	er and	1	<ul> <li>T-REF (1CN-9) inputs a toque reference, torque feed-forward reference or torque limit value depending on the control mode used.</li> <li>P-CON (1CN-41) is used to switch</li> </ul>	between speed <u>P-CON</u> and (1CN-41) reference	
. Honabka.pl	a1340.0	and a	between torque control and speed control.         When 1CN-41 is open       Torque control         When 1CN-41 is at 0 V       Speed control         For Torque Control when P-CON is OFF:	ww.	Ser.
set www.idbac		Pris.	<ul> <li>T-REF reference controls torque.</li> <li>V-REF can be used to limit motor speed.</li> </ul>	www.boc	ANNON LOOC
automatyka.pl	1210H2.P		<ul> <li>V-REF voltage (+) limits motor speed during forward or reverse rotation.</li> <li>Principle of Speed Restriction:</li> </ul>	Motor speed	J
www.idbe	1	1	When the speed exceeds the speed limit, negative feedback of torque proportional to the difference between the current speed and the	Speed limit rar V-REF	ige manufor
automatyka.	Cale No.		limit speed is performed to return the speed to within the normal speed range. Therefore, the actual motor speed limit value has a certain range depending on the load conditions.	, tobaltonat/ka.	.158 <sup>015</sup>

www.gauonabka.pl

www.clautomatika.pl

Cn Sett				in the second second	Control Mode	N. N. N. N.	, 
Bit B	Bit A				-		
ġ.			et in bit	ol when P-CO F of user cons		bit F of Cn-02 determine the	)
			ser stant	Speed Reference	Torque Reference	all <sup>o</sup>	3
	S.C.	Cn-01	Cn-02	Input (V-REF)	Input (T-REF)	Remarks	9
	Sealer .	Bit F	Bit F	(1CN-5,-6)	(1-REF) (1CN-9,-10)	a share	
				Speed contro	l		
<u>ò</u>		0	0	Speed reference	Cannot be used	10 <sup>0</sup> 0	
1	1	Mornato		Speed contro feed-forward	I with torque	Any value can be set in bit F of Cn-02 (0 and 1 have the same effect).	30
	il. Andra	0° 1		Speed reference	Torque feed-forward	For details of speed control with torque feed-forward, refer to <i>3.2.8 Using Torque</i> <i>Feed-forward Function</i> .	S~
ò.		0.3	2.2	Speed contro limit by analo reference		For details of speed control with torque limit by analog voltage reference, refer to 3.2.9 Using Torque	
		JION'S		Speed reference	Torque limit value	Restriction by Analog Voltage Reference.	30
	de la companya de la comp	8.		S.	1	. S	50
0	0	Speed co	ontrol	(Standard se	tting)	1	
0	1	Zero-clar	np spee	ed control (Re	fer to 3.4.3.)	27	
6			6		6	6	
ç.		L.			Non	No.	
ne fol	lowing	input sigr	nals per	form torque of	control.	allan.	
		250		allo		all <sup>o</sup>	N.
				Se	rvopack		
				Se Se	гуораск	an' anti-	

3) The following input signals perform torque control. www.idhautor

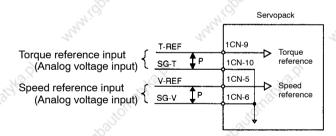
oka.p

010.0

www.dautor

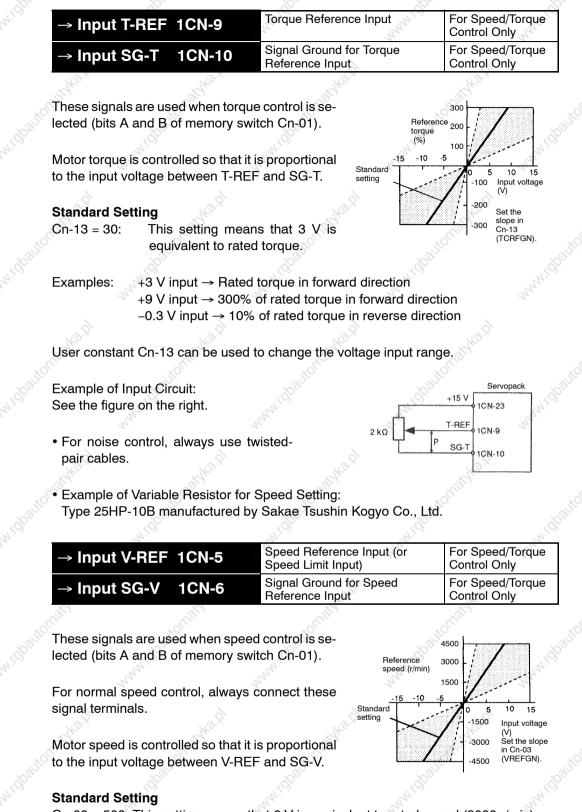
1×3.91

MMM. GBUILDY



\$P: Represents twisted-pair cables

3.2.7 Using Torque Control cont.



Cn-03 = 500: This setting means that 6 V is equivalent to rated speed (3000 r/min).

Examples:

+6 V input  $\rightarrow$  3000 r/min in forward direction +1 V input  $\rightarrow$  500 r/min in forward direction

-3 V input  $\rightarrow$  1500 r/min in reverse direction

3

2 kΩ

Servopack

1CN-23

1CN-5

1CN-6

+15 V

V-REF

SG-V

User constant Cn-03 can be used to change the voltage input range. (This is also applicable to speed restriction.)

Example of Input Circuit: See the figure on the right.

 For noise control, always use twistedpair cables.

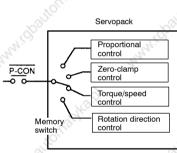
• Example of Variable Resistor for Speed Setting: Type 25HP-10B manufactured by Sakae Tsushin Kogyo Co., Ltd.

When input signal  $\overline{P}$ -CON is used to switch between speed reference and torque reference for torque control II, set both bits A and B of memory switch Cn-01 to 1.

$\rightarrow$ Input P-0	CON 1CN-41	Proportional Control, etc.	For Speed/Torque Control and Position Control
5°.	Card.	NO.	AN'

The function of this input signal varies according to the memory switch setting.

Cn-02 Bit 2	Cn-01 Bit B	Cn-01 Bit A	Function of P-CON
0	0	Qard	Proportional control (Standard setting)
0	NN OF	1	Speed control with zero-clamp function Switching between zero-clamp enabled/ prohibited mode
્રે૦	1	0	Torque control I (P-CON is not used.)
0	1	18	Torque control II
1		NUTON-	Changing the direction of rotation during contact input speed control.



The function of P-CON signal varies according to the memory switch setting.

3.2.7 Using Torque Control cont.

### Torque/Speed Changeover Control

This function is used to switch between torque control and speed control in torque control II mode.

ON: 1CN-41 is at	low level.	Speed control	- All
S OFF: 1CN-41 is a	t high level.	Torque control	KOL.

4) Set the following user constants for torque control according to the servo system used.

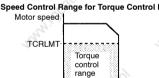
Cn-13 TCRFGN Torque Reference Gain	Unit: 0.1 V/Rated Torque	Setting Range: 10 to 100	Setting:	For Speed/Torque Control Only
------------------------------------------	--------------------------------	--------------------------------	----------	----------------------------------

Sets the voltage range of torque reference input T-REF (1CN-9) according to the output form of the host controller or external circuit.

The factory setting is 30, so the rated torque is  $3 V (30 \times 0.1)$ .

	TCRLMT Speed Limit for Torque		Setting Range: 0 to	,	For Speed/Torque
Cn-14	Control I	.,	0	Maximum Speed	

Sets a motor speed limit value in this constant when torque control I is selected.



Reference

voltage (V)

Set this reference voltage

Toraue

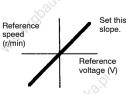
Reference torque Rated torque

This user constant is used to prevent machine overspeed during torque control.

For torque control I, set bits A and B of memory switch Cn-01.

	19	- C		14	P14
Cn-03	VREFGN Speed Reference	Unit: (r/min)/V	0	Setting:	For Speed/Torque Control Only
- 2-	Gain		10 to 🔍 🔿	500	~ ~ ~
No	No		2162		No

Sets the voltage range of speed reference input V-REF (1CN-3) according to the output form of the host controller or external circuit.



The factory setting is 500 [rated speed (3000 r/min)/6 V = 500].

## 3.2.8 Using Torque Feed-forward Function



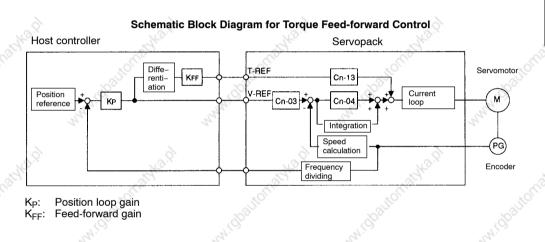
### For speed control only.

## 1) Outline

The torque feed-forward function reduces positioning time. It differentiates a speed reference at the host controller (prepared by the customer) to generate a torque feed-forward reference, then sends this torque feed-forward reference and the speed reference to the Servopack.

Too high a torque feed-forward value will result in overshoot or undershoot. To prevent this, set the optimum value while observing system response.

Connect a speed reference signal line and torque feed-forward reference signal line from the host controller to V-REF (1CN-5, 1CN-6) and T-REF (1CN-9, 1CN-10), respectively.



### 2) How to Use Torque Feed-forward Function

To use the torque feed-forward function, set the following memory switch to 1.

		<u></u>		
C	$:n_0 \to Bit \in \mathbb{A}$	Selection of Torque Feed-forward Function	Factory Setting: 0	For Speed Control Only
	19	104	14	64

Enables the torque feed-forward function.

To use the torque feed-forward function, input a speed reference to the V-REF terminal and a torque feed-forward reference to the T-REF terminal.

The host controller must generate a torque feed-forward reference from a speed reference.

Setting	Meaning	, all	
0	Does not use the torque feed-forward function.	all and a second	
1	Uses the torque feed-forward function.	. office	

3.2.9 Using Torque Restriction by Analog Voltage Reference

- This function cannot be used with the function for torque restriction by analog voltage reference, described in 3.2.9 Using Torque Restriction by Analog Voltage Reference.
- For user constants and control modes, refer to Appendix D List of User Constants.
- 3) Setting a Torque Feed-forward Value in User Constant Cn-13

The factory setting is Cn-13 = 30. If, for example, the torque feed-forward value is  $\pm 3 \text{ V}$ , torque is restricted to  $\pm 100\%$  (rated torque).

	8	0		6		8
	Nº.	TCRFGN	Unit: 0.1	Setting	Factory	For Speed/Torque
	Cn-13	Torque Reference	V/Rated	Range:	Setting:	Control Only
8		Gain	Torque	10 to 100	30	×0 <sup>6</sup>
-				14		. Nº

## 3.2.9 Using Torque Restriction by Analog Voltage Reference

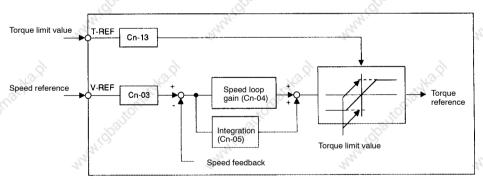


For speed control only.

1) Outline

This function restricts torque by assigning the T-REF terminal (1CN-9, 1CN-10) a torque limit value in terms of analog voltage. Since torque reference input terminal T-REF is used as an input terminal, this function cannot be used for torque control.

Schematic Block Diagram for Torque Restriction by Analog Voltage Reference



98

## 2) How to Use Torque Restriction by Analog Voltage Reference

To use this torque restriction function, set the following memory switch to 1.

$\sim$		the second se	£	1 Ex	
5	Cn-02 Bit F	Torque Restriction by Analog Voltage Reference	Factory Setting: 0	For Speed Control Only	3
	?				10

Enables this torque restriction function.

To use this function, input a speed reference to the V-REF terminal and a torque limit value to the T-REF terminal.

This function cannot be used for torque control.

Torque restriction cannot be set separately for forward and reverse rotation. (The same setting applies to both forward and reverse rotation.)

Setting	Meaning
0	Uses the T-REF terminal as a torque reference or torque feed-forward reference input terminal.
1	Uses the T-REF terminal as a torque limit value input terminal.

- This function cannot be used with the torque feed-forward function described in *3.2.8* Using Torque Feed-forward Function.
- For user constants and control modes, refer to Appendix D List of User Constants.

### 3) Setting a Torque Limit Value in User Constant Cn-13

The factory setting is Cn-13 = 30. If, for example, the torque limit value is 3 V, torque is restricted to 100% (rated torque).

Ī	Cn-13	TCRFGN Torque Reference Gain	Unit: 0.1 V/ Rated Torque	Setting Range: 10 to 100	Factory Setting: 30	For Speed/Torque Control Only
L		Gain	loique	10 10 100	30	de la companya

90

3.2.10 Using the Reference Pulse Inhibit Function (INHIBIT)

## 3.2.10 Using the Reference Pulse Inhibit Function (INHIBIT)

Positions

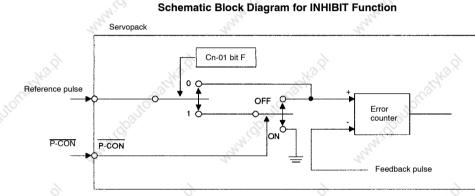
## For position control only.

## 1) Outline

This function inhibits a position control from counting input reference pulses.

While this function is being used, the motor remains in servo locked (clamped) status. The P-CON signal is used to enable or prohibit this function.

When this function is used, therefore, the  $\overline{P}$ -CON signal cannot be used to switch between proportion (P) control and proportional/integral (PI) control for speed loop. (PI control is always used.)



2) How to Use Reference Pulse Inhibit Function: INHIBIT

To use the INHIBIT function, set the following memory switch to 1:

<u> </u>	0	0	S.
Cn-01 Bit F	Reference Pulse Inhibit Function (INHIBIT)	Factory Setting: 0	For Position Control Only
	SC.	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	S.

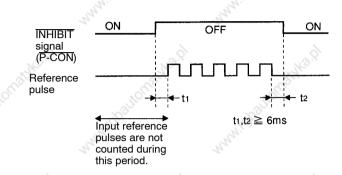
Enables the INHIBIT function.

Se	etting	8	Meaning
N. S.	0		se the INHIBIT function. pulses are always counted.
	S.		NHIBIT function. nal is used to enable or prohibit the INHIBIT function.
		P-CON	Meaning
	Sec.	OFF	Counts reference pulses.
140.P	1	ON	Prohibits the Servopack from counting reference pulses. The motor remains in servo locked (clamped) status.

• Always set bit 2 of memory switch Cn-02 to 0.

If bit 2 is set to 1, the contact input speed control function is selected, and the INHIBIT function cannot be used. (The P-CON signal is used for changing the motor rotation direction. For the contact input speed function, refer to *3.2.6 Using Contact Input Speed Control*.)

3) Relationship between INHIBIT Signal and Reference Pulse



## 3.2.11 Using the Reference Pulse Input Filter Selection Function



For position control only.

## 1) Outline

This function selects a reference pulse input filter inside the Servopack according to the output form of reference pulses from the host controller.

### 2) How to Use Reference Pulse Input Filter

Set the following memory switch according to the output form of reference pulses from the host controller:

0	N 62		02	021
Cn-02 Bit F	Reference Pulse Input Filter Selection Function	Factory Setting: 0	For Position Control Only	2
. 67	<i>B</i> .	Q	G	

Sets the memory switch according to the output form (line driver or open collector) of reference pulses from the host controller.

Setting	Meaning
0	Output form of reference pulses from host controller: Line driver output (maximum frequency of reference pulse: 450 kpps)
1	Output form of reference pulses from host controller: Open collector output (maximum frequency of reference pulse: 200 kpps)

For open collector output, the wire length must be as short as possible (maximum 3 m).

3

3.2.12 Using the Analog Monitor

## 3.2.12 Using the Analog Monitor

1) The following two analog voltage monitor signals are output.

		. 19	No.
Output $\rightarrow$ TRQ-M 10	CN-16	Torque monitor	For Speed/Torque Control
Output $\rightarrow$ VTG-M 10	CN-17	Speed monitor	Control

- TRQ-M : Torque monitor output ( $\pm$ 3V/ $\pm$ 100% torque) VTG-M : Speed monitor output ( $\pm$ 3V/ $\pm$ 1000 r/min)
- As for the check terminals of the front panel: TMON is the same signal as TRQ-M VTG is the same signal as VTG-M

Signal ground for TMON and VTG is SG0V of check terminals.

The following memory switch is used to modify the signal specifications.

-				
Cn-02	Bit 6	TRQ-M Specifications	Factory Setting: 0	For Speed/Torque Control
	-1-4	- [7]	1.	4

	Setting	Meaning	13.S.
	5° 0	Uses TRQ-M as the torque reference monitor output.	200
ŝ	1	Uses TRQ-M as the speed reference monitor output.	205

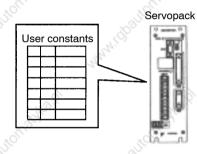
# **3.3** Setting Up the $\Sigma$ Servopack

This section describes how to set user constants to operate the DR2 Servopack.

3.3.1	Setting User Constants	103
3.3.2	Setting the Jog Speed	104
3.3.3	Setting the Number of Encoder Pulses	105
3.3.4	Setting the Motor Type	106

## 3.3.1 Setting User Constants

1)  $\Sigma$ -series Servopacks provide many functions, and have parameters called "user constants" to allow the user to specify each function and perform fine adjustment.



Digital Operator is used to set user constants.

2) User constants are divided into the following two types.

18	S	10 <sup>-2</sup>
് 1)	Memory switch Cn-01, Cn-02	Each bit of this switch is turned ON or OFF to specify a function.
2)	User constant setting Cn-03 and later	A numerical value such as a torque limit value or speed loop gain is set in this constant.
	S	St. St. St.

• For Speed/Torque Control:

User Constant	2020 JUNO	Name and Code		Remarks	
Cn-01	Memory swite	ch and	. a).	Each bit number has a	
Cn-02	Memory switch			switch (ON/OFF).	
Cn-03	VREFGN	Speed reference gain	)		
Cn		·····		Lines and the setting	
Cn				User constant setting	
Cn-2A	PULSNO2	Number of external PG pulses	J	offic	

103

3.3.2 Setting the Jog Speed

• For Position Control:

User Constant		Name and Code	Remarks	
Cn-01	Memory swit	ch d	Each bit number has a	
Cn-02	Memory swite	ch 🥵	switch (ON/OFF).	
Cn-04	LOOPHZ	Speed loop gain	1.500	
Cn	A.C.	141.0		
Cn 📣	h		User constant setting	
Cn-2A	PULSNO2	Number of external PG pulses	Į	

3) For a list of user constants, refer to Appendix D List of User Constants.

Some user constants for speed/torque control and position control have different meanings. Refer to a list of user constants for each type.

4) For details of how to set user constants, refer to 4.1.5 Operation in User Constant Setting Mode

## 3.3.2 Setting the Jog Speed

1) Use the following user constant to set or modify a motor speed when operating the  $\Sigma$ -series Servo from a Digital Operator:

Cn-10	JOGSPD Jog Speed	1	Setting Range: 0 to Maximum Speed	Factory Setting: 500	For Speed/Torque Control and Position Control
					0

This constant is used to set a motor speed when the motor is operated using a Digital Operator. **Operation Using Digital Operator** 



## 3.3.3 Setting the Number of Encoder Pulses

 To ensure that the Σ-series Servo System operates properly, set the type of the encoder to be used and the number of encoder pulses per revolution in the following user constants:

		7. T.		S <sup>e</sup>
Cn-02	Bit 9	Encoder Type Selection	Factory Setting: 0	For Speed/Torque Control and Position Control
-	62	6	14	N.

Set the encoder type according to the servomotor type to be used.

After changing the memory switch setting, turn the power OFF, then ON.

Motor Type	Encoder Type	Preset Value
SGM-0310 SGMP-0310	Incremental encoder	0
SGMW1_ SGMPW1_	Absolute encoder	2 1

		100		000	
	PULSNO	Unit: Pulses	Setting	Factory	For Speed/Torque
	Number of	Per Revolution	Range:	Setting:	Control and
Cn-11	Encoder Pulses	22	Number of	2048	Position Control
			Encoder		
6	6		Pulses		6
.0.2	2.0.2		.0.2		.0.2

Set the number of encoder pulses according to the servomotor type to be used. If this user constant is set incorrectly, system operation cannot be guaranteed.

### After changing the user constant setting, turn the power OFF, then ON.

Motor Type	Number of Encoder Pulses Per Revolution	Preset Value
SGM-00310 SGMP-00310	Incremental encoder: 2048 pulses per revolution	2048
SGM-OOW1O SGMP-OOW1O	Absolute encoder: 1024 pulses per revolution	1024

3

3.3.4 Setting the Motor Type

## 3.3.4 Setting the Motor Type

1) To ensure that the  $\Sigma$ -series Servo System operates properly, set the type of the servomotor to be used in the following user constant.

and the	ander	allho	Ables	and
Cn-02 Bit 8	Motor Selection	Factory Setting: DR2-000000000000000000000000000000000000	For Speed/Torque Control and Position Control	auton

Set this memory switch according to the servomotor type to be used (SGM or SGMP). After changing the memory switch setting, turn the power OFF, then ON. This makes the new setting valid.

300	Motor Type	Preset Value
March 1921	SGM-	0
20	SGMP-	1
	astra.el	ather, ather,
www.dbaut	Matthe Manuel Balton	able.pl
14		

# 3.4 Setting Stop Mode

This section describes how to stop the motor properly.

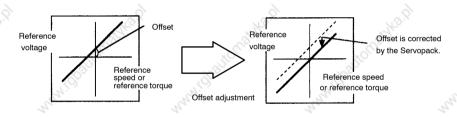
3.4.1	Adjusting Offset	107
3.4.2	Using Dynamic Brake	108
3.4.3	Using Zero-Clamp	109
3.4.4	Using Holding Brake	110

## 3.4.1 Adjusting Offset

1) "Why does not the motor stop?"

When 0 V is specified as reference voltage for Servopack for speed/torque control, the motor may rotate at a very slow speed and fail to stop. This happens when reference voltage from the host controller or external circuit has a slight reference offset (in mV units). If this offset is adjusted to 0 V, the motor will stop.

When reference voltage from the host controller or external circuit has an offset



2) The following two methods can be used to adjust the reference offset to 0 V.

1)	Automatic adjustment of reference offset	Reference offset is automatically adjusted to 0 V.
2)	Manual adjustment of reference offset	Reference offset can be intentionally set to a specified value.

**NOTE** If a position control loop is formed in the host controller, do not use automatic adjustment in 1. Always use manual adjustment in 2.

3.4.2 Using Dynamic Brake

3) For detailed adjustment procedures, refer to the following sections.

St.	1 <sup>2</sup> 1 <sup>2</sup>
	Adjustment Method
1) Automatic adjustment of reference offset	4.2.4 Reference Offset Automatic Adjustment
2) Manual adjustment of reference offset	4.2.5 Speed Reference Offset Manual AdjustmentMode
105	<u>6</u>

## 3.4.2 Using Dynamic Brake

1) To stop the servomotor by applying **dynamic brake (DB)**, set desired values in the following memory switch. If dynamic brake is not used, the servomotor will stop naturally due to machine friction.

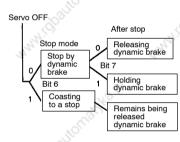
	· · · · · · · · · · · · · · · · · · ·	62
Cn-01Bit 6	How to Stop Motor When Servo is Turned OFF	For Speed/Torque Control and Position Control
Cn-01Bit 7	Operation to Be Performed When Motor Stops After Servo is Turned OFF	For Speed/Torque Control and Position Control

The Servopack enters servo OFF status when:

- Servo ON input signal (S-ON, 1CN-40) is turned OFF
- Servo alarm arises

Main power is turned OFF

Specify how to stop the motor when one of the above events occurs during operation.



	Setting	Meaning
E.	0	Stops the motor by dynamic brake.
Cn-01 bit 6	1	Causes the motor to coast to a stop. The motor power is OFF and stops due to machine friction.

If dynamic brake stop mode is selected, specify the operation to be performed when the motor stops.

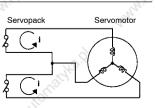
2	Setting	Meaning	3424
Cn-01 bit 7	0	Releases dynamic brake after the motor stops.	
	1	Does not release dynamic brake even after the motor stop	).
510		1.0 1.0	



## Dynamic brake (DB)

One of the general methods to cause a motor sudden stop. "Dynamic brake" suddenly stops a servomotor by shorting its electrical circuit.

This dynamic brake circuit is incorporated in the Servopack.



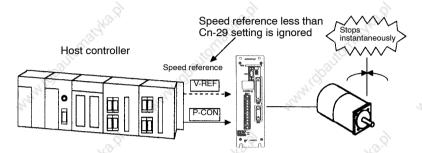
3

# 3.4.3 Using Zero-Clamp

$\sim$	
Speed/Torque	

1) The zero-clamp function is used for a system in which the host controller does not form a position loop by speed reference input.

In other words, this function is used to cause the motor to stop and enter a servo locked status when the input voltage of speed reference V-REF is not 0 V. When the zero-clamp function is turned ON, an internal position loop is temporarily formed, causing the motor to be clamped within one pulse. Even if the motor is forcibly rotated by external force, it returns to the zero-clamp position.



2) Set the following memory switch so that input signal P-CON can be used to enable or disable the zero-clamp function.

10	10	24	10
Cn-01Bit A	Control Mode Selection	Factory Setting:0	For Speed/Torque Control Only
Cn-01Bit B	Control Mode Selection	Factory Setting:0	For Speed/Torque Control Only
	- C	20-1	-10°''

→ Input P-CON 1CN-41 Proportional Control, etc. For Speed/Torque Control and Position Control

Cn Set	-01 ting	-1K2.91	Control Mode
Bit B	Bit A	C.C.	Adr Adr
0	1	Zero-clamp Speed ControlThis speed control allowszero-clamp function to bethe motor stops.A speed reference is inpV-REF (1CN-5).P-CON (1CN-41) is usezero-clamp function ONP-CON (1CN-41) is usezero-clamp function ONP-CON (1CN-41) is usezero-clamp function ONP-CON (1CN-41) is usezero-clamp function ON(1CN-41) is usezero-clamp function ONON (1CN-41) is usezero-clamp function ON(1CN-41) is usezero-clamp function ON(1CN-41) is usezero-clamp function ONON (1CN-41) is usezero-clamp function ON	the Speed refe <u>rence V-REF (1CN-5)</u> ut from Zero-clamp P-CON (1CN-41) d to turn the or OFF. Zero-clamp is performed when the
19. 3	in and a second s	P-CON (1CN-41) is closed (ON)         Turns zero-( function)           • Torque reference input (1CN-9) cannot be used	Aamp n ON -REF

3.4.4 Using Holding Brake

 Set in the following user constant the motor speed level at which zero-clamp is to be performed:

Cn-29	ZCLVL Zero-Clamp Level	Setting Range: 0 to Maximum Speed	Factory Setting: 10	For Speed Control Only
	8.57	10 J		

If zero-clamp speed control is selected, set the motor speed level at which zero-clamp is to be performed.

### **Conditions for Zero-clamp**

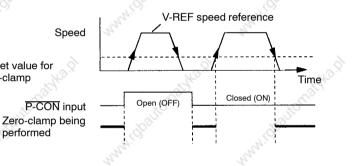
Zero-clamp is performed when all the following conditions are met:

- a) Zero-clamp speed control is selected. (Bits A and B of memory switch Cn-01 are set to 1 and 0, respectively.)
- b) P-CON (1CN-41) is turned ON (0 V).

Preset value for zero-clamp

performed

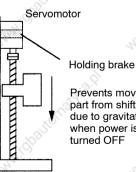
Motor speed drops below the preset value. c)



#### Using Holding Brake 3.4.4

### 1) Outline

Holding brake is useful when a servo drive is used to control a vertical axis. A servomotor with brake prevents the movable part from dropping due to gravitation when the system power is turned OFF.

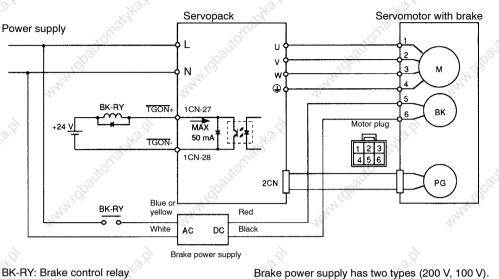


Prevents movable part from shifting due to gravitation when power is

NOTE The built-in brake in Servomotor with brake is a de-energization operation type, which is used for holding purposes only and cannot be used for braking purposes. Use the holding brake only to retain a stopped motor. Brake torque is more than 100% of the rated motor torque.

3

2) Use Servopack contact output-signal TGON+, TGON- and brake power supply to form a brake ON/OFF circuit.



An example of standard wiring is shown below.

Brake power supply has two types (200 V, 100 V).

Set the following memory switch to select the brake interlock output.

Cn-01 Bit E	Selection of TGON+, TGON- Signals	For Speed/Torque Control and Position Control

Set bit E of Cn-01 to 1 to select the brake interlock output.

Setting	Meaning	200
0	Uses the TGON+, TGON- signals as the running output.	240
1 ,	Uses the TGON+, TGON- signals as the brake interlock output.	Ser Contraction

Output → TGON+ 1CN-27	For Speed/Torque Control and
Output → TGON- 1CN-28	 Position Control

This output signal controls the brake when a motor with brake is used. This signal terminal need not be connected when a motor without brake is used.

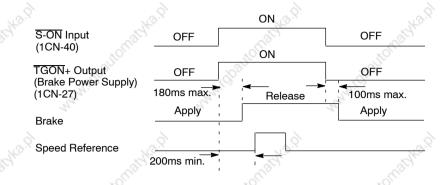
### **Related User Constants**

Cn-12	Time delay from brake signal until servo OFF
Cn-15	Speed level for brake signal output during operation
Cn-16	Output timing of brake signal during motor operation
ON Stat	us: etween 1CN-27 and 1CN-28 is closed Beleases the brake

Circuit between 1CN-27 and 1CN-28 is closed. 1CN-27 is at low level.	1	Releases the brake.
<b>OFF Status:</b> Circuit between 1CN-27 and 1CN-28 is open. 1CN-27 is at high level.		Applies the brake.

3.4.4 Using Holding Brake cont.

 Between the brake is released and applied by brake power (TGON+) ON/OFF, time delay occurs as follows:



Min. 200ms is required between brake power ON (TGON+) and speed reference input. As for the brake holding timing at servo OFF, refer to 4) and 5) shown below.

4) If the machine moves slightly due to gravity when the brake is applied, set the following user constant to adjust brake ON (brake holding) timing:

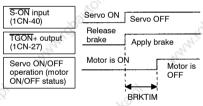
	20	26. Y	×		20	
_	24 <sup>1</sup> 0	Time delay from the time a brake signal is	Unit: 10 ms	Setting Range:	Factory Setting:	For Speed/Torque
Cn-12	BRKTIM	output until servo OFF	10 110	0 to 50	0	Control and
		status occurs				Position Control

This user constant is used to set output timing of brake control signals TGON+ (1CN-27), TGON- (1CN-28) and servo OFF operation (motor output stop) when SGM/SGMP Servomotor with brake is used.

This user constant is not available for alarm oc-

currence and main power OFF.

#### Brake Timing when Motor is in Stopped Status



With the standard setting, the servo is turned OFF when TGON+ signal (brake operation) is output. The machine may move slightly due to gravitation. This movement depends on machine configuration and brake characteristics. If this happens, use this user constant to delay servo OFF timing to prevent the machine from moving.

Set in this constant the brake ON timing used when the motor is in stopped status.

For brake ON timing during motor operation, use Cn-15 and Cn-16.

5) Set the following user constants to adjust brake ON timing so that holding brake is applied when the motor stops.

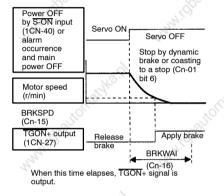
24	Cn-15	BRKSPD	Speed Level at which Brake Signal Is Output during Motor Operation	Unit: r/min	Setting Range: 0 to Maximum Speed	Factory Setting: 100	For Speed/Torque Control and Position Control
	Cn-16	BRKWAI	Output Timing of Brake Signal during Motor Operation	Unit: 10 ms	Setting Range: 10 to 100	Factory Setting: 50	For Speed/Torque Control and Position Control

Cn-15 and Cn-16 are used for SGM/SGMP Servomotors with brake. Use these user constants to set brake timing used when the servo is turned OFF by input signal  $\overline{S}$ -ON (1CN-40) or alarm occurrence during motor rotation.

Since brakes for SGM/SGMP Servomotors are designed as holding brakes, if brake is applied at motor running, brake generates excessive friction. Therefore, brake ON timing when the motor stops must be appropriate. Adjust the user constant settings while observing machine operation.

• Conditions for TGON+ signal (1CN-27) output during motor operation. The circuit between 1CN-27 and 1CN-28 is opened in either of the following situations.

#### Brake Timing when Motor is in Stopped Status



3

113

Motor speed drops below the value set in Cn-15 (BRKSPD) after servo OFF occurs.
 The time set in Cn-16 (BRKWAI) has elapsed since servo OFF occurred.

3.5.1 Using the Soft Start Function

# 3.5 Running the Motor Smoothly

This section explains how to run the servomotor smoothly.

3.5.1	Using the Soft Start Function	114
3.5.2	Using the Smoothing Function	115
3.5.3	Adjusting Gain	115
3.5.4	Adjusting Offset	116
3.5.5	Setting the Torque Reference Filter Time Constant	116

## 3.5.1 Using the Soft Start Function

1) The soft start function adjusts progressive speed reference input inside the Servopack so that acceleration and deceleration can be as constant as possible. To use this function, set the following user constants.

Speed/Torque

3

	5 S			2	24
Cn-07	SFSACC Soft Start Time (Acceleration)	Unit: ms	Setting Range: 0 to 10000	Factory Setting: 0	For Speed/Torque Control Only
Cn-23	SFSDEC Soft Start Time (Deceleration)	Unit: ms	Setting Range: 0 to 10000	Factory Setting: 0	For Speed/Torque Control Only

Speed reference

Servopack internal speed reference Soft start

4500r/min

Cn-07: Set this time interval.

Cn-23: Set this time interval

4500r/min ;`

In the Servopack, a speed reference is multiplied by the acceleration or deceleration value set in Cn-07 or Cn-23 to provide speed control.

Smooth speed control can be achieved when progressive speed references are input or when contact input speed control is used.

Set these user constants as follows.

- Cn-07: Time interval from the time the motor starts until the maximum speed (4500 r/min) is reached
- Cn-23: Time interval from the time the motor is running at the maximum speed (4500 r/min) until it stops



## 3.5.2 Using the Smoothing Function



1) The smoothing function adjusts constant-frequency reference input inside the Servopack so that acceleration and deceleration can be as constant as possible. To use this function, set the following user constant.

Cn-26	ACCTME	Position Reference Acceleration/Deceleration	Unit: 0.1 ms	14. 0	Factory Setting:	For Position
011-20		Time Constant (Smoothing)	3	0 to 640	0	Control Only

This user constant is used for position control only.

This function performs acceleration/deceleration processing for input reference pulses (primary lag characteristics).

This function prevents the motor from running at progressive speeds in the following cases:

Pulse Hz Reference pulse frequency Hz Cn-26 (ACCTME) Reference pulse frequency Hz Cn-26 (ACCTME) Frequency Hz Cn-26 (ACCTME) Frequency Hz Cn-26 (ACCTME) Frequency Hz Cn-26 (ACCTME) Frequency Hz Frequency Hz Cn-26 (ACCTME) Frequency Hz Frequency Frequenc

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Servopac

Reference

- When the host controller which outputs references cannot perform acceleration/deceleration processing
- When reference pulse frequency is too low
- When reference electronic gear ratio is too high (more than 10 times)

This function does not change the travel distance (number of pulses).

## 3.5.3 Adjusting Gain

 If speed loop gain or position loop gain exceeds the allowable limit for the servo system including the machine to be controlled, the system will vibrate or become too susceptible. Under such conditions, smooth operation cannot be expected. Reduce each loop gain value to an appropriate value.

2) For servo gain adjustment, refer to the following section:

3.6.2 Setting Servo Gain

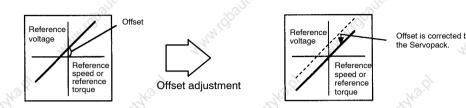
3.5.5 Setting the Torque Reference Filter Time Constant

## 3.5.4 Adjusting Offset



 If reference voltage from the host controller or external circuit has an offset in the vicinity of 0 V, smooth operation cannot be expected. Adjust the reference offset to 0 V.

When Reference Voltage from Host Controller or External Circuit has an Offset



2) The following two methods are available to adjust the reference offset to 0 V.

<ol> <li>Automatic adjustment of reference offset</li> </ol>	Reference offset is automatically adjusted.
<ol> <li>Manual adjustment of reference offset</li> </ol>	Reference offset can be intentionally set to a specified value.

**NOTE** If a position control loop is formed in the host controller, do not use automatic adjustment in 1). Always use manual adjustment in 2).

3) For detailed adjustment procedures, refer to the following sections:

S.	A BUT	Adjustment Method
1)	Automatic adjustment of reference offset	4.2.4 Reference Offset Automatic Adjustment
2)	Manual adjustment of reference offset	4.2.5 Speed Reference Offset Manual AdjustmentMode

## 3.5.5 Setting the Torque Reference Filter Time Constant

 If the machine causes vibration, possibly resulting from the servo drive, adjust the following filter time constant. Vibration may stop.

Cn-17	TRQFIL Torque Reference Filter Time Constant	Unit: 100 μs		,	For Speed/Torque Control and Position Control
-------	-------------------------------------------------	-----------------	--	---	-----------------------------------------------------

Cn-17 is a torque reference filter time constant for the DR2 Servopack. The smaller the value, the higher the torque control response. There is, however, a certain limit depending on machine conditions.

With the standard setting, the machine may cause vibration resulting from the servo drive. In this case, increase the constant setting. Vibration may stop. Vibration can be caused by incorrect gain adjustment, machine problems and so on.

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	2010	and the		autor
Set the	following m	emory switch to select	the torque refe	erence filter degree.
Cn-02	Bit C To	rque Reference Filter	Factory Setting: 0	For Speed/Torque Contro and Position Control
	. St	Rated to a construction of the second	matth	. onabl
Setting	2020	100 M	Meaning	
0	Primary filt	er 🔊		4 <sup>1</sup> .0
1	Secondary	r filter	33	and a star
42.91	N.ISBRUCC	Radika.pl	matkapl	withbaltomatikapi

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www.gautonatika.pl

3.6.2 Setting Servo Gain

# 3.6 Minimizing Positioning Time

This section describes how to minimize positioning time.

3.6.1	Using Autotuning Function	118
3.6.2	Setting Servo Gain	118
3.6.3	Using Feed-forward Control	120
3.6.4	Using Proportional Control	120
3.6.5	Setting Speed Bias	121
3.6.6	Using Mode Switch	122

## 3.6.1 Using Autotuning Function

- If speed loop gain and position loop gain for the servo system are not set properly, positioning may become slow. Techniques and experience are required to set these servo gain values according to machine configuration and machine rigidity.
- 2) Σ-series Servopacks have an autotuning function that automatically measures machine characteristics and sets the necessary servo gain values. With this function, even firsttime servo users can easily perform tuning for servo gain. Servo gain values are set in user constants.
- 3) The following user constants can be automatically set by the autotuning function.

User Constant	Meaning	Ser.
Cn-04	Speed loop gain	19
Cn-05	Speed loop integration time constant	8
Cn-1A	Position loop gain	N.

4) For details of how to perform autotuning, refer to 4.2.3 Autotuning

## 3.6.2 Setting Servo Gain

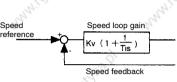
1) Check and reset the servo gain when:

- a) Automatically set servo gain values need to be checked after autotuning.
- b) Each servo gain value checked in a) is to be directly set for another Servopack.
- c) Response performance needs to be further enhanced after autotuning, or servo gain values need to be reset for a system with lower response performance.

2) Set the following user constants related to speed loop as necessary.

1	Cn-04	LOOPHZ Speed Loop Gain (Kv)	Unit: Hz	Setting Range: 1 to 2000	Factory Setting: 80	For Speed/Torque Control and Position Control
2	Cn-05	PITIME Speed Loop Integration Time Constant (Ti)	Unit: 0.01 ms	Setting Range: 2 to 10000	Factory Setting: 2000	For Speed/Torque Control and Position Control

Cn-04 and Cn-05 are a speed loop gain and an integration time constant for the Servopack, respectively.



The higher the speed loop gain value or the smaller the speed loop integration time constant value, the higher the speed control response. There is, however, a certain limit depending on machine characteristics.

These user constants are automatically set by the autotuning function.

The unit of speed loop integration time constant Cn-05 (Ti) can be changed to 0.01 ms.

3) Set the following user constants related to position loop as necessary.

5	4°			22	24
1	POSGN		Setting	Factory	For Position Control
Çn-1A	Position Loop Gain (Kp)	1/s	Range: 1	Setting:	Only
22	2		to 500 🔍	40	200
			1		

This user constant is a position loop gain for the Servopack.

Position loop gain reference Kp Position feedback

Increasing the position loop gain value provides position control with higher response and less error. However, there is a certain limit depending on machine characteristics.

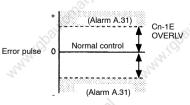
This user constant is automatically set by the autotuning function.



Cn-1E Overflow References Ra	5	For Position Control Only
------------------------------	---	------------------------------

This user constant is for position control only.

Set in this user constant the error pulse level at which a position error pulse overflow alarm (alarm A.31) is detected.



If the machine permits only a small position loop gain value to be set in Cn-1A, an overflow alarm may arise during high-speed operation. In this case, increase the value set in this user constant to suppress alarm detection. 3

3.6.4 Using Proportional Control

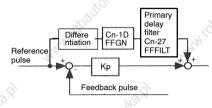
## 3.6.3 Using Feed-forward Control

<u>S</u>LL Positions

Feed-forward control shortens positioning time. To use **feed-forward control**, set the following user constant.

12h."	(25° 1		0.57		(3) <sup>2</sup>
Cn-1D	FFGN Feed-forward Gain	Unit: %	Setting Range: 0 to 100	Factory Setting: 0	For Position Control Only
Cn-27	FFFILT Feed-forward Reference Filter	Unit: 100 μs	Setting Range: 0 to 640	Factory Setting: 0	For Position Control Only

This user constant is for position control only.



This user constant is set to apply feed-forward frequency compensation to position control inside the Servopack.

Use this user constant to shorten positioning time. Too high a value may cause the machine to vibrate. For ordinary machines, set 80% or less in this constant.

## 3.6.4 Using Proportional Control



- If both bits A and B of memory switch Cn-01 are set to 0 as shown below, input signal <u>P-CON</u> serves as a PI/P control changeover switch for speed control loop.
  - PI Control: Proportional/Integral control
  - P Control: Proportional control

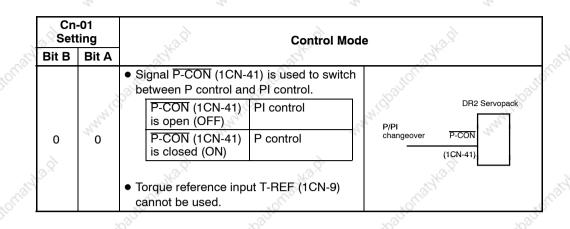
Cn-01 Bit A	Control Mode Selection	Factory Setting: 0	For Speed/Torque Control and Position Control
Cn-01Bit B	Control Mode Selection	Factory Setting: 0	For Speed/Torque Control and Position Control



## Feed-forward control

Control for making necessary corrections beforehand to prevent the control system from receiving the effects of disturbance.

Using feed-forward control increases effective servo gain, enhancing response performance. For speed/torque control only.



- 2) Proportional control can be used in the following two ways.
  - a) The host controller can selectively use P control mode for particular conditions only. This method can prevent the occurrence of overshoot and also shorten settling time. For particular conditions, refer to *3.6.6 Using Mode Switch*.
  - b) In the speed control mode, if PI control mode is used when the speed reference has a reference offset, the motor may rotate at a very slow speed and fail to stop even if 0 is specified as a speed reference. In this case, use P control mode to stop the motor.

## 3.6.5 Setting Speed Bias



The settling time for positioning can be reduced by assigning bias to the speed reference output part in the Servopack. To assign bias, use the following constant.

	22				- All All All All All All All All All Al	
22	Cn-1C	BIASLV Bias		Factory Setting: 0	For Position Control Only	Š
						-

Internal speed reference

> Cn-1C BIASLV

This user constant is for position control only.

This user constant is set to assign an offset to a speed reference in the DR2 Servopack.

Use this constant to shorten settling time.

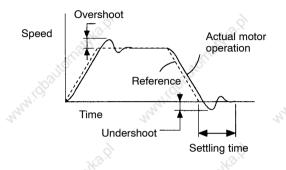
Set this user constant according to machine conditions.

Error pulse

3.6.6 Using Mode Switch

## 3.6.6 Using Mode Switch

- 1) Use the mode switch for the following purposes:
  - a) To prevent overshoot during acceleration or deceleration (for speed control).
  - b) To prevent undershoot during positioning in order to reduce settling time (for position control).



- In other words, the mode switch is a function that automatically switches the speed control mode inside the Servopack from PI control to P control while certain conditions are being established.
- **NOTE** The mode switch is used to fully utilize performance of a servo drive to achieve very highspeed positioning. The speed response waveform must be observed to adjust the mode switch.

For normal use, the speed loop gain and position loop gain set by autotuning provide sufficient speed/position control.

Even if overshoot or undershoot occurs, they can be suppressed by setting the acceleration/deceleration time constant for the host controller, the soft start time constants (Cn-07, Cn-23), or position reference accel/decel time constant (Cn-26) for the Servopack.



### From PI control to P control

PI control means proportional/integral control and P control means proportional control. In short, switching "from PI control to P control" reduces effective servo gain, making the servo system more stable.

3

3) Servopacks can use four types of mode switches (1 to 4). To select a mode switch, use the following memory switch. Note that the mode switch setting methods for speed/ torque control and position control are slightly different.

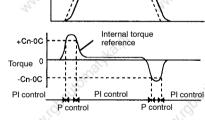
	2		_		S.	and a start	-	Q.
14	For Speed/ Torque Control Memory Switch Cn-01			Positi ontro		utonatite	Monatyle	
			witch			Mode Switch Setting	User Constant	Unit O
	Bit D	Bit C	Bit D	Bit C	Bit B	6		6
12	1	1	-	A.C.	1	Does not use mode switch.	and the	
	0	0	50 <sup>-10</sup>	0	0	Uses torque reference as a detection point. (Standard setting)	Cn-0C	Percentage of rated torque: %
	0	P.	0	1	0	Uses speed reference as a detection point.	Cn-0D	Motor speed: r/min
Sent.	0.1	0	1	CON	0 0	Uses acceleration refer- ence as a detection point.	Cn-0E	Acceleration reference in- side the Servo- pack: 10 (r/min)/s
			് 1	1	0	Uses error pulse as a detection point.	Cn-0F	Reference unit

# When Torque Reference Is Used as a Detection Point of Mode Switch

If a torque reference exceeds the torque value set in user constant Cn-0C, the speed loop switches to P control.

The DR2 Servopack is factory set to this standard mode (Cn-0C = 200).

### Example of Use:



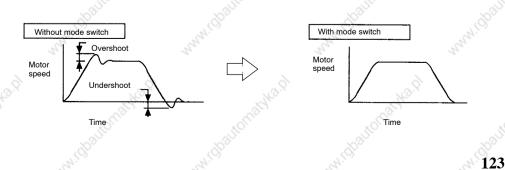
Reference

speed

Speed

If a mode switch is not used and PI control is always performed, torque may enter a saturation state during acceleration or deceleration, causing the motor speed to have overshoot or undershoot.

Using the mode switch suppresses torque saturation and prevents the motor speed from having overshoot and undershoot.



3

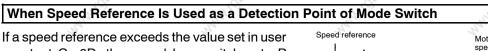
(Standard

Motor

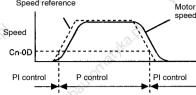
speed

Setting)

3.6.6 Using Mode Switch cont.



constant Cn-0D, the speed loop switches to P control.



Reference

P control

+Cn-0E

Acceleration 0 reference -Cn-0E - -PI control Motor

PI control

acceleration

Motor speed

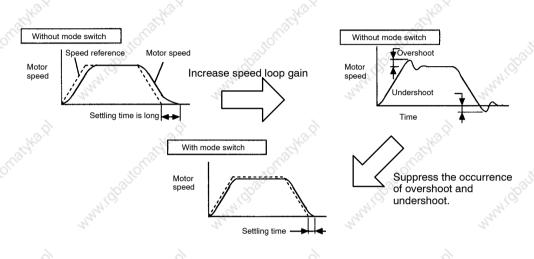
PI control

P control

Example of Use:

The mode switch is used to reduce settling time.

Generally, speed loop gain must be increased to reduce settling time. Using the mode switch suppresses the occurrence of overshoot and undershoot when speed loop gain is increased.



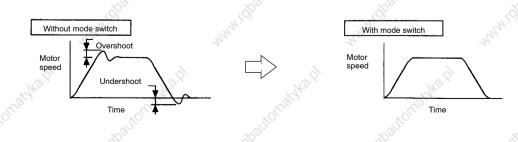
# When Acceleration Is Used as a Detection Point of Mode Switch

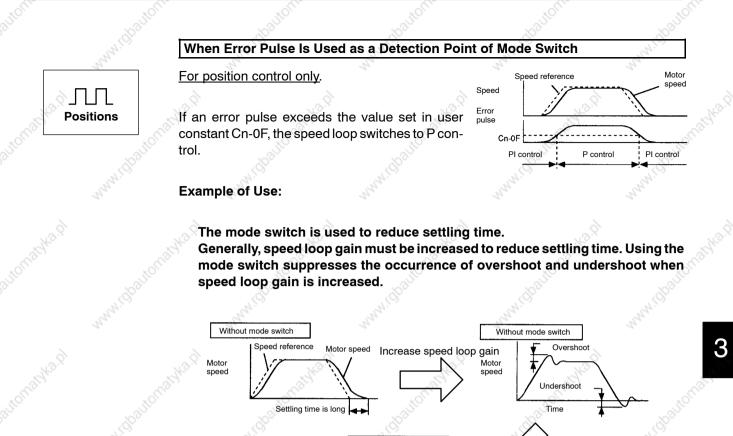
If motor acceleration exceeds the value set in user constant Cn-0E, the speed loop switches to P control.

Example of Use:

If a mode switch is not used and PI control is always performed, torque may enter a saturation state during acceleration or deceleration, causing the motor speed to have overshoot or undershoot.

Using the mode switch suppresses torque saturation and prevents the motor speed from having overshoot and undershoot.





4) The user constants required to set each mode switch are summarized as follows.

With mode switch

Motor speed

Cn-01Bit B	Mode Switch ON/OFF	Factory Setting: 0	For Position Control Only	
	10	10	NOT.	3

Settling time

\_\_\_\_ Positions

This user constant is used to enable or disable the mode switch function.

For position control only.

Setting	Meaning
0	Uses the mode switch function
1	Does not use the mode switch function

Speed Reference Actual motor operation

Suppress the occurrence of overshoot and undershoot.

Mode switch is used to reduce settling time and suppress undershoot when the motor stops. It switches PI control to P control when certain conditions are met.

The Servopack allows use of four different types of mode switch. To select a mode switch, set bits C and D of memory switch Cn-01.

For speed/torque control, bits C and D are used to enable or disable the mode switch function.

3.6.6 Using Mode Switch cont.

1		aballon aballo		abauton
ſ	Cn-01 Bit C	Mode Switch Selection	Factory Setting: 0	For Speed/Torque Control and Position Control
	Cn-01 Bit D	Mode Switch Selection	Factory Setting: 0	For Speed/Torque Control and Position Control

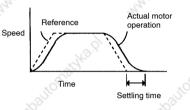
Sw	nory itch 🚽 i-01	d.	Mode Switch Type	User Constant for Setting Detection		
Bit D	Bit C		2.2	<b>Point</b>		
0	0	Uses torque	reference as a detection point.	Cn-0C		
0	1	Uses speed	S Cn-0D			
1	0	Uses acceler	Uses acceleration reference as a detection point.			
1	1	For speed/ torque con- trol	Does not use mode switch.			
Nºº.		For position control	Uses error pulse as a detection point.	Cn-0F		

autor Mode switch is used to reduce settling time and suppress undershoot when the motor 1224 stops. It switches PI control to P control when certain conditions are met.

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	Cn-0C	TRQMSW	Mode Switch (Torque Reference)	Unit: %	Setting Range: 0 to 800	Factory Setting: 200	For Speed/Torque Control and Position Control
2	Cn-0D	REFMSW	Mode Switch (Speed Reference)	Unit: r/min	Setting Range: 0 to 4500	Factory Setting: 0	For Speed/Torque Control and Position Control
	Cn-0E	ACCMSW	Mode Switch (Acceleration Reference)	Unit: 10 (r/min)/s	Setting Range: 0 to 3000	Factory Setting: 0	For Speed/Torque Control and Position Control
2	Cn-0F	ERPMSW	Mode Switch (Error Pulse)	Unit: Refer- ence Unit	Setting Range: 0 to 10000	Factory Setting: 0	For Position Control Only

Mode switch is used to reduce settling time and suppress undershoot when the motor stops. It switches PI control to P control when certain conditions are met.



The Servopack allows use of four different types of mode switch. To select a mode switch, set bits B, C and D of memory switch Cn-01.

Mem	emory Switch Cn-01		Memory Switch Cn-01 Setting		User Constant	Unit	Å
Bit D	Bit C	Bit B	Setting	allan .	all	Ì	
-	-	309 Jul	Does not use mode switch.		S and San		
0	0	0	Uses torque refer- ence as a detec- tion point.	Cn-0C	Percentage of rated torque: %		
0	1	0	Uses speed refer- ence as a detec- tion point.	Cn-0D	Motor speed: r/min	Card a	
1	0	800 m	Uses acceleration reference as a detection point.	Cn-0E	Acceleration reference in- side the DR2 Servopack: 10 (r/min)/s		
1	1	0	Uses error pulse as a detection point.	Cn-0F	Reference unit		

User constant Cn-0F is for position control only.

3.7.1 Using Servo Alarm Output and Alarm Code Output

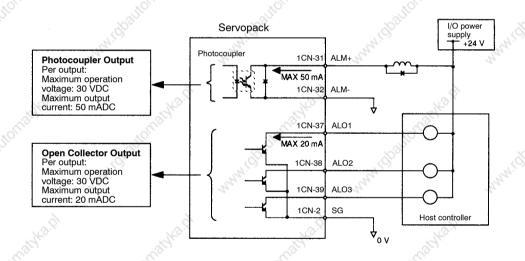
# 3.7 Forming a Protective Sequence

This section describes how to use I/O signals from the Servopack to form a protective sequence for safety purposes.

3.7.1	Using Servo Alarm Output and Alarm Code Output	128
3.7.2	Using Servo ON Input Signal	132
3.7.3	Using Positioning Complete Signal	133
3.7.4	Using Speed Coincidence Output Signal	134
3.7.5	Using Running Output Signal	136
3.7.6	Using Servo Ready Output Signal	138

## 3.7.1 Using Servo Alarm Output and Alarm Code Output

### 1) Basic Wiring for Alarm Output Signals



Provide an external I/O power supply separately. There are no DC power available from Servopack for output signals.

3.7 Forming a Protective Sequence

## 2) Contact Output Signal ALM+, ALM-

e de la companya de l	St is	Position Control
	ignal Ground for Servo Iarm Output	For Speed Torque Control and Position Control

Signal ALM+ is output when the Servopack detects an alarm.

Form an external circuit so that this alarm output (ALM) turns the Servopack main power OFF.

Se	rvopack	
A	larm etection	ALM+ output Turns the power OFF

ON status:	Circuit between 1CN-31 and 1CN-32 is closed. 1CN-31 is at low level.	Normal state
OFF status:	Circuit between 1CN-31 and 1CN-32 is open. 1CN-31 is at high level.	Alarm state

Alarm codes ALO1, ALO2, and ALO3 are output to indicate each alarm type.

### 3) Contact Output Signals ALO1, ALO2, and ALO3

Output → ALO1 1CN-37	Alarm Code Output	For Speed/Torque Control and Position Control
Output → ALO2 1CN-38	Alarm Code Output	For Speed/Torque Control and Position Control
Output → ALO3 1CN-39	Alarm Code Output	For Speed/Torque Control and Position Control
Output → SG 1CN-2	Signal Ground for Alarm Code Output	For Speed/Torque Control and Position Control
20	16°	×~

These signals output an alarm code to indicate the type of an alarm detected by the Servopack.

Use these signals to display alarm codes at the host controller.

3.7.1 Using Servo Alarm Output and Alarm Code Output cont.

## 4) Relationship between Alarm Display and Alarm Code Output

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	ay and Alarm Code Output:				NO.S.	H3A	
Alarm	Alarm	Alarm Code Output			Alarm Type	Alarm Description	
Display	ALO1	ALO2	ALO3	(ALM+) Output		( due to the second sec	
R0	×	×	×	×	User constant error	An absolute encoder error or curred or user constant is faulty.	
an <sup>war</sup> r 10	0	XX	×	×	Overcurrent	Overcurrent flowed thorough the main circuit. Servopack overheated.	
05 <i>Я</i>	×	0	×	×	Fuse blown	Fuse of main circuit power supply is blown.	
R 30	0	0	×	×	Regenera- tive error	Failure of regenerative circu	
M <sup>ar</sup> 83 (	0	0142	×	×	Position error pulse overflow	The number of pulses in er counter has exceeded the preset value.	
R40	XDai	×	0	Mary Xoour	Overvoltage or undervol- tage	Main circuit DC voltage is overvoltage or undervoltage	
RSI	0	×	0	×	Overspeed	Motor speed has exceeded the 110% of the maximum a lowable speed.	
оr я	0	010	0	×	Overload	Motor and Servopack are overloaded.	
8.8	X	×	×	×	Absolute encoder er- ror	Absolute encoder is faulty.	
AP 1	×	×	×	×	Reference input read error	Failure of analog voltage ref erence input read	
8: <u>*</u>	0.0	ornalis ×	0	X ANIO DALL	Overrun Disconnec- tion of PG signal line	Overrun occurred due to mo tor or encoder signal wiring faults. Encoder signal line is discor nected.	

 $\bigcirc$  : Output transistor is ON

 $\times$  : Output transistor is OFF

\* : Displays an alarm category number.

For details, refer to Appendix E List of Alarm Displays.

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3.7 Forming a Protective Sequence

Ī	Alarm	Alarm Code Output			Servo Alarm		Alarm Description
	Display	ALO1	ALO2	ALO3	(ALM+) Output	Alarm Type	Alarm Description
A.	°C243		and	efined	obautomat	Digital Operator transmis-	Communication error oc- curred between Digital Oper- ator and Servopack.
	E P F B (	2000 Jac	Und	enned		sion error	, disant we lighted
Î	899	×	×	×	0	No error 🔌	Na.
	à		Sec.		_	Ś	à

- : Output transistor is ON
- $\times$  : Output transistor is OFF
- \* : Displays an alarm category number.
- For details, refer to Appendix E List of Alarm Displays.
- 5) When the servo alarm (ALM+) is output, eliminate the cause of the alarm and set the following ALMRST input signal at low level (0V) to reset the alarm state.

→ Input ALMRST 1CN-44 Control and Position Con	CN-44 Con	
------------------------------------------------	-----------	--

This signal is used to reset the servo alarm state.

Alarm state can be reset using the Digital Operator. Also, alarm state is reset at control power ON/OFF.

When an alarm occurs, always eliminate the cause before resetting the alarm state. 6.2.1 Troubleshooting Problems with Alarm Display describes how to troubleshoot the system when an alarm arises.

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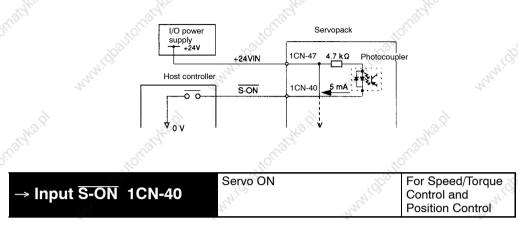
3

Speed/Torque

3.7.2 Using Servo ON Input Signal

# 3.7.2 Using Servo ON Input Signal

1) This section describes how to wire and use contact input signal "servo ON (S-ON)." Use this signal to forcibly turn the servomotor OFF from the host controller.



This signal is used to turn the motor ON or OFF.

ON: 1CN-40 is at low level	Turns the motor ON. This is normal operation state. Motor is oper- ated according to input signals. (called "servo ON state").
OFF: 1CN-40 is at	Turns the motor OFF. This is inoperable state (called "servo OFF state").
high level	If the servo is turned OFF during motor operation, the motor is decelerated to a stop by applying dynamic brake (standard setting).
S. S. S.	This function can be selected by setting bits 6 and 7 of memory switch Cn-01.

- **NOTE** Do not use the S-ON signal to start or stop the motor. Always use an input reference to start and stop the motor.
  - 2) If the S-ON signal is not to be used, set the following memory switch to 1:

	all <sup>e</sup>	S	-C	
Cn-01 Bit 0	Use of Servo ON Input Signal	Factory Setting: 0	For Speed/Torque Control and Position Control	ă.
4	S. S		A. A.	$\sum_{i=1}^{n}$

This memory switch is used to enable or disable the servo ON input signal  $\overline{\text{S-ON}}$  (1CN-40).

#### Servopack

1<u>CN-40</u> (S-ON)

When external short-circuit wiring is omitted, set the memory switch to "1."

When S-ON is not used, this short-circuit wiring can be omitted.

Setting	24	Meaning	2	24
0	Uses servo ON signa (When 1CN-40 is ope	ll <u>S-ON</u> . en, servo is OFF. When 10	CN-14 is at 0 V, se	ervo is ON.)
1 ( <sup>51)</sup> 1	Does not use servo C (Always servo is ON.	DN signal <u>S-ON</u> . Equivalent to shortcircuit	t 1CN-14 and 0V.)	Carlos Carlos

#### 3.7.3 Using Positioning Complete Signal 1) This section describes how to wire and use contact output-signal "positioning complete output (COIN)." This signal is output to indicate that servomotor operation is complete. I/O power supply Servopack +24 V Photocoupler output 1CN-25 COIN+ Per output: Maximum operation voltage: 1CN-26 COIN-30 VDC Maximum output current: 50 mADC Output $\rightarrow \overline{\text{COIN}}$ + 1CN-25 Positioning Complete Output For Position Output → COIN- 1CN-26 **Control Only** For position control only. Reference Motor This output signal indicates that motor operation Speed is complete during position control. The host con-Cn-1B (COINLV) Error troller uses this signal as an interlock to confirm pulse (Un-08) that positioning is complete. COIN+ (1CN-25)

ON status:	Circuit between 1CN-25 and 1CN-26 is closed. 1CN-25 is at low level.	Positioning is complete (position error is below the preset value).
OFF status:	Circuit between 1CN-25 and 1CN-26 is open. 1CN-25 is at high level.	Positioning is not complete (position error is over the preset value.)

Preset Value: Cn-1B (positioning complete range)

2) Set the number of error pulses in the following user constant Cn-1B to adjust output timing of COIN (positioning complete output).

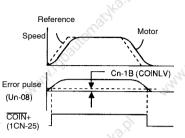


3.7.4 Using Speed Coincidence Output Signal

			~~~		~~~	<u>.</u>
Cn-1B	COINLV	Positioning Complete	Unit: Reference	Range: 0	,	For Position Control Only
		Range	Unit	to 250		

For position control only.

This user constant is used to set output timing of positioning complete signal ( $\overline{COIN}$ +, 1CN-25) to be output when motor operation is complete after a position reference pulse has been input.



Set the number of error pulses in terms of reference unit (the number of input pulses that is defined using the electronic gear function).

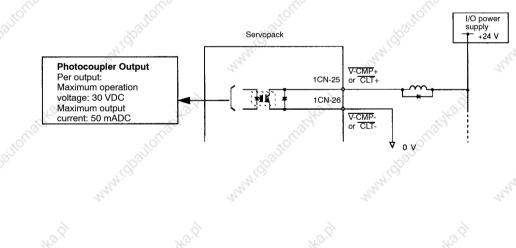
If too large a value is set in this user constant, error may become too small when the motor runs at a low speed, causing  $\overline{\text{COIN}}$ + to be output continuously.

COINLV does not affect the final positioning accuracy.

# 3.7.4 Using Speed Coincidence Output Signal



1) This section describes how to wire and use contact output signal "speed coincidence outputs (LCT+, CLT-)." This signal is output to indicate that actual motor speed matches a reference speed. The host controller uses this signal as an interlock.



			.x0°	
Output $\rightarrow \overline{C}$	LT+ 1CN-25	Speed Coinci	dence Output	For Speed/Torque Control Only
Output $\rightarrow \overline{C}$	LT- 1CN-26	Speed Coinci	dence Output	For Speed/Torque Control Only
Ho.	and a r	all an		SB40.x
For speed/torque	e control only.	dbauton.	Motor speed	
<u>.</u>	nal indicates that he input speed re			Reference speed V-CMP+ is output
40°''	tonatyka	tomatyko.		within this range.
ON Circuit	between 1CN-25 a	nd 1CN-26 is		ed matches the speed

OFF status:	open.	Actual motor speed does not match the speed reference (speed difference is greater than the preset value).
ON status:	closed. 1CN-25 is at low level.	reference (speed difference is below the preset value).

Preset value: Cn-22 (speed coincidence signal output width)

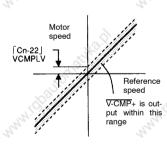
2) Set the following user constant to specify the output conditions for speed coincidence signal V-CMP.

. O.X		10 <sup>-X</sup>		×		@ <sup>×</sup>
Cn-22	VCMPLV	Speed Coincidence Signal Output Width	20	Setting Range: 0 to Max. Speed	Factory Setting: 10	For Speed/Torque Control Only

For speed/torque control only

Set the output conditions for speed coincidence signal  $\overline{V-CMP}$ + (1CN-25).

 $\nabla$ -CMP+ signal is output when the difference between the reference speed and actual motor speed is not greater than the preset value.



Example: When preset value is 100 and reference speed is 2000 r/min.

V-CMP+ is ON (circuit between 1CN-25 and 1CN-26 is closed) when the speed is between 1900 and 2100 r/min.

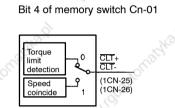
3.7.5 Using Running Output Signal

When output signals CLT+ and CLT- are used as the speed coincide output, set the following Note memory switch (Cn-01 bit4) to 1.

Cn-01 Bit 4	CLT+, CLT- Output Signals Selection	Factory Setting: 0	For Speed/Torque Control and Position Control
	A.V.	A.V.	~~~

Sets the output conditions for output signals CLT+ (1CN-25) and CLT- (1CN-26).

	Le Le .
Setting	Meaning
any O.P.	Uses CLT+, CLT- output signals as a torque limit output signal. Refer to 3.1.3 for details.
1	Uses CLT+, CLT- output signals as a speed coincide output signal.

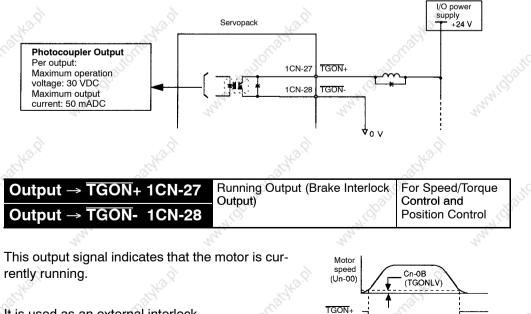


When CLT+, CLT- output signals are changed, the following bit data are also changed:

- Status indication mode bit data
- Monitor mode Un-05 bit 4

# 3.7.5 Using Running Output Signal

1) This section describes how to wire and use contact output signals TGON+, TGON- as a running output signal. This signal indicates that a servomotor is currently running.



(1CN-27)

It is used as an external interlock.



Memory switch Cn-01 bit E

0

የ

TGON+

(!CN-27)

Rotation detection

Brake

interlock output

	ON status: 🚿	Circuit between 1CN-27 and 1CN-28 is closed. 1CN-27 is at low level.	Motor is running. (Motor speed is greater than the preset value.)
12	OFF status:	Circuit between 1CN-27 and 1CN-28 is open. 1CN-27 is at high level.	Motor is stopped. (Motor speed is below the preset value.)

Preset value: Cn-0B (zero-speed level)

**Note** This function is changed to another function depending on the setting of bit E of memory switch Cn-01.

 To use TGON+, TGON- as a running output signals, set the following memory switch to "0."

	6-1 · · ·		helt "
Cn-01 Bit E	TGON+, TGON- Output Signals Selection	Factory	For Speed/Torque Control and Position Control

This memory switch is used to set output conditions for output signals TGON+, TGON-(1CN-27).

When TGON+, TGON- signals are changed, the following bit data are also changed:

- Status indication mode bit data
- Monitor mode Un-05 bit 4

Uses TGON+, TGON- as a running output signals.         TGON+, TGON- compare motor speed with the value set in Cn-0B (TGONL)         Motor speed ≥ preset value       Closes circuit between 1CN-27 and 1CN-28.         Motor speed < preset value       Opens circuit between 1CN-27 and 1CN-28.	Setting	SS Me	eaning	20
0 and 1CN-28. Motor speed < preset value Opens circuit between 1CN-27	2		• • • • • • • • • • • • • • • • • • •	ONLV
	o So	Motor speed ≥ preset value		7
		Motor speed < preset value		7
Uses TGON+, TGON- as a torque limit output signal.		Saloft. Saloft.	and 1CN-28.	

3.7.6 Using Servo Ready Output

 Use the following user constant to specify the output conditions for running output signals TGON+, TGON-.

	nit: Range: 1 to	Setting: Co	peed/Torque ontrol and osition Control
--	------------------	-------------	--

This user constant is used to set the speed level at which the Servopack determines that the motor is running and then outputs a signal.

The following signals are output when motor speed exceeds the preset value. (The circuit between 1CN-27 and 1CN-28 is closed when motor speed exceeds the preset value.)

Signals are output when motor speed exceeds the preset value.

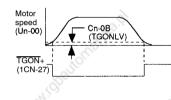
• TGON+ (1CN-27)

Status indication mode bit data

Monitor mode Un-05 bit 4

User Constant Setting:

Memory switch Cn-01 bit E = 0

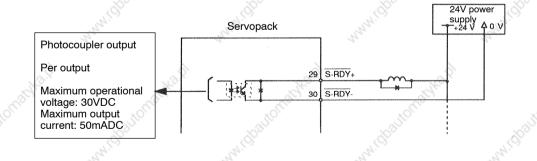


### 3.7.6 Using Servo Ready Output

 This section describes how to wire and use photocoupler output signal S-RDY (servo ready).

"Servo ready" means that the Servopack is not in servo alarm state when the main circuit is turned ON. For absolute encoder specifications, "servo ready" means that, in addition to the above, the SEN signal is at high level and the absolute encoder is also in ready state.

Also, alarm state is reset at control power ON/OFF.



27	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	A2	Ň	1
	abauton	toattorn.	abalitont	doauton
Output	→ <mark>S-RDY</mark>	Servo Ready Outpu	Cont	Speed/Torque rol and tion Control

142.9

5140.01

www.colauton

142.91

www.dbailor

				-	Position Control	
	£3.9	18.9		<u>े</u>	14 <sup>2</sup> 9	
tonat	This sigr	nal indicates that the	Servopack is read	y to receive servo O	N signals.	onato
www.lbbb	ON status:	Circuit is closed or s	signal is at low level.	servo ready state	and the second	1
<i>1</i> 9°	OFF status:	Circuit is open or sig	gnal is at high level.	Not in servo ready s	tate	
and and	P.X	Cathla.H	- addres	x S	No.X	Carles
10°11011		abalitor,	doautor.	abauton	10 <sup>03</sup>	01
en <sup>ani.S</sup>		and mill	ANATA!	And C.	and the Contract of Contract o	
						6

3.8.1 Wiring Instructions

# 3.8 Special Wiring

This section describes special wiring methods including the one for noise control. Always refer to *3.8.1 Notes on Wiring* and *3.8.2 Wiring for Noise Control*, and refer to other sections as necessary.

3.8.1	Wiring Instructions	140
3.8.2	Wiring for Noise Control	142
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3.8.4	Using Regenerative Units	148
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3.8.7	Using DR2 Servopack with High Voltage Line	161
3.8.8	Connector Terminal Layouts	163

## 3.8.1 Wiring Instructions

To ensure safe and stable operation, always refer to the following wiring instructions.

**NOTE** Always use the following cables for reference input and encoder wiring.

10	Cable Type	Yaskawa Drawing No.	Maximum Allowable Length
For reference input	Twisted-pair ables	r	3 m (9.8 ft.)
For encoder	Multiconductor shielded twisted-pair cable	B9400064 (for incremental encoder) DP8409123 (for absolute encoder)	20 m (65.6 ft.)

• Trim off the excess portion of the cable to minimize the cable length.

NOTE For a ground wire, use as thick a cable as possible.

- At least class 3 grounding (ground to 100 Ω or less) is recommended.
- Always use one-line grounding.
- If the motor is insulated from the machine, ground the motor directly.

**NOTE** Do not bend or apply tension to cables.

 Since the conductor of a signal cable is very thin (0.2 to 0.3 mm), handle it with adequate care.

3.8 Special Wiring

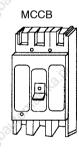
**NOTE** Use a noise filter to prevent noise interference. (For details, refer to the following *Caution*.)

 If the servo is to be used near private houses or may receive noise interference, install a noise filter on the input side of the power supply line. Since this Servopack is designed as an industrial device, it provides no mechanism to prevent noise interference. Noise filter

NOTE To prevent malfunction due to noise, take the following actions:

- Position the input reference device and noise filter as close to the Servopack as possible.
- Always install a surge absorber circuit in the relay, solenoid and magnetic contactor coils.
- The distance between a power line (such as a power supply line or motor cable) and a signal line must be at least 30 cm (12 in). Do not put the power and signal lines in the same duct or bundle them together.
- Do not share the power supply with an electric welder or electrical discharge machine. When the Servopack is placed near a high-frequency oscillator, install a noise filter on the input side of the power supply line.
- **Note** a) Since Servopack uses high-speed switching elements, signal lines may receive noise. To prevent this, always take the above actions.
  - b) For details of grounding and noise filters, refer to *3.8.2 Wiring for Noise Control*.
- **NOTE** Use a molded-case circuit breaker (MCCB) or fuse to protect the power supply line from high voltage.
  - This Servopack is directly connected to commercial power supply without a transformer. Always use an MCCB or fuse to protect the servo system from accidental high voltage.

 Select an appropriate MCCB or fuse according to the Servopack capacity and the number of Servopacks to be used as shown below.



3.8.2 Wiring for Noise Control

MCCB or Fuse for Each Power Capacity

Power Voltage	Servopack Type	Power Capacity Per Servopack (kVA) (see note 1)	Power Capacity Per MCCB or Fuse (A) (see note 2)
5	DR2-A3A	0.25	J.C.
	DR2-A5A	0.3	
000.14	DR2-01A	0.5	5
200 V	DR2-02A	0.75	te da
	DR2-04A	1.2	9
	DR2-08A	2.2	16
20	DR2-A3B	0.25	10
5	DR2-A5B	0.3	5
100 V	DR2-01B	0.5	10311
	DR2-02B	0.75	N 8 N
3	DR2-03B	1.4	15

Note 1) Power capacity at rated load

 Operating characteristics (25°C): 2 seconds or more for 200%, 0.01 second or more for 700%

When control circuit breaker and main circuit breaker are used separately, be aware of in-rush current (30 to 40A, for 5ms or less) flows at control power ON.

 A fast-operating fuse cannot be used because the Servopack power supply is a capacitor input type. A fast-operating fuse may blow out when the power is turned ON.

### 3.8.2 Wiring for Noise Control

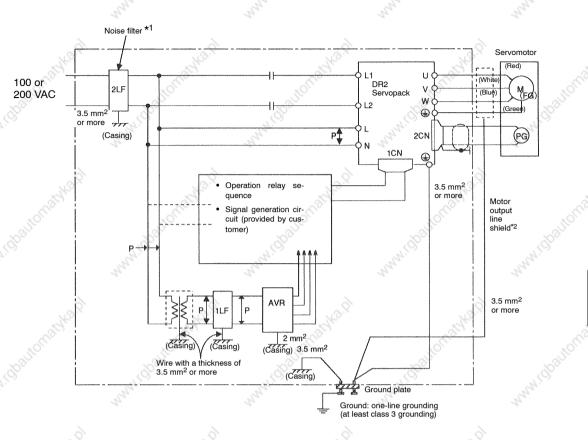
<u>This noise control do not conform to the EMC instructions.</u> To adapt DR2 Servopack to EMC instructions, refer to *7 Measures to Satisfy the Requirements of EMC Instructions.* 

#### 1) Example of Wiring for Noise Control

- a) This Servopack uses high-speed switching elements in the main circuit. It may receive "switching noise" from these high-speed switching elements if wiring or ground-ing around the Servopack is not appropriate. To prevent this, always wire and ground the Servopack correctly.
- b) This Servopack has a built-in microprocessor (CPU). To protect the microprocessor from external noise, install a noise filter in place.

3

c) The following is an example of wiring for noise control.



- \* 1 When using a noise filter, always observe the following wiring instructions:
- \*2 Normally, motor output line shield is not required.
- Note 1 For a ground wire to be connected to the casing, use a thick wire with a thick ness of at least 3.5 mm<sup>2</sup> (preferably, plain stitch cooper wire). However, be aware that max. connectable size of ground terminal ⊕ of Servopack is 2.5mm<sup>2</sup>.
  - 2 For wires indicated by P<sup>+</sup>, use twisted-pair cables whenever possible.

#### 2) Correct Grounding

Always ground the motor ground terminal.

Always connect servomotor ground terminal FG (green) to the Servopack ground terminal  $\oplus$ . Be sure to ground the ground terminal  $\oplus$ .

- If the servomotor is grounded via the machine, a switching noise current will flow from the Servopack power unit through motor stray capacitance. The above grounding is required to prevent the adverse effects of switching noise.
- If the reference input line receives noise, do the following.

3.8.2 Wiring for Noise Control cont.

Ground the 0 V line (such as SG-V and SG-T) of the reference input line. If the main circuit wiring for the motor is accommodated in a metal conduit, ground the conduit and its junction box. For all grounding, always use one-line grounding.

#### 3) Noise Filter Installation

a) Use an inhibit type noise filter to prevent noise from the power supply line.

Install a noise filter on the power supply line for peripheral equipment as necessary.

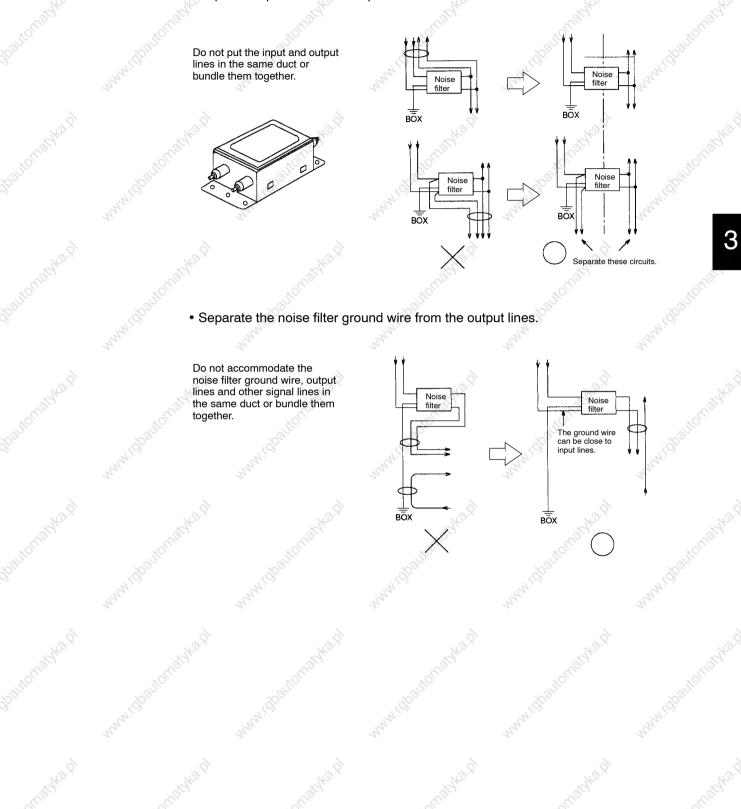
The following table lists recommended noise filters for each Servopack type.

#### Noise Filter Types

102		132	18×		- 10 <sup>-2</sup>
Power	Sonia	opack Type	Noise Filter	Recommend	led Noise Filter
Voltage	Servo	раск туре	Connection	Type 🔬	Specifications
	30 W (0.04 HP)	DR2-A3A	1 Bar	LF-205A	Single-phase 200 VAC, 5 A
	50 W (0.07 HP)	DR2-A5A		A. C.	A. A
000.1	100 W (0.13 HP)	DR2-01A	, all		. 3 <sup>9</sup>
200 V	200 W (0.27 HP)	DR2-02A	(Correct)	5	38
	400 W (0.53 HP)	DR2-04A	erre t	LF-210	Single-phase 200 VAC, 10 A
	750 W (1.01 HP)	DR2-08A	75 <u>-</u>	LF-220	Single-phase 200 VAC, 20 A
6	30 W (0.04 HP)	DR2-A3B	(Incorrect) ∘᠇ᠧᠵᠵᢅ≁⊷	LF-205A	Single-phase 200 VAC, 5 A
e Harri	50 W (0.07 HP)	DR2-A5B	Ϋ́.	~	3.N
100 V	100 W (0.13 HP)	DR2-01B	JORITON.	to all of	
	200 W (0.27 HP)	DR2-02B		LF-210	Single-phase 200 VAC, 10 A
2	300 W (0.39 HP)	DR2-03B		LF-220	Single-phase 200 VAC, 20 A

**Note** These noise filters are manufactured by Tokin Corp. and available from Yaskawa. For noise filters, contact your nearest Yaskawa sales representatives.

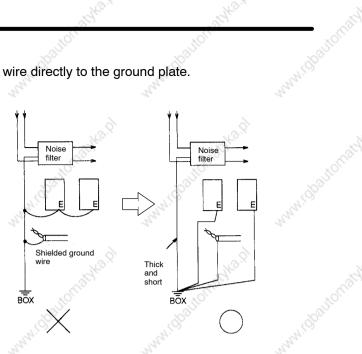
- b) Always observe the following installation and wiring instructions. Incorrect use of a noise filter halves its benefits.
- Separate input lines from output lines.



3.8.2 Wiring for Noise Control cont.

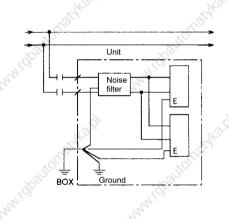
• Connect the noise filter ground wire directly to the ground plate.

Do not connect the noise filter ground wire to other ground wires.



• When grounding a noise filter inside a Unit.

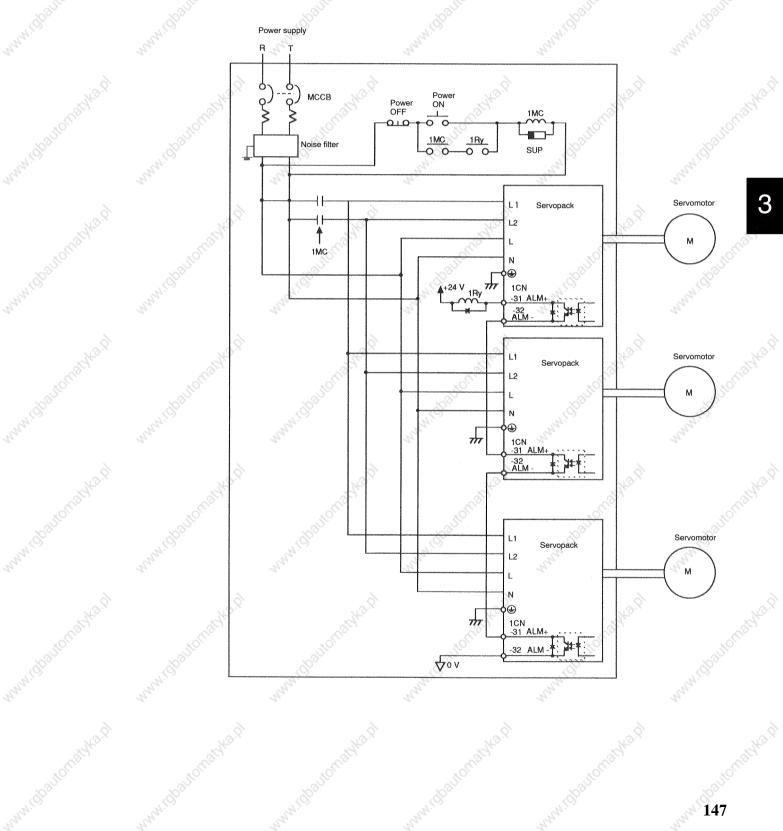
If a noise filter is located inside a Unit, connect the noise filter ground wire and the ground wires from other devices inside the Unit to the ground plate for the Unit first, then ground these wires.



# 3.8.3 Using More Than One Servo Drive

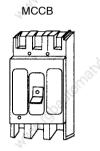
#### Example of Wiring More than One Servo Drive

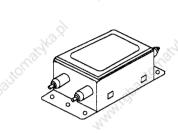
**Note** Make sure to connect only one cable to power input terminals (L1, L2, L, N). Never connect more than one cables to one terminal.



3.8.4 Using Regenerative Units

- Connect the alarm output (ALM) terminals for the three Servopacks in series to enable alarm detection relay 1Ry to operate. This is because ALM is a logical complement output signal, so the output transistor is turned OFF when the system enters an alarm state.
- 2) Multiple servos can share a single MCCB or noise filter. Always select a MCCB or noise filter that has enough capacity for the total power capacity (load conditions) of those servos. For details, refer to page 142.





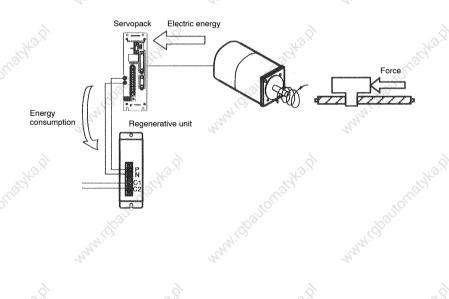
Noise filter

## 3.8.4 Using Regenerative Units

**Note** Regenerative unit can be applied only to 200V 30W to 200W (types DR2-A3A, A5A, 01A, 02A). For 200V 400W, 750W and all types of 100V, regenerative unit cannot be used.

#### 1) "What is a Regenerative Unit?"

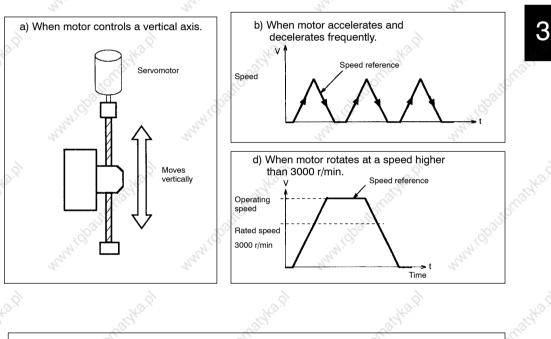
A regenerative unit is designed to safely consume electric energy that is generated when the servomotor is rotated by the load.



#### 2) "When is a Regenerative Unit Required?"

For general use, a generative unit is not required. In the following cases, however, the user must determine whether a regenerative unit is required or not:

- a) When the motor is used to control a vertical axis.
- b) When the motor starts and stops frequently.
- c) When load inertia exceeds the allowable load inertia on the motor side.
- d) When the motor rotates at a speed higher than the rated speed (3000 r/min).



c) When load inertia is too high.

Servomotor Load

Load inertia > Allowable load inertia for servomotor

3) "How can we Determine Whether a Regenerative Unit is Required or Not?"

Using software "regenerative capacity check program" enables the user to easily determine whether a regenerative unit is required. This software is included as part of Yaskawa proprietary software "**AC servomotor sizing software**," which is supplied free of charge. Use this software as necessary.

3.8.4 Using Regenerative Units cont.

4) Connecting a Regenerative Unit

DR2 Servopack (DR2-A3A, A5A, 01A or 02A) Servomoto 1MC Single-phase 200-230 VAC or 100-115 VAC -11 L1 U A. М -1.2 W 0 1 Ν æ  $\eta \eta$ PG 1CN-2CN 5Ry Photocouple 31 Alarm 32 1MC N OFF C1 010 õ č õ ō 00 Alarm 1MC 5Rv C2 Regenerative unit

The standard connection diagram for a regenerative unit is shown below.

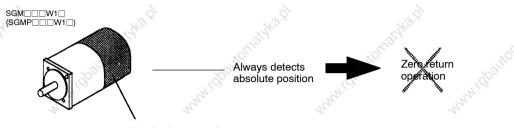
- a) A regenerative unit has the following fault detection functions:
  - Detecting broken wiring in a regenerative resistor
  - Detecting faults in a regenerative transistor
  - Detecting overvoltage
- b) When one of these fault detection functions operates, the internal alarm relay is actuated. Then, the circuit between output terminals C1 and C2 is opened.
- c) Form a sequence so that the Servopack main power is turned OFF when the alarm relay is actuated.
- d) Once the alarm relay is actuated, it takes two or three seconds until the system returns to the normal state. This time is required for the main capacitor inside the Servopack to discharge electricity.

3

# 3.8.5 Using an Absolute Encoder

#### 1) Outline

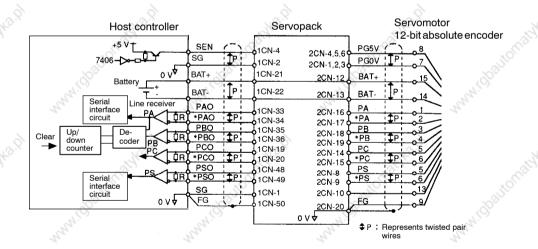
An absolute value detection system detects an absolute position of the machine even when the servo system is OFF. If such a system is to be formed in the host controller, use an SGM or SGMP Servomotor with absolute encoder. Consequently, automatic operation can be performed without zero return operation immediately after the power is turned ON.



12-bit absolute encoder

#### 2) Standard Connection Diagram for a 12-bit Absolute Encoder Mounted on a Servomotor

Interface Circuit



Line Receiver Used: SN75175 or MC3486 manufactured by Texas Instruments Inc. Termination Resistor R: 220 to 470  $\Omega$ 

Normally, PAO serial data is used. In this case, PS serial interface is unnecessary.

3.8.5 Using an Absolute Encoder cont.

#### SEN signal

- The SEN signal must be set at high level after at least three seconds after the power is turned ON.
- When the SEN signal is changed from low level to high level, +5 V is applied to the absolute encoder, and serial data and initial incremental pulses are transmitted.

#### er, and serial data and initial inses are transmitted. Not turned ON until these operations are complete, regardless of the s

+5 V 1

7406 or

equival

**Electrical Specifications** 

SEN

SG

At high level

Approx. 1mA

1CN

1CN-2

A PNP transistor is recommended.

Servopack

1<u>00</u>Ω

4 7k O 🗍

Host controller

 The motor is not turned ON until these operations are complete, regardless of the servo ON signal (S-ON).

#### 3) Memory Switch to Determine Whether to Use Input Signal SEN



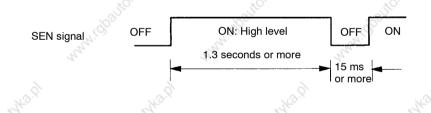
This memory switch is used to determine whether to use input signal SEN (1CN-4).

This memory switch is available for absolute encoders only (not for incremental encoders).

der.		
29	Servopa	ck
>	1CN-4 SEN	Servomoto
	Al	osolute encode
	· (03	

Setting	Meaning	Sol.
0	Uses SEN signal.	ANN!
1	Does not use SEN signal.	4.

**NOTE** If the SEN signal is to be turned OFF, then ON again, it must remain at high level for at least 1.3 seconds before being turned OFF.



#### 4) Memory Switch to 1 to Select Absolute Encoder

	20° 20°		X)**
Cn-02 Bit 9	Encoder Type Selection	Factory Setting: 0	For Speed/Torque Control and Position Control

Sets the encoder type according to the servomotor type to be used.

#### After changing the memory switch setting, turn the power OFF, then ON.

Motor Type	Number of Encoder Pulses Per Revolution	Preset Value
SGM31_ SGMP31_	Incremental encoder: 2048 pulses per revolution	0
SGMW1_ SGMPW1_	Absolute encoder: 1024 pulses per revolution	1

Use the following user constant to set the number of pulses for the absolute encoder to be used:

aball <sup>o</sup> aball	Encoder Pulses	and the	5
--------------------------	-------------------	---------	---

Sets the number of encoder pulses according to the servomotor type to be used. After changing this user constant setting, turn the power OFF, then ON. This makes the new setting valid.

Motor Type	Number of Encoder Pulses Per Revolution	Preset Value
SGM-00310 SGMP-00310	Incremental encoder: 2048 pulses per revolution	2048
SGM-000W10 SGMP-000W10	Absolute encoder: 1024 pulses per revolution	1024

#### 5) Using a Battery

Use the following battery to enable the absolute encoder to store position information even when the power is turned OFF. Load the battery in the host controller and connect it to Servopack input terminals BAT and BAT0.

Recommended battery: Lithium battery Toshiba Battery ER6V C3 Type 3.6 V, 2000 mAH	<ul> <li>Connect the battery securely to prevent contact faults resulting from environmental changes or aging.</li> </ul>
	Battery voltage is not monitored inside the Servopack.
	Provide a battery voltage monitor circuit as necessary. Minimum voltage: 2.8 V

#### 6) Setting up Absolute Encoder

- a) Set up the absolute encoder in the following cases:
- When starting the machine for the first time
- When the absolute encoder is not connected to power supply or backup power supply (battery) for more than two days

NOTE

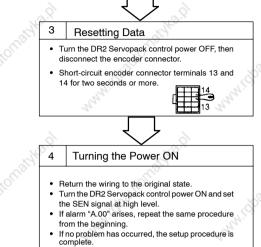
Improper setup may cause malfunctions such as improper encoder operation and/or strain on the battery. Follow the setup procedure on the next page.

3.8.5 Using an Absolute Encoder cont.

- b) The setup procedure is as follows:
  - 1 Turning DR2 Servopack Control Power ON
  - Wire the DR2 Servopack, motor and encoder in the normal way.
  - Connect the battery and turn the DR2 Servopack
     ON.

#### 2 Turning the Encoder ON

- Set the SEN signal at high level.
  - Keep the encoder turned ON for at least three minutes.
  - It does not matter even if alarm status arises.



**NOTE** Setting up the encoder sets the revolution count inside the encoder to 0. After setting up the encoder, always reset the machine home position. Operating the machine without the home position being reset does not only damage the machine but may also cause an accident resulting in injury or death.

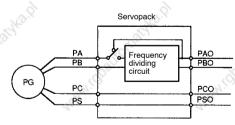
#### 7) Absolute Data Exchange Sequence

The Servopack sends absolute data to the host controller when receiving output from a 12-bit absolute encoder. This data exchange sequence is described below.

Use the following detailed information when designing a host controller.

#### a) Outline of Absolute Signal

The 12-bit absolute encoder outputs PAO, PBO, PCO and PSO as shown on the right.



Signal Name	Status	Contents	
PAO	Initial state	Serial data Initial incremental pulse	, č
	Normal state	Incremental pulse	all'al.
000	Initial state	Initial incremental pulse	1
PBO	Normal state	Incremental pulse	
PCO	Normal state	Home position pulse	
PSO	Normal state	Rotation count serial data	

3

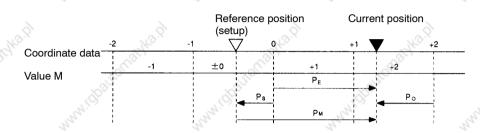
#### b) Contents of Absolute Data

Serial Data:

Indicates how many turns the motor shaft has made from the reference position (position specified at setup).

Initial Incremental Pulse:

Outputs pulses at the same pulse rate as when the motor shaft rotates from the home position to the current position at the maximum speed of 4900 r/min.



Absolute data P<sub>M</sub> can be determined using the following formula.

100
$P_E = M \times R + P_O$
$P_{M} = P_{E} - P_{S}$

Ρε	Current value read by encoder	142
M	Serial data (rotation count data)	
Po	Number of initial incremental pulses (Normally, this is a negative value)	
Ps	Number of initial incremental pulses read at setup	
Рм	Current value required for the customer system	
R	Number of pulses per encoder revolution (pulse count after dividing, value of Cn-0A)	.3

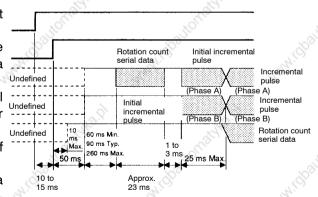
#### c) Absolute Data Transmitting Sequence

(1) Set the SEN signal at high level.

(2) After 100 ms, set the system to serial data reception-waiting-state. Clear the incremental pulse up/down counter to zero.

(3) Receive eight bytes of serial data.

(4) The system enters a normal incremental op-



eration state approximately 50 ms after the last serial data is received.

3.8.5 Using an Absolute Encoder cont.

#### d) Detailed Specifications of Each Signal

- Specifications of PAO Serial Data:
  - The number of revolutions is output in five digits.

Data transmission method	Start-stop synchronization (ASYNC)
Baud rate	9600
Start bit	1 bit
Stop bit	1 bit
Parity	Even number
Character code	ASCII 7-bit code
Data format	8 characters. As shown on the right.

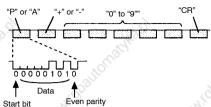
Specifications of PSO Serial Data:

The number of revolutions and the absolute position within one revolution are always output in five and four digits, respectively. The transmission cycle is approximately 40 ms.

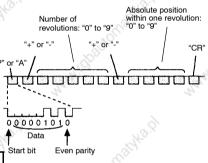
A3	N N
Data transmission method	Start-stop synchronization (ASYNC)
Baud rate	9600
Start bit	1 bit
Stop bit	1 bit
Parity	Even number
Character code	ASCII 7-bit code
Data format	13 characters. As shown on the right.

Incremental Pulse and Home Position
 Pulse:

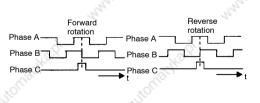
Initial incremental pulses which provide absolute data are first divided by the frequency divider inside the Servopack and then output in the same way as normal incremental pulses.



- Data is P+00000 (CR) or P-00000 (CR) when the number of revolutions is zero.
- The maximum number of revolutions is ±99999. If this value is exceeded, it returns to 00000.



- Absolute position data within one revolution is a value before frequency dividing. (4,096 pulses per revolution)
- Absolute position data increases during forward rotation (standard setting).
   (Not valid in reverse rotation mode)



• Note that phase C is not divided so its pulse width is narrower than phase A.

3.8 Special Wiring

Output terminals: PAO (1CN-33) \*PAO (1CN-34) PBO (1CN-35) \*PBO (1CN-36)

Output

3

157

Phase A

Phase B

Servopack

Phase A Fre-

duency B divider

Preset value: 16

www.www.wwwwwwww

1 revolution

Servomotor encoder

PG

Setting example:

• Use the following user constant to set the pulse dividing ratio.

Cn-0A	PGRAT Dividing Ratio Setting	Unit: P/R	Setting Range: 16 to Number of Encoder Pulses	Factory Setting: 2048	For Speed/Torque Control and Position Control
-------	------------------------------------	-----------	--	-----------------------------	---

Set the number of output pulses for PG output signals (PAO, \*PAO, PBO and \*PBO).

Pulses from motor encoder (PG) are divided by the preset number of pulses before being output.

The number of output pulses per revolution is set in this user constant. Set this value according to the reference unit of the machine or controller to be used.

The setting range varies according to the encoder used.

	Motor Type	Number of Encoder Pulses Per Revolution	Setting Range
2	SGM-00310 SGMP-00310	Incremental encoder: 2048 pulses per revolution	16 to 2048
	SGMW1_ SGMPW1_	Absolute encoder: 1024 pulses per revolution	16 to 1024

3.8.5 Using an Absolute Encoder cont.

#### 8) Alarm Display

When a 12-bit absolute encoder is used, the following alarms are detected and displayed.

ist of Alarms.	Bonn and Bonn		MALIGBAUL	Saller State	30.0
Alarm Type	Meaning	Digital Operator Display	PAO Serial Data	PSO Serial Data	
Backup Alarm	Indicates that backup voltage drop was detected. (This alarm helps maintain reliability of rotation count data.)		ALM81. CR	ALARMOA BACK CR	automat
Battery Alarm	Indicates that backup voltage drop was detected. (This alarm warns of battery replacement and disconnection.)		ALM83. CR	ALARMOD BATT CR	1
Checksum Error	Indicates that an error was detected in memory data check.	1 882	ALM82. CR	ALARMOB CHEC CR	SULLON'
Overspeed	Indicates that the motor was running at a speed exceeding 400 r/min when the encoder was turned ON.		ALM85. CR	ALARMOP OVER CR	~
Absolute Error	Indicates that an error was detected in sensor check inside the encoder.	1 1981	ALM84. CR	ALARMOH ABSO CR	SULLOF OF
Backup/Battery Combination Alarm			ALM81. CR	ALARMOE BACK (BATT) CR	

The SEN signal can be used to output alarm information from PAO and PSO as serial data. (This function is not available if the Servopack control power is turned OFF by the external circuit when an alarm occurs.)

	SEN Signal	"H" Error det	ection "H"	۲ <u>ــــــــــــــــــــــــــــــــــــ</u>	"H"	<u>ــــــــــــــــــــــــــــــــــــ</u>	R
-bauton	Digital Operator Display	or bb	Absolute enco (Details unkno		Absolute enc (Alarm type in		automatyka.P.
www.chall	PAO Serial Data		pulse	ALM80. CR	ALARMO*	ALM8*.	
×ð	PSO Serial Data	P±====, CR	H±=====, and so on	(Undefined)	ALARMO* **** CR	(Undefined)	onatyka.pl
MMMIGBBILL	the second second	NICODOUT	www.idbau		AND MICHOUL	Mannell, C	Sant.

#### 9) Absolute Encoder Home Position Error Detection

Cn-02 Bit 1	Absolute Encoder Home	Factory	For Speed/Torque Control
	Position Error Detection	Setting: 0	and Position Control

This memory switch is used to specify whether to use **home position error detection** (alarm A.80) when an absolute encoder is used.

	Setting	Meaning
	<u>_</u> 0 0	Detects a home position error.
3	1	Does not detect a home position error.

Normally, set this memory switch to "0."

This memory switch has no significance when an incremental encoder is used.

### 3.8.6 Extending an Encoder Cable

1) Both incremental and absolute encoders have a standard encoder cable (maximum 20 meters (65.6 ft.)). If a longer cable is required, prepare an extension cable as described below. The maximum allowable cable length is 50 meters (164 ft.).

 $\cap$ 

a) 3-meter (19.8 ft.) Cable with Connectors:

- For incremental encoder: DP9320082-1
- For absolute encoder: DP9320084-1



#### Home position error detection

This function detects an encoder count error resulting from noise. It checks the number of pulses per motor revolution, and outputs a home position error alarm if that number is incorrect.

If the absolute encoder detects an error, it inverts phase C and notifies the Servopack of the error. In this case, this "home position error detection" function also works.

3.8.6 Extending an Encoder Cable cont.

b) 50-meter (164 ft.) Extension Cable:

• For both incremental and absolute encoders: DP8409179

5

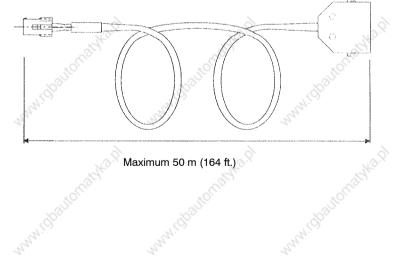
f ff

Cut this cable 30 cm (0.98 ft.) or less from each end.

Be sure to connect each wire correctly www.6020000000000000000000 (see the following table).

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www.obautomati



Maximum 50 m (164 ft.)

2) Connect cables of the same color to each other as shown in the table below. Note that wiring for incremental and absolute encoders is different.

Signal Name	Color and Wire Cable with Cor		Color and Wire 50-meter Exter Cable (DP8409	nsion
PG5V	Red	AWG22	Red	AWG16
PG0V	Black	AWG22	Black	AWG16
FG	Green/Yellow	AWG22	Green/Yellow	AWG16
PA	Blue	AWG26	Blue	AWG26
*PA	White/Blue	AWG26	White/Blue	AWG26
PB	Yellow	AWG26	Yellow	AWG26
*PB	White/Yellow	AWG26	White/Yellow	AWG26
PC	Green	AWG26	Green	AWG26
*PC	White/Green	AWG26	White/Green	AWG26
PS	Violet	AWG26	Purple	AWG26
*PS	White/Green	AWG26	White/Green	AWG26
RESET	White/Gray	AWG26	White/Gray	AWG26
BAT	Orange	AWG26	Orange	AWG26
BAT0	White/Orange	AWG26	White/Orange	AWG26

Only the absolute encoder can be connected.

# 3.8.7 Using DR2 Servopack with High Voltage Line

 DR2 Servopacks are divided into single-phase 200 V and single-phase 100 V types according to supply voltage.

If, however, three-phase 400 VAC class (400 V, 440 V) power supply must be used, prepare the following power transformer (for single-phase).

2000	a de la calencia de l	?``		See.	
(	JION .	JICI			
	<primary side=""></primary>	do <	<secondary side=""></secondary>	•	
	1) 400 or 440 VAC	<b>&gt;</b>	200 VAC		31255
	2) 400 or 440 VAC		100 VAC		
NO.P	Ha.P.	×	, <u>?</u> ]	Ha. P.	
S.	A.	S.		2	

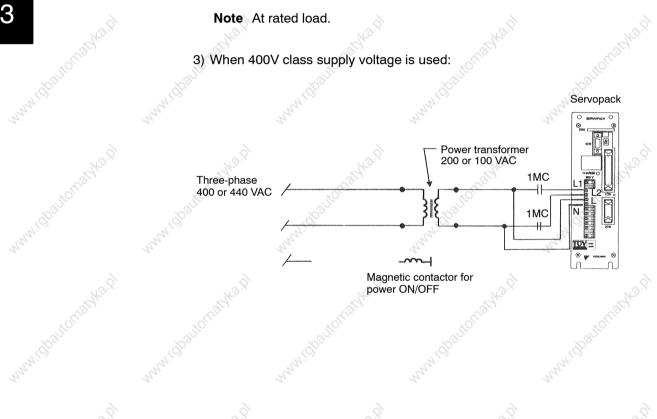
3.8.7 Using DR2 Servopack with High Voltage Line cont.

Market Ballonatykan 2) Select appropriate power transformer capacity according to the following table.

Supply Voltage	Servopack Type	Power Supply Capacity Per DR2 Servopack (kVA) (see note)	tomat
S. S. S.	DR2-A3A	0.25	
550	DR2-A5A	0.3	~3 <sup>50</sup>
	DR2-01A	0.5	8
200 V	DR2-02A	0.75	
	DR2-04A	1.2	
6	DR2-08A	2.2	
Nº.	DR2-A3B	0.25	tornat
S. C.	DR2-A5B	0.3	
ు <sup>ం</sup> 100 V	DR2-01B	0.5	30
100 V	DR2-02B	0.75	80
	DR2-03B	1.4	

Note At rated load.

3) When 400V class supply voltage is used:



3

# 3.8.8 Connector Terminal Layouts

This section describes connector terminal layouts for Servopacks, Servomotors and Digital Operator.

#### 1) Servopack Connectors for Speed/Torque and Position Control

ich ierminai Layout							89		
50	FG	Frame Ground	]	. And the	i.	18	PL3	Open Collector Refer- ence Power Supply	
49	*PSO	Line Driver output	1			17	VTG-M	Speed Monitor	
48	PSO	Phase-S	32	ALM-	6	16	TRQ-M	Torque Monitor	
47	+24V IN	External Input Power Supply	31	ALM+	Servo Alarm Output	15	CLR	Error Counter Clear	
46	N-CL	Reverse Current Limit ON Input	30	S-RDY-	Servo Ready Output	14	*CLR	Input	
45	P-CL	Forward Current Limit ON Input	29	S-RDY+	Servo Ready Output	13	PL2	Open Collector Refer- ence Power Supply	
44	ALM- RST	Alarm Reset Input	28	TGON-	TOON Output Signal	12	*SIGN	Deference Cian Innut	
43	N-OT	Reverse Running Pro- hibit Input	27	TGON+	TGON Output Signal	11	SIGN	Reference Sign Input	
42	P-OT	Forward Running Pro- hibit Input	26	CLT (COIN-)	Current Limit Detection	10	SG	GND	
41	P-CON	P Control Input	25	CLT (COIN+)	Output	9	T-REF	Torque Reference Input	
40	S-ON	Servo ON Input	24	-15V	Speed/Torque Refer-	8	*PULS	Reference Pulse Input	
39	ALO3	Alarm Code Output.	23	+15V	ence Power Supply	7	PULS		
38	ALO2	Open Collector Output	22	BAT-	Battery -	6	SG	GND	
37	ALO1	Rout	21	BAT+	Battery +	5	V-REF	Speed Reference Input	
36	*PBO	Line Driver Outrud	20	*PCO	Dia Dia Contract	4	SEN	SEN Signal Input	
35	PBO	Line Driver Output Phase-B	19	PCO	Line Driver Output Phase-C	3	PL1	Open Collector Refer- ence Power Supply	
34	*PAO	Line Driver Output	4		3	2	SG	0110	
33	PAO	Phase-A				1	SG	GND	

#### 1CN Terminal Layout

 Servopack Side Connector type: MR-50RFA4 (manufactured by Honda Tsushin Kogyo Co., Ltd.)

Cable Side

Connector type: MR-50M (Soldering type, manufactured by Honda Tsushin Kogyo Co., Ltd.)

MRP-50M01 (Caulking type, manufactured by Honda Tsushin Kogyo Co., Ltd.)

Connector case type: MR-50L (manufactured by Honda Tsushin Kogyo Co.,

Ltd.)

3.8.8 Connector Terminal Layouts cont.

#### **2CN Terminal Layout**

· For Incremental Encoder

~~~~
PG0V
PG0V
PG0V
PG5V
PG5V
PG5V
DIR
A. A
5

#### · For 12-bit Absolute Encoder

14	> PC	1	2	1	PG0V
15	*PC	8	PS 般	2	PG0V
15	Q*'	9	*PS	2	
16	PA N	10	RESET	3	PG0V
× 17	*PA	10	TESET	4	PG5V
18	PB	11	NN. C	5	PG5V
10	A.	12	BAT	J.	E.
19	*PB	13	BAT0	6	PG5V
20	FG	2	2	7	DIR
	N. A.	E.	- No		N.

Servopack Side Connector type: MR-20RMA4 (manufactured by Honda Tsushin Kogyo Co.,

Ltd.)

• Cable Side

Connector type: MR-20F (Soldering type, manufactured by Honda Tsushin Kogyo Co., Ltd.)

MRP-20F01 (Caulking type, manufactured by Honda Tsushin Kogyo Co., Ltd.)

Connector case type: MR-20L (manufactured by Honda Tsushin Kogyo Co.,

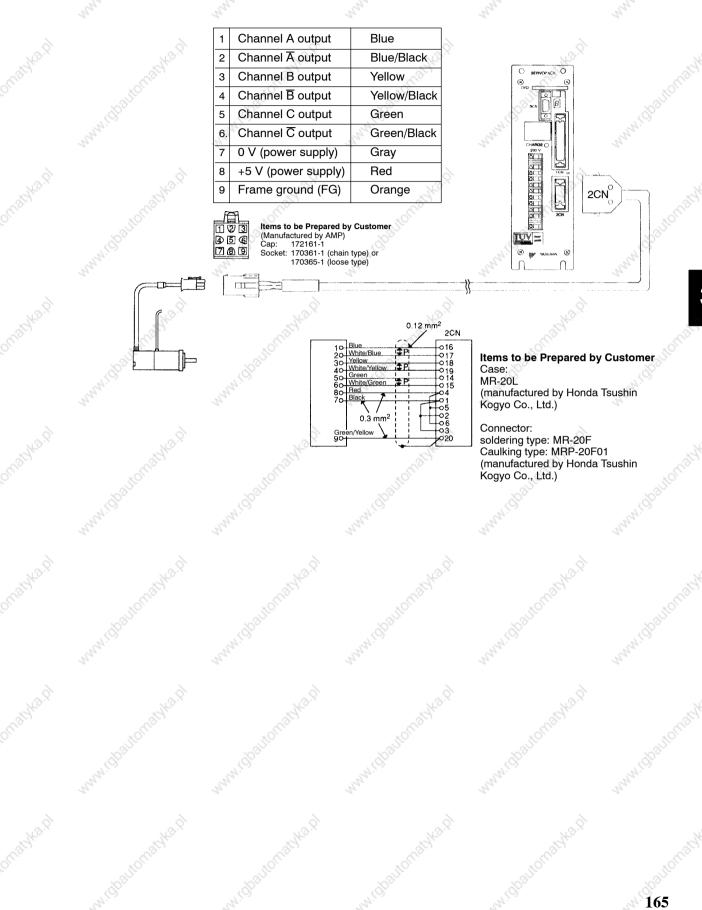
Ltd.)

3.8 Special Wiring

#### 2) Connectors for Incremental Encoder

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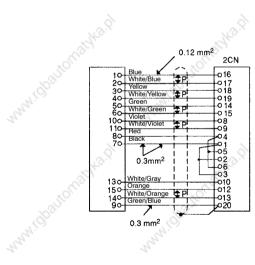
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Annah 100

#### 3) Connectors for Absolute Encoder

3.8.8 Connector	· Terminal Layouts cont.		and the second	all C	way to
14. <sup>10</sup>	3) Connectors	for <i>i</i>	Absolute Encoder		Anny COL
		1	Channel A output	Blue	
-NO.X	NO.Y	2	Channel A output	White/Blue	
- Clab	C. C. C.	3	Channel B output	Yellow	
1 <sup>10</sup>	and the second s	4	Channel B output	White/Yellow	and the second
	J. St.	5	Channel Z output	Green	, do
	ANN ST	6	Channel Z output	White/Green	and the second
	Do not use this termi-	7	0 V (power supply)	Black	1.
	nal. (It is used to dis-	8	+5 V (power supply)	Red 👌	O SERVOPACK C
No.	charge electricity from capacitor before ship-	9	Frame ground (FG)	Green/Yellow	×
allar,	ment.)	10	Channel S output	Purple	
and the		11	Channel S output	White/Purple	n the second
S.	1 CU	12	(Capacitor reset)	(Gray)	CHARGE O 200 V [Q]]
	3 <sup>51</sup> 3	13	Reset	White/Gray	
		14	0 V (battery)	White/Orange	
à	Ś	15	3.6 V (battery)	Orange	
N.Gballonable		) [	tems to be Prepared by Custome Manufactured by AMP) Cap:172163-1 Socket: 170361-1 (chain type) or 170365-1 (loose type)	r	

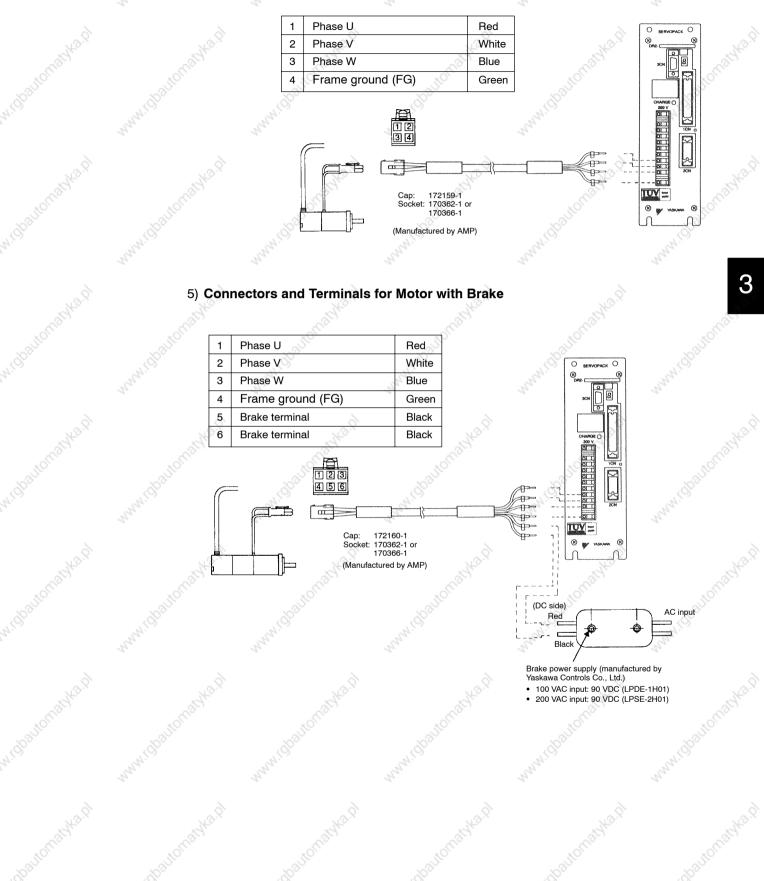


, dpautomatika, pl Items to be Prepared by Customer Case: MR-20L www.dbautomatika.pl (manufactured by Honda Tsushin Kogyo Co., Ltd.)

2CN

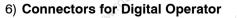
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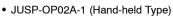
Connector: soldering type: MR-20F Caulking type: MRP-20F01 (manufactured by Honda Tsushin Kogyo Co., Ltd.)



4) Connectors and Terminals for Standard-type Motor without Brake

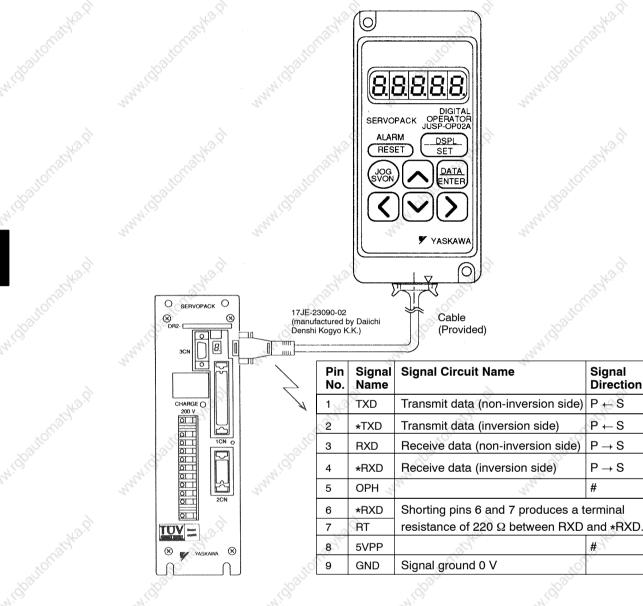
3.8.8 Connector Terminal Layouts cont.





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This chapter describes the basic operation of the digital operator and the convenient features it offers.

All constant settings and motor operations are possible by simple, convenient, operation.

Operate the digital operator as you read through this chapter.

4.1	Basi	c Operations	170
		Connecting the Digital Operator	170
24.1	4.1.2	Resetting Servo Alarms	171
	4.1.3	Basic Functions and Mode Selection	172
	4.1.4	Operation in Status Display Mode	173
	4.1.5	Operation in User Constant Setting Mode	176
	4.1.6	Operation in Monitor Mode	179
	305	100° to 100	
4.2	Usin	g the Functions	183
24.15		Operation in Alarm Trace-back Mode	183
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	4.2.3	Autotuning	188
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	4.2.7	Checking Motor Type	201
N. 197	4.2.8	Checking Software Version	201
24		Nº S	

4.1.1 Connecting the Digital Operator

#### **Basic Operations** 4.1

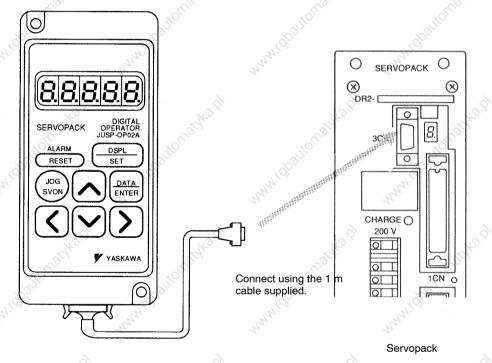
This section describes the basic operations using the Digital Operator.

4.1.1	Connecting the Digital Operator	170
4.1.2	Resetting Servo Alarms	171
4.1.3	Basic Functions and Mode Selection	172
4.1.4	Operation in Status Display Mode	173
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4.1.6	Operation in Monitor Mode	179

#### **Connecting the Digital Operator** 4.1.1

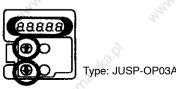
The applicable Digital Operator type is JUSP-OP02A-1 (Hand-held Type) . Hand-held type is connected to the Servopack as shown below.

JUSP-OP02A-1 (Hand-held Type)



 The Digital Operator connector can be connected or disconnected while the Servopack power is ON.

Note Mount type digital operator (JUSP-OP03A) cannot be used.



## 4.1.2 Resetting Servo Alarms

Servo alarms can be reset using the Digital Operator. (Servo alarms can also be reset by the 1CN-44, ALMRST input signal. Refer to 3.7.1 for details.)



**NOTE** After an alarm occurs, remove the cause of the alarm before resetting it. Refer to *Section 6.2 Troubleshooting* to determine and remedy the cause of an alarm.

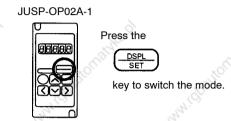
4.1.3 Basic Functions and Mode Selection

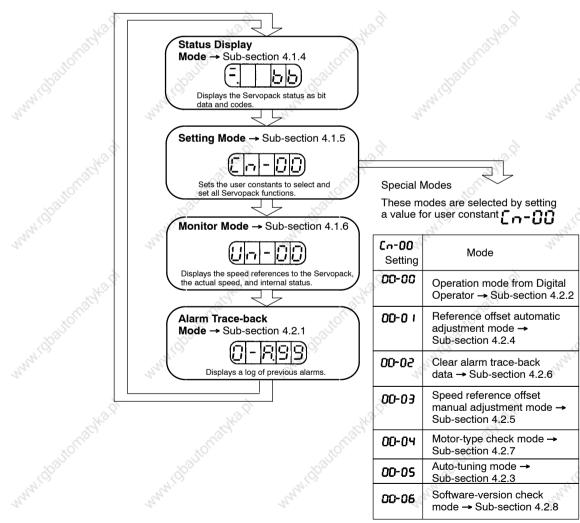
## 4.1.3 Basic Functions and Mode Selection

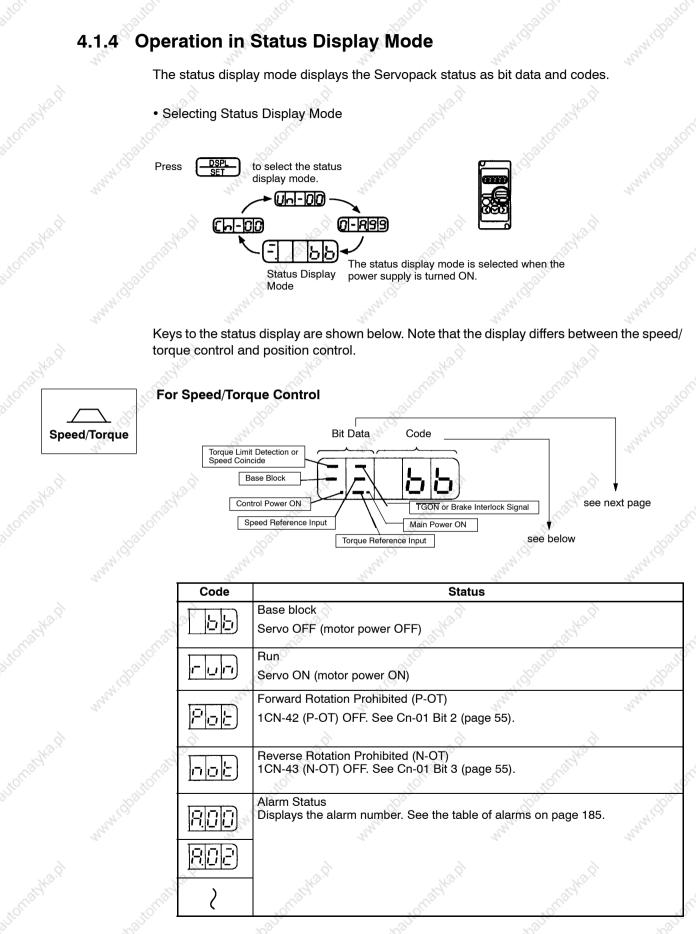
Digital Operator operation allows status display, user constant setting, operating reference, and auto-tuning operations.

**Basic Mode Selection** 

The four basic modes are listed below. Each time the mode key is pressed, the next mode in the sequence is selected.







4.1.4 Operation in Status Display Mode cont. www.idoal

Mode cont.	-auton
Bit Data	Description
Control Power ON	Lit when Servopack control power ON. Not lit when Servopack control power OFF.
Main Power ON	Lit when Servopack main circuit power ON. Not lit when Servopack main circuit power OFF.
Base Block	Lit for base block. not lit at servo ON.
Torque Limit Detection or Speed Coincide (Selected by Cn-01 bit 4) TGON or Brake Interlock Signal	Lit if Servopack internal torque reference exceeds preset value. Not lit if Servopack internal torque reference is below preset value. Preset value: Set in Cn-08, -09 (max. torque is standard setting) Cn-18 is preset value during 1CN-45 (P-CL) input. Cn-19 is preset value during 1CN-46 (N-CL) input. (100% of rated torque are standard setting for Cn-18, Cn-19) Not lit during torque control. Lit if motor speed reaches speed reference. Otherwise, not lit. Lit if motor speed exceeds preset value.
(selected by Cn-01 Bit E)	Not lit if motor speed exceeds preset value. Preset value: Set in Cn-0B (20 r/min is factory setting)
abyka.h	When brake interlock is ON, between 1CN-27 and -28 is closed and 1CN-27 is Low level, lit when brake is releaded. When brake interlock is OFF, between 1CN-27 and -28 is open and 1CN-27 is High level, not lit when brake operates.
Speed Reference Input	Lit if input speed reference exceeds preset value. Not lit if input speed reference is below preset value. Specified value: Set in Cn-0B (20 r/min is factory setting)
Torque Reference Input	Lit if input torque reference exceeds preset value. Not lit if input torque reference is below preset value. Preset value: Set in Cn-0B (10% rated torque is standard setting)

4

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all all	asha?	ad that	ad the fait	4.1 Bas	ic Operations
M. Goallont	For Position C	ontrol	and the state of the second se	www.idbaltonic	www.gautone
Positions	Positio	Base Block trol Power ON Reference Pulse Input	TGON or Brake Interlock Signal	see below	ext page
-Hail	No.A.	No.P.	No.9	12.Q.	No.
W. Challonas		Base block Servo OFF Run	Status	NALIDBOLIONION	MAN LIBOUR MARS
. tonatikan	Pob Pob	Servo ON Forward Rotation Pro	ohibited See Cn-01 Bit 2 (page 5	5).	AND
and a same		Alarm Status	. See Cn-01 Bit 3 (page 5	£1.	enner Charles
M. GBaltonadyapt	<u>800</u> )   <u>802</u>  }	-35Ha.P	umber. See the table of a	ASHAR.P.	www.ldtautsmatthat
M.GBaltonadian	idballonabyka.hl	.tobattomatyka.pl	www.cobautomatyka.pl	MM. Gballonaykapt	www.igbautomatykar
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M.Gballomadkant MMM	idizationatyka.pl	.Fobautomatyka.ht	www.dbautomatyka.hl	MM. Gbatomatykapi	man 175

4.1.5 Operation in User Constant Setting Mode

Bit Data	Description
Control Power ON	Lit when Servopack control power ON. Not lit when Servopack control power OFF.
Main Power ON	Lit when Servopack main circuit power ON. Not lit when Servopack main circuit power OFF.
Base Block	Lit for base block. Not lit at servo ON.
Positioning Complete	Lit if error between position reference and actual motor position is below preset value. Not lit if error between position reference and actual motor position exceeds preset value. Preset value: Set in Cn-1B (1 pulse is standard setting)
TGON or Brake Interlock Signal (selected by Cn-01 Bit E)	Lit if motor speed exceeds preset value. Not lit if motor speed is below preset value. Preset value: Set in Cn-0B (20 r/min is standard setting)
and and a start and a start and a start a star	When brake interlock is ON, between 1CN-27 and -28 is closed and 1CN-27 is Low level, lit when brake is releaded. When brake interlock is OFF, between 1CN-27 and -28 is open and 1CN-27 is High level, not lit when brake operates.
Reference Pulse Input	Lit if reference pulse is input. Not lit if no reference pulse is input.
CLR Input	Lit when clear signal is input. Not lit when clear signal is not input.

## 4.1.5 Operation in User Constant Setting Mode

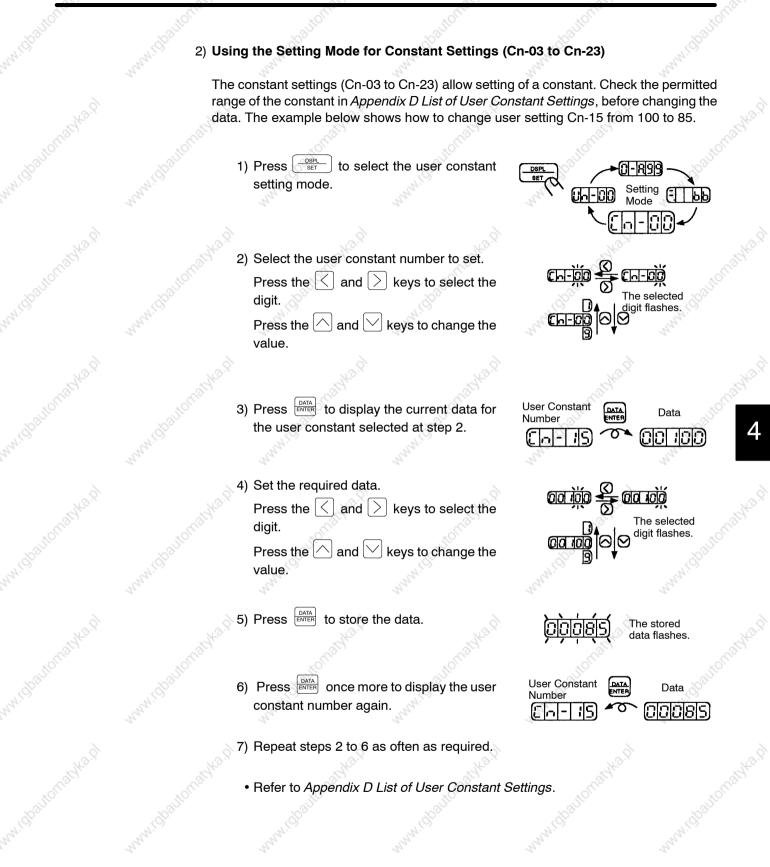
1) Two types of user constant are used

- a) Constant Settings (Cn-03 to Cn-23)
- b) Memory Switches (Cn-01, Cn-02)

The setting method is different for each type.

The Servopack offers a large number of functions, which are selected and adjusted by the user constant settings.

The constant settings (Cn-03 to Cn-23) allow setting of a constant within a fixed range. The memory switches (Cn-01, Cn-02) allow the required functions to be selected. Refer to *Appendix D List of User Constant Settings*.



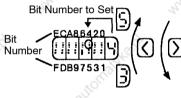
4.1.5 Operation in User Constant Setting Mode cont.

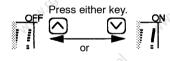
3) Using the Setting Mode for Memory Switches (Cn-01, Cn-02)

**Turn the bits of the memory switches ON and OFF** to select the functions required. The example below shows how to turn ON Bit 4 of memory switch Cn-01.

- Press been set in the set of th
- 2) Select the user constant number to set.
  Press the and keys to select the digit.
  Press the and keys to change the
- 3) Press DATA to display the current data for the memory switch selected at step 2.

- User Constant Us
- Press the ≤ and ≥ keys to select the bit number to set.
- 5) Press the And Weys to set the memory switch data ON or OFF for the bit number.
- 6) Repeat steps 4 and 5 as often as required.
- 7) Press to <u>store the data</u>.





The stored data flashes.

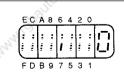


#### Turning Bits ON and OFF

value.

Memory switches use bits, not numbers, to select functions.

Sixteen bits are available (1 to 9 and A to E). Select the required functions by turning the appropriate bit ON (function ON) or OFF (function OFF).



4.1 Basic Operations

Memory

Ы

 $\nabla$ 

Data

Data

1518

 $\Box$ 

-1-10G

Monitor

Mode

6-899

DATA

DATA

Switch Data

. . . . . . . .

User Constant

n|-|A

Number

DSPL

Monitor

Number

00-1-1010

Monitor

Number

ristellele

E

- 8) Press ENTER once more to display the user constant number again.
  - Refer to Appendix D List of User Constant Settings.

## 4.1.6 Operation in Monitor Mode

- 1) The monitor mode allows the reference values input into the Servopack, I/O signal status, and Servopack internal status to be monitored.
  - The monitor mode can be set during motor operation.

#### 2) Using the Monitor Mode

The example below shows how to display 1500, the contents of monitor number Un-00.

- 1) Press  $\begin{bmatrix} DSPL \\ SET \end{bmatrix}$  to select the monitor mode
- 2) Press the 🛆 and 🖂 keys to select the monitor number to display.
- 3) Press Data to display the data for the monitor number selected at step 2.
- 4) Press once more to display the monitor number again.

F

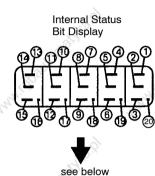
4.1.6 Operation in Monitor Mode cont.

 Keys to Monitor Mode Display are shown below. Note that the display differs between the speed/torque control and position control types.

# Speed/Torque

For	Speed/	/Torque	Control	
	x ~ 2 ~			

Monitor Number	Monitor Display
Un-00	Actual motor speed Units: r/min
Un-0 I	Input speed reference Units: r/min
Un-02	Internal torque reference Units: % (with respect to rated torque)
Un-03	Number of pulses from motor U-phase edge
-	Units: pulses
Un-04	Electrical angle Units: 0.1deg
Un-05	Internal status bit display -



Bit # Description Related I/O Signal, User Constant 1CN-31(ALM) 1 Servo alarm 2 Dynamic brake ON Reverse rotation mode Cn-02 Bit 0, 2CN-7(DIR) 3 1CN-27 (TG-ON), status display 4 During motor rotation or brake interlock signal mode 5 Torque limit or speed coincide 1CN-25 (V-CMP), status display mode Mode switch ON 6 1CN-45 (P-CL) 7 During forward torque Or contact input speed control limit During reverse torque 1CN-46 (N-CL) 8 limit 9 Motor power ON 10 A-phase 2CN-33(PA), 2CN-34(\*PA) 11 **B**-phase 2CN-35(PB), 2CN-36(\*PB) 12 C-phase 2CN-19(PC), 2CN-20(\*PC) 13 U-phase Only when incremental encoder is used. Only when incremental encoder is 14 V-phase used W-phase Only when incremental encoder is 15 used. 1CN-40 (S-ON), Cn-01 Bit 0 16 Servo ON 1CN-41 (P-CON), Cn-01 Bit A, B, 17 P operation, zero clamp, or rotation direction Cn-02 Bit 2 input 18 Forward overtravel 1CN-42 (P-OT), Cn-01 Bit 2 1CN-43 (N-OT), Cn-01 Bit 3 19 Reverse overtravel 20 SEN signal input 1CN-4 (SEN)

#### 4.1 Basic Operations



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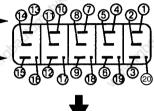
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	Tes.		"Ver	"Con	
	JOTT		utorn	autonit	
	For Position	Cont	rol		4444
sitions	Monito Numbe	-	Monitor D	isplay	
	Un-00	Ac	tual motor speed	Units: r/min	
1.000	Jon 02		ernal torque reference hits: % (with respec	ct to rated torque)	
3525	Un-03	Nu	imber of pulses from m	otor U-phase edge Units: pulses	- day
	վո-ՕԿ	Ele	ectrical angle	Units: 0.1deg	
	Un-05	Int	ernal status bit display	anaby.	
, S	Un-05	Int	ernal status bit display	partic	
ACALCA.	Un-08		sitional error hits: x1 reference unit ( x100 reference un	Cn-02 Bit E = 0) it  (Cn-02 Bit E = 1	)
	Un-09		eference pulse counter hits: Reference unit Displays 0 to 6553	No	
	360.	, S <sup>2</sup>	, <sup>360</sup> ,	paulo.	
A. M. M.	Monitor #	Bit #	Descrip	otion	10-10-10
	Un-05	1	Servo alarm		1C

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Internal Status Bit Display



		»-		allon-	
Monitor #	Bit #	Descri	ption	Related I/O Signal, Use Constant	er
Un-05	1	Servo alarm		1CN-31 (ALM)	
2	2	Dynamic brake ON	2	20	
	3	Reverse rotation mod	de 🔬	Cn-02 Bit 0, 2CN-7 (DIR)	
	4	During motor rotation signal	or brake interlock	1CN-27 (TG-ON), status dis mode	splay
	5	Positioning complete	<u>8</u>	1CN-25 (COIN) , status dis mode	olay
	6	Mode switch ON		4. H.	
ġ.	7		Or contact input speed control	1CN-45 (P-CL)	
	8	During reverse torque limit	madhe	1CN-46 (N-CL)	
	9	Motor power ON	alle and a second	alle alle	2
	10	A-phase	50	2CN-33(PA), 2CN-34(*PA)	0
	e <sup>2</sup> 11	B-phase		2CN-35(PB), 2CN-36(*PB)	7.
	12	C-phase		2CN-19(PC), 2CN-20(*PC)	
3. <sup>9</sup>	13	U-phase		Only when incremental enc is used.	oder
	14	V-phase	automore	Only when incremental enc is used.	oder
	15	W-phase	900	Only when incremental enc is used.	oder
	16	Servo ON		1CN-40 (S-ON), Cn-01 Bit (	)
	17	P operation or rotation	on direction input	1CN-41 (P-CON)	
S.	18	Forward overtravel		1CN-42 (P-OT), Cn-01 Bit 2	
	19	Reverse overtravel	and the second	1CN-43 (N-OT), Cn-01 Bit 3	3
	20	Not used			
	www.ido	Sur		and the series and	181

4.1.6 Operation in Monitor Mode cont. Margari (1881

Mode cont.		isalto".	ballon. bal
Monitor #	Bit #	Description	Related I/O Signal, User Constant
Un-06	1	Input reference pulse	1CN-1 (PLUS), 1CN-2(*PULS)
. A	2	Input pulse sign	1CN-3(SIGN), 1CN-4 (*SIGN)
and the	3	Error counter clear input	1CN-5 (CLR), 1CN-6(*CLR)
autorit	4 to 12	Not used.	diautorit data
	13	Full-closed Phase-A	4CN-2 (FA), 4CN-3 ( <b>*</b> FA)
	14	Full-closed Phase-B	4CN-4 (FB), 4CN-5 ( <b>*</b> FB)
d'	15	Full-closed Phase-C	4CN-6 (FC), 4CN-7 (*FC)
. HOTOTOMO	16 to 20	Not used.	. tomaste

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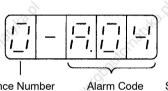
## 4.2 Using the Functions

This section describes how to use the basic operations described in section 1 to operate and adjust the motor.

	4.2.1	Operation in Alarm Trace-back Mode	183
	4.2.2	Operation Using the Digital Operator	186
	4.2.3 📎	Autotuning	188
	4.2.4	Reference Offset Automatic Adjustment	195
	4.2.5	Speed Reference Offset Manual Adjustment Mode	197
50	4.2.6	Clearing Alarm Trace-back Data	200
	4.2.7	Checking Motor Type	201
	4.2.8	Checking Software Version	201

## 4.2.1 Operation in Alarm Trace-back Mode

 The alarm trace-back mode displays up to ten alarms which occurred previously. By allowing confirmation of what alarm occurred when, it is a useful aid to speed up troubleshooting.



Alarm Sequence Number The higher the number, the older the alarm data See the table of alarms on page 185.

NOTE The alarm trace-back data is not cleared on alarm reset or when the Servopack power is turned OFF. This does not adversely affect operation.
 The data is cleared using the special mode: Clear alarm trace-back data.
 Refer to sub-section *4.2.6* for details.

4.2.1 Operation in Alarm Trace-back Mode cont.

2) Using the Alarm Trace-back Mode

alarm data.

Follow the procedure below to determine which alarms occurred previously.

1) Press DBPL to select the alarm traceback mode.

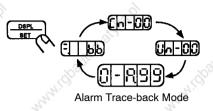
2) Press the  $\bigtriangleup$  and  $\bigotimes$  keys to scroll the

alarm sequence numbers up and down

and display information on previous

alarms. The higher the left-hand digit

(alarm sequence number), the older the



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www.dbautor 3) The table below lists the alarms displayed in the alarm trace-back mode.

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Displayed Alarm Code	Description
R.0.0	Absolute data error
8.0.2	User constant breakdown
804	User constant setting error
	Overcurrent
8.20	Blown fuse
R.3.0	Regenerative error
8,3 1	Position error pulse overflow (for position control only)
À RYD	Overvoltage
8.5 /	Overspeed
สาญ	Overload
880	Absolute encoder error
× 8.8 i	Absolute encoder back-up error
8.82	Absolute encoder checksum error
883	Absolute encoder battery error
<u></u>	Absolute encoder data error
× 885	Absolute encoder overspeed
8.6 I N	Reference input read error
200	Servo overrun detected (This function prevents (or minimizes)
8.6.7	overrun.) Encoder output phase error
8.6.2	Incremental encoder initial pulse error Encoder A-, B-phase disconnection
<u> </u>	AND
864	Encoder C-phase disconnection
RE 6	External PG A-, B-phase disconnection
	External PG C-phase disconnection
899	Not an alarm. Reset by alarm reset or Servopack power ON.

4.2.2 Operation Using the Digital Operator

The following are operator-related alarms which are not recorded by alarm trace-back.

CRFOO	Digital Operator transmission error 1	10.A	7
СРЕОТ	Digital Operator transmission error 2	NOT RALL.	
		6V	

• Refer to the troubleshooting procedures when an alarm occurs, described in section 6.2.

### 4.2.2 Operation Using the Digital Operator

#### Simple Motor Check

Operation from the Digital Operator allows the Servopack to run the motor. This allows rapid checking of basic operations during machine set-up and testing, without the trouble of connecting a host controller.

Used during machine set-up and testing. Forward, reverse, speed settings possible. Power No need to connect to host controller or external circuits. Motor can be run just from the Digital Operator.

#### 1) Operation Using the Digital Operator

Use the following procedure to operate the motor from the Digital Operator

1) Press <u>set</u> to select the user constant setting mode.

Ĥ

0-899 DSPL 00-100 Setting Mode

2) Select the user constant number Cn-00. (User constant Cn-00 is selected when the power is turned ON.)

Press the  $\leq$  and  $\geq$  keys to select the digit.

Press the  $\bigtriangleup$  and  $\bigvee$  keys to change the value.

- 3) Press ENTER to display the current data for the user constant Cn-00.
- 4) Press the 🖄 and 🖂 keys to change the data to 00.

(This user constant is set to 00 when the power is turned ON.)

5) Press (SET) to set the Digital Operator in operation mode. Operation is now possible under Digital Operator control.

 Press (JOG SVON) to set the servo ON status (motor power turned ON).

Select Servo ON/Servo OFF

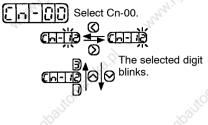
Press the and keys to operate the motor.

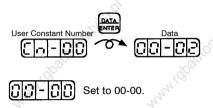
Motor Forward/Reverse Rotation

8) Press bereform to revert to bereform. This sets the servo OFF status (motor power turned OFF).

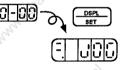
(Alternatively, press  $\begin{pmatrix} JOG \\ SVON \end{pmatrix}$  to set the servo OFF status.)

 Press ENTER to return to the setting mode display. This disables operation under Digital Operator control.

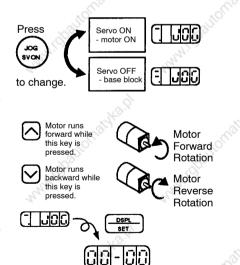








Display for operation mode from Digital Operator



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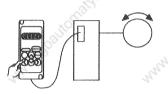
#### 4.2.3 Autotuning

#### 2) Changing Motor Speed

The motor speed for operation under Digital Operator control can be changed with a following user constant.

Cn-10	JOGSPD Jog Speed	Unit: r/min	Setting Range: 0 to MAX. Speed	Factory Setting: 500	For Speed/ Torque Control and Position Control

Set the motor speed (JOG speed) in this user constant when motor is operated using the digital operator.



Set the motor speed (JOG speed) in this user constant when motor is operated using the digital operator.

For details about setting the motor speed, refer to 4.1.5 Operation in User Constant Setting Mode and Appendix D List of User Constants.

## 4.2.3 Autotuning

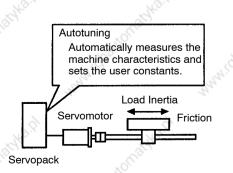


No experience required to achieve optimum settings.

The Servopack contains a built-in autotuning function to automatically measure the machine characteristics and set the user constants.

Servo drives normally require tuning to match the machine configuration and rigidity. This tuning requires a great deal of experience and is difficult for a person unfamiliar with the tuning procedure.

However, autotuning allows even totally inexperienced people to easily complete the tuning.





Autotuning is similar to auto-focus for a camera.

Speed/To	∑ orque	Speed/torque control	Position	Position control
Cn-04	Spee	ed loop gain	Cn-04	Speed loop gain
Cn-05	Spee	ed loop integration time	Cn-05	Speed loop integration time constant
51	2	13 <sup>1</sup>	Cn-1A	Position loop gain

#### 3) User Constants Automatically Settable with Autotuning

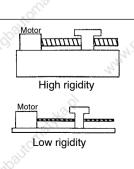
Once autotuning has been completed, the autotuning procedure can be omitted for subsequent machines, providing the machine specifications remain unchanged. It is sufficient to directly set the user constants for subsequent machines. The **machine rigidity** can be selected from one of seven levels.

- **NOTE** Conduct autotuning with the motor attached to the machine. Make sure that the machine is ready for operation and take sufficient safety precautions when operating the machine.
  - Make sure that the P-CON signal is OFF (PI control is selected) before starting autotuning.
  - Before conducting autotuning, make sure that setting of user constant Cn-10 is 500 (factory setting).
  - Make sure that the speed control mode is set to PI control before starting autotuning. If the mode switch is used, PI control automatically switches to P control above a set operating level (PI control to P control switching level), even if the P-CON signal is OFF. If the mode switch is used, follow operation a) or operation b) below before starting autotuning.
    - a) Set the user constants to disable the mode switch.
       Speed control: Set both Cn-01 Bit C and Bit D to 1.
       Position control: Set both Cn-01 Bit B to 1.
    - b) Increase the operating level, such that P control is not selected. In practice, set the operating level as shown in the table below.



#### Machine Rigidity

The machine rigidity is one of the machine characteristics related to servo control. Set the servo to high response for a machine, such as a machine tool, with high rigidity, and to low response for a machine, such as a robot, with low rigidity.



4.2.3 Autotuning cont.

	uton ballon	1081401 1081401	1081101
A. 19	Operating Level	User Constant Setting	. and .
	Torque reference	Cn-0C to maximum torque	200
Ī	Speed reference	Cn-0D to a preset value exceeding Cn-10	
Ī	Acceleration	Cn-0E to the maximum value: 3000	
Ī	Error pulse	Cn-0F to the maximum value: 10000	23
	Hoft. Hoft.	ton. ton.	. HORT

Refer to 3.6.6 using mode switch for details of the mode switch function. www.gautonaylan www.cballonatykal www.clautonasko

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www.dbautonastka.pl

4.2 Using the Functions

#### 4) Using Autotuning

Follow the procedure below to run autotuning.

- 1) Press <u>SET</u> to select the user constant setting mode.
- Select the user constant number Cn-00. (User constant Cn-00 is selected when the power is turned ON.)

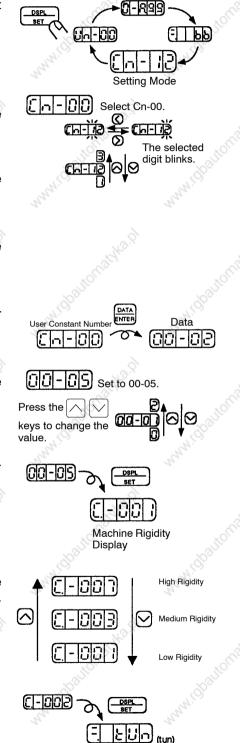
Press the  $\leq$  and  $\geq$  keys to select the digit.

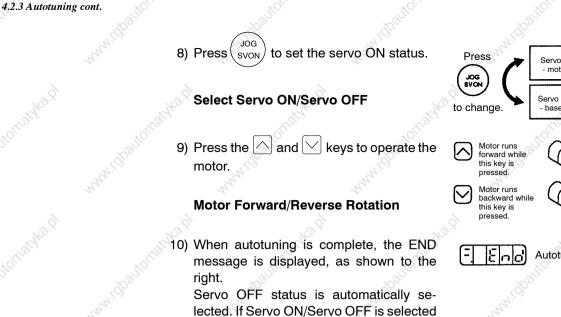
Press the  $\bigtriangleup$  and  $\bigvee$  keys to change the value.

- 3) Press *DATA* to display the current data for the user constant Cn-00.
- 4) Press the 🛆 and 🖂 keys to change the data to 05.
- Press by the machine rigidity.

Press the and keys to select the machine rigidity. If the actual rigidity is unknown, select medium rigidity.

7) Press  $\frac{\text{DSPL}}{\text{SET}}$  to select autotuning mode.

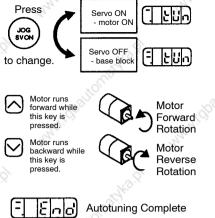




11) Release the A and keys to revert to the CC-OS display.

by a signal from an external contact, turn

12) Press LATA TO return to the setting mode display. This ends the autotuning operation.



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00-09

Setting Mode Display Refer to sub-section 3) on page 192 for the precautions relating to autotuning

#### 5) Precautions Relating to Autotuning

this signal OFF.

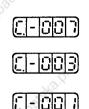
a) Speed Setting During Autotuning

The motor speed during autotuning is set by user constant Cn-10. Set to 500 r/min., which is the factory setting. Autotuning may be unsuccessful if this value is set too low.

The motor runs intermittently while the  $[\land]$  or  $[\checkmark]$ key is held down. The motor does not rotate continuously.

#### b) Machine Rigidity Selection

Select the machine rigidity as described below. If the actual rigidity is unknown, select medium rigidity.



**High Rigidity** 

Low Rigidity

Medium Rigidity

If the Machine Resonates

At servo ON when the  $\binom{JOG}{SVON}$  key is pressed or when the motor is operated by press-

ing the  $\bigcirc$  or  $\bigcirc$  key, machine resonance indicates an inappropriate machine rigidity setting.

Follow the procedure below to correct the machine rigidity setting, and run autotuning once more.

(1) Press the  $\frac{DSPL}{SET}$  key to cancel autotuning.

(2) Press the <u>set</u> key once more to enter the machine rigidity setting mode. Reduce the setting by one.

If Autotuning Does Not End

(1) Press the  $\left\lfloor \frac{DSPL}{SET} \right\rfloor$  key to cancel autotuning.

(2) Press the <u>set</u> key once more to enter the machine rigidity setting mode. Increase the setting by one.

Autotuning may not end for machines with large play or extremely low rigidity. In these cases, use conventional manual adjustment.

4.2.3 Autotuning cont.

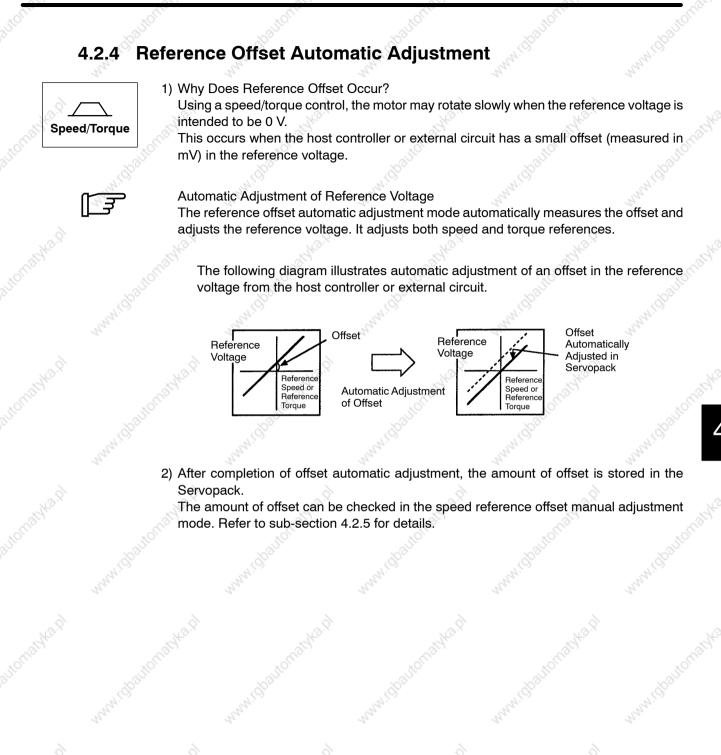
- c) Input Signals
- The OT signal and SEN signal (absolute encoder only) are enabled during autotuning. Input the OT signal and SEN signal (absolute encoder only) during autotuning. To conduct autotuning without inputting these signals, set user constant Cn-01 Bits 1, 2, and 3 to 1.
- · Autotuning is not possible during overtravel (P-OT or N-OT signal OFF). Load N-OT ON P-OT Motor OFF Load p-ot ON N-OT ON Motor
- · Conduct autotuning when no overtravel has occurred (both P-OT and N-OT signal ON).
- Set the P-CON signal OFF during autotuning.

If the mode switch is used, take one of the steps below before running autotuning.

- (1) Cancel the mode switch.
- (2) Set the mode switch operating level to a high level.

Refer to page 122 for details about setting the mode switch.

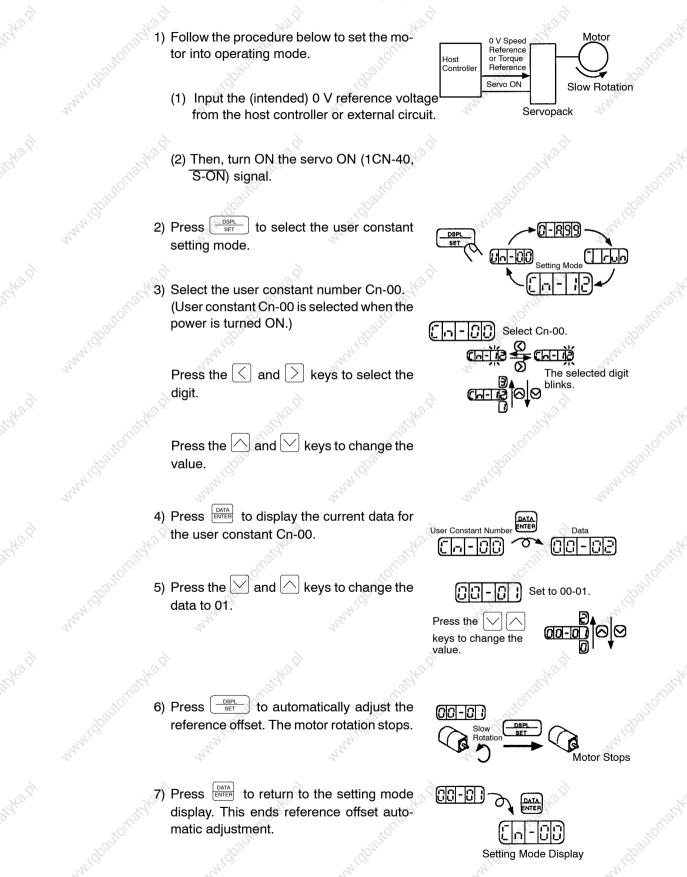
 If using the S-ON signal to set the servo ON status, display before turning End ON the S-ON signal.



4.2.4 Reference Offset Automatic Adjustment cont.

#### 3) Using the Reference Offset Automatic Adjustment Mode

Follow the procedure below to automatically adjust the reference offset.



4) The reference offset automatic adjustment mode cannot be used where a position loop is formed with the host controller and the error pulses are zeroed when servo lock is stopped.

In this case, use the speed reference offset manual adjustment mode. Refer to sub-section 4.2.5 for details.

Zero-clamp speed control is available to force the motor to stop during zero speed reference. Refer to sub-section 3.4.3 for details.

## 4.2.5 Speed Reference Offset Manual Adjustment Mode



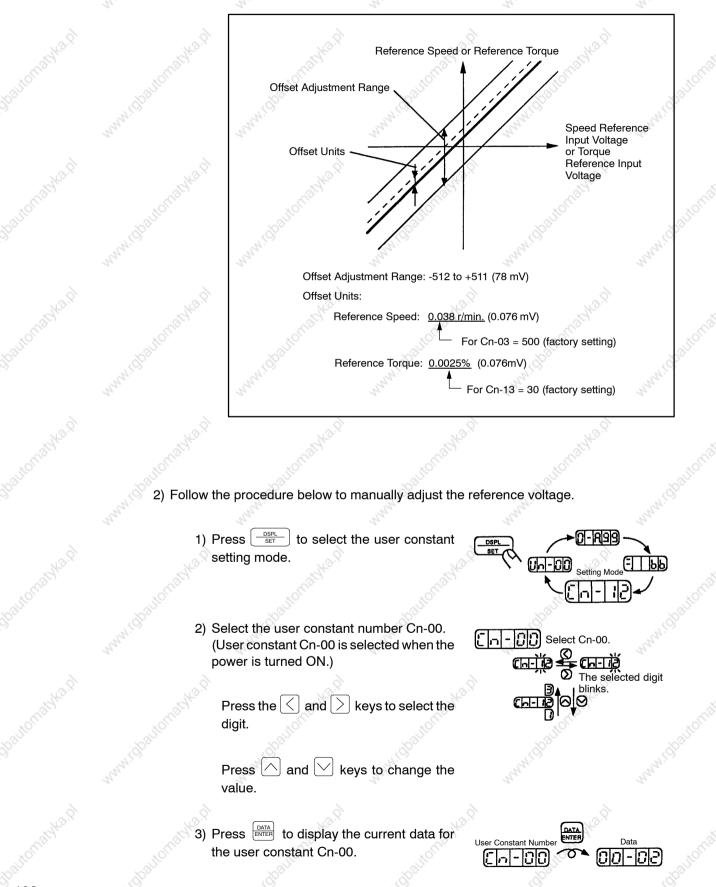
- 1) Speed reference offset manual adjustment is available for the speed/torque control. It is very convenient in the following situations:
  - If a position loop is formed with the host controller and the error pulses are zeroed when servo lock is stopped.
  - To deliberately set the offset to some value.

This mode can also be used to check the data set in the reference offset automatic adjustment mode.

In principle, this mode operates in the same way as the reference offset automatic adjustment mode, except that the amount of offset is directly input during the adjustment. The offset can be set for speed references only.

4.2.5 Speed Reference Offset Manual Adjustment Mode cont.

Offset Adjustment Range and Setting Units are as follows:



4.2 Using the Functions

4) Press the || and ||keys to change the **CO-C3** Set to 00-03. data to 03. Press the  $\sim$ ଚାତ keys to change the value. 5) Press to select the speed refer-DSPL SET ence offset manual adjustment mode. Speed Reference 8000 Offset Manual (The amount of speed reference offset is Adjustment Mode displayed.) 6) Press the  $|\wedge|$ and  $\bigvee$ keys to adjust the amount of offset. (Adjust the speed references.) 7) Press to enter the torque refer-8-003 ence offset manual adjustment mode. DSPL SET (The amount of torque reference offset is displayed.) 00 8) Press the  $|\wedge|$  and  $|\vee|$ keys to adjust the amount of offset. (Adjust the torque references.) 9) Press to return to the user constant 61 101016 DSPL SET data display. 03 10) Press ENTER to return to the setting mode 60-03 DATA display. This ends the reference offset manual adjustment.  $\mathbf{n}$ 

4.2.6 Clearing Alarm Trace-back Data

## 4.2.6 Clearing Alarm Trace-back Data

1) This procedure clears the alarm history, which stores the alarms occurring in the Servopack. Each alarm in the alarm history is set to A99, which is not an alarm code. Refer to *4.2.1 Operation in Alarm Trace-back Mode* for details.

> DSPL SET

2) Follow the procedure below to clear the alarm trace-back data.

- Press <sup>DSPL</sup> SET
   to select the user constant setting mode.
- Select the user constant number Cn-00. (User constant Cn-00 is selected when the power is turned ON.)
- Image: Select Cn-00.

   Image: Select Cn-00.
   </tr

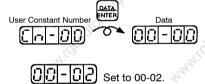
01-100

0-899

Setting Mod

Press the  $\leq$  and  $\geq$  keys to select the digit.

- Press the  $\bigtriangleup$  and  $\bigtriangledown$  keys to change the value.
- 3) Press KITER to display the current data for the user constant Cn-00.
- 4) Press the 🖄 and 💟 keys to change the data to 02.
- 5) Press bereformed to clear the alarm trace-back data.
- 6) Press ENTER to return to the user constant data display.



Press the V Press

Clear the alarm trace-back data.

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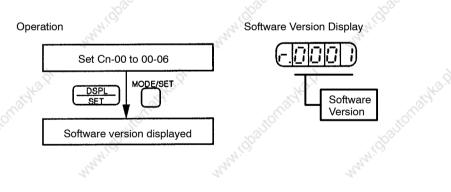
DSP

User Constant Nu

#### 4.2.7 Checking Motor Type 1) Set Cn-00 to 00-04 to select the motor-type check mode. This mode is used for maintenance and is not normally used by the customer. Operation Motor Type Display Set Cn-00 to 00-04 8000 MODE/SET Motor Capacity DSP 9E: 30W Motor Type 0: SGM 200V 1: SGM 100V 2: SGMP 200V 3: SGMP 100V b2: 50W 01: 100W 02: 200W Motor type displayed 03: 300W 04: 400W 08: 750W MODE/SET DSF Modification Index Modification Index (Modification No.) Display (Modification No.) displayed Hexadecimal Display 0000 $(1) \times 16^3 + (2) \times 16^2 + (3) \times 16 + (4)$ Modification index (Modification No.)

## 4.2.8 Checking Software Version

1) Set Cn-00 to 00-06 to select the software-version check mode. This mode is used for maintenance and is not normally used by the customer.



# SERVO SELECTION AND DATA SHEETS

This chapter describes how to select  $\Sigma$ -Series servo drives and peripheral devices.

The section also presents the specifications and dimensional drawings required for selection and design.

Choose and carefully read the relevant sections of this chapter.

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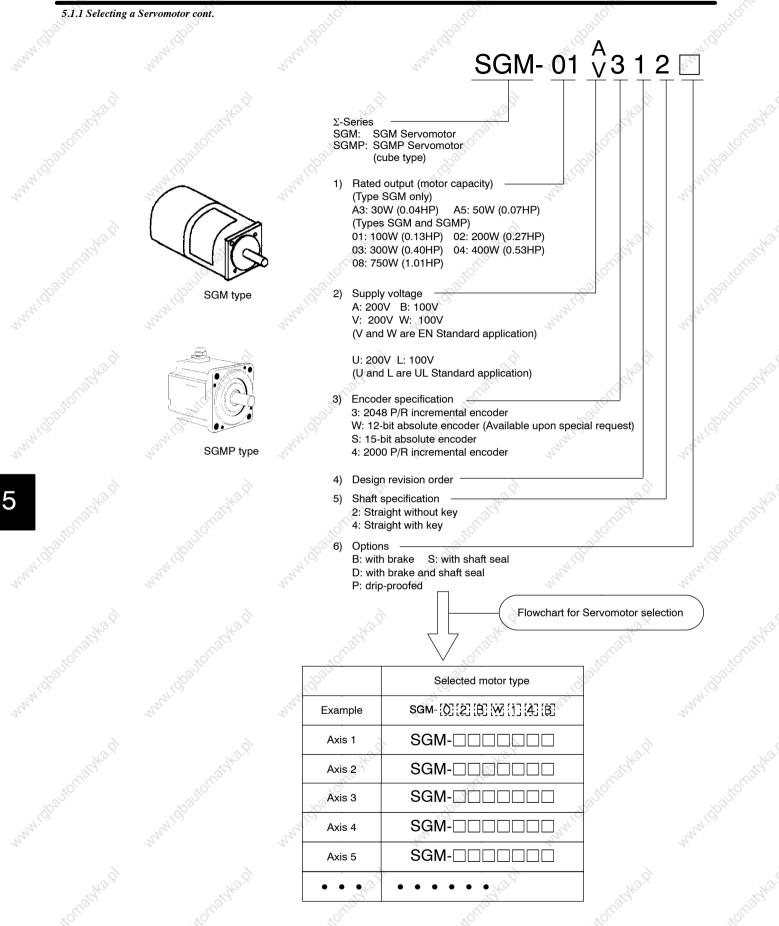
# 5.1 Selecting a $\Sigma$ -Series Servo

This section describes how to select the  $\Sigma$ -Series Servomotor, Servopack, and Digital Operator.

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5.1.3	Digital Operator	216

## 5.1.1 Selecting a Servomotor

1) The selection of an SGM or SGMP Servomotor matched to the servo system in which it is used is based on the servomotor type, that is, the seven alphanumeric characters after "SGM-" or "SGMP-", described below. The numbers (1) to (6) below correspond to the numbers in the flowchart for Servomotor selection on the following pages.



 The actual selection of the SGM or SGMP Servomotor is conducted according to the flowchart in the next page.

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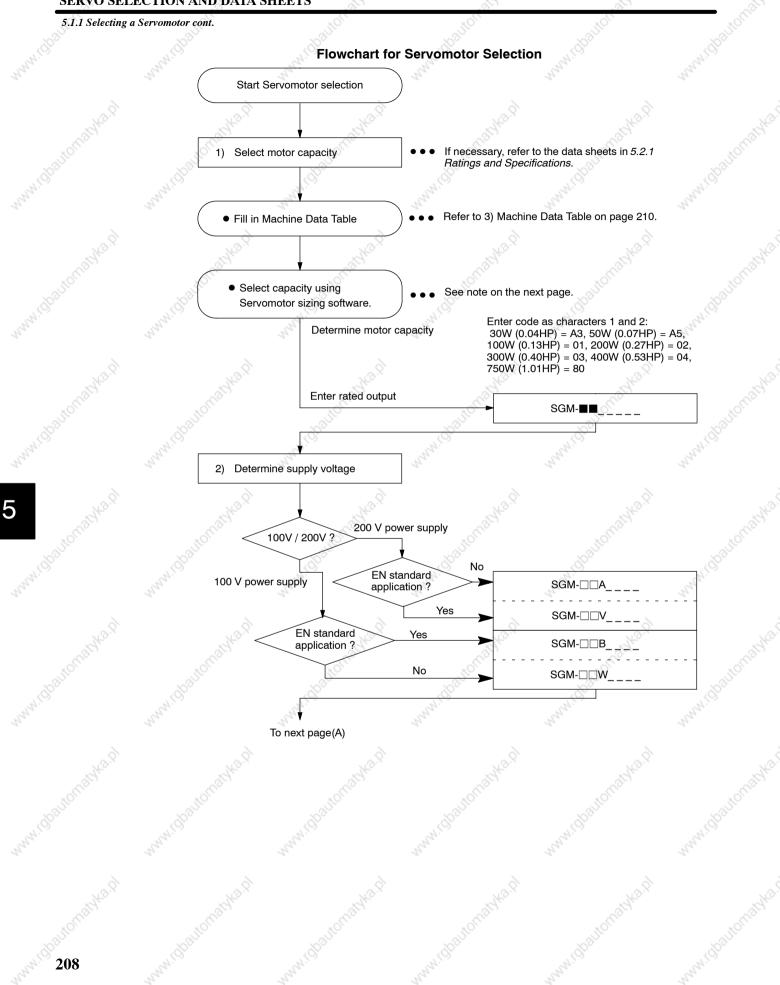
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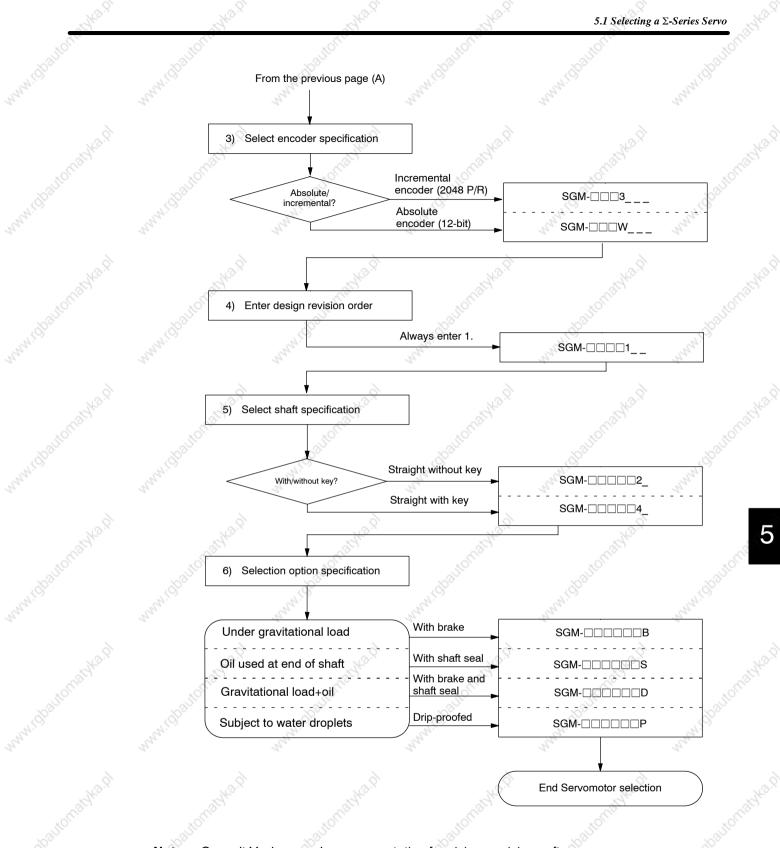
If an SGMP Servomotor is selected, replace SGM with SGMP. SGMP Servomotors are available from 100W (0.13HP) to 750W (1.01HP). A 1500W (2.01HP) type also exists but the DR2 Servopack can handle up to 750W (1.01HP).

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Note Consult Yaskawa sales representative for sizing or sizing software.

5.1.1 Selecting a Servomotor cont.

3) Machine Data Table

Fill out the machine data table below as an aid to selecting the drive system. When the machine data table is complete, use the servomotor sizing software to select the motor capacity.

	Nº S	No.	Nº.	Nº.	No.	
	1) Ball Screw Horizontal A	Axis	Chill.	C.S.	C. B.	Carlo Carlo
	Load mass	w S	kg (lb)	3 <sup>10</sup>	all <sup>C</sup>	J.COV
	Thrust 🔗	F 🕉	—kg (lb)	2		S°
and in	Coefficient of friction	μ	<u> </u>	F → 	Table W	and the second
29	Overall efficiency	η	24			24
	Gear ratio	R (= Nm/NI)		Motor	Ball scre	w
	Gear+coupling	GD <sup>2</sup> g	—kg₊cm² (lb₊in².)	Gear+coup		8
	Ball screw pitch	P	—mm (in.)	GD <sup>2</sup> g	all	200
	Ball screw diameter	D	mm (in.)	HOL.	NON	101
	Ball screw length	L .8°	—mm (in.)			.80
AN IS	2) Ball Screw Vertical Axis	s shi	State.		and in	- Sahi
220	Load mass	W <sub>1</sub>	—kg (lb)	7	-	24
	Counterweight	W <sub>2</sub>	—kg (lb)			
	Coefficient of friction	u PS	<u>~</u> ?``	N <sup>S</sup> M	otor	N
	Overall efficiency	'n	and in	Card's		100
	Gear ratio	R (= Nm/Nl)	<u>01.</u>	Gear+couplin GD <sup>2</sup> g		10
	Gear+coupling	GD <sup>2</sup> g	—kg⋅cm² (lb⋅in².)	8	, stall	.8
ANNI S	Ball screw pitch	P	mm (in.)		w1	and the second
22	Ball screw diameter	D A	mm (in.)	7		22
	Ball screw length		mm (in.)		Ball screw	
5	3) Timing Belt	- 12 X		Ke X.	No. Y.	8
0	Load mass	S.M.	—kg (lb)	Pulley	w star	1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 -
	Thrust	F S	—kg (lb) —kg (lb)	GD <sup>2</sup> d F	<u> </u>	
	Coefficient of friction	μ	Kg (ib)			
Mar.	Overall efficiency	η γουνοιαίο			Timing bel	t Salah
27	Gear ratio	R (= Nm/NI)	St.	Gear GD <sup>2</sup> g	toupiniu	24
	Gear+coupling	GD <sup>2</sup> g	—kg⋅cm² (lb⋅in².)			
	Pulley	GD <sup>2</sup> d	—kg⋅cm² (lb⋅in².)	Motor	NO.8	N
	Pulley diameter	D	mm (in.)	Carlos .	Card Card	A. C. A. C.
	4) Rack and Pinion	Č.	ç. ( )	J.C.	JEO.	
S	Load mass	w S	—kg (lb)			30
and	Thrust	F	—kg (lb)	Ę,	W	and in
Tr.	Coefficient of friction	μ		4 3	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	ack
	Overall efficiency	η	- >		Pinion	
	Gear ratio	R (= Nm/Nl)	- Haix	Gear+co GD <sup>2</sup> g	upling Moto	r N
	Gear+coupling	GD <sup>2</sup> g	—kg⋅cm² (lb⋅in².)	GD <sup>2</sup> g		
	Pinion diameter	D	mm (in.)	J.O.	JON .	300
	Pinion thickness	t dav	mm (in.)	57	don -	.8
and the second	State State	Ser.	Ser.		Stat.	-Sahi

est and	and the second s	and March	at 19.01	5.1 Selecting a	Σ-Series Servo
وبر. رو	JON.	auton.	Holl.	-allon	~auton.
5) Roll Feeder	A.C.			. ALC	CALCH
Load GD <sup>2</sup>	${\sf GD}^2\ell$	—_kg⋅cm² (lb⋅in².)		Press forc	e
Tension	F <sub>0</sub>	—_kg (lb)			
Press force	NP N	—kg (lb)	NO.S	$\checkmark$	Roller
Roller diameter	D	mm (in.)	Cath F		
Coefficient of friction	μ <sup>OT</sup> μ		KOC .		35
Overall efficiency	້ ຖ ເອັ	<u> </u>	Motor		GD <sup>2</sup> l
Gear ratio	R (= Nm/NI)		(	Gear+coupling	and the second s
Gear+coupling	GD <sup>2</sup> g	—kg⋅cm² (lb⋅in².)	1	7- Y	24
6) Rotor	J	<u> </u>	6	2	
Load GD <sup>2</sup>	CD24	kg₊cm² (lb₊in².)	ALO.X	-Her?	
10°'	GD²ℓ		allar	- Call	C.a.
Load torque	5 <sup>0</sup> Tℓ	—kg⋅cm <sup>2</sup> (lb⋅in <sup>2</sup> .)	1 <sup>6</sup> .		? 
Overall efficiency	່ ໆ 🔬	<u> </u>	Motor		N. Sol
Gear ratio	R (= Nm/NI)	- www.	Gear+	coupling Gr	$)^2 \ell$
Gear+coupling	GD <sup>2</sup> g	—kg⋅cm² (lb⋅in².)	GD <sup>2</sup> g	GL	• • • •
7) Others	à	à	à	6	
Load GD <sup>2</sup>	GD <sup>2</sup> ℓ	——kg₊cm² (lb₊in².)	alle.	Ster.	
Load torque	Tl	kg⋅cm² (lb⋅in².)		offar	
Motor speed	Nm 🚽	r/min		NON CONTRACT	See. Se
DUTY	td M	—s		M.C.	N.C
Positioning time	ts and	—s 31		141	32 all
Accel/decel time	ta	—s			
<ul> <li>Duty cycle</li> </ul>	R	R	29	R	
DUTY	td	s <u>₩</u> s	and the	- All Mar	, 3
Positioning distance	Ls	,mm (in.)	Nº Ve	725	
Moving member spee	ed Vℓ	🔊 —m/min 🔬	Ls	Ban A	
Positioning time	ts and	—s "M <sup>ALO</sup>	ta	ts ta	<u>(</u>
10	24	—mm (in.) —m/min —s		td to	want .
	la	s	¥		*
	If both are entered, spec	·	202	N.8.9	
<ul> <li>Operating environm</li> </ul>		erature	all	Caper.	
	Other	J.OT	301	- Stor	
, de		° S <sup>o</sup>			
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5.1.2 Selecting a Servopack

## 5.1.2 Selecting a Servopack

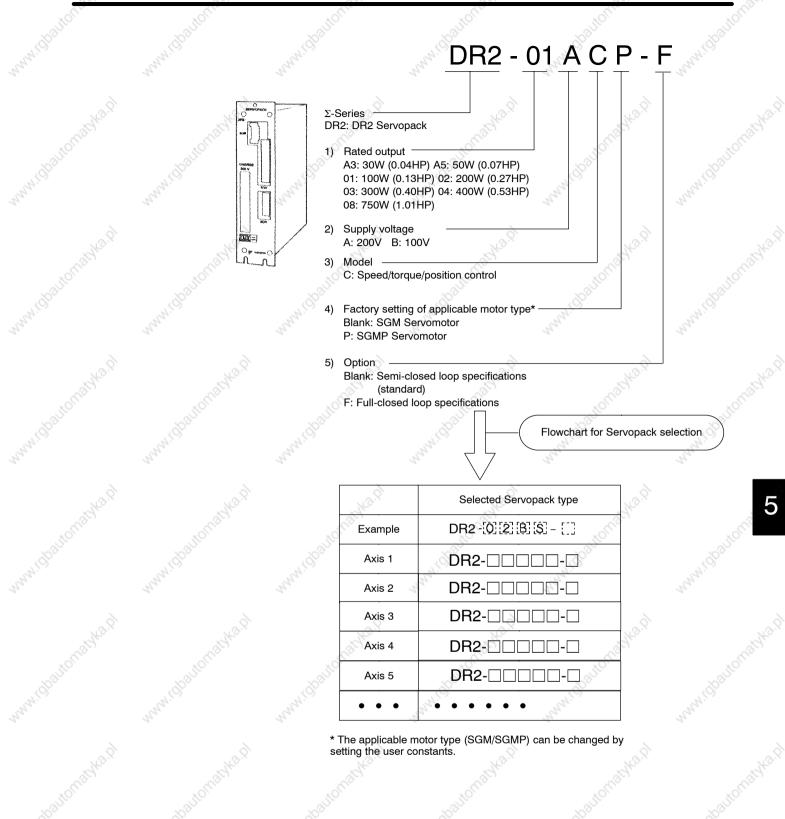
 The selection of a DR2 Servopack matched to the servo system in which it is used is based on the Servopack type, that is, the four to six alphanumeric characters after "DR2-", described below. The numbers 1) to 5) below correspond to the numbers in the flowchart for Servopack selection on the following pages.

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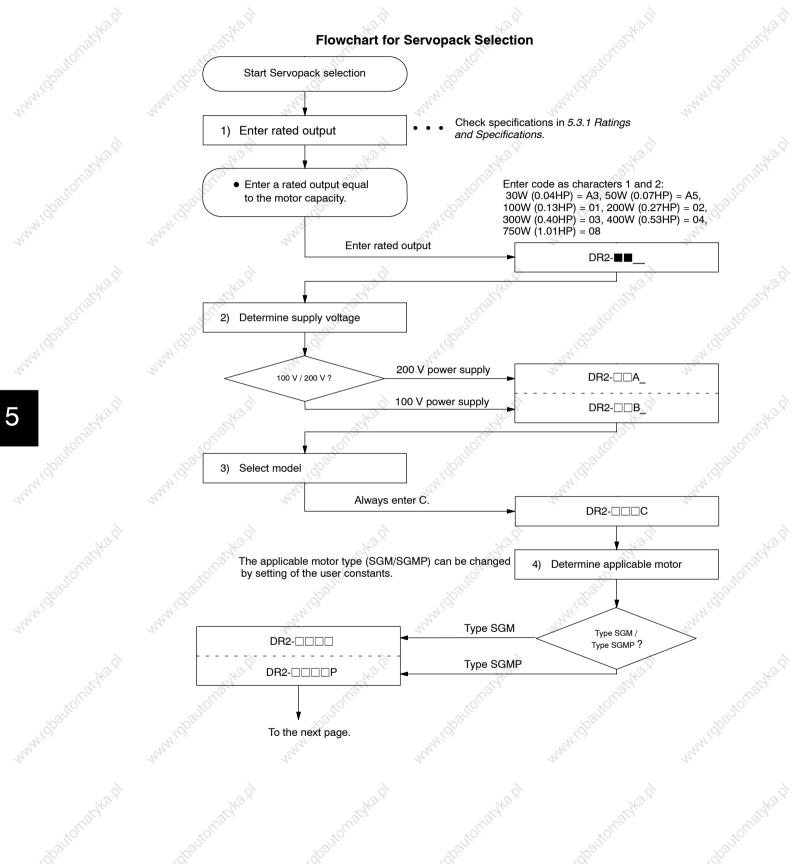
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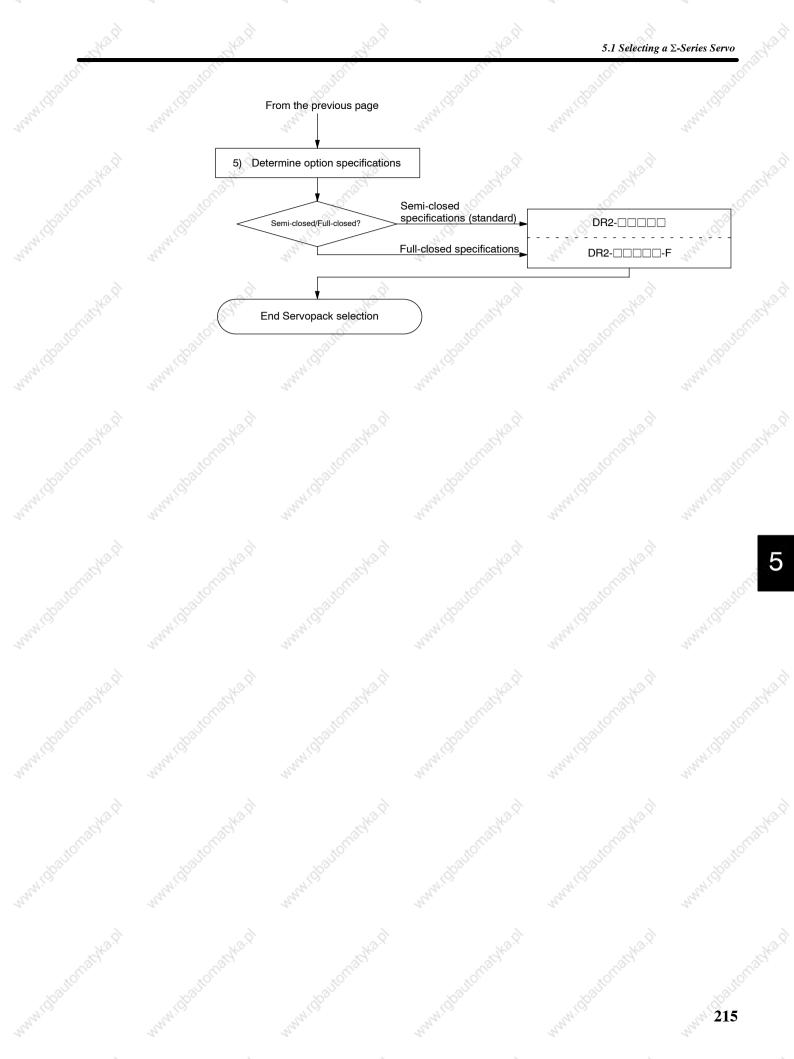
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5.1.2 Selecting a Servopack cont.

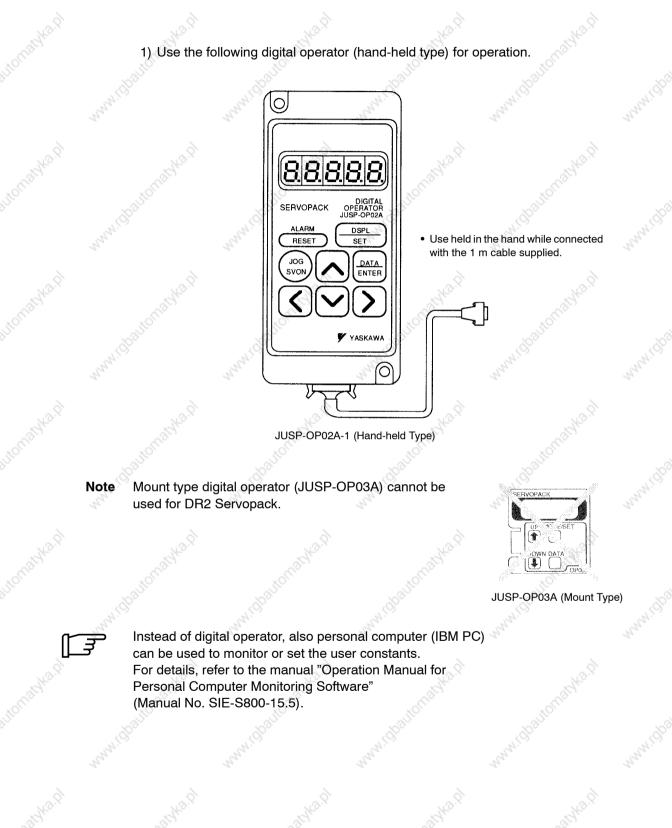
 The actual selection of the DR2 Servopack is conducted according to the following flowchart.





5.1.3 Digital Operator

# 5.1.3 Digital Operator



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# 5.2 SGM Servomotor

This section presents tables of ratings and specifications for SGM and SGMP Servomotors. Refer to these tables when selecting a Servomotor.

5.2.1Ratings and Specifications2175.2.2Mechanical Characteristics230

## 5.2.1 Ratings and Specifications

- 1) The ratings and specifications of SGM and SGMP Servomotors are shown below. Refer to them as required when selecting a Servomotor.
- 2) Ratings and Specifications of 200-VAC SGM Servomotors

Time rating: Heat resistance class: Vibration class: Withstand voltage: Insulation resistance: Enclosure: Ambient temperature: Ambient humidity: Excitation: Drive method: Mounting: continuous Class B (Class A for UL spec. type SGM-□U) 15µm or below 1500 VAC 500 VDC 10MΩ min. totally enclosed, self-cooled 0 to 40°C 20% to 80% (non-condensing) permanent magnet direct drive flange method

5.2.1 Ratings and Specifications cont.

SGM Servomotor	S.ª	A3A A3V	A5A A5V	01A 01V	02A 02V	04A 04V	08A 08V
Rated Output*1	W (HP)	30 (0.04)	50 (0.07)	100 (0.13)	200 (0.27)	400 (0.53)	750 (1.01)
Rated Torque*1 *2	N⋅m	0.095	0.159	0.318 📈	0.637	1.27	2.39
AND AND	(oz₊in)	(13.5)	(22.6)	(45.1)	(90.1)	(181)	(338)
Instantaneous Peak Torque*1	N⋅m	0.29	0.48	0.96	1.91	3.82	7.1
	(oz₊in)	(40.5)	(67.7)	(135)	(270)	(542)	(1010)
Rated Curent*1	A (rms)	0.42	0.6	0.87	2.0	2.6	4.4
Instantaneous Max Current*1	A (rms) 🚿	1.3	1.9	2.8	6.0	8.0	13.9
Rated Speed*1	r/min	3000			2	•	2
Instantaneous Max Speed*1	r/min	4500	22	12	2	N.C	8
Torque Constant*1	N⋅m/A (rms)	0.255	0.286	0.408	0.355	0.533	0.590
NIGDAUL	(oz₊in/A) (rms)	(36.2)	(40.5)	(57.8)	(50.2)	(75.5)	(83.5)
Moment of Inertia [J <sub>M</sub> ]	kg⋅m² ×10 <sup>-4</sup>	0.021	0.026	0.040	0.123	0.191	0.671
13.Q	(oz₊in₊s²× 10 <sup>−3</sup> )	(0.288)	(0.368)	(0.576)	(1.74)	(2.70)	(9.52)
Rated Power Rate*1	kW/s	4.36	9.63	25.4 🔊	32.8	84.6	85.1
Rated Angular Acceleration*1	rad/s <sup>2</sup>	45200	61200	79500	51800	666000	35600
Inertia Time Constant	ms	1.5	0.9	0.5	0.4	0.3	0.3
Inductive Time Constant	ms	1.5	1.8	1.9	5.4	6.4	13

\*1 These items and torque-motor speed characteristics quoted in combination with a DR2 Servopack at an armature winding temperature of 100°C. Other values quoted at 20°C. All values typical at power voltage 200V.

\*2 Rated torques are continuous allowable torque values at 40°C with a 250 x 250 x 6 (mm) (9.84 x 9.84 x 0.24 (in.)) heat sink attached.

**NOTE** The ratings and specifications above refer to a standard Servomotor.

Add the numerical values below to the moment of inertia values in the table for a motor fitted with **a holding brake** and/or a 12-bit absolute encoder.

Other specifications will also change slightly.



#### Holding Brake

The holding brake is automatically applied to the motor shaft to prevent the load falling in vertical axis applications when the motor power supply is turned off or fails. It is only to hold the load and cannot be used for stopping motor.



Load

Prevent load falling

5.2 SGM Servomotor

www.ldbau	- Al	Туре	<u> </u>		SC	GM-		
And And	Item 5	44	A3A A3V	A5A A5V	01A 01V	02A 02V	04A 04V	08A 08V
	Holding brake	kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.0085	0		0.058	0	0.14
	No.	$(oz \cdot in \cdot s^2 \times 10^{-3})$	(0.120)	N.C.		(0.816)	9-11 0-11	(1.98)
	12-bit absolute	kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.025			S		
~3 <sup>3</sup>	encoder	(oz.in.s <sup>2</sup> ×10 <sup>−3</sup> )	(0.352)			S. S.		
ANNI OF					0			10

#### **Electrical Specifications of the Holding Brake**

242.9

	a) SGM Type (F	a) SGM Type (Rated Voltage: 90 VDC) Standard									
MANNIC BRUT	Motor Model	Motor Capacity (W)	NN.IGBOULO	Holding Brake	Specification	an interior					
and and	h war	~	Capacity (W)	Holding Torque (kg-cm)	Coil Resistance (Ω at 20°C)	Rated Current (A at 20°C)					
	SGM-A3	30 💉	6	2.0	1350	0.067					
	SGM-A5	50	6	2.0	1350	0.067					
~a <sup>lft</sup>	SGM-01	100	6 200	3.5	1350	0.067					
Andra 1600	SGM-02	200	6.5	15	1246	0.072					
All'	SGM-04	400	6.5	15 🖓	1246	0.072					
	SGM-08	750	6	25	1350	0.067					

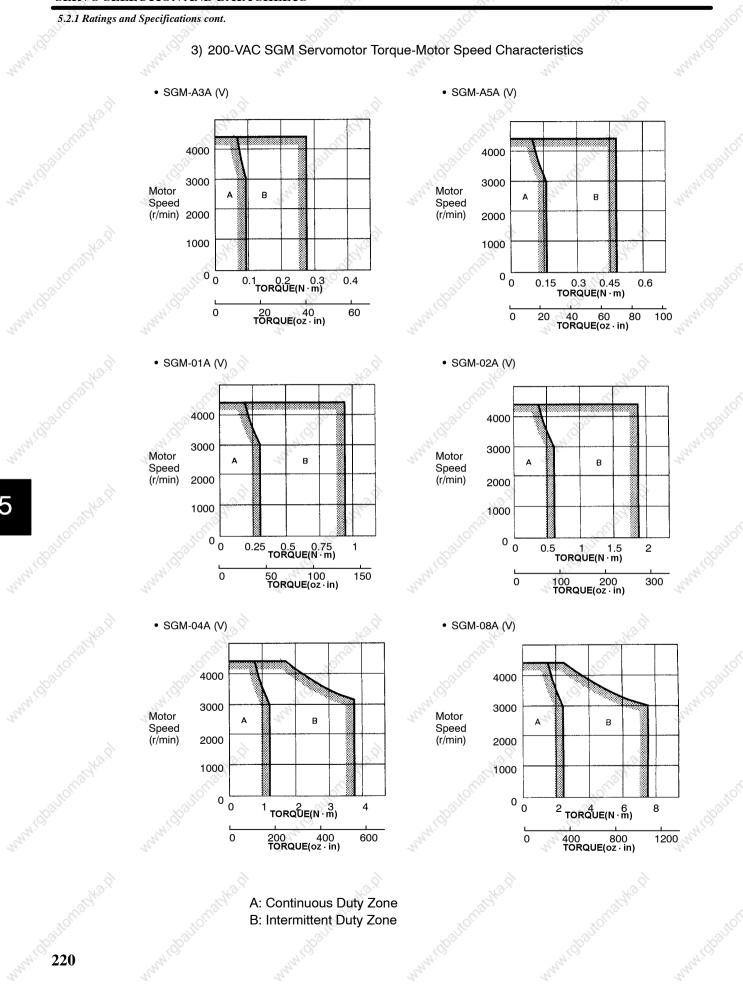
b) SGM Type (Rated Voltage: 24 VDC) ... Semi-standard

NW GDOLL	Motor Model	Motor Capacity (W)	ANNAL 600	Holding Brake Specifications		
	18. <sup>1</sup>	13.9	Capacity (W)	Holding Torque (kg-cm)	Coil Resistance (Ω at 20°C)	Rated Current (A at 20°C)
	SGM-A3	30	6	2.0	96	0.25
30	SGM-A5	50	6	2.0	96	0.25
300	SGM-01	100	6 8	3.5	96	0.25
A.1.000	SGM-02	200	6.5	15	89	0.27
	SGM-04	400	6.5	15	89	0.27
	SGM-08	750	6	25	96	0.25
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5.2.1 Ratings and Specifications cont.

3) 200-VAC SGM Servomotor Torque-Motor Speed Characteristics



A: Continuous Duty Zone **B: Intermittent Duty Zone** 

4) Ratings and Specifications of 200-VAC SGMP Servomotors

Time rating: Heat resistance class: Vibration class: Withstand voltage: Insulation resistance: Enclosure: Ambient temperature: Ambient temperature: Ambient humidity: Excitation: Drive method: Mounting: continuous Class B (Class A for UL spec. type SGMP- $\Box$ U) 15µm or below 1500 VAC 500 VDC 10M $\Omega$  min. totally enclosed, self-cooled 0 to 40°C 20% to 80% (non-condensing) permanent magnet direct drive flange method

	SGMP Servom	otor	01A 01V	02A 02V	04A 04V	08A 08V
Rated Outp	ut *1	W (HP)	100 (0.13)	200 (0.27)	400 (0.54)	750 (1.01)
Rated Torqu	ue *1 *2	N⋅m	0.318	0.637	1.27	2.39
and the	St.	(oz₊in)	(45.1)	(90.1)	(181)	(338)
	ous Peak Torque	N·m 🔬	0.96	1.91	3.82	7.1
et source.		(oz∙in)	(135)	(270)	(542)	(1010)
Rated Curre	ent *1	A (rms)	0.89	2.0	2.6	4.1
Instantanec *1	ous Peak Current	A (rms)	2.8	6.0	8.0	13.9
Rated Rota	tion Speed *1	r/min	3000	6		8
Max. Rotati	on Speed *1	r/min	4500	Non	K	<u>0</u> ~
Torque Constant *1		N·m/A (rms)	0.392	0.349	0.535	0.641
	,5°	oz₊in/A (rms) ൣ≶	55.5	49.4	75.8	91.0
	Incremental encoder, no	(=GD <sup>2</sup> <sub>M</sub> /4) kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.065	0.209	0.347	2.11
	holding brake	$(oz \cdot in \cdot s^2 \times 10^{-3})$	(0.917)	(2.96)	(4.92)	(29.9)
	Incremental encoder, with	(=GD <sup>2</sup> <sub>M</sub> /4) kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.103	0.307	0.445	2.52
de	holding brake	$(\text{oz}\cdot\text{in}\cdot\text{s}^2\times10^{-3})$	(1.46)	(4.35)	(6.31)	(35.7)
	Absolute encoder, no	(=GD <sup>2</sup> <sub>M</sub> /4) kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.090	0.234	0.372	2.14
	holding brake	$(oz \cdot in \cdot s^2 \times 10^{-3})$	(1.27)	(3.31)	(5.27)	(30.3)
	Absolute encoder, with	(=GD <sup>2</sup> <sub>M</sub> /4) kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.128	0.332	0.470	2.55
	holding brake	$(oz \cdot in \cdot s^2 \times 10^{-3})$	(1.81)	(4.70)	(6.66)	(36.1)
Rated Powe	er Rate *1	kW/s	15.7	19.4	46.8	26.9
Rated Angu	lar Acceleration	rad/s <sup>2</sup>	49200	30500	36700	11300
Inertia Time	e Constant	ms sol	0.7	0.6	0.4	0.7
Inductive Ti	me Constant	ms N	3.7	7.4	8.5	18

\*1 These items and torque-motor speed characteristics quoted in combination with a DR2 Servopack at an armature winding temperature of 100°C. Other values quoted at 20°C. All values typical at power voltage 200V.

5.2.1 Ratings and Specifications cont.

\*2 Rated torques are continuous allowable torque values at 40°C with an attached heat sink as specified below.

#### **Electrical Specifications of the Holding Brake**

a) SGMP Type (Rated Voltage: 90 VDC) ..... Standard

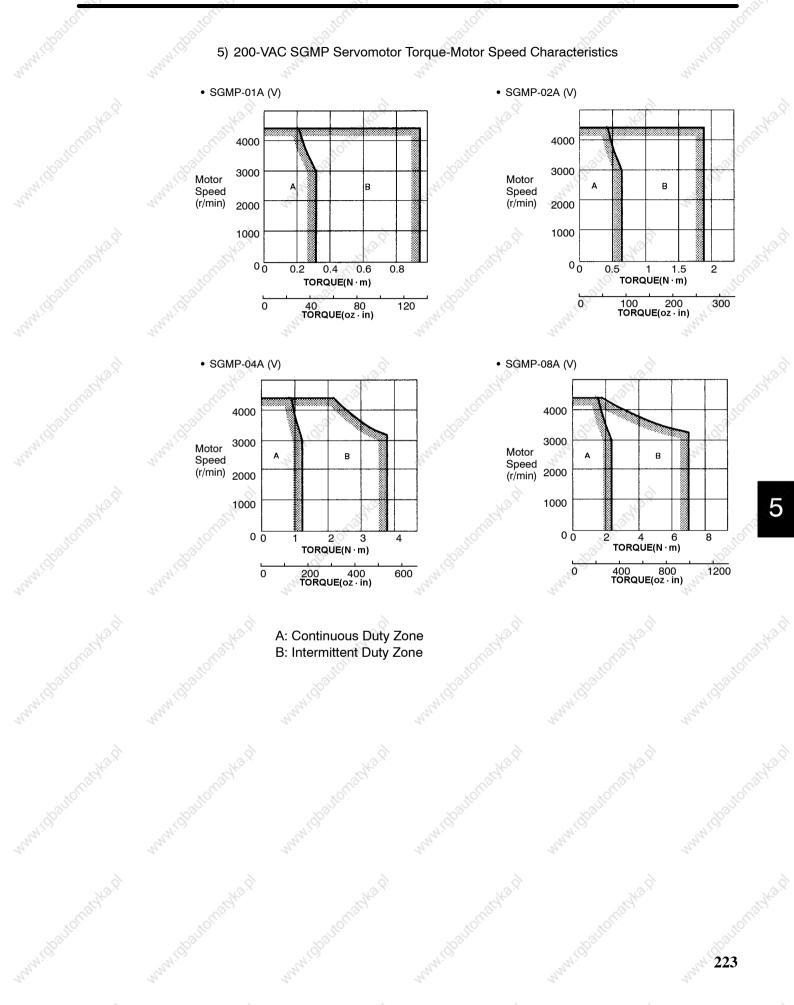
Motor Model	Motor Capacity (W)		Holding Brak	e Specification	<b>S</b> )
and and a second	Spalle	Capacity (W)	Holding Torque (kg-cm)	Coil Resistance (Ω at 20°C)	Rated Current (A at 20°C)
SGMP-01	100	6	5.0	1555	0.062
SGMP-02	200	5	10	1573	0.056
SGMP-04	400	7.6	20	1062	0.085
SGMP-08	750	7.5	37	1083	0.083

b) SGMP Type (Rated Voltage: 24 VDC) ..... Semi-standard

Motor Model	Motor Capacity (W)	Holding Brake Specifications				
utomat Walt	automator	Capacity (W)	Holding Torque (kg-cm)	Coil Resistance (Ω at 20°C)	Rated Current (A at 20°C)	
SGMP-01	100	6 6	5.0	114	0.23	
SGMP-02	200	5 3	10	116	0.21	
SGMP-04	400	7.6	20	89	0.29	
SGMP-08	750	7.5	37	77	0.31	

Chart

5.2 SGM Servomotor



5.2.1 Ratings and Specifications cont.

#### 6) Ratings and Specifications of 100-VAC SGM Servomotors

Time rating: Heat resistance class: Vibration class: Withstand voltage: Insulation resistance: Enclosure: Ambient temperature: Ambient temperature: Ambient humidity: Excitation: Drive method: Mounting: continuous Class B (Class A for UL spec. type SGM- $\Box$ U) 15µm or below 1500 VAC 500 VDC 10M $\Omega$  min. totally enclosed, self-cooled 0 to 40°C 20% to 80% (non-condensing) permanent magnet direct drive flange method

SGM Servomo	otor	A3B A3W	A5B A5W	01B 01W	02B 02W	03B 03W
Rated Output *1	W (HP)	30 (0.04)	50 (0.07)	100 (0.13)	200 (0.27)	300 (0.40)
Rated Torque * <sup>1</sup> * <sup>2</sup>	N⋅m	0.095	0.159	0.318	0.637	0.95
10 <sup>.9</sup>	(oz₊in)	(13.5)	(22.6)	(45.1)	(90.1)	(135.0)
Instantaneous Peak Torque *1	N⋅m	0.29	0.48 🔬	0.96	1.91 🔊	3.72
lor. Hou	(oz∙in) 🔬	(40.5)	(67.7)	(135)	(270)	(527.7)
Rated Current *1	A (rms)	0.63	0.9	2.2	2.7	3.7
nstantaneous Peak Current *1	A (rms)	2.0	2.9	7.1	8.4	14.8
Rated Rotation Speed *1	r/min 💉	3000	32	the second		2ha
Max. Rotation Speed *1	r/min	4500				
Torque Constant *1	N⋅m/A (rms)	0.168	0.194	0.156	0.255	0.279
19 <sup>1</sup>	oz.in/A (rms)	(23.8)	(27.5)	(22.1)	(36.1)	(39.6)
Moment of Inertia	(=GD <sup>2</sup> <sub>M</sub> /4) kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.021	0.026	0.040	0.123	0.191
19 <sup>1</sup>	$(oz \cdot in \cdot s^2 \times 10^{-3})$	(0.288)	(0.368)	(0.576)	(1.74)	(2.71)
Rated Power Rating *1	kW/s	4.36	9.63	25.4	32.8	47.3
Rated Angular Acceleration *1	rad/s <sup>2</sup>	45200	61200	79500	51800	49700
Inertia Time Constant	ms	1.6	0.9	0.6	0.4	0.3
Inductive Time Constant	ms	1.3	1.6	1.6	5.7	5.3

\*1 These items and torque-motor speed characteristics quoted in combination with a DR2 Servopack at an armature winding temperature of 100°C. Other values quoted at 20°C. All values typical at power voltage 100V.

\*2 Rated torques are continuous allowable torque values at 40°C with a 250 x 250 x 6 (mm) (9.84 x 9.84 x 0.24 (in.)) heat sink attached.

NOTE

The ratings and specifications above refer to a standard Servomotor.

Add the numerical values below to the moment of inertia values in the table for a motor fitted with a holding brake and/or a 12-bit absolute encoder.

Other specifications will also change slightly.

8	Туре	Туре			SGM-				
Item	and the second sec	A3B	A5B	01B	02B	03B			
Holding brake	kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.0085		-1	0.058				
8	(oz.in.s <sup>2</sup> ×10 <sup>-3</sup> )	0.12	8		0.82				
12-bit absolute	kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.025	to.		Nº.				
encoder	$(oz \cdot in \cdot s^2 \times 10^{-3})$	0.36			S.				

#### **Electrical Specifications of the Holding Brake**

a) SGM Type (Rated Voltage: 90 VDC) .. Standard

Motor Model	Motor Capacity (W)	Holding Brake Specifications							
		Capacity (W)	Holding Torque (kg-cm)	Coil Resistance (Ω at 20°C)	Rated Current (A at 20°C)				
SGM-A3	30	6	2.0	1350	0.067				
SGM-A5	50	6	2.0	1350	0.067				
SGM-01	100	6	3.5	1350	0.067				
SGM-02	200	6.5	15	1246	0.072				
SGM-03	400	6.5	15	1246	0.072				

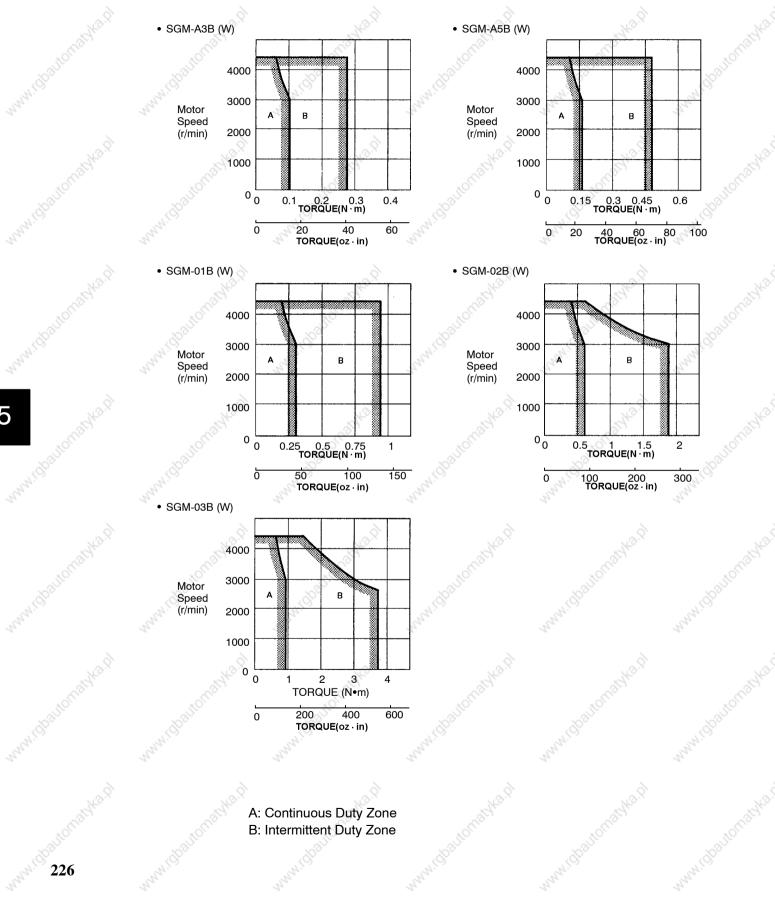
b) SGM Type (Rated Voltage: 24 VDC) ... Semi-standard

Motor Model	otor Model Motor Capacity (W)		Holding Brake Specifications							
		Capacity (W)	Holding Torque (kg-cm)	Coil Resistance (Ω at 20°C)	Rated Current (A at 20°C)					
SGM-A3	30	6	2.0	96	0.25					
SGM-A5	50	6	2.0	96	0.25					
SGM-01	100	6	3.5	96	0.25					
SGM-02	200	6.5	15	89	0.27					
SGM-03	400	6.5	15	89	0.27					

5.2.1 Ratings and Specifications cont.

7) 100-VAC SGM Servomotor Torque-Motor Speed Characteristics

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A: Continuous Duty Zone **B: Intermittent Duty Zone** 

8) Ratings and Specifications of 100-VAC SGMP Servomotors

Time rating: Heat resistance class: Vibration class: Withstand voltage: Insulation resistance: Enclosure: Ambient temperature: Ambient temperature: Ambient humidity: Excitation: Drive method: Mounting:

continuous Class B (Class A for UL spec. type SGMP- $\Box$ U) 15µm or below 1500 VAC 500 VDC 10M $\Omega$  min. totally enclosed, self-cooled 0 to 40°C 20% to 80% (non-condensing) permanent magnet direct drive flange method

ALBO S	GMP Servomotor	and the second s	01B 01W	02B 02W	03B 03W
Rated Output*1	W (HP)	100 (0.13)	200 (0.27)	300 (0.40)	
Rated Torque*1 *2		N⋅m	0.318	0.637	0.955
Q.	, ad	(oz∙in)	(45.1)	(90.1)	(135)
Instantaneous Peak Torqu	ue*1	N⋅m	0.96	1.91	2.86
.v.	*offic	(oz⋅in)	(135)	(270)	(406)
Rated Current*1	Ser.	A (rms)	2.2	2.7	4.3
Instantaneous Peak Curre	ent*1	A (rms)	7.1	8.4	13.9
Rated Rotation Speed*1	24	r/min	3000	34	32.00
Max. Rotation Speed*1		r/min	4500		
Torque Constant*1	ŝ	N⋅m/A (rms)	0.160	0.258	0.246
Store .	Stor 2	oz₊in/A (rms)	22.8	36.5	34.9
Moment of Inertia	Incremental encoder, no holding brake	(=GD <sup>2</sup> <sub>M</sub> /4) kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.065	0.209	0.347
So.		$(oz \cdot in \cdot s^2 \times 10^{-3})$	(0.917)	(2.96)	(4.92)
ANAN.	Incremental encoder, with holding brake	(=GD <sup>2</sup> <sub>M</sub> /4) kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.103	0.307	0.445
		(oz.in.s <sup>2</sup> ×10 <sup>-3</sup> )	(1.46)	(4.35)	(6.31)
,3140.9	Absolute encoder, no holding brake	(=GD <sup>2</sup> <sub>M</sub> /4) kg⋅m <sup>2</sup> ×10 <sup>-4</sup>	0.090	0.234	0.372
°.	, offic	$(oz \cdot in \cdot s^2 \times 10^{-3})$	(1.27)	(3.31)	(5.27)
1 dbaur	Absolute encoder, with holding brake	$(=GD^{2}M/4)$ kg·m <sup>2</sup> ×10 <sup>-4</sup>	0.128	0.332	0.470
and an	and the second sec	$(oz \cdot in \cdot s^2 \times 10^{-3})$	(1.81)	(4.70)	(6.66)
Rated Power Rate*1	-4°-	kW/s	15.7	19.4	26.3
Rated Angular Acceleration	on* <sup>1</sup> 👌	rad/s <sup>2</sup>	49200 👌	30500	27500
nertia Time Constant	No.	ms	0.8	0.7	0.4
nductive Time Constant	e., S	ms	3.6	6.3	8.5

- \*1 These items and torque-motor speed characteristics quoted in combination with a DR2 Servopack at an armature winding temperature of 100°C. Other values quoted at 20°C. All values typical at power voltage 100V.
- <sup>2</sup> Rated torques are continuous allowable torque values at 40°C with a 250 x 250 x 6 (mm) (9.84 x 9.84 x 0.24 (in.)) heat sink attached.

5.2.1 Ratings and Specifications cont.

#### **Electrical Specifications of the Holding Brake**

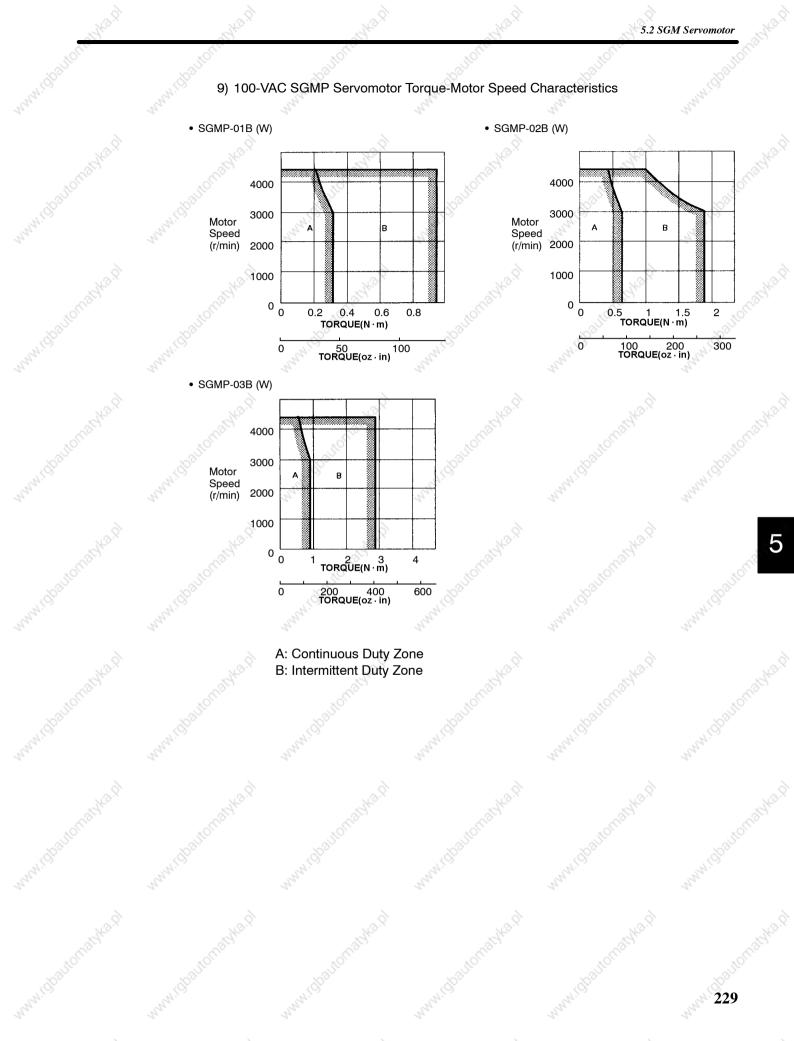
a) SGMP Type (Rated Voltage: 90 VDC) ..... Standard

Motor Model	Motor Capacity (W)		Holding Brak	e Specification	S
s.	1.1808D	Capacity (W)	Holding Torque (kg-cm)	Coil Resistance (Ω at 20°C)	Rated Current (A at 20°C)
SGMP-01	100	6	5.0	1555	0.062
SGMP-02	200	5	10	1573	0.056
SGMP-04	400	7.6	20	1062	0.085
SGMP-08	750	7.5	37	1083	0.083
SGMP-15	1500	10 🔊	73	832	0.11

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Motor Model	Motor Capacity (W)	Capacity						
<sup>100</sup>	paulo.	Capacity (W)	Holding Torque (kg-cm)	Coil Resistance (Ω at 20°C)	Rated Current (A at 20°C)			
SGMP-01	100	6	5.0	114	0.23 💉			
SGMP-02	200	5	10	116	0.21			
SGMP-04	400 🖉	7.6	20	89	0.29			
SGMP-08	750	7.5	37	77	0.31			
SGMP-15	1500	10 🔊	73	58	0.42			
ANA	0	4 <sup>2</sup> 2 <sup>2</sup> n <sup>1</sup> ,00		and and it is a second second	Second State			

5.2 SGM Servomotor



5.2.2 Mechanical Characteristics

# 5.2.2 Mechanical Characteristics

1) Allowable Radial Load, Allowable Thrust Load

The output shaft allowable loads for SGM and SGMP Servomotor are shown below.

Conduct mechanical design such that the thrust loads and radial loads do not exceed the values stated below.

Servomotor Type	Allowable Radial Load Fr [N(lb)]	Allowable Thrust Load Fs [N(lb)]	LR mm (in.)	Reference Diagram
SGM-A3	68 (15)	54 (12)	20 (0.82)	8
SGM-A5	68 (15)	54 (12)	20 (0.82)	and and the second s
SGM-01	78 (17)	54 (12)	20 (0.82)	34
SGM-02	245 (55)	74 (16)	25 (1.02)	
SGM-03	245 (55)	74 (16)	25 (1.02)	
SGM-04	245 (55)	74 (16)	25 (1.02)	
SGM-08	392 (88)	147 (33)	35 (1.43)	Fs Fs
SGMP-01	78 (17)	49 (11)	20 (0.82)	
SGMP-02	245 (55)	68 (15)	25 (1.02)	s
SGMP-03	245 (55)	68 (15)	25 (1.02)	32
SGMP-04	245 (55)	68 (15)	25 (1.02)	
SGMP-08	392 (88)	147 (33)	35 (1.43)	13.2
P	B.	•	B	B

**Note** The radial load and thrust load limit values are the sum of the loads generated by the motor torque and the external loads applied to the shaft.

#### 2) Mechanical Tolerance

The tolerances of the SGM and SGMP Servomotor output shaft and installation are shown in the table below.

Tolerance (T.I.R.)	Reference Diagram	
Perpendicularity between flange face and output shaft	0.04mm (0.0016in.)	
Mating concentricity of flange O.D.	0.04mm (0.0016in.)	
Run-out at end of shaft C	0.02mm (0.00079in.)	

Note T.I.R. = Total Indicator Reading

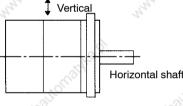
3) Direction of Motor Rotation

Positive rotation of the servomotor is counterclockwise, viewing from the load.

4) Impact Resistance

Mount the servomotor with the axis horizontal. The servomotor must withstand the following vertical impacts.

- Impact Acceleration: 98 m/s<sup>2</sup> (10 G)
- Number of Impacts: 2



5

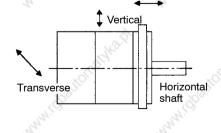
**NOTE** In SGM and SGMP Servomotors, an accurate detector is attached to the shaft at the opposite end from the load.

Avoid applying impacts directly to the shaft as these may damage the detector.

5) Vibration Resistance

Mount the servomotor with the axis horizontal. The servomotor must withstand the following vibration accelerations in three directions: vertical, transverse, and longitudinal.

• Vibration Acceleration: 24.5 m/s<sup>2</sup> (2.5 G)



Longitudinal

# SERVO SELECTION AND DATA SHEETS 5.2.2 Mechanical Characteristics cont. 6) Vibration Class Vibration Measurement Position The SGM and SGMP Servomotors meet the following vibration class at rated speed. Vibration Class: 15µm or below www.epaitonayka.pl 5 www.dautomatika.pl

Vibration Class

TERMS

www.idoatomatika. Vibration class 15µm or below indicates that the total amplitude of vibration of the motor alone, running at rated speed, does not exceed 15µm.

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# 5.3 Servopack Ratings and Specifications

This section presents tables of DR2 Servopack ratings and specifications separately for speed/torque control and for position control.

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	5.3.4	Starting Time and Stopping Time	240
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Š	5.3.6	Overhanging Loads	246

## 5.3.1 Ratings and Specifications

1) The ratings and specifications of the DR2 Servopack are shown below. Refer to them as required when selecting a Servopack.

Refer to the specifications listed for combination with the appropriate type of Servomotor.

<ol><li>Ratings and</li></ol>	Specifications	of DR2 Se	ervopack for	Speed/Torc	ue Control

NO.X	Voltage	e 13.2	I		200	VAC		12º.2			100 VA	С	
Servopack	Туре	DR2-	A3AC	A5AC	01AC	02AC	04AC	08AC	A3BC	A5BC	01BC	02BC	03BC
Max. Applica W (HP)	able Motor	<sup>r</sup> Capacity	30 (0.04)	50 (0.07)	100 (0.13)	200 (0.27)	400 (0.53)	750 (1.01)	30 (0.04)	50 (0.07)	100 (0.13)	200 (0.27)	300 (0.40)
Combined	Motor	Туре	АЗА	A5A	01A🗌	02A	04A	08A	A3B	A5B□	01B	02B	03B
Specifica- tions	1	Motor Capacity W (HP)	30 (0.04)	50 (0.07)	100 (0.13)	200 (0.27)	400 (0.53)	750 (1.01)	30 (0.04)	50 (0.07)	100 (0.13)	200 (0.27)	300 (0.40)
Store ?		Rated/Max. Motor Speed	3000/45	500 r/min	Nº.9	<u> </u>		13K2.9	3000/4	500 r/mir	n <sub>N</sub> P.S	6	<u> </u>
0		Applicable encoder	Increme	ntal encc	der 2048	3 P/R, ab	solute en	coder 102	24 P/R	autor	C.C.		2
	and it.	Allowable Load Inertia <sup>*1</sup> J <sub>L</sub> $kg \cdot m^2 \times 10^{-4}$	0.63 (8.80)	0.78 (11.0)	1.20 (17.0)	3.69 (52.2)	5.73 (81.1)	20.1 (284.6)	0.63 (8.80)	0.78 (11.0)	1.20 (17.0)	3.69 (52.2)	5.73 (81.1)
5134 <sup>20,2</sup>		(oz.in.s <sup>2</sup> ×10 <sup>-3</sup> ) SGM (Upper)/ SGMP (Lower)	_	_	1.95 (27.6)	6.27 (88.8)	10.41 (147.4)	18.5 (262.0)	-		1.95 (27.6)	6.27 (88.8)	10.41 (147.4
65	Max. Out	put Current	1.3	1.9 🔬	2.8	6.0	8.0	13.9	2.0	2.9	7.1	8.4	14.8
	Continuou Current	us Output A (rms)* <sup>9</sup>	0.42	0.60	0.87 (0.89)	2.0	2.6	4.4 (4.1)	0.63	0.90	2.2	2.7	3.7 (4.3)
·	Max. Outp A (rms)	put Current	1.3	1.9	2.8	6.0	8.0	13.9	2.0	2.9	7.1	8.4	14.8

5.3.1 Rating	s and Spec	ifications cont.		3	0			300			300		
	\/_l+-	do.		- Bar		VAC	- An				100 VA	<u></u>	Š
Servonack	Voltag	DR2-	A3AC	A5AC	01AC	VAC	04AC	08AC	A3BC	A5BC	01BC	02BC	03BC
	Max. Applicable Motor Capacity		30 (0.04)	0 50 100 200 400 750 30 50 100 200 300									
Basic Specifica-	Power S (Main/co	upply ntrol circuit)	Single- 50/60H		0 to 230 \	VAC+109	% to -15%	%,	Single- -15%* <sup>2</sup>	phase 10 2, 50/60H	)0 to 115 Iz	VAC+10	)% to
tions	Control N	/lethod	Single-	phase, fu	II-wave re	ectificatio	n IGBT-F	WM (sine	-wave dri	ven)	50		
	Feedbac	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 19			oder 2048	3 P/R, ab	osolute er	ncoder 10	24 P/R				
	Loca- tion	Ambient Temp.	0 to +5			3	and the second s		3	and an			- Caller
		Storage Temp. Ambient/Stor-		-20 to +85°C 90% or less (non-condensing)									
-35/K2.9		age Humidity Vibration/Shock	0.5/2G		all a	5.		and the	<u>,</u> ?`		and a	28	
100 m	Otra esta una	Resistance	Deeler	nounted*7	of the second			- 203			-705		
5	Structure		2.5 (5.5	100			3.7 (8.1	6)	2.5 (5.5	51)	2	3.7 (8.	16)
Perfor-	Speed C	ontrol Range*4	1:5000	ι." 		1	24-		3	C4.		1	Sec.
mance	Speed Reau-	Load Regulation		00%:0.0	1% max.	(at rated	speed)		2			2	
man	lation*5	Voltage Regulation	+10% t	10% to -15%: 0.01% max. (at rated speed)									
		Temperature Regulation	25±25	°C: ±0.2	% max. (	at rated s	speed)	50		. S	50		ð
	Frequence Characte		250 Hz	(at J <sub>L</sub> =J	м)	4	ja <sup>sa</sup>		3	a <sup>ra</sup>			14. 14. 14.
	Torque C (Repeata		±2.0%		~	2		0	2			2	
de.	Accel/De	cel Time Setting	0 to 10	s	- Alexander			and the	·		S.		
Input Signal	Speed Refer-	Rated Refer- ence Voltage						ve referer rated torq	-	ed speed	d (factory	setting)	
	ence	Input Impedance		Variable setting range: $\pm 2$ to $\pm 10$ VDC at rated torque Approx. $30 k\Omega$									
	1	Circuit Time Constant	Approx	. 330μs		, ,							1ª
aller.	Torque Refer-	Rated Refer- ence Voltage					•	ve referer rated torq	· ·	ed speed	d (factory	setting)	
HOLIO	ence	Input Impedance	Approx		or			Holling .			JLOF C		
		Circuit Time Constant	Approx	. 330µs			Jan Co			JAN			and I.O.
l/O Signals	Posi-	Output Form		· ·	line drive		14		1	19			20
Signals	tion Output	Frequency Dividing Ratio	(16 to N	N) /N (N=2	2048, 102	24)* <sup>6</sup>			2			2	
tomatyte	Sequenc	e Input	interna	setting s	peed), fo	rward ru	n stop (P·	e by torqu -OT), reve selection	erse run s	top (N-O	T), currei	nt limit +	selection
d <sup>2</sup>	Sequenc	e Output	Torque	limit dete		speed co	oincidenc	e), motor		- 7	~		
Dynamic Br	-							or overtra		la.			200
External Re	generative	e Unit						ad inertia*	· · · · · · · · · · · · · · · · · · ·			~	
Overtravel	·		-					celeration	· · ·		N	28	
Protective F	unctions	onats'			erload, ov J error, en			eed, refer blown	ence inpu	t read er	ror, overi	un preve	ention,

Indicators	Power (green LED) and status/alarm (red, 7-segment LEDs)
in the second se	Digital operator: status/alarm (red, 7-segment LEDs ×5)
Others	Torque control, zero clamp operation (position loop stop}, soft start/stop, speed coincidence, brake interlock signal output, reverse run connection, JOG run, auto-tuning

\*1 Allowable load inertia ranges require no optional regenerative unit (applicable to 200V 30W to 200W) or external regenerative resistor (applicable to 100V 200W, 300W or 200V 400W, 750W). Values are when motor speed is 3000r/min max. If load inertias exceed these ranges, restrict the operation or use a regenerative unit (applicable to 200V 30W to 200W) or external regenerative resistor (applicable to 100V 200W, 200W, 300W or 200V 400W, 750W). For details, refer to 5.3.5 Load Inertia.

\*2 Supply voltage should not exceed 230 V + 10% (253 V) or 115 V + 10% (127 V). A step-down transformer is required if the voltage should exceed these values.

\*<sup>3</sup> Use within the ambient temperature range. When enclosed in a box, the internal temperatures must not exceed the ambient temperature range.

\*4 The lowest speed of the speed control range is the speed at which the motor does not stop under 100% load.

\*<sup>5</sup> Speed regulation is defined as follows:

Speed regulation =  $\frac{\text{No-load-speed} - \text{Full-load-speed}}{\text{Rated speed}} \times 100\%$ 

The motor speed may change due to voltage variations or amplifier drift and changes in processing resistance due to temperature variation. These ratios of the speed changes to the rated speed represent the speed regulation due to voltage and temperature variations.

\*<sup>6</sup> N is the number of encoder pulses.

 $*^7$  Base mount can be available as an option (DR2- $\Box$ Y7)

\*<sup>8</sup> Open collector output can be available as an option (DR2- $\Box$ Y1).

\*9 Values in parenthesis show SGMP type Servomotor.

5.3.1 Ratings and Specifications cont.

### 3) Ratings and Specifications of DR2 Servopack for Position Control

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Voltage			200 VAC					100 VAC			I		
Servopack Type DR2-			A3AC	A5AC	01AC	02AC	04AC	08AC	A3BC	A5BC	01BC	02BC	03BC
Max. Applicable Motor Capacity W (HP)			30 (0.04)	50 (0.07)	100 (0.13)	200 (0.27)	400 (0.53)	750 (1.01)	30 (0.04)	50 (0.07)	100 (0.13)	200 (0.27)	300 (0.40)
Combined	Motor	Туре	АЗА	A5A	01A🗆	02A	04A	08A	A3B	A5B	01B	02B	03B
Specifica- tions	4	Motor Capacity W (HP)	30 (0.04)	50 (0.07)	100 (0.13)	200 (0.27)	400 (0.53)	750 (1.01)	30 (0.04)	50 (0.07)	100 (0.13)	200 (0.27)	300 (0.40)
	hr.	Rated/ Max. Motor Speed	3000/4500 r/min 3000/4500 r/min										
Caption		Applicable encoder	Incremental encoder 2048 P/R, absolute encoder 1024 P/R										
2101.		Allowable Load Inertia <sup>*1</sup> $J_L$ $kg \cdot m^2 \times 10^{-4}$ (oz.in.s <sup>2</sup> × 10 <sup>-3</sup> )	0.63 (8.80)	0.78 (11.0)	1.20 (17.0)	3.69 (52.2)	5.73 (81.1)	20.1 (284.6)	0.63 (8.80)	0.78 (11.0)	1.20 (17.0)	3.69 (52.2)	5.73 (81.1)
		SGM (Upper)/ SGMP (Lower)	-	-	1.95 (27.6)	6.27 (88.8)	10.41 (147.4)	18.5 (262.0)	-	44 -	1.95 (27.6)	6.27 (88.8)	10.41 (147.4)
Combined Specifica-	Continu Current	ious Output	0.42	0.6	0.87 (0.89)	2.0	2.6	4.4 (4.1)	0.63	0.90	2.2	2.7	3.7 (4.3)
tions	Max. O	utput Current	1.3	1.9	2.8	6.0	8.0	13.9	2.0	2.9	7.1	8.4	14.8
Basic Specifica-	Power Supply (Main/control circuit)		Single-phase 200 to 230 VAC, +10% to -15%,         Single-phase 100 to 115 VAC*2, +10% to -15%, 50/60 Hz*2										
tions	Control Method		-					VM (sine-		ven)			and and it
tonabkan	Feedback				oder 204	8 P/R, ab	solute end	coder 102	4 P/R	20			20
	Loca- tion	Ambient Temp.	0 to 55			8			8			2	
		Storage Temp. Ambient/Stor- age Humidity	-20°C to +85°C       90% or less (with no condensation)										
		Vibration/Shock Resistance	0.5/2G										
	Structure		Rack-m	nounted*5	5								
	Approx. Mass kg (lb)		2.5 (5.5	- th			3.7 (8.1	6)	2.5 (5.5	51)		3.7 (8.	16)
Perfor-	Bias Setting		0 to 450 r/min. (Setting resolution: 1 r/min.)										
mance	Feed Forward Compensation		0 to 100% (Setting resolution: 1%)										
10 Mar	Position Complete Width Setting		0 to 250 reference units. Reference unit: minimum unit of position data which moves load										
Input Signal	Refer- Type ence		SIGN + PULSE train, 90° phase difference 2-phase pulse, (A-phase+B-phase), CCW pulse+CW pulse										
	Pulse	Pulse Form	Line driver (+5 V level), open collector (+5 V or +12 V level)										
		Pulse Frequency	0 to 450 kpps										
No.	Control	-	CLEAR (input pulse form identical to reference pulse) A-, B-, C-phase line driver* <sup>6</sup>										
I/O Signals	Posi- tion Out- Frequency			•	line drive =2048, 10			Stor and			JEC. COL	1	
	put	Dividing Ratio	Servo ON, P drive (or motor forward/reverse by internal speed setting), forward run stop (P-OT),								(P-OT),		
	A <sup>N</sup>		reverse run stop (N-OT), alarm reset, current limit + selection (or internal speed selection), current limit – selection (or internal speed selection)								), current		
No.	Sequence Output		Positioning complete, motor running output (or external brake interlock), servo ready, servo alarm 3-bit alarm codes								vo alarm,		
Dynamic B		1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	Operated at main power OFF, servo alarm or overtravel. Required when exceeding the allowable load inertia										
External Re	egenerativ	ve Unit	Require	ed when o	exceeding	g the allow	wable load	a inertia			1.5°		

Overtravel	Dynamic brake stop at P-OT or N-OT or deceleration stop
Protective Functions	Overcurrent, overload, overvoltage, overspeed, overrun prevention, origin error, CPU error, encoder error, overflow, fuse blown, undervoltage
Indicators	Power (green LED) and status/alarm (red, 7-segment LEDs)
where where	Digital operator: status/alarm (red, 7-segment LEDs ×5)
Others	Brake interlock signal output, reverse run connection, JOG run, electronic gear, auto-tuning

- \*1 Allowable load inertia ranges require no optional external regenerative unit (applicable to 200V 30W to 200W) or external regenerative resistor (applicable to 100V 200W, 300W or 200V 400W, 750W). Values are when motor speed is 3000r/min max. If load inertias exceed these ranges, restrict the operation or use a regenerative unit (applicable to 200V 30W to 200W) or external regenerative resistor (applicable to 100V 200W, 200W, 300W or 200V 400W, 750W). For details, refer to *5.3.5 Load Inertia*.
- \*<sup>2</sup> Supply voltage should not exceed 230 V + 10% (253 V) or 115 V + 10% (127 V). A step-down transformer is required if the voltage should exceed these values.
- \*<sup>3</sup> Use within the ambient temperature range. When enclosed in a box, the internal temperatures must not exceed the ambient temperature range.
- \*4 N is the number of encoder pulses.
- \*<sup>5</sup> Base mount can be available as an option (DR2- $\Box$ Y7).
- \*<sup>6</sup> Open collector output can be available as an option (DR2- $\Box$  Y1).
- \*7 Values in parenthesis show SGMP type Servomotor.

# 5.3.2 Power Consumption

5.3.2 Power Cou Servopack Type DR2-		Output Current	14	Power Loss W	in and a second second	<total></total>	
		(Effective Value) A	Main Circuit	Regenerative Resistor	Control Circuit	Power Loss W	
Supply Voltage 200V	A3A□ (30W-0.04HP)	0.42	2.9	Monia	. Home	15.9	JOR OF
	A5A (50W-0.07HP)	0.6	4.2	9 <sup>67</sup>	J.W. Char	17.2	
	01A□ (100W-0.13HP)	0.87	6.3	1 -	3	19.3	
WR3.9	02A□ (200W-0.27HP)	2.0	14.5	ANO.O	87	27.5	~
Pollor,	04A□ (400W-0.53HP)	2.6	22.2	- HOMIS	utoman	41.2	JONO
	08A⊡ (750W-1.01HP)	4.4	36.1	6	13	55.1	
Supply Voltage 100V	A3B□ (30W-0.04HP)	0.63	2.9		350	15.9	
Janathan w	A5B (50W-0.07HP)	0.90	4.4	ALO.O.		17.4	
	01B□ (100W-0.13HP)	2.2	12.0	utoman's	tona	25.0	JION B
	02B (200W-0.27HP)	2.7	16.2	Sec. 1	WHICE DOL	35.2	
	03B□ (300W-0.40HP)	3.7	20.1	6	A. A.	39.1	

Power loss of regenerative resistor shows the allowable loss. If this value is exceeded, re-Note move the built-in regenerative resistor inside the Servopack and install a resistor externally. Before installing an external regenerative resistor, contact your Yaskawa representative.

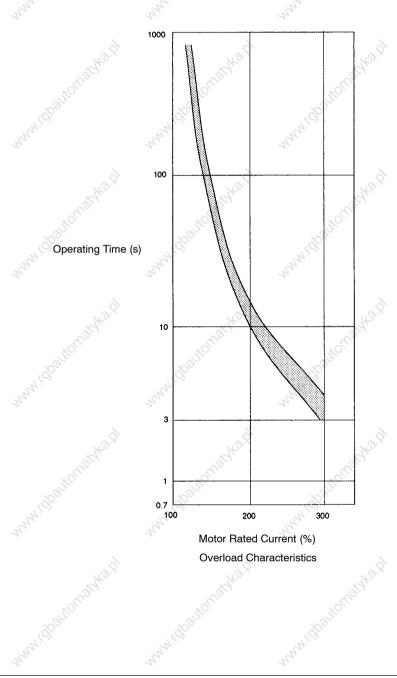
www.idpa

www.dbautomat

# 5.3.3 Overload Characteristics

The Servopack has a built-in overload protective function to protect the Servopack and Servomotor from overload. Therefore, the Servopack allowable power is limited by the overload protective function, as shown below.

The overload detection level is quoted under **hot start** conditions at a motor ambient temperature of 40°C.



TERMS

Hot Start

Indicates that both Servopack and Servomotor have run long enough at rated load to be thermally saturated.

5.3.4 Starting Time and Stopping Time

# 5.3.4 Starting Time and Stopping Time

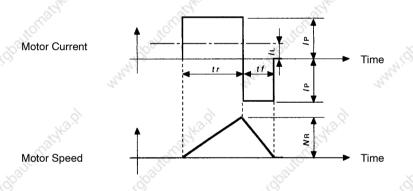
1) The motor starting time (tr) and stopping time (tf) under constant load are calculated by the following formulas. The motor viscous torque and friction torque are ignored.

Starting Time: 
$$\text{tf} = 104.7 \times \frac{N_R (J_M + J_L)}{K_* I_R (\alpha - \beta)}$$
 [ms]

$$Stopping \mbox{ Time: } tf = 104.7 \times \frac{N_{R} \left(J_{M} + J_{L}\right)}{K_{t} \cdot I_{R} \left(\alpha + \beta\right)} \mbox{ [ms]}$$

N<sub>R</sub>: Motor rated speed (r/min.)

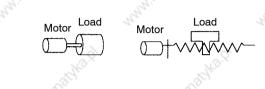
- $J_M$ : Motor moment of inertia (kg·m<sup>2</sup>=lb·in·s<sup>2</sup>) ... (GD<sup>2</sup><sub>M</sub>/4)
- $J_L$ : Load converted to shaft moment of inertia (kg·m²) . . (GD²\_L/4)
- $K_t$ : Motor torque constant (N·m/A=lb·in/A)
- I<sub>R</sub>: Motor rated current (A)
- $\alpha = I_P/I_R$ : Accel/decel current coefficient
- [where I<sub>P</sub> is accel/decel current (accel/decel current is  $\alpha$  times the motor rated current) (A)]  $\beta$ =I<sub>L</sub>/I<sub>R</sub>]: Load current coefficient
- [I\_]: Load torque equivalent current (load current is  $\beta$  times the motor rated current) (A)]



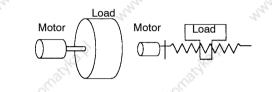


# 5.3.5 Load Inertia

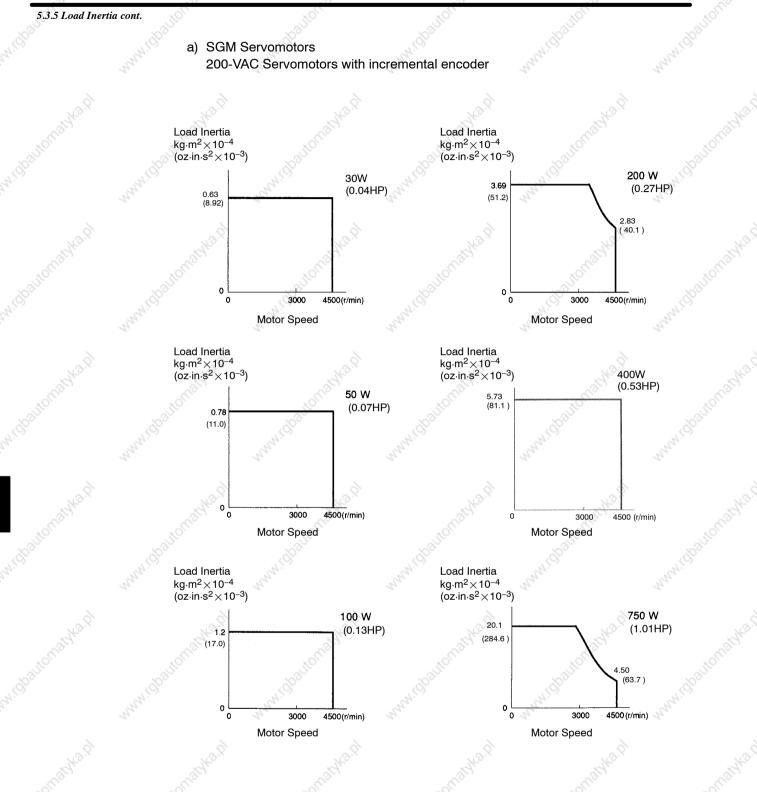
- The larger the load inertia becomes, the worse the movement response of the load. The size of the load inertia [J<sub>L</sub>] allowable when using a Servomotor depends on the motor capacity, as shown in the diagrams below.
  - Small Load Inertia



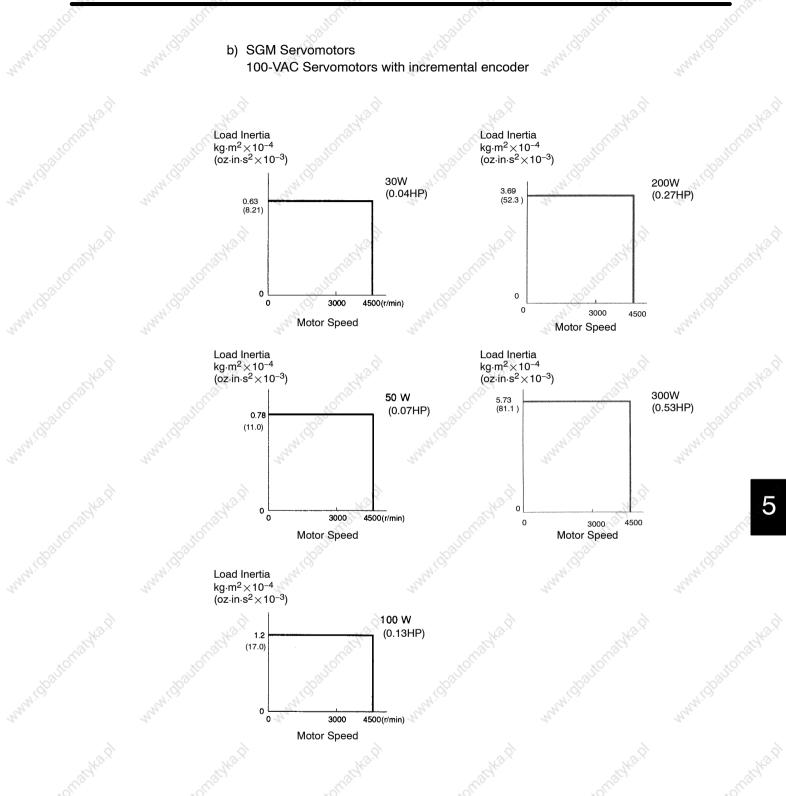
Large Load Inertia



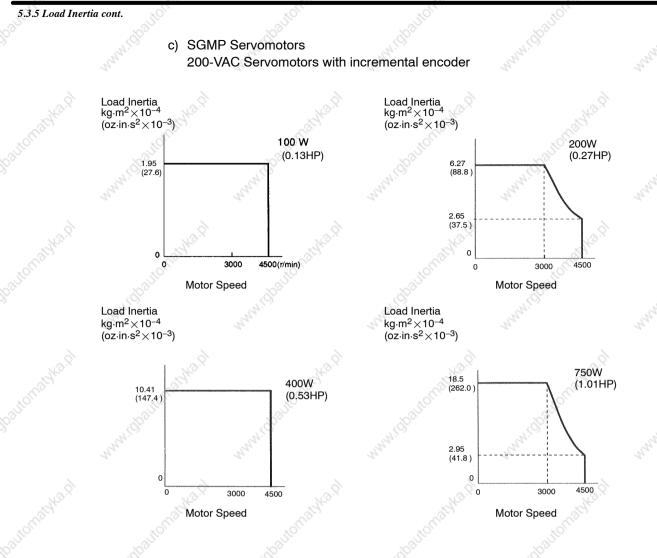
5



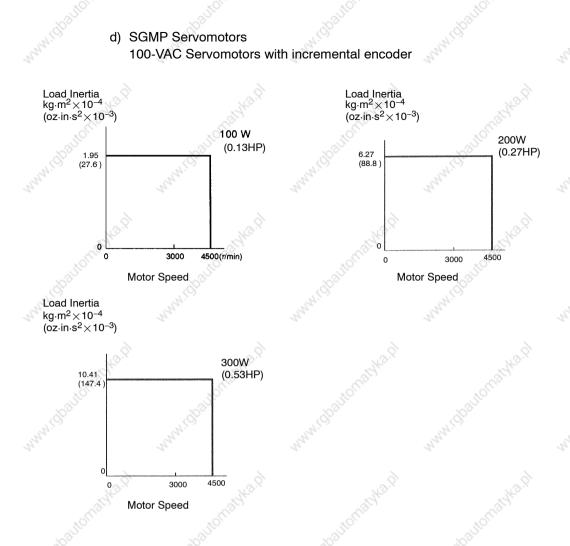
- Note 1 The above diagrams represent deceleration under maximum torque. Applying an acceleration/deceleration curve to the reference allows operation outside the range of the diagrams. (That is, characteristics change according to pattern of operation and load )conditions.
  - 2 As for 400W and 750W types, make sure not to perform frequent accel/decel, since regenerativeresistor is incorporated inside the Servopack.



- Note
- 1 The above diagrams represent deceleration under maximum torque. Applying an acceleration/deceleration curve to the reference allows operation outside the range of the dia grams. (That is, characteristics change according to pattern of operation and load conditions).
- 2 As for 200W and 300W types, make sure not to perform frequent accel/decel, since regenerative resistor is incorporated inside the Servopack.



Note 1 Diagrams above represent deceleration under maximum torque. Applying an acceleration/ deceleration curve to the reference allows operation outside the range of the diagrams. (That is, the characteristics change according to pattern of operation and load conditions).
 2 As for 400W and 750W types, make sure not to perform frequent accel/decel, since regenerative resistor is incorporated inside the Servopack.



Note

 Diagrams above represent deceleration under maximum torque. Applying an acceleration/ deceleration curve to the reference allows operation outside the range of the diagrams. (That is, the characteristics change according to pattern of operation and load conditions).
 As for 200W and 300W types, make sure not to perform frequent accel/decel, since regenerative resistor is incorporated inside the Servopack.

#### 5.3.6 Overhanging Loads

 An overvoltage alarm is likely during deceleration if the load inertia exceeds the range of the diagrams. Take one of the countermeasures below.

- a) Reduce the torque limit value.
- b) Reduce the deceleration rate.
- c) Reduce the maximum speed used.
- d) Add a regenerative unit (applicable to 200V 30W to 200W) or external regenerative resistor (applicable to 100V 200W, 300W or 200V 400W, 750W).

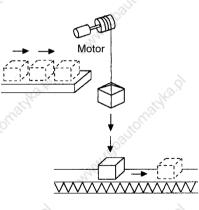
# 5.3.6 Overhanging Loads

1) A Servomotor may not be operated under an overhanging load, that is a load which tends to continually rotate the motor.

Under an overhanging load (e.g. when the direction of the torque applied by the motor is opposite from the direction of shaft rotation), the Servopack regenerative brake is applied continuously and the regenerative energy of the load may exceed the allowable range and damage the Servopack.

The regenerative brake capacity of the DR2 Servopack is rated for short-time operation, approximately equivalent to the deceleration stopping time.

• Overhanging Load Example 1: Motor drive for vertical axis, using no counterweight



Overhanging Load Example 2: Tension control drive

Tension Motor

Motor subject to be rotated from feed motor to keep applied tension.

# 5.4 Σ-Series Dimensional Drawings

This section presents dimensional drawings of the  $\Sigma$ -Series Servomotor, Servopack, and Digital Operator.

5.4.1	Servomotor Dimensional Drawings	247
5.4.2	Servomotor Dimensional Drawings (TÜV approved, conforming to the machine instructions)	289
5.4.3	Servopack Dimensional Drawings	329
5.4.4	Digital Operator Dimensional Drawing	334

# 5.4.1 Servomotor Dimensional Drawings

- 1) The dimensional drawings of the SGM Servomotors are broadly grouped into the following four categories.
  - a) Incremental encoder, no brake (from page 248)
  - b) Incremental encoder, with brake (from page 253)
  - c) Absolute encoder, no brake (from page 258)
  - d) Absolute encoder, with brake (from page 264)

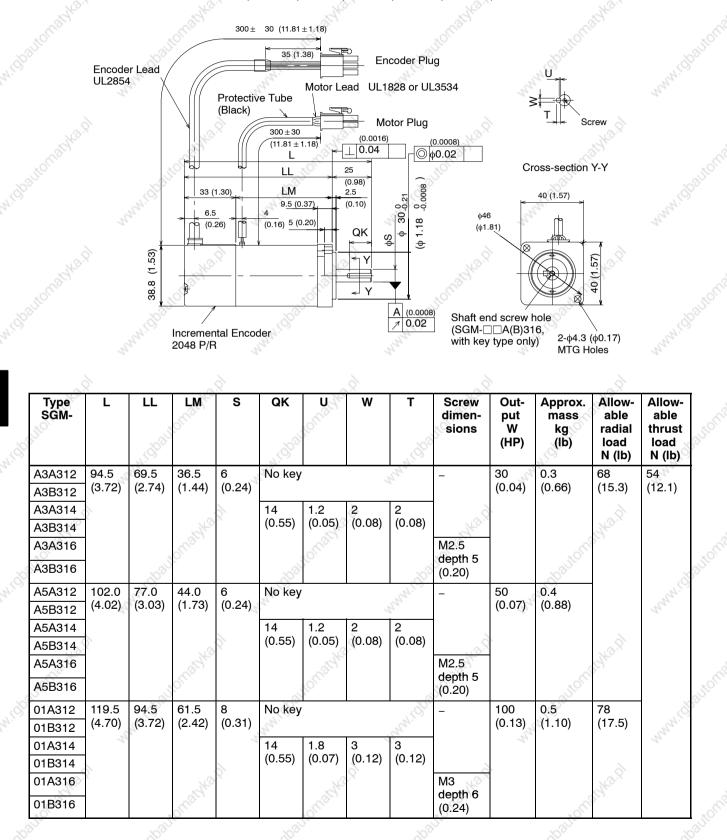
Motor capacities are available as 30 W (0.04 HP), 50 W (0.07 HP), 100 W (0.13 HP), 200 W (0.27 HP), 300 W (0.40 HP), 400 W (0.53 HP), 750 W (1.01 HP). These are grouped into three categories, as follows:

- 30W (0.04 HP), 50W (0.07 HP), 100W (0.13 HP)
- 200W (0.27 HP), 300W (0.40 HP), 400W (0.53 HP)
- 750W (1.01 HP)
- As for the dimensional drawings of SGMP servomotors, see from the page 269 on.
- As for the dimensional drawings of TÜV approved SGM servomotors, see from the page 289 on.
- As for the dimensional drawings of TÜV approved SGMP servomotors, see from the page 309 on.

5.4.1 Servomotor Dimensional Drawings cont.

(1) SGM Servomotor Incremental encoder, no brake (Type SGM-0310)

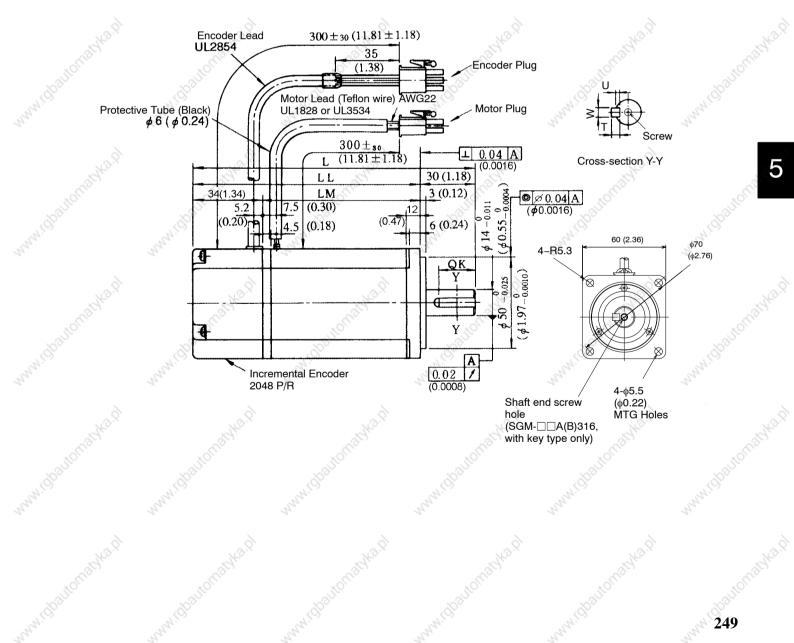
• 30W (0.04 HP), 50W (0.07 HP),100W (0.13 HP)



248

- Note 1) The detector uses an incremental encoder 2048 P/R.
  - 2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.
  - 3) "A3A(B)314", "A3A(B)316", "A5A(B)314", "A5A(B)316" "01A(B)314" and "01A(B)316" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.

# • 200 W (0.27 HP), 300 W (0.40 HP), 400 W (0.53 HP)



5.4.1 Servomotor Dimensional Drawings con	ıt.
-------------------------------------------	-----

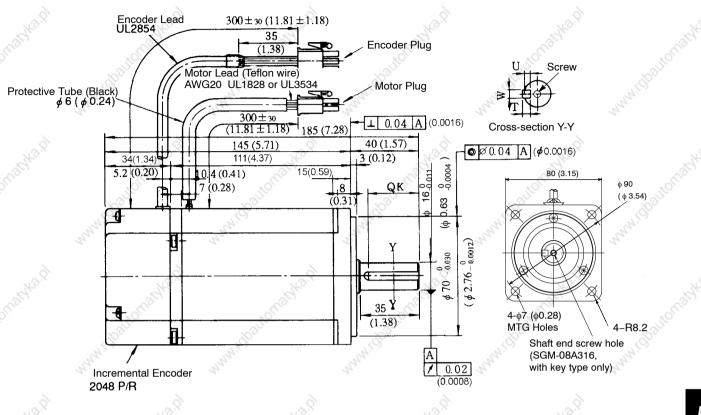
ANN M.O.	Type SGM-	L 4	ALC.	LM	QK	U.S.	W	T	Screw dimensions	Out put W (HP)	Approx. mass kg (Ib)	Allow- able radial load N (lb)	Allow- able thrust load N (lb)
	02A312	126.5	96.5	62.5	No key	,	2		- 33	200	1.1	245	74
	02B312	(4.98)	(3.80)	(2.46)			. No.		xoffic	(0.27)	(2.43)	(55.1)	(16.6)
	02A314		200	5	20	3	5	5	10 <sup>2102</sup>		1030		
	02B314		34.10		(0.79)	(0.12)	(0.20)	(0.20)	and C.		A.O.		32.0
3435	02A316	5	24		~	122			M5,	4	2		A A A A
	02B316								depth 8 (0.31)				
	03B312	154.5	124.5	90.5	No key	,		2	-	300	1.7	S.	
	03B314	(6.08)	(4.90)	(3.56)	20	3	5	5	all a	(0.40)	(3.75)	de la	
	03B316		à	Lor lo	(0.79)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		150	10-1	
	04A312	154.5	124.5	90.5	No key	. 8	·		- 8	400	1.7		3
And ANT	04A314	(6.08)	(4.90)	(3.56)	20	3	5	5	and a	(0.53)	(3.75)		A A A A A
24	04A316	3			(0.79)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	1			L.

Note 1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.
- 3) "02A(B)314", "02A(B)316" "03B314", "03B316", "04A314" and "04A316" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.

idbauto

• 750 W (1.01 HP)



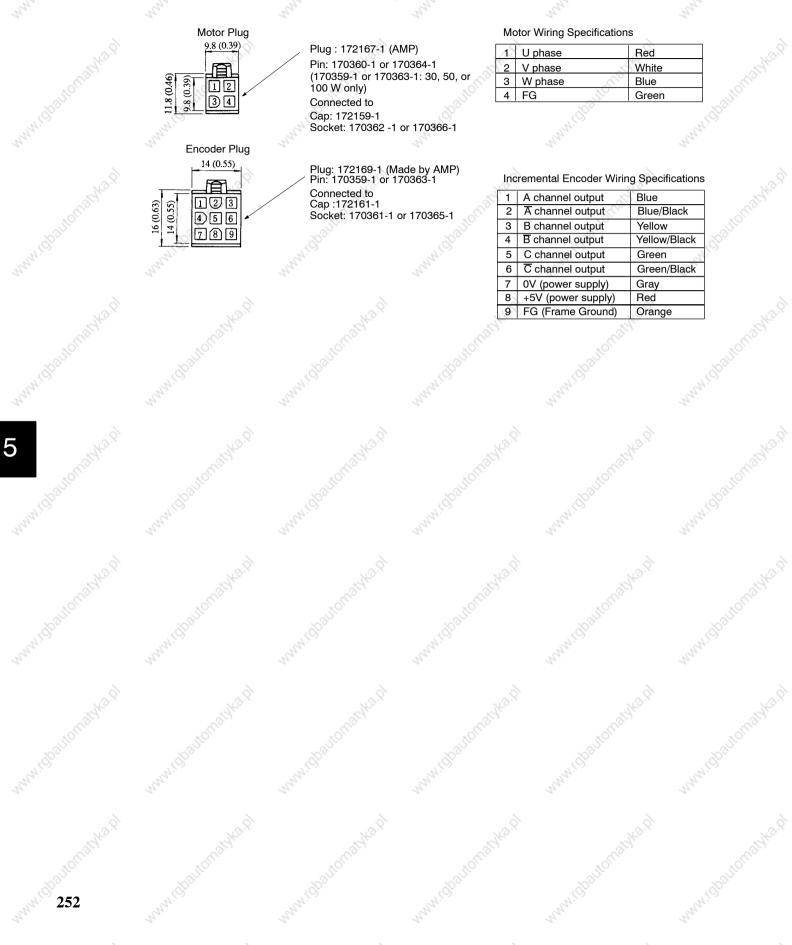
Type SGM-	QK	U C	o <sup>©</sup> W	Т	Screw dimen- sions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08A312	No key	,		2	-	750	3.4	392 (88.1)	147 (33.0)
08A314	30	3	5	5		(1.01)	(7.50)	12.S	
08A316	(1.18)	(0.12)	(0.20)	(0.20)	M5, depth 8(0.31)	Card .		omater	

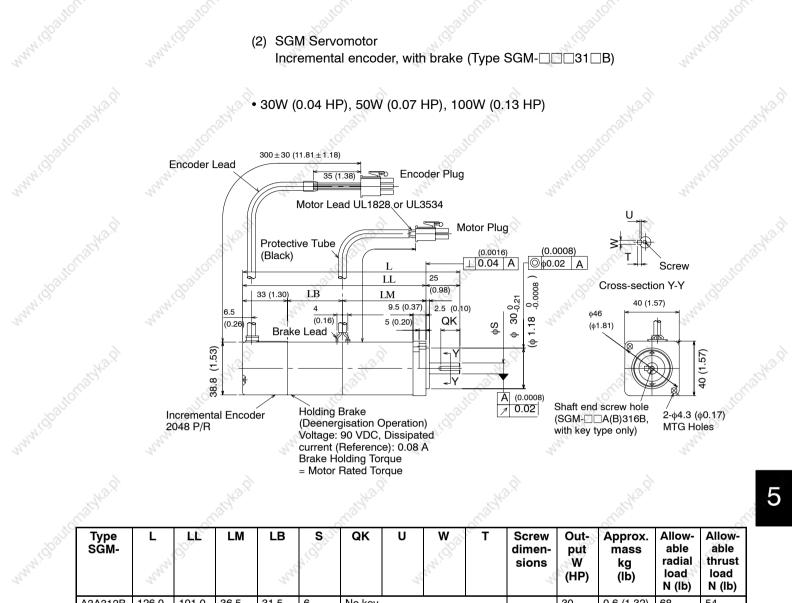
**Note** 1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "A" indicates 200 V specification.
- 3) "08A314" and "08A316" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.

5.4.1 Servomotor Dimensional Drawings cont.

• Details of Motor and Encoder Plugs (Common for 30 W (0.04 HP) to 750 W (1.01 HP)



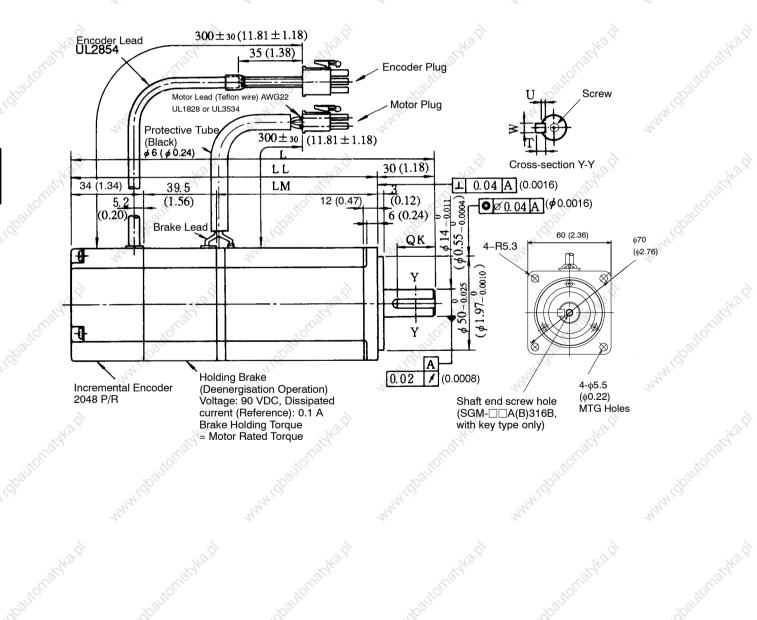


MMM. Balto	Type SGM-	L	S. FE	LM	LB	S.U.S.	QK	U	W.	Т	Screw dimen- sions	Out- put W	Approx. mass kg	Allow- able radial load	Allow- able thrust load
24		24			24			2			2	(HP)	(lb)	N (lb)	N (lb)
	A3A312B	126.0	101.0 (3.98)	36.5	31.5	6 (0.24)	No key	1			2	30 (0.04)	0.6 (1.32)	68	54
	A3B312B	(4.96)	(3.98)	(1.44)	(1.24)	(0.24)	10	~		N	×.	(0.04)	NO.Y	(15.3)	(12.1)
	A3A314B	-		(P)			14 (0.55)	1.2 (0.05)	2 (0.08)	2 (0.08)			Sec.		4
30	A3B314B		.50				(0.55)	(0.03)	(0.08)	(0.08)			10°		.30
. 30°-	A3A316B		8			. 8°					M2.5, depth 5	. 80			.8°
and it	A3B316B	554			S	14			Sty .		(0.20)	JAN.		5	A
450	A5A312B	133.5	108.5	44.0	31.5	6	No key	2			- 24	50	0.7 (1.54)	1922	
	A5B312B	(5.26)	(4.27)	(1.73)	(1.24)	(0.24)						(0.07)			
	A5A314B						14	1.2	2	2	2				
	A5B314B			125			(0.55)	(0.05)	(0.08)	(0.08)			2 M		
.0	A5A316B		. 5				C .			30.	M2.5,		5		.S
10 <sup>71/11</sup>	A5B316B	1	Sam			1000			.00	5°	depth 5 (0.20)	50	5		1000
N.C.	01A312B	160.0	135.0	61.5	40.5	8	No key	I	N.C.		-	100	0.8 (1.76)	78	1.0
454	01B312B	(6.30)	(5.31)	(2.42)	(1.59)	(0.31)			52		2	(0.13)		(17.5)	
	01A314B						14	1.8	3	3					
	01B314B			0			(0.55)	(0.07)	(0.12)	(0.12)	6		0		
	01A316B			Nº.			No			N	M3,		No.		
3	01B316B	-	5	Q-11			Carl.			S. Carrie	depth 6 (0.24)		S. S.		3
-alle		I	~3 <sup>5</sup>	I	1	~35	I	1	23	25	· ,	1	5	1	
"igh		2	S.						100			100			253
and a second		-1224				2.						26-2		22	433
-4		-4			-0										

5.4.1 Servomotor Dimensional Drawings cont.

Note 1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.
- A3A(B)314B", "A3A(B)316B", "A5A(B)314B", "A5A(B)316B", "01A(B)314B" and "01A(B)316B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
  - 200 W (0.53 HP), 300 W (0.40 HP), 400 W (0.27 HP)



5.4  $\Sigma$ -Series Dimensional Drawings

		, C	Q			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			<u></u>				A	2-
	Type SGM-	And	LL	LM	QK	Ű	W	T da Martin	Screw dimensions	Out- put W (HP)	Approx. mass kg (Ib)	Allow- able radial load N (lb)	Allow- able thrust load N (lb)	
	02A312B	166.0	136.0	62.5	No key		54		- 59	200	1.6	245	74	5
ð	02B312B	(6.54)	(5.35)	(2.46)		30,			KOR"	(0.27)	(3.53)	(55.1)	(16.6)	100
-	02A314B	2	SP		20	3	5	5	10812		10302			62
	02B314B	all.	5		(0.79)	(0.12)	(0.20)	(0.20)	S.		2. <sup>0</sup> .		34.0	
	02A316B	44			- day			224	M5, depth 8	174			A. C. C.	
	02B316B								(0.31)					
	03B312B	194.0	164.0	90.5	No key		2			300	2.2	à		
	03B314B	(7.64)	(6.46)	(3.56)	20	3	5	5	and the	(0.40)	(4.85)	34		
Ő,	03B316B		autorn's		(0.79)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		autorni			autornio
	04A312B		S		No key	80	_		E.	400	S		8	<i></i>
	04A314B	and i			20	3	5	5		(0.53)	Sec.		A. C. A.	
	04A316B	24			(0.79)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	4			14	

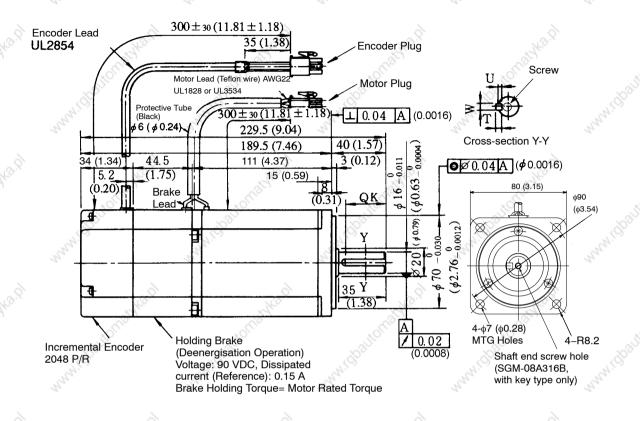
Note

1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.
- 3) "02A(B)314B", "02A(B)316B", "03B314B", "03B316B", "04A314B" and "04A316B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.

5.4.1 Servomotor Dimensional Drawings cont.

• 750 W (1.01 HP)



					NO.X			
QK	U	W at	т	Screw dimen- sions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
No key	and			44	750	4.3	392 (88.1)	147 (33.0)
30	3	5	5	4	(1.01)	(9.48)		20
(1.18)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	aler?		aska.P	
	No key 30	No key 30 3	No key         5	No key         5         5	No key         -           30         3         5         5           (1.18)         (0.12)         (0.20)         (0.20)         M5, depth 8	No key         -         750 (1.18)           30         3         5         5           (1.18)         (0.12)         (0.20)         (0.20)         M5, depth 8	No key         -         750 (1.18)         4.3 (0.12)           30 (1.18)         3 (0.12)         5 (0.20)         5 (0.20)         -         750 (0.20)         4.3 (1.01)         (9.48)	No key         -         750 (1.18)         4.3 (9.48)         392 (88.1)           30 (1.18)         3 (0.12)         5 (0.20)         5 (0.20)         -         750 (0.20)         4.3 (1.01)         392 (88.1)

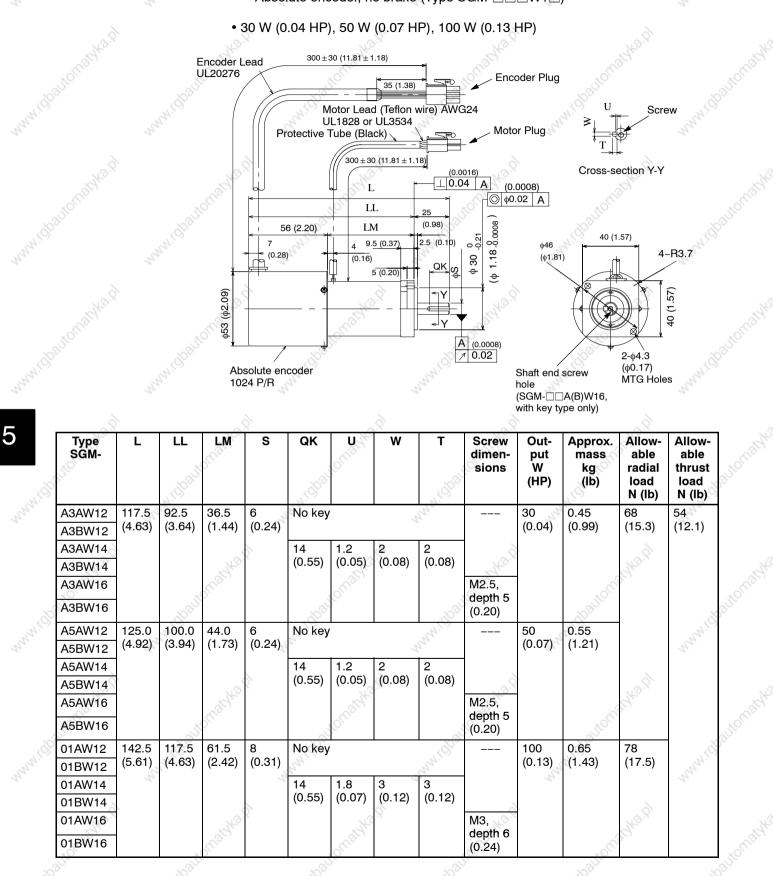
Note 1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "A" indicates 200 V specification.
- "08A314B" and "08A316B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.

• Details of Motor and Encoder Plugs (Common for 30 W (0.04 HP) to 750 W (1.01 HP) Motor Plug Motor Wiring Specifications 9.8 (0.39) Plug: 172168-1 (AMP) Pin: 170360-1 or 170364-1 U phase 1 Red 11.8 (0.46) (17359-1 or 170363-1: 30, 50, or 9.8 (0.39) V phase 123 2 White 100 W only) 456 3 W phase Blue Connected to Green/Yellow 4 Cap: 172160-1 FG Socket: 170362 -1 or 170366-1 5 Brake terminal Red Brake terminal Black 6 Encoder Plug 14 (0.55) Incremental Encoder Wiring Specifications Plug: 172169-1 (AMP) Pin: 170359-1 or 170363-1 Blue 1 A channel output 123 16 (0.63) 14 (0.55) Connected to 2 Blue/Black A channel output 4 5 6 Cap :172161-1 3 B channel output Yellow 789 Socket: 170361-1 or 170365-1 4 B channel output Yellow/Black C channel output 5 Green C channel output 6 Green/Black 7 0V (power supply) Gray +5V (power supply) 8 Red 9 Orange FG (Frame Ground) 257

5.4.1 Servomotor Dimensional Drawings cont.

(3) SGM Servomotor Absolute encoder, no brake (Type SGM-

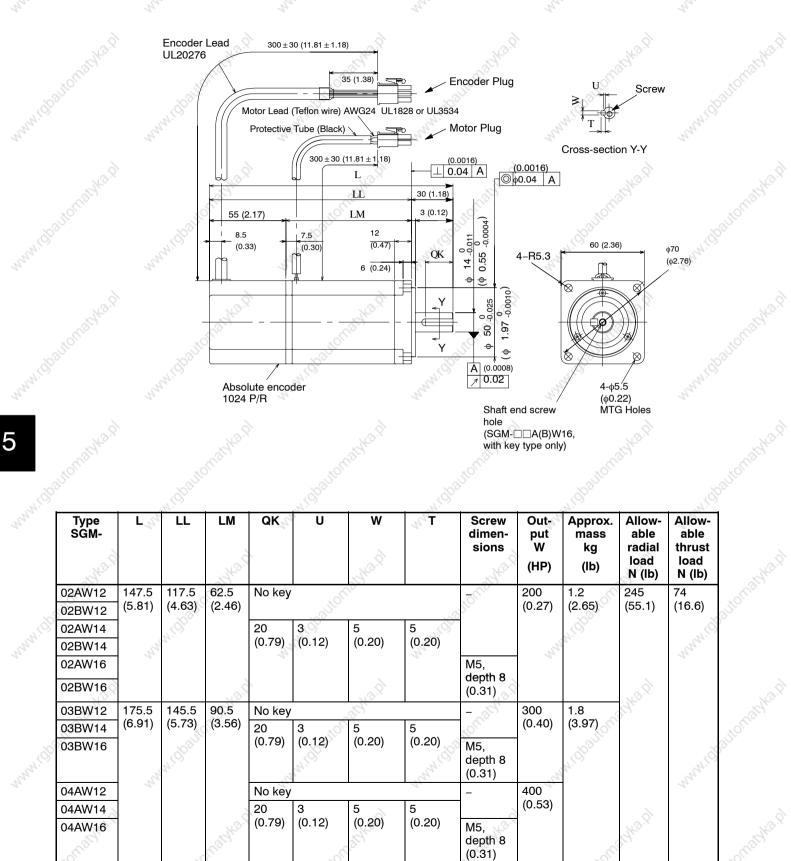


5

- Note 1) The detector uses a 12-bit absolute encoder 1024 P/R.
  - 2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.
  - 3) "A3A(B)W14", "A3A(B)W16", "A5A(B)W14", "A5A(B)W16", "01A(B)W14" and "01A(B)W16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.

5.4.1 Servomotor Dimensional Drawings cont.

• 200 W (0.27 HP), 300W (0.40 HP), 400 W (0.53 HP)

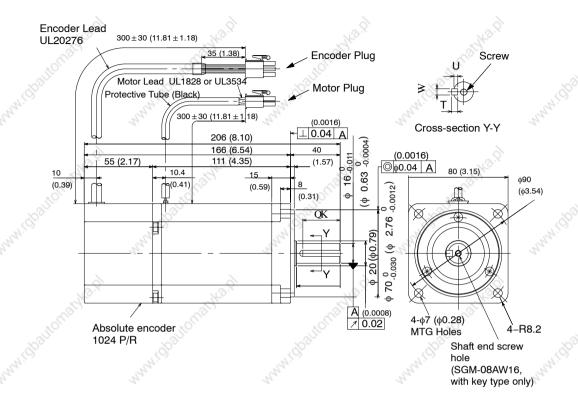


5

- Note 1) The detector uses a 12-bit absolute encoder 1024 P/R.
  - 2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.
  - 3) "02A(B)W14", "02A(B)W16", "03BW14" "03BW16", "04AW14" and "04AW16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.

5.4.1 Servomotor Dimensional Drawings cont.

• 750 W (1.01 HP)



Type SGM-	QK	U	W	Т	Screw dimen- sions	Output W (HP)	Approx. mass kg (Ib)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08AW12	No key				-	750	3.5	392 (88.1)	147 (33.0)
08AW14	30 🔿	3	5	50		(1.01)	(7.72)	ŝ	
08AW16	(1.18)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	of and the		tonadito	

Note

e 1) The detector uses a 12-bit absolute encoder 1024 P/R.

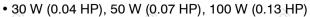
2) Type "A" indicates 200 V specification.

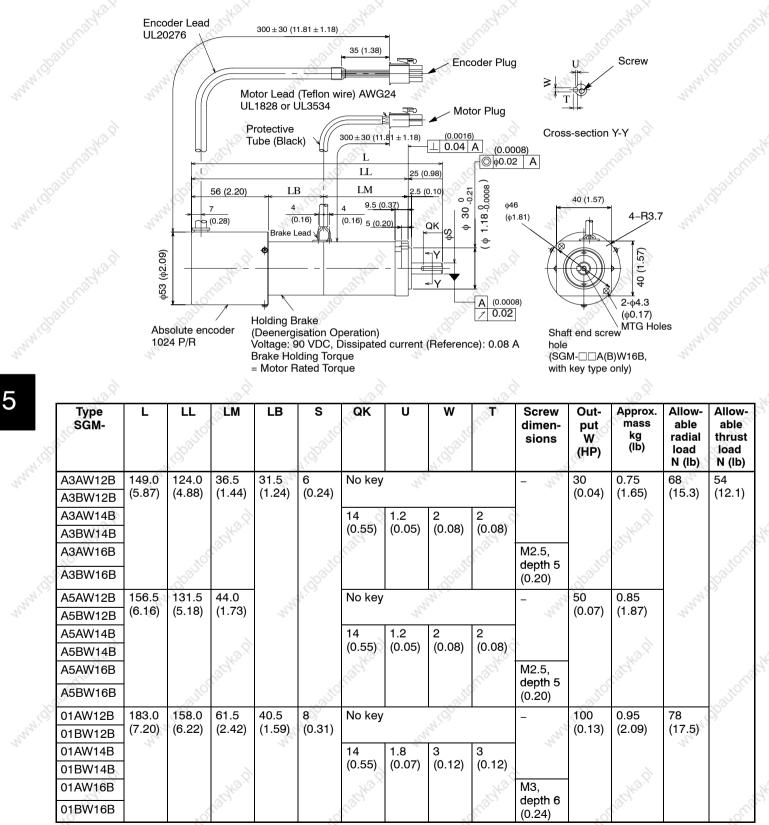
- 3) "08AW14" and "08AW16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.

• Details of Motor and Encoder Plugs (Common for 30 W (0.04 HP) to 750 W (1.01 HP) Motor Plug Motor Wiring Specifications Plug : 172167-1 (AMP) 1 U phase Red 12 34 Pin: 170360-1 or 170364-1 2 V phase White (17359-1 or 170363-1; 30, 50, or 100 W only) 3 W phase Blue ANNINI, CO 4 FG Green/Yellow Connected to Cap: 172159-1 Socket: 170362 -1 or 170366-1 Encoder Plug Plug: 172171-1 (AMP) Pin: 170359-1 or 170363-1 Incremental Encoder Wiring Specifications Connected to Cap :172163-1 Socket: 170361-1 or 170365-1 4 Blue A channel output 13 14 15 2 Ā White/Blue channel output 3 B channel output Yellow 4 B channel output White/Yellow 5 Z channel output Green Z channel output White/Green 6 7 0 V (power supply) Gray 8 +5 V (power supply) Red FG (Frame Ground) Orange 9 10 S channel output Purple White/Purple S channel output 11 (12) (Capacitor reset) (Gray) White/Gray 13 Reset 14 0V(battery) White/Orange 3.6V(battery) Orange 15 \* Terminal to discharge capacitor for product dispatch. Do not use.

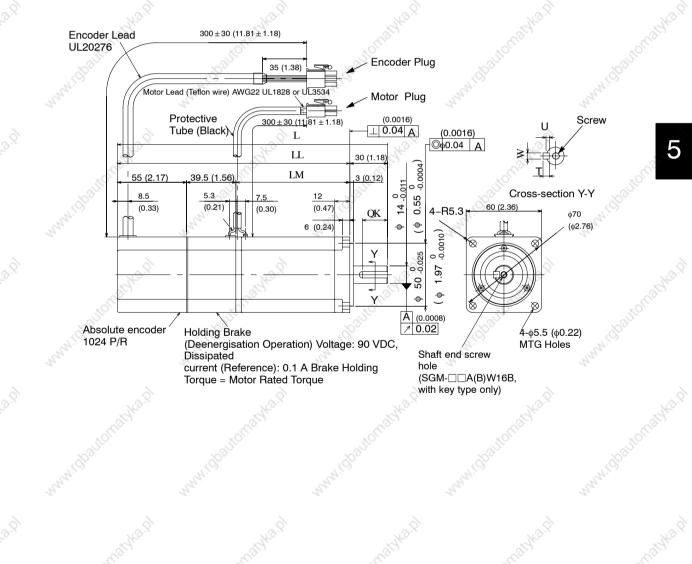
5.4.1 Servomotor Dimensional Drawings cont.

 (4) SGM Servomotor Absolute encoder, with brake (Type SGM-□□W1□B)





- Note 1) The detector uses a 12-bit absolute encoder 1024 P/R.
  - 2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.
  - "A3A(B)W14B", "A3A(B)W16B", "A5A(B)W14B", "A5A(B)W16B", "01A(B)W14B" and "01A(B)W16B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.
  - 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.



#### • 200 W (0.27 HP), 300 W (0.40 HP), 400 W (0.53 HP)

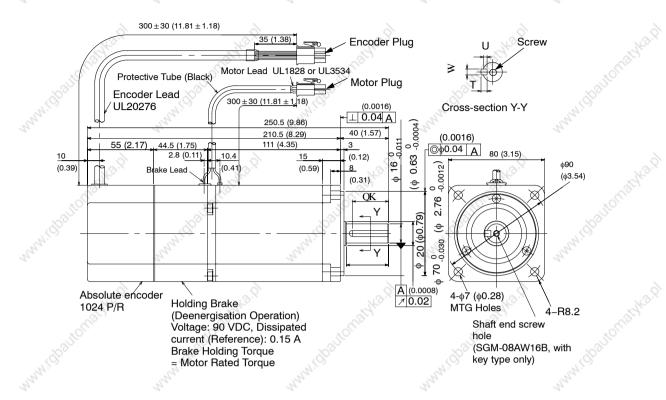
5.	4.1	l Sei	rvomotor	Dim	ensiona	l D	rawings cont.	
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		~??.								~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			
Type SGM-	L MAN	È.L	LM	QK	ψ <sup>2</sup> U	W Xan	T	Screw dimen- sions	Out- put W (HP) (HP)	Approx. mass kg (lb)	Allow- able radial load N (lb)	Allow- able thrust load N (Ib)	2
02AW12B	187.0	157.0	62.5	No key		25			200	1.7	245	74	S.
02BW12B	(7.36)	(6.18)	(2.46)		28			205	(0.27)	(3.75)	(55.1)	(16.6)	205
02AW14B		2000		20	3	5	5	2000		20	2		2000
02BW14B		S		(0.79)	(0.12)	(0.20)	(0.20)	12 M		AN.CO		and and	2
02AW16B	1222			200			-122	M5,		1924		4545	
02BW16B	-		6			ò	1	depth 8 (0.31)	6		2		
03BW12B	215.0	185.0	90.5	No key		Nº.		-	300	2.3	Nº.		
03BW14B	(8.46)	(7.28)	(3.56)	20	3	5	5	S.	(0.40)	(5.07)	Star.		S. S.
03BW16B		350		(0.79)	(0.12)	(0.20)	(0.20)	M5,			50		S.C.
r	33	, So		5	1. <sup>20°</sup>		5 (0.20)	depth 8 (0.31)		Say in		54	S.
04AW12B	1927			No key	,		24	-	400	200		344	
04AW14B	1			20	3	5	5		(0.53)				
04AW16B			20140.P	(0.79)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	SCH40.9		a Carles	5	-Car

Note

- 1) The detector uses a 12-bit absolute encoder 1024 P/R.
  - 2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.
  - 3) "02A(B)W14B", "02A(B)W16B", "03BW14B", "03BW16B", "04AW14B" and "04AW16B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.
  - 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.

• 750 W (1.01 HP)



Type SGM-	QK	U	W C	Т	Screw dimen- sions (Ib)	Output W (HP)	Approx. mass kg (Ib)	Allow- able radial load (lb)	Allow- able thrust load N (lb)
08AW12B	No key	A.		A.	-	750	4.5	392	147
08AW14B	30 (1.18)	3 (0.12)	5 (0.20)	5 (0.20)		(1.01)	(9.92)	(88.1)	(33.0)
08AW16B	Ma.g.		Weap!		M5, depth 8 (0.31)	2		19.Q	

Note

1) The detector uses a 12-bit absolute encoder 1024 P/R.

- 2) Type "A" indicates 200 V specification.
- "08AW14B" and "08AW16B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.

5.4.1 Servomotor Dimensional Drawings cont.

• Details of Motor and Encoder Plugs (Common for 30 W (0.04 HP) to 750 W (1.01 HP)

Motor Plug

123

456

Plug : 172168-1 (AMP) Pin: 170360-1 or 170364-1 (17359-1 or 170363-1: 30, 50, or 100 W only) Connected to Cap: 172160-1 Socket: 170362 -1 or 170366-1

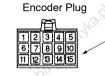
#### Motor Wiring Specifications

	1	U phase	Red
	2	V phase	White
	3	W phase	Blue
8	4	FG	Green/Yellow
	5	Brake terminal	Red
	6	Brake terminal	Black

# Incremental Encoder Wiring Specifications

			- X			
5-1 (Ja	1	A channel output	Blue			
	2	A channel output	White/Blue			
	3	B channel output	Yellow			
	4	B channel output	White/Yellow			
	5	Z channel output	Green			
	6	Z channel output	White/Green			
	7	0 V (power supply)	Black			
	8	+5 V (power supply)	Red			
	9	FG (Frame Ground)	Green/Yellow			
	10	S channel output	Purple			
	11	S channel output	White/Purple			
*	(12)	(Capacitor reset)	(Gray)			
	13	Reset 🔗	White/Gray			
ALALAN.O.	14	0V(battery)	White/Orange			
24	15	3.6V(battery)	Orange 🛛 🖄			

\* Terminal to discharge capacitor for product dispatch. Do not use.



Plug: 172171-1 (AMP) Pin: 170359-1 or 170363-1 Connected to Cap :172163-1 Socket: 170361-1 or 170365-1

- 2) The dimensional drawings of the SGMP Servomotors are broadly grouped into the following four categories.
  - a) Incremental encoder, no brake (from page 270)
  - b) Incremental encoder, with brake (from page 275)
  - c) Absolute encoder, no brake (from page 280)
  - d) Absolute encoder, with brake (from page 284)

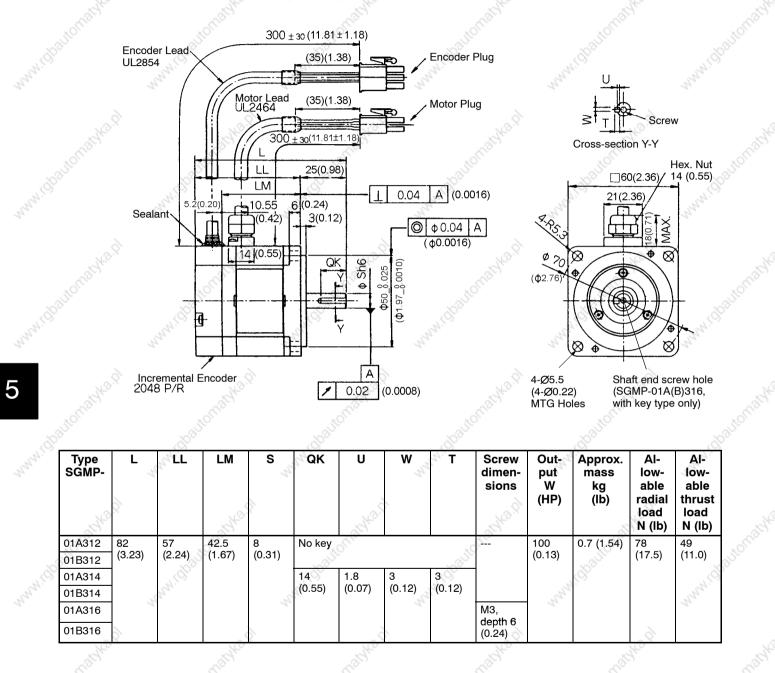
Motor capacities are available as 100 W (0.13 HP), 200 W (0.27 HP), 300 W (0.40 HP) , 400 W (0.53 HP), 750 W (1.01 HP). These are grouped into three categories, as follows:

- 100W (0.13 HP)
- 200W (0.27 HP), 300W (0.40 HP), 400W (0.53 HP)
- 750W (1.01 HP)
- As for the dimensional drawings of SGM servomotors, see from page 247 on.
- As for the dimensional drawings of TÜV approved SGM servomotors, see from the page 289 on.
- As for the dimensional drawings of TÜV approved SGMP servomotors, see from the page 309 on.

5.4.1 Servomotor Dimensional Drawings cont.

(1) SGMP Servomotor Incremental encoder, no brake (Type SGM-0310) www.idbalto

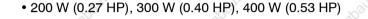
• 100 W (0.13 HP)

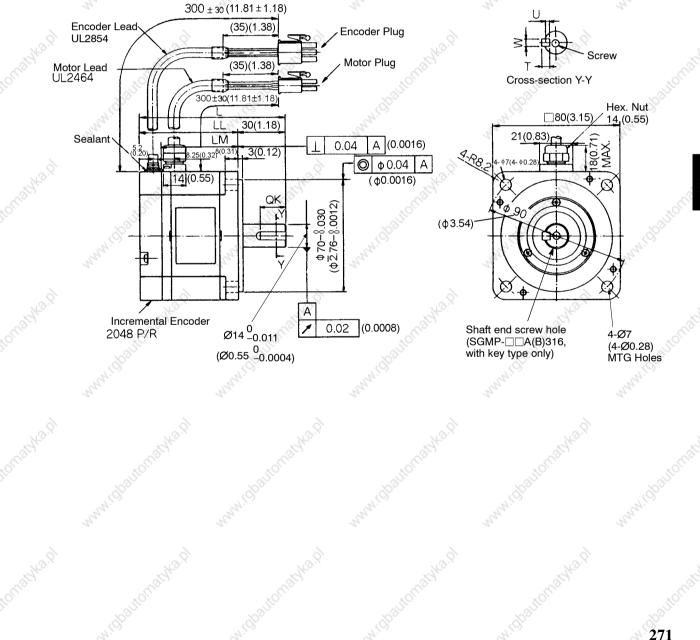


Note 1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.
- "01A(B)314" and "01A(B)316" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.

5) Conforms to "IP55" protective structure (except connector and output shaft faces).





5.4.1 Servomotor Dimensional Drawings cont.

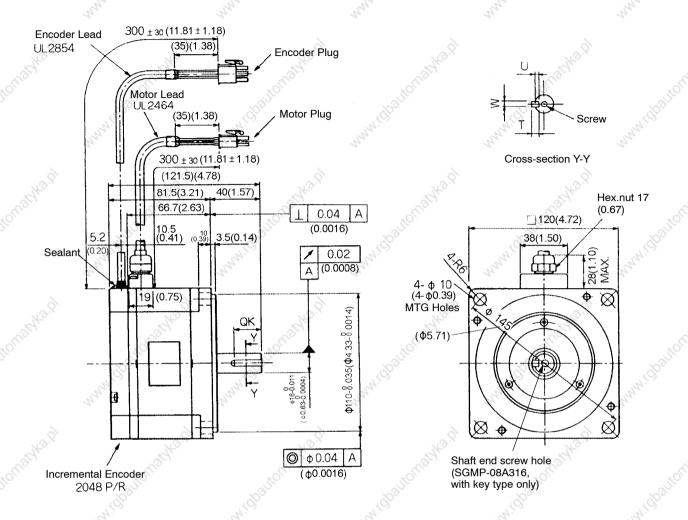
Type SGMP-	L 3	1 <sup>36</sup>	LM	QK	<sup>d</sup> . O	w	T	Screw di- men- sions	Out- put W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
02A312	92	62	48.1	No key		A.			200	1.4	245 (55.1)	68 (15.3)
02B312	(3.62)	(2.44)	(1.89)			Ser.			(0.27)	(3.09)	200	
02A314		3	0	16	3	5	5	10			NO.	
02B314				(0.63)	(0.12)	(0.20)	(0.20)	Son Son			Ser .	
02A316		n'i li		. S.	and .		344	M5, depth		And all	0	ANNON!!!
02B316	2					2		8 (0.31)	~			
03B312	112	82	68.1_0	<sup>&lt;</sup> No key	•	NO.			000	2.1	12.5	
03B314	(4.41)	(3.23)	(2.68)	16	3	5	5		(0.40)	(4.63)	20	
03B316		armi, dipali	o <sup>c .</sup>	(0.63)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		and the contract of the contra	patton.	ANNAL OF
04A312	2			No key			20		400	29		24
04A314				16	3	5	5		(0.53)		2	
04A316	8.	2	onativo	(0.63)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	Carly Co.P.		tonatha.	

Note

- 1) The detector uses an incremental encoder 2048 P/R.
  - 2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.
  - 3) "02A(B)314", "02A(B)316", "04A314", "04A316", "03B314", and 03B316 have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.
  - 5) Conforms to "IP55" protective structure (except connector and output shaft faces).

5.4  $\Sigma$ -Series Dimensional Drawings

• 750 W (1.01 HP)



Type SGMP-	QK	U	w	T	Screw dimensions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08A312	No key				6	750	4.2	392 (88.1)	147 (33.0)
08A314	22	3	5 30	5	JLO D	(1.01)	(9.26)	3 <sup>0</sup>	
08A316	(0.87)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		WHICH CONTRACT		WHI DO

Note 1) The detector uses an incremental encoder 2048 P/R.

2) Type "A" indicates 200 V specification.

- "08A314" and "08A316" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 35 mm (1.38in.) from the motor mounting surface.

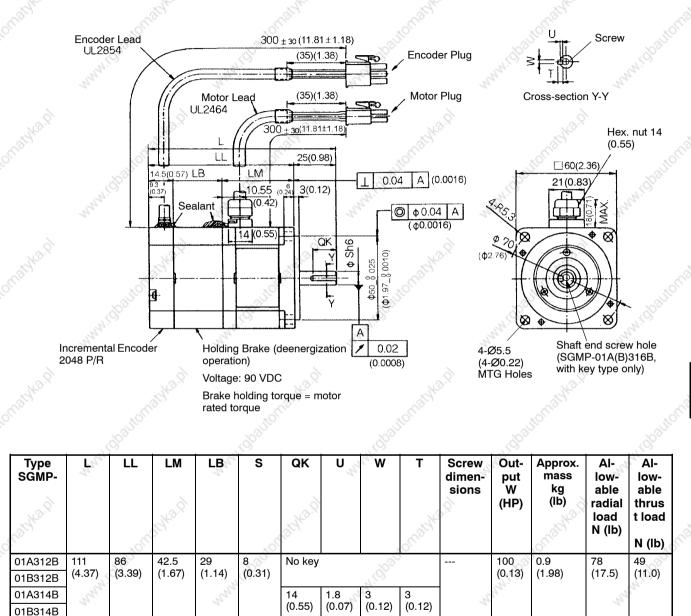
5) Conforms to IP55 protective structure (except connector and output shaft faces).

5.4.1 Servomotor Dimensional Drawings cont.

• Details of Motor and Encoder Plugs (Common for 100 W (0.13HP) to 750 W (1.01HP))



- (2) SGMP Servomotor
  - Incremental encoder, with brake (Type SGMP-
- 🔊• 100 W (0.13HP)



Note

01A316B

01B316B

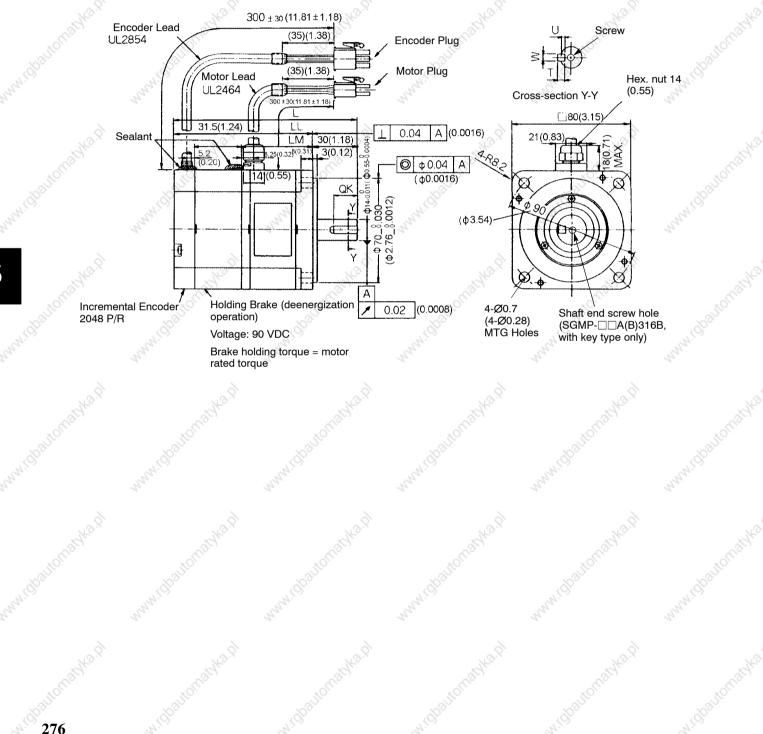
- 1) The detector uses an incremental encoder 2048 P/R.
- 2) Type "A" indicates 200 V specification, and type "B" indicates 100V specification.
- "01A(B)314B" and "01A(B)316B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.

M3, depth 6

(0.24)

5.4.1 Servomotor Dimensional Drawings cont.

- 4) The quoted allowable radial load is the value at a position 20 mm (0.79in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
- 6) Conforms to IP55 protective structure (except connector and output shaft faces).
  - 200 W (0.27HP), 300W (0.40 HP), 400 W (0.53HP)

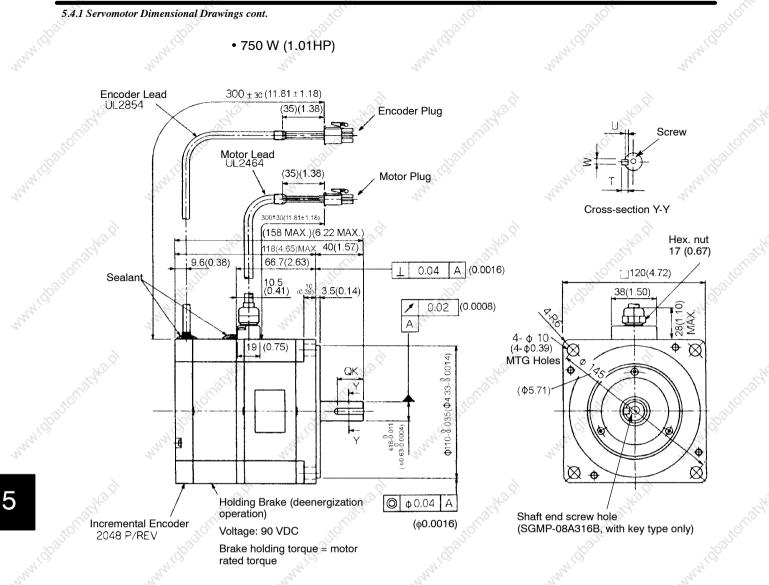


5.4  $\Sigma$ -Series Dimensional Drawings

						Q			)~				
	Type SGMP-	1. 14 14 14	LL	LM	QK	U	W	Terry 19	Screw dimen- sions	Out- put W (HP)	Approx. mass kg (Ib)	Allow- able radial load N (lb)	Allow- able thrust load N (lb)
C	02A312B	123.5	93.5	48.1	No key	S.	3		29	200	1.9	245	68
3	02B312B	(4.86)	(3.68)	(1.89)		10,			, office	(0.27)	(4.19)	(55.1)	(15.3)
(	02A314B	2	300		16	3	5	5	6 <sup>15</sup>		1000		2
(	02B314B	A.C	5		(0.63)	(0.12)	(0.20)	(0.20)			N.O.		. N.C
	02A316B	444			And Contraction			44	M5, depth 8	4	141		And And
0	02B316B			~			~		(0.31)	2		2	
(	03B312B	143.5	113.5	68.1	No key		NO.X		1	300	2.6	Sto. ?!	
	03B314B	(5.65)	(4.47)	(2.68)	16	3 🔬	5	5	20	(0.40)	(5.73)	S.	
0	03B316B		10		(0.63)	(0.12)	(0.20)	(0.20)	M5,		8		
		al C	S.		, d	8°~		, d	depth 8 (0.31)		N. GDOL		, jõ
(	04A312B	Jan Star			No key			July 1		400	120		Achard St.
(	04A314B				16	3	5	5	]	(0.53)			
0	04A316B		.5	12.0.	(0.63)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	0.		25340.Q	

Note

- 1) The detector uses an incremental encoder 2048 P/R.
  - 2) Type "A" indicates 200 V specification, and type "B" indicates 100V specification.
  - 3) "02A(B)314B", "02A(B)316B", "03B314B" "03B316B" "04A314B" and "04A316B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 25 mm (0.98in.) from the motor mounting surface.
  - 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
- 6) Conforms to IP55 protective structure (except connector and output shaft faces).



Type SGMP-	QK	Û	W	Stor.	Screw dimen- sions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)	Homate
08A312B	No key		200		- 8	750	6.1	392 (88.1)	147 (33.0)	8° -
08A314B		3 (0.12)	5 (0.20)	5 (0.20)	Sel.	(1.01)	(13.45)	S	and its	
08A316B	(0.87)	250			M5,		250		200	
					depth 8					
	-	8		6	(0.31)	à	· · · · · · · · · · · · · · · · · · ·	4	5	

Note

1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "A" indicates 200 V specification.
- 3) "08A314B" and "08A316B" have a keyed shaft. The keyway complies with JIS B www.dbautomat 1301-1976 (precision). A straight key is supplied.

- 4) The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
- 6) Conforms to IP55 protective structure (except connector and output shaft faces).
- Details of Motor and Encoder Plugs (Common for 100 W (0.13 HP) to 750 W (1.01 HP))

Motor Plug

Plug : 172168-1 (AMP) Pin 170360-1 or 170364-1 Connected to Cap 172160-1 Socket 170362-1 or 170366-1

Encoder Plug

456

789

Plug: 172169-1 (AMP) Pin: 170359-1 or 170366-1 Connected to Cap :172161-1 Socket: 170361-1 or 170365-1 Motor Wiring Specifications

	1	U phase	Red
	2	V phase	White
	3	W phase	Blue
13	4	FG 📈	Green/Yellow
5	5	Brake terminal	Black
	6	Brake terminal	Black

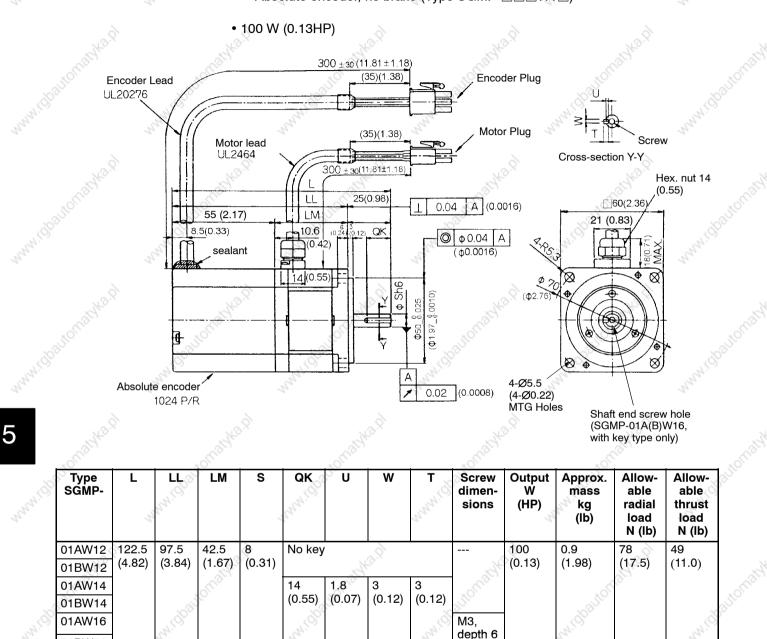
Incremental Encoder Wiring Specifications

		19	19
	1	A channel output	Blue
	2	A channel output	Blue/Black
	े3	B channel output	Yellow
2	4	B channel output	Yellow/Black
	5	C channel output	Green
	6	C channel output	Green/Black
	7	0 V (power supply)	Gray
	8	+5 V (power supply)	Red
	9	FG (Frame Ground)	Orange

5

5.4.1 Servomotor Dimensional Drawings cont.

(3) SGMP Servomotor Absolute encoder, no brake (Type SGMP-



Note

01BW16

1) The detector uses a 12-bit absolute encoder 1024 P/R.

2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.

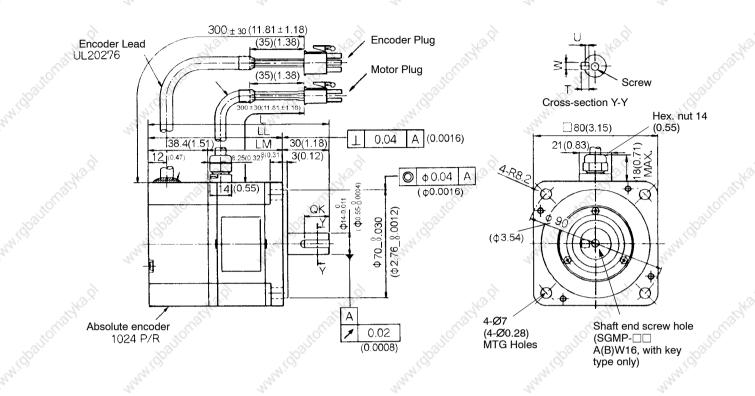
3) "01A(B)W14" and "01A(B)W16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.

(0.24)

4) The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.

5) Conforms to IP55 protective structure (except connector and output shaft faces).

• 200 W (0.27 HP), 300 W (0.40 HP) (100 V only), 400 W (0.53HP) (200 V only)



ŝ	Type SGMP-	L	LL	LM	QK	U	<b>W</b> ?	Т	Screw dimen- sions	Out- put W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
(	02AW12	116.5	86.5	48.1	No key	.80			.8	200	1.6	245 (55.1)	68 (15.3)
(	02BW12	(4.59)	(3.41)	(1.89)	424	200				(0.27)	(3.53)		, NAV.
(	02AW14	Les.			16	3	5	5	]		Ray		20
(	02BW14				(0.63)	(0.12)	(0.20)	(0.20)					
(	02AW16			20.8			2.8		M5,	28		astra.P	
Į	02BW16			fel -		2	and a		depth 8 (0.31)	3		C. S. C.	
(	03BW12	136.5	106.5	68.1	No key	- all				300	2.3	50	, S
(	03BW14	(5.37)	(4.19)	(2.68)	16	3	5	5	So.	(0.40)	(5.07)	1	S°
(	03BW16	14. 14. 14.			(0.63)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		A A A A		ANNAL COOL
(	04AW12			22	No key		2.00	1		400	1	Carly a.P.	
(	04AW14			dr.	16	3	5	5	3	(0.53)		all'a	
0	04AW16		apautorn'	0	(0.63)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		.8	Jtom's	. doau

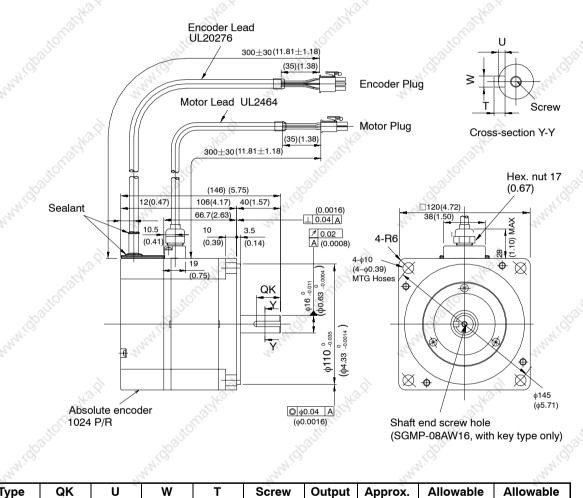
**Note** 1) The detector uses a 12-bit absolute encoder 1024 P/R.

2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.

5.4.1 Servomotor Dimensional Drawings cont.

- "02A(B)W14", "02A(B)W16", "03BW14", "03BW16", "04AW14", and "04AW16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.

5) Conforms to IP55 protective structure (except connector and output shaft faces).



• 750 W (1.01HP)

Type SGMP-	QK	U 2	W	T NKa.P	Screw dimen- sions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08AW12	No key			S.	-	750	4.8	392 (88.1)	147 (33.0)
08AW14	22	3	5 5	5		(1.01)	(10.58)	alle	
08AW16	(0.87)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		44	4. <sup>100</sup>	www.i0

Note 1) The detector uses a 12-bit absolute encoder 1024 P/R

- 2) Type "A" indicates 200 V specification.
- 3) "08AW14" and "08AW16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.

5) Conforms to IP55 protective structure (except connector and output shaft faces).

Details of Motor and Encoder Plugs (Common for 100 W (0.13 HP) to 750 W (1.01 HP))





Plug : 172167-1 (AMP) Pin 170360-1 or 170364-1 Connected to Cap 172159-1 Socket 170362-1 or 170366-1

#### Motor Wiring Specifications

3	5.	U phase	Red	
8	2	V phase	White	
	3	W phase	Blue	3
	4	FG	Green/Yellow	ę.

Encoder Plug



Plug: 172171-1 (AMP) Pin: 170359-1 or 170363-1 Connected to Cap :172163-1 Socket: 170361-1 or 170365-1

Absolute Encoder Wiring Specifications

	ŠЧ	A channel output	Blue				
Ş	2	A channel output	White/Blue				
	3	B channel output	Yellow				
	4	B channel output	White/Yellow				
	5	Z channel output	Green				
	6	Z channel output	White/Green				
	7	0 V (power supply)	Black				
	8	+5 V (power supply)	Red				
	9	FG (Frame Ground)	Green/Yellow				
ŝ	10	S channel output	Purple				
ř.	11	S channel output	White/Purple				
*	(12)	(Capacitor reset)	(Gray)				
	13	Reset	White/Gray				
	14	0V(battery)	White/Orange				
	15	3.6V(battery)	Orange				

Terminal to discharge capacitor for product dispatch. Do not use.

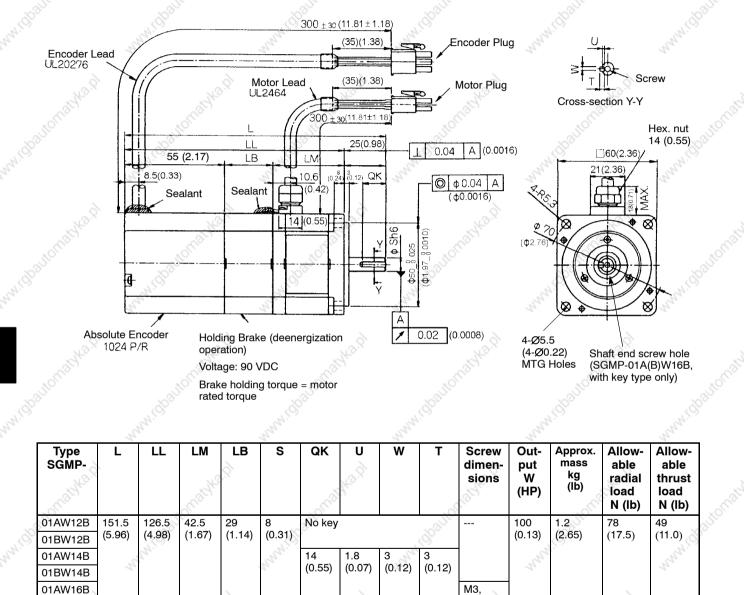
5.4.1 Servomotor Dimensional Drawings cont.

(4) SGMP Servomotor

Absolute encoder, with brake (Type SGMP-DUW1DB)

www.idballc

• 100 W (0.13 HP)



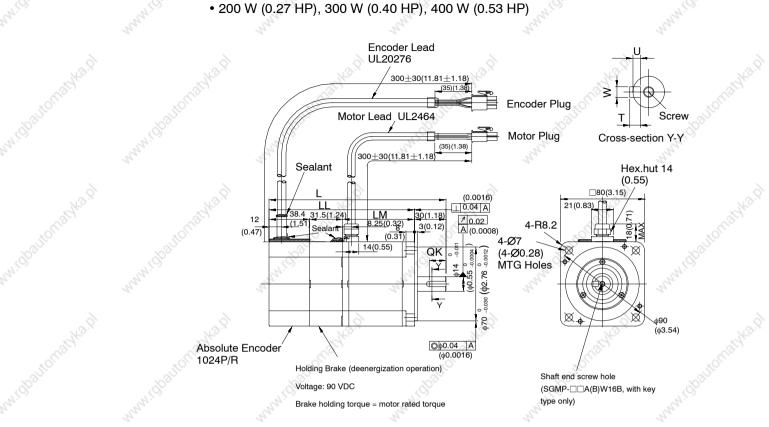
depth 6

(0.24)

01BW16B

- Note 1) The detector uses a 12-bit absolute encoder 1024 P/R.
  - 2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.
  - "01A(B)W14B" and "01A(B)W16B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.
  - 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
  - 6) Conforms to IP55 protective structure (except connector and output shaft faces).

5.4.1 Servomotor Dimensional Drawings cont.



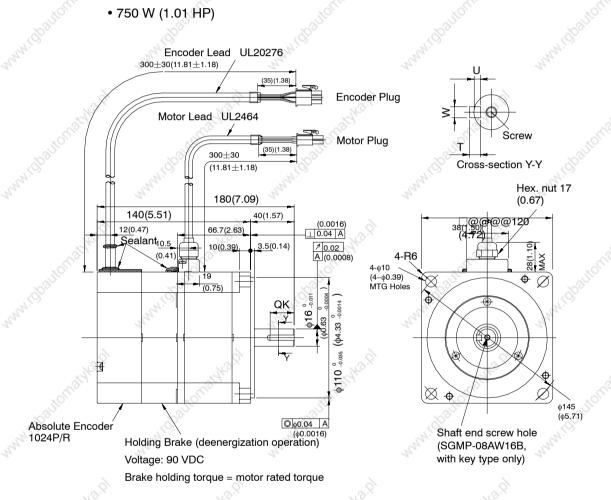
Type SGMP-	L	LL JOS <sup>UTC</sup>	LM	QK	U	Wa	₹т	Screw dimen- sions	Output W (HP)	Approx. mass kg (lb)	Allow- able ra- dial load N (lb)	Allow- able thrust load N (lb)	automat
02AW12B	148	118	48.1	No key	14:00			100	200	2.3	245 (55.1)	68 (15.3)	
02BW12B	(5.83)	(4.65)	(1.89)	34			4	24	(0.27)	(5.07)		34	
02AW14B				16	3	5	5						
02BW14B			200	(0.63)	(0.12)	(0.20)	(0.20)		200				
02AW16B			de			de		M5,	S.		de la		ă
02BW16B	-	30	C .		3	S.		depth 8 (0.31)	<u></u>		J. MORT		JONC
03BW12B	168	138	68.1	No key	S				300	3.0 🔬	0	.8	e.
03BW14B	(6.61)	(5.43)	(2.68)	16	3	5	5	and a start	(0.40)	(6.61)		and it.	
03BW16B	24			(0.63)	(0.12)	(0.20)	(0.20)	M5,		24		24	
à			2			~	2	depth 8 (0.31)	Ś		ŝ		
04AW12B			Ale	No key		de la	-		400		34°		3
04AW14B	1	- 6	C'a	16	3	5	5		(0.53)		- Alan		
04AW16B	1	4.10Daule		(0.63)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		June 1.	Bille	i.	Contra Contra

Note 1) The detector uses a 12-bit absolute encoder 1024 P/R.

2) Type "A" indicates 200 V specification, and type "B" indicates 100 V specification.

- "02A(B)W14B", "02A(B)W16B", "03BW14B", "03BW16B", "04AW14B" and "04AW16B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.

6) Conforms to IP55 protective structure (except connector and output shaft faces).



Type SGMP-	QK	U	<sup>2</sup> c.M	Т	Screw dimen- sions	Output W (HP)	Approx. mass kg (Ib)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08AW12B	No key	4.		4.	-	750	6.2	392 (88.1)	147 (33.0)
08AW14B	22	3	5	5 (0.20)		(1.01)	(13.67)	8	
08AW16B	(0.87)	(0.12)	(0.20)	×	M5, depth 8 (0.31)	SH B.X		onatyka	

5.4.1 Servomotor Dimensional Drawings cont.

Note 1) The detector uses a 12-bit absolute encoder 1024 P/R.

- 2) Type "A" indicates 200 V specification.
- "08AW14B" and "08AW16B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- The quoted allowable radial load is the value at a position 35 mm (1.38 in) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
- 6) Conforms to IP55 protective structure (except connector and output shaft faces).

• Details of Motor and Encoder Plugs (Common for 100W (0.13 HP) to 750 W (1.01 HP))

Motor Plug



Encoder Plug

Plug : 172168-1 (AMP) Pin 170360-1 or 170364-1(1 to 4pin) 170359-1 or 170363 (5 to 6 pin) (17360-1 or 17364-1:only 750W)

Connected to Cap 172160-1 Socket 170362-1 or 170366-1

Plug: 172171-1 (AMP) Pin: 170359-1 or 170363-1

Socket: 170361-1 or 170365-1

Connected to Cap :172163-1

Motor Wiring Specifications

	0.	0.
1	U phase	Red
2	V phase	White
3	W phase	Blue
4	FG 🔗	Green/Yellow
5	Brake terminal 🔊	Black
6	Brake terminal	Black

Absolute Encoder Wiring Specifications

		2	100
	÷.	A channel output	Blue
3	2	A channel output	White/Blue
2	3	B channel output 🔊	Yellow
	4	B channel output	White/Yellow
	5	Z channel output	Green
	6	$\overline{Z}$ channel output	White/Green
	7	0 V (power supply)	Black 🔈
	8	+5 V (power supply)	Red
	9	FG (Frame Ground)	Green/Yellow
,	10	S channel output	Purple
ş	<sup>©</sup> 11	S channel output	White/Purple
r	(12)	(Capacitor reset)	(Gray)
	13	Reset	White/Gray
	14	0V(battery)	White/Orange 🖄
	15	3.6V(battery)	Orange

 Terminal to discharge capacitor for product dispatch. Do not use.

# 5.4.2 Servomotor Dimensional Drawings (TÜV approved, conforming to the machine instructions)

1) The dimensional drawings of TÜV approved SGM Servomotors (conforming to the machine instructions) are broadly grouped into the following four categories.

- a) Incremental encoder, no brake (from page 290)
- b) Incremental encoder, with brake (from page 294)
- c) Absolute encoder, no brake (from page 299)
- d) Absolute encoder, with brake (from page 304)

Motor capacities are available as 30 W (0.04 HP), 50 W (0.07 HP), 100 W (0.13 HP), 200 W (0.27 HP), 300 W (0.40 HP), 400 W (0.53 HP), 750 W (1.01 HP). These are grouped into three categories, as follows:

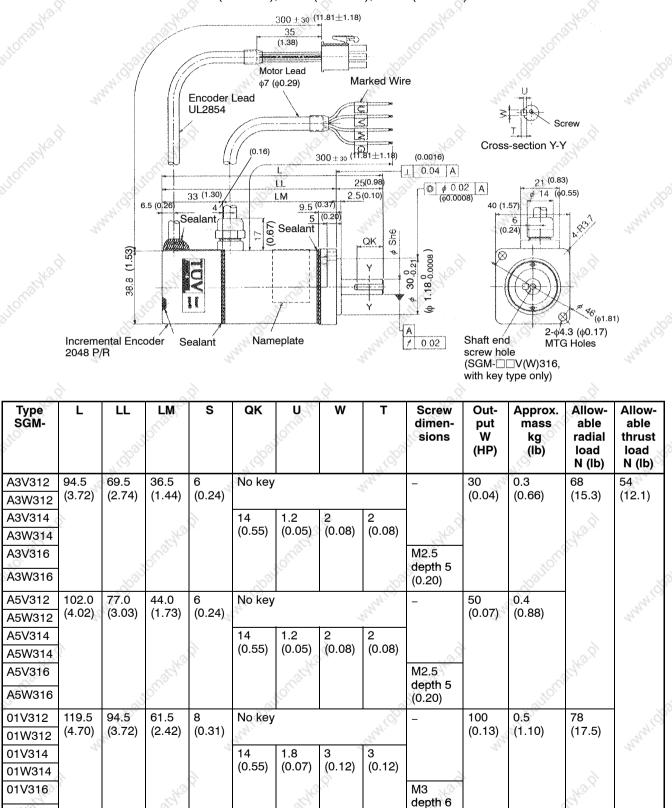
- 30W (0.04 HP), 50W (0.07 HP), 100W (0.13 HP)
- 200W (0.27 HP), 300W (0.40 HP), 400W (0.53 HP)
- 750W (1.01 HP)

- As for the dimensional drawings of SGM servomotors, see from the page 247 on.
- As for the dimensional drawings of SGMP servomotors, see from the page 269 on.
- As for the dimensional drawings of TÜV approved SGMP servomotors, see from the page 309 on.

All drawings conform to the machine instructions. As for the motor drawings conforming to the EMC instructions, encoder plug and its accessories are different. For details, contact your Yaskawa representative.

5.4.2 Servomotor Dimensional Drawings cont.

- TÜV approved (conforming to the machine instructions) SGM Servomotor Incremental encoder, no brake (Type SGM-□□31□)
- 30W (0.04 HP), 50W (0.07 HP),100W (0.13 HP)

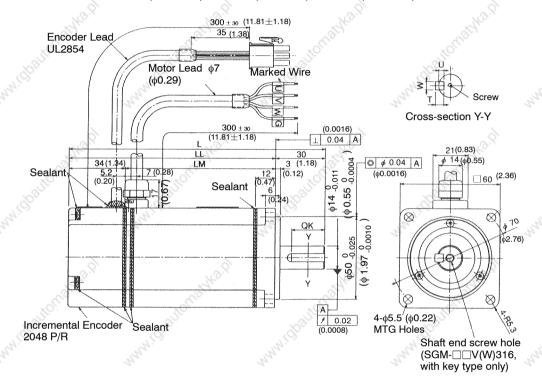


(0.24)

MAN COOLE

01W316

- Note 1) The detector uses an incremental encoder 2048 P/R.
  - 2) Type "V" indicates 200 V specification, and type "W" indicates 100 V specification.
  - "A3V(W)314", "A3V(W)316", "A5V(W)314", "A5V(W)316", "01V(W)314" and "01V(W)316" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.

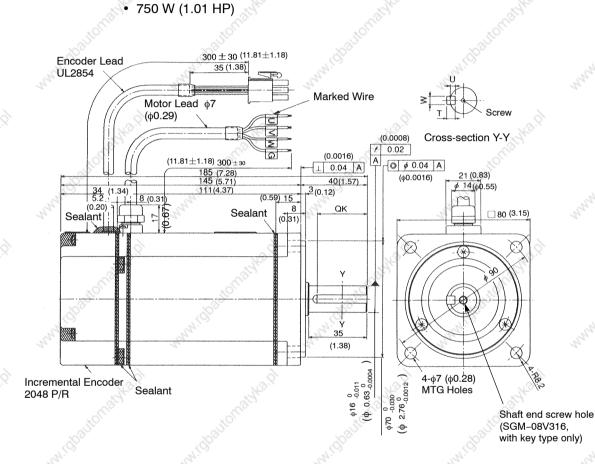


• 200 W (0.27 HP), 300 W (0.40 HP), 400 W (0.53 HP)

www.dbalto	Type SGM-	L	LL	LM	QK	U	W	Т	Screw dimensions	Out- put W (HP)	Approx. mass kg (Ib)	Allow- able radial load N (lb)	Allow- able thrust load N (lb)	onatyka.pl
A.O.	02V312	126.5	96.5	62.5	No key	0			<u>19</u>	200	91.1	245	74	
34 <sup>35</sup>	02W312	(4.98)	(3.80)	(2.46)	222			355		(0.27)	(2.43)	(55.1)	(16.6)	
	02V314				20	3	5	5	-					
	02W314			S.	(0.79)	(0.12)	(0.20)	(0.20)	à			È.		Ś
	02V316			Stor.			Stor.		M5,		E	0		254/2.0
	02W316			0			0		depth 8 (0.31)					S. S.
and the	03W312	154.5	124.5	90.5	No key	235			- 35	300	1,1			2
S. St.	03W314	(6.08)	(4.90)	(3.56)	20	3	5	5	S.	(0.40)	(2.43)		May 1000	
3350	03W316				(0.79)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	44		~	and a second	
	04V312			~	No key		~ ~		-	400	]	2		~
	04V314			12.5	20	3	5	5	N.ª.S.	(0.53)	N	3.8		29.9
	04V316	]	. 5	5°'	(0.79)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		C. C. S. S.			C. and

5.4.2 Servomotor Dimensional Drawings cont.

- Note 1) The detector uses an incremental encoder 2048 P/R.
  - 2) Type "V" indicates 200 V specification, and type "W" indicates 100 V specification.
  - 3) "02V(W)314", "02V(W)316", "03W314", "03W316", "04V314" and "04V316" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.

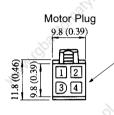


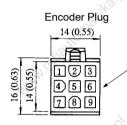
Type SGM-	QK	U	W	T	Screw dimen- sions	Output W (HP)	Approx. mass kg (Ib)	Allowable radial load N (lb)	Allowable thrust load N (lb)	
08V312	No key	1	 	Cart	-	750 (1.01)	3.4 (7.50)	392 (88.1)	147 (33.0)	math
08V314 08V316	30 (1.18)	3 (0.12)	5 (0.20)	5 (0.20)	M5, 🔬	(1501)	(7.50)	paule	Š	AND AND
12		4	10		depth 8(0.31)		and		and the second	

Note 1) The detector uses an incremental encoder 2048 P/R.

2) Type "V" indicates 200 V specification.

- "08V314" and "08V316" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.
- Details of Motor and Encoder Plugs (Common for 30 W (0.04 HP) to 750 W (1.01 HP)





Plug : 172167-1 (AMP) Pin: 170360-1 or 170364-1 (170359-1 or 170363-1: 30, 50, or 100 W only) Connected to Cap: 172159-1 Socket: 170362 -1 or 170366-1

Plug: 172169-1 (Made by AMP) Pin: 170359-1 or 170363-1 Connected to Cap :172161-1 Socket: 170361-1 or 170365-1

#### Motor Wiring Specifications

1	U phase	Red
2	V phase	White
3	W phase	Blue
4	FG	Green

#### Incremental Encoder Wiring Specifications

1	A channel output	Blue
2	A channel output	Blue/Black
3	B channel output	Yellow
4	B channel output	Yellow/Black
5	C channel output	Green
6	C channel output	Green/Black
7	0 V (power supply)	Gray
8	+5 V (power supply)	Red
9	FG (Frame Ground)	Orange

5.4.2 Servomotor Dimensional Drawings cont.

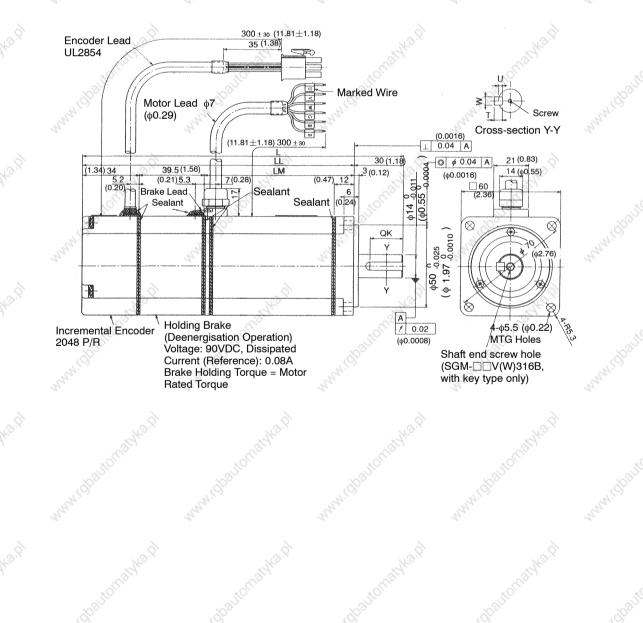
- (2) TÜV approved (conforming to the machine instructions) SGM Servomotor Incremental encoder, with brake (Type SGM-0310B)
- 300 ± 30 (11.81±1.18) 35 (1.38) Marked Wire Encoder Lead UL2854 Σ N G Screw Motor Lead T 8 φ7 (φ0.29) Cross-section Y-Y (0.0016) 11.81±1.18) 300±30 1 0.04 A 25 (0.98) 11 21 (0.83) 0 \$ 0.02 A 33 (1.30) 6.5 (0.26) Sealant LB LM 2.5 (0.10) ø 14 φ0.55) (¢0.0008) (0.37)9.5 (0.16)4 40 5 (0.20) Sealant 6 Sealant 5 QK (¢1.81) (0.24) Sh6 38.8 (1.53) -0.0008 ) -0 0 -0.21 Y ND1 φ30 <sub>-</sub> d i (φ1.18 -Ð\$ Incremental A / 0.02 Sealant 2-\u00f34.3 (\u00f40.17) Nameplate Encoder MTG Holes Screw (×2) 2048 P/R (0.0008) Shaft end screw hole Holding Brake (Deenergisation Operation) Voltage: 90VDC, Dissipated (SGM- UV(W)316B, with key type only) Current (Reference): 0.08A Brake Holding Torque = Motor Rated Torque

N. C. C.	Type SGM-			LM	LB	S	QK	U	₩ A A A A A A A A A A A A A A A A A A A	Sary L	Screw dimen- sions	Out- put W (HP)	Approx. mass kg (lb)	Allow- able radial load N (lb)	Allow- able thrust load N (lb)	~
	A3V312B	126.0 (4.96)	101.0 (3.98)	36.5 (1.44)	31.5 (1.24)	6 (0.24)	No key	6			- 6	30 (0.04)	0.6 (1.32)	68 (15.3)	54 (12.1)	
	A3W312B	( )	( )	Nº Nº	, ,	( )	14	1.2	2		Nº"	· ,	Nº2	~ /	· /	A
	A3V314B A3W314B			S.			(0.55)	(0.05)	∠ (0.08)	2 (0.08)			S.			Ĩ
0	A3W314B		2	ço.		0	300	l`´´	、 <i>,</i>	S.S.	M2.5,	_	3 <sup>10</sup>		2	Q.
1 <sup>20</sup>	A3W316B		en ich			.n.n.i.O			and C	8	depth 5 (0.20)	MANIO			NAN'ION	
•	A5V312B	133.5	108.5	44.0	31.5	6	No key		24		-	50	0.7 (1.54)	1	C	
	A5W312B	(5.26)	(4.27)	(1.73)	(1.24)	(0.24)						(0.07)				
	A5V314B				2		14	1.2	2	2	2.8		?	9		
	A5W314B			all all			(0.55)	(0.05)	(0.08)	(0.08)	5		all all			.5
	A5V316B			5			. No.			.05	M2.5,		. No.			5
20	A5W316B		1000			25	20		2	Sault	depth 5 (0.20)	×	30 <sup>00</sup>		2000	~ 
A.C.	01V312B	160.0	135.0	61.5	40.5	8	No key		all.	0	-	100	0.8 (1.76)	78	A1.0	
ъ.	01W312B	(6.30)	(5.31)	(2.42)	(1.59)	(0.31)			32			(0.13)		(17.5)	24	
	01V314B						14	1.8	3	3						
	01W314B				<u>9</u>		(0.55)	(0.07)	(0.12)	(0.12)	à		0	Q.		
	01V316B			- Sti			A	2		2	M3,		Nº			3
	01W316B			S			Sec.			- Second	depth 6 (0.24)		Sol			S°.
erst 60%	294	A.	ANI-COOL			NNNI BE	5.5°		Margar C	paule		www.lo	Dalle .	1	ereral. Bas	£

• 30W (0.04 HP), 50W (0.07 HP), 100W (0.13 HP)

Note 1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "V" indicates 200 V specification, and type "W" indicates 100 V specification.
- "A3V(W)314B", "A3V(W)316B", "A5V(W)314B", "A5V(W)316B", "01V(W)314B" and "01V(W)316B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
  - 200 W (0.53 HP), 300 W (0.40 HP), 400 W (0.27 HP)



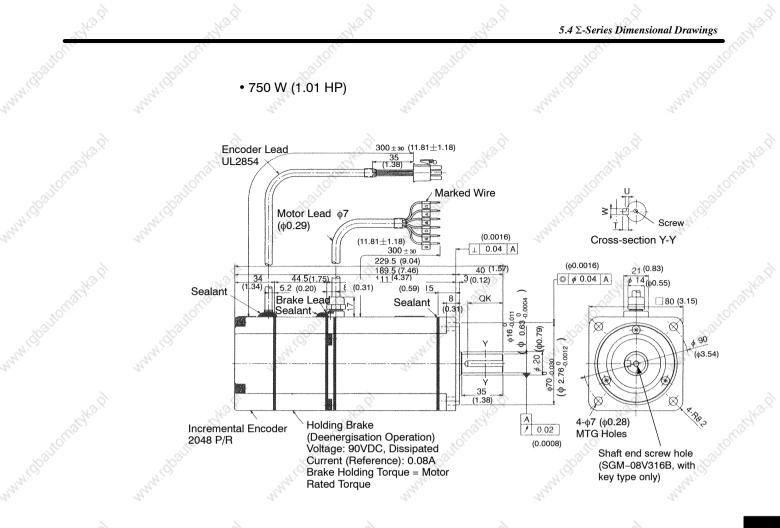
5.4.2 Servomotor Dimensional Drawings cont.

Type SGM-	Lin 4 4	LL	LM	QK	U	W	<b>-</b> 100 100 100 100 100 100 100 100 100 10	Screw diminsions	Out- put W (HP)	Approx. mass kg (Ib)	Allow- able radial load N (lb)	Allow- able thrust load N (lb)
02V312B	166.0	136.0	62.5	No key	-à	ist.		- 57	200	1.6	245	74
02W312B	(6.54)	(5.35)	(2.46)		of	-		, office	(0.27)	(3.53)	(55.1)	(16.6)
02V314B	2	69 <sup>22</sup>		20	3	5	5	10000		10000		2
02W314B	and Contraction	5		(0.79)	(0.12)	(0.20)	(0.20)	0.		N.O.		34.19
02V316B	- Salar			- and			222	M5, depth 8	44			And St.
02W316B								(0.31)				
03W312B	194.0	164.0	90.5	No key		2			300	2.2	2	
03W314B	(7.64)	(6.46)	(3.56)	20	3	5	5	and the	(0.40)	(4.85)	dre.	
03W316B		autorn's		(0.79)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		autorn	p	
04V312B		50		No key	5			89°	400	80		ð
04V314B	and in			20	3	5	5 2		(0.53)	Gr.		And I
04V316B	27			(0.79)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	24			2

Note

1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "V" indicates 200 V specification, and type "W" indicates 100 V specification.
- "02V(W)314B", "02V(W)316B", "03W314B", "03W316B", "04V314B" and "04V316B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.



	3.8		10°			12º.S		28	
Type SGM-	QK	U	SOLUTION STATE	Т	Screw dimen- sions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08V312B	No key	ala.		34		750	4.3	392 (88.1)	147 (33.0)
08V314B	30	3	5	5		(1.01)	(9.48)		24
08V316B	(1.18)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	×2.9		13/2.01	
	<b>SGM-</b> 08V312B 08V314B	<b>SGM-</b> 08V312B No key 08V314B 30 (4 10)	SGM-           08V312B         No key           08V314B         30         3           (1,12)         (2,12)         (2,12)	SGM-         08V312B         No key           08V314B         30         3         5           08V314B         (0.10)         (0.20)	SGM-         08V312B         No key           08V314B         30         3         5         5           08V314B         30         3         5         5	SGM-         dimensions           08V312B         No key         -           08V314B         30         3         5         5           08V316B         (1.18)         (0.12)         (0.20)         M5, depth 8	SGM-         dimen- sions         W (HP)           08V312B         No key         –         750 (1.01)           08V314B         30 (1.18)         3 (0.12)         5 (0.20)         5 (0.20)         –         750 (1.01)           08V316B         (1.18)         (0.12)         5 (0.20)         5 (0.20)         M5, depth 8	SGM-         Image: SGM-	SGM-         Image: SGM-         Image: Constraint of the second s

**Note** 1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "V" indicates 200 V specification.
- "08V314B" and "08V316B have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.

5

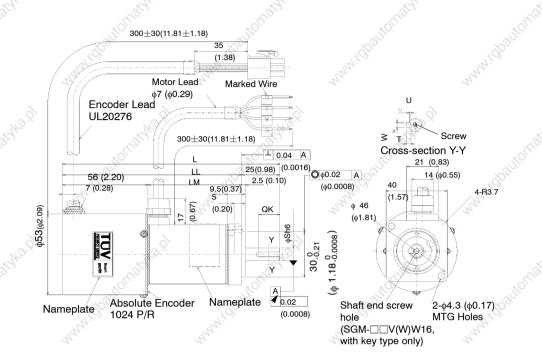
5.4.2 Servomotor Dimensional Drawings cont.

• Details of Motor and Encoder Plugs (Common for 30 W (0.04 HP) to 750 W (1.01 HP)



- (3) TÜV approved (conforming to the machine instructions) SGM Servomotor Absolute encoder, no brake (Type SGM-
- 30 W (0.04 HP), 50 W (0.07 HP), 100 W (0.13 HP)

NAR R



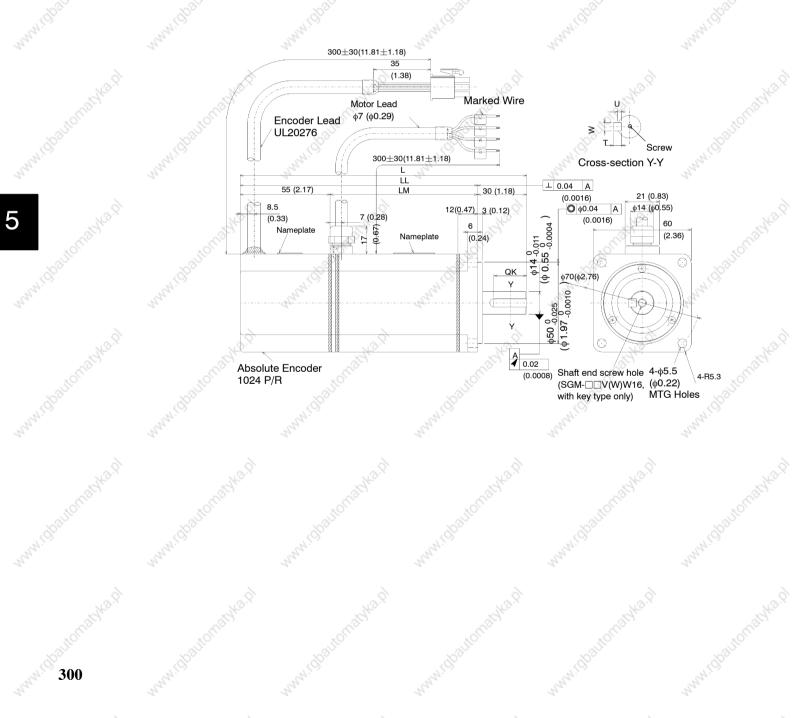
				~×						X			×.×		
www.tobauto	Type SGM-	L	Pautonie	SLM	S	QK	SU	W	T spauton	Screw dimen- sions	Out- put W (HP)	Approx. mass kg (lb)	Allow- able radial load N (lb)	Allow- able thrust load N (lb)	5 5
ala an	A3VW12 A3WW12	117.5 (4.63)	92.5 (3.64)	36.5 (1.44)	6 (0.24)	No key	1	1 <sup>2</sup>			30 (0.04)	0.45 (0.99)	68 (15.3)	54 (12.1)	
		()	(,		(,	14	1.2	2			(,	()	(····)	()	
	A3VW14 A3WW14			12.8		(0.55)	(0.05)	∠ (0.08)	2 (0.08)	12º.9		N			10
	A3VW14 A3VW16		2ª	6		(/	25	()	()	M2.5,		20			AN I
10			10			10			10	depth 5		20			5
	A3WW16	.2	Ser .			200			Son -	(0.20)	, è	9 <sup>0</sup>		and the second s	
. Sales	A5VW12	125.0	100.0	44.0	42	No key	,	1	1.5		50	0.55		and its	
E.	A5WW12	(4.92)	(3.94)	(1.73)	444			20			(0.07)	(1.21)	1		
	A5VW14					14	1.2	2	2						
	A5WW14			2.2.8		(0.55)	(0.05)	(0.08)	(0.08)	23.8		s.C	8		135
	A5VW16		à	er.			20			M2.5,		201			and
all of the	A5WW16		auton			autor			autor	depth 5 (0.20)		alton		15	5
Ser.	01VW12	142.5	117.5	61.5	8	No key	/		S		100 🔇	0.65	78	. S <sup>or</sup>	
	01WW12	(5.61)	(4.63)	(2.42)	(0.31)		_	554			(0.13)	(1.43)	(17.5)	2020	
¢	01VW14	- A -				14	1.8	3	3						
	01WW14			6		(0.55)	(0.07)	(0.12)	(0.12)	6			6		2
	01VW16		,	X2.			Nº.			МЗ,		24	6°)		Nº.
. 6	01WW16		.5	) ·		.5	8° '		30.	depth 6 (0.24)		offar			S. S.
doann		2	6aur			Day.			, doan			Carre Carre		. Bar	-
JAN. C		- Shi			54						- Shi			299	
24		- Sha			R						- Str			14.	

5.4.2 Servomotor Dimensional Drawings cont.

Note 1) The detector uses a 12-bit absolute encoder 1024 P/R.

- 2) Type "V" indicates 200 V specification, and type "W" indicates 100 V specification.
- "A3V(W)W14", "A3V(W)W16", "A5V(W)W14", "A5V(W)W16", "01V(W)W14" and "01V(W)W16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.

• 200 W (0.27 HP), 300W (0.40 HP), 400 W (0.53 HP)



5.4  $\Sigma$ -Series Dimensional Drawings

Type SGM-	- NA	LL	LM	QK	U	W	T	Screw dimen- sions	Output W (HP)	Approx. mass kg (Ib)	Allow- able radial load N (lb)	Allow- able thrust load N (lb)
02VW12	147.5	117.5	62.5	No key	6	P2	-	- 8	200	1.2	245	74
02WW12	(5.81)	(4.63)	(2.46)		70,			, on u	(7.87)	(2.65)	(55.1)	(16.6)
02VW14		San and		20	3	5	5	Star Star		10000		10 <sup>10</sup>
02WW14	14	5		(0.79)	(0.12)	(0.20)	(0.20)	O.		N.O.		
02VW16	44			All A			444	M5, depth 8		e a la l		32
02WW16			~			~		(0.31)	2			
03WW12	175.5	145.5	90.5	No key		NO.S			300	1.8	140.Q	
03WW14	(6.91)	(5.73)	(3.56)	20	3	5	5	1	(0.40)	(3.97)	Ser .	
03WW16		pauton		(0.79)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	-	. dbaute	<u>`</u>	www.dbaut
04VW12	and and			No key	I		1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 19	-	400	and the second		Sec. 1
04VW14				20	3	5	5	1	(15.7)			2
04VW16		, ci	12. A.	(0.79)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	29.9		addra d	

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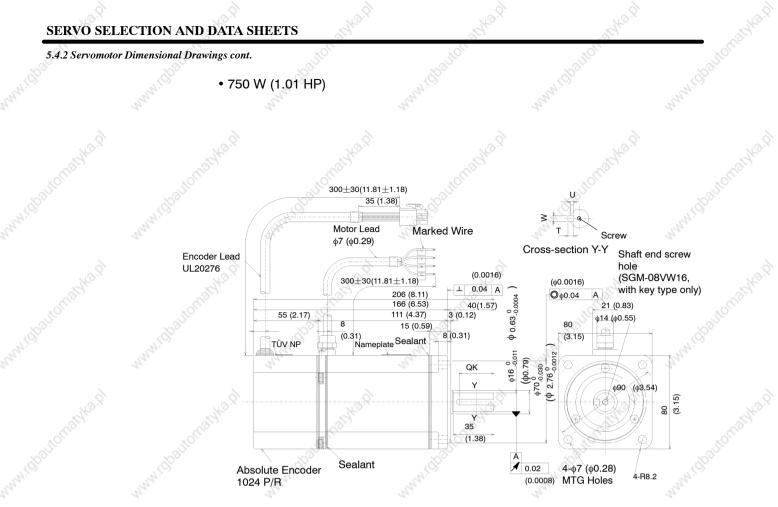
Note

30

- 1) The detector uses a 12-bit absolute encoder 1024 P/R.
- 2) Type "V" indicates 200 V specification, and type "W" indicates 100 V specification.

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- "02V(W)W14", "02V(W)W16", "03WW14" "03WW16", "04VW14" and "04VW16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.



Type SGM-	QK	U	w Sautoma	Υ <sup>σ</sup> Τ	Screw dimen- sions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08VW12	No key	2	9		- <u>40-</u>	750	3.5	392 (88.1)	147 (33.0)
08VW14	30	3	5	5	and a second	(1.01)	(7.72)		Server.
08VW16	(1.18)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	(a.9)		N.S.V	

**Note** 1) The detector uses a 12-bit absolute encoder 1024 P/R.

- 2) Type "V" indicates 200 V specification.
- "08VW14" and "08VW16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.

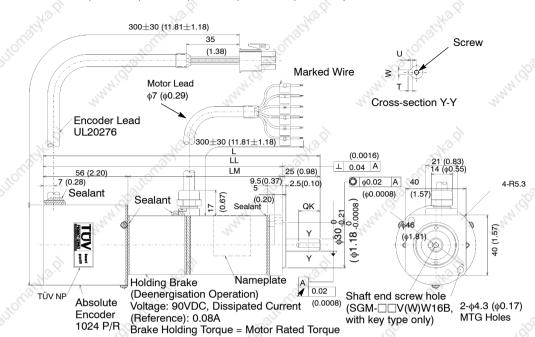
 The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.

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• Details of Motor and Encoder Plugs (Common for 30 W (0.04 HP) to 750 W (1.01 HP) Motor Plug Motor Wiring Specifications Plug : 172167-1 (AMP) Red 1 U phase 12 Pin: 170360-1 or 170364-1 2 V phase White (17359-1 or 170363-1: 30, 50, or 100 W only) W phase Blue 3 4 FG Green/Yellow Connected to Cap: 172159-1 Socket: 170362 -1 or 170366-1 Encoder Plug Plug: 172171-1 (AMP) Pin: 170359-1 or 170363-1 Incremental Encoder Wiring Specifications Connected to Cap :172163-1 Socket: 170361-1 or 170365-1 Blue 1 A channel output 13 14 15 2 Ā White/Blue channel output 3 B channel output Yellow 4 B channel output White/Yellow Green Z channel output 5 Z channel output White/Green 6 Gray 7 0 V (power supply) 8 +5 V (power supply) Red 9 FG (Frame Ground) Orange 10 S channel output Purple S channel output 11 White/Purple (12) (Capacitor reset) \* (Gray) Reset 13 White/Gray 0V(battery) 14 White/Orange 3.6V(battery) 15 Orange \* Terminal to discharge capacitor for product dispatch. Do not use. 303

5.4.2 Servomotor Dimensional Drawings cont.

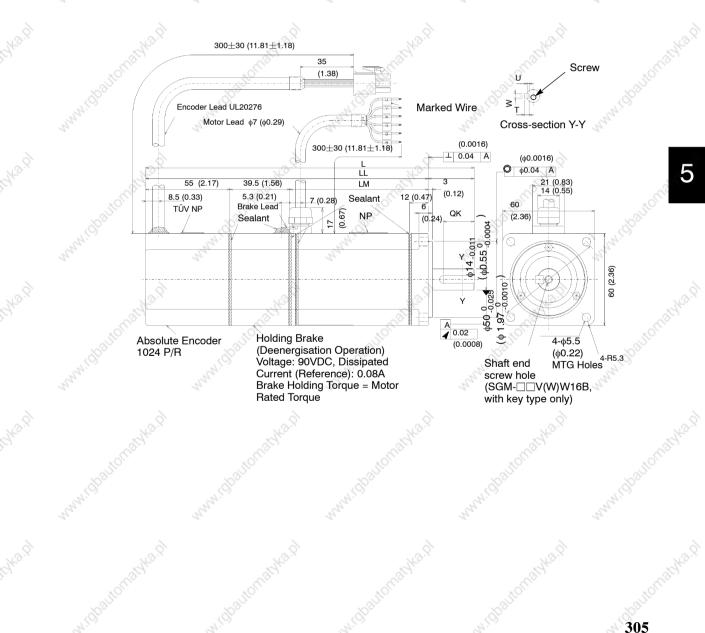
- (4) TÜV approved (conforming to the machine instructions) SGM Servomotor Absolute encoder, with brake (Type SGM-
- 30 W (0.04 HP), 50 W (0.07 HP), 100 W (0.13 HP)



Type SGM-	L <sup>a</sup>	LL	LM	LB	S	QK	U	w	T Nadkan	Screw dimen -sions	Out- put W (HP)	Appr ox. mass kg (Ib)	Al- low- able radial load N (lb)	Al- low- able thrust load N (lb)	anatyka.P
A3VW12B A3WW12B	149.0 (5.87)	124.0 (4.88)	36.5 (1.44)	31.5 (1.24)	6 (0.24)	No key		. Sparre			30 (0.04)	0.75 (1.65)	68 (15.3)	54 (12.1)	Ϋ́
A3VW14B A3WW14B	444			444		14 (0.55)	1.2 (0.05)	2 (0.08)	2 (0.08)	44	24.		14	a <sup>ch'</sup>	
A3VW16B A3WW16B			at 12.9			ratyka.p			(native.)	M2.5, depth 5 (0.20)		Cristine's	12		mathar
A5VW12B A5WW12B	156.5 (6.16)	131.5 (5.18)	44.0 (1.73)	31.5 (1.24)	1 dbaute	No key		NIGDOUT			50 (0.07)	0.85 (1.87)		J. Idani	e e e e e e e e e e e e e e e e e e e
A5VW14B A5WW14B	44			44		14 (0.55)	1.2 (0.05)	2 (0.08)	2 (0.08)	14			4	5	
A5VW16B A5WW16B		- 6	at 12.0		- 6	Cate Ha.P			(100H2.)	M2.5, depth 5 (0.20)		materia	2		matyka.P
01VW12B 01WW12B	183.0 (7.20)	158.0 (6.22)	61.5 (2.42)	40.5 (1.59)	8 (0.31)	No key		NIGPORT			100 (0.13)	0.95 (2.09)	78 (17.5)	AL BOALS	~
01VW14B 01WW14B	44			4		14 (0.55)	1.8 (0.07)	3 (0.12)	3 (0.12)	4			4	Se .	
01VW16B 01WW16B		, d <sup>i</sup>	at 140.0		.0	Cardha P		× C	(ratelka ?	M3, depth 6 (0.24)		or any a	10		ornatyka
304	4444	Idpant.		3444	AIGD SDL		A. C.	WIGDON.		20	and I down		14	And Hope	7

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- Note 1) The detector uses a 12-bit absolute encoder 1024 P/R.
  - 2) Type "V" indicates 200 V specification, and type "W" indicates 100 V specification.
  - "A3V(W)W14B", "A3V(W)W16B", "A5V(W)W14B", "A5V(W)W16B", "01V(W)W14B" and "01V(W)W16B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.
  - 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
    - 200 W (0.27 HP), 300 W (0.40 HP), 400 W (0.53 HP)



5.4.2 Servomotor Dimensional Drawings cont.

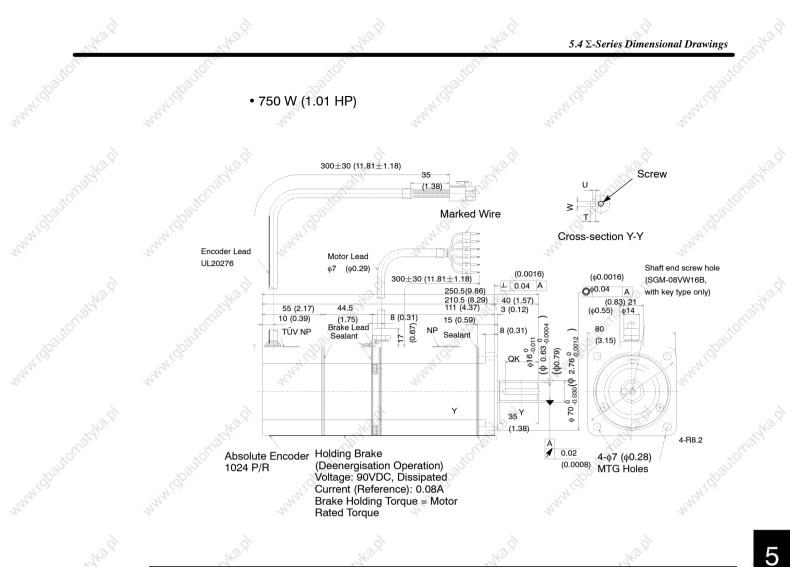
Type SGM-	_ 4 14	LL	LM	QK	U	W	1. P.	Screw dimen- sions	Out put W (HP)	Approx. mass kg (lb)	Allow- able radial load N (lb)	Allow- able thrust load N (lb)
02VW12B	187.0	157.0	62.5	No key		S.S.			200	1.7	245	74
02WW12B	(7.36)	(6.18)	(2.46)		xċ	5		203	(0.27)	(3.75)	(55.1)	(16.6)
02VW14B		2000		20	3	5	5	2000			2	
02WW14B	3	S.		(0.79)	(0.12)	(0.20)	(0.20)	24		34.10		3
02VW16B	454			242			12	M5, depth 8		124		44
02WW16B			~			2		(0.31)	~		2	
03WW12B	215.0	185.0	90.5	No key		NO.X	•	-	300	2.3	Nº.	2
03WW14B	(8.46)	(7.28)	(3.56)	20	3	5	5		(0.40)	(5.07)	and	
03WW16B		30		(0.79)	(0.12)	(0.20)	(0.20)	M5, 💉			30	
5		j.Son			1000			depth 8 (0.31)		100	5	
04VW12B	-15-54			No key			14	-	400	4 <sup>a<sup>a</sup>n<sup>i</sup></sup>		34
04VW14B				20	3	5	5	]	(0.53)			
04VW16B	1		6	(0.79)	(0.12)	(0.20)	(0.20)	M5,	6			5
and the state			all and			and and		depth 8 (0.31)	Str.		and and	

Note 1) The detector uses a 12-bit absolute encoder 1024 P/R.

- 2) Type "V" indicates 200 V specification, and type "W" indicates 100 V specification.
- 3) "02V(W)W14B", "02V(W)W16B", "03WW14B", "03WW16B", "04VW14B" and "04VW16B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.

 The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.

5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.



Type SGM-	QK	U	opauton's	Т	Screw dimen- sions (lb)	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08VW12B	No key	224			323	750	4.5	392 (88.1)	147 (33.0)
08VW14B	30	3	5	5		(1.01)	(9.92)		
08VW16B	(1.18)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	140.9		.H2.9	

- **Note** 1) The detector uses a 12-bit absolute encoder 1024 P/R.
  - 2) Type "V" indicates 200 V specification.
  - "08VW14B" and "08VW16B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.
  - 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.

5.4.2 Servomotor Dimensional Drawings cont.

• Details of Motor and Encoder Plugs (Common for 30 W (0.04 HP) to 750 W (1.01 HP)

Motor Plug

123

4 5 6

Plug : 172168-1 (AMP) Pin: 170360-1 or 170364-1 (17359-1 or 170363-1: 30, 50, or 100 W only) Connected to Cap: 172160-1 Socket: 170362 -1 or 170366-1

#### Motor Wiring Specifications

	1	U phase	Red 🔬				
	2	V phase	White				
	3	W phase	Blue				
Į	4	FG	Green/Yellow				
1	5	Brake terminal	Red				
	6	Brake terminal	Black				

# Encoder Plug



Plug: 172171-1 (AMP) Pin: 170359-1 or 170363-1 Connected to Cap :172163-1 Socket: 170361-1 or 170365-1

#### Incremental Encoder Wiring Specifications

	1	A channel output	Blue 🖉				
	2	A channel output	White/Blue				
	3	B channel output	Yellow				
20	4	B channel output	White/Yellow				
9.	5	Z channel output	Green				
	6	Z channel output	White/Green				
	7	0 V (power supply)	Black				
	8	+5 V (power supply)	Red				
	9	FG (Frame Ground)	Green/Yellow				
	10	S channel output	Purple				
	11_	S channel output	White/Purple				
*	(12)	(Capacitor reset)	(Gray)				
8	13	Reset	White/Gray				
1	14	0V(battery)	White/Orange				
	15	3.6V(battery)	Orange				

\* Terminal to discharge capacitor for product dispatch. Do not use.

- 2) The dimensional drawings of TÜV approved SGMP Servomotors (conforming to the machine instructions) are broadly grouped into the following four categories.
  - a) Incremental encoder, no brake (from page 310)
  - b) Incremental encoder, with brake (from page 314)
  - c) Absolute encoder, no brake (from page 319)
  - d) Absolute encoder, with brake (from page 324)

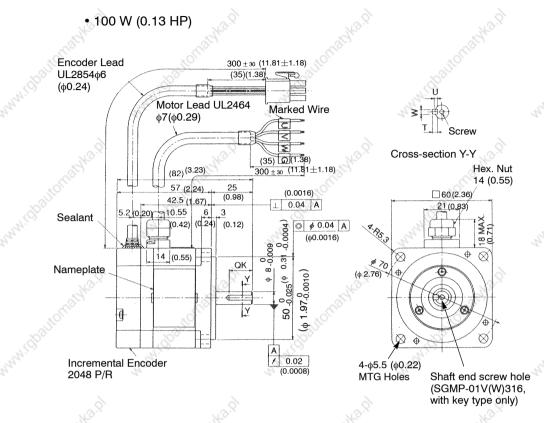
Motor capacities are available as 100 W (0.13 HP), 200 W (0.27 HP), 300 W (0.40 HP) , 400 W (0.53 HP), 750 W (1.01 HP). These are grouped into three categories, as follows:

- 100W (0.13 HP)
- 200W (0.27 HP), 300W (0.40 HP), 400W (0.53 HP)
- 750W (1.01 HP)
- As for the dimensional drawings of SGM servomotors, see from the page 247 on.
- As for the dimensional drawings of SGMP servomotors, see from the page 269 on.
- As for the dimensional drawings of TÜV approved SGM servomotors, see from the page 289 on.

All drawings conform to the machine instructions. As for the motor drawings conforming to the EMC instructions, encoder plug and its accessories are different. For details, contact your Yaskawa representative.

5.4.2 Servomotor Dimensional Drawings cont.

 TÜV approved (conforming to the machine instructions) SGMP Servomotor Incremental encoder, no brake (Type SGMP-□□31□)

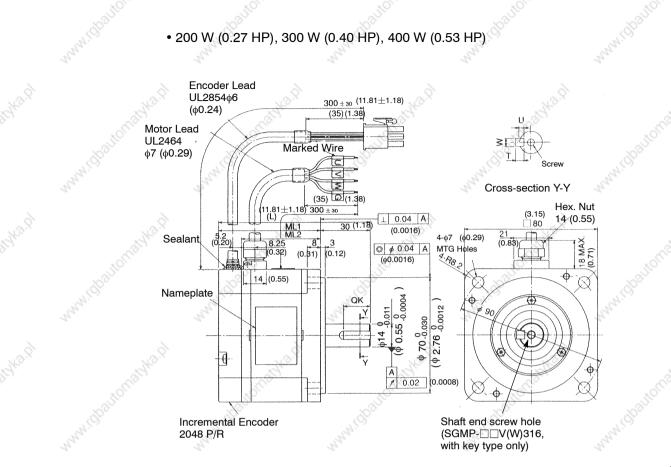


Type SGMP-	QK	U	w	SUTION IN	Screw dimensions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
01V312	No key		220		312	100 (0.13)	0.7 (1.54)	78 (17.5)	49 (11.0)
01W312									
01V314	14	1.8	3	3	8		8	ò	
01W314	(0.55)	(0.07)	(0.12)	(0.12)	\$^^	K	\$^^	and No.	
01V316	S.			S.	M3, depth 6	S.		L.S.	
01W316	.30			30	(0.24)	30		.30	
6.	50	-	6	So		.80	6.	ç°	, č

Note 1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "V" indicates 200 V specification, and type "W" indicates 100 V specification.
- "01V(W)314" and "01V(W)316" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.

5) Conforms to "IP55" protective structure (except connector and output shaft faces).



_	20			20			200			20		28		
ŝ	Type SGMP-	L	ML1	ML2	QK	U	Ŵ	Т	Screw dimen- sions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)	
-		A 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		48.1	No key	9		.15	<u>192</u>	200	1.4	245 (55.1)	68 (15.3)	
	020012	(3.62)	(2.44)	(1.89)	See.	3		ļ ,	(0.27)	(3.09)		2 an		
-	02V314		' 1	ا ب ا		3	5	5	ļ ,					
	02W314	'	'	12.8	(0.63)	(0.12)	(0.20)	(0.20)		13.8		32.9		
	02V316			Pr-	1 1	ļ .	18 and		M5,	ST.		1000H2.pl		
5	02W316		JON	r I		JION	3		depth 8 (0.31)	C.	_3	-0	.J.	
Γ			-C 1	68.1	No key	300			30	300	2.1		.800	
Γ	03W314	(4.41)		(3.23)	(3.23)	(2.68)		3	5	5		(0.40)	(4.63)	
Ī	03W316	27	' İ	1	(0.63)	(0.12)	(0.20)	(0.20)	M5,	1	14		24	
	Ś			<u>à</u>			à		depth 8 (0.31)	à		(an/a.n)		
Γ	04V312		۱ ا	Stor.	No key		ALCON			400		No.		
ā	04V314	'	2	Б		3	5	5	3	(0.53)		Car's		
-	04V316	and s	Partio.		(0.63)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	1	W. Chai	3 <sup>0</sup> .	WIGDOUT	

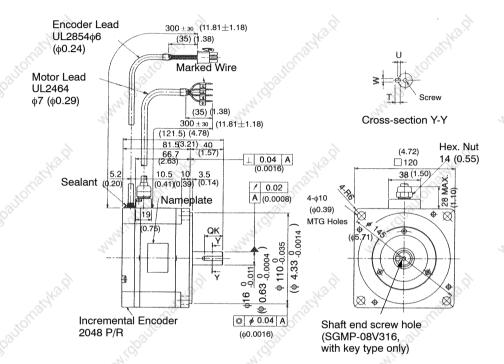
# Note 1) The detector uses an incremental encoder 2048 P/R.

2) Type "V" indicates 200 V specification, and type "W" indicates 100 V specification.

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5.4.2 Servomotor Dimensional Drawings cont.

- 3) "02V(W)314", "02V(W)316", "04V314", "04V316", "03W314", and 03W316 have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.
- 5) Conforms to "IP55" protective structure (except connector and output shaft faces)
  - 750 W (1.01 HP)



					~~~		~~		~~~
Type SGMP-	QK	U P.R.	W	T	Screw dimensions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08V312	No key			30.		750	4.6	392 (80.1)	147 (33.0)
08V314	22	3	5 8	5	201	(1.01)	(10.14)	2030	~
08V316	(0.87)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		and and a second	0	

Note

- The detector uses an incremental encoder 2048 P/R.
  - 2) Type "V" indicates 200 V specification.
  - 3) "08V314" and "08V316" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 35 mm (1.38in.) from the motor mounting surface.
  - 5) Conforms to IP55 protective structure (except connector and output shaft faces).

5.4  $\Sigma$ -Series Dimensional Drawings

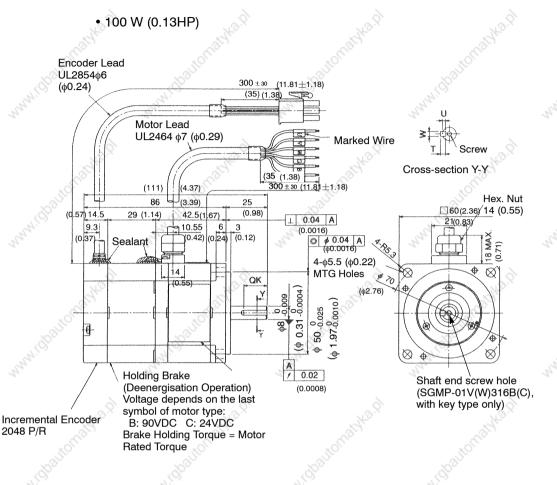
NN. Obautor • Details of Motor and Encoder Plugs (Common for 100 W (0.13HP) to 750 W (1.01HP)) Motor Wiring Specifications Motor Plug Plug : 172167-1 (AMP) Pin: 170360-1 or 170364-1 Red 10 U phase 2 V phase White 1 1 2 9 з W phase Connected to Cap 172159-1 Socket 170362-1 or 170366-1 Blue Green/Yellow 4 FG Encoder Plug Plug: 172169-1 (AMP) Pin: 170359-1 or 170363-1 Incremental Encoder Wiring Specifications Connected to Blue 456 Cap :172161-1 Socket: 170361-1 or 170365-1 1 A channel output Blue/Black 2 Ā channel output Yellow з B channel output Yellow/Black 4 B channel output Green 5 C channel output Green/Black C channel output 6 Gray 7 0 V (power supply) +5 V (power supply) Red 8 www.ldbautomatika.pl 9 FG (Frame Ground) Orange thautomatika.pl

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5.4.2 Servomotor Dimensional Drawings cont.

(2) TÜV approved (conforming to the machine instructions) SGMP Servomotor Incremental encoder, with brake (Type SGMP-□□31□B)



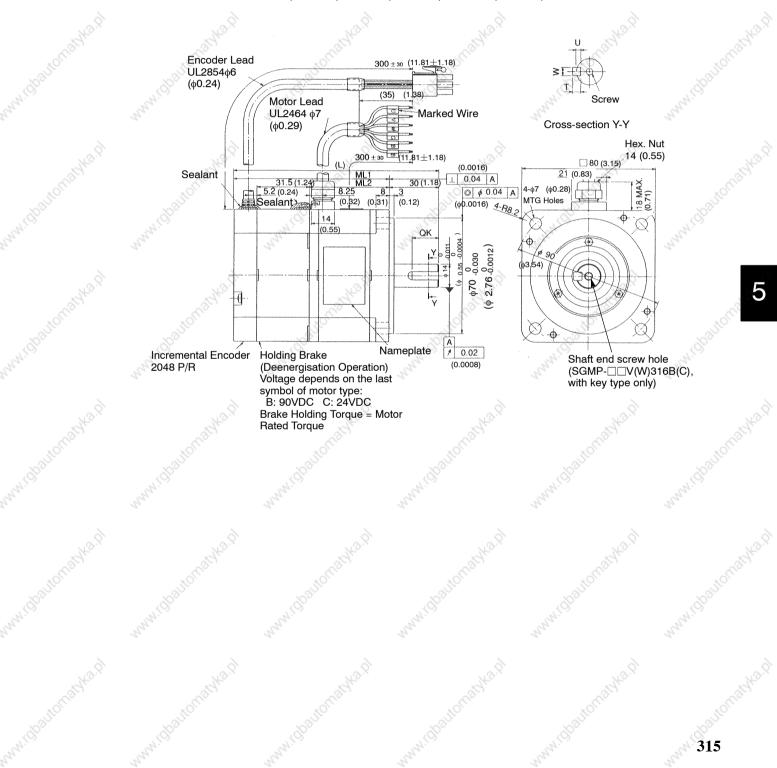
Type SGMP-	QK	U	W	Т	Screw dimensions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
01V312B(C)	No key			100		100	0.9	78 (17.5)	49 (11.0)
01V314B(C)	14	1.8	3 ో	3	. 5	(0.13)	(1.98)	-660	
01V316B(C)	(0.55)	(0.07)	(0.12)	(0.12)	M3, depth 6 (0.24)		.2	Balle	ó.
01W312B(C)	No key	344	Q.,		A.M.M.		and		And St.
01W314B(C)	14 (0.55) 🔊	1.8 (0.07)	3 (0.12)	3 (0.12)	M3, depth 6 (0.24)	6		à	
01W316B(C)		(0.07)	(3.12)	2 No.	(0.2.)	aller.x		alto.	

**Note** 1) The detector uses an incremental encoder 2048 P/R.

2) Type "V" indicates 200 V specification, and "W" indicates 100V specification.

 "01V314B(C)", "01V316B(C)", "01W314B(C)" and "01W316B(C)" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.

- 4) The quoted allowable radial load is the value at a position 20 mm (0.79in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
- 6) Conforms to IP55 protective structure (except connector and output shaft faces).
  - 200 W (0.27HP), 300W (0.40 HP), 400 W (0.53HP)



5.4.2 Servomotor Dimensional Drawings cont.

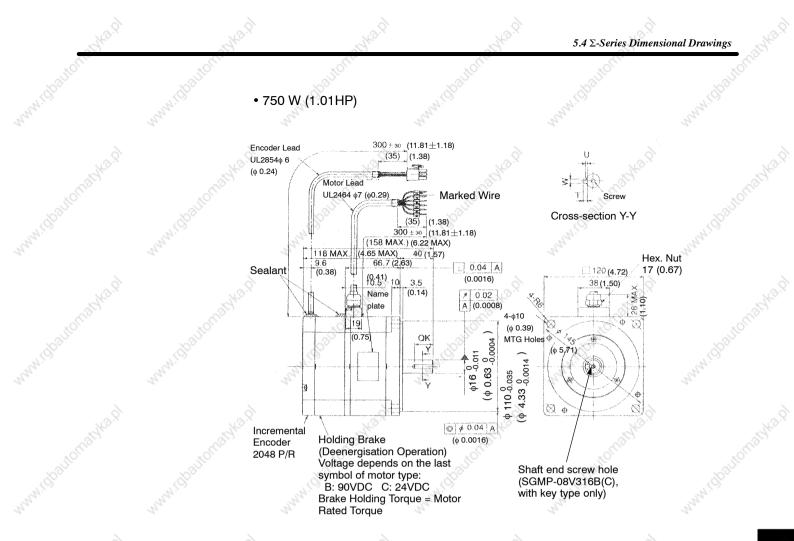
Type SGMP-	Lal. Martin	LL	LM	QK	U	W	T chill Activity	Screw dimen- sions	Output W (HP)	Approx. mass kg (lb)	Allow- able radial load N (lb)	Allow- able thrust load N (lb)	
02V312B(C)	123.5	93.5 🔬	48.1	No key	3	d	•	- 8	200	1.9 (4.19)	245	68	
02V314B(C)	(4.86)	(3.68)	(1.89)	16	3 5	5	5	170,	(0.27)	×0	(55.1)	(15.3)	10
02V316B(C)	, d	5305		(0.63)	(0.12)	(0.20)	(0.20)	M5 depth 8	-	1 dbaur		J.S	
02W312B(C)	and and a second			No key	,			-		and a state		and and it	
02W314B(C)	-7-			16	3	5	5					1	
02W316B(C)			22	(0.63)	(0.12)	(0.20)	(0.20)	M5 depth 8	23.9		20.0		
03W312B(C)	143.5	113.5	68.1	No key	2	2		- 2	300	2.6 (0.10)	5		
03W314B(C)	(5.65)	(4.47)	(2.68)	16	3 0	5	5	101	(0.40)				10
03W316B(C)		Ser.		(0.63)	(0.12)	(0.20)	(0.20)	M5 depth 8	-	W. GDar		, N. Co	5
04V312B(C)	1000			No key	,	•	24	-	400	12 <sup>25</sup>		2. Andrew Andrew	
04V314B(C)				16	3	5	5		(0.53)				
04V316B(C)			49.Q	(0.63)	(0.12)	(0.20)	(0.20)	M5 depth 8	12.2		Nº.Q		

Note 1) The detector uses an incremental encoder 2048 P/R.

- 2) Type "V" indicates 200 V specification, and "W" indicates 100V specification.
- 3) "02V314B(C)", "02V316B(C)", "02W314B(C)", "02W316B(C)", "03W314B(C)",
   "03W316B(C)", "04V314B(C)" and "04V316B(C)" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 25 mm (0.98in.) from the motor mounting surface.

5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.

6) Conforms to IP55 protective structure (except connector and output shaft faces).

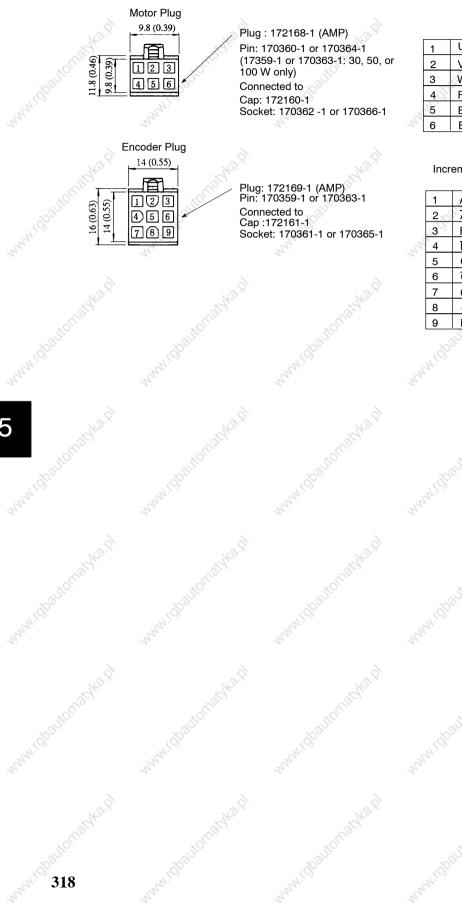


				10 <sup>2</sup>		10.2		18 <sup>.2</sup>	
Type SGMP-	QK	U	W all	Т	Screw dimens ions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08V312B(C)	No key	344		÷	Sec. 1	750	5.7	392 (88.1)	147 (33.0)
08V314B(C)	22(0.87)	3(0.12)	5(0.20)	5(0.20)	M5	(1.01)	(12.57)		2hr
08V316B(C)	2			2	Depth 8	2		2	

- Note 1) The detector uses an incremental encoder 2048 P/R.
  - 2) Type "V" indicates 200 V specification.
  - "08V314B(C)" and "08V316B(C)" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.
  - 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
  - 6) Conforms to IP55 protective structure (except connector and output shaft faces).

5.4.2 Servomotor Dimensional Drawings cont.

• Details of Motor and Encoder Plugs (Common for 100 W (0.13 HP) to 750 W (1.01 HP))



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#### Motor Wiring Specifications

		Motor Wiring Spec	ifications
[	1	U phase	Red
	2	V phase	White 🔨
	3	W phase	Blue
	48	FG	Green/Yellow
1	5	Brake terminal	Red
2	6	Brake terminal 📣	Black

Incremental Encoder Wiring Specifications

1	A channel output	Blue 🔊
2		Biele
	A channel output	Blue/Black
3	B channel output	Yellow
4	B channel output 🔬	Yellow/Black
5	C channel output	Green
6	C channel output	Green/Black
7	0V (power supply)	Gray
8	+5 V(power supply)	Red 🔊
9	FG (Frame Ground)	Orange
-		

- (3) TÜV approved (conforming to the machine instructions) SGMP Servomotor Absolute encoder, no brake (Type SGMP-□□W1□)
- 300 ± 30 (11.81 ± 1.18) (35) (1.38) Motor Lead UL2464 Marked Wire Encoder Lead φ7 (φ 0.29) Screw UL20276 68 (0.31) Cross-section Y-Y (35) (1.38) (35) (1.38) (11.81±1.18) Hex. Nut 14 (0.55) (4.82) 122.5 (0.0016) - [\_\_\_\_\_0.04 \_\_\_] 97.5 (3.84) (1.67) 60 (2.36) 55 (2.17) 42.5 25 (0.98) 21(0.83) 6 3 OK (0.42) 0.24) (0.12) @ \$ 0.04 A 8.5 (0.33) (0.0016) Sealant AF. <u>@</u>e 4-\u00f355 (\u00f30.22) 14 (0.55) Φ R  $\otimes$ MTG Holes \$ 70 -0.000 -0.0010 ) (\$ 2.76) 0.025 0.31 φ50.6 97 A 6  $\otimes$  $\otimes$ 0.02 Shaft end screw hole Nameplate 12-bit Absolute 1 (SGMP-01V(W)W16, Encoder 1024 P/R with key type only)

100 W (0.13HP)

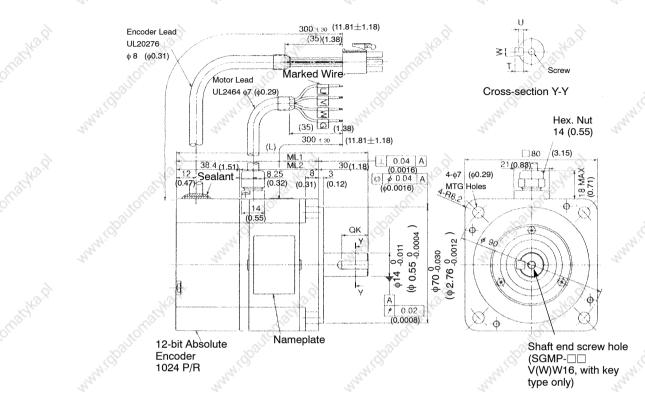
Type SGMP-	QK	U	W. idonitio	т	Screw dimensions	Out- put W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
01VW12	No key	20			- 4	100	0.95	78 (17.5)	49 (11.0)
01WW12						(0.13)	(2.09)		
01VW14	140	1.8	3	3 8		10	Q*	NO.S	
01WW14	(0.55)	(0.07)	(0.12)	(0.12)		20		ornabyto.	
01VW16					МЗ,	p <sup>r</sup>		S.	
01WW16			Bar		depth 6 (0.24)		8	3	. S

Note

- 1) The detector uses a 12-bit absolute encoder 1024 P/R.
  - 2) Type "V" indicates 200 V specification, and "W" indicates 100 V specification.
  - "01V(W)W14" and "01V(W)W16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
  - 4) The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.
  - 5) Conforms to IP55 protective structure (except connector and output shaft faces).

5.4.2 Servomotor Dimensional Drawings cont.

• 200 W (0.27 HP), 300 W (0.40 HP) (100 V only), 400 W (0.53HP) (200 V only)

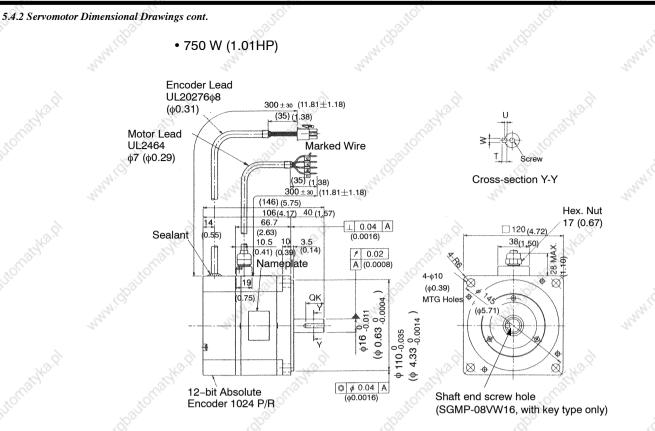


Type SGMP-	L	LL	LM	QK	U	WC0	Т	Screw dimen- sions	Out- put W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)	
02VW12	116.5	86.5	48.1	No key	110			30	200	1.6	245 (55.1)	68 (15.3)	
02WW12	(4.59)	(3.41)	(1.89)	4	12°		3	22	(0.27)	(3.53)		Sealer -	
02VW14				16	3	5	5						
02WW14			Ś	(0.63)	(0.12)	(0.20)	(0.20)		à	k.			
02VW16			all'a			No		M5,	A.		Str.		
02WW16	-	.5	C.S.			6 Car		depth 8 (0.31)	C		. HOLLO		
03WW12	136.5	106.5	68.1	No key	.80			20	300	2.3	Ser.	2	
03WW14	(5.37)	(4.19)	(2.68)	16	3	5	5	Ser. 19	(0.40)	(5.07)	2	ala al	
03WW16	- A		à	(0.63)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	14 15		nn h	May May	55
04VW12			Nº.	No key		Nº	×		400		Nº.	¢.	
04VW14	1		S.	16	3	5	5		(0.53)		tomatyka		
04VW16		N.I. ODOUT	5	(0.63)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)		and and a second	Spantor.	- Alexandre	

Note 1) The detector uses a 12-bit absolute encoder 1024 P/R.

2) Type "V" indicates 200 V specification, and "W" indicates 100 V specification.

- 3) "02V(W)W14", "02V(W)W16", "03WW14", "03WW16", "04VW14", and "04VW16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.
- 5) Conforms to IP55 protective structure (except connector and output shaft faces).



Type SGMP-	QK	U 2 <sup>2</sup>	W	T (2.	Screw dimen- sions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08VW12	No key			S.	-	750	4.7	392 (88.1)	147 (33.0)
08VW14	22	3	5 8	5		(1.01)	(10.36)	- alle	
08VW16	(0.87)	(0.12)	(0.20)	(0.20)	M5, depth 8 (0.31)	S	and the second	1.1 <sup>02</sup>	ana and

Note

1) The detector uses a 12-bit absolute encoder 1024 P/R.

- 2) Type "V" indicates 200 V specification.
- "08VW14" and "08VW16" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.

4) The quoted allowable radial load is the value at a position 35 mm (1.38 in.) from the motor mounting surface.

5) Conforms to IP55 protective structure (except connector and output shaft faces).

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and the	and the	all the	E.	Ę.	5.4 Σ-Serie	s Dimensional Di
von 1	.off	*Offic	, off		70,	
	walle	~3 <sup>01</sup>			alle	
	• Details of N	/lotor and Encoder Plugs (	Common fo	or 1	00 W (0.13 HP) to	o 750 W (1.01
	1997 - 19	1997 - 1997 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 -	<b>C</b>		Salar .	52
	7	2			1	14
			N	/loto	r Wiring Specification	s
13 <sup>2</sup>	Motor Plug	Plug : 172167-1 (AMP) Pin 170360-1 or 170364-1	31	2	U phase	Red
S.S.	1975 - I	Connected to	2		V phase	White
		Cap 172159-1			2	Blue
		Socket 170362-1 or 170366	6-1 <u>5</u>		W phase FG	Green/Yellow
	D I		S I			Green/Tenow
	and the second s	A <sup>N</sup> A			and and	
	Encoder Plug	Plug: 172171-1 (AMP) / Pin: 170359-1 or 170363-1	А	bsc	olute Encoder Wiring S	Specifications
	ET .	Connected to			-	
2	12345	Cap :172163-1 🕥	1	0	A channel output	Blue
all and a second		Socket: 170361-1 or 17036	-÷		A channel output	White/Blue
S. Carl	11 2 3 4 5		3	;	B channel output	Yellow
	35 <sup>0</sup>	_3 <sup>0</sup>	<u> </u>	-	B channel output	White/Yellow
			5	-	Z channel output	Green
	and I have been a second	and the state	6	-	Z channel output	White/Green
	14	2 <sup>5</sup>	7		0V (power supply)	Black
			8	-	+5 V(power supply)	Red
			9	2	FG (Frame Ground)	5 Y .
N3.X	NO.X	NO.X	1	0	S channel output	Purple
30	and the second s		्रत्वे	1	S channel output	White/Purple
	*011	*Offic	× (1	12)	(Capacitor reset)	(Gray)
				3	Reset	White/Gray
	, S		<u>8</u> 1	4	0V(battery)	White/Orange
	al an	station of the state	1	5	3.6V(battery)	Orange
5 <sup>10</sup>	M.Ball	MIGRAUNC	N. GDOUTE		MIGDOUTO	
, ed		here where		2	All Contraction of the Contracti	all and
baitomatike.pl	www.gballonabka.pl	www.tobautomatika.pt	N.GPautomaty		www.thautome	SHOLF.
bautomatyka.pl	www.gballonabka.pl	www.cobautomatika.pt	N.GPaulonad	2.0	www.dbautome	SHRAD H
pautomatyka.pl	www.thaitonatika.hl	www.idbautomatika.pt	N.Goaltonad	2 <sup>9</sup>	www.idbautome	ed <sup>ha.pl</sup>

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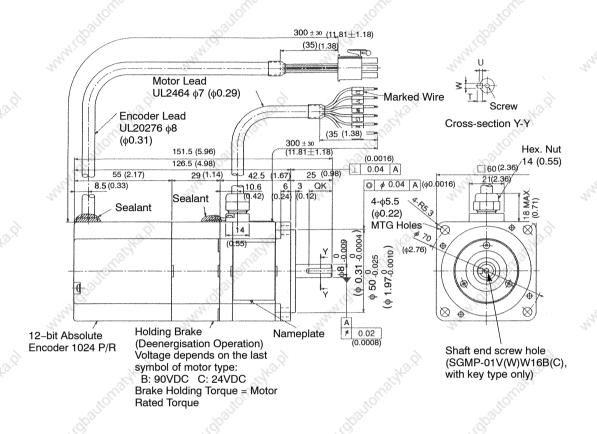
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5.4.2 Servomotor Dimensional Drawings cont.

(4) TÜV approved (conforming to the machine instructions) SGMP Servomotor

Absolute encoder, with brake (Type SGMP-DDW1DB)

• 100 W (0.13 HP)



Type SGMP-	QK	U	W	Т	Screw dimensions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)	
01VW12B(C)	No key			2	<u>~</u>	100	1.2	78 (17.5)	49 (11.0)	
01WW12B(C)	C. C.			HOM OF		(0.13)	(2.65)	HOMOL		30
01VW14B(C)	14 (0.55)	1.8 (0.07)	3 (0.12)	3 (0.12)		300-		So.	. 8	
01WW14B(C)	(0.00)	(0.07)	(0.12)	(0.12)	ALACA .		ALANN'		ANNAL .	
01VW16B(C)	S				M3, depth 6		à	2	5	
01WW16B(C)	C. A.			Card	(0.24)	Card	5°	Cally		

- Note
- 1) The detector uses a 12-bit absolute encoder 1024 P/R.
- 2) Type "V" indicates 200 V specification, and "W" indicates 100 V specification.
- 3) "01VW14B(C)", "01VW16B(C)", "01WW14B(C)" and "01WW16B(C)" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.

4) The quoted allowable radial load is the value at a position 20 mm (0.79 in.) from the motor mounting surface.

Sto.9

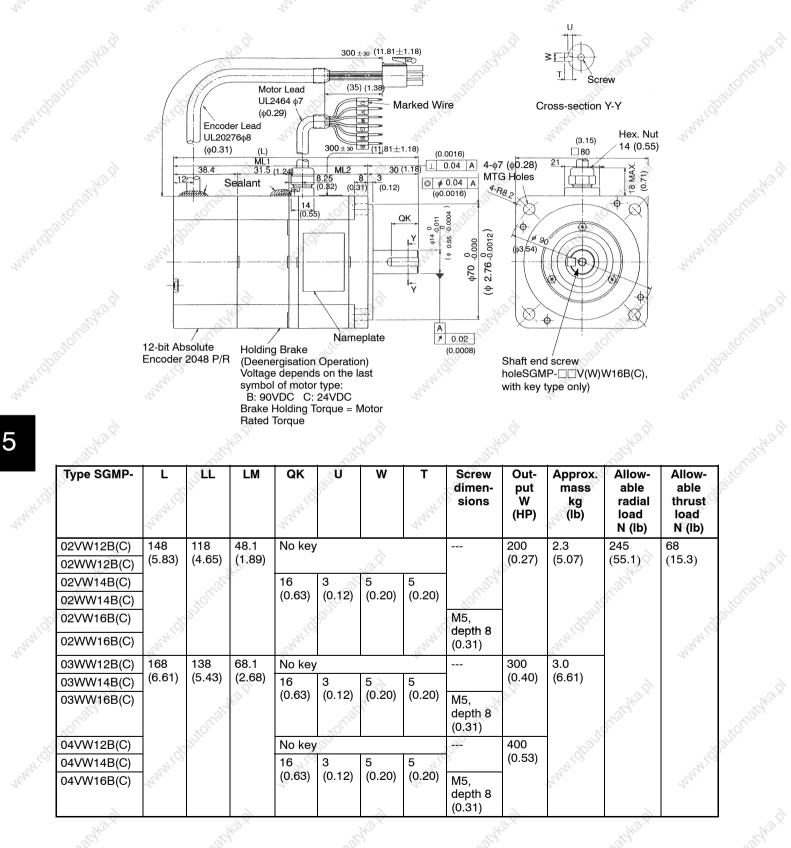
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www.coattor

- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
- 6) Conforms to IP55 protective structure (except connector and output shaft faces).

5.4.2 Servomotor Dimensional Drawings cont.

• 200 W (0.27 HP), 300 W (0.40 HP), 400 W (0.53 HP)

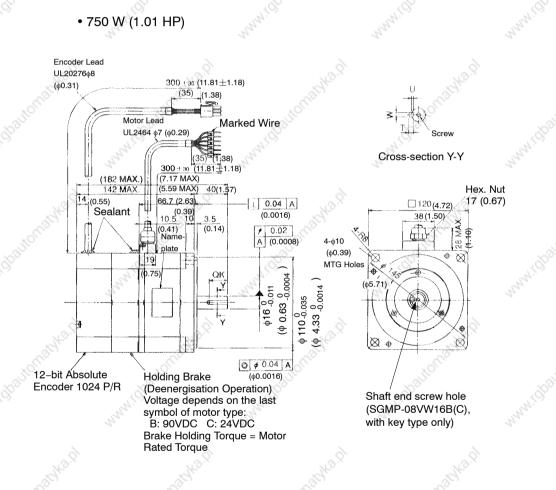


Note

1) The detector uses a 12-bit absolute encoder 1024 P/R.

3

- 2) Type "V" indicates 200 V specification, and "W" indicates 100 V specification.
- 3) "02V(W)W14B", "02V(W)W16B", "03WW14B", "03WW16B", "04VW14B", and "04VW16B" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 25 mm (0.98 in.) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
- 6) Conforms to IP55 protective structure (except connector and output shaft faces).



Type SGMP-	QK	U JOD	<u>о</u> . м	т	Screw dimen- sions	Output W (HP)	Approx. mass kg (lb)	Allowable radial load N (lb)	Allowable thrust load N (lb)
08VW12B(C)	No key	4 °		100	-	750	6.2	392 (88.1)	147 (33.0)
08VW14B(C)	22	3	5	5		(1.01)	(13.67)	8	
08VW16B(C)	(0.87)	(0.12)	(0.20)	(0.20)	M5 depth 8 (0.31)	No.×		omatyka	
ANNI-GDOUL		Nranal (BB)		44	N.IODAUL		Warden 1920		327

5.4.2 Servomotor Dimensional Drawings cont.

Note 1) The detector uses a 12-bit absolute encoder 1024 P/R.

- 2) Type "V" indicates 200 V specification.
- "08VW14B(C)" and "08VW16B(C)" have a keyed shaft. The keyway complies with JIS B 1301-1976 (precision). A straight key is supplied.
- 4) The quoted allowable radial load is the value at a position 35 mm (1.38 in) from the motor mounting surface.
- 5) The electromagnetic brake is only to hold the load in position and cannot be used to stop the motor.
- 6) Conforms to IP55 protective structure (except connector and output shaft faces).
- Details of Motor and Encoder Plugs (Common for 100W (0.13 HP) to 750 W (1.01 HP))

Motor Plug



Plug : 172168-1 (AMP) Pin 170360-1 or 170364-1(1 to 4pin) 170359-1 or 170363 (5 to 6 pin) (17360-1 or 17364-1:only 750W)

Connected to Cap 172160-1 Socket 170362-1 or 170366-1 Motor Wiring Specifications

	0.	
1	U phase	Red
2	V phase	White
3	W phase	Blue
4	FG 🔗	Green/Yellow
5	Brake terminal 🔊	Black
6	Brake terminal	Black

Absolute Encoder Wiring Specifications

		2	100		
	÷.	A channel output	Blue		
3	2	A channel output	White/Blue		
	3	B channel output	Yellow		
	4	B channel output	White/Yellow		
	5	Z channel output	Green		
	6	Z channel output	White/Green		
	7	0 V (power supply)	Black 🚕		
	8	+5 V (power supply)	Red		
	9	FG (Frame Ground)	Green/Yellow		
	10	S channel output	Purple		
	<sup>©</sup> 11	S channel output	White/Purple		
ł	(12)	(Capacitor reset)	(Gray)		
	13	Reset	White/Gray		
	14	0V(battery)	White/Orange 🖄		
	15	3.6V(battery)	Orange		

\* Terminal to discharge capacitor for product dispatch. Do not use.

Encoder Plug



Plug: 172171-1 (AMP) Pin: 170359-1 or 170363-1 Connected to Cap :172163-1 Socket: 170361-1 or 170365-1

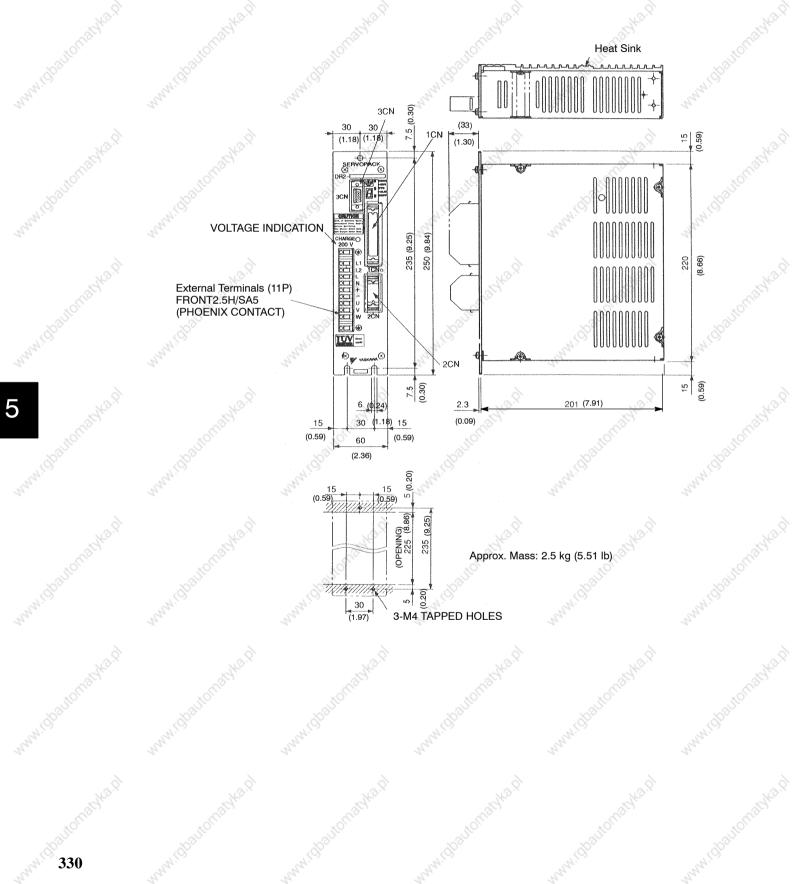
## 5.4.3 Servopack Dimensional Drawings

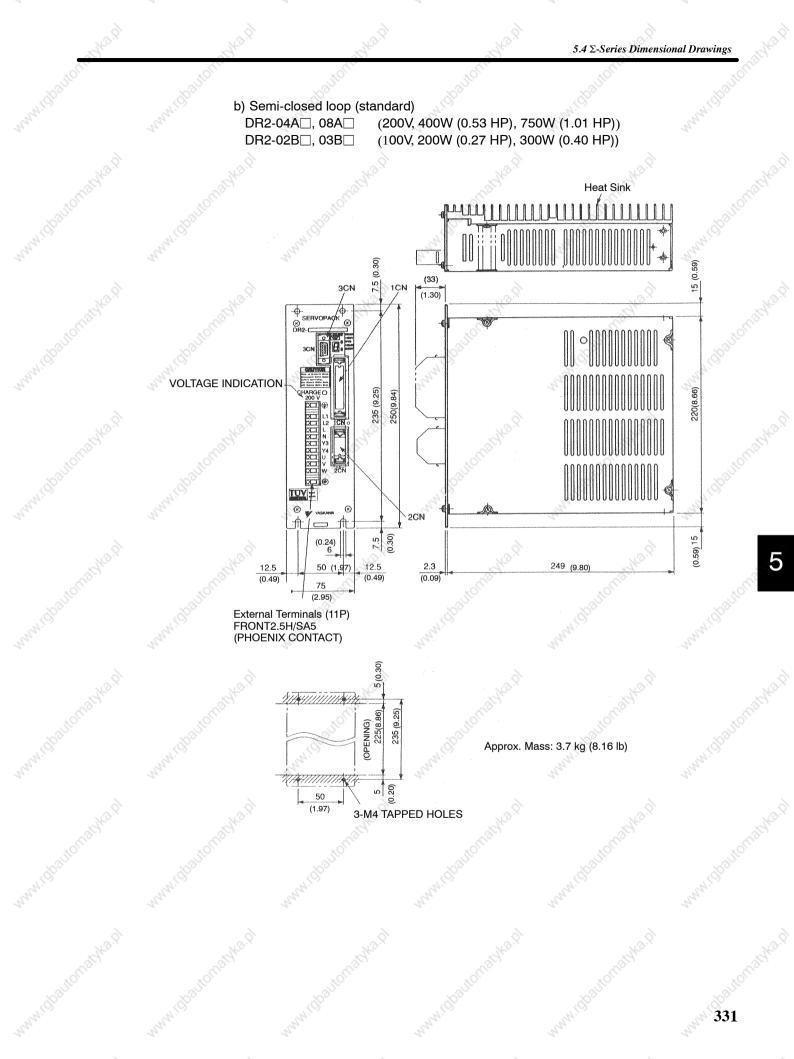
- The dimension drawings of the DR2 Servopack are broadly grouped into the following two categories according to capacity and option specifications (semi-closed or fullclosed loop).
  - a) Semi-closed loop (standard) 200V, 30W (0.04 HP) to 200 W (0.27HP) (Types: DR2-A3A to 02A) 100V, 30W (0.04 HP) to 100 W (0.13HP) (Types: DR2-A3B to 01B)
  - b) Semi-closed loop (standard)
    - 200V, 400W (0.53 HP), 750W (1.01 HP) (Types: DR2-04A□, 08A□) 100V, 200W (0.27 HP), 300W (0.40 HP) (Types: DR2-02B□,03B□)
  - c) Full-closed loop (option)
     200V, 30W (0.04 HP) to 200W (0.27 HP) (Types: DR2-A3A□-F to 02A□-F)
     100V, 30W (0.04 HP) to 100W (0.13 HP) (Types: DR2-A3B□-F to 01B□-F)
  - d) Full-closed loop (option)
    200V, 400W (0.53 HP) to 750W (1.01 HP) (Types: DR2-04A□-F to 08A□-F)
    100V, 200W (0.27 HP) to 300W (0.40 HP) (Types: DR2-02B□-F to 03B□-F)

5.4.3 Servopack Dimensional Drawings cont.



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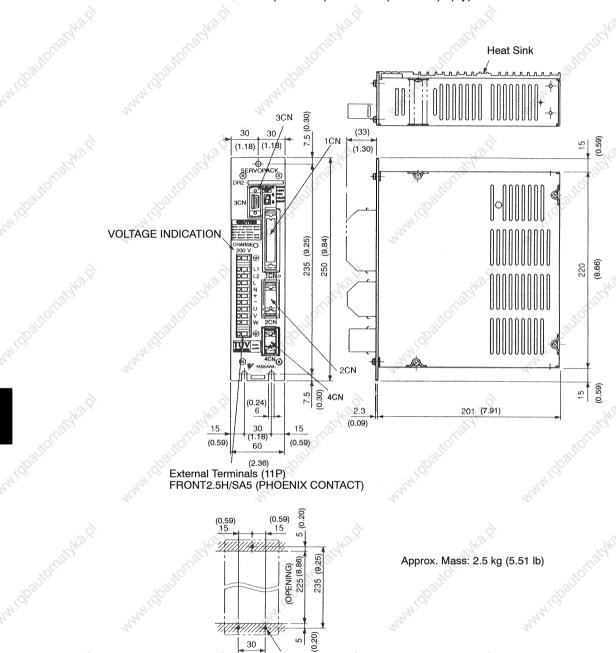






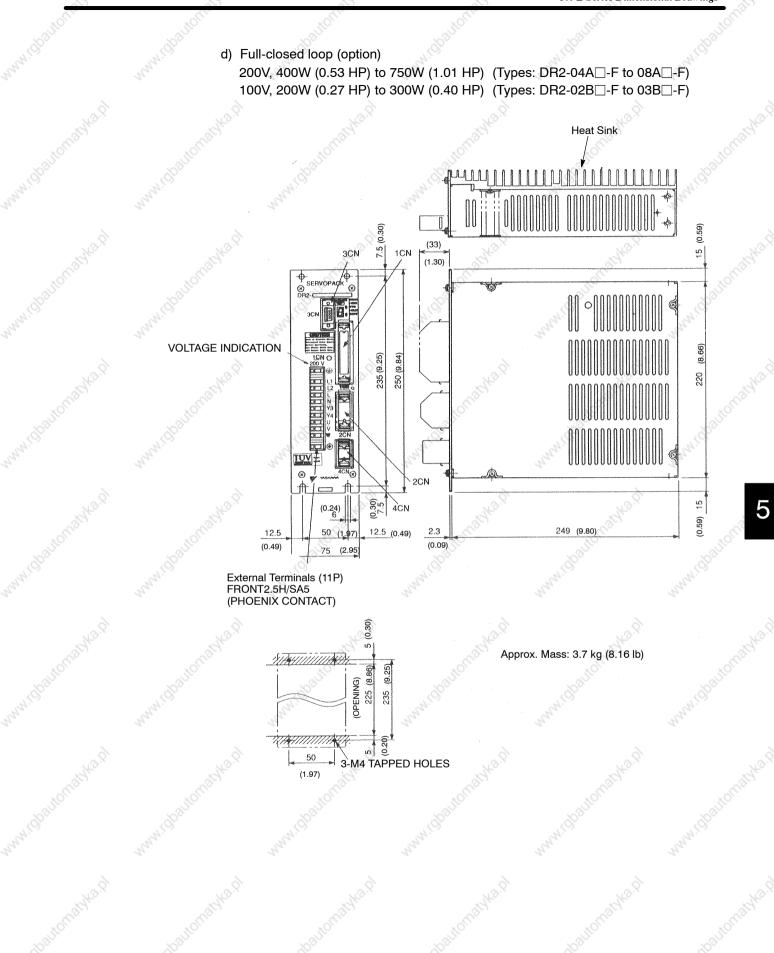
5.4.3 Servopack Dimensional Drawings cont.

c) Full-closed loop (option)
200V, 30W (0.04 HP) to 200W (0.27 HP) (Types: DR2-A3A□-F to 02A□-F)
100V, 30W (0.04 HP) to 100W (0.13 HP) (Types: DR2-A3B□-F to 01B□-F)



(1.97)

3-M4 TAPPED HOLES

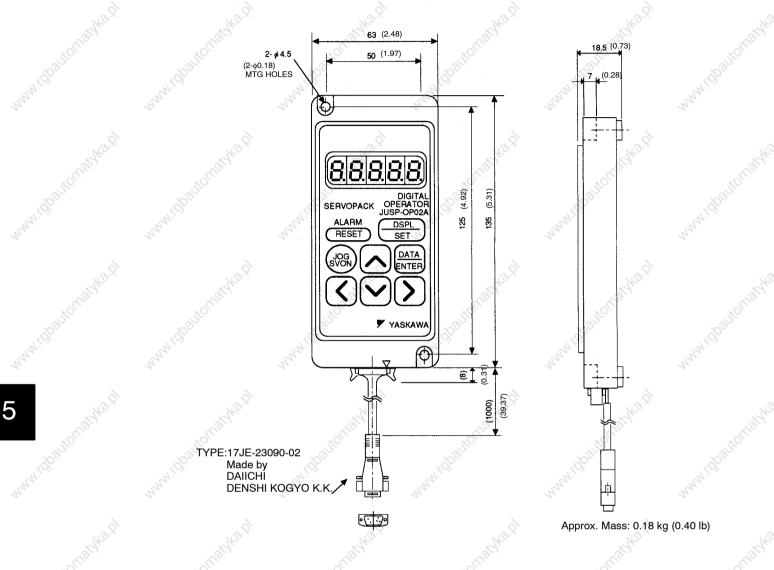


5.4.4 Digital Operator Dimensional Drawing

# 5.4.4 Digital Operator Dimensional Drawing

a) JUSP-OP02A-1 (Hand-held type)

www.idoallot



Note Mount type digital operator (type: JUSP-OP03A) cannot be used for DR2 Servopack.

# 5.5 Selecting Peripheral Devices

This section shows how to select peripheral devices using flowcharts. Order lists for Servomotors, Servopacks, digital operators, and peripheral devices are also included.

5.5.1	Selecting Peripheral Devices	335
5.5.2	Order List	341

## 5.5.1 Selecting Peripheral Devices

Select the peripheral devices using the flowcharts on the subsequent pages.

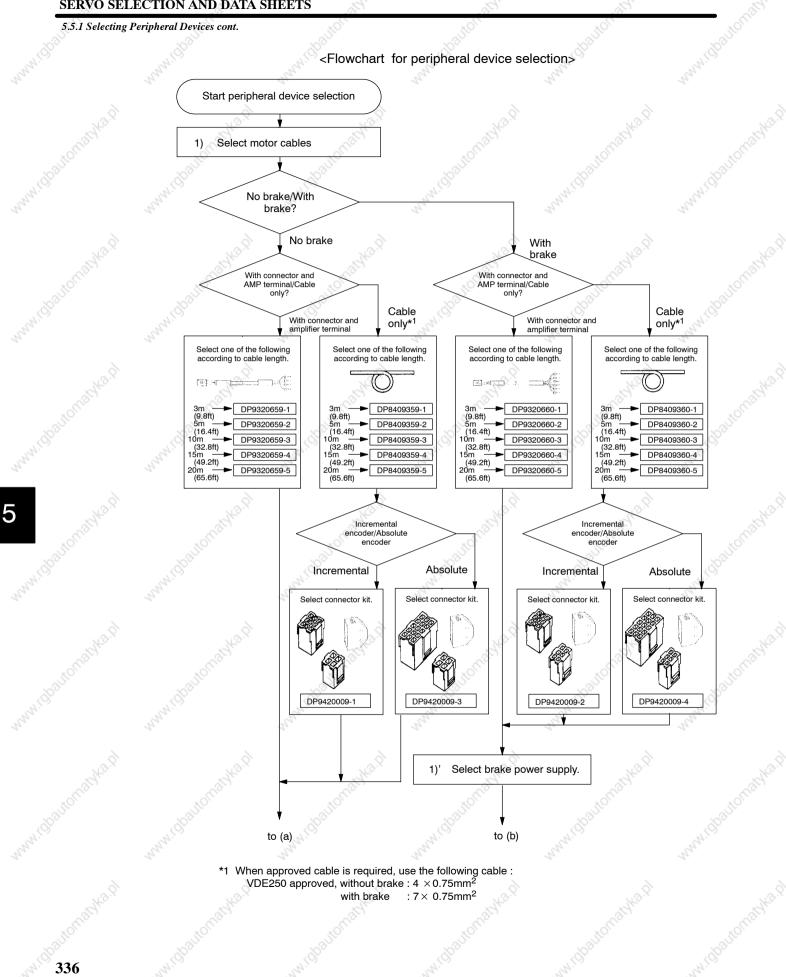
The items below are not included in the flowcharts. Refer to *5.6 Specifications and Dimensional Drawings of Peripheral Devices*.

Variable resistors for speed setting

• Encoder signal converter units

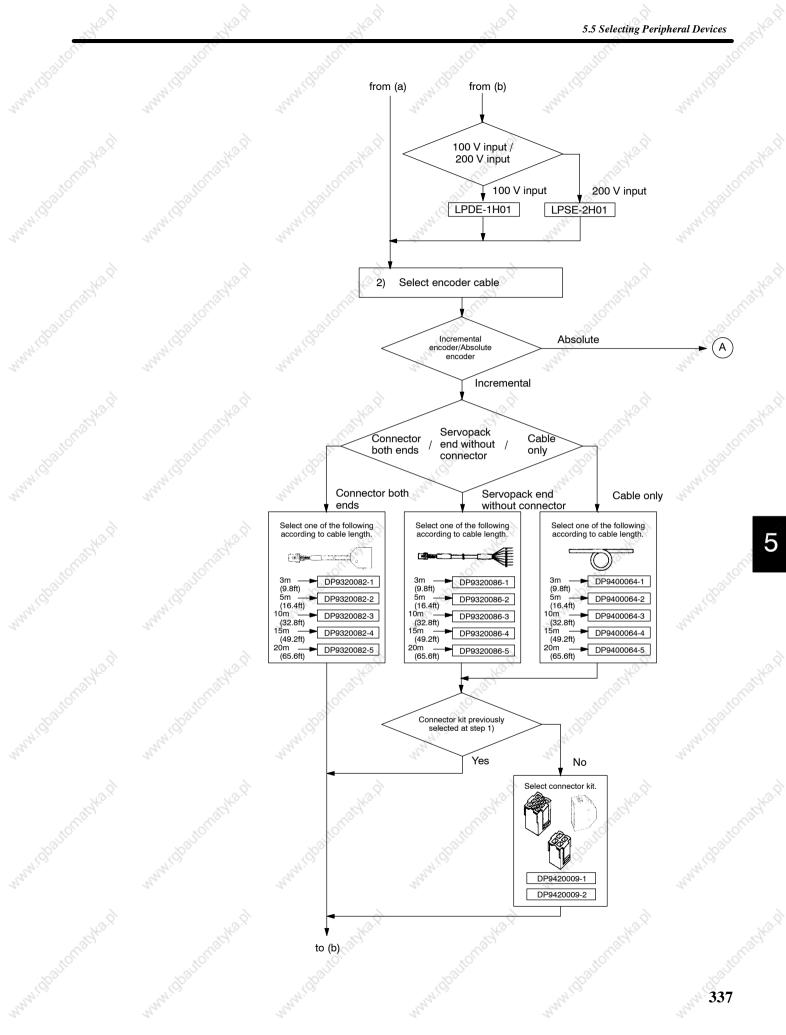
· Cables for connecting PC and Servopack

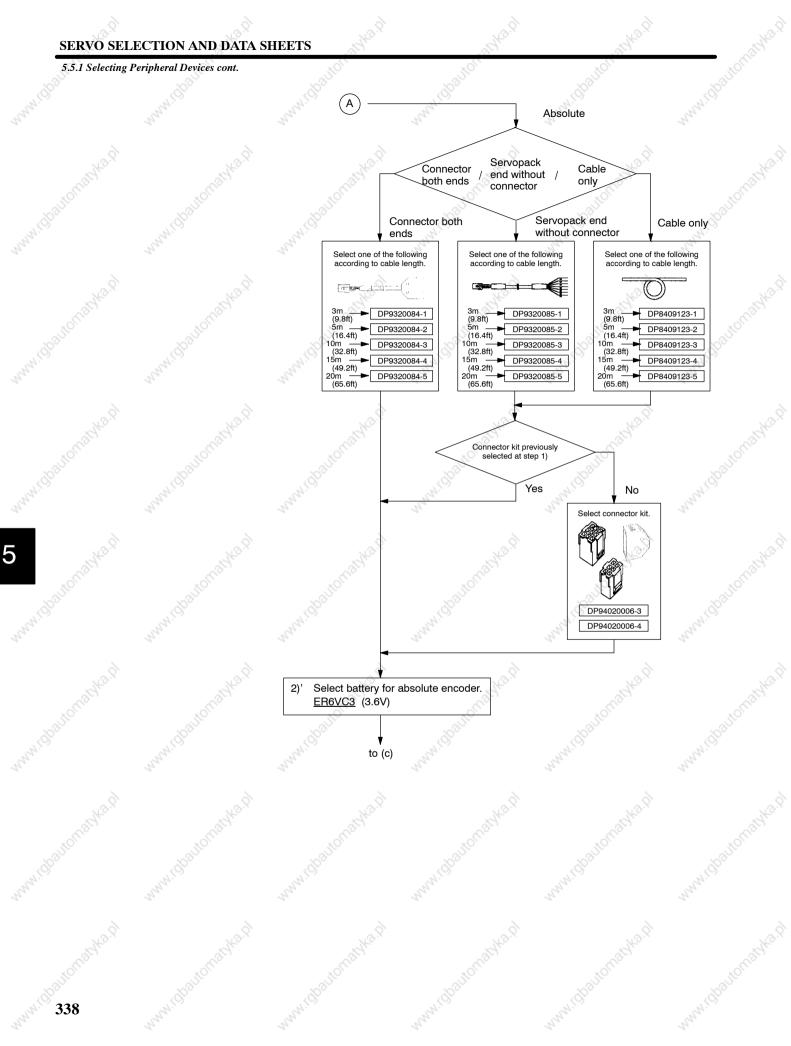
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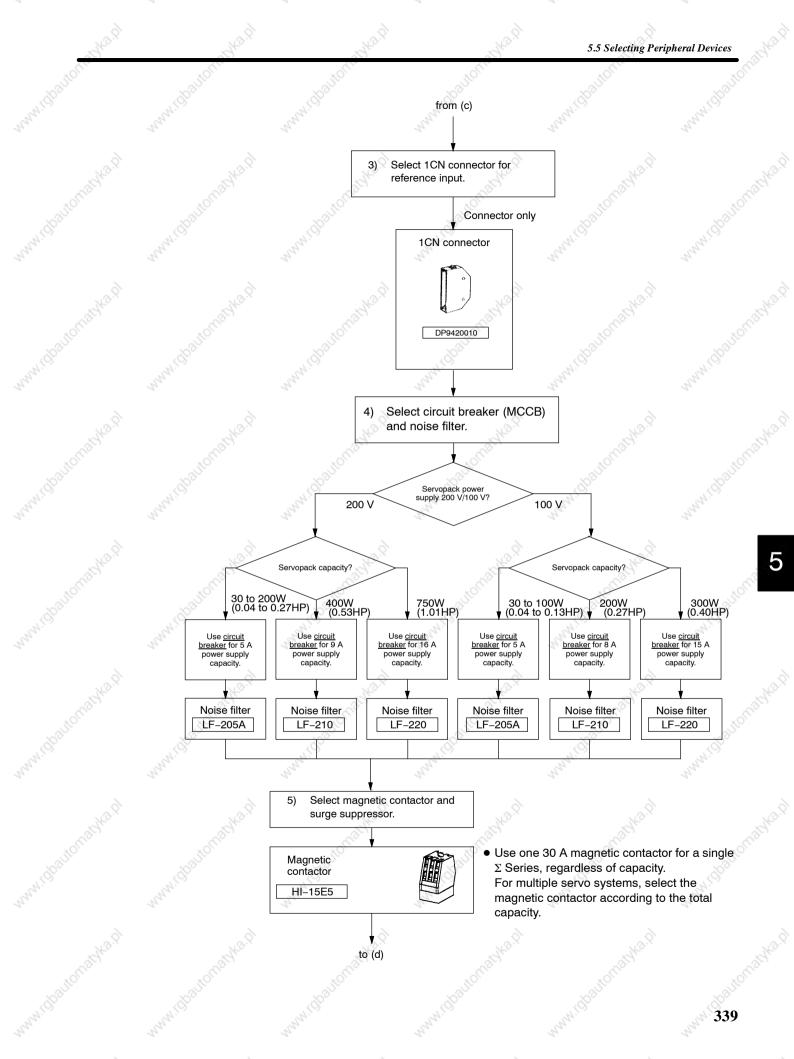


: 7× 0.75mm<sup>2</sup> with brake

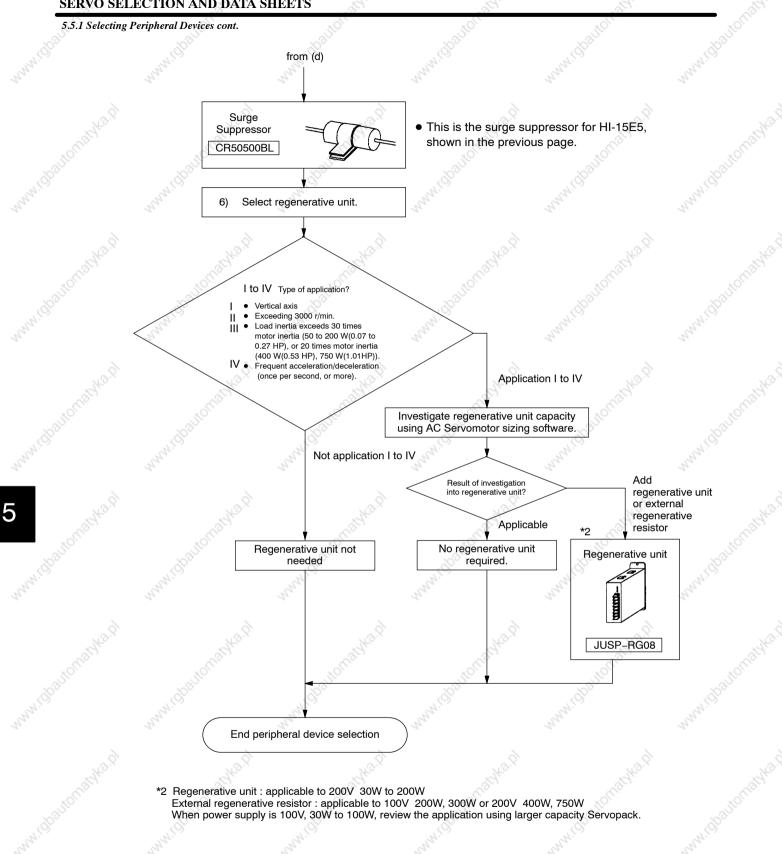
5.5 Selecting Peripheral Devices











# 5.5.2 Order List

 Order lists are given below for the Servomotors, Servopacks, digital operators, and peripheral devices which comprise the AC Servo Σ–Series. These order lists are a convenient aid to selecting peripheral devices.

#### SGM Servomotor

Servomo	otor Type	Qt	У
SGM-	0	6	
SGM-	Brown	Str.	
SGM-	HOLL	KORT.	3
SGM-	Sec.	So.	35
SGM-	and the second s	A.	. And St.
	d		4.

### DR2 Servopack (excluding cables and connectors)

	Serv	opack Type	3	Qty
	DR2-	14	22	22
	DR2-	2	~	~
4	DR2-	×	Ke ×	Max.
2.	DR2-			() · · ·
	DR2-	102111	102111	10711
	DR2-	and C.	1. S.	and the second s

#### SGMP Servomotor

	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	C <sup>1</sup>		
	Servomo	otor Type 🔊	Qty	38
	SGMP-	S. Contraction of the second s	. So	100
	SGMP-	44		2 day
		, ,		
	SGMP-	1.a.9	10 <sup>.2</sup>	
5	SGMP-	Carol .	Sar Sar	4
	SGMP-	and the second	- allor	
	.S	S	S.	8

**Digital Operator** 

#### (Purchase Separately)

D	igital Operator Type	Qi	Qty	
JUSP-OP02A-1	in other	.01	ð.	
~a	ways.	Lan.	AN AN	

M1

5.5.2 Order List cont.

Cables for Servomotor without Brake

(with connector and amplifier terminals)

#### (Purchase Separately)

Cable Type	10	ूर्ज Qty
DP9320659-1	3 m (9.8 ft)	8
DP9320659-2	5 m (16.4 ft)	3410
DP9320659-3	10 m (32.8 ft)	14
DP9320659-4	15 m (49.2 ft)	
DP9320659-5	20 m (65.6 ft)	2

(M2

Cables for Servomotor without Brake

......

(Cable Only)\*1

(Purchase Separately)

1	Cable Type	10	Qty 🔬
DP8409359-1	and the second sec	3 m (9.8 ft)	J. S. S.
DP8409359-2		5 m (16.4 ft)	
DP8409359-3	6	10 m (32.8 ft)	0
DP8409359-4	No.	15 m (49.2 ft)	X.
DP8409359-5	alle.	20 m (65.6 ft)	S.C.

\*1 Customer to attach connector and amplifier terminals. Requires K1 connector kit.

(M3

Cables for Servomotor with Brake

a

(with connector and amplifier terminals)

(Purchase Separately)

S.	Cable Type	2	Qty
DP9320660-1	101 101	3 m (9.8 ft)	all and a second
DP9320660-2		5 m (16.4 ft)	S
DP9320660-3	20 <sup>20</sup>	10 m (32.8 ft)	8
DP9320660-4	4 <sup>10</sup> 44 <sup>10</sup>	15 m (49.2 ft)	and in the second se
DP9320660-5	in and in the second se	20 m (65.6 ft)	194



Cables for Servomotor with Brake

### (Cable Only)\*1

#### (Purchase Separately)

Cable	туре	Qty
DP8409360-1	3 m (9.8 ft)	1 <sup>10</sup>
DP8409360-2	5 m (16.4 f	ft)
DP8409360-3	10 m (32.8	3 ft)
DP8409360-4	15 m (49.2	? ft)
DP8409360-5	20 m (65.6	6 ft)
0×	. 19 <sup>-2</sup>	-0 <sup>-5</sup>

Customer to attach connector and amplifier terminals. Requires (K1) connector kit. \*1



**Connector Kits** 

(Purchase Separately)

	105	2 O Y		
Connect	or Kit Type	AN CONTRACT	Qty	Maria
DP9420009-1 (Incremental e	ncoder, no brake)	20	1	<i>a</i> .
DP9420009-2 (Incremental e	ncoder, with brake)		~	
DP9420009-3 (Absolute enco	oder, no brake) 🛛 🔬		NO.X	
DP9420009-4 (Absolute enco	oder, with brake)		N. S. S.	
12.	22.		( N	

- The three products in the diagrams below are supplied as a set.
- 1) Encoder Connector for Motor End of Cable ... one connector for incremental or absolute encoder
- 2) Motor Connector for Motor End of Cable ... one connector for Servomotor with or without brake
- 3) Encoder Connector for Servopack End of Cable ... one 2CN connector
  - 1) Encoder Connector for Motor End of Cable



For Incremental Encoder For Absolute Encoder

2) Motor Connector

for Motor End of Cable

3) Encoder Connector for Servopack End of Cable



No Brake

5.5.2 Order List cont.

Brake Power Supply (for motor with brake)

(Purchase Separately)

			10×	_
all a	Brake Power Si	upply Type 🔬 🔬	Qty	
LPSE-2H01 (	for 200 V)	Loff.	×01.	
LPDE-1H01 (	for 100 V)	10 <sup>m</sup>	13 <sup>2</sup> 12	X
	201	10.	201	201

(E1)

Cables for Incremental Encoder

(Connector Both Ends)

(Purchase Separately)

al.	Cable Type	A.	Qty 🔊
DP9320082-1	24	3m (9.8 ft)	14
DP9320082-2		5m (16.4 ft)	
DP9320082-3	20	10m (32.8 ft)	2
DP9320082-4	all and a second	15m (49.2 ft)	St.
DP9320082-5	*offic	20m (65.6 ft)	*off

( E2 )

Cables for Incremental Encoder

f.9

(Purchase Separately)

(Servopack end without connectors)\*2

 Cable Type
 Qty

 DP9320086-1
 3m (9.8 ft)

 DP9320086-2
 5m (16.4 ft)

 DP9320086-3
 10m (32.8 ft)

 DP9320086-4
 15m (49.2 ft)

 DP9320086-5
 20m (65.6 ft)

\*2 Customer to attach connector to Servopack end of cable. Requires K1 connector kit.



E4

Cables for Incremental Encoder

## (Cable Only)\*3

#### (Purchase Separately)

10 <sup>1</sup>	Cable Type	10	Qty 📎
B9400064-1	. So.	3m (9.8 ft)	. So
B9400064-2	Nº 1	5m (16.4 ft)	J. M.
B9400064-3	2hr	10m (32.8 ft)	The.
B9400064-4		15m (49.2 ft)	
B9400064-5		20m (65.6 ft)	10. <sup>2</sup>
d' wildbautomad.			
	B9400064-1 B9400064-2 B9400064-3 B9400064-4	B9400064-4	B9400064–4 15m (49.2 ft)

\*3 Customer to attach connector to both ends of cable. Requires K1 connector kit.

<sup>7</sup> Cables for Absolute Encoder

111 103

(Connector Both Ends)

(Purchase Separately)

Cable Type	Q Qty
DP9320084-1	3m (9.8 ft)
DP9320084-2	5m (16.4 ft)
DP9320084-3	10m (32.8 ft)
DP9320084-4	15m (49.2 ft)
DP9320084-5	20m (65.6 ft)

5.5.2 Order List cont.

E5

Cables for Absolute Encoder

(Servopack end without connectors)\*2

(Purchase Separately)

Cable Type	. 10°		_√⊂ Qty
DP9320085-1	.20	3m (9.8 ft)	
DP9320085-2	14.	5m (16.4 ft)	and in the second se
DP9320085-3		10m (32.8 ft)	2
DP9320085-4		15m (49.2 ft)	
DP9320085-5		20m (65.6 ft)	32



\*2 Customer to attach connector to Servopack end of cable. Requires K1 connector kit.

Cables for Absolute Encoder

(Cable Only)\*3

E6

#### (Purchase Separately)

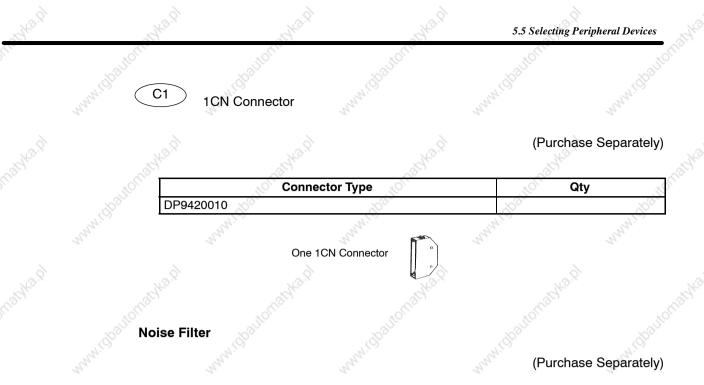
Cable Type	Qty	
DP8409123-1	3m (9.8 ft)	10
DP8409123-2	5m (16.4 ft)	8
DP8409123-3	10m (32.8 ft)	Ser. S.
DP8409123-4	15m (49.2 ft)	2ª
DP8409123-5	20m (65.6 ft)	

\*3 Customer to attach connector to both ends of cable. Requires K1 connector kit.

**Battery for Absolute Encoder** 

(Purchase Separately)

Battery Type	Qty
ER6VC3 (3.6V)	



Noise Filter Type		Qty	,
LF-205A (5A)	30	20	
LF-210 (10A)	201	205	2
LF-220 (20A)	20 <sup>70</sup>	2000	202
		16	

### Magnetic Contactor

(Purchase Separately)

Magr	netic Contactor Type	. Kon	Qty	
HI-15E5 (30A)	Star 1	A.		Jest.
Sa	54	Sec.		24

Surge Suppressor

(Purchase Separately)

	Y(Q)	/ OY	20,
Say .	Surge Suppressor Type	- Sale	Qty
CR50500BL	14	2	2.

Regenerative Unit \*4

(Purchase Separately)

347

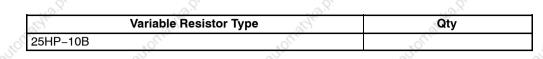
and a set	Sec. 1	Sec. Sec.	22
13	Regenerative Unit Type	1ª	Qty 🚿
JUSP-RG08	2	~	

\*4 Applicable only to 200V, 30W to 200W specification.

5.5.2 Order List cont.

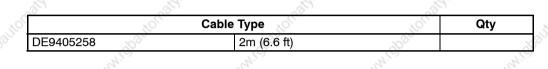
Variable Resistor for Speed Setting

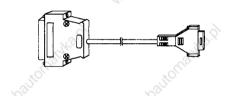
(Purchase Separately)



#### Cables for Connecting PC and Servopack

#### (Purchase Separately)





#### Encoder Signal Converter Unit

#### (Purchase Separately)

- Co	Unit Typ	e	Qty	/
LRX-01/A1	and the second	and the second sec	and the second	
LRX-01/A2	. ( <sup>6</sup>	S.S.	C <sup>20</sup>	.5
LRX-01/A3	and a second sec	A.S.	and the second s	. Shar
LRX-01/A4				

idpautor

This section shows the specifications and dimensional drawings of the peripheral devices required for the  $\Sigma$ -Series servo system. The sequence of peripheral devices is given by the Flowchart for Peripheral Device Selection in *5.5 Selecting Peripheral Devices*.

5.6.1	Cable Specifications and Peripheral Devices	349
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		375
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5.6.15	Cables for Connecting PC and Servopack	381
5.6.16	4CN Connector	385

## 5.6.1 Cable Specifications and Peripheral Devices

1) The rated current of the DR2 Servopack external terminals, cable size, and peripheral devices are listed in the next table.

For wiring, refer to 2.3.1.

5.6.1 Cable Specifica		eripheral Devices		Manne	goanto.	ACAN A	doauto.	ANN AL
	Servopack Type DR2-	Applicable Servomotor	Power supply capacity per Servopack <sup>*1</sup>	MCCB or fuse capacity <sup>*2</sup>	Noise filter type (reference		mmended se filter*3	Power ON/OFF Switch
35		Ser.	kVA	A A	diagram)	Туре	Spec.	Switch
30 W (0.04HP)	A3AC	SGM–A3A □ SGM–A3V □	0.25	5	Applicable	LF-205A	Single-phase 200 VAC Class, 5 A	Contactor 35A or above
50 W (0.07HP)	A5AC	SGM-A5A □ SGM-A5V □ ⊲	0.3	And M.	5° I	AN AN	Class, 5 A	above
100 W (0.13HP)	01AC	SGM-01A SGM-01V	0.5	6	à		à	
NOT WONT	01ACP	SGMP-01A SGMP-01V	Catyle -	,×	all all as		and the	
200 W (0.27HP)	02AC	SGM-02A SGM-02V	0.75		1021101		doautor.	
-11	02ACP	SGMP-02A SGMP-02V	n <sup>m<sup>1</sup>18</sup>	Alan'	~	4544	~	A A A A
400 W (0.53HP)	04AC	SGMP-02V SGM-04A SGM-04V	1.2	9	Ś	LF- 210	Single-phase 200 VAC	
onable	04ACP	SGMP-04V SGMP-04V	onable		.onable		Class, 10 A	
750 W (1.01HP)	08AC	SGM-08A SGM-08V	2.2	16	Not applicable	LF- 220	Single-phase 200 VAC	Les
3	16	4	12 Carl	33	¥.	424	Class, 20 A	14
6	08ACP	SGMP-08A 🗆	1	6	à		Š.	

For power ON/OFF switch, use contactor 30A or above. Note

- \*1 Value at rated load.
- \*2 Braking characteristics (at 25° C): 200% for 2s min., 700% for 0.01s min.
- \*3 Yaskawa recommends noise filters manufactured by Tokin Corp. Yaskawa Controls Co., Ltd. can supply these noise filters.

Servopack Type DR2-		Servomotor capacity per	Servomotor capacity per fuse type		type	Recommended noise filter*3		Power ON/OFF	
	100	Servopack*1 capacity*2 kVA A	(reference diagram)	Туре	Spec.	- switch			
30 W (0.04HP)	A3BC	SGM-A3B 🗆 SGM-A3W 🗆	0.25	5	Applicable	LF- 205A	Single-phase 200 VAC Class, 5 A	Contactor 35A or above	
50 W (0.07HP)	A5BC	SGM-A5B 🗆 SGM-A5W 🗆	0.3	and and a start of the second s	t	and all		www.	
100 W	01BC	SGM-01B	0.5	-	N.,				
(0.13HP)		SGM-01W 🗆	3.2		Not applicable		33.2		
	01BCP	SGMP-01B	and the				S.S.		
		SGMP-01W 🗆	xoffin		) X	,	S		
200 W	02BC	SGM-02B 🗌	0.75	8	2	LF- 210	Single-phase	2000	
(0.27HP)	97	SGM-02W	5	10	1.0	26	.N.O.	200 VAC Class, 10 A	N.C.
1924	02BCP	SGMP-02B 🗌		All Company		1525°	0.000, 1071	State -	
		SGMP-02W 🗆							
300 W	03BC	SGM-03B	1.4	15	6	LF- 220	Single-phase	] [	
(0.40HP)	~	SGM-03W 🗆	. N. O. Y.		Non		200 VAC Class, 20 A		
	03BCP	SGMP-03B	- C. B.		S. C.		Sidoo, 20 A		
	350	SGMP-03W 🗆	35°	3	P.	3	0	35°	

### For 100VAC Class

Note For power ON/OFF switch, use contactor 30A or above.

- \*1 Value at rated load.
- \*2 Braking characteristics (at 25°C): 200% for 2s min., 700% for 0.01s min.
- \*3 Yaskawa recommends noise filters manufactured by Tokin Corp. Yaskawa Controls Co., Ltd. can supply these noise filters.

The types of cable are shown in the table below. Use it in combination with the table above.

	🛇 Cable Type	Conductor Allowable Temperature
Symbol	Name	C AND C
PVC	Normal vinyl cable	
IV.	600 V vinyl cable	60
HIV	Temperature-resistant vinyl cable	75

- Note
- 1) Use cable with 600 V min. withstand voltage for main circuits.
  - 2) Consider allowable current reduction ratio if cables are bundled in PVC or metal ducts.
  - Use temperature-resistant cable under high ambient or panel temperature where normal vinyl cables rapidly deteriorate.

5.6.1 Cable Specifications and Peripheral Devices cont.

2) Cable Specifications

Applied Voltage	/oltage Type L1. L2, 🕀				
	DR2-	Rated Input Current A (rms)	Cable Spec.* <sup>2</sup>	Tightening Torque (N⋅m)	
200VAC	АЗА 🗆	1.3	AWG16 (HIV 1.25) Min.	0.5	
Class	A5A 🗌	1.5	~	~	
13×	01A 🗌 🔄	2.5	4 <sup>3</sup> X	12.7	
)	02A 🗌 🖉	4.0	and a		
	04A 🗆	6.0	AWG14 (HIV 2.0) Min.		
	08A 🗆	11.0	W.O	. the second sec	
100VAC	АЗВ 🗆	2.0	AWG16 (HIV 1.25) Min.	344	
Class	A5B 🗌	2.6			
23.8	01B 🗌	4.5	200	28	
1	02B □ _	8.0	AWG14 (HIV 2.0) Min.	8	
	03B 🗆	14.0	outon'		
	1. A. U.	1.617	1.617		

Cable Specifications for Main Circuit Power Input Terminals

- \*1 When P, N (Y3, Y4) terminals are used, use the same size cable as those of L1, L2. Tightening torque is the same as those of L1, L2 (0.5N·m).
- \*2 The cable specifications were selected under conditions of three cables per bundle at 40°C ambient temperature, with the rated current flowing. Max. connectable cable size is 2.5mm<sup>2</sup>.

Cable Specifications for Control Circuit Power Input Terminals

	Applied Voltage	Servopack Type DR2–	Control Circuit Power Input Terminal				
Ş.K.		automatok	Rated Input Current* <sup>2</sup> A (rms)	Cable Spec.*1	Tightening Torque (N⋅m)		
	200VAC Class	All Models	0.2	AWG16 (HIV 1.25) Min.	0.5		
	100VAC Class	All Models	0.4	Nº CONTRACTOR			

\*1 Max. connectable cable size is 2.5mm<sup>2</sup>.

\*2 When control circuit breaker and main circuit breaker are used separately, be aware of in-rush current (30 to 40 A, for 5 ms or less) flows at control power ON.

Applied Voltage	Servopack Type	Main Ci	cuit Power Input Terminal* U, V, W, ⊕	1
	DR2-	Rated Input Current A (rms)	Cable Spec.*1	Tightening Torque (N⋅m)
200VAC	A3A	0.42	Refer to the "Cable Spec-	0.5 🔬
Class	A5A	0.6	ifications" shown below.	. AN 19
2620	01A□	0.87 (0.89)* <sup>2</sup>	4 <sup>54</sup>	Sea and and a sea and
	02A	2.0		
	04A	2.6	t Hais	
	08A	4.4 (4.1)* <sup>2</sup>	- Carl	
100VAC	A3B	0.63	and the second sec	
Class	A5B	0.9	March BC	
3455	01B□	2.2		3455
	02B	2.7	1	
	03B	3.7 (4.3)* <sup>2</sup>		

Cable Specifications for Motor Connecting Terminals

\*1 Max.connectable cable size is 2.5mm<sup>2</sup>.

\*2 Values in parentheses are applied only when SGMP motor is used.

#### Cable Specifications

(When motor conforms to Japanese Standard)

When Yaskawa cables are used, contact your Yaskawa representative for details. When selecting non–Yaskawa cables, check the cable current rating and consider the operating environment. In this case, use cable sizes AWG 22 to AWG 18 (0.3 to 0.89mm<sup>2</sup>) since motor–side connector has some restriction. As for connectors on motor side, contact your Yaskawa representative.

#### (When motor conforms to EN Standard)

Connector is not supplied with motor power cable. Check the cable current rating and consider the operating environment to select the cable and connector conforming to the EN Standard.

<Motor Power Cable Color> Red White Blue Green/Yellow <Phase> Phase-U Phase-V Phase-W FG

5.6.1 Cable Specifications and Peripheral Devices cont.

3) The appropriate cables for Servopack connectors 1CN and 2CN are shown in the table below. As for the cables conforming to the EMC instructions, refer to 7.2.4 and 7.2.5.

Control I/O Signal Connector	1CN	Cable	Use twisted-pair cable or twisted-pair shielded cable. Max. wiring length is 3m (9.8ft.).	mateka
(dbaute		Finished Cable Dimensions	φ16.0 mm (φ 0.63 in.)MAX.	BULL
PG Signal Connector	2CN	Cable	Use Yaskawa cable. Use twisted-pair shielded cable if Yaskawa cable is not used.	
asherd	asha.c	-auconat	If using cable other than Yaskawa's, use AWG22 for encoder power supply and FG line. Use AWG26 for other signals. These connections permit wiring distances up to 20 m (65.6 ft).	automatyka
MAN. IC		Finished Cable Dimensions	φ11.0mm (φ0.43 in.) MAX.	

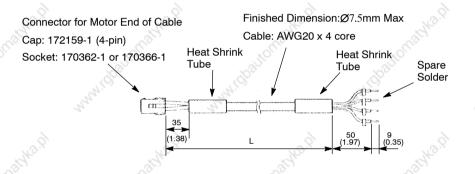
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# 5.6.2 Motor Cables

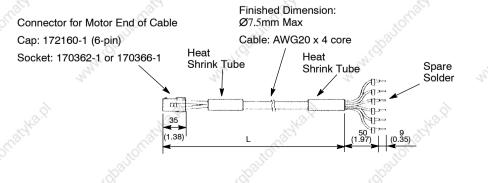
- 1) The dimensions and appearance of the motor cables are shown below. Specify the cable type when ordering.
  - a) Cables For Motor Without Brake (with connector and AMP terminals)

Туре	MANION	L in mm (feet)	141.D
DP9320659-1	3000 <sup>+100</sup>	(10 <sup>+0.33</sup> )	24
DP9320659-2	5000 <sup>+100</sup> 0	(16.7 <sup>+0.33</sup> )	2
DP9320659-3	10000 <sup>+500</sup>	(33.3 0 )	×
DP9320659-4	15000 <sup>+500</sup> 0	(50 <sup>+1.67</sup> 0)	Ban
DP9320659-5	20000 <sup>+500</sup> 0	(66.7 <sup>+1.67</sup> )	and



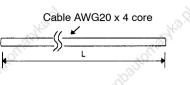
b) Cables For Motor With Brake (with connector and AMP terminals)

Туре	L in mm (feet)	2ª
DP9320660-1	3000 <sup>+100</sup> (10 <sup>0</sup> )	Ś
DP9320660-2	5000 <sup>+100</sup> (16.7 <sup>+0.33</sup> )	
DP9320660-3	10000 <sup>+500</sup> (33.3 <sup>+1.67</sup> )	10 <sup>311</sup>
DP9320660-4	15000 <sup>+500</sup> (50 <sup>+1.67</sup> )	and S.
DP9320660-5	$20000^{+500}_{-0}$ (66.7 $^{+1.67}_{-0}$ )	



5.6.2 Motor Cables cont.

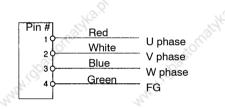
c) Cables For Motor Without Brake (Cable Only)



abalitor	Cable	L		-Dautoman
34 <sup>1</sup> .0	Туре	Arnen!!!	L in mm (feet)	and and services
	DP8409359-1	3000 <sup>+100</sup> 0	(10 <sup>+0.33</sup> )	3.9
, d	DP8409359-2	5000 <sup>+100</sup> 0	(16.7 <sup>+0.33</sup> )	NOTION.
(dbaur	DP8409359-3	10000 <sup>+500</sup> 0	(33.3 <sup>+1.67</sup> )	. (Å <sup>201</sup>
24.	DP8409359-4	15000 <sup>+500</sup> 0		N. N.
	DP8409359-5	20000 <sup>+500</sup> 0	(66.7 <sup>+1.67</sup> )	4
ć	add had		1354 51354 State	Nard N
MIGDONE	AMP Connector Cap: 172159-1 Socket: 170362-1 or 170366-1 (Manu	ifactured by AA		www.cpattor.

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5.6 Specifications and Dimensional Drawings of Peripheral Devices

d) Cables For Motor With Brake (Cable Only)

Cable AWG20 x 6 core

MMIGBBUCONALY	<u> </u>		ats	tonato
Туре	2	L in mm (feet)	412	7
DP8409360-1	3000 <sup>+100</sup> 0	(10 <sup>+0.33</sup> )	No.S.	NO.P
DP8409360-2	5000 <sup>+100</sup> 0	(16.7 <sup>+0.33</sup> )	(Sec.)	S. P.
DP8409360-3	+500 10000 <sup>+500</sup>	(33.3 0 )	B	-
DP8409360-4	15000 <sup>+500</sup>	(50 <sup>+1.67</sup> <sub>0</sub> )	St. St.	
DP8409360-5	20000 <sup>+500</sup> 0	(66.7 <sup>+1.67</sup> 0)	à	à

AMP Connector

Cap: 172160-1

Socket: 170362-1 or 170366-1 (Manufactured by AMP.)

Pin # 10 20 30 40 50 60	Red White Blue Green Black Black	U phase V phase W phase FG (Frame Ground) Br (Brake Terminal) Br (Brake Terminal)
1		20

If cable only is ordered, purchase the AMP connector separately. Refer to 5.6.3 Con nector Kits for details about caps and sockets.

5.6.3 Connector Kits

## 5.6.3 Connector Kits

1) A connector kit comprises three connectors as shown in the diagram below: one encoder connector at both the motor and Servopack ends of the cable and a motor connector for the motor end of the cable.

Encoder Connector for Motor End of Cable Encoder Connector for Servopack End of Cable



Motor Connector for Motor End of Cable



Four types of connector kit are available according to the following information:

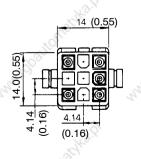
- Is the encoder incremental or absolute?
- Is the motor with or without a brake?

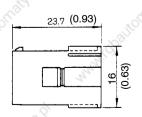
A connector kit is required in the following cases:

- a) If motor cable only is purchased (whether or not motor has a brake).
- b) If the encoder cable with a motor connector only and Servopack end without connector, or encoder cable only is purchased (for either incremental or absolute encoder).

2) Select one of the following two types of encoder cable connector.

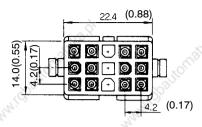
a) For Incremental Encoder

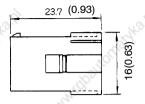




Cap: 172161-1 Socket: 170365-1

b) For Absolute Encoder

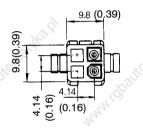


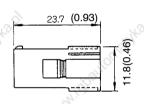


Cap: 172163-1 Socket: 170361-1 or 170365-1

3) Select one of the following two types of motor cable connector.

a) Motor Without Brake

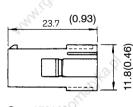




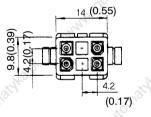
Cap: 172159-1 Socket: 170362-1 or 170366-1

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b) Motor With Brake



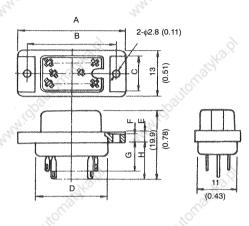
Cap: 172160-1 Socket: 170362-1 or 170366-1



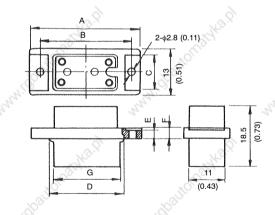
5.6.3 Connector Kits cont.

4) The following shows the encoder connector for the Servopack end of the cable. Caulking type is not provided as the connector kits. When using the caulking type, order separately and use MRP-F type contact.

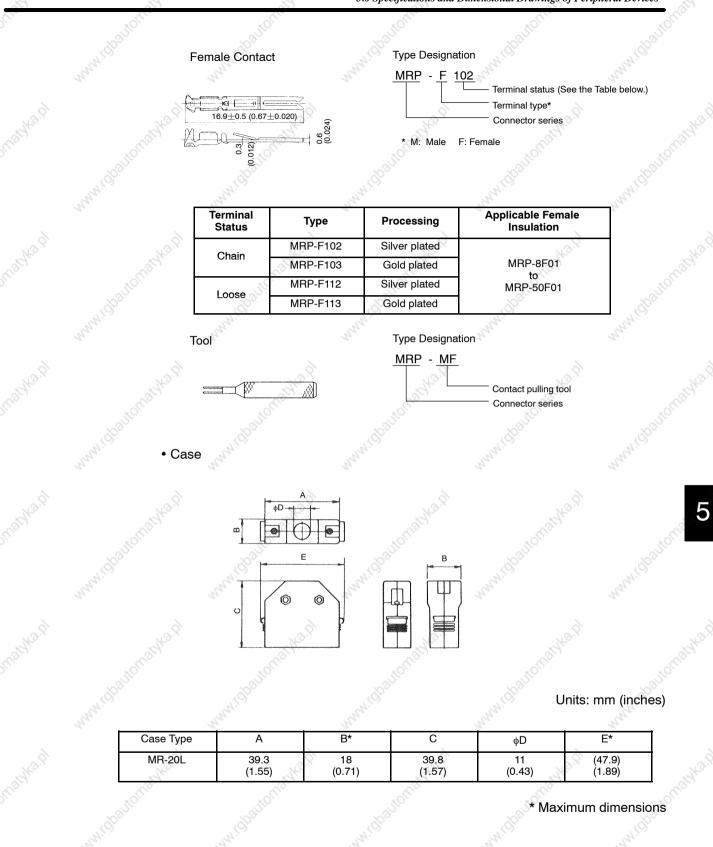
• Connector (Soldering type)



ANNA!	Butomash	WWW. CDS	utomath	MMMIGBRUT		Munnighattonia.	43)	Units: r	nm (inches	pautomatic
	Connector Type	Α	В	С	D	E	۶ ۲	G	н	
5	MR-20F	32.8 (1.29)	27.8 (1.09)	10 (0.39)	22.3 (0.88)	3 (0.12)	2.4 (0.09)	8.4 (0.33)	10.9 (0.43)	Carly
ANN ALO	Salto.	Maran 1982	• Connec	tor (Caulkin	ng type)	ANNON-IGBAILOS	hun	ATOBATON	Mannet	patton.



www.cball	oneoken	www.chai	G D	March 1	(0.43)	n name	Units: m	ım (inches)	pautomatyka.pl
	Connector Type	Α	В	С	D	E	F	G	102
,	MRP-20F01	32.8 (1.29)	27.8 (1.09)	10 (0.39)	22.3 (0.88)	2.4 (0.09)	3 (0.12)	21.3 (0.84)	*ornatyka.P
www.idbau		Munill Ball	<u>&gt;</u> "	MANNIG BE	<u>, , , , , , , , , , , , , , , , , , , </u>	Man 10	5 <sup>601</sup>	A CONTRACTION OF THE OWNER	Daile .



5.6.3 Connector Kits cont.

## 5) The types of connector kit are shown below. Select the type of connector kit according to the connectors selected in (2), (3), and (4) above.

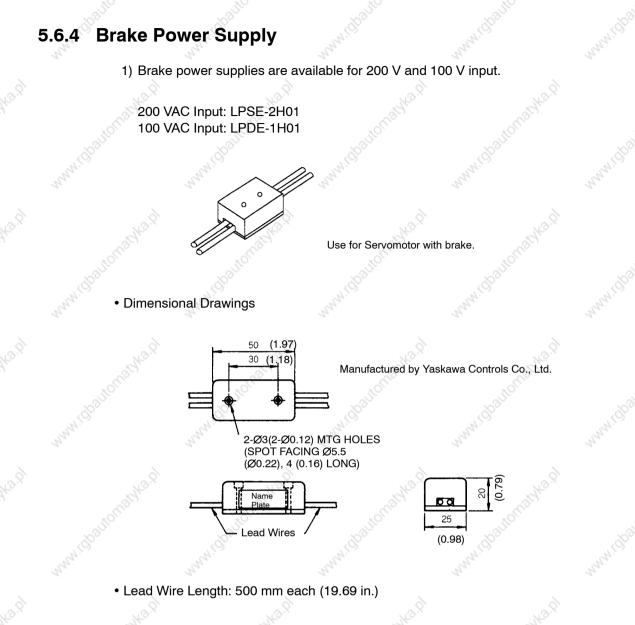
Connector	Applic	ation			J.S.Y		Conne	ctor	Kit Part Lis	st		51	2.2	
Kit Type	Encoder/Mo	otor Cable			For	Enco	der Cable	à	a.		Fo	r Mot	tor Cable	
x01110	8		E	ncod	der End		Se	vopa	ack End		20,			
2	Encoder	Motor	Сар	Ser Constraints	Socke	ət	Connec	tor	Case		Cap		Socke	et 🔬
	Туре	Brake With/ Without	Туре	Q ty	Туре	Qt y	Туре	Q ty	Туре	Q ty	Туре	Q ty	Туре	Qt y
DP9420009-1	Incremental	Without	*1	1	*1	*3	*2	1	*2	1	*1	1	*1	*3
140.91		12.Q	172161 -1		170365 -1	10	MR-20F		MR-20L		172159 -1	N.	170366 -1	5
DP9420009-2	Incremental	With			Carlo I			à	5		*1	ी		*3
J.O.	10215	D		3°	0.		10015	0.			172160 -1			7
DP9420009-3	Absolute	Without	*1 172163	<sup>0</sup> 1		*3 16	anni.Or			14	*1 172159	1	5	*3 5
	1		-1				- C			-2.	-1		2	
DP9420009-4	Absolute	With			6				6		*1	1	6	*3
Nº.		Nº.			Nº.			1	Nº.		172160 -1	A	ð.`	7
xollio	×	5100		x	offic			.5			°6,	<u>, e</u>		
				S.										
	34 9 *1	Manuta	ctured by	AM	Р.						4 <sup>1,0</sup>			A1.0
	22		24							22				20

- \*2 Manufactured by 3M.
- Including one spare. \*3

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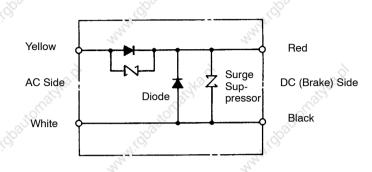
- Max. Ambient Temperature: 60°C
- Lead Wires: Color Coded

4	Brake	
N 100V	200V	200
Blue/White	Yellow/White	Red/Black
autorni	automa	autonia aut
	NIGDO	NIGDO NIGDO
AN AN	44	and and

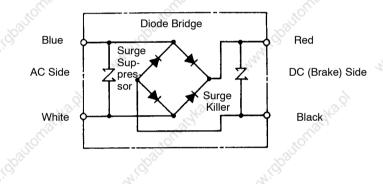
5.6.4 Brake Power Supply cont.

2) The internal circuits are shown below. While it is possible to switch either the AC or DC side of the brake power supply, it is normally safer to switch the AC side. If the DC side is to be switched, install a surge suppressor near the brake coil to prevent the surge voltages due to switching the DC side damaging the brake coil.

• Internal Circuit for 200 VAC Input (LPSE-2H01)



• Internal Circuit for 100 VAC Input (LPDE-1H01)



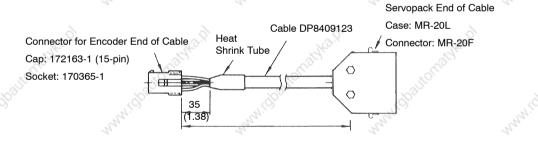
# 5.6.5 Encoder Cables

- 1) The dimensions and appearance of the encoder cables are shown below. Specify the cable type when ordering.
  - As for the cables conforming to the EMC instructions, refer to 7.2.4.
  - a) Cables for Incremental Encoder (Connector Both Ends)

2°.	and		And Barrowski	Connector for Ser Case: MR-20L	vopack End of Cable
Connector for Enc	oder End of Cable	Heat	Cable B9400064	Connector: MR-20	)F
Cap: 172161-1 (9-	pin) \	Shrink Tube			. a. ?
Socket: 170365-1					5
xoffin				0	
1000	10900	35 (1.38)	1020		
14:00	. A. P.	(1.00)	L ()		34. O

Туре	L in mm (feet)	
DP9320082-1	3000 <sup>+100</sup> (10 <sup>0</sup> )	. 6
DP9320082-2	5000 <sup>+100</sup> (16.7 <sup>+0.33</sup> )	Sar
DP9320082-3	$10000^{+500}_{0}$ (33.3 $^{+1.67}_{0}$ )	
DP9320082-4	15000 <sup>+500</sup> (50 <sup>+1.67</sup> <sub>0</sub> )	
DP9320082-5	20000 <sup>+500</sup> (66.7 <sup>+1.67</sup> 0)	

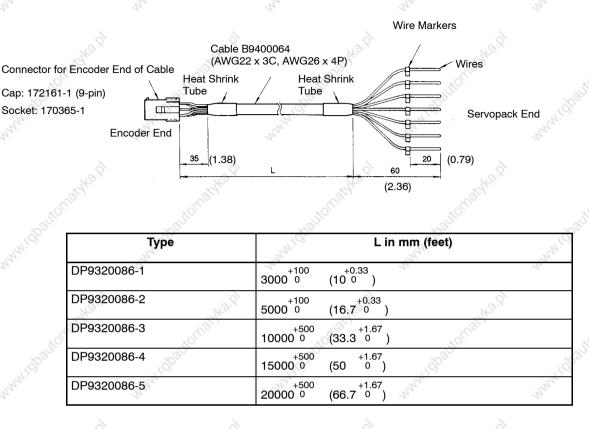
b) Cables for Absolute Encoder (Connector Both Ends)



Туре	ġ.	L in mm (fe	et)
DP9320084-1	3000 <sup>+100</sup> 0	(10 <sup>+0.33</sup> )	S
DP9320084-2	5000 <sup>+100</sup> 0	(16.7 <sup>+0.33</sup> )	and the second second
DP9320084-3	+500 10000 <sup>0</sup>	(33.3 <sup>+1.67</sup> )	14.
DP9320084-4	15000 <sup>+500</sup> 0	(50 <sup>+1.67</sup> 0 )	12.9
DP9320084-5	20000 <sup>+500</sup> 0	(66.7 <sup>+1.67</sup> 0)	R <sup>ab</sup>

5.6.5 Encoder Cables cont.

c) Cables for Incremental Encoder (Servopack End without Connector)



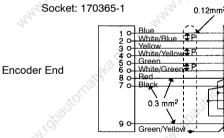
Case: MR-20L (Manufactured by Honda Tsushin Kogyo Co., Ltd.) Connector: MR-20F (Manufactured by Honda

15

02 06

03 020

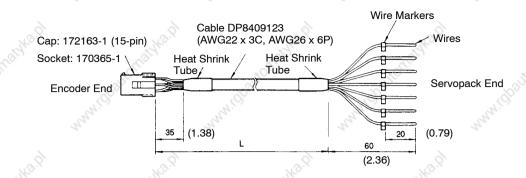
Cap: 172161-1 Tsushin Kogyo Co., Ltd.)



Servopack End

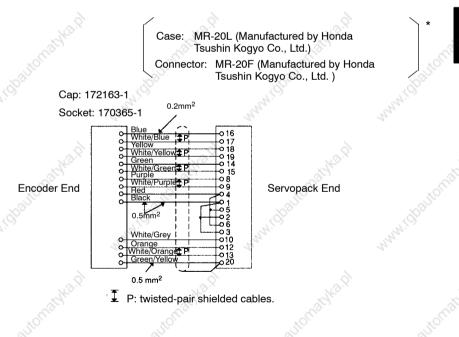
P: twisted-pair shielded cables.

\*Purchase cases and connectors separately. Refer to 5.6.3 Connector Kits for details.



d) Cables for Absolute Encoder (Servopack End without Connector)

Туре	Span	L in mm (feet)	.8000
DP9320085-1	3000 <sup>+100</sup>	(10 <sup>+0.33</sup> )	Service .
DP9320085-2	5000 <sup>+100</sup> 0	(16.7 <sup>+0.33</sup> )	6
DP9320085-3	10000 0	(33.3 0 )	£0
DP9320085-4	15000 <sup>+500</sup> 0	(50 <sup>+1.67</sup> )	1
DP9320085-5	20000 <sup>+500</sup> 0	(66.7 0 )	NNI OD



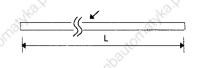
\*Purchase cases and connectors separately. Refer to 5.6.3 Connector Kits for details.

5.6.5 Encoder Cables cont.

e) Cables for Incremental Encoder (Cable Only)

Cable AWG22 x 3C, AWG26 x 4P

www.idbailor



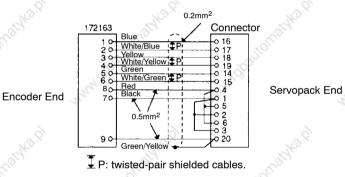
8	BUOMBONST	aballome +	L	Biologia	disulonall en	.85
A. A. A.		Туре	and the second	Lin	mm (feet)	and and it
	B9400064-1	-1K <sup>Q.Q</sup>	3000 <sup>+100</sup> 0	+0.33 (10 <sup>0</sup> )	Ma.P.	
	B9400064-2	HOMAN	5000 <sup>+100</sup> 0	(16.7 <sup>+0.33</sup> )	toman	
15	B9400064-3	1.1dbar	+500 10000 0	(33.3 <sup>+1.67</sup> )	NIGDO.	J.S
4 <sup>ch</sup>	B9400064-4	2 Mars	15000 <sup>+500</sup>	(50 <sup>+1.67</sup> 0)	1 miles	2 and
	B9400064-5		20000 <sup>+500</sup> 0	(66.7 <sup>+1.67</sup> 0)	ad a start	

Cap: 172161-1 (Manufactured by AMP.)

Socket: 170365-1 (Manufactured by AMP.)

Case: MR-20L (Manufactured by Honda Tsushin Kogyo Co., Ltd.)

Connector: MR-20F (Manufactured by Honda Tsushin Kogyo Co., Ltd.)



Purchase caps, sockets, cases, and connectors separately. Refer to 5.6.3. Connector Kits for details.

f) Cables for Absolute Encoder (Cable Only)

Cable AWG22 x 3C,	
L L	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
· 101	10

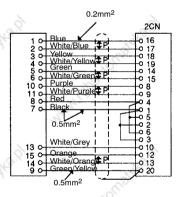
Cable AWG	22 x 3C, AWG26 x 6P	tonat/40.01	.onatika.pl
WIGSTIC	W. CORIN	A. COST	W. OBOUL
Туре	Lin mm	n (feet)	rin .
DP8409123-1	3000 <sup>+100</sup> (10 <sup>+0.33</sup> )	201	
DP8409123-2	5000 <sup>+100</sup> (16.7 <sup>+0.33</sup> )	Matthe	Chatyle.
DP8409123-3	10000 <sup>+500</sup> (33.3 <sup>+1.67</sup> )	dbauto.	. Noally
DP8409123-4	15000 <sup>+500</sup> (50 <sup>+1.67</sup> )	<sup>4</sup> .0	ANN CONTRACT
DP8409123-5	$20000^{+500}_{0}$ (66.7 <sup>+1.67</sup> <sub>0</sub> )		~
· 8.	· 6. · · · · · · · · · · · · · · · · · ·	- Q.	Q,

Cap: 172163-1

www.cbaite

Socket: 170365-1

Case: MR-20L (Manufactured by Honda Tsushin Kogyo Co., Ltd.) Connector: MR-20F (Manufactured by Honda Tsushin Kogyo Co., Ltd.)



 $\overline{\mathbf{I}}$  P: twisted-pair shielded cables.

www.idbaild Purchase caps, sockets, cases, and connectors separately. Refer to 5.6.3. Connector Kits for details.

5.6.5 Encoder Cables cont.

Details of the encoder cables are summarized in the table below.
 These cables are not supplied as accessories with a Servopack or Servomotor.
 Purchase in standard specified lengths as required.

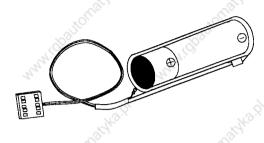
Cable		Absolute Encoder			
Specification	Yaskawa Drg. #B9400064 (Soldering type)	Yaskawa Drg. #DE8400093 (Caulking type)	#DP8409123		
Basic Specifications	Compound KQVV-SW AWG22 x 3C, AWG26 x 4P	KQVV-SB AWG26 x 10P	Compound KQVV-SW AWG22 x 3C, AWG26 x 6P		
Finished Dimension	φ7.5 mm (φ0.30in.)	φ10.0 mm (φ0.39in.)	φ8.0 mm (φ0.31in.)		
Internal Structure and Lead Colors	F1 (A1) (F4) (A2)(A2)(F2) (F3) (F3)	9103 824 765	Be (A1) B2 (A3) (A2) B3 (B4) B3		
utonatyka.pt	A <sub>1</sub> Red A <sub>2</sub> Black A <sub>3</sub> Green/Yellow F <sub>1</sub> Blue – White/Blue (Twisted pair) F <sub>2</sub> Yellow – White/Yellow (Twisted Pair) F <sub>3</sub> Green – White/Green (Twisted Pair) F <sub>4</sub> Orange – White/Orang (Twisted Pair)	<ol> <li>Blue – White (Twisted pair)</li> <li>Yellow – White (Twisted pair)</li> <li>Greem – White (Twisted pair)</li> <li>Red – White (Twisted pair)</li> <li>Purple – White (Twisted Pair)</li> <li>Blue – Brown (Twisted Pair)</li> <li>Yellow – Brown (Twisted Pair)</li> </ol>	A <sub>1</sub> Red A <sub>2</sub> Black A <sub>3</sub> Green/Yellow B <sub>1</sub> Blue – White/Blue (Twisted pair) B <sub>2</sub> Yellow – White/Yellow (Twisted Pair) B <sub>3</sub> Green – White/Green (Twisted Pair) B <sub>4</sub> Orange – White/Orang (Twisted Pair) B <sub>5</sub> Purple – White/Purple (Twisted Pair) B <sub>6</sub> Grey – White/Grey		
	and the set	8 Green – Brown (Twisted pair) 9 Red – Brown (Twisted pair) 10 Purple – Brown (Twisted pair)	(Twisted Pair)		
Yaskawa standard specifications	Standard lengths: 3 m (9.8ft.) , 5 m (16.4ft.) ,	10 m (32.8ft.), 15 m (49.2ft	.), 20 m (65.6ft.) *		

\*When appropriate cable is used, the allowable wiring distance between Servopack and Servomotor (PG) is 20 m (65.6ft.) max.

- Note 1 See items a) to d) in this section for details about cables with connectors.
  - 2 When wiring distance between Servopack and servomotor (PG) exceeds 20m (65.6ft.), max. 50m (164ft.) cable can be available (AWG16, Yaskawa Drg. #DP8409179). For details, contact your Yaskawa representative.

# 5.6.6 Battery for Absolute Encoder

1) Purchase the following battery if using an absolute encoder. (Manufactured by Toshiba Battery Co., Ltd.)



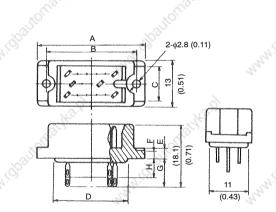
- Lithium Battery: ER 6 V C3
- Nominal Voltage: 3.6 V
- Standard Capacity: 2000 mAh

## 5.6.7 1CN Connector

1) This connector is required to connect the host controller to 1CN on the Servopack.

As for the connector conforming to the EMC instructions, refer to 7.2.5. As for the caulking type contact tool, see 5.6.3 Connector Kits for details, and use MRP-M $\Box$ type contact.

• Connector (Soldering type)

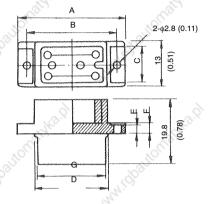


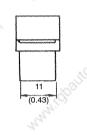
Units: mm (inches)

-30		28		×0`		30		20	2,5
2	Connector Type	A	В	ALCOC.	D	CON E	F	G	H
	MR-50M	61.4 (2.42)	56.4 (2.22)	10 (0.39)	50.9 (2.00)	3 (0.12)	2.4 (0.09)	8.5 (0.33)	6 (0.24)

5.6.7 1CN Connector cont.

• Connector (Caulking type)





Units: mm (inches)

MMM.Idautonati

	ad hour		a Hear		Sto.	
Connector Type	A	В	CUL C	D	J.OT E	F
MRP-20M01	61.4 (2.42)	56.4 (2.22)	10 (0.39)	50.9 (2.00)	2.4 (0.09)	3 (0.12)

www.idautonaykan Male Contact



Type Designation MRP - M 102

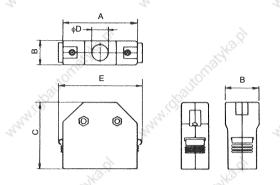
Terminal status (See the Table below.) Terminal type\* Connector series

F: Female \* M: Male

Terminal Status	Туре	Processing	Applicable Male Insulation
Ohavia	MRP-M102	Silver plated	Sec.
Chain	MRP-M103	Gold plated	MRP-8M01
Loose	MRP-M112	Silver plated	MRP-50M01
LOOSe	MRP-M113	Gold plated	a state

www.ighautonatyka.pl

• Case



### Units: mm (inches)

	- 35°		- S		8	8
Case Typ	e	A	B*	С	φD	E*
MR-50L		67.9 2.67) (0	18 0.71)	44.8 (1.76)	16 (0.63)	(76.5) (3.01)

\* Maximum dimensions

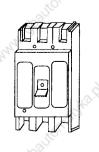
2) The 1CN connector type is shown below.

Connector	Application	19 <sup>10</sup>	Connecto	r Part List	14
Туре		Conn	Connector		ise
à	à	Туре	Qty	Туре	Qty
DP9420010	I/O connector for 1CN (Soldering type)	MR-50M*	Ster.	MR-50L*	1
- www.it	I/O connector for 1CN (Caulking type)	MRP-50M01*	1	MR-50L*	1 what

\* Manufactured by Honda Tsushin Kogyo Co., Ltd.

# 5.6.8 Circuit Breaker

1) The customer should purchase a circuit breaker (MCCB) of appropriate capacity.



• Recommended Product

Ground fault detector for motor protection manufactured by Mitsubishi Electric Co. Ltd. Type: MN50-CF Rated Current: 7.1 A, 10 A, 16 A, 25 A, 32 A, 45A

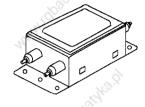
Use to protect the power lines.

#### 5.6.9 Noise Filter

# 5.6.9 Noise Filter

1) Select the noise filter from the following three types according to the Servopack capacity.

As for the noise filter conforming to the EMC instructions, refer to 7.2.2.



Install to eliminate external noise from the power lines.

0

15 (0.59)

33

(1.30)

۲

0 6

50

(1.97)

25

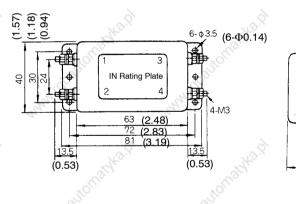
(0.98)

ornardiko	. ser aller	tonatiko	. torratyke	
	Servopack Capa	acity	Noise Filter	Туре 👌
30W(0.04 H	HP),50W(0.07HP),100W(0	0.13HP),200W(0.27HP)	LF-205A	- Salari
200W(0.27	HP)(100V),400W(0.53HP)	1 <sup>1</sup>	LF-210	24
300W(0.40	HP)(100V),750W(1.01HP)		LF-220	

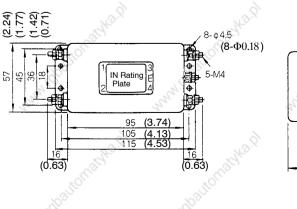
Dimensional Diagrams

57

• LF-205A (Single-phase 200 VAC Class, 5 A)

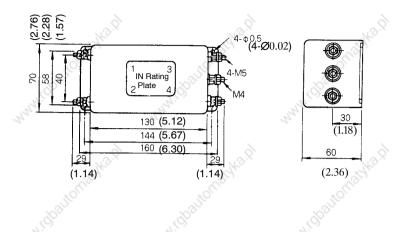


• LF-210 (Single-phase 200 VAC Class, 10 A)





• LF-220 (Single-phase 200 VAC Class, 20 A)



# 5.6.10 Magnetic Contactor

1) Use one 30 A magnetic contactor of the type shown below for a single  $\Sigma$  Series, regardless of capacity. For multiple servo systems, select the magnetic contactor according to the total capacity.

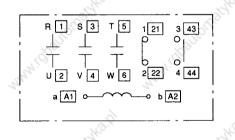


Type: HI-15E5 (30 A)

Turns servo ON and OFF.

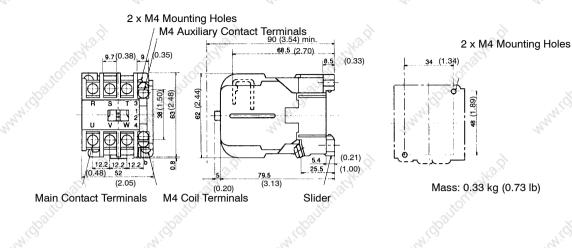
(Note)Attach an appropriate surge suppressor to the magnetic contactor.

Internal Connection Diagram



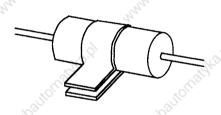
5.6.11 Surge Suppressor

Dimensional Diagram



## 5.6.11 Surge Suppressor

1) Attach a surge suppressor to the magnetic contactor to prevent power supply noise and protect contacts.

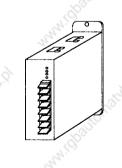


Recommended Product

Spark Killer manufactured by Okaya Electric Industries Co., Ltd. Type: CR50500 (250 VAC) Static Electricity Capacity: 0.5  $\mu$ F  $\pm$  20% Resistance: 50  $\Omega$  (1/2 W)  $\pm$  30%

# 5.6.12 Regenerative Unit

1) Dimensional drawings of the regenerative unit are shown below.



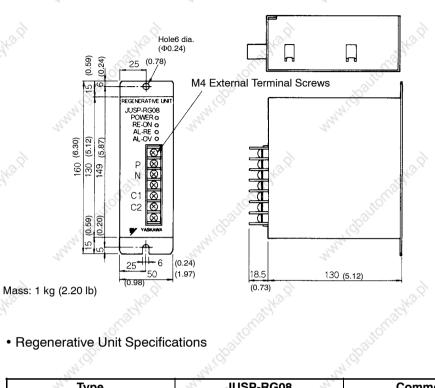
Type: JUSP-RG08

5.6 Specifications and Dimensional Drawings of Peripheral Devices

Dimensional Drawings

340.Q

www.dbautor



Regenerative Unit Specific	cations	- auton
and Ch	and the second	ALC AND AND
Туре	JUSP-RG08	Comments
Applicable Servopack	Only for 200V, 30 to 200W specifications	2
Regenerative Working Voltage	380Vdc	Call Call
Regenerative Process Current	8Adc	Built-in regenerative resistance: 50 Ω, 60 W
Error Detection Functions	Regenerative resistance failure, regenerative transistor failure, overvoltage	and a second sec
Alarm Output	Normally closed contact (open when protective function operates)	200 V operation OK
Dimensions in mm	55W×160H×130D	LON CONTRACT
(inches)	(2.17W $ imes$ 6.30H $ imes$ 5.31D)	18 No. 18

abautomatyka.pl

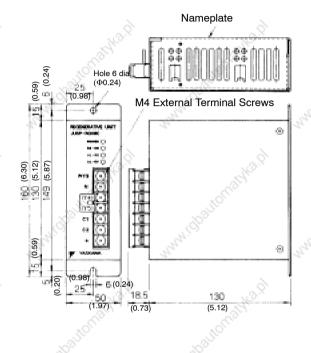
5.6.12 Regenerative cont.

### 2) JUSP-RG08C type

JUSP–RG08C type is an exterior type regenerative unit. When regenerative ability of the built–in resistor is insufficient, install this regenerative unit to enhance the regenerative ability. When regenerative resistor is installed externally, disconnect the jumper cable between terminals Y4 and Y5. Connect exterior type regenerative unit between terminals P/Y3 and Y4.

Dimensional Drawings

Approx. Mass: 1 kg (2.20 lb)



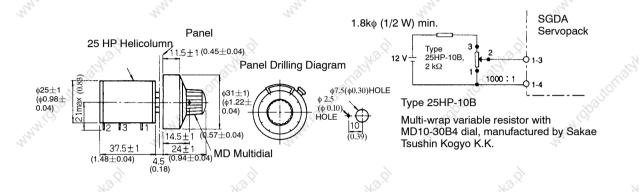
Regenerative Unit Specifications

🔊 Type 🔗	JUSP-RG08C	Remarks
Applicable Servopack	Only for 200 V, 30 to 200 W specifications	NOT ACT
Regenerative Working Voltage	380Vdc	11th 201
Regenerative Processing Current	8Adc	Regenerative Resistance: 50 $\Omega$ , 60 W
Error Detection Function	Regenerative resistance disconnection, regenerative transistor fault, overvoltage	10.P
Minimum Exterior Resistance	50 Ω	-Sflie
Alarm Output	Normally closed contact (open when protective function operates)	200 V operation OK
Dimensions in mm	55W×160H×130D	2 2
(inches)	$(2.17W \times 6.30H \times 5.31D)$	

# 5.6.13 Variable Resistor for Speed Setting

1) This variable resistor is used to give speed references by applying the speed reference voltage from the external power supply across 1CN pins #3 and #4.

Dimensional Drawings



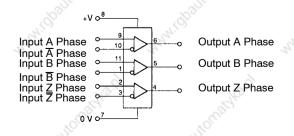
# 5.6.14 Encoder Signal Converter Unit

1) Unit to convert the encoder signal output from the line driver to an open collector output or voltage pulse output.

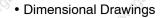
5

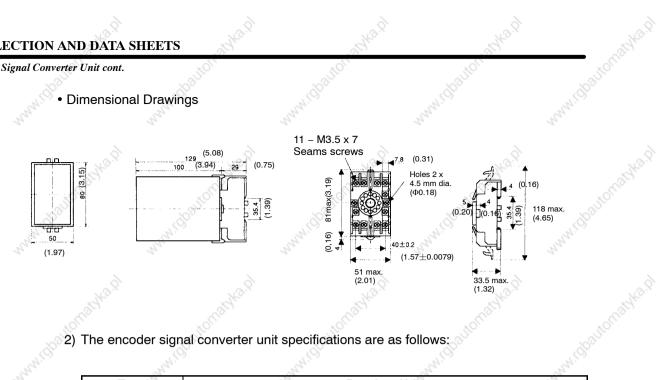


Terminal Numbers



5.6.14 Encoder Signal Converter Unit cont.



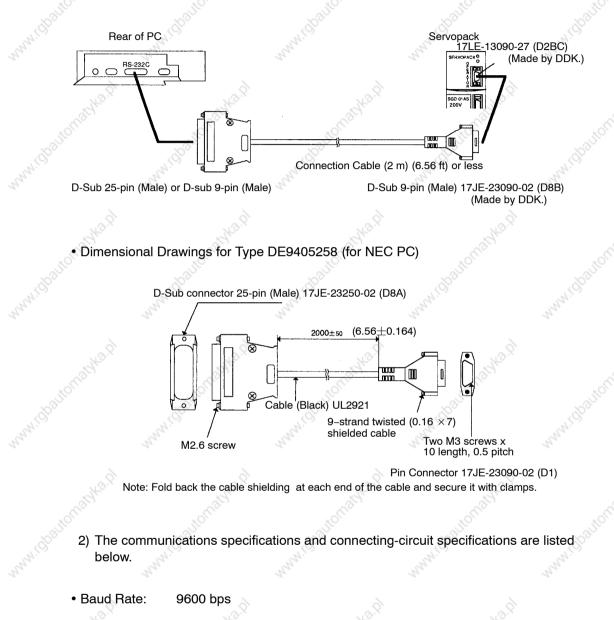


2) The encoder signal converter unit specifications are as follows:

		All -		
Туре		1	/er Unit	~
Spec.	LRX-01/A1	LRX-01/A2	LRX-01/A3	LRX-01/A4
Power Supply	12 VDC ±10%,	100 mA	5 VDC ± 10%,	100 mA
Input Signals	Balanced line dr	river input (RS-422)		Car
Output Signals	Voltage pulse output	Open collector output	Voltage pulse output	Open collector output
Input Signal Level	Voltage different	tial ≥ 0.3 V, internal t	ermination resista	nce 100 Ω
Output Signal Level	H: 10 V min. (1 mA) L: 0.5 V max. (30 mA)	L: 0.5 V max. (30 mA) Withstand voltage: 50 V	H: 3 V min. (1 mA) L: 0.5 V max. (30 mA)	L: 0.5 V max. (30 mA) Withstand voltage: 50 V
Operating Ambient Temperature Range	0 to +60°C	MMIGBUION.	www.idbauto	C.
IC Used 👋	AM26LS32C Re	eceiver IC, or equival	ent 👋	14
634 <sup>0,0</sup>	uomatika.pl	KOMBSHAR	) ,¢	nabha.hl

# 5.6.15 Cables for Connecting PC and Servopack

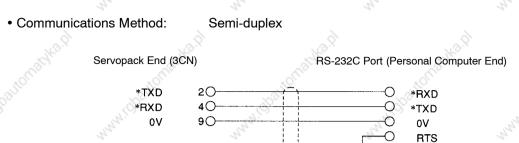
- 1) Special cables for connecting a PC to a Servopack. Using these cables allows monitoring and setting of user constants with a PC.
  - PC software is available for these communications. Ask your Yaskawa representative for details. Operate the software as described in the manual supplied.



- Number of Bits Start: 1 bit Data: 7 bits
  - Data: 7 bits Stop: 1 bit Parity: 1 bit (even)
- Synchronization
- Start-Stop
- XON/XOFF Control
   None

5.6.15 Cables for Connecting PC and Servopack cont.

Shift Control: None



Shield

Note: Maximum cable length is 2 m (6.56 ft).

Case O

FG

3) Connection is also possible to the RS-422A port. In this case, the connection circuit is as follows:

 $\cap$ 

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CTS

FG

- Transmission Distance: 30 m (98.4 ft) max.
- Transmission System: RS-422A

Servopack End (3CN) RS-422A Port (Personal Computer End) TXD 10 RXD \*TXD 20 \*RXD RXD 30 TXD \*RXD 40 -0 \*TXD \*RXD 60 Shield RT 70 0 V 90 0 01 FG 0 Case

• Terminal Arrangement at Servopack End

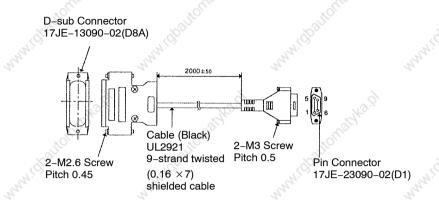
120	Co.	6	Co.
Pin #	Signal Name	Signal Circuit Name	Signal Direction
1	TXD 🔗	Transmit data (not inverted)	P←S
2	*TXD	Transmit data (inverted)	P←S
3	RXD	Receive data (not inverted)	P→S
4	*RXD	Receive data (inverted)	P→S
5	OPH	No.	# 24
6	*RXD	Shorting pins 6 and 7 inserts 220 $\Omega$ te	ermination resistance
7	RT	between RXD and *RXD.	alle .
8	5VPP	19 <sup>1</sup>	#
9	GND	Signal ground 0 V	Sec. Sec.

- P: Personal computer
- S: Servopack
- #: Terminal not used, leave open.

4) Cable for connecting Servopack and IBM PC (IBM compatible PC)

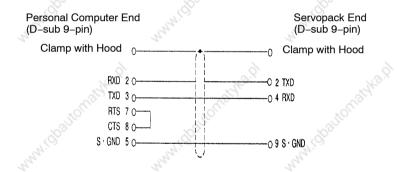
Use Yaskawa DE9408565 type cable.

• Dimensional Drawings: Type DE9408565



Note: Fold back the cable shielding at each end of the cable and secure it with clamp.

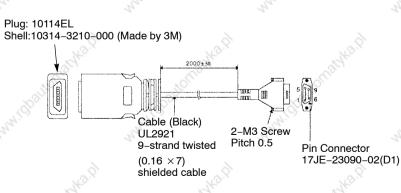




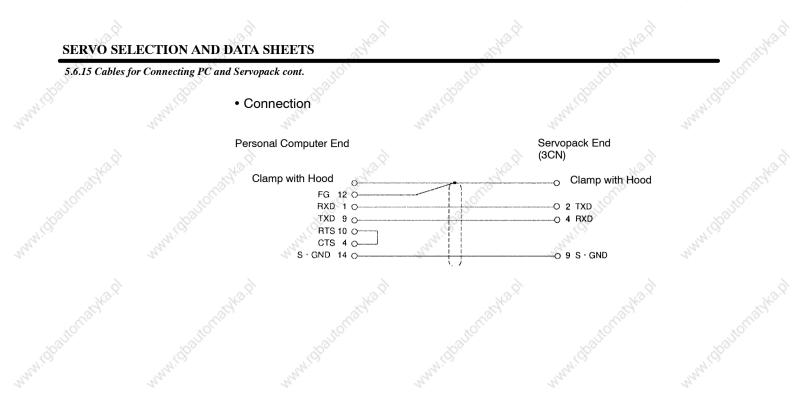
5) Cable for connecting Servopack and NEC PC-98 half-pitch connector

Use Yaskawa DE9408564 type cable.

• Dimensional Drawings: Type DE9408564



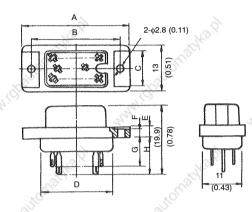
Note: Fold back the cable shielding at each end of the cable and secure it with clamp.



Manned Salton at Hand

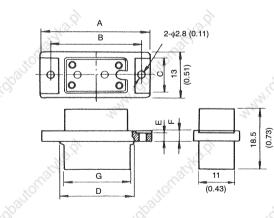
# 5.6.16 4CN Connector

- 1) This 4CN connector is used for full-closed loop specification to connect external PG to 4CN. As for caulking type contacts and tool, refer to 5.6.3 Connector Kits. Use MRP-Fitype contact.
  - Connector (Soldering type)

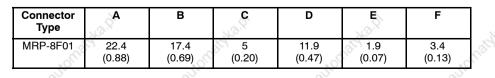


unni obalic	mabke.	MARING BOULD	Real Marine	MAN GOOL				units:	mm (inche	s)
~	Connector Type	Α	В	C	D	E	F	G	н	
	MR-8F	22.4 (0.88)	17.4 (0.69)	10 (0.39)	11.9 (0.47)	3.4 (0.13)	2.8 (0.11)	8 (0.31)	10.5 (0.41)	5

Connector (Caulking type)



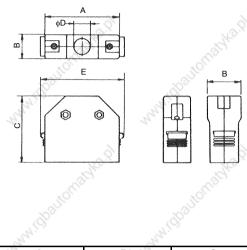
Units: mm (inches)



# SERVO SELECTION AND DATA SHEETS

5.6.16 4CN Connector cont.

Case



www.dbautomatyka.pl

	Units: mm (inches)
	E* 5
MR-8L 31 19 39.8 11 (1.22) (0.75) (1.57) (0.43)	(36.6) (1.44)
www.gballonable ww gballonable www.gballonable	ximum dimensions

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www.gatonayka.pl 5

www.dbautonatyka.pl

This chapter describes the basic inspections and maintenance to be carried out by the customer.

In addition, troubleshooting procedures are described for problems which cause an alarm display and for problems which result in no alarm display.

6.1	Insp	ection and Maintenance	388	
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	6.2.1	Troubleshooting Problems with Alarm Display	391	
	6.2.2	Troubleshooting Problems With No Alarm Display	409	
	6.2.3	Internal Connection Diagram and Instrument Connection Examples	411	50
		and the second of the second o	Survey. Of	

6.1.1 Servomotor

# 6.1 Inspection and Maintenance

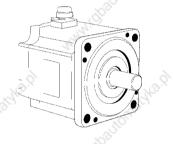
This section describes the basic inspections and maintenance for  $\Sigma$ -Series servo drives.

6.1.1	Servomotor	388
6.1.2	Servopack	389
6.1.3	Replacing Battery for Absolute Encoder	390

# 6.1.1 Servomotor

For inspection and maintenance of servomotors, follow the simple, daily inspection procedures in the table below.

The AC servomotors are brushless. Simple, daily inspection is sufficient. The inspection and maintenance frequencies in the table are only guidelines. Increase or decrease the frequency to suit the operating conditions and environment.



ltem 🔍	Frequency	Procedure	Comments
Vibration and noise	Daily	Touch and listen.	Levels higher than normal?
Appearance	According to degree of contamination	Clean with cloth or compressed air.	tonative
Insulation resistance measurement	Yearly	Disconnect Servopack and test insulation resistance at 500 V. Must exceed 10 M $\Omega$ . (See note below)	Contact your Yaskawa representative if the insulation resistance is below 10 MΩ.
Replace oil seal	Every 5,000 hours	Remove servomotor from machine and replace oil seal.	Applies only to motors with oil seal.
Overhaul	Every 20,000 hours or 5 years	Contact your Yaskawa representative.	The customer should not disassemble and clean the servomotor.

Note Measure across the servomotor FG (green/yellow) and the U-phase (red), V-phase (white), or W-phase (blue) power lead.

During inspection and maintenance, do not disassemble the servomotor. If disassembly of the servomotor is required, contact your Yaskawa representative.

# 6.1.2 Servopack

For inspection and maintenance of the Servopack, follow the inspection procedures in the table below at least once every year.

The Servopack contains highly reliable parts and daily inspection is not required. Carry out the inspections and maintenance in the table below once every year.

ltem	Frequency	Procedure	Remedy 🔬
Clean unit interior and circuit boards	Yearly	Check for dust, dirt, and oil on the surfaces.	Clean with compressed air.
Loose screws	Yearly	Check for loose terminal block and connector screws.	Tighten any loose screws.
Defective parts in unit or on circuit boards.	Yearly	Check for discoloration, damage or discontinuities due to heating.	Contact your Yaskawa representative.

## Part Replacement Schedule

The following parts are subject to mechanical wear or deterioration over time. To avoid failure, replace these parts at the frequency indicated.

Part	Standard Replacement Period	Replacement Method
Smoothing Capacitor	7 to 8 years	Replace with new part.
Relays	42	Replace with new parts.
Fuse	10 years	Replace with new part.
Aluminum Electrolytic Capacitor on Circuit Board	5 years	Replace with new circuit board.

Note Operating Conditions:

- Ambient Temperature: annual average 30°C
- Load Factor: 80% max.
- Operation Rate: 20 hours/day max.

6.1.3 Replacing Battery for Absolute Encoder

# 6.1.3 Replacing Battery for Absolute Encoder

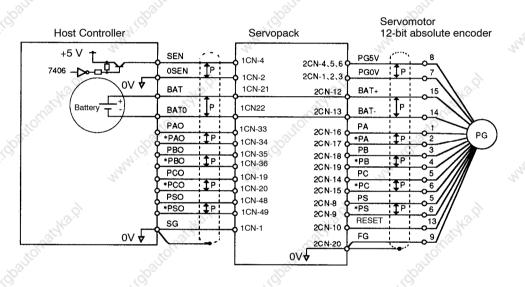
Battery replacement is only required for servo systems using an absolute encoder.

The battery type recommended below (purchased by the customer) is installed in the host controller to allow the absolute encoder to store position data when the power is turned OFF.

Recommended Battery:

Lithium Battery

ER 6 V C3, manufactured by Toshiba Battery Co., Ltd. 3.6 V, 2000 mAh Estimated Life: Approximately 10 years



The battery voltage is not internally monitored in the Servopack. Therefore, detect low battery voltage at the host controller.

### Minimum required battery voltage is 2.8 V.

Replace the battery according to the following procedure if the battery voltage drops to the minimum required battery voltage. The battery maintains absolute position data stored in the encoder.

### **Battery Replacement Procedure:**

- 1) Turn ON the Servopack and wait at least 3 minutes. The absolute encoder capacitors are charged.
- 2) Replace the battery in the host controller. The Servopack power supply can be ON or OFF during battery replacement.
- **Note** After completing step 1 above, the absolute encoder will function normally for up to 2 days with no battery.

# 6.2 Troubleshooting

This section describes causes and remedies for problems which cause an alarm display and for problems which result in no alarm display.

- 6.2.3 Internal Connection Diagram and Instrument Connection Examples ..... 411

# 6.2.1 Troubleshooting Problems with Alarm Display

Refer to the tables below to identify the cause of a problem which causes an alarm display and take the remedy described. Note that A.99 does not indicate an alarm.

Note that A.99 does not indicate an alarm.

Contact your Yaskawa representative if the problem cannot be solved by the described procedures.

# 1. Alarm Display and Troubleshooting Table

#### Display and Outputs

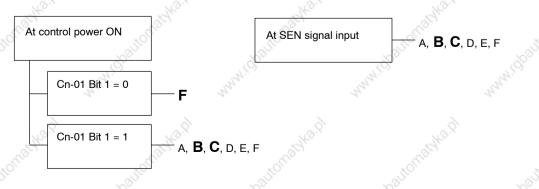
Digital Operator	0 <sup>0</sup>	🔊 Alarr	n Output 🔬 🖉	
Display and	7	Alarm Outpu		
Alarm Name	ALO1	ALO2	ALO3	32
A.00	OFF	OFF	OFF	OFF
Absolute data error	abka.pl	Star		23 <sup>2</sup> .9

OFF: Output transistor is OFF ON: Output transistor is ON

391

6

#### Status When Alarm Occurred

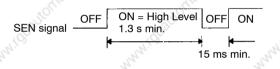


6.2.1 Troubleshooting Problems with Alarm Display cont.

	Cause	Remedy
A	Absolute encoder power not supplied from Servopack.	Use the Servopack power supply for the absolute encoder.
B	Incorrect absolute encoder wiring (PA, PB, RESET, SEN signal (for speed control), etc.)	Check and correct the absolute encoder wiring.
C)	Absolute encoder malfunctioned	<ul> <li>When Cn-01 Bit 1 = 0, turn SEN signal OFF and back ON. (See note)</li> </ul>
	ANNO AND AND	<ul> <li>When Cn-01 Bit 1 = 1, turn Servopack con- trol power OFF and back ON.</li> </ul>
D	Incorrect user constant setting. Incremental encoder used with Cn-01 Bit E set to 1.	Set Cn-01 Bit E to 0.
E	Absolute encoder defective	Replace servomotor.
EQ.	Circuit board (1PWB) defective	Replace Servopack.

# NOTE Resetting SEN Signal

When resetting the SEN signal (i.e., turning it OFF and then back ON) for any reason, keep the SEN signal at the high level for more than 1.3 s before turning it OFF.



# Display and Outputs

<b>Digital Operator</b>	S	🚫 Alarr	n Output 🛛 🚫 🗍			
Display and Alarm Name	2	Alarm Code Output				
Alarm Name	ALO1	ALO2	ALO3	14		
A.02	OFF	OFF	OFF	OFF		
User constants breakdown	all and a second	1	Le contra de la co	all and a second		

OFF: Output transistor is OFF ON: Output transistor is ON

### **Status When Alarm Occurred**

At control power ON

	Cause	Remedy
A	Power turned OFF during parameter write. Alarm occurred next power ON.	Replace Servopack.
B	Circuit board (1PWB) defective	Replace Servopack.
2-	March 16 Ball March 16 Ball	www.thatt

**A**, **B** 

# Display and Outputs

Digital Operator		Alaı	rm Output	
Display and Alarm Name	200	Alarm Output		
Alarm Name	ALO1	ALO2	ALO3 🔊	2
A.04	OFF	OFF 🔬	OFF 🔬	OFF
User constant setting error	20 <sup>2121</sup>	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ut baut	1 Ban

#### OFF: Output transistor is OFF ON: Output transistor is ON

### Status When Alarm Occurred

At control power ON

8	2. 12.	8
de la	Cause	Remedy
A	An out-of-range user constant was previously set or loaded.	Reset all user constants in range. Otherwise, re-load correct user constants.
В	Circuit board (1PWB) defective	Replace Servopack.

**A**, **B** 

### Display and Outputs

Digital Operator			3	
Display and Alarm Name	ço.	Alarm Code Out	put 🔗	Alarm Output
	ALO1	ALO2	ALO3	and all a
A.10	ON	OFF	OFF	OFF 🚿
Overcurrent	× 1		X	~

OFF: Output transistor is OFF ON: Output transistor is ON

**Note** Alarm A10 is reset when the power is turned OFF and back ON. It is not reset by the normal alarm reset.

### **Status When Alarm Occurred**



At main circuit power D

6.2.1 Troubleshooting Problems with Alarm Display cont.

		Č
	Cause	Remedy
A	Wiring grounded between Servopack and servomotor.	Check and correct wiring.
B	Servopack ambient temperature exceeds 55°C	Bring Servopack ambient temperature to 55°C Note Alarm cannot be reset while power transistor module temperature ex- ceeds 90°C.
С	Servomotor U, V, or W phase grounded.	Replace servomotor.
D	<ul><li>Circuit board (1PWB) defective</li><li>Power transistor defective</li></ul>	Replace Servopack.
щ	Current feedback circuit, power transistor, DB relay, or circuit board defective.	Replace Servopack.

# • Display and Outputs

Digital Operator	27	Alarn	n Output	3
Display and Alarm Name	2	Alarm Code Outp	ut	Alarm Out
Alaminanie	ALO1	ALO2	ALO3	10.2
A.20 Fuse blown	OFF	ON tomat	OFF	OFF

OFF: Output transistor is OFF ON: Output transistor is ON

110

# **Status When Alarm Occurred**

At control power ON

Α

5	At main circuit power ON	— в. с
	All and a second se	_, .

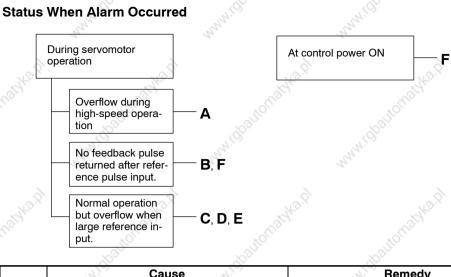
2			
	R	С	

	Cause	Remedy
A S	Circuit board (1PWB) defective	Replace Servopack.
B	Fuse is blown.	Replace Servopack.
C)	Main circuit diode module defective	Replace Servopack.
5	LANON LAND	16 <sup>00</sup>
• Displ	ay and Outputs	AND AND AND

# • Display and Outputs

	<b>Digital Operator</b>	6	Alarm Output			
	Display and Alarm Name	Nor	Alarm Code Outpu	ĴÎ.	Alarm Output	
	Alarm Name	ALO1	ALO2	ALO3	A. C.	
WH. OF	<b>A.31</b> Position error pulse overflow	ON	ON	OFF	OFF	
4	(position control		n an	and and a second se	4	
	. tonatika.pl	. tonatka.p	. torraid		out transistor is OFF ut transistor is ON	
www.ich	ar Ar	h <sup>nit Bat</sup>	www.ldbac	Mary Har	manil	

#### 6.2 Troubleshooting

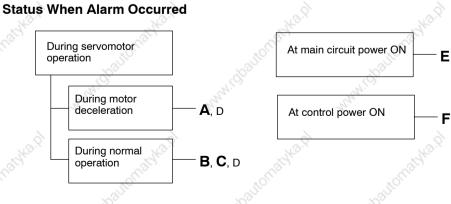


		Hour Hou
	Cause	Remedy
A	Servomotor wiring incorrect.	Check and correct wiring. (Check A-, B-,
B	Encoder wiring incorrect (disconnection, short, power supply, etc.)	C-phase pulses correct at 2CN.)
C /	Servopack adjustment incorrect	Increase speed loop gain (Cn-04) and/or position loop gain (Cn-1A).
D	Servomotor overloaded	Reduce load torque and inertia. Otherwise, replace with larger capacity servomotor.
E	Position reference pulse frequency too	Decrease reference pulse frequency.
	high	Use smoothing function.
		Change electronic gear ratio.
F?	Circuit board (1PWB) defective.	Replace Servopack.
Ser.	18 A.	S
	lay and Outputs	×0 <sup>55</sup> ×

#### Display and Outputs

<ul> <li>Display and O</li> </ul>	utputs	doallo.	dbauto.	
Digital Operator		Alar	m Output	and the second second
Display and Alarm Name		Alarm Code Output		Alarm Output
Alarm Name	ALO1	ALO2	ALO3	2
A.40	OFF	OFF 🔬	ON	OFF
Overvoltage	and the second	20		8

OFF: Output transistor is OFF ON: Output transistor is ON



6.2.1 Troubleshooting Problems with Alarm Display cont.

0	Cause	Remedy
А	Load inertia high and motor speed too high	Change operating conditions.
	19	• Use external regenerative resistor or re- generative unit. (Refer to 3.8.4.)
В	Load exceeds capacity of regenerative unit	Change operating conditions.
C	Servomotor speed too high	Reduce motor speed.
D	Servopack defective	Replace Servopack.
E	Input voltage too high	Change input voltage to normal value.
F	Circuit board (1PWB) defective.	Replace Servopack.

2110

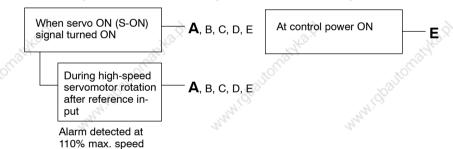
#### Display and Outputs

• Display and O	utputs	č	340.Q	20140.Q
<b>Digital Operator</b>	10	Alaı	rm Output	55
Display and Alarm Name	200	Alarm Code Out	put 🔊	Alarm Output
Alarm Name	ALO1	ALO2	ALO3	24
A.51 🔗	ON	OFF	ON 📣	OFF 📣
Overspeed				

OFF: Output transistor is OFF ON: Output transistor is ON

RUTO

#### **Status When Alarm Occurred**



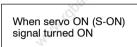
S	Cause	Remedy
AS	Servomotor wiring incorrect.	Check and correct wiring. (Check A-, B-,
302 Juli	• Encoder wiring incorrect (disconnection, short, power supply, etc.)	C-phase pulses correct at 2CN.)
В	Incremental encoder power not supplied from Servopack.	Use the Servopack power supply for the encoder.
С	Noise in encoder wiring.	Separate encoder wiring from main wiring circuits.
D	Incorrect user constant (number of encoder pulses) setting.	Set user constant Cn-11 to the correct number of pulses.
Ē	Circuit board (1PWB) defective	Replace Servopack.
8	anith anith	and the second
		5 <sup>20</sup> 5 <sup>21</sup>

# • Display and Outputs

Digital Operator	Alarm Output				
Display and	Alarm Code Output			Alarm Output	
Alarm Name	ALO1	ALO2	ALO3	3	
<b>A.70</b> Overload	ON	ON	ON	OFF	

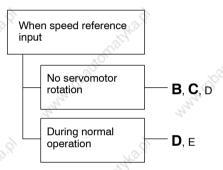
# OFF: Output transistor is OFF ON: Output transistor is ON

# **Status When Alarm Occurred**









ashe.P	During normal operation <b>D</b> , E	143.01	
	Cause	Remedy	
A	Servomotor wiring incorrect or disconnected	Check wiring and connectors at servomotor.	
В	Encoder wiring incorrect or disconnected	Check wiring and connectors at encoder.	
c	Load greatly exceeds rated torque	Reduce load torque and inertia. Otherwise, replace with larger capacity servomotor.	
D	Incremental encoder power not supplied from Servopack.	Use the Servopack power supply for the encoder.	
E	Circuit board (1PWB) defective	Replace Servopack.	
• Displ	ay and Outputs	www.ffic www.ffic	

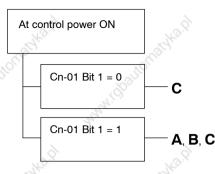
# • Display and Outputs

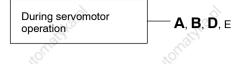
Digital Operator	Alarm Output				
Display and	Alarm Code Output			Alarm Output	
Alarm Name	ALO1	ALO2	ALO3		
A.80 Absolute encoder error (only if absolute encoder is used)	OFF	OFF	OFF	OFF	

OFF: Output transistor is OFF ON: Output transistor is ON

6.2.1 Troubleshooting Problems with Alarm Display cont.

# **Status When Alarm Occurred**





MIODAUTO

55	Cause	Remedy
A	Incorrect absolute encoder wiring (PA, PB, RESET, SEN signal (for speed control), etc.)	Check and correct the absolute encoder wiring.
В	Absolute encoder malfunctioned	When Cn-01 Bit 1 = 0, turn SEN signal OF and back ON.
- Chard	er anasylu	• When Cn-01 Bit 1 = 1, turn Servopack cor trol power OFF and back ON.
С	Circuit board (1PWB) defective	Replace Servopack.
D	Error occurred in absolute encoder.	• When Cn-01 Bit 1 = 0, turn SEN signal OFF and back ON (if servomotor is rotating, first turn servo OFF).
à	Another encoder alarm displayed when SEN signal or power supply turned back ON.	• When Cn-01 Bit 1 = 1, turn Servopack control power OFF and back ON.
E	Servopack miscounted pulses (positional displacement) or malfunctioned due to	<ul> <li>Separate encoder wiring from main wirin circuits.</li> </ul>
	noise.	<ul> <li>When Cn-01 Bit 1 = 0, turn SEN signal OF and back ON (if servomotor is rotating, first turn servo OFF).</li> </ul>
	A A A	• When Cn-01 Bit 1 = 1, turn Servopack con trol power OFF and back ON.
-official	or and the second	nather onather

# 6

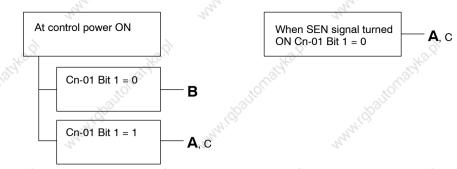
# Display and Outputs

	utputs	ANN MILLS	Ara ani	4444
Digital Operator Display and	Alarm Output			
	29	Alarm Code Outpu	tŜ	Alarm Output
Alarm Name	ALO1	ALO2	ALO3	13 Mar
<b>A.81</b> Absolute encoder back-up error (only if absolute encoder is used)	OFF Jone	OFF	OFF	OFF

tobautomat OFF: Output transistor is OFF ON: Output transistor is ON

6.2 Troubleshooting

# **Status When Alarm Occurred**

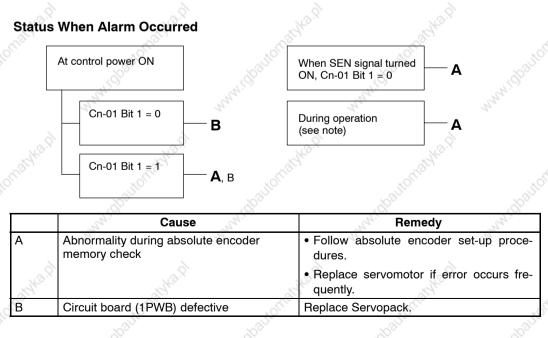


Nº.	Cause	Remedy	
A	The following power supplied to the absolute encoder all failed:	Follow absolute encoder set-up procedures.	3
	• +5 V supply		
	• Battery (ER6V C3)	and the second sec	Ser. Co
	Internal capacitor	in the second seco	200
В	Circuit board (1PWB) defective	Replace Servopack.	
C	Absolute encoder malfunctioned	Replace servomotor.	
600	AND	Replace servomotor.	
Displ	ay and Outputs	autor'	

#### Display and Outputs

Digital Operator	Alarm Output					
Display and		Alarm Output				
Alarm Name	ALO1	ALO2	ALO3			
A.82 Absolute encoder sum-check error (only if absolute encoder is used)	OFF	OFF OFF	OFF	OFF		

### OFF: Output transistor is OFF ON: Output transistor is ON



6.2.1 Troubleshooting Problems with Alarm Display cont.

**Note** An absolute encoder error (**A.80**) is given initially if a sum-check error (**A.82**) is generated during operation.

The sum-check error (**A.82**) occurs after turning the SEN signal (or Servopack power supply) OFF and back ON.

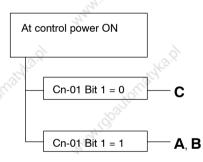
However, the sum-check error (A.82) does occur during operation if the host controller is receiving the S-phase signal (serial data).

# Display and Outputs

<b>Digital Operator</b>	Alarm Output				
Display and Alarm Name	2	Alarm Output			
Alarm Name	ALO1	ALO2	ALO3	Stor Stor	
A.83 Absolute encoder sum-check error (only if absolute encoder is used)	OFF	OFF	OFF	OFF	

# OFF: Output transistor is OFF ON: Output transistor is ON

# Status When Alarm Occurred



When SEN signal turned ON, Cn-01 Bit 1 = 0	— A, B
During operation (see note)	A, <b>B</b>
11.5°	

		Cause	Remedy
7	A X	Battery not connected	Check and correct battery connection.
	S. B.	Battery connection defective	C. C
3	В	Battery voltage below specified value. Specified value: 2.8 V.	Install new battery and turn SEN signal (or Servopack control power) ON.
(	С	Circuit board (1PWB) defective	Replace Servopack.

Note

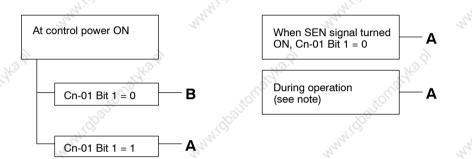
No alarm occurs at the Servopack when a battery error (**A.83**) is generated. The battery error (**A.83**) occurs the next time the SEN signal (or Servopack) turns ON. However, the battery error (**A.83**) can be read during operation if the host controller is receiving the S-phase signal (serial data).

# • Display and Outputs

<b>Digital Operator</b>	Alarm Output				
Display and	6	Alarm Output			
Alarm Name	ALO1	ALO2	ALO3	18° .	
<b>A.84</b> Absolute encoder data error (only if absolute encoder is used)	OFF	OFF 000	OFF OFF	OFF	

#### OFF: Output transistor is OFF ON: Output transistor is ON

### Status When Alarm Occurred



6	Cause	Remedy
A	Absolute encoder malfunctioned	<ul> <li>When Cn-01 Bit 1 = 0, turn SEN signal OFF and back ON.</li> </ul>
<b>P</b> *	dbauto, dbauto,	• When Cn-01 Bit 1 = 1, turn Servopack con- trol power OFF and back ON.
	anan anan'i	• Replace servomotor if error occurs fre- quently.
В	Circuit board (1PWB) defective	Replace Servopack.

Note

No alarm occurs at the Servopack when a data error (A.84) is generated. The data error (A.84) occurs the next time the SEN signal (or Servopack) turns ON.
 However, the data error (A.84) can be read during operation if the host controller is receiving the S-phase signal (serial data).

6.2.1 Troubleshooting Problems with Alarm Display cont.

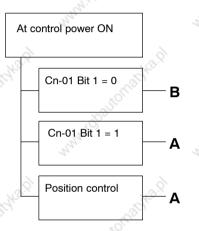
# • Display and Outputs

Digital Oper			Alarr	n Output	
Display a Alarm Nai			Alarm Code Outp	out	Alarm Output
Alarm Na	me	ALO1	ALO2	ALO3	N.
A.85 Absolute enc overspeed (c absolute enc is used)	only if 🔬	F one	OFF	OFF	OFF

### OFF: Output transistor is OFF ON: Output transistor is ON

Α

### Status When Alarm Occurred



When SEN signal turned ON, Cn-01 Bit 1 = 0

Jorio	attonia att	onton attonton
÷	Cause	Remedy
A	Absolute encoder turned ON at a speed exceeding 400 r/min.	Turn ON encoder power supply (or SEN signal or Servopack control power supply) at a speed not exceeding 400 r/min.
В	Circuit board (1PWB) defective	Replace Servopack.

# Display and Outputs

Digital Operator	10	💉 Alarm	Output	
Display and Alarm Name		Alarm Code Outpu	t sa	Alarm Output
Alarm Name	ALO1	ALO2	ALO3	
A.b1 Reference input read error (for speed/torque control only)	OFF	OFF	OFF	OFF
12		Manner O'		ut transistor is OF t transistor is ON

OFF: Output transistor is OFF ON: Output transistor is ON

С

# **Status When Alarm Occurred**

During servomotor operation

At control power ON

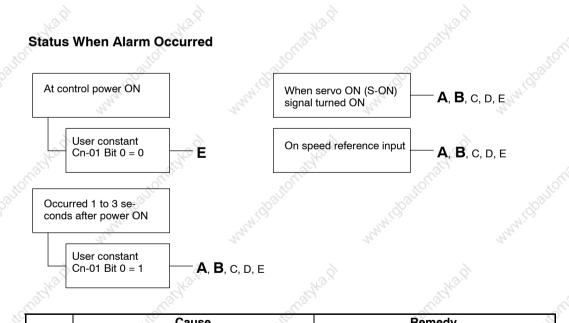
	Cause	Remedy
A	Part malfunctioned in reference read-in unit (A/D converter, etc.).	Reset alarm and restart operation.
В	Part defective in reference read-in unit (A/D converter, etc.).	Replace Servopack.
C Q	Circuit board (1PWB) defective	Replace Servopack.
S. S. S.	matthe mat	to
• Disp	lay and Outputs	wallor wal

**A**, **B** 

# Display and Outputs

ard (TPVD) dele	clive R	epiace Servopack.	- AN
utputs	alighautomatike	NI-BRITON	and an and a second
	Alar	m Output	All Contractions
	Alarm Code Out	out	Alarm Output
ALO1	ALO2	ALO3	à
ON	OFF	ON	OFF
	utputs ALO1	utputs Alarm Alarm Code Outp ALO1 ALO2	Alarm Output       Alarm Output       Alarm Code Output       ALO1     ALO2

OFF: Output transistor is OFF ON: Output transistor is ON



9	Cause	Remedy
A	Servomotor wiring incorrect or disconnected	Check wiring and connectors at servomotor.
В	Encoder wiring incorrect or disconnected	Check wiring and connectors at encoder.
C	Incremental encoder power not supplied from Servopack.	Use the Servopack power supply for the encoder.
Dar	Encoder defective	Replace servomotor.
Ê	Circuit board (1PWB) defective	Replace Servopack.
	www.idball	www.ldball www.ldball 403

6

6.2.1 Troubleshooting Problems with Alarm Display cont.

# • Display and Outputs

ems with Alarm Display cont.		autor		Pour.
<ul> <li>Display and O</li> </ul>	utputs		- CARALIGE	South Start
Digital Operator		Alarm	Output	24
Display and Alarm Name	Alarm Code Output			Alarm Output
Alarmi Name	ALO1	ALO2	ALO3	No.
A.C2	ON S	OFF	ON	OFF
Encoder phase	all <sup>o</sup>	250		50 S
detection error	1 South States	S.	S.	
Incremental	12 Contraction	and and a second	and the second	and a start
encoder initial		24	20	20
pulse error				

# MAN ISBAUTOMAT OFF: Output transistor is OFF ON: Output transistor is ON

automat

#### **Status When Alarm Occurred**

	During servomotor operation	— A, B, C	Occurred 1 to 3 seconds after control power ON	— E, F, G,	34
30 <sup>38</sup>	At control power ON	D, E, F, G, н	During servomotor operation	H	doautomo
r	and the second se	all	alterna in the	]	and the second s

	and the second sec	
	Cause	Remedy
A	Noise in encoder wiring.	Separate encoder wiring from main wirin circuits.
B	Encoder wiring incorrect or poor connection	Check wiring and connectors at encoder
C	Encoder defective	Replace servomotor.
D	Noise in encoder wiring.	Separate encoder wiring from main wirin circuits.
E	Encoder wiring incorrect or poor connection	Check wiring and connectors at encoder
F	Encoder defective	Replace servomotor.
G	Absolute encoder is used.	Set the following user constants as follows: •Cn-02 bit 9 = 1 •Cn-11 (number of encoder pulses)

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# • Display and Outputs

С

D

Encoder defective

Circuit board (1PWB) defective

AN2.01

30

Digital Operator		Alarm	Output	20	]
Display and Alarm Name	Alarm Code Output			Alarm Output	
Alarmi Name	ALO1	ALO2	ALO3		A
A.C3	ON	OFF	ON S	OFF	S.
Encoder A-,	- ALLE	and the second s	and the second	-3 <sup>5</sup>	í
B-phase	97	S.	, S	. S <sup>or</sup>	
B-phase disconnection		and the second s	and and	and the second	
A.C6		2	20	24	
External PG	~	~		~	
A-, B-phase	NO.S.	12×2	3	22	N
disconnection	and a	Maska P	J.	·	201
(only for	205	201	205	8	5
full-closed loop specification)	20 <sup>2</sup>	1072	1000	10 <sup>62</sup>	
No. Thermonical and	ц)	- 10. - 10.		3 <sup>1</sup> ,0,	J
344		324	OEE: Outo		
			•	ut transistor is OFF	

autor

# OFF: Output transistor is OFF ON: Output transistor is ON

2	Statu	s When Alarm Occurred	no. automo.	autornio.
Annah 1900	A	t control power ON	When servo ON (S-ON) signal turned ON	AI. BC
	Cartho		During servomotor A, B, C, D	600
www.idbau		ccurred 1 to 3 seconds ter control power ON	www.dballoll	N. Obauton
	St.	User constant Cn-01 Bit 0 = 1	attan	
	d C	Cause	Remedy	2500
WIGDON	A	Encoder wiring incorrect or poor connection	Check wiring and connectors at enco	der.
A. A.	В	Noise in encoder wiring.	Separate encoder wiring from main w circuits.	viring

Replace servomotor.

Replace Servopack.

6

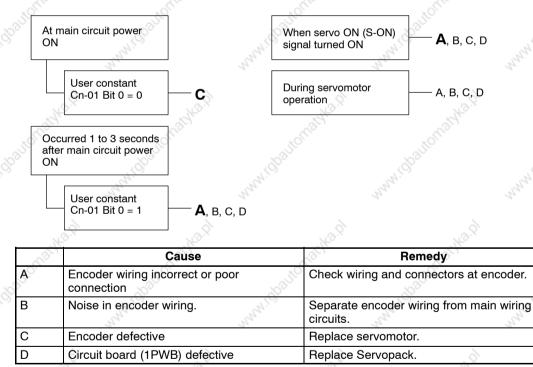
www.igbaitomat

6.2.1 Troubleshooting Problems with Alarm Display cont.

### Display and Outputs

<ul> <li>Display and O</li> </ul>	outputs		and the second	Sec. 1
<b>Digital Operator</b>		Alarm	n Output	
Display and Alarm Name	6	Alarm Code Outp	uto	Alarm Output
Alarm Name	ALO1	ALO2	ALO3	Nº.
A.C4 Encoder C-phase disconnection A.C7	ON	OFF	ON	OFF
External PG C-phase disconnection (only for full-closed loop specification)	utomatika.pl	automatik	23.21 -3	Statika.pl

**Status When Alarm Occurred** 



# • Display and Outputs

Digital Operator		Alarm C	Dutput	~
Display and Alarm Name	6	Alarm Code Output		Alarm Output
Alarm Name	ALO1	ALO2	ALO3	2.
<b>CPF00</b> Digital operator transmission error 1	Not specified	uldbaltomat.	Williamona.	1. Contraction of the second sec

Note This alarm is not stored in alarm trace-back function memory.

# **Status When Alarm Occurred**

St	atus When Alarm Oc	curred	tonaghe."	tomatika
	At control power ON. Digital operator con- nected before Servo- pack power turned ON.	A, B, C, D	Digital operator conected to Servopack while con- trol power turned ON.	<b>A</b> , <b>B</b> , <b>C</b> , <b>D</b>

20	Cause	Remedy 🛇
A	Cable defective or poor contact between	Check connector connections.
	digital operator and Servopack.	Replace cable.
В	Malfunction due to external noise	Separate digital operator and cable from noise source.
С	Digital operator defective	Replace digital operator.
D	Servopack defective	Replace Servopack.

# Display and Outputs

Digital Operator	3 <sup>00</sup>	🔊 Alarm	Output 🔬	
Display and Alarm Name	6°	Alarm Code Outpu	Alarm Output	
Alarm Name	ALO1	ALO2	ALO3	and it.
CPF01	Not specified	24	2	14
Digital operator transmission error 2	-Ha.P	Ma.g		. H2.P

Note

This alarm is not stored in alarm trace-back function memory.

During operation

### **Status When Alarm Occurred**

noise source.			No Remedy
noise source.			S2
C Digital operator defective Beplace digital operator	B Malfund	ion due to external noise	Separate digital operator and cable from noise source.
	C Digital c	perator defective	Replace digital operator.
D Servopack defective Replace Servopack.	D Servopa	ck defective	Replace Servopack.

6.2.1 Troubleshooting Problems with Alarm Display cont.

6

MMM. GBallonagka.pl

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ems with Alarm Displa	y cont.	1	LON IN THE REAL PROPERTY OF	auton	
• Display and C	outputs		and the second	Sc	
Digital Operator		27	Alarm Output	27	
Display and Alarm Name	0	Alarm Code	Output	Alarm Output	
Alarm Name	ALO1	ALO	2 N ALO3	No.	
A.99	OFF	OFF	OFF	ON	8

# **Status When Alarm Occurred**

MMM. GBallonagkan Indicates normal operation. Not an alarm. ANNIAL OC

# 6.2.2 Troubleshooting Problems with No Alarm Display

Refer to the tables below to identify the cause of a problem which causes no alarm display and take the remedy described.

# Turn OFF the servo system power supply before commencing the shaded procedures.

Contact your Yaskawa representative if the problem cannot be solved by the described procedures.

	NO. NO.		
Symptom	Cause	Inspection	Remedy
Servomotor does not star	rt Power not connected	Check voltage across L1 and L2, L and N.	Correct the power circuit.
anne C	Loose connection	Check terminals of connectors (1CN, 2CN).	Tighten any loose parts.
~	Connector (1CN) external wiring incorrect	Check connector (1CN) external wiring	Refer to connection diagram and correct wiring.
aller.	Servomotor or encoder wiring disconnected.	all the it	Reconnect wiring
Ne Autor	Overloaded	Run under no load.	Reduce load or replace with larger capacity servomotor.
WW. BC	Speed/position references not input	Check input pins of connector 1CN.	Correctly input speed/position references.
32	S-ON is turned OFF	Cn-01 Bit 0 is 0.	Turn S-ON input ON.
WRO.P	P-CON input function setting incorrect	Refer to Subsection 3.2.1.	Refer to Subsection 3.2.1 and set user constants to match application.
.0°.'	Reference pulse mode selection incorrect.	Refer to Subsection 3.2.2.	Select correct user constants Cn-02 Bits 3, 4, 5.
W.IODOC	Encoder type differs from user constant setting.	Incremental or absolute encoder?	Set user constants Cn-01 Bit E to the encoder type used.
1 Martin	P-OT and N-OT inputs are turned OFF.	(If Cn-01 Bits 2, 3 are 0)	Turn P-OT and N-OT input signals ON.
NO.S.	CLR input is turned ON	Check status of error counter clear input.	Turn CLR input OFF.
	SEN input is turned OFF.	Absolute encoder used with Cn-01 Bit 1 set to 0.	Turn SEN input ON.
Servomotor moves instantaneously, then sto	ps Number of encoder pulses differs from user constant setting.	2048 pulses/revolution or 1024 pulses/revolution	Set the user constant (Cn-11) to match the number of encoder pulses.
14	Servomotor or encoder wiring incorrect.	2 2	Refer to Subsection 3.8.8 and correct wiring.
Suddenly stops during operation and will not res	Alarm reset signal (ALM-RST) is turned ON because an alarm occurred.	ALCON ACT	Remove cause of alarm. Turn alarm reset signal (ALM-RST) from ON to OFF.
Servomotor speed unstal	ble Wiring connection to motor defective	Check connection of power lead (U, V, and W phase) and encoder connectors.	Tighten any loose terminals or connectors.

#### **Troubleshooting Table No Alarm Display**

6.2.2 Troubleshooting Problems wit	h No Alarm Display cont.	abauto.	10 <sup>20110</sup>
Symptom	Cause	Inspection	Remedy
Servomotor vibrates at approximately 200 to	Speed loop gain value too high.	14	Reduce speed loop gain (Cn-04) preset value.
400 Hz.	Speed/position reference input lead too long.	automatyka.pl	Minimize length of speed/position reference input lead, with impedance not exceeding several hundred ohms
Mannieller	Speed/position reference input lead is bundled with power cables.	Mannell, CC	Separate reference input lead at least 30 cm from power cables.
High rotation speed overshoot on starting and stopping.	Speed loop gain value too high.	who di	Reduce speed loop gain (Cn-04) preset value.
Servomotor overheated	Ambient temperature too high	Measure servomotor ambient temperature.	Reduce ambient temperature to 40°C max.
NIGDS'	Servomotor surface dirty	Visual check	Clean dust and oil from motor surface.
A.M.	Overloaded	Run under no load.	Reduce load or replace with larger capacity servomotor.
Abnormal noise	Mechanical mounting incorrect	Servomotor mounting screws loose?	Tighten mounting screws.
AND A	d'	Coupling not centered?	Center coupling.
40 . 40	HOC.	Coupling unbalanced?	Balance coupling.
, widdoor	Bearing defective	Check noise and vibration near bearing.	Consult your Yaskawa representative if defective.
And	Machine causing vibrations	Foreign object intrusion, damage or deformation of sliding parts of machine.	Consult with machine manufacturer.
Speed reference 0 V but servomotor rotates.	Speed reference voltage offset applied	Stradyko.P	Refer to Subsections 4.2.4 and 4.2.5 and adjust reference offset.

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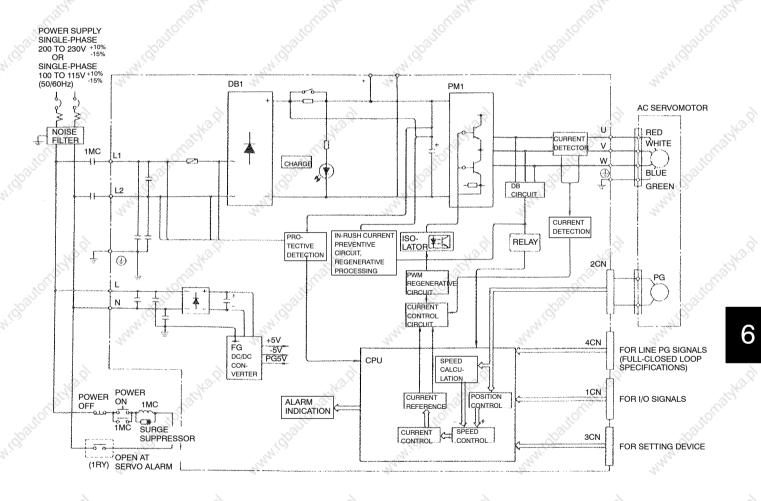
# 6.2.3 Internal Connection Diagram and Instrument Connection Examples

The DR2 Servopack internal connection diagram and instrument connection examples are given below.

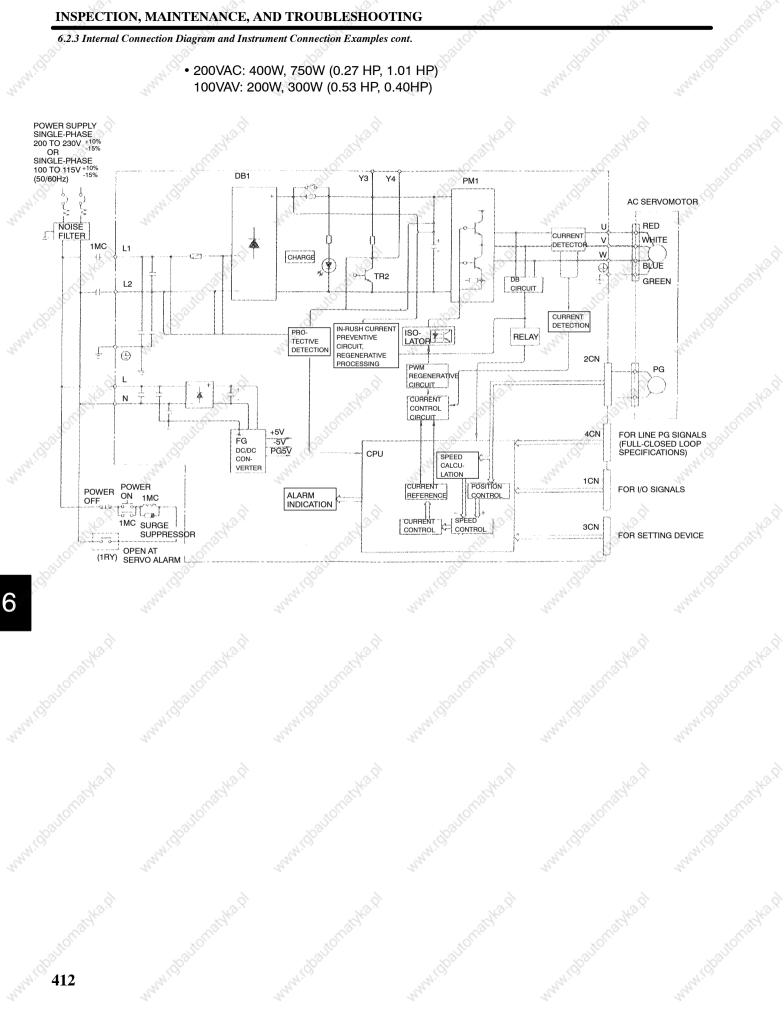
Refer to these diagrams during inspection and maintenance.

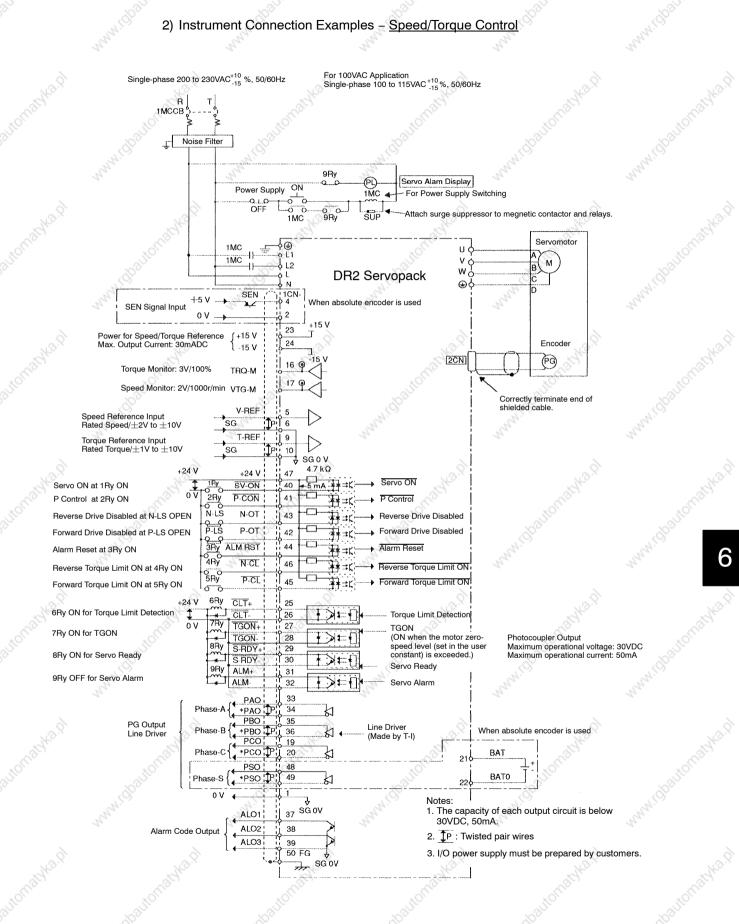
1) Internal Connection Diagram

• 200VAC: 30W to 200W (0.04 HP to 0.53 HP) 100VAV: 30W to 100W (0.04 HP to 0.13HP)



6.2.3 Internal Connection Diagram and Instrument Connection Examples cont.





6.2.3 Internal Connection Diagram and Instrument Connection Examples cont.

numilipauto 3) Instrument Connection Examples – Position Control For 100VAC Application Single-phase 100 to 115VAC +10 -15 Single-phase 200 to 230VAC<sup>+10</sup><sub>-15</sub> %, 50/60Hz %. 50/60Hz R 1MCCB Noise Filter 9Ry Servo Alam Display PL ON Power Supply 1MC a For Power Supply Switching õ ~~~~ OFF -0 0 1MC o o-9Ry Attach surge suppressor to megnetic contactor and relays. SUP Ð 1MC Servomotor -11 L1 U DR2 Servopack 1MC 12 v м w N ٢ 1CN 7 150Ω PULS 8 \*PULS <u></u>\*\*≓Κ Reference Pulse (Max. 450kpps) 11 SIGN **m** \*SIGN 12 Encoder 10 10 [2CN] (PG) 15 CLR -Error Counter Clear Signal +++=K \*CLR 14 (Active High) SG OV Correctly terminate end of SEN +5V4 shielded cable. When absolute encoder is used SEN Signal Input 31 οv 2 16 Q Torque Monitor: 3V/100% TRQ-M 4CN (PG) 17 Q Speed Monitor: 2V/1000r/min VTG-M External PG +24 V +24 V 47k0 47 Full-closed type only Servo ON at 1Ry ON 45 mA . ++ =K-1 Ph SV-ON 40 Servo ON 0 0 2Ry 0 0 N-LS 01 141 -07 P Control at 2Rv ON P-CON 7+=K Control N-OT Reverse Drive Disabled at N-LS OPEN 43 Reverse Drive Disabled F+ =K P-LS Forward Drive Disabled at P-LS OPEN P-OT 42 + Forward Drive Disabled ₹₹≓K 3Ry 4Ry ALM RST Alarm Reset at 3Ry ON 44 Alarm Reset ;\*\*⇒(;) N-CL Reverse Torque Limit ON at 4Ry ON 46 Reverse Torque Limit ON ++=K 5Ry Forward Torque Limit ON at 5Ry ON P-CL 45 Forward Torque Limit ON ¥+≓K 0 0 +24 V 6Ry COIN+ 25 6Ry ON for Positioning Completed Positioning Completed N≠€ COIN-26 + Photocoupler Output Maximum operational 7Ry 0V TGON 27 TGON 7Ry ON for TGON (ON when the motor zero-8Ry S-RDY 28 D=F voltage: 30VDC Maximum operational speed level (set in the user 1 29 8Ry ON for Servo Ready constant) is exceeded.) 30 **I**>⊧€ current: 50mA -#-S-RDY-9Ry ALM+ Servo Ready 31 9Ry ON for Servo Alarm Ŧ N=F Servo Alarm ALM 32 33 PAO τĊ Phase-A 34 \*PAO 1 35 PBO \*РВО **Д**Р Ј PG Output Line Driver Phase-B 36 A When absolute encoder is used (Made by T-I) Line Driver PCO \*PCO PI Phase-C 20 2 BAT 21 48 PSO BATO 49 Phase-S \*PSO 4 22 οv Notes 37 SĞ OV 1. The capacity of each output circuit is below ALO1 30VDC, 50mA. ALO2 38 Alarm Code Output 2. **1**P: Twisted pair wires ALO3 39 <sup>50</sup> FG 3. I/O power supply must be prepared by SGOV customers. m í

# **MEASURES TO SATISFY THE REQUIREMENTS OF EMC DIRECTIVE**

This chapter outlines EMC directive of European Safe Standard especially to DR2 Servopack.

In addition, section 2 describes concrete measures for DR2 Servopack to conform to EN standard.

	tornal	anathe tomath		roman
7.1	Wh	at is European Safe Standard?	416	
april .	7.1.1	What is EN Standard?	416	
	7.1.2	What is CE Marking?	416	
	7.1.3	EMC Directive	417	
	7.1.4	Certification Body TÜV Authorized by EU	417	J.
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7

MEASURES TO SATISFY THE REQUIREMENTS OF EMC DIRECTIVE

7.1.2 What is CE Marking?

# 7.1 What is European Safe Standard?

This section outlines the contents of EN standard, CE marking and EMC directive.

7.1.1	What is EN Standard?	416
7.1.2	What is CE Marking?	416
	EMC Directive	
7.1.4	Certification Body TÜV Authorized by EU	417

# 7.1.1 What is EN Standard?

- Board of directors, which consisted of EC cabinet members, provided "EC directive" in 1985 when the European Union was still called EC, with the purpose of management of products from each area of Europe under one standard over applicable standards of member countries.
- 2) Concrete standard to satisfy "EC directive" is "EN standard (European standard)". At the present time, they have instructions for 12 items such as machine directive, low-voltage directive, etc. in addition to EMC directive specified for each of dozens of standards.

# 7.1.2 What is CE Marking?

1) "CE marking" is a mark to indicate that a product is a safe product conforming to the protection level specified by EC directive.

Attaching this mark to a machine indicates that the machine is a product conforming to EN standards based on EC directive.

In Europe, every industrial machine has been obliged to have CE marking by machine directive since the 1st of January, 1995.

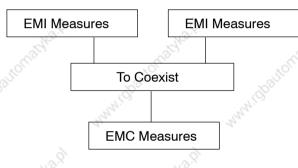
 "CE" is an abbreviation of Communauté Européenne in French, which means European Communities (EC).

After an increase of members, the name has been changed to EU (European Union), but EC is still used for the name of the directive.

# 7.1.3 EMC Directive

- 1) This is one of EC directives related to safe requirements for industrial products. EMC directive is concerned with electro-magnetic interference (magnetic noise) mainly from electronic devices, and specify two measures; whether a product controls generating electro-magnetic interference down to a level where it does not affect other devices (generating side) and whether any measures are provided to prevent an electronic device receiving electro-magnetic interference from malfunctioning (receiving side). If a product is considered in the above two aspects of the generating side and the receiving side of electro-magnetic interference and provided with proper measures, the product can be said to "coexist with electro-magnetic environment", which means that the product satisfies EMC requirements.
- EMC is an abbreviation of Electro-Magnetic Compatibility, indicating electro-magnetic compatibility of a product.

The following diagram outlines the contents explained in 1).



In the above diagram:

EMI: Electro–Magnetic Interference (generating side) EMS: Electro–Magnetic Susceptibility (receiving side)

Machines are to be tested according to their operating status.

# 7.1.4 Certification Body TÜV Authorized by EU

 TÜV is one of the certification bodies authorized by European Union (EU) specified organization, which is a German "technical inspection association".
 TÜV has an office (TÜV Product Service, etc.) in Japan, through which Yaskawa obtains approvals.

DR2 Servopack has been approved by this TÜV.

MEASURES TO SATISFY THE REQUIREMENTS OF EMC DIRECTIVE

7.2.2 Applicable Noise Filter

# 7.2 Measures to Satisfy the Requirements of EMC Directive

This section describes the required measures to adapt DR2 Servopack to EMC directive (EN50081–2, EN50082–2).

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7.2.3	Motor Cables	419
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7.2.6	Digital Operator and Monitoring by Personal Computer	420
7.2.7	The Core on the Cable	421
7.2.8	Wiring	421

# 7.2.1 Applicable Servomotor

 Use Yaskawa Servomotor conforming to EN standard. For details, refer to 5.4.2 Servomotor Dimensional Drawings (TÜV approved).

Servomotor Type Example: SGM-01V312 (200VAC, 100W) SGM-01W312 (100VAC, 100W)

# 7.2.2 Applicable Noise Filter

1) Use the following noise filter.

Make sure to ground the noise filter securely.

Applied Voltage	Servopack Type DR2–	Servopack Rated Input Current A (rms)	Noise Filter Type and Specifications (Input Line)	Noise Filter Type and Specifications (Power Supply for Brake)
	A3A 🗆 🔬	1.3	30°	.J <sup>10</sup> J <sup>10</sup>
MAN ICHOL	A5A 🗆 🔊	1.5 🔗	SUP-P5H-EPR	Do. Do.
	01A🗆	2.5	250V, 5A	Sar.
200VAC Class	02A□	4.0	4	14
	04A□	6.0	SUP-P8H-EPR 250V, 8A	No.R
10mar	08A 🗆 🔬	11.0	SUP-P10H-EPR 250V, 10A	SUP-P5H-EPR 250V, 5A
. And	A3B	2.0	Š	
JAN!	A5B	2.6	SUP-P5H-EPR 250V, 5A	S. M. L.
444	01B	4.5	4	34
100VAC Class	02B□	8.0	SUP-P8H-EPR 250V, 8A	13.9
official	03B	14.0	SUP-P10H-EPR 250V, 10A	Chatter .

7.2 Measures to Satisfy the Requirements of EMC Directive

7

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# 7.2.3 Motor Cables

1) Max. cable length is 20m.

# 7.2.4 Encoder Cables

1) For PG input (2CN), use the following connectors and cables. Max. cable length is 20m.

Connectors on Servopack and Servomotor are plated.

Make sure to ground between PG cable shield and connector case.

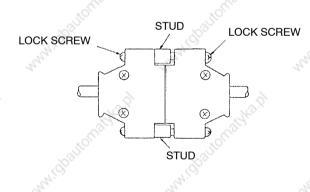
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			- 0 <sup>2</sup> 0	
Encoder	Encoder Type		Absolute	
Cable of	nly	B9400064*1	DP8409123*1	
Connector on	Case	MR-20L4* <sup>2</sup>		
Servopack Side	Connector	MR-20F*2		
Connector on N	lotor Side	17JE13090-02D8A* <sup>3</sup>	17JE13150-02D8A* <sup>3</sup>	
Stud for Connector	on Motor Side	17L-002A* <sup>3</sup>		
		is the second		

\*1 Contact your Yaskawa representative for details.

\*2 Made by Honda Tsushin Kogyo Co., Ltd.

\*3 Made by DDK Ltd.

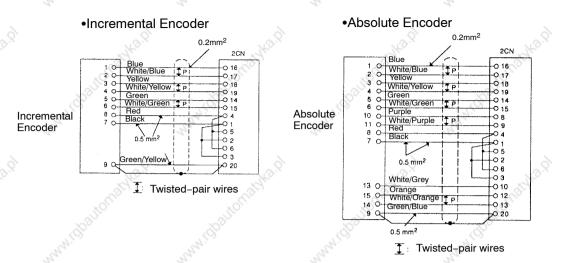
Connect the motor side connectors as shown below using studs.



### MEASURES TO SATISFY THE REQUIREMENTS OF EMC DIRECTIVE

7.2.6 Digital Operator and Monitoring by Personal Computer

2) Connect the PG cable as follows:



# 7.2.5 Control I/O

 For control I/O (1CN) connector, use the following connector. Connector case shown below is plated.

For 1CN cable, use the shielded cable and make sure to ground between cable shield and connector case.

Also, perform shield processing on host controller side securely.

Connector: MR–50M Connector Case: MR–50L4

# 7.2.6 Digital Operator and Monitoring by Personal Computer

1) Use digital operator or personal computer (for monitoring) only at test run. Disconnect them during normal operation.

7.2 Measures to Satisfy the Requirements of EMC Directive

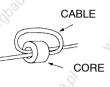
# 7.2.7 The Core on the Cable

1) Attach the core on the cable as shown below:

Core specifications

Note: 1.5 turn is as shown below:

_XO*	
Core Model	ESD-SR-25
Quantity	45
Turn	1.5
Manufacturer	Tokin Corp.

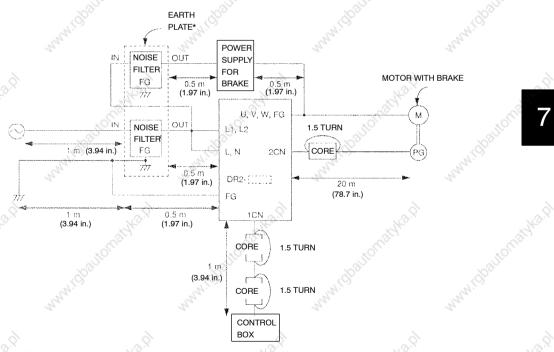


• Cable line and the line position where the core is attached:

Cable Line	PG Line	I/O Signal Input Line
Line Position	Near the Servopack side	Near the host controller and
Line Position	Near the Servopack side	Servopack

## 7.2.8 Wiring

1) The following diagram shows the wiring example for motor with brake. The noise filter and the core are shown in the same figure.



\* When eatrth plate is not used, polish the mounted noise filter part with sand paper to expose the metal. Then, ground the noise filter securely on the panel.

# Appendix A

# Differences Between DR2 and DR1, SGDA and SGD Servopacks

tomatyka

The functions and performance of Servopacks DR2, DR1, SGDA and SGD are listed and compared in the Tables.

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## Comparison of the DR2 Servopack with the DR1 Servopack (1)

Item	DR2 Servopack	DR1 Servopack	
Speed Loop Frequency Characteristics	250 Hz	100 Hz	
Servo Gain Compensation (See note 1)	Yes	No	
Auto Tuning	7-stage settings	No	
Serial Communications Features	User constant setting/editing Reference to all monitored values Auto-tuning Alarm trace-back confirmation	No	
Multi-axis Communications	Yes (However, use rotary switch when axis is set.)	No	
100 V, 300 W Version	Yes (External dimensions identical to 200 V, 750 W version)	No	
Applicable Servomotors	Both SGM and SGMP servomotors	SGM servomotors.	
A Marine	Either servomotor type can be used by changing user constant (memory switch) setting. No Servopack change required.	Not applicable to SGMP Servomotors.	
Torque Feed Forward (See note 2)	Yes Torque feed forward and torque restriction with analog references cannot be used	No	
Torque Restriction with Analog References (See note 2)	Yes simultaneously. Settings identical for forward and reverse.	No	
Reference Pulse Input Unit Filter Selection (See note 3)	Yes Select according to output form of the customer's controller (line driver or open collector).	Yes	
External Reference Receive During Contact Input Speed Control	Selectable (Software version: 0003 or later. See Par. 4.2.8.)	Always receivable	
Reference Pulse Inhibit	Yes Switch the P-CON signal with the user constant settings.	No	
Reference Pulse Value Display (See note 3)	Possible (Monitor mode Un-09)	Not possible	
Analog Speed Monitor	2V/1000r/min	0.5V/1000r/min	
Analog Torque Monitor	3V/100%	0.5V/100%	
PG Dividing Open Collector Output	Can be available as an option	Available only to Phase-C	
Full-closed Loop	Possible	Not possible	
Electronic Gear Function	Yes	No	
Soft Stop Function	Yes	The same as that of soft start	
Smoothing Function	Yes	No	
Regenerative Processing Circuit	None However, only 200V, 30W to 200W can be connectable to regenerative unit. (200V, 30W to 200W 100V, 30W to 100W)	None Regenerative unit cannot be connected. (200V, 30W to 100W 100V, 30W and 50W)	
Jon	Incorporated (200V, 400W and 750W 100V, 200W and 300W)	Incorporated (200V, 200W to 750W 100V, 100W and 200W)	
Power Supply	Main circuit and control circuit are separated.	and and and a second se	

Note

- 1) Material is being prepared on speed loop servo gain compensation. Lighautomatol\*
  - 2) Speed control type only.
  - 3) Position control type only.

-	adhail adhail	ad <sup>ka,ti</sup>	2 <sup>1,1</sup>
108ULON	. waton.	obalion.	iosuton. iosuto
S	Item	DR2 Servopack	DR1 Servopack
Γ	Digital Operator	Hand-held type: JUSP-OP02A-1	Hand-held type: JUSP-OP02A
ľ	Motor Cable	3, 5, 10, 15, 20m are available. (Not the same types as those of SGD, SGDA	A) 3, 5, 10, 15, 20m are available. (The same types as those of SGD, SGDA)
d	Encoder Cable	3,5,10,15,20m are available (Not the same t	types as those of SGD, SGDA)
	Conformable Overseas Standard	TÜV approved (Conforming to EN61010)	No
	Control Type	Speed, torque and position are controlled by	the same Servopack.
	User Constant Cn-05 Setting Unit	0.01ms	1ms
, obalion	ASHARI MANNIGBAUTORIASHARI	www.gbaitonatika.pl	and manufaltonatives, and manufalto

www.ighautomatika.n

# Comparison of the DR2 Servopack with the DR1 Servopack (2)

	ltem	DR2 Servopack	DR1 Servopack	Remarks
Туре	-utonetyke.pt	DR2-□□AC (Semi-closed type) DR2-□□AC-F (Full-closed type)	DR1-□□AC (Incremental type) DR1-□□AA (Absolute type)	As for DR2, factory setting of applicable motor is SGM Servomotor.
2°	MANNIG BOL	DR2-□□ACP (Semi-closed type) DR2-□□ACP-F (Full-closed type)	. doo - www.	Factory setting of applicable motor is SGMP Servomotor.
Outside Dimen	sions	60W ×250H ×204D (200V: 30W to 200W) (100V: 30W to 100W)	60W × 250H × 250D (200V: 30W to 200W) (100V: 30W to 100W)	Mounting hole position is in common with DR2 and DR1.
JICOMO.	www.dbautorio	75W ×250H ×252D (200V: 400W and 750W) (100V: 200W and 300W)	75W ×250H ×250D (200V: 400W and 750W) (100V: 200W)	Spattorno
Base-mount ty	ре	Option	No	
Motor Terminal	s onable.pl	External terminals in conformance with Standard (PHOENIX CONTACT)	External terminal (M4 screw)	onatika.pl
Encoder Conne	ector 2CN	MR-20RMA	MR-20RMA	Common with DR2 and DR1. (Different from SGD type)
Connector 4CN for Full-closed Type		MR-8RMA	- 4	2
External I/O Signals	Used Connector	MR-50RFA	MR-50RFA	Common with DR2 and DR1.
(1CN)	3-pin	PL1: PULS pull-up	SG: Signal ground	PL1, 2 and 3 are used
Jton.	5-pin	V-REF: Exclusive for speed reference input	IN-A: Main input	for pull-up of open collector input. Signals other than
No.C.	9-pin	T-REF: Exclusive for torque reference input	IN-B: Auxiliary input	described here are used in common with DR2 and DR1.
S.	13-pin	PL2: SIGN pull-up	SG: Signal ground	AN AN
30	18-pin 💉	PL3: CLR pull-up	SG: Signal ground	autor.
5	23-pin	+15V: Reference power supply 30mA	PHC: Phase-C open collector	Sport
	24-pin	-15V: Reference power supply 30mA	SG: Signal ground √	44

## Comparison of the SGDA Servopack with the SGD Servopack

Serial Communications Use Features Ref Auto	age settings	150 Hz
Servo Gain Compensation (See note 1)YesAuto Tuning7-stSerial Communications FeaturesUse Refr Auto		No
Auto Tuning 7-st Serial Communications Use Features Refu		024
Features Ref		3-stage settings
	r constant setting/editing erence to all monitored values p-tuning m trace-back confirmation	User constant setting/editing
	(However, 1:1 communications when axis ress is set.)	No
100 V, 300 W Version Yes	(External dimensions identical to 200 V, W version)	No
Eith use	n SGM and SGMP servomotors er servomotor type can be used by changing r constant (memory switch) setting. Servopack change required.	SGM servomotors. Servopack must be change SGMP servomotor. SGMP-compatible Servopa
hadden www.idautomadda.com	www.daatonabla.p	SGD-
Torque Feed Forward (See note 2)	Torque feed forward and torque restriction with analog references cannot be used	No
Torque Restriction with Analog References (See note 2)	simultaneously. Settings identical for forward and reverse.	No
Reference Pulse Input UnitYesFilter Selection (See note 3)	Select according to output form of the customer's controller (line driver or open collector).	None
External Reference Receive Pos During Contact Input Speed Control	sible	Not possible
Reference Pulse Inhibit Yes	Switch the P-CON signal with the user constant settings.	No
Display (See note 3)	sible (Monitor mode Un-09)	Not possible
Analog Speed Monitor No		No
Analog Torque Monitor No	All All	No
Output	be available as an option	Not possible
	possible	Not possible
Electronic Gear Function Yes	off <sup>or</sup>	Yes
Soft Stop Function Yes	all all	Yes
	e (Renererative <u>unit</u> can be connectable.)	Yes
Circuit N	4. 4.	17
Digital Operator Har	n circuit and control circuit are separated. d-held type : JUSP-OP02A-1 int type : JUSP-OP03	NO.

A

#### DIFFERENCES BETWEEN DR2 AND DR1, SGDA AND SGD SERVOPACKS

lot. "	abalton abalton	aballon.	108 <sup>Uton</sup>
Item N	SGDA Servopack	SGD Servopack	and is
Encoder Cable 🖑	3,5,10,15,20m are available	P.	200
Conformable Overseas Standard	No	б. б.	
Control Type	Speed/torque and position are controlled by the	different type Servopack.	
Jser Constant Cn-05 Setting Jnit	1ms	JIONO	HOLD

MMM. GOBULONBHAR

- 1) Material is being prepared on speed loop servo gain compensation.
- 2) Speed control type only.

3) Position control type only.

# Appendix **B**

# Servo Adjustment

This appendix presents the basic rules for  $\Sigma$ -Series AC Servopack gain adjustment, describes various adjustment techniques, and gives some preset values as guidelines.

	E.	1°°°°		S. Nor
	Jtor	-autonic -autonic	wallor	
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	B.2.2	Manual Adjustment	433	
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B.1.1  $\Sigma$ -Series AC Servopacks and Gain Adjustment Methods

## **B.1** Σ-Series AC Servopack Gain Adjustment

This section gives some basic information required to adjust the servo system.

B.1.1	$\Sigma$ -Series AC Servopacks and Gain Adjustment Methods $\ldots$	430
B.1.2	Basic Rules for Gain Adjustment	431

#### B.1.1 Σ-Series AC Servopacks and Gain Adjustment Methods

 Five types of Σ-Series AC Servopack are available: DR1, SGDA, SGDB, SGD and the current DR2.

The adjustment method is basically identical for each Servopack type, except that autotuning is not available for some types.

The DR2, SGDA,SGDB and SGD Servopacks allow both manual adjustment by the conventional method of observing the machine response and automatic adjustment using the internal auto-tuning function. The DR1 Servopack does not offer auto-tuning.

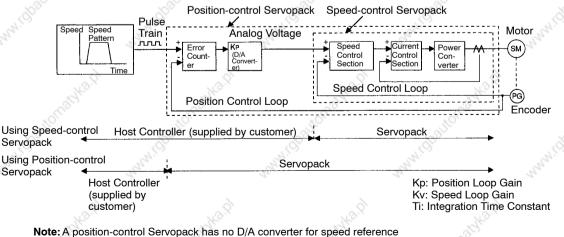
- 2) The main user constants changed by the customer to adjust the servo system include the following:
  - Cn-04 (Speed Loop Gain)
  - Cn-05 (Speed Loop Integration Time Constant)
  - Cn-17 (Torque Reference Filter Time Constant)
  - Cn-1A (Position Loop Gain)

In a speed-control Servopack (where speed references are applied as analog voltages), the position loop is controlled by the host controller, so the position loop gain is normally adjusted at the host controller.

If adjustment is not possible at the host controller, the same adjustment can be achieved using Cn-03 (Speed Reference Gain), but the servomotor may not reach maximum speed for some preset values of this user constant.

A simple block diagram of the servo system is shown below.

#### Servo System Block Diagram



output. This conversion is handled by internal calculations.

## **B.1.2 Basic Rules for Gain Adjustment**

 The servo system comprises three feedback systems: position loop, speed loop, and current loop. The response must increase from outer loop to inner loop (see Servo System Block Diagram, above). The response deteriorates and oscillates if this principle is not obeyed.

The customer cannot adjust the current loop. Sufficient response is assured for the current loop.

The customer can adjust the position loop gain and speed loop gain, as well as the speed loop integration time constant and torque reference filter.

2) The position loop and speed loop must be adjusted to provide a balanced response. In particular, if the position loop gain only is increased (adjustment with Cn-03 at the Servopack if position loop gain adjustment is not possible at the host controller), the speed references oscillate and the result is increased, oscillating position control times. If the position loop gain (or Cn-03) is increased, the speed loop gain (Cn-04) must be similarly increased.

If the mechanical system starts to oscillate after the position loop gain and speed loop gain are increased, do not increase the gains further.

 The position loop gain should not normally be increased above the characteristic frequency of the mechanical system.

For example, the harmonic gears used in an articulated robot form a structure with extremely poor rigidity and a characteristic frequency of approximately 10 to 20 Hz. This type of machine allows a position loop gain of only 10 to 20 (1/sec).

Conversely, the characteristic frequency of a precision machine tool such as a chip mounter or IC bonder exceeds 70 Hz, allowing a position loop gain exceeding 70 (1/sec) for some machines.

Therefore, although the response of the servo system (controller, servo driver, motor, detectors, etc.) is an important factor where good response is required, it is also important to improve the rigidity of the mechanical system.

4) In cases where the position loop response is greater than or equal to the speed loop response and linear acceleration or deceleration is attempted, the poor speed loop response and follow-up cause an accumulation of position loop errors and result in increased output of speed references from the position loop.

The motor moves faster and overshoots as a result of increased speed references, and the position loop tends to decrease the speed references. However, the poor motor follow-up due to the poor speed loop response results in oscillating speed references, as shown in the diagram below.

If this problem occurs, reduce the position loop gain or increase the speed loop gain to eliminate the speed reference oscillations.

# Speed Reference Output with Unbalanced Position Loop Gain and Speed Loop Gain

Speed Reference

Speed references actually output from controller
 Speed references calculated in controller

Time

Β

#### SERVO ADJUSTMENT

**B.2.1** Adjusting Using Auto-tuning

# B.2 Adjusting a Servopack for Speed Control

This section gives examples of adjusting the gains of a Servopack for speed control manually and using auto-tuning.

B.2.1	Adjusting Using Auto-tuning	432
B.2.2	Manual Adjustment	433

### **B.2.1 Adjusting Using Auto-tuning**

The DR1 Servopack does not offer auto-tuning.

- 1) Important Points About Auto-tuning
  - a) Speed During Auto-tuning

Auto-tuning may not function correctly if the speed is too low. Set the speed to approximately 500 r/min.

Set the speed with the user constant Cn-10 (Jog speed)

b) Selecting Machine Rigidity

If the machine rigidity is unknown, select the rigidity according to the following standards.

Machine Rigidity	
DR2, SGDA, SGDB	SGD
3 (C-003) to 7 (C-007)	High/medium response
2 (C-002) to 3 (C-003)	Medium response
1 (C-001) to 3 (C-003)	Low/medium response
1 (C-001) to 2 (C-002)	Low response
1 (C-001) to 2 (C-002)	Low response
	DR2, SGDA, SGDB           3 (C-003) to 7 (C-007)           2 (C-002) to 3 (C-003)           1 (C-001) to 3 (C-003)           1 (C-001) to 2 (C-002)

\* Product name: Harmonic Drive

Select the machine rigidity level for DR2, SGDA and SGDB and according to the table.

Level	Rigidity
7 (C-007)	High
6 (C-006)	() ()
5 (C-005)	: 4
4 (C-004)	:
3 (C-003)	Medium
2 (C-002)	: 3 <sup>3</sup>
1 (C-001)	Low

В

Auto-tuning may not end if high response is selected for a low-rigidity machine or low response is selected for a high-rigidity machine.

If this occurs, halt the auto-tuning and change the machine rigidity selection.

2) If Auto-tuning is Unsuccessful

Auto-tuning may be unsuccessful (the end of auto-tuning not displayed) for machines with large play or extremely low rigidity.

Similarly, auto-tuning may be unsuccessful for a machine with high load inertia (exceeding 15 to 30 times the motor moment of inertia).

In these cases, use conventional manual adjustment.

Even if auto-tuning is successful for a machine with large fluctuations in load inertia or load torque, vibrations or noise may still occur in some positions.

3) Response During Operation is Unsatisfactory after Auto-tuning

Auto-tuning sets the gain and integration time constant with some safety margin (to avoid oscillations). This can result in positioning times.

In particular, the target position may not be reached if low response is selected, because the machine does not move in response to the final minute references. An excessively high setting of the integration time constant (Cn-05) during auto-tuning is one cause of this problem.

If response is slow after auto-tuning, the speed loop gain cannot be manually increased very much before oscillation starts.

In this case, manually reduce the integration time constant while observing the machine behavior to ensure oscillation does not occur.

Auto-tuning does not set the torque reference filter (Cn-17) or speed reference gain (Cn-03).

#### **B.2.2 Manual Adjustment**

1) The role of each user constant is briefly described below.

#### a) Speed Loop Gain (Cn-04)

This user constant sets the speed loop response.

The response is improved by setting this user constant to the maximum value in the range which does not cause vibrations in the mechanical system. The following formula relates the speed loop gain to the load inertia.

Speed Loop Gain Kv [Hz] =  $\frac{2}{\frac{GD_L^2}{GD_M^2} + 1} \times \text{(Cn-04 Preset value)}$ 

GD<sub>L</sub><sup>2:</sup> Motor Axis Converted Load Inertia GD<sub>M</sub><sup>2</sup>: Motor Moment of Inertia Β

433

#### SERVO ADJUSTMENT

B.2.2 Manual Adjustment cont.

#### b) Speed Loop Integration Time Constant (Cn-05)

The speed loop has an integration element to allow response to micro-inputs. This integration element can produce a delay in the servo system, and the positioning setting time increases and response becomes slower as the time constant increases. However, the integration time constant must be increased to prevent machine vibration if the load inertia is large or the mechanical system includes a element that is prone to vibration.

The following formula calculates a guideline value.

$$Ti \ge 2.3 \times \frac{1}{2\pi \times Kv}$$

Ti: Integration Time Constant (sec) Kv: Speed Loop Gain (Hz) (calculated above)

c) Torque Reference Filter Time Constant (Cn-17)

When a ball screw is used, torsional resonance may occur which increases the pitch of the vibration noise.

This vibration can sometimes be overcome by increasing the torque reference filter time constant.

However, this filter will produce a delay in the servo system, just like the integration time constant, and its value should not be increased more than necessary.

d) Speed Reference Gain (Cn-03)

Changing the speed reference gain (Cn-03) changes the position loop gain an equivalent amount. That is, reducing the speed reference gain is equivalent to reducing the position loop gain and increasing it is equivalent to increasing the position loop gain. Use this user constant (Cn-03) in the following circumstances:

- No position loop gain adjustment at host controller (including cases where fine adjustment not possible by changing number of D/A converter bits)
- Clamping the speed reference output range to specific speeds

Normally leave at the factory setting.

NOTE

For a speed-control SGD or SGDA Servopack or SGDB or DR2 Servopack used for speed control, the position loop gain (Cn-1A) is valid in zero-clamp mode only. The position loop gain (Cn-1A) user constant is always invalid for a DR1 Servopack. For normal control, change the position loop gain at the host controller or adjust the speed reference gain (Cn-03) in the Servopack.

Changing Cn-1A does not change the position loop gain.

2) Adjustment Procedure

- a) Set the position loop gain at the host controller to a low value and increase the speed loop gain (Cn-04) within the range that no abnormal noise or vibration occurs. If adjustment of the position loop gain is not possible at the host controller, reduce the speed reference gain (Cn-03).
- b) Slightly reduce the speed loop gain from the value at step 1, and increase the position loop gain at the host controller in the range that no overshooting or vibration occurs. If adjustment of the position loop gain is not possible at the host controller, increase the speed reference gain (Cn-03).
- c) Determine the speed loop integration time constant (Cn-05), by observing the positioning setting time and vibrations in the mechanical system.
   The positioning setting time may become excessive if the speed loop integration time constant (Cn-05) is too large.
- d) It is not necessary to change the torque reference filter time constant (Cn-17) unless torsional resonance occurs in the machine shafts. Torsional resonance may be indicated by a high vibration noise. Adjust the torque reference filter time constant (Cn-17) to reduce the vibration noise.
- e) Finally, fine adjustment of the position gain, speed gain, and integration time constant is required to determine the optimum point for step response.

**B.3.1** Adjusting Using Auto-tuning

# **B.3 Adjusting a Servopack for Position Control**

This section gives examples of adjusting the gains of a Servopack for position control manually and using auto-tuning.

B.3.1	Adjusting Using Auto-tuning	436
B 3 2	Manual Adjustment	137

## **B.3.1 Adjusting Using Auto-tuning**

The DR1 Servopack does not offer auto-tuning.

1) Important Points About Auto-tuning

a) Speed During Auto-tuning

Auto-tuning may not function correctly if the speed is too low. Set the speed to approximately 500 r/min.

Set the speed with the user constant Cn-10 (Jog speed).

b) Selecting Machine Rigidity

If the machine rigidity is unknown, select the rigidity according to the following standards.

Drive Method	Machi	ne Rigidity
All All	DR2, SGDA, SGDB	SGD
Ball screw, direct	3 (C-003) to 7 (C-007)	High/medium response
Ball screw, with reduction gears	2 (C-002) to 3 (C-003)	Medium response
Timing belt	1 (C-001) to 3 (C-003)	Low/medium response
Chain	1 (C-001) to 2 (C-002)	Low response
Wave reductiongears*	1 (C-001) to 2 (C-002)	Low response

\* Product name: Harmonic Drive

Select the machine rigidity level for DR2, SGDA and SGDB according to the table.

Level	Rigidity
7 (C-007)	High
6 (C-006)	9
5 (C-005)	: 3
4 (C-004)	:
3 (C-003)	Medium
2 (C-002)	: 3 <sup>4</sup>
1 (C-001)	Low

В

Auto-tuning may not end if high response is selected for a low-rigidity machine or low response is selected for a high-rigidity machine.

If this occurs, halt the auto-tuning and change the machine rigidity selection.

2) If Auto-tuning is Unsuccessful

Auto-tuning may be unsuccessful (the end of auto-tuning not displayed) for machines with large play or extremely low rigidity.

Similarly, auto-tuning may be unsuccessful for a machine with high load inertia (exceeding 15 to 30 times the motor moment of inertia).

In these cases, use conventional manual adjustment.

Even if auto-tuning is successful for a machine with large fluctuations in load inertia or load torque, vibrations or noise may still occur in some positions.

3) Response During Operation is Unsatisfactory after Auto-tuning

Auto-tuning sets the gain and integration time constant with some safety margin (to avoid oscillations). This can result in positioning times.

In particular, the target position may not be reached if low response is selected, because the machine does not move in response to the final minute references. An excessively high setting of the integration time constant (Cn-05) during auto-tuning is one cause of this problem.

If response is slow after auto-tuning, the speed loop gain cannot be manually increased very much before vibration starts.

In this case, manually reduce the integration time constant while observing the machine behavior to ensure oscillation does not occur.

Auto-tuning does not set the torque reference filter (Cn-17).

#### B.3.2 Manual Adjustment

1) The role of each user constant is briefly described below.

#### a) Speed Loop Gain (Cn-04)

This user constant sets the speed loop response.

The response is improved by setting this user constant to the maximum value in the range which does not cause vibrations in the mechanical system. The following formula relates the speed loop gain to the load inertia.

Speed Loop Gain Kv [Hz] =  $\frac{2}{\frac{GD_L^2}{GD_M^2} + 1} \times (Cn-04 \text{ Preset value})$ 

GD<sub>L</sub><sup>2:</sup> Motor Axis Converted Load Inertia GD<sub>M</sub><sup>2</sup>: Motor Moment of Inertia

 b) Speed Loop Integration Time Constant (Cn-05) The speed loop has an integration element to allow response to micro-inputs.

#### SERVO ADJUSTMENT

B.3.2 Manual Adjustment cont.

This integration element can produce a delay in the servo system, and the positioning setting time increases and response becomes slower as the time constant increases. However, the integration time constant must be increased to prevent machine vibration if the load inertia is large or the mechanical system includes a vibration elements. The following formula calculates a guideline value.

 $\mathsf{Ti} \geq 2.3 \times \frac{1}{2\pi \times \mathsf{Kv}}$ 

Ti: Integration Time Constant (sec) Kv: Speed Loop Gain (Hz) (calculated above)

) Torque Reference Filter Time Constant (Cn-17)

When a ball screw is used, torsional resonance may occur which increases the pitch of the vibration noise.

These vibrations can sometimes be overcome by increasing the torque reference filter time constant.

However, this filter can produce a delay in the servo system, as is the integration time constant, and its value should not be increased more than necessary.

#### d) Position Loop Gain

The position loop gain user constant sets the servo system response. The higher the position loop gain is set, the better the response and shorter the positioning times.

To enable a high setting of the position loop gain, increase the machine rigidity and raise the machine characteristic frequency.

Increasing the position loop gain only to improve the response can result in oscillating response of the overall servo system, that is, the speed references output from the position loop oscillate. Therefore, also increase the speed loop gain while observing the response.

#### 2) Adjustment Procedure

- a) Set the position loop gain to a low value and increase the speed loop gain (Cn-04) within the range that no abnormal noise or oscillation occurs.
- b) Slightly reduce the speed loop gain from the value at step 1, and increase the position loop gain in the range that no overshooting or vibration occurs.
- c) Determine the speed loop integration time constant (Cn-05), by observing the positioning set time and vibrations in the mechanical system.
   The positioning set time may become excessive if the speed loop integration time constant (Cn-05) is too large.
- d) It is not necessary to change the torque reference time constant (Cn-17) unless torsional resonance occurs in the machine shafts.

Torsional resonance may be indicated by a high vibration noise. Adjust the torque reference filter time constant to reduce the vibration noise.

e) Finally, fine adjustment of the position gain, speed gain, and integration time constant is required to determine the optimum point for step response, etc.

#### 3) Functions to Improve Response

The mode switch, feed-forward, and bias functions improve response. However, they are not certain to improve response and may even worsen it in some cases. Follow the points outlined below and observe the actual response while making adjustments.

#### a) Mode Switch

The mode switch improves the transition characteristics when the torque references become saturated during acceleration or deceleration.

Above the set level, the speed loop control switches from PI (proportional/integral) control to P (proportional) control.

#### b) Feed-forward Function

Use feed-forward to improve the response speed. However, feed-forward may be ineffective in systems where a sufficiently high value of position loop gain is not possible.

Follow the procedure below to adjust the feed-forward amount (Cn-1D).

- (1) Adjust the speed loop and position loop, as described above.
- (2) Gradually increase the feed-forward amount (Cn-1D), such that the positioning complete (COIN) signal is output early.

At this point, ensure that the positioning complete (COIN) signal breaks up (alternately turns ON/OFF) and that the speed does not overshoot. These problems can arise if the feed-forward is set too high.

For all types of Servopack except DR1, a primary delay filter can be applied to feedforward. This filter can be used to correct breakup (alternatingly turning ON/OFF) of the positioning complete (COIN) signal or speed overshoot arising when feed-forward is activated.

#### c) Bias Function

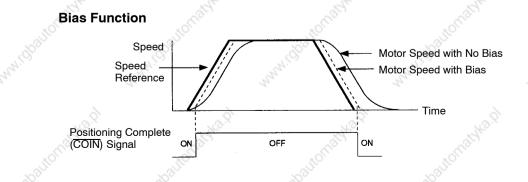
When the lag pulses in the error counter exceeds the positioning complete width (Cn-1B), the bias amount (Cn-1C) is added to the error counter output (speed reference). If the lag pulses in the error counter lies within the positioning complete width (Cn-1B), the bias amount (Cn-1C) is no longer added.

This reduces the number of pulses in the error counter and shortens the positioning time.

The motor speed becomes unstable if the bias amount is too large.

Observe the response during adjustment as the optimum value depends on the load, gain, and positioning complete width.

Set Cn-0C to zero (0) when the bias is not used.



#### SERVO ADJUSTMENT

B.3.2 Manual Adjustment cont.

The adjustment procedures described above are common for all Yaskawa digital AC Servopacks. However, not all functions are available on each Servopack. Consult the technical specifications of your Servopack for details.

The adjustment procedures are also identical for conventional analog servos. However, in this case, the adjustments are made using potentiometers instead of the user constants.

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## B.4 Gain Setting References

This section presents tables of load inertia values for reference when adjusting the gain.

B.4.1 Guidelines for Gain Settings According to Load Inertia Ratio

#### **B.4.1 Guidelines for Gain Settings According to Load Inertia Ratio**

 Adjustment guidelines are given below according to the rigidity of the mechanical system and load inertia. Use these values as guidelines when adjusting according to the procedures described above.

These values are given as guidelines only. Oscillations and poor response may occur inside the specified value ranges. Observe the response (waveform) when optimizing the adjustment.

Higher gains are possible for machines with high rigidity.

a) Machines with High Rigidity

Ball Screw, Direct Drive Machines Example: Chip mounter, IC bonder, precision machine tools

Load/Inertia Ratio (GD <sub>L</sub> <sup>2</sup> /GD <sub>M</sub> <sup>2</sup> )	Position Loop Gain (Cn-1A) [1/s]	Speed Loop Gain (Cn-04) [Hz]	Speed Loop Integration Time Constant (Cn-05) [0.01ms]
1x 🖉	50 to 70	50 to 70	500 to 2000
3 x	348	100 to 140	Slightly increase for
5 x		150 to 200	inertia ratio of 20 x, or
10 x 👌	6	270 to 380	greater.
15 x	Nº.	400 to 560	NO.
20 x	1 Carl	500 to 730	C.C.
30 x 🔊	<u>.</u>	700 to 1100	9. 

For an inertia ratio of 10 x, or greater, slightly reduce the position loop gain and speed loop gain below the values shown and set the integration time constant to a higher value before starting the adjustment.

As the inertia ratio increases, set the position loop gain and speed loop gain to the lower limit of the range of values specified. Conversely, increase the speed loop integration time constant.

b) Machines with Medium Rigidity

Machines driven by ball screw through reduction gears, or machines directly driven by long ball screws.

Example: General machine tools, orthogonal robots, conveyors

#### SERVO ADJUSTMENT

B.4.1 Guidelines for Gain Settings According to Load Inertia Ratio cont.

Load/Inertia Ratio (GD <sub>L</sub> <sup>2</sup> /GD <sub>M</sub> <sup>2</sup> )	Position Loop Gain (Cn-1A) [1/s]	Speed Loop Gain (Cn-04) [Hz]	Speed Loop Integration Time Constant (Cn-05) [0.01ms]
1x 🔊	30 to 50	30 to 50	1000 to 4000
3 x 🔊	ALL LAND	60 to 100	Slightly increase for
5 x	10	90 to 150	inertia ratio of 20 x, or
10 x	5 <sup>2</sup> ×	160 to 270	greater.
15 x	an Co	240 to 400	and a start
20 x	194	310 to 520	35
30 x	1	450 to 770	

For an inertia ratio of 10 x, or greater, slightly reduce the position loop gain and speed loop gain below the values shown and set the integration time constant to a higher value before starting the adjustment.

As the inertia ratio increases, set the position loop gain and speed loop gain to the lower limit of the range of values specified. Conversely, increase the speed loop integration time constant.

c) Machines with Low Rigidity

Machines driven by timing belts, chains or wave reduction gears (product name: Harmonic Drive).

Example: Conveyors, articulated robots

Load/Inertia Ratio (GD <sub>L</sub> <sup>2</sup> /GD <sub>M</sub> <sup>2</sup> )	Position Loop Gain (Cn-1A) [1/s]	Speed Loop Gain (Cn-04) [Hz]	Speed Loop Integration Time Constant (Cn-05) [0.01ms]
1 x	10 to 20	10 to 20	5000 to 10000
3 x	56	20 to 40	Slightly increase for
5 x		30 to 60	inertia ratio of 20 x, or
10 x		50 to 110	greater.
15 x 👌	6	80 to 160	6
20 x	No.	100 to 210	ALC.
30 x	allar.	150 to 310	all
50 X	100	130 10 310	

For an inertia ratio of 10 x, or greater, slightly reduce the position loop gain and speed loop gain below the values shown and set the integration time constant to a higher value before starting the adjustment.

As the inertia ratio increases, set the position loop gain and speed loop gain to the lower limit of the range of values specified. Conversely, increase the speed loop integration time constant.

2) When a speed-control Servopack is used, set the position loop gain at the host controller. If the position loop gain cannot be set at the host controller, adjust the Servopack speed reference gain (Cn-03).

30

The position loop gain (Cn-1A) of a speed-control Servopack is valid in zero-clamp mode only.

The position loop gain is determined from the following relationship.

 $K_p = \frac{VS}{\epsilon}$ 

K<sub>P</sub> [1/s]: Position loop gain VS [PPS]: Steady speed reference ε: (pulse): Steady error

(The number of pulses in the error counter at steady speed.)

443

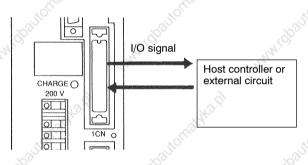
# Appendix **\**

# List of I/O Signals

C

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This appendix lists I/O signal terminals (connector 1CN) on Servopacks which connect to a host controller or external circuit.



Note 1) The meanings of some signals for speed/torque control and position control are different. Always refer to the correct list for the Servopack type.

2) Refer to Chapter 3 for details of how to use I/O signals.

3) Note that the functions of I/O signal terminals differ according to the memory switch (Cn-01, Cn-02) settings.

#### List of Input Signals in Speed/Torque Mode (1) (1CN Terminal No.)

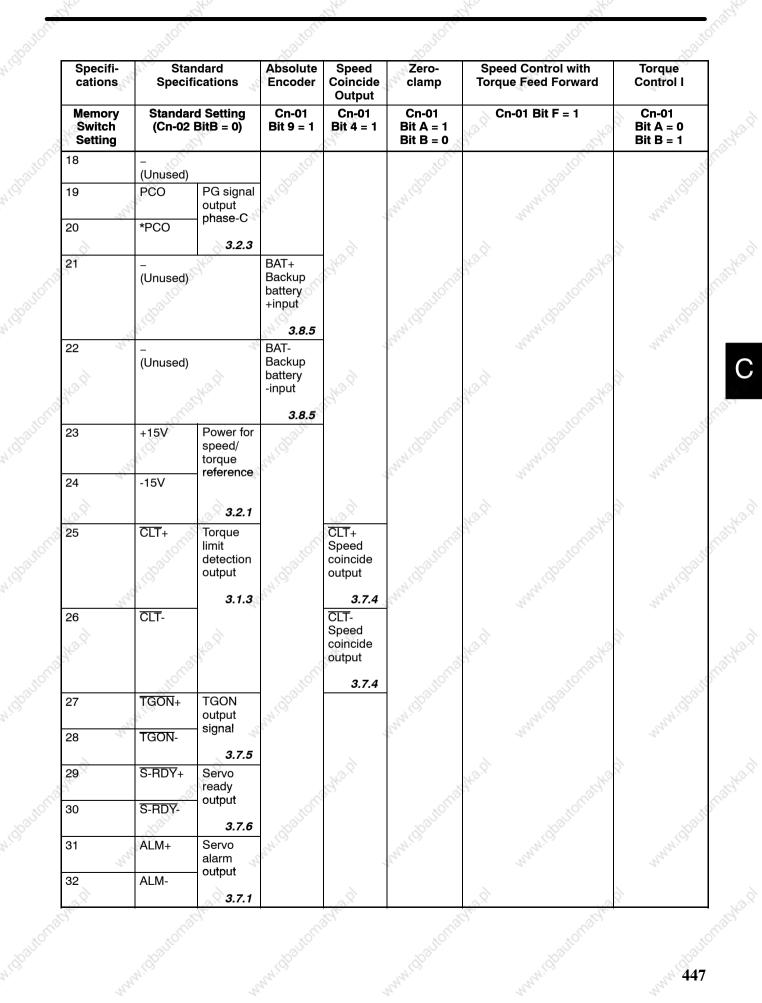
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Manniel Ballo

Speed/Torque

Specifi- cations	Standard Specifications	Absolute Encoder	Speed Coincide Output	Zero- clamp	Speed Control with Torque Feed Forward	Torque Control I
Memory Switch Setting	Standard Setting (Cn-02 BitB = 0)	Cn-01 Bit 9 = 1	Cn-01 Bit 4 = 1	Cn-01 Bit A = 1 Bit B = 0	Cn-01 Bit F = 1	Cn-01 Bit A = 0 Bit B = 1
30H2.9	SG GND		Cather, P		Rachka.	5.940.9
2	SG GND	W.GDQU	, ,	WIGDSH	NIGDAUO.	
3	_ (Unused)	4		44	1 Mart	A. A. A.
1 120140.01	– (Unused)	SEN Sensor ON <i>3.8.5</i>	omabka.pl	8	matha.pl	12. N. C. C.
5	V-REF Speed reference input 3.2.1	ANN HOO		WWW.HDDL	V-REF Speed reference 3.2.8	(Unused) <i>3.2.7</i>
6 N <sup>2</sup> R	SG GND		March		SG GND <b>3.2.8</b>	SG GND <b>3.2.7</b>
Z S	– (Unused)		oman	200	rists autor	Q.
3	– (Unused)	. CNI BO		WHIGOO.	W.Boo	614
9 	T-REF Torque reference input <b>3.2.7</b>	N.	d'	S. C.	T-REF Torque feed forward reference 3.2.8	T-REF Torque reference <i>3.2.7</i>
10	SG GND	-	ornatella	20	SG GND <b>3.2.8</b>	SG GND <b>3.2.7</b>
11	– (Unused)	- www.idbau		www.cjbaut	GND 3.2.8	GIND 3.2.1
12	(Unused)	2		S.	n n	44
13	– (Unused)	_	atta. P		and that all	342.9
14	– (Unused)	ٽين.	orne	~34	n" _auton	~
15	– (Unused) TRQ-M	- www.iCh		June 1. Ch	and Market	Sand Star
	Torque monitor 3.2.12	1	8	1.	9.	6
17 Jan	VTG-M Speed monitor <i>3.2.12</i>		ornatelka	×S	ma <sup>byla</sup> " . of	6340 ×
	WI HBUT	WI GDOD		W. GDau	W. Ball	ward C

С



	Salle		13 <sup>13</sup>		Call		ballon	
Specifi- cations		dard cations	Absolute Encoder	Speed Coincide Output	Zero- clamp	Speed Cont Torque Feed	rol with Forward	Torque Control I
Memory Switch Setting	Standare (Cn-02 I	d Setting BitB = 0)	Cn-01 Bit 9 = 1	Cn-01 Bit 4 = 1	Cn-01 Bit A = 1 Bit B = 0	Cn-01 Bit	F=1	Cn-01 Bit A = 0 Bit B = 1
33	PAO	PG signal output	23	5	-alth	9 <sup>0</sup> 0	~auton"	~
34	*PAO	phase-A <i>3.2.3</i>	. carnilly		CALWIN OF	5	AND CL	, and S
35	PBO	PG signal output	2	~	2	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		2
36	*PBO	phase-B <i>3.2.3</i>		TON A.Y		Cathrait	C. S. N. C.	X
37	ALO1 Alarm code (Open colle	e output	anner 10000	,0^``	www.chaite	3°	WHICH DOUTON	and the second
38 👌	ALO2	3.7.1		6		6		9
CONNO.	Alarm code (Open coll			Mabka.		Cally a.	madre	, <sup>2</sup>
39	ALO3 Alarm code (Open coll		www.cbal		www.dbaut	5	M. GD2010	and the second
~		<b>3.7.1</b>		6		6		6
40	S-ON Servo ON	input		Maryka.		Call No.	Class of the	
41	P-CON P control ir	<i>3.7.2</i>	JANNI (BBI)	Υ. Υ	P-CON Zero-clamp operation	-	M. GDaute	anna 10
~	- J. a	3.6.4	1	~	reference	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		2
42	P-OT Forward ro prohibited	tation		omabylait	3.4.3	CONNO.Y	tomaste	X
43	MAL ODO	3.1.2	whichor		WW. OBOUT		AN. GOOL	And Marken I.
43	N-OT Reverse ro prohibited	otation	12	, Ì	4	19.		3 <sup>3</sup> (2
44	ALM-RST	3.1.2		ornatistic		matthait	. of 3 de	
44	Alarm rese	t input <i>3.7.1</i>	W.GDOU		W. GDSUN		Wildbaur	
45	P-CL Forward to ON input		Ser.	à	Annal I	di di	A	d.
Call No.		3.1.3		all all the second		CONTRACTION OF THE OWNER	Stra Ma	

	abauton.	doauton.		doauton.	douton.	
Specifi- cations	Standard Specifications	Absolute Encoder	Speed Coincide Output	Zero- clamp	Speed Control with Torque Feed Forward	Torque Control
Memory Switch Setting	Standard Setting (Cn-02 BitB = 0)	Cn-01 Bit 9 = 1	Cn-01 Bit 4 = 1	Cn-01 Bit A = 1 Bit B = 0	Cn-01 Bit F = 1	Cn-01 Bit A = 0 Bit B = 1
46	N-CL Reverse torque limit ON input 3.1.3	ANI-OBOLION		www.closuton.	www.cballon	Star Market
47 47	+24VIN I/O power supply 3.2.4		10. 10. 10.		yeard and a solution	4 10,
48 4 <sup>0</sup>	– (Unused)	PSO Phase-S signal output 3.8.5		MANA COBULOR	www.cbaucon	n. Marine
49	– (Unused)	*PSO Phase-S signal output	aka.el	-automa	ka.pl	10.
50	FG Frame ground	3.8.5		annel.CV	-anne GL	Starter .
Mart .	umns.	<b>r</b> " represen	v Its a sectior	.000	ions" column is also applica responding to each signal n	

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# List of Input Signals in Speed/Torque Mode (2) (1CN Terminal No.)

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VANAL GEORGE

all and	20/10-7	all Marx	all he	all and		
S.C.	tome	torne	Home		SUL	
Specifi- cations	Standard Specifications	Brake Interlock Output	M <sup>MIO</sup>	Speed Control	Speed Control with Torque Limit by Analog Voltage Reference	
Memory Switch Setting	Standard Setting (Cn-02 bitB = 0)	Cn-01 Bit E	Cn-02   Cn-01 Bit B = 0	Bit 2 = 1 Cn-01 Bit B = 1	Cn-02 Bit F = 1	
1	SG	,°`	WH. Chanto.	WHICH DOUT	and the second	
2	SG	7		4	Nº Nº	
3 (kan)	GND - (Unused)	natikani	nadha	3	Callen	
4	_ (Unused)	50°	10autor	1001		
5	V-REF Speed reference input	4	- (Unused)	V-REF Speed reference	V-REF Speed reference	
	3.2.1	Ś	3.2.6	3.2.6	3.2.9	
6	SG	1 No	SG	SG	SG	
	GND	LOL.	GND	GND	GND	
7	10 <sup>1</sup>		3.2.6	3.2.6	3.2.9	
7	- (Unused)	4		4	Sec. 1	
8	– (Unused)	NO.P	NO.	ġ.	J.C.R.	
9	T-REF Torque reference input	Lonator.	automatyr		T-REF Torque limit input	
10	3.2.7 SG		CANI-BOC	www.dbaut	3.2.9 SG	
	GND	4	D.a.	in and	SG GND	
2.2	La.g.	22		à.	3.2.9	
110	– (Unused)	anatol	mater		Call.	
12	– (Unused)	5	doann	dbaut	Z	
13	(Unused) - (Unused)	į,	Mr. C.	4 Marth 1. 1	Man Mill	
14	– (Unused)	2		3	, d	
15	– (Unused)	onaby	onabyte		Carden and Carden	
	www.ithat www.itha	2.	(dbaur	. Abab	e	
)	and the second is			S. A. A.	Salah?	

÷	34 <sup>2</sup> ,2	and the design of the second s		etykanti		CONC.	
alton		autor.	- altor		-auton.	-auton.	autor
N.GOL	Specifi- cations		Brake Interlock Output	Contact Input	Speed Control	Speed Control with Torque Limit by Analog Voltage Reference	
automa	Memory Switch Setting	Standard (Cn-02 b	I Setting bitB = 0)	Cn-01 Bit E	Cn-02 Cn-01 Bit B = 0	Bit 2 = 1 Cn-01 Bit B = 1	Cn-02 Bit F = 1
	16 40 <sup>00</sup>	TRQ-M Torque monitor	3.2.12	and	8	ANN HILLS	anner.C
	17 Na.P	VTG-M Speed monitor	3.2.12		1×3.9		te di
	18	– (Unused)	.6	E.	onats	. Sha	
	19	PCO	PG signal output phase-C	and and a start	90000	WWW.GBOULT	MAN. BOUT
	20	*PCO	1			4	14
ž	21		3.2.3	50K2.01	2542.01	ă	¥ <sup>2,0</sup>
Caltono	22	(Unused) -	~allon		Baltone	waitome	
A.C.	23 <sub>44</sub> 44	(Unused) +15V	Power for speed/	ALANA A	651	ALACAN, CL	And Marken
	24	-15V	torque reference	NO.S.	12.Q		12.D
autoria	25	CLT+	3.2.1 Torque limit detection	80	automaty	automat	
A. Hobaltome	26	CLT-	output 3.1.3	and a second	80.	Mary Milde	www.cpaute.
	27	TGON+	TGON output signal	TGON+ Brake interlock signal	Straight		Kali
A. OBAUTORIO	28	TGON-	3.7.5	3.4.4 TGON+ Brake interlock signal	doantomo		www.chauter
				3.4.4		ny ny	Nº Nº
	29 30	S-RDY+	Servo ready output	Ha.g.	N3.9		13. A.
S.S.	30	ALM+	<b>3.7.6</b> Servo alarm	3101	Chatty.	and a second	8°
doalle.	32	ALM-	output 3.7.1		10autro	abaute.	
A.I. Obaltome	33	PAO	PG signal	arara .	$\sim$	and M.C.	www.cball
	34	*PAO	output phase-A <i>3.2.3</i>	6	6		8
rebautoma	34°.	, lobaltomatikov	. Idhauton	13 B Ka.	diautomatiko.	. Idhallomat	ska
	454	14°.	Andre .	And And		Acher .	451

	ballon		, Stol	1021101	10011C	
Specifi- cations	Standard S	pecifications	Brake Interlock Output	Contact Input	Speed Control	Speed Control with Torque Limit by Analog Voltage Reference
Memory Switch Setting	Standar (Cn-02	d Setting bitB = 0)	Cn-01 Bit E	Cn-02 E Cn-01 Bit B = 0	Bit 2 = 1 Cn-01 Bit B = 1	Cn-02 Bit F = 1
35 36	PBO *PBO	PG signal output phase-B <i>3.2.3</i>	4	M <sup>MI</sup>	www.loba	anner C
37 natykani	ALO1 Alarm code out (Open collector	put	onabhail	onadica	2	(ratho.)
38	ALO2 Alarm code out (Open collector		3	and to ball	www.cbau	-arean, c
39	ALO3 Alarm code out (Open collector	put ) <i>3.7.1</i>	natyka,pl	natykar	2	Cathend
40	S-ON Servo on input	3.7.2	10 <sup>1</sup>	, coloautor	, dbaut	5. 5.
41	P-CON P control input	3.6.4	3	in and a second s	A. M. A.	A MARINE
42 Matyka R	P-OT Forward rotatio	, Ś	comatyka,pl	tonabler	2	natha d
43	N-OT Reverse rotatio	n prohibited 3.1.2	4	N <sup>MI</sup> GDOC	MANNIG BOL	ALANA
44	ALM-RST Alarm reset inp	ut 3.7.1	abhail	ablai	<u> </u>	at942.91
45	P-CE Forward torque	limit ON input 3.1.3	LOTTU LOTTU	waitobaltorne	P-CL Contact input speed control 1 <i>3.2.6</i>	See marked
46	N-CE Reverse torque	limit ON input	- SHOLD	N-CL Contact input speed control 2	N-CL Contact input speed control 2	Well W
47	+24VIN I/O power supp	ly <b>3.2.4</b>	ion <sup>io</sup>	3.2.6	3.2.6	No.
48	 (Unused) 	10	1 10	84°	in a start and a start	a and a series of the series o
Lachar.	(Unused)	[0***	offatha.	onalya.		Strand Strand

	allaulo. allaulo		doautor.	dbauton.	
Specifi- cations	Standard Specifications	Brake Interlock Output	Contact Input	Speed Control	Speed Contro with Torque Lin by Analog Voltage
29	A REAL PROPERTY AND A REAL	19. N	A.S.		Reference
Memory Switch Setting	Standard Setting (Cn-02 bitB = 0)	Cn-01 Bit E	Cn-02 Cn-01 Bit B = 0	Bit 2 = 1 Cn-01 Bit B = 1	Cn-02 Bit F = 1
50	FG Frame ground 3.2.3	March	S.	ANNIE STANIE	ANNIN STRANG

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WWW.GBallon

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# List of Input Signals in Speed/Torque Mode (3) (1CN Terminal No.)

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C Crocold	Chandered On a still stall still sti	and the second s	- All	Control	C. A.S.
Specifi- cations	Standard Specifications		lorque	e Control II	D.
Memory Switch	Standard Setting (Cn-02 bitB = 0)		Cn-01 Bi	t A = 1, B = 1	Ale
Setting	(CII-02 DILB = 0)	P-CON = OFF	0= 01	P-CON = ON	19.
ad tail	Wall	50H2.P	Cn-01 Bit F = 0 Cn-02 Bit F = 0	Cn-01 Bit F = 0 Cn-02 Bit F = 1	Cn-01 Bit F = 1 Cn-02 Bit F = 1 or 0
(1°	SG	KOMIO	Horris	1	
	GND	5°	NIGOOL	WIGDOL	4
2	SG	2	2	-3-5-5	and a state
~	GND	6		h	6
3	– (Unused)	advar	advo		AND
4	– (Unused)	MON'	all off	- all	
5	V-REF Speed reference input	V-REF Speed limit	V-REF Speed	V-REF Speed	V-REF Speed
	3.2.1	value 🔍	reference 3.2.7	reference 3.2.7	reference 3.2.7
6	SG	SG SG	SG 5.2.7	SG 5.2.7	SG
Carlow	GND Martin	GND 3.2.7	GND 3.2.7	GND 3.2.7	GND 3.2.7
7		3.2.7	0 3.2.7	5.2.1	3.2.1
8	(Unused)	-	R.M.	ANNON!	and a start
9	(Unused) T-REF	T-REF		T-REF	T-REF
- Steller	Torque reference input	Torque reference	(Unused) <i>3.2.7</i>	Torque limit value	Torque feed forward reference
10	3.2.7 SG	3.2.7 SG	SG	3.2.7 SG	3.2.7 SG
	GND	GND	GND	GND	GND
10	2 <sup>10</sup> - 2 <sup>10</sup>	3.2.7	3.2.7	3.2.7	3.2.7
6	_ (Unused)	Ŕ	~		2
12	– (Unused)	andro	Catol No		Caller
13	_ (Unused)	S.C.	1001101	- aut	þr.
14	– (Unused)	1	and St.	and H. Or	and a series
15	_			14	24
16	(Unused) TRQ-M	×2.9	N.D.	2	12.9
Card.	Torque monitor 3.2.12	ornater	officity.		Cart's
-	aballer 10	300	(Days)	.10015	C. Man

-	40.Q	and that		at3143.91	at 140.01	, ă	34 <sup>2,2</sup>
allon'		-auton.	~3 <sup>110</sup>		~auton.	~auton.	~~~ <sup>3</sup>
	Specifi-	Standard Sp	ecifications		Torque	Control II	WW.CP
	cations Memory	Standard Setting		24	Cn-01 Bi	t A = 1, B = 1	1 miles
	Switch Setting	(Cn-02 I	oitB = 0)	P-CON = OFF	0	P-CON = ON	A.3
autorna	2	-automatyr	autor	40 <sup>1</sup>	Cn-01 Bit F = 0 Cn-02 Bit F = 0	Cn-01 Bit F = 0 Cn-02 Bit F = 1	Cn-01 Bit F = 1 Cn-02 Bit F = 1 or 0
, 	17	VTG-M Speed monitor	3.2.12	A MAN	<u>()</u>	4 Martine Co	www.lot
	18	– (Unused)		à	Ś		à
,on <sup>a</sup>	19	PCO	PG signal output phase-C	50Mort	tornable.	toma	40°
,	20	*PCO	3.2.3	man	dbau.	MARING DOUL	-www.ldDail
		– (Unused)	24	24		24	24
	22	– (Unused)		12.01	102		19.91
JORA	23	+15V	Power for speed/ torque	3191 <sup>-</sup>	automatyle	automa	87 
<i>o</i> -	24	-15V	reference		8°°	ALCO'	11/0°
	54		3.2.1	ANNA ANA		ANN ANN	in the second
	25		Torque limit detection output	Ma.P	Ma.C.		12.Q.
	20	offair	3.1.3	E.	. Alan	-010	р ,
and a	27	TGON+	TGON output signal		Spanne -	apour.	South Star
	28	TGON-	3.7.5	ALAN A	~	S. M. M.	www.gbau
	29	S-RDY+	Servo ready output	1		1.	1
	30	S-RDY-	3.7.6	NO.R	12.2		10.9.
30	31	ALM+	Servo alarm output	3.01	110mater	Itono	8
0	32	ALM-	3.7.1	1	Soon -	1. Char	www.idbai
	33	PAO	PG signal output phase-A	Arner .		Martha Martha	ALANCE .
	34	*PAO	3.2.3	No.S.	N2.9		12. S
automat	35	PBO	PG signal output phase-B	30.	automator.	automat	a. L
- -	36	*PBO	. (S'	h.	60	MIGDE	www.idbai
	37	ALO1	3.2.3	ANN A		in and	A.M.
.3	140.Q	Alarm code outp (Open collector)	out <i>3.7.1</i>	-14 <sup>2,0</sup>	14 <sup>3</sup> ,2		12. 12.
autorna		dbautomat.	dbauton		dbautomar	dbautome	Ball
	. A	de.	and and it is	and a		S. M. M.	455

	102111	200	102110	102111					
Specifi- cations	Standard Specifications	3	Torque	Control II	Sec. 1				
Memory Switch	Standard Setting		Cn-01 Bit A = 1, B = 1						
Setting	(Cn-02 bitB = 0)	P-CON = OFF		P-CON = ON	A.3				
Califf	nautomatyle	stomatyt-	Cn-01 Bit F = 0 Cn-02 Bit F = 0	Cn-01 Bit F = 0 Cn-02 Bit F = 1	Cn-01 Bit F = 1 Cn-02 Bit F = 1 or 0				
38	ALO2 Alarm code output (Open collector) 3.7.1	2	NN C	Margan.C.	anal and				
39 Nain <sup>ka o</sup>	ALO3 Alarm code output (Open collector) 3.7.1	onatika.pl	ionadka.	e xc	nacha.pl				
40	S-ON Servo on input 3.7.2	2	NNI-GOOLL	MANI GDOLL	and the second				
41 (442.0)	P-CON P control input 3.6.4	P-CON Torque/speed control switch	P-CON Torque/speed control switch	P-CON Torque/speed control switch	P-CON Torque/speed control switch				
E.	P-OT	3.2.7	3.2.7	3.2.7	3.2.7				
42	Forward rotation prohibited 3.1.2 N-OT Reverse rotation prohibited 3.1.2		and Chart	www.dball	want want				
44	ALM-RST Alarm reset input 3.7.1	10math	.N.FOBALLOMADY	N.Gbaute	Cardin and				
45	P-CL Forward torque limit ON input	2		Maria .	A.M.				
46	3.1.3 N-CL Reverse torque limit ON input 3.1.3	tomatka.pl	automatoka	and and a second se	RANKA PI				
47	+24VIN I/O power supply 3.2.4	Ľ	NNAL COL	And Marken Color	And and				
48	– (Unused)		No	t.	142.91				
49	– (Unused)	onats	onaty.		Car				
50	FG Frame ground 3.2.3		NW. GBalle	and diale	- Aller				

Note Information described in the "Standard Specifications" column is also applicable to blank columns.

www.coautomatik Number "x.x.x" in box represents a section number corresponding to each signal name. For example, 3.2.3 represents Section 3.2.3.

Mary M. CO 456

# 12 Positions

-340.9

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List of I/O Signals IN Position Control Mode (1) (1CN Terminal No.)

Specifi- cations	Standard Specifications	Absolute Encoder	Brake Interlock	INHIBIT Input	Contact In Con	put Speed
Memory Switch Setting	Standard Setting (Cn-02 Bit B = 1)	Cn-02 Bit 9 = 1	Output Cn-01 Bit E = 1	Cn-01 Bit F = 1 Cn-02 Bit 2 = 0	Cn-01 Bit F = 0 Cn-02 Bit 2 = 1	Cn-01 Bit F = 1 Cn-02 Bit 2 = 1
OUG NO.	SG	tomatic	.8	STUBILIE	110marylo	-
2	SG GND		WWW.GDOL	www.to	Se	ANNA ISS
3	PL1 Power for open collector reference 3.2.2	201K2.01	4	a Bread	213423.D	
4	– (Unused)	SEN Sensor ON signal	W. GBall	ST	Sautorne	NAL BR
5		3.8.5	4	A.M.		32
6	 (Unused) SG GND	mattha		1789K2.0	matykap	
7	PULS Reference pulse input	Caller .	www.chaut	www.el	(Unused) <i>3.2.6</i>	PULS Reference pulse input 3.2.2
8 18 19	*PULS 3.2.2	matthen		Nathe Pl	- (Unused) <i>3.2.6</i>	*PULS Reference pulse input <i>3.2.2</i>
9 10	_ (Unused) SG	Bullon	WWW.GDaut	or .	Callo.	and CO
1	GND		24	4		14
11 A	SIGN Reference sign input	-onadka.pl		matthe	– (Unused) <i>3.2.6</i>	PULS Reference pulse input <i>3.2.2</i>
12	*SIGN 3.2.2	BULL	Wark Gbain	anava.co	(Unused) <i>3.2.6</i>	*PULS Reference pulse input 3.2.2
13	PL2 Power for open collector reference	-ather		~85/8.Q	at the p	
ou.	3.2.2	-SUTOTI-	~35	50°	18100TT	

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Ha.A

www.dbailor

140.01

Switch Setting $(Cn-02 Bit B = 1)$ Bit 9 = 1Bit E = 1 $Cn-02 Bit 2 = 0$ $n = 0$ $Cn-02 Bit 2 = 0$ $n = 0$ 		10211011	1081HOT	X	Dauton	10autor	
Switch Setting $(Cn-02 Bit B = 1)$ Bit 9 = 1Bit E = 1Cn-02 Bit 2 = 0 $n = 0$ Cn-02 Bit 2 = 0 $n = 0$ Cl Cl R $n = 0$ Cl Cl Cl R $n = 0$ Cl Cl R $n = 0$ Cl Cl Cl R <th< th=""><th></th><th>Standard Specifications</th><th>Absolute Encoder</th><th>Interlock</th><th></th><th>Contact Ir Cor</th><th>iput Speed htrol</th></th<>		Standard Specifications	Absolute Encoder	Interlock		Contact Ir Cor	iput Speed htrol
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Switch	Standard Setting (Cn-02 Bit B = 1)			Cn-01 Bit F = 1 Cn-02 Bit 2 = 0	= 0 Cn-02 Bit 2	Cn-02 Bit 2
15       CLR $\stackrel{+}{}$ CLR $\stackrel{+}{}$ CLR Clear input         16       TRO-M Torque monitor       3.2.12 $3.2.6$ 3.2         17       VTG-M Speed monitor       3.2.12 $3.2.6$ $3.2.6$ 18       PL3 Power for open collector reference $3.2.2$ $3.2.7$ 19       PCO       PG signal output phase-C $3.2.3$ 21 $\frac{1}{(Unused)}$ $\frac{BAT+}{battery +}$ input $3.8.5$ 22 $\frac{1}{(Unused)}$ $\frac{BAT-}{battery -}$ input $3.8.5$ 22 $\frac{1}{(Unused)}$ $\frac{BAT-}{battery -}$ input $3.8.5$ 23 $\frac{1}{(Unused)}$ $3.8.5$ 23 $\frac{1}{(Unused)}$ $\frac{1}{25}$ $\frac{1}{COIN+}$	14	*CLR Clear input	ALDBURG.	10	auc	_ (Unused)	CLR Clear input
16       TRQ-M Torque monitor       3.2.12         17       VTG-M Speed monitor       3.2.12         18       PL3 Power for open collector reference       3.2.2         19       PCO       PG signal output phase-C         20       *PCO       3.2.3         21	15	<i>d</i> . <i>d</i> .	¢,	and a start	14	-	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	and the R	TROM	natyle	<u>,</u> 2	Calles P.		<i>3.2.2</i>
Speed monitor3.2.1218 $PL3$ Power for open collector reference3.2.219PC0PG signal ophase-C20*PCO $Orgonization diputphase-C21(Unused)BAT+Backupbattery +inputBAT-Backupbattery -input22(Unused)BAT-Backupbattery -input23(Unused)S.8.523(Unused)S.8.524(Unused)Orgonization diputpositioningcomplete25OIN+Positioningcomplete$		Torque monitor 3.2.12	e topattor	jõ	autor.	1. dpaulor.	, tê
Power for open collector reference3.2.219PC0PG signal output phase-C20*PC03.2.321 $(Unused)$ $I = 10^{-10}$ $I = 1$	17	Speed monitor	2	in and a second s	4	la.	A. A.
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	18 Cather	Power for open collector reference	anathe	10.	maskall	mathe	0.
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	19	PCO PG signal output	ALGORITO AND	, NIC	a <sup>deo</sup>	ALGDOUTC	. Miles
(Unused) Backup battery + input   22 -   (Unused) 3.8.5   23 -   24 -   25 COIN+   Positioning complete	20	*PCO	1997 - 19	and	4	24	A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.A.
22     - (Unused)     BAT- Backup battery - input       23     - (Unused)       24     - (Unused)       25     COIN+	21 AN	– (Unused)	Backup battery + input	<u>,</u> ,8	automatyka.pl	-doautomatike	5. 5.
23     -       24     -       25     COIN+       Positioning complete	22		BAT- Backup battery - input	.e.	adhailt w	an' an	and and a second of the second of the second of the second
complete	23	_ (Unused)	-ballone	~	automo	-ballomo	à
complete	24		AN <sup>1.0</sup>	y way way	rh.	A. C.	ANNA!
3.7.3	26	COIN- complete		<u>à</u>	-1K2.P	-Marine Marine	9
27 TGON+ TGON output signal TGON+ Brake interlock signal 344	27	TGON+ TGON output signal	NAIDONICOROC.	Brake interlock signal	automats	A. Indiautomats	amic
28 TGON- 3.7.5 TGON- Brake interlock	28	TGON- 3.7.5		TGON- Brake	and and a second s		10.

dra ?	and the second s	2	13×31.9		10 <sup>140,01</sup>	ad to A	
	ballon		Sauton	Sall	on	auton	2
Specifi- cations	Standard S	pecifications	Absolute Encoder	Brake Interlock Output	INHIBIT Input	Contact Ir Con	nput Speed ntrol
Memory Switch Setting	Standar (Cn-02 I	d Setting Bit B = 1)	Cn-02 Bit 9 = 1	Cn-01 Bit E = 1	Cn-01 Bit F = 1 Cn-02 Bit 2 = 0	Cn-01 Bit F = 0 Cn-02 Bit 2 = 1	Cn-01 Bit = 1 Cn-02 Bit : = 1
29	S-RDY+	Servo ready output	Salles	. ADBIL		Saller.	S
30	S-RDY-	3.7.6		and the second	and the second se	a	S. M. M. S.
31	ALM+	Servo alarm output	2	1.	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	2	1
32	ALM-	3.7.1	25H2.9		~35H2.P.	~80H2.9	
33	PAO	PG signal output	autor	a.S	50.	auton	
34	*PAO	phase-A	5°°	MANIN' COO	-aval	\$°	and in the
35	PBO	<i>3.2.3</i> PG signal output		4	14		4
36	*PBO	phase-B <i>3.2.3</i>	AK3.9		N43.91	ALO.O	
37	ALO1	Alarm code output	automaty	- All	STIRE	automan	
38	ALO2	(Open collector)		. Junni Co	State of the state	8	JANA I.S
10		3.7.1		1	100		14-
39 40	ALO3	d'	NO.P		N.º. ?	N2.91	
3	Servo ON inp	out 3.7.2	onabl		STUBEY.	-ornatol	
41	P-CON		Selon .	, Bay	P-CON	P-CON	P-CON
14	P control inp	ut "varadita		and all.	INHIBIT input	Rotation direction	Rotation direction
41		3.6.4		2ª	3.2.10		reference a contact
NO.P	NE	2	19.DI		10.2 ×	input speed control	input speed control
31	and of		mater		Class.	3.2.6	3.2.0
42	P-OT	tion	Salle .	10215		Salle Fine	20
42	Forward rota prohibited	Ch.		Mary	. water	8	and in
43	N-OT	3.1.2		41	14		24
22	Reverse rota	tion	2. Charles		2	Pa.	
St.	Sec.	3.1.2	Cald Mar		a and the	Card Mar	
44	ALM-RST Alarm reset i	nput	all of	35	р. <sup>-</sup>	all <sup>OL</sup>	
45	P-CL	3.7.1	)	W.GD	1.450	P-CL	P-CL
40	Forward torq	ue limit ON		1 de la	All A	Contact	Contact
6	input	3.1.3	6		0	input speed control 1	input speed control 1
Ho.	and they	ò."	all and an		all an	3.2.6	3.2.
<u> </u>	NOT S		HOLE	.8	on	, tor	
	doar		3 <sup>2</sup> ~	dbar		Par	S
	Car.	and and and a			and the		45

#### LIST OF I/O SIGNALS

Specifi- cations	Standard Specifications	Absolute Encoder	Brake Interlock Output	INHIBIT Input		nput Speed ntrol
Memory Switch Setting	Standard Setting (Cn-02 Bit B = 1)	Cn-02 Bit 9 = 1	Cn-01 Bit E = 1	Cn-01 Bit F = 1 Cn-02 Bit 2 = 0	Cn-01 Bit F = 0 Cn-02 Bit 2 = 1	Cn-01 Bit F = 1 Cn-02 Bit 2 = 1
46	N-CL Reverse torque limit ON input 3.1.3	41-0 <sup>1/2011</sup> 0	Mary C	Bile white	N-CE Contact input speed control 2	N-CL Contact input speed control 2
47 <sub>Ka</sub> P	+24VfIN I/O power supply <i>3.2.4</i>	onatyke	Q.	matikan	3.2.6	3.2.6
48	– (Unused)	PSO Phase-S signal output	anna C	Bill way	and Balle	Mark C
49	– (Unused)	3.8.5 *PSO Phase-S signal output 3.8.5	Q.	automat Walt	dballomathe	\$. 5.
50	FG Frame ground <i>3.2.3</i>		ANNON'	and a		
marka.k	Note Information describ	ped in the "Sta	No. 10 Specif	fications" column is a	also applicabl	e to blank col

- Information described in the "Standard Specifications" column is also applicable to blank col-Note umns.
  - Number "x.x.x" represents a section number corresponding to each signal name. For example, 3.2.3 represents Section 3.2.3.

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Positions

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List of I/O Signals IN Position Control Mode (2) (1CN Terminal No.)

2	Position:		1		1
		•	Ś	à	à
	te.	all to	- ALY CO.	all the second	allho
Wildbalton	Specifi- cations	Standa	ard Specifications	CCW Pulse + CW Pulse	90°Dirrerence Two-phase Pulse Reference
we altoria	Memory Switch Setting	Sta (C	andard Setting n-02 Bit B = 1)	Cn-02 Bit 5, 4, 3 = 0, 0, 1	Cn-02 Bit 5, 4, 3 = 0, 1, 0 $(\times 1 \text{ multiplication})$ = 0, 1, 1 $(\times 2 \text{ multiplication})$ = 1, 0, 0 $(\times 4 \text{ multiplication})$
ANNON!!!	2	SG GND SG	Martilloo	www.coo	100 Martine 100
1000	3 4	GND PL1 Power for open o - (Unused)	collector reference 3.2.2	abautonabhaite	ballomatha.b.
2	5 6	_ (Unused) SG	when .	www.	www.it
Will Bautomat	7	GND PULS	Reference pulse input	PULS Forward reference pulse input (CCW) 3.2.2	PULS Phase-A reference pulse input 3.2.2
4	8 44	*PULS	3.2.2 S	*PULS Forward reference pulse input (CCW) <i>3.2.2</i>	*PULS Phase-A reference pulse input <i>3.2.2</i>
.S <sup>10</sup>	9 10	– (Unused) SG	udballomats.	aballonaby	ballomats
N <sup>M<sup>A</sup></sup>	11 A <sup>44</sup>	GND SIGN	Reference sign input	SIGN Reverse reference pulse input (CW) 3.2.2	SIGN Phase-B reference pulse input 3.2.2
, dbautorne	12	*SIGN	3.2.2	*SIGN Reverse reference pulse input (CW) <i>3.2.2</i>	*SIGN Phase-B reference pulse input 3.2.2
	13	8	collector reference 3.2.2	and and and	and man.
×	14 15	*CLR CLR	Clear input	-atonatics	-atomatike -att
Margaret. GL	4 hr	N.ICh.	www.lob	Aranal Aranal	461

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# LIST OF I/O SIGNALS

	allor .	autor	auton	allon .
Specifi- cations	Stand	ard Specifications	CCW Pulse + CW Pulse	90°Dirrerence Two-phase Pulse Reference
Memory Switch Setting	Sta (C	andard Setting n-02 Bit B = 1)	Cn-02 Bit 5, 4, 3 = 0, 0, 1	Cn-02 Bit 5, 4, 3 = 0, 1, 0 (× 1 multiplication) = 0, 1, 1 (× 2 multiplication) = 1, 0, 0 (× 4 multiplication)
6	TRQ-M Torque monitor	Man	Non A	a and a second s
7 Hard	VTG-M Speed monitor	3.2.12	nabka.pl	Master of
8	PL3 Power for open of	collector reference 3.2.2	N.Glautor	MIGBOILON.
9	PCO	PG signal output phase-C	All A	t she
0	*PCO	3.2.3		× .
1310.0	– (Unused)	<u> </u>	~39K3.01	~3 <sup>3</sup> / <sup>3</sup> . <sup>9</sup>
2	– (Unused)	.103 <sup>110711</sup>	doauton.	ABRITON'
3	– (Unused)	N. N	and the second second	and and
4				
5 10	(Unused)	Positioning complete signal	NO.S.	10.St
6	COIN-	3.7.3	- Clark	CO201
7	TGON+	TGON output signal	walto.	~auto.
8	TGON-	. (ST	N.C.	and the second
	58	3.7.5	all a	te stat
9	S-RDY+	Servo ready output		
0 0	S-RDY-	3.7.6	N2.9	14 <sup>3</sup> .9'
101	ALM+	Servo alarm output	a fight	an <sup>ab</sup>
2	ALM-	3.7.1	wallto.	walle.
3	PAO	PG signal output phase-A	M.OV	ALCH AL
4	*PAO	3.2.3	All A	1 - A <sup>A</sup>
5	РВО	PG signal output phase-B		
6 🖉	*PBO	3.2.3	NO.S	12.9
7	ALO1	Alarm code output	and the	Taby.
8	ALO2	(Open collector)	autor.	ultor.
9	ALO3	3.7.1	, die	de la companya de la comp
0	S-ON Servo ON input	3.7.2	Margar. 4	an' anal
1 10 <sup>10</sup> .9	P-CON P control input	3.6.4	addra ?	- Stan
0	*0 <sup>60**</sup>	3.0.4	. S <sup>2</sup>	×0 <sup>1</sup> 0
			.N.O.	

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fe <sup>.S</sup>	AND	Table ?	Call Mark	Carly
	toalton.	103 <sup>11011</sup>	toauton toauton	
Specifi- cations	Standard Specifications	CCW Pulse + CW Pulse	90°Dirrerence Two-phase Pulse Reference	I
Memory Switch Setting	Standard Setting (Cn-02 Bit B = 1)	Cn-02 Bit 5, 4, 3 = 0, 0, 1	Cn-02 Bit 5, 4, 3 = 0, 1, 0 $(\times 1 \text{ multiplication})$ = 0, 1, 1 $(\times 2 \text{ multiplication})$ = 1, 0, 0 $(\times 4 \text{ multiplication})$	ROOM
42	P-OT Forward rotation prohibited 3.1.2	2	1	I
43	N-OT Reverse rotation prohibited 3.1.2	2	That Wall	Carly
44	ALM-RST Alarm reset input 3.7.1	dballo.	Soatton	у. Г
45	P-CL Forward torque limit ON input	3 b	6	
46	N-CL Reverse torque limit ON input 3.1.3	3 .onahka.t	-ornatykan	S. COL
47	+24VIN I/O power supply 3.2.4	4 sented and sented	Staute weekstau	I
48	_ (Unused)		34°	I
49	_ (Unused)		- SHAR	200
50	FG Frame ground 3.2.3	3	NSUCOT NEWS	S.

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Note Information described in the "Standard Specifications" column is also applicable to blank columns. Number "x.x.x" represents a section number corresponding to each signal name. For example, 3.2.3 represents Section 3.2.3.

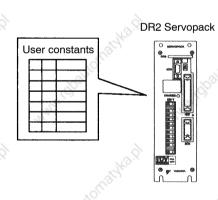
# Appendix **J**

# List of User Constants

•  $\Sigma$ -Series Servopacks provide many functions, and have parameters called "user constants" to allow the user to select each function and perform fine adjustment. This appendix lists these user constants.

• User constants are divided into the following two types:

1) Memory switch Cn-01, Cn-02	Each bit of this switch is turned ON or OFF to select a function.
2) User constant setting Cn-03 and later	A numerical value such as a torque limit value or speed loop gain is set in this constant.



- **Note** 1) Some user constants for speed/torque control and position control are different. Always refer to the correct list of user constants for the Servopack type.
  - 2) Refer to Chapter 3 for details of how to use user constants.
  - 3) For details of how to set user constants, refer to *Section 4.1.5 Operation in User Constant Setting Mode*.

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#### LIST OF USER CONSTANTS



# For Speed/Torque Control

## List of User Constants (User Constant Setting)

mabkart	L	ist of User	Constants (User	Constant	Setting)	34°×	automatyk	9.x
Category	User Constant No.	Code	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Remarks
	Cn-00	Not a user	constant. (Cn-00 is ι	used to sele	ect special	mode for digital	operator.)	
2	Cn-01	Memory sw	vitch (see on page 46	58.)		200		See note 1
and the	Cn-02	Memory sw	vitch (see on page 46	69.)	ð	3	d	See note 1
Gain Related Constants	Cn-03	VREFGN	Speed reference gain	(r/min)/V	10 10 m	2162	500	See 3.2.1, 3.2.7.
	Cn-04	LOOPHZ	Speed loop gain	Hz	¢P.	2000	80	See note 2 See 3.5.2, 3.6.1, 3.6.2.
-142.Pl	Cn-05	PITIME	Speed loop integration time constant	0.01ms	2	10000	2000	See note 2 See 3.5.2, 3.6.1, 3.6.2.
tomats	Cn-1A	POSGN	Position loop gain	1/s	1 (dbautorna	500	40	See note 2 and 3 See 3.5.2, 3.6.1, 3.6.2.
Torque Related Constants	Cn-13	TCRFGN	Torque reference gain	(0.1 V/rated torque)	10	100	30	See 3.2.7, 3.2.8, 3.2.9.
	Cn-06	EMGTRQ	Emergency stop torque	%	0	Max. torque	Max. torque	See 3.1.2.
POLIO	Cn-08	TLMTF	Forward rotation torque limit	%	0 JUDONIO	Max. torque	Max. torque	See 3.1.3.
	Cn-09	TLMTR	Reverse rotation torque limit	%	000	Max. torque	Max. torque	See 3.1.3.
	Cn-14	TCRLMT	Speed limit for torque control I	r/min 🔌	0	4500	4500	See 3.2.7.
Call A.R.	Cn-17	TRQFIL	Torque reference filter time constant	្100 μs	0	250	4	See 3.5.5.
Roll.	Cn-18	CLMIF	Forward external torque limit	%	0 Jon	Max. torque	100	See 3.1.3.
	Cn-19	CLMIR	Reverse external torque limit	%	0	Max. torque	100	See 3.1.3.
Sequence Related Constants	Cn-07	SFSACC	Soft start time (acceleration)	ms	0	10000	0	See note 4 See 3.2.6, 3.5.1.
tonative	Cn-23	SFSDEC	Soft start time (deceleration)	ms	0 utoma	10000	0 tomath	See note 4 See 3.2.6, 3.5.1.
	Cn-0B	TGONLV	Zero-speed level	r/min	18	4500	20	See 3.7.5.
	Cn-12	BRKTIM	Time delay from brake reference until servo OFF	10 ms	0	50	0	See 3.4.4.
onabkap	Cn-15	BRKSPD	Speed level for brake reference output during motor operation	r/min	0	4500	100	See 3.4.4.
66	and the		www.idbat		A.I. Opau	and the second	idpan	Ser. 1

	TO .	76.		"Office"		. office		. 6	
						Sallin			
scorol. C	Category	User Constant No.	Code	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Remarks
	Sequence Related Constants	Cn-16	BRKWAI	Output timing of brake reference during motor operation	10 ms	10	100	50	See 3.4.4.
ANNAL COSTIC	3	Cn-22	VCMPLV	Speed coincidence signal output range	r/min	0	100	10	See 3.7.4.
		Cn-29	ZCLVL	Zero-clamp level	r/min	0	4500	10	See 3.4.3.
	Pulse Related	Cn-0A	PGRAT	Dividing ratio setting	P/R	16	32768	2048	See note 1 See 3.2.3.
Sauto	Constants	Cn-11	PULSNO	Number of encoder pulses	P/R	513	32768	2048	See note 1 See 3.3.3, 3.8.5.
Carden Cor	Other Constants	Cn-0C	TRQMSW	Mode switch (torque reference)	%	0	800	200	See 3.6.6.
с».	1	Cn-0D	REFMSW	Mode switch (speed reference)	r/min	0	4500	0	See 3.6.6.
	1.25H2.9.	Cn-0E	ACCMSW	Mode switch (acceleration reference)	10 (r/min)/s	0 marke	3000	o natyka ?	See 3.6.6.
		Cn-10	JOGSPD	Jog speed	r/min	0	4500	500	See 3.3.2.
and Con	4	Cn-1F	SPEED1	1st speed (contact input speed control)	r/min	0	4500	100	See 3.2.6.
	We R	Cn-20	SPEED2	2nd speed (contact input speed control)	r/min	0	4500	200	See 3.2.6.
Bauto	Carlo Carlo	Cn-21	SPEED3	3rd speed (contact input speed control)	r/min	0 nationation	4500	300	See 3.2.6.
ANNA! OF	4	Cn-28	NFBCC	Speed loop compensation constant		0	100 mm <sup>m</sup> .0	0	ANNA!

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- : User constants that must be always set
- Note 1) After changing the setting, always turn the power OFF, then ON. This makes the new setting valid.
  - 2) Automatically set by autotuning function
  - 3) Valid only when zero-clamp function is used
  - 4) To use soft start function, always set both Cn-07 and Cn-23.

# LIST OF USER CONSTANTS

	N.O.	List	of User Consta	nts (Memory Swite	ch Setting)	N.O.	S. S. S.
~	User Constant No.	Bit No.	Ray .	Set	ting 🔹	4. 4.	Factory Setting
Input signal	Cn-01	0,0	0	NO.	1	AND IN	0
enable/disable	. NOT	E.	Uses servo ON i	nput ( <mark>S-ON</mark> ).	Does not use serv (S-ON). Servo is a		
	300	1	0	S.	1	do.	0 8
	AN A		Uses SEN signa absolute encode	l input (SEN) when r is used.	Does not use SEN (SEN) when abso used. Servopack treats signal volta	lute encoder is automatically	stand in the
NO.X		2	0	NO.N.	1 22	NO.X	0
tonab	autor	S.	Uses forward rot input (P-OT).	ation prohibited	Does not use form prohibited input (F rotation is always	P-OT). Forward	0
	J.S.	3	0 8	Š,	1	J.S.	0 0
	A CALLAN		Uses reverse rot input (N-OT).	ation prohibited	Does not use reverse prohibited input (Trotation is always	N-OT). Reverse	And.
CLT signal		4	0	132	1 38	38	0
switching		E.	Uses CLT signal limit detection ou		Uses CLT signal ( coincide output.	CLT) as speed	
S. –	1021	5	Not used.	2	Not used	and the	0
Sequence selection at	3NIOT	6	0	1. S.	1	N.O.	0 20
alarm condition	4		Stops the motor dynamic brake w arises.		Causes the motor when an alarm ar	to coast to a stop ises.	14
2.2.2		7 8	0		1	. B.S.	1
tonable	autor	Cont of the	When an alarm a motor by applyin and then release	arises, stops the g dynamic brake es dynamic brake.	When an alarm an motor by applying but does not relea		
	So	8	0	S.	1	S	0 8
	A. A.			according to bit 6 ertravel is detected	Decelerates the n applying the torqu Cn-06 when over (P-OT, N-OT).	le specified in	and
No."		9	0	No."	1 1	Non	0
tomat,	MAN IGBALLOY	S.	N-OT), decelerat stop by applying	is detected (P-OT, ees the motor to a the torque specified n turns the servo	When overtravel i N-OT), decelerate stop by applying t in Cn-06 and then zero-clamp.	es the motor to a he torque specified	and the
Control mode	14	B∙A	0•0	0•1	1•0	1•1	0•0
selection		Nº.	Speed control	Speed control with zero-clamp function	Torque control I	Torque control II	
all'a	. Ś	100.		(1)	office	.office.	<u> </u>

### List of User Constants (Memory Switch Setting)

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in a second	User Constant No.	Bit No.	Margan 19	And Set	tting www.	0.	Facto Settir
Mode switch	Cn-01	D•C	0•0	0•1	1•0	1•1	0•0
selection	In the standard	Q. 1	Uses internal torque reference as a condition. (Level setting: Cn-0C)	Uses speed reference as a condition. (Level setting: Cn-0D)	Uses acceleration as a condition. (Level setting: Cn-0E)	Does not use mode switch function.	Š
TGON signal function switch	ζλ.	E	0 Uses TGON signa		1 Uses TGON signa	al as the brake	0
Town		-	running detection	signal.	interlock signal.	~	0
Torque feed-forward function	Clark.	ES,	0 Does not use torqu function.	ue feed-forward	1 Uses torque feed-	forward function.	0
Rotation	Cn-02	0	0	- all	1	alle'	0
direction selection	1.00		Defines counterclo rotation as forward	ockwise (CCW) d rotation.	Defines clockwise forward rotation (r mode).		
Home position error processing selection	2	1	0 Detects home pos absolute encoder i	ition error (when is used).	1 Does not detect h	ome position error.	0
Contact input	, office	2	0		ĥ	xOC <sup>10</sup>	0
speed control	1. COCOL	-	Does not use cont control.	act input speed	Uses contact inpu	t speed control.	
Reserved		3•4 5	Reserved (not to b	pe set)	33		0
Reserved		6	0	8	1	6	0
and the	and and	0	Uses 1CN #16 pin reference monitor.		Uses 1CN #16 pir reference monitor.		
Reserved	31 <sup>0</sup>	7	Reserved (not to b	be set)	ò, .	Jol.	0
Motor selection	S°	8	0 200	S^^^	1	8°	* 3
-	Se	0	SGM motor	and and the	SGMP motor		Ser.
Encoder		9	0 Incremental encod	lor .	1 Absolute encoder		0
Reserved	-	A	Reserved (not to b			Ŕ	0
Selection of speed/torque	onabl	В	0 marsh		130140	SUSTANS.	0
or position control mode	Dan		Speed/torque cont	trol mode selection	Not used.		2
Torque reference filter	S.	С	0	arman <sup>1,0</sup>	1	ļ.,	0
type			Primary		Secondary		
ratika.el	00	rvopa	d'a	ds on the Servopa	ack type as showr	n below.	

Factory Setting
0
1

#### LIST OF USER CONSTANTS

501	Saller.		108 <sup>1101</sup>	ballol. Ballol.	
	User Constant No.	Bit No.	ANNAL ANN	Setting	Factory Setting
Reserved	Cn-02	E•D	Reserved (not to be set)	8	> 0
Torque reference input selection	م	F	0 Uses torque reference or torque feed-forward reference.	1 Uses analog voltage reference as torque limit input.	0

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For Position Control

ЛГ Positions

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# List of User Constants (User Constant Setting)

	autor		autor		autor.		JION .	
Category	User	Code	Name	Unit	Lower	Upper	Factory	Remark
	Constant No.			20	Limit	Limit	Setting	Re
0	Cn-00	Not a user	constant. (Cn-00 is	used to sele	ct special mo	de for digital c	perator.) 👌	See 4.1.
No.	Cn-01	- A A	itch (see on page 4	A	- Nor		Nº S	See note
	Cn-02	Memory sw	itch (see on page 4	476.)	S.		L.	See note
Gain Related Constants	Cn-04	LOOPHS	Speed loop gain	Hz	1 <sup>10</sup>	2000	80	See note See 3.6. 3.6.2.
	Cn-05	PITIME	Speed loop integration time constant	0.01ms	2	10000	2000	See note See 3.6. 3.6.2.
50X0.9	Cn-1A	POSGN	Position loop gain	1/s	1 matthair	500	40	See note See 3.6. 3.6.2.
	Cn-1C	BIASLV	Bias N	r/min	0	450	0	See 3.6.5
	Cn-1D	FFGN	Feed-forward	%	0	100 🔗	0	See 3.6.3
	Cn-26	ACCTME	Position reference acceleration/de celeration time constant	100 μs	0	640	0	See 3.5.2
Carlow Carlow	Cn-27	FFFILT	Feed-forward reference filter	100 μs	0 Johnsteine	640	0 official	See 3.6.
Torque Related	Cn-06	EMGTRQ	Emergency stop torque	%	0	Max. torque	Max. torque	See 3.1.2
Constants	Cn-08	TLMTF	Forward rotation torque limit	%	0	Max. torque	Max. torque	See 3.1.3
advard	Cn-09	TLMTR	Reverse rotation torque limit	%	0	Max. torque	Max. torque	See 3.1.3
	Cn-17	TRQFIL	Torque reference filter time constant	100 μs	0, of the second	250	4	See 3.5.
	Cn-18	CLMIF	Forward external torque limit	%	0	Max. torque	100	See 3.1.
att a R	Cn-19	CLMIR	Reverse external torque limit	%	0	Max. torque	100	See 3.1.
Sequence Related	Cn-0B	TGONLV	Zero-speed level	r/min	1,01 G <sup>UICE</sup>	4500	20	See 3.7.
Constants	Cn-12	BRKTIM	Time delay from brake reference until servo OFF	10 ms	0	50	0	See 3.4.4
Card A.D.	Cn-15	BRKSPD	Speed level for brake reference output during motor operation	r/min	0 conadka.p	4500	100	See 3.4.

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# LIST OF USER CONSTANTS

S <sup>ON</sup>		JION.	Salton.		walter.		Salton.	
Category	User Constant No.	Code	Name	Unit	Lower Limit	Upper Limit	Factory Setting	Remarks
Sequence Related Constants	Cn-16	BRKWAI	Output timing of brake reference during motor operation	10 ms	10	100	50	See 3.4.4.
	Cn-1B	COINLV	Positioning complete range	Reference unit	0	250	3	See 3.7.3.
Pulse Related Constants	Cn-0A	PGRAT	Dividing ratio setting	P/R	16	32768	2048	See note 1 See 3.2.3.
anabha.P	Cn-11	PULSNO	Number of encoder pulses	P/R	513	32768	2048	See note 1 See 3.3.3, 3.8.5.
	Cn-24	RATB	Electronic gear ratio (numerator)		4	65535	4	See note 3 See 3.2.3, 3.2.5.
	Cn-25	RATA	Electronic gear ratio (denominator)	44	1	65535	1	See note 3 See 3.2.3, 3.2.5.
Chardwar?	Cn-2A	PULSNO2	External PG number of pulses	P/R	513	32768	2048	6
Other Constants	Cn-0C	TRQMSW	Mode switch (torque reference)	%	0 Juli	Max. torque	200	See 3.6.6.
	Cn-0D	REFMSW	Mode switch (speed reference)	r/min	0	4500	0	See 3.6.6.
anabha.e.	Cn-0E	ACCMSW	Mode switch (acceleration reference)	10 (r/min)/s	0 marsh	3000	o matyka	See 3.6.6.
	Cn-0F	ERPMSW	Mode switch (error pulse)	Reference unit	0 John Street	10000	0	See 3.6.6.
	Cn-10	JOGSPD	Jog speed	r/min	0	4500	500	See 3.3.2.
	Cn-1E	OVERLV	Overflow	×256 reference unit	1	32767	1024	See note 4 See 3.5.2, 3.6.2.
onadka.	Cn-1F	SPEED1	1st speed (contact input speed control)	r/min	0 tomaty	4500	100 100 100 100 100 100 100 100 100 100	See 3.2.6.
	Cn-20	SPEED2	2nd speed (contact input speed control)	r/min	0	4500	200	See 3.2.6.
à	Cn-21	SPEED3	3rd speed (contact input speed control)	r/min	0	4500	300	See 3.2.6.
tomather.	Cn-28	NFBCC	Speed loop compensation constant	<u>}</u>	0 Nonally	100	0 tomatyko	
,	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	5	WI. HDar	0	N. Char	and	Do.	and Color

: User constants that must be always set www.gautonatyka.pl

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- **Note** 1) After changing the setting, always turn the power OFF, then ON. This makes the new setting valid.
  - 2) Automatically set by autotuning function
  - 3) The following restriction applies to electronic gear ratio (Cn-24 and Cn-25):

$$0.01 \le \frac{B(Cn-24)}{A(Cn-25)} \le 100$$

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4) For user constant Cn-1E, when full-closed loop specification, factory setting is 1.

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# LIST OF USER CONSTANTS

Positio	4924		<b>osition Control</b> User Constants (Memory Switch S	Setting)	anne anne anne	www.c
tomative."	User Constant No.	Bit No.	Settin	ing	Max Jonatha	Factory Setting
nput signal	Cn-01	0	0 8	S 1	900	0
enable/dis- able	And Market		Uses servo ON input (S-ON).	i	Does not use servo ON nput ( <del>S-ON</del> ). Servo is always ON.	Acres .
Ś		1	0	1	2	0
tonatyka	.[603]	10mary*	When absolute encoder is used, uses t SEN input signal (SEN).	Sallon s	When absolute encoder is used, masks the SEN signal. Automatically egarded as High level nside the Servopack.	, cè
Input signal	and and a second	2	0	1	and the second s	0 200
enable/dis- able	~	3	Uses forward rotation prohibited input (P-OT).	r (	Does not use forward otation prohibited input P-OT). Forward rotation is always possible.	2
		3	0	- S	office	0
	www.ibboli	SF	Uses reverse rotation prohibited input (N-OT).	∑  r  (	Does not use reverse otation prohibited input N-OT). Reverse rotation is always possible.	MARANT
- ~		4	Not used.	1	Not used.	0 See note 3
A.		5	Not used.	1	Not used.	0
Sequence		6	0	5	and the second se	0
selection at alarm condition	M.GDO	20.	Stops the motor by applying dynamic b when an alarm arises.	S <sup>o</sup> t	Causes the motor to coast o a stop when an alarm arises.	- AL
	AN CONTRACT	7	0 44 44	1	And and a second	1 34
20140.01		and	When an alarm arises, stops the motor applying dynamic brake and then relea dynamic brake.	ases s	When an alarm arises, stops the motor by applying dynamic brake but does not elease dynamic brake.	12
. S		8	0 10	. S 1		0
	www.cpg	2	Stops the motor according to bit 6 setting when overtravel is detected (P-OT, N-C	OT). s	Decelerates the motor to a stop by applying the torque specified in Cn-06 when overtravel is detected P-OT, N-OT).	want
See.		9	0	1	al a	0
tomatyle	.1003	30matol	When overtravel is detected (P-OT, N-O decelerates the motor to a stop by appl the torque specified in Cn-06 and then turns the servo OFF.	plying ( n t	When overtravel is detected P-OT, N-OT), decelerates he motor to a stop by applying the torque specified in Cn-06 and then	Ś

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User Constant No.         Bit No.         Setting           Operation performed at servo         Cn-01         A         0         1		Factor		
performed		Settin		
	0			
	es not clear error pulse en servo is turned OFF.			
Mode         B         0         1           switch         Uses mode switch function as set in bits D         Doe	0 es not use mode switch	, ĉ		
selection and C of Cn-01. func	iction.	and and it		
D•C 0•0 0•1 1•0		•0		
(Level setting: Cn-0C) a condition. as a condition.	celerationpulse as aacondition.ndition.(Level setting:evel setting:Cn-0F)			
TGON E 0 1	0	and i		
	es TGON signal as the the interlock signal.	22		
Contact F 0 1	e <sup>5</sup> 0			
selection P-CL and N-CL are OFF. whe	ceives pulse reference en both contact signals CE and N-CE are OFF.	ee no		
INHIBIT 0 1	0	14		
	ables INHIBIT function.	dell'		
selection as forward rotation.	0 fines clockwise (CW) ation as forward rotation verse rotation mode).			
Home 1 0 1	0	0		
	es not detect home position or.	ALA ANI		
Contact 2 0 1	0			
control	es contact input speed			
Reference         5•4•         0•0•0         0•0•1         0•1•0         0•1•           pulse form         3         Sign +         CW+CCW         Phase A+         Phase		•0•0		
selection Pulse Pulse Phase B (x 1 Pha	ase A + Phase A + ase B (x 2 Phase B (x 4 Itiplication)	. call		
Reserved 7•6 Reserved (not to be used)	<u>0</u>			
Motor 8 0 1 selection SGM motor SGM		ee no		
Selection     SGM motor     SGM       Encoder     9     0     1	MP motor 2			
Selection 0	solute encoder			

#### LIST OF USER CONSTANTS

	User Constant No.	Bit No.	Setting	want	Factory Setting
Error counter	Cn-02	А	0	1 .	0
clear signal		Smarth	Clears the error counter when an error counter clear signal is at high level.	Clears the error counter when the leading edge of an error counter clear signal rises.	Г 
Selection of	NIGD.	В	0 ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1 10	0 See note 4
speed/torque or position control mode	44		Not used.	Position control mode	See note 4
Torque		С	0	1	0
reference filter		S. S.	Primary	Secondary	
Reference	.3	D	0	1 30	0
pulse logic	SNI BOU		Does not invert reference pulse logic.	Inverts reference pulse logic.	and the second sec
Position	allah .	Е	0	1 1	0 42
error monitor level		K <sup>2</sup>	Displays position error Un-08 in x 1 reference units while in monitor mode.	Displays position error Un-08 in x 100 reference units while in monitor mode.	2
Reference	1	Ę	0	স	0
pulse filter	NIGDOUT	<u>5</u> ~	Line driver (Maximum reference pulse frequency: 450 kpps)	Open collector (Maximum reference pulse frequency: 200 kpps)	1.50

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\_\_\_\_\_: User constants that must be always set

Note

1) Internal speed selection is valid only when bit 2 of Cn-02 is set to "1."

2) The factory setting depends on the Servopack type as shown below.

Servopack Type	Factory Setting
DR2-	0
DR2-□P	1.6
2	S. Contraction of the second s

3) At full-closed loop specification, when Cn-01 bit 4 is set to 1, external PG phase-C disconnection error is not detected.

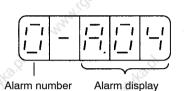
4) At full-closed loop specification, factory setting of Cn-02 bit B is 1.

**NOTE** For the Cn-01 and Cn-02 memory switches, always turn the power OFF and then ON after changing the setting. This makes the new setting valid.

# Appendix E

# **List of Alarm Displays**

• SGDA Servopack allows up to 10 last alarms to be displayed at a digital operator. This function is called a traceback function.



- This appendix provides the name and meaning of each alarm display.
- For details of how to display an alarm, refer to the following section: *4.2.1 Operation in Alarm Trace-back Mode*
- For the cause of each alarm and the action to be taken, refer to the following section:
  6.2.1 Troubleshooting Problems with Alarm Display

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#### LIST OF ALARM DISPLAYS

	rm Disj		7-	-	Alarm	Output		Alarm Name	Meaning	Remarks
	n Digit Operato		segment LED		n Code C		ALM	13.2	La.P.	
U <sup>torra</sup>	9	00	 D.	ALO1 OFF	AL02 OFF	AL03 OFF	Output OFF	Absolute data error	Absolute data fails to be received, or received absolute data is abnormal.	For absolute encoder only
	<i>R. L</i>	72	<i>[</i> ].	OFF	OFF	OFF	OFF	User constant breakdown	Checksum results of user constants are abnormal.	S. C.
, offi <sup>3</sup>	A. [	]4	0.	OFF	OFF	OFF	OFF	User constant setting error	The user constant setting is outside the allowable setting range.	
2	A.	10	MIGON.	ON	OFF	OFF	OFF	Overcurrent	An overcurrent flowed through the power transistor.	AN IN
	R, c	20	2.	OFF	ON	OFF	OFF	Blown fuse	Fuse is blown.	24
LICC <sup>8</sup>	<i>A.</i> :		<u>2.</u> 3.	ON	ON	OFF	OFF	Regenerative error	Defective regenerative resistor Regenerative resistor disconnection	
-	<i>R.</i> :	3 /	<u>.</u>	ON	ON ()	OFF	OFF	Position error pulse overflow	Position error pulse has exceeded the value set in user constant Cn-1E (overflow).	For position control only
.500	<i>A.</i> '	40	Ч.	OFF	OFF	ON -ornacit	OFF	Overvoltage or undervoltage	The main circuit voltage for motor operation has become too high or too low.	
27	<i>R.</i> <u>4</u>	51	5.	ON	OFF	ON	OFF	Overspeed	Motor speed has exceeded 4950 r/min.	8
	R.	70	7.	ON	ON	ON	OFF	Overload	Rated torque was exceeded during continuous operation.	A.
	<i>Ħ. E</i>	30	<i>B</i> .	OFF	OFF	OFF	OFF	Absolute encoder error	The number of pulses per absolute encoder revolution is abnormal.	For absolute encoder only

# Alarm Display

OFF: **ON**:

FF: Output transistor is OFF N: Output transistor is ON



#### Checksum

An automatic check function for a set of data such as user constants. It stores the sum of user constant data, recalculates the sum at specific timing, and then checks whether the stored value matches the recalculated value. This function is a simple method of checking whether a set of data is correct.

adka.P.	Nº	,21		alla.Y		00K2.P.	all all		
	ballon		100110	2011		408ULOTT	abauton	1000	
Alarm Display	7-		14	Output	and and a second	Alarm Name	Meaning	Remark	
on Digital Operator	Segment LED	Alarn ALO1	n Code C AL02	Output AL03	ALM Output		4	n an	
A.B (	B. Jo	OFF	OFF	OFF	OFF	Absolute encoder backup error	All three power supplies for the absolute encoder (+5 V, battery and internal capacitor) have failed.	For absolute encoder only	
<i>R. B 2</i>	<i>B</i> .	OFF	OFF	OFF	OFF	Absolute encoder checksum error	The checksum results of absolute encoder memory is abnormal.	For absolute encoder only	
R. 8 3	8.	OFF	OFF	OFF	OFF	Absolute encoder battery error	Battery voltage for the absolute encoder is abnormal.	For absolute encoder only	
A. 8 4	<i>B.</i>	OFF	OFF	OFF	OFF	Absolute encoder data error	The checksum results of absolute encoder memory is abnormal.	For absolute encoder only	
A. 8 5	<i>8.</i>	OFF	OFF	OFF Manyka P	OFF	Absolute encoder overspeed	The motor was running at a speed exceeding 400 r/min when the absolute encoder was turned ON.	For absolute encoder only	
Я.Ь [	Б.	OFF	OFF	OFF	OFF	Reference input read error	Servopack CPU failed to detect reference input.	N1.000	
<i>R.C. I</i>	Γ.	ON A	OFF	ON	OFF	Servo overun detected	The servomotor (encoder) ran out of control.	and	
A.C.2	C. ye	ON	OFF	ON	OFF	Encoder output phase error Incremental encoder initial pulse error	Phases A, B and C output by the encoder are abnormal. Wiring of encoder phase A or B is disconnected.	an bai	
R. [] 3	Ε.	ON 🔬	OFF	ON	OFF	Encoder A-, B-phase disconnection	Phases A, B and C output by the encoder are abnormal.	Se al	
Я.[Ч	E.Nº	ON	OFF	ON	OFF	Encoder C-phase disconnection	Wiring of encoder phases C is disconnected.		
R. C 6	ς Γ.	ON	OFF	ON	OFF	Full-closed loop A-, B-phase disconnection	A-, B-phase of external PG is disconnected.	Only for full-close specifi- cation	
Я.С.7	Γ.	ON	OFF	ON	OFF	Full-closed loop C-phase disconnection	C-phase of external PG is disconnected.	Only for full-close specifi- cation	
en e	OFF:	Outo	ut transis	tor is OF	E M	gbauton.	Midballon	W. dbail	

dbautor OFF: Output transistor is OFF Output transistor is ON ON: www.gauonauka.pl www.gautonayka.pl

#### LIST OF ALARM DISPLAYS

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Alarm Display	7-		-	Output		Alarm Name	Meaning	Remarks	
on Digital Operator	Segment LED	Alarm Code Output ALO1 AL02 AL03		ALM Output	9	11	24		
C P F O O	automat	Undefin	Undefined		<sup>3</sup> .9	Digital operator transmission error 1	Digital operator fails to communicate with Servopack even five seconds after power is turned ON.	These alarms are not stored in alarm traceback	
[PFDI	en.co-	Undefin	ed		14	Digital operator transmission error 2	Transmission error has occurred five consecutive times.	s memory.	
R. 9 9		OFF	OFF	OFF	ON	Not an error	Normal operation status		
10 marthe	OFF: ON:	-	t transist t transist			widdautomadke	W.GBaltomatike	ALION	

# Appendix F

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# **Relationship between Reference Forms** and User Constants

This appendix lists the relationship between reference forms and user constants.

#### <Remarks>

- O: Related to or possibly related to
- $\times$ : Not related at all

# Relationship between Reference Forms and User Constants (1)

- O: Related to or possibly related to
- $\times$  : Not related at all

WR.D	Wall all	<ul> <li>C: Related to or possibly related to</li> <li>× : Not related at all</li> </ul>					
tonar'	tonat,		tomat	tona			
User Constant	User Constant Name	NNN IN	(Cn-02 E	Control Mode Bit B = 0)	Service Se		
No.	4 4	Speed	Control		Control		
utomatika.pl	widbaltomabka.pl	Speed Control (Standard) Cn-01 Bit A = 0 Bit B = 0	Cn-02 I Speed Control with Zero-clamp Function Bit A = 1 Bit B = 0	Bit 2 = 0 Torque Control I Bit A = 0 Bit B = 1	Torque Control II Bit A = 1 Bit B = 1		
Cn-03	Speed reference gain	0	0	×			
Cn-04	Speed loop gain	0	0	0	$\bigcirc$		
Cn-05	Speed loop integration time constant	0	00	×	A S		
Cn-06	Emergency stop torque	0	0	×	0		
Cn-07	Soft start time (acceleration)	0	NO 0	X	0		
Cn-08	Forward torque limit	0	0	Ő	0		
Cn-09	Reverse torque limit	0	0	0			
Cn-0A	Encoder pulse dividing ratio	0	0	0	0		
Cn-0B	Zero-speed level	0	QQ	0	<u></u>		
Cn-0C	Mode switch (torque reference)	0	Ő	×	×		
Cn-0D	Mode switch (speed reference)	0	0 N	× ₅6	×		
Cn-0E	Mode switch (acceleration)	0	0	×	×		
Cn-0F	Mode switch (error pulse)	×	×	×	×		
Cn-10	JOG speed	0	0	×~ 0	O -224		
Cn-11	Number of encoder pulses	0	0	0	<u> </u>		
Cn-12	Time delay from brake reference until servo	0	O	0	0		
Cn-13	Torque reference gain	0	0	0,50	$\bigcirc$		
Cn-14	Speed limit for torque control I	0	0	Ő	×		
Cn-15	Speed level for brake reference output during motor operation	0	0		O water		
Cn-16	Output timing of brake reference during motor operation	0	0	0	0		
Cn-17	Torque reference filter time constant	0	0	0	0		
Cn-18	Forward external torque limit	0	<u>0</u>	0,0	0		
Cn-19	Reverse external torque limit	0 8	0	0	0		
Cn-1A	Position loop gain	×	0	×	×		
Cn-1B	Position complete range	×	×	×	×		
Cn-1C	Bias	×	×ò	×	> ×		
Cn-1D	Feed forward	×	×	×	×		
Cn-1E	Overflow	×	× "no	×	×		
482	man bar manifiliat	WANNIGS		www.idbab	Anni O		

No.x	aller aller		all and a second	all	S
C.	balton.	10 <sup>3110</sup>	55	bauton	X
User Constant	User Constant Name		Speed/Torque (Cn-02 B		and the
No.		Speed	Control	Torque	Control
Ś	Ś. Ś.		℃n-02 B	3it 2 = 0	2
natol Ke	MM. Galtomastko	Speed Control (Standard) Cn-01 Bit A = 0 Bit B = 0	Speed Control with Zero-clamp Function Bit A = 1 Bit B = 0	Torque Control I Bit A = 0 Bit B = 1	Torque Control II Bit A = 1 Bit B = 1
Cn-1F	Contact input speed control (1st speed)	×	×	×	×
Cn-20	Contact input speed control (2nd speed)	×	×	×	×
Cn-21	Contact input speed control (3rd speed)	×	×	××	×
Cn-22	Speed coincide signal output range	0	0	×	0
Cn-23	Soft start time (deceleration)	Oscalle	0	×	0
Cn-24	Electronic gear (numerator)	×	×	×	×
Cn-25	Electronic gear (denominator)	×	× 🔊	×	×
Cn-26	Position reference accel/decel time constant	×	×	×	×
Cn-27	Feed forward reference filter	×	×	× 🖉	×
Cn-28	Speed loop compensation constant	0	0	×cari	0
Cn-29	Zero-clamp level	×	0	×	0
Cn-2A	Full-closed number of pulses	×	×	X	×

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# **Relationship between Reference Forms and User Constants (2)**

20143.0	at the fill at the second	à	<ul> <li>Related to or possibly related to</li> <li>X: Not related at all</li> </ul>					
autorne	autorne		utome	altonio				
User Constant No.	User Constant Name	Speed/Torque Control Mode (Cn-02 Bit B = 0)						
NO.		Contact Input Speed Control						
utomaska.el	www.cdbautomastka.pl	Stops at Speed Reference is 0	Stops at Zero-clamp Cn-01	Bit 2 = 1 Analog Speed Reference (V-REF) Input Cn-01	Analog Speed Reference (V-REF) Input with Zero-clamp Function Cn-01			
2	d and a second sec	Bit A = 0 Bit B = 0	Bit A = 1 Bit B = 0	Bit A = 0 Bit B = 1	Bit A = 1 Bit B = 1			
Cn-03	Speed reference gain	×	×	0 _6	0			
Cn-04	Speed loop gain	0	0	0,10	0			
Cn-05	Speed loop integration time constant	0.8	0	Ő	0 8			
Cn-06	Emergency stop torque	0	0	0	O Maria			
Cn-07	Soft start time (acceleration)	0	0	0	0			
Cn-08	Forward torque limit	0	QÒ	0	<u></u>			
Cn-09	Reverse torque limit	0	0	0	0			
Cn-0A	Encoder pulse dividing ratio	0	0 "No	0,00	0			
Cn-0B	Zero-speed level	0 %	0	0	0			
Cn-0C	Mode switch (torque reference)	0	0					
Cn-0D	Mode switch (speed reference)	0	0	0	0			
Cn-0E	Mode switch (acceleration)	0	0	0	<u></u>			
Cn-0F	Mode switch (error pulse)	×	×	×	×			
Cn-10	JOG speed	0	. Shi O	0,500	$\bigcirc$			
Cn-11	Number of encoder pulses	0	0	0,01	0			
Cn-12	Time delay from brake reference until servo OFF	O	0	0				
Cn-13	Torque reference gain	0	0	0	0			
Cn-14 ू	Speed limit for torque control I	0	0	0				
Cn-15	Speed level for brake reference output during motor operation	0	0	0	0			
Cn-16	Output timing of brake reference during motor operation	0	0	0	0			
Cn-17	Torque reference filter time constant	0	0	0	O and			
Cn-18	Forward external torque limit	0	0	0				
Cn-19	Reverse external torque limit	0	0	0	<u></u>			
Cn-1A	Position loop gain	0	0	0	0			
Cn-1B	Position complete range	×	STO X	× Sh	×			
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Ten .	Ales Ales		and the	Stor Bar	
	dauon. dauon.	doautor		doautonu	
User Constant	User Constant Name	March!	Speed/Torque (Cn-02 E	Control Mode Bit B = 0)	and all
No.			Contact Input	Speed Control	
2	à à		<u></u> Cn-02 E		2
Card Are	WWW.GBaltonatics	Stops at Speed Reference is 0 Cn-01 Bit A = 0 Bit B = 0	Stops at Zero-clamp Cn-01 Bit A = 1 Bit B = 0	Analog Speed Reference (V-REF) Input Cn-01 Bit A = 0 Bit B = 1	Analog Speed Reference (V-REF) Input with Zero-clamp Function Cn-01 Bit A = 1 Bit B = 1
Cn-1C	Bias	×	×	X	
Cn-1D	Feed forward	× ×	×	×	×
Cn-1E	Overflow	×	×	× %	× Ò
Cn-1F	Contact input speed control (1st speed)	0	0	0	0
Cn-20	Contact input speed control (2nd speed)	0	0	0	0
Cn-21	Contact input speed control (3rd speed)	0	0	0	0
Cn-22	Speed coincide signal output range	0	5 O	0	0
Cn-23	Soft start time (deceleration)	0 0	0	0	0
Cn-24	Electronic gear (numerator)	×	×	X X	× ,ð
Cn-25	Electronic gear (denominator)	×	×	×	×
Cn-26	Position reference accel/decel time constant	×	×	×	×
Cn-27	Feed forward reference filter	×	×	Х	×
Cn-28	Speed loop compensation constant	0	23 <sup>40</sup> O	0 2	0
Cn-29	Zero-clamp level	× só	0	×	0
Cn-2A	Full-closed number of pulses	×	×	×	×

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# Relationship between Reference Forms and User Constants (3)

- O: Related to or possibly related to
- ×: Not related at all

automatoka.	dballomatikat dballomatika	×: Not	related at all	doatto
User Constant	User Constant Name		ition Control M Cn-02 Bit B =	
No.	No. C. No.	Position Control Cn-02	6	t Speed
Litonator	www.ldballomaty.	Bit 2 = 0 Position Control (Standard)		2 = 1 Pulse Reference Input Cn-01 Bit F = 1
Cn-03	Speed reference gain	×		
Cn-04	Speed loop gain	0	0	0
Cn-05	Speed loop integration time constant	0	0	0.40
Cn-06	Emergency stop torque	0 8	0	0
Cn-07	Soft start time (acceleration)	×	0	
Cn-08	Forward torque limit	0	0	0
Cn-09 👌	Reverse torque limit 🔿	0	0	0
Cn-0A	Encoder pulse dividing ratio	0	0	0
Cn-0B	Zero-speed level	0	0	0.0
Cn-0C	Mode switch (torque reference)	0 20	0	0
Cn-0D	Mode switch (speed reference)	0	0	0
Cn-0E	Mode switch (acceleration)	0	0	0
Cn-0F 📐	Mode switch (error pulse)	0	~	0
Cn-10	JOG speed	0	0	0
Cn-11	Number of encoder pulses	0	0	0 8
Cn-12	Time delay from brake reference until servo OFF	0	0	00
Cn-13	Torque reference gain	×	×	×
Cn-14	Speed limit for torque control I	×	х	×
Cn-15	Speed level for brake reference output during motor operation	0	0	0
Cn-16	Output timing of brake reference during motor operation	0	LOTTO O	0
Cn-17	Torque reference filter time constant	0 8	0	0
Cn-18	Forward external torque limit	0	0	0
Cn-19	Reverse external torque limit	0	0	0
Cn-1A	Position loop gain	0	×ò	0
Cn-1B	Position complete range	0	×	0
Cn-1C	Bias	$\bigcirc$	× ×	0

doautor		aballon aballon	doautor		dballon
april 1	User Constant	User Constant Name		ition Control M Cn-02 Bit B = 1	
	No.		Position Control		t Speed
	1.050×0.9	abyla.P	Cn-02 Bit 2 = 0	Cn- Bit 2	-02 2 = 1
W. Kobauto		www.dbaitonu	Position Control (Standard)	Stops at Speed Reference is 0 Cn-01 Bit F = 0	Pulse Reference Input Cn-01 Bit F = 1
	Cn-1D	Feed forward	0	×	0
	Cn-1E	Overflow	0	×	0
20	Cn-1F	Contact input speed control (1st speed)	× số	0	0
1000	Cn-20	Contact input speed control (2nd speed)	×	0	0°0
44	Cn-21	Contact input speed control (3rd speed)	×	0	0
	Cn-22	Speed coincide signal output range	×	$\circ$ $\sim$	0
	Cn-23	Soft start time (deceleration)	×	0	0
ľ	Cn-24	Electronic gear (numerator)	0	XX	0 1
. 5	Cn-25	Electronic gear (denominator)	0	×	0
150000	Cn-26	Position reference accel/decel time constant	Oscalle	×	0
1 <sup>1</sup> .07	Cn-27	Feed forward reference filter	0	×	N 0
	Cn-28	Speed loop compensation constant		O 44	0
ľ	Cn-29	Zero-clamp level	Х	×	×
	Cn-2A	Full-closed number of pulses	×	X	X
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# Appendix **V**

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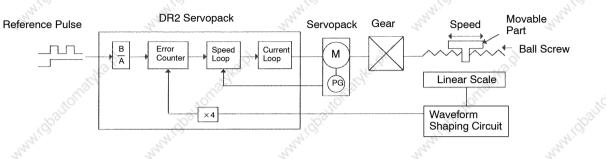
# **Reviewing the Full-closed Loop Specifications**

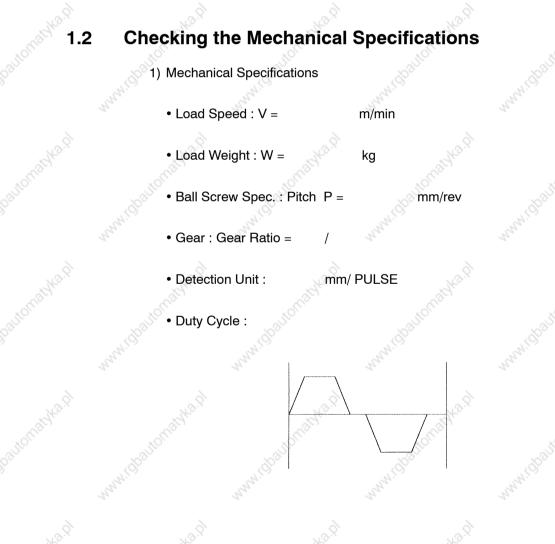
This appendix outlines the checking methods for combination of mechanical specifications, linear scale (linear scale + waveform shaping circuit) and Servopack at full-closed loop specifications.

1

# Grasping the Mechanical Specifications

# 1.1 Full-closed Loop System Configuration





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13/20.P	AN <sup>2</sup> II	adhaid	all all	at the set
HOLL.	HORIT	HOTT	HORIT	MOTTO MOTO
	2) Applicable Serv	omotor and Servopack	norm!	Bat www.lobat
	Servomotor :		(with incremer	ntal encoder)
20,0	NO.S	NO.S	NO.S	12.9°
Carl.	Servopack : E	DR2-D-F ••••Full-clos	sed feedback input o	conditions:
50	autor.		Line driver output f	
	S. S	(2	Max. frequency : 6	
	North North	4 Martin	( <u>4500 ×</u> 60	<u>1.1</u> × 8192 ≒675kPPS)
19.91	13.9	(10 <sup>0)</sup> (3	) Linear scale evalua	ation magnification : 4
Carl	Carlot .	A BINT	able	all
3-0 <sup>1</sup>	3) Applicable Line	ar Scale	JOL .	utol'
	8. B	° (S°		So. So.
	Manufacturer	Anna'	A. A. A.	And State
12.81	• Type :	, s	Scale Interval :	mm
and	Construction of the second sec	A BY	adde	ANT A
3101		aping Circuit : Type =	JON	autor autor
		E, interpolation digital cir ration speed =	m/min	S° S°
		ut frequency =	kHz	J. Martin
		gnal form =	1.	4
Ś	· · · ·	tion magnification =	à	(Conditions under the
all'a	N.~3	n magnification =	and the	combination with
100 C	Measurin Min. edge	g pitch = μm e interval = μs		linear scale) Combination with Max.
	Min. puls			input frequency)
	and Contraction of the second	. www.	. was	S. I. Market
	N. N.	H.	42	Nº.
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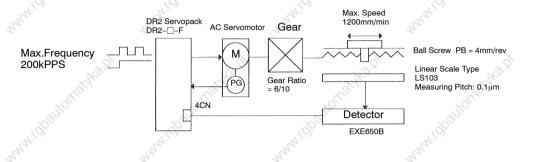
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**REVIEWING THE FULL-CLOSED LOOP SPECIFICATIONS** 

2 Application Example

## 2.1 Configuration



## 2.2 Linear Scale Specifications and Application Review at Full-closed System

- 1) Linear Scale Specifications
  - Manufacturer : HEIDENHAIN
  - Type : LS103, Scale Interval = 10μm = 0.01mm
  - Detector Type : EXE650B
  - Max. Input Frequency : 60kHz (Interpolation magnification : 25)
  - Interpolation Magnification = 25
  - Evaluation Magnification = 4
  - Output Signal : 5V line driver output, phase-A leading (Conforming to DIN66259, EIA standard RS422)
  - Measuring Pitch : 0.1μm
  - Min. Edge Interval and Pulse Width

• When detector EXE650B (interpolation magnification: 25) is used:

	8MHz Clock			10MHz Clock		Switch	ning
Max. Input Frequency fE max	Min. Edge Interval a min	Min. Pulse Width b min	Max. Input Frequency fE max	Min. Edge Interval a min	Min. Pulse Width <sup>b min</sup>	S3	S4
Approx. 60kHz	0.125µs	0.125µs	Approx. 60kHz	0.1µs	0.1µs	K North	×
40kHz 🚿	0.25µs	0.25µs	50kHz	0.2μs	0.2µs	_	×
20kHz	0.5µs	0.5µs	25kHz	0.4μs	0.4µs	×	_
10kHz	1.0µs	1.0μs	12.5kHz	0.8µs	0.8s	- 38	_

(x: Switch is closed)

2) Application Review

a) Linear Scale :

Input Frequency = 
$$\frac{\text{Operation Speed}}{\text{Scale Interval}} = \frac{1200/60}{0.01}$$
  
= 2000PPS < EXE650B Max.InputFrequency

b) Min. Edge Interval and Pulse Width

DR2 receivable max. frequency : 675kHz

$$\frac{10^6}{675000 \times 4}$$
 = 0.3704  $\mu s$   $<$  Min. Edge Interval

• With the above a) and b), switching  $S_3$  and  $S_4$  at 8MHz clock can be performed under both of the following conditions:

		NO.
Max. Input Frequency	S <sub>3</sub>	S4
20kHz	× %	s. –
10kHz	1. - 1. - 1.	-

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c) Feedback Frequency to Detector Output Frequency and Error Counter

Detector Output Frequency = 2000  $\times$  25 = 50000PPS  $\rightarrow$  50kPPS Feedback Frequency = 50  $\times$  4 = 200kPPS

d) DR2 User Constant (Cn-24, -25)

\* Electronic Gear =  $\frac{B}{A} = \frac{Cn-24}{Cn-25} = \frac{Cn-2A \times 4}{\frac{4 \times 6}{0.0001 \times 10}} = \frac{6000 \times 4}{24000} = \frac{1}{1}$ 

#### **REVIEWING THE FULL-CLOSED LOOP SPECIFICATIONS**

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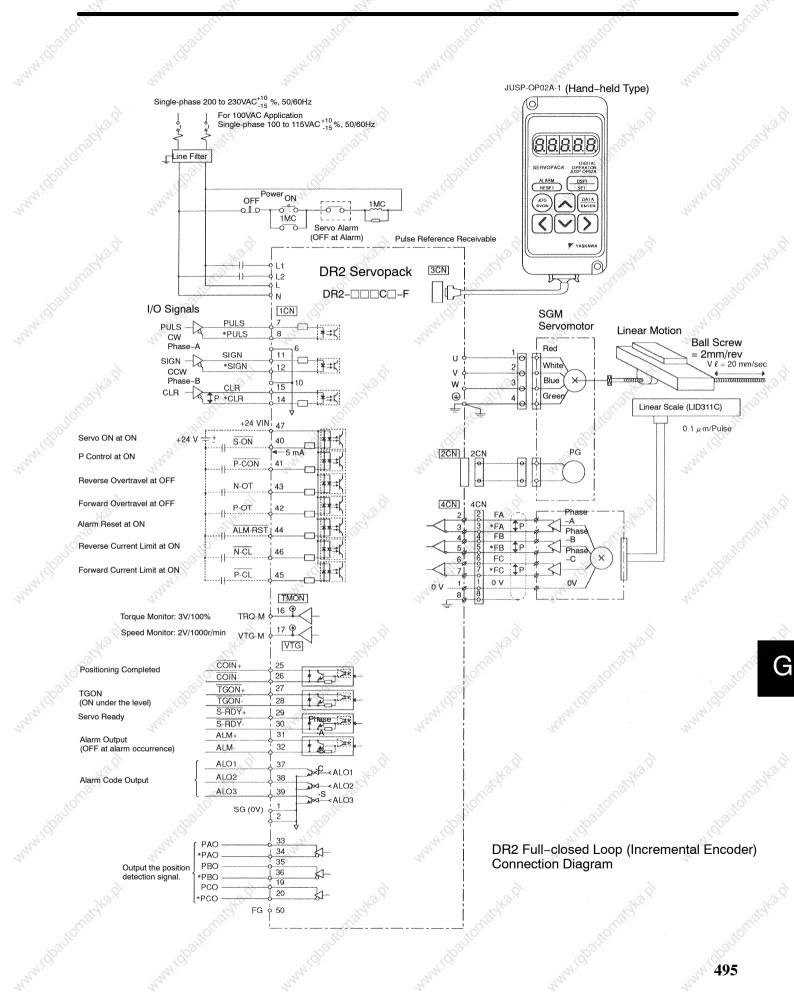
- \* Number of Full–closed Pulses = Cn–2A =  $\frac{4}{\frac{0.01 \times 10}{25 \times 6}}$ 
  - $=\frac{4\times25\times6}{0.01\times10}=6000\text{P/rev}$

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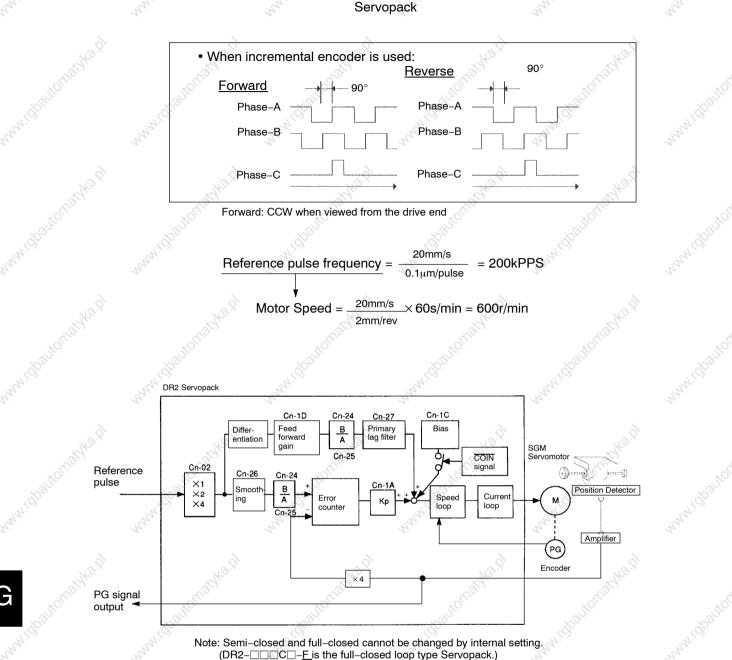
. \* Memory switch Cn-02 Bit B =1

Conditions except above are the same as those of position control at full-closed specifications.

 Reviewing the above data, full-closed loop can be applicable under the above conditions.



#### **REVIEWING THE FULL-CLOSED LOOP SPECIFICATIONS**



e) Output Phase Form: Refer to the following phase relation for the feedback pulse to Servopack

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#### TOKYO OFFICE

New Pier Takeshiba South Tower, 1-16-1, Kaigan, Minatoku, Tokyo 105-6891 Japan Phone 81-3-5402-4511 Fax 81-3-5402-4580

#### YASKAWA ELECTRIC AMERICA, INC. 2121 Norman Drive South, Waukegan, IL 60085, U.S.A.

Phone 1-847-887-7000 Fax 1-847-887-7370 **MOTOMAN INC. HEADQUARTERS** 805 Liberty Lane West Carrollton, OH 45449, U.S.A. Phone 1-937-847-6200 Fax 1-937-847-6277

YASKAWA ELÉTRICO DO BRASIL COMÉRCIO LTDA. Avenida Fagundes Filho, 620 Bairro Saude-Sao Pâulo-SP, Brazil CEP: 04304-000 Phone 55-11-5071-2552 Fax 55-11-5581-8795

#### YASKAWA ELECTRIC EUROPE GmbH Am Kronberger Hang 2, 65824 Schwalbach, Germany Phone 49-6196-569-300 Fax 49-6196-888-301

Motoman Robotics Europe AB Box 504 S38525 Torsås, Sweden

Phone 46-486-48800 Fax 46-486-41410

Motoman Robotec GmbH Kammerfeldstraβe1, 85391 Allershausen, Germany Phone 49-8166-900 Fax 49-8166-9039

YASKAWA ELECTRIC UK LTD. 1 Hunt Hill Orchardton Woods Cumbernauld, G68 9LF, United Kingdom Phone 44-1236-735000 Fax 44-1236-458182

YASKAWA ELECTRIC KOREA CORPORATION Kfpa Bldg #1201, 35-4 Youido-dong, Yeongdungpo-Ku, Seoul 150-010, Korea Phone 82-2-784-7844 Fax 82-2-784-8495

YASKAWA ELECTRIC (SINGAPORE) PTE. LTD. 151 Lorong Chuan, #04-01, New Tech Park Singapore 556741, Singapore Phone 65-282-3003 Fax 65-289-3003

YASKAWA ELECTRIC (SHANGHAI) CO., LTD. 4F No.18 Aona Road, Waigaoqiao Free Trade Zone, Pudong New Area, Shanghai 200131, China Phone 86-21-5866-3470 Fax 86-21-5866-3869

#### YATEC ENGINEERING CORPORATION

Shen Hsiang Tang Sung Chiang Building 10F 146 Sung Chiang Road, Taipei, Taiwan Phone 886-2-2563-0010 Fax 886-2-2567-4677

#### YASKAWA ELECTRIC (HK) COMPANY LIMITED Rm. 2909-10, Hong Kong Plaza, 186-191 Connaught Road West, Hong Kong

Phone 852-2803-2385 Fax 852-2547-5773

#### **BEIJING OFFICE**

Room No. 301 Office Building of Beijing International Club, 21 Jianguomenwai Avenue, Beijing 100020, China Phone 86-10-6532-1850 Fax 86-10-6532-1851

#### TAIPEI OFFICE

Shen Hsiang Tang Sung Chiang Building 10F 146 Sung Chiang Road, Taipei, Taiwan Phone 886-2-2563-0010 Fax 886-2-2567-4677

#### SHANGHAI YASKAWA-TONGJI M & E CO., LTD. 27 Hui He Road Shanghai China 200437

Phone 86-21-6531-4242 Fax 86-21-6553-6060

#### BEIJING YASKAWA BEIKE AUTOMATION ENGINEERING CO., LTD.

30 Xue Yuan Road, Haidian, Beijing P.R. China Post Code: 100083 Phone 86-10-6233-2782 Fax 86-10-6232-1536

#### SHOUGANG MOTOMAN ROBOT CO., LTD.

7, Yongchang-North Street, Beijing Economic Technological Investment & Development Area, Beijing 100076, P.R. China

Phone 86-10-6788-0551 Fax 86-10-6788-2878

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