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**Galvanometer Scanner Driver  
GVD0 Series  
Instruction Manual**

**CITIZEN CHIBA PRECISION CO., LTD.**

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# Preface

Thank you very much for purchasing our GVD0 Series Galvanometer Scanner Driver.

This Instruction Manual explains the specifications, input/output interfaces and important notes concerning GVD0 Series Galvanometer Scanner Driver. Please read this manual carefully to use this product properly.

Failure to comply with the instructions may make our product not to perform fully but also may cause failures and accidents. For your safety, please keep this manual accessible even after read it all.

The definitions of signal words next to this symbol  in this Instruction Manual are as follow. Please be sure to follow them to avoid any danger.

 : This is the symbol used for notification of any general cautions, warnings, and dangers.

## **DANGER:**

This signal word indicates direct hazards. Failure to follow this caution may result in death, serious injury and critical damage to property such as total loss of equipment or fire.

## **WARNING:**

This signal word indicates indirect hazards. Failure to follow this caution may result in death, serious injury and critical damage to property such as total loss of equipment or fire.

## **CAUTION:**

This signal word indicates potential hazards. Failure to follow this caution may result in minor or moderate injury, or partial damage to equipment.

## **NOTE:**

**All rights reserved. This Instruction Manual may not be photocopied or reproduced without our prior written permission.**

**The contents of this Instruction Manual are subject to change without prior notice.**

## 1. Specifications

### 1-1. Driver Model

GVD0 - ##### - ##

\*The model type of GVD0 Series driver differs according to the specifications. Please refer to “10. Details of Model Type and Serial Numbers” for more details.

### 1-2. Applicable Galvanometer Scanner

Citizen Chiba Precision Galvanometer Scanner GVM Series

### 1-3. Main Specification

Power Source Voltage : DC±15V ±10% or DC±24V ±10%  
(5A or more is recommended \*1)

\*1: Please specify the command voltage specification when ordering the product.

Driving System : Linear Drive  
Power Source Current : Approximately (+) 160 mA / (-) 120 mA  
(Power source voltage: DC±15 V when servo is locked)  
Maximum Output : 240W \*2

\*2: By using GVM1445L under power source voltage of DC± 24V

### 1-4. Input Signal

Position Command Input: Voltage Range: ±3.0 Vp-p or ±5.0 Vp-p or ±10.0 Vp-p (Differential)\*3  
(Single-ended inputs referred to ground are available.)

Control Input : Servo ON input (Active LOW)

### 1-5. Output Signal

Position Signal Output : Voltage range / ±1.5 Vp-p or ±2.5 Vp-p or ±5.0 Vp-p \*3  
(Single-ended inputs referred to ground)

\*3: Please specify the command voltage specification when ordering the product. Please see “10. Details of Model Type and Serial Numbers”.

The position signal output is equivalent to half (1/2) of the position command input scale.

### 1-6. Protective Functions

Overheat / Over Positioning / Over Current / Sensor Error

### 1-7. Operating Environment

Ambient Temperature Range : 0°C to (+) 60°C  
Humidity Range : 10% to 85%RH (No condensation)  
Operating Location : Indoor under clean atmosphere

### 1-8. Dimension and Weight

Structure : Open Flame Type  
External Dimension : 93 mm X 57.5 mm X 31 mm (When mounted to the bracket)  
Weight : 60g (including bracket)

## 1-9. Standard Accessories

<Cable Side Connectors>

CN1 Side Socket: DF1B-4S-2.5R (for Power Source Input).....	1 pc
CN3 Side Socket: DF1B-5S-2.5R (for Control Signal Input/Output).....	1 pc
CN1 / CN3 Contact Pin: DF1B-2428SCA.....	9 pcs

\*The applicable cable to the accessory connector is AWG24. Crimping tools are not included in this package.

## 2. Product Overview

Our GVD0 Series is a set of position control driver which drives our galvanometer scanner linearly by a transistor bridge. It contains various functions such as Overcurrent Protection and Overheat Protection etc.



**This product is a driver exclusively for Citizen Chiba Precision's galvanometer scanner. It cannot control any galvanometer scanner made by other manufacturers.**



**CAUTION**

**Do not use this product without a bracket.  
Failure to follow this caution may result in a damage.**

### 3. Input / Output Connector

#### 3-1. Connector for Power Source Input (CN1)

Manufactured by Hirose Electric Co., Ltd.

Model No: DF1B-4P-2.5DSA (01) (For board-side)  
: DF1B-4S-2.5R (For Cable-side)  
: DF1B-2428SCA (For Cable-side)

- Please input power source voltage.
- Applicable cable is AWG24.
- Please use accessory connector after crimped to the cable by using specialized crimping tool. \*4

Terminal No.	Signal / Function
1	Frame Ground
2	DC (+) Power Source Input
3	GND
4	DC (-) Power Source Input



#### CAUTION

\*Please do not apply the voltage more than rated voltage.

\*Please do not connect improperly such as reverse connection of positive and negative.  
Failure to follow this caution may result in a damage.

#### 3-2. Connector for Position Sensor Signal Input (CN2)

Manufactured by Hirose Electric Co., Ltd.

Model No: DF1B-10DP-2.5DS (01) (For board-side)  
: DF1B-10DS-2.5RC (For scanner-side)  
: DF1B-2428SCA (For scanner-side)

- This is for the interface with the scanner position sensor.

Terminal No.	Signal / Function
1	Position Signal Output 1
2	Position Signal Output 2
3	GND
4	GND
5	AGC
6	Frame Ground
7	Frame Ground
8	Frame Ground
9	Motor Winding (-)
10	Motor Winding (+)



This is the driver exclusively for Galvanometer Scanner manufactured by Citizen Chiba Precision. It cannot control any galvanometer scanner made by other manufacturers.

### 3-3. Connector for Control Signal Input / Output (CN3)

Manufactured by Hirose Electric Co., Ltd.

Model No: DF1B-5P-2.5DSA (01) (For board-side)  
: DF1B-5S-2.5R (For scanner-side)  
: DF1B-2428SCA (For scanner-side)

- Please refer to “Section 4: Input / Output Interfaces” for more details on I/O interfaces.
- Applicable cables is AWG24.
- Please use accessory connector after crimped to cable by specialized crimping tool. \*4

Terminal No.	Signal / Function
1	(+) Position Command Input
2	(-) Position Command Input
3	GND
4	Servo ON Input
5	Ready Signal Output

### 3-4. Connector for Driver Power Source Output (CN4)

Manufactured by J. S. T. Mgf. Co., Ltd.

Model No: B3PS-VH (For board-side)  
: VHR-3N (For scanner-side)

- Outputs the power source to drive the galvanometer scanner.
- It is not used for GVM1445 / GVM0930 Series.
- Connectors are certified by UL (File No. E60389) and CSA (File No. 20812).
- Applicable cables are AWG22 to AWG16.

Terminal No.	Signal / Function
1	Frame Ground
2	Motor Winding (-)
3	Motor Winding (+)



This is the driver exclusively for Galvanometer Scanner manufactured by Citizen Chiba Precision. It cannot drive any galvanometer scanners made by other manufacturers.

\*4: Two types of specialized crimping tools for the accessory connectors for CN1 and CN3 on the cable side are available as listed below. (The tools are not included in this package.)

Name	Model
Manual Crimping Tool	DF1B-TA2428SHC
Semi-Automatic Crimping Device	AP105-DF1B-2428S

\*Please contact the connector manufacturer or agent for more details.

### 3-5. Connector for Monitoring Signal Output (CN5)

Manufactured by J. S. T. Mgf. Co., Ltd.

Model No.: RE-H042TD-1130 (For board-side)  
: RE-02 (For scanner-side)  
: RF-SC2210 (For scanner-side)

- Please refer to “4: Input / Output Interfaces” for more details on I / O interfaces.

Terminal No.	Signal / Function
1	(+) Position Signal Output
2	Current Feedback Output
3	Position Error Output
4	Speed Output

### 3-6. Connector for Monitoring Signal Output (CN6)

Manufactured by J. S. T. Mgf. Co., Ltd.

Model No: RE-H (02) 2TD-1130 (For board-side)  
: RE-02 (For cable-side)  
: RF-SC2210 (For cable-side)

- When an alarm is generated, alarm pulses are output.
- Please refer to “4: Input / Output Interfaces” for more details on output signals.

Terminal No.	Signal / Function
1	Alarm Pulse Output
2	GND

### 3-7. Connector for Monitoring Signal Power Source Output (CN7)

Manufactured by J. S. T. Mgf. Co., Ltd.

Model No: RE-H (02) 2TD-1130 (For board-side)  
: RE-02 (For cable -side)  
: RF-SC2210 (For cable-side)

- It outputs  $\pm 12V$  Power Source for monitoring signal.

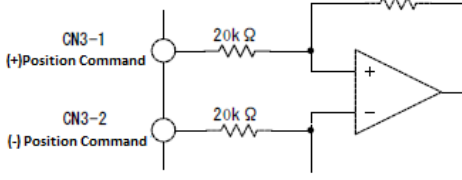
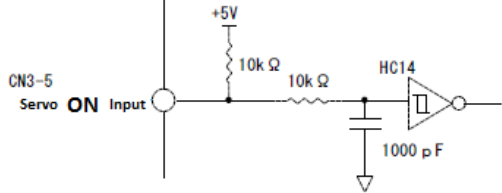
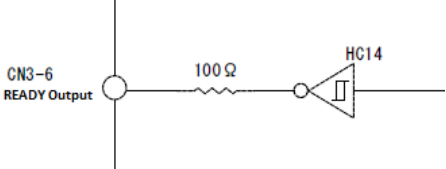
Terminal No.	Signal / Function
1	DC (+) 12V Power Source Outputs
2	DC (-) 12 V Power Source Outputs




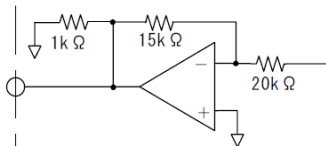
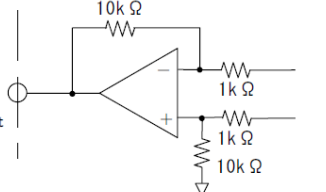
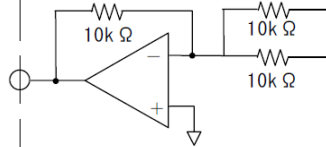
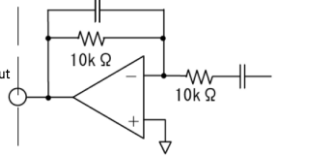
#### 4. Input / Output Interfaces

The functions of the connector terminals and Input / Output interface circuits are as follows:

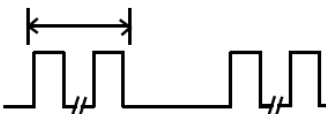
##### 4-1. Connector for Control Signal Input / Output (CN3)

Terminal No. / Signal Name	Functions / Usage	Interface Circuits
CN3-1 / CN3-2  Position Command Input	<p>This is the terminal to input a command voltage for scanner's position control.</p> <p>In case of single ended input referred to ground is selected, make CN3-2 short-circuited with CN3-3 (GND) and input position command voltage to CN3-1.</p>	
CN3-4  Servo ON Input	<p>This is the terminal to input Servo ON / OFF.</p> <p>When short-circuited against GND, it would be Servo ON. (Active LOW)</p>	
CN3-5  READY Signal Output	<p>This is the terminal to output LOW level when no error is generated.</p> <p>It would output High level (DC (+)5V through protective resistance of 100Ω) when an error is generated.</p>	

#### 4-2. Connector for Monitoring Signal Output (CN5)



Terminal No./ Signal Name	Functions / Usage	Interface Circuits
CN5-1 Position Signal Output	This is the terminal to output the voltage equivalent to half (1/2) of scanner position.  <b>CAUTION</b> Do not short-circuit this terminal with GND.	
CN5-2 Current Feedback Signal Output	This is the terminal to output 1 V/A of voltage equivalent to scanner driving current.	
CN5-3 Position Error Output	This is the terminal to output the error between position command signal and position signal.	
CN5-4 Speed Output	This is the terminal to output the signal equivalent to scanner speed.	

#### 4-3. Connector for Monitoring Signal Output (CN6)

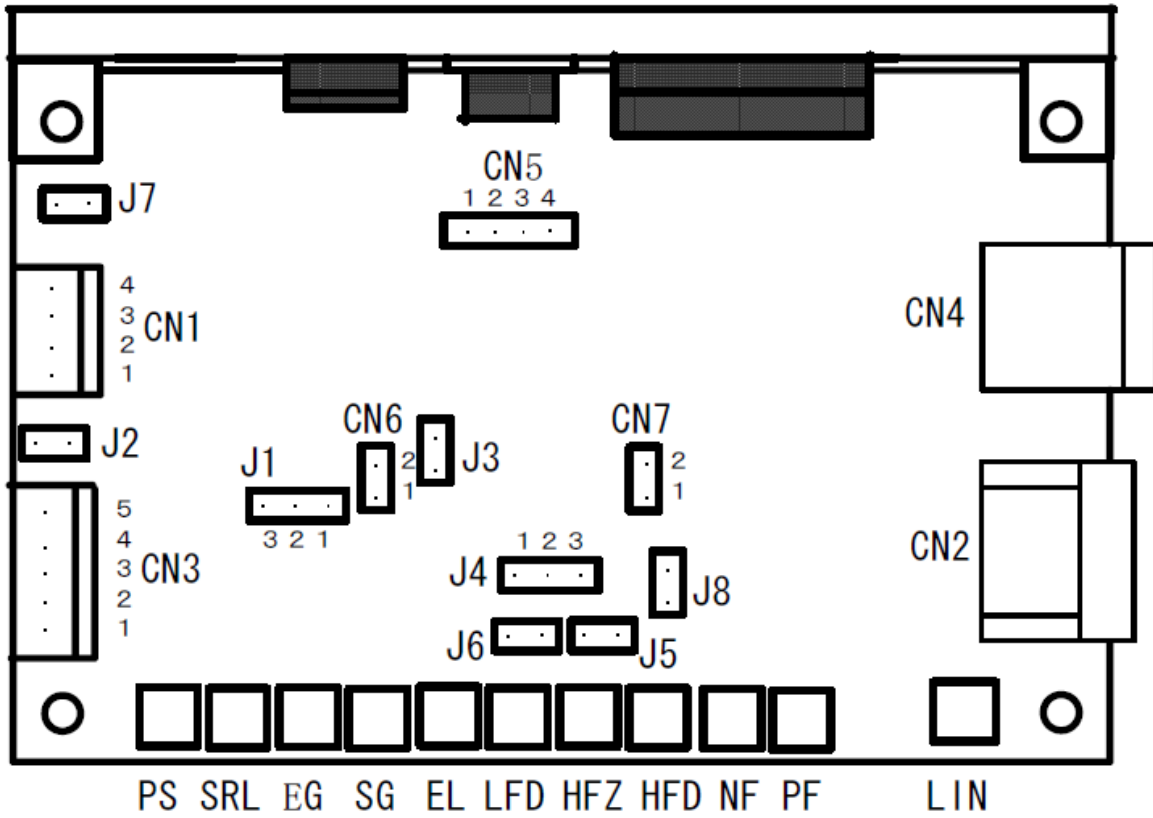
Terminal No. Signal Name	Function / Usage														
CN6-1 Alarm Pulse Output	This is the terminal to output alarm pulse when an alarm is generated. The numbers of sequence pulse vary according to the causes listed below. <b>The Numbers of Consecutive Pulse</b>  <table border="1" data-bbox="454 1590 1125 1848"> <thead> <tr> <th>Number of Pulse</th> <th>Cause of the Alarm</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Sensor Error</td> </tr> <tr> <td>2</td> <td>Over Current</td> </tr> <tr> <td>3</td> <td>Overheat</td> </tr> <tr> <td>4</td> <td>Over Position</td> </tr> <tr> <td>5</td> <td>Power Source Voltage Error</td> </tr> <tr> <td>6</td> <td>Over Position (Latch)</td> </tr> </tbody> </table>	Number of Pulse	Cause of the Alarm	1	Sensor Error	2	Over Current	3	Overheat	4	Over Position	5	Power Source Voltage Error	6	Over Position (Latch)
Number of Pulse	Cause of the Alarm														
1	Sensor Error														
2	Over Current														
3	Overheat														
4	Over Position														
5	Power Source Voltage Error														
6	Over Position (Latch)														

## 5. Volumes for Adjustments

The functions of the volumes are as follows:

Volume Name	Content
PS	<p><b><u>Adjustment for Position Command Input Scale (Minor Tuning on Fill-Scale Scanning Angle)</u></b></p> <p>This allows to adjust position command input and position output of voltage scale. It also allows minor tuning on full-scanning angle at the same time. The voltage-scale decreases by driving CCW (reduces the maximum scan angle).</p> <p> <b>The voltage error between position command input and position output would be generated by this volume adjustment.</b></p>
SRL	<p><b><u>Adjustment for Slew Rate Limiter on Position Command Input</u></b></p> <p>This allows to adjust the response speed of the large step. The response speed increases by driving CCW. The rate depends on the amount of load inertia and current capacity of the power source.</p>
EG	<p><b><u>Adjustment for Position Error Amplifier Gain</u></b></p> <p>This allows to adjust acceleration while scanner is driving. Acceleration would increase by driving CW.</p>
SG	<p><b><u>Adjustment for Proportional Gain on Position Signal</u></b></p> <p>This allows to adjust first overshoot to be small under positioning control.</p>
EL	<p><b><u>Adjustment for Error Limiter</u></b></p> <p>This allows to adjust response speed of large step. It is enabled only for P Control. The response speed increases by driving CCW.</p>
LFD	<p><b><u>Adjustment for Position Signal Derivative Gain</u></b></p> <p>This allows to adjust overshoot and undershoot to be small under positioning control. It works effectively for low frequency components.</p>
HFZ	<p><b><u>Minor Tuning for Frequency Band on Current Integration Feedback Signal</u></b></p> <p>This allows minor tuning on overshoot and undershoot to be small under positioning control.</p>
HFD	<p><b><u>Adjustment for Current Integral Gain</u></b></p> <p>This allows to adjust overshoot and undershoot to be small under positioning control. This works effectively for high frequency components.</p>
NF	<p><b><u>Adjustment for Center Frequency of Notch Filter</u></b></p> <p>This allows to adjust the center frequency of notch filter to remove resonance. The center frequency decreases by driving CW.</p>
PF	<p><b><u>Adjustment for Position Signal Scale (Minor Tuning for Full-Scale Scanning Angle)</u></b></p> <p>This allows to adjust the gain of position signal which is input from the scanner. It also allows to adjust full-scale scanning angel at the same time.</p> <p> <b>This volume adjustment may change initial setting largely. Please contact our Sales representative before the adjustment.</b></p>
LIN	<p><b><u>Correction of Linearity</u></b></p> <p>We adjust non linearity to be less than 0.1% according to the pairing scanner before delivery.</p>

The layout of adjustment volumes and jumpers is as below:



## 6. Jumpers for Selecting Functions

### 6-1. J1, J2, J3, and J6: Selecting Position Command Input Limit

	J1	J2	J3	J6
Slew Rate Limiter	1-2	Short	Open	Open
Slew Rate Limiter and Sigmoidal (S shaped) Circuit	1-2	Short	Short	Open
Error Limiter (Enabled Only for P Control)	2-3	Open	--	Short

### 6-2. J4, and J5: Switching Control System

	J4	J5
P Control	1-2	Open
PI control	2-3	Short

### 6-3. J7: Process of GND and Frame Ground

	J7
GND and Frame Ground Connection (Initial setting)	Short
GND and Frame Ground unconnected	Open

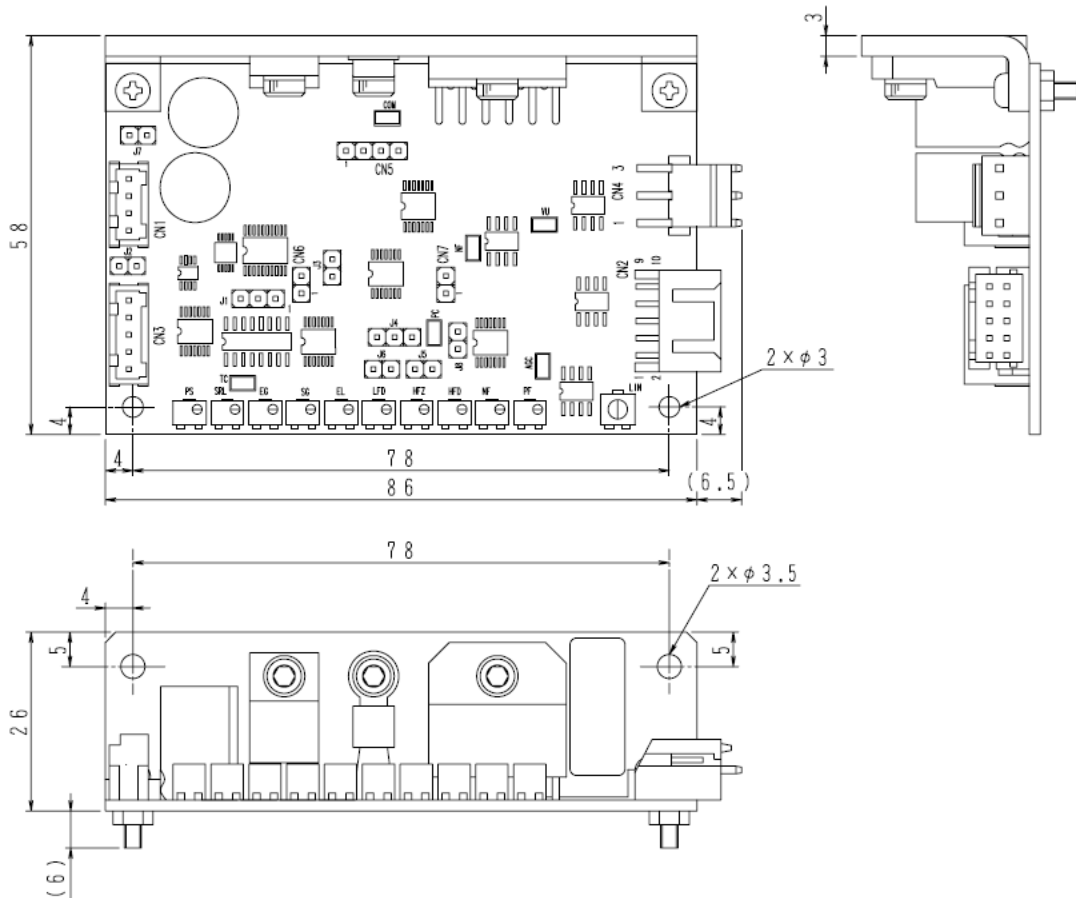
### 6-4. J8: Jumper for Manufacturer Adjustment

This is the jumper for manufacturer adjustment. It is set as Short initially. Please do not change the setting.

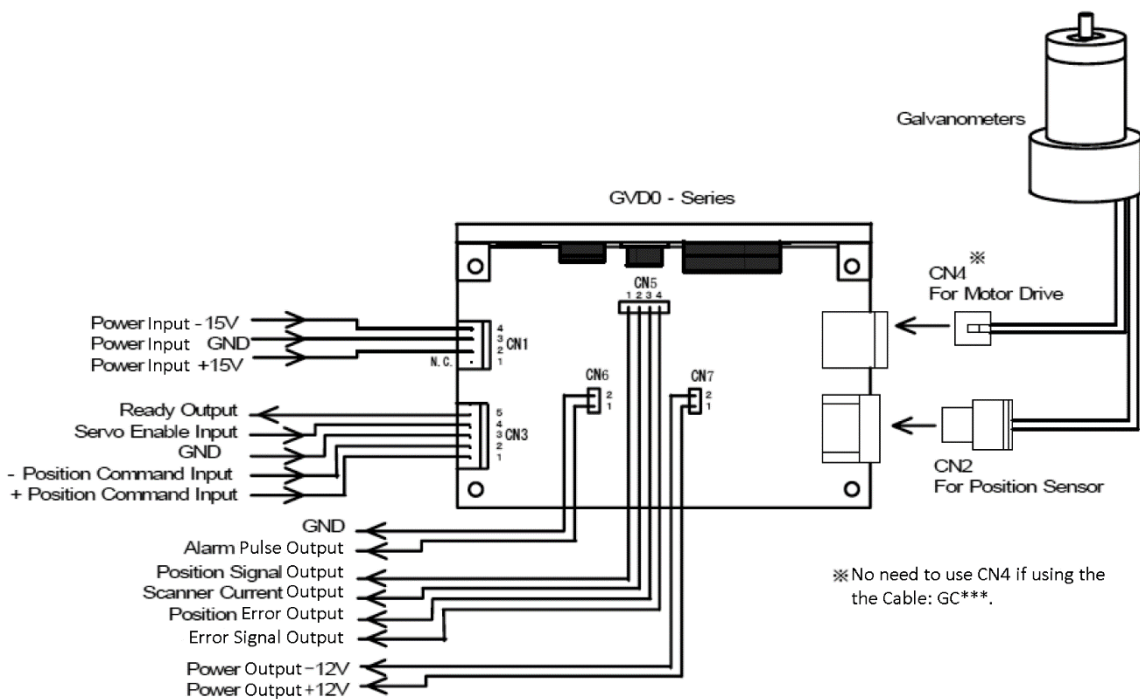
#### \*Initial Jumper Setting:

Jumpers for position command input limit and control system are adjusted according to the control system that a customer specified when ordering the product.

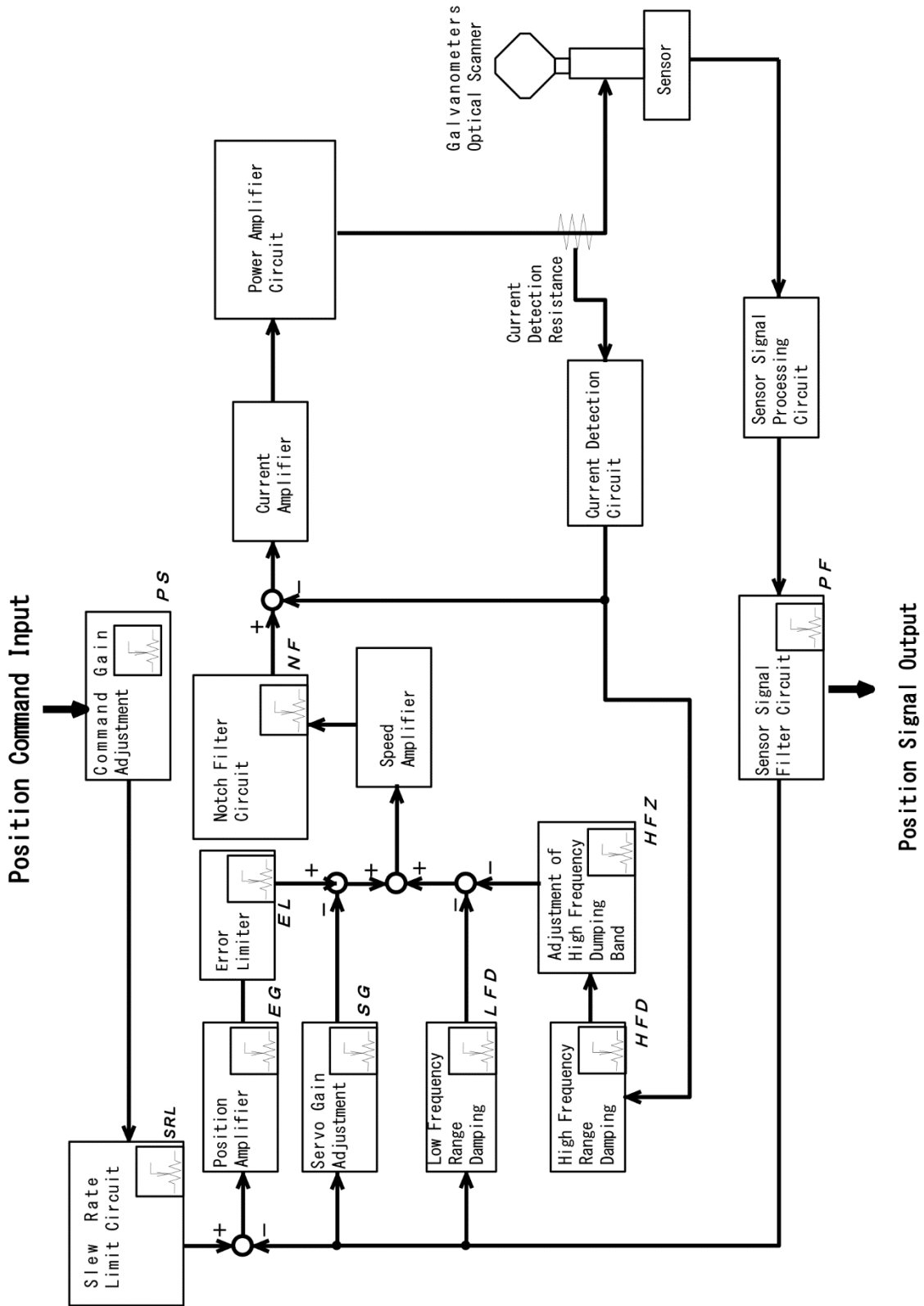
## 7. Outline Drawing



## 8. External Connection Drawing

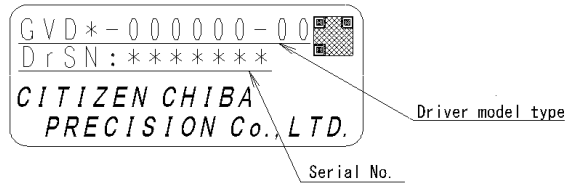


## 9. Block Diagram

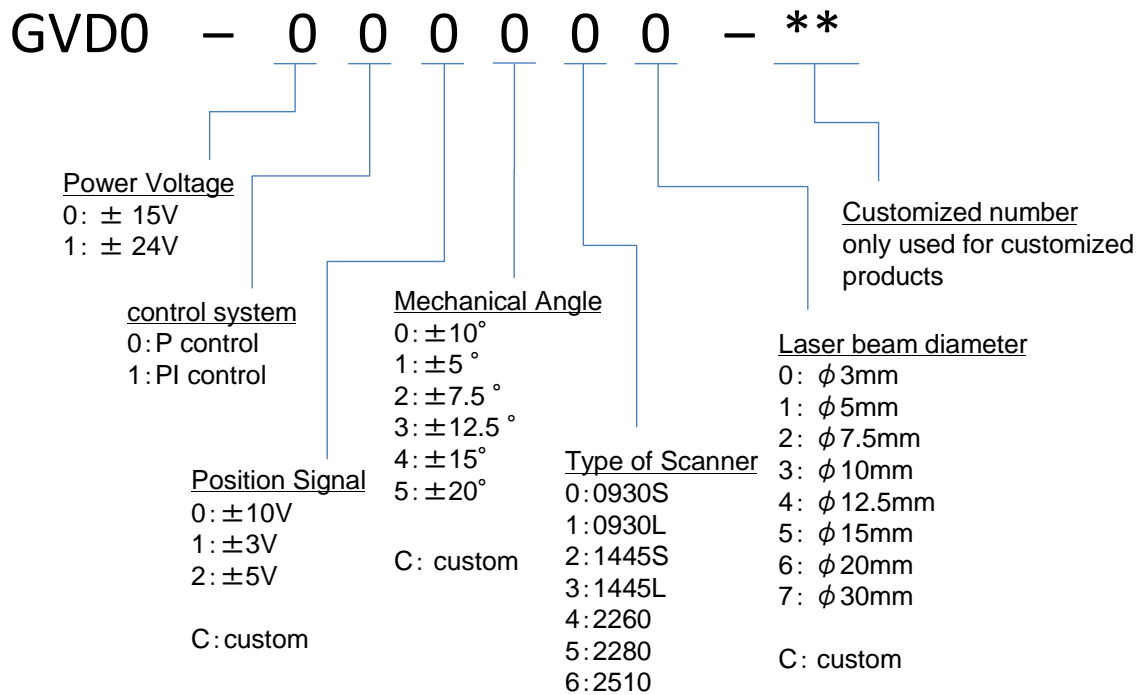


## 10. Details of Model Type and Serial Numbers

Model type and Serial Numbers are indicated on the name plate which is attached on chassis as below:



### 10-1. Driver Model Type



### 10-2. Serial Number

YY  
Shipping Year
M  
Shipping Month
0001  
Sequence Number

\*Shipping Year indicates last two digits of the year (EG: 18 for year of 2018)

\*Following months are indicated as follow: October: X, November: Y, December: Z



## **11. Product Warranty**

1. Duration of this warranty is one year from the date of delivery. If the customer discovered a defect in material and workmanship within this period, we will repair the product for free only if the customer carry it in or return it to our company address by customer's expense. Please note that it would take several days to repair.
2. For the defect caused by "misuse" or "mishandling" by any party, or the defect caused later than one year from the date of delivery, the customer is responsible for repairing charges. We will repair the product only if the customer carry it in to our company address or the customer is responsible to all shipping charges.
3. We are not liable to the damages caused during transit. Please pack the product with sufficient cushioning materials to prevent external vibration.

## **12. Contact Information**

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