

High-performance Single-phase Thyristor Power Controller

FPZ-[] []RS Type (With SCR alarm output)

Instruction Manual

FPZS00-E2

Congratulations on your new FOREST FPZ Type Single-phase Thyristor Power Controller. For proper operation of this compact, special thyristor power controller, read this manual carefully before use. Keep this manual handy for you and others who use this thyristor power controller.



WARNING

- Provide an appropriate external protection circuit where your system could suffer serious damage by a failure, if any, or other problems of this thyristor power controller.
- Be sure to turn on the power switch of your new thyristor power controller only after completing all cable connections properly. Failure to do so could lead to fire, electric shock, or damage to the controller.
- Make sure to use this thyristor power controller within the limits specified in this manual. Use of this controller out of the specifications could lead to fire or failure of the controller.
- DO NOT touch the power terminal and other high-tension section of this product. Failure to do so could lead to electric shock.
- DO NOT attempt to remodel, dismantle, overhaul or repair this thyristor power controller on your own. Failure to do so could lead to fire, electric shock, or damage to the controller.

Warning concerning the Export Trade Control Act

This product is subject to the clauses of the Export Trade Control Act, of Japan. You are required not to use, or not to allow any end user to use, this product for any purposes related to Weapons of Mass Destruction, for military applications or for military facilities. Take care not to allow illegal export of this product in case of resale.

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1. Introduction

1.1 Outline

This manual provides general and detailed information on FOREST FPZ Type High-performance Single-phase Thyristor Power Controller. Readers of this manual should be familiar with basic knowledge of electrical as well as control equipment.

1.2 Precautions

- This product is designed for use on the instrument panel. The equipment to which this product is mounted should provide protections against the power terminal and other high-tension section of this product.
- Make sure to follow the precautions and instructions given in this manual. Failure to do so could lead to serious injury or accident.
- Follow the electrical regulations and other related rules of your region for cable connections.
- Use an appropriately rated fuse and other necessary circuit protections for the power cable and input/output cables of this product.
- Do not allow metal chips and wire fragments to get into this product. Failure to do so could lead to fire, electric shock, or damage to the product.
- Clamp the terminal screws securely at the specified torque. Imperfect clamping could lead to fire, electric shock, or damage to the product. (The recommended torque value is indicated in the Dimensional Outline Drawings.
- When installed, provide sufficient clearances around this product to allow heat radiation. Do not block its air vent.
- Do not connect cables to the blank terminals of this product.
- Be sure to turn the power off before cleaning this product.
- Clean the product with a soft, dry cloth. Use of thinner for cleaning could deteriorate or discolor its external cover.

1.3 Before Use

- FOREST is not responsible for the following damage caused to the user or others by the use of this product:
 - Damage incurred due to the impact of the operation results of this product
 - Damage caused by defects of this product that are unforeseen by FOREST before shipping
 - All other consequential damage
- Periodical maintenance is essential for prolonged, safe use of this product. This product contains parts subject to determined life or susceptible to aged deterioration.
- This manual is subject to change without prior notice.
It has been carefully prepared for your handy reference. Should you discover anything wrong or missing in this manual, please contact us.
- All rights reserved. No part of this document may be used or reproduced in any manner whatsoever without written permission of FOREST Corporation.





1.4 Symbols and Markings Used in This Manual

For your safety and proper operation of this product, the following signal words and symbols are used in this manual.

< Signal Words >

- WARNING** : Precaution indicating a dangerous situation which, if not avoided, could lead to death or serious injury, electric shock, fire or burn.
- CAUTION** : Remarks about operation procedures which, if not followed with special attention, could lead to damage to the equipment.
- REFERENCE** : Additional remarks, such as exceptional conditions, that will be of help to you when operating and handling your new thyristor power controller.

< Symbols >

-  : Hot
-  : Special attention required for your safety
-  : Ground terminal
(To prevent electric shock, grounding of the installation point is required.)
-  : Notes or complementary explanations for tables, illustrations and diagrams

2. Description of Type Code

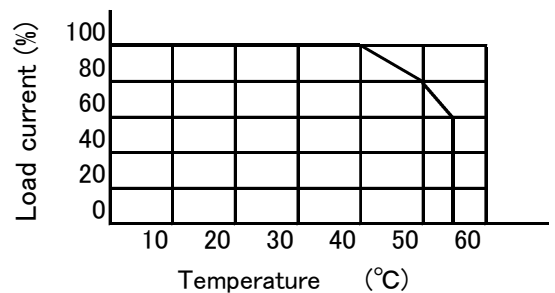
Specification	Description	Specification Code			Load power voltage - []
		FPZ	[]	R S	
Product type		FPZ			
Rated current	Max. load current - 30 A		03		- 2200V AC
	Max. load current - 50 A		05		- 4400V AC
	Max. load current - 70 A		07		
	Max. load current - 100 A		10		
Applicable load	Linear (R) load			R	
Alarm output	With SCR alarm output			S	

3. Installation Place

CAUTION Avoid installing this unit in the following places:

- A place exposed to direct sunlight or where the ambient temperature exceeds 40°C or becomes lower than 0°C (If the ambient temperature exceeds 40°C, the maximum load current of the unit will decrease).
- A place exposed to high humidity (ambient humidity out of the range of 35 to 90%RH) or where the unit may be exposed to water.
- A place where the unit may be exposed to corrosive and inflammable gases.
- A place subject to direct impacts or vibration.
- A place subject to strong inductive interference or where the unit may be exposed to static electricity, noises and/or magnetism.

Temperature characteristics of load current

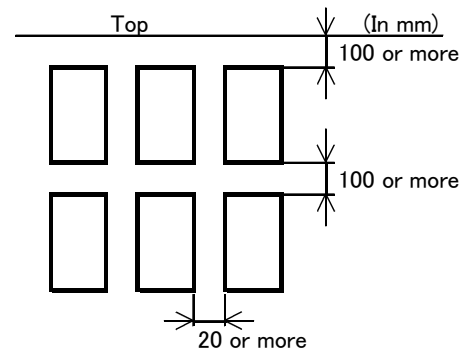


4. Instructions for Installation

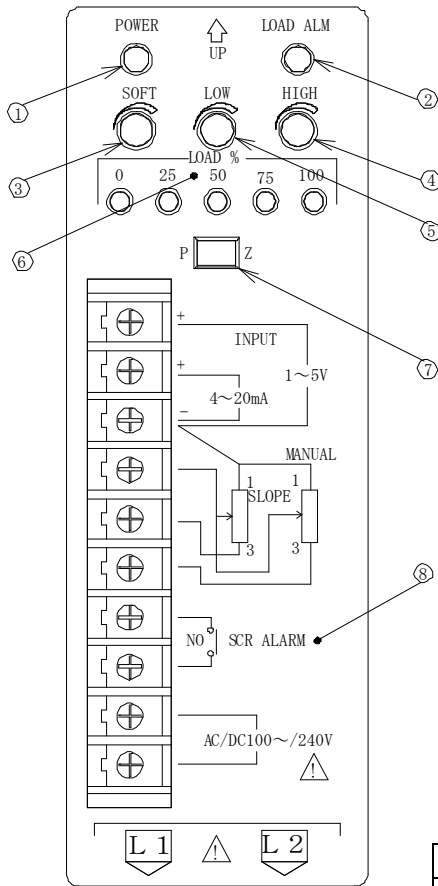
CAUTION

Because this unit generates a large volume of heat, thermal convection of air is utilized for its cooling. Therefore, install the unit following the conditions below:

- Mount the unit on the wall so that the UP mark (↑) comes up.
- Provide a clearance of 20 mm or more on either side of the unit.
- Provide a clearance of 100 mm or more top and bottom of the unit.



5. Description of the Panel



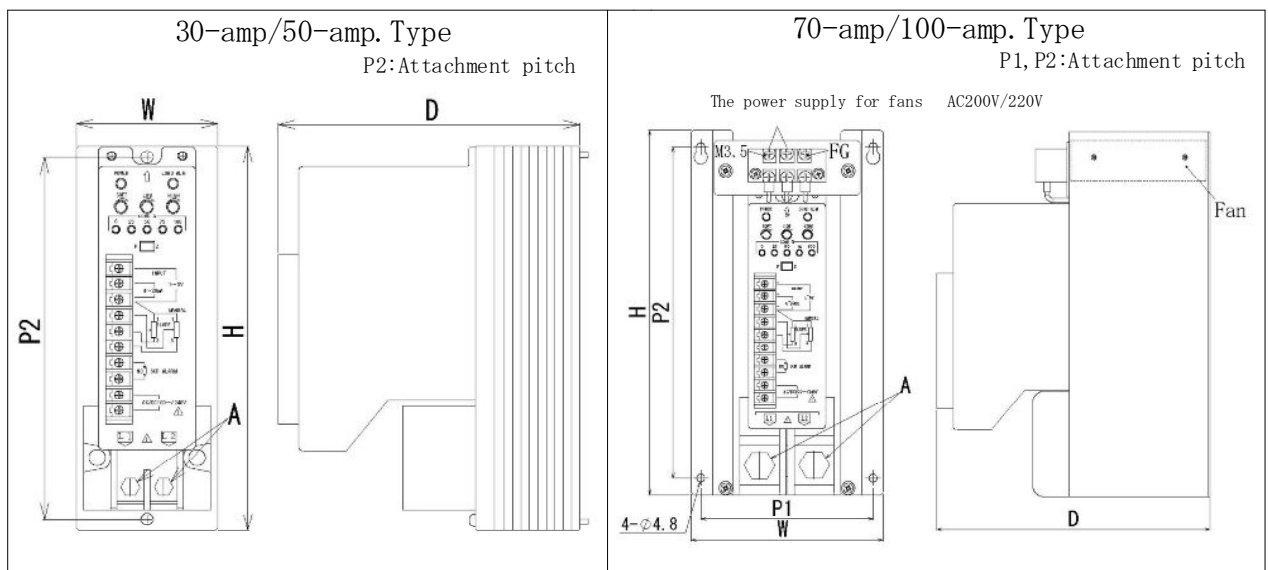
Numeral	Name	Description
①	POWER lamp (Green)	Comes on when you turn the operation power switch on. The lamp blinks when a problem occurs in the unit.
②	LOAD ALM lamp (Red)	Comes on when there is a load break or SCR short.
③	SOFT start dial	Use this dial to set soft startup. 0.5~10sec
④	HIGH control dial	Use this dial to set the HIGH control values 0~100%
⑤	LOW control dial	Use this dial to set the LOW control values 0~50%
⑥	LOAD % lamps (Yellow)	Indicate the percentage (%) of the load voltage.
⑦	Control selector switch	Turning this switch to 'P' position, phase control becomes active. Turning the switch to 'Z' position, zero cross control becomes active.
⑧	SCR alarm output	When load is disconnected, Or SCR short-circuit, Or SCR opens, between contacts opens.

Outside size table

(UNIT:mm)

	W	H	P1	P2	D	weight(kg)	A
30 A	48	170	---	160 ±0.5	135	1	M4 bolt
50 A	68	185	---	175 ±0.5	145	1.5	M5 bolt
70 A	116	220	104	200	165	2.6	M5 bolt
100 A	116	220	104	200	165	2.6	M8 bolt

6. Dimensional Outline Drawings



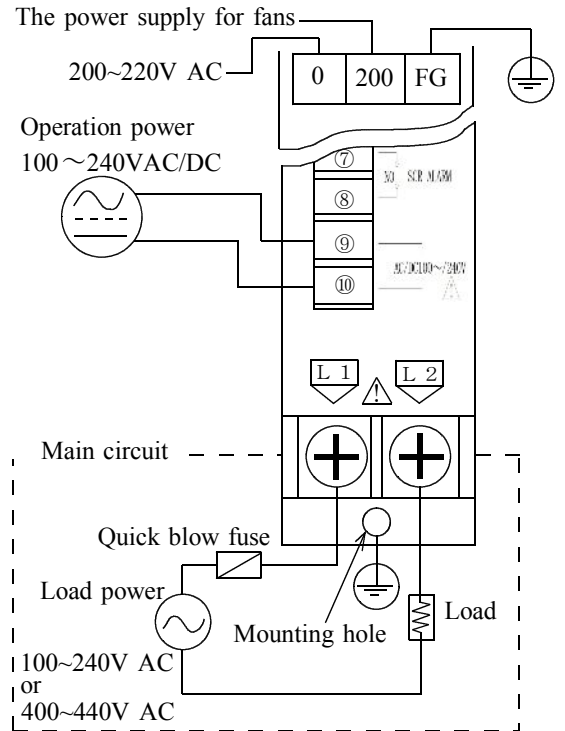
7. Typical External Connections

7.1 Connection between Main Circuit and Power Circuit

- ✳ The load power and operation power of the main circuit may have different phases.
- By way of example, you may use 200 VAC for load power and 100 VAC for operation power.

CAUTION

- Tighten the screws of terminals L1 and L2 securely at the specified torque.
 - 1.2 N/m for 30-amp. Type (M4)
 - 1.5 N/m for 50-amp. Type (M5)
 - 1.5 N/m for 70-amp. Type (M5)
 - 5.0 N/m for 100-amp. Type (M8)
- For connection of the main circuit, use a wire that provides sufficient allowance in relation to the load current.



7.2 Input Control Signal Wiring

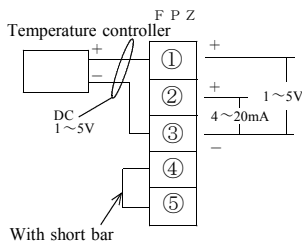
CAUTION

If no external command device is used, be sure to short terminals 4 and 5.

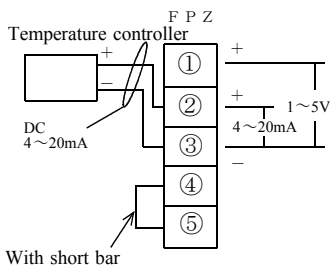
- One-to-one combination with a temperature controller

- Parallel operation of 3 units combined with a temperature controller

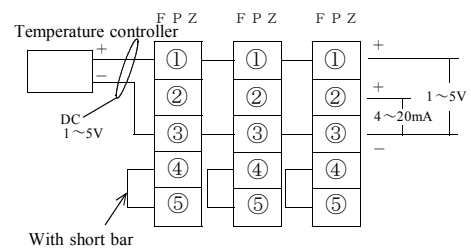
Input signals: 1~5 VDC



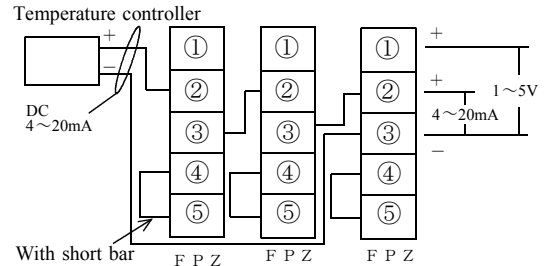
Input signals: 4~20mADC



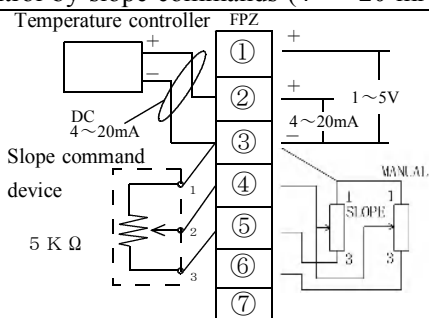
Input signals: 1~5 VDC



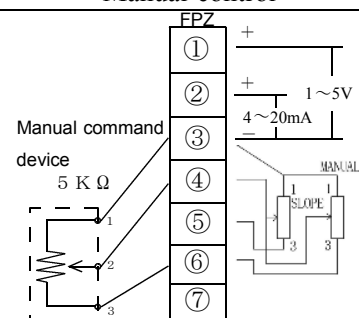
Input signals: 4~20mADC



Control by slope commands (4 ~ 20 mADC)



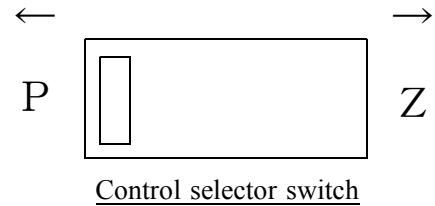
Manual control



8. Description of Functions

8.1 Selection of Control System (When shipped, the phase control system is active.)

- Set the selector switch to 'P' position to turn the phase control system on. (The effective voltage proportional to the preset input value is output.)
- Set the selector switch to 'Z' position to turn the zero cross control system on. (The effective voltage proportional to the preset input value is output.)

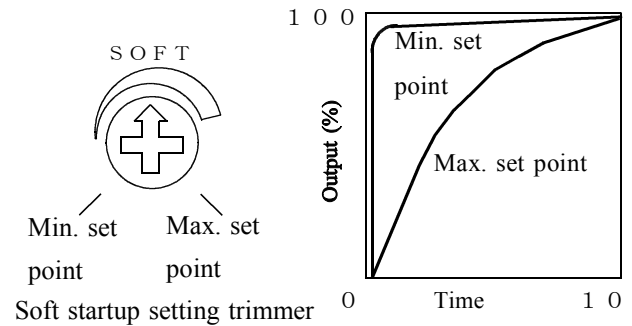


CAUTION

Make sure to turn the operation power off before switching. Switching with the power supply on could lead to trouble of the unit.

8.2 Soft Startup Facility

A variable control type soft startup facility is incorporated in the standard specification of the unit, with the available control time ranging from approximately 0.5 to 10 seconds. (When shipped, the unit is set for about 0.5 seconds.) This facility allows a gentle change of output levels even when the preset input values abruptly change, thus inhibiting rush currents.

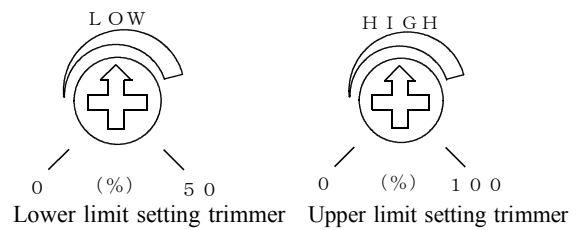


- The control time above is the time span required until the maximum voltage waveform output is obtained.

8.3 HIGH/LOW Control

This feature, included in the standard specification, allows you to set a desired output value in relation to the input control signal.

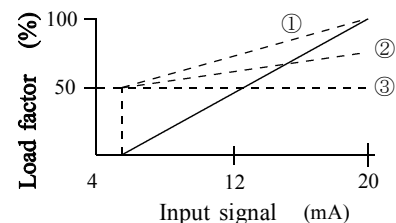
- Upper limit (HIGH): Use this dial to set a desired full point.
- Lower limit (LOW): Use this dial to set a desired first transition point.



REFERENCE

The performance shown by the solid line on the right is achieved with the input signal specification of 4~20 mA and the upper/lower limit values set at 100% and 0%, respectively (settings at shipping). The performance will be as shown by the dotted line ① when you change the LOW control value to 50% and leave the HIGH control value at 100%.

Then changing the HIGH control value to 50% will give the performance shown by the dotted line ②. Next, change the HIGH control value to 0%, and the performance will be as shown by the dotted line ③.



8.4 Monitoring

● LOAD ALM lamp

Lighting of this lamp indicates that there is a problem in the main circuit. The problem will be one of the following:

- 1) Load break (heater disconnected);
- 2) Short-circuit of thyristor (SCR);
- 3) Load supply voltage not supplied

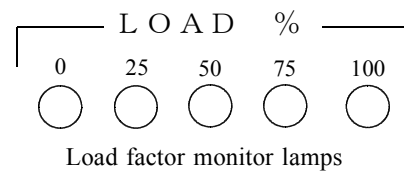
● LOAD % lamps

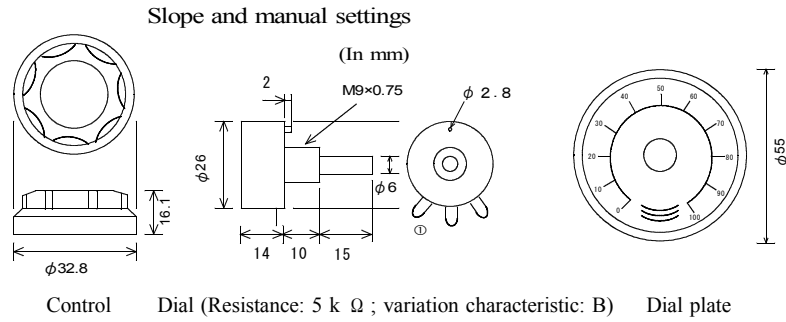
These lamps come on when the load voltage exceeds (0%, 25%, 50%, 75%, 100%) $\pm 5\%$ of the load supply voltage.

● Relay contact output 30 VDC 0.5 A Contact operation

- 1) When an operation power supply is OFF, between contacts open. (Non-Excitation)
- 2) When an operation power supply is ON: Moreover, it short-circuit between contacts at the time of normal operation. (Excitation) Moreover, it opens between contacts at the time of unusual operation. (Non-Excitation)

- External command device (Optional)





9. Inspections, Maintenance and Troubleshooting

Perform the following inspections and maintenance to keep the unit always in the best conditions.

9.1 Inspections

- After completing the connections and before you put the power supply to work, check the load wire once again to ensure safety.
- After the power supply is put to work, check that power is properly regulated.

9.2 Maintenance

- Loosened screws of terminals L1 and L2 generate heat. After confirming that power is off, check that these screws are firmly clamped.
- This unit contains parts subject to determined life or susceptible to aged deterioration. Periodical maintenance is suggested.

9.3 Troubleshooting

① Output kept standing

Symptom/Checkpoint	Cause(s)/Action
1) LOAD ALM lamp stays on.	Thyristor may have been shorted. The cause may be an extraordinary load, overcurrent or wrong installation, among others. REPAIR REQUIRED
2) LOAD % lamp stays on.	Input error. Check the external connection by referring to "Typical External Connections" in Section 7.
	Input signal error. Check the temperature controller for any trouble.

② Output disabled

Symptom/Checkpoint	Cause(s)/Action
1) LOAD ALM lamp stays on.	Heater wiring may have a break. Check the loading side for any problem.
	Check whether the load supply voltage is being properly supplied.
2) LOAD % lamp does not come on.	Input error. Check the external connection by referring to "Typical External Connections" in Section 7.
	Input signal error. Check the temperature controller for any trouble.
3) POWER lamp does not come on.	Check whether the 100-240 VAC/DC rated voltage is being properly applied.
4) POWER lamp is blinking.	Some problem in the unit. Turn the operation power source off, then turn it on once again. ※ If the lamp is not reset, REPAIR REQUIRED.

③ No normal output available

Symptom/Checkpoint	Cause(s)/Action
1) LOAD 100% lamp does not come on, and 100% output cannot be obtained.	Check whether there is 100% input control signal.
	Check whether the HIGH control dial is turned to the full right.
2) LOAD 100% lamp is on but 100% output cannot be obtained.	Thyristor (SCR) may have failed. REPAIR REQUIRED
3) Output proportional to the input control signal is not available.	Check whether the HIGH/LOW control dials and the dial of the external slope command device are positioned at right points, each respectively.

10. Specifications

Number of phases:	Single phase
Rated load current:	30/50/70/100 A AC
Minimum load current:	0.3 A
Load supply voltage:	100-240/380-440 VAC
Load power frequency:	50/60 Hz (Automatic detection)
Control system:	Phase control or zero cross control (Selection by switch operation)
Applicable load:	Linear (R) load
Load make-break device:	Thyristor (SCR) module
Alarm output:	Contact Rating 30 VDC 0.5A
Operation power source:	100-240 VAC/DC
Cooling system:	Self-cooled (30/50 A AC), Compulsive-cooled using a fan.(70/100 A AC)
The power supply for cooling:	200-220 VAC
Permissible voltage fluctuation:	Within $\pm 10\%$ of the rated value
Working temperature range:	-10°C to +55°C (Operation guaranteed); 0°C to +40°C (Performance guaranteed)
Working humidity range:	90%RH or less (without bedewing)
Environmental conditions:	No exposure to corrosive/inflammable gases, dust or vibration
Installation conditions:	Vertical mounting (No closed mounting)
Outside size:	Refer to attached sheet appearance figure.
Insulation resistance:	Over 50 M Ω (500 VDC) between the main circuit terminals and the case
Insulation withstand voltage:	2000 VAC for one minute between the main circuit terminals and the case



When working this equipment (70A, 100A equipment), the fan motor for cooling is driving.
Please use it after checking.
If it is used with the fan motor for cooling stopped, there is fear, such as a fire (burn).

FOREST Co., Ltd.

Head Office

Shimouma 4-14-15, Setagaya-ku, Tokyo 154-0002, Japan

Telephone: +81 3 3421 5141

Fax: +81 3 3421 5145

Yamanashi Fuji Plant

Shibokusa, Oshino-mura, Minami-Tsuru, Yamanashi

401-0511, Japan

Telephone: +81 555 84 2503

Fax: +81 555 84 3157