

OPERATION MANUAL

EXTERNAL SIGNAL INTERFACE

MODEL EX01-PCR

Model EX01-PCR External Signal Interface is an optional device for the PCR Series Frequency Converter. The EX01-PCR cannot be used for other equipment.

This manual covers primarily the method of hooking up the EX01-PCR to the PCR Series Frequency Converter.

When using the EX01-PCR, be sure to read also the operation manual for the PCR Series Frequency Converter.

First Edition

KIKUSUI ELECTRONICS CORPORATION

(KIKUSUI PART NO. Z1-987-520)

Power Requirements of this Product

Power requirements of this product have been changed and the relevant sections of the Operation Manual should be revised accordingly.

(Revision should be applied to items indicated by a check mark)

Input voltage

The input voltage of this product is _____ VAC,
and the voltage range is _____ to _____ VAC. Use the product within this range only.

Input fuse

The rating of this product's input fuse is _____ A, _____ VAC, and _____.

WARNING

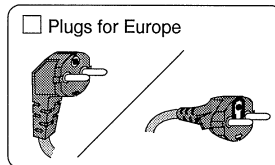
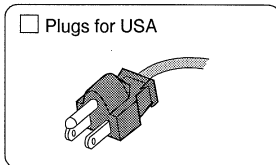
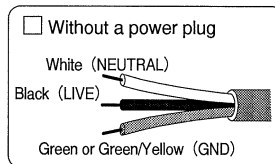
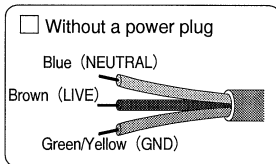
- To avoid electrical shock, always disconnect the AC power cable or turn off the switch on the switchboard before attempting to check or replace the fuse.
- Use a fuse element having a shape, rating, and characteristics suitable for this product. The use of a fuse with a different rating or one that short circuits the fuse holder may result in fire, electric shock, or irreparable damage.

AC power cable

The product is provided with AC power cables described below. If the cable has no power plug, attach a power plug or crimp-style terminals to the cable in accordance with the wire colors specified in the drawing.

WARNING

- The attachment of a power plug or crimp-style terminals must be carried out by qualified personnel.



Provided by Kikusui agents

Kikusui agents can provide you with suitable AC power cable.
For further information, contact your Kikusui agent.

Another Cable _____

TABLE OF CONTENTS

	<u>PAGE</u>
1. GENERAL INFORMATION	1
1.1 Introduction	1
1.2 Features	1
2. SPECIFICATIONS	2
2.1 Electrical Specifications	2
2.2 Function Specifications	3
2.3 Other Specifications	3
2.4 Outline Drawing	4
3. OPERATION	5
3.1 Panel Features	5
3.2 Precautions Before Operation	5
3.3 Preparation for Use	8
3.3.1 Warning	8
3.3.2 Connecting EX01-PCR to PCR Series	8
3.3.3 Basic operation confirmation and offset adjustment	10
3.4 Basic Operation Method	11
3.5 Precise Offset and Gain Adjustment (for correcter use of the instrument)	12
4. BEFORE ORDERING REPAIR SERVICE	16

1. GENERAL INFORMATION

1.1 Introduction

The EX01-PCR is an optional instrument that enables the PCR Series Frequency Converter (hereafter abbreviated as PCR Series) to be controlled by an external AC signal.

Before using the EX01-PCR, read this manual and PCR Series Operation Manual carefully.

1.2 Features

The EX01-PCR has the following features:

- It enables the PCR Series to be used as a power amplifier.
- When used with a one-control parallel operation cable (PD01M-PCR/PD01S-PCR type), it enables the PCR Series to be used as a power amplifier of up to 20 kVA.

2. SPECIFICATIONS

This section describes the specifications of the EX01-PCR connected to the PCR Series. For the specifications of the PCR Series itself, refer to the PCR Series Operation Manual.

2.1 Electrical Specifications

External signal input voltage	0 to approx. 1.4V rms (Distortion factor must be 1% or less)
Input impedance	600Ω±5%
External signal input frequency	5 to 500Hz
Voltage amplification factor (gain)	Approx. 100 times/approx. 200 times Fine adjustment is possible (At PCR Series output range of 100V/200V)
Non-linearity characteristic of voltage amplification factor	±0.2% or less (At PCR Series output voltage of 20-140V/40-280V, without load)
Output voltage harmonic distortion	[PCR Series harmonic distortion] +0.3% or less (When the external input signal harmonic distortion is 1% or less)
Frequency fluctuation of output voltage	±2% or less (The output conditions conform to those of PCR Series)
Temperature stability of output voltage	500ppm/°C (Typical value)
Insulation resistance	30MΩ or more (500V DC) INPUT terminal of EX01-PCR - PCR Series input terminals, output terminals, and case
Withstand voltage	500V AC, 1 minute INPUT terminal of EX01-PCR - PCR Series case
	1500V AC, 1 minute INPUT terminal of EX01-PCR - PCR Series input and output terminals

2.2 Function Specifications

INT/EXT mode switching	The EX01-PCR can be set in the INT mode (PCR Series internal control mode) or EXT mode (external input signal control mode) by a switch on its panel surface.
Operation function *(in EXT mode only)	Only the RANGE/SET switch (output voltage range switch), OUTPUT switch (output on/off), LIMIT switch (limit voltage setting), CLEAR switch, and KEY LOCK switch on the PCR Series operation/display panel are effective.
Display function *(in EXT mode only)	Only the 100V/200V lamp (output voltage range), OUTPUT lamp (output on/off status), OVER LOAD lamp (overload protective function active state), ALARM lamp (overvoltage protective function active state), MASTER/SLAVE lamp (parallel operation state), EXT lamp (external input signal control state), voltmeter, and ammeter on the PCR Series operation/display panel are effective.
Others	The EX01-PCR can be used with the one-control parallel operation cable(PD01M-PCR/PD01S-PCR type).

* In the INT mode, all the specifications of the PCR Series Frequency Converter are effective.

2.3 Other Specifications

Ambient Operating Temperature and Humidity	0 to +50°C, 10 to 90% RH (Non condensing)
Maximum external dimensions	29W × 137H × 124D mm (1.14W × 5.39H × 4.88D in.)
Weight	Approx. 130 g (4.6 oz)
Accessory	Operation manual (1 copy)

88.5.25

8771304

2-4 Outline Drawing

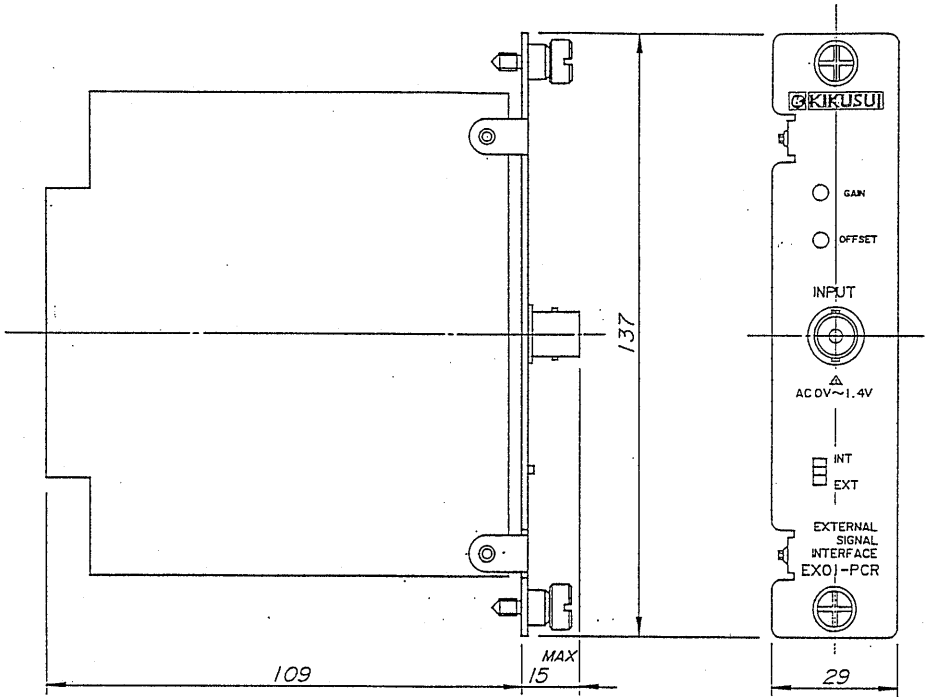


Figure 2-1

877130

3. OPERATION

3.1 Panel Features

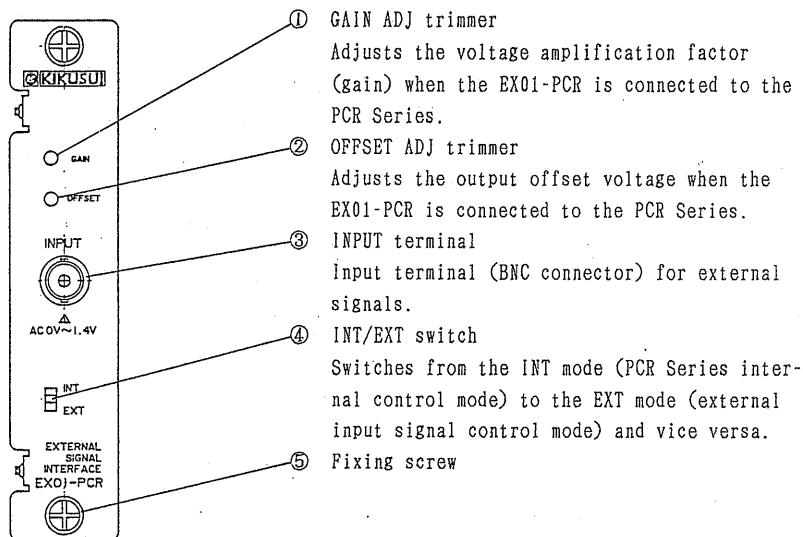


Figure 3-1

3.2 Precautions Before Operation

1. External input signal

(1) Input voltage

When the EX01-PCR is connected to the PCR Series, the voltage amplification factor (gain) or the PCR Series is fixed at approximately 100 times (output voltage range = 100V) or 200 times (output voltage range = 200V). (Fine adjustment can be done by the GAIN ADJ trimmer ① on the panel. See Item 3, Section 3.5 for details.)

In other words, the maximum external input voltage required to obtain the maximum rated output voltage of PCR Series, that is, 140V rms or 280V rms (output voltage range = 100V or 200V), is 1.4V rms (sign wave).

When setting the level (voltage range) of the external input signal, consider the above voltage amplification factor.

Note that the output voltage of the PCR Series is roughly proportioned to the input voltage of the EX01-PCR.

Note: Do not apply overvoltage (2V rms or $\pm 3V$ peak or higher) to the INPUT terminal of the EX01-PCR.
If the overvoltage is applied, the protective function of the PCR Series may stop the signal output or failure of the EX01-PCR may occur.
Also, consider the withstand voltage (especially between the INPUT terminal ③ and PCR Series case).

(2) Input frequency

When the EX01-PCR is connected to the PCR Series, the input frequency range is 5 to 500 Hz.

Note: Do not input a signal of the frequency higher or lower than the specified range.
If such a signal is input, the protective function may stop the output of signals from the PCR Series or the PCR Series may not function correctly.
Especially, do not input a signal of the frequency higher than 500 Hz.

(3) Input harmonic distortion

The waveform harmonic distortion of the signal input to the EX01-PCR must be less than 1%.

Note: If the input signal harmonic distortion is high, the maximum voltage may not be output from the PCR Series.
When the waveform of the input signal has many high frequency harmonics components, the harmonics components may not appear in the waveform of the voltage output from the PCR Series even if the measured distortion factor of the input signal is less than 1%. Also, such a waveform of the input signal may cause failure of the PCR Series.
For any questions, please contact our Service Office.

(4) Input impedance

The input impedance of the EX01-PCR is approximately 600Ω.

Note: If the output impedance of the signal generator connected to the INPUT terminal ③ of the EX01-PCR is too high, the voltage input to the EX01-PCR is insufficient and the voltage output from the PCR Series may not reach the expected value.
(For example, when a signal output from the oscillator whose output impedance is 600Ω and open output voltage is 2V rms is applied to the EX01-PCR, the actual voltage input to the EX01-PCR is reduced to 1V rms ($2 \times 600 / (600 + 600)$)).

2. Offset voltage

Be sure to adjust the offset before using the EX01-PCR.

- The offset voltage means the DC voltage component of the signal output from the PCR Series.

Note: Depending on the type of the load connected to the PCR Series, the above offset voltage may cause unstable operation or failure of the load.
Also, signals may not be output from the PCR Series or the signal output may be stopped as the PCR Series Protective function operates.

- The DC amplifier configuration is adopted so that stable output may be obtained from a signal of even low frequency (5 Hz) when the EX01-PCR is connected to the PCR Series.

If the external input signal has a DC voltage component, it will be output from the PCR Series as an offset voltage.
Also, the offset voltage of the internal amplifier itself may affect the load.

Therefore, be sure to execute the offset adjustment according to the explanation in Section 3.3.3 when turning on the power for the first time for the PCR Series connected with the EX01-PCR.

3.3 Preparation for Use

3.3.1 Warnings

- Notes:
- Only one unit of EX01-PCR is allowed to be used on one unit of PCR Series; that is, the EX01-PCR may be inserted into only one I/O slot (SLOT1 or SLOT2) of the PCR Series. The use of two EX01-PCR units on one PCR Series unit will cause failure.
 - Before inserting the EX01-PCR, be sure to turn off the POWER switch of the PCR Series.
 - Since the PCB on the EX01-PCR is uncovered, be careful not to give a shock of static electricity when taking out the interface board from the carton or inserting it into the PCR Series. Also, do not touch any part of the interface board except its panel.

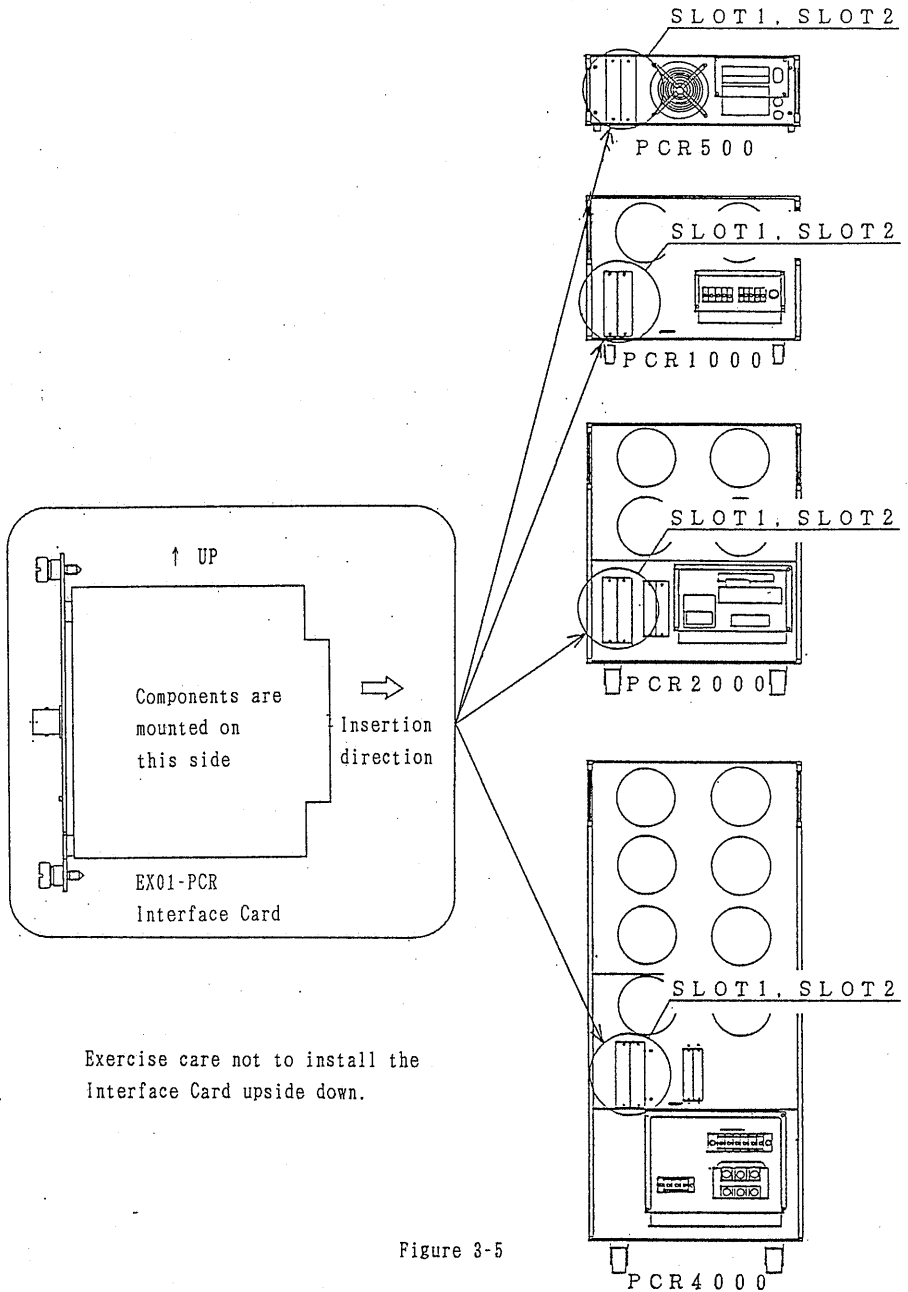
PCB=Printed circuit board

- The EX01-PCR must not be used with the 3P01-PCR Series.

3.3.2 Connecting EX01-PCR to PCR Series

As shown in Figure 3-2, insert the EX01-PCR into SLOT1 or SLOT2 of the PCR Series rear panel.

Then, fasten the fixing screw ⊕ tightly by a screwdriver.



Exercise care not to install the Interface Card upside down.

Figure 3-5

3.3.3 Basic operation confirmation and offset adjustment

When executing the confirmation and adjustment explained in this section, do not connect any load to the output terminal of the PCR Series.

1. Power-on

- 1) After inserting the EX01-PCR into the PCR Series according to the explanation in Section 3.3.2, slide the INT/EXT switch ④ of the EX01-PCR to the EXT side (EXT mode).

To the INPUT terminal ③ of the EX01-PCR, connect the signal source to be used actually. If the signal source does not have a DC component, do not connect anything to the INPUT terminal. (The AC voltage component of the signal source must be set to 0.)

- 2) Turn on the POWER switch of the PCR Series to set it in the active state. Then, confirm that the EXT lamp and range lamp (100V or 200V) are on and voltmeter and ammeter are active on the PCR Series operation/display panel. Leave the PCR Series in this state for more than 10 minutes (aging).

2. Simple offset adjustment method

- 1) Set the output voltage range of the PCR Series to 200V, and turn on the OUTPUT switch.
- 2) Turn the OFFSET ADJ trimmer ② of the EX01-PCR slowly till the voltmeter of the PCR Series indicates 0V.

Note: ○ If the POWER switch goes off automatically immediately after the OUTPUT switch is turned on, turn the OFFSET ADJ trimmer ② slightly to either direction and turn on the POWER switch and OUTPUT switch again. If the POWER switch still goes off, turn the OFFSET ADJ trimmer to the same direction and turn on the POWER and OFFSET switches again.

When the OFFSET ADJ trimmer cannot be turned any further as a result of repeating the above operation, turn it to the opposite direction little by little from its initial position and repeat the same operation.

- Execute the offset adjustment periodically.

For more accurate offset adjustment, see Section 3.5.

3.4 Basic Operation Method

1. Setting output voltage and frequency

The PCR Series can output voltage in proportion to the voltage input to the EX01-PCR.

The frequency of the signal output from the PCR Series is the same as that input to the EX01-PCR.

Note: ◦ When the signal output is stopped (the POWER or OUTPUT switch is turned off) by the protective function of the PCR Series, check the following points:

- 1) If the OUTPUT lamp is off (OUTPUT-switch-off state) and ALARM lamp is on on the PCR Series operation/display panel, the output voltage is greater than the limit voltage of the PCR Series and the overvoltage protective function is active. In this case, check the limit voltage, input voltage, and harmonic distortion, and if they are OK, turn off the POWER switch of the PCR Series and turn on the OUTPUT switch again. Then, gradually increase the voltage input to the EX01-PCR till the desired output voltage is obtained.
- 2) Any one of the errors listed below will turn off the POWER switch of the PCR Series. Eliminate the error cause and turn on the POWER switch again.
 - The voltage input to the EX01-PCR is so high that the voltage output from the PCR Series exceeds 280V.
 - The frequency of the signal input to the EX01-PCR (that is, frequency of the signal output from the PCR Series) is lower than 5 Hz.
 - The voltage input to the EX01-PCR has a DC component, or the offset adjustment (see Sections 3.3.3 and 3.5) is incomplete.

The protective function of the PCR Series operates whether the EX01-PCR is inserted or not; that is, it may be caused to operate by a factor other than the above listed ones. Refer to the PCR Series Operation Manual for details.

- When the voltage input to the EX01-PCR is raised suddenly, the waveform of the voltage output from the PCR Series may be distorted momentarily. This problem will not be caused if the OUTPUT switch of the PCR Series is turned on after the input voltage is stabilized.

2. Switching INT mode/EXT mode

When the INT/EXT switch ④ on the EX01-PCR panel is slid to the INT side, the functions and specifications of the PCR Series without the EX01-PCR are presented to the user. (INT mode)

In the EXT mode, the EXT lamp on the PCR Series operation/display panel is turned on.

Note: Before sliding the INT/EXT switch, be sure to turn off the POWER switch of the PCR Series.

Sliding the INT/EXT switch during operation of the PCR Series may cause abnormal signal output or failure of the instrument.

3.5 Precise Offset and Gain Adjustment (for correcter use of the instrument)

This section explains the methods of adjusting the offset and gain precisely.

1. Preparation for adjustment

1) Get the following items ready:

- Voltmeter that can measure DC and AC voltage
- Sign wave signal generator or equivalent instrument (Output voltage = 1.4V rms or higher at 600Ω load. Wave harmonic distortion = 1% or less.)
This instrument is not necessary if the gain adjustment is not executed.
- Screwdriver for adjustment or equivalent tool

- 2) Connect the signal generator (or equivalent instrument) to the INPUT terminal ③ of the EX01-PCR, and the voltmeter to the OUTPUT terminal board of the PCR Series.
- See Figure 3-3. For the method of inserting the EX01-PCR into the PCR Series, see Section 3.3.2.

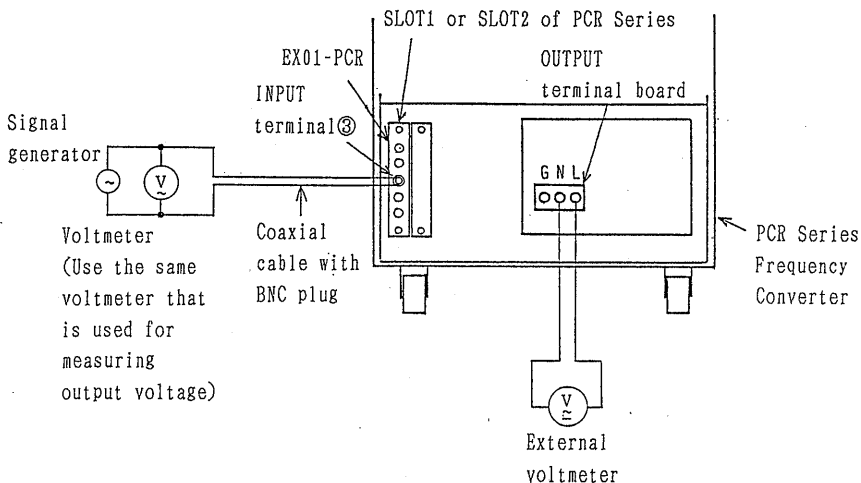


Figure 3-3

- 3) After sliding the INT/EXT switch ④ of the EX01-PCR to the EXT side (EXT mode), turn on the POWER switch of the PCR Series to set the instrument in the active state.
- Set the output voltage range to the range to be used actually.
(Do not connect any load to the output terminal of the PCR Series, and do not turn on the OUTPUT switch.)
- Refer to the PCR Series Operation Manual for the method of operating the PCR Series in details.
- 4) Keep the instrument in this state for more than 30 minutes (aging).

2. Offset adjustment

After completing the aging of the above step 4), adjust the offset as follows:

- 1) Set the output of the signal generator to the minimum, and if the signal generator has a DC offset function, deactivate it. Or the signal generator may be disconnected from the INPUT terminal ③ of the EX01-PCR. Then, set the external voltmeter in the DC voltage measuring mode and to the maximum voltage range.
- 2) Turn on the OUTPUT switch of the PCR Series, and turn the OFFSET ADJ trimmer ② of the EX01-PCR slowly till the output voltage (offset voltage) indicated by the external voltmeter is minimized.

3. Gain adjustment

This section explains how to adjust accurately the voltage amplification factor (gain) obtained when the EX01-PCR is incorporated into the PCR Series. This operation may be omitted if precision of the gain is not required, but it is useful in the application of the instrument.

- 1) After completing the offset adjustment explained in Section 2, turn off the OUTPUT switch of the PCR Series and set the output voltage range to 100V range.
Then, set the limit voltage to 142.5V.
- 2) Set the output voltage of the signal generator to 1V rms (and frequency to approximately 200 Hz or to the value to be used actually), and turn on the OUTPUT switch of the PCR Series.
Turn the GAIN ADJ trimmer ① of the EX01-PCR till the output voltage of the PCR Series (indicated by external voltmeter) becomes 100V rms.
- 3) Then, set the output voltage of the signal generator to 1.4V rms, and confirm that the voltage output from the PCR Series is 140V±0.3V rms.
- 4) Set the PCR Series limit voltage to 285.0V, and switch the output voltage range to 200V range keeping the signal generator output voltage at 1.4V rms. (When switching the range, the OUTPUT switch need be turned off.)
Confirm that the output voltage is 280V±1V rms.

4. Protective function confirmation procedure

After completing the adjustments explained in Sections 2 and 3, confirm the operation of the protective function as follows:

- 1) From the conditions of Item 4) of Section 3 above, lower the limit voltage of the PCR Series gradually. Confirm that the OUTPUT switch is turned off (OUTPUT lamp is turned off or ALARM lamp is turned on) and the output voltage is approximately 0V when the limit voltage (indicated by the PCR Series voltmeter) has reached 250 - 275V.
Then, turn off the POWER switch and turn it on again.
- 2) Set the limit voltage to 285.0V again, turn on the OUTPUT switch, and set the output frequency of the signal generator to 5 Hz. Then, lower the output frequency of the signal generator gradually, and confirm that the POWER switch is turned off when the output frequency has been reduced to approximately 1 Hz.

Note: If the adjustments and confirmations explained in the above sections 1 to 4 cannot be carried out successfully, please contact our Service Office.

877150

4. BEFORE ORDERING REPAIR SERVICE

When the instrument does not seem to operate correctly, check the items listed in Table 4-1 before sending it for repair.

Table 4-1. Trouble Check Items

Symptom	Check Item	Probable Cause
○ Power switch cannot be turned on (or goes off abnormally)	1. Isn't the voltage input to EX01-PCR higher than 1.4V rms ?	○ Internal protective function is active
	2. Isn't the frequency of the signal input to EX01-PCR lower than 5 Hz. Or isn't DC voltage supplied ?	○ Internal protective function is active ○ The offset voltage of the signal generator connected to EX01-PCR is inappropriate.
	3. Is the offset voltage of EX01-PCR adjusted correctly ?	○ Incomplete offset adjustment
	4. All the above items are OK	○ Circuit failure
○ OUTPUT switch cannot be turned on (or goes off abnormally)	1. Isn't the ALARM lamp on?	○ Overtemperature protective function is active
	2. Isn't the ALARM lamp on and the input voltage of EX01-PCR higher than 1.4V rms ? Or isn't the limit voltage set too low?	○ Overvoltage output protective function is active
	3. All the above items are OK	○ Circuit failure
○ Output waveform is distorted, or no waveform is output	1. Is it distorted, by the sudden change of the signal input to EX01-PCR?	○ Normal (The power-failure waveform to avoid sudden change of output voltage cannot be generated by the use of EX01-PCR)
	2. Isn't the waveform of the signal input to EX01-PCR distorted?	○ Error of the signal source connected to EX01-PCR

	3. Is EXT lamp on?	○ The mode switch of the EX01-PCR is not set to EXT side
	4. All the above items are OK	○ Circuit failure
○ Offset/gain cannot be adjusted	1. Is the signal input to EX01-PCR normal?	○ Error of the signal generator connected to EX01-PCR
	2. Is the operation procedure correct?	○ Incorrect adjustment method
	3. All the above items are OK	○ Circuit failure

If the instrument is judged to be defective as a result of checking the above items, contact our Service Office; if not, eliminate the error cause and use the instrument.