

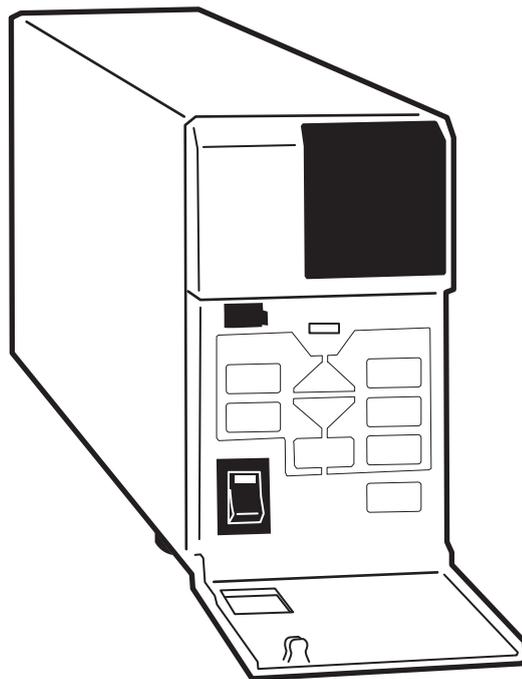
Part No. Z1-004-132, IB018171  
Jul. 2009

## Operation Manual

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Power Supply Controller

# PIA3200



# 正誤表

## PIA3200 取扱説明書 Part No. Z1-004-130, IB014583

本取扱説明書を以下のように変更いたします。  
お手数ですが訂正してご使用ください。

ページ 139

「付録 E ID 一覧」

	ID 番号	形名	出力電圧 設定範囲 [V]	出力電流 設定範囲 [A]
変更前	038	PAD110-30LA	0.00 ~ 110.00	0.000 ~ 30.000
変更後	038	PAD110-32LA	0.00 ~ 110.00	0.000 ~ 32.000

## Manual Changes

### PIA3200 Operation Manual Part No. Z1-004-132, IB018171

Please make the following changes to the text in this manual.

Page 137

“Appendix E, List of IDs”

	Model ID	Model	Output voltage setting range [V]	Output current setting range [A]
Previous	038	PAD110-30LA	0.00 ~ 110.00	0.000 ~ 30.000
New	038	PAD110-32LA	0.00 ~ 110.00	0.000 ~ 32.000

Thank you for purchasing the PIA3200 Power Supply Controller.

## About this manual

This manual is intended for first-time users of this product. It gives an overview of the PIA3200 and describes various settings, operation, commands, maintenance, safety precautions, etc.

Read this manual thoroughly to use the functions of the PIA3200 effectively. You can also review this manual when you are confused about an operation or when a problem occurs.

After reading, keep the manual nearby so that you may refer it as needed. When moving the product to other location, be sure to bring this manual as well.

If you find any incorrectly arranged or missing pages in this manual, they will be replaced.

If the manual gets lost or soiled, a new copy can be provided for a fee. In either case, please contact a Kikusui distributor or agent, and provide the "Kikusui Part No." given on the cover page.

This manual has been prepared with the utmost care, however, if you have questions or note any errors or omissions, please contact a Kikusui distributor or agent.

## Applicable ROM version of the PIA3200

This manual applies to the PIA3200 with ROM version 1.4X. When making an inquiry about the product, please provide us with the following information:

The model (indicated at the top section on the front panel)

The ROM version (see p.114)

The serial number (indicated at the bottom section on the rear panel)

## How to read this manual

This manual is designed to be read from beginning to end. We recommend that you read the manual thoroughly from the beginning before using the PIA3200 for the first time.

## Intended readers of this manual

This manual is intended for users of the PIA3200 or persons teaching other users on how to operate the PIA3200.

The manual assumes that the reader has electrical knowledge.

Information on commands is provided with the premise that the reader has sufficient knowledge about controlling measuring instruments using a personal computer.

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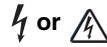
Both unit specifications and the contents of this manual are subject to change without notice.

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## Safety symbols

For the safe use and safe maintenance of this product, the following symbols are used throughout operation manual and on the product. Note the meaning of each of the symbols to ensure safe use of the product. (Not all symbols may be used.)



Indicates that a high voltage (over 1 000 V) is used here. Touching the part causes a possibly fatal electric shock. If physical contact is required by your work, start work only after you make sure that no voltage is output here.

### DANGER

Indicates an imminently hazardous situation which, if ignored, will result in death or serious injury.



### WARNING

Indicates a potentially hazardous situation which, if ignored, could result in death or serious injury.



### CAUTION

Indicates a potentially hazardous situation which, if ignored, may result in damage to the product or other property.



Indicates a prohibited act.



Indicates a general danger, warning, or caution. When this symbol is marked on the product, see the relevant section in this manual.



Protective conductor terminal.



Chassis (frame) terminal.



On (supply).



Off (supply).



In position of a bi-stable push control.



Out position of a bi-stable push control.

## Notations used in this manual

- The PIA3200 Power Supply Controller is also simply referred to as the PIA3200 in this manual.
- The host controller is also referred to the word "PC" as it is used in this manual. The "PC" is a generic term for personal computers and work stations.
- The following markings are used with the explanations in this manual.



Indicates a potentially hazardous situation which, if ignored, could result in death or serious injury.



Indicates a potentially hazardous situation which, if ignored, may result in damage to the product or other property.



Indicates information that you should know.



Explanation of terminology or operation principle.



Indicates reference to detailed information.

# 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 Possible electric shock.**

- Before attempting to check or replace the fuse, be sure to turn the **POWER** switch off and removing the plug of power cord from an outlet or turn off the circuit breaker of switchboard.
  - Use a fuse element having a shape, rating, and characteristics suitable for this product.
-

## Safety precautions

The following safety precautions must be observed to avoid fire hazards, electric shock, accidents, and other failures. Keep them in mind and make sure to observe them.

Using the product in a manner that is not specified in this manual may impair the protection functions provided by the product.



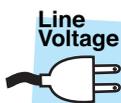
### Users

- This product must be used only by qualified personnel who understand the contents of this operation manual.
- If unqualified personnel is to use the product, be sure the product is handled under the supervision of qualified personnel (those who have electrical knowledge). This is to prevent the possibility of personal injury.



### Purpose of use

- Never use the product for purposes other than the product's intended use.
- This product is not designed or manufactured for general home or consumer use.



### Input power

- Use the product within the rated input line voltage range.
- For applying power, use the supplied power cord. For details, see the respective page in this operation manual.
- This product is designed as an equipment of IEC Overvoltage Category II (energy-consuming equipment supplied from the fixed installation).



### Fuse

- The fuse can be replaced on this product. When replacing the fuse, use a fuse of shape, rating, and characteristics that conform to the product. For details, see the respective page in this operation manual.



### Cover

- Some parts inside the product may cause physical hazards. Do not remove the external cover.



### Grounding

- This product is an IEC Safety Class I equipment (equipment with a protective conductor terminal). To prevent electric shock, be sure to connect the protective conductor terminal of the product to electrical ground (safety ground).



### Installation

- This product is designed for safe indoor use. Be sure to use the product indoors.
- When installing products, be sure to observe precautions concerning installation location. For details, see the respective page in this operation manual.



### Relocation

- Turn off the POWER switch, and disconnect the cables before relocating the product.
- When relocating the product, be sure to include the manual.



### Operation

- If a malfunction or abnormality is detected on the product, stop using it immediately, and remove the power cord plug from the outlet. Make sure the product is not used until it is completely repaired.
- Do not disassemble or modify the product. If you need to modify the product, contact your Kikusui distributor or agent.



### Maintenance and inspection

- To prevent electric shock, be sure to unplug the product before carrying out maintenance or inspection. Do not remove the external cover.
- Check periodically that there are no tears or breaks in the power cord.
- If the panel needs cleaning, gently wipe using a soft cloth with water-diluted neutral detergent. Do not use volatile chemicals such as benzene or thinner.
- To maintain the performance and safe operation of the product, we recommend that periodic maintenance, inspection, cleaning, and calibration to be performed.



### Service

- Kikusui service engineers will perform internal service of the product. If the product needs adjustment or repairs, contact your Kikusui distributor or agent.

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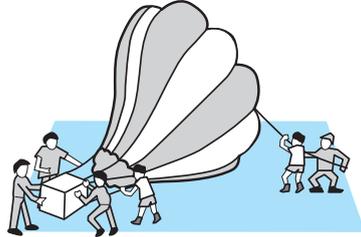
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# Search by Topic

## Preparation



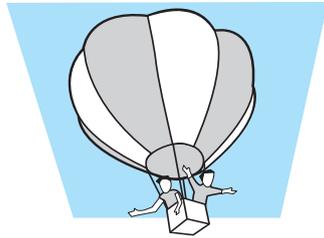
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## Maintenance

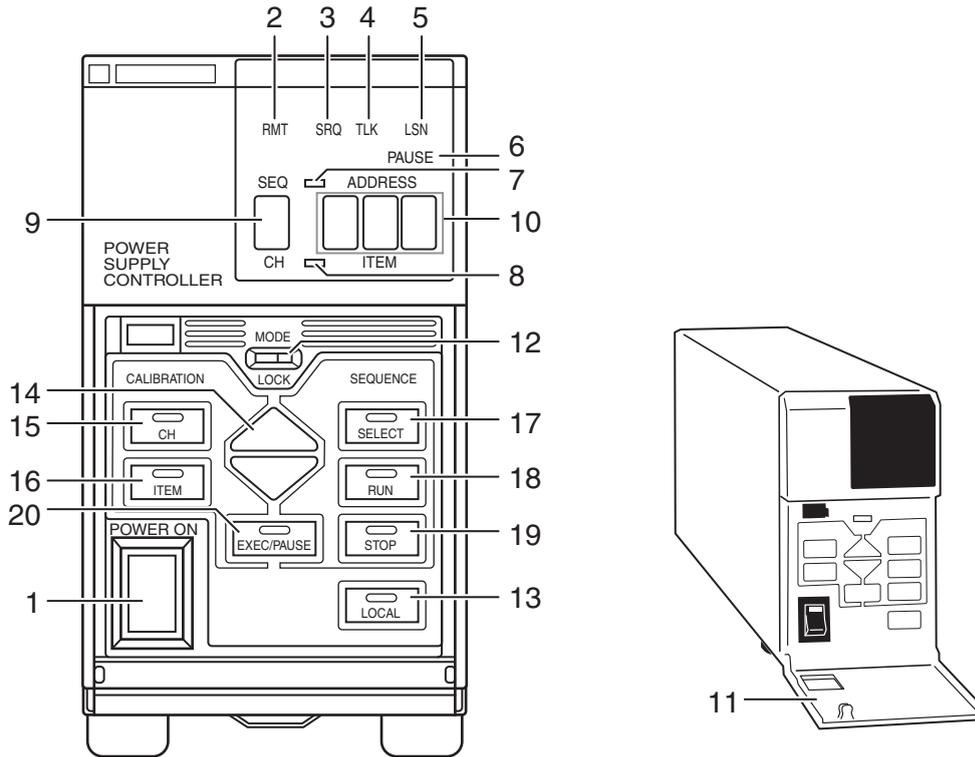


- **How do I replace the fuse?**
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## Troubleshooting

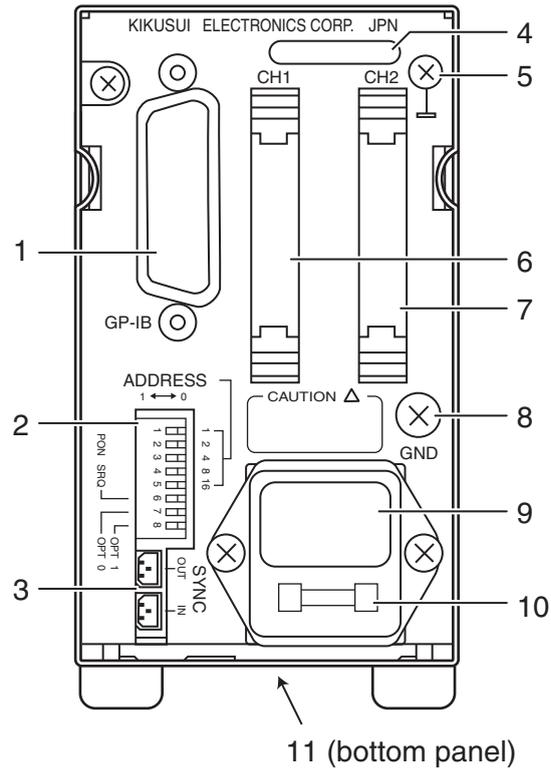
See "Troubleshooting" on page 134.

# Front panel



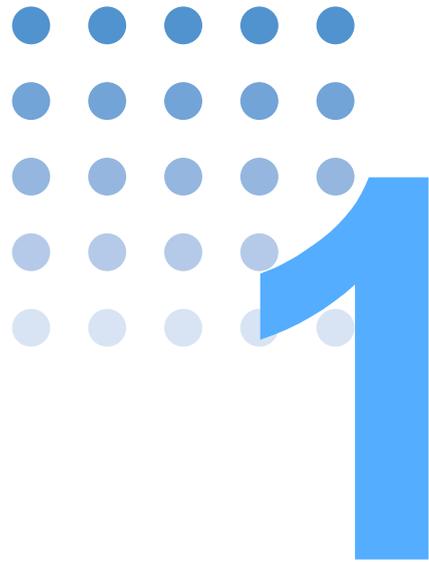
No.	Name	Description	<a href="#">See</a>
1	POWER switch	Turns the power on/off.	p. 22
2	RMT LED	Illuminates when the PIA is being controlled remotely.	p. 59
3	SRQ LED	Illuminates while a service request is being generated.	p. 75
4	TLK LED	Illuminates when the PIA3200 is set to talker mode.	—
5	LSN LED	Illuminates when the PIA3200 is set to listener mode.	—
6	PAUSE LED	Illuminates when the PIA3200 is paused in Sequence Control mode.	p. 116
7	SEQ LED	Illuminates in Sequence Control mode.	p. 116
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9	Display 1	Displays the program number, channel number, etc.	—
10	Display 2	Displays the address, item number, etc.	—
11	Panel cover	Operation panel cover.	p. 112
12	MODE switch	Switches modes.	p. 112
13	LOCAL key	Switches between remote and local modes.	p. 115
14	▲▼ key	Increases or decreases values and selects settings.	—
15	CH key	Used to select the channel you want to calibrate (valid in Calibration mode).	—
16	ITEM key	Selects the calibration item (valid in Calibration mode).	—
17	SELECT key	Selects sequence program step-change patterns (valid in Sequence Control mode).	p. 117
18	RUN key	Starts or resumes a sequence program (valid in Sequence Control mode).	p. 116
19	STOP key	Stops a sequence program (valid in Sequence Control mode).	p. 117
20	EXEC/PAUSE key	Executes calibration (when in Calibration mode). Pauses the execution of a sequence program (valid in Sequence Control mode) or selects service information (when in GPIB control mode with the MODE switch set to LOCK).	—

# Rear panel



No.	Name	Description	See
1	GPIB connector	GPIB interface	p. 20
2	ADDRESS switch	Dipswitch for setting the address	p. 20
3	SYNC connector	Alarm synchronization connector	p. 74
4	Serial number	PIA3200 serial number	—
5	Signal ground terminal.	Signal grounding (M3)	p. 23
6	CH1 connector	Power supply connector (channel 1)	p. 23
7	CH2 connector	Power supply connector (channel 2)	p. 23
8	GND terminal	Ground terminal (M5)	—
9	AC LINE	PIA3200 AC inlet	p. 18
10	Fuse holder	Input power supply fuse and spare fuse holder	p. 130
11	Voltage range switch	Switches the input line voltage range (located on the bottom panel)	p. 18





# General Description

This chapter gives an overview of the PIA3200 and the available options.

# Product Overview

The PIA3200 is a multi-functional controller that can control up to two DC power supplies.

To control DC power supplies from the PC, commands are sent from the PC to the PIA3200 via a GPIB bus. The CPU block in the PIA3200 analyze these commands and controls the DC power supplies properly.

The CPU block is isolated from the A/D and D/A converter blocks by the photocoupler. The I/O connector between CH1 I/O and CH2 I are isolated from the GPIB connector.

## Features

### ● GPIB control

You can change the settings such as the output voltage, output current, and overvoltage protection (OVP) of two DC power supplies via GPIB (IEEE-488BUS). You can read measured values such as the output voltage and output current of each DC power supply.

On the PAK-A DC Power Supply Series, all external control features can be controlled. On the PAD-L/PAD-LA Series, PMC-A Series, PAS Series, and PAN/PAN-A Series, selected descriptions can be controlled.

### Calibration

You can easily calibrate output voltages, output currents, and other settings and also the readback values of the connected power supplies.

### Sequence operation

You can save output programs that you set using commands to the internal memory. You can execute programs from the PC or from the panel. You can also execute a program one step at a time.

### Alarm synchronization

If you use multiple PIA3200s, you can use the alarm synchronization feature to quickly shut down the output or execute another specified action. The PIA3200s can quickly communicate alarm information with each other through the alarm synchronization I/O terminals separated from the GPIB port. This feature enables to construct a safer power supply system.

The PIA3200 is equipped with a undervoltage protection circuit. It can detect low output voltage of the DC power supplies.

### Auto-tracking protection (only available on the PAK-A Series)

This feature enables the overvoltage protection and undervoltage protection settings to automatically change based on the output voltage setting. This feature resolves you from having annoyed settings.

For more details on options, contact your Kikusui agent or distributor.

## Terminal units (TU01-PIA, TU02-PIA, and TU03-PIA)

You can connect a terminal unit to a PAD-L/PAD-LA Series, PMC-A Series, or PAN/PAN-A Series power supply to read back the output voltages, switch between remote and local modes, and monitor status (modification to the DC power supply is also necessary). By combining a terminal unit with a shunt unit (SH Series), you can read back the output current from the PAD-L/PAD-LA Series and PAN/PAN-A Series.

## Shunt unit

The accuracy of the output current readback values from the PAK-A Series and PMC-A Series is approximately 2 % of the full-scale current. When you connect a shunt unit, the accuracy of the output current readback values improves to 0.3 % of the full-scale current.

By combining a shunt unit with a terminal unit, you can read back the output current from the PAD-L/PAD-LA Series and PAN/PAN-A Series.

Name	Model	Notes
Shunt unit	SH10	10 A
	SH50	50 A

## Cables

You can use an optional cable to connect the PIA3200 and a DC power supply at a distance.

Name	Model	Notes
Cable (26-pin shielded cable)	SC01-05	50 cm
	SC01-10	1 m
	SC01-20	2 m

## Rackmount option

### ■ To rackmount the PIA3200 with PAK-A or PMC-A Series power supplies

Name	Model	Notes
Rackmount adapter	KRA3	Inch rack EIA standard
	KRA150	Milli rack JIS standard
Blank panel	KBP3-6	1/6
	KBP3-3	1/3
	KBP3-4	1/4
	KBP3-2	1/2

### ■ To rackmount the PIA3200 with PAD-L Series power supplies

Name	Model	Notes
Rackmount frame	RMF4	Inch rack EIA standard
	RMF4M	Milli rack JIS standard
Blank panel	BP6	1/6
	BP3	1/3
	BP4	1/4
	BP2	1/2



# Installation and Preparation

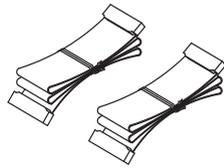
This chapter describes the procedures of unpacking and preparation of this product before use.

# Checking the Package Contents

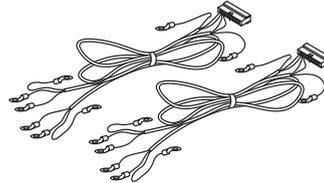
When you receive the product, check that all accessories are included and they have not been damaged during transportation.

If any of the accessories are damaged or missing, contact your Kikusui agent or distributor.

We recommend that you keep all packing materials, in case the product needs to be transported at a later date.



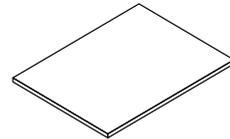
26-pin cable (2 pcs.)  
[83-22-6050]



2-pin x 3 cable (2 pcs.)  
[91-89-9914]



Alarm synchronization cable (1 pc.)  
[91-89-9911]



Operation manual (this manual, 1 pc.)  
[Z1-004-132]



Rating: 125 Vac, 10 A  
PLUG: NEMA5-15  
[85-AA-0003]

or



Rating: 250 Vac, 10 A  
PLUG: CEE7/7  
[85-AA-0005]

or



Rating: 250 Vac, 10 A  
PLUG: GB1002  
[85-10-0790]

Power cord  
(1 pc.)

The power cord that is provided varies depending on the destination for the product at the factory-shipment.

See p. 130

A spare fuse (0.2 A time lag, [99-02-0009]) is installed in the product.

# Precautions about Installation Location

You must observe the following precautions when installing the product.

- **Do not use the product in a flammable atmosphere.**

To prevent the possibility of explosion or fire, do not use the product near alcohol, thinner or other combustible materials, or in an atmosphere containing such vapors.

- **Avoid locations where the product is exposed to high temperature or direct sunlight.**

Do not install the product near a heater or in areas subject to drastic temperature changes.

Operating temperature range: 0 °C to +40 °C (32 °F to +104 °F)

Storage temperature range: -20 °C to +70 °C (-4 °F to +158 °F)

- **Avoid humid environments.**

Do not install the product in high-humidity locations near a boiler, humidifier, or water supply.

Operating humidity range: 10 %rh to 90 %rh (no condensation)

Storage humidity range: 90 %rh or less (no condensation)

Condensation may form even within the operating humidity range. If this happens, do not use the product until the condensation dries up completely.

- **Be sure to use the product indoors.**

This product is designed for safe indoor use.

- **Do not install the product in a corrosive atmosphere.**

Do not install the product in a corrosive atmosphere or in environments containing sulfuric acid mist, etc. This may cause corrosion of various conductors or poor connector contacts inside the product, which could lead to malfunction and failure, and possibly fire.

- **Do not install the product in a dusty location.**

Accumulation of dust can lead to electric shock or fire.

- **Do not use the product in a poor-ventilated location.**

Provide adequate space around the product to allow air to circulate around it.

- **Do not place objects on top of the product.**

Placing heavy objects on top may cause malfunction.

- **Do not install the product on an inclined surface or in a location subject to vibrations.**

The product may fall or tip over causing damages and injuries.

- **Do not use the product in a location subject to strong magnetic or electric fields or a location where the input power supply signal contains large amounts of distortion or noise.**

Doing so may cause the product to malfunction.

# Precautions for Moving the Product

When moving or transporting the product to the installation location, be sure to:

- **Turn the POWER switch off.**  
Moving the product with the POWER switch turned on may cause electric shock or damage to the product.
- **Disconnect all wiring.**  
Moving the product with the cables connected may cause wires to break or injuries due to the product falling over.
- **Use the original packing materials when transporting the product.**  
Otherwise, damage may result from vibrations or from the product falling during transportation.
- **Include this manual.**

# Connecting the Power Cord

## Before Connecting the Power Cord (Switching the input line voltage range)

Before applying input power to the product, be sure to check that the voltage range switch, which is located on the bottom panel, is set properly.

**⚠ WARNING** • Possible electric shock. When changing the voltage range switch, be sure to remove the power cord plug from the outlet.

**⚠ CAUTION** • Do not allow the input line voltage range to be exceeded, because it may cause malfunction or unstable operation.

If the line voltage range is not appropriate, change the voltage range switch.

VOLTAGE SELECT	SWITCH POSITION	FUSE
85 V to 115 V	A <input type="radio"/> B C <input type="radio"/> D	0.2 A S.B
98 V to 132 V	A <input type="radio"/> B C <input type="radio"/> D	
170 V to 230 V	A <input type="radio"/> B C <input type="radio"/> D	
195 V to 254 V	A <input type="radio"/> B C <input type="radio"/> D	

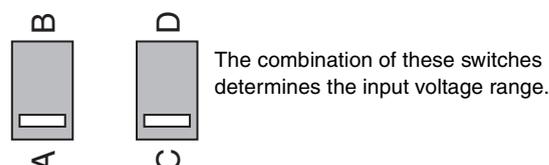


Fig. 2-1 Voltage range switch (example for 85 V to 115 V)

## Connecting the Power Cord for the Product

### WARNING

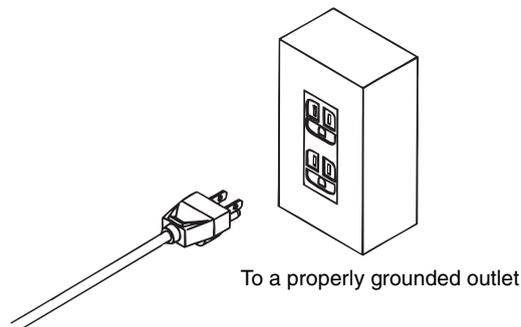
- This product is an IEC Safety Class I equipment (equipment with a protective conductor terminal). To prevent electric shock, be sure to ground (earth) the product.
- This product is grounded through the ground wire of the power cord. Be sure to connect the power plug to an outlet with an appropriate earth ground.

### NOTE

- Use the supplied power cord to connect to an AC power line. If the supplied power cord cannot be used because the rated voltage or the plug shape is incompatible, have a qualified engineer replace it with an appropriate power cord that is 3 m or less in length. If obtaining an appropriate power cord is difficult, consult your Kikusui agent or distributor.
- A power cord with a plug can be used to disconnect the product from the AC line in an emergency. Connect the plug to an easily accessible power outlet so that the plug can be removed from the outlet at any time. Be sure to provide adequate clearance around the power outlet.
- Do not use the supplied power cord for other devices.

This product falls under IEC Overvoltage Category II (which applies to energy-consuming equipment supplied from the fixed installation).

- 1 Check that the POWER switch is off.**
- 2 Check whether or not the AC power line is compatible with the input rating of the product.**  
The product can receive a nominal line voltage in the range of 85 Vac to 115 Vac, 98 Vac to 132 Vac, 170 Vac to 230 Vac, or 195 Vac to 254 Vac. The acceptable frequencies are 48 Hz to 62 Hz.
- 3 Connect the power cord to the rear-panel AC inlet (marked AC LINE).**
- 4 Connect the power cord plug to an outlet.**



# Connecting the PIA3200 to a PC (Using GPIB )



Turn the POWER switch off, and then connect to the GPIB port. Otherwise, the PIA3200 may malfunction.

The insulation voltage between the GPIB port and I/O port on the PIA3200 is 500 VDC. The PC is insulated from the connected power supply output.

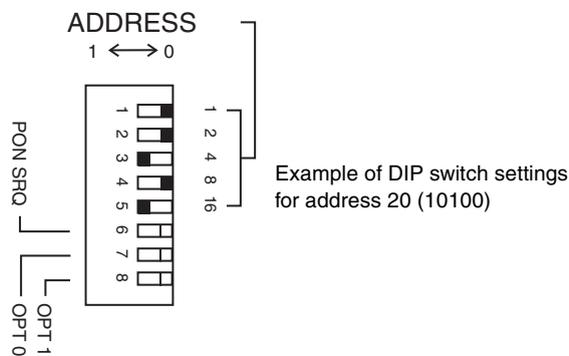
You can connect up to four PIA3200s (which means that you can connect up to eight DC power supplies) to a PC via GPIB.

- 1 Check that the POWER switch is off.**
- 2 Use a GPIB (IEEE488) cable to connect the PIA3200 to a PC.**  
The IEEE488 cable is not supplied with the PIA3200.  
Secure the connector to the port with the screws.

## Setting the GPIB address

The GPIB address (from 0 to 30) is set using the top five ADDRESS DIP switches on the rear panel. Set the address in binary.

Set the GPIB address so that it does not overlap with that of other devices.



## Configuring the Power-On Service Request (PON SRQ)

If you turn the PIA3200 on with ADDRESS switch 6 set to 1, a service request (SRQ) is generated on the GPIB bus, and the PON SRQ bit in the serial polling register is set.

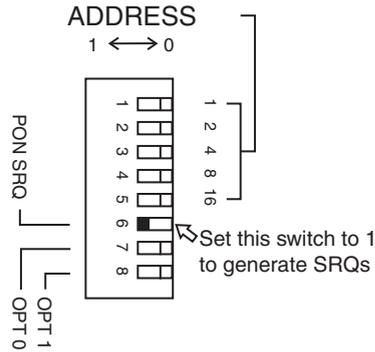
An SRQ is also generated when the microcomputer in the PIA3200 freezes. (If the microcomputer freezes, all settings that cannot be backed up are initialized.)

When you execute serial polling, PON is cleared. The power-on service request can be used to notify the host computer of power-on events and errors.

An SRQ is also generated when there is a momentary power failure. The PIA3200 can withstand a momentary power failure up to approximately 30 ms.

See p. 75

See p. 60



# Turning the Power on

## Turning the POWER switch on

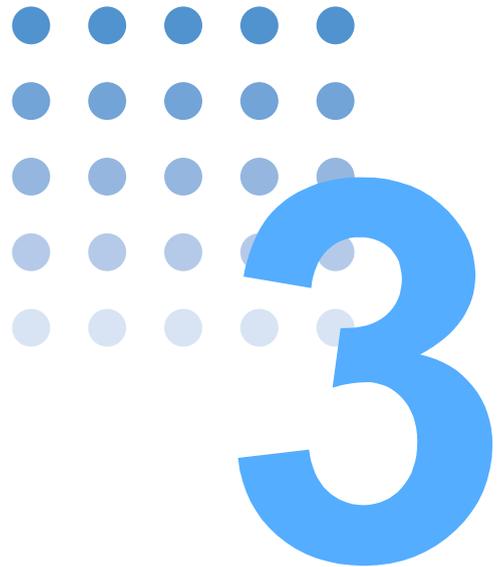
See p. 18

- 1** Check that the front-panel POWER switch is off.
- 2** Check that the voltage range switch is set properly.
- 3** Check that the power cord is connected properly.
- 4** Press the top of the POWER switch to turn the power on.

The buzzer sounds, and all LEDs light for 1 second. Display 2 shows “---” for 5 seconds, and the PIA3200 starts testing the internal ROM and RAM. When the test is complete, the buzzer sounds again, and “---” is cleared from display 2.

## Turning the POWER switch off

Press the bottom of the POWER switch to turn the power off.



---

## Connecting to DC Power Supplies

This chapter describes how to connect the PIA3200 to DC power supplies and how to configure the power supplies.

The procedure to connect the power supplies and the power supply features that the PIA3200 can control vary depending on the combinations of the types of DC power supplies that are connected and their options. For simplicity, the explanations are provided for the cases when one DC power supply is connected. The PIA3200 can actually connect to up to two DC power supplies.

# Connecting to a PAD-L Series

## Control Description

There are three ways to connect the PIA3200 to a PAD-L Series power supply depending on the items that you want to control. The PIA3200 cannot control the PAD600-1.5L or the PAD1K-0.2L.

The following items become controllable.

Control Item	Connection			
	TU01+SH	TU01	Direct	
Output voltage setting	Yes	Yes	Yes	
Output current setting	With limitations <sup>*1</sup>	With limitations <sup>*1</sup>	Yes	
Output voltage readback	Yes	Yes	No	
Output current readback (accuracy: 0.3 % of full scale)	Yes	No	No	
Output on/off setting <sup>*2</sup>	With limitations <sup>*1</sup>	With limitations <sup>*1</sup>	No	
POWER switch off setting	Yes	Yes	No	
Status monitoring	POWER switch off	With limitations <sup>*3</sup>	With limitations <sup>*3</sup>	No
	C.V mode	With limitations <sup>*3</sup>	With limitations <sup>*3</sup>	No
	C.C mode	With limitations <sup>*3</sup>	With limitations <sup>*3</sup>	No
	Overheating	With limitations <sup>*3</sup>	With limitations <sup>*3</sup>	No
	Overvoltage protection activation	With limitations <sup>*3</sup>	With limitations <sup>*3</sup>	No

\*1 Select whether to control the output current setting or the output on/off setting.

\*2 The output drops to nearly 0 V by setting the CV reference to 0 on TYPE0 and I2 and by setting the CC reference to 0 on all other types.

\*3 A DIN connector must be added to the power supply at the Kikusui factory (this modification is not possible on all models).

## Making the connection

See p. 13

A 26-pin cable (that is 0.5 m in length) is used to connect the PIA3200 to a PAD-L Series power supply. To place the PIA3200 and the PAD-L at a distance, use the optional cable in place of the 26-pin cable.

Make sure that the POWER switches are off before making the connection.

Lock the connectors.

### Connection via the TU01 and SH

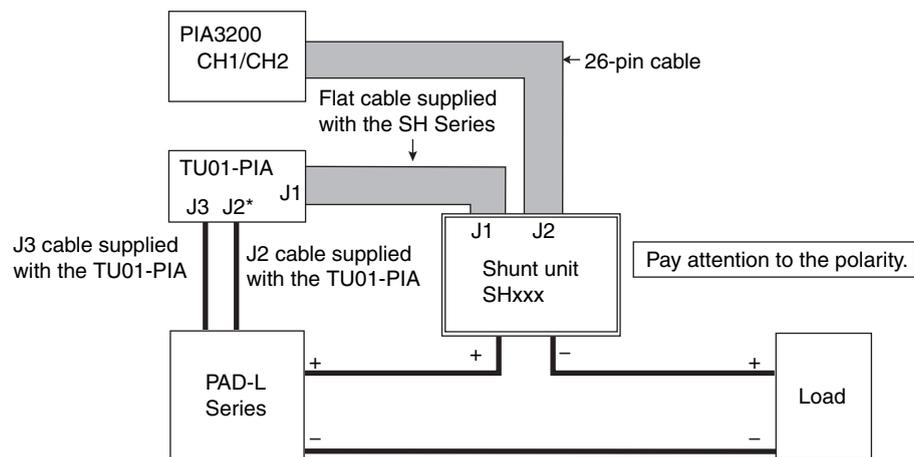
This configuration uses a TU01-PIA terminal unit and a SH Series shunt unit.

To monitor the status, a DIN connector must be added to the PIA3200 at the Kikusui factory. For details, contact your Kikusui agent or distributor.

The SH Series shunt unit enables output current readback (at an accuracy of 0.3 % of full scale).

Connect the PIA3200 to the SH Series shunt unit with a 26-pin cable. Connect the SH Series shunt unit to the TU01-PIA with the flat cable supplied with the SH Series.

Connect the TU01-PIA to the PAD-L Series power supply with the cable supplied with the TU01-PIA. For details on how to connect the cables, see the respective operation manuals.



\* Only connect when monitoring the status

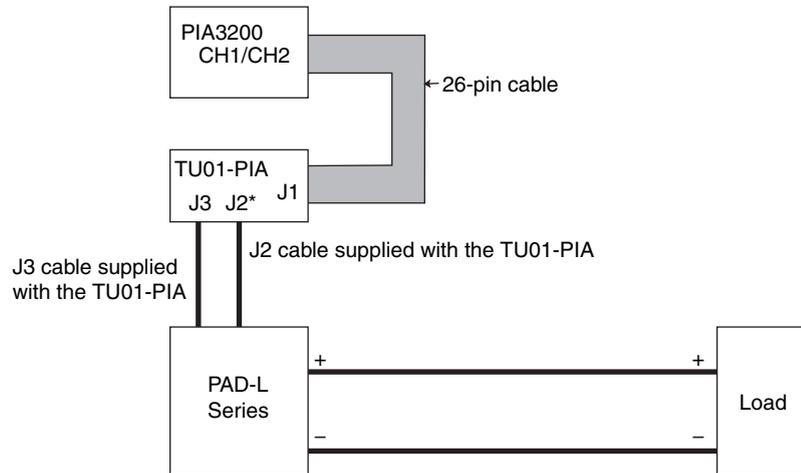
### Connection via the TU01

This configuration uses the TU01-PIA terminal unit.

To monitor the status, a DIN connector must be added to the PIA3200 at the Kikusui factory. For details, contact your Kikusui agent or distributor.

Connect the PIA3200 to the TU01-PIA with the supplied 26-pin cable. Connect the TU01-PIA to the PAD-L Series power supply with the cable supplied with the TU01-PIA.

For details on how to connect the cables, see the respective operation manuals.



\* Only connect when monitoring the status

### Direct connection

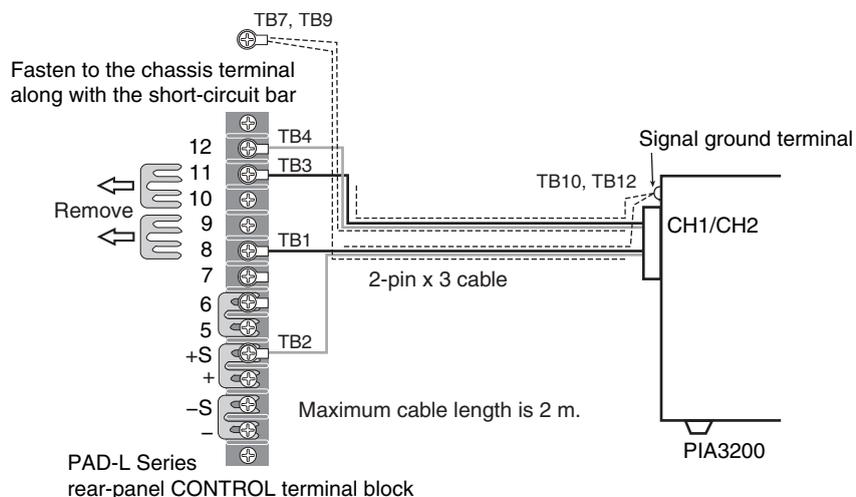
Before making connections, be sure to change the PAD-L Series power supply's SW1 slide switch setting. For details, see "Output Current Control with External Voltage" in the PAD-L Series operation manual.

After you set the slide switch, connect the PIA3200 to the PAD-L Series power supply with the supplied 2-pin x 3 cable.

Connect one end of the shielded wire to the PIA3200's signal ground terminal (M3).

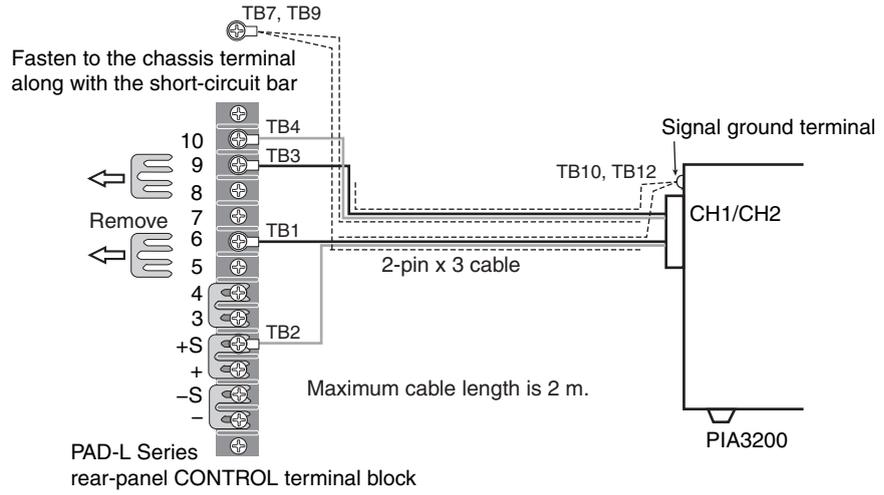
If necessary, connect the other end of the shielded wire to the PAD-L's chassis terminal along with the short-circuit bar.

#### ■ For the PAD-L TYPE0, I2 Series



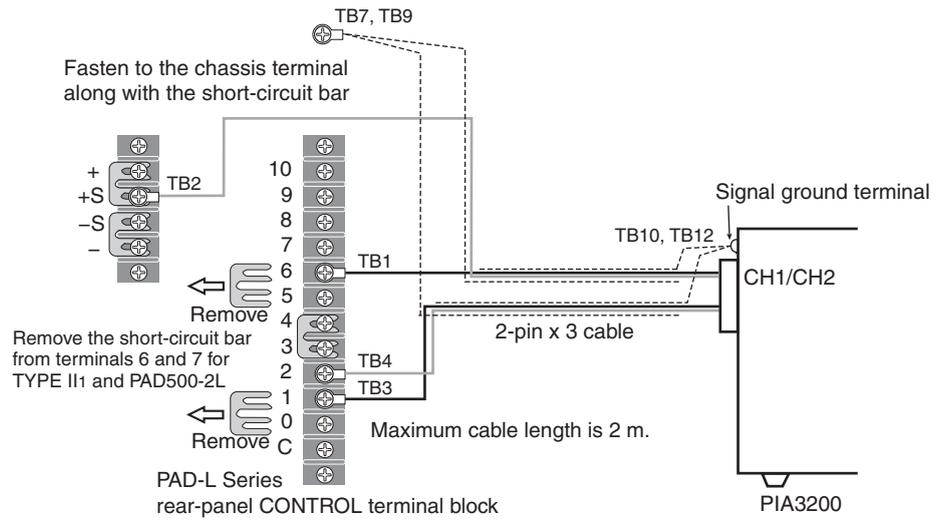
PAD-L Series CONTROL terminal block	2-pin x 3 cable	Notes
Pin 8	TB1	Output voltage control
Pin +S	TB2	Output voltage control common
Pin 11	TB3	Output current control
Pin 12	TB4	Output current control common

■ For the PAD-L TYPE I3 Series



PAD-L Series CONTROL terminal block	2-pin x 3 cable	Notes
Pin 6	TB1	Output voltage control
Pin +S	TB2	Output voltage control common
Pin 9	TB3	Output current control
Pin 10	TB4	Output current control common

■ For the PAD-L TYPE II, III, IV, V, and VI Series



PAD-L Series CONTROL terminal block	2-pin x 3 cable	Notes
Pin 6	TB1	Output voltage control
Pin +S	TB2	Output voltage control common
Pin 1	TB3	Output current control
Pin 2	TB4	Output current control common

## When you are finished with the connection

### Configuring the PAD-L Series power supply panel

Before starting to control the PAD-L, turn the PAD-L output setting knobs fully clockwise.

**NOTE**

We recommend that you use the guard cap so that you do not turn the output setting knobs by mistake. Turning the output setting knobs after calibration will cause the calibration value to change.

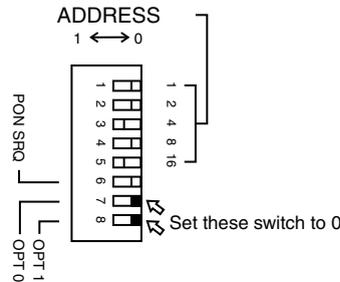
### Setting the model ID

If the PAD-L is connected via the TU01 and SH or via the TU01, set the ID on the terminal unit.

For direct connection, set the ID by sending a command.

Check that the ADDRESS switch 7(OPT 0) and 8(OPT 1) are set to 0. Otherwise, you cannot set the model ID.

See p. 55



Model ID	Model	Output voltage setting range [V]	Output current setting range [A]	SH Series
040	PAD35- 30L/LP	0.000 to 35.000	0.000 to 30.000	SH50
041	PAD35- 50L/LP	0.000 to 35.000	0.00 to 50.00	SH50
042	PAD35- 60L/LP	0.000 to 35.000	0.00 to 60.00	Special order
043	PAD35-100L/LP	0.000 to 35.000	0.00 to 100.00	Special order
044	PAD35-200L/LP	0.000 to 35.000	0.00 to 200.00	Special order
045	PAD35-300LPT	0.000 to 35.000	0.00 to 300.00	Special order
046	PAD55- 3L	0.00 to 55.00	0.0000 to 3.0000	SH10
047	PAD55- 6L	0.00 to 55.00	0.000 to 6.000	SH10
048	PAD55- 10L	0.00 to 55.00	0.000 to 10.000	SH10
049	PAD55- 20L	0.00 to 55.00	0.000 to 20.000	SH50
050	PAD55- 35L	0.00 to 55.00	0.000 to 35.000	SH50
051	PAD55- 60L	0.00 to 55.00	0.00 to 60.00	Special order
052	PAD55-120L	0.00 to 55.00	0.00 to 120.00	Special order
020	PAD60-35L	0.00 to 60.00	0.000 to 35.000	SH50
021	PAD60-60L	0.00 to 60.00	0.00 to 60.00	Special order
022	PAD60-120L	0.00 to 60.00	0.00 to 120.00	Special order
053	PAD60-200LPT	0.00 to 60.00	0.00 to 200.00	Special order
054	PAD70-2.5L	0.00 to 70.00	0.0000 to 2.5000	SH10
055	PAD70- 5L	0.00 to 70.00	0.000 to 5.000	SH10
056	PAD70- 8L	0.00 to 70.00	0.000 to 8.000	SH10
057	PAD70- 15L	0.00 to 70.00	0.000 to 15.000	SH50

Model ID	Model	Output voltage setting range [V]	Output current setting range [A]	SH Series
058	PAD110-1.5L	0.00 to 110.00	0.0000 to 1.5000	Special order
059	PAD110- 3L	0.00 to 110.00	0.0000 to 3.0000	SH10
060	PAD110- 5L	0.00 to 110.00	0.000 to 5.000	SH10
061	PAD110- 10L	0.00 to 110.00	0.000 to 10.000	SH10
062	PAD110- 20L	0.00 to 110.00	0.000 to 20.000	SH50
063	PAD110- 30L	0.00 to 110.00	0.000 to 30.000	SH50
064	PAD110- 60L	0.00 to 110.00	0.00 to 60.00	Special order
065	PAD160- 1L	0.00 to 160.00	0.0000 to 1.0000	Special order
066	PAD160- 2L	0.00 to 160.00	0.0000 to 2.0000	Special order
067	PAD160-3.5L	0.00 to 160.00	0.0000 to 3.5000	SH10
068	PAD160- 7L	0.00 to 160.00	0.000 to 7.000	SH10
069	PAD250-2.5L	0.00 to 250.00	0.0000 to 2.5000	SH10
070	PAD250-4.5L	0.00 to 250.00	0.000 to 4.500	SH10
071	PAD250- 8L	0.00 to 250.00	0.000 to 8.000	SH10
072	PAD250- 15L	0.00 to 250.00	0.000 to 15.000	SH50
073	PAD500- 2L	0.0 to 500.0	0.0000 to 2.0000	Special order

## Performing calibration

If you set a new ID, be sure to calibrate the PAD-L.

 p. 70 , p. 118

You can calibrate the PAD-L from the panel or by using a command. The available calibration types are from ITEM1 to ITEM4.

## Checking the PAD-L operation

After calibration, check the PAD-L operation by setting a voltage via GPIB.

Check procedure (example)

Send the message "MODE 0;CH 1;VSET 12.0" to the PIA3200, and check that the PAD-L preset voltage is set to 12.0 V.

# Connecting to a PAD-LA Series

## NOTE

A PIA3200 with ROM version 1.40 or later is needed to use the PIA3200 with PAD-LA Series power supplies. For instructions on how to check the ROM version, see “Confirm the ROM version” on page 114.

## Control Description

The PIA3200 controls PAD-LA Series power supplies using voltage signals from 0 V to approximately 10 V.

There are three ways to connect the PIA3200 to a PAD-LA Series power supply depending on the items that you want to control.

To connect to a PAD-LA Series power supply via the TU02 and SH or via the TU02, the PAD-LA Series power supply must be modified so that it can connect to the terminal unit. For details, contact your Kikusui agent or distributor.

The following items become controllable.

Control Item	Connection			
	TU02+SH <sup>*1</sup>	TU02 <sup>*1</sup>	Direct	
Output voltage setting	Yes	Yes	Yes	
Output current setting	Yes	Yes	Yes	
Output voltage readback	Yes	Yes	No	
Output current readback	Yes	No	No	
Output on/off setting	Yes	Yes	No	
POWER switch off setting	Yes	Yes	No	
Status monitoring	Alarm	With limitations <sup>*2</sup>	With limitations <sup>*2</sup>	No
	C.V mode	With limitations <sup>*2</sup>	With limitations <sup>*2</sup>	No
	C.C mode	With limitations <sup>*2</sup>	With limitations <sup>*2</sup>	No

\*1 The PAD-LA Series power supply must be modified at the Kikusui factory so that the power supply can connect to the terminal unit.

\*2 A DIN connector must be added to the power supply at the Kikusui factory (this modification is not possible on all models).

## Making the connection

See p. 13

A 26-pin cable (that is 0.5 m in length) is used to connect the PIA3200 to a PAD-L Series power supply. To place the PIA3200 and the PAD-LA at a distance, use the optional cable in place of the 26-pin cable.

Check that the power cords are disconnected from the outlet or that the switchboard is off before making the connection.

Lock the connectors.

### Connection via the TU02 and SH

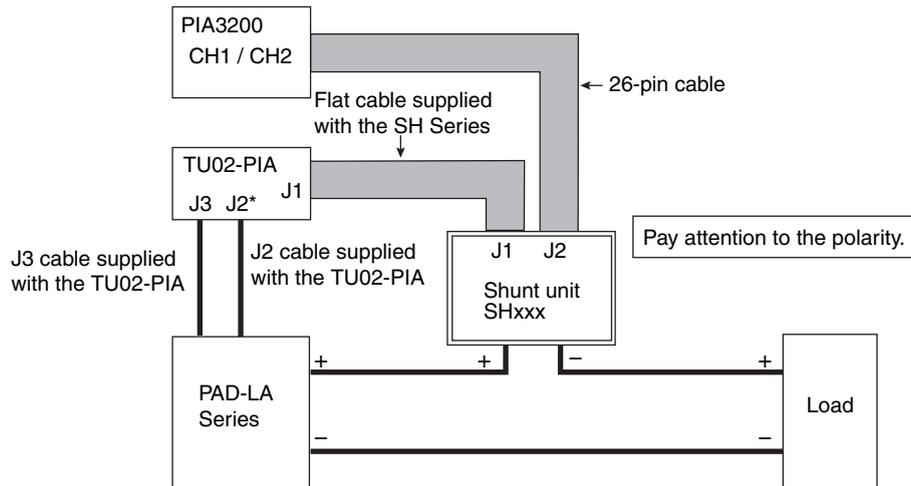
This configuration uses a TU02-PIA terminal unit and a SH Series shunt unit.

To use this configuration, the PAD-LA Series power supply must be modified so that it can connect to the terminal unit. To monitor the status, a DIN connector must be added to the PIA3200 at the Kikusui factory. For details, contact your Kikusui agent or distributor.

The SH Series shunt unit enables output current readback (at an accuracy of 0.3 % of full scale).

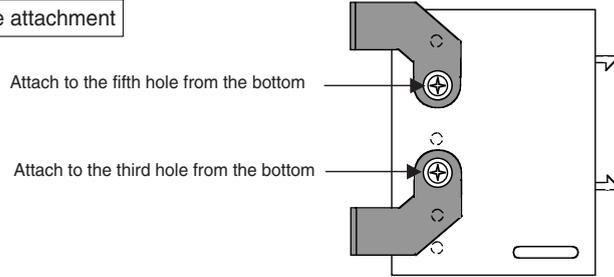
Connect the PIA3200 to the SH Series shunt unit with a 26-pin cable. Connect the SH Series shunt unit to the TU02-PIA with the flat cable supplied with the SH Series.

Connect the TU02-PIA to the PAD-LA Series power supply with the cable supplied with the TU02-PIA. For details on how to connect the cables, see the respective operation manuals.

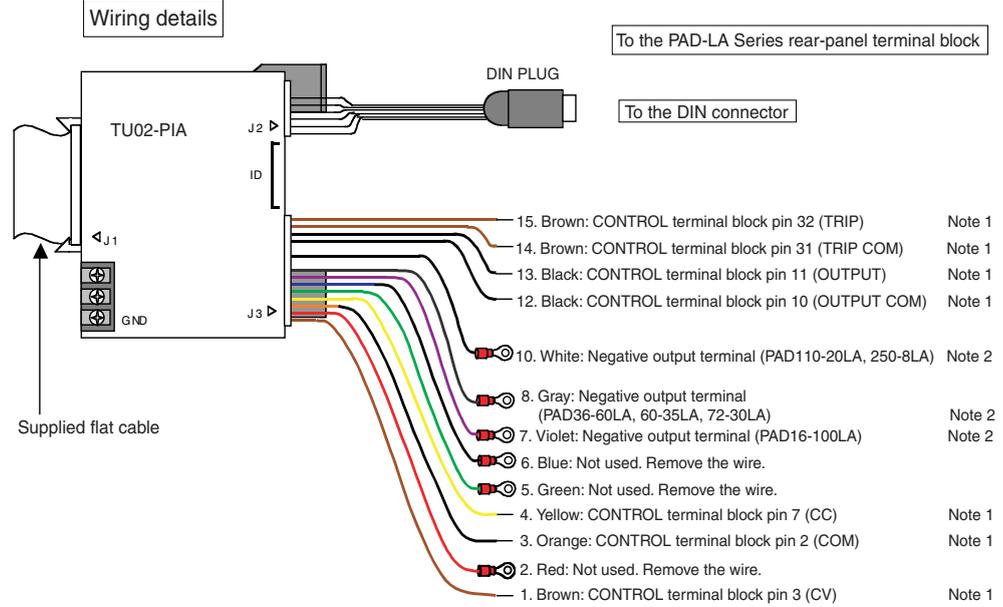


\* Only connect when monitoring the status

Angle attachment



Wiring details



Note 1 Because the wires in the J3 Wire Kit that is supplied with the TU02-PIA have crimp terminals attached at the ends, cut the crimp terminals off from the wires that you will connect to the PAD-LA control terminals. Then, strip 9 mm of the covering and attach the wires to the terminals.

Note 2 The connection of wires 7, 8, and 10 in the J3 Wire Kit varies depending on the power supply model. Remove the wires that are not going to be used. Replace the wire that is going to be used with the PAN-A extension cable with a M4 crimping terminal that is supplied with the TU02-PIA.

### Connection via the TU02

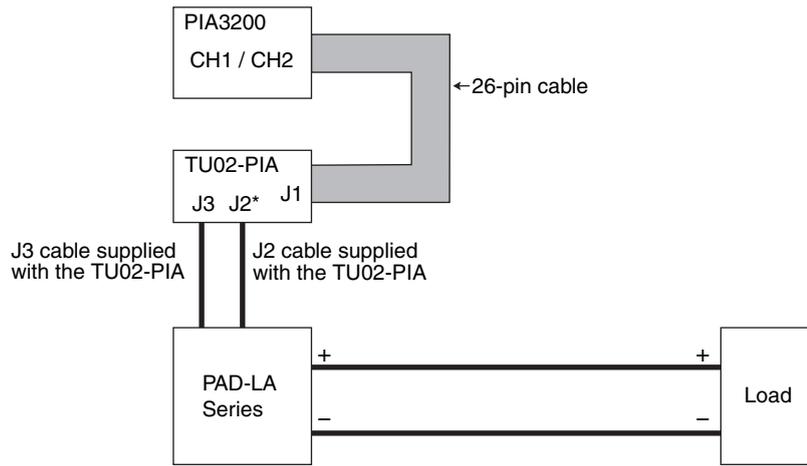
This configuration uses the PIA3200 and the TU02-PIA terminal unit.

To use this configuration, the PAD-LA Series power supply must be modified so that it can connect to the terminal unit. To monitor status, a DIN connector must be added to the PIA3200 at the Kikusui factory. For detail, contact your Kikusui agent or distributor.

Connect the PIA3200 to the TU02-PIA with the supplied 26-pin cable.

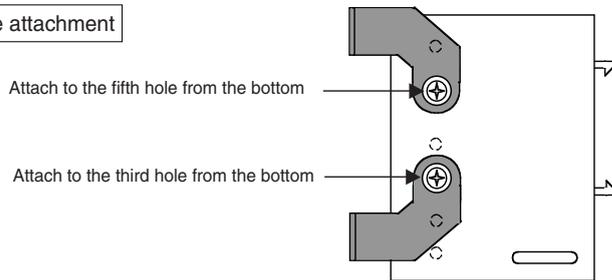
Connect the TU02-PIA to the PAD-LA Series power supply with the cable supplied with the TU02-PIA.

For details on how to connect the cables, see the respective operation manuals.

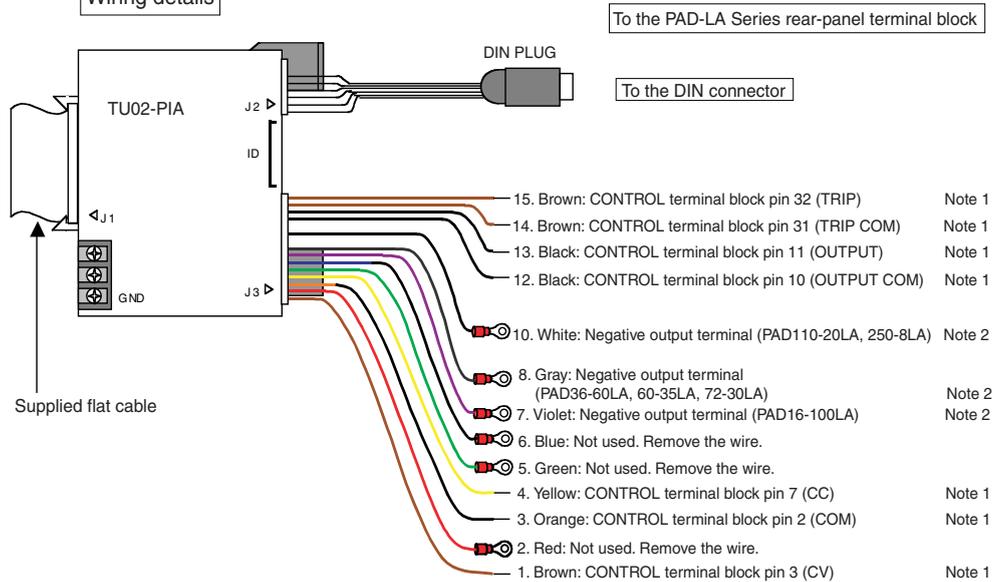


\* Only connect when monitoring the status

Angle attachment



Wiring details



Note 1 Because the wires in the J3 Wire Kit that is supplied with the TU02-PIA have crimp terminals attached at the ends, cut the crimp terminals off from the wires that you will connect to the PAD-LA control terminals. Then, strip 9 mm of the covering and attach the wires to the terminals.

Note 2 The connection of wires 7, 8, and 10 in the J3 Wire Kit varies depending on the power supply model. Remove the wires that are not going to be used. Replace the wire that is going to be used with the PAN-A extension cable with a M4 crimping terminal that is supplied with the TU02-PIA.

### Direct connection

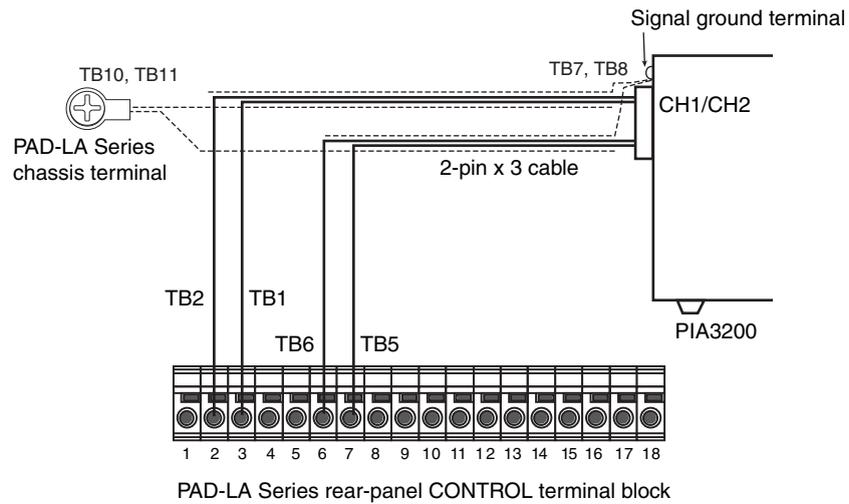
Connect the PIA3200 to the PAD-LA Series power supply with the supplied 2-pin x 3 cable. TB3 and TB4 are not used. Insulate and bundle them or cut them off at the root of the 2-pin x 3 cable connector.

Connect one end of the shielded wire to the PIA3200's signal ground terminal (M3).

If necessary, connect the other end of the shielded wire to the PAD-LA's chassis terminal along with the short-circuit bar.

**NOTE**

Do not connect the shielded wire to the PAD-LA's positive output terminal. Depending on how the PAD-LA output terminal is grounded, the shielded wire may short the output terminal.



PAD-LA Series CONTROL terminal block	2-pin x 3 cable	Notes
Pin 3	TB1	Output voltage control
Pin 2	TB2	Output voltage control common
Pin 7	TB5	Output current control
Pin 6	TB6	Output current control common

## When you are finished with the connection

### Configuring the PAD-LA Series power supply panel

- 1 Set the S1 and S2 switches on the PAD-LA front panel to the top position (to enable CC and CV remote control modes).
- 2 Turn the PAD-LA's output setting knobs fully clockwise.

**NOTE**

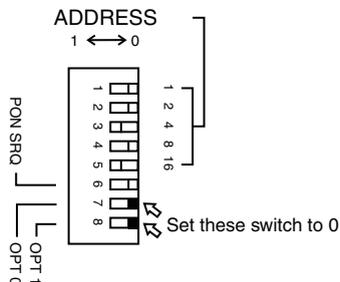
We recommend that you use the guard cap so that you do not turn the output setting knob by mistake. Turning the output settings knob after calibration will cause the calibration values to change.

### Setting the model ID

See p. 55

If the PAD-LA is connected via the TU02 and SH or via the TU02, set the ID on the terminal unit. For direct connection, set the ID by sending a command.

Check that the ADDRESS switch 7(OPT 0) and 8(OPT 1) are set to 0. Otherwise, you cannot set the model ID.



Model ID	Model	Output voltage setting range [V]	Output current setting range [A]	SH Series
030	PAD16-100LA	0.000 to 16.000	0.00 to 100.00	Special order
031	PAD36-60LA	0.000 to 36.000	0.00 to 60.00	Special order
036	PAD36-100LA	0.000 to 36.000	0.00 to 100.00	Special order
032	PAD60-35LA	0.00 to 60.00	0.000 to 35.000	SH50
037	PAD60-60LA	0.00 to 60.00	0.00 to 60.00	Special order
033	PAD72-30LA	0.00 to 72.00	0.000 to 30.000	SH50
034	PAD110-20LA	0.00 to 110.00	0.000 to 20.000	SH50
038	PAD110-30LA	0.00 to 110.00	0.000 to 30.000	SH50
035	PAD250-8LA	0.00 to 250.00	0.000 to 8.000	SH10
039	PAD250-15LA	0.00 to 250.00	0.000 to 15.000	SH50

### Performing calibration

See p. 70 , p. 118

If you set a new ID, be sure to calibrate the PAD-LA. The available calibration types are from ITEM1 to ITEM4.

### Checking the PAD-LA operation

After calibration, check the PAD-LA operation by setting a voltage via GPIB.

Check procedure (example)

Send the message "MODE 0;CH 1;VSET 12.00" to the PIA3200, and check that the PAD-LA SET voltage is set to 12.00 V.

# Connecting to a PAK-A Series



When controlling a PAK-A Series power supply using the PIA3200, do not use the pins other than the remote sensing pins (which are pins 4 and 6) and the one-control parallel operation pin (which is pin 17) on the J1 terminal or use the remote control feature. If you do, the PAK-A may malfunction.

## Control Description

To control a PAK-A Series power supply using the PIA3200, the IF01-PAK-A interface card, a PAK-A factory option, is required. If the interface card is not installed, contact your Kikusui agent or distributor.

There are two ways to connect the PIA3200 to a PAK-A Series power supply depending on the items that you want to control.

The following items become controllable.

Control Item	Connection		
	SH	Direct	
Output voltage setting	Yes	Yes	
Output current setting	Yes	Yes	
Output voltage readback	Yes	Yes	
Output current readback	Yes <sup>*1</sup>	Yes <sup>*2</sup>	
Overvoltage protection setting	Yes	Yes	
Undervoltage protection setting	Yes	Yes	
Output on/off setting	Yes	Yes	
POWER switch off setting	Yes	Yes	
Remote/local switching	Yes	Yes	
Status monitoring	POWER switch off	Yes	Yes
	C.V mode	Yes	Yes
	C.C mode	Yes	Yes
	Output on/off	Yes	Yes
	Overheating	Yes	Yes
	Undervoltage protection activation	Yes	Yes
	Overvoltage protection activation	Yes	Yes

\*1 Accuracy: 0.3 % of full scale

\*2 Accuracy: 1.5 % of full scale

## Making the connection

See p. 13

A 26-pin cable (that is 0.5 m in length) is used to connect the PIA3200 to a PAK-A Series power supply. To place the PIA3200 and the PAK-A at a distance, use the optional cable in place of the 26-pin cable.

Make sure that the POWER switches are off before making the connection.

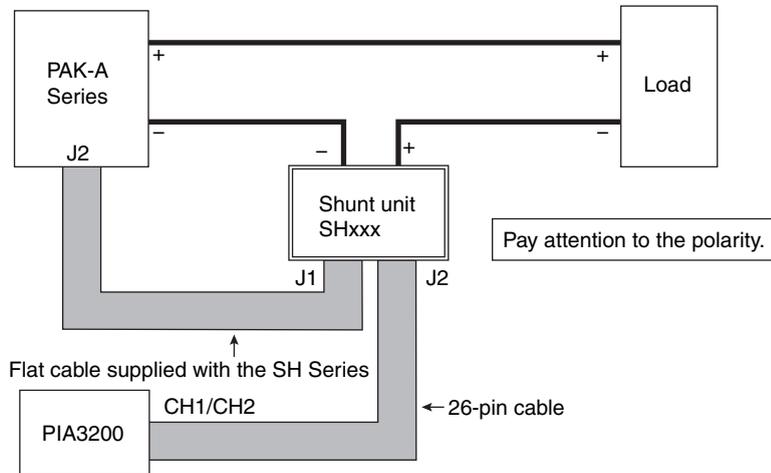
Lock the connectors.

### Connection via the SH

The SH Series shunt unit enables output current readback at an accuracy of 0.3 % of full scale, which is more accurate than what you would get through a direct connection.

Connect the PIA3200 to the SH Series shunt unit with a 26-pin cable. Connect the SH Series shunt unit to the PAK-A with the flat cable supplied with the SH Series.

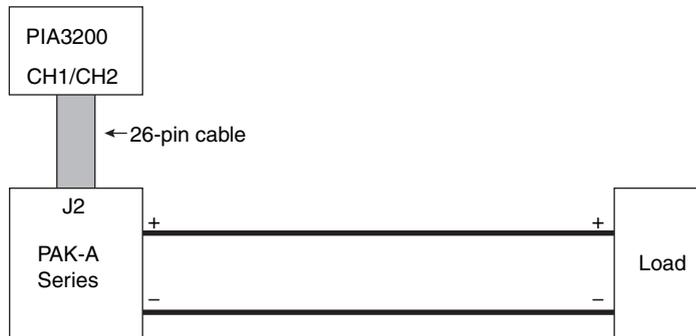
For instructions on how to connect the PAK-A Series power supply to the SH shunt unit, see the operation manual supplied with the SH Series.



### Direct connection

The output current monitor readback accuracy is 2 % of full scale. The SH Series shunt unit enables more accurate output current readback (at an accuracy of 0.3 % of full scale).

Connect the PIA3200 to the PAK-A with the supplied 26-pin cable.



## When you are finished with the connection

### Setting the PAK-A Series switches

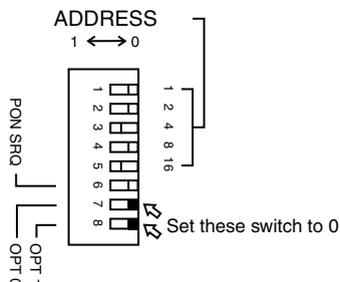
Before starting to control the PAK-A, set the S1 switch on the PAK-A rear panel and the S2 to S8 switches on the top panel as follows:

SW Number	Display	Switch position	Notes
S1	1	ON	Set 1, 2, and 3 ON to enable GPIB control mode
	2	ON	
	3	ON	
	4	ON or OFF	Normally ON. Switch OFF to enable the panel output switch.
	5	No	Not used
S2	REMOTE SENSING	ON or OFF	Normally OFF. Switch ON to enable remote sensing.
S3	O.V.P CONTROL	REMOTE or LOCAL	Normally REMOTE. Set to LOCAL to set the OVP from the panel.
S4	PARALLEL OPERATION	MASTER	Select master
S5	C.C REMOTE	EIN	Select remote control using current
S6		No	Not used
S7	C.V REMOTE	EIN	Select remote control using voltage
S8		No	Not used

## Setting the model ID

IDs are already assigned to the PAK-A Series power supplies. The PIA3200 automatically identifies the ID when you connect the PIA3200 to the PAK-A with the 26-pin cable and turn it on.

Check that the ADDRESS switch 7(OPT 0) and 8(OPT 1) are set to 0. Otherwise, you cannot set the model ID.



Model ID	Model	Output voltage setting range [V]	Output current setting range [A]	SH Series
001	PAK6- 60A	0.000 to 6.000	0.00 to 60.00	Special order
002	PAK6-120A	0.000 to 6.000	0.00 to 120.00	Special order
003	PAK6-160A	0.000 to 6.000	0.00 to 160.00	Special order
004	PAK10-35A	0.000 to 10.000	0.000 to 35.000	SH50
005	PAK10-70A	0.000 to 10.000	0.00 to 70.00	Special order
006	PAK10-100A	0.000 to 10.000	0.00 to 100.00	Special order
007	PAK20-18A	0.000 to 20.000	0.000 to 18.000	SH50
008	PAK20-36A	0.000 to 20.000	0.000 to 36.000	SH50
009	PAK20-50A	0.000 to 20.000	0.00 to 50.00	SH50
010	PAK35-10A	0.000 to 35.000	0.000 to 10.000	SH10
011	PAK35-20A	0.000 to 35.000	0.000 to 20.000	SH50
012	PAK35-30A	0.000 to 35.000	0.000 to 30.000	SH50
013	PAK60- 6A	0.00 to 60.00	0.000 to 6.000	SH10
014	PAK60-12A	0.00 to 60.00	0.000 to 12.000	Special order
015	PAK60-18A	0.00 to 60.00	0.000 to 18.000	SH50

## Performing calibration

If you set a new ID, be sure to calibrate the PAK-A.  
The available calibration types are from ITEM1 to ITEM6.

See p. 70 , p. 118

## Checking the PAK-A operation

After calibration, check the PAK-A operation by setting a voltage via GPIB.

Check procedure (example)

Send the message "MODE 0;CH 1;REM 1;VSET 12.0" to the PIA3200, and check that the PAK-A preset voltage is set to 12.0 V.

# Connecting to a PAN/PAN-A Series

## NOTE

A PIA3200 with ROM version 1.20 or later is needed to use the PIA3200 with PAN/PAN-A Series power supplies (version 1.30 or later is needed for PAN-A Series power supplies with a 60-V rated output voltage). For instructions on how to check the version, see “Confirm the ROM version” on page 114.

## Control Description

The PIA3200 controls PAN/PAN-A Series power supplies using voltage signals from 0 V to approximately 10 V.

There are three ways to connect the PIA3200 to a PAN/PAN-A Series power supply depending on the items that you want to control.

To connect to a PAN/PAN-A Series power supply via the TU02 and SH or via the TU02, the PAN/PAN-A Series power supply must be modified so that it can connect to the terminal unit. For details, contact your Kikusui agent or distributor.

The following items become controllable.

Control Item	Connection			
	TU02+SH <sup>*1</sup>	TU02 <sup>*1</sup>	Direct	
Output voltage setting	Yes	Yes	Yes	
Output current setting	Yes	Yes	Yes	
Output voltage readback	Yes	Yes	No	
Output current readback	Yes	No	No	
Output on/off setting	Yes	Yes	No	
Status monitoring	Alarm	With limitations <sup>*2</sup>	With limitations <sup>*2</sup>	No
	C.V mode	With limitations <sup>*2</sup>	With limitations <sup>*2</sup>	No
	C.C mode	With limitations <sup>*2</sup>	With limitations <sup>*2</sup>	No

\*1 The PAN/PAN-A Series power supply must be modified at the Kikusui factory so that the power supply can connect to the terminal unit.

\*2 A DIN connector must be added to the power supply at the Kikusui factory (this modification is not possible on all models).

## Making the connection

See p. 13

A 26-pin cable (that is 0.5 m in length) is used to connect the PIA3200 to a PAN/PAN-A Series power supply. To place the PIA3200 and the PAN/PAN-A at a distance, use the optional cable in place of the 26-pin cable.

Check that the power cords are disconnected from the outlet or that the switchboard is off before making the connection.

Lock the connectors.

### Connection via the TU02 and SH

This configuration uses a TU02-PIA terminal unit and a SH Series shunt unit.

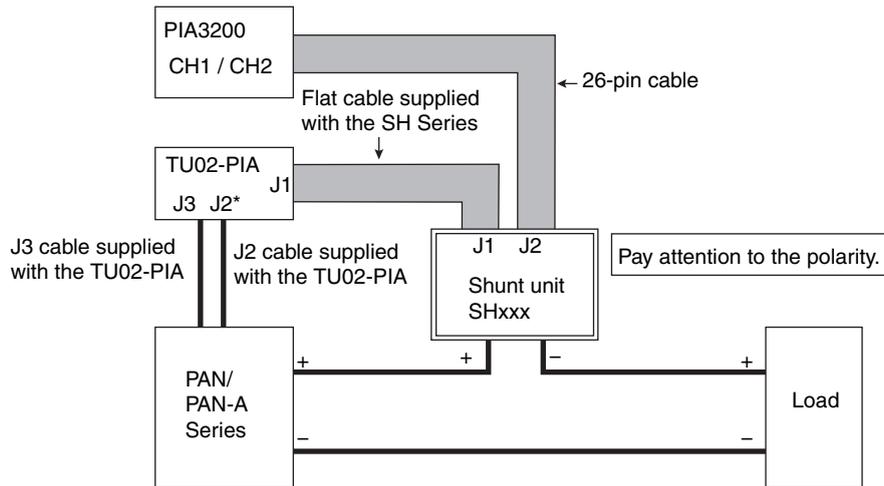
To use this configuration, the PAN/PAN-A Series power supply must be modified so that it can connect to the terminal unit. For details, contact your Kikusui agent or distributor.

The SH Series shunt unit enables current readback.

Connect the PIA3200 to the SH Series shunt unit with a 26-pin cable. Connect the SH Series shunt unit to the TU02-PIA with the flat cable supplied with the SH Series.

Connect the TU02-PIA to the PAN/PAN-A Series power supply with the cable supplied with the TU02-PIA.

For details on how to connect the cables, see the respective operation manuals.



\* Only connect when monitoring the status

### Connection via the TU02

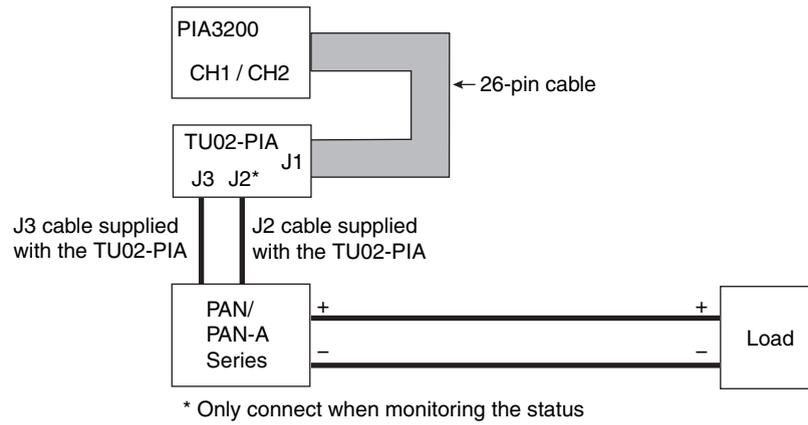
This configuration uses the TU02-PIA terminal unit.

To use this configuration, the PAN/PAN-A Series power supply must be modified so that it can connect to the terminal unit. For details, contact your Kikusui agent or distributor.

Connect the PIA3200 to the TU02-PIA with the supplied 26-pin cable.

Connect the TU02-PIA to the PAN/PAN-A Series power supply with the cable supplied with the TU02-PIA.

For details on how to connect the cables, see the respective operation manuals.



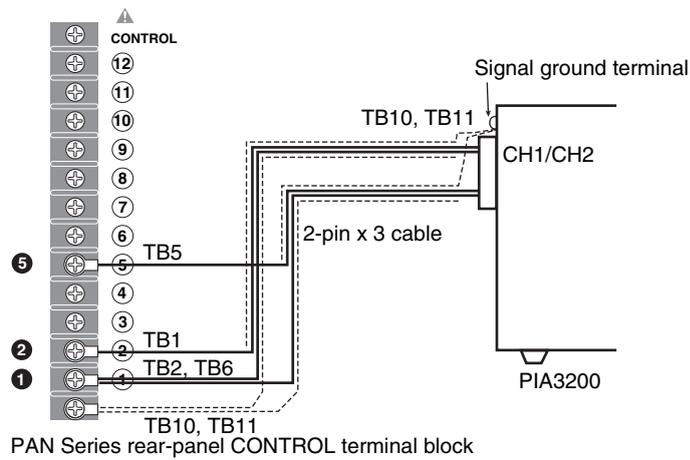
### Direct connection

Connect the PIA3200 to the PAD-L Series power supply with the supplied 2-pin x 3 cable. TB3 and TB4 are not used. Insulate and bundle them or cut them off at the root of the 2-pin x 3 cable connector.

Connect one end of the shielded wire to the PIA3200's signal ground terminal (M3).

If necessary, connect the other end of the shielded wire to the PAN/PAN-A's terminal unit set-screw or to the PAN/PAN-A's control terminal cover setscrew along with the short-circuit bar.

### PAN Series

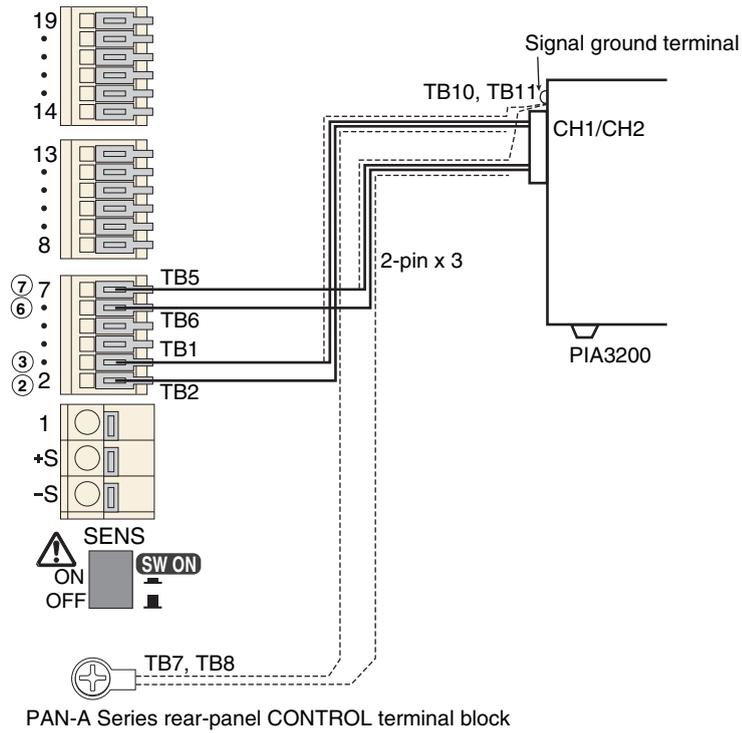


PAN Series CONTROL terminal block	2-pin x 3 cable	Notes
Pin 2	TB1	Output voltage control
Pin 1	TB2	Output voltage control common
Pin 5	TB5	Output current control
Pin 1	TB6	Output current control common

**NOTE**

Do not connect the shielded wire to the PAN Series' positive output terminal or CONTROL terminal pin 1 (A COM). Depending on how the PAN output terminal is grounded, the shielded wire may short the output terminal.

■ PAN-A Series



PAN-A Series CONTROL terminal block	2-pin x 3 cable	Notes
Pin 3	TB1	Output voltage control
Pin 2	TB2	Output voltage control common
Shielded wire		
Pin 7	TB5	Output current control
Pin 6	TB6	Output current control common
Shielded wire		

**NOTE**

Do not connect the shielded wire to the PAN-A's positive output terminal. Depending on how the PAN-A output terminal is grounded, the shielded wire may short the output terminal.

## When you are finished with the connection

### Configuring the PAN/PAN-A Series power supply panel

- 1 Set the S1 and S3 switches on the PAN/PAN-A control panel to the top position (to enable CC and CV remote control modes).
- 2 Turn the PAN/PAN-A's output setting knobs fully clockwise.

#### NOTE

We recommend that you use the guard cap so that you do not turn the output setting knob by mistake. Turning the output setting knobs after calibration will cause the calibration values to change.

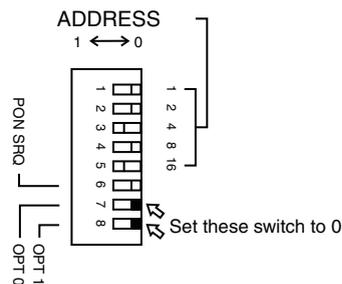
### Setting the model ID

If the PAN/PAN-A is connected via the TU02 and SH or via the TU02, set the ID on the terminal unit.

For direct connection, set the ID by sending a command.

Check that the ADDRESS switch 7(OPT 0) and 8(OPT 1) are set to 0. Otherwise, you cannot set the model ID.

See p. 55



Model ID	Model	Output voltage setting range [V]	Output current setting range [A]	SH Series
094	PAN16-10(A)	0.000 to 16.000	0.000 to 10.000	SH10
095	PAN16-18(A)	0.000 to 16.000	0.000 to 18.000	SH50
096	PAN16-30(A)	0.000 to 16.000	0.000 to 30.000	SH50
097	PAN16-50(A)	0.000 to 16.000	0.00 to 50.00	SH50
098	PAN35-5(A)	0.000 to 35.000	0.000 to 5.000	SH10
099	PAN35-10(A)	0.000 to 35.000	0.000 to 10.000	SH10
100	PAN35-20(A)	0.000 to 35.000	0.000 to 20.000	SH50
101	PAN35-30(A)	0.000 to 35.000	0.000 to 30.000	SH50
102	PAN55-3(A)	0.00 to 55.00	0.0000 to 3.0000	SH10
103	PAN55-6(A)	0.00 to 55.00	0.000 to 6.000	SH10
104	PAN55-10(A)	0.00 to 55.00	0.000 to 10.000	SH10
105	PAN55-20(A)	0.00 to 55.00	0.000 to 20.000	SH50
016	PAN60-3A	0.00 to 60.00	0.0000 to 3.0000	SH10
017	PAN60-6A	0.00 to 60.00	0.000 to 6.000	SH10
018	PAN60-10A	0.00 to 60.00	0.000 to 10.000	SH10
019	PAN60-20A	0.00 to 60.00	0.000 to 20.000	SH50
106	PAN70-2.5(A)	0.00 to 70.00	0.0000 to 2.5000	SH10

Model ID	Model	Output voltage setting range [V]	Output current setting range [A]	SH Series
107	PAN70-5(A)	0.00 to 70.00	0.000 to 5.000	SH10
108	PAN70-8(A)	0.00 to 70.00	0.000 to 8.000	SH10
109	PAN70-15(A)	0.00 to 70.00	0.000 to 15.000	SH50
110	PAN110-1.5(A)	0.00 to 110.00	0.0000 to 1.5000	Special order
111	PAN110-3(A)	0.00 to 110.00	0.0000 to 3.0000	SH10
112	PAN110-5(A)	0.00 to 110.00	0.000 to 5.000	SH10
113	PAN110-10(A)	0.00 to 110.00	0.000 to 10.000	SH10
114	PAN160-1(A)	0.00 to 160.00	0.0000 to 1.0000	Special order
115	PAN160-2(A)	0.00 to 160.00	0.0000 to 2.0000	Special order
116	PAN160-3.5(A)	0.00 to 160.00	0.0000 to 3.5000	SH10
117	PAN160-7(A)	0.00 to 160.00	0.000 to 7.000	SH10
118	PAN250-2.5(A)	0.00 to 250.00	0.0000 to 2.5000	SH10
119	PAN250-4.5(A)	0.00 to 250.00	0.000 to 4.500	SH10

### Performing calibration

If you set a new ID, be sure to calibrate the PAN/PAN-A.  
The available calibration types are from ITEM1 to ITEM4.

 p. 70 , p. 118

### Checking the PAN/PAN-A operation

After calibration, check the PAN/PAN-A operation by setting a voltage via GPIB.

Check procedure (example)

Send the message "MODE 0;CH 1;VSET 12.0" to the PIA3200, and check that the PAN/PAN-A preset voltage is set to 12.0 V.

# Connecting to a PAS Series

## NOTE

A PIA3200 with ROM version 1.30 or later is needed to use the PIA3200 with PAS Series power supplies. For instructions on how to check the version, see “Confirm the ROM version” on page 114.

## control Description

To control a PAS Series power supply, the optional TU03-PIA terminal unit is needed.

The following items become controllable.

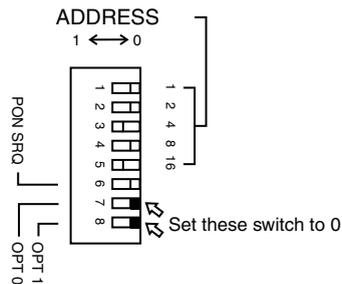
- Output voltage setting
- Output current setting
- Output voltage readback
- Output current readback
- Overvoltage protection setting
- Undervoltage protection setting
- Output on/off setting
- POWER switch off setting
- Status monitoring
  - POWER switch off
  - C.V mode
  - C.C mode
  - Output on/off
  - Alarm

## Making the connection and configuring the PAS

For instructions on how to connect the PIA3200 to the PAS and how to configure the PAS, see the operation manual of the TU03-PIA terminal unit.

### Model ID checking

Check that the ADDRESS switch 7(OPT 0) and 8(OPT 1) are set to 0. Otherwise, you cannot set the model ID.



Model ID	Model	Output voltage setting range [V]	Output current setting range [A]	SH Series
023	PAS10-35	0.000 to 10.000	0.000 to 35.000	SH10
024	PAS10-70	0.000 to 10.000	0.00 to 70.00	SH50
026	PAS10-105	0.000 to 10.000	0.00 to 105.00	SH50
027	PAS20-18	0.000 to 20.000	0.000 to 18.000	SH50
028	PAS20-36	0.000 to 20.000	0.000 to 36.000	SH10
029	PAS20-54	0.000 to 20.000	0.00 to 54.00	SH10
075	PAS40-9	0.00 to 40.00	0.000 to 9.000	SH50
076	PAS40-18	0.00 to 40.00	0.000 to 18.000	SH50
077	PAS40-27	0.00 to 40.00	0.000 to 27.000	SH10
120	PAS60-6	0.000 to 60.00	0.000 to 6.000	SH10
121	PAS60-12	0.000 to 60.00	0.000 to 12.000	SH10
122	PAS60-18	0.000 to 60.00	0.000 to 18.000	SH50
123	PAS80-4.5	0.000 to 80.00	0.000 to 4.500	SH10
124	PAS80-9	0.000 to 80.00	0.000 to 9.000	SH10
125	PAS80-13.5	0.000 to 80.00	0.000 to 13.500	SH10

# Connecting to a PMC-A Series

## Control Description

There are two ways to connect the PIA3200 to a PMC-A Series power supply depending on the items that you want to control.

To control a PMC-A Series power supply, the optional SC02-PIA cable for the PMC-A is needed.

The following items become controllable.

- Output voltage setting
- Output current setting
- Output current readback (only available with the connection via the SH)

## Making the connection

See p. 13

A 26-pin cable (that is 0.5 m in length) is used to connect the PIA3200 to a PMC-A Series power supply. To place the PIA3200 and the PMC-A at a distance, use the optional cable in place of the 26-pin cable.

Make sure that the POWER switches are off before making the connection.

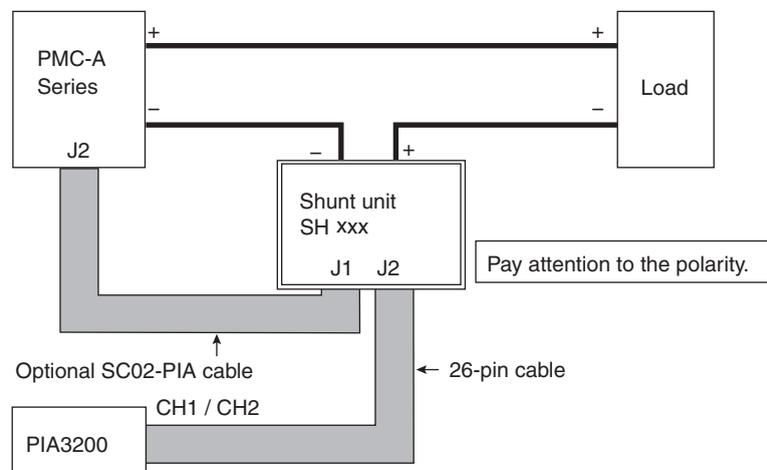
Lock the connectors.

### Connection via the SH

The SH Series shunt unit enables output current readback.

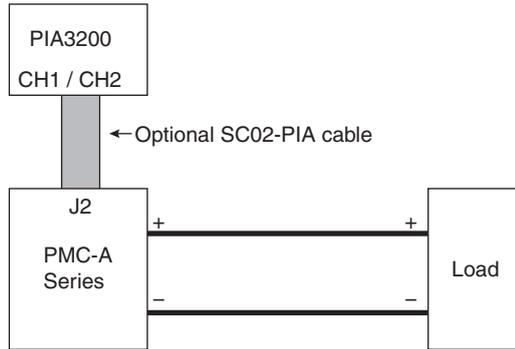
Connect the PIA3200 to the SH Series shunt unit with a 26-pin cable. Use the optional SC02-PIA cable to connect the PMC-A to the SH.

For instructions on how to connect the PMC-A Series power supply to the SH shunt unit, see the operation manual supplied with the SH Series.



### Direct connection

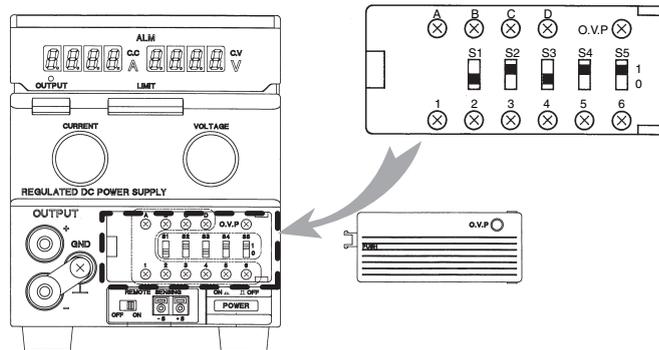
Connect the PIA3200 to the PMC-A Series power supply with the optional SC02-PIA cable. For details on the connection, see the PMC-A Series operation manual.



## When you are finished with the connection

### Setting the PMC-A Series switches

Before starting to control the PMC-A, set the S1 to S5 switches in the PMC-A front sub-panel as follows (to enable CC and CV remote control modes):



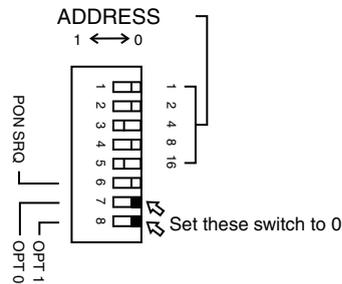
Switch Number	Switch Position
S1	Bottom (0)
S2	Top (1)
S3	Bottom (0)
S4	Top (1)
S5	Top (1)

## Setting the model ID

See p. 55

Set the ID by sending a command.

Check that the ADDRESS switch 7(OPT 0) and 8(OPT 1) are set to 0. Otherwise, you cannot set the model ID.



Model ID	Model	Output voltage setting range [V]	Output current setting range [A]	SH Series
079	PMC10-3A	0.000 to 10.000	0.0000 to 3.0000	SH10
080	PMC18-1A	0.000 to 18.000	0.0000 to 1.0000	Special order
081	PMC18-2A	0.000 to 18.000	0.0000 to 2.0000	Special order
082	PMC18-3A	0.000 to 18.000	0.0000 to 3.0000	SH10
083	PMC18-5A	0.000 to 18.000	0.000 to 5.000	SH10
084	PMC35-0.5A	0.000 to 35.000	0.0000 to 0.5000	Special order
085	PMC35-1A	0.000 to 35.000	0.0000 to 1.0000	Special order
086	PMC35-2A	0.000 to 35.000	0.0000 to 2.0000	Special order
087	PMC35-3A	0.000 to 35.000	0.0000 to 3.0000	SH10
088	PMC70-1A	0.00 to 70.00	0.0000 to 1.0000	Special order
089	PMC110-0.6A	0.00 to 110.00	0.0000 to 0.6000	Special order
090	PMC160-0.4A	0.00 to 160.00	0.0000 to 0.4000	Special order
091	PMC250-0.25A	0.00 to 250.00	0.00000 to 0.25000	Special order
092	PMC 350-0.2A	0.00 to 350.00	0.00000 to 0.20000	Special order
093	PMC 500-0.1A	0.0 to 500.0	0.00000 to 0.10000	Special order

## Performing calibration

See p. 70 , p. 118

If you set a new ID, be sure to calibrate the PMC-A.

The available calibration types are from ITEM1 to ITEM4.

## Checking the PMC-A operation

After calibration, check the PMC-A operation by setting a voltage via GPIB.

Check procedure (example)

Send the message "MODE 0;CH 1;VSET 12.0" to the PIA3200, and check that the PMC-A preset voltage is set to 12.0 V.





# Remote Control

This chapter describes how to configure various settings using commands.

# Basic Settings

## Sending commands and receiving responses

The terms of “Message” refers to information that is exchanged between the controller (PC) and the PIA3200.

There are two types of messages which are classified in the “command” that are sent from the PC to the PIA3200 and the “response” that are sent from the PIA3200 to the PC.

Do not send commands until approximately 6 seconds after you turn the PIA3200 on. It may cause the PIA3200 to operate improperly.

You can send two or more commands at once by using semicolons(;).

CH 1;VSET 10V                      Specify channel 1, and set the voltage to 10 V.

This command is equivalent to sending the following two commands.

CH 1                                  Specify channel 1.

VSET 10V                            Set the channel 1 voltage to 10 V.

You can either include or exclude a unit of measurement to values. The transmitted result will be the same.

You can inquire the settings or the status of the PIA3200 by adding a question mark(?) on the end of program header section. When you send a query, the PIA3200 returns its status and measured values to the host computer. This is the response.

CH 1;VSET 10V                      Specify channel 1, and set the voltage to 10 V.

CH 2;VSET 12V                      Specify channel 2, and set the voltage to 12 V.

If you send CH \*;VSET?, the PIA3200 returns the responses for channel 1 and 2 with each response separated by a comma(,).

The PIA3200 returns CH1 VSET 10.00V, CH2 VSET 12.00V.

If you do not want headers (including channel headers) or units to be returned in responses, use the following command.

HEAD 0                                Specify the PIA3200 not to return headers and units.

If you send this command, the PIA3200 will return “10.00,12.00” in response to CH \*;VSET?

You can also change the separator.

SEPARATOR 2                         Change the separator to a semicolon(;).

If you send this command, the PIA3200 will return “10.00;12.00” in response to CH \*;VSET?

## Selecting a Mode

The PIA3200 has three modes of operation. Set the mode first, and then execute other commands. The commands may be valid or invalid depends on the operation mode.

- GPIB control mode (LOCK) **GPIB** (MODE 0)  
Select this mode when you are not using the sequence control or calibration.
- Sequence Control mode **SEQ** (MODE 1)  
Select this mode to apply sequence control to the PIA3200.
- Calibration mode **CAL** (MODE 2)  
Select this mode to calibrate the PIA3200.

## Setting the model ID

Set the model ID for the PIA3200 can recognize information of the connected power supplies.

- PAK-A Series power supplies  
If you are connecting PAK-A Series power supplies, the PIA3200 automatically detects the ID. Therefore, there is no need to set the ID using the ID command.
- Connections when using a terminal unit  
If you are connecting power supplies using a terminal unit, set the ID on the terminal unit. For instructions, see the operation manual of the terminal unit.
- Other connections  
Only the first ID command for each channel is valid after power-on. If you set the ID incorrectly, turn the PIA3200 POWER switch off and then turn it back on.  
It takes approximately 5 seconds to execute the ID command for each channel.  
CH 1      Specify channel 1.  
ID 005    Specify 5 of the model ID.

## Specifying a channel

The PIA3200 is equipped with two I/O connectors which can control two power supplies. Before proceeding various settings, you select the power supply connected to either I/O connector or to specify the channel. The CH command is used to specify a channel.

The commands that are marked with the  icon described in Chapter 5 are valid to apply to both channels, CH1 and CH2, regardless of which channel is specified.

CH 1	Specify channel 1.
VSET 35V	Set the channel 1 voltage to 35 V.
ISET 10A	Set the channel 1 current to 10 A.
CH 2	Specify channel 2.
VSET 10V	Set the channel 2 voltage to 10 V.
VPM 1	Enable the auto-tracking output voltage protection mode (ALL CH).

You can specify both channels simultaneously by using an asterisk(\*).

CH *;VSET 10V	Specify both channels, 1 and 2, and set their voltages to 10 V.
---------------	---

This command is equivalent to sending the following command.

```
CH 1;VSET 10V;CH 2;VSET 10V
```

If you send a query with specifying both channels, the response will contain the data for both channels.

If the channel 1 voltage is set to 10 V and the channel 2 voltage is set to 12 V, the PIA3200 will return the following response to CH\*;VSET?

```
CH1 VSET 10.00V, CH2 VSET 12.00V
```

## Setting and Output of Voltage and Current

After setting the channel but before setting the voltage or current, use the REM command so that the DC power supplies that you connected to can be remotely controlled.

Use the VSET command to set the voltage, the ISET command to set the current, and the OUT command to turn the output on and off.

Use the VOUT? query to measure the voltage and the IOUT? query to measure the current.

When the power is turned on, the output voltage is set to 0 V, and the output current is set to 0 A.

When you set the output current, be sure to set the output voltage. The output current will only flow when you set the output voltage.

Because the output voltage may not rise in some cases, set the output current first and then set the output voltage.

Wait for the output voltage of the connected power supplies to rise to an adequate level (which is equal to the power supply's output response time  $\times$  1.5 + 150 ms). 150 ms is the sampling period of the A/D converter.

MODE 0	Enable the GPIB control mode.
CH 1	Specify channel 1.
REM 1	Set the power supply to remote control mode (valid only for the PAK-A Series).
ISET 0.5A	Set the current to 0.5 A.



## Setting the output protection feature

There are two types of output voltage protection features available on the PIA3200: overvoltage protection (OVP) and undervoltage protection (UVP).

Based on the ID setting, the PIA3200 automatically selects whether to use the hardware OVP built into the connected power supplies or the PIA3200's software OVP. The software OVP is used for power supplies other than the PAK-A series.

Undervoltage protection is achieved through the PIA3200's software UVP. The software UVP functions only when the output is on.

When using output voltage protection, especially when using UVP, be sure to send the OUT 0 command before turning the entire system off. Otherwise, the POWER switches on the connected power supplies may turn off.

To use software OVP and UVP, it is required for that the PIA3200 needs to read back the output voltage of the power supplies.

To increase the value of OVP setting, send OVSET and then send VSET. To decrease the value of OVP setting, send VSET, wait for the voltage to drop to the set value, and then send OVSET.

To increase the UVP setting, send VSET, wait for the voltage to reach the set value, and then send UVSET. To decrease the UVP setting, send UVSET and then VSET. To set UVP, be sure to turn the output on (using OUT 1).

To set how the power supply will react (turn the power off, turn the output off, or execute VSET 0) when OVP or UVP is activated, use the ALMMODE command.

MODE 0	Enable the GPIB control mode.
VPM 0	Turn the auto-tracking feature off
CH 1	Specify channel 1.
REM 1	Set the power supply to remote control mode (valid only for the PAK-A Series).
ISSET 10;VSET 0;UVSET -35	Set the current to 10 A, the voltage to 0 V, and UVP to -35 V.
ALMMODE 0,0,4,0,0,0,0	Turn the power off when UVP is activated.
OVSET 26	Set OVP to 26 V.
VSET 10;OUT 1	Set the voltage to 10 V, and turn the output on.
UVSET 9V	Set UVP to 9 V.
OUT 0	Turn the output off.

### Auto-tracking output voltage protection feature

The PIA3200 has an auto-tracking output voltage protection feature that automatically sets to track the setting value (VSET) of output voltage to protect the output voltage. This feature is effective when the output voltage is varied over a relatively long interval.

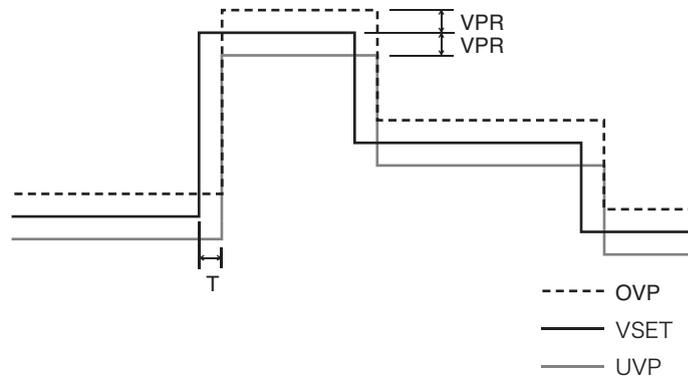
Use the VPM command to select either on or off of the auto tracking feature. The value of VPM setting is saved even when the power of PIA3200 is turned off.

When the auto-tracking feature is on, the OVP value is determined by adding the value set by the VPR command to the VSET value. The UVP value is determined by subtracting the value set by VPR from the VSET value. The VPR value applies to both OVP and UVP and cannot be set separately. When the VSET value changes, the OVP and UVP values change simultaneously.

The rise and fall time of output voltage vary depending on the connected power supplies. They also vary depending on the connected load. The UVP and OVP must be set by taking concerns of these times.

As shown in the following figure, the VPTIME command is used to specify the time when the configuration of OVP and UVP is completed. The longer the rise and fall times, the greater the VPTIME value must be.

The VPTIME setting error is  $5\% \pm 20$  ms. The VPTIME command is valid when auto tracking mode is enabled (when VPM is set to 1).



MODE 0	Enable the GPIB control mode.
VPM 1;VPTIME 0.5;VPR 2	Turn the auto-tracking feature on, set the tracking time to 0.5 s, and set the tracking offset to 2 V.
CH1	Specify channel 1.
REM 1	Set the power supply to remote control mode (valid only for the PAK-A Series).
ISET 10;VSET 0;OUT 1	Set the current to 10 A and the voltage to 0 V (OVP is set to 2 V and UVP is set to -2 V), and turn the output on.
VSET 10	Set the voltage to 10 V (OVP is set to 12 V and UVP to 8 V).
VSET 20	Set the voltage to 20 V (OVP is set to 22 V and UVP to 18 V).
OUT 0	Turn the output off.

The auto-tracking feature only functions while the output is on (when OUT is set to 1).

## Switching between remote and local modes

There are two levels of remote/local switching. One is the switching of the PIA3200, and the other is the switching of the DC power supplies that are connected to the PIA3200.

### Switching between the PIA3200 remote and local modes

The PIA3200 is set to remote mode from a PC. When you send any command to the PIA3200, the PIA3200 switches to remote mode, and the RMT LED illuminates.

To switch the PIA3200 to local mode, press the LOCAL key on the PIA3200.

### Switching between the power supplies' remote and local modes

You can use the REM command to set the PAK-A Series output voltage and output current and to turn the PAK-A Series output on and off.

For all other cases, switch the mode directly on the power supplies.

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## Momentary power failure

The PIA3200 can withstand a momentary power failure up to approximately 30 ms. If the line power fails for longer than 30 ms, the PIA3200 operates in the same way as when the CLR command is received.

The following values are initialized.

- Output voltage value (VSET)
- Output current value (ISET)
- Overvoltage protection value (OVSET)
- Undervoltage protection value (UVSET)
- Mode switch (MODE)

If an alarm action is in progress, the alarm is cleared. If the power-on service request is enabled on the rear-panel ADDRESS switch, an SRQ is generated to notify the PC of the momentary power failure.

## Command buffer

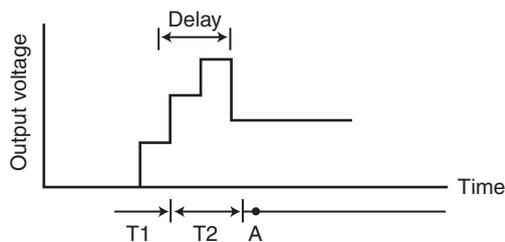
When the PIA3200 receives a command through the GPIB bus, the command is placed in the command buffer. The internal CPU executes commands in the buffer in order.

Because the GPIB bus simply places commands in the command buffer, commands can be received quickly.

In the following program, when an attempt is made to read back data, the GPIB-bus handshaking is held off (paused), and the commands in the buffer are executed in order while the bus is held off. When all commands have been executed, the VSET15 value is read back.

When there are many commands before the readback command, handshaking is held off for a long period.

CH *	Specify channels 1 and 2.
REM 1	Switch the power supplies to remote mode.
ISET 10	Set the current to 10 A.
VSET 10	Set the voltage to 10 V.
OUT 1	Turn the output on.
VSET 20	Set the voltage to 20 V.
VSET 30	Set the voltage to 30 V.
VSET 15	Set the voltage to 15 V.
VSET?	Query the voltage value.



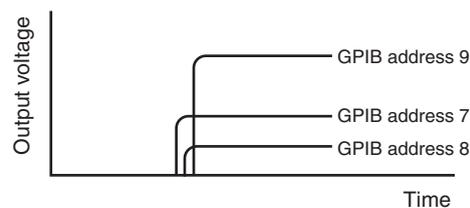
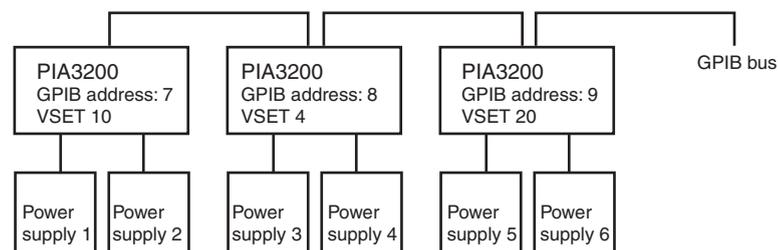
T1 indicates the time when VSET 15 in the previous program enters the buffer. The bus is held off for T2, and the readback is executed at point A.

This behavior becomes prominent when auto-tracking output voltage protection is enabled. When the protection is enabled, the time to execute a VSET command is approximately twice VPTIME.

CH *	Specify channels 1 and 2.
REM 1	Switch the power supplies to remote mode.
VPM 1	Enable the auto-tracking voltage protection feature.
ISSET 10	Set the current to 10 A.
VSET 10	Set the voltage to 10 V.
OUT 1	Turn the output on.
VSET 20	Set the voltage to 20 V.
VSET 30	Set the voltage to 30 V.
VSET 15	Set the voltage to 15 V.
VSET?	Query the voltage value.

By using the command buffer, appropriate output voltages can be achieved about the same time in a system that consists of multiple PIA3200s that are connected together.

Example when three PIA3200s are connected and the command buffer is used



## “@” and “@@” symbols

If you add “@” or “@@” to the end of a command, the PIA3200 receives the next command after the processing of the current command is finished. Commands are not accumulated in the command buffer.

“@” and “@@” are valid when the command delimiter is set to CR, CR+LF, LF, CR+EOI, CR+LF+EOI, or LF+EOI. When the delimiter is EOI, use “@@”.

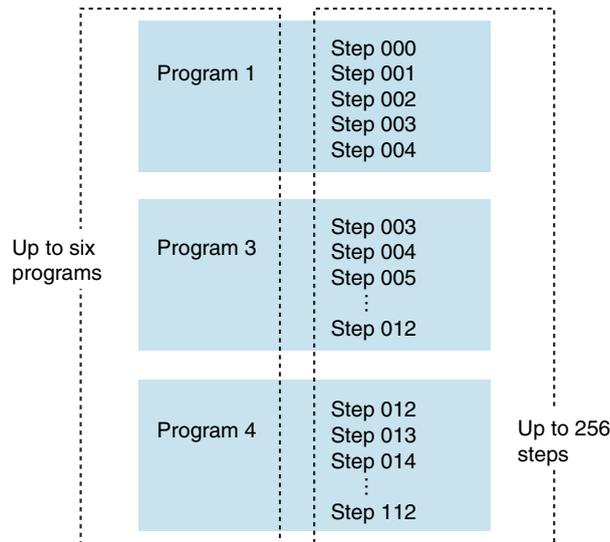
CH *@@	Specify channels 1 and 2, and wait for the process to finish.
REM 1@	Switch the power supplies to remote mode, and wait for the process to finish.
ISSET 10@;VSET 10@	Set the current to 10 A, and wait for the process to finish. Then set the voltage to 10 V, and wait for the process to finish.
OUT 1@	Turn the output on, and wait for the process to finish.
VSET 20@	Set the voltage to 20 V, and wait for the process to finish.
VSET 30@	Set the voltage to 30 V, and wait for the process to finish.
VSET 15@	Set the voltage to 15 V, and wait for the process to finish.
VSET?	Query the voltage value.

# Using the Sequence Control Feature

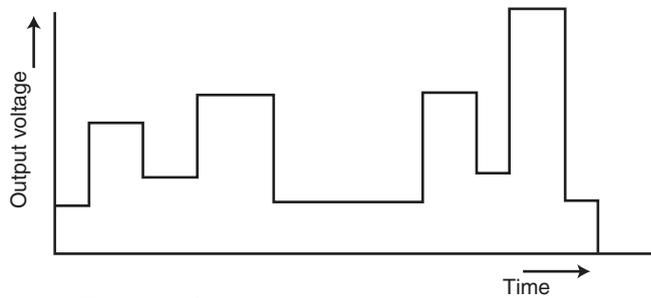
The sequence control is a feature that automatically executes preset steps one at a time. You can enable Sequence Control mode by setting the PIA3200 front-panel MODE switch to SEQUENCE or by sending the MODE1 command to the PIA3200.

You can save the contents of the sequence memory to the PIA3200 by using the SAVE command. You can also execute and stop the sequence feature from the front panel.

To create a sequence, it is required to understand the definition of “program” and “step”. The program is an aggregate which consist of steps.



Sequence configuration example



Example of sequence execution

## Sequence speed

There are two sequence speeds that you can choose from. You specify the sequence speed for each program.

### ■ Normal-Speed Sequence (NSP)

In Normal-Speed Sequence, you can set the duration of each step in the range of approximately 50 ms to 1 h. Normal-Speed Sequence is suitable for long-duration tests. It enables you to monitor the output of power supplies that are running and to monitor the power supply status through the GPIB interface.

### ■ High-Speed Sequence (VHSP)

There are two High-Speed Sequence modes: High-Speed Voltage Sequence mode that controls the output voltage at high speeds and High-Speed Current mode that controls the output current at high speeds.

The minimum time to execute a step is at 0.2 ms.

In High-Speed Voltage Sequence, do not connect output pins (DA2 and DA4). In High-Speed Current Sequence, do not connect output pin (DA1).

## Setting steps

You specify one execution condition in a step. The maximum number of steps that you can set is 256.

Item	Condition	Command		
CH1	Output voltage	CH 1;SVSET		
	Output current	Varies depending on the connected power supplies.		
	OVP			
	UVP			
	Power off <sup>*1</sup>		Send the command to switch the power off	
	Output on/off <sup>*1</sup>	0: Off, 1: On	CH 1;SPOW	
	Remote/local <sup>*1</sup>	0: Local, 1: Remote	CH 1;SOUT	
	Digital output <sup>*1</sup>	0 to 127	CH 1;SREM	
	CH2	Output voltage	CH 1;SDSET	
		Output current	Varies depending on the connected power supplies.	
OVP				
UVP				
Power off <sup>*1</sup>		Send the command to switch the power off		
Output on/off <sup>*1</sup>		0: Off, 1: On	CH 2;SPOW	
Remote/local <sup>*1</sup>		0: Local, 1: Remote	CH 2;SOUT	
Digital output <sup>*1</sup>		0 to 127	CH 2;SREM	
Execution time		Normal-Speed Sequence	0.05 to 7999 or 8000 which represents infinity	CH 2;SDSET
		High-Speed Sequence	0.0002 to 0.9998 or 0.9999 which represents infinity	TIME
Pause <sup>*2</sup>	0: Pause, 1: Not pause	HTIME		
Step number	1 to 256	PMARK		
		—		

\*1 The last specified value takes effect.

\*2 Valid for Normal-Speed Sequence

Step commands are specified by adding the letter “S” in front of the commands that are normally used. You specify the step number by adding a comma after the command value and then the step number itself. Step commands are not executed until you send the RUN command.

CH 1	Specify channel 1.
S1SET 5,1	Set the step 1 current to 5 A.
S2SET 5,2	Set the step 2 current to 5 A.
PMARK 1,2	Add a pause after step 2.

In High-Speed Sequence, only the output voltage, output current, and digital output items are used.

## Setting a step execution time

You can set a normal-speed execution time and a high-speed execution time for each step. Specify the step number after the time value.

You cannot set the execution time separately for each channel. Each step is executed simultaneously on CH1 and CH2. Take this into consideration when setting the output voltage and other values.

TIME 10,1	Set the normal-speed execution time of step 1 to 1 second.
TIME 5,2	Set the normal-speed execution time of step 2 to 5 second.
HTIME 0.01,3	Set the high-speed execution time of step 3 to 0.01 second.

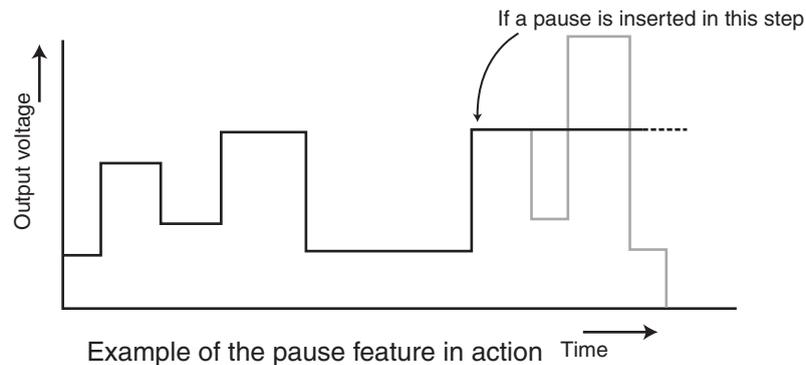
## Setting pauses (applies only to Normal-Speed Sequence)

You can set a pause to each step. When you set a pause, the PIA3200 automatically pauses after executing the step. It is more accurate than pressing the PAUSE key on the front panel.

The pause feature is valid for Normal-Speed Sequence. Pauses are ignored in a high-speed sequence.

You cannot set pauses separately for each channel. Steps are executed simultaneously on CH1 and CH2.

You can unpaue by sending the RUN command.



Example of the pause feature in action

## Checking the contents of a step

Use SMEM? to query the contents of a step. Attach the step number that you want to query after SMEM? For example, if you want to check the contents of step 10, send the following query.

SMEM? 10

The response to SMEM? 10 will contain the following items in order, with each item separated by a comma.

Normal-Speed Sequence execution time

High-Speed Sequence execution time

Pause on or off

CH1 voltage

CH2 voltage

CH1 current

CH2 current

CH1 OVP

CH2 OVP

CH1 UVP

CH2 UVP

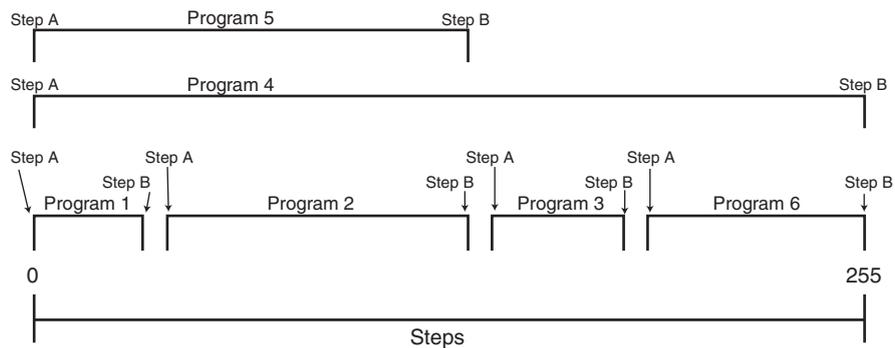
CH1 digital output setting

CH2 digital output setting

## Setting programs

A program is a collection of steps. You can specify a range of steps and set how many times to repeat the range of steps. You can configure up to six programs by using the ADR command.

Item	Condition
Program number	1 to 6
Sequence speed	0: Normal-Speed Sequence 1: Normal-Speed Sequence with auto-tracking output voltage protection 2: High-Speed Voltage Sequence 3: High-Speed Current Sequence
Start step (step A)	0 to 255
End step (step B)	0 to 255
Step-change pattern	0: Step increment 1: Step decrement 2: Step increment and then decrement
Execution count	0: Infinite 1 to 10000
Final output step (Normal-Speed Sequence only)	0 to 255



Example of specifying a program step range

Set the items in order using the ADR command, with each item separated by a comma.

ADR 2,0,0,5,0,10,0

Configure program 2 as follows: normal speed, repeat steps 0 to 5 ten times by incrementing the address, and end with step 0.

To use the auto-tracking output voltage protection feature, first set the tracking offset and tracking time. You cannot set these values separately for each step.

CH 1

Specify channel 1.

MODE 1

Switch to Sequence Control mode.

VPTIME 0.5;VPR 2

Set the tracking time to 0.5 s and the tracking offset to 2 V.

ADR 2,1,0,5,0,10,0

Configure program 2 as follows: normal speed with auto-tracking, repeat steps 0 to 5 ten times by incrementing the address, and end with step 0.

■ **Start step and end step**

Specify a range of steps to execute. Be sure to set step A to a number less than step B. If you set step A equal to step B, the program will not be executed.

■ **Sequence speed**

Specify the sequence speed. In High-Speed Sequence, pauses in steps are ignored.

■ **Final output**

The output of the step specified as the final step is what the power supplies will deliver upon the completion of the program. If the final step is not specified, the output will be at the previous value.

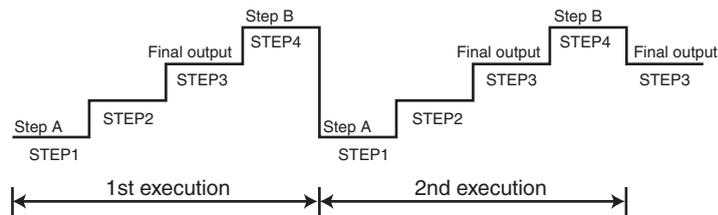
If you stop a program using the STOP command or the STOP key, the final-step value is ignored.

■ **Step-change pattern**

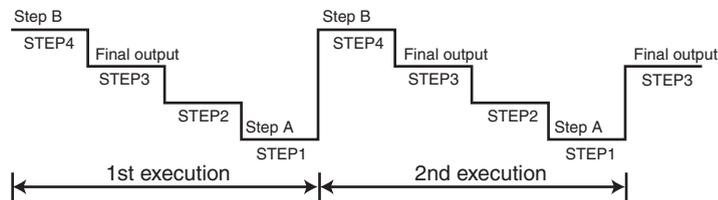
Specify how steps will advance by setting the step-change pattern. There are three step-change patterns: step increment, step decrement, and step increment and then decrement.

The following figure illustrates the three step-change patterns when the step range is set to 1 to 4 (step A set to 1 and step B set to 4), the execution count is set to 2, and the final step is set to 3.

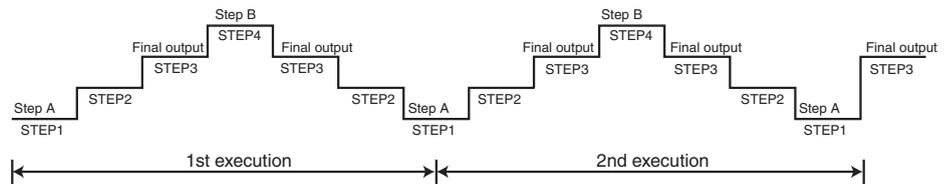
- Step increment



- Step decrement



- Step increment and then decrement



## Checking the contents of a program

Use ADR? to query the contents of a program. Attach the program number that you want to query after ADR?. For example, if you want to check the contents of program 3, send the following query.

ADR? 3

The response to ADR? 3 will contain the following items in order, with each item separated by a comma: sequence control mode, start step, end step, step-change pattern, execution count, and final step.

## Saving and loading sequences

You can save the contents of a sequence to the PIA3200.

### ■ Saving a sequence

You can use the SAVE command to save the memory contents to memory. It takes approximately 3 seconds to save the contents to memory after you send the SAVE command. If you add "@" to the end of the SAVE command (as in SAVE@), the GPIB bus is held while the save operation is taking place.

The following settings are saved.

- Tracking offset and tracking time of the auto-tracking output voltage protection feature
- Step contents
- Program contents

CH 1	Specify channel 1.
MODE 1	Enable Sequence Control mode
VPTIME 0.5;VPR 2	Set the tracking time to 0.5 s and the tracking offset to 2 V.
SREM1,0;SOUT1,0;SISSET 10,0;SVSET 0,0;TIME 2.5,0	Configure step 0.
SREM1,1;SOUT1,1;SISSET 10,1;SVSET 2,1;TIME 2.5,1	Configure step 1.
SREM1,2;SOUT1,2;SISSET 10,2;SVSET 4,2;TIME 2.5,2	Configure step 2.
SREM1,3;SOUT1,3;SISSET 10,3;SVSET 6,3;TIME 2.5,3	Configure step 3.
SREM1,4;SOUT1,4;SISSET 10,4;SVSET 8,4;TIME 2.5,4	Configure step 4.
SREM1,5;SOUT1,5;SISSET 10,5;SVSET 10,5;TIME 2.5,5	Configure step 5
ADR 2,0,0,5,0,10,0	Configure program 2 as follows: normal speed, repeat steps 0 to 5 ten times by incrementing the address, and end with step 0.
SAVE@	Save the sequence.
MODE 0	Enable GPIB Control mode.

### ■ Loading a sequence

The contents of a sequence that you saved can be loaded using the LOAD command. It takes approximately 6 seconds for the memory contents to be loaded after you send the LOAD command. If you add "@" to the end of the LOAD command (as in LOAD@), the GPIB bus is held while the load operation is taking place.

## Running and stopping programs

### Running a program

When you are finish configuring a program, you can run it.

To run the program, send the SELECT command to specify the appropriate program number, and then send the RUN command.

You can specify the start step and pause step with the RUN command.

You can omit the start step. If you omit it, the program starts from the step specified in the program.

You can omit the pause step. If you omit it, the program does not pause. In High-Speed Sequence, the program does not pause even if you set the pause step in the RUN command, or even if pauses are specified in steps.

SELECT 3	Specify program number 3.
RUN	Run program 3.
RUN 2,5	Start program 3 from step 2 and pause at step 5.

The following commands are invalid while a program is running or is paused.

ADR	ALMMODE	CAL	DOW	NDSET	FINISH	HTIME
ID	ISSET	OUT	OVSET	PAUSE	PMARK	POW
REM	SDSET	SLECT	SISSET	SMEM	SOVSET	SOUT
SPOW	SUVSET	SVSET	TIME	UP	UVSET	VPM
VPR	VPTIME	VSET				

If an alarm is triggered while a program is running, the program stops.

In High-Speed Sequence, the output voltage and output current cannot be monitored while a program is running. The CH1 and CH2 programs start simultaneously, and each step is carried out about the same time between the channels. However, in a long-duration program, the channels will not be synchronized. The time the program ends will be offset between the channels.

Given a program with a step range of 40 to 250, if you want to run step 188 and 200 to 202 one step at a time, send these commands:

```
RUN 188,188
RUN 200,200
RUN 201,201
RUN 202,202
```

To run the program from step 50, send this command:

```
RUN 50
```

To run the program from step 40 and pause at step 140, send this command:

```
RUN ,140
```

If you send the following command for a program with a step range of 40 to 250

```
RUN 15,140
```

the program starts from step 40 and pauses at step 140.

### Stopping a program

If you send the STOP command while a program is running, the program stops at the specified step. If you do not specify the step, the program stops immediately.

STOP 30	Stop the program at step 30.
---------	------------------------------

# Calibration by Device Configuration (remote)

When using the PIA3200 in combination with power supplies, you must calibrate analog outputs and monitoring signals beforehand.

Calibrate the offset and full-scale values in the following order.

- Calibrate the output voltage setting and output voltage monitoring signal.
- Calibrate the output current setting and output current monitoring signal.
- Calibrate overvoltage protection (OVP: only on the PAK-A Series)

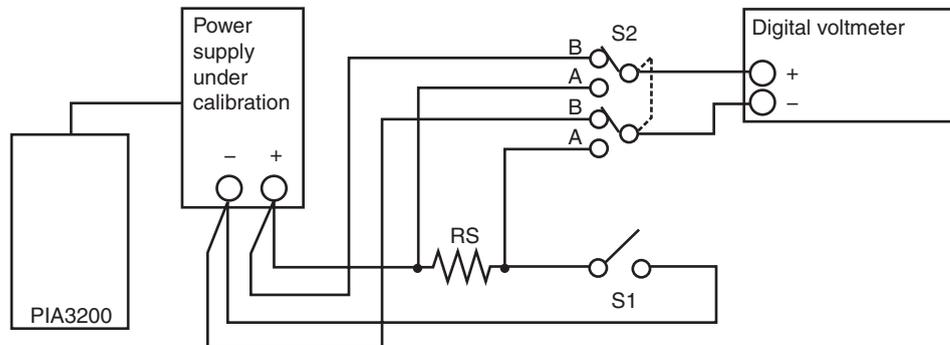
## Calibration preparation

Before performing calibration, ready a digital voltmeter and circuit (wiring). The accuracy of the measuring instruments affects the calibration accuracy. See below for the requirements.

- A properly calibrated digital voltmeter with accuracy of 0.001 %
- A shunt (RS) with an accuracy around 0.2 %

## Connecting the components for calibration

Use wires that can apply to adequately handle the rated current of the power supply under calibration. Switch settings vary depending on the item you want to calibrate. See the following table for the appropriate switch settings.



Item to calibrate	Switch position	
	S1	S2
Output voltage offset	OFF	B
Output voltage full-scale value	OFF	B
Output current offset	ON	A
Output current full-scale value	ON	A
OVP offset	OFF	B
OVP full-scale value	OFF	B

## Calibration procedure

Use the MODE command to specify the calibration mode, and use the CAL command to specify the channel to calibrate and the item to calibrate. Calibration starts when you send the CAL command. Once calibration starts, use the UP and DOWN commands to make adjustments.

In the CAL command, set the channel first and then the item to calibrate.

Item to calibrate

- 1 Output voltage offset
- 2 Output voltage full-scale value
- 3 Output current offset
- 4 Output current full-scale value
- 5 OVP offset (only on the PAK-A Series)
- 6 OVP full-scale value (only on the PAK-A Series)

MODE 2	Enable the calibration mode
CAL 1,1	Calibrate the output voltage offset of channel 1.
UP 100	Adjust the voltage.
FINISH	Finish the calibration of the output voltage offset of channel 1.
CAL 1,2	Calibrate the output voltage full-scale value of channel 1.
FINISH	Finish the calibration of the output voltage full-scale value of channel 1.
MODE 0	Enable GPIB Control mode.

The variable range of offset and full-scale values on the PIA3200 is extremely wide. We recommend that you check the offset and full-scale values using the limit switch on the connected power supply after calibration.

# Alarms

## Generating and clearing alarms

### Alarm sources

Alarm sources that trigger alarms are the OVP, OHP, UVP, POW, CC and CV events that occur in the power supplies connected to the PIA3200. An alarm is said to have triggered when one of these events occurs and the PIA3200 is ready to perform an alarm action.

Depending on the type of DC power supply or how it is connected to the PIA3200, the PIA3200 may not be ready to perform an alarm action even when the OVP, OHP, UVP, POW, CC, or CV status becomes true on a power supply that is connected to the PIA3200.

Alarm source	Description
OVP	Overvoltage protection was activated.
OHP	Overheat protection was activated.
UVP	Undervoltage protection was activated.
SYNC	An alarm occurred in another PIA and the alarm sync input terminal was activated, or an alarm occurred on the other channel of this PIA.
POW	The input power to the connected power supplies was turned off.
C. C	A connected power supply entered constant current mode.
C. V	A connected power supply entered constant voltage mode.

### Alarm actions

When the alarm mode register is configured and an alarm is triggered, the PIA3200 displays the letter “A” in Display 1 (the left 7-segment LED) and performs the action that is set in the alarm mode register. This action is called *alarm action*.

The following three alarm actions are available: POWER OFF, OUT OFF, and REF OFF.

Alarm action	Description	Commands that are ignored while an alarm action is in progress	ALMMODE value
POWER OFF	Turns the connected power supplies' POWER switches off.	POW	4
OUT OFF	Turns the connected power supplies' output off.	OUT	2
REF OFF	Sets the VSET and ISET values to zero.	VSET, ISET	1

See p. 74

### ■ Configuring an alarm action

Set whether or not the PIA3200 will execute an alarm action when an alarm is triggered using the alarm mode register.

If an alarm action is executed, the PIA3200 alarm sync output terminal is activated.

If an alarm action is executed while a program is running, the program stops.

Depending on the DC power supply, the power supply may perform an action other than that specified by the alarm mode register. This is a result of the DC power supply's specifications. For details, see the operation manual of the power supply.

For example, PAK-A Series' power will turn off unconditionally when OVP is activated. Configure the alarm mode register by considering safety issues after recovery.

If you specify POWER OFF in the alarm mode register and the alarm action is executed, you cannot turn the connected power supplies on using the POWER switches. To turn the power supplies on again, also turn the PIA3200 POWER switch on.

### ■ Clearing an alarm

An alarm is held until you send the RST command or turn the PIA3200 off. You can also use the CLR command to clear an alarm.

Even if you clear an alarm, if the cause of the alarm is not resolved, an alarm will be triggered again.

## Alarm action delay feature

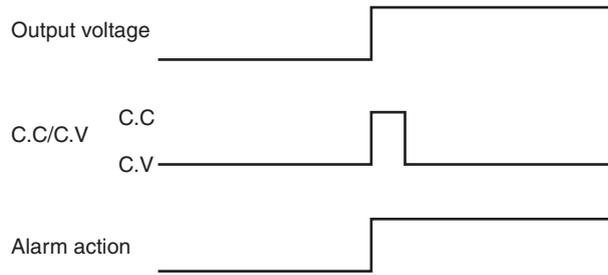
The alarm action delay feature delays the execution of the alarm action after an alarm source is detected. If the alarm source still remains after the delay, the alarm action is executed. If the alarm source clears within the delay period, the alarm action is not executed.

The setting of the fault register and the generation of SRQs are also delayed. Even if the alarm mode register is not set, the setting of the fault register bit corresponding to the alarm source is delayed.

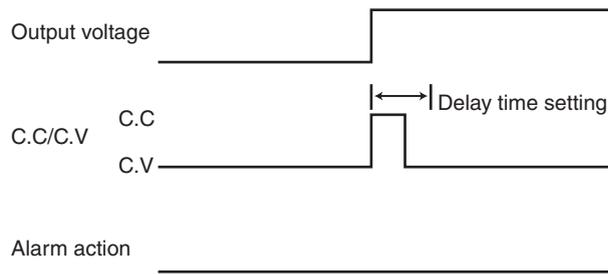
Use the DLY command to set the delay value. The delay applies to all alarm sources except SYNC. You cannot set the delay value separately for each alarm source.

For example, consider a DC power supply used in C.V mode. You set the PIA3200 to monitor alarms that are triggered when the power supply enters C.C mode. In the case of a capacitive load, the power supply temporarily enters C.C mode if the applied voltage is changed suddenly. By setting an appropriate delay value, you can make the PIA3200 ignore alarms during the delay period and effectively filter out temporary C.C modes.

Delay time not specified



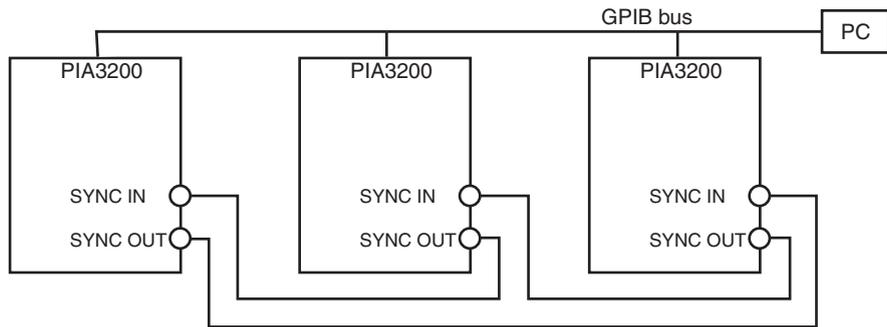
Delay time specified



## Alarm synchronization

You can connect up to four PIA3200s to your PC and connect up to eight power supplies to the four PIA3200s.

When using two or more PIA3200s, you can achieve alarm synchronization by connecting the alarm sync connectors OUT and IN between each PIA3200 using the supplied alarm synchronization cable. When an alarm is triggered in one of the connected PIA3200s, the other PIA3200s receive the information, and the alarm source SYNC is activated. Alarm action is executed according to the alarm mode register setting for SYNC.



On the PAK-A Series, alarm synchronization may not work if the alarm delay value is set to a large value. Keep the delay value less than approximately 0.5 s.

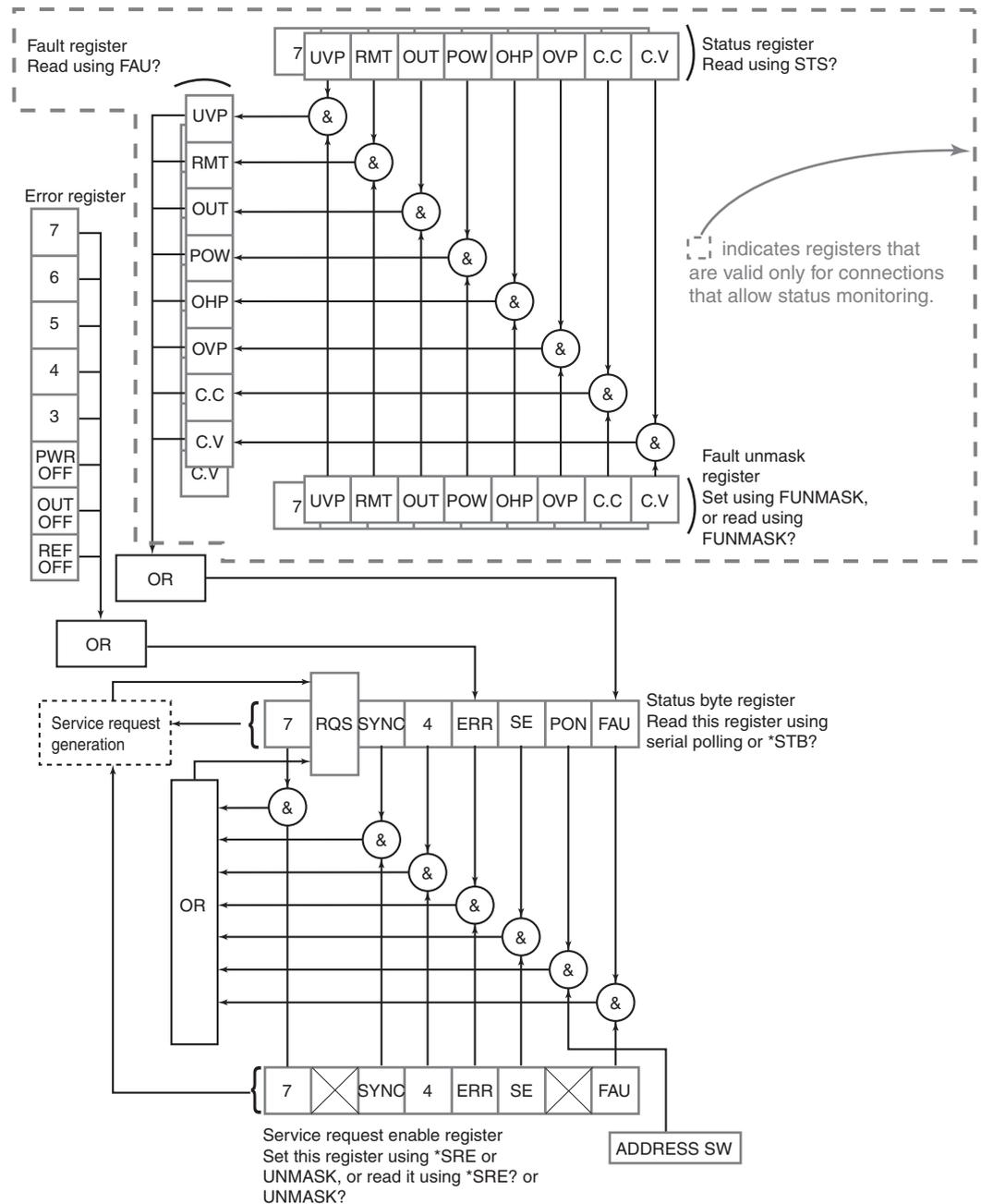
# Status Monitoring

You can monitor the PIA3200 status and the status of the connected power supplies by using service requests (SRQs).

The PIA3200 has an 8-bit status register for each channel. The status of each power supply is recorded in the register in real time. You can monitor the status by reading back the status register.

There is a fault register with the same bit arrangement as the status register. The fault register is set in relation to the fault unmask register. A bit that has been unmasked by the fault unmask register is recorded in the fault register. If any of the bits in the fault register is set, the FAU bit in the serial polling register is set. If a bit in the serial polling register has been unmasked by the unmask register, the PIA3200 generates an SRQ on the GPIB bus when the bit is set.

A bit that has been set in the fault register is held and the next SRQ is not generated until the fault register is read back. Each channel has a fault register, status register, and fault unmask register.



### ■ Serial polling register

The serial polling register corresponds to the status byte in the GPIB bus specifications. You can monitor the PIA3200 status by reading the serial polling register.

### ■ Unmask register

The unmask register has the same bit arrangement as the serial polling register. This register allows the generation of service requests for each bit.

### ■ Status register

Each channel has a status register. The register indicates the status of the connected power supply.

### ■ Fault register

The fault register has the same bit arrangement as the status register. When one of the status register bits change from 0 to 1, the corresponding fault register bit changes to 1. The fault register is reset when it is read. If any of the bits in the fault register is set to 1, the FAU bit in the serial polling register is set to 1.

### ■ Fault unmask register

The fault unmask register has the same bit arrangement as the fault register. This register allows the specified bits in the fault register to be set.

# Sample Programs

The sample programs provided in this section are written in Microsoft Visual Basic. The programs assume that VISA COM software is used for the I/O library.

For VISA COM software, you can use the KI-VISA Library (3.0.x or later) that you can download from the Kikusui Website, NI-VISA (VER. 3.0 or later on Windows 2000 or VER. 3.2 or later on Windows XP) by National Instruments, or Agilent VISA (Agilent I/O Library M.01.00 or later) by Agilent Technologies.

```
Dim rm As VisaComLib.ResourceManager
Dim msg As VisaComLib.IMessage

:*****
'
' Set the ID, and check the set ID
'
:*****

Private Sub CommandButton1_Click()

    Set rm = CreateObject("VISA.GlobalRM")           ' Open VISA.
    Set msg = rm.Open("GPIB0::1::INSTR", NO_LOCK, 0, "")

    msg.WriteString ("MODE 0")                       ' Set to GPIB control mode.

    msg.WriteString ("ID 10")                        ' Set the ID.
    Application.Wait (Now + TimeValue("0:00:7"))    ' Wait for about 7 seconds.

    msg.WriteString ("ID?")
    Cells(1, 1) = msg.ReadString(20)

    msg.Close                                         ' Close VISA.

End Sub
```

```
*****  
,  
, Set the voltage and current and read the output values  
,  
*****  
Private Sub VsetIset_Click()  
  
    Dim VoltVal As String  
    Dim CurrentVal As String  
  
    Set rm = CreateObject("VISA.GlobalRM")           ' Open VISA.  
    Set msg = rm.Open("GPIB0::1::INSTR", NO_LOCK, 0, "")  
  
    VoltVal = Space$(20)  
    CurrentVal = Space$(20)  
  
    msg.WriteString ("MODE 0")                       ' Set to GPIB control mode.  
  
    msg.WriteString ("VSET 10")                     ' Set the voltage to 10 V.  
  
    msg.WriteString ("VOUT?")                       ' Read the voltage  
    VoltVal = msg.ReadString(20)  
  
    msg.WriteString ("ISET 10")                     ' Set the current to 10 A.  
  
    msg.WriteString ("IOUT?")                       ' Read the current.  
    CurrentVal = msg.ReadString(20)  
  
    msg.Close                                         ' Close VISA.  
  
End Sub
```

```

*****
'
' Configure the sequence memory
'
*****
Private Sub SequenceMemorySet_Click()

    Dim SeqCharactor As String
    Dim LoopCnt As Integer
    Dim SeqAdress As Integer
    Dim VoltSetSetp As Double
    Dim VoltSetValue As Double

    Set rm = CreateObject("VISA.GlobalRM")           ' Open VISA.
    Set msg = rm.Open("GPIB0::1::INSTR", NO_LOCK, 0, "")

    msg.WriteString ("CH 1")                        ' Specify channel 1.
    msg.WriteString ("ID 10")                       ' Set ID10 <PAK 35- 10 A/AM>.
    Application.Wait (Now + TimeValue("0:00:7"))    ' Wait for about 7 seconds.

    msg.WriteString ("MODE 1")                     ' Enable Sequence Control mode.

    VoltSetSetp = 35 / 256                          ' Calculate the amount of voltage change per step to
                                                    ' change voltages at equal intervals from step 0 to 255.

    For LoopCnt = 0 To 255                          ' Loop counter that corresponds to the step number
        SeqAdress = LoopCnt                         ' Set the step number.

        ' Set the output voltage.
        VoltSetValue = VoltSetValue + VoltSetSetp   ' Calculate the voltage to set.
        SeqCharactor = "SVSET " & CStr(VoltSetValue) & ", " & CStr(SeqAdress) ' Create the command string
        msg.WriteString (SeqCharactor)             ' Send the voltage set command.

    ' Set the Normal-Speed Sequence execution time.
        msg.WriteString ("TIME 0.1, " & CStr(SeqAdress)) ' Set all steps to 0.1 s.

    ' Set the High-Speed Sequence execution time.
        msg.WriteString ("HTIME 0.001, " & CStr(SeqAdress)) ' Set all steps to 0.001 s.

    Next LoopCnt

    ' Save the set values.
    msg.WriteString ("SAVE")

    msg.Close                                       ' Close VISA.

End Sub

```

```

'*****
'
'   Execute a normal-speed sequence
'
'*****
Private Sub NomalSpeedSeqStart_Click()

    Set rm = CreateObject("VISA.GlobalRM")           ' Open VISA.
    Set msg = rm.Open("GPIB0::1::INSTR", NO_LOCK, 0, "")

    msg.WriteString ("MODE 1")                       ' Enable Sequence Control mode.
    msg.WriteString ("ADR 1, 0, 0, 255, 0, 10, 0")    ' Execute the ADR command.
    msg.WriteString ("SELECT 1")                     ' Set the program number.
    msg.WriteString ("RUN 10, 100")                  ' Execute from step 0 to 100.

    msg.Close                                         ' Close VISA.

End Sub
'*****
'
'   Execute a high-speed sequence
'
'*****
Private Sub HighSpeedSeqStart_Click()

    Set rm = CreateObject("VISA.GlobalRM")           ' Open VISA.
    Set msg = rm.Open("GPIB0::1::INSTR", NO_LOCK, 0, "")

    msg.WriteString ("MODE 1")                       ' Enable Sequence Control mode.
    msg.WriteString ("ADR 2, 2, 0, 50, 0, 10, 0")    ' Execute the ADR command.
    msg.WriteString ("SELECT 2")                     ' Set the program number.
    msg.WriteString ("RUN 10, 100")                  ' Execute from step 10. The pause (step 100) is invalid in
                                                    ' High-Speed Sequence mode.

    msg.Close                                         ' Close VISA.

End Sub

```



---

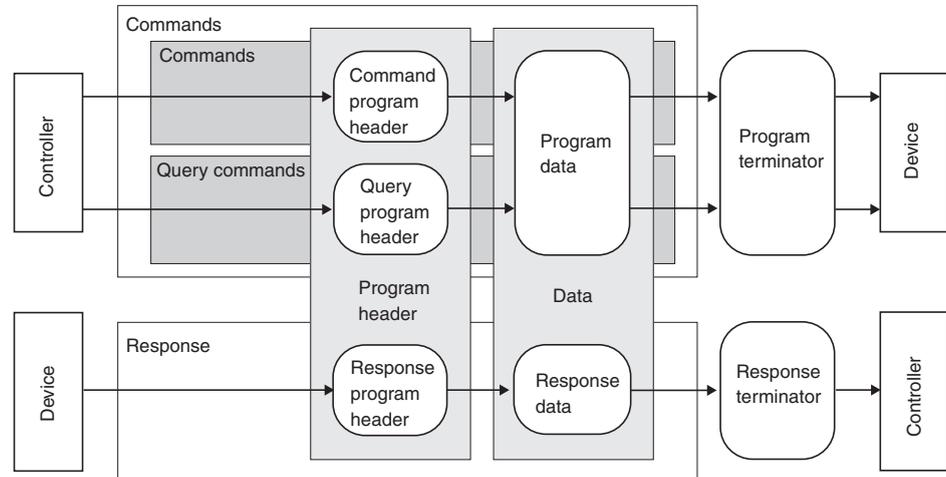
## Command Reference

This chapter explains the structure and syntax of commands used to remotely control the PIA3200. It also explains the details of each command, registers, and so on.

# Overview of Commands

This section explains the terminology used to describe communications between the PIA3200 and devices.

Device messages refer to commands and responses that a device supports.



Whether a command can actually be used depends on the connected DC power supply.

## Messages

Commands are sent from a controller to a device. Responses are sent from a device to a controller.

A command consists of the program header and data sections.

### Commands

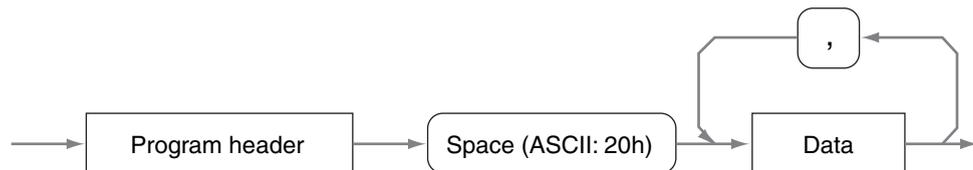
Commands execute specific features or change settings of a device. Queries retrieve device settings and status.

#### ■ Command syntax

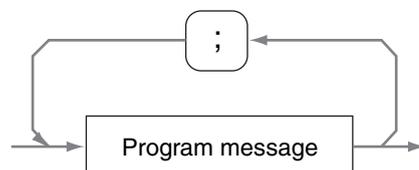
The program header section is separated from the data section with a space (ASCII: 20h).



Multiple data values are concatenated with a comma (ASCII: 2Ch) between each value.



Commands are concatenated with a semicolon (ASCII: 3Bh).



To write a data value in hexadecimal notation, precede the value with “#H.”

(Ex.) To write the decimal value 10 in hexadecimal notation, write “#H0A”.

You can attach units to data values.

You can also attach positive or negative signs before data values.

Commands are concatenated with a semicolon to create a compound command.

**VSET 100; ISET 10**

If you attach “@” to the end of a command, the execution of the next command is held until the execution of the current command finishes. Use “@@” when the program message terminator is EOI.

An error occurs if the command syntax is not correct.

When an error occurs, the command is discarded, and the panel buzzer sounds.

Commands are not case-sensitive.

### ■ Queries

Queries can be used to retrieve device settings and status.

To make a query, add a question mark at the end of the program header section. If a query has data value, enter a space after the question mark followed by the data value.

### Responses

Responses with a unit have five fixed digits with a sign in front (a space for positive and “-” for negative). The decimal place is fixed for each model. The decimal place varies depending on the model. For details on decimal places, see the model ID tables in chapter 3, “Connecting to DC Power Supplies.” The integer part is zero-suppressed and filled with spaces. If the response is -1.00, the PIA3200 returns “-\_\_1.00”.

For responses without a unit, the number of digits is fixed at 3. Digits higher than the most significant digit are filled with zeros. If the response is 1, the PIA3200 returns “001.”

## Terminator

Commands are terminated with a program terminator. Response messages are terminated with a response terminator.

### ■ Program terminator

You can use any of the following terminators. You do not have to specify in advance which terminator you will use.

- LF
- LF + EOI
- EOI
- CR + EOI

### ■ Response terminator

The default terminator is CR+LF+EOI. You can use the TRM or DELIMITER command to select any of the following terminators.

- CR + LF + EOI
- LF + EOI
- EOI
- CR + EOI

## Command description conventions

### Special symbols

The following special symbols are used in this manual to describe commands.

- { } Characters and numbers separated by “|” in braces “{ }” indicate options. Select one of the options.  
Do not write braces “{ }” in the actual program.
- < > “< >” indicate data. Do not write “<” or “>” in the actual program.
- [ ] Brackets “[ ]” indicate that it can be omitted. Do not write brackets “[ ]” in the actual program.

### Icons

	The set values of the commands indicated by this icon are stored on the EEPROM and are retained even when the power is turned off.
	Commands indicated by this icon affect both CH1 and CH2.
	Commands indicated by this icon are valid in GPIB Control mode (excluding Calibration mode and Sequence Control mode). They are available after you execute MODE 0.
	Commands indicated by this icon are valid in Sequence Control mode. They are available after you execute MODE 1.
	Commands indicated by this icon are valid in Calibration mode. They are available after you execute MODE 2.
	The values of commands indicated by this icon are saved when you send the SAVE command.

# Specify the Channels

## CH

ALL  
CH

GPIB

SEQ

CAL

Specify which channel, CH1 or CH2, that the DC power supply that you will configure is connected to. The value that you specify with the CH command remains valid until you send the next CH command.

**Command** CH <DATA>  
CH?

Program data Value: 1 CH1 (default)  
2 CH2  
\* CH1 and CH2

(Ex.) To set the channel 1 and channel 2 outputs to 10 V  
CH \*;VSET 10V

or

CH 1;VSET 10V;CH 2;VSET 10V

**Response** Returns the current channel that is specified.

(Ex.) When CH1 is specified  
Returns CH1.

(Ex.) When CH\* is specified  
Returns CH\*.

5

Command Reference

# Specify the ID

## ID

BACK  
UP

GPIB

See Chapter 3

Specifies the model ID.

Only the first ID command for each channel is valid after power-on. If you set the ID incorrectly, turn the PIA3200 POWER switch off and then turn it back on.

It takes approximately 5 seconds to execute the ID command for each channel.

**Command** ID <DATA>  
ID?

Program data Value: 001 to 125 (10 by default)

**Response** Returns the currently specified ID and model name. The response for the PAN-A Series is returned with the PAN Series name.

(Ex.) When model ID 10 and PAK35-10A/AM are specified  
Returns ID\_010\_PAK35-10A/AM.

# Switch between Remote and Local Modes

## REM

GPIB

Switches between remote and local modes on the connected power supplies.

**Command** `REM {0|1}`  
`REM?`

Program data	Value:	0	Local (default)
		1	Remote

**Response** Returns the current mode, remote or local.  
(Ex.) When the current mode is set to remote  
Returns REM\_001.

# Set the Digital Output

## Set the mode

---

Be aware that valid and invalid commands vary depending on the mode.  
Set the mode first with the MODE command, and then execute other commands.

## MODE

ALL  
CH

GPIB

SEQ

CAL

Sets the operation mode.

**Command** `MODE {0|1|2}`  
`MODE?`

Program data	Value:	0	GPIB Control (LOCK) mode
		1	Sequence Control mode
		2	Calibration mode

**Response** Returns the current operation mode.  
(Ex.) When the current operation mode is set to Sequence Control  
Returns MODE\_001.

# Turn the output on or off

## OUT

GPIB

Turns the output on or off of the connected power supplies.

**Command** `OUT {0 | 1 | OFF | ON}`  
`OUT?`

Program data Value: 0, OFF Output off (default)  
1, ON Output on

**Response** Returns the current output state.  
(Ex.) When the output is on  
Returns OUT\_001.

# Turn the power off

## POW

GPIB

Turns the power switch off of the connected power supplies.

**Command** `POW`

## Collectively configure the digital output

### DSET

GPIB

Pins 11 to 17 of the I/O connector are the DC power supplies' digital outputs. This command collectively configures the output on/off, power off, and remote/local settings. The value is determined by the logical sum of weighted bits. Each setting is assigned to one of these bits. If you use the POW, OUT, or REM command after using the DSET command, the corresponding value will change.

Bit	Bit weight	Bit name	Description
0	1	DO0	Output on or off. Specify 1 to turn it on.
1	2	DO1	Power off. Specify 1 to turn it off.
2	4	DO2	Not used
3	8	DO3	Remote or local. Specify 1 for remote.
4	16	DO4	Not used
5	32	DO5	Not used

**Command** **DSET <DATA>**  
**DSET?**

Program data Value: 0 to 127

(Ex.) To turn the DC power supplies' output on in remote mode (equivalent to REM1;OUT1)  
DSET 009

**Response** Returns the digital output settings.

## Query the digital input

### DIN

GPIB
SEQ
CAL

Pins 18 to 25 of the I/O connector are the DC power supplies' digital inputs. They are used to query the power supply status.

**Command** **DIN?**

**Response** Returns the input status of the I/O connector using a value expressed as a logical sum of weighted bits.

Bit	Bit weight	Bit name	Description
0	1	D10	C.V mode
1	2	D11	C.C mode
2	4	D12	OVP
3	8	D13	Overheating
4	16	D14	Power off
5	32	D15	Output off
6	64	D16	Remote or local
7	128	D17	Connection complete

# Set the Output Current and Voltage

The decimal place in settings and responses varies depending on the connected power supply type. For details on the decimal place of the connected power supply, see “Setting the model ID” or “Checking the model ID” in the respective section of “Connecting to DC Power Supplies” in chapter 3.

## Set the output current

To set the output current of the DC power supply, also set the output voltages. Current will only flow when you set the output voltage. The output voltage when the power is turned on is 0 V.

### ISET

GPIB

Sets the connected power supplies' output currents.

**Command** `ISET <DATA>`  
`ISET?`

Program data Value: Varies depending on the connected power supplies (0 A by default).  
Unit: A

 Chapter 3

**Response** Returns the present output current (ISET\_±xxxxxA).

### IOUT

GPIB

SEQ

CAL

Returns the measured output current.

**Command** `IOUT?`

**Response** Returns the present measured output current (IOUT\_±xxxxxA).

## Set the output voltage

To set the output voltage of the DC power supply, set the output current first prior to setting the output voltage. The output voltages may not rise in some cases if the output currents are not set. The output current when the power is turned on is 0 A.

Wait for the output voltage of the connected power supplies to rise to an adequate level (which is equal to the power supply's output response time  $\times 1.5 + 150$  ms).

150 ms is the sampling period of the A/D converter.

## VSET

GPIB

Sets the connected power supplies' output voltages.

**Command** `VSET <DATA>`  
`VSET?`

Program data Value: Varies depending on the connected power supplies (0 V by default).

 [Chapter 3](#)

Unit: V

**Response** Returns the present output voltage (VSET\_±xxxxxV).

## VOUT

GPIB

SEQ

CAL

Returns the measured output voltage.

**Command** `VOUT?`

**Response** Returns the present measured output voltage (VOUT\_±xxxxxV).

# Output Voltage Protection

There are two types of output voltage protection features available on the PIA3200: overvoltage protection (OVP) and undervoltage protection (UVP).

When using output voltage protection, especially when using UVP, be sure to send the OUT 0 command before turning the entire system off. Otherwise, the POWER switches on the connected power supplies may turn off.

To use software OVP and software UVP, the PIA3200 must be able to read back the power supplies' output voltages.

The decimal place for settings and responses varies depending on the type of connected power supply.

Using the ALMMODE command, you must set the power supplies' action that takes place when the OVP or UVP is activated.

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 p. 109

## OVSET

GPIB

Sets the overvoltage protection voltage (OVP).

**Command** **OVSET <DATA>**  
**OVSET?**

Program data Value: 0 V to 110 % of full scale (110 % of full scale by default)  
Unit: V

 Chapter 3

**Response** Returns the present overvoltage protection voltage (OVSET\_±xxxxxV).

## UVSET

GPIB

Sets the undervoltage protection voltage (UVP). To disable UVP action, set the UVSET value equal to -full scale.

**Command** **UVSET <DATA>**  
**UVSET?**

Program data Value: -full scale to +full scale (-full scale by default)  
Unit: V

 Chapter 3

**Response** Returns the present undervoltage protection voltage (UVSET\_±xxxxxV).

## Set the auto-tracking output voltage protection feature

The PIA3200 has an auto-tracking output voltage protection feature that automatically sets OVP and UVP based on the output voltage setting (which is set by VSET).

### VPM

**BACK UP** **ALL CH** **GPIB**

Turns the auto-tracking output voltage protection feature on or off.

**Command** **VPM {0 | 1}**  
**VPM?**

Program data	Value:	0	Auto-tracking output voltage protection feature off (default) Apply the normal OVP and UVP settings
		1	Auto-tracking output voltage protection feature on OVP and UVP track the output voltage.

**Response** Returns whether the auto-tracking output voltage protection feature is on or off.  
(Ex.) When the auto-tracking output voltage protection feature is on  
Returns VPM\_001.

### VPR

**BACK UP** **GPIB** **SEQ** **SAVE**

Sets the tracking offset (the voltage offset to assign to OVP and UVP relative to the output voltage) of the auto-tracking output voltage protection feature.

**Command** **VPR <DATA>**  
**VPR?**

Program data	Value:	0 V to 10 % of +full scale (10 % of the rated voltage by default)
	Unit:	V

 [Chapter 3](#)

**Response** Returns the tracking offset (VPR\_±xxxxV) of the auto-tracking output voltage protection feature.

### VPTIME

**BACK UP** **GPIB** **SEQ** **SAVE**

Sets the tracking time of the auto-tracking output voltage protection feature. The time value is valid when the auto-tracking feature is on (which is set with VPM 1).

**Command** **VPTIME <DATA>**  
**VPTIME?**

Program data	Value:	0.1 to 2.0	Tracking time (0.1 by default)
	Unit:	s	

**Response** Returns the tracking time of the auto-tracking output voltage protection feature (VPTIME\_\_\_\_x.xs).

# Sequence Control Mode

The PIA3200 can operate based on 256-step sequences.

## Switch between remote and local modes (in Sequence Control mode)

### SREM

SEQ

SAVE

Sets the connected power supplies to remote or local mode at the specified step.

**Command** **SREM** {0|1}, <DATA>

Program data {0|1} Remote or local setting

Value:	0	Local (default)
	1	Remote

<DATA>The step to specify

Value:	0 to 255	Step number
--------	----------	-------------

## Turn the output on or off (in Sequence Control mode)

### SOUT

SEQ

SAVE

Turns the connected power supplies' outputs on or off at the specified step.

**Command** **SOUT** {0|1|OFF|ON}, <DATA>

Program data {0|1|OFF|ON} Output on/off setting

Value:	0	Output off
	1	Output on (default)

<DATA>The step to specify

Value:	0 to 255	Step number
--------	----------	-------------

## Turn the output off (in Sequence Control mode)

### SPOW

SEQ SAVE

Turns the connected power supplies' POWER switches off at the specified step.

**Command** SPOW <DATA>

Program data Value: 0 to 255 Step number

## Set the digital output (in Sequence Control mode)

### SDSET

SEQ SAVE

At the specified step, it can set for the operation mode, the connected power supplies' output on or off settings, and the power-off settings at once.

If you use the SPOW, SOUT, or SREM command after using the SDSET command, the corresponding value will change.

Bit	Bit weight	Bit name	Description
0	1	DO0	Output on or off. Specify 1 to turn it on.
1	2	DO1	Power off. Specify 1 to turn it off.
2	4	DO2	Not used
3	8	DO3	Remote or local. Specify 1 for remote.
4	16	DO4	Not used
5	32	DO5	Not used

**Command** SDSET <DATA1>, <DATA2>

Program data <DATA1>Configure the digital output

Value: 0 to 127

<DATA2>The step to specify

Value: 0 to 255 Step number

## Set the output current (in Sequence Control mode)

### SISET

SEQ

SAVE

Sets the connected power supplies' output currents at the specified step.

The decimal place for settings and responses varies depending on the connected power supply type. For details on the decimal place of the connected power supply, see "Setting the model ID" or "Checking the model ID" in the respective section of "Connecting to DC Power Supplies" in chapter 3.

**Command** **SISET** <DATA1>, <DATA2>

Program data <DATA1>Output current setting

Value: Varies depending on the connected power supplies (0 A by default).

Unit: A

<DATA2>The step to specify

Value: 0 to 255 Step number

## Set the output voltage (in Sequence Control mode)

### SVSET

SEQ

SAVE

Sets the connected power supplies' output voltages at the specified step.

The decimal place for settings and responses varies depending on the connected power supply type. For details on the decimal place of the connected power supply, see "Setting the model ID" or "Checking the model ID" in the respective section of "Connecting to DC Power Supplies" in chapter 3.

**Command** **SVSET** <DATA1>, <DATA2>

Program data <DATA1>Output voltage setting

Value: Varies depending on the connected power supplies (0 A by default).

Unit: V

<DATA2>The step to specify

Value: 0 to 255 Step number

## Set the protection feature (in Sequence Control mode)

The decimal place for settings and responses varies depending on the connected power supply type. For details on the decimal place of the connected power supply, see “Setting the model ID” or “Checking the model ID” in the respective section of “Connecting to DC Power Supplies” in chapter 3.

### SOVSET

SEQ SAVE

Sets the overvoltage protection voltage (OVP) at the specified step.

**Command** `SOVSET <DATA1>, <DATA2>`

Program data <DATA1>Overvoltage protection setting  
 Value: 0 V to 110 % of full scale (110 % of full scale by default)  
 Unit: V  
 <DATA2>The step to specify  
 Value: 0 to 255 Step number

### SUVSET

SEQ SAVE

Sets the undervoltage protection voltage (UVP) at the specified step. To disable UVP action, set the UVSET value equal to -full scale.

**Command** `SUVSET <DATA1>, <DATA2>`

Program data <DATA1>Overvoltage protection setting  
 Value: -full scale to +full scale (-full scale by default)  
 Unit: V  
 <DATA2>The step to specify  
 Value: 0 to 255 Step number

## Set the execution time

### TIME

ALL CH SEQ SAVE

See p. 92

See p. 98

Sets the execution time per step in Normal-Speed Sequence mode.

If the auto-tracking output voltage protection mode is enabled, set the value at least twice the tracking time (VPTIME). Otherwise, the auto-tracking feature will not work properly.

Use the ADR command to set the auto-tracking output voltage protection mode.

**Command** TIME <DATA1>, <DATA2>

Program data <DATA1>Execution time  
 Value: 0.05 to 7999 (0.05 by default)  
           8000            Infinity  
 Unit:     s  
 <DATA2>The step to specify  
 Value: 0 to 255        Step number

### HTIME

ALL CH SEQ SAVE

Sets the execution time per step in High-Speed Sequence mode.

**Command** HTIME <DATA1>, <DATA2>

Program data <DATA1>Execution time  
 Value: 0.0002 to 0.9998 (0.0002 by default)  
           0.9999            Infinity  
 Unit:     s  
 <DATA2>The step to specify  
 Value: 0 to 255        Step number

## Insert a pause

### PMARK

ALL CH SEQ SAVE

Inserts a pause. This command is valid in Normal-Speed Sequence mode.

**Command** PMARK {0 | 1}, <DATA2>

Program data {0|1} Pause  
 Value: 0                    Do not insert a pause (default)  
           1                    Insert a pause  
 <DATA2>The step to specify  
 Value: 0 to 255        Step number

## Check the contents of a step

### SMEM

ALL CH GPIB

Queries the settings in the specified step.

**Command** SMEM? <DATA>

Program data Value: 1 to 255 Step number

**Response** Returns the settings assigned to the specified step with each setting separated by a comma in this order: Normal-Speed Sequence execution time, High-Speed Sequence execution time, pause insertion, CH1 output voltage, CH2 output voltage, CH1 output current, CH2 output current, CH1 OVP, CH2 OVP, CH1 UVP, CH2 UVP, CH1 digital output setting, and CH2 digital output setting.

(Ex.) If step 1 contains the following settings: Normal-Speed Sequence execution time: 10, High-Speed Sequence execution time: 0.0002, pause insertion: no, CH1 output voltage: 5 V, CH2 output voltage: 0 V, CH1 output current: 10 A, CH2 output current: 0 A, CH1 OVP: 6 V, CH2 OVP: 0 V, CH1 UVP: 1 A, CH2 UVP: 0 A, CH1 digital control: 0, and CH2 digital control: 0

The PIA3200 will return the following in response to SMEM? 1.

SMEM\_1,10,0.0002,0,5,0,10,0,6,0,1,0,0,0.

## Set the program

### ADR

ALL CH SEQ SAVE

For the specified program, sets the range of sequence step to execute, the step-change pattern to use, and the number of times to execute the program. You can configure up to six programs. Use the SAVE command to save the settings. Be sure to set the step range so that the start step (step A) is less than the end step (step B).

**Command** ADR <DATA1>, <DATA2>, <DATA3>, <DATA4>, <DATA5>, <DATA6>, <DATA7>  
ADR? <DATA1>

Program data <DATA1>Program number

Value: 1 to 6 (1 by default)

<DATA2>Sequence speed

Value: 0 Normal-Speed Sequence (default)  
1 Normal Speed Sequence with auto-tracking output voltage protection  
2 High-Speed Voltage Sequence  
3 High-Speed Current Sequence

<DATA3>Start step (step A)

Value: 0 to 255 (0 by default)

<DATA4>End step (step B)

Value: 0 to 255 (255 by default)

<DATA5>Step-change pattern

Value: 0 Address increment (default)  
 1 Address decrement  
 2 Address increment and then decrement

<DATA6>Execution count

Value: 0 Infinity (default)  
 1 to 10000

<DATA7>Final output address

Value: 0 to 255 (0 by default)

**Response** Returns the settings assigned to the specified program with each setting separated by a comma in this order: Sequence Control mode, step range (step A and step B), step-change pattern, execution count, and final output address.

(Ex.) If program 1 contains the following settings: Sequence Control mode: Normal-Speed Sequence, start step: 3, end step: 10, step-change pattern: address increment, execution count: 3, and final output address: 5

The PIA3200 will return the following in response to ADR? 1.

ADR\_1,0,3,10,0,3,5

## Execute a program

### SELECT

ALL  
CH

GPIB

Specifies the program number you want to execute.

**Command** **SELECT <DATA>**  
**SELECT?**

Program data Value: 1 to 6 Program number

**Response** Returns the program number that will be executed.

(Ex.) If program number 2 is specified, the PIA3200 will return the following:  
 SELECT 002

### RUN

ALL  
CH

GPIB

Runs or pauses the specified program.

**Command** **RUN <DATA1>, <DATA2>**  
**RUN?**

Program data <DATA1>Start step (can be omitted)  
 Value: 0 to 255 (the start address specified by the ADR command by default)  
 <DATA2>Pause step (can be omitted; no pause if omitted)  
 The DATA2 value is invalid in High-Speed Sequence mode.  
 Value: 0 to 255

**Response** Returns the start step and pause step in the program that will be executed. If the pause step is not specified, the PIA3200 returns -1.

## STOP

ALL CH 2 GPIB

Stops the program that is running.

**Command** STOP <DATA>  
STOP?

Program data Value: 0 to 255 Stop-step number (-1 by default; can be omitted; stops at the current step if omitted)

**Response** Returns the specified stop-step number. If a step is not specified, the PIA3200 returns -1.

## PAUSE

ALL CH 2 GPIB

Pauses the program that is running in Normal-Speed Sequence mode. This command is invalid in High-Speed Sequence mode.

**Command** PAUSE

## SSTS

ALL CH 2 GPIB

Returns the current program execution status.

**Command** SSTS?

**Response** Returns the current program's execution status and the current step number separated by a comma.

The PIA3200 returns 000 for the current step in High-Speed Sequence mode.

Response form Execution status  
0 Stopped  
1 Running  
2 Paused

(Ex.) If the current program is paused at step 20, the PIA3200 returns the following:

SSTS\_002,020.

## Save and load sequences

The contents of the sequence are cleared when the PIA3200 POWER switch is turned off.

The PIA3200 can store the contents of the sequence.

The SREM, SOUT, SPOW, SDSET, SISET, SVSET, SOVSET, SUVSET, TIME, HTIME, PMARK, ADR, VPTIME, VPR values can be saved or loaded.

### SAVE

ALL CH GPIB

Saves the contents of the sequence memory. The save operation takes approximately 3 seconds.

We recommend that you send this command by attaching @ or @@ at the end of the command.

**Command** SAVE

### LOAD

ALL CH GPIB

Loads the contents of the stored sequence. It takes approximately 6 seconds to load the contents from the EEPROM.

We recommend that you send this command by attaching @ or @@ at the end of the command.

**Command** LOAD

# Other Settings

## Initialize the PIA3200 to factory default conditions

### CLR

ALL CH GPIB SEQ CAL

See p. 131

Initializes the PIA3200 settings. This command is the same as the GPIB bus line message DCL. It also clears alarms.

Command CLR

## Set the response data

### SEPARATOR

BACK UP ALL CH GPIB SEQ CAL

Sets the separator used in response data. If the appropriate separator is not selected, the PC may not be able to read the response correctly.

Command **SEPARATOR {0|1|2|3}**  
**SEPARATOR?**

Program data	Value:	0	Specify a comma ( , ) (default)
		1	Specify "LF"
		2	Specify a semicolon ( ; )
		3	Specify a slash ( / )

**Response** Returns the separator that is specified.

(Ex.) When the current separator is set to slash  
Returns SEPARATOR 003.

### DELIMITER

BACK UP ALL CH GPIB SEQ CAL

Sets the delimiter that will be used in responses. EOI is sent at the same time as the last character.

Command **DELIMITER {0|1|2|3}**  
**DELIMITER?**

Program data	Value:	0	Specify "CRLF+EOI" (default)
		1	Specify "CR+EOI"
		2	Specify "LF+EOI"
		3	Specify "EOI"

**Response** Returns the delimiter that is specified.  
 (Ex.) When the current delimiter is set to LF+EOI  
 Returns DELIMITER\_002.

## HEAD

BACK  
UP

ALL  
CH

GPIB

SEQ

CAL

Sets whether or not to include the header (including the channel header) and the unit of measurement in responses.

**Command** HEAD {0 | 1}  
 HEAD?

Program data	Value:	0	Do not add the header and the unit of measurement
		1	Add the header and the unit of measurement (default)

**Response** Returns the header and unit setting.  
 (Ex.) When the PIA3200 is configured to include the unit  
 Returns HEAD\_001.

## Query the error

If there are errors in a command header or set data, an error occurs. Error information is stored in the error register. The contents of the error register are retained until they are read back.

## ERR

GPIB

SEQ

CAL

Queries the contents of the error register.

**Command** ERR?

**Response** Returns the contents of the error register.  
 (Ex.) When there is an error in the header  
 Returns ERR 001.  
 (Ex.) When there is an error in the set data  
 Returns ERR\_002.

## Alarms

---

### DLY

**BACK UP** **GPIB** **SEQ** **CAL**

Sets the delay for activating alarms. This command also delays the setting of the fault register and the generation of the SRQ. The delay applies to all alarm sources except SYNC. You cannot set the delay value separately for each alarm source.

**Command** **DLY** <DATA>  
**DLY?**

Program data Value: 0.1 to 9.9 Delay time  
Unit: s

**Response** Returns the alarm delay value.  
(Ex.) If the delay is set to 5 seconds  
Returns DLY\_\_\_\_\_5.0.

### RST

**ALL CH** **GPIB** **SEQ** **CAL**

Clears the alarm. If the cause of the alarm is not resolved, an alarm will be triggered again.

**Command** **RST**

## Calibration commands

### CAL

ALL CH CAL

Starts calibration on the specified channel and item.

**Command** CAL <DATA1>, <DATA2>

Program data <DATA1>Channel number

Value:	1	Channel 1
	2	Channel 2

<DATA2>Item to calibrate (set values 5 and 6 only for the PAK-A. Do not set them for other DC power supplies.)

Value:	1	Output voltage offset
	2	Output voltage full-scale value
	3	Output current offset
	4	Output current full-scale value
	5	OVP offset
	6	OVP full-scale value

### UP

ALL CH CAL

Increases the adjustment value. If one command is not enough to make the adjustment, send the command again.

**Command** UP <DATA>

Program data Value: 0 to 255 Increases by approximately 0.8 % of the full-scale value when 255 is specified

Resolution:1

### DOWN

ALL CH CAL

Decreases the adjustment value. If one command is not enough to make the adjustment, send the command again.

**Command** DOWN <DATA>

Program data Value: 0 to 255 Decreases by approximately 0.8 % of the full-scale value when 255 is specified

Resolution:1

### FINISH

ALL CH CAL

Finishes calibration.

**Command** FINISH

## Commands compatible with the DPO2212A and DPO2212

You can use the commands for the DPO2212A and DPO2212 digital programming options to control the connected power supplies' output voltages and output currents through the PIA3200.

### A1K / K

ALL CH GPIB CAL

Sets the CH1 output voltage or output current. When the set data unit is V, the output voltage is set. When the unit is A, the output current is set. The only valid delimiters are CR or CR+LF. The operation of the A1K command is the same as that of the K command.

**Command** A1K <DATA>  
K <DATA>

Program data Value: 000 to 999 000 represents zero, and 999 represents the full-scale value.  
Resolution:1  
Unit: V or A

### A2K

ALL CH GPIB CAL

Sets the CH2 output voltage or output current. When the set data unit is V, the output voltage is set. When the unit is A, the output current is set. The only valid delimiters are CR or CR+LF.

**Command** A2K <DATA>

Program data Value: 000 to 999 000 represents zero, and 999 represents the full-scale value.  
Resolution:1  
Unit: V or A

# Registers

## Serial polling register and unmask register

The serial polling register corresponds to the status byte in the GPIB bus specifications.

You perform serial polling to view the contents of this register. Read the status byte according to the instructions in your PC instruction manual.

You can monitor the entire PIA3200 status by reading the serial polling register.

The unmask register has the same bit arrangement as the serial polling register and allows the generation of service requests based on the contents of each bit.

Bit	Bit weight	Bit name	Description
0	1	FAU	Indicates that a bit in the fault register of a channel has been set.
1	2	PON <sup>*1</sup>	Indicates that the PIA3200 has been turned on. This bit is also set when the PIA3200 is initialized. The PON bit is cleared when serial polling is performed.
2	4	SE	Indicates that the sequence execution has been completed. This bit is not set if you stop the sequence operation by using the STOP command. The SE bit is cleared when serial polling is performed.
3	8	ERR	Indicates that a syntax error, over-range error, or some other error has occurred. This bit is reset by reading back the error register.
4	16	NOT USED	—
5	32	SYNC	Indicates that the SYNC input terminal has been activated.
6	64	RQS <sup>*2</sup>	Indicates that a service request is occurring.
7	128	NOT USED	—

\*1 You can mask or unmask the bit by using the rear-panel ADDRESS switch 6.

\*2 You cannot mask the RQS bit.

### UNMASK

BACK  
UP

GPIB

SEQ

CAL

Sets the unmask register to allow the generation of service requests.

**Command** UNMASK <DATA>  
UNMASK?

Program data Value: 0 to 255 (0 by default)

**Response** Returns the contents of the unmask register.

(Ex.) If FAU and SE are set  
Returns UNMASK\_005.

## Status register, fault register, and fault unmask register

Each channel has a status register. The register indicates the status of the connected power supply.

The bit arrangement is the same between the fault register and the status register. When one of the status register bits change from 0 to 1, the corresponding fault register bit changes to 1. The contents of this register are changed when the register is read.

If any of the bits in the fault register is set, the FAU bit in the serial polling register is set.

The fault unmask register has the same bit arrangement as the fault register. This register allows the specified bits in the fault register to be set.

To allow the generation of service requests, you must unmask the FAU bit with the unmask register.

Bit	Bit weight	Bit name	Description
0	1	C.V	Indicates that the connected power supply is in constant voltage mode.
1	2	C. C	Indicates that the connected power supply is in constant current mode.
2	4	OVP	Indicates that the OVP has been activated.
3	8	OHP	Indicates that the OHP has been activated.
4	16	POW	Indicates that the input power to the connected device has been turned off.
5	32	OUT	Indicates that the output has been turned off.
6	64	REMOTE	Indicates that the power supply has entered remote mode, allowing the PIA to control it.
7	128	UVP	Indicates that the UVP has been activated.

### STS

GPIB SEQ CAL

Queries the contents of the status register.

**Command** STS?

**Response** Returns the contents of the status register.

### FAU

GPIB SEQ CAL

Queries the contents of the fault register.

**Command** FAU?

**Response** Returns the contents of the fault register.

## FUNMASK

BACK  
UP

GPIB

SEQ

CAL

Sets the fault unmask register to allow the FAU bit in the serial polling register to be set.

**Command** **FUNMASK** <DATA>  
**FUNMASK?**

Program data Value: 0 to 255 (0 by default)

**Response** Returns the contents of the fault unmask register.  
(Ex.) If OVP and OHP are masked  
Returns FUNMASK\_012.

## Alarm mode register

The alarm mode register determines whether or not the power is turned off, whether or not the output is turned off, or whether or not the VSET and ISET values are set to zero when an alarm is triggered.

It takes approximately 60 ms for the VSET and ISET values to be reset to zero after an alarm occurs.

If you specify POWER OFF in the alarm mode register and the alarm action is executed, you cannot turn the connected power supplies on using the POWER switches. To turn the power supplies on again, also turn the PIA3200 POWER switch on.

Bit	Bit weight	Bit name	Description
0	1	REF OFF	Sets the VSET and ISET values to zero.
1	2	OUT OFF	Turns the connected DC power supplies' output off.
2	4	POWER OFF	Turns the connected power supplies' POWER switches off.
3	8	NOT USED	—
4	16	NOT USED	—
5	32	NOT USED	—
6	64	NOT USED	—
7	128	NOT USED	—

## ALMMODE

BACK  
UP

GPIB

Sets the alarm mode register.

**Command** **ALMMODE**  
<DATA1>, <DATA2>, <DATA3>, <DATA4>, <DATA5>, <DATA6>, <DATA7>  
**ALMMODE?**

Program data <DATA1>OVP, <DATA2>OHP, <DATA3>UVP, <DATA4>SYNC, <DATA5>POW, <DATA6>CC,  
<DATA7>CV  
Value: 0 to 7 (0 by default)

**Response** Returns the contents of the alarm mode register in this order: OVP, OHP, UVP, SNYC, POW, CC, and CV.



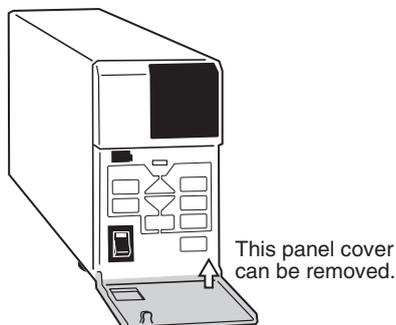


# Operation from the Panel

This chapter explains how to operate the PIA3200 from the front panel.

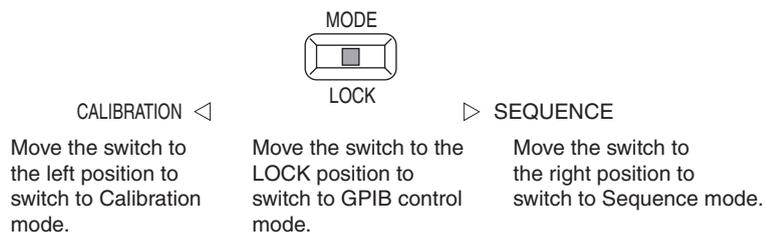
## Panel Cover

The front control panel has a cover to prevent the panel from being accessed needlessly. To open the panel, press the upper left section of the panel cover as shown in the figure below. You can remove the panel cover by lifting the cover when it is open.



## Switching the Mode

The PIA3200 has three modes of operation that you can switch with the MODE switch.



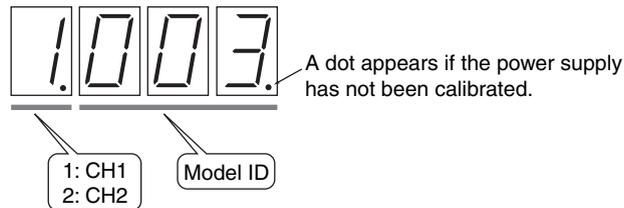
- GPIB Control mode (LOCK)  
Disables all control-panel keys except the LOCAL, ▲ ▼, and EXEC/PAUSE keys. This mode is normally set for the remote control operation.
- Calibration mode  
Enables the CH, ITEM, ▲ ▼, and EXEC/PAUSE keys.
- Sequence Control mode (SEQUENCE)  
Enables the SELECT, RUN, ▲ ▼, and EXEC/PAUSE keys.

# Confirm the Model ID and Version

In GPIB Control mode, you can confirm the model ID, GPIB address, and ROM version from the control panel.

## Confirm the model ID

Example for the case when the CH1 model ID is 3



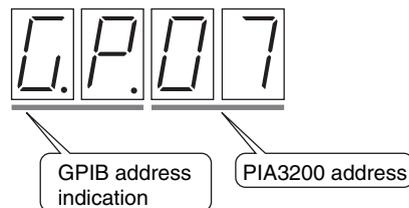
**1** Set the MODE switch to LOCK (GPIB Control mode).

**2** Press ▲.

The PIA3200 displays the model IDs for CH1 and CH2 alternately for approximately 1 second. Model ID “255” indicates no connection.

## Confirm the GPIB address

Example of GPIB address number 7

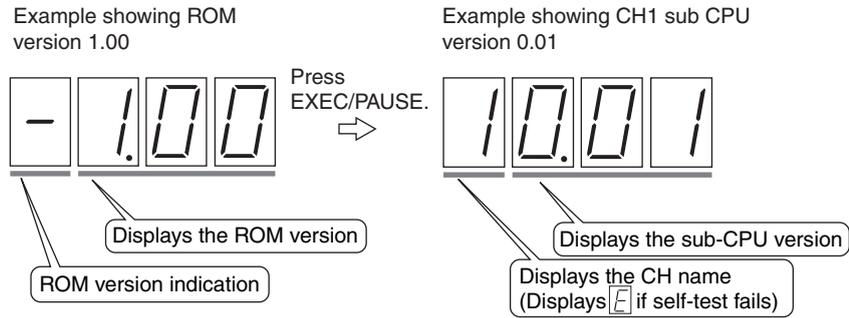


**1** Set the MODE switch to LOCK (GPIB Control mode).

**2** Press ▼.

The PIA3200 displays its own GPIB address for approximately 1 second.

## Confirm the ROM version



- 1 Set the MODE switch to LOCK (GPIB Control mode).**
- 2 Press EXEC/PAUSE.**  
The PIA3200 displays the ROM version for approximately 1 second.
- 3 Press EXEC/PAUSE again.**  
The PIA3200 displays the CH1 sub-CPU version for approximately 1 second and then the CH2 sub-CPU version for approximately 1 second.

# Switching between Remote and Local Modes

There are two levels of remote/local switching. One is the switching of the PIA3200, and the other is the switching of the DC power supplies that are connected to the PIA3200.

## Switching between the PIA3200 remote and local modes

The PIA3200 is set to remote mode from a PC. When you send any command to the PIA3200, the PIA3200 switches to remote mode, and the RMT LED illuminates.

To switch the PIA3200 to local mode, press the LOCAL key on the PIA3200.

## Switching between the power supplies' remote and local modes

### ■ Connections using a terminal unit

Use the switch on the terminal unit to switch the power supplies between local and remote. Be sure to remove the loads from the power supplies before switching the mode. If you switch the power supplies from remote to local with the load connected, the output specified on the DC power supplies' panels will be applied to the load creating a dangerous condition.

When the PAD-L Series is connected via a terminal unit, you cannot switch the output current between remote and local modes.

### ■ Direct connection

- PMC-A Series, PAD-LA Series, PAN/PAN-A Series

Switch between remote and local modes using the DC power supplies' front-panel switches.

- PAD-L Series

These power supplies enter remote mode when they are connected to the PIA3200. To switch to local mode, you must set the connection back to the original state.

- PAK-A Series

Switch between remote and local modes of the output voltage and output current settings and the output on/off setting by using the REM command. To switch between remote and local modes of the overvoltage protection setting, use the PAK-A S3 switch.

 See p. 86

# Running a Sequence Program

See p. 66

You can load and run a sequence program from the control panel.

The contents of a program can be set using commands. They cannot be set from the control panel.

## 1 Open the PIA3200 panel cover.

## 2 Set the MODE switch to SEQUENCE.

The SEQ LED illuminates, and the PIA3200 switches to Sequence Control mode.

Display 1 (the left 7-segment LED) shows the program number, and Display 2 (the three right 7-segment LEDs) shows the sequence status.

The SELECT, RUN, STOP, and LOCAL keys are valid.

## 3 Press SELECT to select a program number.

Each time you press SELECT, the program number is incremented in the range of 1 to 6.

## 4 Press RUN to run the selected program.

While the program is running, the program number blinks in Display 1, and the current step number is indicated in Display 2. The SELECT key is invalid while the program is running.

The program stops automatically when it finishes.

## 5 Set the MODE switch to LOCK.

The PIA3200 switches to GPIB Control mode.

## 6 Close the panel cover.

### ■ Sequence status display in Display 2 (the three right 7-segment LEDs)

Sequence Control mode	Stopped	Running or paused
Normal-Speed Sequence	nor	The current step
Normal-Speed Sequence with auto-tracking output voltage protection	nAU	The current step
High-Speed Voltage Sequence	uHS	HSu
High-Speed Current Sequence	iHS	HSi

### ■ When alarms occur

When an alarm occurs, the program stops.

To clear alarms, turn the POWER switch off and then turn it back on.

### ■ Pausing programs

To pause the program that is running, press EXEC/PAUSE. The PIA3200 PAUSE LED illuminates. The power supplies keep delivering the output that is specified in the paused step until the step is unpaused.

The program also can be paused if a pause is specified in a step.

When a High-Speed Sequence program is running, the program does not pause even if you press EXEC/PAUSE.

The SELECT key is invalid while the program is paused.

To release pausing, press ▲ to increment the step, and then press RUN. The PIA3200 PAUSE LED clears, and program execution resumes.

### ■ Stopping the program

To stop the program that is running, press STOP. The output voltage and output current are set to zero, and the OVP and UVP values are initialized. The output turns off.

### ■ Displaying program information

If you press the following keys while the program is paused, the program settings appear in Display 1 and Display 2 for approximately 2 seconds.

Key	Display 1	Display 2
▲	S.	Step range (step A)
▼	E.	Step range (step B)
EXEC/PAUSE	P.	Step-change pattern
		“ _ _ ” Step increment
		“ _ _ ” Step decrement
		“ _ _ ” Step increment and then decrement
STOP	C.	Execution count Displays “9.9.9.” when the execution count is greater than or equal to 999

## Practical applications (Normal-Speed Sequence only)

### ■ Pause the program that is running and resume the program from the previous or next step

#### 1 Press EXEC/PAUSE to pause the program.

The PAUSE LED illuminates. You can also pause the program by inserting a pause in a step setting.

#### 2 Press ▲ or ▼ to select the step that you want to resume the program from.

The step display blinks, and only the step number changes. The output does not change.

#### 3 Press RUN to resume the program from the selected step.

The PAUSE LED clears.

### ■ Pause the program that is running and run the program step by step from the previous or next step

#### 1 Press EXEC/PAUSE to pause the program.

The PAUSE LED illuminates. You can also pause the program by inserting a pause in a step setting.

#### 2 Press ▲ or ▼ to select the step that you want to resume the program from.

The step display blinks, and only the step number changes. The output does not change.

#### 3 Press EXEC/PAUSE to execute the selected step.

The step display illuminates, and the power supplies deliver the output specified in that step.

#### 4 Press ▲ or ▼ again to change the step number as in step 2 . Press EXEC/PAUSE to execute the selected step.

You can run the program step by step by repeating step 4 .

If you want to run the program step by step from the first step, insert a pause in the first step.

# Calibration by Device Configuration (panel)

When using the PIA3200 in combination with power supplies, you must calibrate the analog outputs and monitoring signals beforehand. The CH LED illuminates when calibration is in progress.

Calibrate the offset and full-scale values in the following order.

- Calibrate the output voltage setting and output voltage monitoring signal (ITEM1 and ITEM2).
- Calibrate the output current setting and output current monitoring signal (ITEM3 and ITEM4).
- Calibrate overvoltage protection (OVP; only on the PAK-A Series; ITEM5 and ITEM6)

Before performing calibration, ready the following digital voltmeter and circuit (wiring). The accuracy of the measuring instruments affects the calibration accuracy. See below for the requirements.

- A properly calibrated digital voltmeter with an accuracy of 0.001 %
- A shunt (RS) with accuracy around 0.2 %

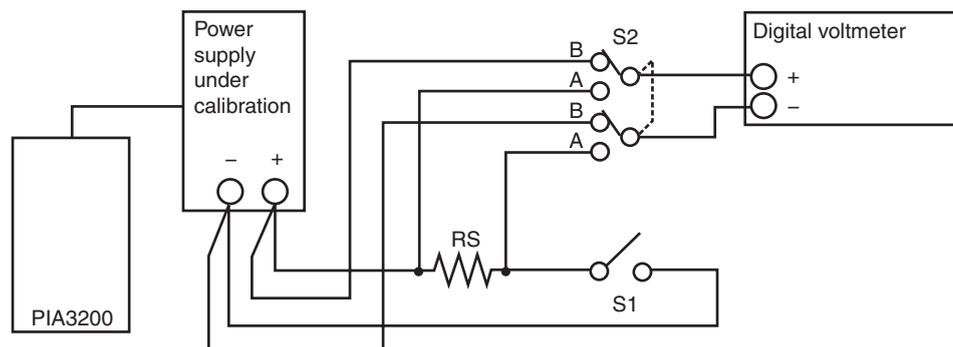
After calibration finishes, wait a few seconds, and then set the MODE switch back to LOCK. The calibration values are stored to the PIA3200. The calibration values may not be saved if you change the MODE switch immediately after calibration finishes.

The PIA3200 generates a low beep sound under the following conditions.

Status	Description
Out of the setting calibration range	Both the measuring and setting calibration are not performed properly. Confirm the condition such as the wiring, setting values.
Out of the measuring calibration range	The measuring calibration is not performed properly. The setting calibration is completed. When the product does not have a feature of read back voltage or current, the PIA3200 generates a low beep sound due to inability of the measuring calibration.

## ■ Connecting the components for calibration

Use wires that can adequately handle the rated current of the power supply under calibration.



## Calibrating the output voltage setting and output voltage monitoring signal (ITEM1 and ITEM2)

 p. 118

Calibrate the output voltage setting and the offset (ITEM1) and full-scale (ITEM2) values of the output voltage monitoring signal.

- 1 Set S1 to off and S2 to B.**
- 2 Turn on the PIA3200 POWER switch.**
- 3 Turn on the power supply that you want to calibrate.**
- 4 Set the MODE switch to CALIBRATION.**  
The CH LED illuminates, and the PIA3200 switches to Calibration mode.  
Display 1 shows the channel that will be calibrated, and Display 2 shows the calibration ITEM number.
- 5 Press CH to set the channel you want to calibrate to CH1 or CH2.**  
The channel number appears in Display 1.
- 6 Press ITEM to select ITEM1.**  
The item number appears in Display 2 (the three right 7-segment LEDs), and the calibration of the output voltage setting and the output voltage monitoring signal's offset are selected.
- 7 Press EXECUTE.**  
The item number blinks, and the minimum output voltage is delivered from the power supply being calibrated.
- 8 Use ▲ and ▼ to adjust the output voltage to match the power supply's minimum output voltage.**  
If you press ▲ or ▼ once, a beep sounds, and the value changes. If you hold a key down, two beeps sound, and the value changes by a greater amount.  
When you finish adjusting the offset, calibrate the full-scale value next.
- 9 Press ITEM to select ITEM2.**  
The item number appears, and the output voltage setting and the output voltage monitoring signal's full-scale value are selected.
- 10 Press EXECUTE.**  
The item number blinks.
- 11 Use ▲ and ▼ to adjust the output voltage to match the power supply's rated voltage (the full-scale value).**

Next, calibrate the output current setting and the output current monitoring signal.

To finish calibration, set the MODE switch back to LOCK position. The calibration values are stored to the PIA3200.

## Calibrating the output current setting and output current monitoring signal (ITEM3 and ITEM4)

After calibrating the output voltage setting and the output voltage monitoring signal, calibrate the output current setting and the offset (ITEM3) and full-scale (ITEM4) values of the output current monitoring signal.

If you are connecting the power supply with a shunt unit, set in advance the output ranges H, L, and M on the shunt unit to the appropriate settings for the connected power supply.

See p. 118

**1 Set S1 to off and S2 to A.**

**2 Set S1 to on.**

**3 Press ITEM to select ITEM3.**

The item number appears in Display 2 (the three right 7-segment LEDs), and the calibration of the output current setting and the output current monitoring signal's offset are selected.

**4 Press EXECUTE.**

The item number blinks, and the minimum output current is delivered from the power supply being calibrated.

**5 Use ▲ and ▼ to adjust the output current so that it reads 0 A.**

If you press ▲ or ▼ once, a beep sounds, and the value changes. If you hold a key down, two beeps sound, and the value changes by a greater amount.

When you finish adjusting the offset, calibrate the full-scale value next.

**6 Press ITEM to select ITEM4.**

The item number appears, and the output current setting and the output current monitoring signal's full-scale value are selected.

**7 Press EXECUTE.**

The item number blinks.

**8 Use ▲ and ▼ to adjust the output current to match the power supply's rated current (the full-scale value).**

**9 For power supplies other than PAK-A Series, set the MODE switch back to LOCK.**

The calibration values are stored to the PIA3200.

If you have not calibrated the output voltage setting and the output voltage monitoring signal, calibrate them (ITEM1 and ITEM2).

For the PAK-A Series, continue on to calibrate the overvoltage protection (OVP) values.

To finish calibration, set the MODE switch back to LOCK position. The calibration values are stored to the PIA3200.

## Calibrating the overvoltage protection (OVP) values (for the PAK-A Series; ITEM5 and ITEM6)

 p. 118

Before calibrating the OVP values, be sure to calibrate the output voltage setting (ITEM1) and the output voltage monitoring signal (ITEM2).

- 1 Check that S1 is off.**
- 2 Press ITEM to select ITEM5.**  
The item number appears in Display 2 (the three right 7-segment LEDs), and the calibration of the overvoltage protection offset is selected.
- 3 Press EXECUTE.**  
The item number blinks, and the offset is automatically calibrated. A few seconds later, the power switch turns off.  
You finish calibrating the offset. Next calibrate the full-scale value.
- 4 Turn on the power supply that you want to calibrate.**
- 5 Check that S1 is off.**
- 6 Press ITEM to select ITEM6.**  
The item number appears, and the calibration of the overvoltage protection full-scale value is selected.
- 7 Press EXECUTE.**  
The item number blinks, and the full-scale value is automatically calibrated. A few seconds later, the power switch turns off.  
You finish calibrating the overvoltage protection values.
- 8 Set the MODE switch back to LOCK.**  
The calibration values are stored to the PIA3200. A low beep sounds if the PIA3200 is not calibrated properly. If this happens, check the wiring or settings.  
If you have not calibrated the output current setting and the output current monitoring signal, calibrate them (ITEM3 and ITEM4).





# Specifications

This chapter contains the specifications and the outline drawing.

Unless specified otherwise, the specifications are for the following settings and conditions.

- After 30-minute warm-up at 25 °C.
- After calibration.
- f.s: Maximum value in the setting range in the ID table.
- TYP: Represents a typical value.

About output ripples

Because the effects of wiring and the output ripple from the PIA3200 are amplified by the connected power supply, the output ripple that results when the PIA3200 is connected to the power supply may be more than the output ripple that the power supply by itself would produce.

Output voltage	Setting of actual output value by ID	Yes
	Setting range	See "List of IDs" on page 137
	Resolution	0.025 % of f.s
	Accuracy	$\pm 0.012$ % of f.s + the linearity of the connected power supply
	Temperature coefficient	$\pm 50$ PPM/°C of f.s + the temperature coefficient of the connected power supply
Output current	Setting of actual output value by ID	Yes
	Setting range	See the relevant ID table in "Connecting to DC Power Supplies" in chapter 3.
	Resolution	0.025 % of f.s
	Accuracy	$\pm 0.012$ % of f.s <sup>*1</sup> + the linearity of the connected power supply
	Temperature coefficient	$\pm 50$ PPM/°C of f.s + the temperature coefficient of the connected power supply
Overvoltage protection	Setting of actual output value by ID	Yes
	Setting range	0 V to 110 % of f.s
	Resolution	0.1 % of f.s
	Accuracy	$\pm 0.1$ % of f.s
	Auto-tracking mode	Yes
Undervoltage protection	Setting of actual output value by ID	Yes
	Setting range	-f.s to +f.s
	Resolution	0.1 % of f.s
	Accuracy	$\pm 0.1$ % of f.s
	Auto-tracking mode	Yes
The number of PIA3200s that can synchronize alarms		Up to 4 units

\*1  $\pm 0.025$  % of f.s when the PAD-L Series is connected.

## Sequence

Common to Normal Speed and High Speed	Programs	Up to 6
	Steps	Up to 256
Normal-Speed Sequence	Selectable range of execution time <sup>*1</sup>	0.05 s to 7999 s and ∞
	Execution time resolution <sup>*1</sup>	0.01 s
	Execution time accuracy <sup>*1</sup>	5×10 <sup>-5</sup> of the set value ± T where T: 10 ms (actual time between 0.05 s and 80 s) 0.1 s (actual time between 81 s to 800 s) 1 s (actual time between 801 s to 7999 s)
	Controlled descriptions	Output voltage, output current, overvoltage protection, undervoltage protection, and digital output settings
High-Speed Sequence	Selectable range of execution time <sup>*1</sup>	0.2 ms to 999.8 ms and ∞
	Execution time resolution <sup>*1</sup>	0.1 ms
	Execution time accuracy <sup>*1</sup>	5×10 <sup>-5</sup> of the set value ± 0.01 s
	Controlled descriptions	Output voltage or output current setting and digital output setting <sup>*2</sup>

\*1 Per step.

\*2 The other output setting is configured from the DC power supply's front panel.

## Readback

### Output voltage readback

	PAK-A Series	Power supplies other than the PAK-A Series connected through a terminal unit
Resolution	0.025 % of f.s	
Accuracy	±0.1 % of f.s	±0.2 % of f.s
Temperature coefficient	±200 PPM/°C of f.s (TYP)	

### Output current readback

	PAK-A Series direct connection	All power supplies connected through a shunt unit
Resolution	0.025 % of f.s	
Accuracy	±1.5 % of f.s	±0.3 % of f.s
Temperature coefficient	±200 PPM/°C of f.s (TYP)	±100 PPM/°C of f.s (TYP)

## GPIB

GPIB hardware	Complies with IEEE 728		
GPIB capabilities	Source handshaking	SH1	Full capability
	Acceptor handshaking	AH1	Full capability
	Talker	T6	Capability available
	Listener	L4	Capability available
	Service request	SR1	Full capability
	Remote local	RL1	Full capability
	Parallel polling	PP0	No capability
	Device clear	DC1	Full capability
	Device trigger	DT0	No capability
	Controller	C0	No capability
Selectable range of GPIB addresses	0 to 30		
Command execution time (TYP)*1	Approx. 100 ms		

\*1 The program response time is the sum of command execution time and output response time. The time varies depending on the connected power supplies and their load conditions. For detail of output response time, see the respective operation manual . Note that the time is even longer for capacitive loads.

## I/O connector

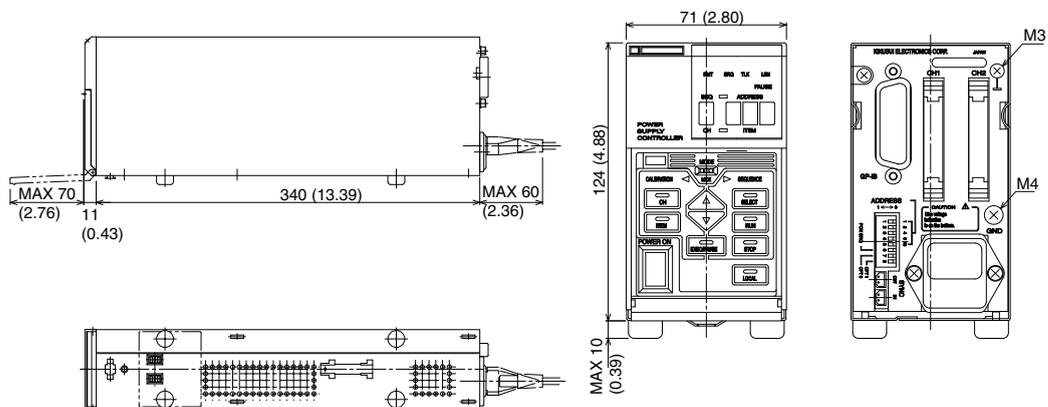
SIGNAL I/O		Two Omron XG4A (MIL) 26-pin flat cable connectors				
Common and shield	1 SHELD	—	Shield			
	2 AG1	—	Analog common (DA1, DA2, DA3, AD1, AD2)			
	3 AG2	—	Output current 2 (DA4) common			
Analog output	4 DA1	○	Output voltage setting	Selectable range: 0 V to +10 V; output current: 2 mA; resolution: 0.025 % of f.s; accuracy: 0.0125 % of f.s; ripple: 0.5 mVrms; temperature coefficient: 50 ppm/°C of f.s (TYP)		
	5 DA2	○	Output current 1 setting			
	6 DA4	H	○	Output current 2 setting	Selectable range: 0 V to +1.5 V	Output current: 2 mA; resolution: 0.025 % of f.s; accuracy: 0.0125 % of f.s; ripple: 0.5 mVrms; temperature coefficient: 100 ppm/°C of f.s (TYP)
		M	○			
		L	○		Selectable range: 0 V to +0.4 V	
7 DA3	○	OVP setting	Selectable range: 0 V to +10 V; output current: 2 mA; resolution: 0.1 % of f.s; accuracy: 0.1 % of f.s; ripple: 0.5 mArms; temperature coefficient: 50 ppm/°C of f.s (TYP)			
Analog input	8 AD1		Output voltage monitoring	Voltage range: 0 V to 10 V	Input resistance: 1 MΩ; resolution: 0.025 % of f.s; accuracy: 0.025 % of f.s; temperature coefficient: 50 ppm/°C of f.s (TYP)	
	9 AD2		Output current monitoring	Voltage range: 0 V to 1 V		
Common	10 DG1	—	Digital common (DO0 to DO6, +5 V)			
Digital output	11 DO0 (LSB)	○	Output on/off	Low for on	Open-collector circuit; maximum voltage: 30 V, maximum current: 10 mA	
	12 DO1	○	Power off	Low for off		
	13 DO2	○	Not used	Low active		
	14 DO3	○	Remote or local	Low for remote		
	15 DO4	○	Not used	Low active		
	16 DO5	○	Not used	Low active		
	17 DO6 (MSB)	○	ID selection	Low active		
Digital input (for ID selection is high)	18 DI0		C.V mode	Low active	Pulled up to + 5 V through 4.7 kΩ; threshold level: CMOS; becomes ID input when ID selection is low	
	19 DI1		C.C mode	Low active		
	20 DI2		OVP	Low active		
	21 DI3		Overheating	Low active		
	22 DI4		Power off	Low for off		
	23 DI5		Output off	Low for off		
	24 DI6		Remote or local	Low for remote		
	25 DI7		Connection complete	Low active		
Shield	26 +5V	—	Do not use			

## General specifications

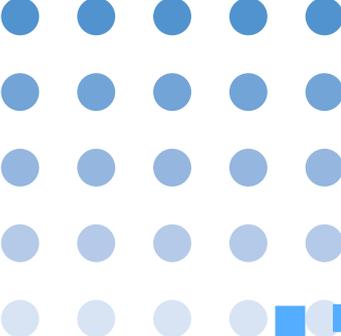
Environment	Altitude of Installed location		Indoors up to 2000 m above sea level
	Operating range	Temperature	0 °C to 40 °C (32 °F to 104 °F)
		Humidity	10 %rh to 90 %rh (no condensation)
	Storage range	Temperature	-20 °C to 70 °C (-4 °F to 158 °F)
Humidity		90 %rh or less (no condensation)	
Power supply	Nominal input rating*1		85 Vac to 115 Vac, 98 Vac to 132 Vac, 170 Vac to 230 Vac, 195 Vac to 254 Vac
	Line frequency range		48 Hz to 62 Hz
	Power consumption		17 VA or less
Insulation resistance Between the AC line and chassis, between the CH1 I/O terminal and chassis, between the CH2 I/O terminal and chassis, between GPIB and chassis			30 MΩ or higher at 500 Vdc
Withstand voltage	Between the AC line and chassis, between the AC line and GPIB, between the AC line and the CH1 I/O terminal, between the AC line and the CH2 I/O terminal		1500 Vac for 1 minute
	Between the CH1 I/O terminal and chassis, between the CH2 I/O terminal and chassis, between the CH1 I/O terminal and the CH2 I/O terminal, between GPIB and chassis		500 Vac for 1 minute
Dimensions			See "Dimensions."
Weight			Approx. 2.5 kg (5.51 lb)
Accessories	Alarm synchronization cable		1 pc.
	Operation manual		1 pc.
	26-pin cable (50 cm)		2 pcs.
	2-pin x 3 cable (1 m)		2 pcs.
	Power cord		1 pc.

\*1 Select using the line voltage selection switch on the bottom panel

## Dimensions



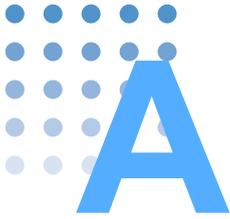
Unit: mm (inch)



# Appendix

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- A Maintenance
- B List of default settings
- C List of messages
- D Troubleshooting
- E List of IDs



# Replacing the Fuse



**WARNING**

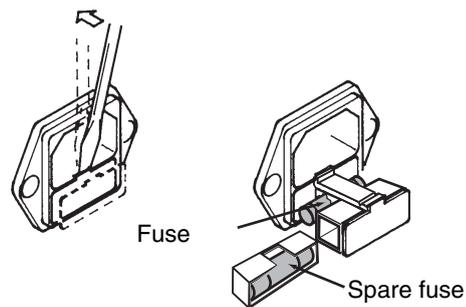
Possible electric shock. Be sure to turn the **POWER** switch off and remove the power cord from the AC outlet before checking or replacing the fuse.

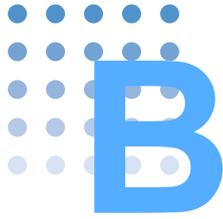


**CAUTION**

Possible damage to the product. Use a fuse with shape, rating, and characteristics that are compatible with the product. Do not use the product with the fuse holder shorted.

- 1** Turn the **POWER** switch off, and remove the power cord plug from the outlet.
- 2** Remove the power cord from the AC inlet on the rear panel.
- 3** Using a flat-blade screwdriver, remove the fuse holder.  
Replace the fuse (rating: 0.2 A time lag).



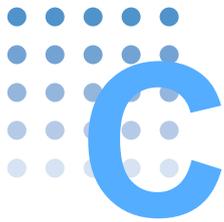


# Default Settings

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When you send the CLR command to the PIA3200, the items in the following table are reset to factory default settings.

Item	Default value	Command
Operation mode	0	MODE 0
Output	Off	OUT 0
Output voltage setting	0 V	VSET 0V
Output current setting	0 A	ISET 0A
Overvoltage protection setting	Maximum value	OVSET (The value varies depending on the model.)
Undervoltage protection setting	Minimum value	UVSET (The value varies depending on the model.)



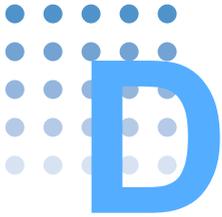
# List of Messages

R/W: R indicates query command, and W indicates set command.  
f.s: Maximum value in the setting range in the ID table.

Command	Value	Description	R/W
A1K	000 to 999	Sets the CH1 output voltage and output current in volts or amperes <sup>*1</sup>	W
A2K	000 to 999	Sets the CH2 output voltage and output current in volts or amperes <sup>*1</sup>	W
ADR	1 to 6	Address number <sup>*2</sup>	R/W
	0, 1, 2, 3	Sequence speed <sup>*2</sup>	
	0 to 255	Step range (step A) <sup>*2</sup>	
	0 to 255	Step range (step B) <sup>*2</sup>	
	0, 1, 2	Step-change pattern <sup>*2</sup>	
	0, 1 to 10000 <sup>*3</sup>	Execution count <sup>*2</sup>	
	0 to 255	Final address <sup>*2</sup>	
ALMMODE	1 to 7	OVP <sup>*4</sup>	R/W
	1 to 7	OHP <sup>*4</sup>	
	1 to 7	UVP <sup>*4</sup>	
	1 to 7	SNYC <sup>*4</sup>	
	1 to 7	POW <sup>*4</sup>	
	1 to 7	CC <sup>*4</sup>	
	1 to 7	CV <sup>*4</sup>	
CAL	1, 2	Specifies the channel to calibrate	W
	1, 2, 3, 4, 5, 6	Sets the calibration item	
CH	1, 2, *	Specifies the channels	R/W
CLR		Resets settings to default	W
DELIMITER	0, 1, 2, 3	Sets the delimiter	R/W
DIN		Queries the digital input	R
DLY	0.1 to 9.9	Sets the alarm delay time	R/W
DOWN	0 to 255	Decreases the value for calibration adjustment	W
DSET	0 to 127	Configures the digital output	R/W
ERR		Queries the contents of the error register	R
FAU		Queries the fault register	R
FINISH		Finishes the calibration	W
FUNMASK	0 to 255	Masks the fault register	R/W
HEAD	0, 1	Sets whether to include the header and unit in responses	R/W
HTIME	0.0002 to 0.9998, 0.9999 <sup>*5</sup>	High-Speed execution time in seconds <sup>*6</sup>	W
	0 to 255	Step number	
ID	001 to 125	Sets the ID	R/W
IOUT		Queries the measured current in amperes	R
ISET	Varies depending on the connected power supply	Sets the current in amperes	R/W
K	000 to 999	Sets the CH1 output voltage and output current in volts or amperes <sup>*1</sup>	W
LOAD		Loads the sequence	W
MODE	0, 1, 2	Sets the mode	R/W
OUT	0, 1	Turns the power supplies' output on or off	R/W

Command	Value	Description	R/W
OVSET	0 to 110 % of f.s	OVP in unit of volts	R/W
PAUSE		Pauses the program	W
PMARK	0, 1	Pause <sup>*6</sup>	W
	0 to 255	Step number	
POW		Turns the power off	W
REM	0, 1	Switches the power supplies between remote and local modes	R/W
RST		Clears alarms	W
RUN	0 to 255	Start step number <sup>*6, *7</sup>	W/R
	0 to 255	Pause step number <sup>*7</sup>	
SAVE		Saves the sequence	W
SDSET	0 to 127	Configures the digital output <sup>*6</sup>	W
	0 to 255	Step number	
SELECT	1 to 6	Specifies the program number to run	R/W
SEPARATOR	0, 1, 2, 3	Sets the separator	R/W
SISSET	Varies depending on the connected power supply	Sets the current in amperes <sup>*6</sup>	W
SMEM	0 to 255 <sup>*8</sup>	Queries the step contents <sup>*6</sup>	R
SOUT	0, 1	Turns the output on or off <sup>*6</sup>	W
	0 to 255	Step number	
SOVSET	0 to 110 % of f.s	OVP in unit of volts <sup>*6</sup>	W
	0 to 255	Step number	
SPOW	0 to 255 <sup>*8</sup>	Turns the power off <sup>*6</sup>	W
SREM	0,1	Switches to remote or local <sup>*6</sup>	W
	0 to 255	Step number	
SSTS	0, 1, 2	Queries the program execution status	R
STOP	0 to 255	Stops the program <sup>*7</sup>	R/W
STS		Queries the status register	R
SUVSET	-f.s to f.s	UVP in unit of volts <sup>*6</sup>	W
	0 to 255	Step number	
SVSET	Varies depending on the connected power supply	Sets the voltage in volts <sup>*6</sup>	W
	0 to 255	Step number	
TIME	0.05 to 7999, 8000 <sup>*9</sup>	Normal-Speed execution time in seconds <sup>*6</sup>	W
	0 to 255	Step number	
UNMASK	0 to 255	Sets the unmask register	R/W
UP	0 to 255	Increases the value for calibration adjustment	W
UVSET	-f.s to f.s	UVP in unit of volts	R/W
VOUT		Queries the measured voltage	R
VPM	0, 1	Enables or disables auto-tracking output voltage protection	R/W
VPR	0 to 10 % of +f.s	Tracking offset of auto-tracking output voltage protection in unit of volts	R/W
VPTIME	0.1 to 2.0	Tracking time of auto-tracking output voltage protection	R/W
VSET	Varies depending on the connected power supply	Sets the voltage in volts	R/W

- \*1 Specify to use voltage or current by the value of unit.
- \*2 Sequence program setting
- \*3 10000 is infinity
- \*4 Alarm setting
- \*5 0.9999 is infinity
- \*6 Step setting
- \*7 The setting value can be omitted.
- \*8 The setting value is a step number.
- \*9 8000 is infinity



# Troubleshooting

This appendix introduces troubleshooting measures. Typical symptoms are listed. Check whether any of the symptoms below apply to your case. In some cases, the problem can be solved easily. If you cannot solve the problem even after taking appropriate measures, contact your Kikusui agent or distributor..

## The power does not turn on.

Symptom	Items to check	Remedy
The PIA3200 does not operate even when the POWER switch is turned on.	Is the power cord connected?	Connect the power cord to the outlet, and supply the appropriate AC power. <a href="#">See</a> p. 18
	Is the fuse blown?	Replace the fuse. <a href="#">See</a> p. 130
	Is the voltage range switch set correctly?	Set it to the appropriate range. <a href="#">See</a> p. 18

## Commands cannot be sent properly.

Symptom	Items to check	Remedy
The buzzer sounds when a command is sent.	Is there a delimiter in the command?	Commands can only be sent properly when using appropriate settings. Please check the settings.
	Is the command syntax correct?	
	Is the alarm in effect?	
Commands cannot be sent.	Is the mode set correctly?	
	Is the GPIB address set properly?	
	Is the REN line at high level?	

## Responses cannot be received properly.

Symptom	Items to check	Remedy
Responses cannot be received.	Is the GPIB address set properly?	Commands can only be received properly when using appropriate settings. Please check the settings.
	Is the delimiter correct?	
	Is the mode set correctly?	
	Is there enough receive buffer on the PC?	Allocate sufficient receive buffer.

## Output is unstable.

Symptom	Items to check	Remedy
The ripple becomes large	Is the setting of voltage range switch applied correctly?	Set it to the appropriate range.
	Isn't the AC input voltage low?	
The level is abnormal.	Is the ID applied correctly?	
	Is the cable connected properly?	
	Did you calibrate?	

## Sequences do not work properly.

Symptom	Items to check	Remedy
Cannot run the sequence. (The program number does not blink.)	Is the voltage range switch set correctly?	Set it to the appropriate range.
	Isn't the AC input voltage low?	
	Is the ID applied correctly?	
	Is the time data applied correctly?	
The output is abnormal.	Check the sequence information with ADR?	Use appropriate settings that applies to the power supply responses.
	Check the auto-tracking operation with VPR? Check the relative VPTIME and TIME settings.	
	Check other channels in High-Speed Sequence mode.	
	Is the sequence paused?	
		Unpause.  p. 65

## Cannot calibrate properly.

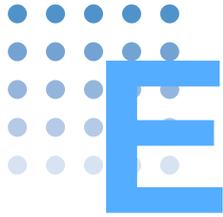
Symptom	Items to check	Remedy
The output does not change with UP and DOWN commands.	Is a program running? Is Calibration mode selected?	UP and DOWN are invalid when a program is running or when the PIA3200 is in Calibration mode.
	Are the connected power supplies working properly?	Check the DC power supplies.
	Are the specified channels correct?	Set them correctly.
The error buzzer sounds after the FINISH command.	Is the ID applied correctly?	Readback errors occur when the PAD-L Series is connected through the TU01.
	Is the PAD-L Series connected through the TU01?	
ITEM5 and ITEM6 cannot be calibrated.	Are the connected power supplies not the PAK-A Series?	OVP calibration is not necessary on power supplies other than the PAK-A series.
	Is the PAK-A set to LOCAL OVP operation mode?	Clear LOCAL OVP.
	Did you calibrate ITEM1 and ITEM2 before calibrating ITEM5 and ITEM6?	Calibrate ITEM1 and ITEM2 first.  p. 118

Symptom	Items to check	Remedy
ITEM1 and ITEM2 cannot be calibrated properly.	Are the ID and channels correct?	Set them correctly.
	Are the I/O cables connected properly?	
	Is the S1 switch turned on (in CC mode)?	
	Is the OVP tripped due to an inappropriate LOCAL OVP setting?	
	Are the PAD-L's output setting knobs turned fully clockwise?	
	Is the offset off by an extreme amount? <sup>*1</sup>	
ITEM3 and ITEM4 cannot be calibrated.	Is the calibration program correct?	If the resistance is too large, the power supplies will not switch to CC mode. Adjust the offset. Check the program.
	Is the ID correct?	
	Are the I/O cables connected properly?	
	Is the shunt resistance for measurement too large?	
	Is the offset off by an extreme amount? <sup>*1</sup>	
Calibration values are not backed up.	Is the calibration program correct?	Move the MODE switch after waiting for a few seconds. Send MODE 2.  p. 112
	Are you moving the MODE switch to the LOCK position immediately after calibration?	
	Did you send MODE 0?	

\*1 You can check the offset using the limit switch on the connected power supply. The variable range of offset and full-scale value on the PIA3200 is extensively wide. So, be aware that once the offset is off by an extreme amount, you must hold down the ▲ or ▼ key until it restores the offset to the proper value.

### The ID cannot be set properly.

Symptom	Items to check	Remedy
The ID cannot be set.	Are the rear-panel dipswitch settings correct (OPT 0 and OPT 1 set to zero)?	Turn the power supplies off and then back on.



# List of IDs

Model ID	Model	Output voltage setting range [V]	Output current setting range [A]
046	PAD55-3L	0.00 ~ 55.00	0.0000 ~ 3.0000
047	PAD55-6L	0.00 ~ 55.00	0.000 ~ 6.000
048	PAD55-10L	0.00 ~ 55.00	0.000 ~ 10.000
049	PAD55-20L	0.00 ~ 55.00	0.000 ~ 20.000
050	PAD55-35L	0.00 ~ 55.00	0.000 ~ 35.000
051	PAD55-60L	0.00 ~ 55.00	0.00 ~ 60.00
052	PAD55-120L	0.00 ~ 55.00	0.00 ~ 120.00
053	PAD60-200LPT	0.00 ~ 60.00	0.00 ~ 200.00
054	PAD70-2.5L	0.00 ~ 70.00	0.0000 ~ 2.5000
055	PAD70-5L	0.00 ~ 70.00	0.000 ~ 5.000
056	PAD70-8L	0.00 ~ 70.00	0.000 ~ 8.000
057	PAD70-15L	0.00 ~ 70.00	0.000 ~ 15.000
058	PAD110-1.5L	0.00 ~ 110.00	0.0000 ~ 1.5000
059	PAD110-3L	0.00 ~ 110.00	0.0000 ~ 3.0000
060	PAD110-5L	0.00 ~ 110.00	0.000 ~ 5.000
061	PAD110-10L	0.00 ~ 110.00	0.000 ~ 10.000
062	PAD110-20L	0.00 ~ 110.00	0.000 ~ 20.000
063	PAD110-30L	0.00 ~ 110.00	0.000 ~ 30.000
064	PAD110-60L	0.00 ~ 110.00	0.00 ~ 60.00
065	PAD160-1L	0.00 ~ 160.00	0.0000 ~ 1.0000
066	PAD160-2L	0.00 ~ 160.00	0.0000 ~ 2.0000
067	PAD160-3.5L	0.00 ~ 160.00	0.0000 ~ 3.5000
068	PAD160-7L	0.00 ~ 160.00	0.000 ~ 7.000
069	PAD250-2.5L	0.00 ~ 250.00	0.0000 ~ 2.5000
070	PAD250-4.5L	0.00 ~ 250.00	0.0000 ~ 4.5000
071	PAD250-8L	0.00 ~ 250.00	0.000 ~ 8.000
072	PAD250-15L	0.00 ~ 250.00	0.000 ~ 15.000
073	PAD500-2L	0.0 ~ 500.0	0.0000 ~ 2.0000
074	Und. 60k-60k[M]	0.00 ~ FS	0 ~ FS
075	PAS40-9	0.00 ~ 40.00	0.000 ~ 9.000
076	PAS40-18	0.00 ~ 40.00	0.000 ~ 18.000
077	PAS40-27	0.00 ~ 40.00	0.000 ~ 27.000
078	Und. 60k-60k[L]	0.00 ~ FS	0 ~ FS
079	PMC10-3A	0.000 ~ 10.000	0.0000 ~ 3.0000
080	PMC18-1A	0.000 ~ 18.000	0.0000 ~ 1.0000
081	PMC18-2A	0.000 ~ 18.000	0.0000 ~ 2.0000
082	PMC18-3A	0.000 ~ 18.000	0.0000 ~ 3.0000
083	PMC18-5A	0.000 ~ 18.000	0.000 ~ 5.000
084	PMC35-0.5A	0.000 ~ 35.000	0.0000 ~ 0.5000
085	PMC35-1A	0.000 ~ 35.000	0.0000 ~ 1.0000
086	PMC35-2A	0.000 ~ 35.000	0.0000 ~ 2.0000
087	PMC35-3A	0.000 ~ 35.000	0.0000 ~ 3.0000
088	PMC70-1A	0.00 ~ 70.00	0.0000 ~ 1.0000
089	PMC110-0.6A	0.00 ~ 110.00	0.0000 ~ 0.6000
090	PMC160-0.4A	0.00 ~ 160.00	0.0000 ~ 0.4000

Model ID	Model	Output voltage setting range [V]	Output current setting range [A]
001	PAK6-60A	0.000 ~ 6.000	0.00 ~ 60.00
002	PAK6-120A	0.000 ~ 6.000	0.00 ~ 120.00
003	PAK6-160A	0.000 ~ 6.000	0.00 ~ 160.00
004	PAK10-35A	0.000 ~ 10.000	0.000 ~ 35.000
005	PAK10-70A	0.000 ~ 10.000	0.00 ~ 70.00
006	PAK10-100A	0.000 ~ 10.000	0.00 ~ 100.00
007	PAK20-18A	0.000 ~ 20.000	0.000 ~ 18.000
008	PAK20-36A	0.000 ~ 20.000	0.000 ~ 36.000
009	PAK20-50A	0.000 ~ 20.000	0.00 ~ 50.00
010	PAK35-10A	0.000 ~ 35.000	0.000 ~ 10.000
011	PAK35-20A	0.000 ~ 35.000	0.000 ~ 20.000
012	PAK35-30A	0.000 ~ 35.000	0.000 ~ 30.000
013	PAK60-6A	0.00 ~ 60.00	0.000 ~ 6.000
014	PAK60-12A	0.00 ~ 60.00	0.000 ~ 12.000
015	PAK60-18A	0.00 ~ 60.00	0.000 ~ 18.000
016	PAN60-3A	0.00 ~ 60.00	0.0000 ~ 3.0000
017	PAN60-6A	0.00 ~ 60.00	0.000 ~ 6.000
018	PAN60-10A	0.00 ~ 60.00	0.000 ~ 10.000
019	PAN60-20A	0.00 ~ 60.00	0.000 ~ 20.000
020	PAD60-35L	0.00 ~ 60.00	0.000 ~ 35.000
021	PAD60-60L	0.00 ~ 60.00	0.00 ~ 60.00
022	PAD60-120L	0.00 ~ 60.00	0.00 ~ 120.00
023	PAS10-35	0.000 ~ 10.000	0.000 ~ 35.000
024	PAS10-70	0.000 ~ 10.000	0.00 ~ 70.00
025	Und. 60k-60k[H]	0 ~ FS	0 ~ FS
026	PAS10-105	0.000 ~ 10.000	0.00 ~ 105.00
027	PAS20-18	0.000 ~ 20.000	0.000 ~ 18.000
028	PAS20-36	0.000 ~ 20.000	0.000 ~ 36.000
029	PAS20-54	0.000 ~ 20.000	0.00 ~ 54.00
030	PAD16-100LA	0.000 ~ 16.000	0.00 ~ 100.00
031	PAD36-60LA	0.000 ~ 36.000	0.00 ~ 60.00
032	PAD60-35LA	0.00 ~ 60.00	0.000 ~ 35.000
033	PAD72-30LA	0.00 ~ 72.00	0.000 ~ 30.000
034	PAD110-20LA	0.00 ~ 110.00	0.000 ~ 20.000
035	PAD250-8LA	0.00 ~ 250.00	0.000 ~ 8.000
036	PAD36-100LA	0.000 ~ 36.000	0.00 ~ 100.00
037	PAD60-60LA	0.00 ~ 60.00	0.00 ~ 60.00
038	PAD110-30LA	0.00 ~ 110.00	0.000 ~ 30.000
039	PAD250-15LA	0.00 ~ 250.00	0.000 ~ 15.000
040	PAD35-30L/LP	0.000 ~ 35.000	0.000 ~ 30.000
041	PAD35-50L/LP	0.000 ~ 35.000	0.00 ~ 50.00
042	PAD35-60L/LP	0.000 ~ 35.000	0.00 ~ 60.00
043	PAD35-100L/LP	0.000 ~ 35.000	0.00 ~ 100.00
044	PAD35-200L/LP	0.000 ~ 35.000	0.00 ~ 200.00
045	PAD35-300L/LP	0.000 ~ 35.000	0.00 ~ 300.00

Appx

Model ID	Model	Output voltage setting range [V]	Output current setting range [A]
091	PMC250-0.25A	0.00 ~ 250.00	0.00000 ~ 0.25000
092	PMC350-0.2A	0.00 ~ 350.00	0.00000 ~ 0.20000
093	PMC500-0.1A	0.0 ~ 500.0	0.00000 ~ 0.10000
094	PAN16-10(A)	0.000 ~ 16.000	0.000 ~ 10.000
095	PAN16-18(A)	0.000 ~ 16.000	0.000 ~ 18.000
096	PAN16-30(A)	0.000 ~ 16.000	0.000 ~ 30.000
097	PAN16-50(A)	0.000 ~ 16.000	0.00 ~ 50.00
098	PAN35-5(A)	0.000 ~ 35.000	0.000 ~ 5.000
099	PAN35-10(A)	0.000 ~ 35.000	0.000 ~ 10.000
100	PAN35-20(A)	0.000 ~ 35.000	0.000 ~ 20.000
101	PAN35-30(A)	0.000 ~ 35.000	0.000 ~ 30.000
102	PAN55-3(A)	0.00 ~ 55.00	0.0000 ~ 3.0000
103	PAN55-6(A)	0.00 ~ 55.00	0.000 ~ 6.000
104	PAN55-10(A)	0.00 ~ 55.00	0.000 ~ 10.000
105	PAN55-20(A)	0.00 ~ 55.00	0.000 ~ 20.000
106	PAN70-2.5(A)	0.00 ~ 70.00	0.0000 ~ 2.5000
107	PAN70-5(A)	0.00 ~ 70.00	0.000 ~ 5.000
108	PAN70-8(A)	0.00 ~ 70.00	0.000 ~ 8.000
109	PAN70-15(A)	0.00 ~ 70.00	0.000 ~ 15.000
110	PAN110-1.5(A)	0.00 ~ 110.00	0.0000 ~ 1.5000
111	PAN110-3(A)	0.00 ~ 110.00	0.0000 ~ 3.0000
112	PAN110-5(A)	0.00 ~ 110.00	0.000 ~ 5.000
113	PAN110-10(A)	0.00 ~ 110.00	0.000 ~ 10.000
114	PAN160-1(A)	0.00 ~ 160.00	0.0000 ~ 1.0000
115	PAN160-2(A)	0.00 ~ 160.00	0.0000 ~ 2.0000
116	PAN160-3.5(A)	0.00 ~ 160.00	0.0000 ~ 3.5000
117	PAN160-7(A)	0.00 ~ 160.00	0.000 ~ 7.000
118	PAN250-2.5(A)	0.00 ~ 250.00	0.0000 ~ 2.5000
119	PAN250-4.5(A)	0.00 ~ 250.00	0.000 ~ 4.500
120	PAS60-6	0.00 ~ 60.00	0.000 ~ 6.000
121	PAS60-12	0.00 ~ 60.00	0.000 ~ 12.000
122	PAS60-18	0.00 ~ 60.00	0.000 ~ 18.000
123	PAS80-4.5	0.00 ~ 80.00	0.000 ~ 4.500
124	PAS80-9	0.00 ~ 80.00	0.000 ~ 9.000
125	PAS80-13.5	0.00 ~ 80.00	0.000 ~ 13.500

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