DPO2212A GPIB PROGRAMMER INSTRUCTION MANUAL

# *Operation Manual*

## GPIB PROGRAMMER

## DPO2212A

KIKUSUI

Part No. Z1-982-020 IB002022

## Use of Operation Manual

Please read through and understand this Operation Manual before operating the product. After reading, always keep the manual nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.
If you find any incorrectly arranged or missing pages in this manual, they will be replaced. If the manual it gets lost or soiled, a new copy can be provided for a fee. In either case, please contact Kikusui distributor/agent, and provide the “Part No.” given on the cover.
This manual has been prepared with the utmost care; however, if you have any questions, or note any errors or omissions, please contact Kikusui distributor/agent.

# Power Requirements of this Product

Power requirements of this product have been changed and the relevant sections of the Operation Manual should be revised accordingly. (Revision should be applied to items indicated by a check mark ☑.)

☐ **Input voltage**

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

☐ **Input fuse**

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

**WARNING**

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

# Power Requirements of this Product (cont'd)

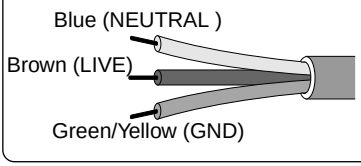
### ☐ AC power cord

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

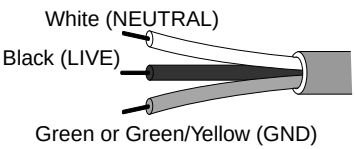
**WARNING**

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

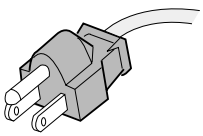
### ☐ Without a power plug



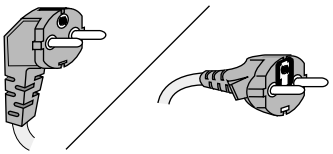

### ☐ Without a power plug




### ☐ Plugs for USA



### ☐ Plugs for Europe



### ☐ Provided by Kikusui distributor/agent

Kikusui agents can provide you with suitable AC power cord. For further information, contact Kikusui distributor/agent.

| Models dropped from production | | |
|---|---|---|
| PAA | Series | |
| PAB-A | Series | |
| PAD-L | Series | ＊1 |
| PAD-LP | Series | |
| PAE | Series | |
| PAL | Series | |
| PAL-P | Series | |
| PAR | Series | |
| PHS | Series | |
| PLZ-W | Series | |

＊1 Models are available in PAD-L series.

| | |
|---|---|
| PAD 16-100L | PAD 110-30L |
| PAD 35-50L | PAD 110-60L |
| PAD 35-60L | PAD 250-8L |
| PAD 35-100L | PAD 250-15L |
| PAD 35-200L | PAD 300-1A |
| PAD 35-200LT | PAD 500-0.6A |
| PAD 55-35L | PAD 500-1.2A |
| PAD 55-60L | PAD 500-2L |
| PAD 55-120L | PAD 600-1.5L |
| PAD 110-20L | PAD 1K-0.2L |

# ⚠Safety Precautions

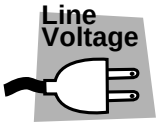
The following safety precautions must be observed to avoid fire hazard, electrical shock, accidents, and other failures. Keep them in mind and make sure that all of them are observed properly.

## Users

- This product must be used only by qualified personnel who understand the contents of this operation manual.
- If it is handled by disqualified personnel, personal injury may result. Be sure to handle it under supervision of qualified personnel (those who have electrical knowledge.)
- This product is not designed or manufactured for general home or consumer use.

## Purposes of use

- Do not use the product for purposes other than those described in the operation manual.



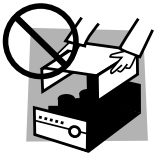

## Input power

- Use the product with the specified input power voltage.
- For applying power, use the AC power cord provided. Note that the provided power cord is not use with some products that can switch among different input power voltages or use 100 V and 200 V without switching between them. In such a case, use an appropriate power cord. For details, see the relevant page of this operation manual.

## Fuse

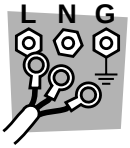
- With products with a fuse holder on the exterior surface, the fuse can be replaced with a new one.

When replacing a fuse, use the one which has appropriate shape, ratings, and specifications.



## Cover

- There are parts inside the product which may cause physical hazards. Do not remove the external cover.




## Installation

- When installing products be sure to observe "Precautions for Installation" described in this manual.
- To avoid electrical shock, connect the protective ground terminal to electrical ground (safety ground).
- When applying power to the products from a switchboard, be sure work is performed by a qualified and licensed electrician or is conducted under the direction of such a person.
- When installing products with casters, be sure to lock the casters.

## Relocation

- Turn off the power switch and then disconnect all cables when relocating the product.
- Use two or more persons when relocating the product which weights more than 20 kg. The weight of the products can be found on the rear panel of the product and/or in this operation manual.
- Use extra precautions such as using more people when relocating into or out of present locations including inclines or steps. Also handle carefully when relocating tall products as they can fall over easily.
- Be sure the operation manual be included when the product is relocated.


## Operation

- Check that the AC input voltage setting and the fuse rating are satisfied and that there is no abnormality on the surface of the AC power cord. Be sure to unplug the AC power cord or stop applying power before checking.
- If any abnormality or failure is detected in the products, stop using it immediately. Unplug the AC power cord or disconnect the AC power cord from the switchboard. Be careful not to allow the product to be used before it is completely repaired.
- For output wiring or load cables, use connection cables with larger current capacity.
- Do not disassemble or modify the product. If it must be modified, contact Kikusui distributor/ agent.

## Maintenance and checking

- To avoid electrical shock, be absolutely sure to unplug the AC power cord or stop applying power before performing maintenance or checking.
- Do not remove the cover when performing maintenance or checking.
- To maintain performance and safe operation of the product, it is recommended that periodic maintenance, checking, cleaning, and calibration be performed.

## Service

- Internal service is to be done by Kikusui service engineers. If the product must be adjusted or repaired, contact Kikusui distributor/agent.

# TABLE OF CONTENTS

# 1. GENERAL

## 1-1. General

Model DPO2212A GP-IB Programmer is an interface for programmed control of Kikusui's Regulated DC Power Supplies and Electronic Loads via a GP-IB bus (IEEE-488-1978) from a computer.

The DPO2212A converts digital signals received from the computer into analog signal outputs (two channels of 12-bit (3 digits BCD) resolution signals and one channel of 8-bit resolution). The DPO2212A has a service request function and a talker function, allowing you to implement power supply systems of high safety.

Note: Be sure to read thoroughly this instruction manual before using the DPO2212A. Refer also to the instruction manuals of the Power Supplies and Electronic Loads to be connected to the DPO2212A.

## 2. SPECIFICATIONS

| Specifications | | | |
|---|---|---|---|
| 1. Digital Inputs | Applicable Standards | IEEE-488-1978 | |
| | Interface Functions | SH1, AH1, T6, L3, SR1, RL0, PP0, DC1, DT0, C0 | |
| | Input Connector | 24-pin ribbon connector | |
| | Setting address | 0 - 30 | |
| | Bus Cable Length | Total bus cable length = [No. of devices connected to bus] × [2 m (6.56 ft) or less] ≦ 20 m (65.6 ft) | |
| 2. Analog Output | Channels | A1, A2 | A3 |
| | Maximum Output Voltage *1<br><br>Variable Range | 8.5 V - 10.2 V<br><br>0.25 V - 1.5 V | 8.5 V - 10.1 V |
| | Maximum Output Current | 3 mA | |
| | Resolution | 0.1% *2 | 0.4% *2 |
| | Accuracy | 0.05% *2 | 0.2% *2 |
| | Output Ripple | 300 μV rms (5 Hz - 1 MHz) | |
| | Source effect | 0.005% + 1 mV *3 | |
| | Load effect | 0.005% + 1 mV *4 | |
| | Temperature Coefficient | 50 ppm/°C (typical) *5 | |

*1: For maximum input data

*2: For maximum output voltage, at ambient temperature 25°C (77°F)

*3: Regulation against ±15% change of line voltage from nominal voltage

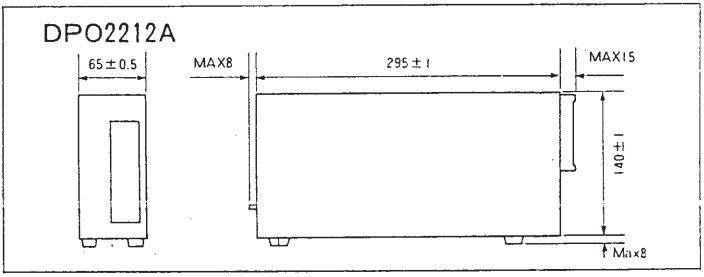
*4: Regulation against 0% - 100% change of load

*5: At low range (0.25 V - 1.5 V): 100 ppm/°C

| | | |
|---|---|---|
| 3. Optional Function | | Remote/Local Selector switch (except A3) |
| 4. Interruption | Interruption Bits | 2 bits × 2, negative logic, TTL level |
| | Input Connectors | 8-pin DIN connector × 2 |
| 5. Contact Signal Outputs | | Dual contacts |
| 6. Ambient Temperature and Himidity | | 0°C to 40°C (32°F to 104°F), 10% to 90% RH |
| 7. AC Line Voltage (Single-phase, 50/60 Hz) | | A: 85 V - 115 V; C: 183 V - 247 V<br>B: 98 V - 132 V; D: 195 V - 254 V<br>One of A, B, C, D is selectable with line voltage selector on bottom. |
| 8. Withstanding Voltage | | |
| | Between GP-IB Connector and Each Output | 500 V AC, 1 minute |
| | Between Analog Outputs | 500 V AC, 1 minute |
| | Between Each Output and Case | 500 V AC, 1 minute |
| | Between AC Line Input and Case | 1500 V AC, 1 minute |
| | Between AC Line Input and Each Output | 1500 V AC, 1 minute |
| 9. Insulation Resistances | | |
| | Between AC Line Input and Case | 30 MΩ or over, with 500 V DC |
| | Between Each Output and Case | 30 MΩ or over, with 500 V DC |
| 10. Power Consumption | | 18 VA |
| 11. Dimensions | | 65 W × 140 H × 295 D mm<br>(2.56 W × 5.51 H × 11.61 D in.)<br>[Case dimensions: See the Case Dimension Drawing.] |

| | | |
|---|---|---|
| 12. Weight | Approx. 2.4 kg (5.3 lbs) | |
| 13. Accessories | 8 pin DIN connectors | 2 |
| | Instruction Manual | 1 |

Case Dimension Drawing



# 3. OPERATING INSTRUCTIONS

## 3-1. Notes Before Use

### 3-1-1. System Structure

When making up a system employing the DPO2212A and a power supply, be sure to fully study the specifications of both DPO2212A and power supply.

1) The major input/output specifications of the DPO2212A are as shown in Table 3-1.

Table 3-1

| | | |
|---|---|---|
| 1. Analog outputs | 12 bits (3 digits BCD) | ×2 ch |
| | 8 bits | ×1 ch |
| 2. Interruption | To J1 | 2 bits |
| | To J2 | 2 bits |
| 3. Relay contact outputs *1 (Make-contacts) | To J1 | 1 make-contact |
| | To J2 | 1 make-contact |

*1: The contacts are made concurrently.

2) The items which can be controlled by one DPO2212A for one power supply are as shown in Table 3-2.

Table 3-2

| | Voltage Only | Current Only | Voltage and Current | Mode Interruption | Abnormality Interruption | Power Off |
|---|---|---|---|---|---|---|
| PAA ＊5 | ○ | ○ | ○ | × | × | ○ |
| PAB-A | ○ | ○ | × | × | × | × |
| PAD-L 0・$I_2$・$I_3$・II ＊6 | ○ | ○ | ○ | × | × | ○ ＊4 |
| PAD-L III・IV・V | ○ | ○ | ○ | × | × | ○ |
| PAD-LP | ○ | ○ | ○ | ○ ＊2 | ○ ＊3 | ○ ＊4 |
| PAD-LPT | ○ | ○ | ○ | ○ ＊2 | ○ | ○ |
| PAE | ○ | ○ | ○ | × | × | ○ |
| PAK | ○ | ○ | ○ | ○ | ○ | ○ |
| PAL | ○ | ○ | ○ | × | × | ○ ＊4 |
| PAL-P | ○ | ○ | ○ | ○ ＊2 | ○ ＊3 | ○ ＊4 |
| PAN(-A) | ○ | ○ | ○ | × | × | × |
| PAR | ○ | ○ | ○ | × | × | × |
| PHS | ○ | × | × | × | ○ | × |
| PLZ-W | ○ | ○ | ○ | × | × | × |
| PLZ-W2 PLZ-W2A | × | ○ | × | × | × | × |
| PLZ-WU | × | ○ | × | × | × | × |
| PMC-A | ○ | ○ | ○ | × | × | × |

*2:Interruption is effected when modes are changed from CC to CV or from CV to CC.

*3:Of PAD-LP Types 0 and I2 and PAL-P Type I2 Power Supplies, interruption is effected only when the OVP circuit has tripped.

No interruption is effected when the power is turned off.

*4:Of PAD-L/PAD-LP Types 0 and I2 and PAL/PAL-P Type I2 Power Supplies, the rectifier circuit is blocked (stops).

*5:Of the PAA Power Supplies, the very low portion (close to 0V or 0A) drops out and cannot be successfully controlled. Only the range within the specification can be controlled.

*6:DPO2212A is not available to PAD1K-0.2L.

Note: Of the PAD-L and PAD-LP Power Supplies manufactured before December 1983, output current control cannot be done unless they are modified. For the modification, please consult your Kikusui agent. The date of manufacture can be identified by the serial number of each power supply. If the third column from the left-hand end of the serial number is 4 or over, no modification is necessary.

The PAD16-500L Power Supplies and the PAD-L Series Power Supplies with rated output 500 V or over need this modification regardless of their dates of manufacture.

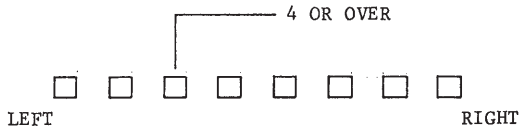
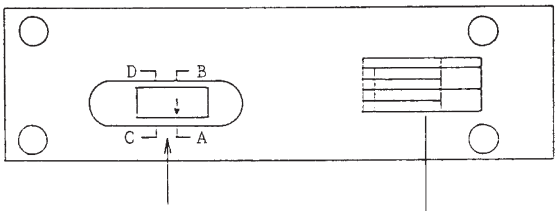



Figure 3-1

3-1-2. AC Line Voltage

1) Confirming the AC Line Voltage

Before connecting the DPO 2212A to an AC line, confirm that its AC line voltage selector is set correctly for the AC line voltage. The settings of the selector and corresponding AC line voltages and fuses are shown on the bottom of the DPO2212A as illustrated in Figure 3-2.




AC LINE VOLTAGE SELECTOR

Figure 3-2

A, B, C, D: Denote positions of AC line voltage selector

| | Line Voltage | Fuse |
|---|---|---|
| A | 85 V - 115 V | 0.5 A |
| B | 98 V - 132 V | 0.5 A |
| C | 183 V - 247 V | 0.3 A |
| D | 195 V - 254 V | 0.3 A |

2) Selecting the AC Line Voltage Range

You can select from four AC line voltage ranges shown in Figure 3-2. AC line voltage range is selected by changing a direction of AC line voltage selector. But changes from 100V system voltage range (A or B) to 200V system voltage range (C or D) and vice versa require a replacement of the input fuse as can be seen from Figure 3-2.

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**⚠WARNING** · It is necessary to open the external cover of DPO2212A to replace the input fuse. There are parts that may cause physical hazards inside the DPO2212A. Do not remove the external cover.

Contact Kikusui distributor/agent for a change of AC line voltage range with input fuse replacement.

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○ The power plug provided at the end of the power cord is for ranges A and B only and it cannot be used for ranges C and D. For ranges C and D, cut away the plug from the cord and replace it with a plug of sufficient ratings for ranges C and D or replace it with solderless terminals for direct connection to a power distribution panel.

Note: When range C or D is specified when ordering, the DPO2212A is shipped without any plug or solderless terminal provided at the end of the power cord.

### 3-1-3. Requirements of Place of Installation

○ The ambient temperature range to satisfy the performance specification is 0 to 40˚C (32 to 104˚F). Note that performance and longevity of semiconductors are exponentially degraded by high temperatures.

○ Avoid highly humid or dusty place.

○ Select a place reasonably free from vibration.

○ Although the DPO2212A is incorporated with provisions against noise, do not install it in a place where it may by subjected to unreasonably large noise. Pay attention also to noise suppression provisions of surrounding devices.

3-2. Description of Components

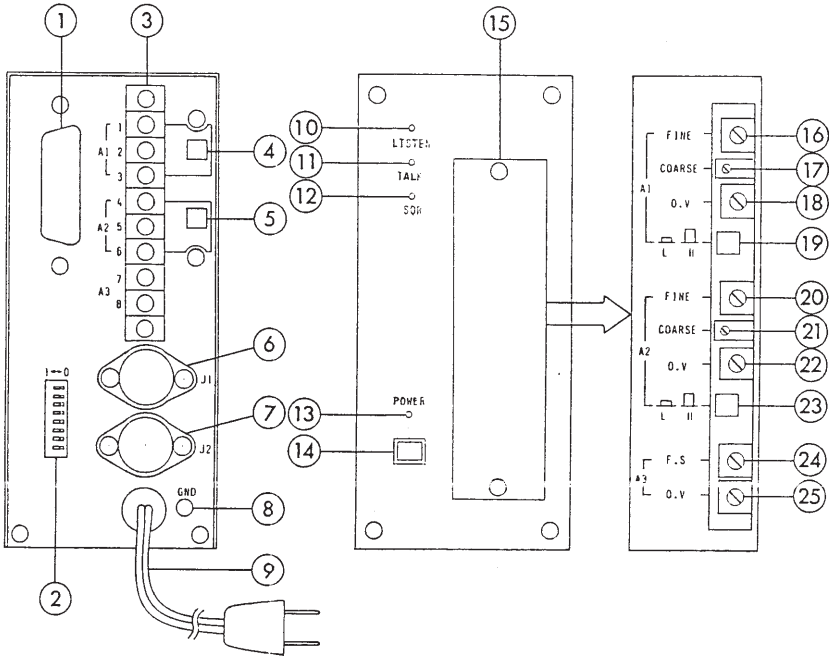


Figure 3-3

(1) GP-IB Connector (GP-IB)

A 24-pin ribbon-cable connector of IEEE-488-1978 Std, GP-IB Connector. Connect the GP-IB bus cable to this connector. If the cable connector is of the IEC Std, use an IEC-to-IEEE connector adaptor.

(2) Address Setting Switches

An 8-pole DIP switch to set an address for the DPO2212A on the GP-IB system. This switch is used also to set the LISTEN ONLY mode and to set the key codes for A1 and A2. (See Section 3-3-2.)

③ Analog Output Terminals

Terminals for analog outputs of channels A1, A2, and A3. These analog outputs are used as external control signals for the power supply unit. The terminals are of a binding screw type (M3).

④ Remote/Local Switch for Channel A1 (REMOTE/LOCAL)

A switch to select the remote mode or the local mode for channel A1. When the A1 output terminals are connected to the power supply as described later and this switch is thrown to the REMOTE position, the A1 analog output signal is fed to the power supply and it is controlled by the data received via the GP-IB bus. When this switch is thrown to the LOCAL position, the power supply is set to the local mode and can be manually controlled with its front panel switches and controls.

⑤ Remote/Local Switch for Channel A2 (REMOTE/LOCAL)

The function of this switch is identical with that of the switch of ④, except that this switch is for channel A2.

⑥ Digital I/O Connector J1 (J1)

A connector for interrupt signal input and make-contact signal output.

⑦ Digital I/O Connector J2 (J2)

A connector for interrupt signal input and make-contact signal output.

⑧ Ground Terminal (GND)

The terminal (M3 binding-screw terminal) to ground the DPO2212A.

[Be sure to ground this terminal for the sake of safety and to prevent erroneous operations which could be caused by external noise.]

⑨ Power Cord with Plug

⑩ Status Indicator Lamp (LISTEN)

This lamp (green LED) illuminates during the period the DPO2212A on the GP-IB bus is in the listener status.

⑪ Status Indicator Lamp (TALK)

This lamp (yellow LED) illuminates during the period the DPO2212A on the GP-IB bus is in the talker status. It illuminates when the DPO2212A is sending out its status byte or data.

⑫ Status Indicator Lamp (SRQ)

This lamp (red LED) illuminates during the period the DPO2212A is sending out a service request signal onto the GP-IB bus.

⑬ Power Indicator Lamp (POWER)

This lamp (green LED) illuminates to indicate that the power of the DPO2212A is on.

⑭ Power Switch

The main power switch of the DPO2212A.

⑮ Subpanel

To provide access to the internal range selector switches and analog output controls.

⑯ A1 Output Voltage Fine Control (FINE)

For fine control of A1 analog output voltage. 1-turn potentiometer. Screwdriver adjustment type.

⑰ A1 Output Voltage Coarse Control (COARSE)

For coarse control of A1 analog output voltage. 20-turn potentiometer. Screwdriver adjustment type.

⑱ A1 Output Offset Control (0.V)

For offset control of A1 analog output. Screwdriver adjustment potentiometer.

⑲ A1 Output Range Switch ( ⊓ H ⊓ L )

For A1 analog output range selection. The popped-up state (the button surface is nearly flush with the panel surface) is for the high range; the pushed-in state is for the low range.

⑳ A2 Output Voltage Fine Control (FINE)

For fine control of A2 analog output.

㉑ A2 Output Voltage Coarse Control (COARSE)

For coarse control of A2 analog output. 20-turn potentiometer. Screwdriver adjustment type.

㉒ A2 Output Offset Control (0.V)

For offset control of A2 analog output. Screwdriver adjustment potentiometer.

㉓ A2 Output Range Switch ( ⊓ H ⊓ L )

For A2 analog output range selection. The popped-up state (the pushbutton surface is nearly flush with the panel surface) is for the high range; The pushed-in state is for the low range.

㉔ A3 Output Voltage Control (F.S)

To control the analog output of A3. Screwdriver adjustment potentiometer.

㉕ A3 Offset Control

To control the offset of analog output of A3. Screwdriver adjustment potentiometer.

## 3-3. Connections and Settings

### 3-3-1. Connection Between DPO2212A and GP-IB Bus Cable

○ Connect the GP-IB bus cable to the GP-IB connector of the DPO2212A.

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**⚠CAUTION** • Never connect or disconnect the connectors when the power of the DPO2212A is on or when the bus is in operation. Such will cause erroneous operations and failures.

Securely fix the GP-IB bus cable connector to the GP-IB connector of the DPO2212A with screws.

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### 3-3-2. Setting Address

○ An address for the DPO2212A on the GP-IB bus can be set with the ADDRESS switch. The switch has eight element switches and five of which are used as digital switches to set an address for the DPO2212A. An address number can be set with a binary number, within a range of decimal 0 to 30. In the example shown in Figure 3-4, the digital switches are set for digital "10100", or decimal 20.

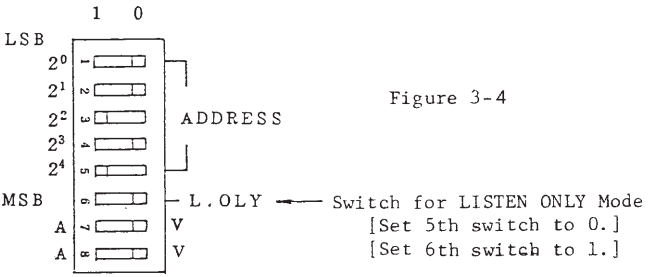



Figure 3-4

## 3-4. Operating Instructions for Analog Outputs

### 3-4-1. Connection to Power Supply

Connect each output signal of the DPO2212A to the "terminal for the output voltage control by external voltage signal" or to the "terminal output current control by external voltage signal" of the power supply to be controlled, referring to Section "Applications" of the instruction manual of the power supply. When doing this, observe the following instructions also.

- Use a stranded pair of wires or a shielded cable. Ground the shielding wire of each shielded cable as shown in the electrical connection examples on subsequent pages.
- Do not run the shielded cable for a long distance, lest it should pick up noise. It should not exceed 2 meters (0.56 feet).
- Be sure to ground the GND terminal of the power supply and that of the DPO2212A in order to suppress noise.

1) Examples of Connections to Power Supplies

○ PAA Series (A1 for output voltage control and A2 for output current control)

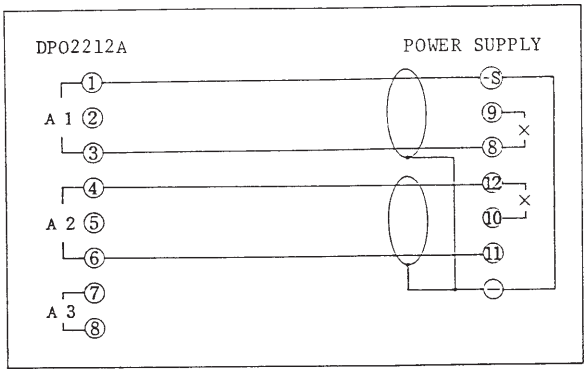



Figure 3-5

Note: Of the PAA Series Power Supplies, REMOTE/LOCAL mode selection by the rear panel switch of the DPO2212A is unavailable.

○ PAB-A Series
(A1 for output current or voltage control)

Selection between output voltage control and output current control should be done inside the PAB-A Power Supply.

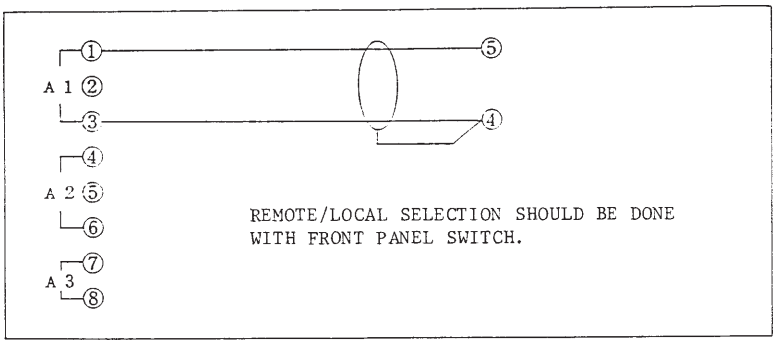



Figure 3-6

○ PAD-L and PAD-LP Series
Types 0 and I2 (A1 for output voltage control and A2 for output current control)

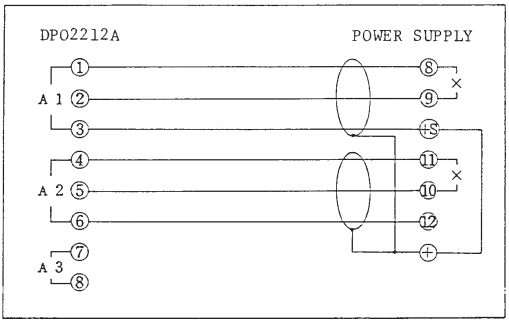



Figure 3-7

Type I3 (A1 for output voltage control and A2 for output current control)

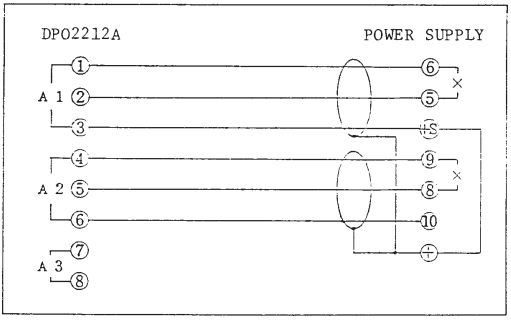



Figure 3-8

Types II, III, IV, V, VI (A1 for output voltage control and A2 for output current control)

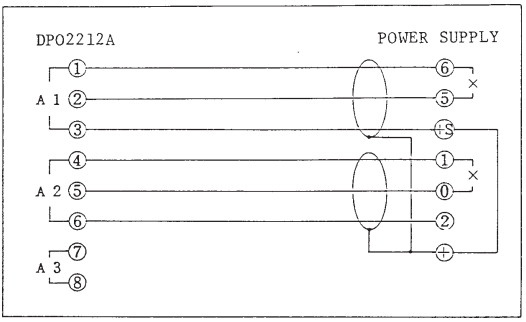



Figure 3-9

○ PAE Series (A1 for output voltage control and A2 for output current control)

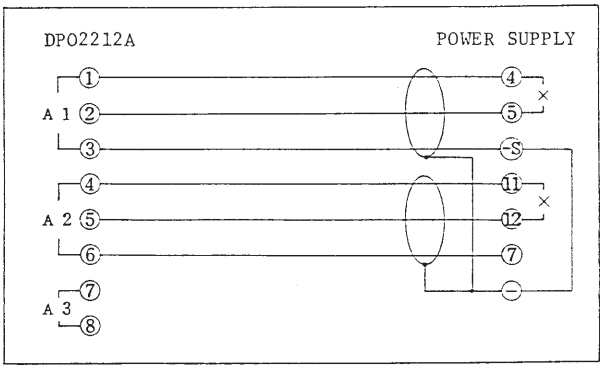



Figure 3-10

○ PAK Series (A1 for output voltage control and A2 for output current control)

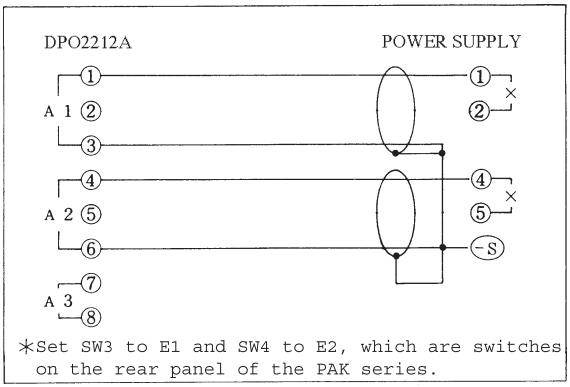



Figure 3-11

* To switch between Remote and Local, use SW1 and SW2 on the rear panel of the PAK series.

○ PAL and PAL-LP Series
(A1 for output voltage control and A2 for output current control)

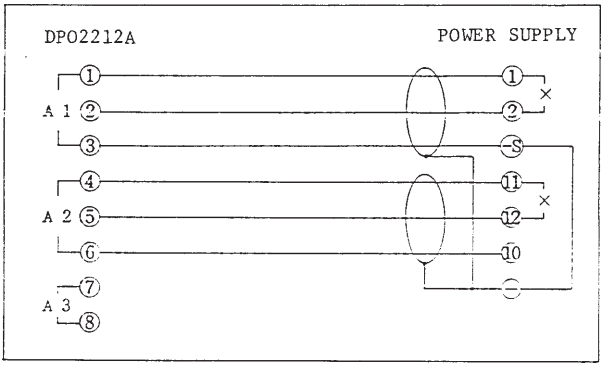



Figure 3-12

○ PAN Series (A1 for output voltage control and A2 for output current control)

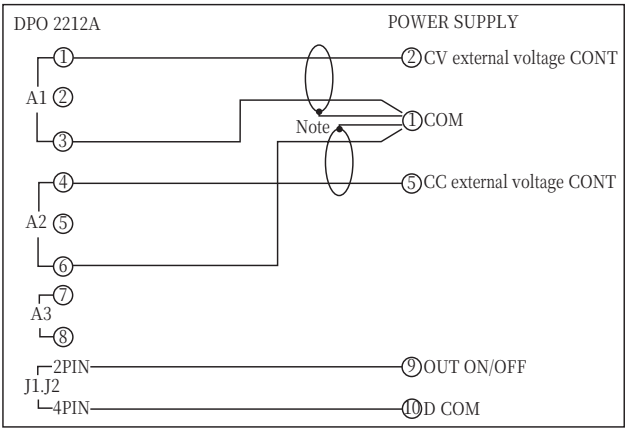



Figure 3-13

Note:When connecting a shield to the DPO2212A, insulate the shield without connecting it to the case of the power supply.

* To switch between Remote and Local, use the switch on the control panel of the PAN series. For details, refer to the operation manual of the PAN series.

○ PAN-A Series
(A1 for output voltage control and A2 for output current control)

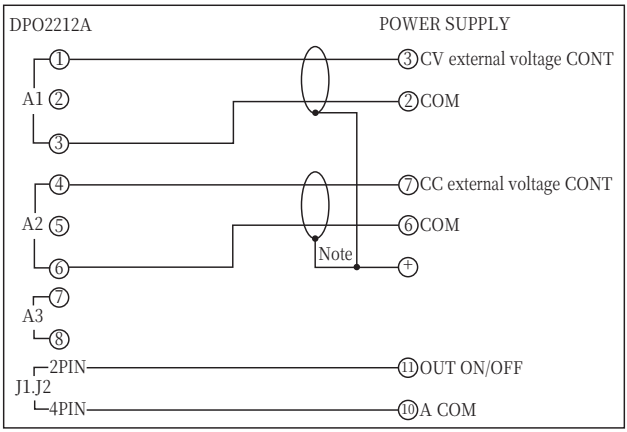



Figure 3-14

Note: When connecting a shield to the DPO2212A, insulate the shield without connecting it to the case of the power supply.

* To switch between Remote and Local, use the switch on the control panel of the PAN-A series. For details, refer to the operation manual of the PAN-A series.

○ PAR Series (A1 for output voltage control and A2 for output current control)

To control output voltage and output current with the DPO2212A, optional remote control board for the PAR series is necessary.

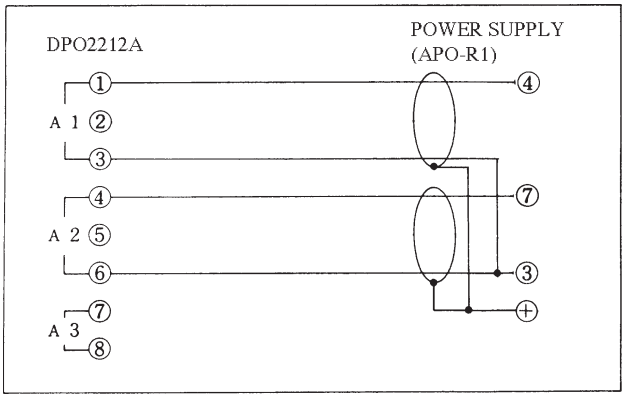



Figure 3-15

* To switch between Remote and Local, use the remote/ local switch on the front panel of the PAR series. For details, refer to the operation manual of the PAR series.

○ PHS Series (A1 for output voltage control)

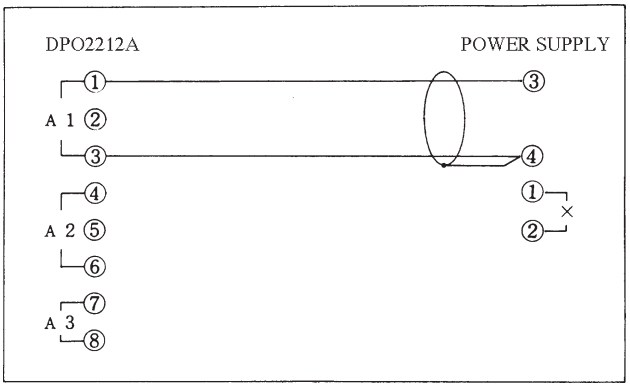



Figure 3-16

○ PLZ-W Series
(A1 is used to control output (load) current. A2 is used to control output (load) voltage.)

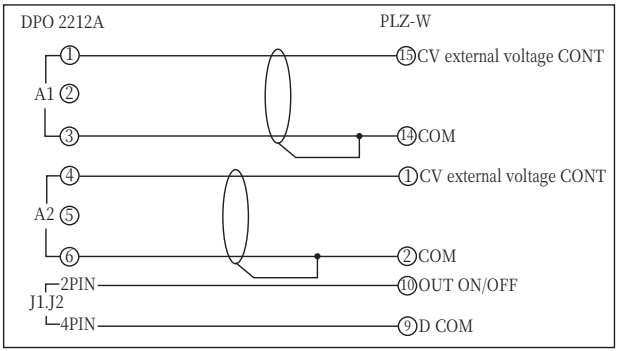



Figure 3-17

* The output range of the DPO2212A is the HI range.
* To switch between Remote and Local, use the function switch on the front panel of the PLZ-W series. For details, refer to the operation manual of the PLZ-W series.

○ PLZ-W2 and PLZ-W2A Series (A1 is used to control output (load) current.)

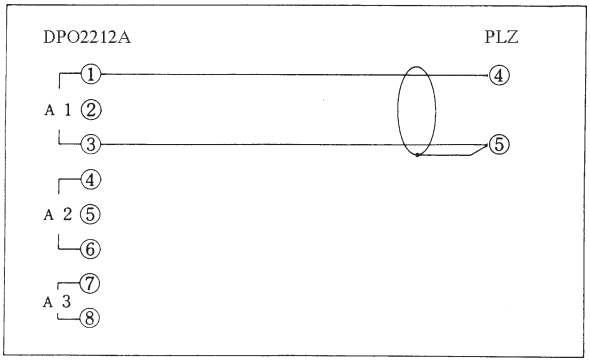



Figure 3-18

* To switch between Remote and Local, use the INT/EXT switch on the front panel of the PLZ-W2 or PLZ-W2A series. For details, refer to the operation manual of the PLZ-W2 or PLZ-W2A series.

○ PLZ-WU Series (A1 is used to control output (load) current.)

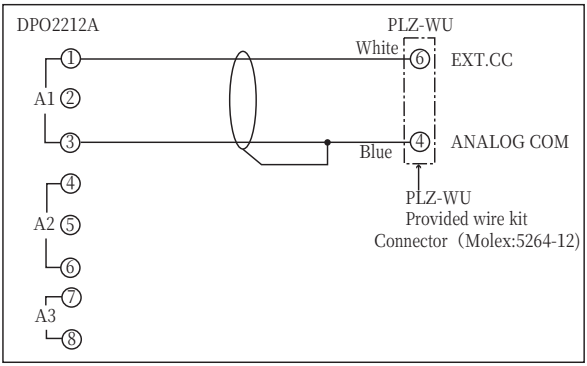



Figure 3-19

* The output range of the DPO2212A is the HI range.
* To switch between Remote and Local, use the EXT/INT switch on the front panel of the PLZ-WU series. For details, refer to the operation manual of the PLZ-WU series.

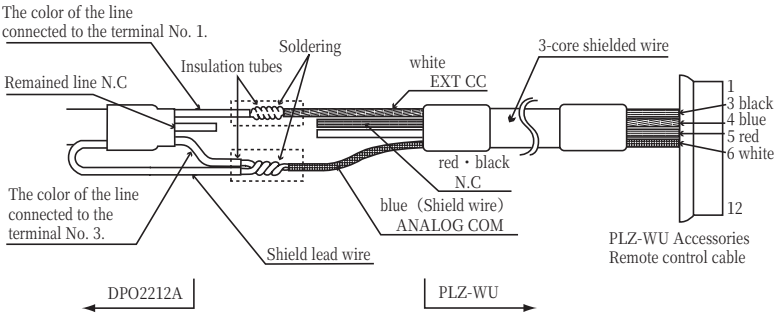



Figure 3-20

* Cut the cable end with the shield lead wire of the provided wire kit sample (3-core shielded wire) in DPO2212A, and connect it to the provided control wire kit in PLZ-WU as shown in Fig. 3-20. Insulate the soldered part with an insulation shrinkage tube.

○ PMC-A Series
(A1 for output voltage control and A2 for output current control)

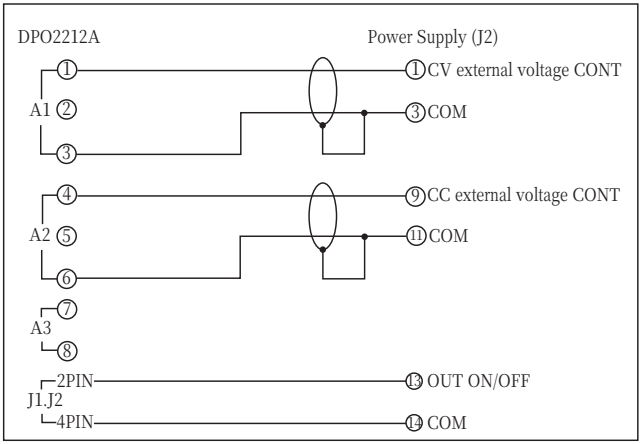



Figure 3-21

* The output range of the DPO2212A is the HI range.
* To switch between Remote and Local, use the EXT/INT switch on the front panel of the PMC-A series. For details, refer to the operation manual of the PMC-A series.

○ Wiring of shield wire between PMC-A and DPO2212A

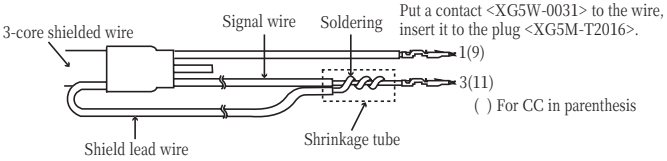



Figure 3-22

* The output range of the DPO2212A is the HI range.
* The provided wire sample in DPO2212A is the 3-core shielded wire which crimping terminals are attached to both ends of the wire. Cut crimping terminals of the power supply side (the cable end with the shield lead wire) off the wire. Put the plug (provided in PMC-A) to the wire as shown in PMC-A operation manual.
* Solder the shield wire and the signal wire connected to external control terminals (pin number 3 and 11). Insulate the soldered part with an insulation shrinkage tube. See Fig. 3-22.

3-4-2. Code Format Setting

1) Code Formats

The DPO2212A operates with ASCII codes received via the GP-IB bus. Normally, the computer provides programs in which the codes for controlling the DPO2212A are stated with characters, and converts them into ASCII codes and sends them onto the GP-IB bus.

To control each channel of the DPO2212A, the computer should send ASCII codes as shown below. The delimiter is (CR). EOI and (LF), if any, are ignored.

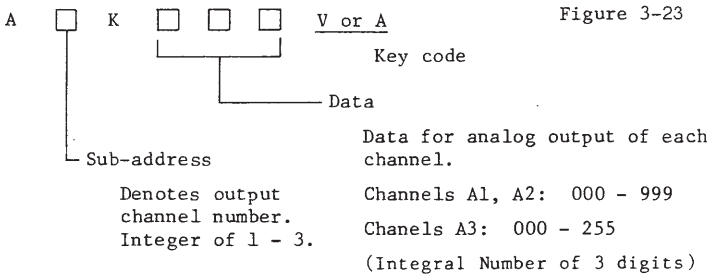



Figure 3-23

2) Key Code Setting

The "V or A" section shown in Figure 3-14 is for a key code. This section is used to select either V or A with the 7th or 8th digital switch on the rear panel. The 7th switch is to set a key code for channel A1 and the 8th switch is to set a key code for channel A2. The key code of channel A3 is fixed at V.

As you throw the switch to V, the code format becomes

A □ K □ □ □ V.

As you throw the switch to A, the code format becomes

A □ K □ □ □ A.

### 3-4-3. Overall System Adjustment

When adjustment is made for the overall system comprised of the DPO2212A and power supply, the front panel controls (potentiometers) of the power supply may affect the set value even when setting for the output is done in the remote mode as described later. To prevent this, set at first the front panel controls to the maximum positions (clockwise extreme positions).

Set the REMOTE/LOCAL switch of the DPO2212A to the LOCAL state.

Allow a stabilization period of about 30 minutes after turning on the DPO2212A and power supply.

1) Measuring Instrument and Device

- For measurement, use an instrument which has an accuracy of approximately 1/5 times or thereabout of the setting accuracy. When the setting accuracy is 12 bits (3 digits BCD), a digital multimeter of 5-1/2 or 6 digits is most recommendable.

- For the voltage-drop resistor that is inserted in a circuit to measure its current in terms of voltage, use a well calibrated resistor.

2) Range Setting

- The ranges of the remote control voltages differ by the models of power supplies. Select a range to suit that of the power supply to be controlled, referring to its instruction manual.

  H range: 8.5 V - 10.2 V
  L range: 0.25 V - 1.5 V

  To gain access to the range switch, remove the subpanel of the front panel. The pressed-in state (⊓) of the switch is for the L range and the popped-up state (⊓) is for the H range. (See Figure 3-5.)

3) Offset Adjustment

The power supply is with positive offset as shown in Figure 3-24. By letting the DPO2212A provide a corresponding positive offset as shown in Figure 3-25, offsetless relationship between input data and power supply output can be obtained as shown in Figure 3-26.

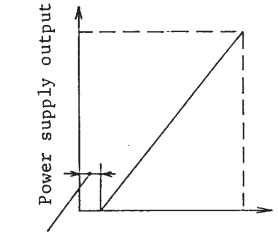



Figure 3-24

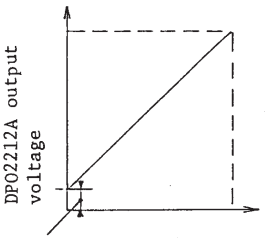



Figure 3-25

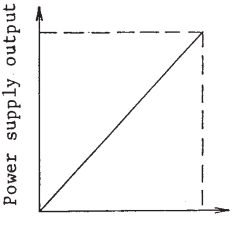



Figure 3-26

- o If the offset of the power supply is more than can be balanced out by the offset function of the DPO2212A, adjust the offset of the power supply with the OFFSET control (screwdriver adjustment potentiometer) on the front panel of the power supply. (Some of the PAL Series Power Supplies require that the subpanel be removed to gain access to this control.)

- o To gain access to the OFFSET controls of the DPO2212A, remove the subpanel of the front panel.

- o Be sure to turn on the DPO2212A first and the power supply next.

4) Adjustment of Maximum Output

The maximum output voltage or current of the power supply should be adjusted with the COARSE and FINE output voltage controls of the DPO2212A. (See Figure 3-3.) Apply the maximum data from the computer and adjust the controls so that the required voltage or current is obtained. The maximum data of channel A1 or A2 (12-bit resolution) is 999 and that of channel A3 (8-bit resolution) is 255.

### 3-4-4. Notes for Use of System

1) Sequence of Power Turn On or Off

- Turn on or off the powers of the DPO2212A and power supply in the following sequences:

To turn on: ① DPO2212A — ② POWER SUPPLY

To turn off: ① POWER SUPPLY — ② DPO2212A

If the powers are turned on or off in a wrong sequence, overshoots and other abnormality may result. The correct sequences are especially important when controlling the output current of Type I3, II, III, IV, V or VI Power Supply of PAD-L (LP) Series.

When the powers are turned on, the output is initialized at 0 V. If the powers are turned off after setting the output and then the powers are turned on again, the power supply will be initialized at 0 V again.

2) Recommendation of Use of OVP Function

When remote-controlling the output voltage, it is highly recommended to use the overvoltage protector (OVP) of the power supply to be controlled, from the viewpoint of system safety.

3) Recommendation of Use of Guard Cap

- Depending on models of power supplies, the output may vary if a front panel control (output voltage control or output current control) is varied. Models and controls which affect the output are shown in Table 3-3. If the operator inadvertently change the setting of such front panel control, the output value may vary from that set by the computer and troubles may result. In order to guard against this type of troubles, use the guard caps which are supplied as accessories of the power supply. (For how to use the guard caps, refer to the instructions for the guard caps.)

Table 3-3

| | | Output voltage control | Output current control |
|---|---|---|---|
| ∗1 | PAA | ○ | × |
| | PAB-A | ○ | ○ |
| ∗2 | PAD-L(-LP)<br>TYPE 0・$I_1$・$I_2$ | ○ | × |
| ∗2 | PAD-L(-LP)<br>TYPE $I_3$・II・III・IV・V・VI | × | × |
| | PAE | ○ | ○ |
| | PAL(-P) | ○ | ○ |
| | PAN(-A) | ○ | ○ |
| | PLZ-W | — | ○ |
| | PLZ-W2 | — | × |
| | PLZ-W2A | — | ○ |
| | PLZ-WU | — | ○ |
| | PMC-A | × | × |

○:The front-panel control affects the remote setting.

×:The front-panel control does not affect the remote setting.

*1:No guard caps accompany the PAA Series Power Supplies.

To install guard caps on them, modification is necessary.

For the modification, consult your Kikusui agent.

*2:Of PAD500-1.2L or PAD600-1.5L, the output voltage control alone affects the remote setting.

## 3-5. Instructions for Digital I/O

### 3-5-1. Interruption

The digital I/O connectors of the DPO2212A have 4-bit interrupt signal input pins and deliver a service request (SRQ) signal onto the GP-IB bus when an interruption has occurred. They also deliver a status byte in response to poll.

1) Digital I/O Connector Pin Layout and Circuitry

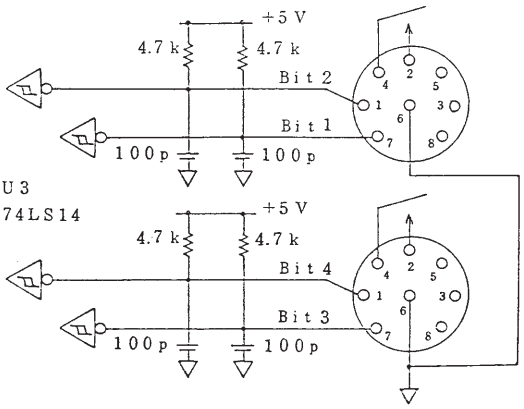



Figure 3-27

Digital I/O Connector J1

As viewed from rear panel

Digital I/O Connector J2

Table 3-4

| | Interrupt signal input | Contact signal output* |
|---|---|---|
| J1 | 1, 7, 6 | 2, 4 |
| J2 | 1, 7, 6 | 2, 4 |

} Pin No.

*: Contact ratings: 24 V DC, 0.1 A
120 V AC, 0.1 A

Withstanding voltage
of contacts of J1, J2: 500 V AC, 1 minute

- To connect the digital I/O to the power supply or other device, use a stranded pair of wires or a shielded cable for the digital signal. When a shielded cable is used, connect its outer shielding braided wire to the GND terminal.

2) Service Request (SRQ)

An SRQ signal is generated as a logical sum signal (OR signal) of the service request signals of the DPO2212A. Also, a status byte signal is sent onto the GP-IB bus in response to serial poll. The signals are of the negative logic (the L level is for true) and an SRQ signal is generated at the fall down edge of the signal from H level to the L level. Timing of interruption is shown in Figure 3-28.

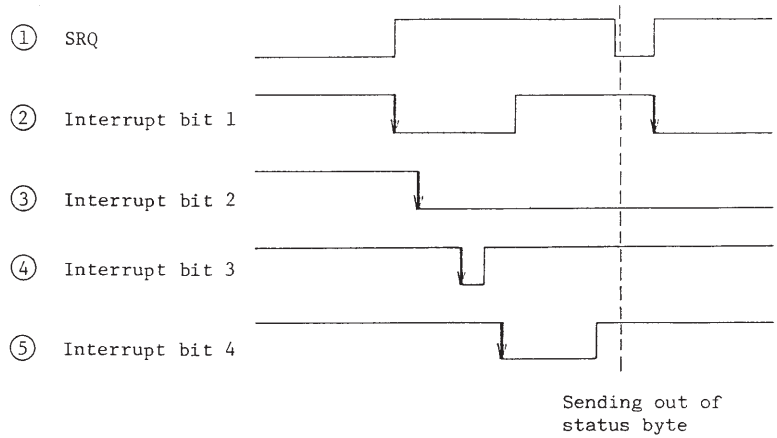



Figure 3-28

3) Status Byte

o Status byte in response to serial polling:

For the status byte which is sent onto the GP-IB bus in response to serial poll from the computer when an SRQ has occurred, the pins of the digital I/O connectors are assigned as shown in Table 3-5.

| Pin No. | Pin 1 of J2 | Pin 7 of J2 | Pin 1 of J1 | Pin 7 of J1 |
|---|---|---|---|---|
| Bit No. | Bit 4 | Bit 3 | Bit 2 | Bit 1 |

Table 3-5

MSB LSB

| 0 | 1 | 0 | 0 | bit 4 | bit 3 | bit 2 | bit 1 |
|---|---|---|---|---|---|---|---|

Means SRQ generated.

Figure 3-29

o In the case of the example shown in Figure 3-28, the status byte is as shown in Figure 3-30.

MSB LSB

| 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
|---|---|---|---|---|---|---|---|

Figure 3-30

- Status byte which can be sent out at any time:

  As the DPO2212A is designated for a talker by the computer, it sends onto the GP-IB bus a status byte which represents the logic status of the interrupt signal input pins of the digital I/O connectors. The delimiter generated in this case is EOI.

MSB LSB

| 0 | 0 | 0 | 0 | bit 4 | bit 3 | bit 2 | bit 1 |
|---|---|---|---|---|---|---|---|

Figure 3-31

### 3-5-2. Contact Signal Output

When the DPO2212A has received an SDC (Selected Device Clear) command or a DC (Device Clear) command via the GP-IB bus, it delivers a relay contact signal (make-contact signal) through the digital I/O connectors.

1) Set

When an SDC or DC command in ASCII code is sent from the computer, a make-contact signal is delivered through the digital I/O connectors. (See Figure 3-27.) The two contacts are made concurrently.

2) Reset

To break the contact which has been made, the following code should be sent from the computer.

RESET (or abbreviation R)

The delimiter in either case is (CR). EOI and (LF), if any, are ignored.

### 3-5-3. Indicator Lamps

The DPO2212A has LISTEN, TALK, SRQ, and POWER indicator lamps.

- The LISTEN lamp illuminates during the period the DPO2212A is designated as a listener to receive data.
- The TALK lamp illuminates during the period the DPO2212A is designated as a talker to send out its status byte.

- The SRQ lamp illuminates when an SRQ signal is generated and sent out onto the GP-IB bus. It goes off immediately before sending the status byte in response to serial poll.
- The POWER lamp illuminates to indicate that the power of the DPO2212A is on.

# 4. PROGRAMMING EXAMPLES

## 4-1. Notes for Programming

### 1) Program Formats

- For data in any program statement, be sure to specify it with an integral number of 3 digits as shown in Table 4-1. (Refer to the programming examples.) The output does not vary unless 3 digits are specified.

| Data to be specified | Data to be programmed |
|---|---|
| 0 | 000 |
| 9 | 009 |
| 99 | 099 |
| 255 | 255 |
| 999 | 999 |

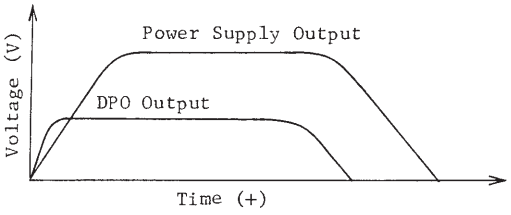
Table 4-1

- Only V or A is valid for the key code. If other letter or character is specified for the key code, the output does not change.

### 2) Rise Time and Fall Time of Power Supply Output

Although the programmer output responds quite rapidly (its output rise time and fall time are approximately 200 µs), the power supply responds only very slowly (its output rise time and fall time are approximately 100 ms - 300 ms as may differ by the load conditions). In general, the larger the current rating of the power supply, the slower is its output response.

Thus, the operation speed of the system is limited by the inherent rise time and fall time of the power supply. Programming should be made within these limits of response speed. That is, wait time to cope with the rise time and fall time of the power supply should be specified in the program.

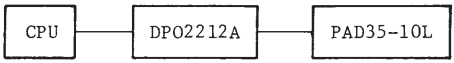


## 4-2. Programming Examples

Examples of programs with PC8001, PC8011, or PC8097 Computer System are shown in this section.

### A. Output Setting Program (1)

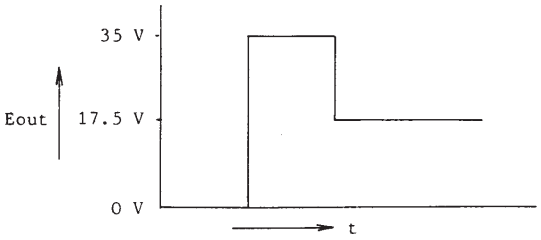
- o For programming with data which has been calculated beforehand
- o System structure




| | |
|---|---|
| Channel A1 | Output voltage setting |
| Channel A2 | Output current setting |

```
 10 REM*****FUNDAMENTAL*****
 20 DEFUSR 0=&H6000 ---┐
 30 A=USR0 (1) --------┘------ GP-IB initialization
 40 A$="000"
 50 B$="999"
 60 C$="500"                          *1
 70 PRINT@8;"A2K"+C$+"A" -------- Output current setting
                                  (Current limit setting)
 80 PRINT@8;"A1K"+A$+"V" -------- Output voltage setting (1)
 90 GOSUB 200
100 PRINT@8;"A1K"+B$+"V" -------- Output voltage setting (2)
110 GOSUB 200
120 PRINT@8;"A1K"+C$+"V" -------- Output voltage setting (3)
130 GOSUB 200
140 END
200 REM===Time interval===
210 FOR A=0 TO 200: NEXT A ------ Wait time
220 RETURN
```

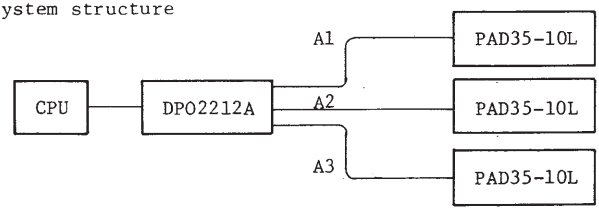
*1: For output voltage setting, set the output current first and the output voltage next.



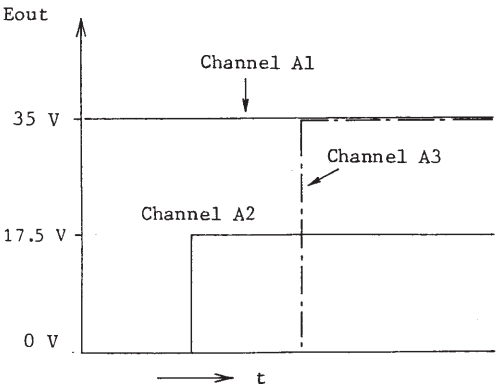
B. Output Setting Program (2)

o For programming output voltages of three power supplies with data which has been calculated beforehand

o System structure



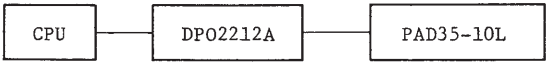

```
 10 REM*****FUNDAMENTAL*****
 20 DEFUSR 0=&H6000 ----┐
 30 A=USR0 (1) ---------┘------ GP-IB initialization
 40 A$="999";"OUTPUT35V
 50 B$="500";"OUTPUT17.5V
 60 C$="255";"OUTPUT35V
 70 PRINT@8;"A1K"+A$+"V"  ------ Channel A1 output voltage setting
 80 GOSUB200
 90 PRINT@8;"A2K"+B$+"V"  ------ Channel A2 output voltage setting
100 GOSUB200
110 PRINT@8;"A3K"+C$+"V"  ------ Channel A3 output voltage setting
120 GOSUB200
130 END
200 REM===time interval===
210 FOR A=0 TO 200; NEXT A ----- Wait time setting
220 RETURN
```



C. Output Setting Program (3)

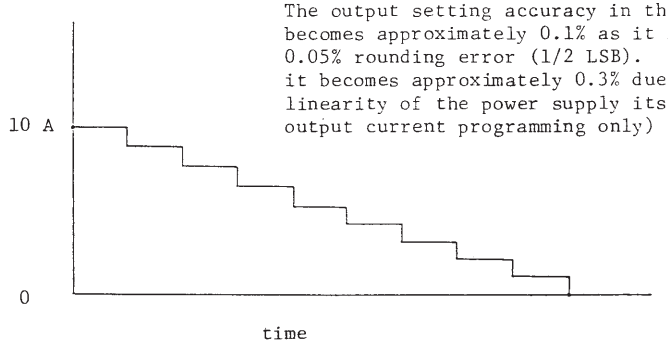
o To work out a program which involves a calculation formula

o System structure




| | |
|---|---|
| Channel A1 | Output voltage setting |
| Channel A2 | Output current setting |

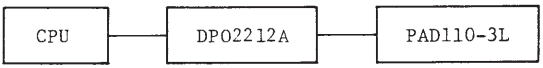
```
 10 '*****fundamental*****
 20 DEFUSR 0=&H6000 ----┐
                        ├------ GP-IB initialization
 30 A=USR0 (1) --------┘
 40 PRINT@8;"A1K999V" ---------- Output voltage setting *1
 50 FOR X=10 TO 0 STEP-1
 60 GOSUB300
 70 PRINT@8;"A2K"+B$+"A" ------- Output current setting
 80 GOSUB200
 90 NEXT X
100 END
110 '
120 '
200 '===time interval===
210 FOR A=0 TO 200; NEXT A
220 RETURN
300 '====sub=======
310 E=INT(X*999/10+.5) --------- Calculation program
320 F=E+1000 ---------┐
                      |
330 A$=STR$(F)        ├------- Statements to output data
                      |        with 3 characters
340 B$=RIGHT$(A$,3) ----┘
350 RETURN
```




The output setting accuracy in this case becomes approximately 0.1% as it involves 0.05% rounding error (1/2 LSB). Actually, it becomes approximately 0.3% due to the linearity of the power supply itself. (For output current programming only)

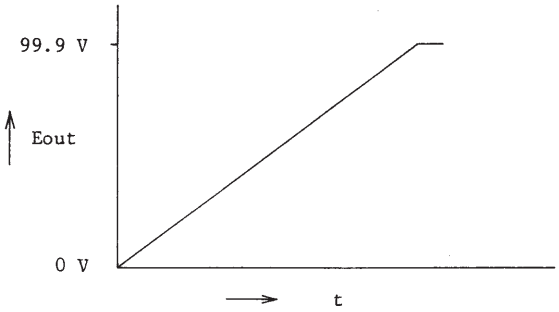
D. To set the maximum output value at the value same with the maximum data value

- For programming for PAD110-3L with its analog system adjusted so that its output voltage becomes 99.9 V when input data is 999.
- System structure



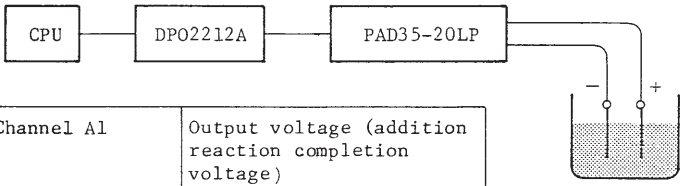

| | |
|---|---|
| Channel A1 | Output voltage |
| Channel A2 | Output current |

```
 10 '*****fundamental*****
 20 '**0V TO 99.9V step, 1V**
 30 DEFUSR 0=&H6000 ---┐
 40 A=USR0(1) ---------┘-------- GP-IB initialization
 50 PRINT@8;"A2K999A" ---------- Output current (current limit)
                                 setting
 60 FOR X=0 TO 999 STEP 1
 70 GOSUB300
 80 PRINT@8;"A1K"+B$+"V"  -------- Output voltage setting
 90 GOSUB200
100 NEXT X
110 END
120 '
130 '
200 '===time interval====
210 FOR A=0 TO 200: NEXT A
220 RETURN
300 '=====sub=======
310 F=E+1000 --------┐
320 A$=STR$(F)       ├------- Statements to deliver output
330 B$=RIGHT$(A$,3)  |        with 3 characters
340 RETURN ----------┘
```



E. Control of Chemical Addition Reaction

o In chemical addition reaction, to detect transition of power supply from CC to CV as completion of addition reaction and to send a service request signal to the computer to turn off the power supply




| | |
|---|---|
| Channel A1 | Output voltage (addition reaction completion voltage) |
| Channel A2 | Output current (addition reaction current) |
| Interrupt signal (service request signal) | o Bit 1: Change from CC to CV<br>o Bit 2: Power off |

```
10 DEFUSR 0=&H6000 ----┐
                       ├----- GP-IB initialization
20 A=USR0(1) ---------┘
30 SRQ DISABLE
40 ON SRQ GOSUB 300 ---------- Service request destination
                               address setting
50 PRINT@7;"A1K500V" --------- Output voltage setting (addition
                               reaction completion voltage setting)
60 SRQ ENABLE ---------------- Service request enable
70 GOSUB 600 ---------┐
                      ├----- Power supply operation check
80 IF B=1 THEN 70 ----┘
90 PRINT@;"A2K888A" ---------- Output current setting
100 A=5*5;GOTO100 ------------ To wait for service request
                               occurrence (or other processing
                               program)
110 END
120 '
130 '
300 '====serial poll====
310 POLL 7, S
320 IF S=65 THEN GOSUB 400 ----┐
                               ├Status byte check
330 IF S=66 OR S=67 THEN GOTO 500┘
```

```
340 SRQ ENABLE: RETURN
350 '
360 '
400 '====power off====
410 GOSUB 600
420 IF E=0 THEN 450 ELSE 430
430 WBYTE&H3F,&H41,&H27,&H4; ---- Device clear
440 BEEP
450 RETURN
460 '
470 '
500 '====hatherd====
510 BEEP 1
520 END
530 '
540 '
600 '====read status====
610 FOR C=0 TO 200; NEXT C
620 RBYTE&H3F,&H21,&H47;B ------Digital I/O check
630 RETURN
```

## 5. OPERATING PRINCIPLE

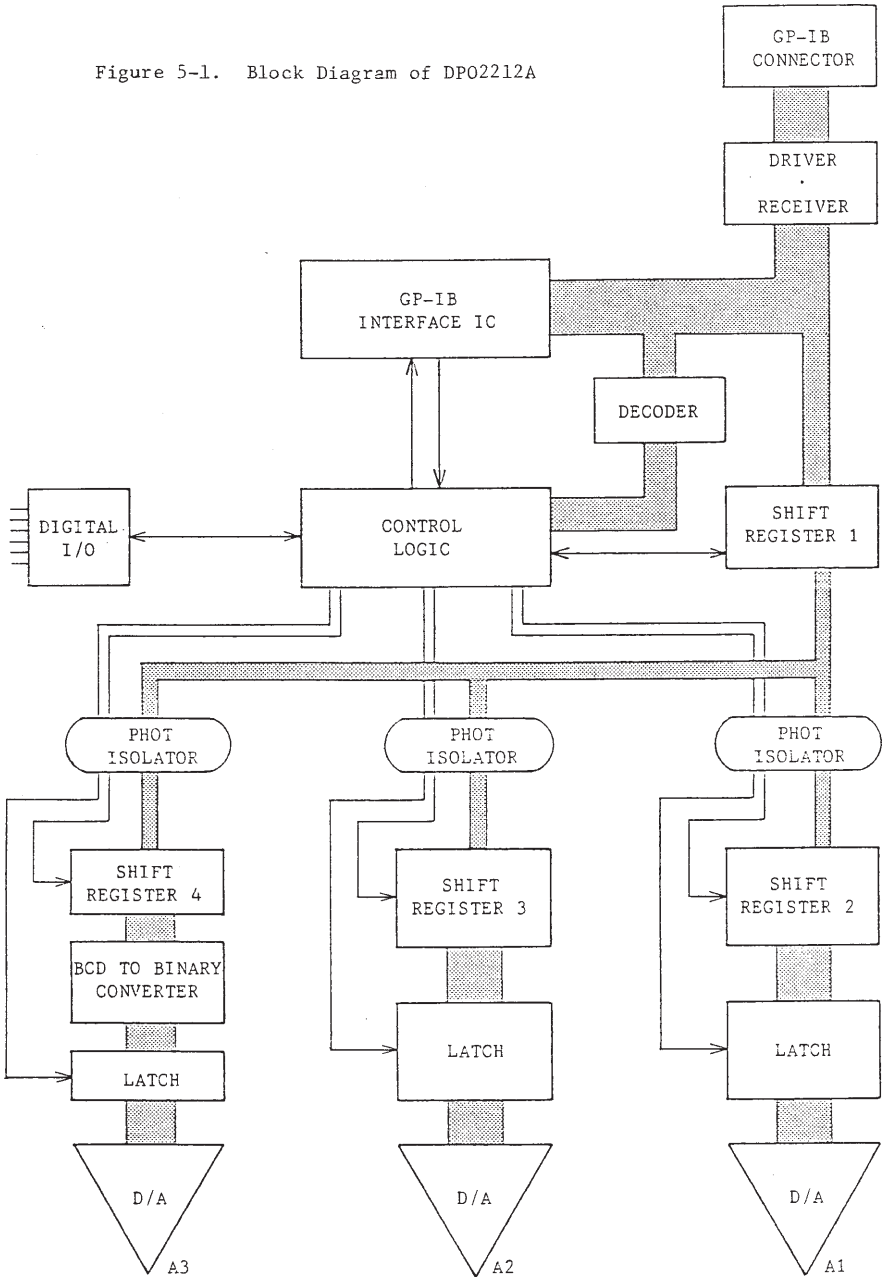
A block diagram of the DPO2212A is shown in Figure 5-1. Digital signals received through the GP-IB connector are in the ASCII code formats and are fed for timing to the internal control logic, color coded for coded/decoded. The output voltage data alone is fed to shift register 1 and then sent to shift registers 2, 3 and 4 via the photo-isolators being dictated by the control logic. Shift registers 2, 3 and 4 convert serial data into parallel data. Being dictated by the latch clock signal received from the control logic, the data is fed to the D/A converters in order to be converted into analog output signals.

Of channel A3, the BCD data of the shift register is converted into binary data and the full 8-bit data is fed to the D/A converter. The other D/A converters are BCD 3-digit type.

The GP-IB interface IC is for handshaking of the DPO2212A with the computer, and it provides handshaking timing for data, command, address and other signals conveyed via the GP-IB bus.

The digital I/O is dictated by the control logic circuit.

Figure 5-1. Block Diagram of DPO2212A



# 6. MAINTENANCE

## 6-1. Inspection and Adjustment

Periodically inspect and adjust the DPO2212A in order that it maintains its best performance for a long period of time.

1) Cleaning the DPO2212A

When the panel surfaces of the DPO2212A have become dirty, wipe them with a cloth moistened with neutral soapsuds or alcohol. Then, wipe them with a dry cloth. Never use thinner or benzene.

2) Inspecting the Power Cord

Inspect the cord and plug for damage and breakage.

3) Adjustment

Adjust the DPO2212A referring to Section 3-4-3 "Overall System Adjustment."

## 6-2. Troubleshooting

This section describes some symptoms of possible malfunctions encountered during use of the unit, along with appropriate remedies. Here, we provide five typical symptoms and possible check items for each;you simply find the relevant item. Ideally, you will be able to cure these symptoms without difficulty.
When you find a relevant item, follow the corresponding remedy. If this does not solve or improve the problem, or if no relevant item can be located, please contact Kikusui distributor/agent.

| Symptom | Check item | Probable cause |
|---|---|---|
| o Power indicator lamp does not turn on. | 1. Check that the power plug is not disconnected. | o Broken AC power cord |
| | 2. Check that the input power fuse is not blown out. | o AC line voltage is too high.<br>o AC line selector is not correctly set.<br>(Remedy the cause and then replace the fuse.) |
| | 3. Check whether the output can be set or not. | o If the output can be set, the lamp itself is defective. |
| o No output at all | 1. Software check | o Data is entered with lower-case letters.<br>o Data is not represented with three characters.<br>o Key code is invalid.<br>o Wrong address is set.<br>o No subaddress is set.<br>o Wrong characters are used.<br>o GP-IB start program of computer is not set.<br>o Invalid output statement. |
| | 2. Hardware check | o REMOTE/LOCAL switch is set to LOCAL.<br>o Fuse is blown out.<br>o Circuit failure |

| Symptom | Check item | Probable cause |
|---|---|---|
| o Unestablished output | 1. Software check | o Delimiter is not CR. (EOI and LF are ignored.)<br>o Software error |
| | 2. Hardware check | o GND terminal is not connected to ground.<br>o Large noise is generated by nearby devices.<br>o AC line voltage is high. |
| o Insufficient output | 1. Software check<br>2. Hardware check | o Input data is small.<br>o RANGE switch is set to L. |
| o Unstable output (large ripple) | 1. Check the AC line voltage. | o Line voltage is low.<br>o Line voltage selector setting is incorrect.<br>o Line voltage is not within the specification range. |
| | 2. (When drift is cause of trouble) | o Allow about 30 minutes of stabilization time. |