INSTRUCTION MANUAL

GP-IB PROGRAMMER

DPO2212

KIKUSUI ELECTRONICS CORPORATION

843652

Power Requirements of this Product

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

☐ Input voltage

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

☐ Input fuse

The rating of this product's input fuse is _____A, _____VAC, and _____.

WARNING

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

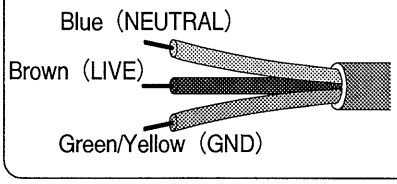
☐ AC power cable

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

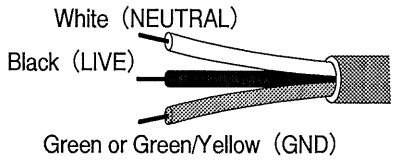
WARNING

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

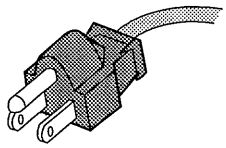
☐ Without a power plug



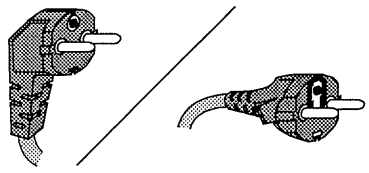
☐ Without a power plug



☐ Plugs for USA



☐ Plugs for Europe



☐ Provided by Kikusui agents

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

☐ Another Cable _____

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KIKUSUI

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1. GENERAL

1-1. General

Model DPO2212 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 DPO2212 provides an analog signal which is obtained by converting a digital signal received from the computer. The DPO2212 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 DPO2212. Refer also to the instruction manuals of the Power Supplies and Electronic Loads to be connected to the DPO2212.

2. SPECIFICATIONS

Specifications		
1. Digital Inputs	Applicable Standard	IEEE-488-1978
	Interface Functions	SH1, AH1, T6, L3, SR1, RL0, PP0, DC1, DT0, C0
	Input Connector	24-pin ribbon connector
	Address setting	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	No. of channels	1 channel
	Maximum Output Voltage *1	8.5 V - 10.2 V (H range)
	Variable Range	0.25 V - 1.5 V (L range)
	Maximum Output Current	3 mA
	Resolution	0.1% *2
	Accuracy	0.05% *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

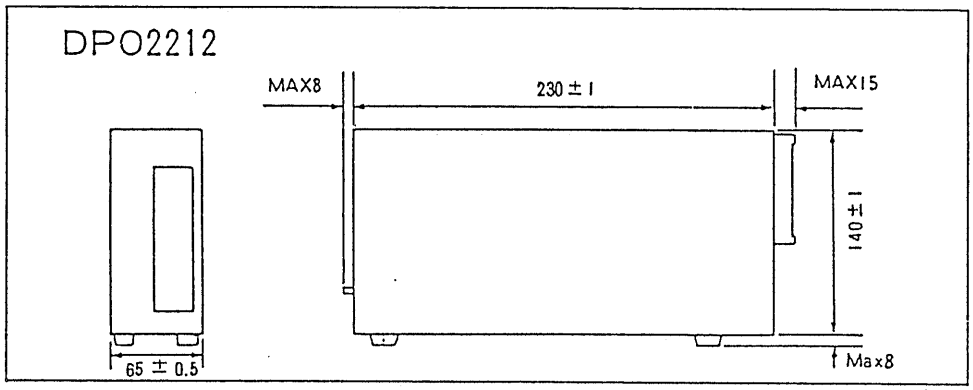
*4: Regulation against 0% - 100% change of load

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

Specification		
3. Optional Function		Remote/Local Selector switch
4. Interruption	Interruption Bits	2 bits × 1, negative logic, TTL level
	Input Connector	8-pin DIN connector
5. Contact Signal Output		1 contact
6. Ambient Temperature and Humidity		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 B: 98 V - 132 V; D: 195 V - 254 V One of A, B, C, D is selectable with line voltage selector on bottom.
8. Delectric Strength		
	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		13 VA
11. Dimensions		65 W × 140 H × 230 D mm (2.56 W × 5.51 H × 9.05 D in.) [Case dimensions: See the Case Dimension Drawing.]

12. Weight	Approx. 2.4 kg (5.3 lbs)
13. Accessories	8-pin DIN connectors 1 Fuse, 0.5 A 1 Fuse, 0.3 A 1 Line voltage selector plug 1 Instruction Manual 1

Case Dimension Drawing



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3. OPERATING INSTRUCTIONS

3-1. Notes Before Use

3-1-1. System Structure

When making up a system employing the DPO2212 and a power supply, be sure to fully study the specifications of both DPO2212 and power supply.

1) The major input/output specifications of the DPO2212 are as shown in Table 3-1.

Table 3-1

1. Analog output	12 bits (3 digits BCD)	×1 ch
2. Interruption	To J1	2 bits
3. Relay contact output (Make-contacts)	To J1	1 make-contact

2) The items which can be controlled by one DPO2212 for one power supply are as shown in Table 3-2.

Table 3-2

	Voltage	Current	*1 Mode Interruption	*2 Abnormality Interruption	*3 Power Off
PAD-L	o	o	×	×	o
PAD-LP	o	o	o	o	o
PAL	o	o	×	×	o
PAL-P	o	o	o	o	o
PAE	o	o	×	×	o
PAB-A	o	o	×	×	×
PAA *4	o	o	×	×	×
PLZ-W	o	o	×	×	×
PLZ-W2	×	o	×	×	×

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

*2: Of PAD-LP Types 0 and I2 and PAL-LP Type I2 Power Supplies, interruption is effected only when the OVP circuit has tripped. No interruption is effected when power is turned off.

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

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

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.

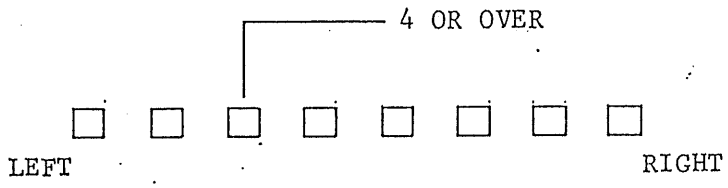

Figure 3-1

3-1-2. AC Line Voltage

1) Confirming the AC Line Voltage

Before connecting the DPO2212 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 DPO2212 as illustrated in Figure 3-2.

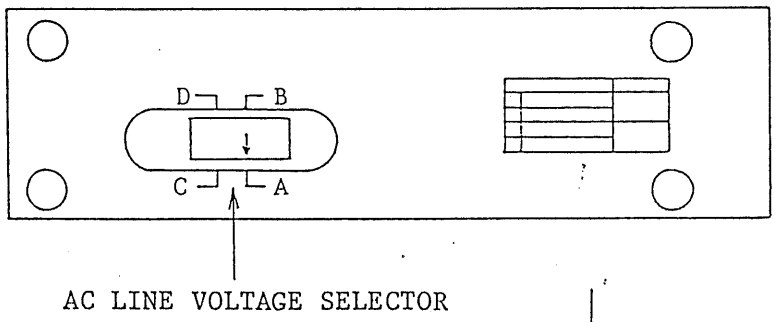

Figure 3-2

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) Modifying the AC Line Voltage

The DPO2212 is shipped with its AC line voltage selector set at range A, unless specified otherwise when ordering. However, the AC line voltage setting can be modified by the customer as indicated on the bottom of the DPO2212. When modifying the AC line voltage, be sure to observe the following instructions.

a) Be sure to disconnect the power plug of the DPO2212 from the AC line outlet.

b) Be sure to check that the fuse is a one corresponding to the AC line voltage and replace it, as required, with an accessory fuse.

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c) 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 DPO2212 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 DPO2212 is incorporated with provisions against noise, do not install it in a place where it may be subjected to unreasonably large noise. Pay attention also to noise suppression provisions of surrounding devices.

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3-2. Description of Components

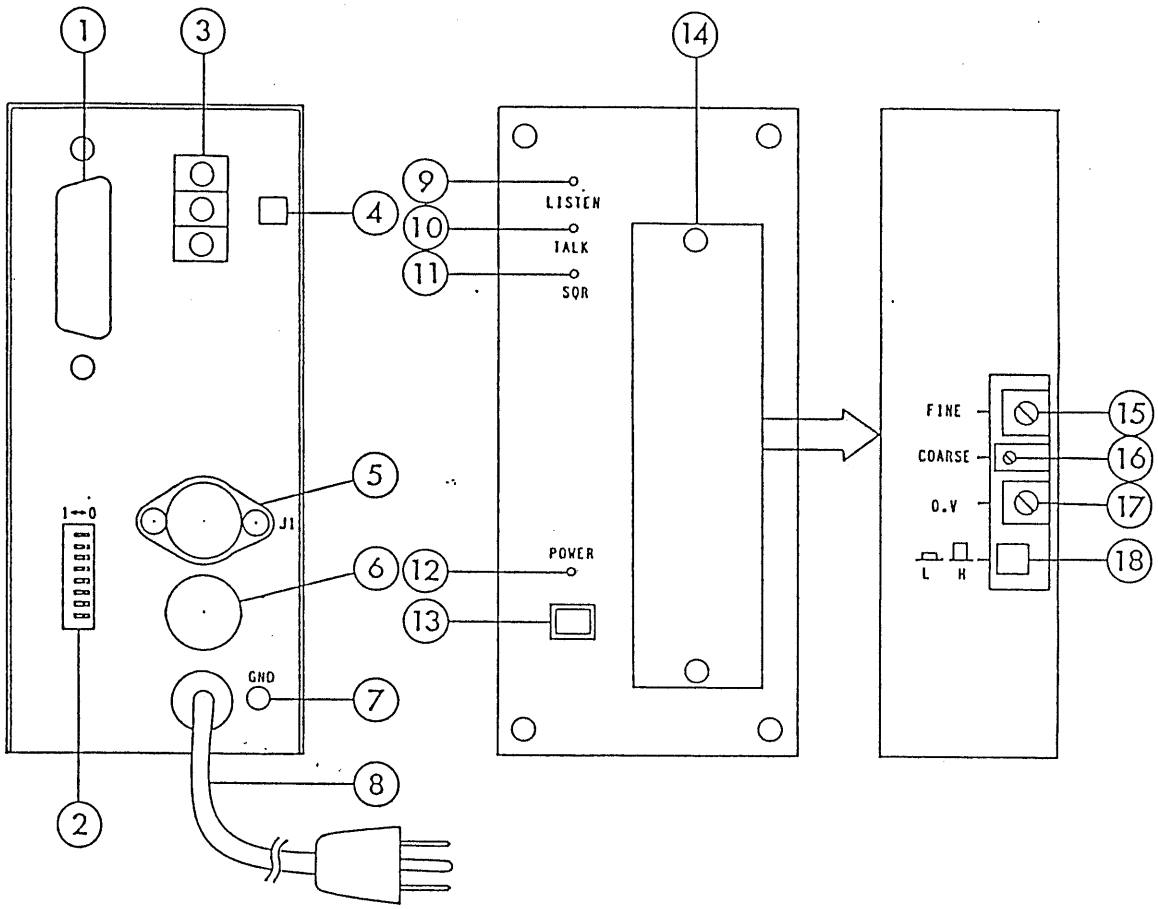

Figure 3-3

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 DPO2212 on the GP-IB system. This switch is used also to set the LISTEN ONLY mode and to set the key codes. (See Section 3-3-2.)

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③ Analog Output Terminals

Terminals for analog output. The analog output is used as an external control signal for the power supply unit. The terminals are of a binding screw type (M3).

④ Remote/Local Selector Switch

A switch to select either the remote mode or the local mode. When the output terminals are connected to the power supply as described later and this switch is thrown to the REMOTE position, the 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 Digital I/O Connector J1 (J1)

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

⑥ Fuse Holder

⑦ Ground Terminal (GND)

The terminal (M3 binding-screw terminal) to ground the DPO2212. [Be sure to ground this terminal for the sake of safety and to prevent erroneous operations which could be caused by external noise.]

⑧ Power Cord with Plug

⑨ Status Indicator Lamp (LISTEN)

This lamp (green LED) illuminates during the period the DPO2212 on the GP-IB bus is in the listener status.

⑩ Status Indicator Lamp (TALK)

This lamp (yellow LED) illuminates during the period the DPO2212 on the GP-IB bus is in the talker status. It illuminates when the DPO2212 is sending out its status byte or data.

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⑪ Status Indicator Lamp (SRQ)

This lamp (red LED) illuminates during the period the DPO2212 is sending out a service request signal onto the GP-IB bus.

⑫ Power Indicator Lamp (POWER)

This lamp (green LED) illuminates to indicate that the power of the DPO2212 is on.

⑬ Power Switch

The main power switch of the DPO2212.

⑭ Subpanel

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

⑮ Output Voltage Fine Control (FINE)

For fine control of analog output voltage. 1-turn potentiometer.

⑯ Output Voltage Coarse Control (COARSE)

For coarse control of analog output voltage. 20-turn potentiometer.

⑰ Output Offset Control (O.V)

For offset control of analog output.

⑱ Output Range Switch (H L)

For 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.

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3-3. Connections and Settings

3-3-1. Connection Between DPO2212 and GP-IB Bus Cable

- o Connect the GP-IB bus cable to the GP-IB connector of the DPO2212.

  Precautions: Never connect or disconnect the connectors when power of the DPO2212 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 DPO2212 with screws.

3-3-2. Address Setting

- o An address for the DPO2212 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 DPO2212. 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 binary "10100", or decimal 20.

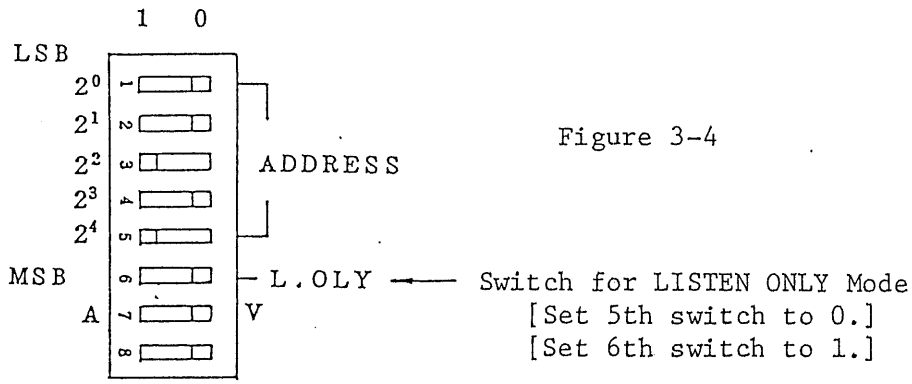

Figure 3-4

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3-4. Operating Instructions for Analog Output

3-4-1. Connection to Power Supply

Connect the output signal of the DPO2212 to the "terminal for the output voltage control by external voltage signal" or to the "terminal for 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.

- o 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.
- o Do not run the shielded cable for a long distance, lest it should pick up noise. It should not exceed 2 meters (6.5 feet).
- o Be sure to ground the GND terminal of the power supply and that of the DPO2212 in order to suppress noise.

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1) Examples of Connections to Power Supplies

o PAD-L and PAD-LP Series

Types 0 and I2

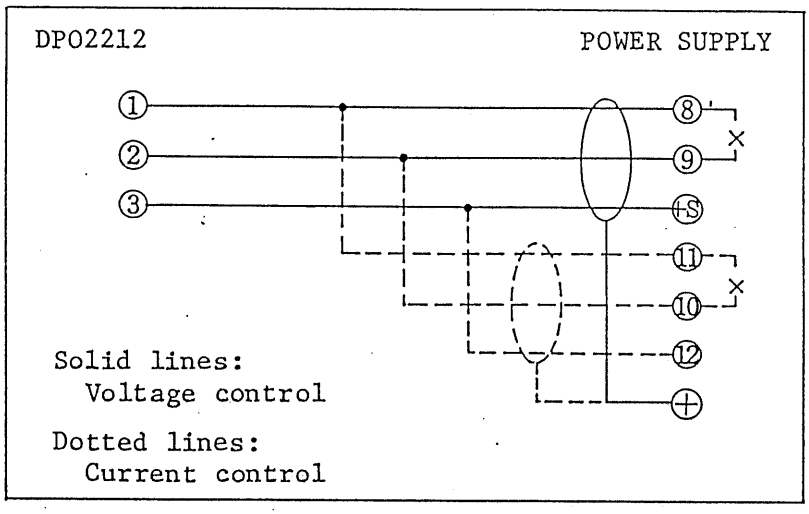

Figure 3-5

Type I3

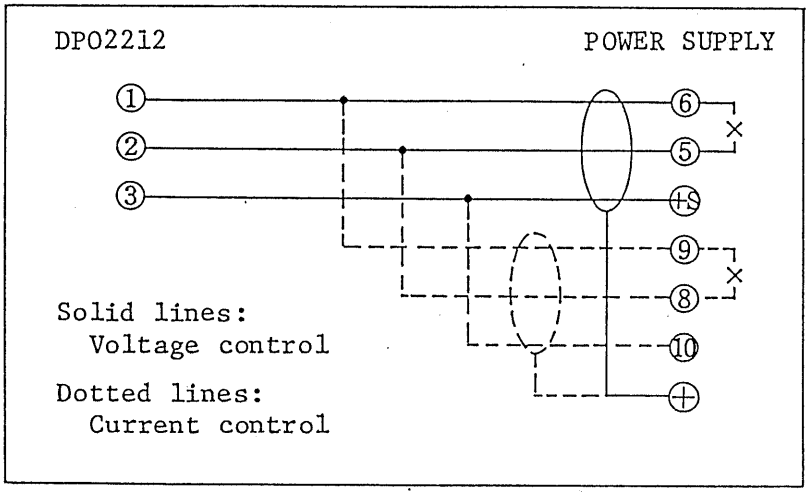

Figure 3-6

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Types II, III, IV, V, VI

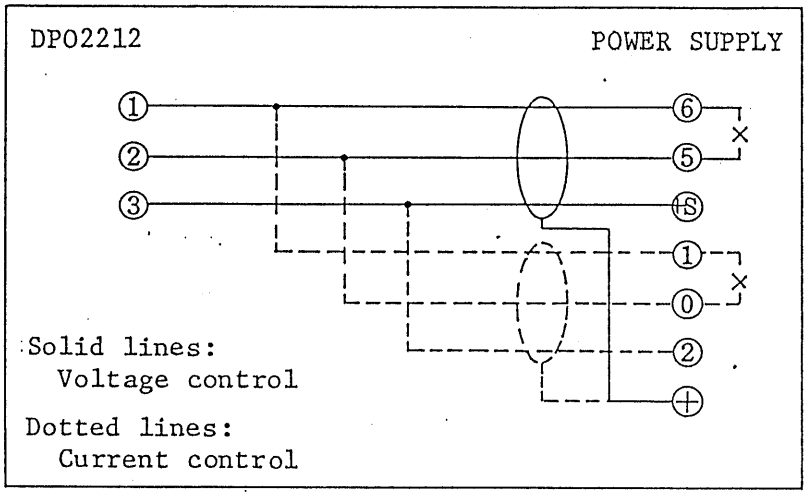

Figure 3-7

o PAL and PAL-LP Series

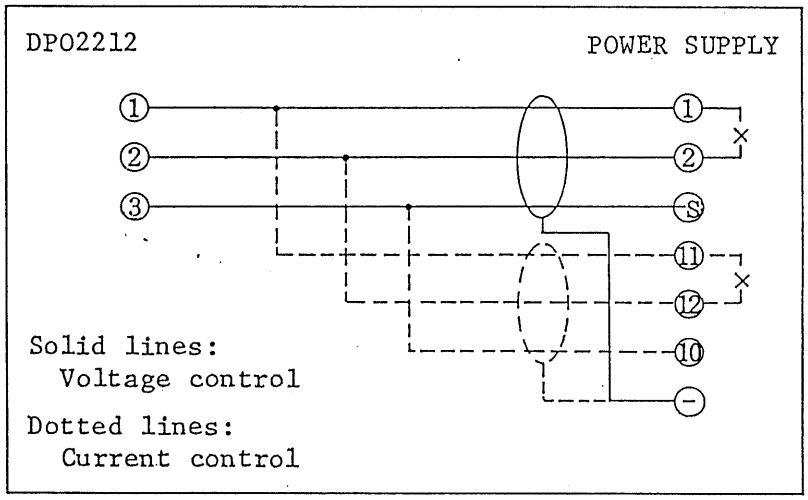

Figure 3-8

o PAE Series

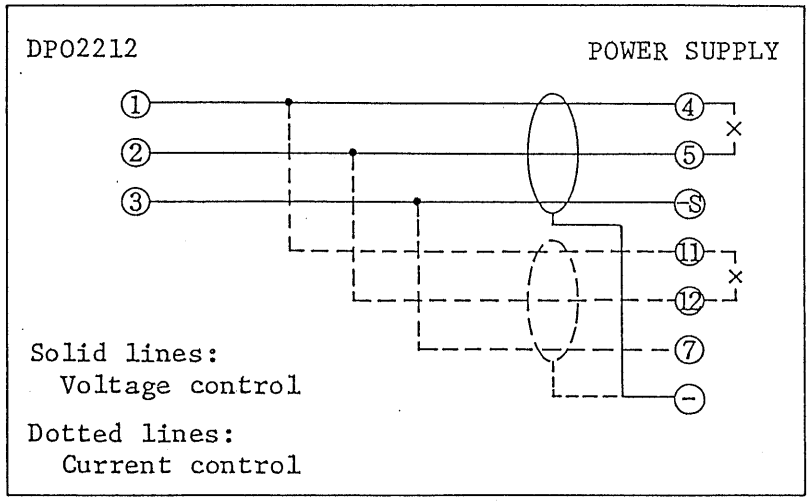

Figure 3-9

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o PAA Series

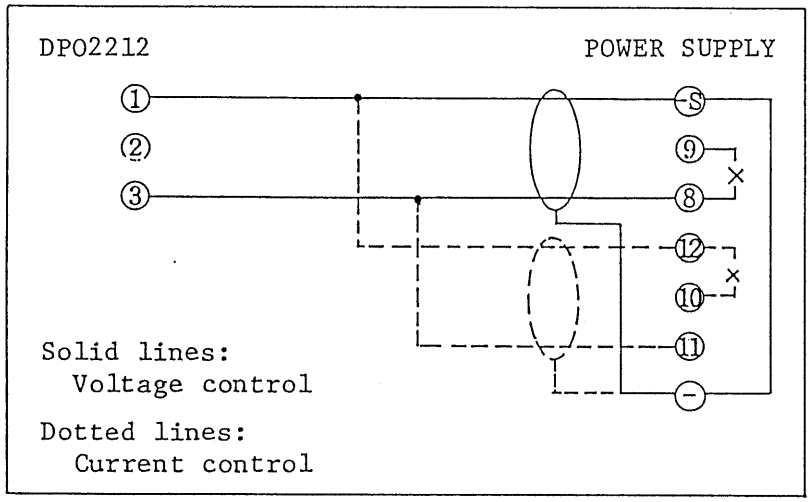

Figure 3-10

Note: Of the PAA Series Power Supplies, REMOTE/LOCAL mode selection by the rear panel switch of the DPO2212 is unavailable.

o PAB-A Series

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

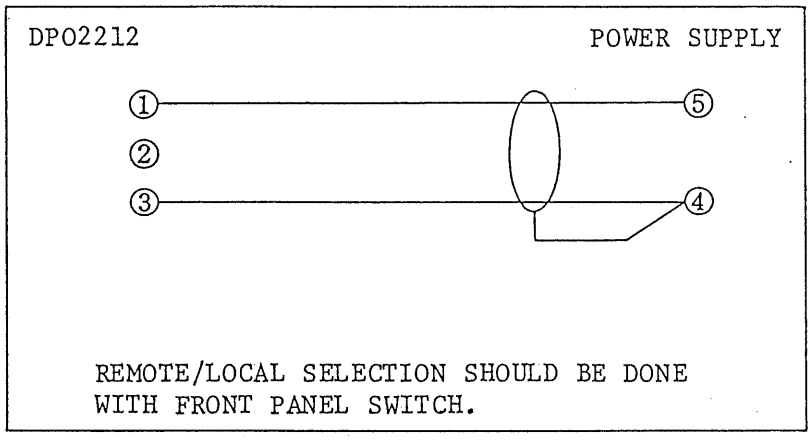

Figure 3-11

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3-4-2. Code Format Setting

1) Code Formats

The DPO2212 operates with ASCII codes received via the GP-IB bus. Normally, the computer provides programs in which the codes for controlling the DPO2212 are stated with characters, and converts them into ASCII codes and sends them onto the GP-IB bus.

To control the channel of the DPO2212, the computer should send ASCII codes as shown below. The delimiter is (CR). EOI and (LF), if any, are ignored.

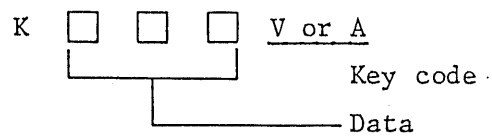

Figure 3-12

Data for analog output of channel.

(3-digit integer of 000 - 999)

2) Key Code Setting

The "V or A" section shown in Figure 3-12 is for a key code. This section is used to select either V or A with the 7th digital switch of the DIP switch on the rear panel.

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

K □ □ □ V.

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

K □ □ □ A.

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3-4-3. Overall System Adjustment

When adjustment is made for the overall system comprised of the DPO2212 and a 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 DPO2212 to the REMOTE state.

Allow a stabilization period of about 30 minutes after turning on the DPO2212 and the power supply.

1) Measuring Instrument and Device

- For measurement, use an instrument which has an accuracy of approximately 1/5 times 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 3-3.)

3) Offset Adjustment

The power supply is with positive offset as shown in Figure 3-13. By letting the DPO2212 provide a corresponding positive offset as shown in Figure 3-14, offsetless relationship between input data and power supply output can be obtained as shown in Figure 3-15.

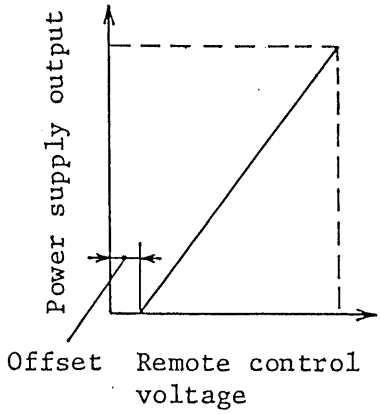

Figure 3-13

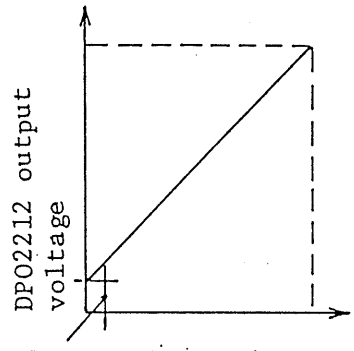

Figure 3-14

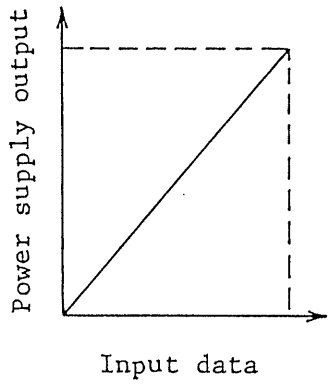

Figure 3-15

- If the offset of the power supply is more than can be balanced out by the offset function of the DPO2212, 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.)

- To gain access to the OFFSET controls of the DPO2212, remove the subpanel of the front panel.

- Be sure to turn on the DPO2212 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 DPO2212. (See Figure 3-3.) Apply the maximum data (999) from the computer and adjust the controls so that the required voltage or current is obtained.

3-4-4. Notes for Use of System

1) Sequence of Power Turn On or Off

o Turn on or off powers of the DPO2212 and power supply in the following sequences:

To turn on:	①	DPO2212	— ②	POWER SUPPLY
To turn off:	①	POWER SUPPLY	— ②	DPO2212

If 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 power of the DPO2212 is turned on, the output is initialized at 0 V. If power is turned off after setting the output and then power is 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

o 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.)

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Table 3-3

		Output voltage control	Output current control
	PAD-L (-LP) Types 0, I1, I2	o	×
*1	PAD-L (-LP) Types I3, II, III, IV, V, VI	×	×
	PAL (-P)	o	o
	PAE	o	o
	PAB-A	o	o
*2	PAA	o	×

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

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

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

*2: 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.

3-5. Instructions for Digital I/O

3-5-1. Interruption

The digital I/O connector of the DPO2212 has 2-bit interrupt signal input pins and delivers a service request (SRQ) signal onto the GP-IB bus when an interruption has occurred. It also delivers a status byte in response to serial poll.

843674

1) Digital I/O Connector Pin Layout and Circuitry

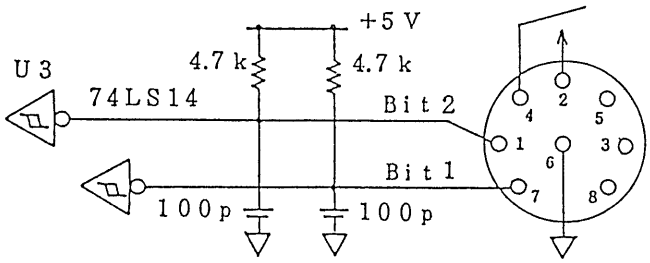


Figure 3-16

Digital I/O Connector J1

As viewed from rear panel

Table 3-4

	Interrupt signal input	Contact signal output*	
J1	1, 7, 6	2, 4	Pin No.

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

Dielectric strength
between pins of J1: 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 DPO2212. 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 active) 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 3-17.

843675

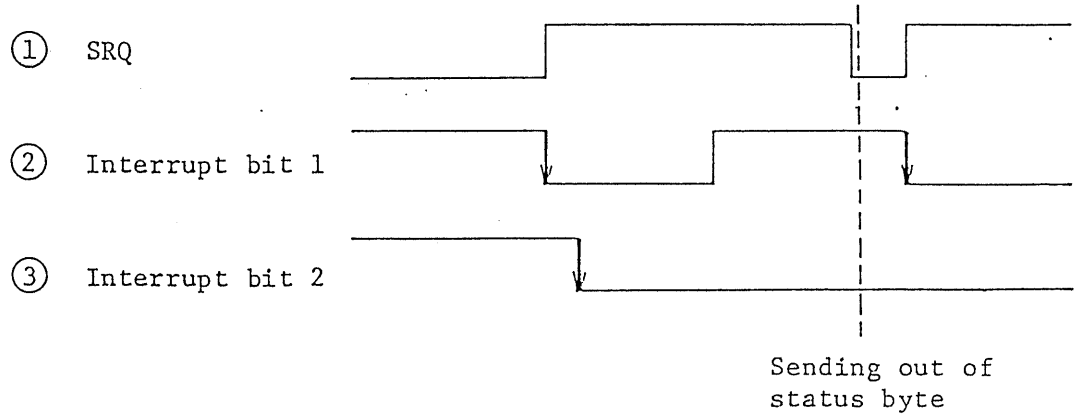


Figure 3-17

3) Status Byte

o Status byte in response to serial polling:

The bits of status byte are assigned to pins of the digital I/O connector as shown in Table 3-5 and sent out as shown in Figure 3-18 in response to serial polling from the computer when an SRQ has occurred.

Pin No.	Pin 1 of J1	Pin 7 of J1
Bit No.	Bit 2	Bit 1

Table 3-5

MSB LSB

0	1	0	0	0	0	Bit 2	Bit 1

↑ Means SRQ generated.

Figure 3-18

o In the case of the example shown in Figure 3-17, the status byte is as shown in Figure 3-19.

MSB LSB

0	1	0	0	0	0	1	0

Figure 3-19

843676

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

As the DPO2212 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	0	0	bit 2	bit 1

Figure 3-20

3-5-2. Contact Signal Output

When the DPO2212 has received as 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 3-16.)

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 DPO2212 has LISTEN, TALK, SRQ, and POWER indicator lamps.

o The LISTEN lamp illuminates during the period the DPO2212 is designated as a listener to receive data.

o The TALK lamp illuminates during the period the DPO2212 is designated as a talker to send out its status byte.

843677

- 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 power of the DP02212 is on.

843078

4. PROGRAMMING EXAMPLES

4-1. Notes for Programming

1) Program Formats

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

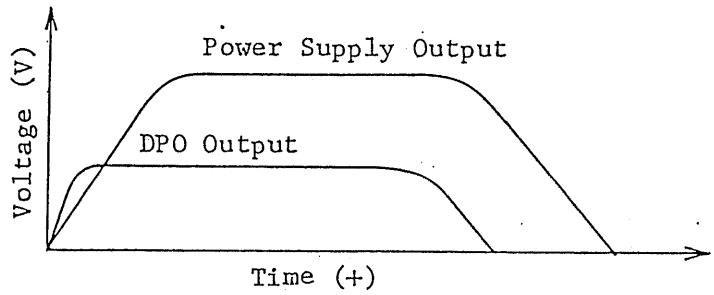
Data to be specified	Data to be programmed
0	000
9	009
99	099
255	255
999	999

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

When programming the output voltage or output current of a DC power supply, take note of the fact that the rise time of the PAD-L series Power Supplies is slow (100 ms - 300 ms) while that of the D/A converter is fast (approx. 200 μs). The fall time also is slow (approx. 200 ms, although differs by the conditions of the load) and this is especially true when the capacity of the power supply is large. 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.



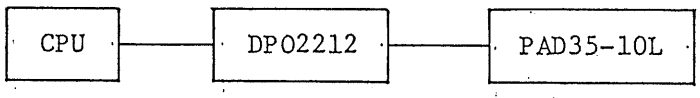
843679

4-2. Programming Examples

Examples of programs for PC8801 + PC8897 computer system or HP-85 are shown in this section.

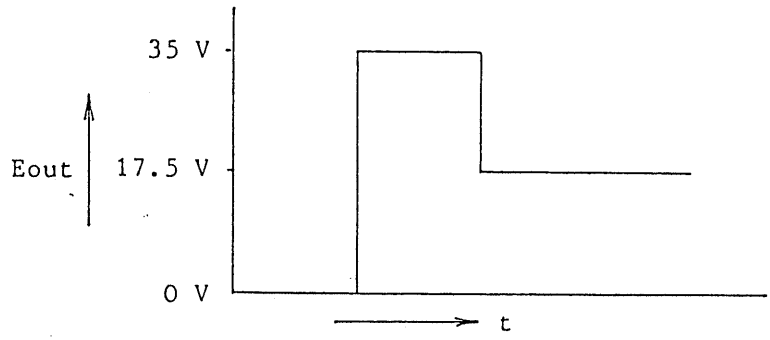
A. Output Setting Program (1) (Output Voltage Setting)

o System structure



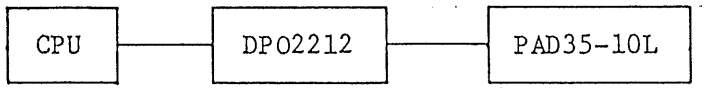

```
10  REM *** FUNDAMENTAL 1 FOR PC8801***
20  PRINT@8;"K000V" .....   Output voltage setting (1)
30  GOSUB 200
40  PRINT@8;"K999V" .....   Output voltage setting (2)
50  GOSUB 200
60  PRINT@8;"K500V" .....   Output voltage setting (3)
70  GOSUB 200
80  END
90'
100'
200 REM=====TIME INTERVAL=====
210 FOR A=0 TO 1000 : NEXT A .....  Wait time
220 RETURN
```

```
10  REM *** FUNDAMENTAL 1 FOR HP-85***
20  OUTPUT 708;"K000V"
30  GOSUB 200
40  OUTPUT 708;"K999V"
50  GOSUB 200
60  OUTPUT 708;"K500V"
70  GOSUB 200
90  !
100 !
200 REM=====TIME INTERVAL=====
210 FOR A=0 TO 1000 @ NEXT A
220 RETURN
```



B. Output Setting Program (2) (Output Current Setting)

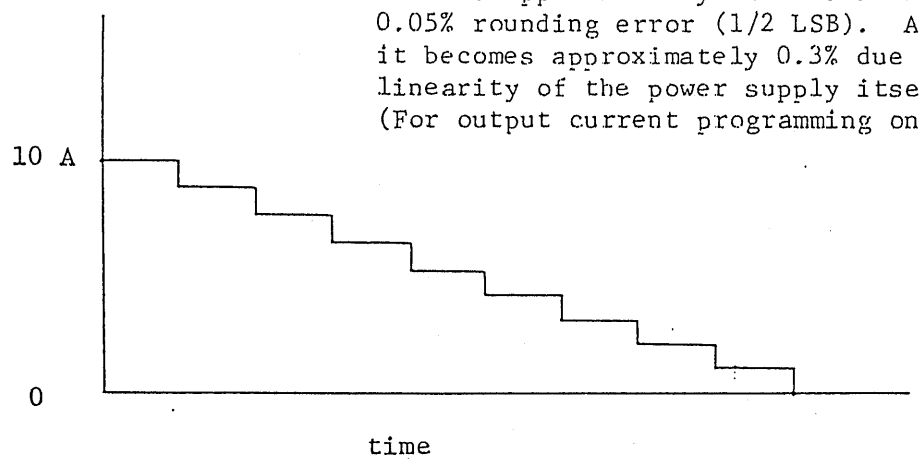
o System structure




```
10  '*****FUNDAMENTAL 2 FOR PC8801*****
20  FOR X=10 TO 0 STEP-1
30  GOSUB 300
40  PRINT@8;"K"+B$="A" .....   Output current setting
50  GOSUB 200
60  NEXT X
100  END
110'
120'
200' ===TIME INTERVAL===
210  FOR A=0 TO 1000;NEXT A
220  RETURN
300' ====SUB=======
310  E=INT(X*999/10+.5) .....   Calculation formula
320  F=E+1000 ............
330  A$=STR$(F)           :...   To output data with 3 characters
340  B$=RIGHT$ (A$, 3) ..:
350  RETURN
```

```
10  REM***FUNDAMENTAL 2 FOR HP-85***
20  FOR X=10 TO 0 STEP-1
30  GOSUB 300
40  OUTPUT 708;"K" & B$&"A"
50  GOSUB 200
60  NEXT X
100 END
110 !
120 !
200 !=====TIME INTERVAL=====
210 FOR A=0 TO 1000 @ NEXT A
220 RETURN
300 !=====SUB=====
310 E=IP(X*999/10+.5)
320 F=E+1000
330 A$=VAL$(F)
340 B$=A$[2, 4]
350 RETURN
```

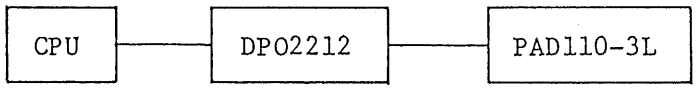
The output setting accuracy in this case becomes approximately 0.1% as it involves 0.05% rounding error (1/2 LSB). Actually, it becomes approximately 0.3% due to the linearity of the power supply itself. (For output current programming only)



C. 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




```
10  '*****FUNDAMENTAL 3 FOR PC8801*****
20  '**0V TO 99.9V STEP.1V**
30  FOR X=0 TO 999 STEP 1
40  GOSUB 300
50  PRINT@8;"K"+B$="V" ..... Output voltage setting
60  GOSUB 200
70  NEXT X
80  END
90'
100'
200'===TIME INTERVAL====
210 FOR A=0 TO 1000:NEXT A
220 RETURN
300'=====SUB=======
310 F=X+1000
320 A$=STR$(F) ........
330 B$=RIGHT$(A$, 3)  :.... To output data with 3 characters
340 RETURN ...........:
```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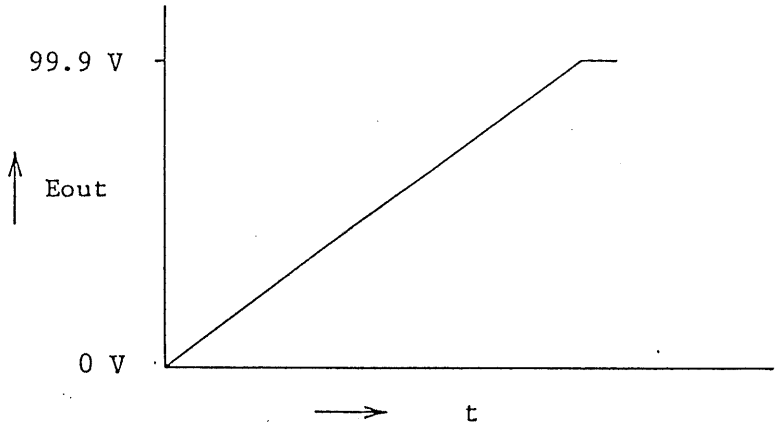
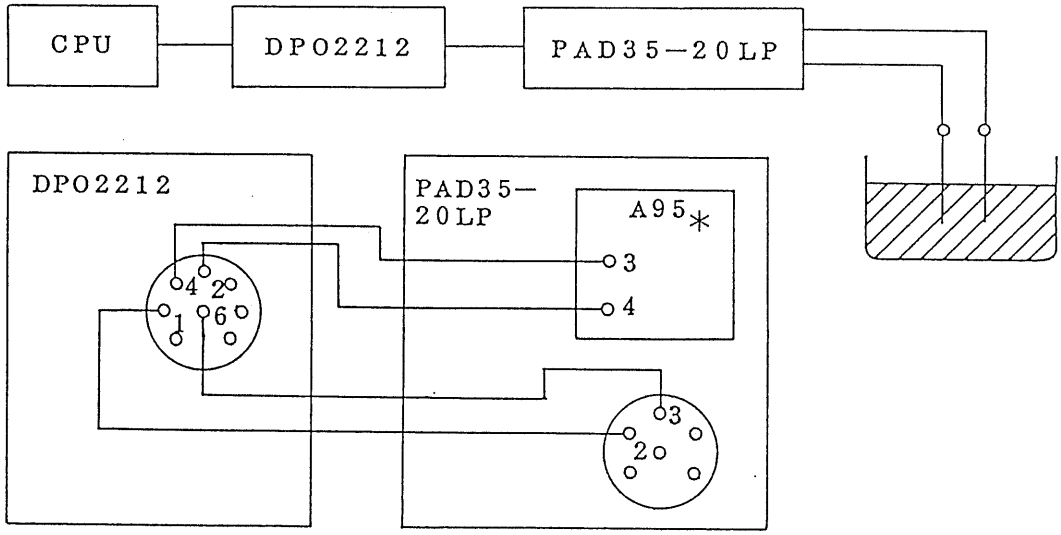
```
10  REM***FUNDAMENTAL 3 FOR HP-85***
20  REM***0 V TO 99.9V STEP.1V***
30  FOR X=0 TO 999
40  GOSUB 300
50  OUTPUT 708;"K"& B$&"V"
60  GOSUB 200
70  NEXT X
80  END
90!
100!
200!=====TIME INTERVAL=====
210 FOR A=0 TO 1000 @NEXT A
220 RETURN
300 =====SUB=====
310 F=X+1000
320 A$=VAL$(F)
330 B$=A$[2, 4]
340 RETURN
```



D. 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



* Remove the cover of the power supply and connect terminals 3 and 4 of PCB A95 on the back of the rear terminal board to pins 2 and 4 of the DIN connector of the DPO2212.

Interrupt signal	o Bit 1: Change from CC to CV o Bit 2: Power off

843088

```
10  REM***FUNDAMENTAL 4 FOR PC8801***
20  ON SRQ GOSUB 300 ........  To set destination address when
                               service request occurred
30  SRQ ON  ................  To enable interrupt
40  GOSUB 600  ..........
                         :....  To check power supply operation
50  IF B=1 THEN 70 .....:
60  PRINT @7;"K888A" ........  To set output current
70  A=5*5;GOTO 70 ...........  To wait until occurrence of service
                               request
80  END
90'
100'
300'=====SERIAL POLL=====
310 POLL 7, S
320 IF S=65 THEN GOSUB 400 ..........
                                   :...  To check status byte
330 IF S=66 OR S=67 THEN GOTO 500...:
340 SRQ ON:RETURN
350'
360'
400'=====power off=====
410 GOSUB 600
420 IF B=0 THEN 450 ELSE 430
430 WBYTE &H3F, &H41, &H27, &H4; ......  Occurrence of device clear
440 BEEP
450 RETURN
460'
470'
500'===== hazard =====
510 BEEP 1
520 END
530'
540'
600'=====read status=====
610 FOR K=0 TO 1000;NEXT K
620 BBYTE &H3F, &H21, &H47;B .........  To check digital I/O
630 RETURN
```

```
10  REM***FUNDAMENTAL 4 FOR HP-85***
20  ON INTER 7 GOSUB 300
30  ENABLE INTR 7;8
40  GOSUB 600
50  IF B=1 THEN 30
60  OUTPUT 707;"K888A"
70  A=5*5 @ GOTO 50
80  END
90!
100!
300 REM=====SERIAL POLL=====
310 S=SPOLL(707)
320 IF S=65 THEN 330 ELSE 340
330 GOSUE 400
340 IF S=66 OR S=67 THEN 500
350 ENABLE INTR 7;8 @RETURN
360!
370!
400!=====POWER OFF=====
410 GOSUB 600
420 IF B=0 THEN 450
430 CLEAR 707
440 BEEP
450 RETURN
460!
470!
500!===== HAZARD =====
510 BEEP
520 END
530!
540!
600!=====READ STATUS=====
610 FOR C=0 TO 1000 @ NEXT C
620 ENTER 707 USING "#%,B";B
630 RETURN
```

5. OPERATING PRINCIPLE

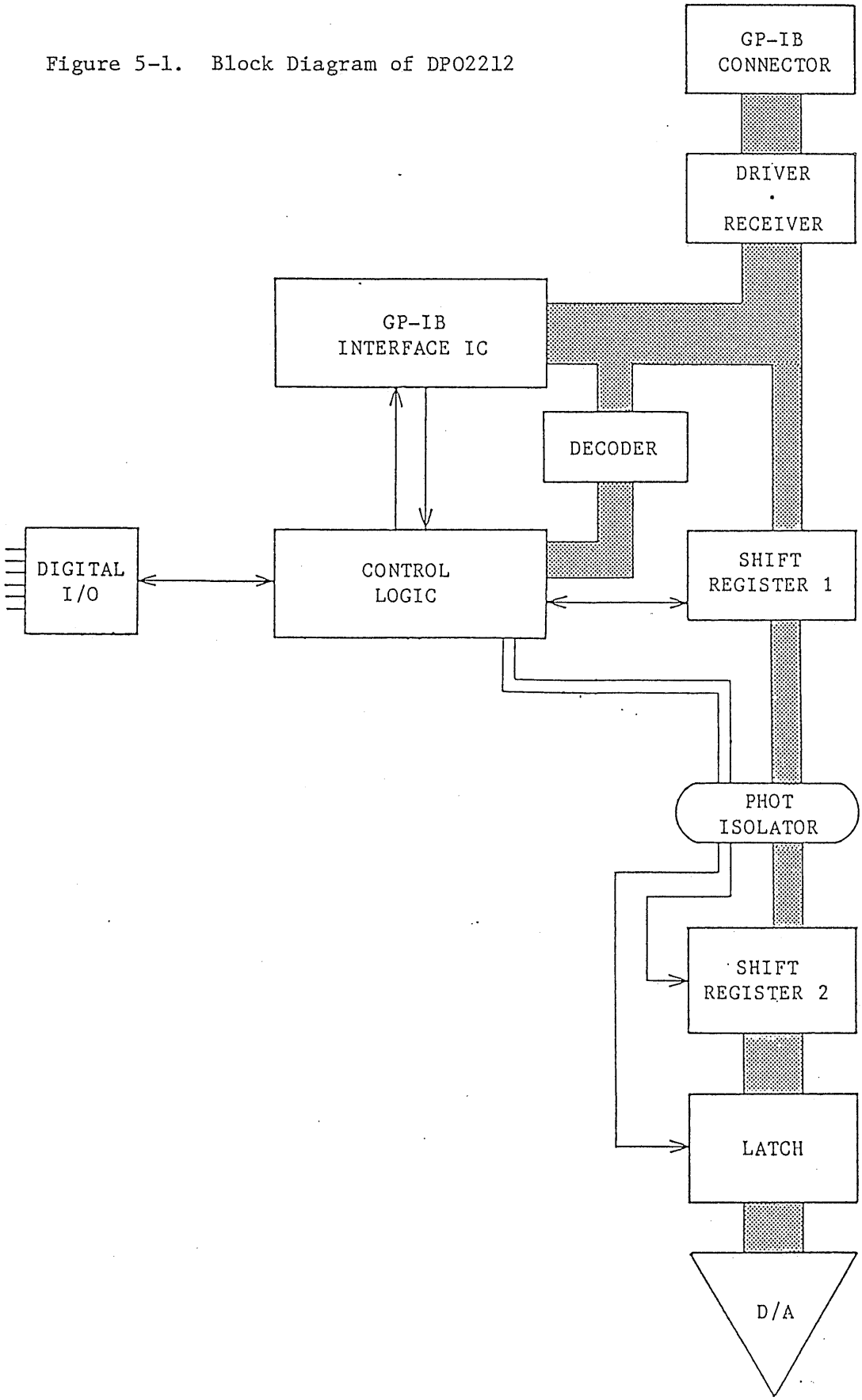
A block diagram of the DPO2212 is shown in Figure 5-1. Digital signals received through the GP-IB connector are in the ASCII code formats and are fed with the control logic timing identified by the internal code decoder. The output voltage data alone is fed to shift register 1 and then sent to shift register 2 via the photo-isolator being dictated by the control logic. Shift register 2 converts 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 converter in order to be converted into an analog output signal. The D/A converter is a 3-digit BCD type.

The GP-IB interface IC is for handshaking of the DPO2212 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.

843083

Figure 5-1. Block Diagram of DPO2212



6. MAINTENANCE

6-1. Inspection and Adjustment

Periodically inspect and adjust the DPO2212 in order that it maintains its best performance for a long period of time.

6-1-1. Cleaning the DPO2212

When the panel surfaces of the DPO2212 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.

When dust is collected on the internal components, blow away dust using a compressed air (the exhaust air of a vacuum cleaner may be used).

6-1-2. Removing the Cover

To remove the cover, remove the four screws and pull up the cover as shown in Figure 6-1.

6-1-3. Inspecting the Power Cord

Inspect the cord and plug for damage and breakage.

6-1-4. Adjustment

Adjust the DPO2212 referring to Section 3-4-3 "Overall System Adjustment."

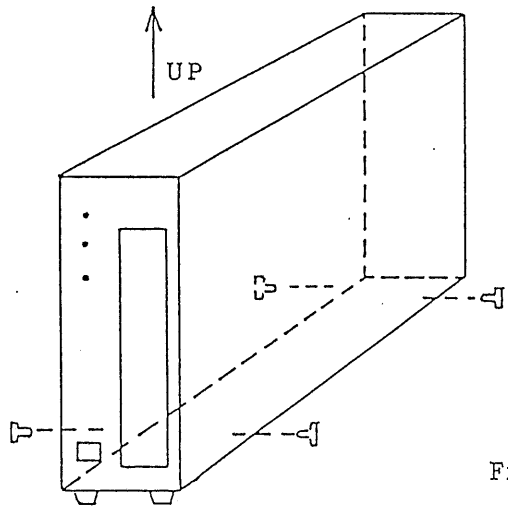


Figure 6-1

6-2. Troubleshooting

When troubles are encountered, check the items shown in the following. For repair service, please order your Kikusui 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. o AC line selector is not correctly set. (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. o Data is not represented with three characters. o Key code is invalid. o Address setting is invalid. o Wrong characters are used. o GP-IB start program of computer is not set. o Invalid output statement.
	2. Hardware check	o REMOTE/LOCAL switch is set to LOCAL. o Fuse is blown out. o Circuit failure

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

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