

INSTRUCTION MANUAL

REGULATED DC POWER SUPPLY

PAR-A SERIES

PAR18-6APAR36-3A

OPTIONAL INTERFACE UNITS FOR PAR-A SERIES

IF-41RS

IF-41GU

IF-41USB

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USING THE PRODUCT SAFELY

■ Preface

To use the product safely, read this user's guide to the end. Before using this product, understand how to correctly use it.

If you read this manual but you do not understand how to use it, call the company or each sales office that is indicated on the back cover of this user's guide. After you read this manual, save it so that you can read it anytime as required.




■ Notes on reading this user's guide

The contents of this user's guide include technical terms in part of their explanation.

If you do not understand those terms, do not hesitate to ask the company or each sales office.

■ Pictorial indication and warning character indication

This user's guide and product show the warning and caution items required to safely use the product. The following pictorial indication and warning character indication are provided.

<p><Pictorial indication></p> 	<p>Some part of this product or the user's guide may show this pictorial indication. In this case, if the product is incorrectly used in that part, a serious danger may be brought about on the user's body or the product.</p> <p>To use the part with this pictorial indication, be sure to refer to this user's guide.</p>
<p>< Warning character indication ></p> <p> WARNING</p> <p> CAUTION</p>	<p>If you use the product, ignoring this indication, you may get killed or seriously injured. This indication shows that the warning item to avoid the danger is provided.</p> <p>If you incorrectly use the product, ignoring this indication, you may get slightly injured or the product may be damaged. This indication shows that the caution item to avoid the danger is provided.</p>

USING THE PRODUCT SAFELY



WARNING

■ Do not remove the product's covers and panels

Never remove the product's covers and panels for any purpose.

Otherwise, the user's electric shock or a fire may be incurred.

■ Warning on using the product

The warning items given below are to avoid danger to the user's body and life and avoid the damage and deterioration of the product.

Use the product, observing the following warning and caution items.

■ Warning about Input Power

- Be sure to use the product within the source voltage rating marked on the product. Disobedience to this warning may result in a fire. The rated source voltage of this product is AV 100V to 240V (voltage fluctuation: within $\pm 10\%$), single-phase. (AC250V max.)
- Use the AC power cable supplied with the product. Using another power cable may result in electric shocks, electrocution or a fire. If the supplied AC power cable is damaged, stop using it and contact your dealer or our distributor. Using the product with the damaged AC power cable may result in electric shocks, electrocution or a fire.
- The product will not run if the input protection fuse has blown. The protection fuse is built in the product and cannot be replaced by the user. If it has blown, contact your dealer or our distributor without opening the case. Our serviceman will replace it. The user must not attempt to replace the fuse at his/her discretion. Disobedience to this warning may result in electric shocks, electrocution or a fire. IF 100V or 120V is to be changed into 220V or 230V, power cord need to be changed.

■ About Grounding

- Be sure to connect the ground wire of the three-wire power cable supplied with the product (or the ground terminal of the three-pole plug of the cable) to the earth. The chassis of the product is grounded to the GND.

USING THE PRODUCT SAFELY



WARNING

■ **Warning about Installation Conditions**

- Use the product in the operation temperature range shown in the manual. Do not use the product with the vent holes blocked or in a high ambient temperature. Disobedience to this warning may result in a fire.
- Use the product in the operation humidity range shown in the manual. When moving it to a room at different humidity, pay attention to dew condensation due to rapid humidity change. Do not handle the product with wet hands. Disobedience to this warning may result in electric shocks, electrocution or a fire.
- Do not use the product in or around a place where combustible gas, explosive gas or vapor is produced or stored. Disobedience to this warning may result in explosion or a fire. Do not use the product in or around a place where corrosive gas is produced or accumulated. Disobedience to this warning may result in serious damages to the product.
- Do not put metallic or combustible objects or pour water into the product through the vent holes, etc. Disobedience to this warning may result in electric shocks, electrocution or a fire.

■ **Warning about Errors in Operation**

- If the product produces smoke, fire or odor in operation, stop using the product, turn it off, and disconnect the AC power cable from the AC outlet. Make sure that the fire hasn't spread to other equipment, then contact your dealer or our distributor

USING THE PRODUCT SAFELY



CAUTION

■ Caution about Installation Condition

- If this product is used in a place with much electrical noises, it may malfunction. Be sure to ground this product using the GND terminal of the 3-core power cable or the GND lead wire of a 3P-2P conversion plug, if used, when it is necessary to use this product in a place with much electrical noises.

■ External Control I/O Connector

- The external control I/O connector has its maximum rating. The maximum rating must not be exceeded. Input or output over the maximum rating may result in damages to the product.

■ Before Long-Term Unemployment

- If the product is to be unused for a long period of time, disconnect the AC power cable from the AC outlet.

■ Calibration

- The product has been inspected under strict quality control before shipment. It is, however, subject to change in the performances due to aged deterioration of parts. To maintain its performances for long, we recommend that it should be calibrated periodically. For calibration, please contact your dealer or our distributor.

■ Daily Maintenance

- Do not use thinner, benzine or other solvents to clean the case, panels, knobs, etc. of the product. Such solvent may separate the coating or deteriorate the resin surface.
- Clean the case, panels, knobs, etc. lightly with soft cloth moistened with neutral detergent.
- Before cleaning the product, disconnect the power plug from the AC outlet. Be careful not to put water, detergent or other foreign matters into the product.

USING THE PRODUCT SAFELY



CAUTION

■ Input/output terminal

Maximum input to the input terminals is specified to prevent the product from being damaged.

Do not supply input, exceeding the specifications that are indicated in the "Rating" or "Caution on use" column in the user's guide of the product. Otherwise, a product failure is caused.

Also, do not supply power to the output terminals from the outside.

Otherwise, a product failure is caused.

■ When the product is left unused for a long time

Be sure to remove the power plug from the outlet.

(Calibration)

Although the performance and specifications of the product are checked under strict quality control during shipment from the factory, they may slightly change because of secular changes in its parts. It is recommended to periodically calibrate the product so that it is used with its performance and specifications stable. For consultation about the product calibration, call the dealer or the company or each sales office where you bought the product.

(Daily maintenance)

When you clean off the dirt of the product covers, panels, and knobs, avoid solvents such as thinner and benzene. Otherwise, paint may peel off or the resin surface may be affected.

To wipe off the covers, panels, and knobs, use a soft cloth with neutral detergent in it.

During cleaning, be careful that water, detergents, and other foreign matters do not get into the product.

If a liquid or metal gets into the product, an electric shock and fire are caused.

During cleaning, remove the power cord plug from the outlet.

Use the product correctly and safely, observing the above warning and caution items.

Because the user's guide indicates caution items even in individual items, observe those caution items to correctly use the product.

If you have questions or comments about the content of the user's guide, call the company's sales office.

1. PAR-A SERIES

1-1. About This Manual

This manual applies to the following PAR-A series power supply units and optional interface units.

- PAR18-6A, PAR36-3A

Optional interface units for the PAR-A series:

- IF-41RS, IF-41GU, IF-41USB

"YB" models with built-in factory options

1-2. Outline of Product

The PAR-A series are dropper type multi-output DC stabilized power supply units. With the tracking, delay and four-point preset functions, each unit has a wide variety of applications. The optional interface boards IF-41GU, IF-41RS and IF-41USB are built in the PAR-A series and interface with computers. Each PAR-A series power supply unit connected with a computer is connectable with another PAR-A series power supply unit through the local bus, allowing construction of an intelligent power supply system. It is possible to control all power supply units in the system and read back the current and voltage values from the computer.

1-3. Features

1-3-1. PAR-A power supply unit

- With a CPU and four preset memory units, the PAR-A power supply unit may store preset voltage and current of each channel. This function enables easy switching of the voltage (or current).
- The output voltage and current are displayed on seven-segment, four-digit red LED indicators. Fine adjustment functions are provided for accurate setting.
- It is possible to select PRESET 1 to PRESET 4, turn on or off MAIN OUTPUT key, detect an OHA alarm and input an alarm through the external contacts.
- The YB option is available. This factory option lowers the output voltage quickly when output is turned off with no load or light load. "YB" is added to the product code of a model with this option. (Example: PW18-6AYB)
- The PAR-A power supply unit has a remote sensing terminal. The remote sensing function compensates for voltage drop of wires.

1-3-2. IF-41RS (Option)

- The PAR-A power supply unit with a built-in IF-41RS is possible to remote-control when it is connected with a computer by RS-232C. The computer controlling the PAR-A power supply unit is called the master unit, and the controlled PAR-A power supply unit is called the slave unit. It is possible to connect a maximum of four slave units, which are connected with one another with modular cables.
- It is also possible to specify equipment other than a computer as the master unit. If the PAR-A power supply unit is specified as the master unit, operating the master unit causes the other four PAR-A power supply units to execute the same operation. (Master operation)
- It is also possible to specify the GP-620 (our GP-IB adapter) or RT-63 (our remote controller) as the master unit, which may remote-control the PAR-A power supply unit.
- The PAR-A power supply unit is compatible with the PAR-A series (our power supply unit). It is possible to construct a system containing PWR series power supply unit(s).

1-3-3. IF-41GU (Option)

- The IF-41GU is an optional board, which features higher transmission rate than the IF-41RS and may control more power supply units simultaneously.
- It is connected with a computer through GP-IB or USB. A maximum of fourteen or thirty-two units may be connected directly with a computer through GP-IB or USB, respectively.
- It is also possible to construct a large-scale system if thirty-one PAR-A power supply units are connected with a PAR-A power supply unit directly connected with a computer using two sets of twisted pair cables and these units are remote-controlled.

1-3-4. IF-41USB (Option)

- The IF-41USB is an option board with the USB connector and local bus, which have the same functions of those of the IF-41GU.
- It allows the user to construct a system at lower cost than using the IF-41GU.

1-4. Accessories

<PAR-A power supply unit>

AC power cable × 1、

Instruction manual × 1、

Lead wires with connectors for external contact control × 1

<IF-41RS, IF-41GU and IF-41USB>

Simple manual × 1

Lead wire with Y terminal for FG connection × 1

FG – control line connector × 1

2. SPECIFICATIONS

Specifications of PAR-A

Item	PAR18-6A	PAR36-3A
Output voltage	0V to 18V	0V to 36V
Voltage setting resolution	10mV	
Voltage setting accuracy	± (0.5%SET+20mV)	
	23°C±5°C、after 30-minute aging	
Output current	0A to 6A	0A to 3A
Current setting resolution	1mA	
Current setting accuracy	± (1%SET+5mA)	
	23°C±5°C、after 30-minute aging	
CV characteristics		
Input variation	1mV	
	(For ±10% variation of source voltage)	
Load variation	2mV	
	(for 0% to 100% variation)	
Ripple noise	0.5mV	
	Measured in the RMS method using 5Hz to 1MHz signals	
Transient response (TYP)	50 μ s	
Temperature coefficient	60ppm/°C : (at rated output voltage)	
CC characteristics		
Input variation	2mA	
	(For ±10% variation of source voltage)	
Load variation	5mA	
	(For 0% to 100% variation)	
Ripple noise	1.5mA	
	Measured in the RMS method using 5Hz to 1MHz signals	
Temperature Coefficient	150ppm/°C : (at rated output current)	
Voltage & current indication		
Voltage indicator	4-digit red LEDs, lowest digit: 1mV	
Voltage indication accuracy & resolution	± (0.5%rdg+20mV)/10mV	
	23°C±5°C、after 30-minute aging	
Current indicator	4-digit red LEDs, lowest digit: 1mA	
Current indication accuracy & resolution	± (1%rdg+5mA)/1mA	
	23°C±5°C、after 30-minute aging	
Voltage & current Indication range	-2.5%FS to +102.5%FS/0%FS to +102.5%FS	

Power consumption

source voltage	AC100V	AC115V	AC120V	AC200V	AC220V	AC230V
PAR18-6A	Approx. 213W/ 278VA	Approx. 213W/ 278VA	Approx. 223W/ 285VA	Approx. 213W/ 278VA	Approx. 234W/ 305VA	Approx. 213W/ 278VA
	Approx. 189W/ 255VA	Approx. 189W/ 255VA	Approx. 193W/ 265VA	Approx. 189W/ 255VA	Approx. 208W/ 280VA	Approx. 189W/ 255VA

Common Specifications of PAR-A

Item	Rating
Functions	Described in PANELS and FUNCTIONS AND OPERATION PROCEDURES.
Grounding	Positive, COM or negative grounding is possible.
Protection	MAIN OUTPUT key is turned off if exhaust air temperature becomes too high.
Heat radiation	Described in PANELS and FUNCTIONS AND OPERATION PROCEDURES.
Input voltage	AC100V, 115V, 200V and 230V, 50Hz/60Hz selectable. Voltage fluctuation: $\pm 10\%$
Operating temperature range	0°C to 40°C
Operating humidity range	30%RH to 85%RH (No dew condensation)
Storage temperature range	-20°C to 60°C
Storage humidity range	20%RH to 85%RH (No dew condensation)
Dielectric strength voltage	Primary - casing: AC1500V for 1 minute Primary - secondary: AC1500V for 1 minute
Insulation resistance	Primary - casing & primary - secondary: 10M Ω or more at DC500V Secondary - casing: 5M Ω or more at DC250V
To-earth voltage	\pm DC250V
Frame dimensions [mm]	138(W) \times 124(H) \times 380(D)
Max. dimensions [mm]	140(W) \times 147.9(H) \times 402.9(D)
Weight	Approx.9.1kg
Accessories	AC power cable \times 1, Instruction manual \times 1, Lead wires with connectors for external contact control \times 1

Specifications of YB Option

Item	Rating
Output voltage fall time (90% of rated voltage \rightarrow 10%)	100ms or less
Residual voltage	40mV or less

Specifications of remote sensing terminal

Item	Rating
Compensating voltage range	1V, one way

※ The CV characteristics and voltage display specifications show the values at the sensing end.

The transient characteristics are the specifications when the sensing function is not used.

Communication Specifications of IF-41RS

<Local bus (PW bus)> (IN/OUT pin 3 of connector J1)

Data transmission rate	9600 bps, error: 5% or less	
Data code structure	Start bit	1 [bit]
	Data bit	7 [bit]
	Parity bit	1 [bit]
	Stop bit	1 [bit]
Parity	Even parity	
Max. cable length	1.5[m]	
Signal type	Single-flow NRZ	0 : 5[V]
		1 : 0[V]
Connectable units	4 units	

<Local bus> (IN pins 2 & 5 of connector J1, connector J2)

Electrical level	Conforms to RS-232C.	
Data transmission rate	9600 bps, error: 5% or less	
Data code structure	Start bit	1[bit]
	Data bit	7[bit]
	Parity bit	1[bit]
	Stop bit	1[bit]
Parity	Even parity	
Max. cable length	10 [m] (between computer & IF-41RS)	

Other specifications are the same as those of the local bus (PW bus).

Communication Specifications of IF-41GU (GP-IB Block)

GP-IB	
Electrical specifications	Conforms to IEEE488-1978.
Mechanical specifications	Conforms to IEEE488-1978.
Interface functions	SH1, AH1, T6, TE0, L3, LE0, SR1, RL1, PP0, DC0, DT0, C0
Address setting	Possible to set address between 0 and 30 and listen-only mode when turning on power.
Send delimiters	CR•LF + EOI
Listener functions	Possible to set all output conditions of units under control.
Talker functions	Possible to detect all output and setting conditions of units under control.
Service request functions	Informs of change in CC/CV status, occurrence of alarm, and response to inquiry.

Communication Specifications of IF-41GU/IF-41USB (USB Block)

USB block	
Specifications	Conforms to USB Revision 1.1
Connector shape	USB series B
Transfer rate	Full speed

3. INSTRUCTIONS ON USE

3-1. Checking Source Voltage

- Use the PAR-A series power supply units in the rated source voltage range.
- The rated source voltage of the PAR-A series power supply unit is AC100V, 115V, 120V, 200V, 220V or 230V (voltage fluctuation: $\pm 10\%$), single-phase, 50Hz or 60 Hz.
- The rated source voltage of the PAR-A series power supply unit may be selected with two switches on the bottom plate. Be sure to check the source voltage before using the unit. See section "5-3. Changing Source Voltage" for the method of changing the source voltage setting.

3-2. Connecting AC Cable

- Use an AC power cable suitable to the input voltage rating of the PAR-A unit. Make sure that the power switch is switched off, and connect the power cable to the AC power inlet securely.

3-3. Precautions for Connecting Output Terminals

- The PAR-A series is a multi-channel power supply unit, which outputs positive and negative voltages. Do not short the output terminals of the units sharing the same COM. Otherwise, a trouble occurs.
- The PAR-A series is a floating type power supply unit. When it is used in the floating condition, high potential difference may be produced between the frame GND and output terminals (and COM terminal). If the frame GND and output terminals (or COM terminal) are shorted in this condition, the PAR-A unit and/or instruments connected with it may be damaged. Normally, short-circuit the GND (frame GND) and COM terminal with the shorting bar supplied with the product. Make sure that the MAIN OUTPUT key switch is set to OFF before connecting or removing the shorting bar between/from the COM or GND terminal.

3-4. Installation Environments

- The allowable ambient temperature range of the PAR-A series power supply unit is from 0°C to 40°C. Do not use the unit at a temperature over or below this range. If the unit is used in a hot place and the internal temperature rises, the built-in overheat protection circuit works and turns off the MAIN OUTPUT key. Do not use the unit in the condition where the vents in the top panel and air outlet port in the rear panel are blocked. Blocking these ports will also raise the internal temperature. Keep sufficient distances between these ports and objects. In some conditions, hot air blows out of the air outlet port in the rear panel. Be careful.
- Do not use the PAR-A power supply unit in a place with much dust or corrosive gas. Such substance may enhance deterioration of the product.

4. PANELS

4-1. Front Panel



Fig.1 Front Panel

1 Voltage indicator (4-digit red LEDs)

- Indicates the set voltage, output voltage, PC address, system address, and software versions of the PAR-A series and IF-41GU, IF-41USB or IF-41RS (option). The LEDs on the left of the 7-segment LEDs show the negative signs when negative values are displayed.
- The PC address, system address and software version of the IF-41GU, IF-41USB or IF-41RS are displayed when the IF-41GU, IF-41USB or IF-41RS is used.
- It is possible to change the value of a digit of the seven-segment LEDs indicated by a red LED below it with the rotary encoder 12.

2 Current indicator (4-digit red LEDs)

- Indicates the set current, output current, PC address, system address, OHA alarm and Ear alarm. The LED on the left of the seven-segment LEDs shows the minus sign and goes on when indicating a negative value.
- The PC address or system address is displayed when the optional IF-41GU, IF41-RS or IF-41USB is used.
- It is possible to change the value of a digit of the seven-segment LEDs indicated by a red LED below it with the rotary encoder 12.

[3] KEY LOCK/LOCAL key (Green)

- Changes the key lock state (with the LED on) into the local state (with the LED off), and vice versa.
- ◆ See section "6-4. Usage of KEY LOCK/LOCAL Key" below.

[4] LIMIT key (Green)

- Selects which to display on the voltage indicator [1] and current indicator [2]: Output values, or set values.

[5] PRESET 1,2,3,4 key (Green)

- These keys are used to store the set voltage and current values in PRESET 1 (or 2 to 4) and recall the stored values.
- ◆ See section "6-3. Memory Function" below.

[6] MEMORY key (Green)

- Stores store the set voltage and current values in PRESET 1 to 4.
- ◆ See section "6-3. Memory Function" below.

[7] V key (Green) and A key (Green)

- These keys are used to select which value to change with the rotary encoder [12]: Set voltage, or set current.

[8] MAIN OUTPUT key (Red)

- Turns on or off a channel selected with the OUTPUT SELECT key [9].
- ◆ See section "6-2 Output Off Function".

[9] OUTPUT SELECT key and CV/CC status indicator (Green/red)

(1) OUTPUT SELECT key

- Turns on or off the output of each channel. The output of a channel selected with this key is turned on when the MAIN OUTPUT key is turned on.

(2) CV/CC (power state) indicator

- Indicates the operating state (CV or CC) when the MAIN OUTPUT key [9] is on. Lit up green in the CV state. Lit up red in the CC state.

- ◆ See section "6-2. Output Functions" below.

[10] DISPLAY (Orange)

- Stores setting of the OUTPUT SELECT and PRESET keys when the power switch is thrown.
- ◆ See section "6-3-5. Storing key setting".

11 DIGIT key

- Selects a digit of the set voltage or current to be changed.

12 Rotary encoder

- Changes the set voltage, current or delay time. Clockwise rotation increases the value. Counterclockwise rotation decreases it.

13 Positive output terminal

- Positive output terminal of power supply.

14 Positive remote sensing terminal

- Positive remote sensing terminal for the voltage remote sensing function.

15 Positive remote sensing shorting bar

- Connects the positive output terminal and positive remote sensing terminal. Remove this bar only when using the voltage remote sensing function.
- ※ If this shorting bar is removed when the voltage remote sensing function is not used, voltage over the set voltage is output through the output terminals of the PAR-A power supply unit.

16 Negative output terminal

- Negative output terminal of power supply.

17 Negative remote sensing terminal

- Negative remote sensing terminal for the voltage remote sensing function.

18 Negative remote sensing shorting bar

- Connects the negative output terminal and negative remote sensing terminal. Remove this bar only when using the voltage remote sensing function.
- ※ If this shorting bar is removed when the voltage remote sensing function is not used, voltage over the set voltage is output through the output terminals of the PAR-A power supply unit.

19 Frame GND terminal

- A grounding terminal for the output terminals.

20 Shorting bar

- Short-circuits the output terminals and GND terminal. Remove this bar only when using the output of the PAR-A power supply unit in the floating condition.

21 Power switch

- Turns on or off the PAR-A power supply unit.

22 Handle

- The unit has a handle at the top. Hold it to move the unit.
- ※ If the unit is mounted in a rack and the handle is unnecessary, it may be removed.

23 Feet

- The unit has four feet on the bottom plate.
- ※ If the unit is mounted in a rack and the feet are unnecessary, they may be removed.

4-2. Rear Panel

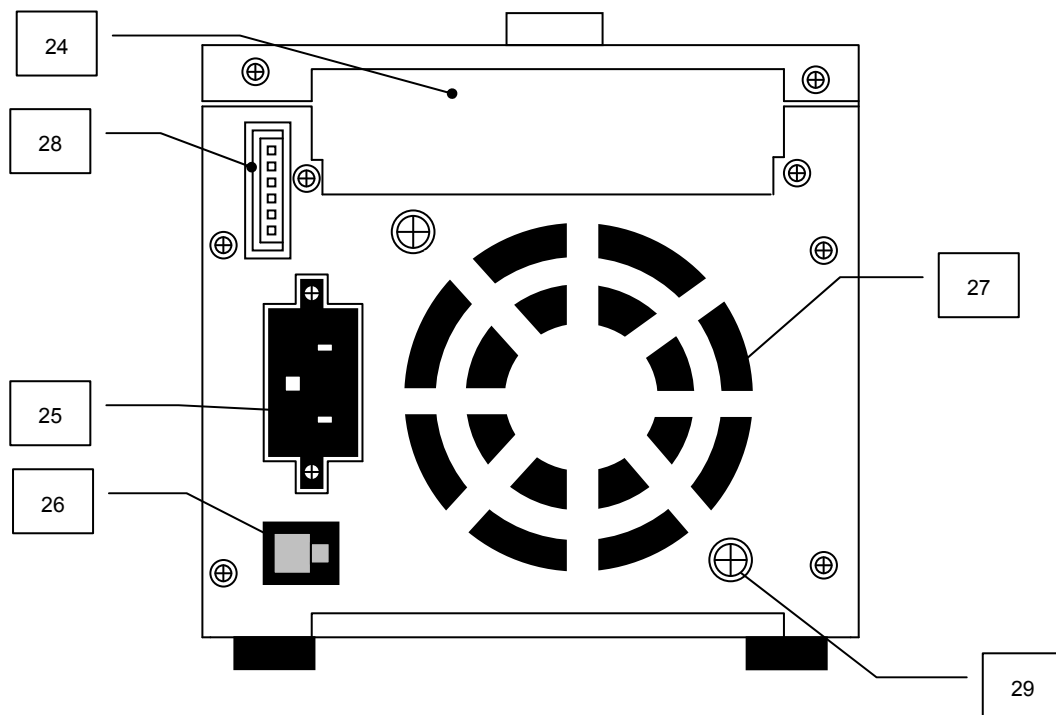


Fig.2 Rear Panel

24 Optional board mounting section

- The optional remote control board is mounted in this section.
- The PAR-A power supply unit is supplied with a dummy panel mounted here if it incorporates no optional board.

25 AC power inlet

- Connect the AC power cable to this inlet to supply commercial AC power to the unit.

26 Fuse holder

- There is a primary side protection fuse in the fuse holder.

27 Air outlet port

- A fan exhausts air through this port.

28 External contact control connector J1

- This connector is used for external contact control.
- ◆ See section "7. EXTERNAL CONTACT CONTROL" below.

29 GND screw

- Connect a grounding wire to this screw if it is impossible to ground the PAR-A series with the AC power cable supplied with the product.

4-3. Bottom Plate

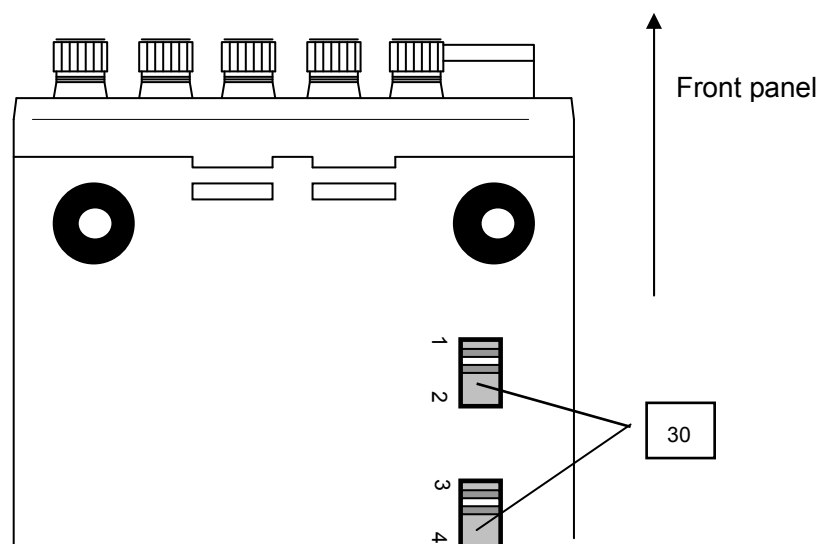


Fig.3 Bottom Plate

30 AC source voltage selector switches 1 and 4

- These switches change the voltage of AC power source: 100V, 115V, 200V or 230V.
- ◆ See section "5-4 Changing Source Voltage" below.

5. GENERAL INSTRUCTIONS

5-1. Turning On Power

5-1-1. Display when power is turned on

- Connect the AC power cable of the PAR-A power supply unit properly and throw the power switch.
The following characters are displayed on the voltage and current indicators until the unit becomes ready for normal operation.

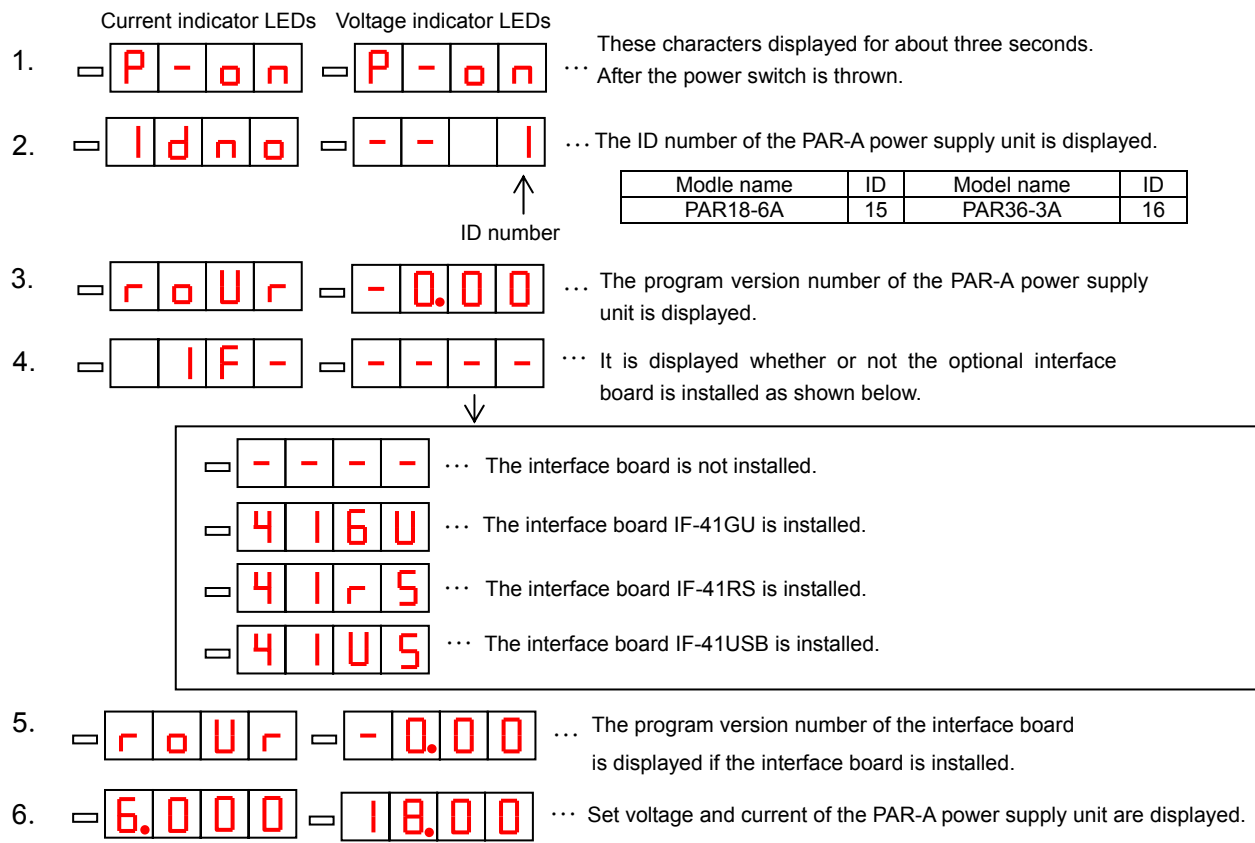


Fig.4 Display when Turning On Power

5-1-2. Initial setting when power is turned on

- The default setting and the setting after initializing the memory are as shown below.
- The setting that may be stored using the memory functions shown in "6-3. Memory Function" and the MW1 command shown in "8-7-11. Storing set data (MW1) " are as shown below.

Item	Initial setting	Backup
V key/A key	Off	×
MAIN OUTPUT key	Off	×
OUTPUT SELECT key	On	○
LIMIT key	Lit in green.	×
REMOTE/LOCAL key	Off	×
PRESET key	PRESET 1 is lit in green.	○
Set voltage of PRESET 1 to 4	0.00	○
Set current of PRESET 1 to 4	0.000	○

Table 1. Memorable Set Items

5-2. Overheat Alarm (OHA)

- If the air inlet port in the top panel or air outlet port in the rear panel is blocked or the PAR-A unit is used at a temperature higher than the upper limit of the allowable temperature range, the temperature of exhaust air from the PAR-A unit becomes too high. An overheat alarm (OHA) occurs in such a case. When an OHA alarm occurs, the MAIN OUTPUT key goes out and all channels are turned off forcibly.
- The characters "oHA" are displayed on the current indicator when an OHA alarm occurs.
- The PAR-A unit is reset to the non-OHA condition automatically if the internal temperature lowers. (The unit is reset with the MAIN OUTPUT key off. It is reset with the MAIN OUTPUT key on if the main output is activated through external contact control.)

5-3. Changing Source Voltage

- The PAR-A power supply unit runs on AC100V, 115V 200V or 230V, which is selectable.



CAUTION:

Be sure to disconnect the AC power cable from the unit or turn off the breaker on the power distribution board before changing the source voltage. Use a fuse of the characteristics and capacity shown below. If an inappropriate fuse is used, the PAR-A power supply unit may become faulty. Be careful.

Use an AC power cable suitable to the input voltage rating of the PAR-A unit. Make sure that the power switch is switched off, and connect the power cable to the AC power inlet securely.

Changing the source voltage

1. Make sure that the AC power cable is disconnected from the unit.
2. Select the intended source voltage with the switches on the bottom plate of the unit. (See Fig.5)
3. Take out the fuse from the fuse holder on the rear panel.

Replace it with an appropriate fuse. (See Fig.5,6)

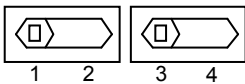
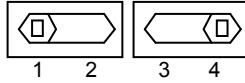
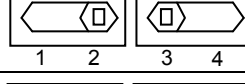
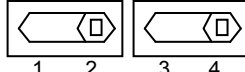
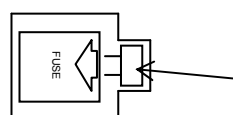
Source voltage	SWITCH POSITION	Fuse rating
AC100V		250V 3.15A Time lag fuse
AC115V		
AC120V		
AC200V		250V 1.6A Time lag fuse
AC220V		
AC230V		

Fig.5 Source Voltages and Switching Positions



Press this part in the arrow direction to remove.

Push the fuse until a click sound is heard.

Fig.6 Replacing Protection Fuse

5-4. Connecting Loads

<Precautions>

- Use crimp-style terminals, etc. to connect loads with the output terminals of the PAR-A power supply unit firmly.
- Use wires of sufficient current capacity for connection.
- Be sure to shut off the MAIN OUTPUT key switch of the PAR-A unit before connecting or disconnecting wires. This is important for the safety.
- The PAR-A unit incorporates a capacitor of several hundred microfarads between the COM terminal and each output terminal and a resistor for discharging this capacitor when the output is turned off. When the PAR-A unit is used to charge a battery, connect a diode in series as shown in Fig.7 below to prevent electric charge of the load from being discharged to the output of the PAR-A unit.

Connect a diode that meets the following conditions:

- Must have sufficient reverse voltage resistance against the rated voltage of the PAR-A unit.
- Must have sufficient forward current capacity against the rated current of the PAR-A unit.
- Take proper measures for radiating heat generated by the element.

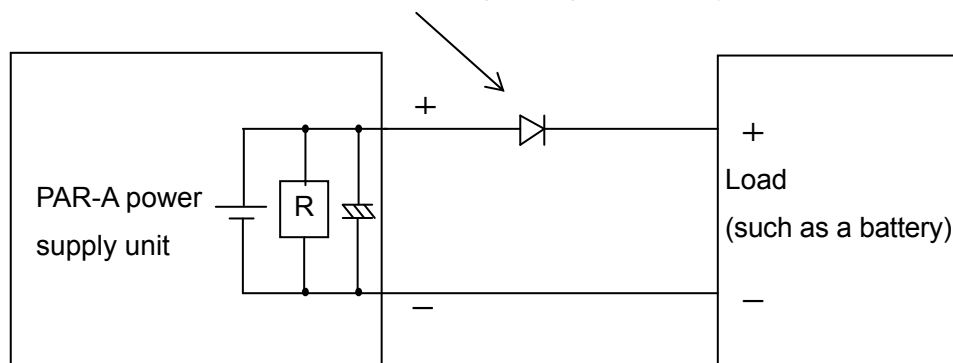


Fig.7 Connecting Load with Energy

6. FUNCTIONS AND OPERATION PROCEDURES

6-1. Basic Operations

6-1-1. Set value and output value display

- The set voltage and current are displayed on the voltage and current indicators when the MAIN OUTPUT key is off. The output voltage and current are displayed on the voltage and current indicators when the MAIN OUTPUT key is on. If you press the LIMIT key, the LED of the key goes on and the set voltage and current are displayed on the voltage and current indicators.

6-1-2. Voltage setting procedures

Operation procedures

1. Press the V key. The LED of the key is lit up in green. (If you press the V key again in the condition where the LED is on, the LED goes out and the operation in step 4 is disabled.)
2. Turn on the red LED below a digit of the voltage indicator whose value should be changed with the DIGIT key.
3. Set a voltage value with the rotary encoder.

6-1-3. Current setting procedures

Operation procedures

1. Press the A key. The LED of the key is lit up in green. (If you press the A key again in the condition where the LED is on, the LED goes out and the operation in step 4 is disabled.)
2. Turn on the red LED below a digit of the current indicator whose value should be changed with the DIGIT key.
3. Set a current value with the rotary encoder.

6-1-4. Fine adjustment of voltage (or current)

Function: It is possible to adjust finely the output voltage (or current) at lower resolution than the display digit.

- The LEDs below the voltage (current) displayed on the PAR-A power supply unit indicate the variable digits. Pressing the right portion of the DIGIT key moves the variable digit to the right. Pressing it further turns off all LEDs. The value one digit lower than the displayed value may be fine-adjusted by rotating the rotary encoder in this condition.
- The voltage may be fine-adjusted in steps of approximately 1mV.
The current may be fine-adjusted in steps of approximately 0.1mA.

※ The setting accuracy shown in SPECIFICATIONS is not guaranteed in fine adjustment.

6-2. Output Functions

Function: When the MAIN OUTPUT key is turned on the channel with its OUTPUT SELECT LED lit is turned on.



CAUTION:

Make sure that wires are connected with the output terminals firmly before pressing the MAIN OUTPUT key.

6-2-1. Method of turning on or off the output with the MAIN OUTPUT key

Operation procedures

1. When the OUTPUT SELECT key is pressed, the lamp lights green.
2. Turn on the MAIN OUTPUT key. The output is turned on.
3. When the MAIN OUTPUT key is pressed again, the key goes out and the outputs of all channels are turned off.

6-2-2. Method of turning on or off the output with the OUTPUT SELECT key

- If the off OUTPUT SELECT key is pressed while the MAIN OUTPUT key is on, the output is turned on. The lamp is lit in green in the CV operation mode or in red in the CC operation mode.
- If an OUTPUT SELECT key that is lit in green (or red) is pressed while the MAIN OUTPUT key is on, the LED of the pressed key goes out and the channel of that LED is turned off.

6-3. Memory Function

Function: It is possible to store the set voltage and current and recall them. The set voltage and current values are stored in PRESET. It is also possible to store the key settings when power is turned on.

<Precautions>

- It takes approximately 0.3 seconds to store the set voltage and current in the preset memory. Operations of all keys, rotary encoder and external contact control are disabled in this period.

6-3-1. Storing preset voltage/current values

Operation procedures

1. Press the PRESET key of the preset memory (1, 2, 3 or 4) where the set voltage and current should be stored. The LED is lit up in green.
2. Set voltage and current values to be stored.
3. Press the MEMORY key. The LED of the PRESET key pressed in step 1 blinks in green.

When the PRESET key whose LED is blinking in green is pressed, the LED is lit up in green and the set voltage and current are stored in that preset memory. To cancel the memory operation, press the MEMORY key again while the LED of the PRESET key is blinking in green.

The blinking LED is lit up and the memory operation is canceled.

<Precautions>

- Note that it is impossible to recall the voltage or current set with the rotary encoder unless they are stored in the preset memory through the operation described in section 6-3-1 "Storing set voltage and current in preset memory".

6-3-2. Recalling preset values

- The set voltage and current stored in preset 1 to preset 4 by pressing the PRESET keys 1 to 4.

6-3-3. Storing values in preset memory in MAIN OUTPUT key on mode

Operation procedures

1. Press the LIMIT key while the MAIN OUTPUT key is on.
2. Set voltage and current are displayed on the voltage and current indicators.
3. Press the PRESET key of the preset memory whose data should be changed. The LED of some PRESET key (1 to 4) is lit. Note that no data may be written in the preset memory whose LED is lit.
4. The LED of the PRESET key pressed in step 3 blinks. The voltage and current stored in that preset memory are displayed.
5. Change the displayed voltage and current to intended values.
6. Press the PRESET key whose LED is blinking. The LED goes out and the voltage and current set in step 5 are written in that preset memory. (To cancel the memory operation, press the MEMORY key without pressing the PRESET key whose LED is blinking.) On completion of operation, the set voltage and current are displayed on the voltage and current indicators. (Condition in step 2)

6-3-4. Copying preset values

Operation procedures

1. Press the PRESET key of the memory where the original voltage and current are stored. The LED of the key is lit up in green.
2. Press the MEMORY key. The LED of the PRESET key pressed in step 1 blinks in green.
3. Press the PRESET key of the memory where the data should be copied. The LED of the PRESET key blinking in green goes out, and the LED of the pressed PRESET key is lit up in green. The set voltage and current are copied in the preset memory whose LED is lit in green.

6-3-5. Storing setting of each key

Function: It is possible to store the settings of the OUTPUT SELECT, PRESET keys when the power switch is thrown.

Operation procedures

1. If the off MEMORY key is pressed while the MAIN OUTPUT key is off, the PRESET key blinks.

If the DISPLAY key is pressed at this time, the blinking PRESET key is lit up. Setting of each key at the point when the power switch is turned on may be stored in this condition.

2. To cancel operation, press the MEMORY key, instead of the DISPLAY/STATUS key, in the same procedures.

6-3-6. Initializing setting

Function: Initialize the settings of the PRESET 1 to 4 and OUTPUT SELECT keys completely (to the default conditions).

Operation procedures

1. Throw the power switch while holding the MEMORY key. The characters "dAtA" and "CIAr" are displayed on the current indicator and voltage indicator, respectively, and the memory is initialized.
2. The above remain displayed on the LEDs when initialization is executed. It takes approximately 2 seconds to initialize the setting.

(All other functions of the PAR-A power supply unit stop.)

<Precautions>

- Do not shut off the power switch for the initialization period. Results of initialization are not guaranteed if the power switch is shut off. Retry initialization of it fails.

6-4. Usage of KEYLOCK/LOCAL Key

Function: This function changes the mode of the PAR-A power supply unit: key lock mode, or local mode.

Key lock mode (Lit in green) : Any other keys than the KEY LOCK/LOCAL key are invalid.

Local mode (Off) : All keys may be operated manually.

Remote mode (Lit in red) : Any other keys than the KEY LOCK/LOCAL key are invalid.

Operation procedures

1. When the switches on the panel are operated manually, holding the KEY LOCK/LOCAL key for about a second changes the key lock mode into the local mode, and vice versa.
2. When signals are output to the PAR-A unit through the IF-41GU, IF-41RS or IF-41USB (in the remote mode), the LED of the KEY LOCK/LOCAL key is lit up in red and panel operations are disabled. If the KEY LOCK/LOCAL key is pressed in this condition, the LED of the key goes out and panel operations are enabled. When signals are output again to the PAR-A unit through remote control, the LED of the key is lit up in red and the PAR-A unit enters the remote mode.
3. The LED of the KEY LOCK/LOCAL key blinks in the external contact control mode. (For details, see section "7. EXTERNAL CONTACT CONTROL" below.) If the KEY LOCK/LOCAL key is pressed while its LED is blinking, the key lock function works, though the LED does not stop blinking. To cancel the key lock function, press the key again.

6-5. Usage of Remote Sensing Function

6-5-1. Remote sensing terminals

When a load is connected with the output terminals, the voltage at the terminals of the load is subject to load fluctuation due to voltage drop, which is caused by the contact resistance of the output terminals or resistance of the connected wires. The remote sensing function allows the user to set the voltage at the terminals of the load finely.

The product is supplied with the remote sensing terminals are connected with the output terminals with shorting bars as shown below. To use the remote sensing function, remove the screws from the remote sensing terminals, remove the shorting bars, and connect the lead wires with terminals supplied with the product. Be sure to turn off output when connecting the lead wires to the sensing terminals. Otherwise, the sensing terminal may be short-circuited with the output terminal, resulting in a failure, since the sensing terminals are close to the output terminals.

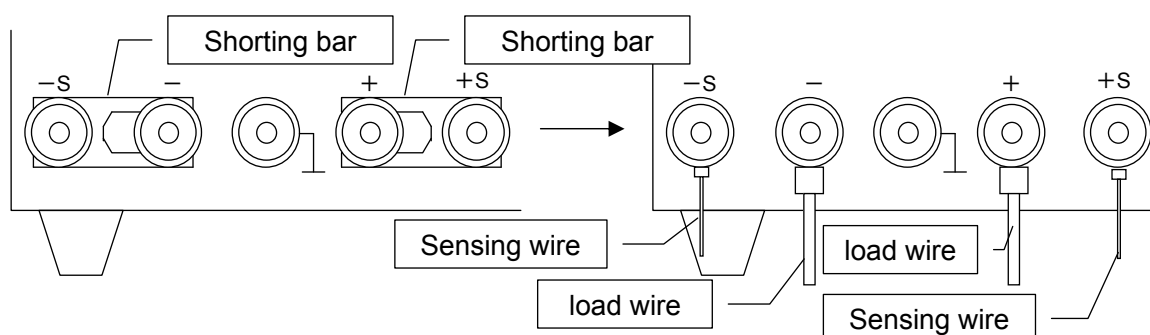


Fig.8 Output Terminals on Front Panel

6-5-2. Remote sensing connection

Connect the wires as shown below. The wires cancel the voltage drop, and the set voltage is output to the terminals of the load. The voltage is compensated by 1V per wire. Voltage over the rated voltage may not be output.

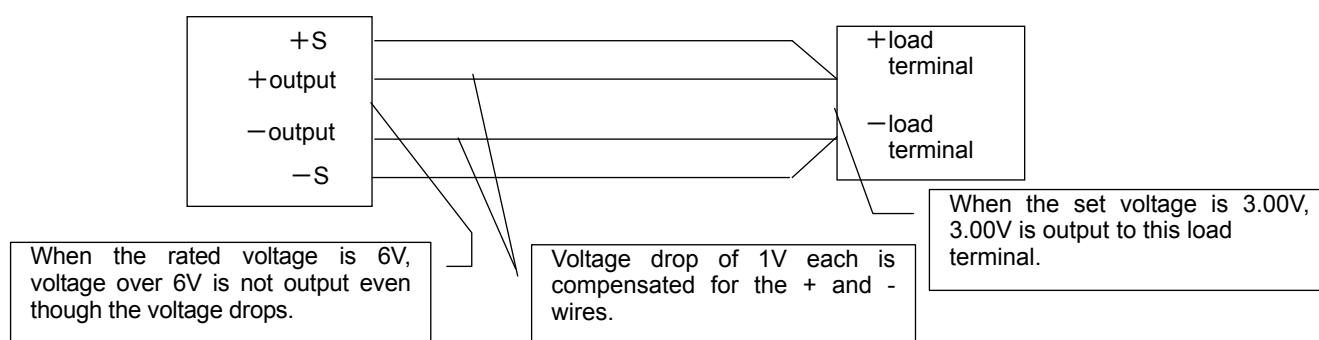


Fig.9 Connection with Load when Using Remote Sensing Function

※ Voltage over the set value is output if the sensing wires are disconnected.

The inductance and capacity of the output wires may cause oscillation if too long wires are connected with the load. In such a case, connect electrolytic capacitors of about 100μF with the load terminals.

7. EXTERNAL CONTACT CONTROL

7-1. Outline of Functions

- It is possible to control the MAIN OUTPUT key and the PRESET 1 to PRESET 4 keys through the external contact control connector on the rear panel (hereinafter referred to as the connector J1). It is also possible to input an external alarm signal (for turning off the MAIN OUTPUT key forcedly) and output an alarm signal through the connector J1.
- Open all pins of the connector J1 to operate the PAR-A power supply unit with the keys on the front panel.
- When some of S1 to S6 shown in Fig.10 is turned on, the LED of the KEY LOCK/LOCAL key on the front panel blinks in green.

7-2. Specifications of External Contact Control Connector

Pin No.	Function
1,2	Used for alarm signal input or output when short-circuited with pin 1 to 2.
3	COM terminal of the internal circuits. Used for external contact control when short-circuited with pin 2 to 6.
4 to 7	Used for preset operation when short-circuited with pin 3.
8	Used for main output operation when short-circuited with pin 3.

- ※ Connect the lead wires with connectors supplied with the PAR-A unit with the connector J1.
- ※ If it is necessary to expand the lead wires with connectors supplied with the PAR-A unit, they must be soldered properly and the soldered joint must be protected with insulation tube or the like.
- ※ The lead wires with connectors supplied with the PAR-A unit are color-coded according to the markings of the J1 on the rear panel.

7-3. Operation Procedures

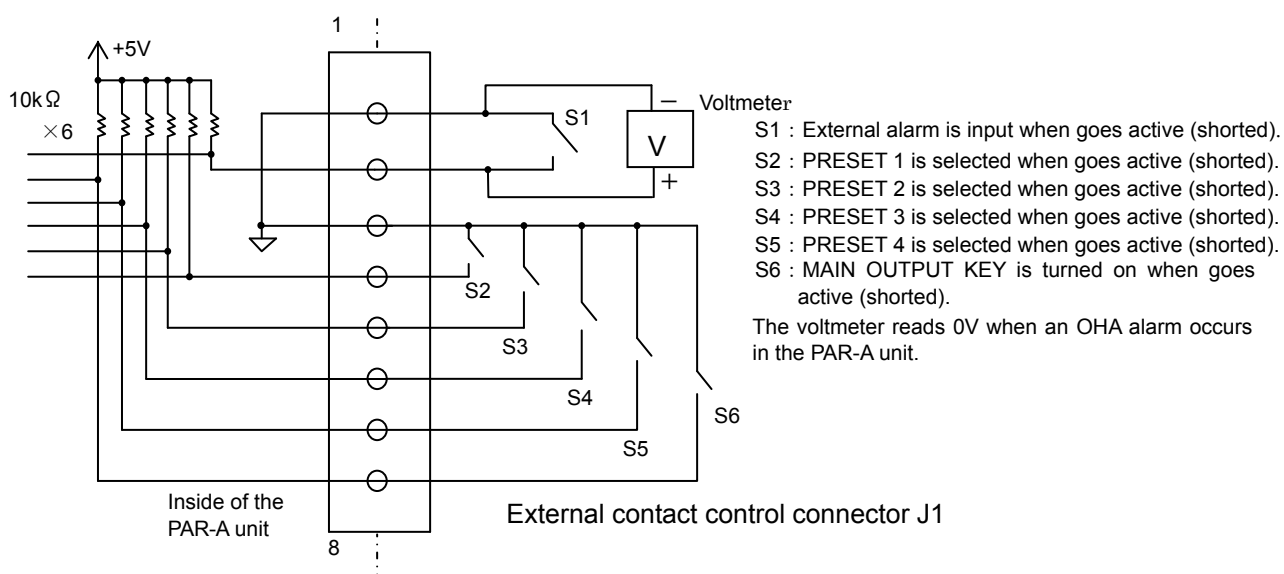


Fig.10 Usage of External Contact Control

7-3-1. Turning on/off MAIN OUTPUT key through external contacts

- When S6 shown in Fig.10 goes active (i.e., pins 3 and 8 are short-circuited), the MAIN OUTPUT key is turned on. Note that the MAIN OUTPUT key is always active, except an alarm status, when pins 3 and 8 are short-circuited.
- Fig.11 shows the relationship between S6 and the MAIN OUTPUT key on the front panel.

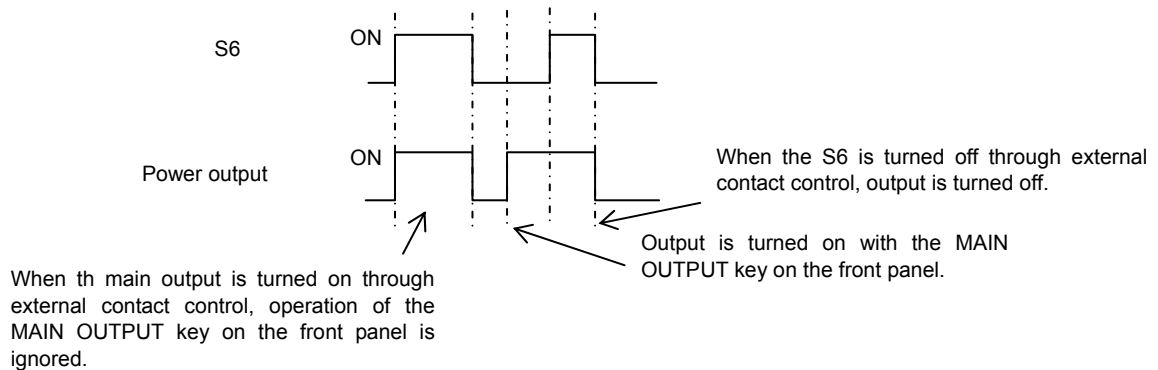


Fig.11 Relationship between S6 and the MAIN OUTPUT Key on Front Panel.

7-3-2. Selecting PRESET 1 key to PRESET 4 key through external contacts

- It is possible to select PRESET 1 key to PRESET 4 key by turning on (i.e., short-circuiting) S2 to S5 shown in Fig.10.
- If some PRESET is selected with the external contacts, the PRESET keys on the front panel are not functional.
- When PRESET 1 key to PRESET 4 key are selected simultaneously with the external contacts, the order of priority is PRESET 1 key > PRESET 2 key > PRESET 3 key > PRESET 4 key.

7-3-3. Detecting OHA signal

- If the exhaust air temperature becomes too high and an OHA (overheat alarm) occurs, pin 2 shown in Fig.10 goes Low. The OHA function may be checked with a voltmeter connected as shown in Fig.10.

7-3-4. Inputting alarm signal through external contacts

- It is possible to bring the PAR-A power supply unit into the alarm status by turning on S1 shown in Fig. 10 (i.e., short-circuiting pins 1 and 2). It is possible to maintain the alarm status by keeping S1 on.
- In the alarm status, the MAIN OUTPUT key is turned off forcedly like the OHA.
- ◆ See section "5-3. Changing Source Voltage".
- The characters "EAR" are displayed on the current indicator.

7-3-5. Inputting several alarms through external contexts

- If pins 1 of the PAR-A power supply units are connected with each other and pins 2 are also connected with each other in a system with several PAR-A power supply units, all units enter the alarm status when an OHA occurs in some unit.

<Precautions>

It is possible to connect a maximum of 5 units using J1.

8. REMOTE CONTROL

- Terms used in the descriptions below

Master unit: A unit that controls the slave units.

Slave units: All PAR-A power supply units controlled by the master unit when the IF-41RS is used. PAR-A power supply units connected with the local bus master unit through the local bus when the IF-41GU/IF-41USB is used.

Local bus: A bus for connecting the PAR-A power supply units. Use modular cables when the IF-41RS is used. Use twisted pair cables when the IF-41GU/IF-41USB is used.

Local bus master: PAR-A power supply units connected directly with the computer when the IF-41GU/IF-41USB is used.

※ that the PAR-A power supply unit will not accept any other commands than LL1, LC1 and ST0 to 5 when an OHA occurs in it or an alarm is input to it through the external contacts.

8-1. Connecting IF-41RS

- It is possible to connect a maximum of four PAR-A power supply units (with the IF-41RS units built in) with a master unit (such as a computer) with modular cables and control the PAR-A power supply units. The PAR-A power supply units to be controlled as the slave units must have system addresses (between 1 and 26).
- ◆ See sections "8-3-2. Setting addresses" and "8-3-3. Address setting range and set value".
- It is recommended that modular cables CB-0603S, 0615S, 0630S or 06100S be used for connection.
- The maximum cable length of the system is 10 meters between the computer and IF-41RS.

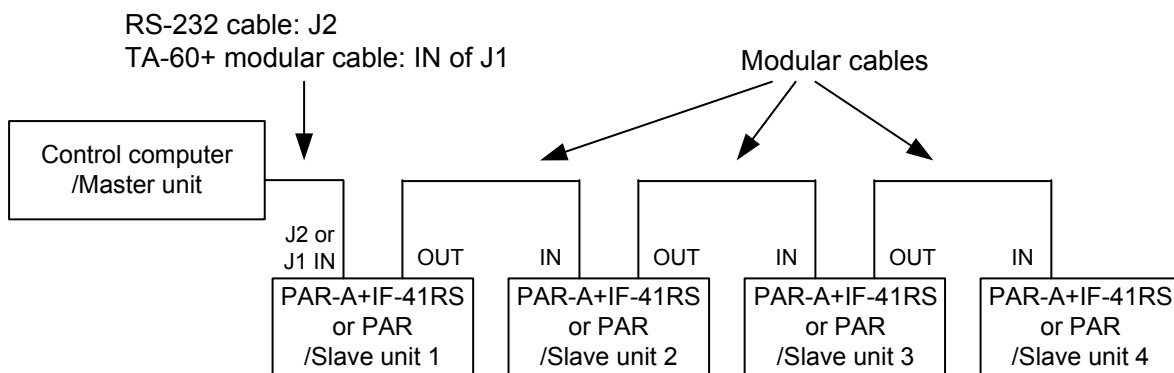
<Precautions>

- Before connecting the cables, turn off the master unit and slave units.
- Be sure to connect the IN and OUT terminals of the connectors J1. Connecting the IN (or OUT) terminals with each other may cause troubles.

8-1-1. Remote control using computer

- The slave units may be connected with the master unit in two ways as shown below.
 - ① Connect the RS-232C connector of the computer with the connector J2 (D-sub 9-pin connector) of the PAR-A unit. (A cross cable may be used. However, it is necessary to set the RS-232C flow control of the computer to "None" in such a case.)
 - ② Connect the RS-232C connector of the computer with IN of the connector J1 using the TA-60 (Our RS-232C-to-modular conversion cable).
- As shown in Fig.12 a maximum of three PAR-A or PAR-A power supply units may be connected with the slave unit connected with the computer using modular cables. Any models may be connected. In this application, the send messages must conform to the transmission and reception procedures using the IF-41RS shown in section "8-4. Transmission and Reception Procedures Using IF-41RS (without using GP-620)" below.

Transmit message will be echo back to receiving side.
- Set the address zero of the computer using the software.
- For the RS-232C communication specifications, see Communication Specifications of IF-41RS in section 2.



※ Use the general-purpose cross or interlink RS-232C cables.

Fig. 12 Computer Control Using IF-41RS

8-1-2. Master operation

- If a PAR-A power supply unit with a built-in IF-41RS is set to address 0 and connected as the master unit as shown in Fig.13, operations of the master unit are reflected upon four slave units. The operations shown below are reflected upon four slave units:
 - ① Setting of the DISPLAY/STATUS key (Selection of channels whose set value or output values are to be displayed).
 - ② Selection of PRESET 1 to PRESET 4.
 - ③ Turning on and off the MAIN OUTPUT key.
 - ④ Setting of each OUTPUT SELECT key.
 - ⑤ Turning on and off the delay function and delay time of each channel.
 - ⑥ Set voltage and current of each channel.
- In the master operation, values and conditions set on the master unit are reflected upon the slave units. Therefore, items not operated on the master unit are as executed as set in the slave units in advance.
- The master operation assumes that the master unit and slave units are the same-model PAR-A power supply units.
- Turn off the TRACKING ON/OFF key of the slave units before starting master operation. The same PRESET keys of the slave units must be turned on (and their LEDs must be lit up).
- If setting of the voltage and current are with the rotary encoder and setting of the voltage and current using PRESET 1 to 4 are executed together in the master operation, the voltages and currents of the master unit and slave units become different. Change the voltages and current in the master-slave operation in either of the following methods:
 - ① Change the voltages and currents using the rotary encoder only without pressing the PRESET keys, after master operation starts.
 - ② Set the voltages and currents in the preset memory of the master unit and slave units in advance, and set the voltages and currents by selecting PRESET 1 key to PRESET 4 key.

<Precautions>

- Do not use the memory function during master operation. Though the memory of the master unit may be used, data stored in the memory is not reflected upon the slave units. Thus, the set values of the master unit and slave units become different.
- When the master operation starts (and the master unit is operated), the slave units enter the remote mode. Any panel operations are disabled on the slave units.

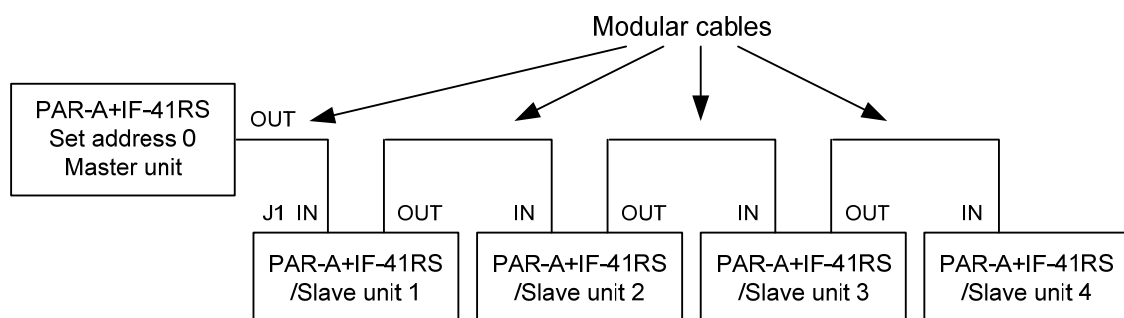


Fig.13 Computer Control Using IF-41RS

8-1-3. Remote control using RT-63

- When the RT-63 (our remote controller) is used as the master unit and the PAR-A units (with the IF-41RS units built in) are connected as shown in Fig.14, it is possible to control the following operations of a maximum of four PAR-A units:

- ① Turning on and off the MAIN OUTPUT key.
- ② Switching PRESET 1 key to PRESET 4 key (select PRESET 4 key with VARIABLE key.)

- PWR power supply units may be used as the slave units.

<Precautions>

- Be sure to connect the RT-63 with the PAR-A units in the condition where the power switches of the PAR-A units are off.
- The OUTPUT PROTECT key of the RT-63 is invalid for the PAR-A units. Turn off the OUTPUT PROTECT key of the RT-63.

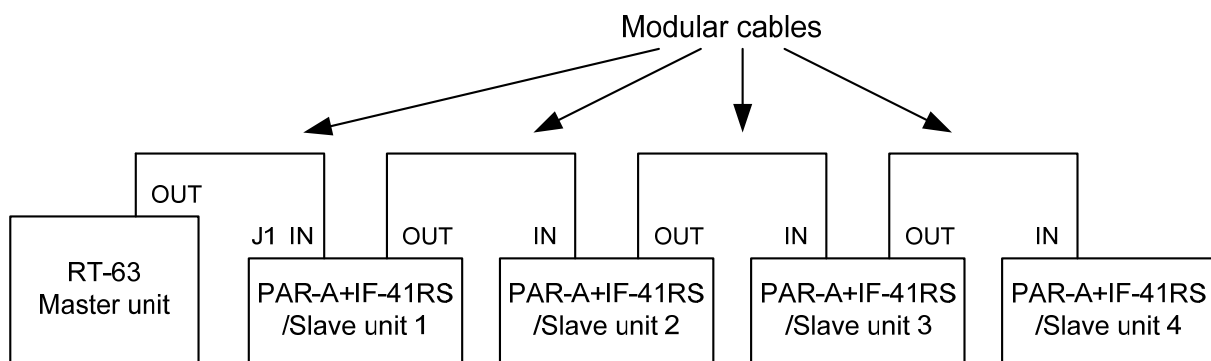


Fig.14 Computer Control Using RT-63

8-1-4. Remote control using GP-620

(Our GP-IB adapter). Connect the units as shown in Fig.15. It is possible to control a maximum of four PAR-A units (with the IF-41RS units built in). For connection of the GP-620 with a computer and setting, refer to the manual of the GP-620.

GP-IB cable Modular cables

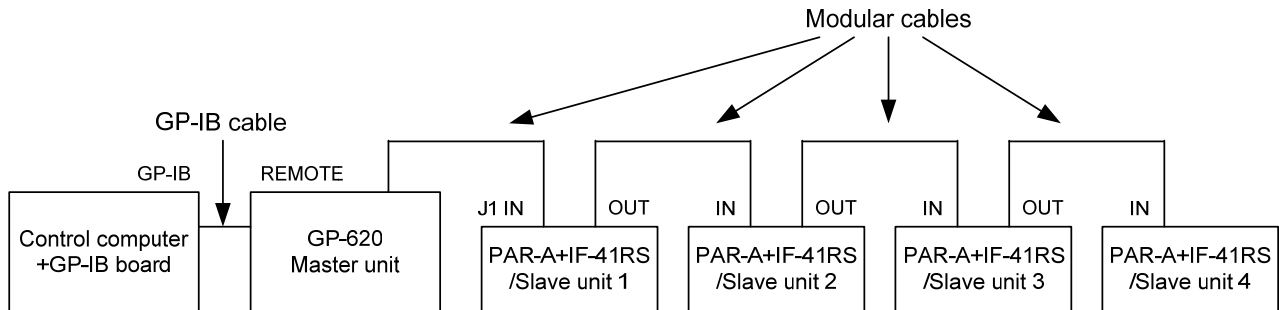


Fig.15 Remote Control Using GP-620

8-2. Connecting IF-41GU/IF-41USB

- It is possible to control the PAR-A power supply units using the IF-41GU through the GP-IB or USB. (IF-41USB : USB only) It is necessary to set the PC addresses and system addresses in the local bus master. Set the system addresses only in the slave units.
- The PAR-A series and PW-A series power supply units can only be connected and the PAR series PAR-H series and PWR series cannot be connected.
- For the address setting procedures, see sections "8-3-2. Setting addresses" and "8-3-3. Address setting range and set value".
- Be sure to turn on the local bus master unit after turning all other slave units.

8-2-1. Remote control through GP-IB (IF-41GU only)

- It is possible to connect a maximum of 14 local bus master units directly with a computer using GP-IB cables. It is possible to connect a maximum of 31 slave units with each local bus master unit connected directly with the computer using two twisted pair wires. Fig.16 shows the connection diagram.

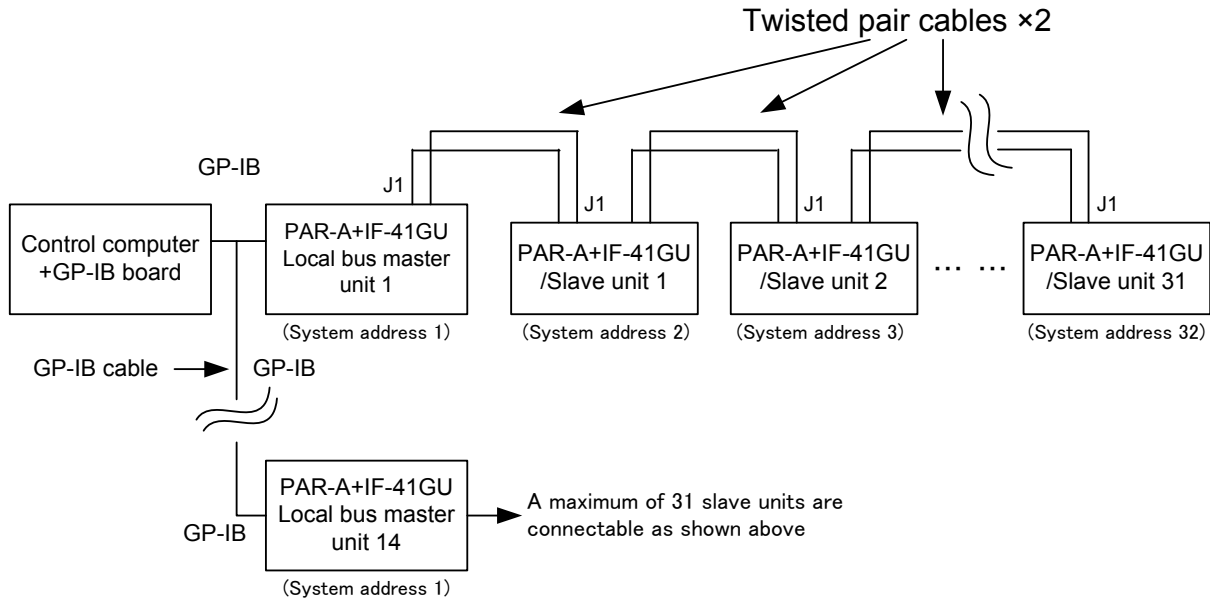


Fig.16 Remote Control through GP-IB using IF-41GU

8-2-2. Control through USB

- It is possible to connect a maximum of 32 local bus master units (except HUB) directly with a computer using USB cable. It is possible to connect a maximum of 31 slave units with each local bus master unit connected directly with the computer using two twisted pair wires. Fig.17 shows the connection diagram.

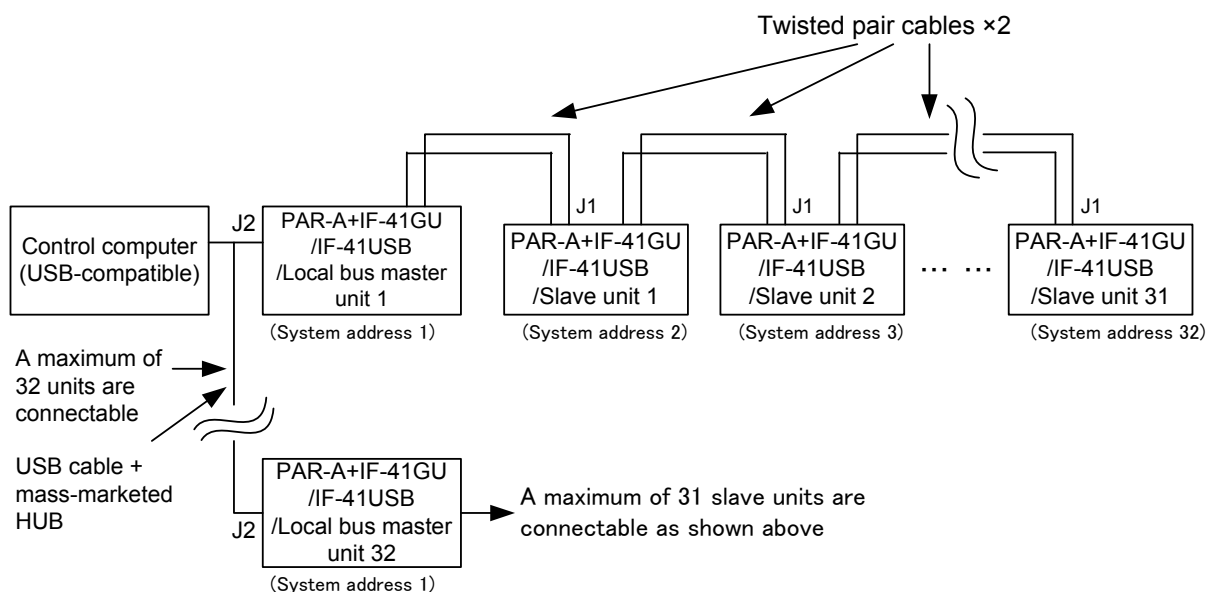


Fig.17 Remote Control through USB using IF-41GU/IF-41USB

8-2-3. Connecting IF-41GU/IF-41USB local bus

- Observe the following instructions when connecting the twisted pair cables for local bus connection:
 - ① The total length of the local bus must be 200 meters or less. Its resistance must be 50 ohms or less.
 - ② Turn on the switches S1 of both the local bus master unit and the last IF-41GU/ IF-41USB unit connected with the local bus. S1 is the switch for turning on or off the terminal resistance. Pressing up the lever switch S1 is on-state. (Depress the lever switch S1 in case of the power supply with IF-41GU or IF-41USB)
 - ③ Connect the wires that meet the following conditions with J1 of each IF-41GU/IF-41USB unit:
Single wire : 0.4mm to 1.2mm diameter/ Twisted wires : 0.3 mm² to 1.2 mm², AWG16 to 22

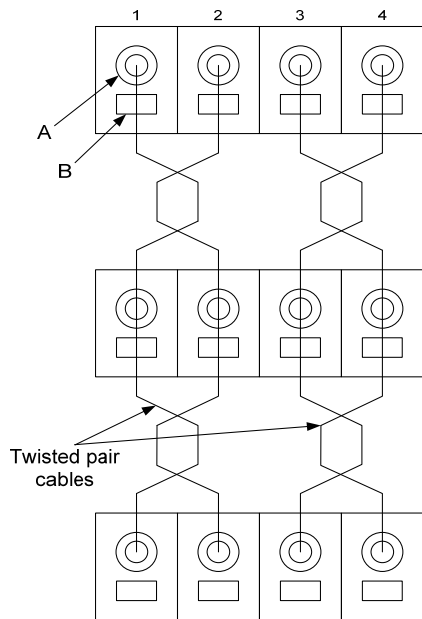


Fig.18 Local Bus Connection

Connect local bus wires with the terminals of the same numbers 1 to 4 shown on the left.

Twist wires 1 and 2. Twist wires 3 and 4.

Connection procedures

1. Prepare twisted pair cables suitable to local bus connection.
Peel off insulation up to 11 mm from the end.
2. Prepare a flat-head screwdriver having the blade width of 2.6 mm. Hold the button "B", insert the end of the wire into "A" and fix it.
3. It is necessary to insert two wires simultaneously, except the first and last wires. Insert them with care not to allow them to come off.

8-3. Setting Addresses

8-3-1. Addresses

- It is necessary to set addresses of the PAR-A power supply units before starting remote control.
There are two addresses: System addresses, and PC addresses.
 - ① System address: This is an address of the PAR-A power supply unit. It is necessary to assign system addresses to all PAR-A power supply units to be remote-controlled using the IF-41GU, IF-41RS or IF-41USB.
 - ② PC address: This address should be assigned only when the IF-41GU/IF-41USB is used. It is necessary to assign a PC address to the local bus master unit to be connected with a computer through the GP-IB or USB. Consider that the PC address corresponds to the GP-IB address when the local bus master unit is connected with a computer through the GP-IB. It serves as an identification parameter when the local bus master unit is connected with a computer through the USB.
- ◆ See section "9-3-2. Setting addresses" below.

8-3-2. Setting addresses

Operation procedures

1. Hold the A key of the PAR-A power supply unit and throw the power switch. Keep holding the A key until the characters "P-on" displayed on the voltage and current indicators change into "Idno". When the characters "SyAd" are displayed on the voltage and current indicators, it is possible to set the system address.
 2. Change the value with the rotary encoder and press the MEMORY key. The value is stored.
When the PAR-A power supply unit incorporates the IF-41GU/IF-41USB and the system address is set to 1, the characters "PcAd" are displayed and operation proceeds to PC address setting. Likewise, change the value with the rotary encoder and press the MEMORY key. Normal display is restored after completion of setting.
- ※ The address setting range differs with the communication method.
- ◆ See section "9-3-3. Address setting range and set value" below and set the addresses properly.

8-3-3. Address setting range and set value

Optional board	Connection method		System address	PC address
IF-41RS	Remote control from computer		1 to 26	—
	Master operation	Master	0	—
		Slave	1 to 26	—
	Remote control using RT-63		1 to 26	—
IF-41GU	Remote control using GP-620		1 to 26	—
	Control thru. GP-IB	Slave	2 to 32	—
		Local bus master	1	0 to 31
IF-41GU IF-41USB	Control thru. USB	Slave	2 to 32	—
		Local bus master	1	0 to 31

- ※ The connection methods shown in the table above correspond to the descriptions in sections "8-1. Connecting IF-41RS " and "8-2. Connecting IF-41GU/IF-41USB ".
- ※ The number of the addresses is not the same as the number of connectable units.
For the number of connectable unit, see sections "8-2-1. Remote control through GP-IB (IF-41GU only)" and "8-2-2. Control through USB" .
- ※ The system address and PC address are set to 1 by default or after the memory is cleared.

<Precautions>

- Do not assign the same system address to several slave units when the IF-41RS boards are used.
- Do not assign the same PC address to several local bus master units when the IF-41GU/ IF-41USB boards are used. Do not assign the same system address to several slave units connected with the local bus master unit through the local bus. Otherwise, the units will not run normally.
- When the units are connected with a computer through the USB, the PC addresses are similar to the IDs for unit identification. They are different from the USB addresses. The USB addresses are assigned automatically to the USB devices by the computer and need not be specified.
- In GP-IB control, a unit having the PC address of 31 runs in the listen-only mode.

8-4. Transmission and Reception Procedures Using IF-41RS (without using GP-620)

- ASCII7-unit codes are used for transmission using the IF-41RS (without using the GP-620)

	b7 b6 b5	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4~b1		0	1	2	3	4	5	6	7
0000	0	NUL	TC7 (DLE)	SP	0	@	P	'	p
0001	1	TC1 (SOH)	DC1	!	1	A	Q	a	q
0010	2	TC2 (STX)	DC2	"	2	B	R	b	r
0011	3	TC3 (ETX)	DC3	#	3	C	S	c	s
0100	4	TC4 (EOT)	DC4	\$	4	D	T	d	t
0101	5	TC5 (ENQ)	TC8 (NAK)	%	5	E	U	e	u
0110	6	TC6 (ACK)	TC9 (SYN)	&	6	F	V	f	v
0111	7	BEL	TC10 (ETB)	,	7	G	W	g	w
1000	8	FE0(BS)	CAN	(	8	H	X	h	x
1001	9	FE(HT)	EM	)	9	I	Y	i	y
1010	A	FE2(LF)	SUB	*	:	J	Z	j	z
1011	B	FE3(VT)	ESC	+	;	K	[	k	{
1100	C	FE4(FF)	IS4(FS)	,	<	L	\(¥)	l	|
1101	D	FE5(CR)	IS3(GS)	—	=	M	]	m	}
1110	E	SO	IS2(RS)	.	>	N	^	n	~
1111	F	SI	IS1(US)	/	?	O	—	o	DEL

Table 2. ASCII Code List

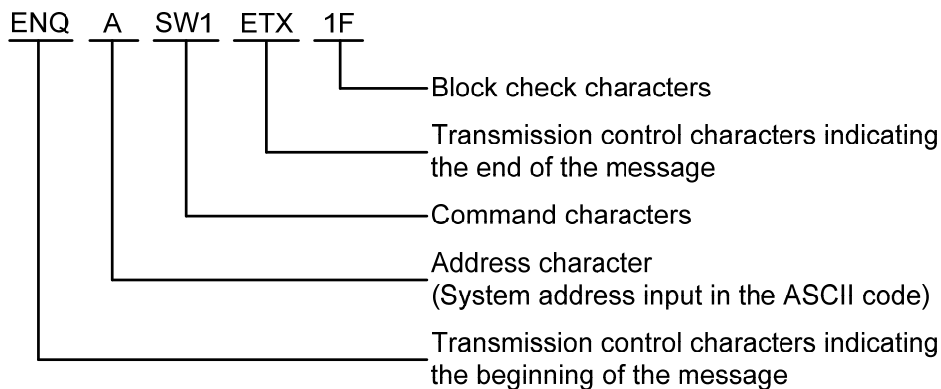
8-4-1. Message structure

- Write a message to be sent from the master unit to the PAR-A power supply unit through the IF-41RS as shown in example 1.
- It is possible to use multi-commands using command characters.
The command separator must be ",".
- The master unit may send a message consisting of a maximum of 255 characters to the PAR-A power supply unit.
- A message with the address characters with "#" are sent to all PAR-A power supply units.
(Broadcast mode)
- A message sent by a PAR-A power supply unit must have the structure shown in example 1.
(when the PAR-A power supply unit is allowed to send a response message or service request.)

<Precautions>

- Do not put any spaces among characters. However, it is possible to put a space among alphanumeric and numeric command characters. (It is possible to write SW 1 in example 1.)
In this case, the space is counted as a character.
- When a send request command such as ST or PWID is sent in the broadcast mode, signal collision occurs. Do not send a send request command in the broadcast mode.

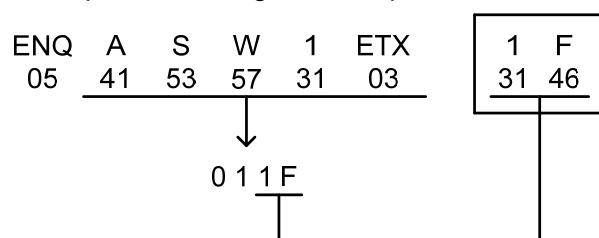
<Example 1> Sending a signal for turning on the MAIN OUTPUT key of the slave unit having the system address of 1



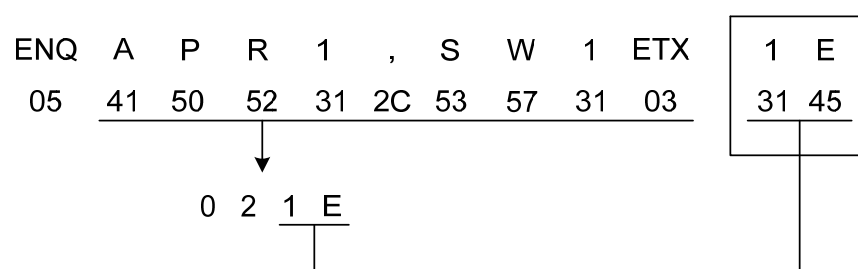
Block check characters

- The block check characters have two bytes. The ASCII values of seven bits from the bit following the transmission control characters indicating the beginning of the message to the transmission control characters indicating the end of the message are added in binary. The value of low-order eight bits is expressed in hexadecimal and is converted into the ASCII code. The block check characters indicate the ASCII code.

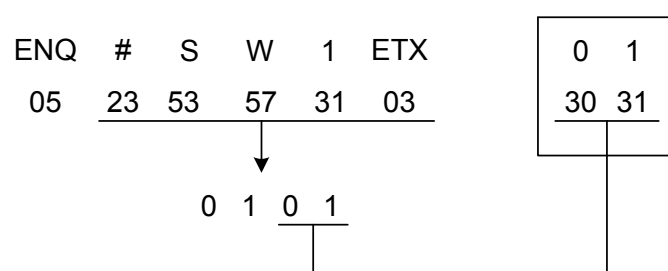
<Example 2> Message in example 1



<Example 3> Selecting PRESET 1 of the slave unit having the system address of 1 and turning on the main output key (using multi-commands)



<Example 4> When signals for turning on the MAIN OUTPUT key are sent to all slave units.



<Precautions>

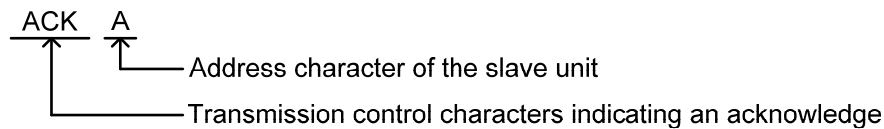
- A syntax error occurs if a message is not constructed properly. The slave units ignore that message.
- If a message contains information exceeding the rated voltage and current of a slave unit, the slave unit is set to the maximum rating.
- Make sure that the slave unit sends no message to the master unit before sending a message from the master unit to the slave unit.

8-4-2. Precautions for sending or receiving message

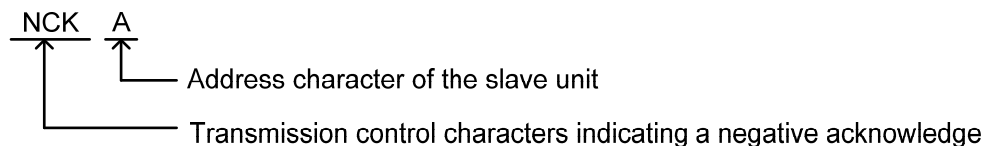
- When the master unit sends a message to the slave unit, the slave unit sends an acknowledge or negative acknowledge to the computer.
- When the slave unit receives a message properly, it sends the transmission control characters indicating an acknowledge and address character to the master unit. If the slave unit fails to receive a message properly, it sends the transmission control characters indicating a negative acknowledge and address character to the master unit.

<Example 5> ENQ A S W 1 ETX 1 F ...From the master unit to the slave unit

When the slave unit receives the SW1 command properly, it sends the following message:



When the slave unit receives the SW1 command properly, it sends the following message:



<Precautions>

- The acknowledge or negative acknowledge sent by the slave unit to the master unit indicates whether or not the slave unit received a message from the master unit properly. The slave unit sends an acknowledge to the master unit if the relationship between the characters and block check characters of the message sent by the master unit to the slave unit is correct, even though the message contains a syntax error or out-of-range error. The slave unit sends a negative acknowledge to the master unit if the relationship between the characters and block check characters of the message sent by the master unit to the slave unit is incorrect, even though the message contains correct characters.
- The slave unit sends no acknowledge or negative acknowledge to the master unit only when it receives a broadcast mode message.
- If the slave unit sends no acknowledge or negative acknowledge to the master unit, even though the master unit sends a message to the slave unit, and the master unit retries sending a message to the slave unit again, the master unit must retry sending 500ms after completion of the previous transmission. Otherwise, signal collision may occur.

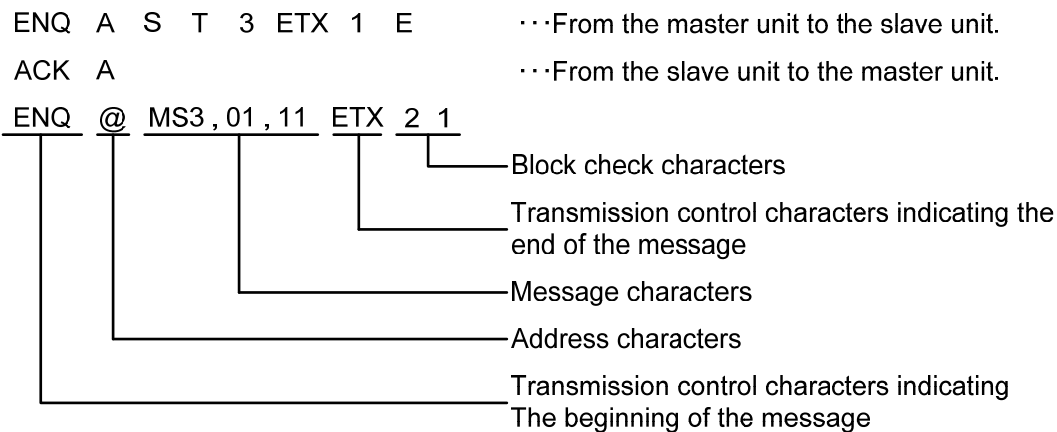
Status after sending negative acknowledge

- When the slave unit sends a negative acknowledge to the master unit, it runs in the condition before sending the acknowledge. If an acknowledge sent by the slave unit to the master unit contains a syntax error, the slave unit ignores the message and runs in the condition before sending the acknowledge.
- If a message containing multi-commands is sent and one multi-command character has a syntax error, the slave unit ignores the command containing the syntax error but it executes the other commands.

8-4-3. Specifying slave machine as talker from master unit

- When the master unit sends a command requiring a response message to the slave unit and the slave unit sends an acknowledge, a message having the structure shown in example 6 is sent to the master unit.

<Example 6> Inquiring about the model of the PAR-A power supply unit controlled in address 1.
(Command: MS3)



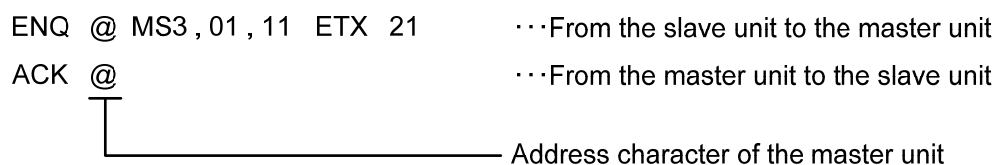
<Precautions>

- The service request function must be disabled when the master unit sends a command requiring a response message to the slave unit. Otherwise, signal collision may occur in the PAR-A transmission path.

8-4-4. Acknowledge or negative acknowledge to slave units

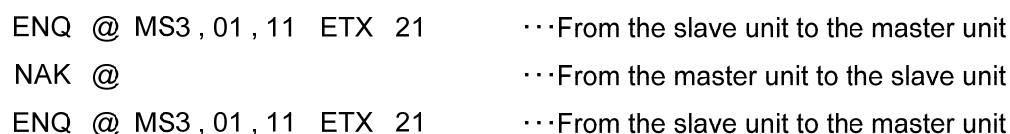
- The master unit must send an acknowledge or negative acknowledge to the slave unit within 500ms after completion of message transmission from the slave unit to the master unit.

<Example7>



If the master unit sends a negative acknowledge, the slave unit resends the same message to the master unit.

<Example 8>



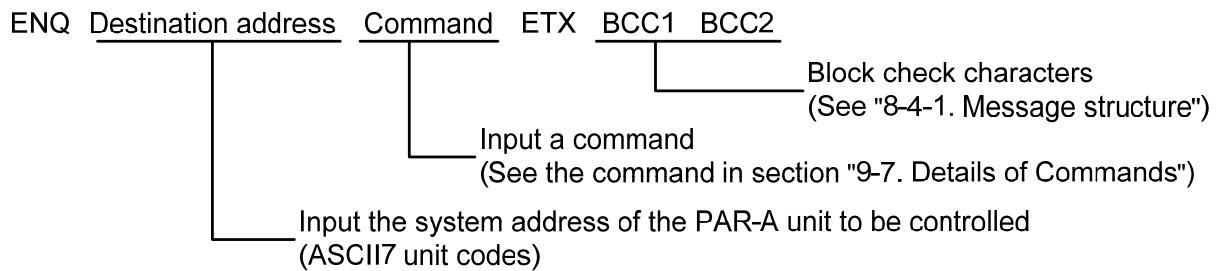
<Precautions>

- Unless the master unit sends an acknowledge or negative acknowledge to the slave unit, the slave unit sends a message to the master unit twice.

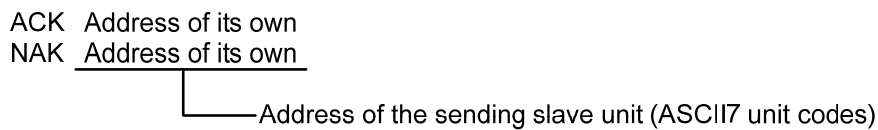
8-4-5. Message structure list when using IF-41RS

Using a command for controlling the slave unit

- From the master unit to the slave unit

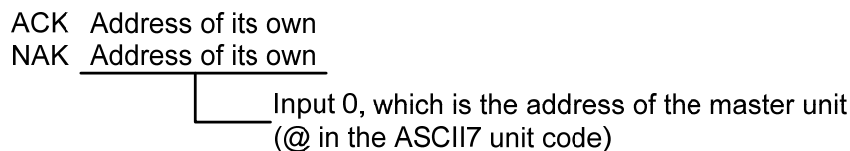
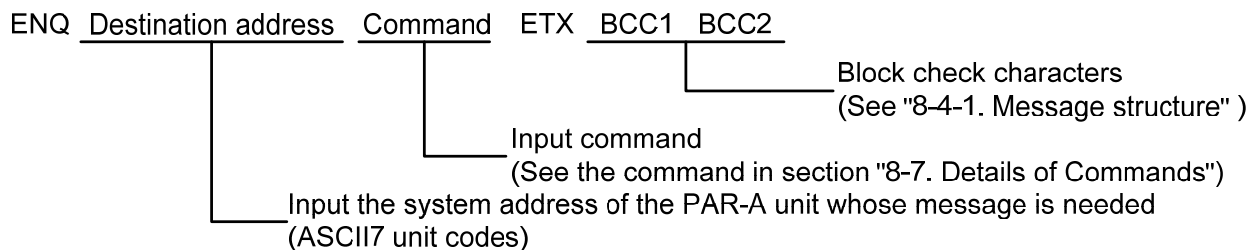


- From the slave unit to the master unit

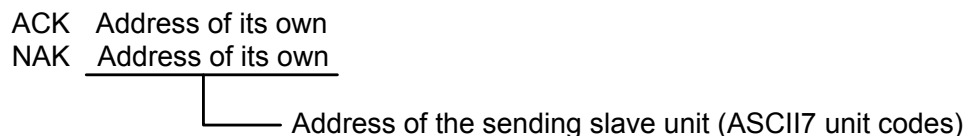
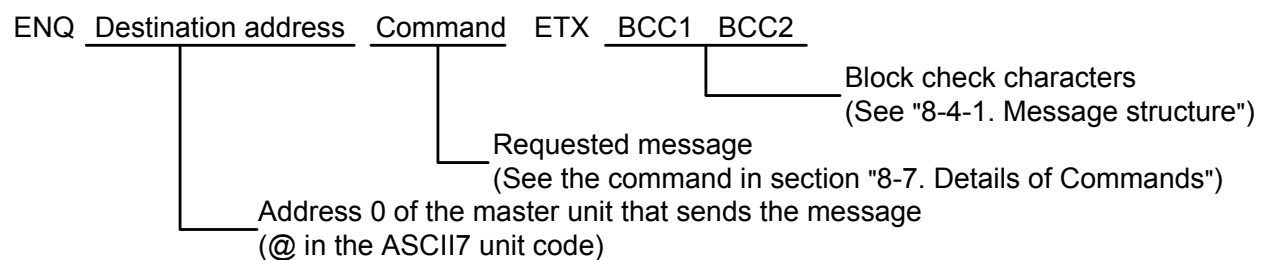


Using a command requiring a response message

- From the master unit to the slave unit



- From the slave unit to the master unit

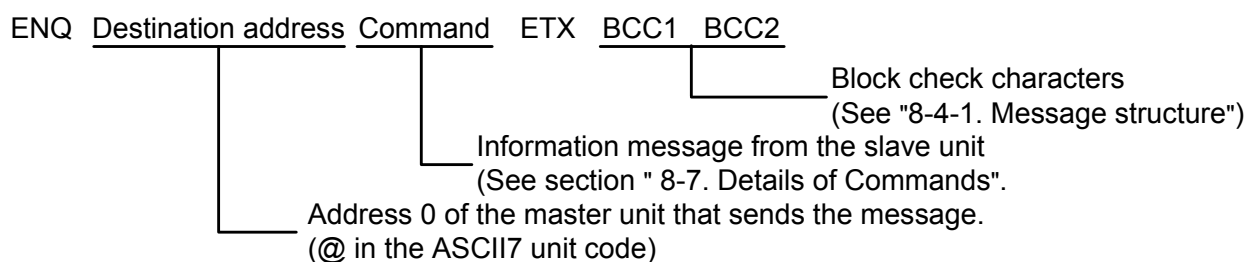


When a service request is enabled

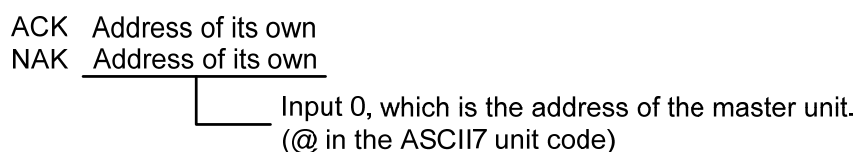
When a service request is enabled, the slave unit sends a message.

◆ See the command in section "8-7. Details of Commands".

- From the slave unit to the master unit



- From the master unit to the slave unit



8-5. Usage of IF-41GU/IF-41USB

8-5-1. Usage of GPIB (IF-41GU only)

- Recommended

GP-IB controller :All GP-IB controllers made by National Instruments.

The GP-IB cards of other manufacturers will offer trouble-free operations. However, our does not warrant their performances and may not provide support services in some cases.

- Delimiters :The following delimiters of the commands sent to the PAR-A units are valid. LF only, CR•LF, LF + EOI, CR•LF + EOI, and EOI only The delimiters of the commands sent by the PAR-A units are CR•LF + EOI. It is impossible to deactivate EOI using the IF-41GU.

8-5-2. Usage of USB

- The vendor ID is 098F (hexadecimal).
The product ID of the IF-41GU is 1000 (hexadecimal).
The product ID of the IF-41USB is 1001 (hexadecimal).
- The USB driver can be downloaded from the homepage show below. If it cannot be downloaded, contact the company and our distributor.
<http://www.texio.co.jp>
The API and sample program may also be downloaded.

8-5-3. Status bytes

- When a slave unit issues a message, the master unit receiving it sets the following status byte according to the message.

Message from slave units	Status byte
CC message	41H
MS message	42H
UU message	43H
Other message	50H

If a single statement contains several messages, the status byte is that of the first message.

<Example 9> The status byte is 50H when a message from the slave unit is PWID...; ST0....

8-5-4. Application configuration

- Create an application in the sequence shown below when using the service request function using the IF-41GU/IF-41USB or sending a command requiring a response message.

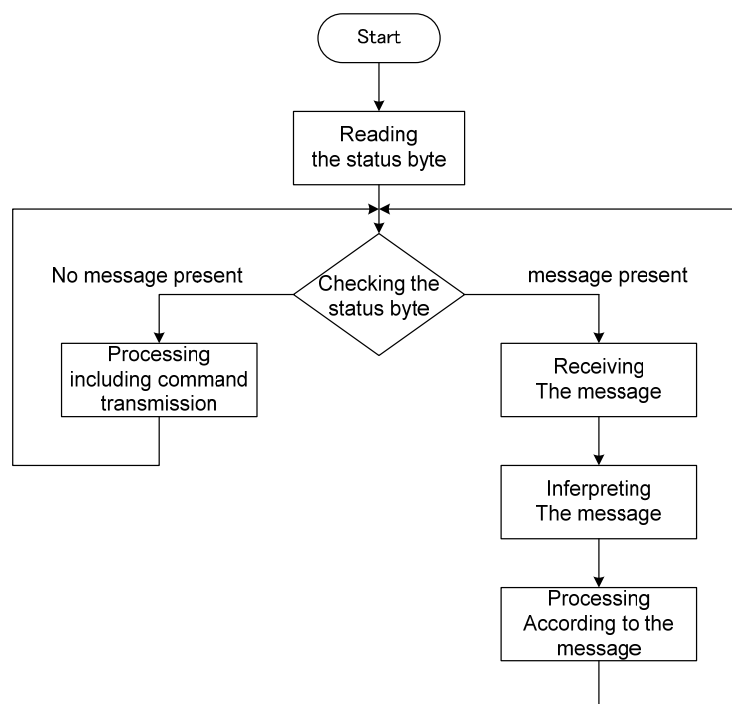


Fig.19 Flow Chart when Receiving Message from PAR-A Power Supply Unit

- Monitor the status byte at all times. Receive a message to the local bus master. The local bus master may store a maximum of 32 messages. Data is overwritten from older one if no message is received.
- Before sending a message, monitor the status byte and make sure that the PAR-A units send no messages.
- When a command requiring a response message is received, the time until returning a message or the order of response messages to the message sent by the local bus master may change. Check the status byte to see if a message is present or absent. Be sure to interpret the message header and address when interpreting a message.

8-6. Sending Commands (through GP-IB or USB)

8-6-1. Precautions for sending commands

<Precautions>

- It is possible to send several commands in a line through the GP-IB or USB by separating them with commas (,) that serve as the separators. A single line may contain a maximum of 80 characters. (Multi-commands)
- The PW command is used to select a unit to be controlled. Put it before other commands or send it alone.
- There are time lags of several dozens of milliseconds in execution of commands by the slave units.
- When the IF-41GU/IF-41USB is used, it is possible to use the broadcast commands, ST commands and PWID commands with several addresses specified. However, the IF-41GU/IF-41USB has a lot of response messages. Thus, some messages may be lost unless all of these response messages are received. (The IF-41GU/IF-41USB may store a maximum of 32 response messages. When it receives a new message, the response messages are deleted from older ones.) Create a program so that the status byte described in section "8-5-3. Status bytes" is monitored and a message is received if some value is set in it. See section "8-5-4. Application configuration" above.
- When the same command is continuously sent, execution of commands may be thinned out. Be sure to send the respective commands at 100ms interval.

8-6-2. Selecting unit to be controlled

- Specify a unit to be controlled using the PW command before sending a command to a PAR-A power supply unit through the GP-IB or USB using the IF-41GU/IF-41USB or the IF-41RS and GP-620.
- ◆ See the command functions in section "9-7-1. Setting unit to be controlled".

8-7. Details of Commands

8-7-1. Setting unit to be controlled

- This command specifies a power supply unit to be controlled when the IF-41GU/IF-41USB is used.

PW * *

*** *** : 0, 1 to 32

Specify the system address of a power supply unit to be controlled. When the value of 0 is specified (broadcast specification), all power supply units connected with a specified local bus master are controlled. When the power is turned on, 0 (broadcast) is selected.

<Precautions>

- It is possible to control several units using the IF-41GU/IF-41USB by writing their addresses in a line using the PW command. The PW command is executed earlier than any other commands.

< Example 10> PW1, PW2, PW31, SW1 ... These commands turn on the MAIN OUTPUT keys of three PAR-A power supply units of addresses 1, 2 and 31. If PW1, PW2, SW1, PW31, SW0 are specified, the SW1 and SW0 commands are sent to the PAR-A power supply units of addresses 1, 2 and 31. As a result, the MAIN OUTPUT keys of three units are turned off (SW0).

8-7-2. Setting voltage or current

- These commands set the voltages and currents of PRESET 1 to PRESET 4. If the PAR-A power supply unit is turned off and turned on then, the voltages and currents set in PRESET 1 to PRESET 4 are lost, since these commands do not store the set values. Execute the MW1 command shown in "8-7-11. Storing set data" to store values in PRESET 1 to PRESET 4.

Values to be set	Volt. setting command	Cur. setting command
PRESET 4	VA * * * *	AA * * * *
PRESET 1	VE * * * *	AE * * * *
PRESET 2	VJ * * * *	AJ * * * *
PRESET 3	VN * * * *	AN * * * *

*** * * *** ... Voltage or current set value

Integer type VA1000 : Sets the voltage of A channel to 10.00V in PRESET 4.

Real number type VA10.00 : Sets the voltage of A channel to 10.00V in PRESET 4.

Integer type AA0123 : Sets the current of A channel to 1.230A in PRESET 4.

Real number type AA1.234 : Sets the current of A channel to 1.234A in PRESET 4

<Precautions>

- Input an absolute value without the negative sign in the place of *** * * *** to change the channel of negative output.
- The PRESET 4 key of the PAR-A power supply unit corresponds to the VARIABLE key of the PAR power supply unit. Thus, VA, VB, VC, VD, AA, AB, AC and AD are the preset 4 setting commands. In preset selection described in "8-7-5. Selecting preset memory ", PR0 is selects preset 4.

8-7-3. Turning on/off MAIN OUTPUT key

SW0/SW1

- The SW command turns on or off the main output key of the PAR-A power supply unit.
SW0 turns off the MAIN OUTPUT key. SW1 turns on the MAIN OUTPUT key.

<Precautions>

- If several commands including SW1 are sent using the multi-command function, all commands may not be executed, depending on the order of the commands. It is recommended that the SW1 command should be sent independently without using the multi-command function.

8-7-4. Turning on/off OUTPUT SELECT key

Turns on or off the OUTPUT SELECT key : OA *

* ...1: Turns on the output select function, 0: turns off the OUTPUT SELECT key.

- ◆ See section "6-2. Output Functions" above.

8-7-5. Selecting preset memory

PR0/PR1/PR2/PR3

- The PR command selects from which preset memory to recall data, PRESET 1 to PRESET 4.

PR0:PRESET 4

PR1:PRESET 1

PR2:PRESET 2

PR3:PRESET 3

<Precautions>

- PR0 serves as the VARIABLE key call command for the PWR, PAR and PAR-H.

8-7-6. Status output request

ST0/ST1/ST2/ST3/ST4/ST5

Request to output the output voltage,

output current and operation mode : **ST0** (Integer type)

Request to output all preset data : **ST1** (Integer type)

Request to output all statuses : **ST2**

Request to output the ID data : **ST3**

Request to output the output voltage,

output current and operation mode : **ST4** (Real number type)

Request to output all preset data : **ST5** (Real number type)

- MS0, MS1, MS2, MS3, MS4 and MS5 messages are returned in response to the ST0, ST1, ST2, ST3, ST4 and ST5 commands, respectively.

- ◆ See sections "8-7-15. Sending output voltage, output current or operation mode (Response to the ST0 command)" to "8-7-20. Sending all preset values (Response to the ST1 command)".

8-7-7. ID output request

PWID

- The PWID command requests the information (ID) of the power supply. For the details of the returned message, see section "8-7-21. Sending power supply data (Response to the PWID command)".

8-7-8. Local setting

LC1

- The LC1 command changes the remote mode of the PAR-A unit into the local mode.

8-7-9. Local lockout

LL1

- The LL1 command disables the LOCAL. As a result, the PAR-A unit may not be brought into the local mode even if the KEY LOCK / LOCAL key on the front panel is pressed.

<Precautions>

- Upon receiving the LL1 command, the PAR-A unit automatically enters the remote mode, where any panel operations are not accepted. To bring the PAR-A unit into the local mode, press the KEY LOCK/LOCAL key or issue the LC1 command. In the local mode, the PAR-A unit accepts panel operations. However, the KEY LOCK / LOCAL key is not functional if the LL1 command has been issued. The LC1 command may only bring the PAR-A unit into the local mode.

The GP-IB messages REN, LL0 and GTL are invalid for the PAR-A unit.

8-7-10. Disabling or enabling service request

SR0 / SR1

- The SR command enables or disables the service request function. The SR0 command disables it, and the SR1 command enables it. The service request function is disabled when power is turned on.
- ◆ See sections "8-7-25. Information of constant-voltage/constant-current mode" and "8-7-26. Information of alarm status" below.

Service request

- If the service request function is enabled with the SR1 command and either of the following conditions is detected, a message is sent automatically.
 - ① Transition from the constant-voltage (CV) mode to the constant-current (CC) mode, and vice versa.
 - ② Alarm statusThese are detected at an interval of about 100ms. No message may be sent in a shorter period.

8-7-11. Storing set data

MW1

- The MW1 command stores all storable settings in the EEPROM. It takes about 15 seconds (approx 2 seconds for after Ver. 3.00 of the unit) to store data. Do not send any commands or carry out any operations until PAR-A unit send "MW1" message when store data is finished.
- ◆ See section "5-1-2. Initial setting when power is turned on" above.

8-7-12. Checking controlled unit

PW?

- The PW? command checks the addresses of the slave units currently specified as the units to be controlled.
- This command is valid only when the IF-41GU/IF-41USB is used.

8-7-13. Checking connected slave unit

SLV?

- The SLV? command checks the addresses of the slave units connected.
- This command is valid only when the IF-41GU/IF-41USB is used.

8-7-14. Inquiry about optional board ID

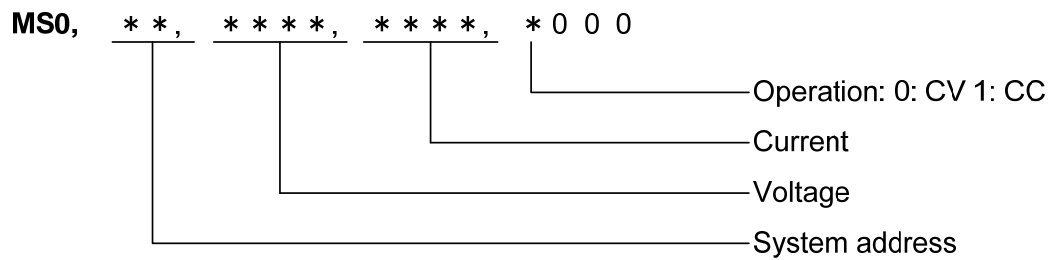
*** IDN?**

- The * IDN? command inquires about the ID of the optional board built in the local bus master.
- This command is valid only when the IF-41GU/IF-41USB is used.

8-7-15. Sending output voltage, output current or operation mode (Response to the ST0 command)

MS0, **, **, ****, ******

- The output voltage, output current and operation status requested by the ST0 command are sent in integer.



Response message

- The set voltages, set currents, output voltages or output currents are not sent with the negative signs, even if they are negative values.
- An integer parameter in each response message meets the following condition.
The third decimal place is rounded off. The value is multiplied by 100. The value is always displayed in a four-digit integer.

<Example 11> 1.000 is expressed as 0100, 12.340 is expressed as 1234, and 12.345 is expressed as 1235.

※ A value displayed down to the third decimal place on the panel may be different in a response message, since the third decimal place of the response message is rounded off.

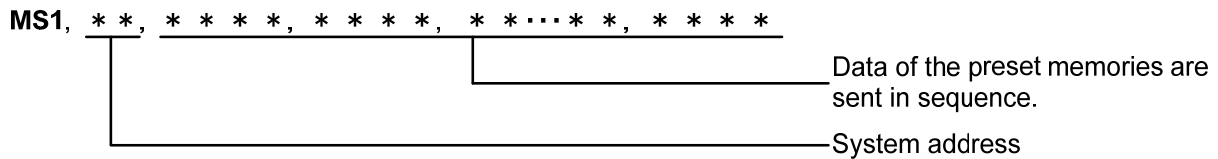
A real number parameter in each message meets the following condition. The parameter is displayed down to the fifth decimal place at the maximum. (The sixth decimal place is rounded off). Continuous zeroes in decimal places are not displayed. The decimal point is always displayed.

<Example 12> 1.000000 is expressed as 1. 12.345678 is expressed as 12.34568.

8-7-16. Sending all preset values (Response to the ST1 command)

MS1, **, **, ****, *...*, ******

- Data of all preset memories requested by the ST1 command are sent in integer.



※ Preset data are sent in integer in the following order:

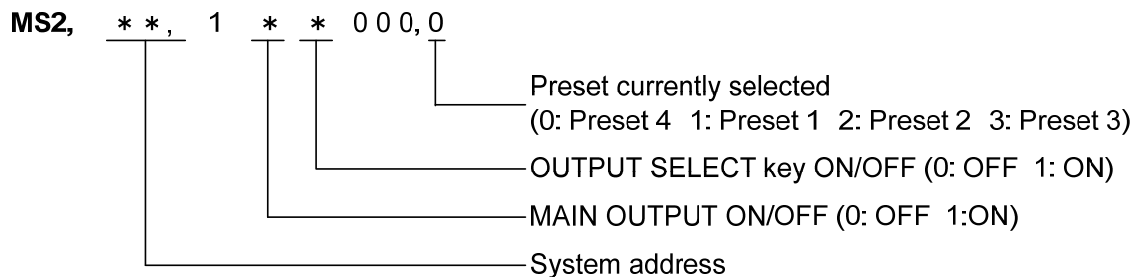
PRESET 4 set voltage, PRESET 4 set current, PRESET 1 set voltage, PRESET 1 set current,
PRESET 2 set voltage, PRESET 2 set current, PRESET 3 set voltage, PRESET 3 set current

8-7-17. Sending all equipment statuses (Response to the ST2 command)

MS2, **, 1, *, *000, *

- All statuses of the units requested by the ST2 command are sent.

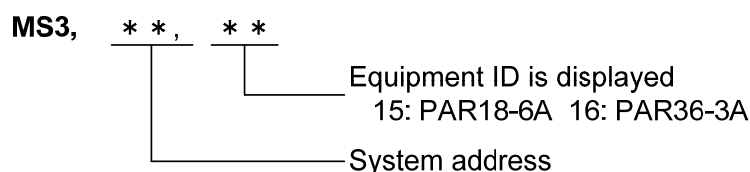
The parameters are sent in the order shown below.



8-7-18. Sending ID data (Response to the ST3 command)

MS3, **, **

- The system address and equipment ID are sent in response to the ST3 command.



8-7-19. Sending output voltage, output current or operation mode (Response to the ST4 command)

- The output voltage, output current, and operation status requested by the ST4 command are sent in real numbers. The message format is the same as MS0 shown in "8-7-15. Sending output voltage, output current or operation mode (Response to the ST0 command)".

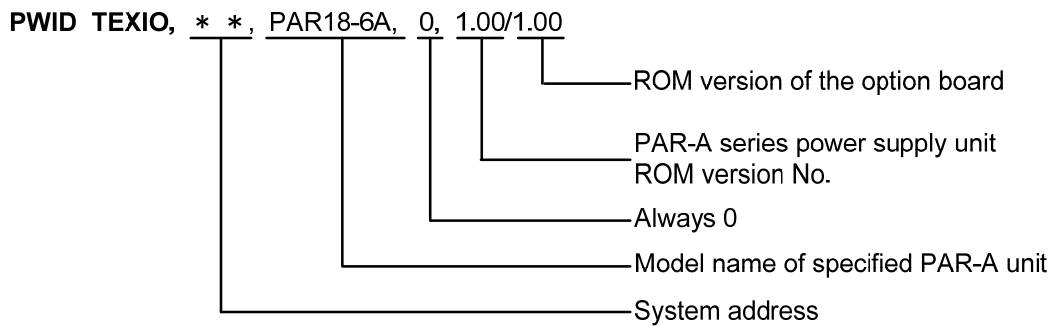
8-7-20. Sending all preset values (Response to the ST5 command)

- Data in all preset memories requested by the ST5 command are sent in real numbers.

The message format is the same as MS1 shown in "8-7-16. Sending all preset values (Response to the ST1 command)".

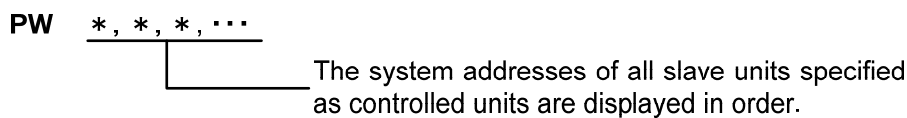
8-7-21. Sending power supply data (Response to the PWID command)

- Response to the PWID command



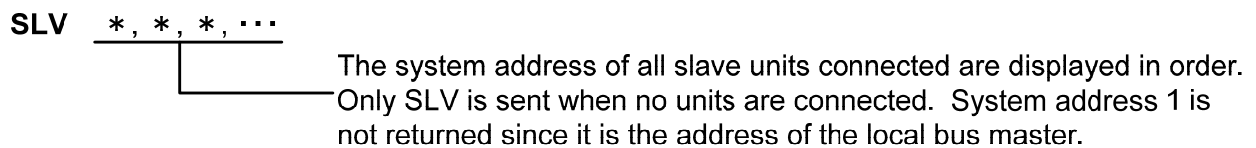
8-7-22. Sending address of controlled unit (IF-41GU/IF-41USB only)

- Response to the PW? command



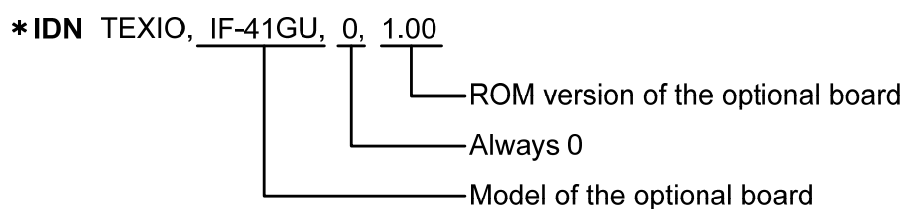
8-7-23. Sending addresses of all connected slave units (IF-41GU/IF-41USB only)

- Response to the SLV? Command



8-7-24. Sending optional board ID (IF-41GU/IF-41USB only)

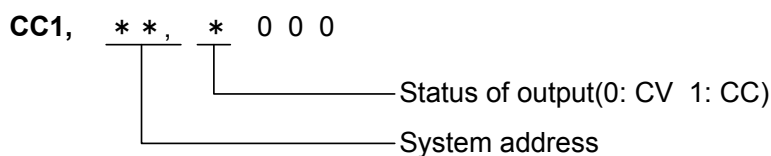
- Response to the *IDN? command



8-7-25. Information of constant-voltage/constant-current mode

CC1, * *, * 000

- Command is sent from slave unit to master unit when the service request function is enabled by the SR1 command and the constant-voltage (CV) mode changes into the constant-current (CC) mode or the constant-current mode changes into the constant-voltage mode.

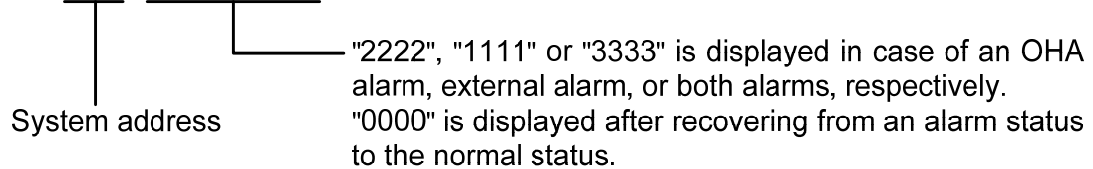


8-7-26. Information of alarm status

UU1, **, ****

- Command is sent from slave unit to master unit when the service request function is enabled by the SR1 command and an OHA or external alarm signal brings the PAR-A power supply unit into the alarm status or the PAR-A power supply unit recovers from the alarm status.

UU1 , **, ****



8-7-27. Information about completion of storing the set data

MW1, **

- The slave unit sends this command to the master unit when storage of the set data in the EEPROM caused by the MW1 command is complete.

MW1 , **



8-8. Command List

Setting of the IF-41GU, IF-41USB or IF-41RS + GP-620

No.	Item	Default value	Command	page
1	Unit to be controlled	0 (Broadcast)	PW	41

Inquiry to the IF-41GU/IF-41USB (Valid only when the IF-41GU/IF-41USB is used)

No.	Item	Send command	Response command	page
1	Inquiry about controlled units	PW?	PW	44
2	Equipment ID	* IDN?	* IDN	44,47
3	Connected slave units	SLV?	SLV	44,47

Send commands

No.	Item	Default value	Send command	page
1	Output voltage setting	0.00V	VA, VE, VJ, VN	41
2	Output current setting	0.000A	AA, AE, AJ, AN	41
3	OUTPUT	OFF	SW0/1	42
4	OUTPUT SELECT	ON	OA	42
5	PRESET	PRESET1	PR0,...,PR3	42
6	Local	Local	LC1	43
7	Local lockout	No lock-out	LL1	43
8	Service request	Disable	SR0/1	43
9	Storing set data	—	MW1	44

Commands for which responses are made

No.	Item	Send command	Response command	page
1	Status request	ST0 to 5	MS0 to 5	42,45,46
2	ID request	PWID	PWID	43,47

Information messages (Service request function)

No.	Item	Message	page
1	Constant-voltage & Constant-current mode	CC1	47
2	Alarm	UU1	48
3	Storing the set data is complete	MW1	48

※ The following commands have different functions from those of the PAR power supply unit.

Be careful.

ST1 The +/- flag and delay time, which have no effects in the PAR power supply unit, are returned as the parameters. In the PAR-A power supply unit, this command is used for voltage and current setting only.

ST2 The external control and OUTPUT PROTECT parameters are disused.

The OUTPUT SELECT parameter is added.

ST3 The number of characters of the parameter is changed from four into five, since the model ID is changed from one character into two characters.

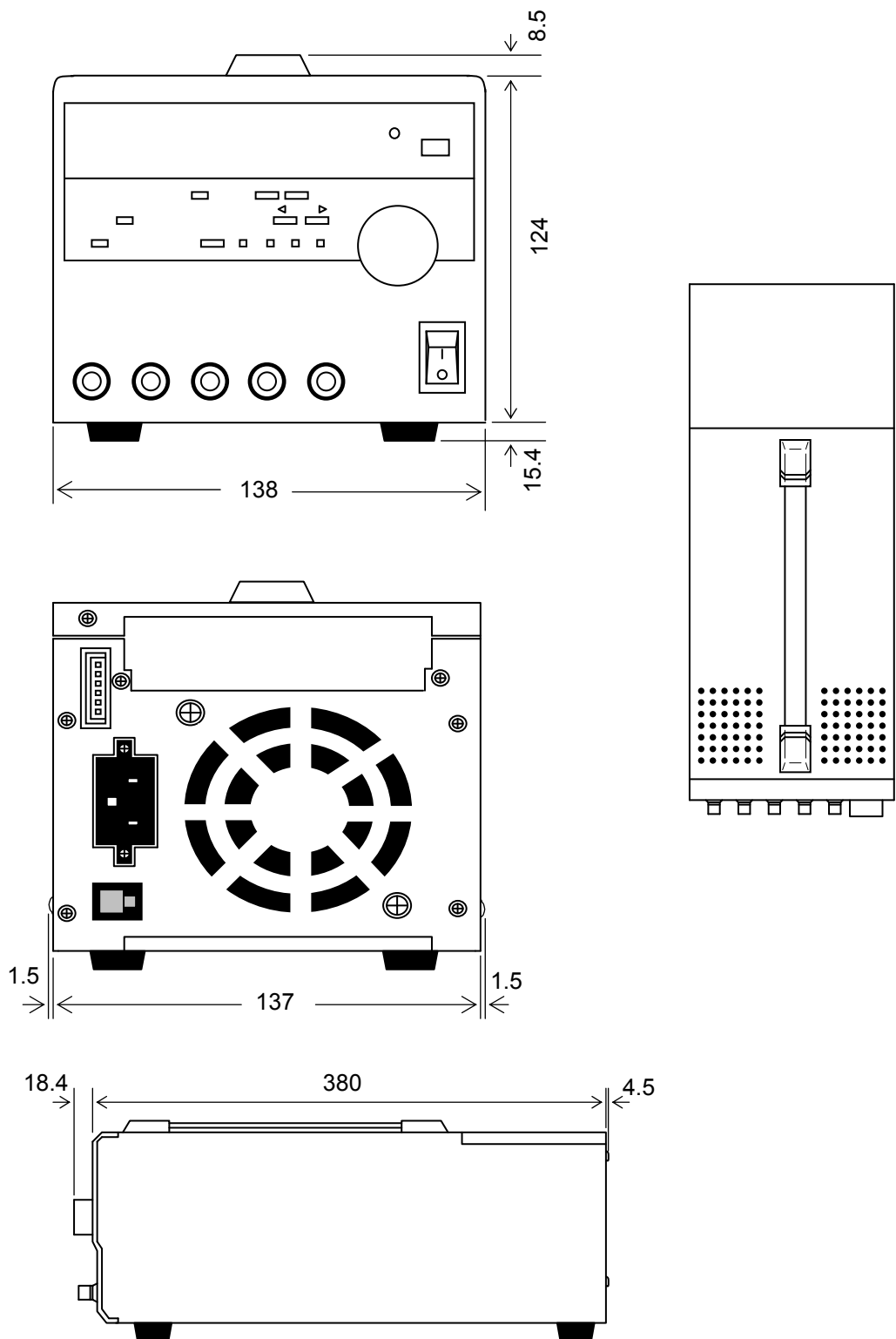
9. OPERATION FAILURES

- If the PAR-A power supply unit becomes faulty, check the following matters.

Phenomenon	Possible cause	Action
Power is not turned on though power switch is thrown. (LED on front panel does not go on.)	AC cable is not connected securely or is broken.	Connect the AC cable securely. Or, replace the broken AC cable.
	Input AC voltage is too high. Or, the fuse has blown due to an error in the PAR-A power supply unit.	Replace the fuse. Adjust the AC voltage with the switches on the bottom properly.
	Input AC voltage is too low.	Adjust the AC voltage with the switches on the bottom properly.
No voltage is output even if the MAIN OUTPUT key switch is pressed.	External alarm function is turned on through external contact control.	Open pin 1 (or 3) and 2 of the external contact control connector.
	Current is set to 0.00 A in the CC mode.	Increase the set current.
	The OUTPUT SELECT key is not selected.	The OUTPUT SELECT key of an intended channel is not pressed.
MAIN OUTPUT key switch may not be shut off.	External output function is turned on through external contact control.	Open pin 3 (or 1) and 8 of the external contact control connector.
Output voltage is unstable or excessive noises are input.	Commercial frequency noises are detected due to low AC voltage.	Adjust the AC voltage with the switches on the bottom properly.
	There is a strong magnetic field or electrical field nearby.	Move the unit apart from the equipment, which may produce the magnetic or electrical field. Twist the wires.

- If the phenomenon is not shown above or does not disappear even though the above-shown actions are taken, contact the nearest dealer.

10. OUTSIDE DEMENSIONS





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