



R6142/44

Programmable DC

Voltage/Current Generator

Maintenance Manual

MANUAL NUMBER FME-8335201B01

Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this instrument, please read the manual carefully before using. Note that ADC Corporation (hereafter referred to as ADC) bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this instrument.

If the equipment is used in a manner not specified by ADC, the protection provided by the equipment may be impaired.

- **Warning Labels**

Warning labels are applied to ADC products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest ADC dealer. Our address and phone number are listed at the end of this manual.

Symbols of those warning labels are shown below together with their meaning.

DANGER: Indicates an imminently hazardous situation which will result in death or serious personal injury.

WARNING: Indicates a potentially hazardous situation which will result in death or serious personal injury.

CAUTION: Indicates a potentially hazardous situation which will result in personal injury or a damage to property including the product.

- **Basic Precautions**

Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

- Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas.
- When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
- When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.
- Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.
- Connect the power cable to a power outlet that is connected to a protected ground terminal. Grounding will be defeated if you use an extension cord which does not include a protective conductor terminal.
- Be sure to use fuses rated for the voltage in question.
- Do not use this instrument with the case open.
- Do not place anything on the product and do not apply excessive pressure to the product. Also, do not place flower pots or other containers containing liquid such as chemicals near this

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product.

- When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.
- When using the product on a cart, fix it with belts to avoid its drop.
- When connecting the product to peripheral equipment, turn the power off.

- **Caution Symbols Used Within this Manual**

Symbols indicating items requiring caution which are used in this manual are shown below together with their meaning.

DANGER: Indicates an item where there is a danger of serious personal injury (death or serious injury).

WARNING: Indicates an item relating to personal safety or health.

CAUTION: Indicates an item relating to possible damage to the product or instrument or relating to a restriction on operation.

- **Safety Marks on the Product**

The following safety marks can be found on ADC products.



: ATTENTION - Refer to manual.



: Protective ground (earth) terminal.



: DANGER - High voltage.



: CAUTION - Risk of electric shock.

- **Replacing Parts with Limited Life**

The following parts used in the instrument are main parts with limited life.

Replace the parts listed below before their expected lifespan has expired to maintain the performance and function of the instrument.

Note that the estimated lifespan for the parts listed below may be shortened by factors such as the environment where the instrument is stored or used, and how often the instrument is used.

The parts inside are not user-replaceable. For a part replacement, please contact the ADC sales office for servicing.

Each product may use parts with limited life.

For more information, refer to the section in this document where the parts with limited life are described.

Main Parts with Limited Life

Part name	Life
Unit power supply	5 years
Fan motor	5 years
Electrolytic capacitor	5 years
LCD display	6 years
LCD backlight	2.5 years
Floppy disk drive	5 years
Memory backup battery	5 years

- **Hard Disk Mounted Products**

The operational warnings are listed below.

- Do not move, shock and vibrate the product while the power is turned on.
Reading or writing data in the hard disk unit is performed with the memory disk turning at a high speed. It is a very delicate process.
- Store and operate the products under the following environmental conditions.
An area with no sudden temperature changes.
An area away from shock or vibrations.
An area free from moisture, dirt, or dust.
An area away from magnets or an instrument which generates a magnetic field.
- Make back-ups of important data.
The data stored in the disk may become damaged if the product is mishandled. The hard disc has a limited life span which depends on the operational conditions. Note that there is no guarantee for any loss of data.

- **Precautions when Disposing of this Instrument**

When disposing of harmful substances, be sure dispose of them properly with abiding by the state-provided law.

Harmful substances: (1) PCB (polycarbon biphenyl)
(2) Mercury
(3) Ni-Cd (nickel cadmium)
(4) Other

Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder).

Example: fluorescent tubes, batteries

Environmental Conditions

This instrument should be only be used in an area which satisfies the following conditions:

- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- Altitude of up to 2000 m

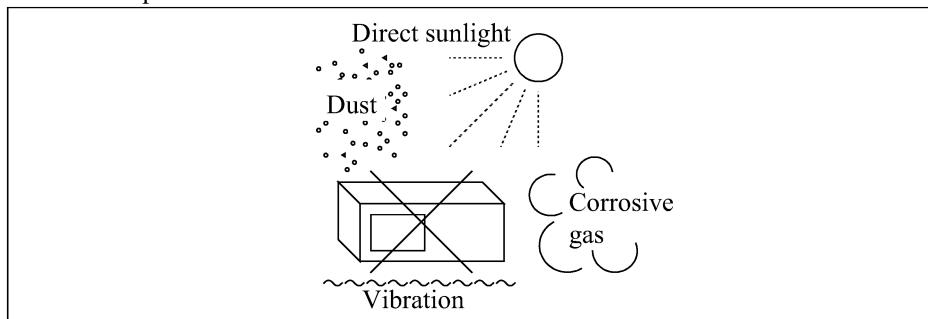


Figure-1 Environmental Conditions

- Operating position

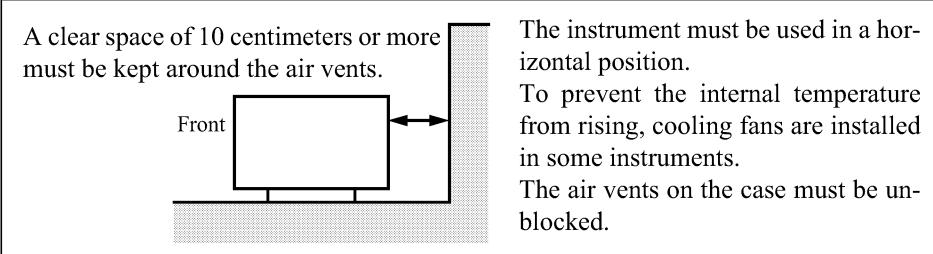


Figure-2 Operating Position

- Storage position

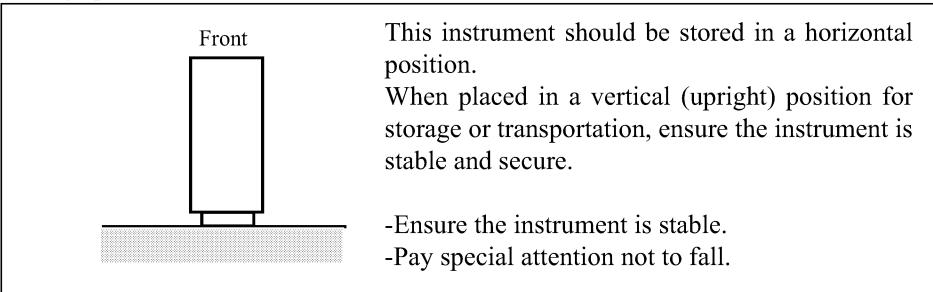


Figure-3 Storage Position

- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.
Impulse withstand voltage (over-voltage) category II defined by IEC60364-4-443
Pollution Degree 2

Types of Power Cable

Replace any references to the power cable type, according to the following table, with the appropriate power cable type for your country.

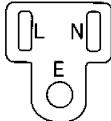
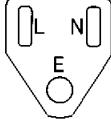
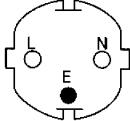
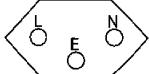
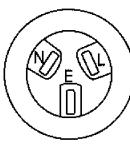
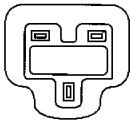
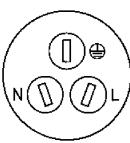
Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
	CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
	SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
	SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: -----
	BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417
	CCC: China	250 V at 10 A Black 2 m (6 ft)	Straight: A114009 (Option 94) Angled: A114109

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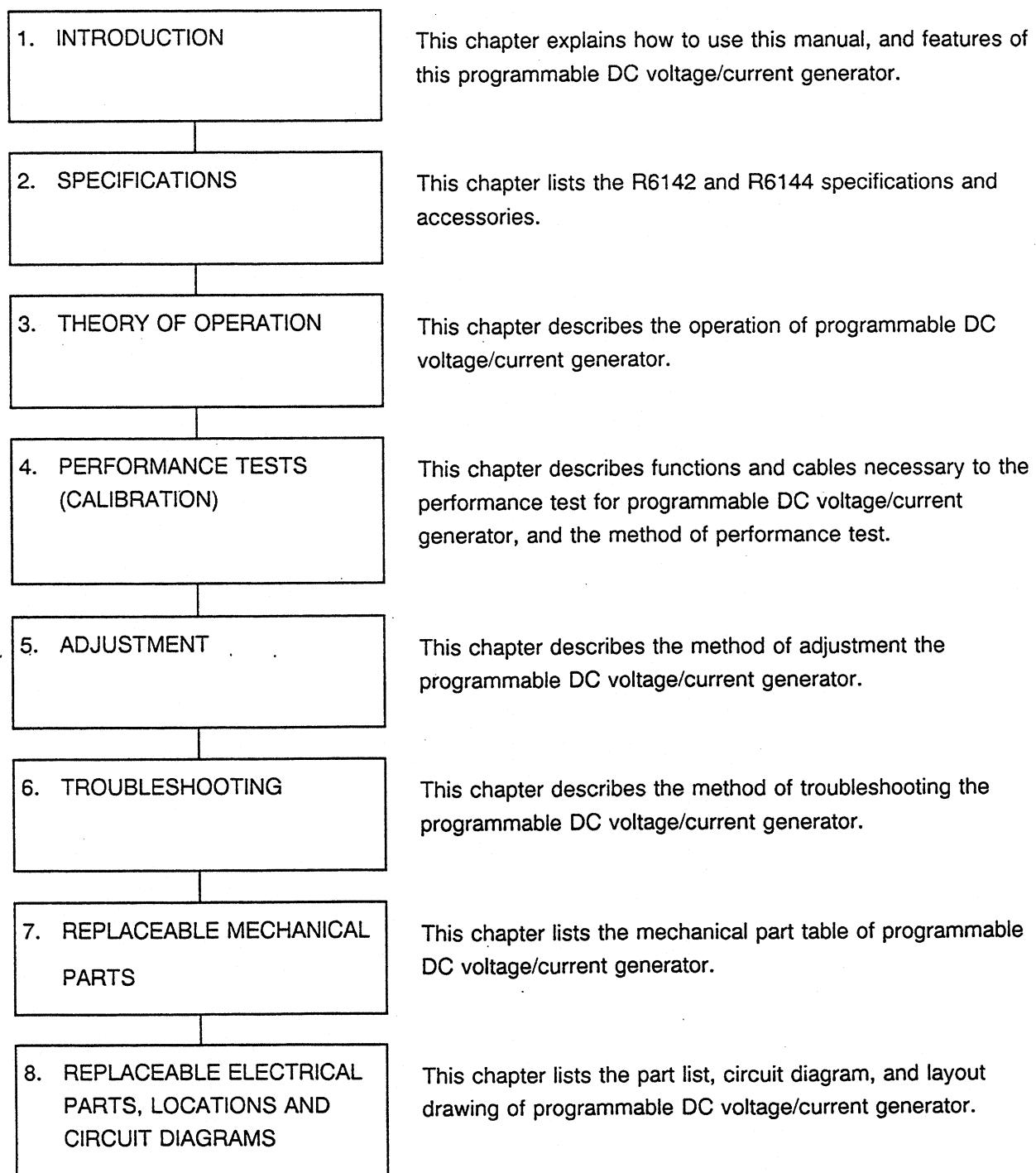
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1. INTRODUCTION

This chapter explains how to use this manual, and features of this programmable DC voltage/current generator.

1.1 How to Use This Manual



1.2 Product Outline

1.2 Product Outline

1.2.1 Outline of R6142

The R6142 is a DC voltage/current generator employing a time-division D/A conversion technique. The R6142 generates a DC voltage of 0 to $\pm 12V$ at a minimum step of one microvolt, and a DC current of 0 to $\pm 120mA$ at a minimum step of 0.1 microampere. The R6142 features excellent linearity and stability, high throughput, and highly reliable and accurate outputs with low noise.

A 160-step memory and the all-digit sweep function implement a greater applicability to electronic components tests and lesson operation and test time.

The R6142 has the GPIB interface and BCD parallel interface as standard for connection with various host machines, such as personal computers, minicomputers, and sequence controllers, to construct automatic evaluation system.

Features:

- A maximum voltage/current output of 12V/120mA
- High-resolution output at a minimum of one microvolt/100 nanoamperes
- Six-month assurance of voltage generation at as high an accuracy as 0.03%, and a current generation at 0.04%
- 110ppm linearity and monotonicity for use over full scale
- Low noise, 3mVp-p (BW = 20MHz), for high measurement reliability
- Memory to store up to 160 data setting
- All-digit sweep function for a greater measurement applicability
- GPIB interface and BCD parallel interface, provided as standard, for connection to various host machines

1.2 Product Outline

1.2.2 Outline of R6144

The R6144 is a DC voltage/current generator employing a time-division D/A conversion technique. The R6144 generates a DC voltage of 0 to $\pm 32V$ at a minimum step of one microvolt, and a DC current of 0 to $\pm 160mA$ at a minimum step of 0.1 microampere. The R6144 features excellent linearity and stability, high throughput, and highly reliable and accurate outputs with low noise.

A 160-step memory and the all-digit sweep function implement a greater applicability to electronic components tests and lesson operation and test time.

The R6144 has the GPIB interface and BCD parallel interface as standard for connection with various host machines, such as personal computers, minicomputers, and sequence controllers, to construct automatic evaluation systems.

Features:

- A maximum voltage/current output of 32V/160mA
- High-resolution output at a minimum of one microvolt/100 nanoamperes
- Six-month assurance of voltage generation at as high an accuracy as 0.03%, and a current generation at 0.04%
- 900ppm linearity and monotonicity for use over full scale
- Low noise, 3mVp-p (BW = 20MHz), for high measurement reliability
- Memory to store up to 160 data setting
- All-digit sweep function for a greater measurement applicability
- GPIB interface and BCD parallel interface, provided as standard, for connection to various host machines

2. SPECIFICATIONS

2.1 Specifications of R6142

2.1.1 Voltage/Current Generation

- Output range, accuracy, and stability:

Range	Output range	Resolution	Overall accuracy (6 months) \pm (% of setting + X)	Stability (1 day) \pm (% of setting + X)	Temperature coefficient \pm (ppm/ $^{\circ}$ C of setting + X/ $^{\circ}$ C)
10mV	0 to \pm 11.999mV	1 μ V	0.03 + 5 μ V	0.01 + 4 μ V	20 + 200 μ V
100mV	0 to \pm 119.99mV	10 μ V	0.03 + 25 μ V	0.01 + 10 μ V	20 + 2 μ V
1V	0 to \pm 1.1999V	100 μ V	0.03 + 200 μ V	0.01 + 50 μ V	20 + 10 μ V
10V	0 to \pm 11.999V	1mV	0.03 + 2mV	0.01 + 200 μ V	20 + 40 μ V
1mA	0 to \pm 1.1999mA	100nA	0.035 + 300nA	0.01 + 20nA	20 + 4nA
10mA	0 to \pm 11.999mA	1 μ A	0.035 + 3 μ A	0.01 + 200nA	20 + 40nA
100mA	0 to \pm 119.99mA	10 μ A	0.04 + 30 μ A	0.01 + 2 μ A	20 + 400nA

- The overall accuracy and stability are at $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, 70% RH or less, and a constant power supply and load.
- The temperature coefficient is at 0°C to 50°C .
- The overall accuracy includes a linearity error.
- Linearity:
 \pm 110ppm for the full scale of all ranges.

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2.1 *Specifications of R6142*

- Maximum load, output resistance, and output noise:

Range	Maximum load current/voltage	Output resistance	Output noise (P-P)		
			DC to 100Hz	DC to 10kHz	20Hz to 20MHz
10mV	0.6µA (20kΩ load that causes a 0.01% error)	Approx. 2Ω	5µV	10µV	3mV
100mV	6µA		15µV	30µV	
1V	Source: 120mA Rank : 100mA	0.4mΩ or less	80µV	150µV	6µA
10V		4mΩ or less	200µV	500µV	
1mV	10V Output following voltage	100MΩ or more	30nA	150nA	8µA
10mV		10MΩ or more	300nA	400nA	
100mV		1MΩ or more	3µA	4µA	

- The output noise for the 1mA, 10mA, and 100mA ranges is at a load resistance of 1kΩ.
- The output resistance for the 1V and 10V ranges is at 4-wire connection. The output resistance for other ranges is at 2-wire connection.
- Noise elimination ratio in common mode:
80dB or more at an unbalanced impedance of 1kΩ ,DC and 50/60Hz
- Line regulation:
 $\pm 0.007\%$ of a range at rated-voltage fluctuations of - 15% to + 10%
- Load regulation:
 $\pm 0.005\%$ of a range (excluding the 10mV and 100mV ranges) at the maximum load of 4-wire connection

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2.1 Specifications of R6142

- Maximum load capacitance and inductance:

Range	Maximum load capacitance	Maximum load inductance
1/10V	1000 μ F	500 μ H
1/10/100mV	100 μ F	1mH

- The maximum load inductance for the 1/10V range and the maximum load capacitance for the 1/10/100mA range are those while the limiter is operating at the maximum setting.

2.1 Specifications of R6142

2.1.2 Execution Speed

- Settling time:

The time interval, following the start of output changing, required for the output to enter $\pm 0.1\%$ centered on the final value of the output when the output changes from zero to the full scale at the maximum limiter setting

Range	Load condition	Overshoot/ undershoot	Settling time
All ranges	Maximum resistance load	$\pm 0.1\%$ centered on final value	50ms or less
1V and 10V ranges	30 μ F capacitance connected		50ms or less
	100 μ F capacitance connected		60ms or less

- Execution time:

The time interval between the reception of a program code through the GPIB interface or an output level through the BCD interface and the start of output changing, 5ms or less
(The execution time for the use of the GPIB interface assumes that model 216 of HP 9000 Series is used.)

2.1.3 Voltage/Current Limiter

- Range of setting and stability:

	Range of setting	6-month stability $\pm (\% \text{ of setting} + X)$
Current limiter	5mA to 120mA	10 + 1mA
Voltage limiter	1V to 10V	5 + 100mV

- The stability is at $23 \pm 5^\circ\text{C}$.
- The current limiter is effective when the R6142 is engaged in source operation.

2.1 Specifications of R6142

2.1.4 Memory

- Number of storage portions:
160 channels
- Recall mode:
 - Random : A channel is specified to recall data form.
 - Step : The TRIGGER signal is input or the STEP key is pressed to recall data channel by channel.
 - Scan : Data is recalled from channels at a step time specified on the built-in timer.
- Scan mode:
 - Single : Scanning starts from the first channel and ends at the last channel.
 - Repeated : Scanning is repeated over the first channel through the last channel.
- Step time:
 - The time interval when one-channel data is output in the scan mode or sweep mode.
 - The step time can be varied from 0.1 second to 10 seconds at an interval of 0.1 second.

2.1.5 Sweep

- Sweep : The current set value is continuously incremented to the full scale or decremented to zero at a specified step time. The TRIGGER signal input or pressing the Δ or ∇ key stops the sweep.
Resolution : Count1, 10, 100, and 1000

2.1.6 Input/Output

- TRIGGER input:

A TTL negative-logic pulse with a 5 milliseconds or more width that is input to the TRIGGER input terminal on the rear panel to start/stop the step operation, scanning, or to stop the sweep operation.

Input terminal : BNC connector

- READY output:

A TTL negative-logic pulse with about a 10 milliseconds width that is output from the READY output terminal on the rear panel about 50 milliseconds after the output level changes in the operate ON state.

Output terminal : BNC connector

- GPIB interface:

Standard : IEEE STD488-1978

Interface function : SH1, AH1, T6, L3, SR1, RL1, PP0, DC1, DT1, C0, E1

Output data : Setting on the front panel

Remote programming : Functions and control excluding the POWER, SENSE, EXT CAL, and OPR HOLD switches, limiter setting, and device addressing

- BCD parallel interface:

Connector : BCD INPUT connector (36-pin, Amphenol type) on the rear panel

Remote programming : Output level (BCD parallel, negative logic, up to 5 digits), polarity, range, operate status, and load signal

2.1.7 General Specifications

- Output : Floating unipolar output
- Output terminals:
Binding post terminals on the front panel (High output, High sense, Low output, Low sense)
- Maximum terminal-to-terminal applied voltage:

Terminal	Maximum applied voltage	
	Positive	Negative
High to Low	- 0.5V to + 32V peak	+ 0.5V to - 32V peak
Low to housing	± 500 V peak	

- Remote sensing system:
4-wire (4WIRE) or 2-wire (2WIRE) connection can be selected with the SENSE switch on the front panel.
- Maximum remote sensing voltage:
0.3V between High/Low output and sense lines including a voltage drop caused by cable resistance
- Setting method:
 - Manual setting : All-digit sweep setting with Δ or ∇ key, and direct setting with numeric keys
 - Remote setting : Setting through GPIB interface or BCD parallel interface
- Display and indication:
 - Output setting : Polarity + 5-digit 7-segment display + Unit
 - Operation : Limiter, operate status (LED lamp)
 - Mode : Direct, memory, step (LED lamp)
 - GPIB : LISTEN, SRQ, REMOTE (LED lamp)
- Backup parameters:
Output level, polarity, range, memory data, step time, first/last channel, scan mode, operate ON state (OPR HOLD switch ON), GPIB/BCD remote mode, device address
- Warm-up time:
The time interval required until a specified accuracy is attained, 30 minutes

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2.1 Specifications of R6142

• Operating environment:

Ambient temperature : 0°C to +50°C

Relative humidity : 85% or less, dew condensation not acceptable

• Storage environment:

Ambient temperature : -25°C to +70°C

• Power supply:

90 to 110 Volts AC, 48 to 66Hz

• Supply voltage selection:

The supply voltage can be changed with the selector switch on the rear panel.

Option No.	Standard	Opt. 32	Opt. 42	Opt. 44
Supply voltage	90V to 110V	103V to 132V	198V to 242V	207V to 250V

• Use 120V and 240V for 115V and 230V respectively.

• Power consumption:

26VA or less

• Dimensions:

Approx. 240 (width) × 88 (height) × 360 (depth) mm

• Weight : Approx. 4kg

2.2 Specifications of R6144

2.2.1 Voltage/Current Generation

- Output range, accuracy, and stability:

Range	Output range	Resolution	Overall accuracy (6 months) ± (% of setting + X)	Stability (1 day) ± (% of setting + X)	Temperature coefficient ± (ppm/°C of setting + X/°C)
10mV	0 to ± 16.000mV	1µV	0.03 + 5µV	0.01 + 4µV	20 + 200µV
100mV	0 to ± 160.00mV	10µV	0.03 + 25µV	0.01 + 10µV	20 + 2µV
1V	0 to ± 1.6000V	100µV	0.03 + 200µV	0.01 + 50µV	20 + 10µV
10V	0 to ± 16.000V	1mV	0.03 + 2mV	0.01 + 200µV	20 + 40µV
30V	0 to ± 32.000V	2mV	0.03 + 4mV	0.01 + 300µV	20 + 60µV
1mA	0 to ± 1.6000mA	100nA	0.035 + 300nA	0.01 + 20nA	20 + 4nA
10mA	0 to ± 16.000mA	1µA	0.035 + 3µA	0.01 + 200nA	20 + 40nA
100mA	0 to ± 160.00mA	10µA	0.04 + 30µA	0.01 + 2µA	20 + 400nA

- The overall accuracy and stability are at $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, 70% RH or less, and a constant power supply and load.
- The temperature coefficient is at 0°C to 50°C .
- The overall accuracy includes a linearity error.
- Linearity:
 ± 90 ppm for the full scale of all ranges.

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2.2 Specifications of R6144

- Maximum load, output resistance, and output noise:

Range	Maximum load current/voltage	Output resistance	Output noise (P-P)		
			DC to 100Hz	DC to 10kHz	20Hz to 20MHz
10mV	0.8µA (20kΩ load that causes a 0.01% error)	Approx. 2Ω	5µV	10µV	3mV
100mV	8µA		15µV	30µV	
1V	Source: 160mA Rank : 100mA		80µV	150µV	
10V	0.4mΩ or less	200µV	500µV	6µA	
30V	4mΩ or less	400µV	1mV		
1mV	28V Output following voltage	100MΩ or more	30nA		150nA
10mV		10MΩ or more	300nA		400nA
100mV		1MΩ or more	3µA		4µA

- The output noise for the 1mA, 10mA, and 100mA ranges is at a load resistance of 1kΩ.
- The output resistance for the 1V, 10V, and 30V ranges is at 4-wire connection. The output resistance for other ranges is at 2-wire connection.
- Noise elimination ratio in common mode:
80dB or more at an unbalanced impedance of 1kΩ ,DC and 50/60Hz
- Line regulation:
± 0.005% of a range at rated-voltage fluctuations of - 15% to + 10%
- Load regulation:
± 0.005% of a range (excluding the 10mV and 100mV ranges) at the maximum load of 4-wire connection

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2.2 Specifications of R6144

- Maximum load capacitance and inductance:

Range	Maximum load capacitance	Maximum load inductance
1/10/30V	1000µF	500µH
1/10/100mV	100µF	1mH

- The maximum load inductance for the 1/10/30V range and the maximum load capacitance for the 1/10/100mA range are those while the limiter is operating at the maximum setting.

2.2 Specifications of R6144

2.2.2 Execution Speed

- Settling time:

The time interval, following the start of output changing, required for the output to enter $\pm 0.1\%$ centered on the final value of the output when the output changes from zero to the full scale at the maximum limiter setting

Range	Load condition	Overshoot/ undershoot	Settling time
All ranges	Maximum resistance load	$\pm 0.1\%$ centered on final value	50ms or less
1V, 10V, and 30V ranges	30 μ F capacitance connected		50ms or less
	100 μ F capacitance connected		60ms or less

- Execution time:

The time interval between the reception of a program code through the GPIB interface or an output level through the BCD interface and the start of output changing, 5ms or less
 (The execution time for the use of the GPIB interface assumes that model 216 of HP 9000 Series is used.)

2.2.3 Voltage/Current Limiter

- Range of setting and stability:

	Range of setting	6-month stability \pm (% of setting + X)
Current limiter	5mA to 160mA	10 + 1mA
Voltage limiter	1V to 28V	5 + 100mV

- The stability is at $23^\circ\text{C} \pm 5^\circ\text{C}$.
- The current limiter is effective when the R6144 is engaged in source operation.

2.2.4 Memory

- Number of storage portions:
160 channels
- Recall mode:
 - Random : A channel is specified to recall data from.
 - Step : The TRIGGER signal is input or the STEP key is pressed to recall data channel by channel.
 - Scan : Data is recalled from channels at a step time specified on the built-in timer.
- Scan mode:
 - Single : Scanning starts from the first channel and ends at the last channel.
 - Repeated : Scanning is repeated over the first channel through the last channel.
- Step time:
The time interval when one-channel data is output in the scan mode or sweep mode. The step time can be varied from 0.1 second to 10 seconds at an interval of 0.1 second.

2.2.5 Sweep

- Sweep : The current set value is continuously incremented to the full scale or decremented to zero at a specified step time. The TRIGGER signal input or pressing the Δ or ∇ key stops the sweep.
Resolution : Count 1, 10, 100, and 1000

2.2.6 Input/Output

- TRIGGER input:

A TTL negative-logic pulse with a 5 milliseconds or more width that is input to the TRIGGER input terminal on the rear panel to start/stop the step operation, scanning, or to stop the sweep operation.

Input terminal : BNC connector

- READY output:

A TTL negative-logic pulse with about a 10 milliseconds width that is output from the READY output terminal on the rear panel about 50 milliseconds after the output level changes in the operate ON state.

Output terminal : BNC connector

- GPIB interface:

Standard : IEEE STD488-1978

Interface function : SH1, AH1, T6, L3, SR1, RL1, PP0, DC1, DT1, C0, E1

Output data : Setting on the front panel

Remote programming : Functions and control excluding the POWER, SENSE, EXT CAL, and OPR HOLD switches, limiter setting, and device addressing

- BCD parallel interface:

Connector : BCD INPUT connector (36-pin, Amphenol type) on the rear panel

Remote programming : Output level (BCD parallel, negative logic, up to 5 digits), polarity, range, operate status, and load signal

2.2.7 General Specifications

- Output : Floating unipolar output
- Output terminals:
Binding post terminals on the front panel (High output, High sense, Low output, Low sense)
- Maximum terminal-to-terminal applied voltage:

Terminal	Maximum applied voltage	
	Positive	Negative
High to Low	- 0.5V to + 32V peak	+ 0.5V to - 32V peak
Low to housing	± 500 V peak	

- Remote sensing system:
4-wire (4WIRE) or 2-wire (2WIRE) connection can be selected with the SENSE switch on the front panel.
- Maximum remote sensing voltage:
0.3V between High/Low output and sense lines including a voltage drop caused by cable resistance
- Setting method:
 - Manual setting : All-digit sweep setting with Δ or ∇ key, and direct setting with numeric keys
 - Remote setting : Setting through GPIB interface or BCD parallel interface
- Display and indication:
 - Output setting : Polarity + 5-digit 7-segment display + Unit
 - Operation : Limiter, operate status (LED lamp)
 - Mode : Direct, memory, step (LED lamp)
 - GPIB : LISTEN, SRQ, REMOTE (LED lamp)
- Backup parameters:
Output level, polarity, range, memory data, step time, first/last channel, scan mode, operate ON state (OPR HOLD switch ON), GPIB/BCD remote mode, device address
- Warm-up time:
The time interval required until a specified accuracy is attained, 30 minutes

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2.2 Specifications of R6144

● Operating environment:

Ambient temperature : 0°C to +50°C

Relative humidity : 85% or less, dew condensation not acceptable

● Storage environment:

Ambient temperature : -25°C to +70°C

● Power supply:

90 to 110 Volts AC, 48-66 Hz

● Supply voltage selection:

The supply voltage can be changed with the selector switch on the rear panel.

Option No.	Standard	Opt. 32	Opt. 42	Opt. 44
Supply voltage	90V to 110V	103V to 132V	198V to 242V	207V to 250V

• Use 120V and 240V for 115V and 230V respectively.

● Power consumption:

27VA or less

● Dimensions:

Approx. 240 (width) × 88 (height) × 360 (depth) mm

● Weight : Approx. 4kg

3. THEORY OF OPERATION

3.1 Block Diagram

The R6142/6144 is a DC voltage generator that applies pulse width modulation (PWM), which is used widely in communications and magnetic recording areas, for voltage division by the time division method.

Figure 3-1 shows the block diagram of the R6142/6144.

The R6142/6144 consists of the following three basic blocks: controller, reference voltage generator, and output amplifier.

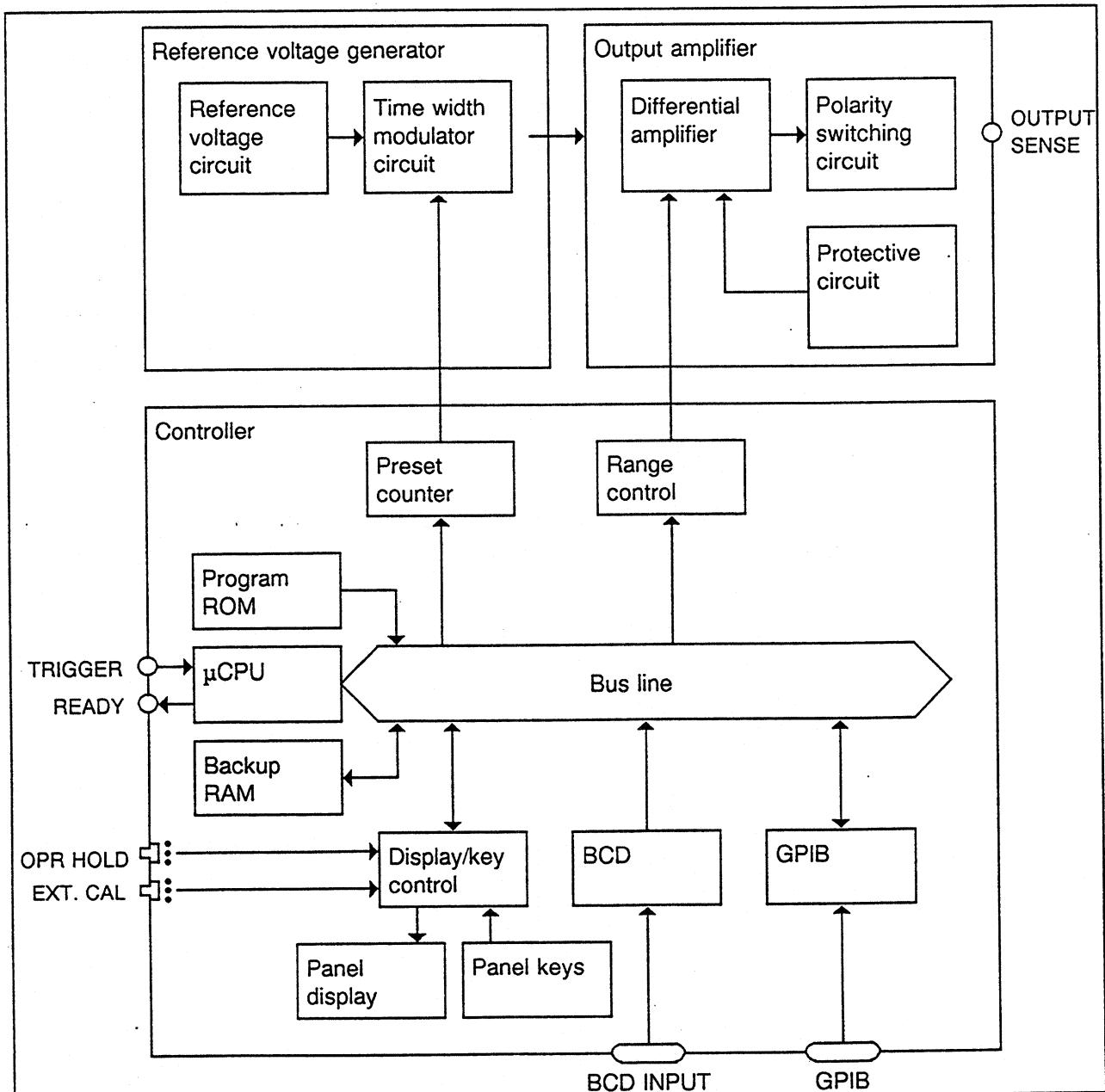


Figure 3-1 Block Diagram

3.2 Block Description

3.2 Block Description

This section briefly describes the blocks.

(1) Controller

The µCPU controls inputs by key operation from the panel and display on the panel. Data received through the selected BCD parallel interface or GPIB interface is processed by the µCPU, converted to PWM modulated pulses by the preset counter, and sent to the reference voltage generator.

(2) Reference voltage generator

The reference voltage generator consists of a time width modulator circuit and a reference voltage circuit which divides voltage by the time division method. Figure 3-2 (a) is an equivalent circuit of voltage division by the time division method.

Input reference voltage E_z is converted to an intermittent signal with time and averaged by the low-pass filter, R and C . The ratio between reference voltage E_z and averaged output voltage E_s , i.e. voltage division ratio, depends on the time ratio of the intermittence. The intermittent signal, that is produced by switching reference voltage E_z on and off with switch SW, is a square wave which is made up of reference voltage E_z lasting for time T_1 and zero voltage lasting for T_2 . Average voltage E_s of the square waves in Figure 3-2 (b) is calculated as follows:

$$E_s = \frac{T_1}{T_1 + T_2} \cdot E_z$$

Any output level can be obtained by changing time T_1 for a fixed time of T_1 plus T_2 .

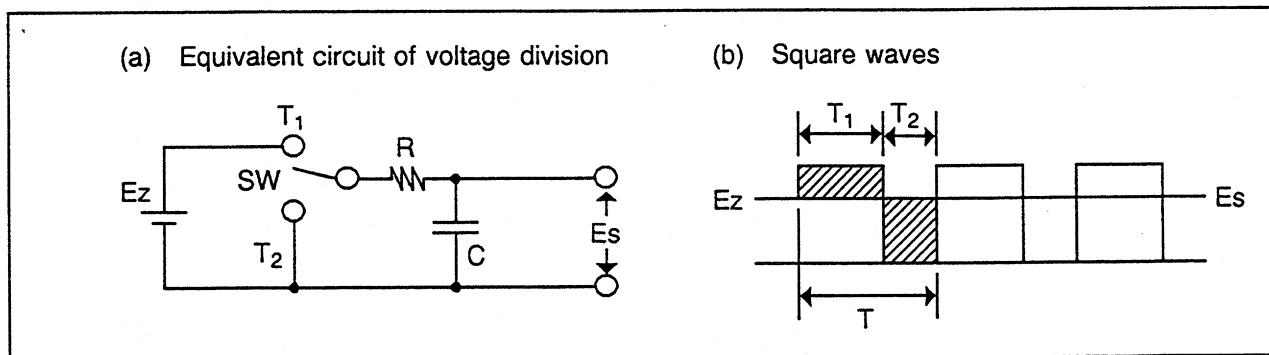


Figure 3-2 Time Division Method

The reference voltage circuit generates reference voltage E_z . The time width modulator circuit generates pulses with pulse width T_1 corresponding to a set output level. Reference voltage E_z is switched and the low-pass filter averages the pulses to generate a required voltage.

(3) Output amplifier

The output amplifier consists of a differential amplifier, a polarity switching circuit, and a protective circuit. Figure 3-3 shows the principle of the output amplifier and polarity switching circuit.

The R6142/6144 switches ranges by changing R_f , R_1 , and R_s .

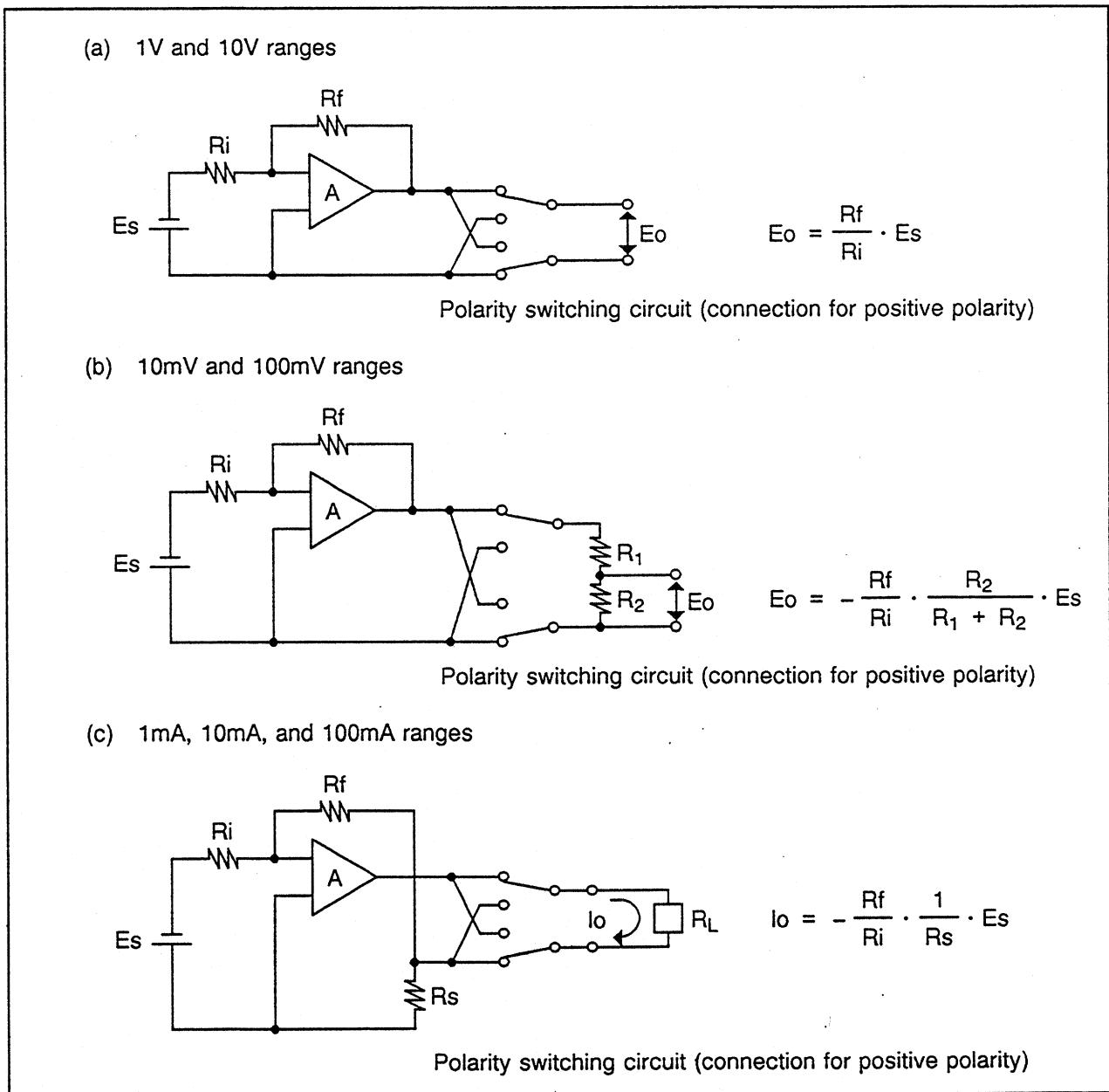


Figure 3-3 Principle of the Output Amplifier and Polarity Switching Circuit

4.1 Test Equipment

4. PERFORMANCE TEST (CALIBRATION)

4.1 Test Equipment

Table 4-1 List of Test Equipment

Equipment generic name	Minimum use specifications				MFR. Model/Option applicable		
DC voltmeter	Accuracy		100nV to 20mV	100ppm	Advantest	R6871E	
			1μV to 100V	40ppm			
DC ammeter or reference resistor	Accuracy	Ammeter	1μA to 200mA	90ppm	HP	HP3458A	
			10nA to 20mA	60ppm			
		Ref. resistor	1KΩ	20ppm	Advantest	TR1332-1K	
			100Ω	20ppm	Advantest	TR1332-100	
			1Ω	50ppm	Yokogawa	2792-1Ω	
Oscilloscope	Sensitivity		1mV/div to 5V/div		Kikusui Elec.	COM7201	
	Bandwidth		DC to 20MHz, -3dB or less				
High-sensitive oscilloscope	Sensitivity		10μV to 10V		TEKTRONIX	7633 7A22 7B53A	
	Bandwidth		DC to 100Hz, -3dB DC to 10kHz, -3dB				
DC voltage source	Output voltage		10.000V ± 5mV 0.000V ± 2mV		Advantest	R6142	
	Resolution		1mV				
Computer	Interface		GPIB		NEC NEC	PC-9801 PC-9801-29N	
Pulse generator	Output level		TTL level		HP	HP8116A	
	Pulse width		5msec				

4.2 Performance Test Items

4.2 Performance Test Items

4.2.1 R6142 performance test items

Table 4-2 R6142 Performance Test Items

UUT (Unit Under Test) parameter/ function	Performance specifications			Test method
Precheck & revision	Operation check			Check the initial operation.
Key switch operation	Operation check			Check the key switch operation.
Output voltage	00.000mV	-0.0050mV to 0.0050mV		Measure the output voltage using a DC voltmeter.
	11.999mV	11.9904mV to 12.0076mV		
	-11.999mV	-11.9904mV to -12.0076mV		
	000.00mV	-0.0250mV to 0.0250mV		
	111.99mV	119.9290mV to 120.0510mV		
	0.0000V	-0.2000mV to 0.2000mV		
	1.1999V	1199.3400mV to 1200.4600mV		
	00.000mV	-2.000mV to 2.000mV		
	11.999V	11.993400V to 12.004600V		
Output current	0.0000mA	-0.0003mA to 0.0003mA		Measure the output current using an ammeter.
	1.1999mA	1.19918mA to 1.20062mA		
	00.000mA	-0.003mA to 0.003mA		
	11.999mA	11.9918mA to 12.0062mA		
	000.00mA	-0.03mA to 0.03mA		
	119.99mA	119.912mA to 120.068mA		
Output noise		DC to 100Hz	DC to 10kHz	Measure the output noise using an oscilloscope or high-sensitive oscilloscope.
	06.000mV	5 μ Vp-p	10 μ Vp-p	
	060.00mV	15 μ Vp-p	30 μ Vp-p	
	0.6000V	80 μ Vp-p	150 μ Vp-p	
	06.000V	200 μ Vp-p	500 μ Vp-p	6 μ Ap-p
	0.0000mA	30nAp-p	150nAp-p	
	00.000mA	300nAp-p	400nAp-p	
	000.00mA	3 μ Ap-p	4 μ Ap-p	
Voltage limiter	Must support 1 to 10Vdc setup.			Check the voltage limiter operation using a DC voltmeter.
Current limiter	Must support 5 to 120mA setup.			Check the current limiter operation using a DC ammeter.
GPIB interface	Operation check			Connect a computer and check the remote operation via GPIB.
BCD interface	Operation check			Connect a BCD input signal setup circuit and check the remote operation via BCD interface.
Ready signal	Operation check			Check the ready signal on the oscilloscope.
Trigger signal	Operation check			Check the trigger signal operation using a pulse generator.

4.2 Performance Test Items

4.2.2 R6144 performance test items

Table 4-3 R6144 Performance Test Items

UUT (Unit Under Test) parameter/ function	Performance specifications			Test method
Precheck & revision	Operation check			Check the initial operation.
Key switch operation	Operation check			Check the key switch operation.
Output voltage	00.000mV	-0.0050mV to 0.0050mV		Measure the output voltage using a DC voltmeter.
	16.000mV	15.9902mV to 16.0098mV		
	-16.000mV	-15.9902mV to -16.0098mV		
	000.00mV	-0.0250mV to 0.0250mV		
	160.00mV	159.9270mV to 160.0730mV		
	0.0000V	-0.2000mV to 0.2000mV		
	1.6000V	1599.3200mV to 1600.6800mV		
	00.000mV	-2.000mV to 2.000mV		
	16.000V	15.993200V to 16.006800V		
	00.000V *	-0.00300V to 0.00300V		
Output current	32.000V *	31.98740V to 32.01260V		Measure the output current using an ammeter.
	0.0000mA	-0.0003mA to 0.0003mA		
	1.6000mA	1.59914mA to 1.60086mA		
	00.000mA	-0.003mA to 0.003mA		
	16.000mA	15.9914mA to 16.0086mA		
	000.00mA	-0.03mA to 0.03mA		
Output noise	160.00mA	159.914mA to 160.086mA		Measure the output noise using an oscilloscope or high-sensitive oscilloscope.
		DC to 100Hz	DC to 10kHz	
	08.000mV	5 μ Vp-p	10 μ Vp-p	
	080.00mV	15 μ Vp-p	30 μ Vp-p	
	0.8000V	80 μ Vp-p	150 μ Vp-p	
	08.000V	200 μ Vp-p	500 μ Vp-p	
	16.000V*	400 μ Vp-p	1mVp-p	
	0.0000mA	30nAp-p	150nAp-p	
	00.000mA	300nAp-p	400nAp-p	
Voltage limiter	000.00mA	3 μ Ap-p	4 μ Ap-p	Check the voltage limiter operation using a DC voltmeter.
Current limiter	Must support 1 to 28Vdc setup.			Check the current limiter operation using a DC ammeter.
GPIB interface	Must support 5 to 160mA setup.			Connect a computer and check the remote operation via GPIB.
BCD interface	Operation check			Connect a BCD input signal setup circuit and check the remote operation via BCD interface.
Ready signal	Operation check			Check the ready signal on the oscilloscope.
Trigger signal	Operation check			Check the trigger signal operation using a pulse generator.

4.3 Performance Test Method

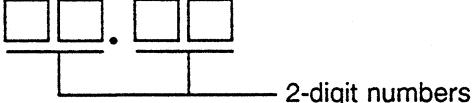
4.3 Performance Test Method

Cautions:

- (1) Use the AC power source having the specified voltage.
- (2) Before connecting the power cable, make sure that the system POWER switch has been turned OFF.
- (3) Perform the test in the following ambient conditions:
Temperature : 23°C ±3°C
Humidity : 70% (relative) or less
Ambient : There should be no excessive dusts, vibration and electrical noise.
- (4) Preheat the system at least 2 hours before you start the test.
Each tester must also be preheated for the specified time.

4.3.1 Precheck and revision test

Procedure:

- ① Turn the power supply on.
- ② Make sure that the LED lights 3 or 4 seconds on the front panel and it indicates the following value (if so, the operation is normal):


2-digit numbers
- ③ If an error code is displayed, go to Section 6.2 "Troubleshooting".
- ④ If the operation is abnormal, go to Section 6.3 "Problems in Precheck and Revision Test".

4.3.2 Key switch operation test

Procedure:

- ① Check the key switch status on the front panel by referring to Table 4-4.

Table 4-4 Key Switch Operations

Key	Operation
OPERATE	When pressed once, the LED of OPERATE key lights. When pressed again, the LED goes out.
POLARITY +	The positive sign LED goes out from the display section.
POLARITY 0	Data is set to zero (0) in the display section.
POLARITY -	The negative sign LED lights in the display section.
V	The voltage (V) range LED lights in the display section.
mV	The "mV" range LED lights in the display section.
mA	The "mA" range LED lights in the display section.
MEM	When pressed once, the LED of MEM key lights. When pressed again, the LED goes out.
DATA	When pressed once, the LED of DATA key lights. When pressed again, the LED goes out.
STEP	When pressed once, the LED of STEP key lights. When pressed again, the LED goes out.
0 to 9	Press the DATA key and type any of 0 to 9 keys, and the corresponding digit will be displayed.
LOCAL	Press the STEP and LOCAL keys in this sequence, and "A-□□", "L on L", or "bcd" will be displayed.

- ② If the operation is abnormal, go to Section 6.4 "Problems in Key Switch Operation".

4.3.3 Output voltage test

Procedure:

- ① Connect the R6142/6144 to the R6871E as shown in Figure 4-1.

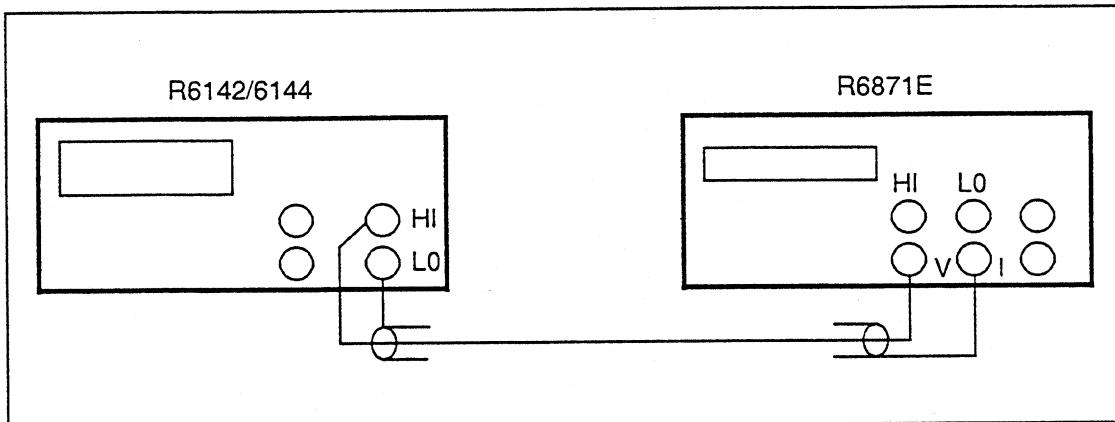


Figure 4-1 Cable Connection for Output Voltage Test

- ② Set each equipment as defined on Table 4-5.

Table 4-5 Parameter Setting for Output Voltage Test

Equipment name	Function	Setting
R6142	SENSE switch	2 WIRE
	Limit I	120mA or more
R6144	SENSE switch	2 WIRE
	Limit I	160mA or more
R6871E	Function	DCV
	Integration time	5PLC
	Auto Zero	ON
	Auto CAL	ON

- ③ Change the R6142/6144 output as defined on Tables 4-6 and 4-7, and read the results on the DC voltmeter.

Make sure that the readout is within the range defined on Tables 4-6 and 4-7. If not, the test result is fail.

- ④ If failed, go to Section 5 "Adjustment".

If the operation is still abnormal after adjustment, go to Section 6.5 "Output Voltage Error".

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4.3 Performance Test Method

Table 4-6 Evaluation of R6142 Results

R6142		R6871E DIGITAL VOLTMETER	
RANGE	SETTING	RANGE	INDICATION RANGE
10mV	00.000mV	200mV	-0.0050mV to 0.0050mV
	11.999mV		11.9904mV to 12.0076mV
	-11.999mV		-11.9904mV to -12.0076mV
100mV	000.00mV		-0.0250mV to 0.0250mV
	119.99mV		119.9290mV to 120.0510mV
1V	0.0000V	2V	-0.2000mV to 0.2000mV
	1.1999V		1199.3400mV to 1200.4600mV
10V	00.000mV	20V	-2.000mV to 2.000mV
	11.999V		11.993400V to 12.004600V

Table 4-7 Evaluation of R6144 Results

R6144		R6871E DIGITAL VOLTMETER	
RANGE	SETTING	RANGE	INDICATION RANGE
10mV	00.000mV	200mV	-0.0050mV to 0.0050mV
	16.000mV		15.9902mV to 16.0098mV
	-16.000mV		-15.9902mV to -16.0098mV
100mV	000.00mV		-0.0250mV to 0.0250mV
	160.00mV		159.9270mV to 160.0730mV
1V	0.0000V	2V	-0.2000mV to 0.2000mV
	1.6000V		1599.3200mV to 1600.6800mV
10V	00.000mV	20V	-2.000mV to 2.000mV
	16.000V		15.993200V to 16.006800V
30V	00.000V	200V	-0.00300V to 0.00300V
	32.000V		31.98740V to 32.01260V

4.3.4 Output current test

Procedure:

- ① Connect the R6142/6144 to the R6871E as shown in Figure 4-2.

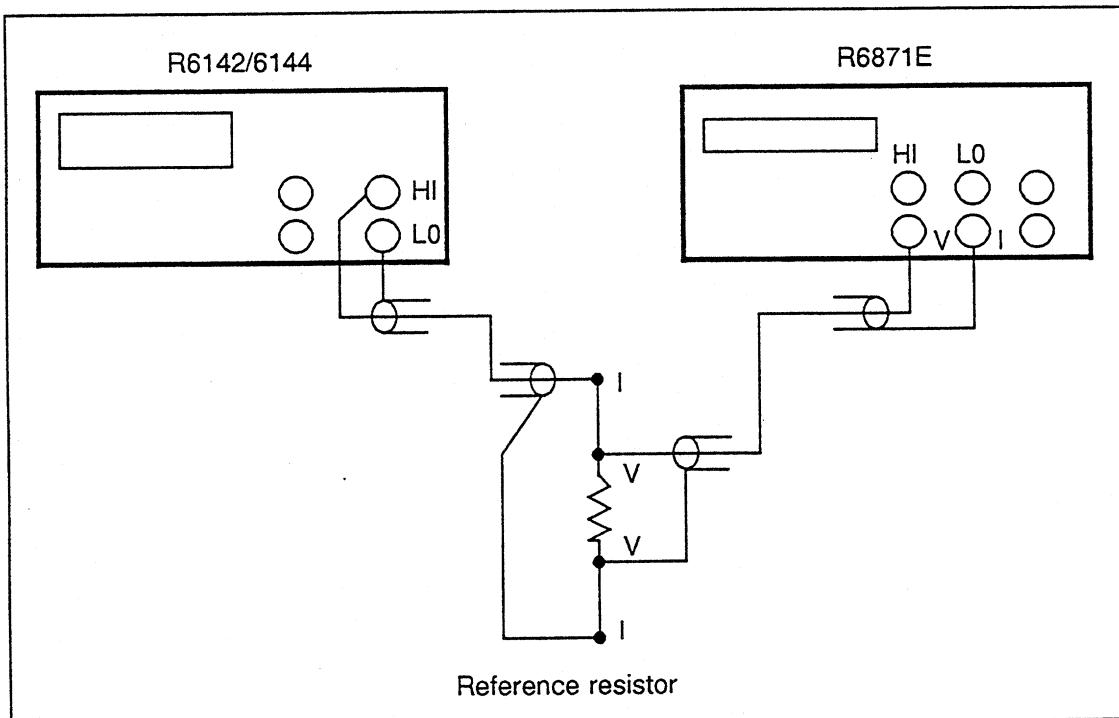


Figure 4-2 Cable Connection for Output Current Test

- ② Set each equipment as defined on Table 4-8.

Table 4-8 Parameter Setting for Output Current Test

Equipment name	Function		Setting
R6142	SENSE switch		2 WIRE
	Limit V		10V or more
R6144	SENSE switch		2 WIRE
	Limit V		28V or more
R6871E	Function		DCV
	Integration time		5PLC
	Range	If 1mA range is set for R6142/6144	2V
		If 10mA range is set for R6142/6144	2V
		If 100mA range is set for R6142/6144	200mV
	Auto Zero		ON
	Auto CAL		ON
Reference resistor	Resistor type	If 1mA range is set for R6142/6144	Advantest TR1332-1K
		If 10mA range is set for R6142/6144	Advantest TR1332-100
		If 100mA range is set for R6142/6144	Yokogawa's 2792-1Ω

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4.3 Performance Test Method

- ③ Change the R6142/6144 output as defined on Tables 4-9 and 4-10, and read the results on the DC voltmeter.

Make sure that the readout is within the range defined on Tables 4-9 and 4-10. If not, the test result is fail.

- ④ If failed, go to Section 5 "Adjustment".

If the operation is still abnormal after adjustment, go to Section 6.6 "Output Current Error".

Table 4-9 Evaluation of R6142 Results

R6142		R6871E DIGITAL VOLTMETER	
RANGE	SETTING	RANGE	INDICATION RANGE
1mA	0.0000mA	2V	-0.3000mV to 0.3000mV
	1.1999mA		1199.1800mV to 1200.6200mV
10mA	00.000mA	200mV	-0.3000mV to 0.3000mV
	11.999mA		1199.1800mV to 1200.6200mV
100mA	000.00mA	200mV	-0.0300mV to 0.0300mV
	119.99mA		119.9120mV to 120.0680mV

Table 4-10 Evaluation of R6144 Results

R6142		R6871E DIGITAL VOLTMETER	
RANGE	SETTING	RANGE	INDICATION RANGE
1mA	0.0000mA	2V	-0.3000mV to 0.3000mV
	1.6000mA		1599.1400mV to 1600.8600mV
10mA	00.000mA	200mV	-0.3000mV to 0.3000mV
	16.000mA		1599.1400mV to 1600.8600mV
100mA	000.00mA	200mV	-0.0300mV to 0.0300mV
	160.00mA		159.9140mV to 160.0860mV

4.3 Performance Test Method

4.3.5 Output Noise Test

Procedure:

- ① Connect an oscilloscope to the R6142/6144 as shown in Figures 4-3 to 4-6.

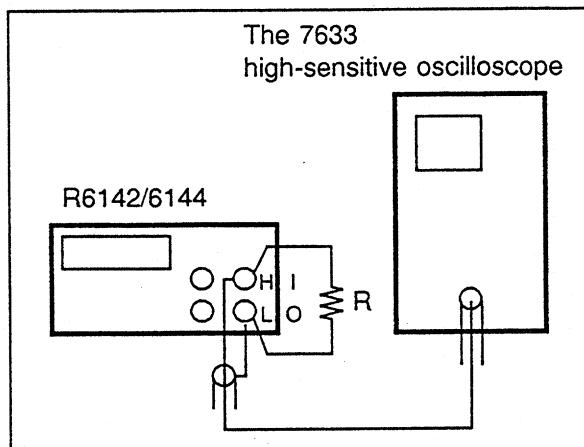


Figure 4-3 Cable Connection for Low-frequency Noise Voltage Measurement

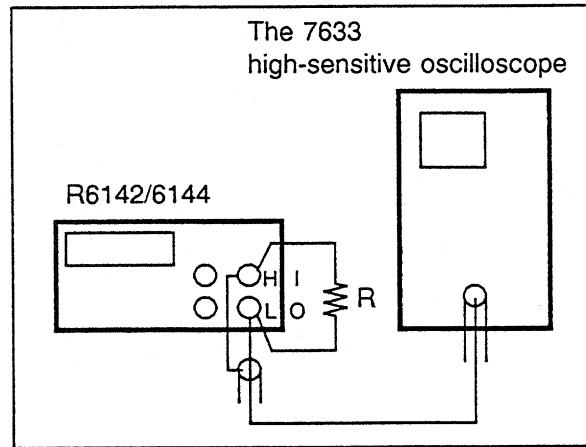


Figure 4-4 Cable Connection for Low-frequency Noise Current Measurement

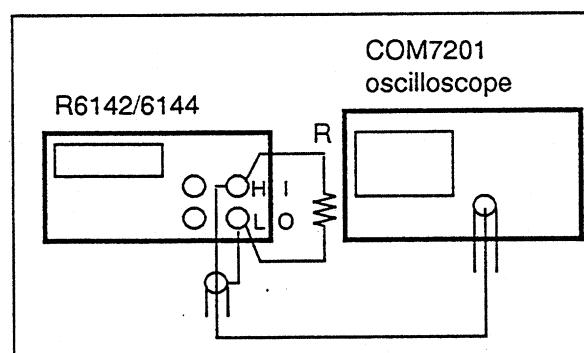


Figure 4-5 Cable Connection for High-frequency Noise Voltage Measurement

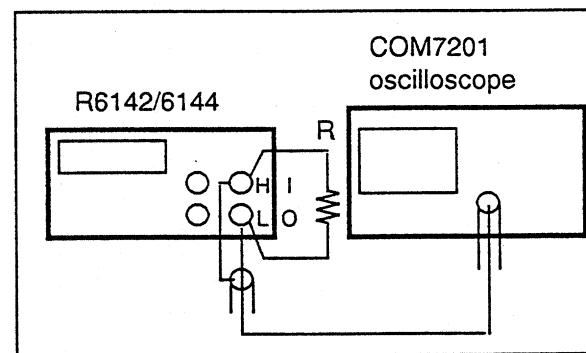


Figure 4-6 Cable Connection for High-frequency Noise Current Measurement

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4.3 Performance Test Method

- ② Set each equipment as defined on Table 4-11.

Table 4-11 Parameter Setting for Output Noise Test

Equipment name	Function	Setting			
		Fig. 4.3	Fig. 4.4	Fig. 4.5	Fig. 4.6
R6142	SENSE switch	2 WIRE			
	Limit control	120mA or more	10V or more	120mA or more	10V or more
R6144	SENSE switch	2 WIRE			
	Limit control	160mA or more	28V or more	160mA or more	28V or more
7633	Bandwidth	DC to 100Hz, DC to 10kHz		*****	*****
	Sweep time	50msec		*****	*****
COM7201	Bandwidth	*****	*****	20 to 20MHz	
	Sweep time	*****	*****	50msec	

- ③ Change the R6142/6144 output as defined on Tables 4-12 and 4-13, and read the results on the oscilloscope.

If the measured value is "xxVp-p", the noise current can be represented as "IN = xx/R".

Make sure that the readout is within the limit defined on Tables 4-12 and 4-13. If not, the test result is fail.

- ④ If failed, go to Section 6.7 "Output Noise Error".

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4.3 Performance Test Method

Table 4-12 Evaluation of R6142 Results

R6142		R_L	Oscilloscope (7633 or COM7201)		
Range	Setting		DC to 100Hz	DC to 10kHz	20 to 20MHz
10mV	06.000mV	10K Ω 1/4W	Fig. 4-3 5 μ Vp-p	Fig. 4-3 10 μ Vp-p	Fig. 4-5 3mVp-p
100mV	060.00mV	10K Ω 1/4W	Fig. 4-3 15 μ Vp-p	Fig. 4-3 30 μ Vp-p	
1V	0.6000V	10 Ω 1/4W	Fig. 4-3 80 μ Vp-p	Fig. 4-3 150 μ Vp-p	
10V	06.000V	100 Ω 1/2W	Fig. 4-3 200 μ Vp-p	Fig. 4-3 500 μ Vp-p	
1mA	0.0000mA	1K Ω 1/4W	Fig. 4-4 30nAp-p	Fig. 4-4 150nAp-p	Fig. 4-6 6 μ Ap-p
10mA	00.000mA	1K Ω 1/4W	Fig. 4-4 300nAp-p	Fig. 4-4 400nAp-p	
100mA	000.00mA	1K Ω 1/4W	Fig. 4-4 3 μ Ap-p	Fig. 4-4 4 μ Ap-p	

Table 4-13 Evaluation of R6144 Results

R6144		R_L	Oscilloscope (7633 or COM7201)		
Range	Setting		DC to 100Hz	DC to 10kHz	20 to 20MHz
10mV	08.000mV	10K Ω 1/4W	Fig. 4-3 5 μ Vp-p	Fig. 4-3 10 μ Vp-p	Fig. 4-5 3mVp-p
100mV	080.00mV	10K Ω 1/4W	Fig. 4-3 15 μ Vp-p	Fig. 4-3 30 μ Vp-p	
1V	0.8000V	10 Ω 1/4W	Fig. 4-3 80 μ Vp-p	Fig. 4-3 150 μ Vp-p	
10V	08.000V	100 Ω 1W	Fig. 4-3 200 μ Vp-p	Fig. 4-3 500 μ Vp-p	
30V	16.000V	200 Ω 2W	Fig. 4-3 400 μ Vp-p	Fig. 4-3 1mVp-p	
1mA	0.0000mA	1K Ω 1/4W	Fig. 4-4 30nAp-p	Fig. 4-4 150nAp-p	Fig. 4-6 6 μ Ap-p
10mA	00.000mA	1K Ω 1/4W	Fig. 4-4 300nAp-p	Fig. 4-4 400nAp-p	
100mA	000.00mA	1K Ω 1/4W	Fig. 4-4 3 μ Ap-p	Fig. 4-4 4 μ Ap-p	

4.3.6 Voltage limiter test

Procedure:

- ① Connect the R6142/6144 to the R6871E as shown in Figure 4-7.

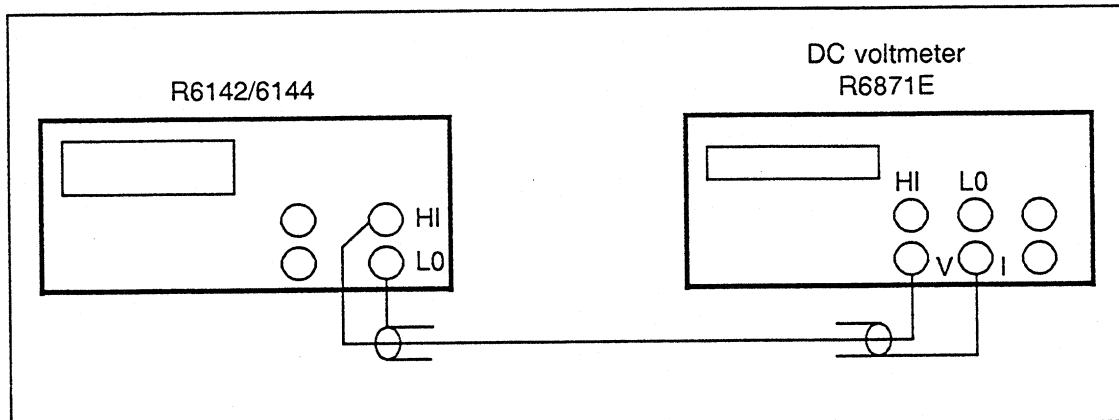


Figure 4-7 Cable Connection for Voltage Limiter Test

- ② Set each equipment as defined on Table 4-14.

Table 4-14 Parameter Setting for Voltage Limiter Test

Equipment name	Function	Setting
R6142/R6144	SENSE switch	2 WIRE
	Range	100mA
	Setting	100.00mA
R6871E	Function	DCV
	Integration time	5PLC
	Auto Zero	ON
	Auto CAL	ON

- ③ Fully rotate the VOLTAGE LIMIT control fully counterclockwise (CCW) on the rear panel, and read the voltage (minimum value) on the scale.

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4.3 Performance Test Method

- ④ Fully rotate the VOLTAGE LIMIT control fully clockwise (CW) on the rear panel, and read the voltage (maximum value) on the scale.
- ⑤ Make sure that the values obtained in Steps ③ and ④ satisfy the requirements defined on Tables 4-15. If not, the test result is fail.
If failed, go to Section 6.8 "Voltage Limiter".

Table 4-15 Evaluation of R6142/6144 Results

Measure model	DMM (R6871E) measure data		Limit LED check	
	MIN	MAX	OPERATE ON	OPERATE OFF
R6142	1V	10V	LED lights.	LED goes out.
R6144	1V	28V		

4.3.7 Current limiter test

Procedure:

- ① Connect the R6142/6144 to the R6871E as shown in Figure 4-8.

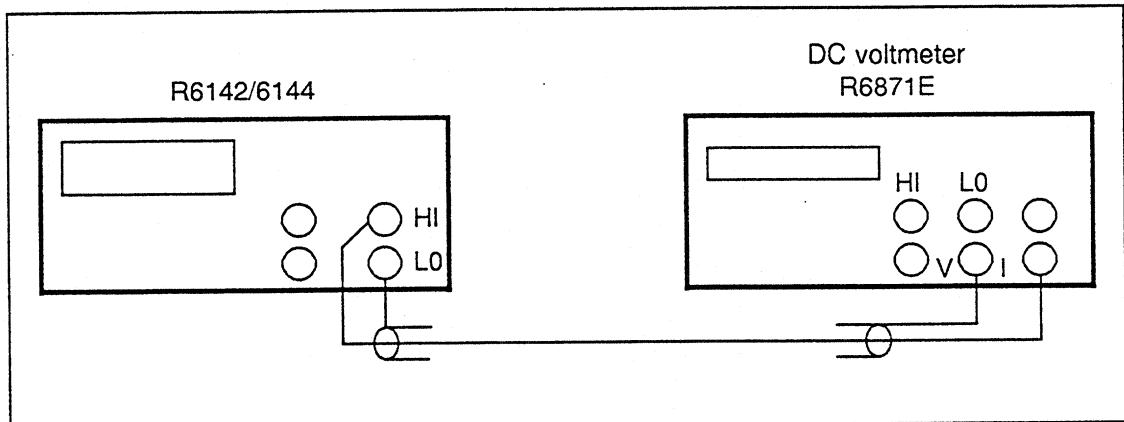


Figure 4-8 Cable Connection for Current Limiter Test

- ② Set each equipment as defined on Table 4-16.

Table 4-16 Parameter Setting for Current Limiter Test

Equipment name	Function	Setting
R6142/R6144	SENSE switch	2 WIRE
	Range	10V
	Setting	10.000V
R6871E	Function	DCI
	Integration time	5PLC
	Auto Zero	ON
	Auto CAL	ON

- ③ Fully rotate the CURRENT LIMIT control fully counterclockwise (CCW) on the front panel, and read the current (minimum value) on the scale.
- ④ Fully rotate the CURRENT LIMIT control fully clockwise (CW) on the rear panel, and read the current (maximum value) on the scale.
- ⑤ Make sure that the values obtained in Steps ③ and ④ satisfy the requirements defined on Tables 4-17. If not, the test result is fail.

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4.3 Performance Test Method

If failed, go to Section 6.9 "Current Limiter".

Table 4-17 Evaluation of R6142/6144 Results

Measure model	DMM (R6871E) measure data		Limit LED check	
	MIN	MAX	When ammeter connected	When output is open
R6142	5mA	120mA	LED lights.	LED goes out.
R6144	5mA	160mA		

4.3 Performance Test Method

4.3.8 GPIB interface test

Procedure:

- ① Connect the R6142/6144 to the PC-9801 personal computer as shown in Figure 4-9.

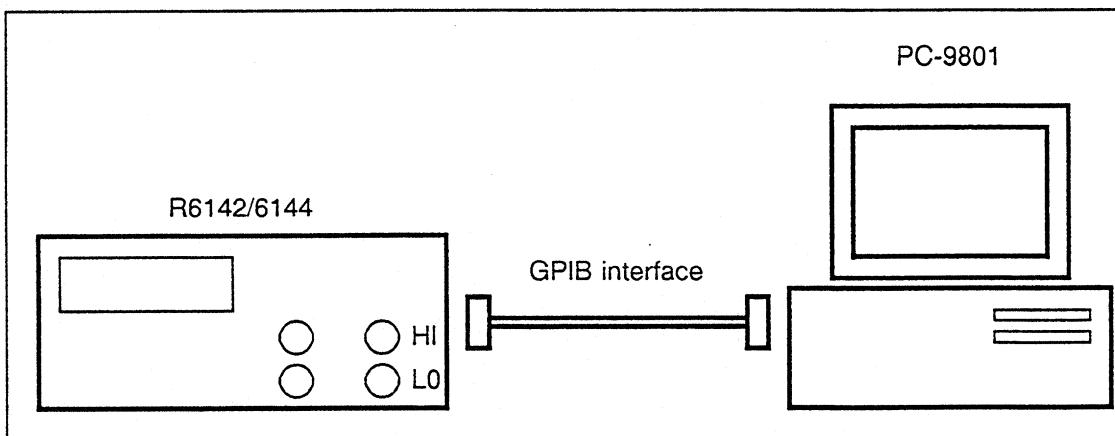


Figure 4-9 Cable Connection for GPIB Interface Test

- ② Set each equipment as defined on Table 4-18.

Table 4-18 Parameter Setting for GPIB Interface Test

Equipment name	Function	Setting
R6142/6144	LOCAL switch	GPIB
	GPIB address	1
PC-9801	(Refer to the Instruction Manual.)	
PC-9801-29N	(Refer to the Instruction Manual.)	

- ③ Run the program as defined on Table 4-19, send the commands from the PC-9801 to the R6142/6144, and make sure that the system operates normally.
- ④ If not, go to Section 6.10 "Problems in GPIB Interface".

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4.3 Performance Test Method

Table 4-19 Evaluation of R6142/6144 Results

Program of PC-9801 computer	Action taken
10 ISET IFC	Generate 5Vdc voltage.
20 ISET REN	
30 CMD DELIM = 0	
40 CMD TIMEOUT = 4	
50 R6144 = 1	
60 PRINT @R6144; "C"	
70 PRINT @R6144; "D5V"	
80 PRINT @R6144; "E"	
90 FOR DELAY = 0 TO 10000 :NEXT	
100 PRINT @R6144; "H"	
110 IRESET REN	
120 FOR DELAY = 0 TO 2000 :NEXT	
130 END	

4.3.9 BCD interface test

Procedure:

- ① Connect the R6142/6144 to the BCD input signal setup circuit as shown in Figure 4-10.

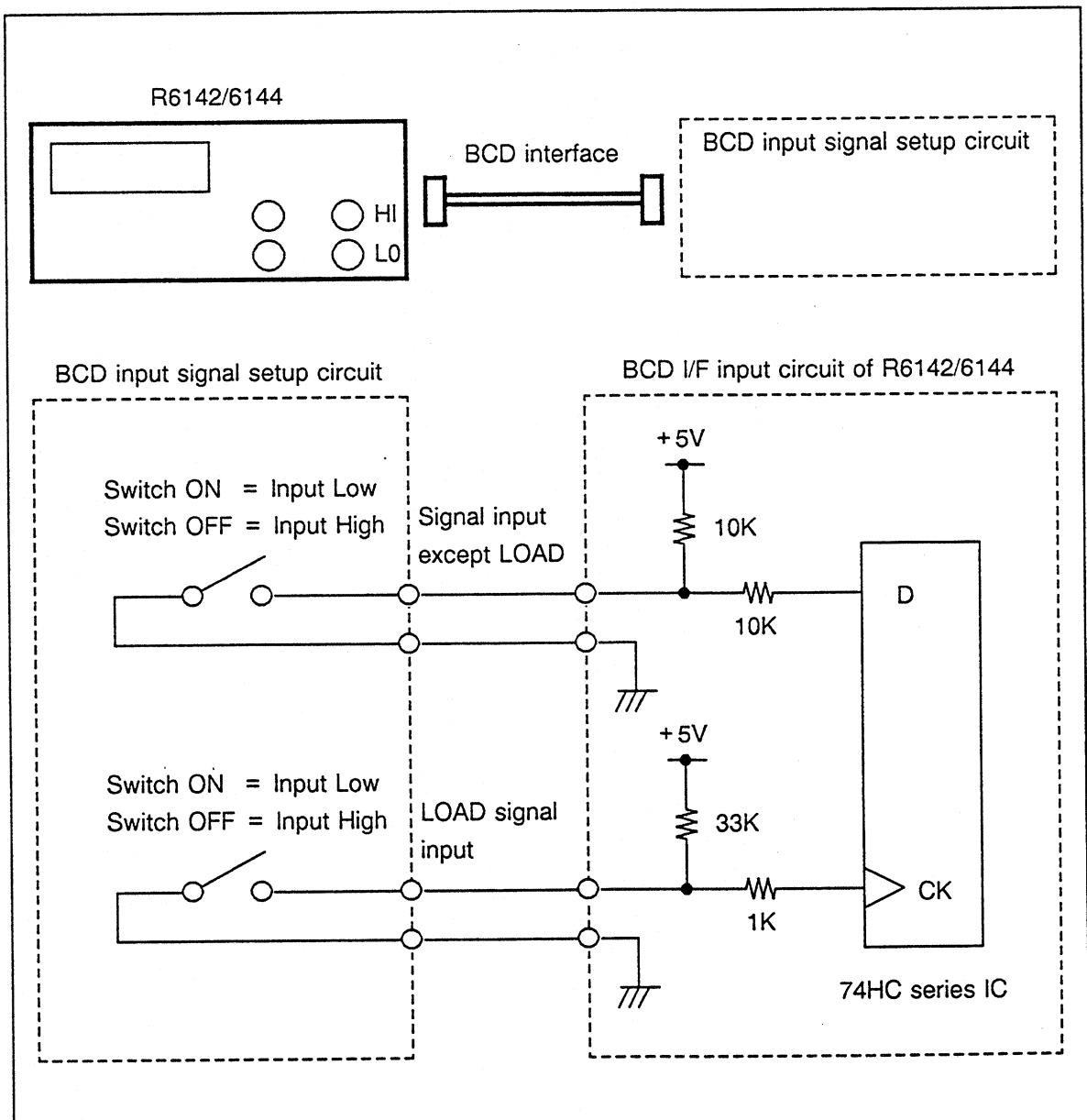


Figure 4-10 Cable Connection for BCD Interface Test

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MAINTENANCE MANUAL**

4.3 Performance Test Method

- ② Set each equipment as defined on Table 4-20.

Table 4-20 Parameter Setting for BCD Interface Test

Equipment name	Function	Setting
R6142/6144	LOCAL switch	BCD
	Operation mode	Full Remote

- ③ Change the setup of each BCD signal by following the instructions given in Figure 4-10 and Table 4-21, and make sure that the system operates normally.
- ④ Make sure that the R6142/6144 does not operate when the LOAD signal is set to logical high and the output signal level is changed.
- ⑤ If the R6142/6144 operates abnormally, go to Section 6.11 "Problems in BCD Interface".

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4.3 Performance Test Method

Table 4-21 Parameter Setting for Ready Signal Test

R6142/R6144 operation status										BCD input signal setup status									
Output level										Range									
10 ⁰ digit					10 ¹ digit					10 ² digit					10 ³ digit				
Data	Range	Polar- ity	Oper- ation	1	2	4	8	1	2	4	8	1	2	4	8	1	2	4	8
1111	10V	+	ON	L	H	H	H	L	H	H	H	L	H	H	H	1	2	mV	10 ⁰ mV
2222	10V	+	ON	H	L	H	H	L	H	H	H	L	H	H	H	L	H	V	10 ¹ V
3333	10V	+	ON	L	L	H	L	H	L	H	L	H	L	H	H	L	H	H	10 ² mA
4444	10V	+	ON	H	L	H	L	H	L	H	L	H	L	H	H	L	H	H	10 ³ mA
5555	10V	+	ON	L	H	L	H	L	H	L	H	L	H	H	L	H	H	H	10 ⁴ mA
6666	10V	+	ON	H	L	H	L	H	L	H	L	H	L	H	H	L	H	H	10 ⁵ mA
7777	10V	+	ON	L	L	H	L	L	H	L	H	L	L	H	H	L	H	H	10 ⁶ mA
8888	10V	+	ON	H	H	L	H	H	L	H	H	L	H	H	H	L	H	H	10 ⁷ mA
9999	10V	+	ON	L	H	L	H	L	H	L	H	L	H	H	L	H	H	H	10 ⁸ mA
10000	10V	+	ON	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	10 ⁹ mA
20000	30V	+	ON	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	10 ¹⁰ mA
30000	30V	+	ON	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	10 ¹¹ mA
10000	10mV	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	10 ⁰ mV
10000	100mV	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	10 ⁻¹ mV
10000	1V	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	10 ⁻² V
10000	1mA	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	10 ⁻³ mA
10000	10mA	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	10 ⁻⁴ mA
10000	100mA	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	10 ⁻⁵ mA

4.3 Performance Test Method

4.3.10 Ready signal test

Procedure:

- ① Connect the R6142/6144 to an oscilloscope as shown in Figure 4-11. Use CH1 of the oscilloscope to observe the output waveforms, and use CH2 of it to observe the Ready signal waveforms.

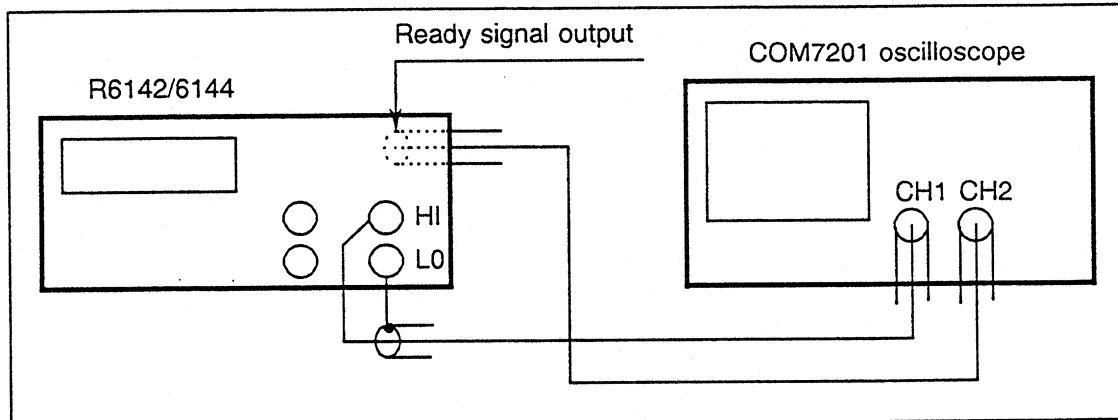


Figure 4-11 Cable Connection for Ready Signal Test

- ② Set each equipment as defined on Table 4-22.

Table 4-22 Parameter Setting for Ready Signal Test

Equipment name	Function		Setting
R6142/6144	SENSE switch		2 WIRE
	Operation mode		ON
	LIMIT I	R6142	120mA or more
		R6144	160mA or more
	Initial value	Range	10V range
		Data	00.000V
	Final value	Range	10V range
		Data	05.000V
COM7201	CH1 VOLT RENGE		2V/div
	CH2 VOLT RENGE		2V/div
	TIME RENGE		10msec/div

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4.3 Performance Test Method

- ③ Change the R6142/6144 output from its initial value to the final value. Measure the time (t_1) between the rise-up of output waveform and the fall of Ready signal waveform. Also, measure the pulse width (t_2) of the Ready signal.

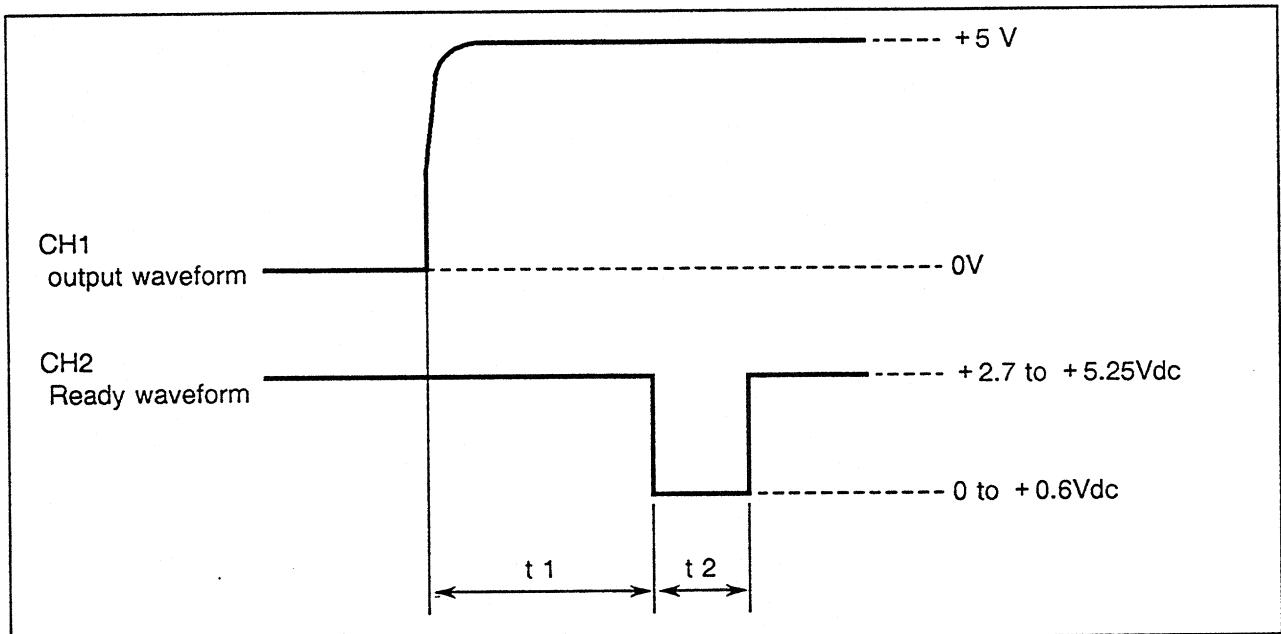


Figure 4-12 Waveform Timing

- ④ Make sure that the measured values satisfy the requirements defined on Table 4-23. If not, the test results are fail.
- ⑤ If failed, go to Section 6.12 "Problems in Ready Signal".

Table 4-23 "t₁" and "t₂" Evaluation Values

Timing point	Readout on COM7201 oscilloscope
t ₁	Approx. 50msec
t ₂	Approx. 10msec

4.3 Performance Test Method

4.3.11 Trigger signal test

Procedure:

- ① Connect the R6142/6144 to the HP8116A as shown in Figure 4-13.

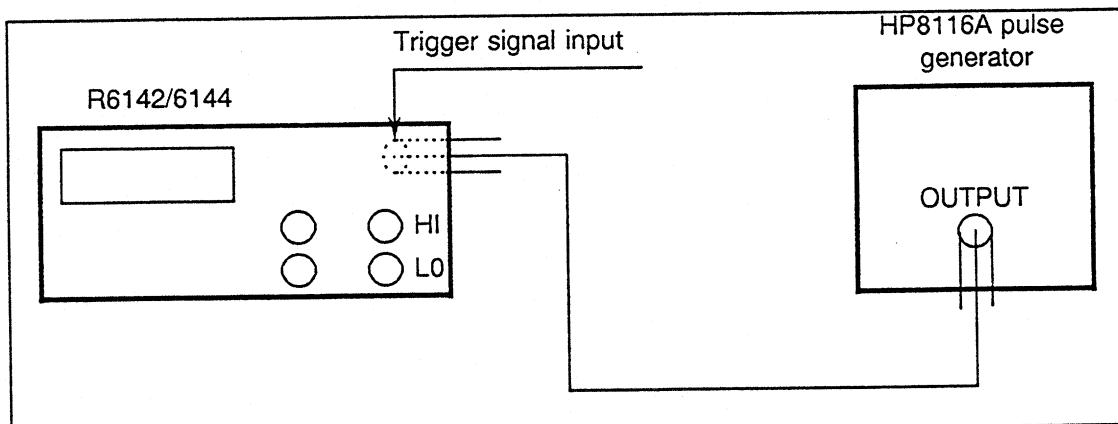


Figure 4-13 Cable Connection for Trigger Signal Test

- ② Set each equipment as defined on Table 4-24.

Table 4-24 Parameter Setting for Trigger Signal Test

Equipment name	Function		Setting
R6142/6144	SENSE switch		2 WIRE
	MEM switch		ON (Step mode)
	First CH		1
	Last CH		2
	LIMIT 1	R6142	120mA or more
		R6144	160mA or more
	CH1 set value	Range	10V range
		Data	00.000V
	CH2 set value	Range	10V range
		Data	05.000V
HP8116A	Output format		Single waveform output
	Output waveforms		See Figure 4-14.

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4.3 Performance Test Method

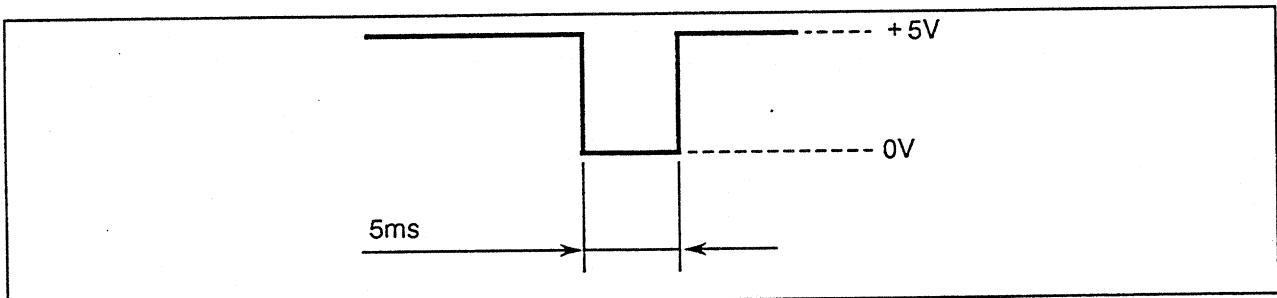


Figure 4-14 Output Waveforms

- ③ Output the single pulse waveforms from the HP8116A and make sure that the R6142/6144 display changes as follows: CH1 → CH2 → CH3
- ④ If not, go to Section 6-13 "Problems in Trigger Signal".

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4.4 Performance Test Check List

4.4 Performance Test Check List

(1) R6142

Manufacturer: _____ Name: _____

Model: _____ ID No.: _____

(1 of 3)

Parameter	Setting	Tolerance limit		Measured value	Reference
		MIN	MAX		
Output Voltage	00.000mV	-0.0050mV	0.0050mV		
	11.999mV	11.9904mV	12.0076mV		
	-11.999mV	-11.9904mV	-12.0076mV		
	000.00mV	-0.0250mV	0.0250mV		
	119.99mV	119.9290mV	120.0510mV		
	0.0000V	-0.2000mV	0.2000mV		
	1.1999V	1199.3400mV	1200.4600mV		
	00.000mV	-2.000mV	2.000mV		
Output current	0.0000mA	-0.0003mA	0.0003mA		
	1.1999mA	1.19918mA	1.20062mA		
	00.000mA	-0.003mA	0.003mA		
	11.999mA	11.9918mA	12.0062mA		
	000.00mA	-0.03mA	0.03mA		
	119.99mA	119.912mA	120.068mA		

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4.4 Performance Test Check List

(2 of 3)

Parameter		Setting	Tolerance limit (MAX)	Measured value	Reference
Output noise	DC to 100Hz	06.000mV	5 μ Vp-p		
		060.00mV	15 μ Vp-p		
		0.6000V	80 μ Vp-p		
		06.000V	200 μ Vp-p		
		0.0000mA	30nAp-p		
		00.000mA	300nAp-p		
		000.00mA	3 μ Ap-p		
	DC to 10kHz	06.000mV	10 μ Vp-p		
		060.00mV	30 μ Vp-p		
		0.6000V	150 μ Vp-p		
		06.000V	500 μ Vp-p		
		0.0000mA	150nAp-p		
		00.000mA	400nAp-p		
		000.00mA	4 μ Ap-p		
	20Hz to 20MHz	06.000mV	3mVp-p		
		060.00mV			
		0.6000V			
		06.000V			
		0.0000mA	6 μ Ap-p		
		00.000mA			
		000.00mA			

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4.4 Performance Test Check List

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Parameter	Setting	Tolerance limit		Measured value	Reference
		MIN	MAX		
Voltage limiter	100.00mA	1V	*****		
		*****	10V		
	OPERATE ON	The LIMIT LED lights.			
	OPERATE OFF	The LIMIT LED goes out.			
Current limiter	10.000V	5mA	*****		
		*****	120mA		
	Ammeter connected	The LIMIT LED lights.			
	Output opened	The LIMIT LED goes out.			
GPIB interface	*****	Normal operation			
BCD interface	*****	Normal operation			
Ready signal	t 1	Approx. 50msec			
	t 2	Approx. 10msec			
Trigger signal	*****	Normal operation			

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4.4 Performance Test Check List

(2) R6144

Manufacturer: _____ Name: _____

Model: _____ ID No.: _____

(1 of 3)

Parameter	Setting	Tolerance limit		Measured value	Reference
		MIN	MAX		
Output Voltage	00.000mV	-0.0050mV	0.0050mV		
	16.000mV	15.9902mV	16.0098mV		
	-16.000mV	-15.9902mV	-16.0098mV		
	000.00mV	-0.0250mV	0.0250mV		
	160.00mV	159.9270mV	160.0730mV		
	0.0000V	-0.2000mV	0.2000mV		
	1.6000V	1599.3200mV	1600.6800mV		
	00.000mV	-2.000mV	2.000mV		
	16.000V	15.993200V	16.006800V		
	00.000V *	-0.00300V	0.00300V		
Output current	32.000V *	31.98740V	32.01260V		
	0.0000mA	-0.0003mA	0.0003mA		
	1.6000mA	1.59914mA	1.60086mA		
	00.000mA	-0.003mA	0.003mA		
	16.000mA	15.9914mA	16.0086mA		
	000.00mA	-0.03mA	0.03mA		
	160.00mA	159.914mA	160.086mA		

* 30V range

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4.4 Performance Test Check List

(2 of 3)

Parameter		Setting	Tolerance limit (MAX)	Measured value	Reference
Output noise	DC to 100Hz	08.000mV	5µVp-p		
		080.00mV	15µVp-p		
		0.8000V	80µVp-p		
		08.000V	200µVp-p		
		16.000V *	400µVp-p		
		0.0000mA	30nAp-p		
		00.000mA	300nAp-p		
		000.00mA	3µAp-p		
	DC to 10kHz	08.000mV	10µVp-p		
		080.00mV	30µVp-p		
		0.8000V	150µVp-p		
		08.000V	500µVp-p		
		16.000V *	1mVp-p		
		0.0000mA	150nAp-p		
		00.000mA	400nAp-p		
		000.00mA	4µAp-p		
	20Hz to 20MHz	08.000mV	3mVp-p		
		080.00mV			
		0.8000V			
		08.000V			
		16.000V *			
		0.0000mA	6µAp-p		
		00.000mA			
		000.00mA			

* 30V range

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4.3 Performance Test Method

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Parameter	Setting	Tolerance limit		Measured value	Reference
		MIN	MAX		
Voltage limiter	100.00mA	1V	*****		
		*****	28V		
	OPERATE ON	The LIMIT LED lights.			
	OPERATE OFF	The LIMIT LED goes out.			
Current limiter	10.000V	5mA	*****		
		*****	160mA		
	Ammeter connected	The LIMIT LED lights.			
	Output opened	The LIMIT LED goes out.			
GPIB interface	*****	Normal operation			
BCD interface	*****	Normal operation			
Ready signal	t 1	Approx. 50msec			
	t 2	Approx. 10msec			
Trigger signal	*****	Normal operation			

5.1 Calibration Items and Method

5. ADJUSTMENT

This chapter explains the standard calibration procedure to keep the output voltage and current specified in Section 4.2 "Performance Test Items". Once calibrated, the output voltage and current can be assured for six months. We recommend to calibrate your system once every six months.

Cautions :

- (1) Use the AC power source having the specified voltage (see Chapter 3 "THEORY OF OPERATION").
- (2) Before connecting the power cable, make sure that the system POWER switch has been turned OFF.
- (3) Perform the test in the following ambient conditions:
Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$
Humidity : 70% (relative) or less
Ambient : There should be no excessive dusts, vibration and electrical noise.
- (4) Preheat the system at least 2 hours before you start the test.
Each tester must also be preheated for the specified time.

5.1 Calibration Items and Method

Table 5-1 Calibration Items and Method of R6142

UUT (Unit Under Test) parameter/function	Performance specifications		Test method
Output voltage	00.000mV	-0.5μV to 0.5μV	Calibrate the system using the DC voltmeter.
	11.999mV	11.9982mV to 11.9998mV	
	000.00mV	-5μV to 5μV	
	119.99mV	119.982μV to 119.998μV	
	0.0000V	-50μV to 50μV	
	1.1999V	1.19982V to 1.19998V	
	00.000mV	-500μV to 500μV	
	11.999V	11.9982V to 11.9998V	
Output current	0.0000mA	-50nA to 50nA	Calibrate the system using the DC ammeter.
	1.1999mA	1.19982mA to 1.19998mA	
	00.000mA	-500nA to 500nA	
	11.999mA	11.9982mA to 11.9998mA	
	000.00mA	-5μA to 5μA	
	119.99mA	119.982mA to 119.998mA	

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5.1 Calibration Items and Method

Table 5-2 Calibration Items and Method of R6144

UUT (Unit Under Test) parameter/function	Performance specifications		Test method
Output voltage	00.000mV	–0.5µV to 0.5µV	Calibrate the system using the DC voltmeter.
	16.000mV	15.999mV to 16.001mV	
	000.00mV	–5µV to 5µV	
	160.00mV	159.99µV to 160.01µV	
	0.0000V	–50µV to 50µV	
	1.6000V	1.5999V to 1.6001V	
	00.000mV	–500µV to 500µV	
	16.000V	15.999V to 16.001V	
	00.000V *	–1mV to 1mV	
	32.000V *	31.998V to 32.002V	
Output current	0.0000mA	–50nA to 50nA	Calibrate the system using the DC ammeter.
	1.6000mA	1.5999mA to 1.6001mA	
	00.000mA	–500nA to 500nA	
	16.000mA	15.999mA to 16.001mA	
	000.00mA	–5µA to 5µA	
	160.00mA	159.99mA to 160.01mA	

* 30V range

5.2 Performance of Instruments

5.2 Performance of Instruments

The performance required for the standard and the measuring instruments are defined on Table 5-3.

Table 5-3 Required Performance of Instruments

Equipment generic name (Q'ty)	Minimum use specifications			MFR., model/option applicable	
DC voltmeter	Accuracy	100nV to 20mV	100ppm	Advantest	R6871E
		1µV to 100V	40ppm		
DC ammeter or reference resistor	Accuracy	1µA to 200mA	90ppm	HP	HP3458A
		10nA to 20mA	60ppm		
		1KΩ	20ppm	Advantest	TR1332-1K
		100Ω	20ppm	Advantest	TR1332-100
		1Ω	50ppm	Yokogawa	2792-1Ω

5.3 Calibration Method

5.3 Calibration Method

5.3.1 Output voltage

Procedure:

- ① Connect the R6142/6144 to the R6871E as shown in Figure 5-1.

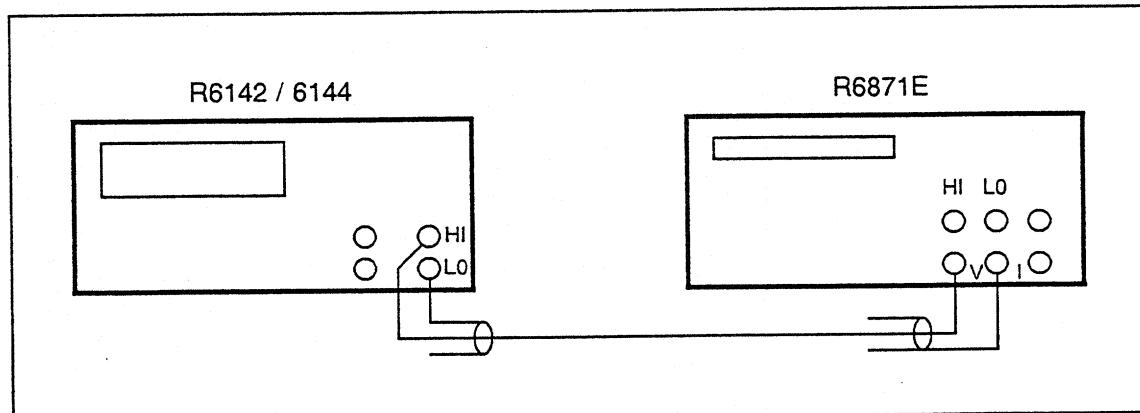


Figure 5-1 Cable Connection for Output Voltage Calibration

- ② Set each equipment as defined on Table 5-4.

Table 5-4 Parameter Setting for Output Voltage Calibration (1)

Equipment name	Function	Setting
R6142	SENSE switch	2 WIRE
	LIMIT I	120mA or more
R6144	SENSE switch	2 WIRE
	LIMIT I	160mA or more
R6871E	Function	DCV
	Integration time	5 PLC
	Auto Zero	ON
	Auto CAL	ON

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5.3 Calibration Method

Table 5-5 Parameter Setting for Output Voltage Calibration (2)

Setting		R6871E range
R6142	R6144	
00.000mV	00.000mV	200mV
11.999mV	16.000mV	
000.00mV	000.00mV	
119.99mV	160.00mV	
0.0000V	0.0000V	2V
1.1999V	1.6000V	
00.000mV	00.000mV	20V
11.999V	16.000V	
None	00.000V	200V
None	32.000V	

- ③ Turn on the EXT CAL switch on the rear panel.
- ④ Press the **[STEP]** and **[mV]** keys to select the Calibration mode.
If it has failed, go to Section 6.14 "Problems in Calibration".
- ⑤ Select the calibration range using the Δ or ∇ key, and set the standard as defined on Table 5-5.
- ⑥ Press the **[OPERATE]** key to light its LED. (OPERATE ON)
- ⑦ Calibrate and check the parameters using the Δ or ∇ key and **[+]** and **[]** keys in the sequence of "+ Zero" and "+ Full scale as shown in Figures 5-2 and 5-3.
- ⑧ Press the **[OPERATE]** key to turn off its LED. (OPERATE OFF)
- ⑨ Repeat Steps ⑤ to ⑧ to calibrate the range between the setup functions.
- ⑩ Turn off the EXT CAL switch on the rear panel, and press the **[STEP]** key.

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5.3 Calibration Method

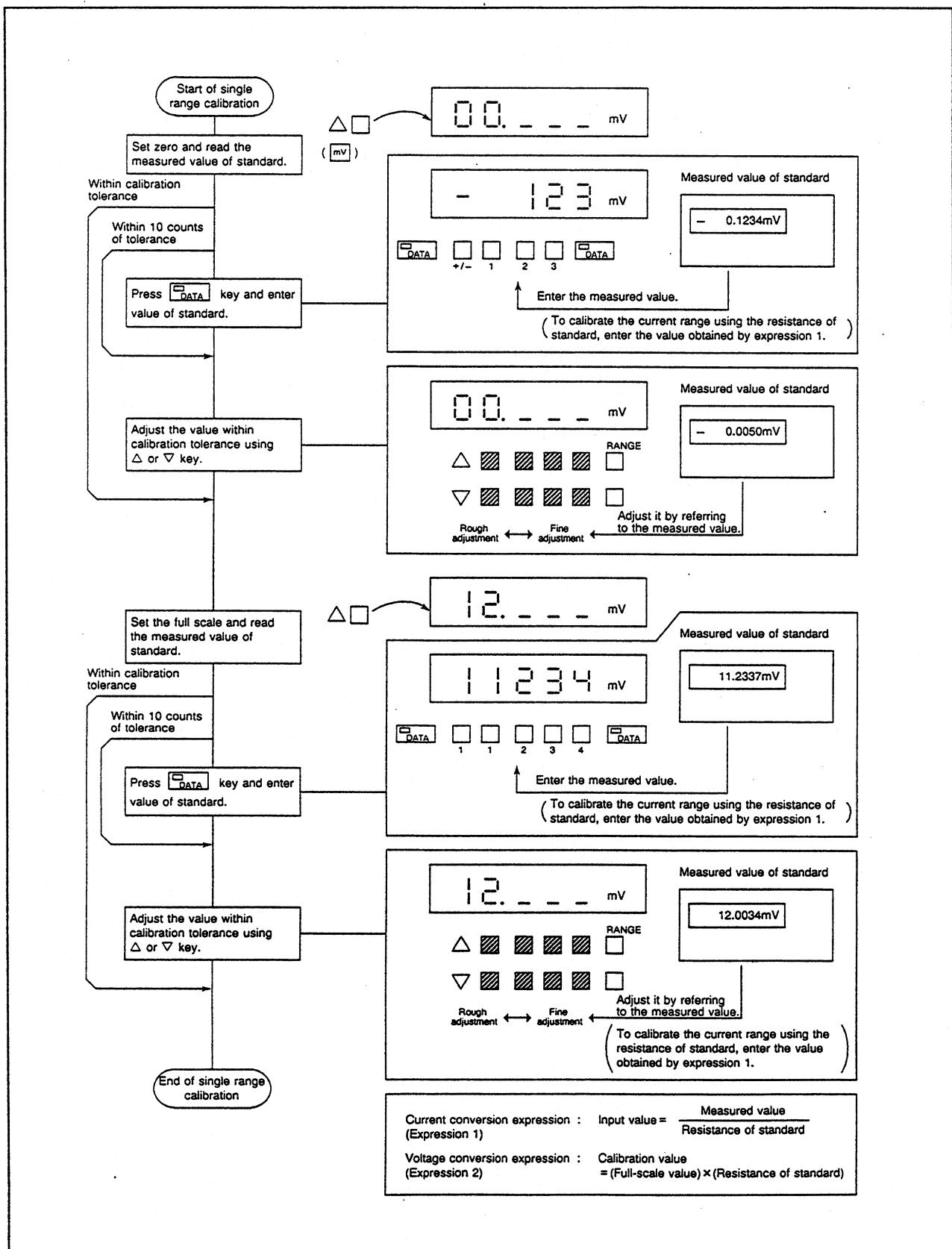


Figure 5-2 Calibration of A Single Range using R6142

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PROGRAMMABLE DC VOLTAGE/CURRENT GENERATOR
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5.3 Calibration Method

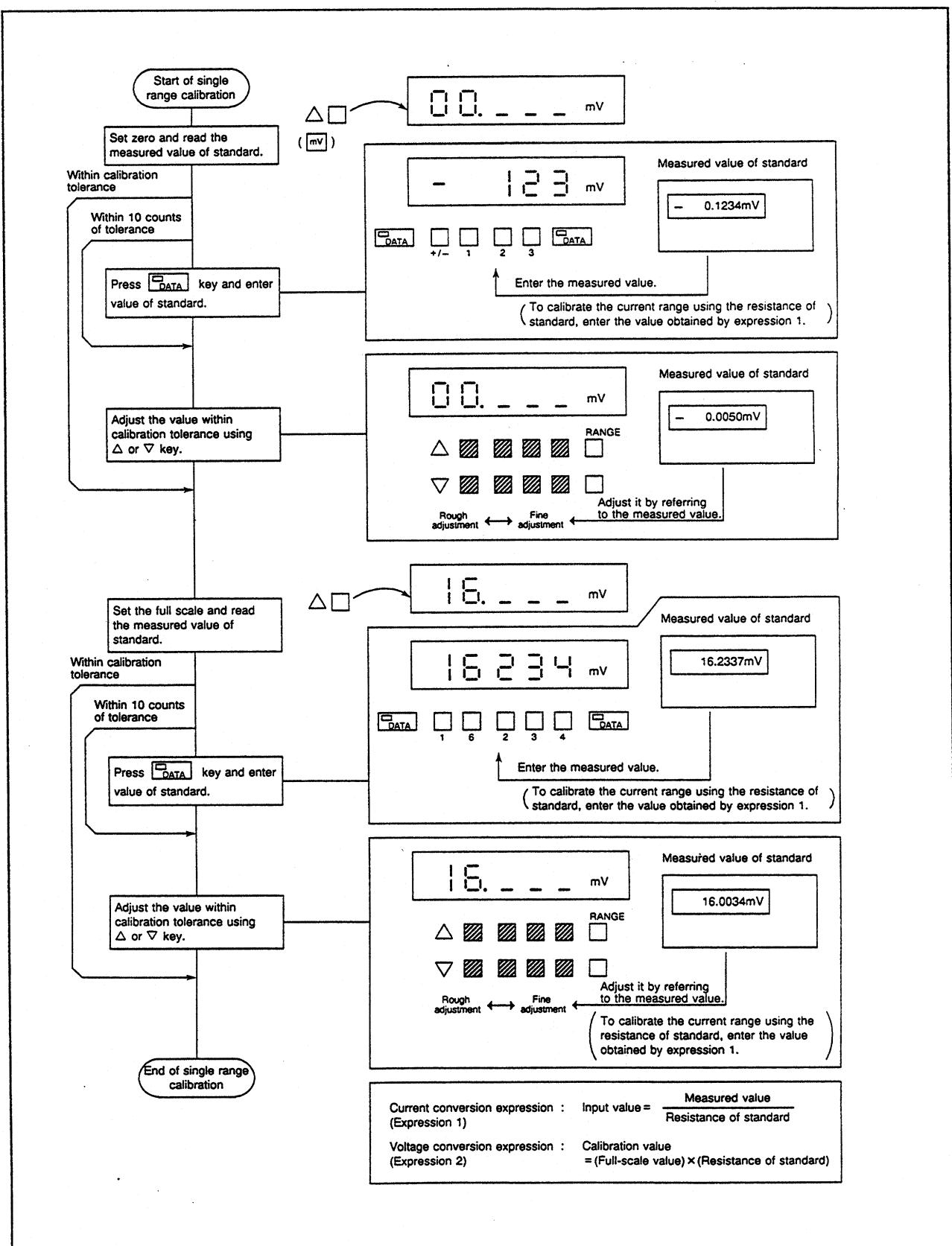


Figure 5-3 Calibration of A Single Range using R6144

5.3.2 Calibration of output current

Procedure:

- ① Connect the R6142/6144 to the R6871E as shown in Figure 5-4.

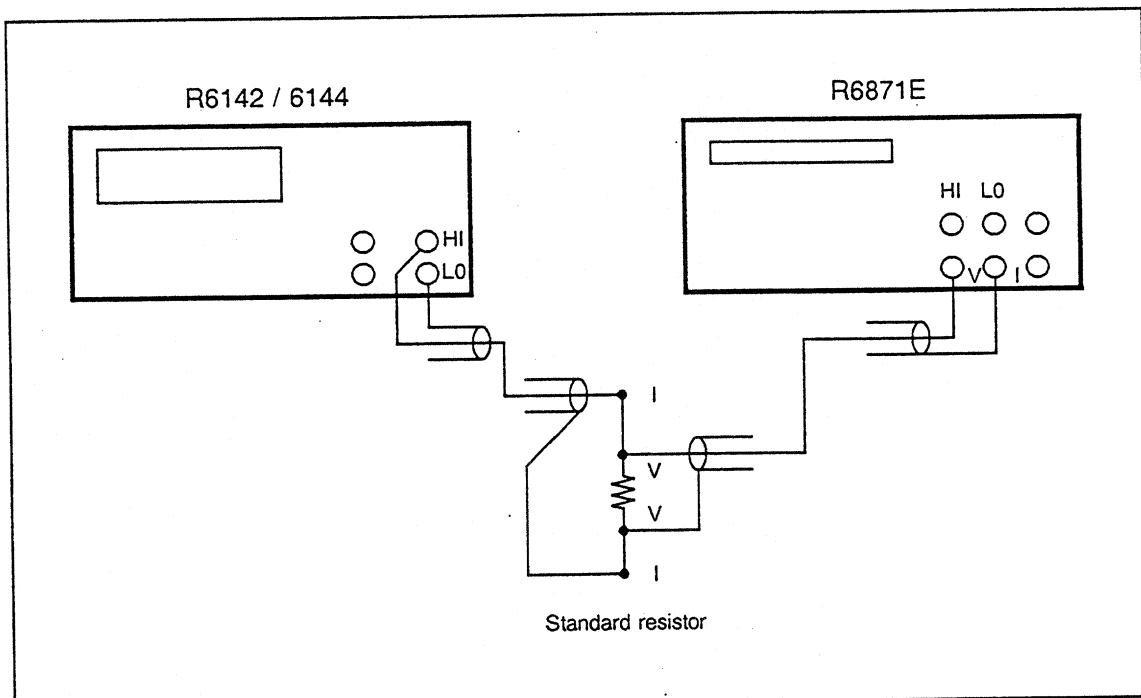


Figure 5-4 Cable Connection for Output Current Calibration

- ② Set each equipment as defined on Table 5-6.

Table 5-6 Parameter Setting for Output Current Calibration (1)

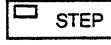
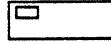
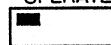
Equipment name	Function	Setting
R6142	SENSE switch	2 WIRE
	Limit V	10V or more
R6144	SENSE switch	2 WIRE
	Limit V	28V or more
R6871E	Function	DCV
	Integration time	5 PLC
	Auto Zero	ON
	Auto CAL	ON

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5.3 Calibration Method

Table 5-7 Parameter Setting for Output Current Calibration (2)

Setting		R6871E range	Resistor
R6142	R6144		
0.0000mA	0.0000mA	2V	1KΩ
1.1999mA	1.6000mA		
00.000mA	00.000mA		100Ω
11.999mA	16.000mA		
000.00mA	000.00mA	200mV	
119.99mA	160.00mA		1Ω

- ③ Press the EXT CAL switch to light its LED on the rear panel.
- ④ Press the  STEP and  mv keys to select the Calibration mode.
If it has failed, go to Section 6.14 "Problems in Calibration".
- ⑤ Select the calibration range using the Δ or ∇ key, and set the standard as defined on Table 5-7.
- ⑥ Press the  OPERATE key to light its LED. (OPERATE ON)
- ⑦ Calibrate and check the parameters using the Δ or ∇ key and  + and  keys in the sequence of "+ Zero" and "+ Full scale" as shown in Figures 5-2 and 5-3.
- ⑧ Press the  OPERATE key to turn off its LED. (OPERATE OFF)
- ⑨ Repeat Steps ⑤ to ⑧ to calibrate the range between the setup functions.
- ⑩ Turn off the EXT CAL switch on the rear panel, and press the  STEP key.

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5.4 Calibration Check List

5.4 Calibration Check List

(1) R6142

Manufacturer : _____ Name : _____
 Model : _____ ID No. : _____

Parameter	Setting	Tolerance limit		Measured value	Reference
		(MIN.)	(MAX.)		
Output voltage	00.000mV	-0.5µV	0.5µV		
	11.999mV	11.9982mV	11.9998mV		
	000.00mV	-5µV	5µV		
	119.99mV	119.982µV	119.998µV		
	0.0000V	-50µV	50µV		
	1.1999V	1.19982V	1.19998V		
	00.000mV	-500µV	500µV		
	11.999V	11.9982V	11.9998V		
Output current	0.0000mA	-50nA	50nA		
	1.1999mA	1.19982mA	1.19998mA		
	00.000mA	-500nA	500nA		
	11.999mA	11.9982mA	11.9998mA		
	000.00mA	-5µA	5µA		
	119.99mA	119.982mA	119.998mA		

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5.4 Calibration Check List

(2) R6144

Manufacturer : _____ Name : _____
 Model : _____ ID No. : _____

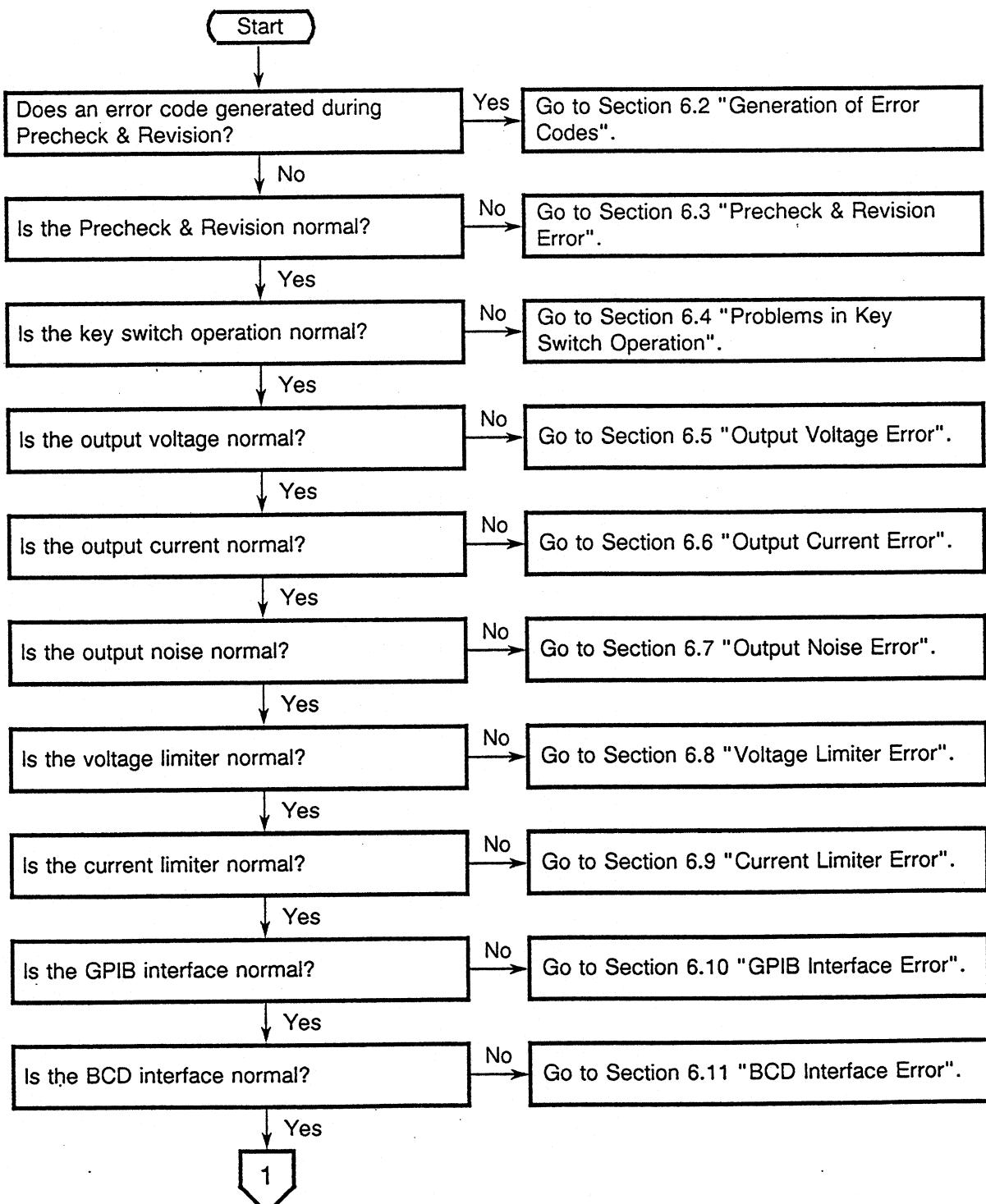
Parameter	Setting	Tolerance limit		Measured value	Reference
		(MIN.)	(MAX.)		
Output voltage	00.000mV	-0.5µV	0.5µV		
	16.000mV	15.999mV	16.001mV		
	000.00mV	-5µV	5µV		
	160.00mV	159.99µV	160.01µV		
	0.0000V	-50µV	50µV		
	1.6000V	1.5999V	1.6001V		
	00.000mV	-500µV	500µV		
	16.000V	15.999V	16.001V		
	00.000V*	-1mV	1mV		
	32.000V*	31.998V	32.002V		
Output current	0.0000mA	-50nA	50nA		
	1.6000mA	1.5999mA	1.6001mA		
	00.000mA	-500nA	500nA		
	16.000mA	15.999mA	16.001mA		
	000.00mA	-5µA	5µA		
	160.00mA	159.99mA	160.01mA		

*30V range

6. TROUBLESHOOTING

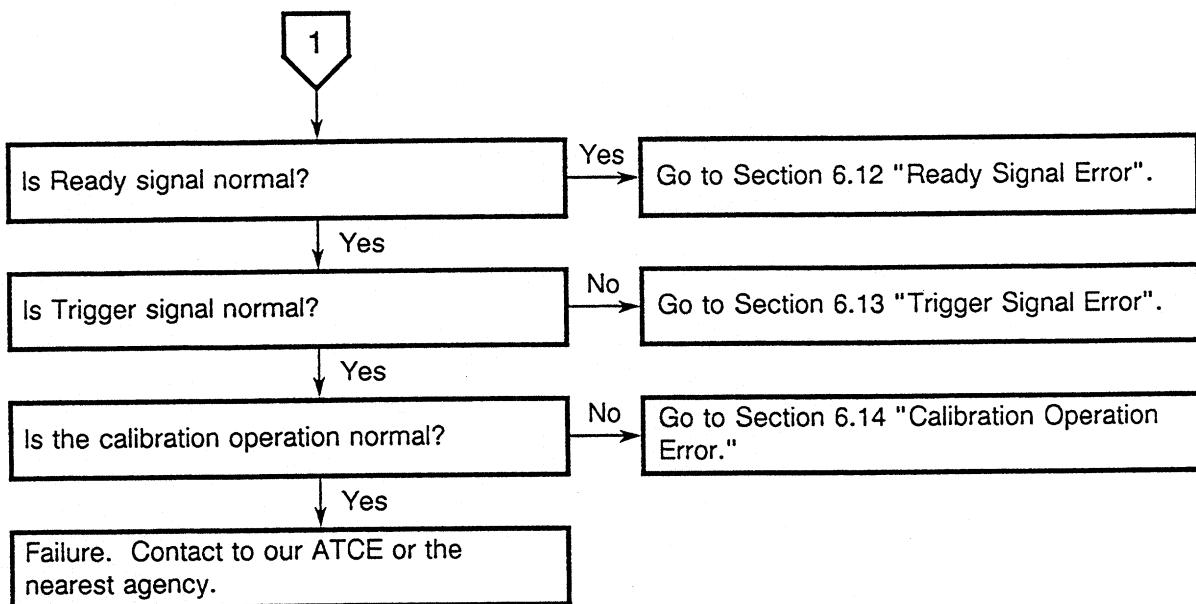
This chapter explains the standard troubleshooting procedure that should be used if the Performance Test (Chapter 4) or Adjustment (Chapter 5) has failed.

6.1 Troubleshooting Flow



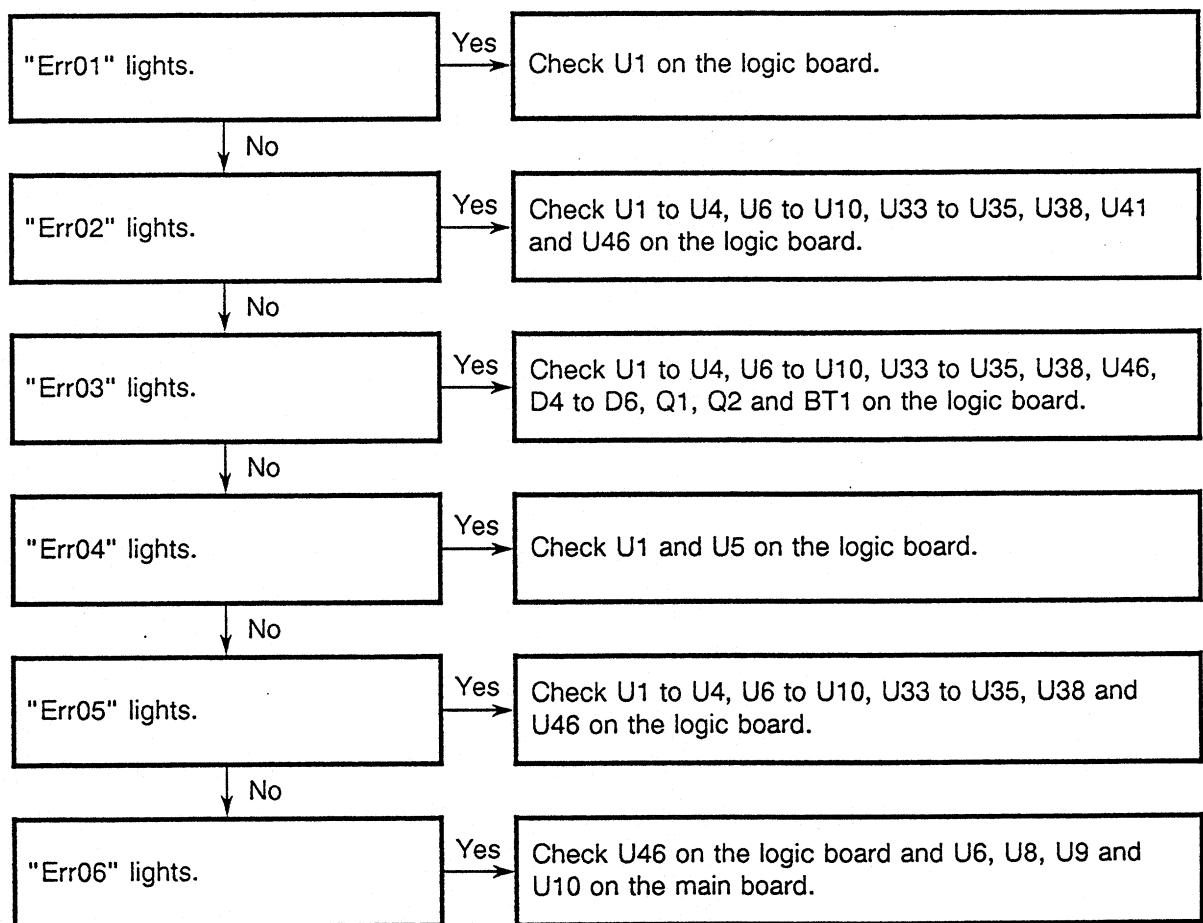
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6.1 Troubleshooting Flow



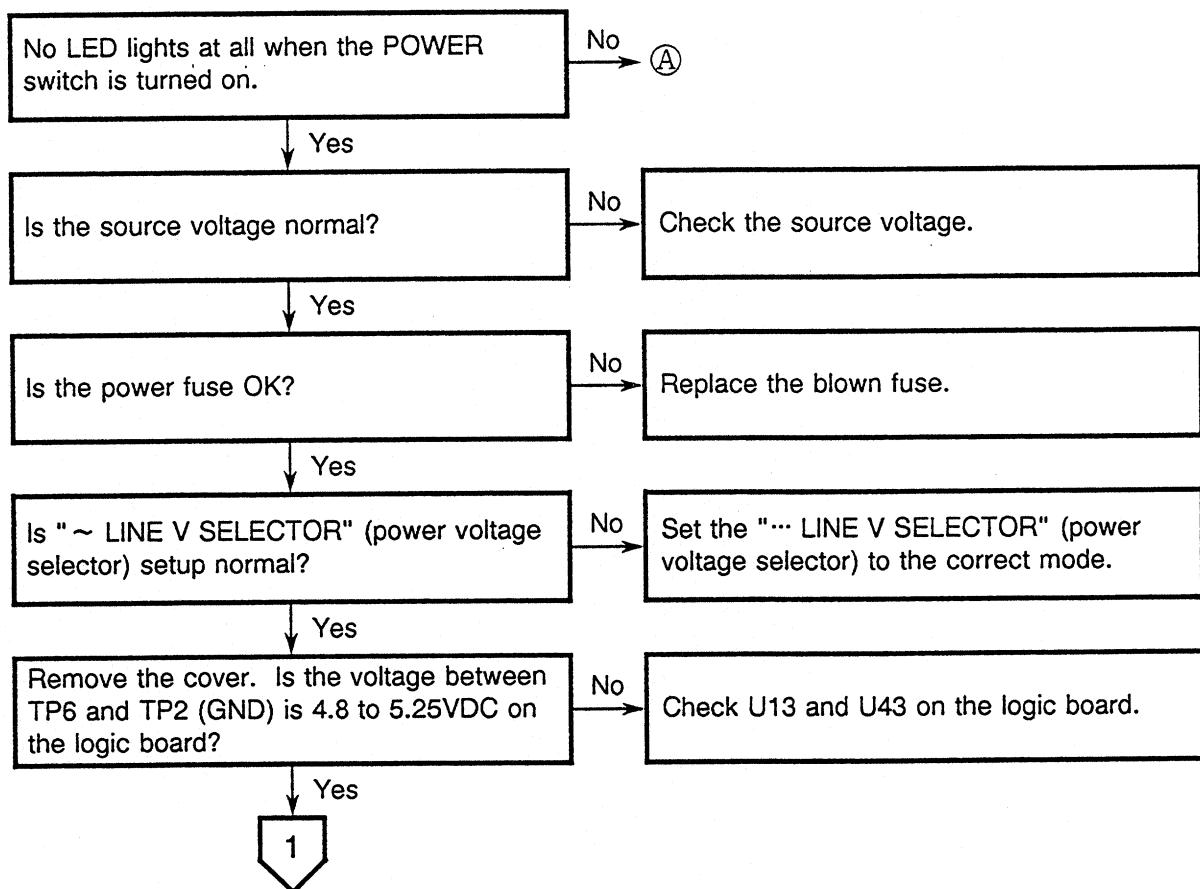
6.2 Generation of Error Codes

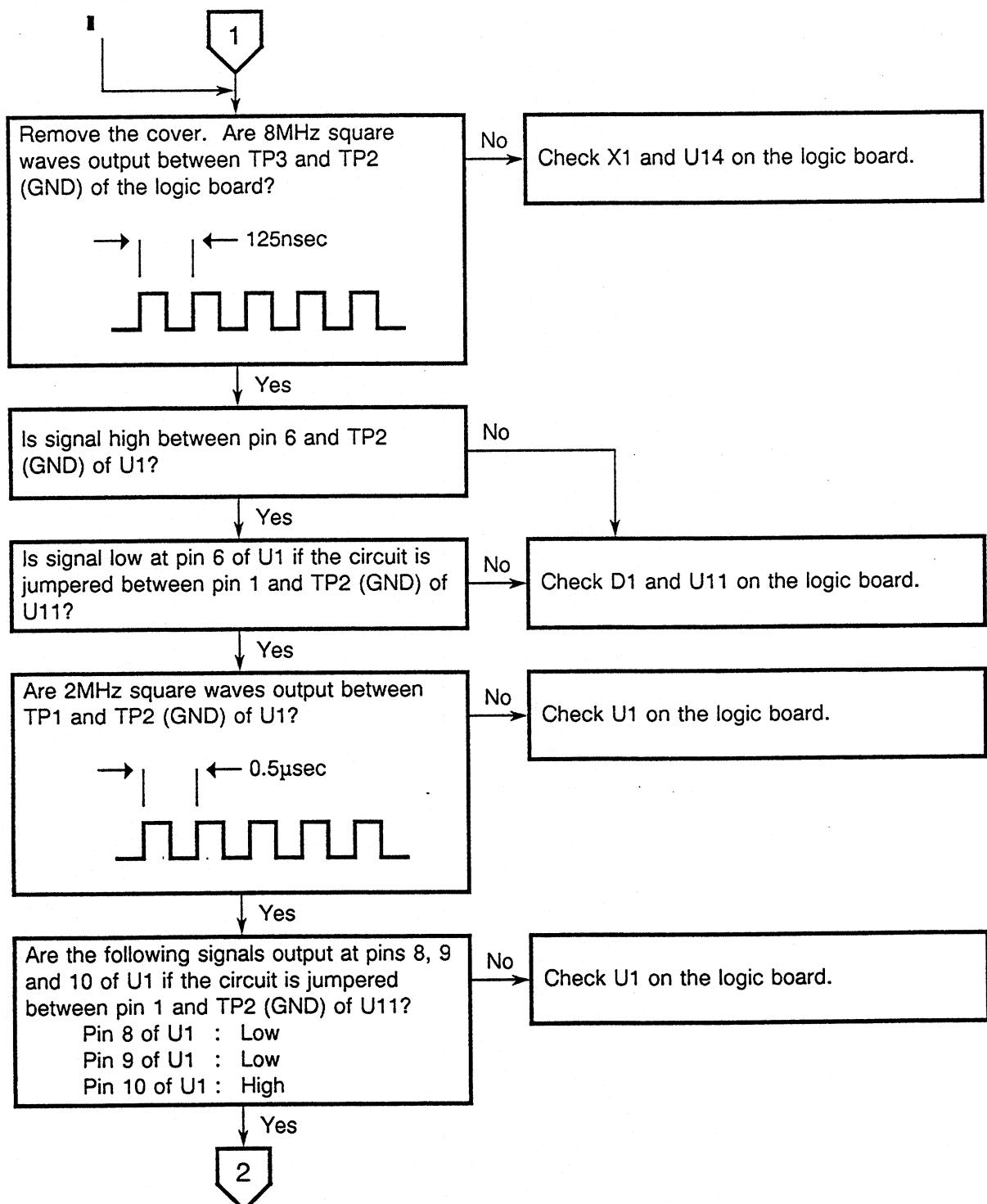
6.2 Generation of Error Codes



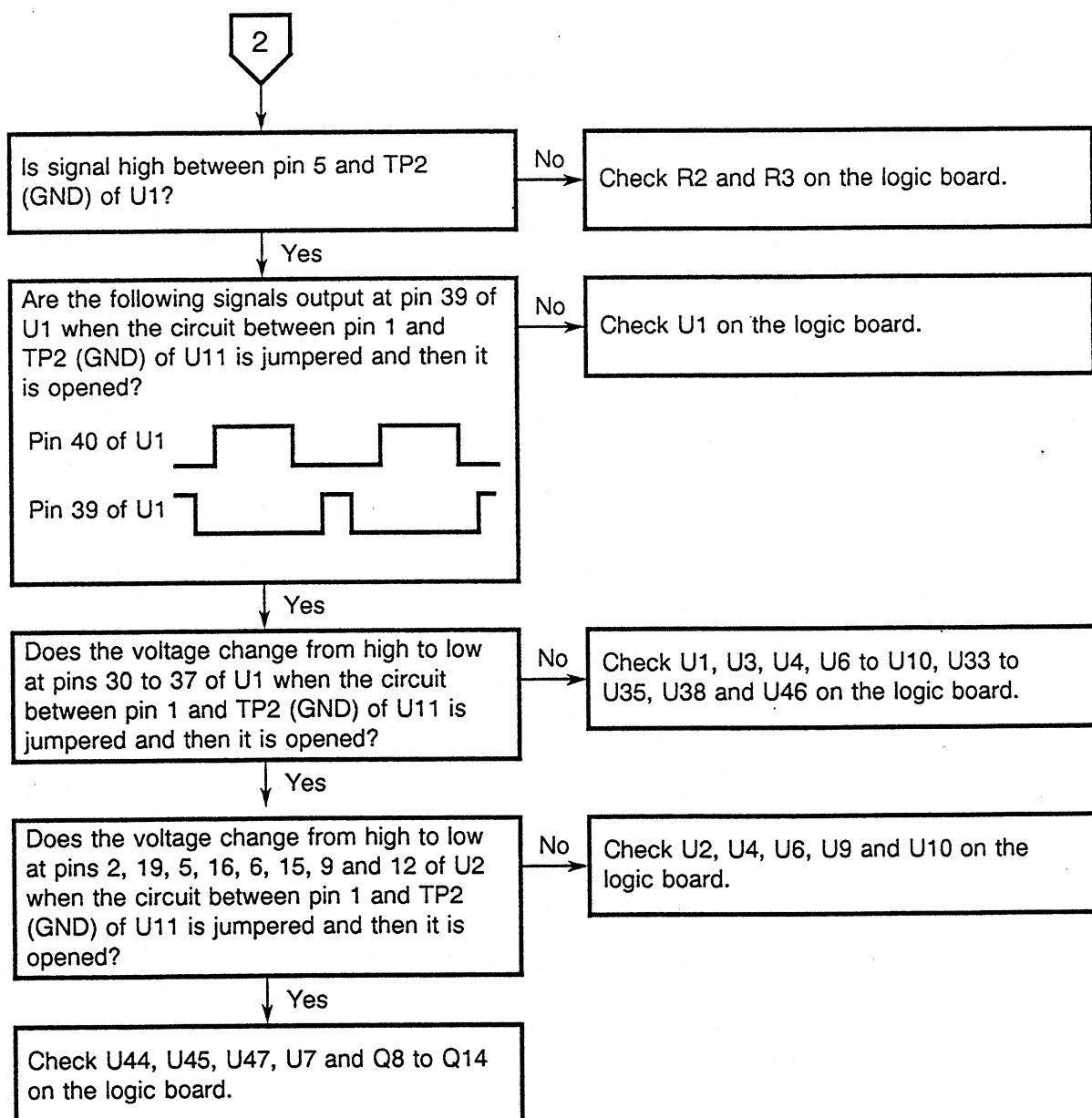
6.3 Precheck & Revision Error

6.3 Precheck & Revision Error



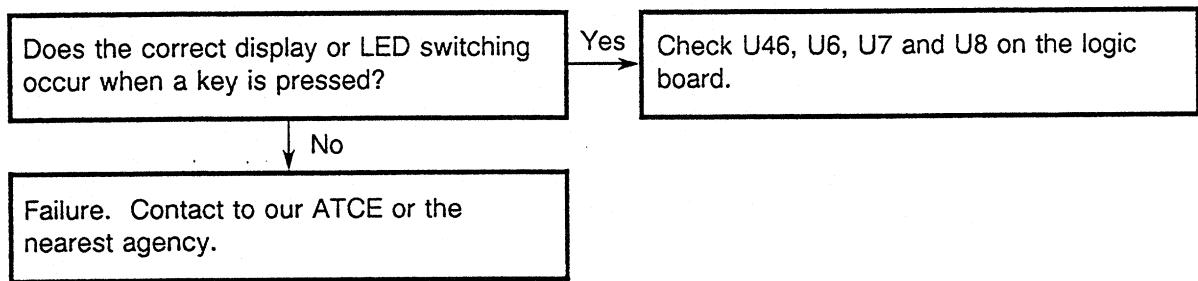


6.3 Precheck & Revision Error



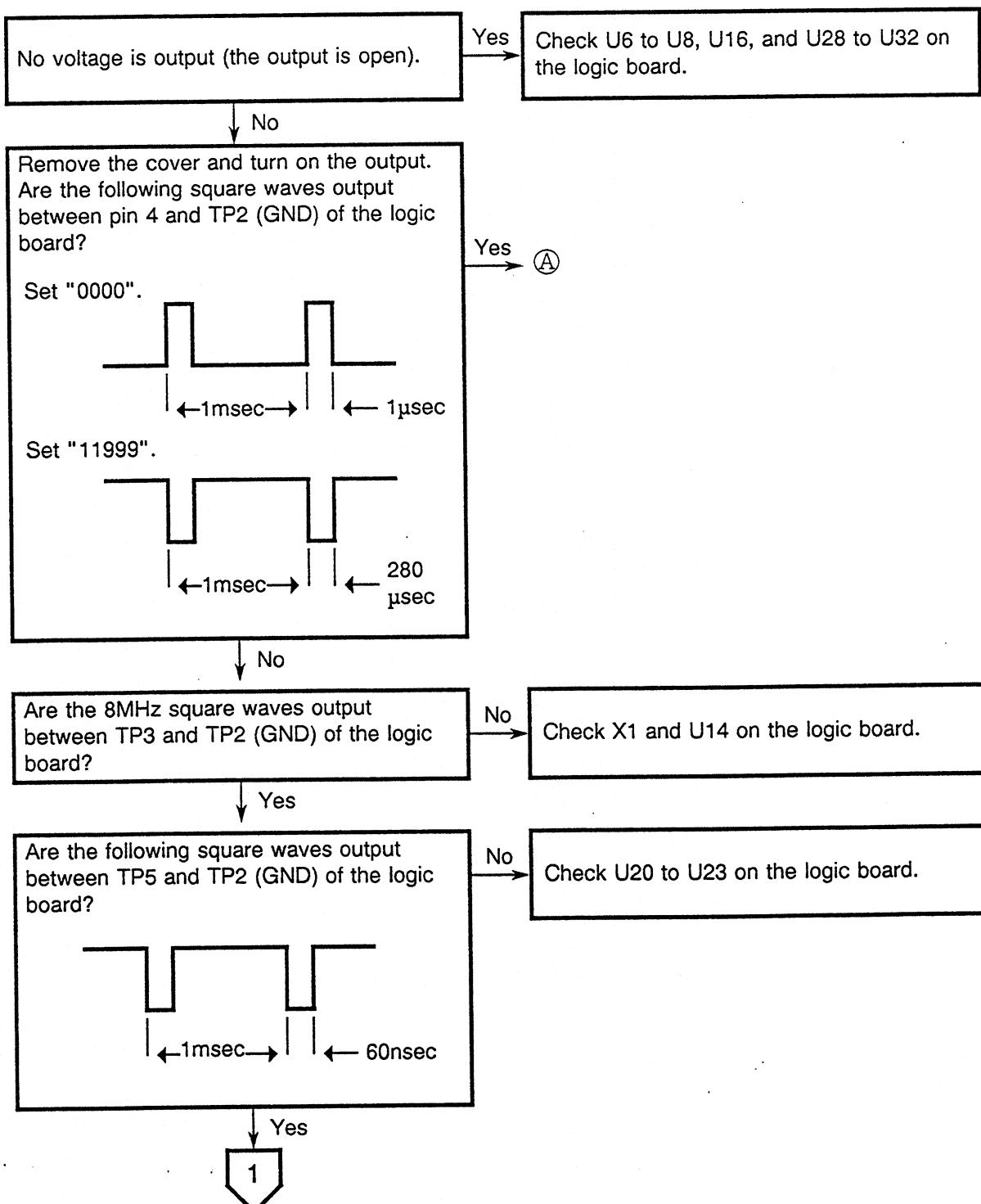
6.4 Problems in Key Switch Operation

6.4 Problems in Key Switch Operation



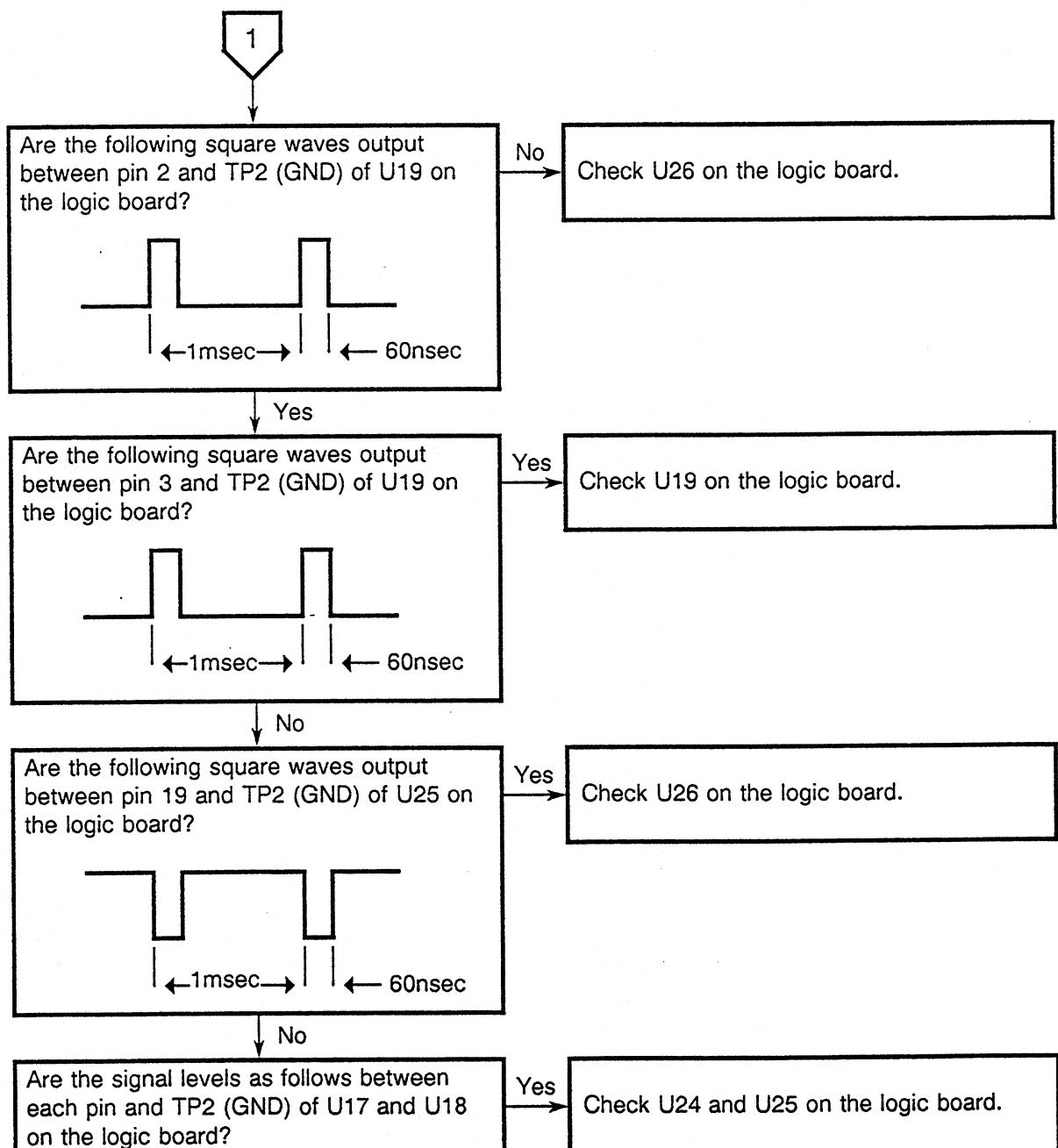
6.5 Output Voltage Error

6.5 Output Voltage Error



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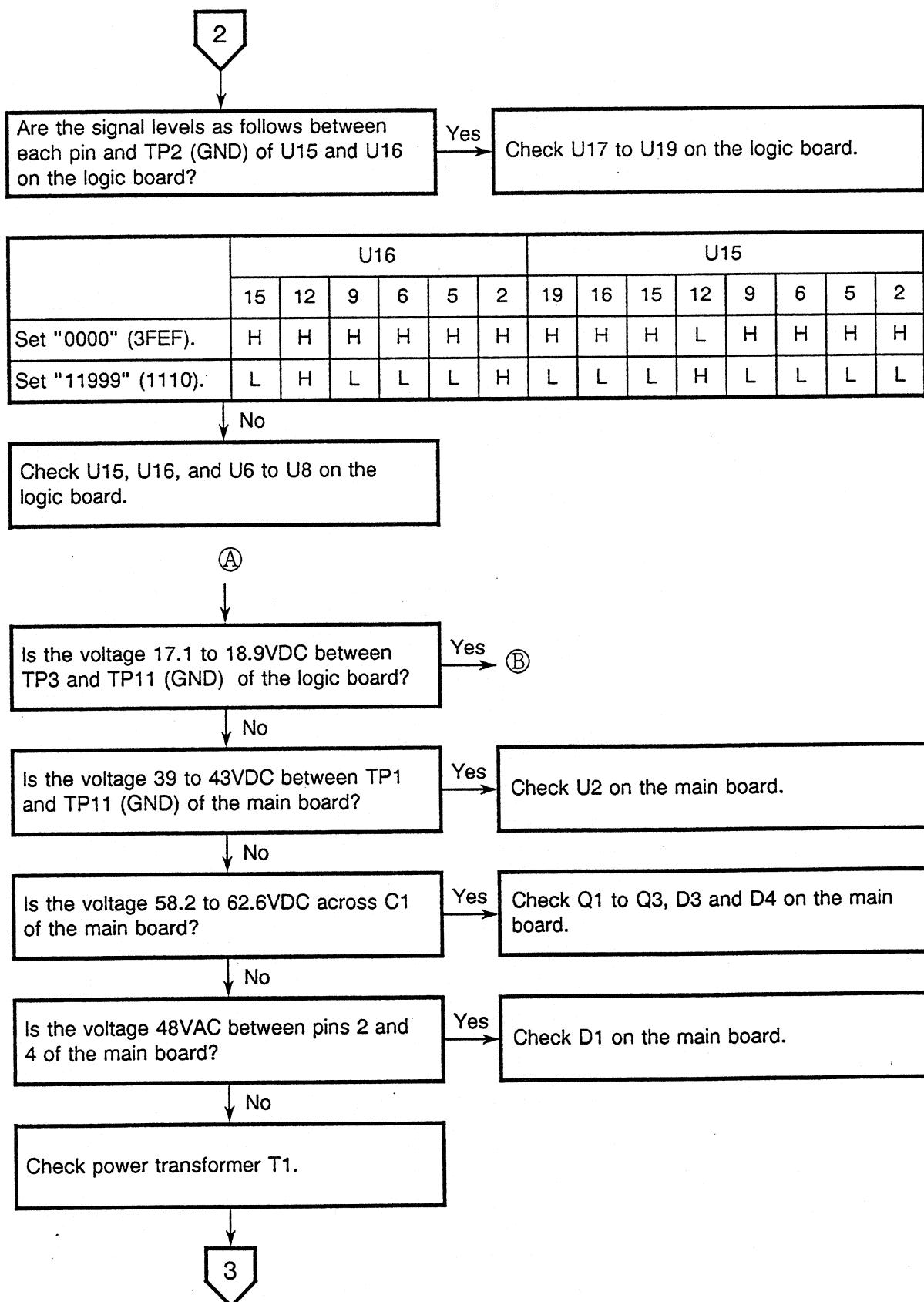
6.5 Output Voltage Error

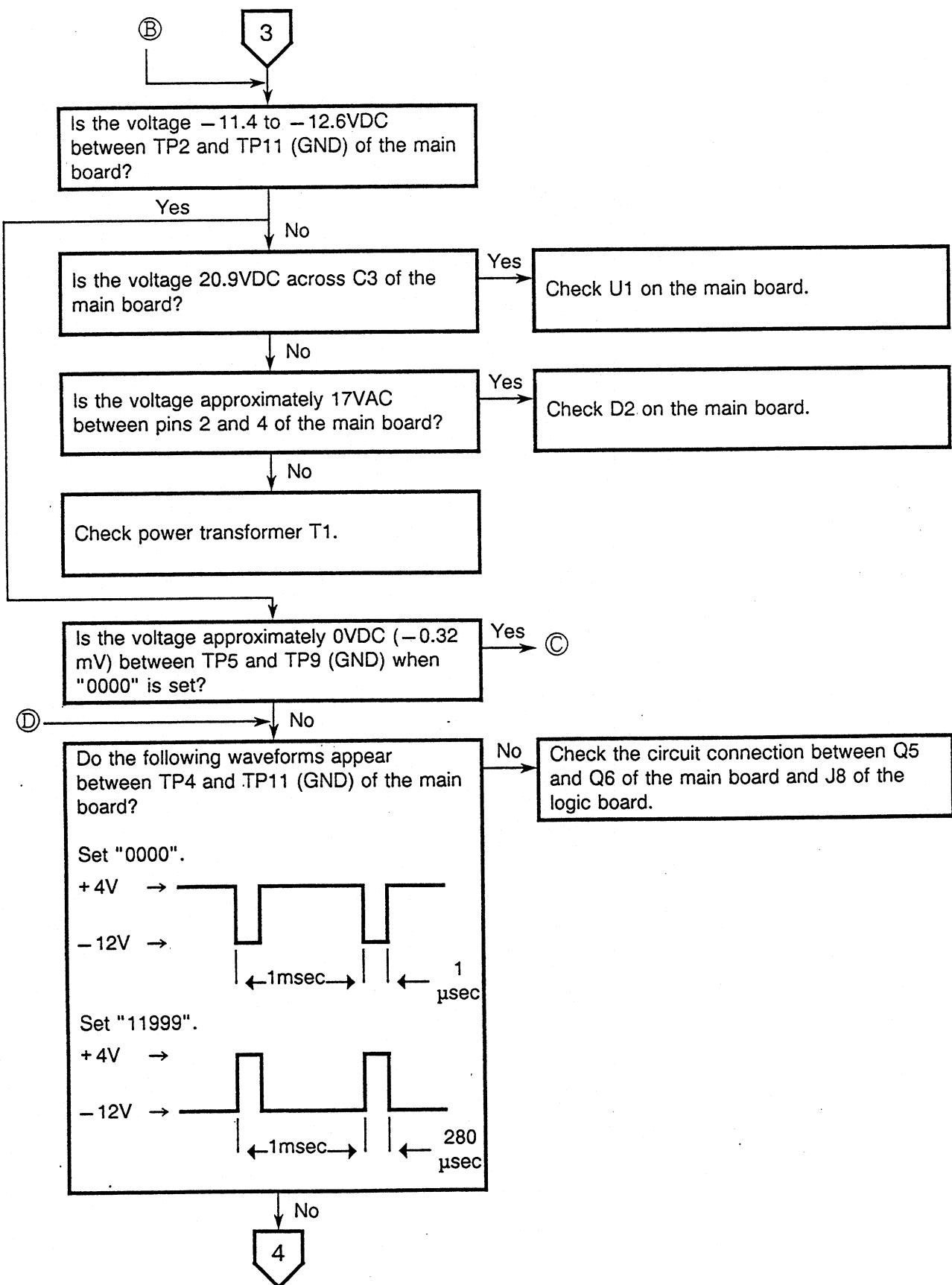


	U18						U17						
	15	12	9	6	5	2	19	16	15	12	9	6	5
Set "0000" (3EFF).	H	H	H	H	H	H	H	H	H	L	H	H	H
Set "11999" (1110).	L	H	L	L	L	H	L	L	L	H	L	L	L

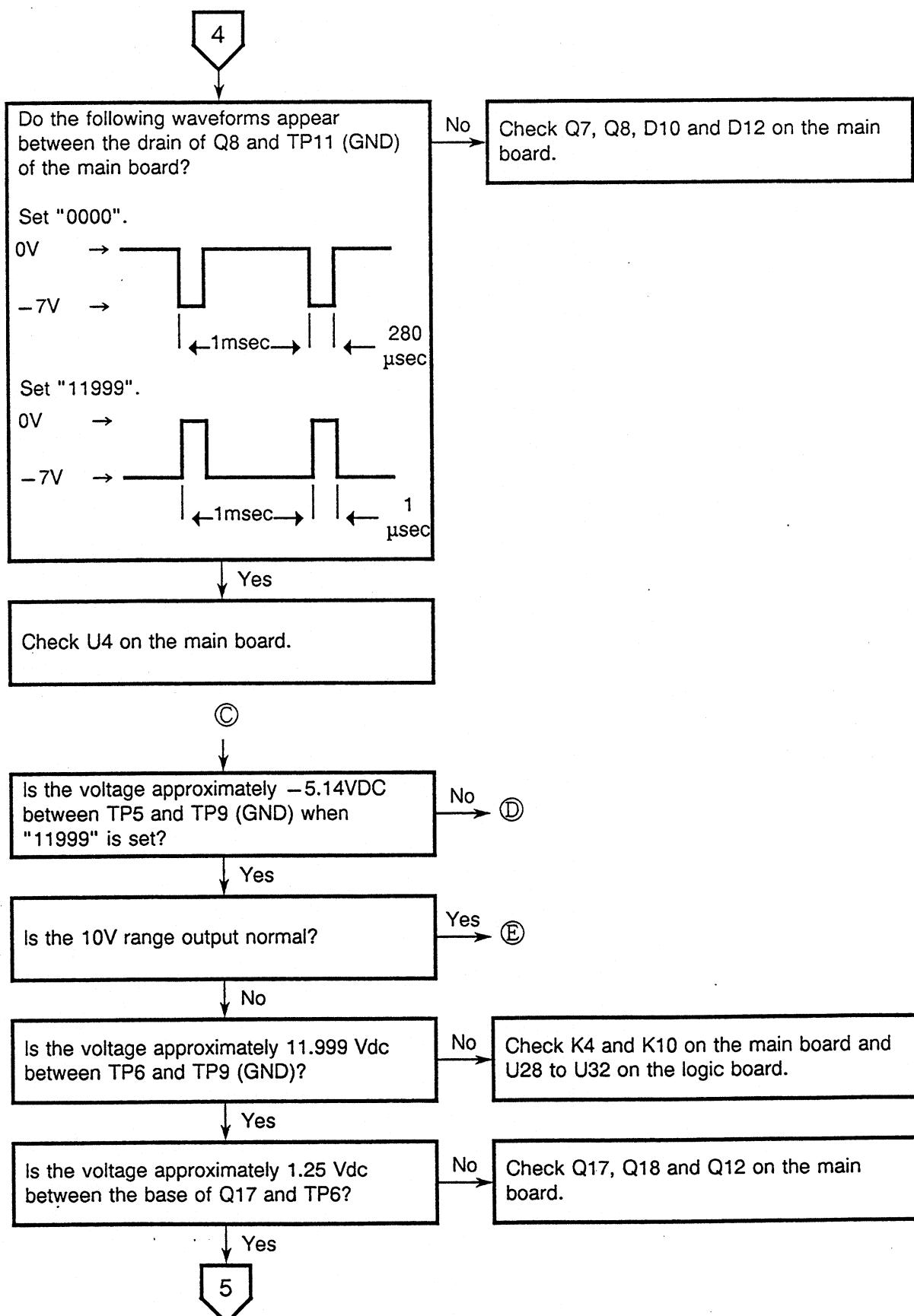
2

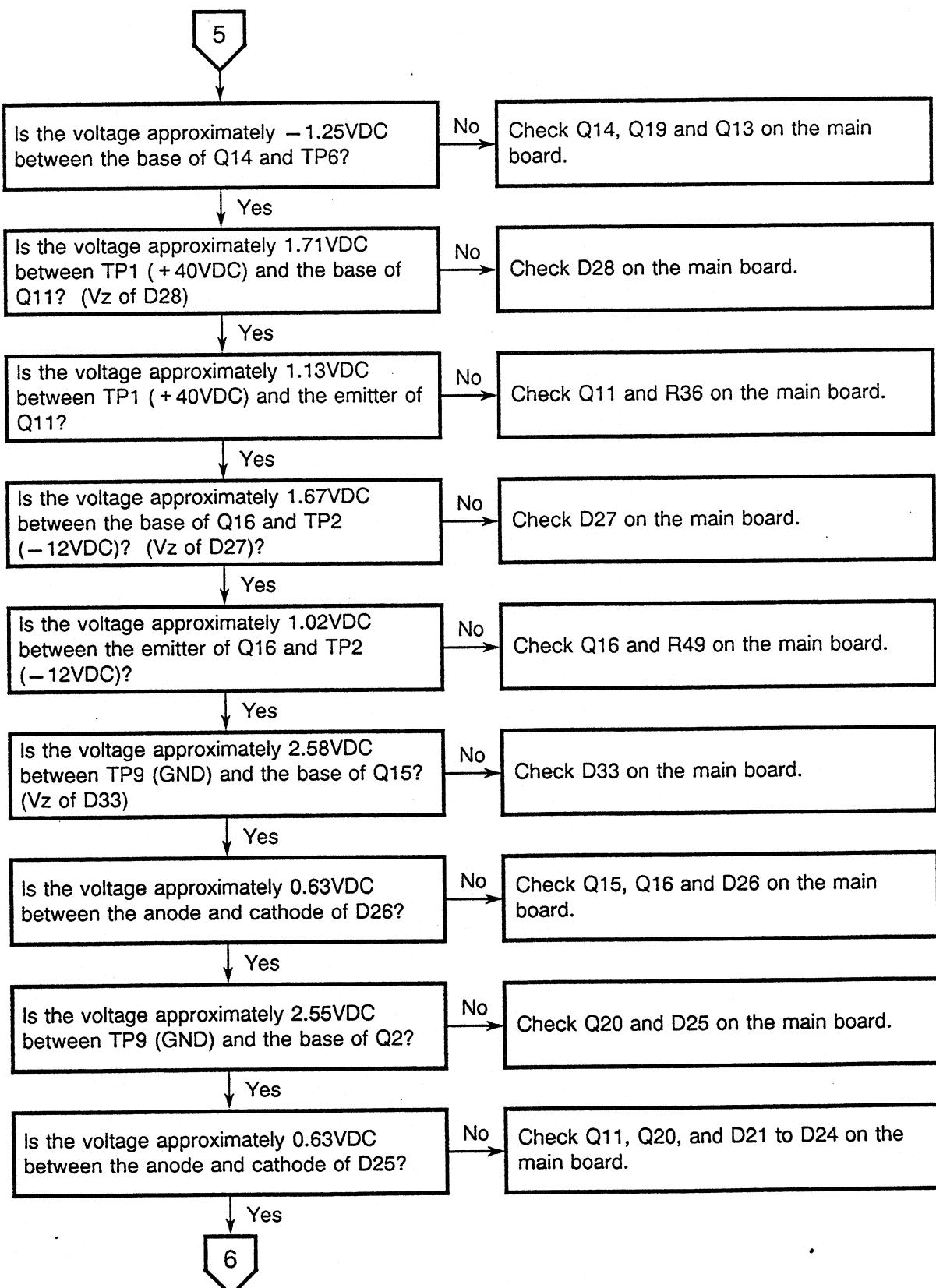
6.5 Output Voltage Error



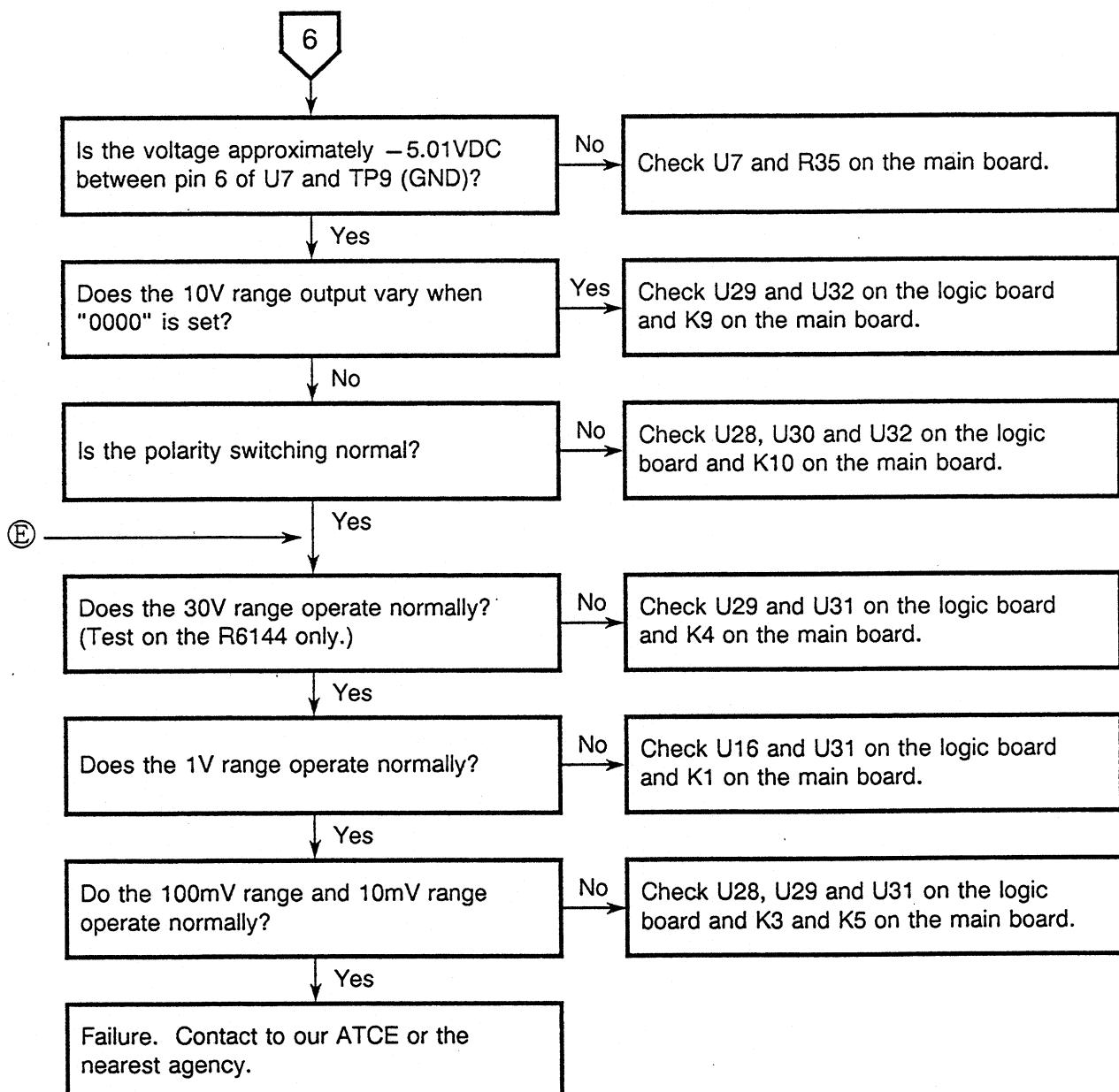


6.5 Output Voltage Error



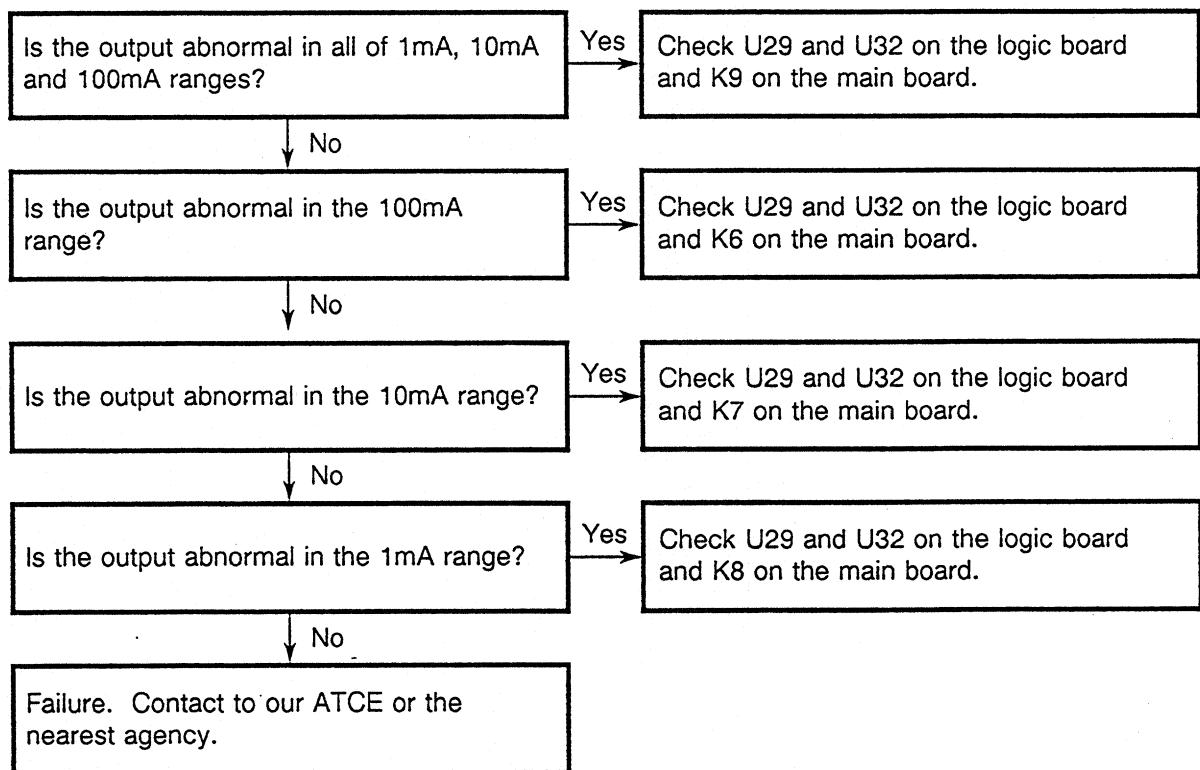


6.5 Output Voltage Error



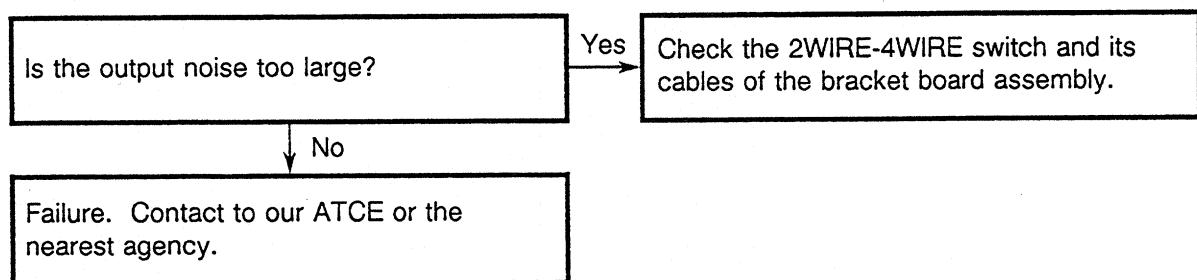
6.6 Output Current Error

6.6 Output Current Error

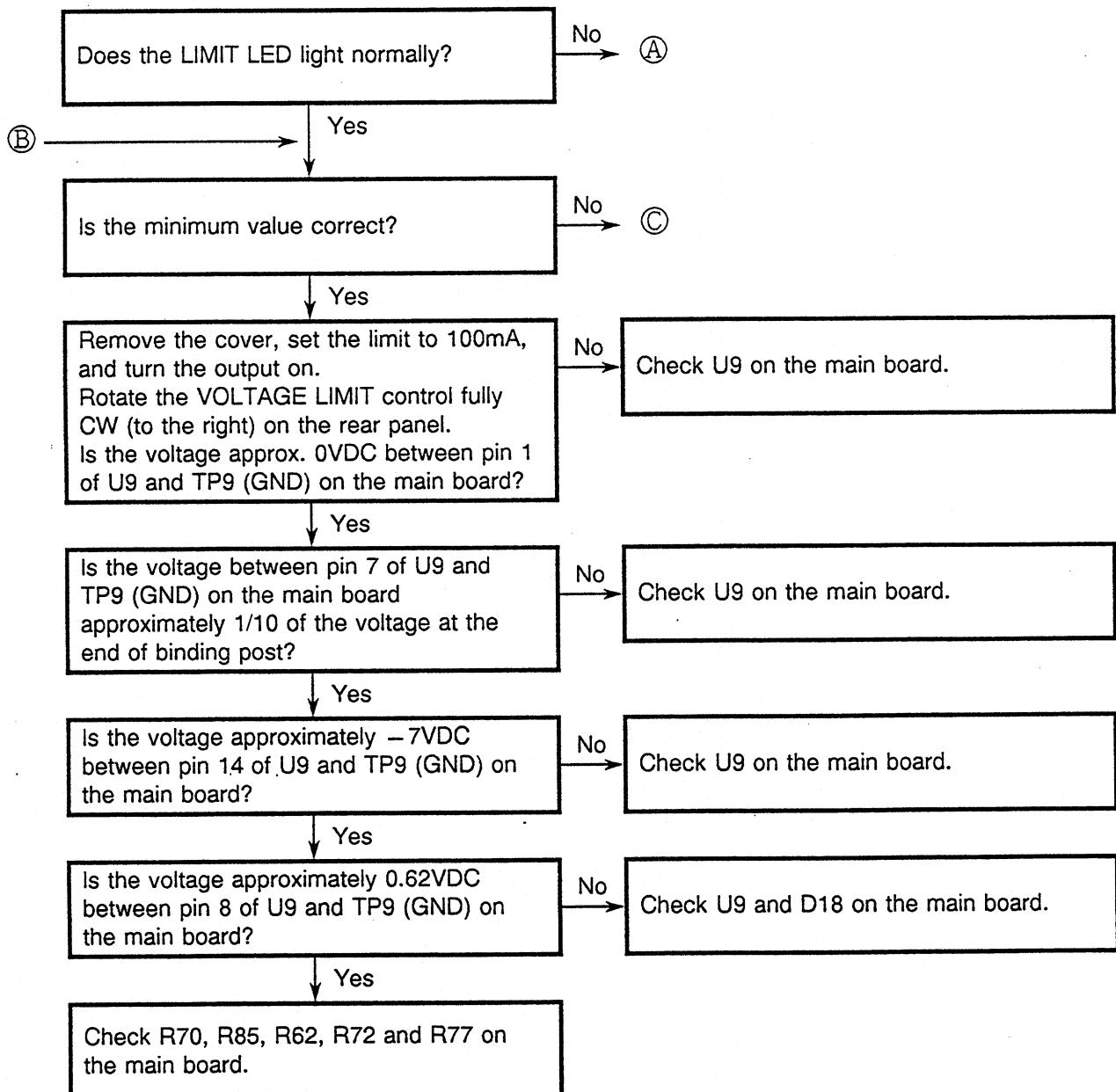


6.7 Output Noise Error

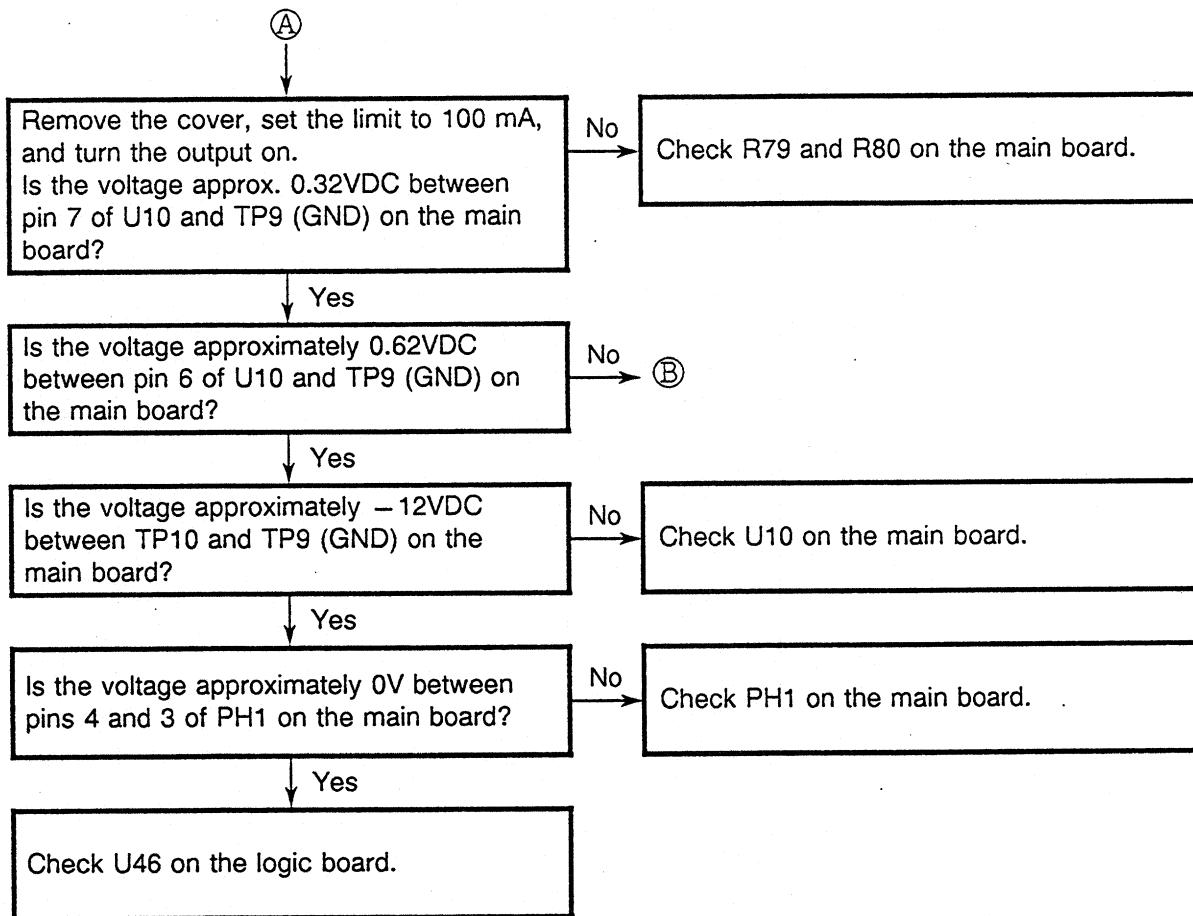
6.7 Output Noise Error

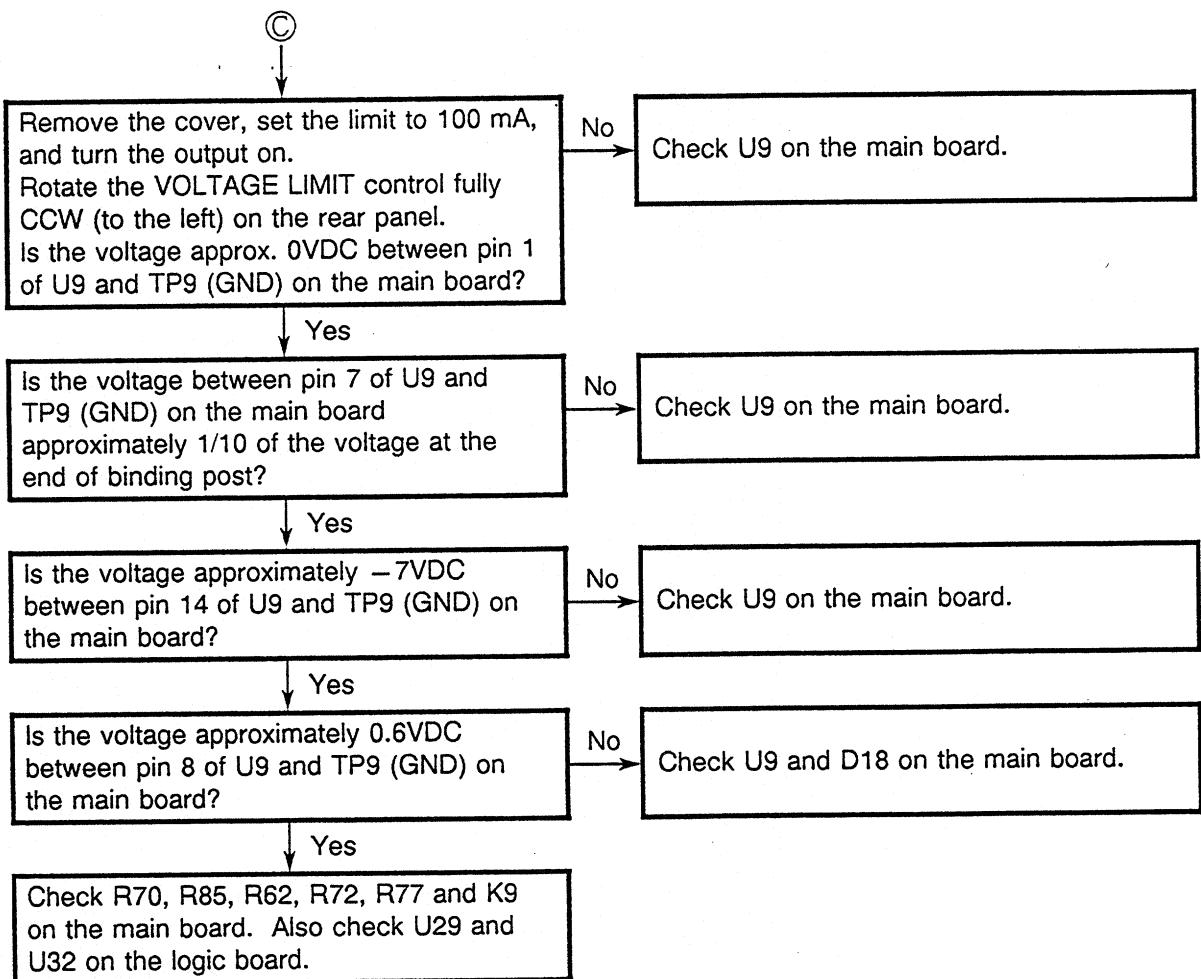


6.8 Voltage Limiter Error



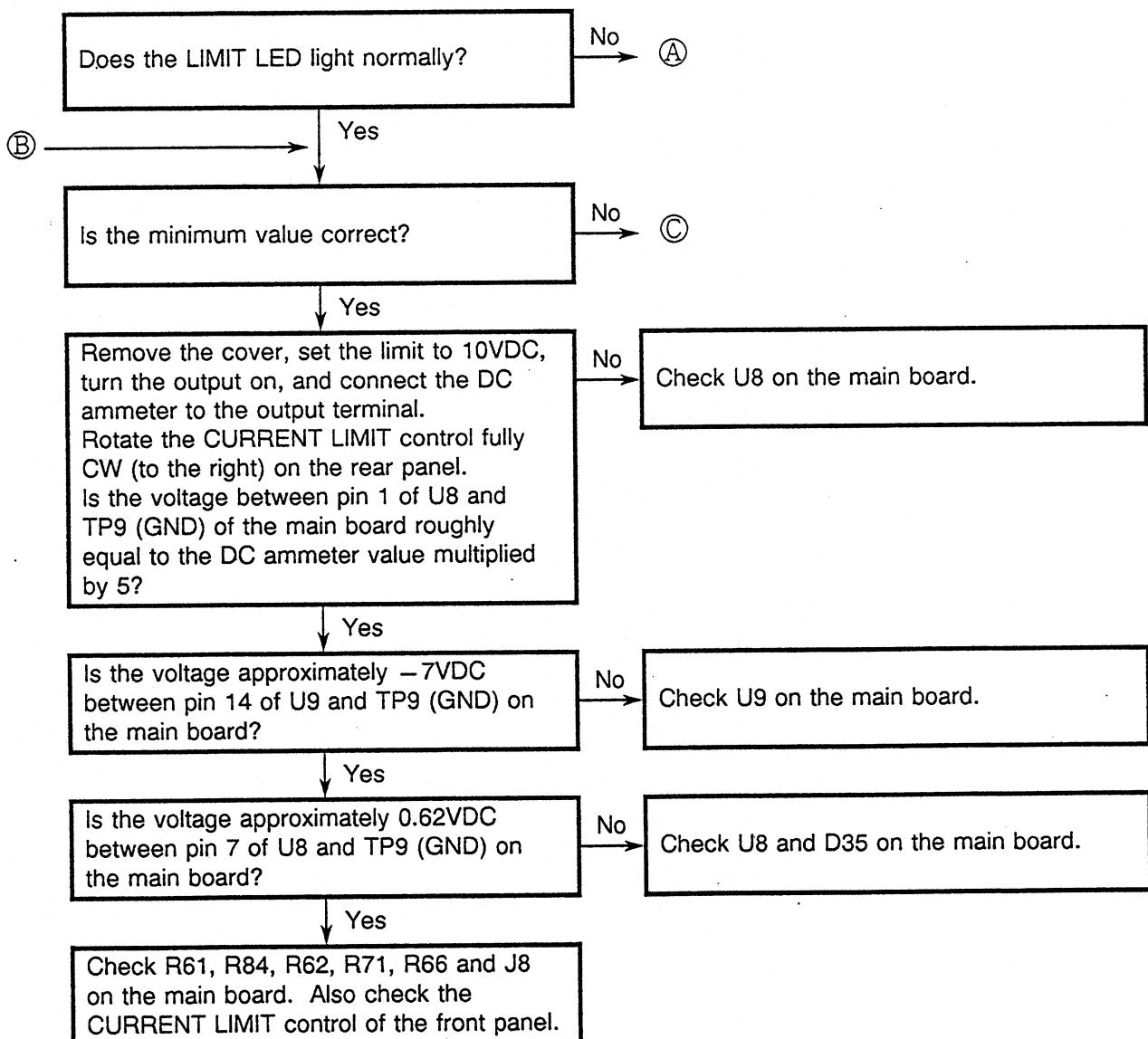
6.8 Voltage Limiter Error

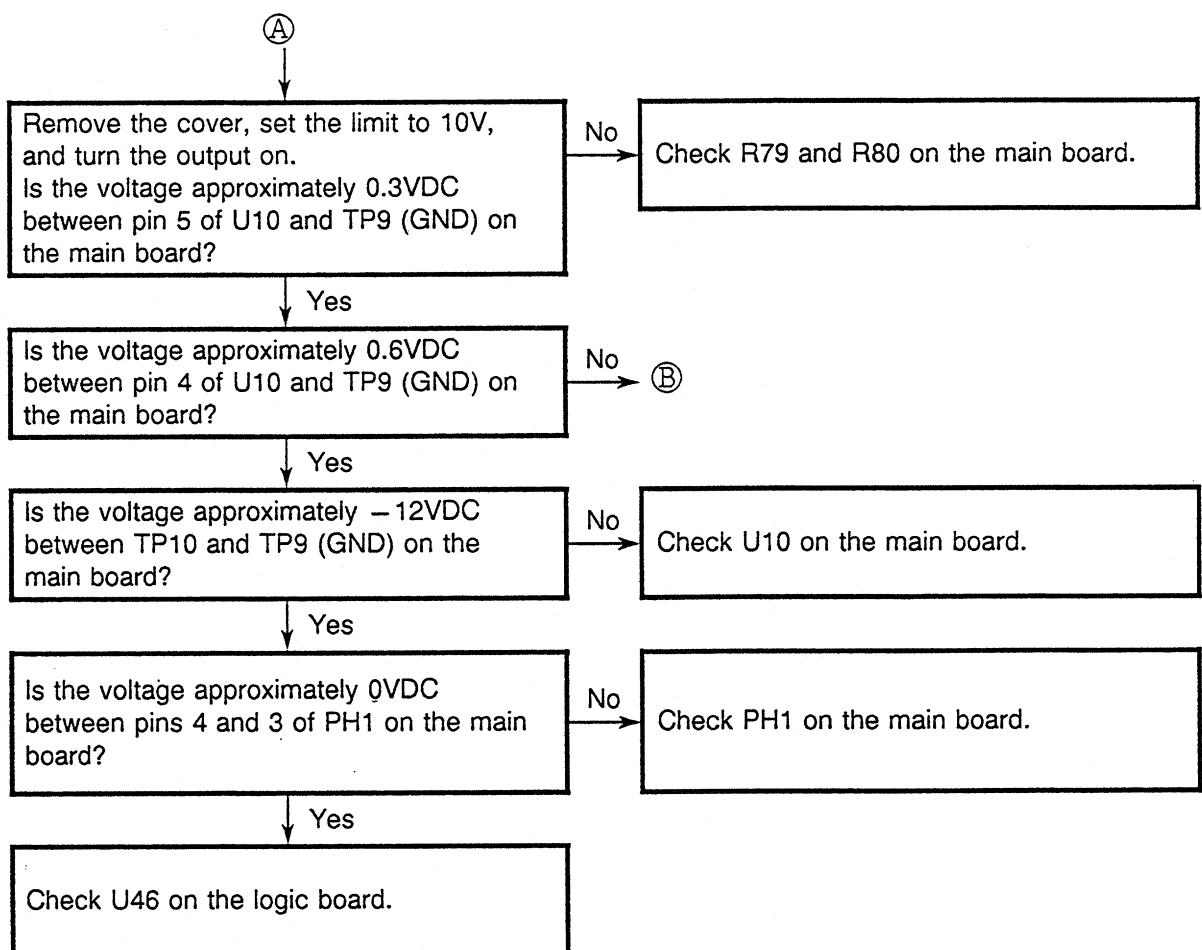




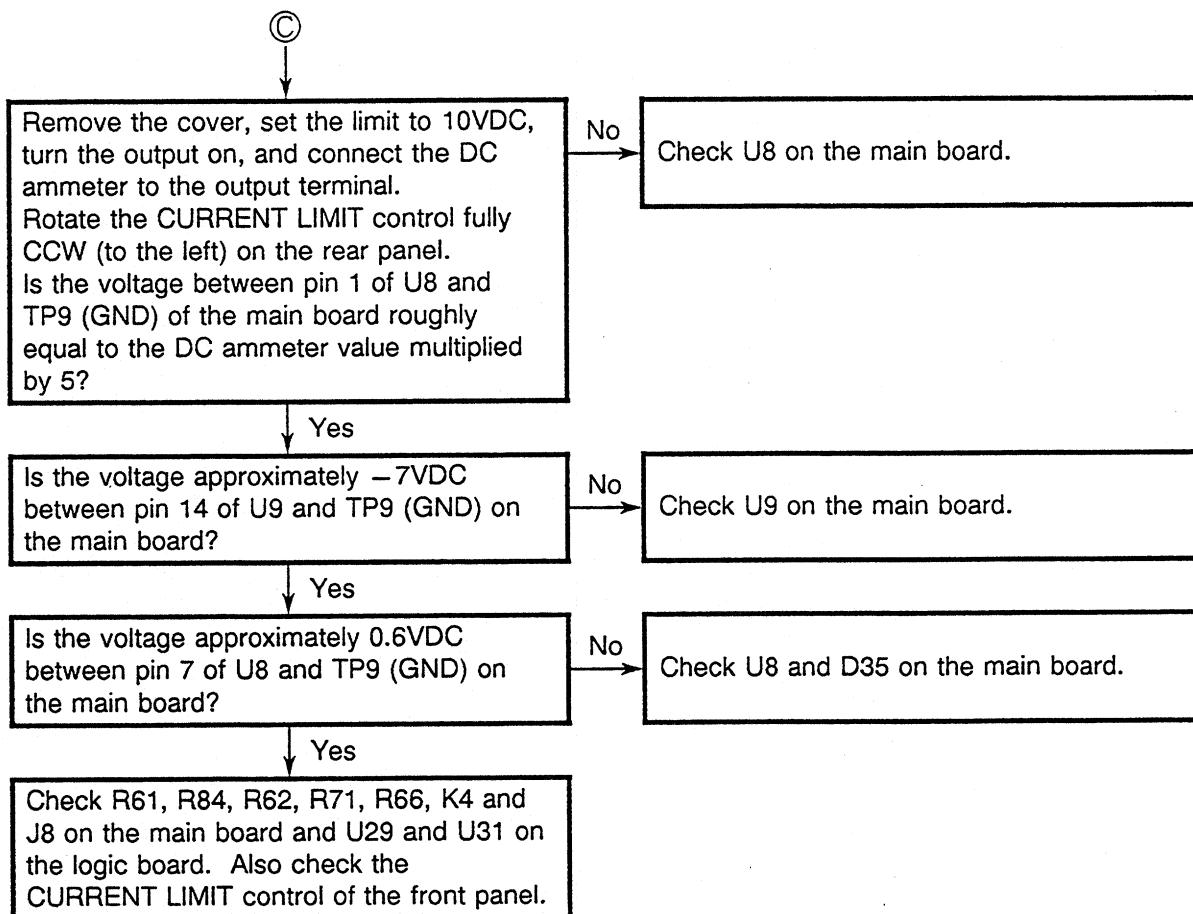
6.9 Current Limiter Error

6.9 Current Limiter Error



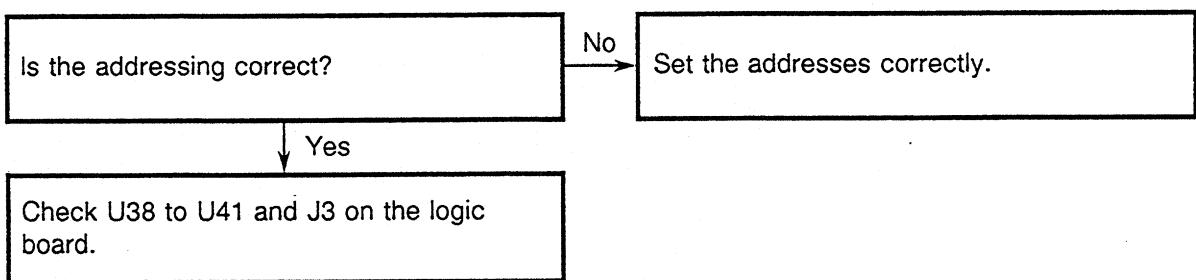


6.9 Current Limiter Error



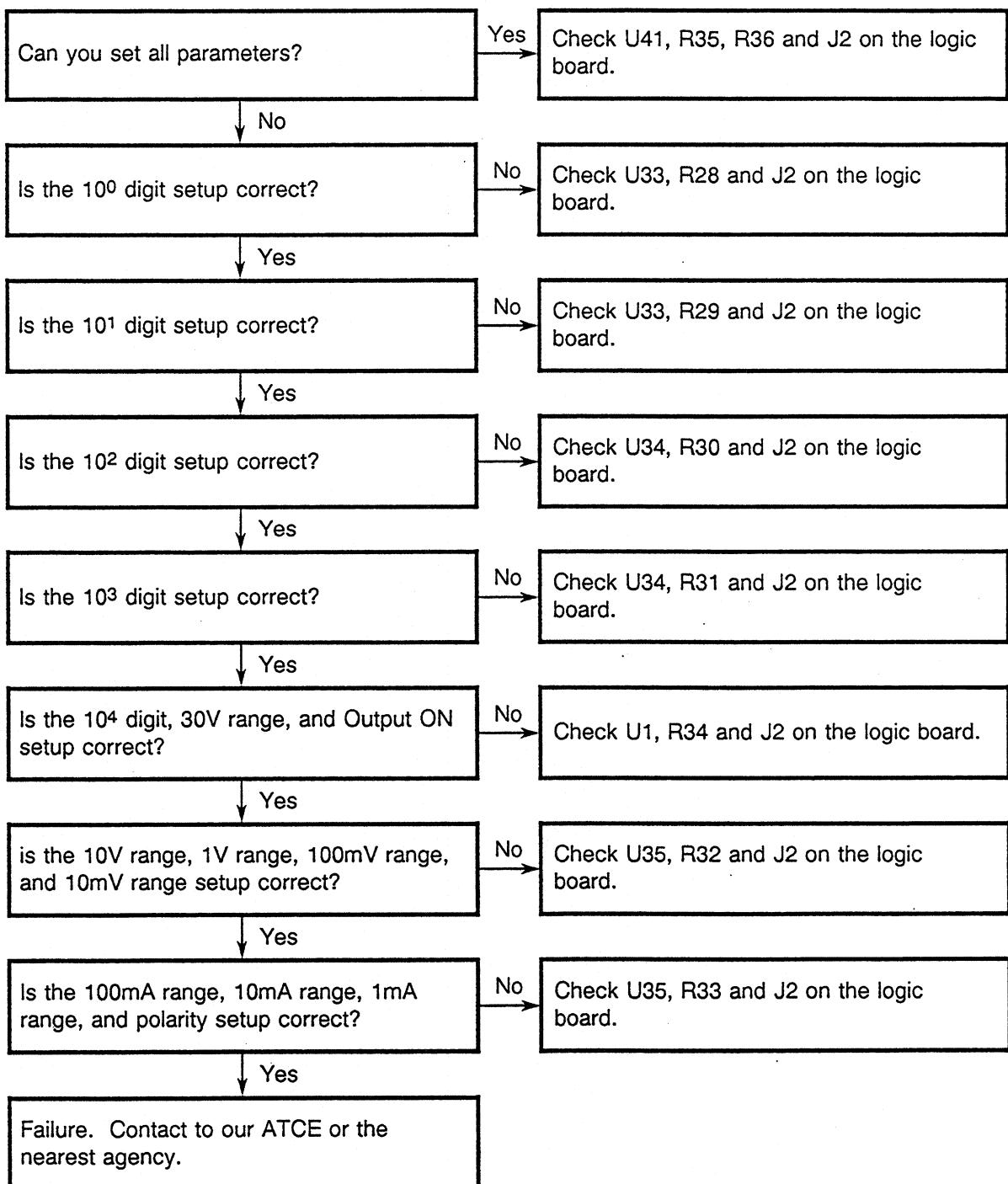
6.10 GPIB Interface Error

6.10 GPIB Interface Error



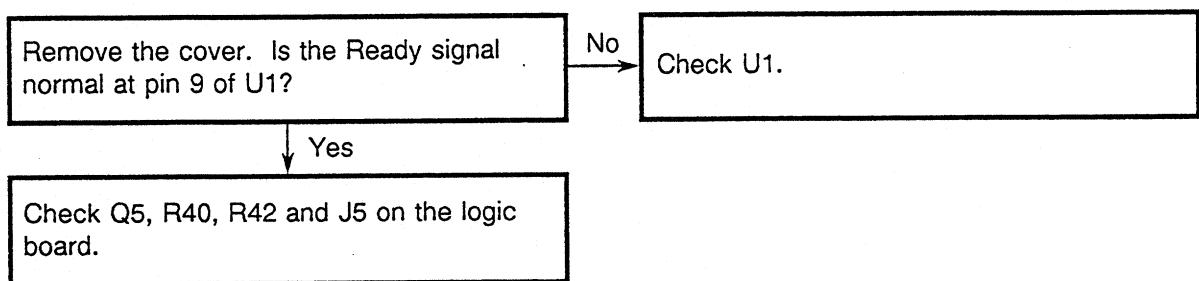
6.11 VDC Interface Error

6.11 VDC Interface Error



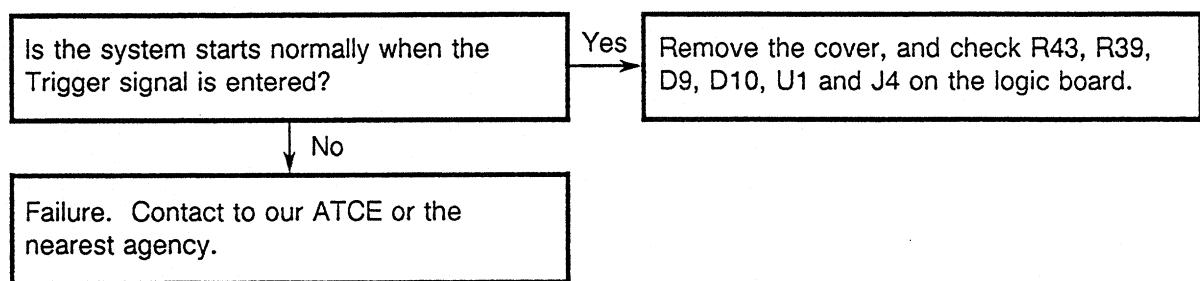
6.12 Ready Signal Error

6.12 Ready Signal Error



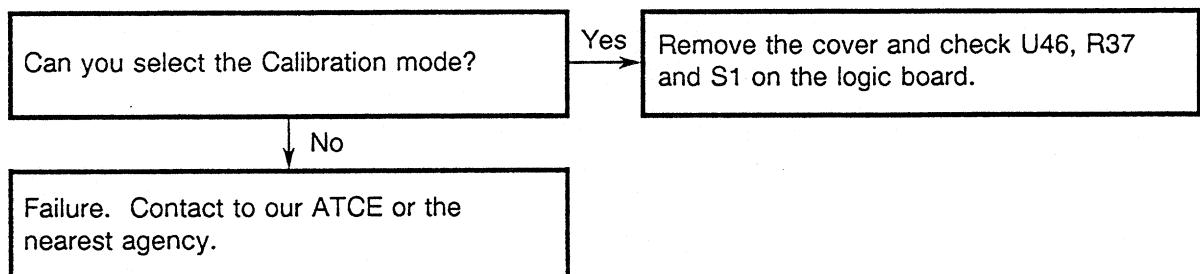
6.13 Trigger Signal Error

6.13 Trigger Signal Error



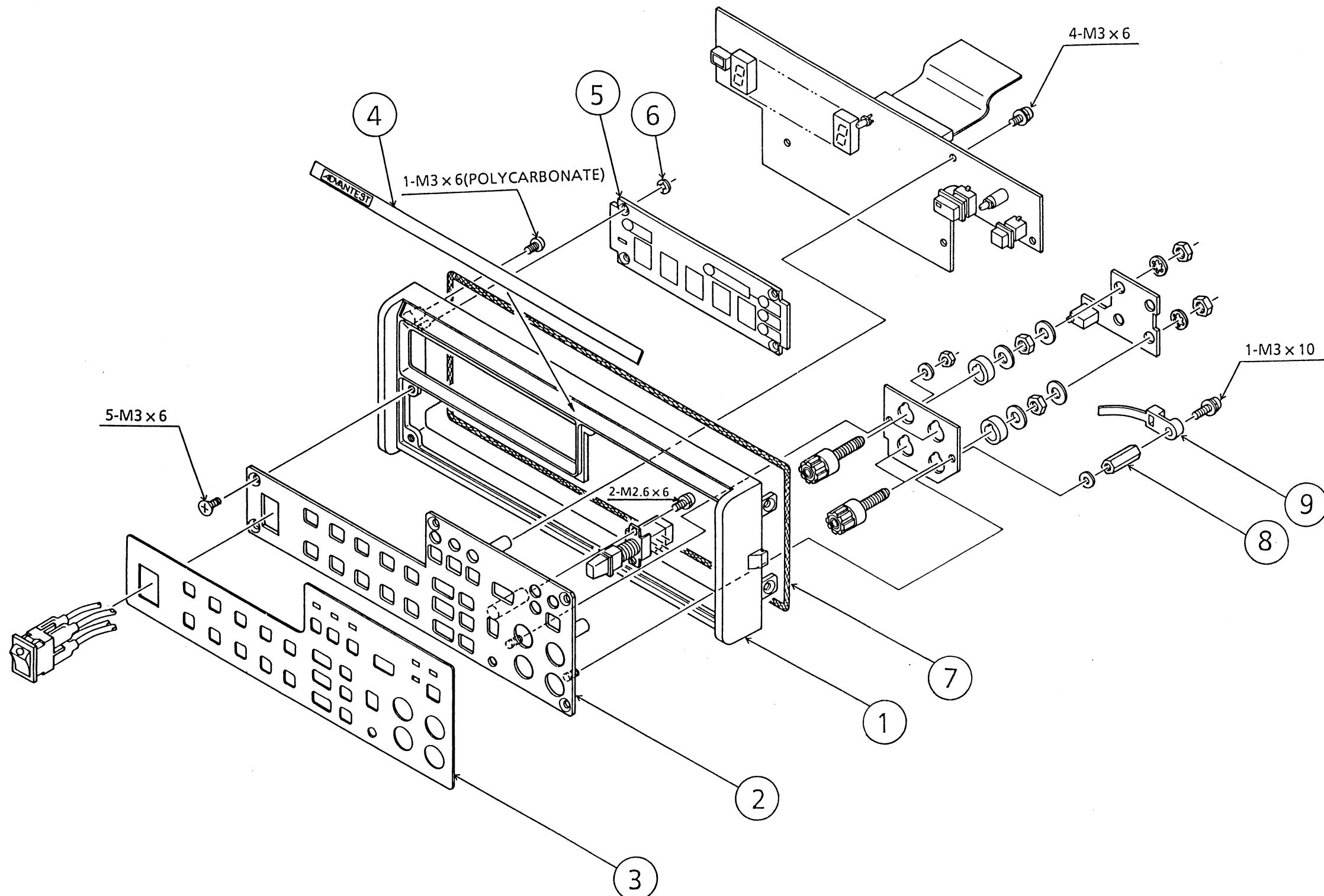
6.14 Calibration Error

6.14 Calibration Error



7. REPLACEABLE MECHANICAL PARTS

R6142



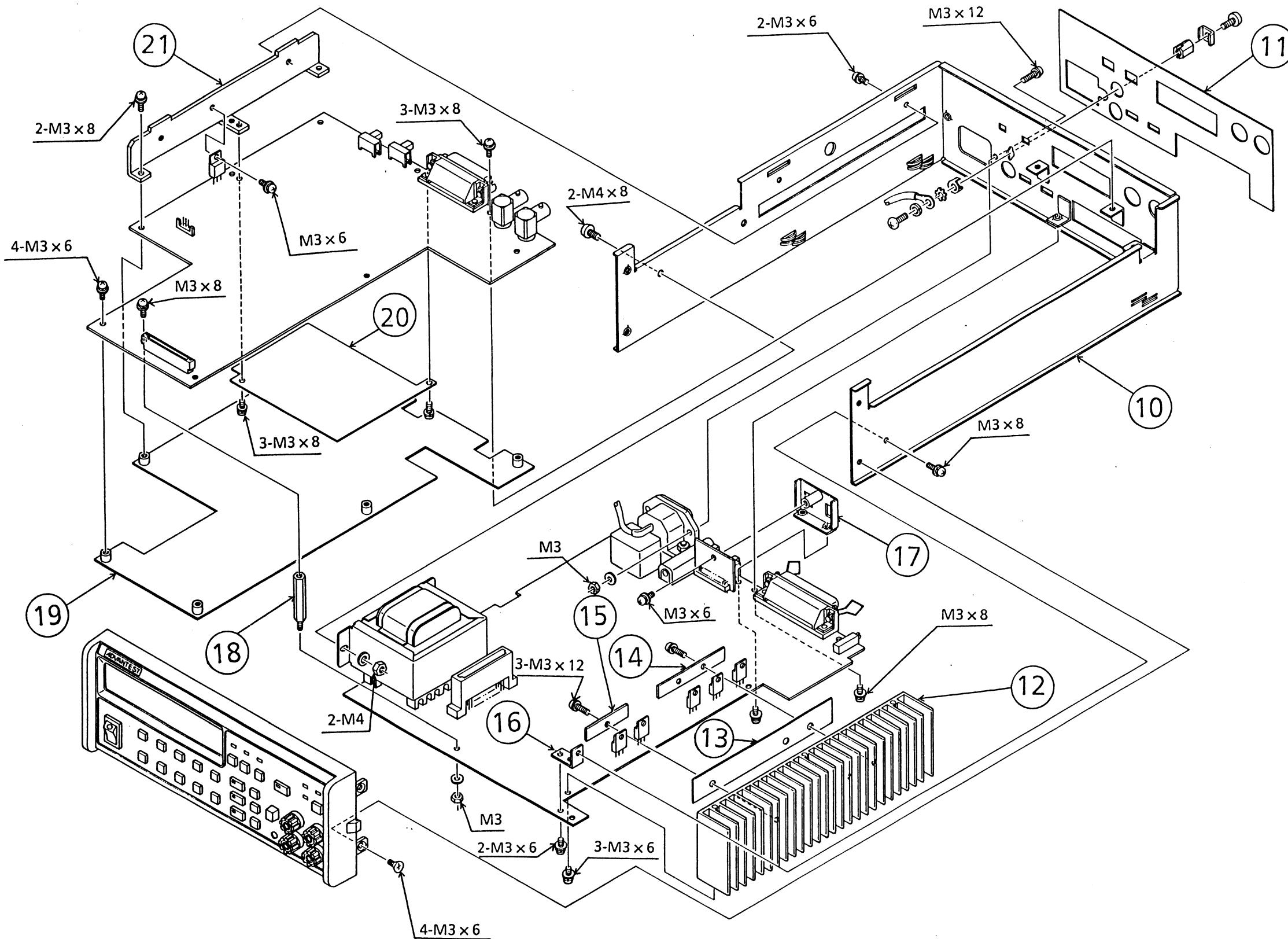
Description	CODE	Q'ty
① FRAME, FRONT	MCT-57422	1
② PANEL, FRONT	MBE-86660	1
③ NAMEPLATE, FRONT PANEL	MNS-86661 002	1
④ NAMEPLATE, TITLE	MNS-95654	1
⑤ FILTER, DISPLAY	MPS-86662 002	1
⑥ NUT, PUSH TYPE	YEE-001121	4
⑦ SEALED LINE	YEE-001586	1
⑧ SPACER	YEE-000782	1
⑨ INSULATING LOCK, WITH CLAMP	ESM-000124	1

R6144

Description	CODE	Q'ty
① FRAME, FRONT	MCT-57422	1
② PANEL, FRONT	MBE-86660	1
③ NAMEPLATE, FRONT PANEL	MNS-86661 001	1
④ NAMEPLATE, TITLE	MNS-86671	1
⑤ FILTER, DISPLAY	MPS-86662 001	1
⑥ NUT, PUSH TYPE	YEE-001121	4
⑦ SEALED LINE	YEE-001586	1
⑧ SPACER	YEE-000782	1
⑨ INSULATING LOCK, WITH CLAMP	ESM-000124	1

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EXPLODED VIEW 1

R6142



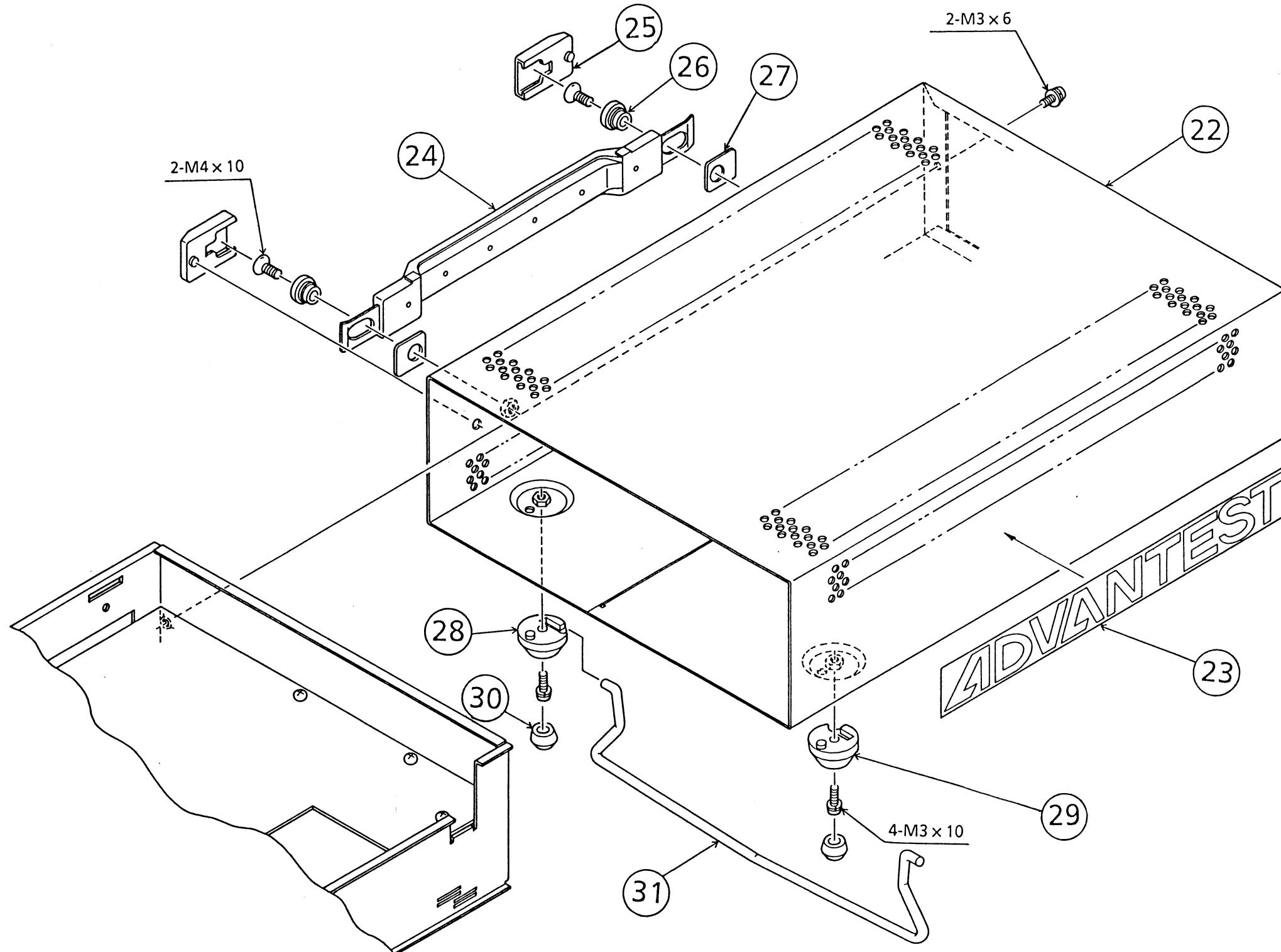
Description	CODE	Q'ty
⑩ CHASSIS	MBB-86659	1
⑪ NAMEPLATE, REAR PANEL	MNS-95683 002	1
⑫ HEAT SINK	MHA-86672	1
⑬ RADIATING SHEET	MPX-86673	1
⑭ TRANSISTOR HOLDER L	MBB-86670	1
⑮ TRANSISTOR HOLDERS	MBB-86669	1
⑯ BOARD HOLDER	MBB-86667	1
⑰ SWITCH GUARD	MBB-95689	1
⑱ SPACER BOLT	YEE-003745	1
⑲ SHIELD BOARD	MBB-86666	1
⑳ INSULATING SHEET	MPX-86674	1
㉑ HEAT PANEL	MBE-86664	1

R6144

Description	CODE	Q'ty
⑩ CHASSIS	MBB-86659	1
⑪ NAMEPLATE, REAR PANEL	MNS-95683 001	1
⑫ HEAT SINK	MHA-86672	1
⑬ RADIATING SHEET	MPX-86673	1
⑭ TRANSISTOR HOLDER L	MBB-86670	1
⑮ TRANSISTOR HOLDERS	MBB-86669	1
⑯ BOARD HOLDER	MBB-86667	1
⑰ SWITCH GUARD	MBB-95689	1
⑱ SPACER BOLT	YEE-003745	1
⑲ SHIELD BOARD	MBB-86666	1
⑳ INSULATING SHEET	MPX-86674	1
㉑ HEAT PANEL	MBE-86664	1

R6142/6144
EXPLODED VIEW 2

R6142



Description	CODE	Q'ty
① CASE	MBT-86668	1
② COMPANY NAMEPLATE, SIDE	MNS-60840	1
③ HANDLE	MMX-54808	1
④ HANDLE COVER	MMX-57440	2
⑤ HANDLE STOPPER	MKX-20548	2
⑥ HANDLE SPACER	MBX-20547	2
⑦ FOOT A, FOR STAND	MMX-10498	2
⑧ FOOT B, FOR STAND	MMX-10499	2
⑨ RUBBER SPHERE	MMX-12291	4
⑩ STAND A	MBC-17074	1

R6144

Description	CODE	Q'ty
① CASE	MBT-86668	1
② COMPANY NAMEPLATE, SIDE	MNS-60840	1
③ HANDLE	MMX-54808	1
④ HANDLE COVER	MMX-57440	2
⑤ HANDLE STOPPER	MKX-20548	2
⑥ HANDLE SPACER	MBX-20547	2
⑦ FOOT A, FOR STAND	MMX-10498	2
⑧ FOOT B, FOR STAND	MMX-10499	2
⑨ RUBBER SPHERE	MMX-12291	4
⑩ STAND A	MBC-17074	1

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8.1 Logic (BLL-017872)

8. REPLACE ABLE ELECTRICAL PARTS

8.1 LOGIC (BLL-017872)

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Parts No.	Advantest Stock No.	Description	Note
C14	CCK-BT4700U16V	C: ALUMINUM ELECTROLYTIC 4700 μ F 16V	
C16	CCK-BX330U10V	C: ALUMINUM ELECTROLYTIC 330 μ F 10V	
C05	CCK-CM3R3U50V	C: ALUMINUM ELECTROLYTIC 3.3 μ F 50V	
C04	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C06	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C09	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C10	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C15	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C20	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C21	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C22	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C23	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C24	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C25	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C26	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C27	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C28	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C29	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C30	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C31	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C32	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C33	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C34	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C35	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C36	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C37	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C38	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C39	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C40	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C41	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C42	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C43	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C50	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C51	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C52	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	

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Parts No.	Advantest Stock No.	Description	Note
C53	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C54	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C55	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C56	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C57	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C58	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C01	CSM-AZ100P50V	C: 100PF 50V	
C11	CSM-BA220P50V	C: 220PF 50V	
C02	CTA-AC1U35V	C: FXD Elect Tantal 1UF 35V	
C08	CTA-AC1U35V	C: FXD Elect Tantal 1UF 35V	
C03	CTA-AC3R3U16V	C: FXD Elect Tantal 3.3UF 16V	
BT01	DBP-001486	BATTERY	
L01	DEE-001351	Core Ferrite Beads	
L04	DEE-001351	Core Ferrite Beads	
L06	DEE-001351	Core Ferrite Beads	
L07	DEE-001351	Core Ferrite Beads	
L15	DEE-001351	Core Ferrite Beads	
L03	DNF-001713	Choke Coil Common Mode	
X01	DXC-001733-1		
J04	JCF-AB001JX22	Connector	
J05	JCF-AB001JX22	Connector	
	JCI-DN028JX01	Connector	
J06	JCP-AA002PX-2	Connector	
J08	JCP-BH003PX01	Connector	
J07	JCR-BN034PX01	Connector	
J03	JCS-BG024JX05	Connector	
J01	JCS-BQ032JX01-1	Connector	
J02	JCS-BQ032JX01-1	Connector	
TP01	JTE-AH001JX01-1	CHECK PIN	
TP02	JTE-AH001JX01-1	CHECK PIN	
TP03	JTE-AH001JX01-1	CHECK PIN	
TP04	JTE-AH001JX01-1	CHECK PIN	
TP05	JTE-AH001JX01-1	CHECK PIN	
TP06	JTE-AH001JX01-1	CHECK PIN	
TP07	JTE-AH001JX01-1	CHECK PIN	
S01	KSL-000152		
S02	KSL-000152		
L16	LCL-B01018-1	L: FXD Coil	
L17	LCL-B01018-1	L: FXD Coil	
L18	LCL-B01018-1	L: FXD Coil	

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Parts No.	Advantest Stock No.	Description	Note
L19	LCL-B01018-1	L: FXD Coil	
L20	LCL-B01018-1	L: FXD Coil	
L21	LCL-B01018-1	L: FXD Coil	
L22	LCL-B01018-1	L: FXD Coil	
L23	LCL-B01018-1	L: FXD Coil	
L02	LTP-000265-1 MBB-86666A-1 MBE-86664A-1 MNS-35263A MPX86674A-1	Transformer	
R48	PLL-217872DD		
R49	RAY-AK100Q4	R: FXD Com 100Q	
R05	RAY-AK100Q4	R: FXD Com 100Q	
R11	RAY-AK220Q4	R: FXD Com 220Q	
R12	RAY-AK220Q4	R: FXD Com 220Q	
R13	RAY-AK220Q4	R: FXD Com 220Q	
R50	RAY-AL100K4	R: FXD Com 100K	
R46	RAY-BGX0010	R: Custom made	
R47	RAY-BGX0010	R: Custom made	
R28	RAY-TGX0017	R: Custom made	
R29	RAY-TGX0017	R: Custom made	
R30	RAY-TGX0017	R: Custom made	
R31	RAY-TGX0017	R: Custom made	
R32	RAY-TGX0017	R: Custom made	
R33	RAY-TGX0017	R: Custom made	
R34	RAY-TGX0017	R: Custom made	
R09	RAY-TL10K4	R: FXD Com 10KQ	
R57	RAY-TL10K4	R: FXD Com 10KQ	
R58	RAY-TL10K4	R: FXD Com 10KQ	
R16	RCS-AG100	R: FXD CAR 100Q +-5% 1/8W	
R55	RCS-AG100	R: FXD CAR 100Q +-5% 1/8W	
R56	RCS-AG100	R: FXD CAR 100Q +-5% 1/8W	
R02	RCB-AG10K	R: FXD CAR 10KQ +-5% 1/8W	
R03	RCB-AG10K	R: FXD CAR 10KQ +-5% 1/8W	
R06	RCB-AG10K	R: FXD CAR 10KQ +-5% 1/8W	
R10	RCB-AG10K	R: FXD CAR 10KQ +-5% 1/8W	
R20	RCB-AG10K	R: FXD CAR 10KQ +-5% 1/8W	
R39	RCB-AG10K	R: FXD CAR 10KQ +-5% 1/8W	
R41	RCB-AG10K	R: FXD CAR 10KQ +-5% 1/8W	

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Parts No.	Advantest Stock No.	Description	Note
R43	RCB-AG10K	R: FXD CAR 10KQ +-5% 1/8W	
R22	RCB-AG150K	R: FXD CAR 150KQ +-5% 1/8W	
R17	RCB-AG1K	R: FXD CAR 1KQ +-5% 1/8W	
R35	RCB-AG1K	R: FXD CAR 1KQ +-5% 1/8W	
R21	RCB-AG1R5K	R: FXD CAR 1.5KQ +-5% 1/8W	
R01	RCB-AG220	R: FXD CAR 220Q +-5% 1/8W	
R04	RCB-AG220	R: FXD CAR 220Q +-5% 1/8W	
R14	RCB-AG220	R: FXD CAR 220Q +-5% 1/8W	
R15	RCB-AG220	R: FXD CAR 220Q +-5% 1/8W	
R23	RCB-AG22K	R: FXD CAR 22KQ +-5% 1/8W	
R27	RCB-AG270	R: FXD CAR 270Q +-5% 1/8W	
R19	RCB-AG330	R: FXD CAR 330Q +-5% 1/8W	
R36	RCB-AG33K	R: FXD CAR 33KQ +-5% 1/8W	
R40	RCB-AG33K	R: FXD CAR 33KQ +-5% 1/8W	
R37	RCB-AG47K	R: FXD CAR 47KQ +-5% 1/8W	
R38	RCB-AG47K	R: FXD CAR 47KQ +-5% 1/8W	
R51	RCB-AG47K	R: FXD CAR 47KQ +-5% 1/8W	
R52	RCB-AG47K	R: FXD CAR 47KQ +-5% 1/8W	
R07	RCB-AG4R7K	R: FXD CAR 4.7KQ +-5% 1/8W	
R08	RCB-AG4R7K	R: FXD CAR 4.7KQ +-5% 1/8W	
R42	RCB-AG4R7K	R: FXD CAR 4.7KQ +-5% 1/8W	
R54	RCB-AG56	R: FXD CAR 56Q +-5% 1/8W	
R18	RCB-AG560	R: FXD CAR 560Q +-5% 1/8W	
D13	SDP-KBPC602		
D01	SDS-1SS270	Diode SI	
D02	SDS-1SS270	Diode SI	
D03	SDS-1SS270	Diode SI	
D06	SDS-1SS270	Diode SI	
D09	SDS-1SS270	Diode SI	
D10	SDS-1SS270	Diode SI	
D14	SDS-1SS270	Diode SI	
D15	SDS-1SS270	Diode SI	
D16	SDS-1SS270	Diode SI	
D17	SDS-1SS270	Diode SI	
D18	SDS-1SS270	Diode SI	
D19	SDS-1SS270	Diode SI	
D20	SDS-1SS270	Diode SI	
D21	SDS-1SS270	Diode SI	
D04	SDS-1SS286	Diode SI	
D05	SDZ-H3-8	Zener Diode	

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Parts No.	Advantest Stock No.	Description	Note
U43	SIA-7805U	IC: Voltage Regulator	
U11	SIA-TL7700	IC: Voltage Pilot	
U01	SIM-63B03	IC: Micro Orocessing Unit	
U09	SIM-74HC00	IC: Quadruple 2 Input Positive-NAND Gate	
U10	SIM-74HC00	IC: Quadruple 2 Input Positive-NAND Gate	
U41	SIM-74HC00	IC: Quadruple 2 Input Positive-NAND Gate	
U28	SIM-74HC04	IC: HEX INVERTERS	
U06	SIM-74HC138	IC: 3-to-8 Line Decoder/Multiplexer	
U07	SIM-74HC138	IC: 3-to-8 Line Decoder/Multiplexer	
U08	SIM-74HC138	IC: 3-to-8 Line Decoder/Multiplexer	
U35	SIM-74HC244	IC: Octal Buffer/Line Driver/Line Receiver	
U46	SIM-74HC244	IC: Octai Buffer/Line Driver/Line Receiver	
U29	SIM-74HC273	IC: Octal D-Type Flip-Flop	
U30	SIM-74HC273	IC: Octal D-Type Flip-Flop	
U02	SIM-74HC373	IC: Octal D-type Latch	
U33	SIM-74HC373	IC: Octal D-type Latch	
U34	SIM-74HC373	IC: Octal D-type Latch	
U15	SIM-74HC374	IC: Octal D-Type Flip-Flop	
U16	SIM-74HC374	IC: Octal D-Type Flip-Flop	
U17	SIM-74HC374	IC: Octal D-Type Flip-Flop	
U18	SIM-74HC374	IC: Octal D-Type Flip-Flop	
U44	SIM-74HC374	IC: Octal D-Type Flip-Flop	
U38	SIM-9914	IC: GPIB CONTROLER	
U26	SIT-74ALS04	IC: HEX INVERTERS	
U19	SIT-74ALS112	IC: DUAL J-K Type Flip-Flop	
U20	SIT-74ALS163-1	IC: SYNCHRONOUS 4-BIT COUNTERS	
U21	SIT-74ALS163-1	IC: SYNCHRONOUS 4-BIT COUNTERS	
U22	SIT-74ALS163-1	IC: SYNCHRONOUS 4-BIT COUNTERS	
U23	SIT-74ALS163-1	IC: SYNCHRONOUS 4-BIT COUNTERS	
U24	SIT-74ALS688-1	IC: 8-BIT MAGNITUDE COMPARATORS	
U25	SIT-74ALS688-1	IC: 8-BIT MAGNITUDE COMPARATORS	
U14	SIT-74ALS74	IC: DUAL D-TYPE FLIP-FLOP	
U45	SIT-74F374	IC: OCTAL D-TYPE FLIP-FLOP	
U31	SIT-74LS06	IC: HEX INVERTERS	
U32	SIT-74LS06	IC: HEX INVERTERS	
U47	SIT-74LS240	IC: OCTAL Buffers	
U39	SIT-75160	IC: OCTAL GPIB Transceivers	
U40	SIT-75161	IC: OCTAL GPIB Transceivers	
U05	SMM-16911	IC: 1K-BIT Serial EEPROM	
U03	SMM-270512*20-1	IC:	

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Parts No.	Advantest Stock No.	Description	Note
U04	SMM-5564A	IC: 64K-BIT STATIC RAM	
Q02	STN-2SC1815-55	Transistor SI NPN	
Q05	STN-2SC1815-55	Transistor SI NPN	
Q01	STP-2SA1015-5	Transistor SI PNP	
Q08	STP-2SB793	Transistor SI PNP	
Q09	STP-2SB793	Transistor SI PNP	
Q10	STP-2SB793	Transistor SI PNP	
Q11	STP-2SB793	Transistor SI PNP	
Q12	STP-2SB793	Transistor SI PNP	
Q13	STP-2SB793	Transistor SI PNP	
Q14	STP-2SB793 YEE-000265-1	Transistor SI PNP	

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8.2 Display (BLF-017871)

8.2 DISPLAY (BLF-017871)

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Parts No.	Advantest Stock No.	Description	Note
J01	JCR-BN034PX01		
SW01	KSP-000250	Switch	
SW02	KSP-000250	Switch	
SW03	KSP-000250	Switch	
SW04	KSP-000250	Switch	
SW05	KSP-000250	Switch	
SW06	KSP-000250	Switch	
SW07	KSP-000250	Switch	
SW08	KSP-000250	Switch	
SW09	KSP-000250	Switch	
SW10	KSP-000250	Switch	
SW11	KSP-000250	Switch	
SW12	KSP-000250	Switch	
SW13	KSP-000250	Switch	
SW14	KSP-000250	Switch	
SW15	KSP-000250	Switch	
SW16	KSP-000250	Switch	
SW17	KSP-000250	Switch	
SW18	KSP-000250	Switch	
SW19	KSP-000250	Switch	
SW20	KSP-000250	Switch	
SW21	KSP-000250 MMS-28960A-1 MMS-86675A-1 MMX-102738	Switch	
	MMX-10276A MMX-21066A MMX-21220A MPX-20541A		
D16	NLD-000003	Light Emitting Diode	
D06	NLD-000010	Light Emitting Diode	
D07	NLD-000010	Light Emitting Diode	
D08	NLD-000010	Light Emitting Diode	
D09	NLD-000010	Light Emitting Diode	
D10	NLD-000010	Light Emitting Diode	

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Parts No.	Advantest Stock No.	Description	Note
D11	NLD-000010	Light Emitting Diode	
D12	NLD-000010	Light Emitting Diode	
D13	NLD-000010	Light Emitting Diode	
D14	NLD-000010	Light Emitting Diode	
D15	NLD-000010	Light Emitting Diode	
D18	NLD-000010	Light Emitting Diode	
D19	NLD-000010	Light Emitting Diode	
D20	NLD-000010	Light Emitting Diode	
D21	NLD-000010	Light Emitting Diode	
D01	NLD-000096	Light Emitting Diode	
D02	NLD-000096	Light Emitting Diode	
D03	NLD-000096	Light Emitting Diode	
D04	NLD-000096	Light Emitting Diode	
D05	NLD-000096	Light Emitting Diode	
D17	NLD-000233-1	Light Emitting Diode	
D26	PLF-217871DD		
D27	SDS-1SS270	Diode SI	
D28	SDS-1SS270	Diode SI	
D29	SDS-1SS270	Diode SI	
D30	SDS-1SS270	Diode SI	
D31	SDS-1SS270	Diode SI	
	ZCA-B0449X09	CABLE	

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8.3 Main (BLI-017873)

8.3 MAIN (BLI-017873)

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Parts No.	Advantest Stock No.	Description	Note
C03	CCK-BT1000U35V	C: ALUMINUM ELECTROLYTIC 1000 μ F 35V	
C02	CCK-BT47U63V	C: ALUMINUM ELECTROLYTIC 47 μ F 63V	
C05	CCK-BX100U16V	C: ALUMINUM ELECTROLYTIC 100 μ F 16V	
C53	CCK-BX220U25V	C: ALUMINUM ELECTROLYTIC 220 μ F 25V	
C52	CCK-BX220U50V	C: ALUMINUM ELECTROLYTIC 220 μ F 50V	
C09	CCL-BX33U25V	C: ALUMINUM ELECTROLYTIC 33 μ F 25V	
C07	CCK-BX47U50V	C: ALUMINUM ELECTROLYTIC 47 μ F 50V	
C01	CCK-BZ470U100V	C: ALUMINUM ELECTROLYTIC 470 μ F 100V	
C21	CFM-AHR068UR1K	C: 0.068 μ F +-10% 100V	
C25	CFM-AHR068UR1K	C: 0.068 μ F +-10% 100V	
C34	CFM-AHR33U100V	C: 0.33 μ F +-10% 100V	
C32	CFM-AHR47U100V	C: 0.47 μ F +-10% 100V	
C30	CFM-AS1500P50V	C: 1500PF	
C48	CFM-ASR01U50V	C: FXD Polyester FLM 0.01UF +-10% 50V	
C49	CFM-ASR01U50V	C: FXD Polyester FLM 0.01UF +-10% 50V	
C19	CFM-ASR022U50V	C: FXD Polyester FLM 0.022UF +-10% 50V	
C22	CFM-ASR033U50V	C: FXD Polyester FLM 0.033UF +-10% 50V	
C20	CFM-ASR047U50V	C: FXD Polyester FLM 0.047UF +-10% 50V	
C33	CFM-ASR047U50V	C: FXD Polyester FLM 0.047UF +-10% 50V	
C35	CFM-BGR033U	C: 0.033 μ F +-10% 250V	
C11	CMC-AC470PR3K		
C04	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C06	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C08	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C17	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C18	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C23	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C24	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C29	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C31	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C39	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C41	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C42	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C43	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	
C44	CSM-AGR1U50V	C: FXD CER 0.1UF +80, -20% 50V	

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Parts No.	Advantest Stock No.	Description	Note
C45	CSM-AGR1U50V	C: FXD CER 0.1UF + 80, -20% 50V	
C46	CSM-AGR1U50V	C: FXD CER 0.1UF + 80, -20% 50V	
C47	CSM-AGR1U50V	C: FXD CER 0.1UF + 80, -20% 50V	
C50	CSM-AGR1U50V	C: FXD CER 0.1UF + 80, -20% 50V	
C51	CSM-AGR1U50V	C: FXD CER 0.1UF + 80, -20% 50V	
C13	CSM-AY100P50V	C: FXD CER 100PF +-10% 50V	
C14	CSM-AY100P50V	C: FXD CER 100PF +-10% 50V	
C15	CSM-AY22P50V	C: FXD CER 22PF +-10% 50V	
C16	CSM-AY22P50V	C: FXD CER 22PF +-10% 50V	
C27	CSM-AY22P50V	C: FXD CER 22PF +-10% 50V	
C28	CSM-AZ100P50V	C: FXD CER 100PF +-10% 50V	
C37	CSM-TG1U50V	C: FXD CER 0.1UF + 80, -20% 50V	
C38	CSM-TG1U50V	C: FXD CER 0.1UF + 80, -20% 50V	
C26	CTA-AC10U16V	C: FXD ELECT TANTAL 10UF 16V	
L01	DEE-000066	Core	
L02	DEE-001351	Core Ferrite Beads	
L03	DEE-001351	Core Ferrite Beads	
L04	DEE-001351	Core Ferrite Beads	
L05	DEE-001351	Core Ferrite Beads	
L06	DEE-001351	Core Ferrite Beads	
L07	DEE-001351	Core Ferrite Beads	
L08	DEE-001351	Core Ferrite Beads	
L09	DEE-001351	Core Ferrite Beads	
L10	DEE-001351	Core Ferrite Beads	
L11	DEE-001351	Core Ferrite Beads	
L12	DEE-001351	Core Ferrite Beads	
L13	DEE-001351	Core Ferrite Beads	
L14	DEE-001351	Core Ferrite Beads	
	DFH-000845	Fuse Holder	
FH01	DFH-001601		
FL01	DFT-AAR315A	Fuse	
J01	DNF-001607		
J02	JCD-AW003PX01		
J03	JCP-AA002PX02	Connector	
J04	JCP-AA002PX02	Connector	
J08	JCP-CK008PX01	Connector	
J07	JCS-BG036JX02	Connector	
J05	JCS-DG032PX01-1	Connector	
J06	JCS-DG032PX01-1	Connector	

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Parts No.	Advantest Stock No.	Description	Note
TP01	JTE-AH001JX01	CHECK PIN	
TP02	JTE-AH001JX01	CHECK PIN	
TP03	JTE-AH001JX01	CHECK PIN	
TP04	JTE-AH001JX01	CHECK PIN	
TP05	JTE-AH001JX01	CHECK PIN	
TP06	JTE-AH001JX01	CHECK PIN	
TP07	JTE-AH001JX01	CHECK PIN	
TP08	JTE-AH001JX01	CHECK PIN	
TP09	JTE-AH001JX01	CHECK PIN	
TP10	JTE-AH001JX01	CHECK PIN	
TP11	JTE-AH001JX01	CHECK PIN	
J09	JTM-AG001JX02		
J10	JTM-AG001JX02		
J11	JTM-AG001JX02		
J12	JTM-AG001JX02		
	JTM-BL001JX03-1	CONNECTORS	
K01	KRL-000905	Relay	
K02	KRL-000905	Relay	
K05	KRL-000905	Relay	
K06	KRL-000905	Relay	
K07	KRL-000905	Relay	
K08	KRL-000905	Relay	
K03	KRL-000935	Relay	
K04	KRL-000936	Relay	
K09	KRL-000936	Relay	
K10	KRL-000937 LTP-001213 MBB-86667A-1 MBB-86669A-1 MBB-86670A-1	Relay Transformer	
R35	MPX-86673A-1 PLL-217873DD RAY-BAX0031-1		
R41	RCB-AG100	R: FXD CAR 100Q + -5% 1/8W	
R42	RCB-AG100	R: FXD CAR 100Q + -5% 1/8W	
R84	RCB-AG100	R: FXD CAR 100Q + -5% 1/8W	
R85	RCB-AG100	R: FXD CAR 100Q + -5% 1/8W	
R12	RCB-AG10K	R: FXD CAR 10KQ + -5% 1/8W	
R16	RCB-AG10K	R: FXD CAR 10KQ + -5% 1/8W	
R47	RCB-AG10K	R: FXD CAR 10KQ + -5% 1/8W	

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Parts No.	Advantest Stock No.	Description	Note
R78	RCB-AG10K	R: FXD CAR 10KQ + -5% 1/8W	
R81	RCB-AG10K	R: FXD CAR 10KQ + -5% 1/8W	
R20	RCB-AG120	R: FXD CAR 120Q + -5% 1/8W	
R13	RCB-AG12K	R: FXD CAR 12KQ + -5% 1/8W	
R18	RCB-AG12K	R: FXD CAR 12KQ + -5% 1/8W	
R29	RCB-AG12K	R: FXD CAR 12KQ + -5% 1/8W	
R30	RCB-AG12K	R: FXD CAR 12KQ + -5% 1/8W	
R37	RCB-AG15K	R: FXD CAR 15KQ + -5% 1/8W	
R03	RCB-AG1R5K	R: FXD CAR 1.5KQ + -5% 1/8W	
R14	RCB-AG2R7K	R: FXD CAR 2.7KQ + -5% 1/8W	
R15	RCB-AG2R7K	R: FXD CAR 2.7KQ + -5% 1/8W	
R19	RCB-AG2R7K	R: FXD CAR 2.7KQ + -5% 1/8W	
R02	RCB-AG33	R: FXD CAR 33Q + -5% 1/8W	
R45	RCB-AG47K	R: FXD CAR 47KQ + -5% 1/8W	
R11	RCB-AG4R7K	R: FXD CAR 4.7KQ + -5% 1/8W	
R17	RCB-AG4R7K	R: FXD CAR 4.7KQ + -5% 1/8W	
R38	RCB-AG4R7K	R: FXD CAR 4.7KQ + -5% 1/8W	
R44	RCB-AG4R7K	R: FXD CAR 4.7KQ + -5% 1/8W	
R83	RCB-AG4R7K	R: FXD CAR 4.7KQ + -5% 1/8W	
R21	RCB-AG56K	R: FXD CAR 56KQ + -5% 1/8W	
R23	RCB-AG56K	R: FXD CAR 56KQ + -5% 1/8W	
R31	RCB-AG56K	R: FXD CAR 56KQ + -5% 1/8W	
R32	RCB-AG56K	R: FXD CAR 56KQ + -5% 1/8W	
R43	RCB-AG5R1	R: FXD CAR 5.1Q + -5% 1/8W	
R25	RCB-AG5R1K	R: FXD CAR 5.1KQ + -5% 1/8W	
R40	RCB-AG5R6	R: FXD CAR 5.6Q + -5% 1/8W	
R48	RCB-AG56K	R: FXD CAR 56KQ + -5% 1/8W	
R39	RCB-AG6R8	R: FXD CAR 6.8Q + -5% 1/8W	
R04	RCB-AG6R8K	R: FXD CAR 6.8KQ + -5% 1/8W	
R46	RCB-AG8R2K	R: FXD CAR 8.2KQ + -5% 1/8W	
R01	RCB-AH2R7	R: FXD CAR 2.7Q + -5% 1/4W	
R52	RFL-AN100R9QD	R: 100.9Ω + -0.5% 0.3W	
R54	RFL-AN180QD	R: 180Ω + -0.5% 0.3W	
R55	RFL-AN18QD	R: 18Ω + -0.5% 0.3W	
R51	RFL-AN1R11KD	R: 1.11KΩ + -0.5% 0.3W	
R56	RFL-AN2QD	R: 2Ω + -0.5% 0.3W	
R53	RFL-AP10QD	R: 10Ω + -0.5% 0.3W	
R65	RMF-AB100KBG		
R68	RMF-AB100KBG		
R74	RMF-AB100KBJ		

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Parts No.	Advantest Stock No.	Description	Note
R75	RFM-AB100KBJ		
R73	RFM-AB10KBG		
R76	RFM-AB10KBG		
R57	RFM-AB10QFJ	R: FXD Metal FLM 10Q +-1% 1/4W	
R60	RFM-AB1R2KFJ	R: FXD Metal FLM 1.2KQ +-1% 1/4W	
R77	RMF-AB1R5KFJ	R: FXD Metal FLM 1.5KQ +-1% 1/4W	
R64	RMF-AB200KBG		
R67	RMF-AB200KBG		
R61	RMF-AB270QFJ	R: FXD Metal FLM 270Q +-1% 1/4W	
R72	RMF-AB3KFJ	R: FXD Metal FLM 3KQ +-1% 1/4W	
R71	RMF-AB3R6KFJ	R: FXD Metal FLM 3.6KQ +-1% 1/4W	
R66	RMF-AB470QFJ	R: FXD Metal FLM 470Q +-1% 1/4W	
R62	RMF-AB4R7KFJ	R: FXD Metal FLM 4.7KQ +-1% 1/4W	
R05	RMF-BJ11KFK	R: FXD Metal FLM 11KQ +-1% 1/4W	
R26	RMF-BJ11KFK	R: FXD Metal FLM 11KQ +-1% 1/4W	
R58	RMF-BJ11KFK	R: FXD Metal FLM 11KQ +-1% 1/4W	
R82	RMF-BJ12KFK	R: FXD Metal FLM 12KQ +-1% 1/4W	
R79	RMF-BJ18KFK	R: FXD Metal FLM 18KQ +-1% 1/4W	
R27	RMF-BJ1KFK	R: FXD Metal FLM 1KQ +-1% 1/4W	
R28	RMF-BJ1MFK	R: FXD Metal FLM 1MQ +-1% 1/4W	
R49	RMF-BJ270QFK	R: FXD Metal FLM 270Q +-1% 1/4W	
R06	RMF-BJ2R2KFK	R: FXD Metal FLM 2.2KQ +-1% 1/4W	
R80	RMF-BJ330QFK	R: FXD Metal FLM 330Q +-1% 1/4W	
R24	RMF-BJ3R3KFK	R: FXD Metal FLM 3.3KQ +-1% 1/4W	
R59	RMF-BJ3R6KFK	R: FXD CAR 3.6KQ +-5% 1/8W	
R50	RMF-BJ4R7KFK	R: FXD Metal FLM 4.7KQ +-1% 1/4W	
R36	RMF-BJ560QFK	R: FXD Metal FLM 560Q +-1% 1/4W	
R07	RPW-AT560		
R70	RVR-AD200K		
R22	RVR-BC100		
D34	SDP-SM1-7	Diode SI	
D01	SDP-W02	Diode SI	
D02	SDP-W02	Diode SI	
D03	SDS-1SS270	Diode SI	
D09	SDS-1SS270	Diode SI	
D10	SDS-1SS270	Diode SI	
D11	SDS-1SS270	Diode SI	
D12	SDS-1SS270	Diode SI	
D21	SDS-1SS270	Diode SI	
D22	SDS-1SS270	Diode SI	

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Parts No.	Advantest Stock No.	Description	Note
D23	SDS-1SS270	Diode SI	
D24	SDS-1SS270	Diode SI	
D25	SDS-1SS270	Diode SI	
D26	SDS-1SS270	Diode SI	
D29	SDS-1SS270	Diode SI	
D30	SDS-1SS270	Diode SI	
D31	SDS-1SS270	Diode SI	
D32	SDS-1SS270	Diode SI	
D35	SDS-1SS270	Diode SI	
D36	SDS-1SS270	Diode SI	
D38	SDS-1SS270	Diode SI	
D39	SDS-1SS270	Diode SI	
D40	SDS-1SS270	Diode SI	
D41	SDS-1SS270	Diode SI	
D42	SDS-1SS270	Diode SI	
D43	SDS-1SS270	Diode SI	
D44	SDS-1SS270	Diode SI	
D45	SDS-1SS270	Diode SI	
D46	SDS-1SS270	Diode SI	
D47	SDS-1SS270	Diode SI	
D48	SDS-1SS270	Diode SI	
D49	SDS-1SS270	Diode SI	
D17	SDS-LD1-19	Diode SI	
D18	SDS-LD1-19	Diode SI	
D19	SDS-LD1-19	Diode SI	
D20	SDS-LD1-19	Diode SI	
D05	SDZ-D240	Zener Diode	
D27	SDZ-H2-8	Zener Diode	
D28	SDZ-H2-8	Zener Diode	
D33	SDZ-H3-8	Zener Diode	
D04	SDZ-W061	Zener Diode	
D13	SDZ-W067	Zener Diode	
PH01	SEC-TLP521*1	Zener Diode	
Q07	SFN-2N4393-18	N-CHANNEL SILICON JUNCTION FET	
Q08	SFN-2N4393-18	N-CHANNEL SILICON JUNCTION FET	
U03	SIA-1021BCN8*7	IC: Precision Reference	
U09	SIA-324	IC: Quadruple Operational Amplifier	
U10	SIA-339	IC: Quad Comparator	
U02	DIA-7818U	IC: VOLTAGE REGULATORS	
U01	SIA-7912U	IC: VOLTAGE REGULATORS	

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Parts No.	Advantest Stock No.	Description	Note
U08	SIA-812	IC: DUAL Operational Amplifier	
U04	SIA-LT1008CN8	IC: Operational Amplifier	
U07	SIA-OP77P	IC: Operational Amplifier	
Q15	STN-2SC1627	Transistor SI NPN	
Q17	STN-2SC1627	Transistor SI NPN	
Q20	STN-2SC1627	Transistor SI NPN	
Q02	STN-2SC1815-55	Transistor SI NPN	
Q03	STN-2SC1815-55	Transistor SI NPN	
Q12	STN-2SC1815-55	Transistor SI NPN	
Q16	STN-2SC1815-55	Transistor SI NPN	
Q01	STN-2SC2238	Transistor SI NPN	
Q18	STN-2SC2238	Transistor SI NPN	
Q05	STN-2SC944	Transistor SI NPN	
Q06	STN-2SC944	Transistor SI NPN	
Q13	STP-2SA1015-5	Transistor SI PNP	
Q11	STP-2SA817	Transistor SI PNP	
Q14	STP-2SA817	Transistor SI PNP	
Q19	STP-2SA968 T:MHA-86672A YEE-000265-1	Transistor SI PNP	
J13	YEE-000542-1 YEE-000733-1 YEE-003745-1	CONNECTORS	

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8.4 Bracket (BLB-017870)

8.4 BRACKET (BLB-017870)

(1 of 1)

Parts No.	Advantest Stock No.	Description	Note
C01	CFM-AS2200P50V DEE-000066 ESM-000257-1 JTB-AA001JX01 JTB-AA001JX02	Core Binding Post Binding Post	
R01	JTM-BL001JX03-1 KSP-000102 PLB-217870DD RVR-DK20K YEE-002494-1	CONNECTORS Switch Multiturn cermet trimmers 20KΩ CONNECTORS	

8.5 SWITCH (BLB-018039)

(1 of 1)

Parts No.	Advantest Stock No.	Description	Note
J01	JCP-AA012PX03		
S01	KSL-000939	SWITCH	
S02	KSL-000939 PLB-218039DD	SWITCH	

8.6 TERMINAL (BLB-017889)

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Parts No.	Advantest Stock No.	Description	Note
	PLB-217889DD		

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8.7 Standard Attachments

8.7 Standard Attachments

(1) WBL-6162T

(1 of 1)

Parts No.	Advantest Stock No.	Description	Note
	DCB-DD2428X01-1 DFT-AAR16A DFT-AAR315A JCD-AL003EX03-1 YEE-000394-1	Fuse Fuse	

(2) WFU-R6142M

(1 of 1)

Parts No.	Advantest Stock No.	Description	Note
	ESM-000124 MBB-86659B-1 MBB-95689A-1 MBC-17074B-1 MBE-86660B-1		
	MBT-86668A-1 MBX-20547A-1 MCT-57422A-1 MKX-20548A-1 MMX-10498A-1		
	MMX-10499A-1 MMX-12291A-1 MMX-18107A-1 MMX-54808A-1 MMX-57440A-1		
	MNS-60840A-1 NMS-86661B-002A-1 MNS-95654A-1 MNS-95683A002A-1 MPS-86662A002A-1		
	YEE000782-1 YEE-001121-1 YEE-001586-1 YKG-E01084-1 YKG-NP3X4-1		

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8.7 Standard Attachments

(3) WFU-6142E (Main Frame)

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Parts No.	Advantest Stock No.	Description	Note
P01	JTE-AG001EX01		
S01	KSS-000889		

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