ADVANTEST®

ADVANTEST CORPORATION

R6142/44
Programmable DC Voltage/Current Generator
Maintenance Manual

MANUAL NUMBER FME-8335201B01

This product has been discontinued.
The Operation Manual is provided by ADC Corporation under the agreement with Advantest Corporation.

First printing July 10, 1992
Printed in Japan

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

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

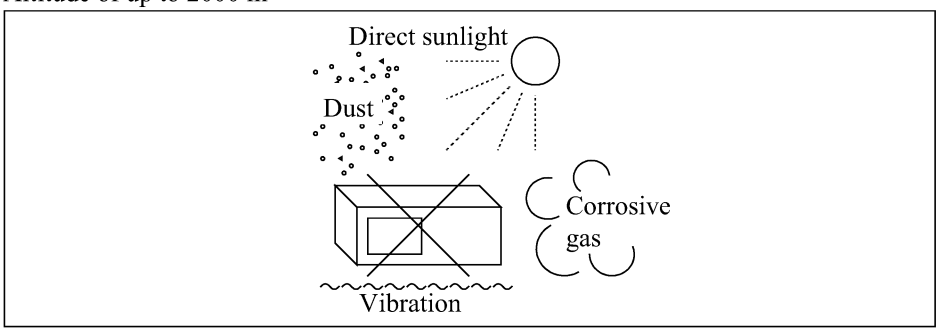


Figure-1 Environmental Conditions

- Operating position

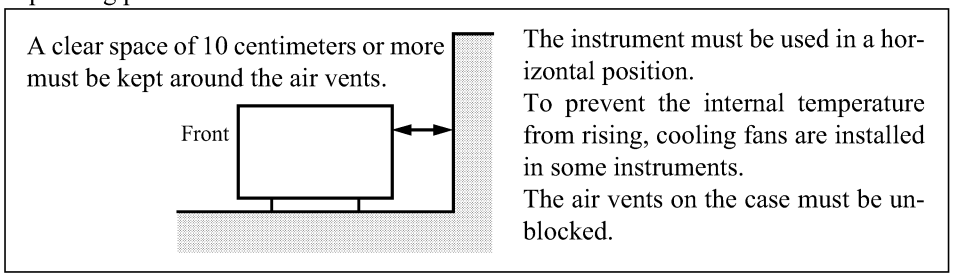


Figure-2 Operating Position

- Storage position

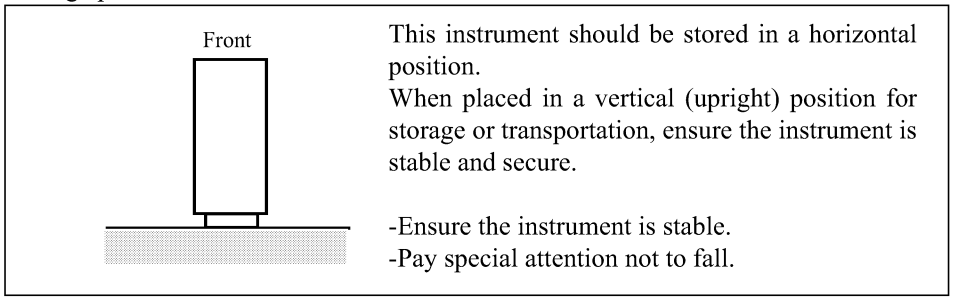


Figure-3 Storage Position

- 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.

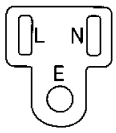
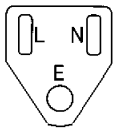
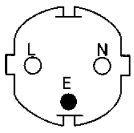
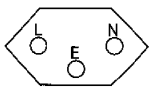
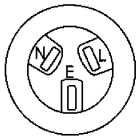
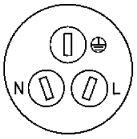
Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) 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

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

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. INTRODUCTION	This chapter explains how to use this manual, and features of this programmable DC voltage/current generator.
2. SPECIFICATIONS	This chapter lists the R6142 and R6144 specifications and accessories.
3. THEORY OF OPERATION	This chapter describes the operation of programmable DC voltage/current generator.
4. PERFORMANCE TESTS (CALIBRATION)	This chapter describes functions and cables necessary to the performance test for programmable DC voltage/current generator, and the method of performance test.
5. ADJUSTMENT	This chapter describes the method of adjustment the programmable DC voltage/current generator.
6. TROUBLESHOOTING	This chapter describes the method of troubleshooting the programmable DC voltage/current generator.
7. REPLACEABLE MECHANICAL PARTS	This chapter lists the mechanical part table of programmable DC voltage/current generator.
8. REPLACEABLE ELECTRICAL PARTS, LOCATIONS AND CIRCUIT DIAGRAMS	This chapter lists the part list, circuit diagram, and layout drawing of programmable DC voltage/current generator.

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 ±12V at a minimum step of one microvolt, and a DC current of 0 to ±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 monotoniciry 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

1.2.2 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 ±32V at a minimum step of one microvolt, and a DC current of 0 to ±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 monotoniciry 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) ± (% of setting + X)	Stability (1 day) ± (% of setting + X)	Temperature coefficient ± (ppm/°C of setting + X/°C)
10mV	0 to ±11.999mV	1μV	0.03 + 5μV	0.01 + 4μV	20 + 200μV
100mV	0 to ±119.99mV	10μV	0.03 + 25μV	0.01 + 10μV	20 + 2μV
1V	0 to ±1.1999V	100μV	0.03 + 200μV	0.01 + 50μV	20 + 10μV
10V	0 to ±11.999V	1mV	0.03 + 2mV	0.01 + 200μV	20 + 40μV
1mA	0 to ± 1.1999mA	100nA	0.035 + 300nA	0.01 + 20nA	20 + 4nA
10mA	0 to ± 11.999mA	1μA	0.035 + 3μA	0.01 + 200nA	20 + 40nA
100mA	0 to ± 119.99mA	10μA	0.04 + 30μA	0.01 + 2μA	20 + 400nA

- The overall accuracy and stability are at 23°C ± 5°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:
  ± 110ppm for the full scale of all ranges.

- 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	
10V			4mΩ or less	200μV	500μV	
1mV	10V Output following voltage		100MΩ or more	30nA	150nA	6μA
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:
  ±0.007% 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

- Maximum load capacitance and inductance:

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

2.1.2 Execution Speed

- Settling time:

  The time interval, following the start of output changing, required for the output to enter ±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	±0.1% centered on final value	50ms or less
1V and10V ranges	30μF capacitance connected		50ms or less
	100μF 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 ±(% of setting + X)
Current limiter	5mA to 120mA	10 + 1mA
Voltage limiter	1V to 10V	5 + 100mV

· The stability is at 23±5°C.
· The current limiter is effective when the R6142 is engaged in source operation.

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 buit-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 △ 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 frount panel
Remote programming	:	Funcions 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 △ 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

- 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°C ± 5°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.

- 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		0.4mΩ or less	80μV	150μV	
10V			4mΩ or less	200μV	500μV	
30V			8mΩ or less	400μV	1mV	
1mV	28V Output following voltage		100MΩ or more	30nA	150nA	6μA
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

- 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.

2.2.2 Execution Speed

- Settling time:

  The time interval, following the start of output changing, required for the output to enter ±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	±0.1% centered on final value	50ms or less
1V, 10V, and 30V ranges	30μF capacitance connected		50ms or less
	100μF 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 ±(% of setting + X)
Current limiter	5mA to 160mA	10 + 1mA
Voltage limiter	1V to 28V	5 + 100mV

  · The stability is at 23°C ± 5°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 △ 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 △ 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

- 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.

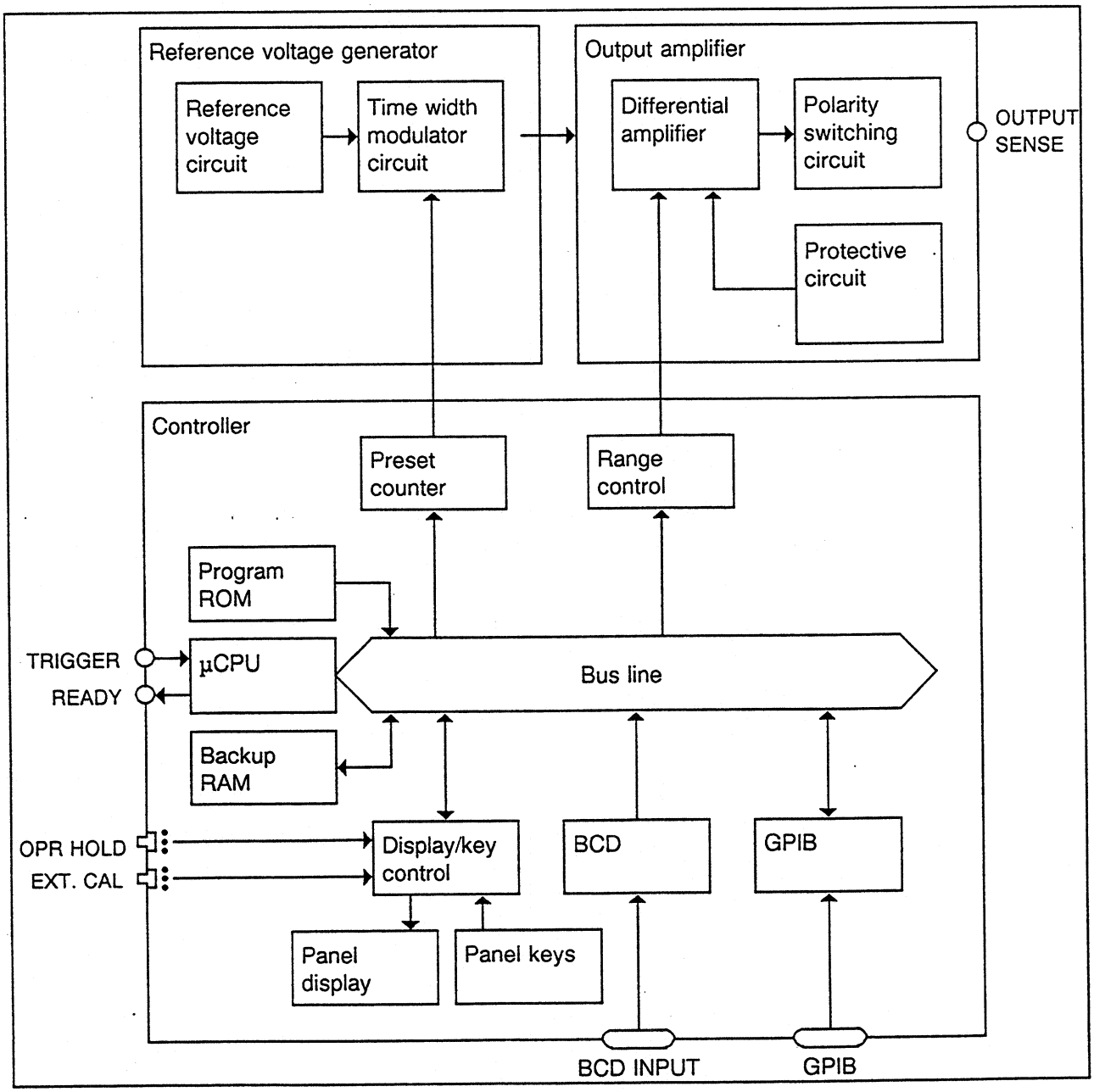


Figure 3-1 Block Diagram

3.2 Block Description

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

$$Es = \frac{T_1}{T_1 + T_2} \cdot Ez$$

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

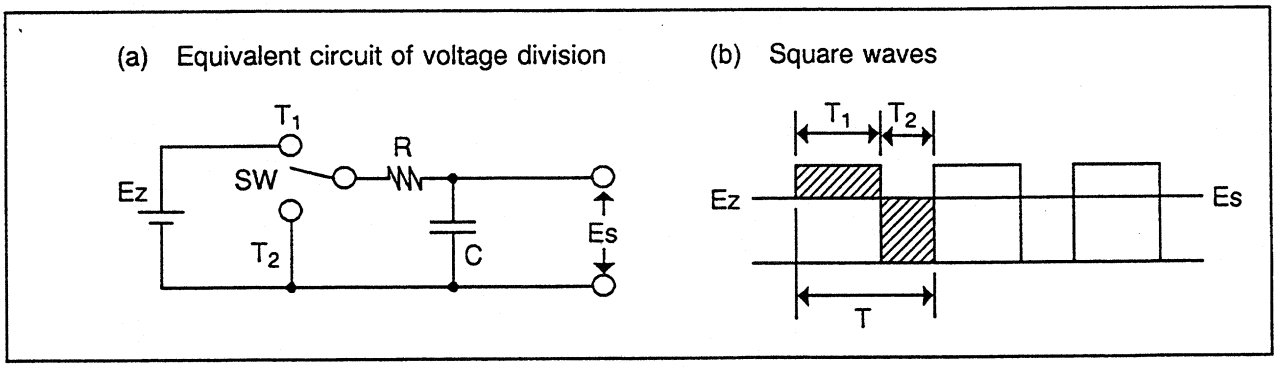


Figure 3-2 Time Division Method

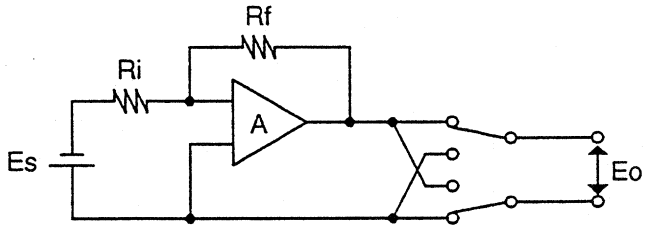
The reference voltage circuit generates reference voltage Ez. The time width modulator circuit generates pulses with pulse width T_1 corresponding to a set output level. Reference voltage Ez is switched and the low-pass filter averages the pulses to generate a required voltage.

(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 Rf, R_1, and Rs.

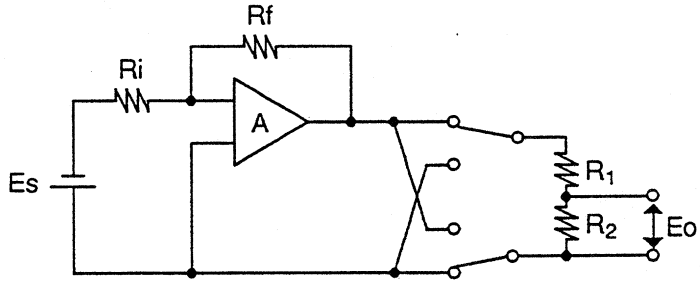
(a) 1V and 10V ranges



$$Eo = \frac{Rf}{Ri} \cdot Es$$

Polarity switching circuit (connection for positive polarity)

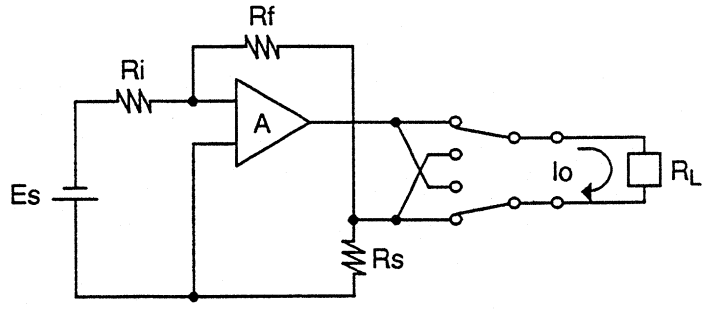
(b) 10mV and 100mV ranges



$$Eo = -\frac{Rf}{Ri} \cdot \frac{R_2}{R_1 + R_2} \cdot Es$$

Polarity switching circuit (connection for positive polarity)

(c) 1mA, 10mA, and 100mA ranges



$$Io = -\frac{Rf}{Ri} \cdot \frac{1}{Rs} \cdot Es$$

Polarity switching circuit (connection for positive polarity)

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

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 TEKTRONIX 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

4.2.1 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	20Hz to 20MHz	Measure the output noise using an oscilloscope or high-sensitive oscilloscope.
	06.000mV	5μVp-p	10μVp-p	3mVp-p	
	060.00mV	15μVp-p	30μVp-p		
	0.6000V	80μVp-p	150μVp-p		
	06.000V	200μVp-p	500μVp-p		
	0.0000mA	30nAp-p	150nAp-p	6μAp-p	
	00.000mA	300nAp-p	400nAp-p		
	000.00mA	3μAp-p	4μAp-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.

4.2.2 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			
	32.000V *	31.98740V to 32.01260V			
Output current	0.0000mA	-0.0003mA to 0.0003mA			Measure the output current using an ammeter.
	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			
	160.00mA	159.914mA to 160.086mA			
Output noise		DC to 100Hz	DC to 10kHz	20Hz to 20MHz	Measure the output noise using an oscilloscope or high-sensitive oscilloscope.
	08.000mV	5μVp-p	10μVp-p	3mVp-p	
	080.00mV	15μVp-p	30μVp-p		
	0.8000V	80μVp-p	150μVp-p		
	08.000V	200μVp-p	500μVp-p		
	16.000V*	400μVp-p	1mVp-p		
	0.0000mA	30nAp-p	150nAp-p	6μAp-p	
	00.000mA	300nAp-p	400nAp-p		
	000.00mA	3μAp-p	4μAp-p		
Voltage limiter	Must support 1 to 28Vdc setup.				Check the voltage limiter operation using a DC voltmeter.
Current limiter	Must support 5 to 160mA 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.

4.3 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.

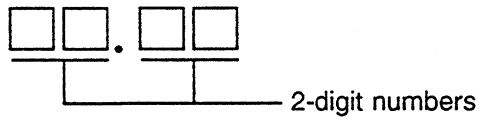
(4) Preheat the system at least 2 hours before you start the test.
Each tester must also be preheated for the specified time.

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):



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.

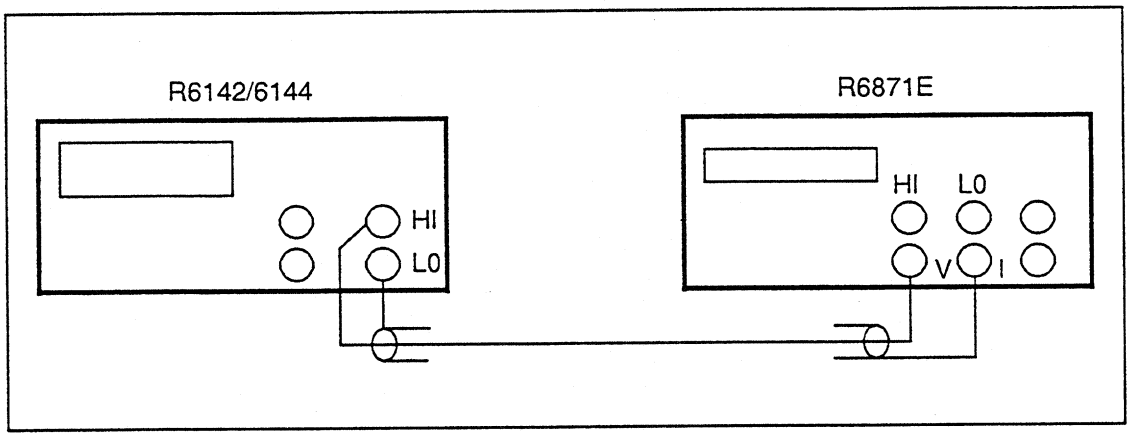


Figure 4-1 Cable Connection for Output Voltage Test

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".

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.

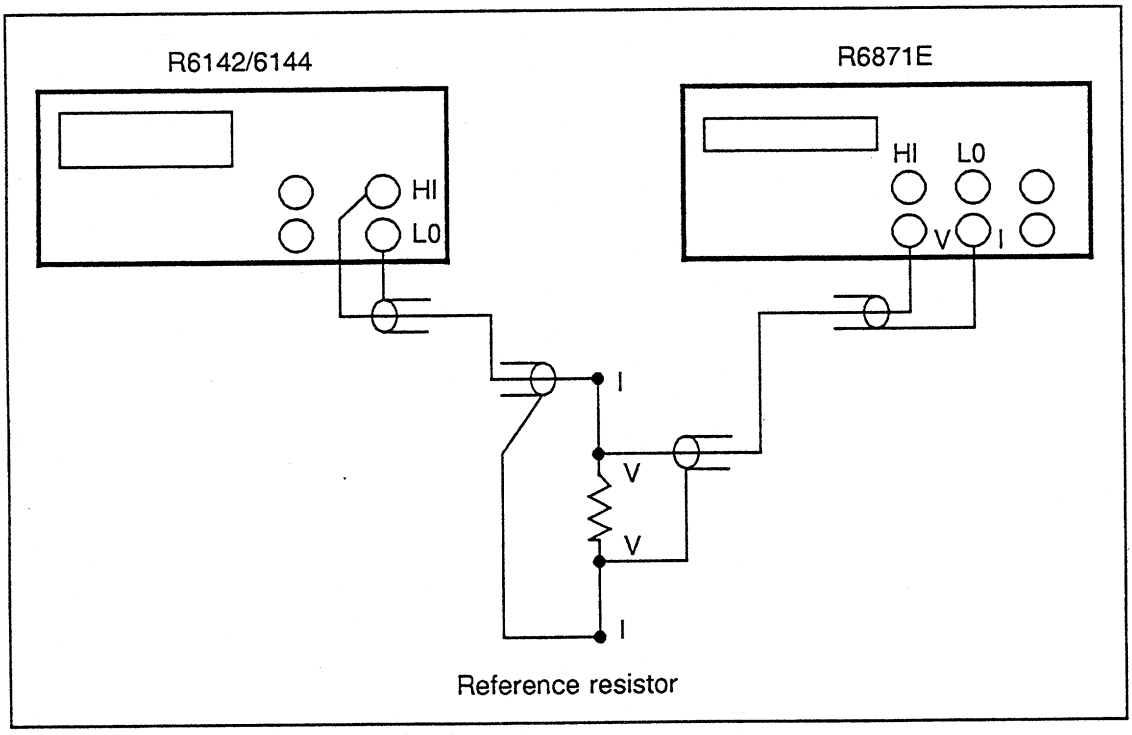


Figure 4-2 Cable Connection for Output Current Test

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

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		-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		-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

4.3.5 Output Noise Test

Procedure:

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

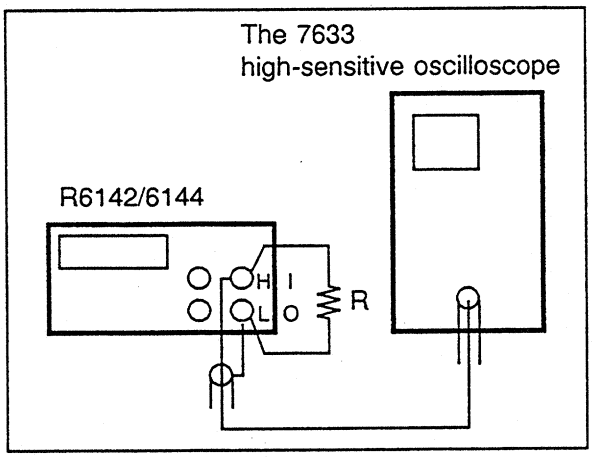


Figure 4-3 Cable Connection for Low-frequency Noise Voltage Measurement

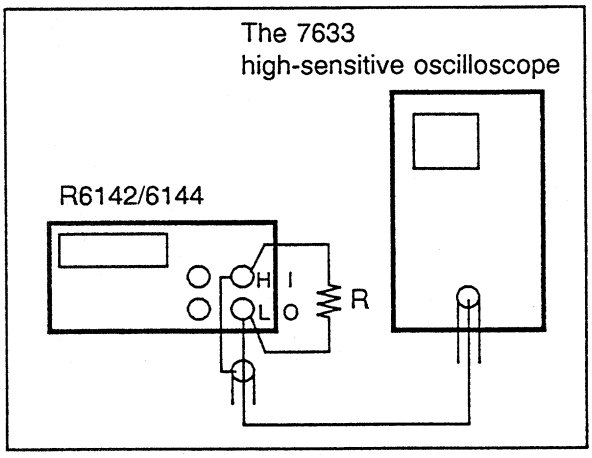


Figure 4-4 Cable Connection for Low-frequency Noise Current Measurement

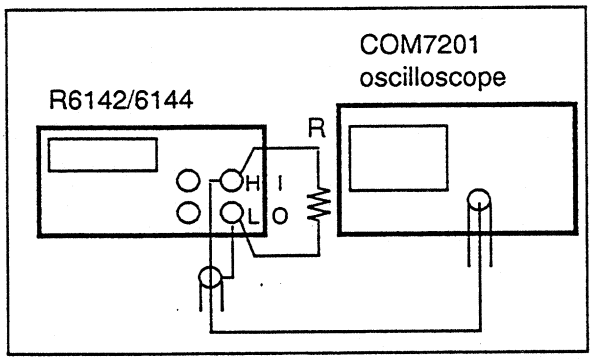


Figure 4-5 Cable Connection for High-frequency Noise Voltage Measurement

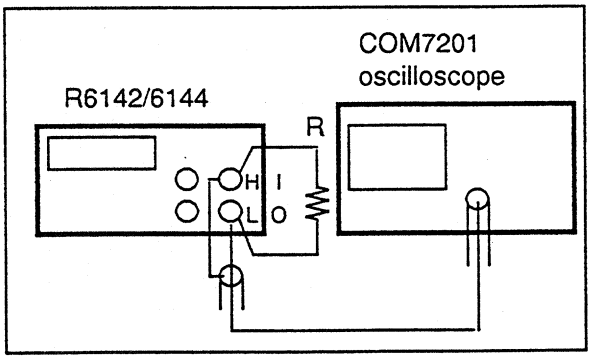


Figure 4-6 Cable Connection for High-frequency Noise Current Measurement

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".

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	10KΩ 1/4W	Fig. 4-3 5μVp-p	Fig. 4-3 10μVp-p	Fig. 4-5 3mVp-p
100mV	060.00mV	10KΩ 1/4W	Fig. 4-3 15μVp-p	Fig. 4-3 30μVp-p	
1V	0.6000V	10Ω 1/4W	Fig. 4-3 80μVp-p	Fig. 4-3 150μVp-p	
10V	06.000V	100Ω 1/2W	Fig. 4-3 200μVp-p	Fig. 4-3 500μVp-p	
1mA	0.0000mA	1KΩ 1/4W	Fig. 4-4 30nAp-p	Fig. 4-4 150nAp-p	Fig. 4-6 6μAp-p
10mA	00.000mA	1KΩ 1/4W	Fig. 4-4 300nAp-p	Fig. 4-4 400nAp-p	
100mA	000.00mA	1KΩ 1/4W	Fig. 4-4 3μAp-p	Fig. 4-4 4μAp-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	10KΩ 1/4W	Fig. 4-3 5μVp-p	Fig. 4-3 10μVp-p	Fig. 4-5 3mVp-p
100mV	080.00mV	10KΩ 1/4W	Fig. 4-3 15μVp-p	Fig. 4-3 30μVp-p	
1V	0.8000V	10Ω 1/4W	Fig. 4-3 80μVp-p	Fig. 4-3 150μVp-p	
10V	08.000V	100Ω 1W	Fig. 4-3 200μVp-p	Fig. 4-3 500μVp-p	
30V	16.000V	200Ω 2W	Fig. 4-3 400μVp-p	Fig. 4-3 1mVp-p	
1mA	0.0000mA	1KΩ 1/4W	Fig. 4-4 30nAp-p	Fig. 4-4 150nAp-p	Fig. 4-6 6μAp-p
10mA	00.000mA	1KΩ 1/4W	Fig. 4-4 300nAp-p	Fig. 4-4 400nAp-p	
100mA	000.00mA	1KΩ 1/4W	Fig. 4-4 3μAp-p	Fig. 4-4 4μAp-p	

4.3.6 Voltage limiter test

Procedure:

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

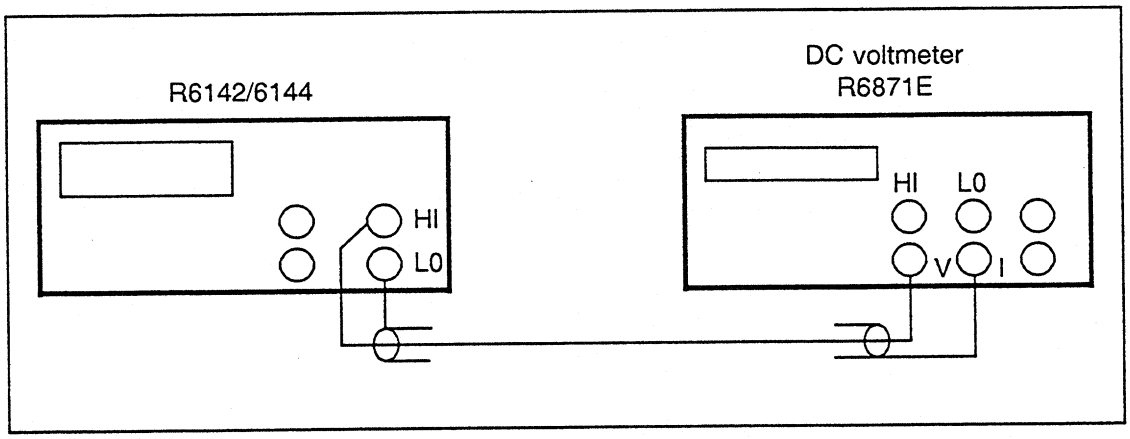


Figure 4-7 Cable Connection for Voltage Limiter Test

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.

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.

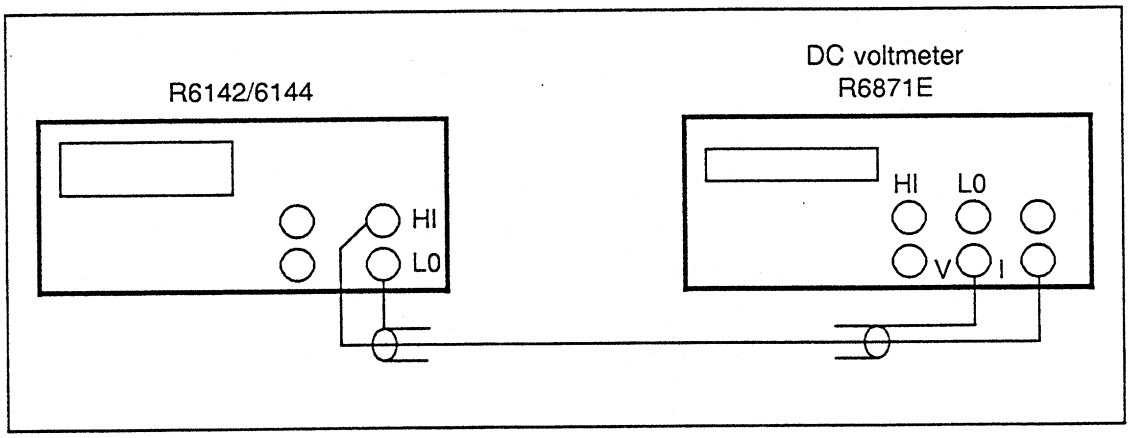


Figure 4-8 Cable Connection for Current Limiter Test

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.

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		

4.3.8 GPIB interface test

Procedure:

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

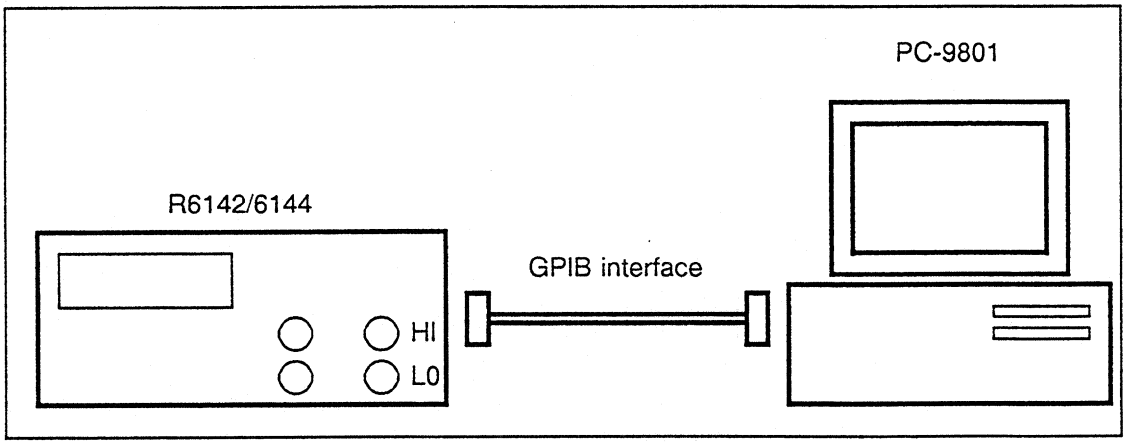


Figure 4-9 Cable Connection for GPIB Interface Test

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".

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.

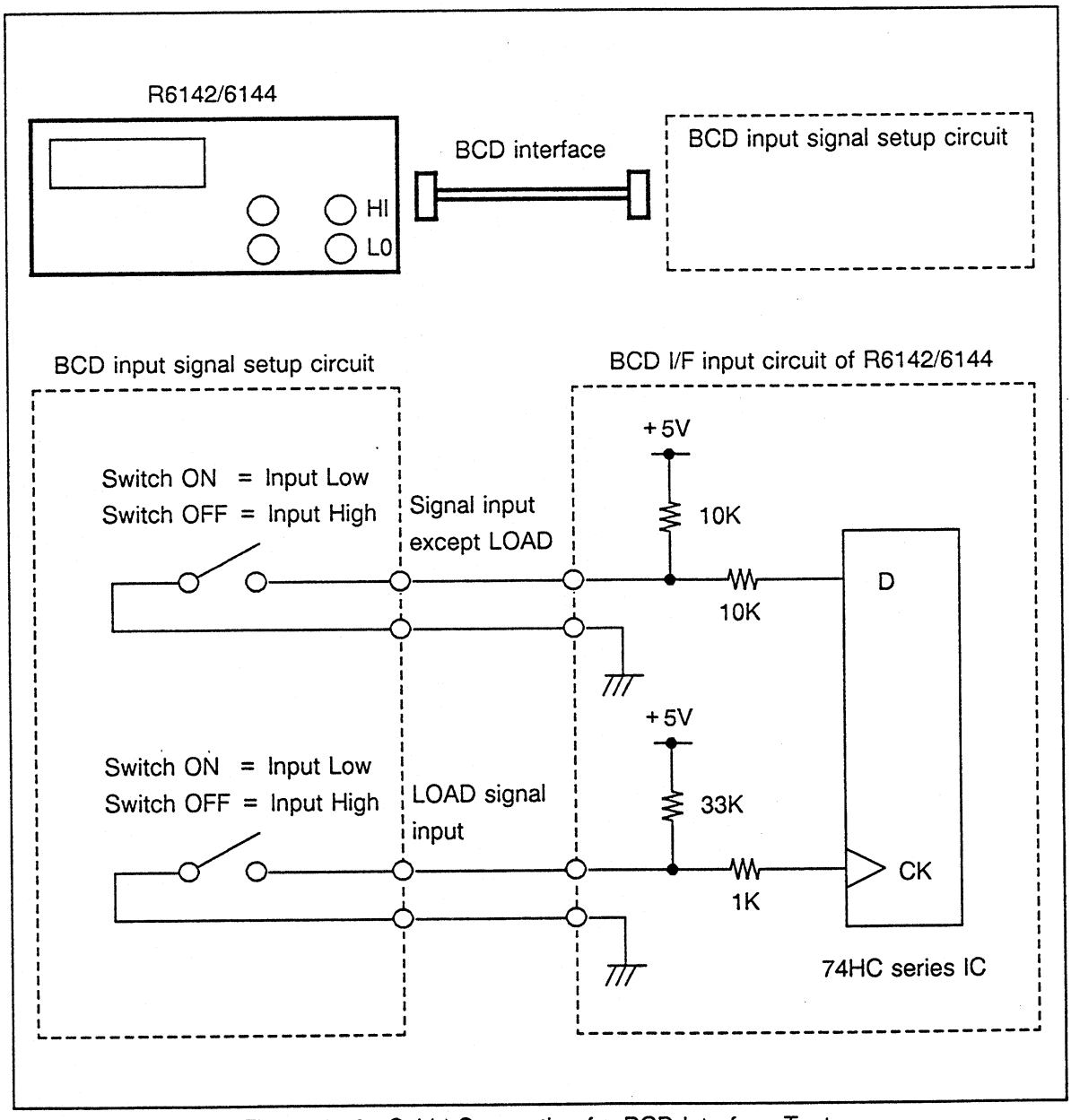


Figure 4-10 Cable Connection for BCD Interface Test

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".

Table 4-21 Parameter Setting for Ready Signal Test

R6142/R6144 operation status				BCD input signal setup status																												
				Output level																		Range								Polarity	Output ON	Load
				10^0 digit				10^1 digit				10^2 digit				10^3 digit				10^4 digit												
Data	Range	Polarity	Operation	1	2	4	8	1	2	4	8	1	2	4	8	1	2	4	8	1	2	10 mV	100 mV	1 V	10 V	30 V	1. mA	10 mA	100 mA			
1111	10V	+	ON	L	H	H	H	L	H	H	H	L	H	H	H	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	L	L
2222	10V	+	ON	H	L	H	H	H	L	H	H	H	L	H	H	H	L	H	H	H	H	H	H	H	L	H	H	H	H	H	L	L
3333	10V	+	ON	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	H	H	H	H	H	L	H	H	H	H	H	L	L
4444	10V	+	ON	H	H	L	H	H	H	L	H	H	H	L	H	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	L	L
5555	10V	+	ON	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	L	L
6666	10V	+	ON	H	L	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	H	H	H	H	L	H	H	H	H	H	L	L
7777	10V	+	ON	L	L	L	H	L	L	L	H	L	L	L	H	L	L	L	H	H	H	H	H	H	L	H	H	H	H	H	L	L
8888	10V	+	ON	H	H	H	L	H	H	H	L	H	H	H	L	H	H	H	L	H	H	H	H	H	L	H	H	H	H	H	L	L
9999	10V	+	ON	L	H	H	L	L	H	H	L	L	H	H	L	L	H	H	L	H	H	H	H	H	L	H	H	H	H	H	L	L
10000	10V	+	ON	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	L	H	H	H	H	H	L	L
20000	30V	+	ON	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	L	H	H	H	H	L	L
30000	30V	+	ON	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	L	H	H	H	H	L	H	H	H	H	L	L
10000	10mV	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	L	H	H	H	H	H	H	H	L	H	L
10000	100mV	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	L	H	H	H	H	H	H	L	H	L
10000	1V	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	L	H	H	H	H	H	L	H	L
10000	1mA	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	L	H	H	L	H	L
10000	10mA	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	L	H	L
10000	100mA	-	OFF	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	L	L	H	L

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.

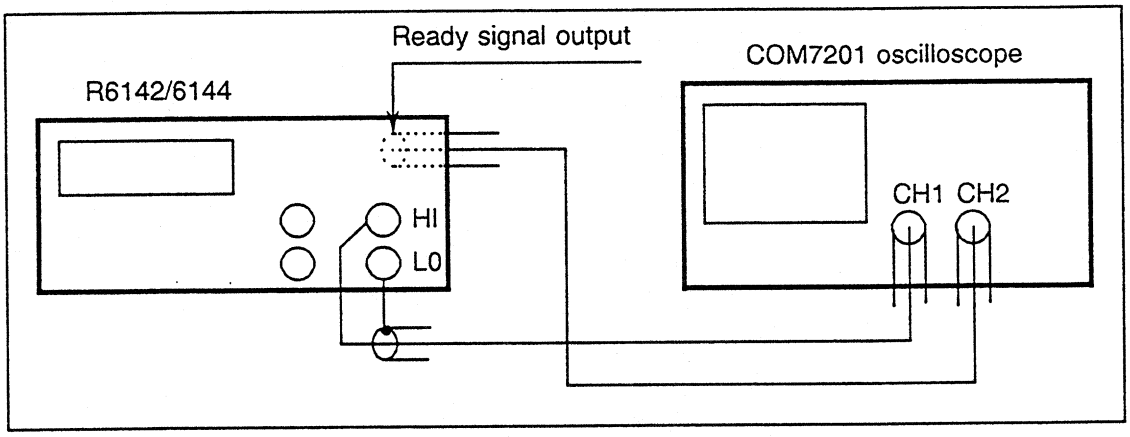


Figure 4-11 Cable Connection for Ready Signal Test

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

③ Change the R6142/6144 output from its initial value to the final value. Measure the time (t1) between the rise-up of output waveform and the fall of Ready signal waveform. Also, measure the pulse width (t2) of the Ready signal.

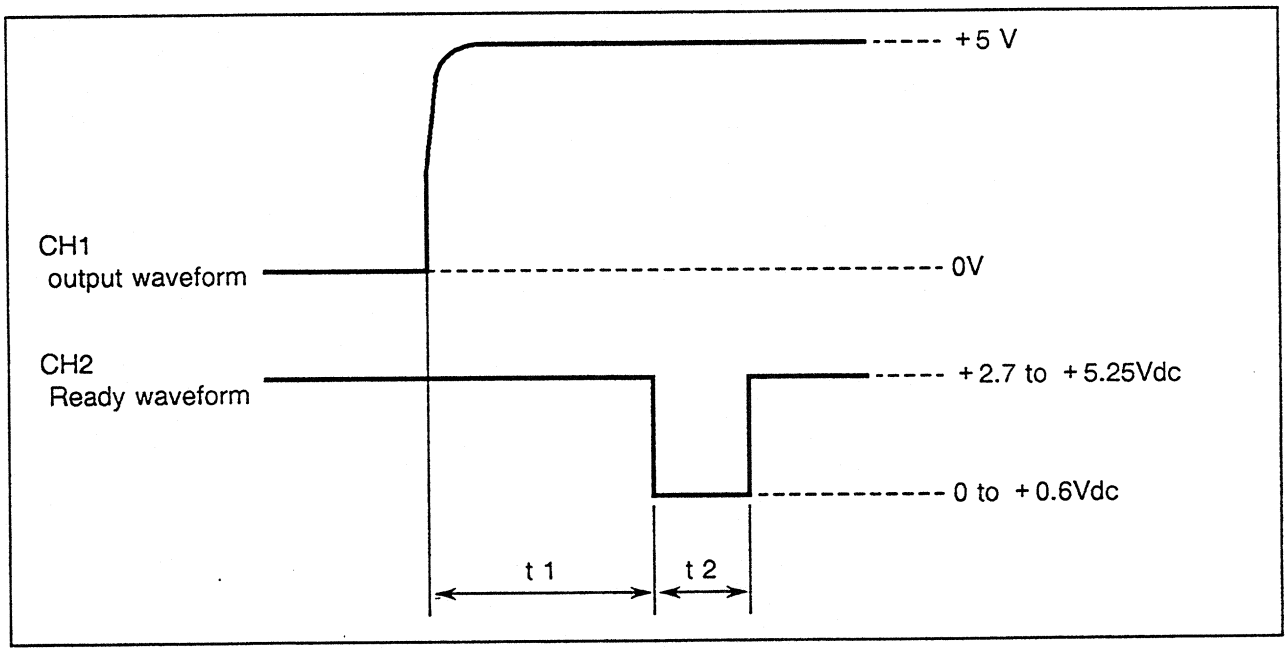


Figure 4-12 Waveform Timing

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
t1	Approx. 50msec
t2	Approx. 10msec

4.3.11 Trigger signal test

Procedure:

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

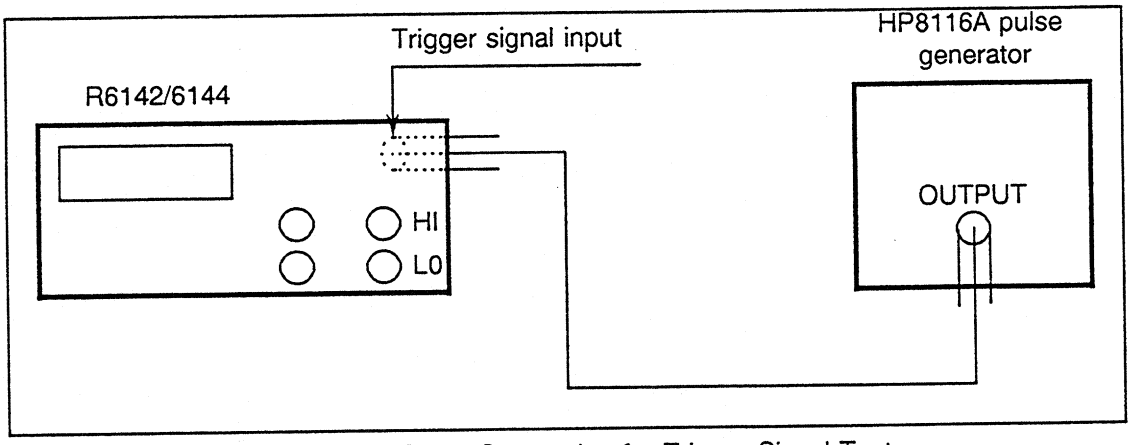


Figure 4-13 Cable Connection for Trigger Signal Test

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 I	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.

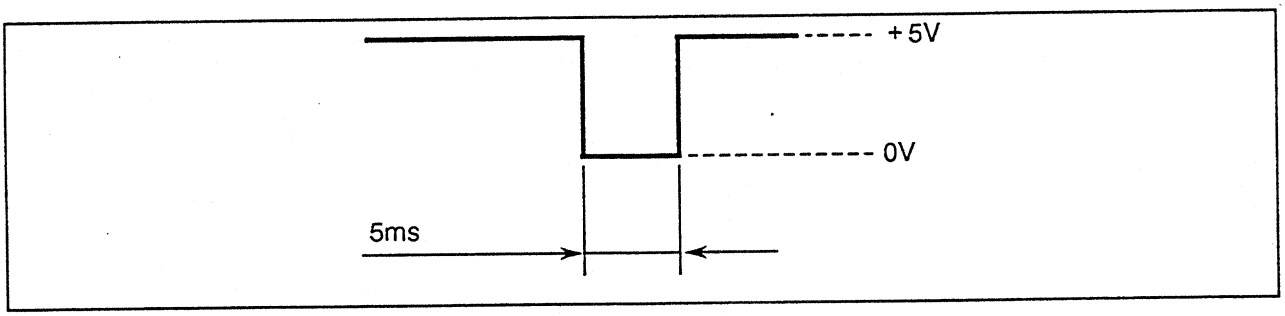


Figure 4-14 Output Waveforms

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".

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		
	11.999V	11.993400V	12.004600V		
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		

(2 of 3)

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

(3 of 3)

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			

(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		
	32.000V *	31.98740V	32.01260V		
Output current	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

(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

(3 of 3)

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. 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°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.

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	

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

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

5.3.1 Output voltage

Procedure:

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

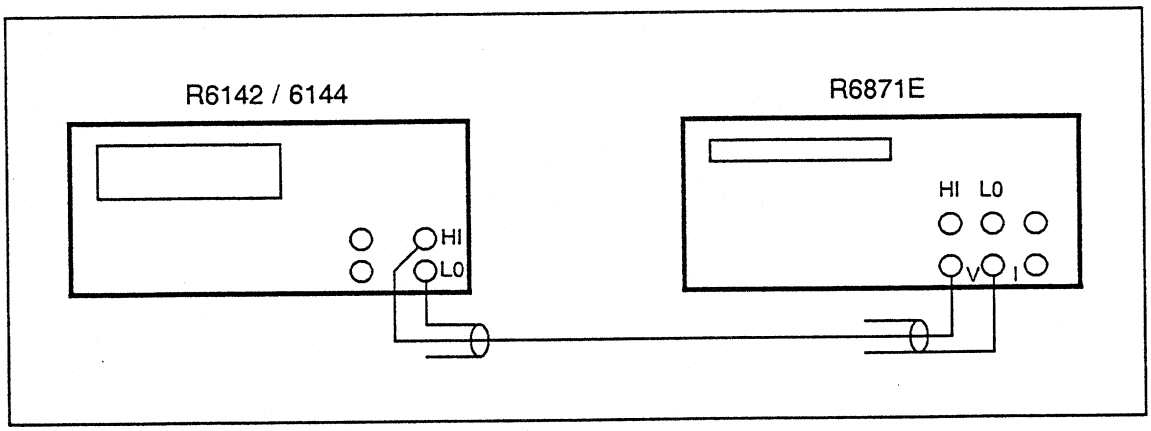


Figure 5-1 Cable Connection for Output Voltage Calibration

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

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 △ 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 △ 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.

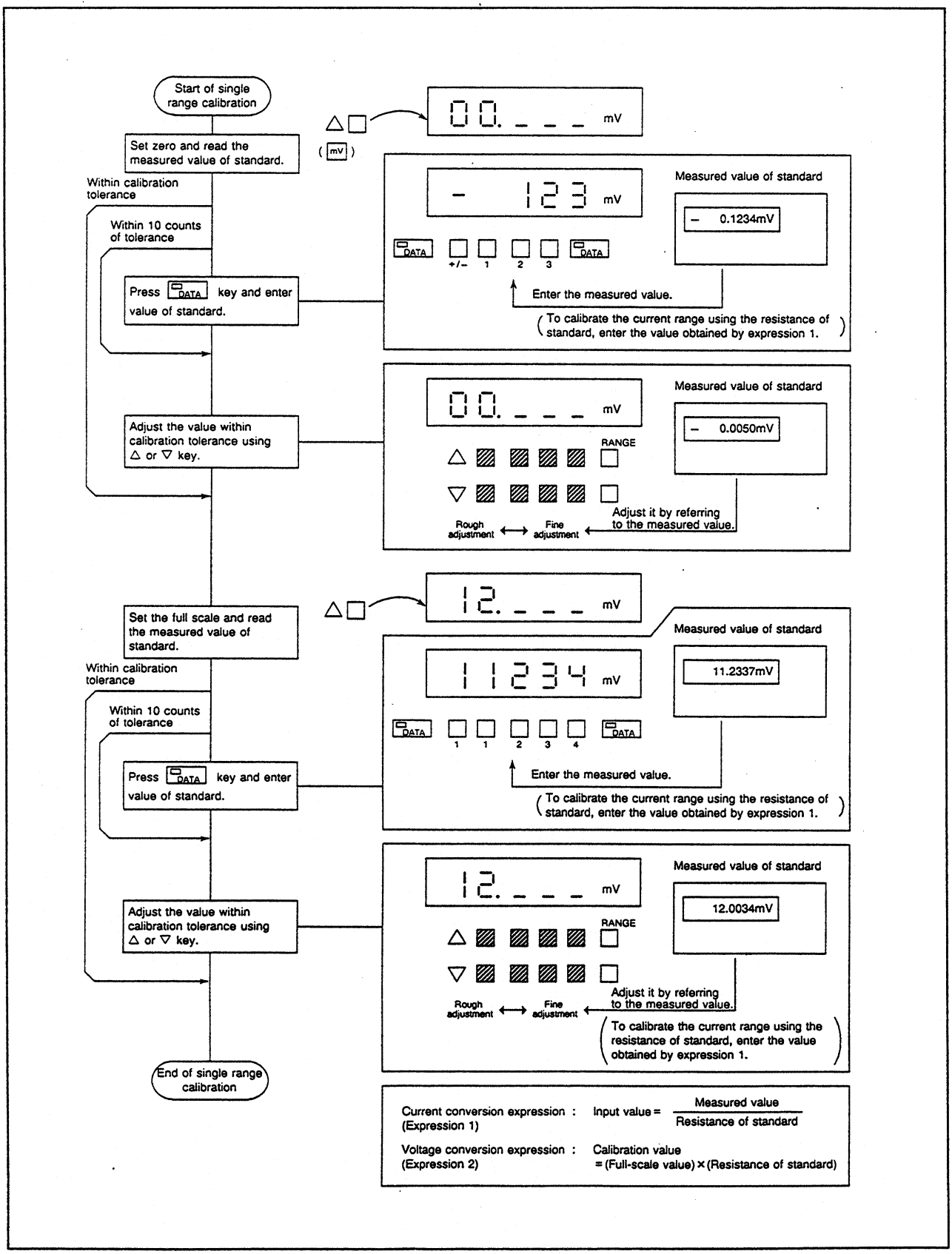


Figure 5-2 Calibration of A Single Range using R6142

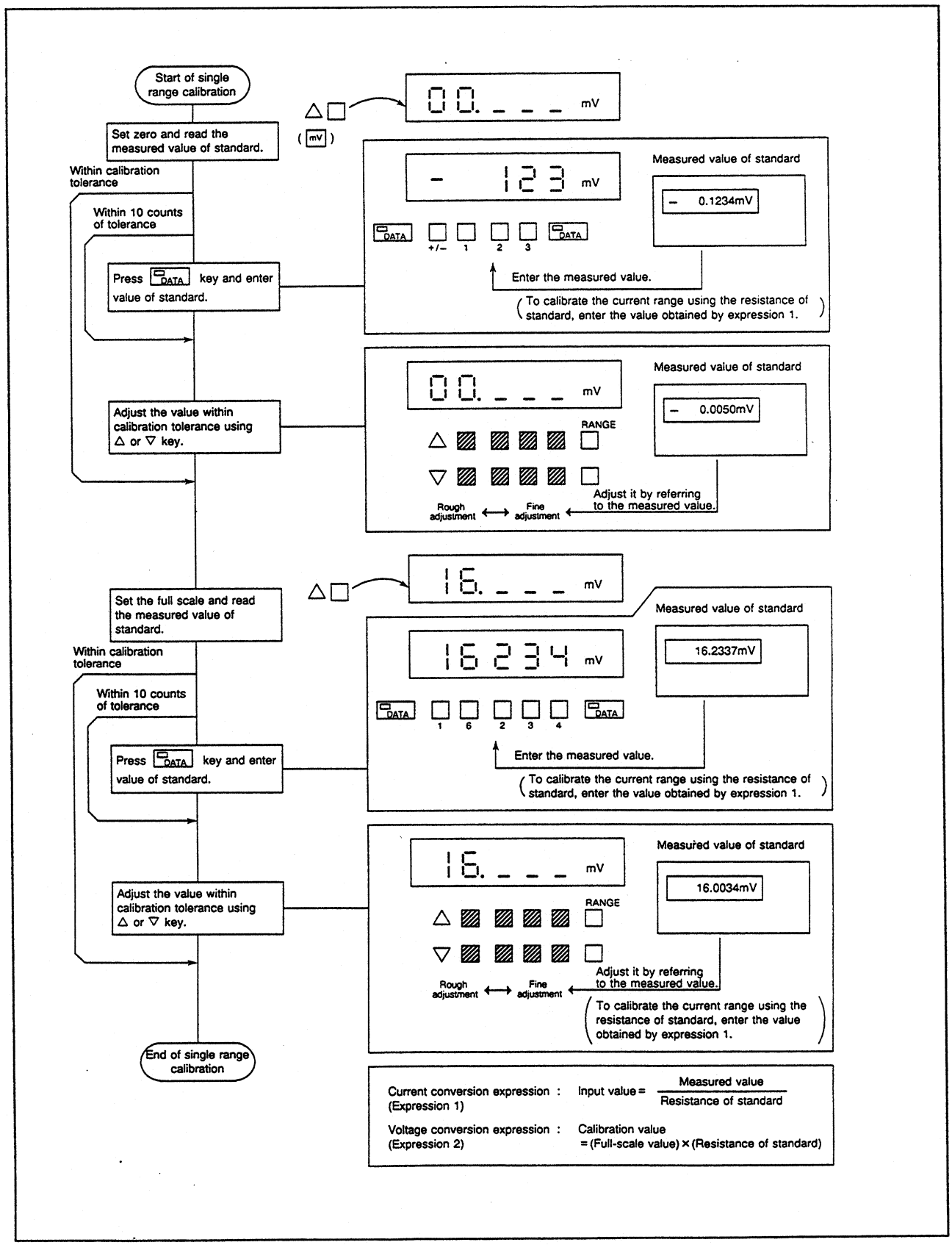


Figure 5-3 Calibration of A Single Range using R6144

5.3.2 Calibration of output current

Procedure:

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

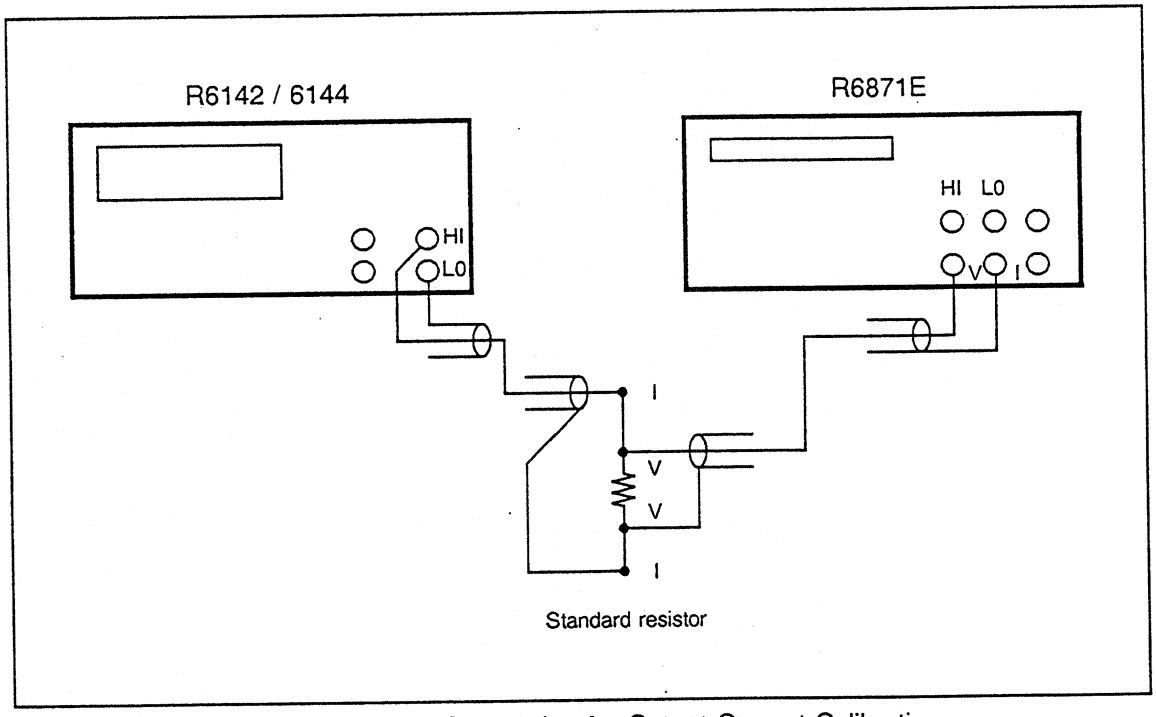


Figure 5-4 Cable Connection for Output Current Calibration

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

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	1Ω
119.99mA	160.00mA		

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 △ 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 △ 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.

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		

(2) R6144

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

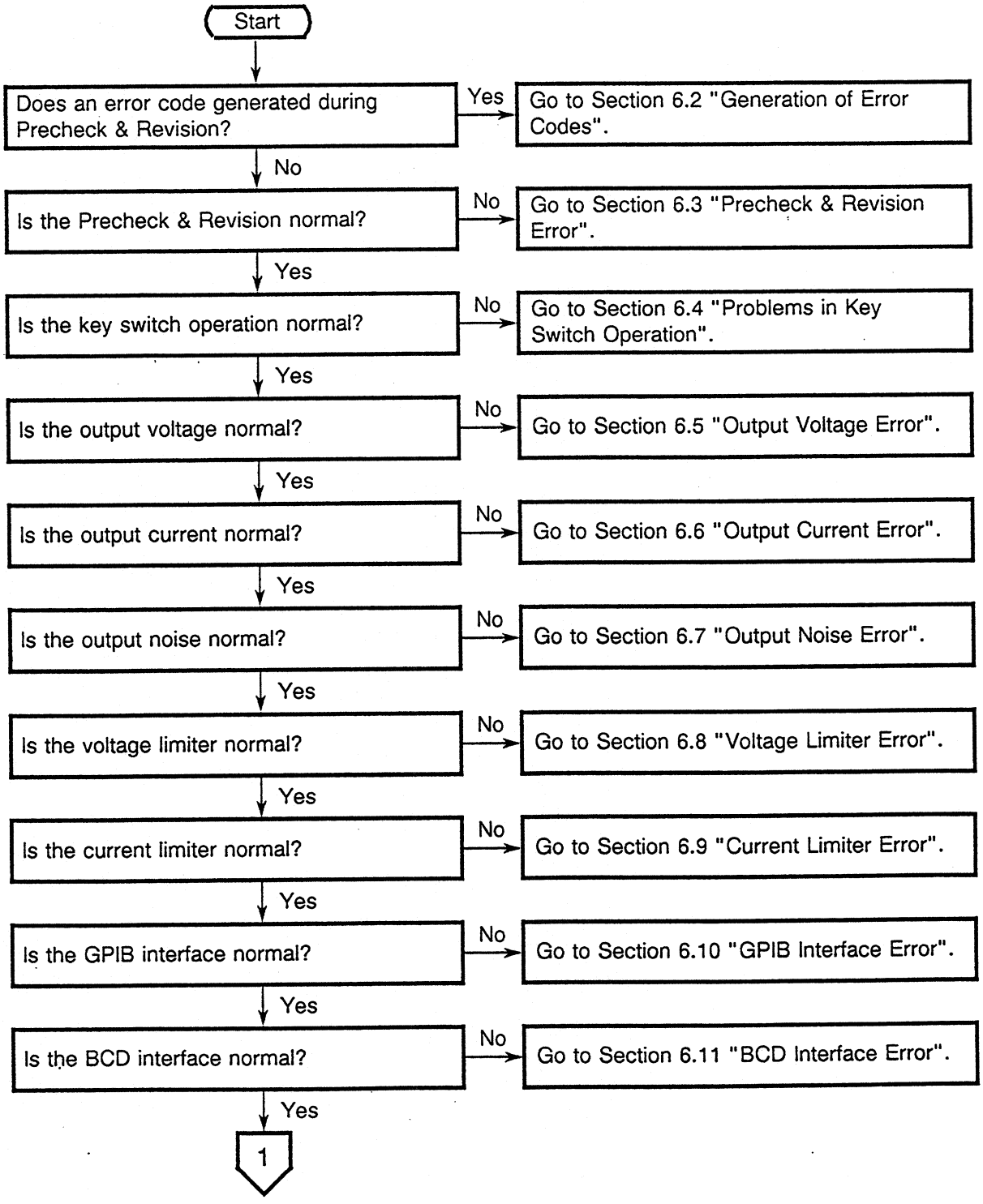
Parameter	Setting	Tolerance limit		Measured value	Reference
		(MIN.)	(MAX.)		
Output voltage	00.000mV	−0.5μV	0.5μV		
	16.000mV	15.999mV	16.001mV		
	000.00mV	−5μV	5μV		
	160.00mV	159.99μV	160.01μV		
	0.0000V	−50μV	50μV		
	1.6000V	1.5999V	1.6001V		
	00.000mV	−500μV	500μV		
	16.000V	15.999V	16.001V		
	00.000V*	−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		

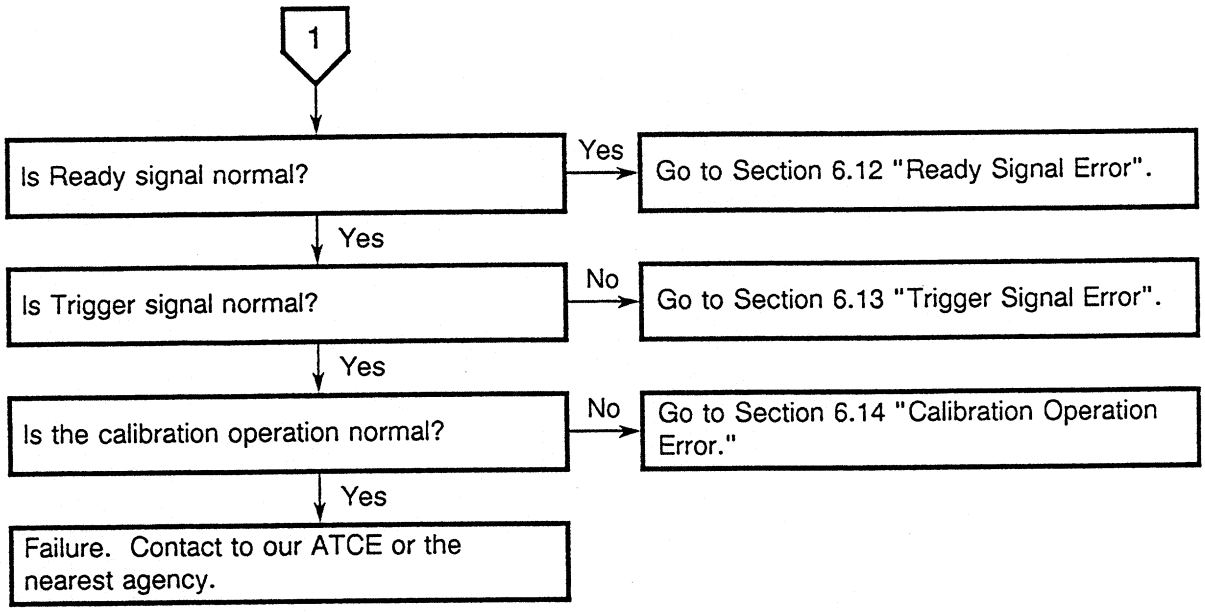
*30V range

6. TROUBLESHOOTING

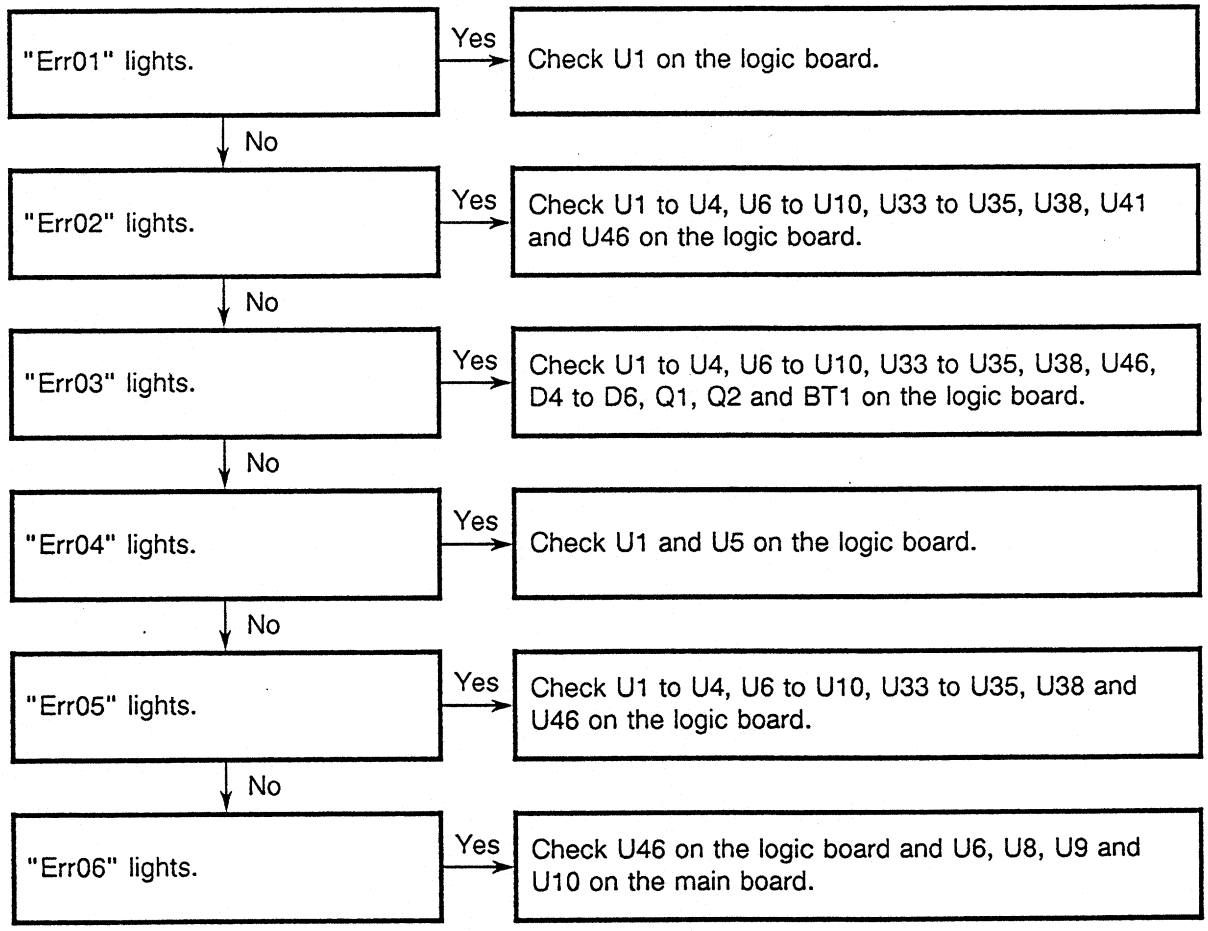
This chapter explains the standard troubleshooting procedure that should be used if the Performance Test (Chapter 4) or Adjustment (Chapter 5) has failed.

6.1 Troubleshooting Flow

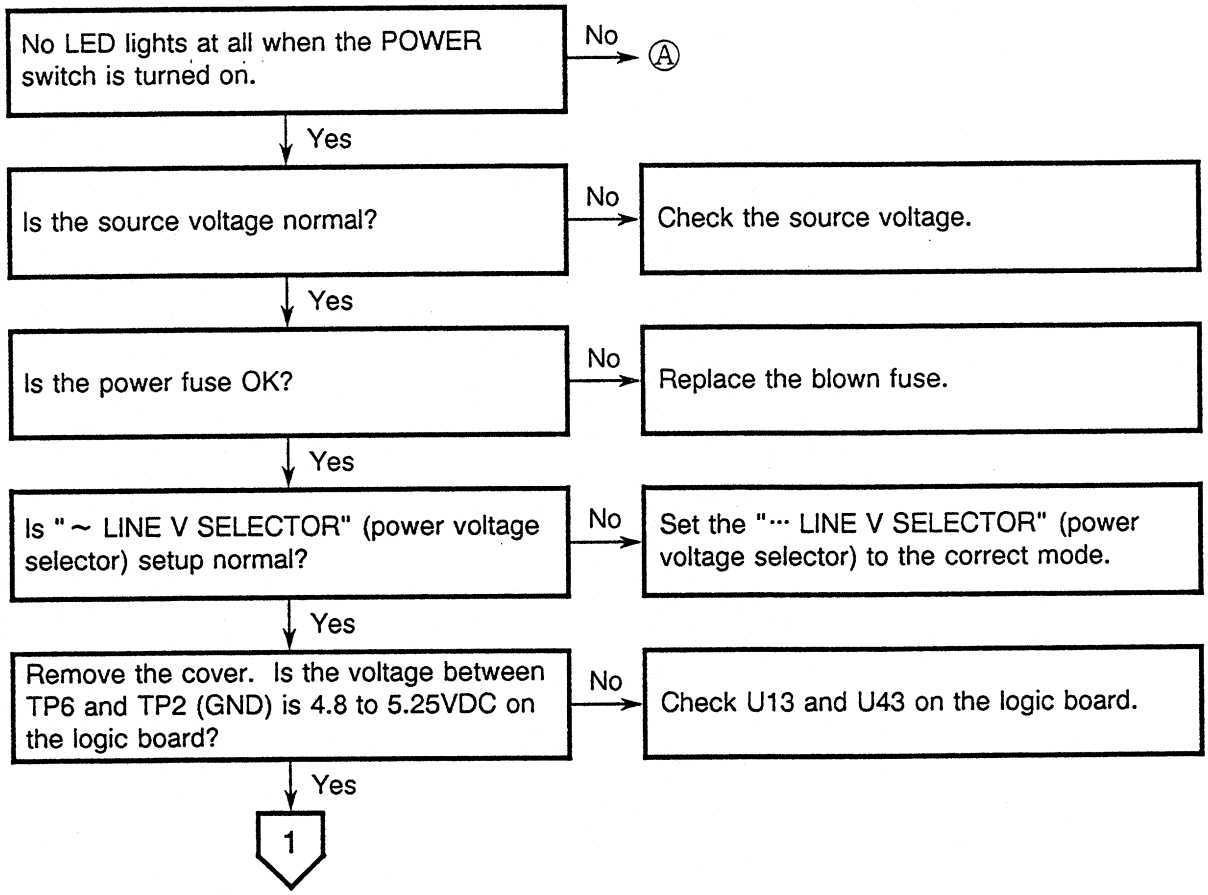


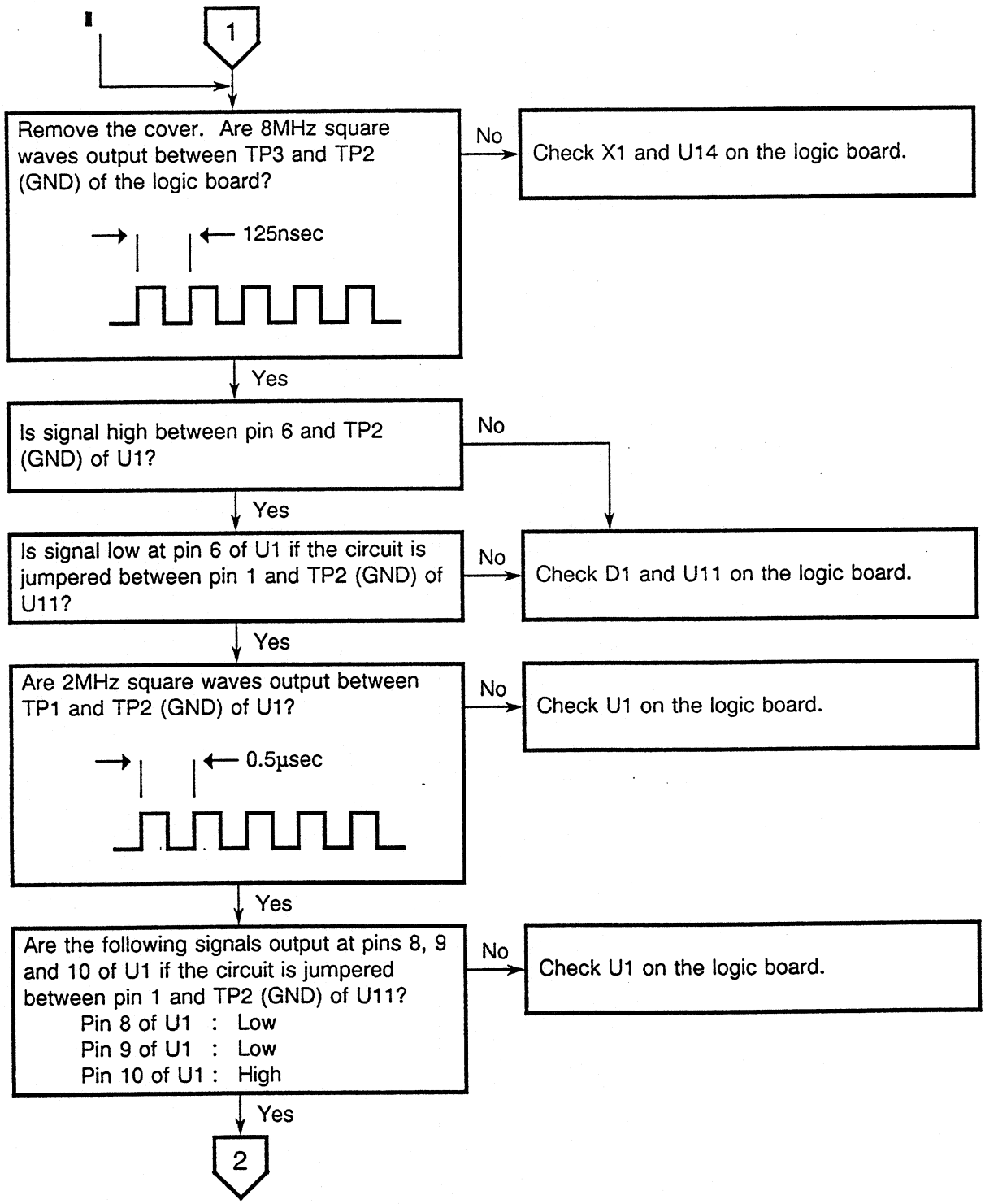

1
Is Ready signal normal?
Yes
Go to Section 6.12 "Ready Signal Error".
Yes
Is Trigger signal normal?
No
Go to Section 6.13 "Trigger Signal Error".
Yes
Is the calibration operation normal?
No
Go to Section 6.14 "Calibration Operation Error."
Yes
Failure. Contact to our ATCE or the nearest agency.

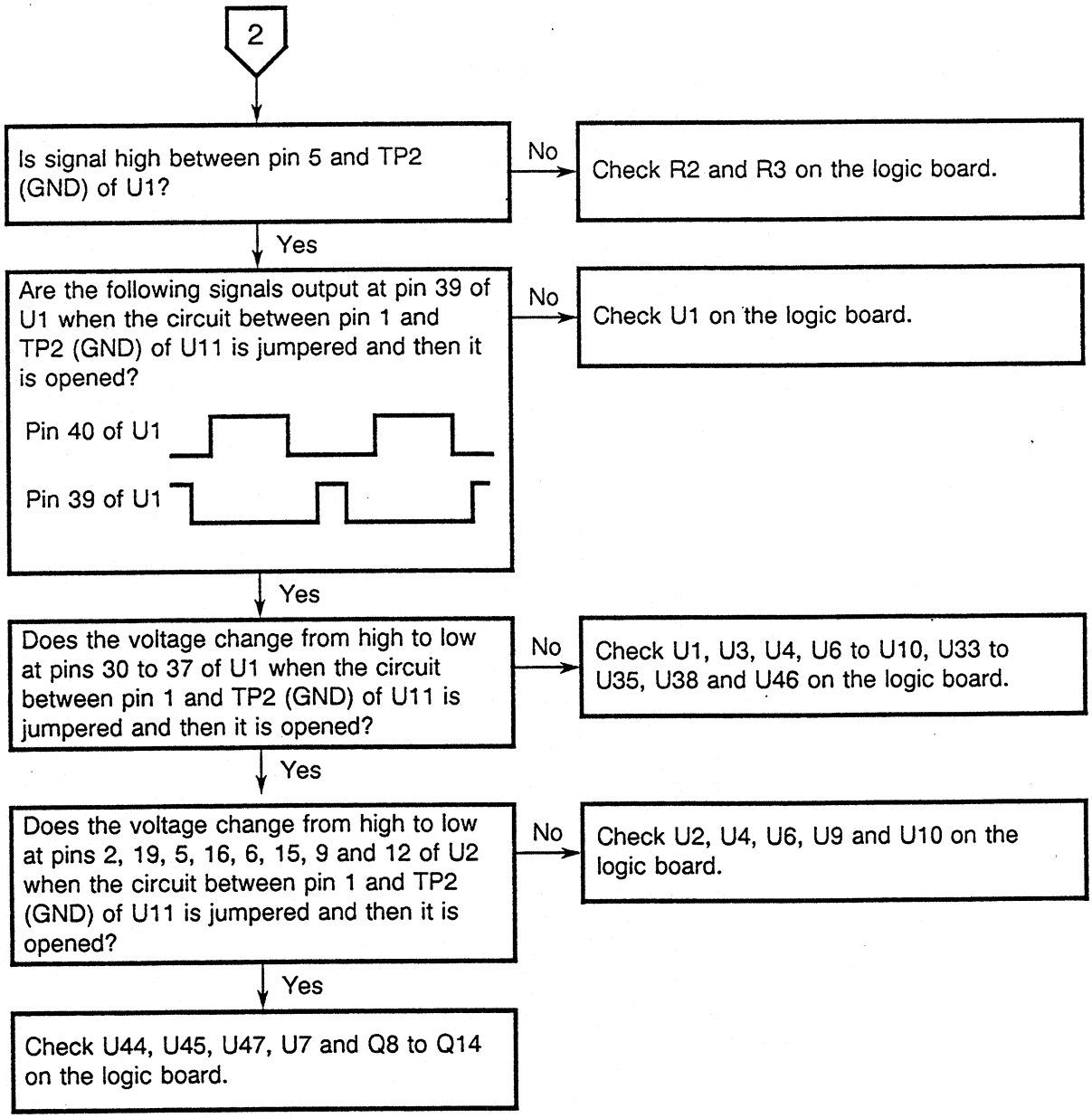
6.2 Generation of Error Codes



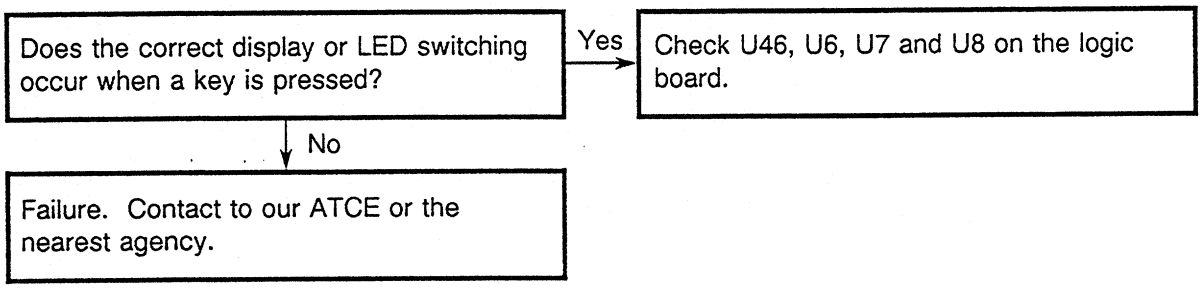
6.3 Precheck & Revision Error



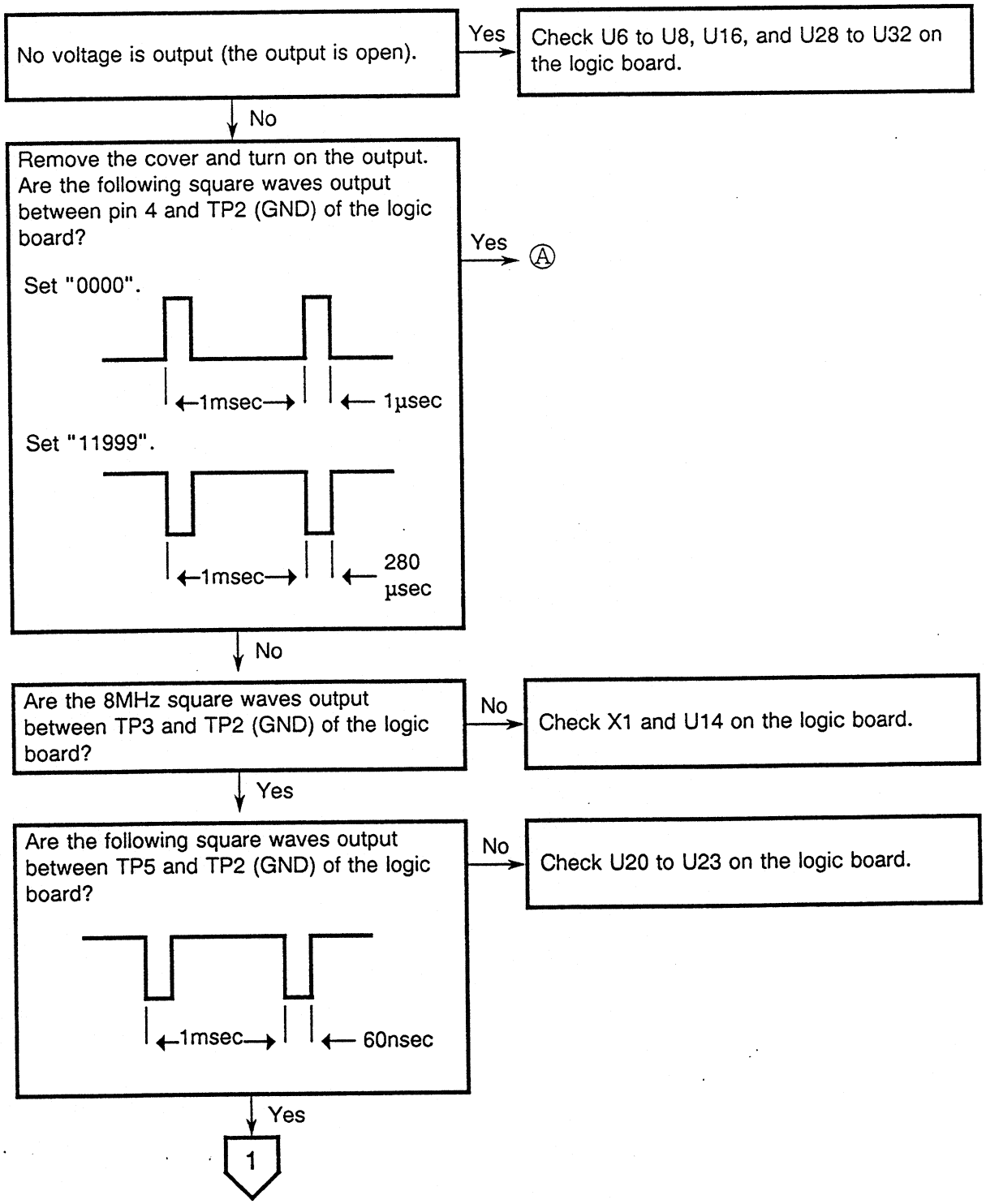

1
Remove the cover. Are 8MHz square waves output between TP3 and TP2 (GND) of the logic board?
125nsec
No
Check X1 and U14 on the logic board.
Yes
Is signal high between pin 6 and TP2 (GND) of U1?
No
Yes
Is signal low at pin 6 of U1 if the circuit is jumpered between pin 1 and TP2 (GND) of U11?
No
Check D1 and U11 on the logic board.
Yes
Are 2MHz square waves output between TP1 and TP2 (GND) of U1?
0.5µsec
No
Check U1 on the logic board.
Yes
Are the following signals output at pins 8, 9 and 10 of U1 if the circuit is jumpered between pin 1 and TP2 (GND) of U11?
Pin 8 of U1 : Low
Pin 9 of U1 : Low
Pin 10 of U1 : High
No
Check U1 on the logic board.
Yes
2


2
Is signal high between pin 5 and TP2 (GND) of U1?
No
Check R2 and R3 on the logic board.
Yes
Are the following signals output at pin 39 of U1 when the circuit between pin 1 and TP2 (GND) of U11 is jumpered and then it is opened?
Pin 40 of U1
Pin 39 of U1
No
Check U1 on the logic board.
Yes
Does the voltage change from high to low at pins 30 to 37 of U1 when the circuit between pin 1 and TP2 (GND) of U11 is jumpered and then it is opened?
No
Check U1, U3, U4, U6 to U10, U33 to U35, U38 and U46 on the logic board.
Yes
Does the voltage change from high to low at pins 2, 19, 5, 16, 6, 15, 9 and 12 of U2 when the circuit between pin 1 and TP2 (GND) of U11 is jumpered and then it is opened?
No
Check U2, U4, U6, U9 and U10 on the logic board.
Yes
Check U44, U45, U47, U7 and Q8 to Q14 on the logic board.

6.4 Problems in Key Switch Operation

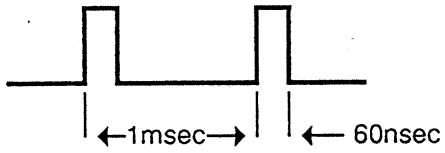


6.5 Output Voltage Error



1

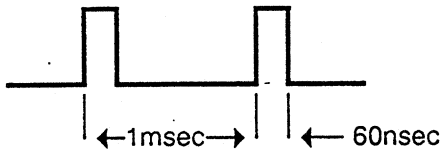
Are the following square waves output between pin 2 and TP2 (GND) of U19 on the logic board?



No → Check U26 on the logic board.

Yes

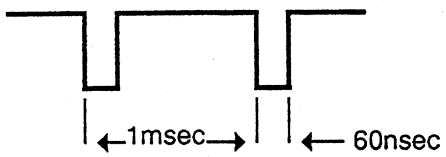
Are the following square waves output between pin 3 and TP2 (GND) of U19 on the logic board?



Yes → Check U19 on the logic board.

No

Are the following square waves output between pin 19 and TP2 (GND) of U25 on the logic board?



Yes → Check U26 on the logic board.

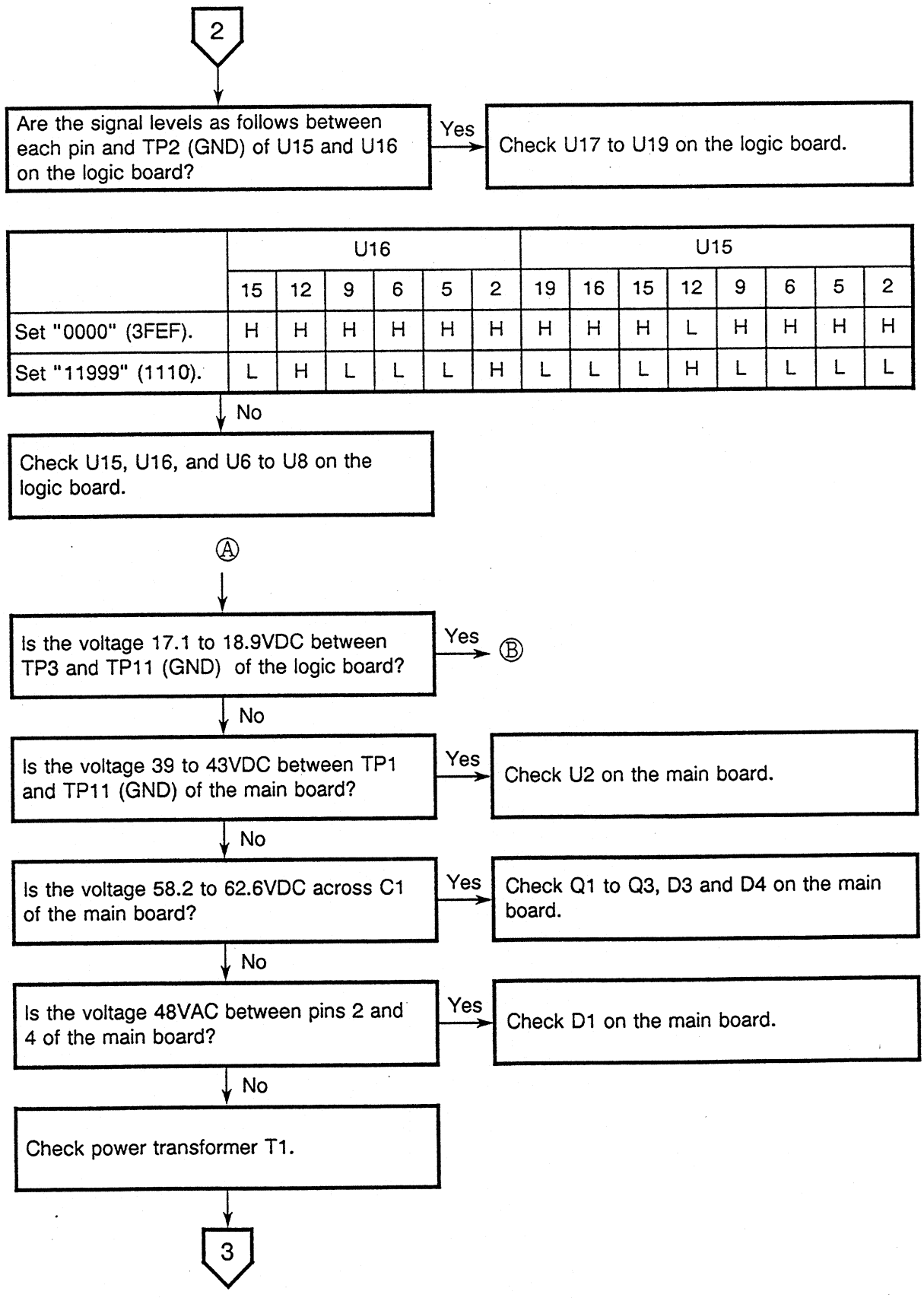
No

Are the signal levels as follows between each pin and TP2 (GND) of U17 and U18 on the logic board?

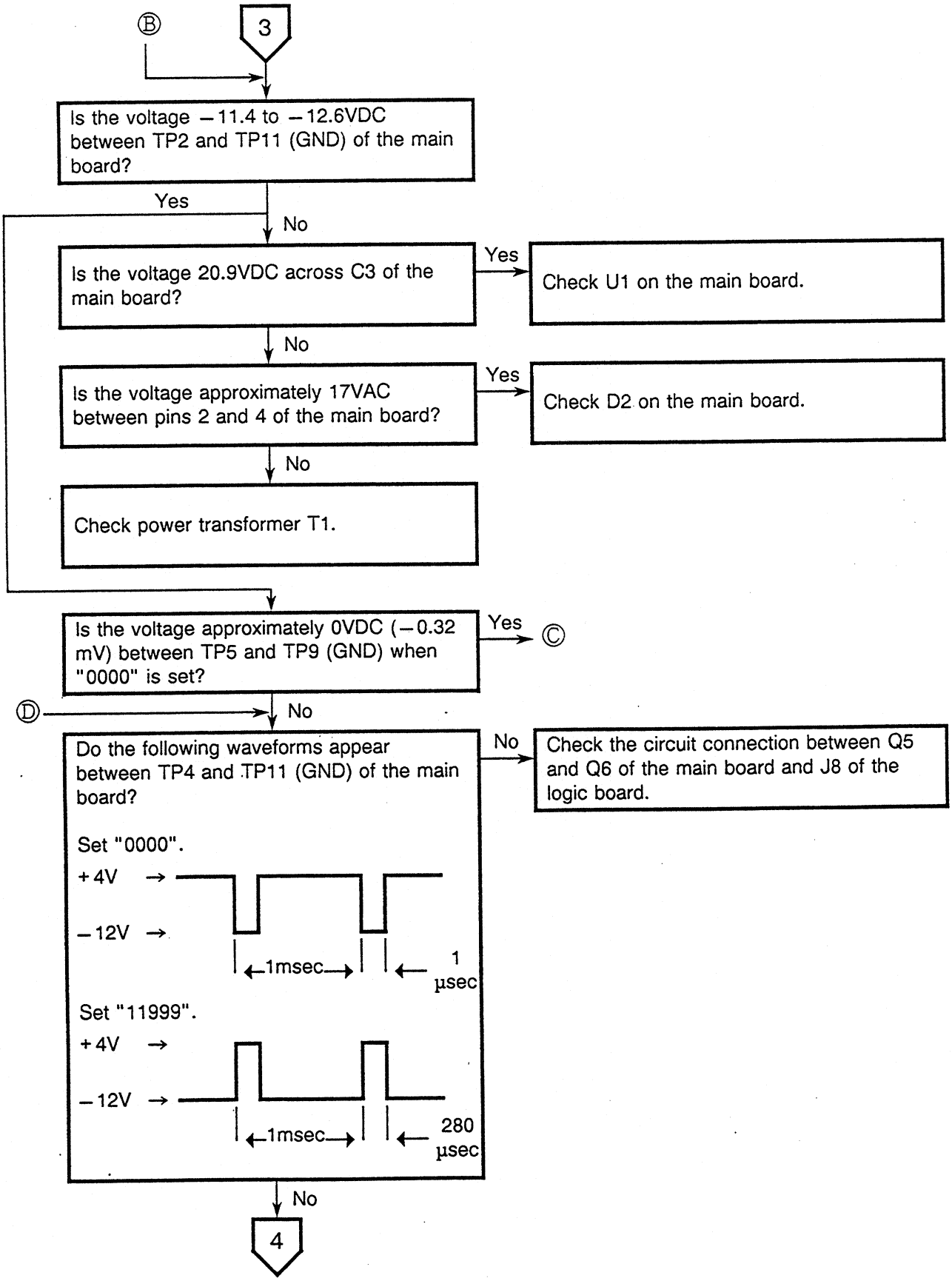
Yes → Check U24 and U25 on the logic board.

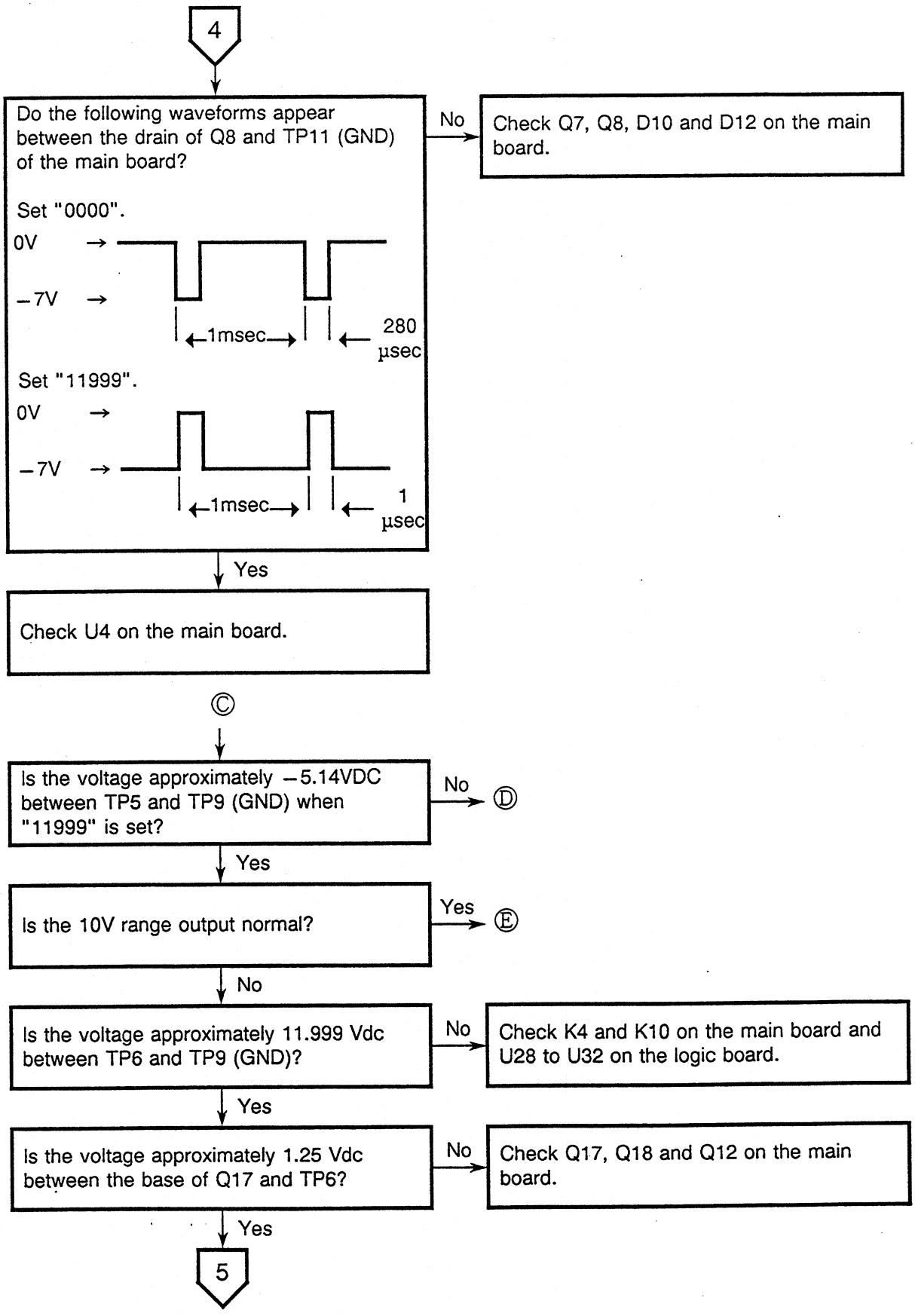
	U18						U17							
	15	12	9	6	5	2	19	16	15	12	9	6	5	2
Set "0000" (3EFF).	H	H	H	H	H	H	H	H	H	L	H	H	H	H
Set "11999" (1110).	L	H	L	L	L	H	L	L	L	H	L	L	L	L

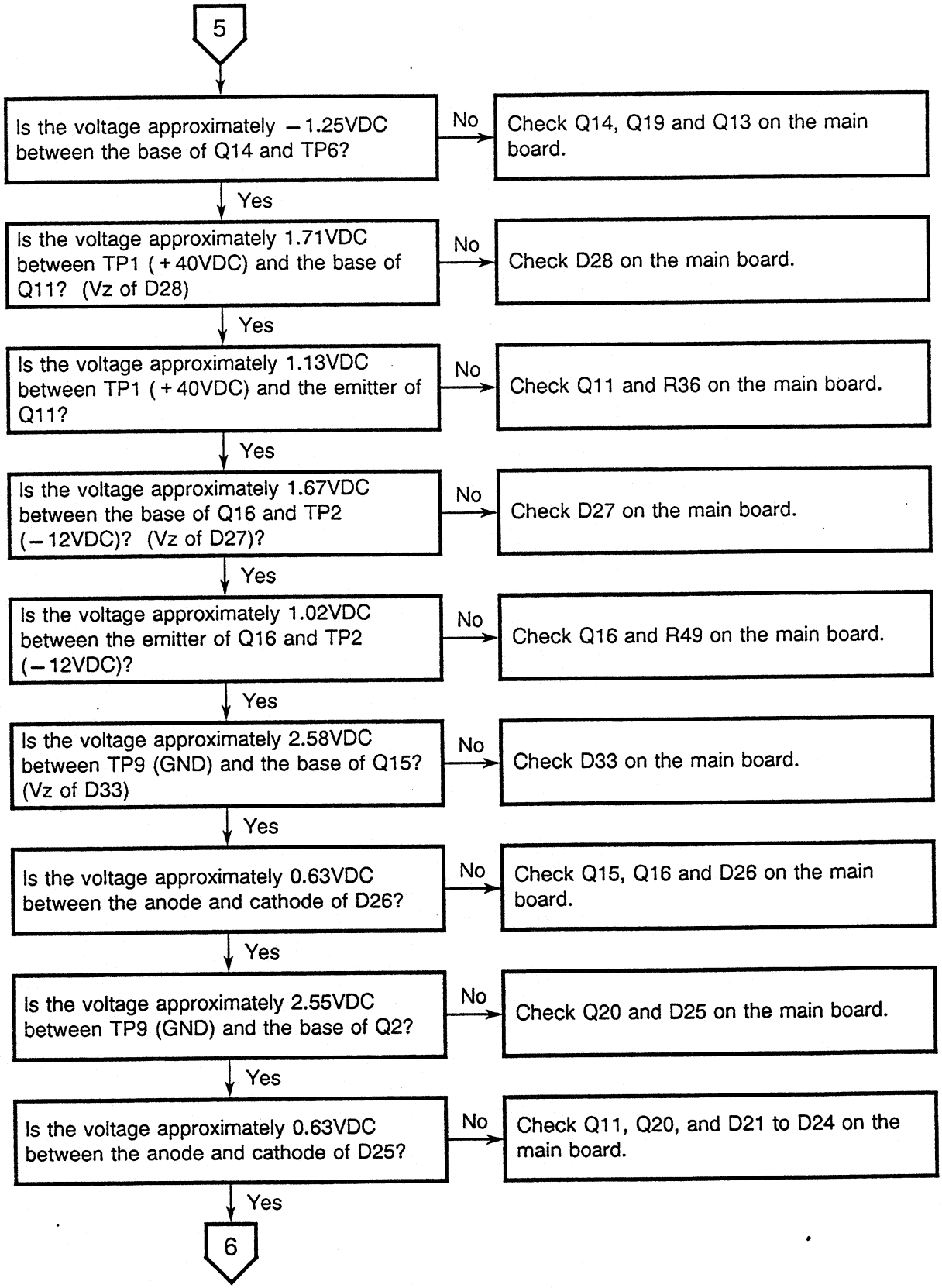
2

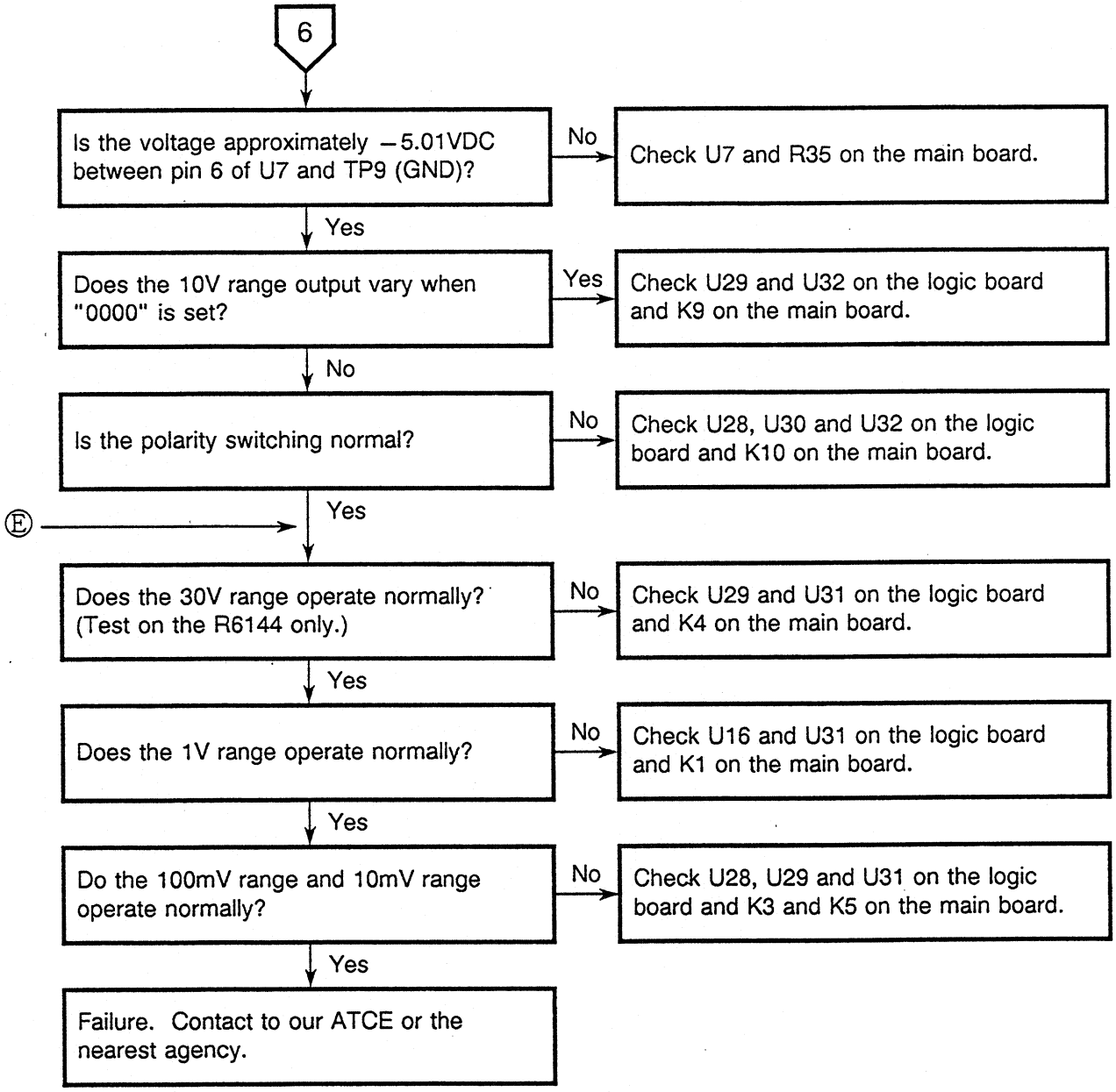


	U16						U15							
	15	12	9	6	5	2	19	16	15	12	9	6	5	2
Set "0000" (3FEF).	H	H	H	H	H	H	H	H	H	L	H	H	H	H
Set "11999" (1110).	L	H	L	L	L	H	L	L	L	H	L	L	L	L

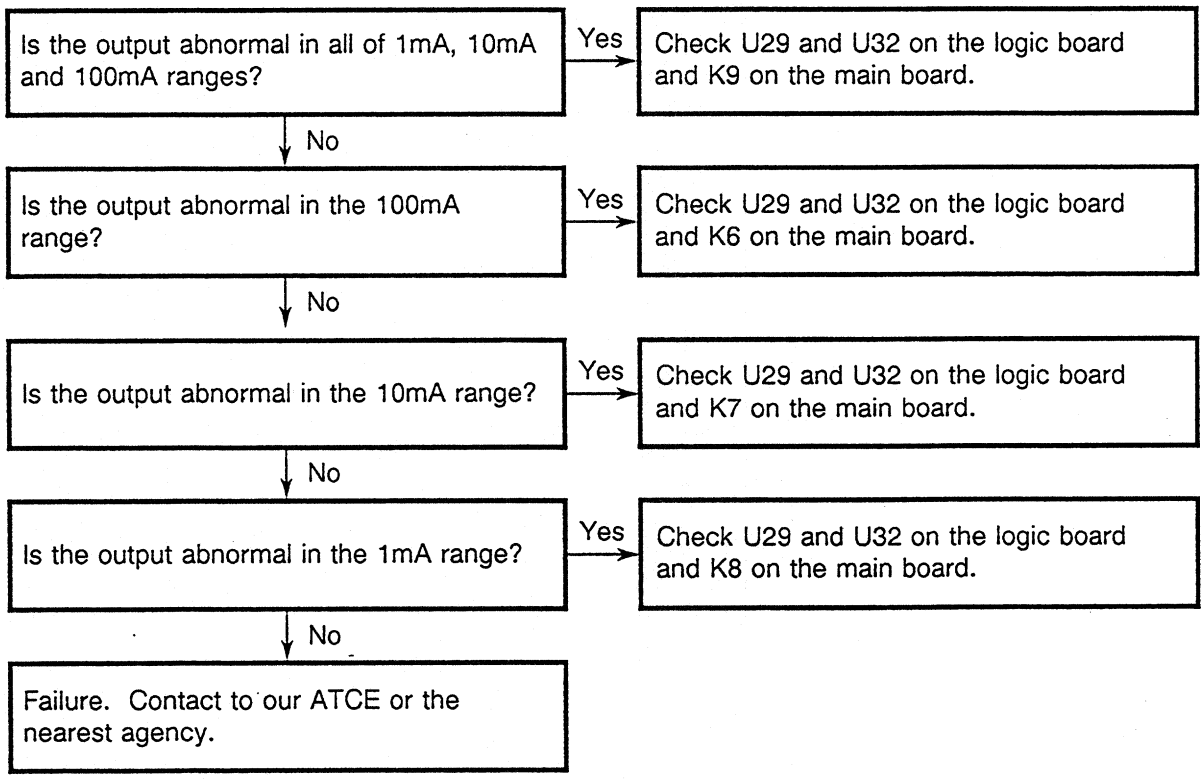

Ⓑ
3
Is the voltage −11.4 to −12.6VDC between TP2 and TP11 (GND) of the main board?
Yes
No
Is the voltage 20.9VDC across C3 of the main board?
Yes
Check U1 on the main board.
No
Is the voltage approximately 17VAC between pins 2 and 4 of the main board?
Yes
Check D2 on the main board.
No
Check power transformer T1.
Is the voltage approximately 0VDC (−0.32 mV) between TP5 and TP9 (GND) when "0000" is set?
Yes
Ⓒ
Ⓓ
No
Do the following waveforms appear between TP4 and TP11 (GND) of the main board?
No
Check the circuit connection between Q5 and Q6 of the main board and J8 of the logic board.
Set "0000".
+4V →
−12V →
1msec
1 µsec
Set "11999".
+4V →
−12V →
1msec
280 µsec
No
4


4
Do the following waveforms appear between the drain of Q8 and TP11 (GND) of the main board?
No
Check Q7, Q8, D10 and D12 on the main board.
Set "0000".
0V
−7V
1msec
280 µsec
Set "11999".
0V
−7V
1msec
1 µsec
Yes
Check U4 on the main board.
©
Is the voltage approximately −5.14VDC between TP5 and TP9 (GND) when "11999" is set?
No
Ⓓ
Yes
Is the 10V range output normal?
Yes
Ⓔ
No
Is the voltage approximately 11.999 Vdc between TP6 and TP9 (GND)?
No
Check K4 and K10 on the main board and U28 to U32 on the logic board.
Yes
Is the voltage approximately 1.25 Vdc between the base of Q17 and TP6?
No
Check Q17, Q18 and Q12 on the main board.
Yes
5

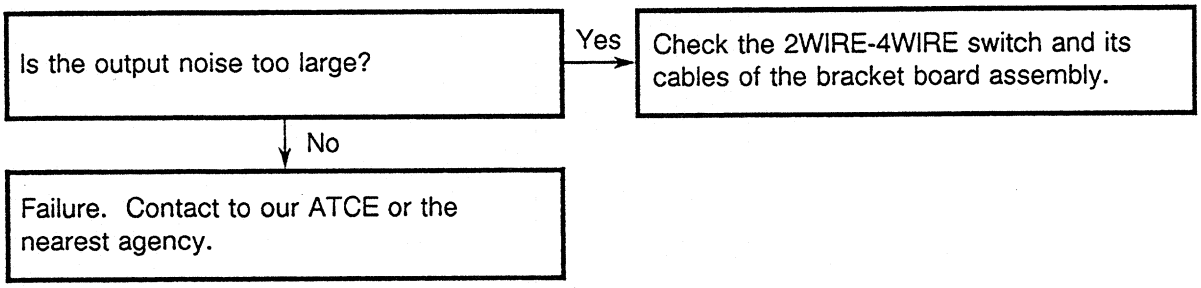

5
Is the voltage approximately −1.25VDC between the base of Q14 and TP6?
No
Check Q14, Q19 and Q13 on the main board.
Yes
Is the voltage approximately 1.71VDC between TP1 (+40VDC) and the base of Q11? (Vz of D28)
No
Check D28 on the main board.
Yes
Is the voltage approximately 1.13VDC between TP1 (+40VDC) and the emitter of Q11?
No
Check Q11 and R36 on the main board.
Yes
Is the voltage approximately 1.67VDC between the base of Q16 and TP2 (−12VDC)? (Vz of D27)?
No
Check D27 on the main board.
Yes
Is the voltage approximately 1.02VDC between the emitter of Q16 and TP2 (−12VDC)?
No
Check Q16 and R49 on the main board.
Yes
Is the voltage approximately 2.58VDC between TP9 (GND) and the base of Q15? (Vz of D33)
No
Check D33 on the main board.
Yes
Is the voltage approximately 0.63VDC between the anode and cathode of D26?
No
Check Q15, Q16 and D26 on the main board.
Yes
Is the voltage approximately 2.55VDC between TP9 (GND) and the base of Q2?
No
Check Q20 and D25 on the main board.
Yes
Is the voltage approximately 0.63VDC between the anode and cathode of D25?
No
Check Q11, Q20, and D21 to D24 on the main board.
Yes
6


6
Is the voltage approximately −5.01VDC between pin 6 of U7 and TP9 (GND)?
No
Check U7 and R35 on the main board.
Yes
Does the 10V range output vary when "0000" is set?
Yes
Check U29 and U32 on the logic board and K9 on the main board.
No
Is the polarity switching normal?
No
Check U28, U30 and U32 on the logic board and K10 on the main board.
Ⓔ
Yes
Does the 30V range operate normally? (Test on the R6144 only.)
No
Check U29 and U31 on the logic board and K4 on the main board.
Yes
Does the 1V range operate normally?
No
Check U16 and U31 on the logic board and K1 on the main board.
Yes
Do the 100mV range and 10mV range operate normally?
No
Check U28, U29 and U31 on the logic board and K3 and K5 on the main board.
Yes
Failure. Contact to our ATCE or the nearest agency.

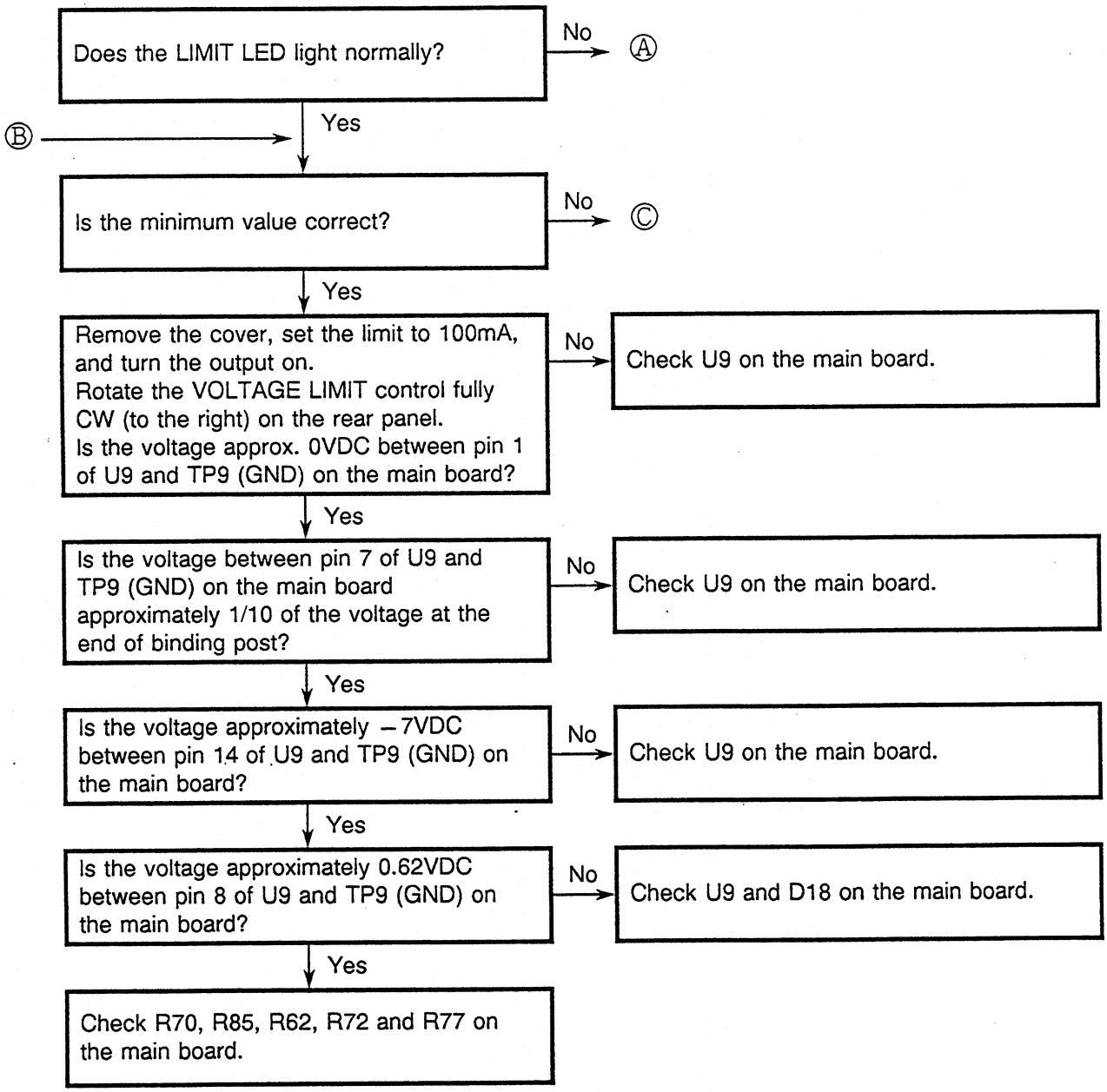
6.6 Output Current Error

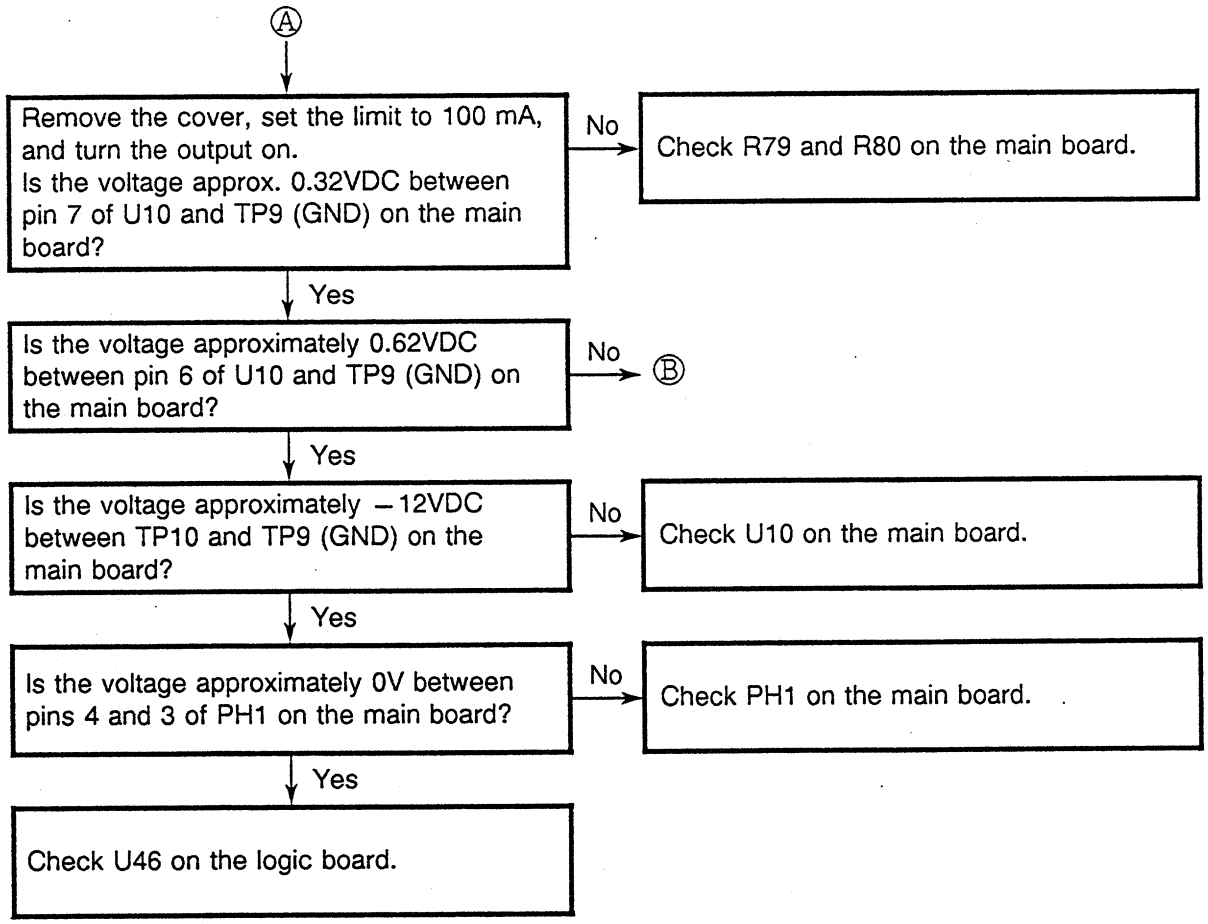


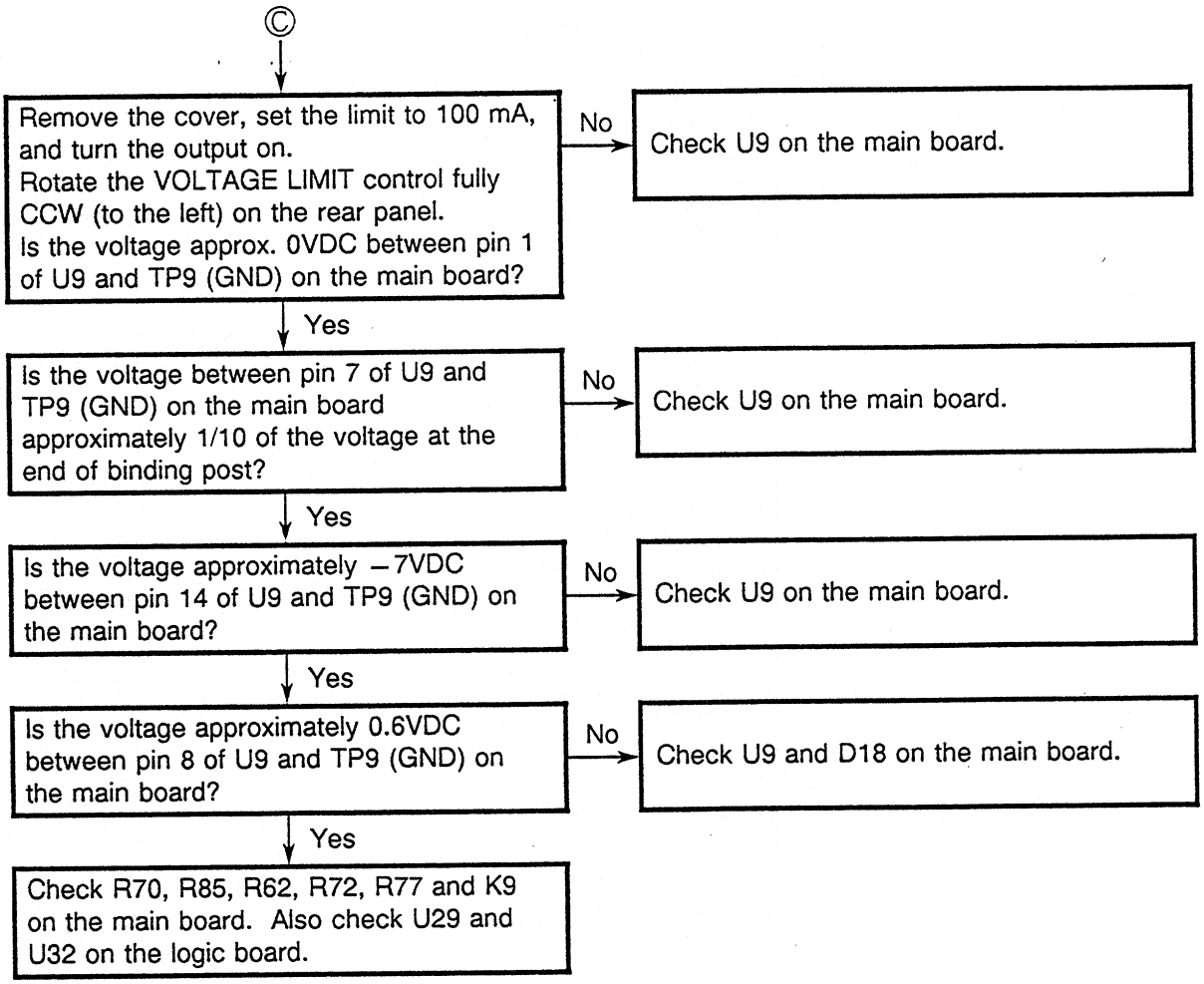
6.7 Output Noise Error



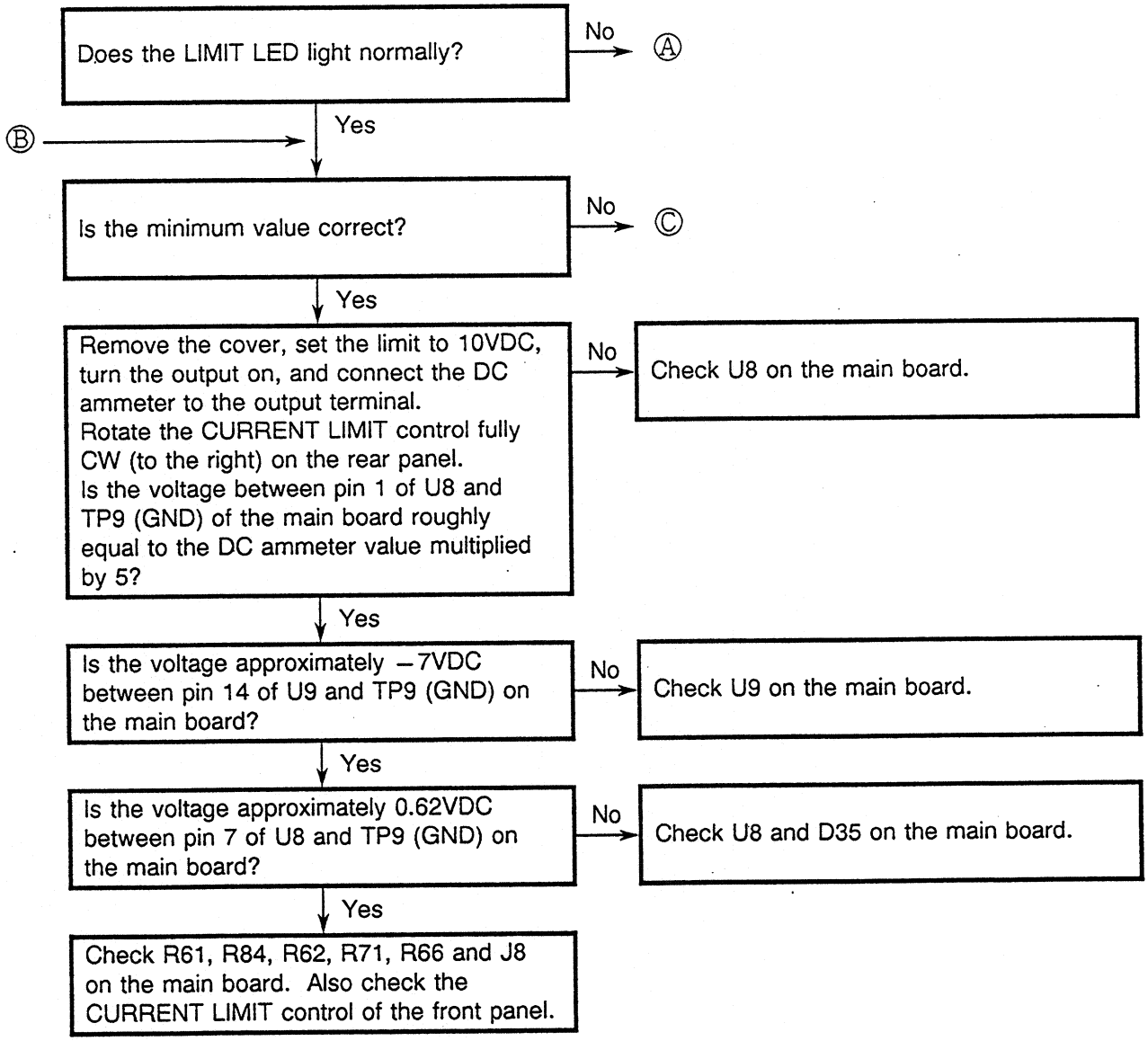
6.8 Voltage Limiter Error

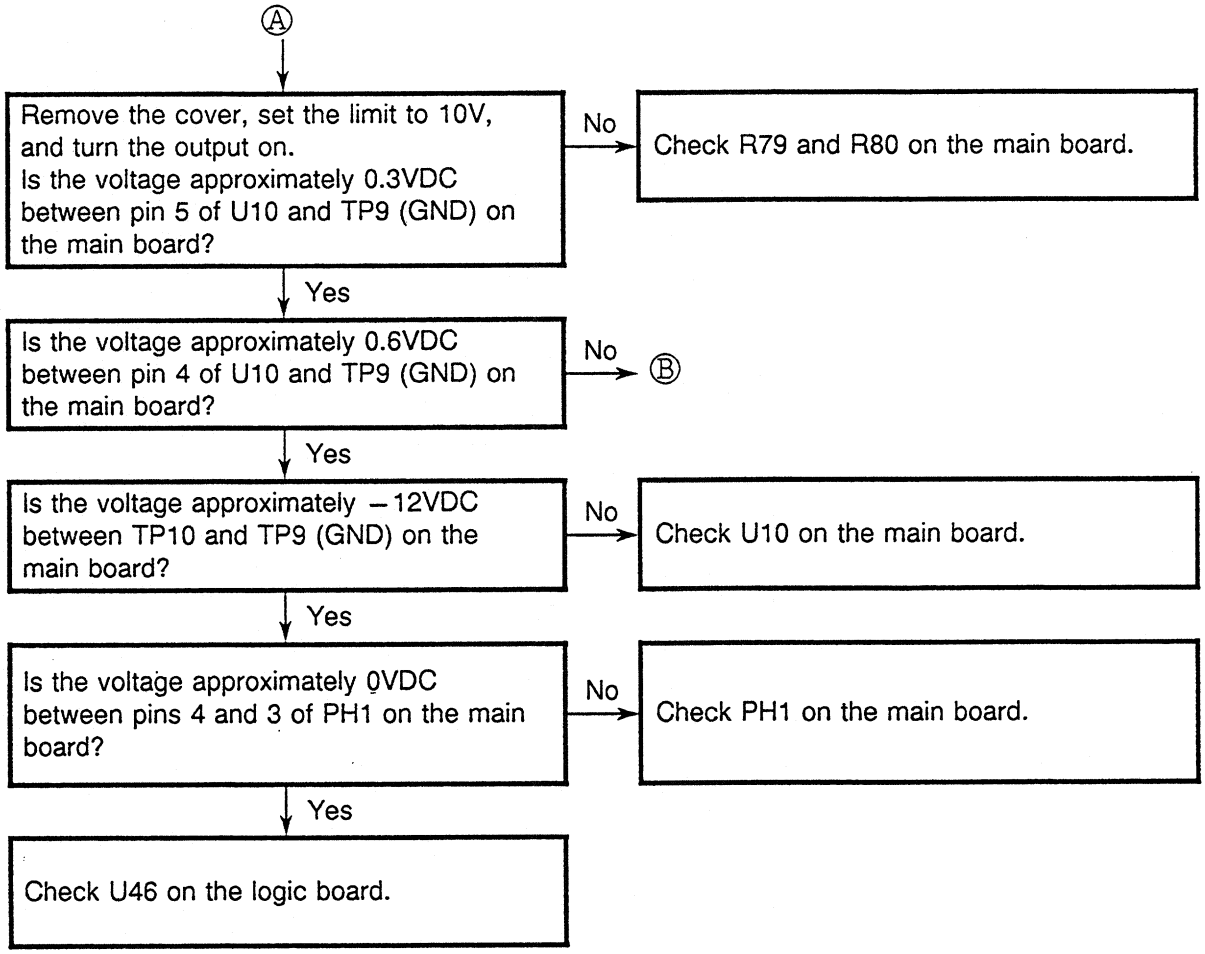


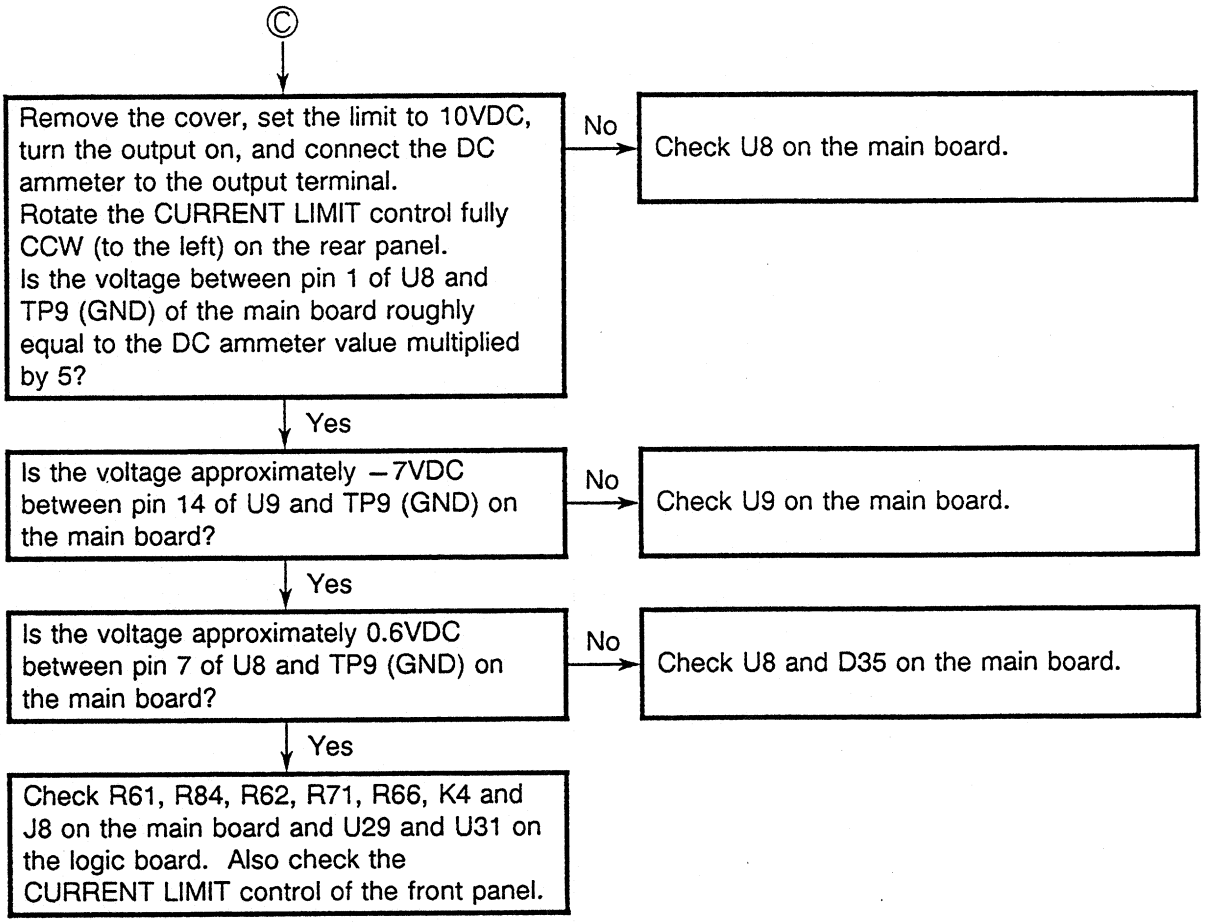

Ⓐ
Remove the cover, set the limit to 100 mA, and turn the output on.
Is the voltage approx. 0.32VDC between pin 7 of U10 and TP9 (GND) on the main board?
No
Check R79 and R80 on the main board.
Yes
Is the voltage approximately 0.62VDC between pin 6 of U10 and TP9 (GND) on the main board?
No
Ⓑ
Yes
Is the voltage approximately −12VDC between TP10 and TP9 (GND) on the main board?
No
Check U10 on the main board.
Yes
Is the voltage approximately 0V between pins 4 and 3 of PH1 on the main board?
No
Check PH1 on the main board.
Yes
Check U46 on the logic board.


Ⓒ
Remove the cover, set the limit to 100 mA, and turn the output on.
Rotate the VOLTAGE LIMIT control fully CCW (to the left) on the rear panel.
Is the voltage approx. 0VDC between pin 1 of U9 and TP9 (GND) on the main board?
No
Check U9 on the main board.
Yes
Is the voltage between pin 7 of U9 and TP9 (GND) on the main board approximately 1/10 of the voltage at the end of binding post?
No
Check U9 on the main board.
Yes
Is the voltage approximately −7VDC between pin 14 of U9 and TP9 (GND) on the main board?
No
Check U9 on the main board.
Yes
Is the voltage approximately 0.6VDC between pin 8 of U9 and TP9 (GND) on the main board?
No
Check U9 and D18 on the main board.
Yes
Check R70, R85, R62, R72, R77 and K9 on the main board. Also check U29 and U32 on the logic board.

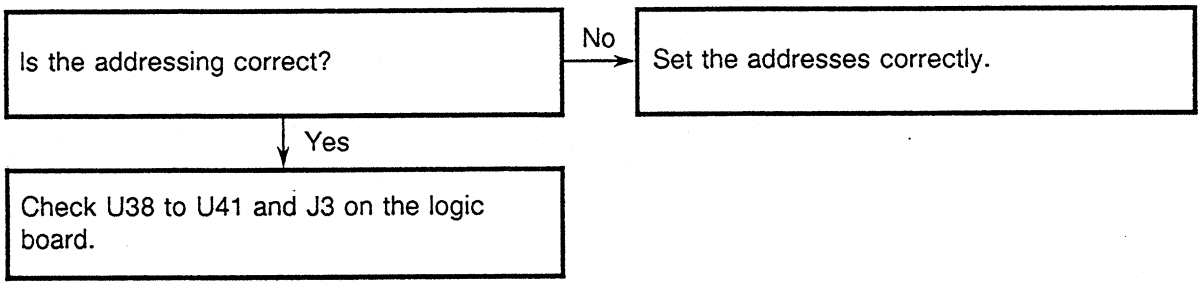
6.9 Current Limiter Error



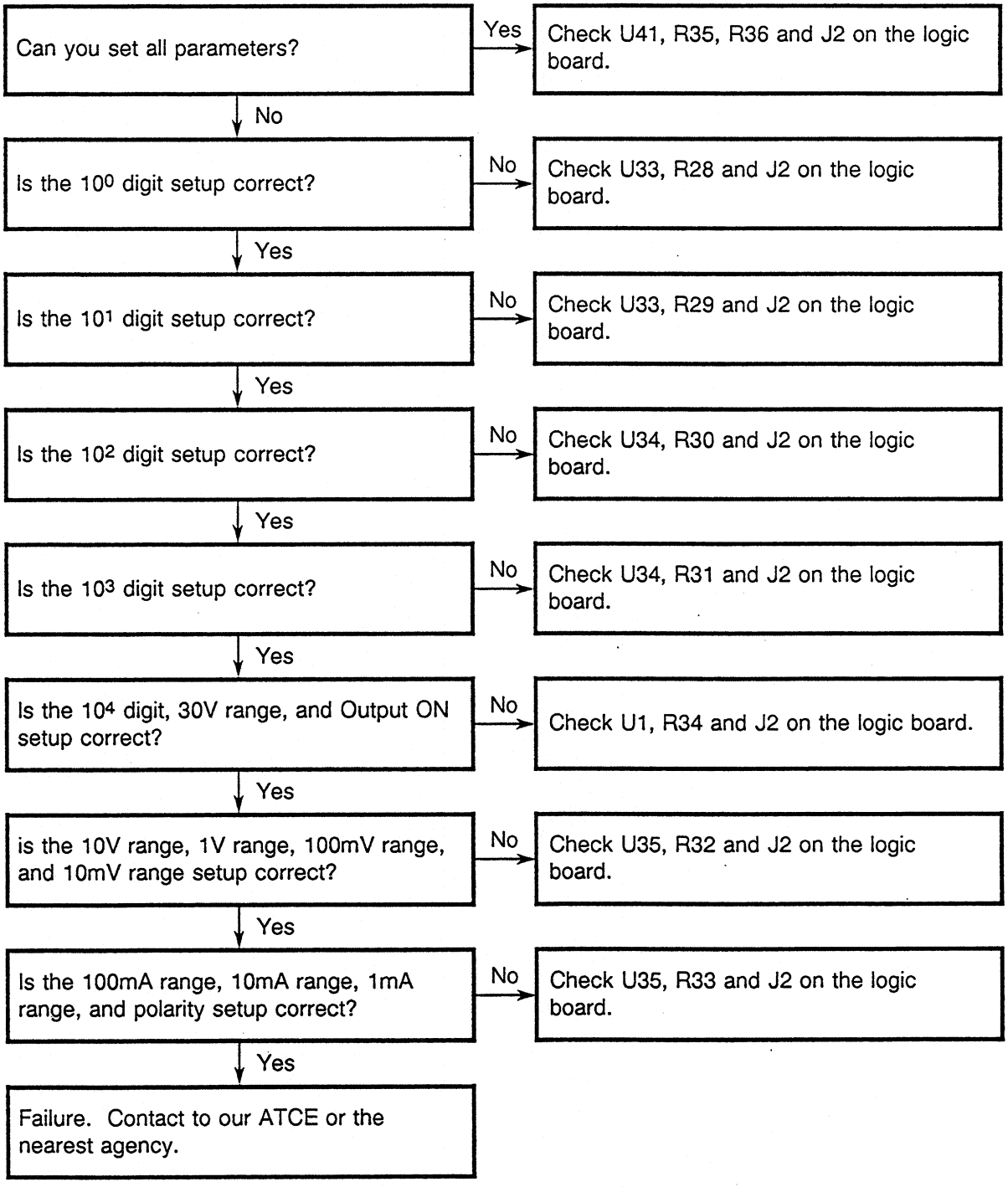

Ⓐ
Remove the cover, set the limit to 10V, and turn the output on.
Is the voltage approximately 0.3VDC between pin 5 of U10 and TP9 (GND) on the main board?
No
Check R79 and R80 on the main board.
Yes
Is the voltage approximately 0.6VDC between pin 4 of U10 and TP9 (GND) on the main board?
No
Ⓑ
Yes
Is the voltage approximately −12VDC between TP10 and TP9 (GND) on the main board?
No
Check U10 on the main board.
Yes
Is the voltage approximately 0VDC between pins 4 and 3 of PH1 on the main board?
No
Check PH1 on the main board.
Yes
Check U46 on the logic board.


©
Remove the cover, set the limit to 10VDC, turn the output on, and connect the DC ammeter to the output terminal.
Rotate the CURRENT LIMIT control fully CCW (to the left) on the rear panel.
Is the voltage between pin 1 of U8 and TP9 (GND) of the main board roughly equal to the DC ammeter value multiplied by 5?
No
Check U8 on the main board.
Yes
Is the voltage approximately −7VDC between pin 14 of U9 and TP9 (GND) on the main board?
No
Check U9 on the main board.
Yes
Is the voltage approximately 0.6VDC between pin 7 of U8 and TP9 (GND) on the main board?
No
Check U8 and D35 on the main board.
Yes
Check R61, R84, R62, R71, R66, K4 and J8 on the main board and U29 and U31 on the logic board. Also check the CURRENT LIMIT control of the front panel.

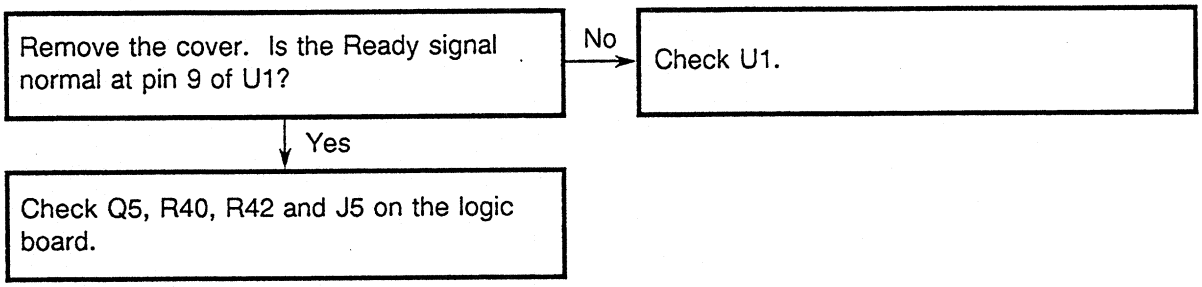
6.10 GPIB Interface Error



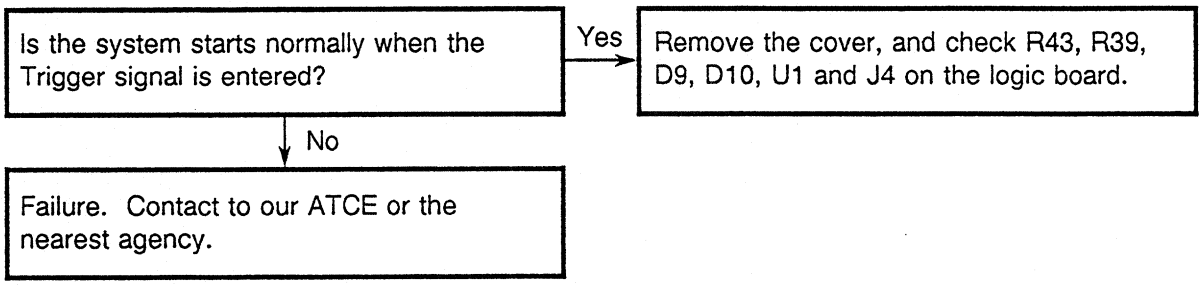
6.11 VDC Interface Error



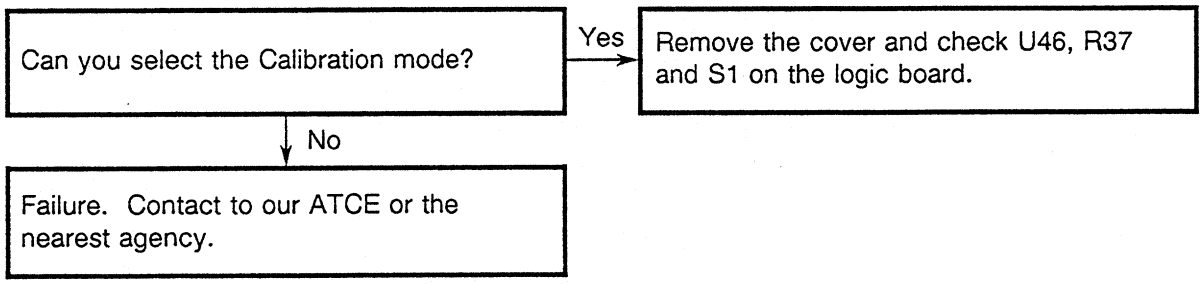
6.12 Ready Signal Error



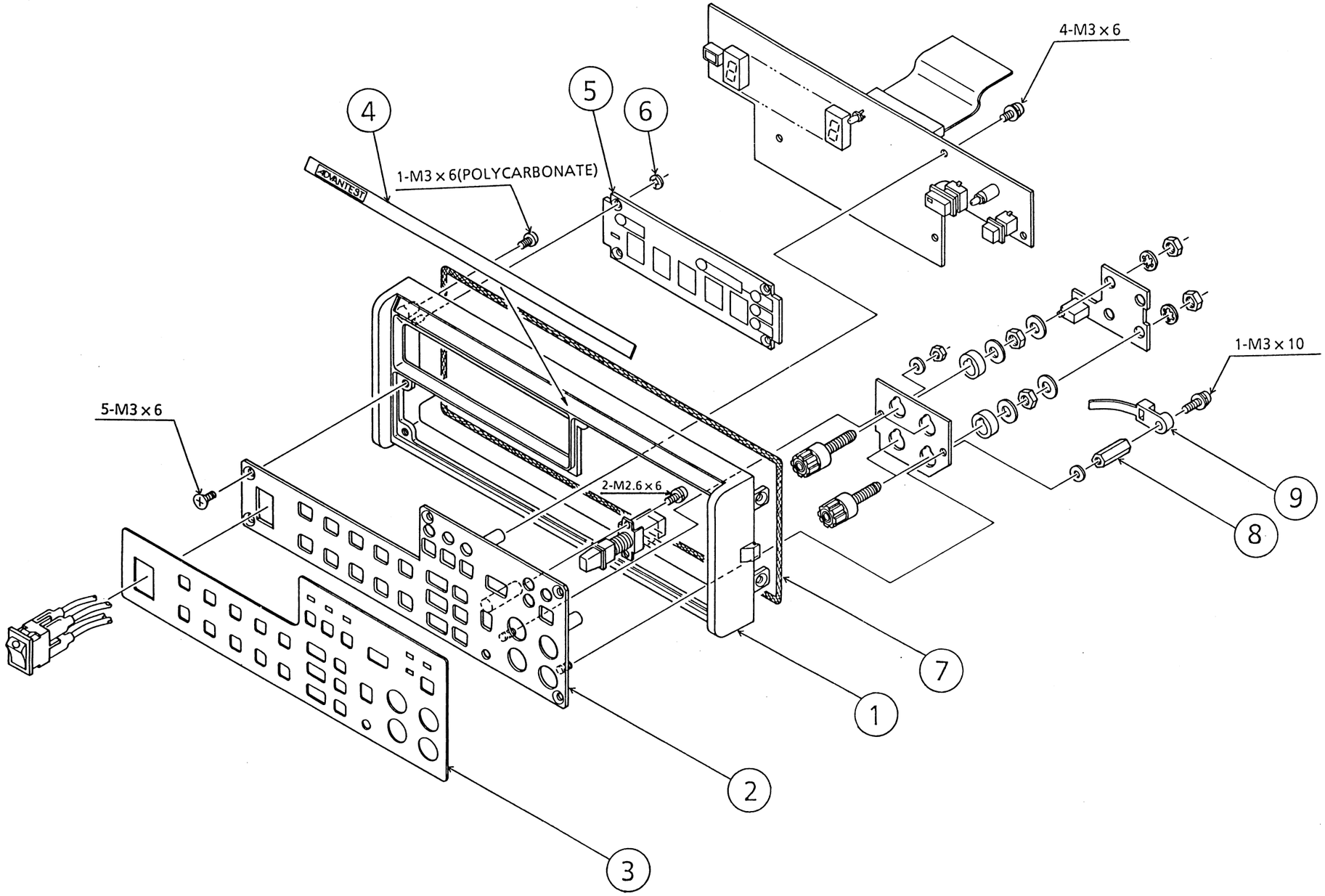
6.13 Trigger Signal Error



6.14 Calibration Error



7. REPLACEABLE MECHANICAL PARTS



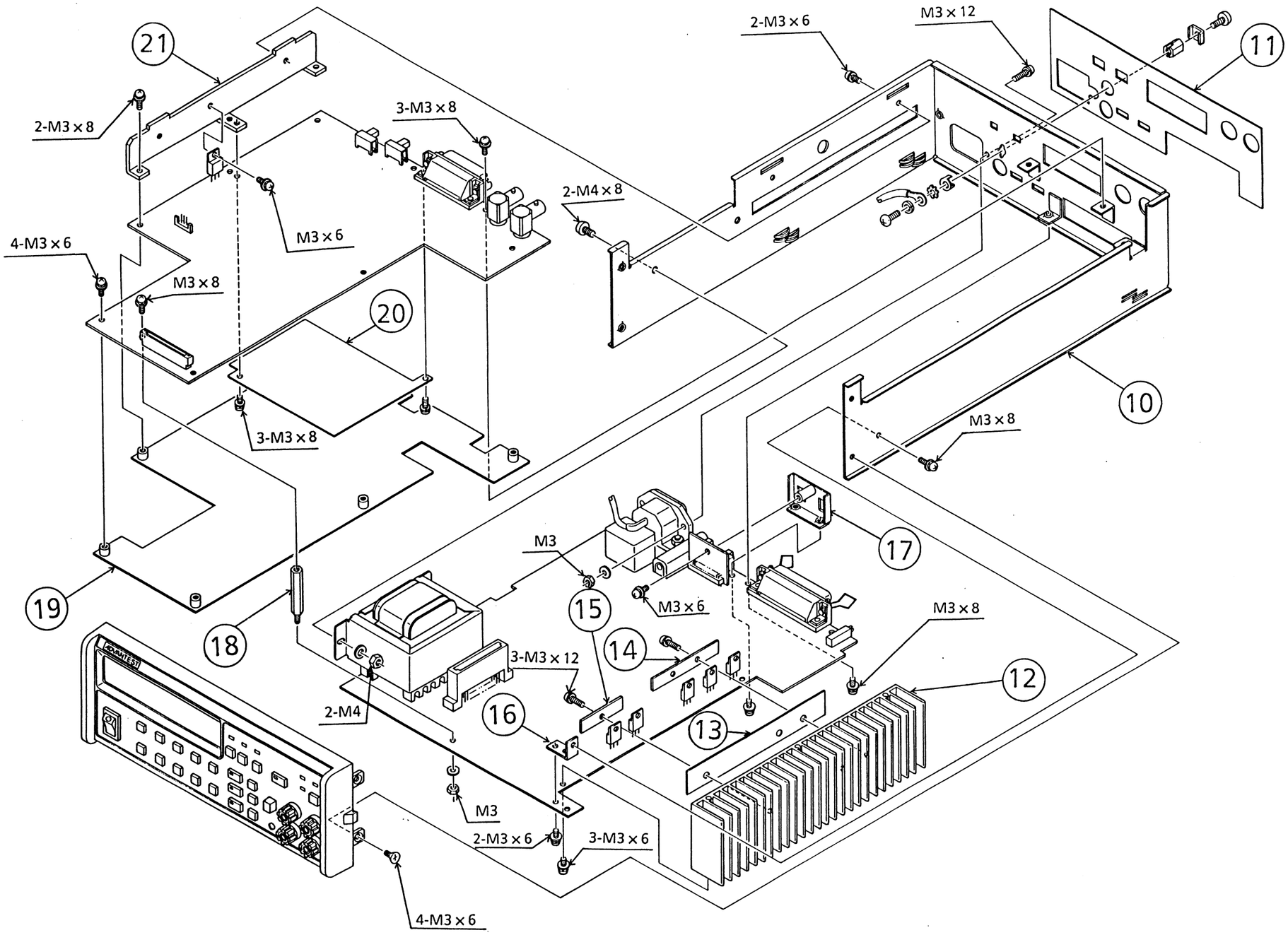
R6142

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

R6142/6144
EXPLODED VIEW 1



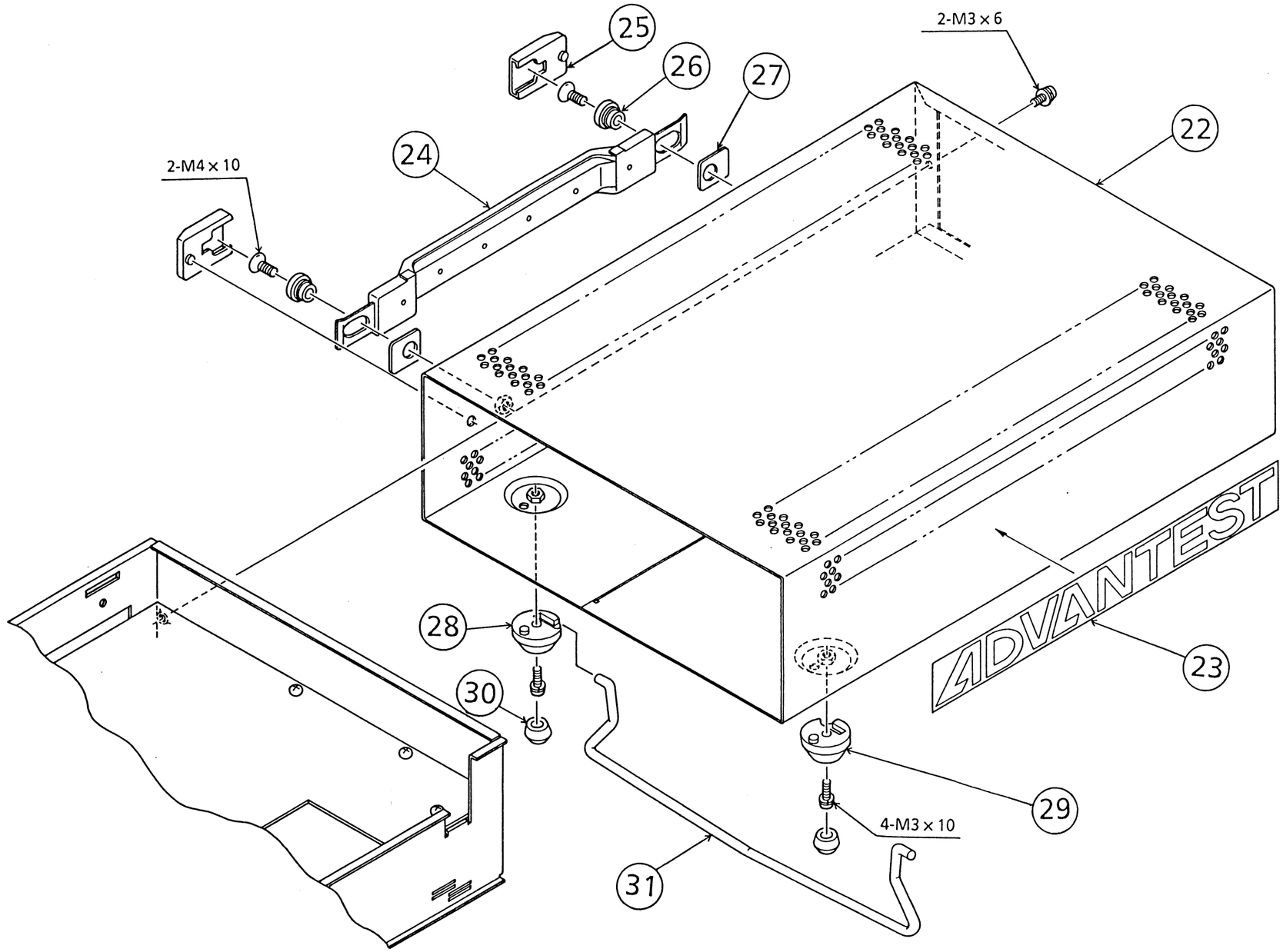
R6142

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 HOLDER S	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 HOLDER S	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
㉒ CASE	MBT-86668	1
㉓ COMPANY NAMEPLATE, SIDE	MNS-60840	1
㉔ HANDLE	MMX-54808	1
㉕ HANDLE COVER	MMX-57440	2
㉖ HANDLE STOPPER	MKX-20548	2
㉗ HANDLE SPACER	MBX-20547	2
㉘ FOOT A, FOR STAND	MMX-10498	2
㉙ FOOT B, FOR STAND	MMX-10499	2
㉚ RUBBER SPHERE	MMX-12291	4
㉛ STAND A	MBC-17074	1

R6144

Description	CODE	Q'ty
㉒ CASE	MBT-86668	1
㉓ COMPANY NAMEPLATE, SIDE	MNS-60840	1
㉔ HANDLE	MMX-54808	1
㉕ HANDLE COVER	MMX-57440	2
㉖ HANDLE STOPPER	MKX-20548	2
㉗ HANDLE SPACER	MBX-20547	2
㉘ FOOT A, FOR STAND	MMX-10498	2
㉙ FOOT B, FOR STAND	MMX-10499	2
㉚ RUBBER SPHERE	MMX-12291	4
㉛ STAND A	MBC-17074	1

R6142/6144
EXPLODED VIEW 3

8. REPLACE ABLE ELECTRICAL PARTS

8.1 LOGIC (BLL-017872)

(1 of 6)

Parts No.	Advantest Stock No.	Description	Note
C14	CCK-BT4700U16V	C: ALUMINUM ELECTROLYTIC 4700μF 16V	
C16	CCK-BX330U10V	C: ALUMINUM ELECTROLYTIC 330μF 10V	
C05	CCK-CM3R3U50V	C: ALUMINUM ELECTROLYTIC 3.3μF 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	

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	

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	Transformer	
	MBB-86666A-1		
	MBE-86664A-1		
	MNS-35263A		
	MPX86674A-1		
	PLL-217872DD		
R48	RAY-AK100Q4	R: FXD Com 100Q	
R49	RAY-AK100Q4	R: FXD Com 100Q	
R05	RAY-AK220Q4	R: FXD Com 220Q	
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	

(4 of 6)

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	

(5 of 6)

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:	

(6 of 6)

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	Transistor SI PNP	
	YEE-000265-1		

8.2 DISPLAY (BLF-017871)

(1 of 2)

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	Switch	
	MMS-28960A-1		
	MMS-86675A-1		
	MMX-102738		
	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	

(2 of 2)

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	
	PLF-217871DD		
D26	SDS-1SS270	Diode SI	
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	

8.3 MAIN (BLL-017873)

(1 of 7)

Parts No.	Advantest Stock No.	Description	Note
C03	CCK-BT1000U35V	C: ALUMINUM ELECTROLYTIC 1000μF 35V	
C02	CCK-BT47U63V	C: ALUMINUM ELECTROLYTIC 47μF 63V	
C05	CCK-BX100U16V	C: ALUMINUM ELECTROLYTIC 100μF 16V	
C53	CCK-BX220U25V	C: ALUMINUM ELECTROLYTIC 220μF 25V	
C52	CCK-BX220U50V	C: ALUMINUM ELECTROLYTIC 220μF 50V	
C09	CCL-BX33U25V	C: ALUMINUM ELECTROLYTIC 33μF 25V	
C07	CCK-BX47U50V	C: ALUMINUM ELECTROLYTIC 47μF 50V	
C01	CCK-BZ470U100V	C: ALUMINUM ELECTROLYTIC 470μF 100V	
C21	CFM-AHR068UR1K	C: 0.068μF +-10% 100V	
C25	CFM-AHR068UR1K	C: 0.068μF +-10% 100V	
C34	CFM-AHR33U100V	C: 0.33μF +-10% 100V	
C32	CFM-AHR47U100V	C: 0.47μF +-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: 0.033μF +-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	

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		
	DFT-AAR315A	Fuse	
FL01	DNF-001607		
J01	JCD-AW003PX01		
J02	JCP-AA002PX02	Connector	
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	

(3 of 7)

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	Relay	
	LTP-001213	Transformer	
	MBB-86667A-1		
	MBB-86669A-1		
	MBB-86670A-1		
	MPX-86673A-1		
	PLL-217873DD		
R35	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	

(4 of 7)

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		

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	

(6 of 7)

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	

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	Transistor SI PNP	
	T:MHA-86672A		
	YEE-000265-1		
	YEE-000542-1		
J13	YEE-000733-1	CONNECTORS	
	YEE-003745-1		

8.4 BRACKET (BLB-017870)

(1 of 1)

Parts No.	Advantest Stock No.	Description	Note
C01	CFM-AS2200P50V		
	DEE-000066	Core	
	ESM-000257-1		
	JTB-AA001JX01	Binding Post	
	JTB-AA001JX02	Binding Post	
	JTM-BL001JX03-1	CONNECTORS	
	KSP-000102	Switch	
	PLB-217870DD		
R01	RVR-DK20K	Multiturn cermet trimmers 20KΩ	
	YEE-002494-1	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	SWITCH	
	PLB-218039DD		

8.6 TERMINAL (BLB-017889)

(1 of 1)

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

8.7 Standard Attachments

(1) WBL-6162T

(1 of 1)

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

(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		

(3) WFU-6142E (Main Frame)

(1 of 1)

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

IMPORTANT INFORMATION FOR ADC CORPORATION SOFTWARE

PLEASE READ CAREFULLY: This is an important notice for the software defined herein. Computer programs including any additions, modifications and updates thereof, operation manuals, and related materials provided by ADC CORPORATION (hereafter referred to as "SOFTWARE"), included in or used with hardware produced by ADC CORPORATION (hereafter referred to as "PRODUCTS").

SOFTWARE License

All rights in and to the SOFTWARE (including, but not limited to, copyright) shall be and remain vested in ADC CORPORATION. ADC CORPORATION hereby grants you a license to use the SOFTWARE only on or with ADC CORPORATION PRODUCTS.

Restrictions

(1) You may not use the SOFTWARE for any purpose other than for the use of the PRODUCTS.
(2) You may not copy, modify, or change, all or any part of, the SOFTWARE without permission from ADC CORPORATION.
(3) You may not reverse engineer, de-compile, or disassemble, all or any part of, the SOFTWARE.

Liability

ADC CORPORATION shall have no liability(1) for any PRODUCT failures, which may arise out of any misuse (misuse is deemed to be use of the SOFTWARE for purposes other than its intended use) of the SOFTWARE.
(2) For any dispute between you and any third party for any reason whatsoever including, but not limited to, infringement of intellectual property rights.

LIMITED WARRANTY

1. Unless otherwise specifically agreed by Seller and Purchaser in writing, ADC CORPORATION will warrant to the Purchaser that during the Warranty Period this Product (other than consumables included in the Product) will be free from defects in material and workmanship and shall conform to the specifications set forth in this Operation Manual.

2. The warranty period for the Product (the "Warranty Period") will be a period of one year commencing on the delivery date of the Product.

3. If the Product is found to be defective during the Warranty Period, ADC CORPORATION will, at its option and in its sole and absolute discretion, either (a) repair the defective Product or part or component thereof or (b) replace the defective Product or part or component thereof, in either case at ADC CORPORATION's sole cost and expense.

4. This limited warranty will not apply to defects or damage to the Product or any part or component thereof resulting from any of the following:

   (a) any modifications, maintenance or repairs other than modifications, maintenance or repairs (i) performed by ADC CORPORATION or (ii) specifically recommended or authorized by ADC CORPORATION and performed in accordance with ADC CORPORATION's instructions;

   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than ADC CORPORATION or its agents);

   (c) use of the Product under operating conditions or environments different than those specified in the Operation Manual or recommended by ADC CORPORATION, including, without limitation, (i) instances where the Product has been subjected to physical stress or electrical voltage exceeding the permissible range and (ii) instances where the corrosion of electrical circuits or other deterioration was accelerated by exposure to corrosive gases or dusty environments;

   (d) use of the Product in connection with software, interfaces, products or parts other than software, interfaces, products or parts supplied or recommended by ADC CORPORATION;

   (e) the occurrence of an event of force majeure, including, without limitation, fire, explosion, geological change, storm, flood, earthquake, tidal wave, lightning or act of war;

   (f) any negligent act or omission of the Purchaser or any third party other than ADC CORPORATION; or

   (g) any product exported from a country where the product was sold.

5. EXCEPT TO THE EXTENT EXPRESSLY PROVIDED HEREIN, ADC CORPORATION HEREBY EXPRESSLY DISCLAIMS, AND THE PURCHASER HEREBY WAIVES, ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, (A) ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND (B) ANY WARRANTY OR REPRESENTATION AS TO THE VALIDITY, SCOPE, EFFECTIVENESS OR USEFULNESS OF ANY TECHNOLOGY OR ANY INVENTION.

6. THE REMEDY SET FORTH HEREIN SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE PURCHASER FOR BREACH OF WARRANTY WITH RESPECT TO THE PRODUCT.

7. ADC CORPORATION WILL NOT HAVE ANY LIABILITY TO THE PURCHASER FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, INCLUDING, WITHOUT LIMITATION, LOSS OF ANTICIPATED PROFITS OR REVENUES, IN ANY AND ALL CIRCUMSTANCES, EVEN IF ADC CORPORATION HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.

CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL BUYER

The product should be thoroughly inspected immediately upon original delivery to buyer. If the product is damaged in any way, a claim should be filed by the buyer with carrier immediately.

CUSTOMER SERVICE DESCRIPTION

Contact an ADC CORPORATION sales representative if a failure occurs.

(1) The repair service lasts ten years from the delivery date of the Product.

(2) The repair and calibration services may be declined if either of the following situations arise.

1) When required parts cannot be procured.

2) When the performance of the Product cannot be maintained after repair.

ADCMT® ADC CORPORATION

77-1, Miyako, Namegawa-machi, Hiki-gun, Saitama 355-0812, Japan