ADVANTEST®

ADVANTEST CORPORATION

INSTRUCTION MANUAL

TR6851

Digital Multimeter

MANUAL NUMBER OED00 911

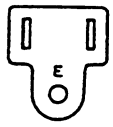
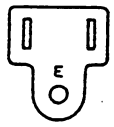
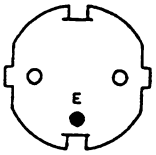
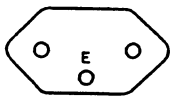
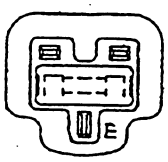
This product has been discontinued.
The Operation Manual is provided by ADC Corporation under the agreement with Advantest Corporation.

Before reselling to other corporations or re-exporting to other countries, you are required to obtain permission from both the Japanese Government under its Export Control Act and the U.S. Government under its Export Control Law.

Printed in Japan

NOTICE

ADVANTEST provides the following power cables for each country. If there was any inconvenience on your use, please contact our subsidiaries or ADVANTEST representatives.

	Plugs	Standards/Countries	Ratings/Color/ Length	Accessory Codes
1		JIS : JAPAN	Rating :125V 7A Color :Black Length :2m	A01402 A01412
2		UL : USA CSA : CANADA	Rating :125V 7A Color :Black Length :2m	A01403 (Opt.95) A01413
3		CEE : EUROPE VDE : FRG OVE : AUSTRIA SEMKO : SWEDEN DEMKO : DENMARK KEMA : NETHERLANDS FIMKO : FINLAND NEMKO : NORWAY CEBEC : BELGIUM	Rating :250V 6A Color :Gray Length :2m	A01404 (Opt.96) A01414
4		SEV : SWITZERLAND	Rating :250V 6A Color :Gray Length :2m	A01405 (Opt.97) A01415
5		SAA : AUSTRALIA NEWZELAND	Rating :250V 6A Color :Gray Length :2m	A01406 (Opt.98)
6		BS : UK	Rating :250V 6A Color :Black Length :2m	A01407 (Opt.99) A01417

Note : "E" shows earth (ground).

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

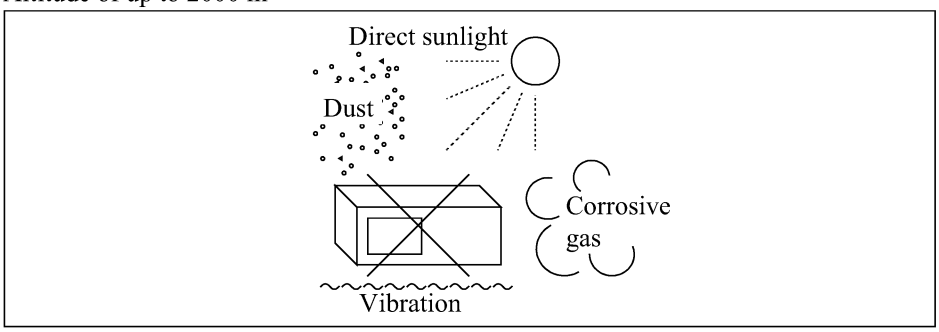


Figure-1 Environmental Conditions

- Operating position

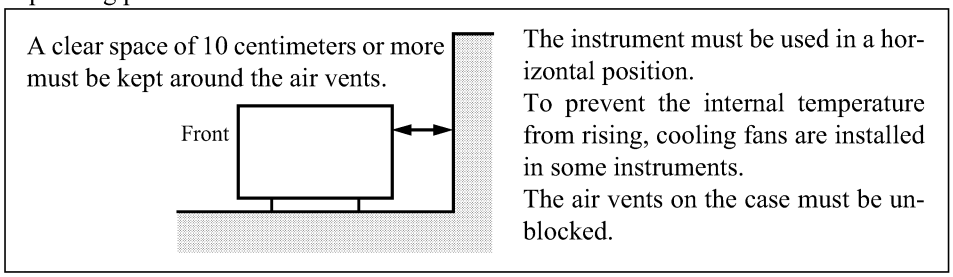


Figure-2 Operating Position

- Storage position

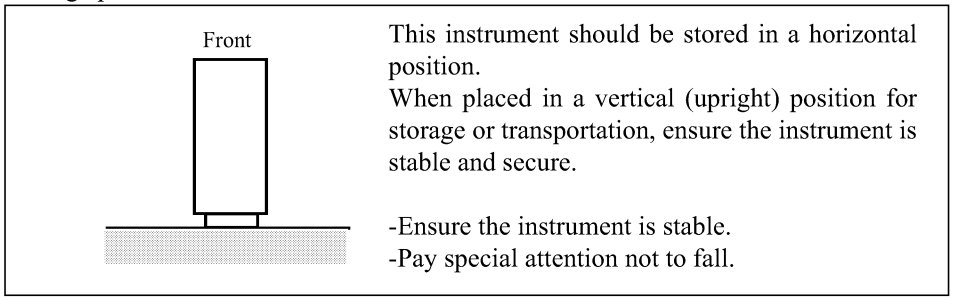


Figure-3 Storage Position

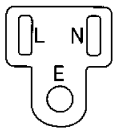
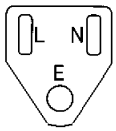
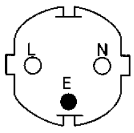
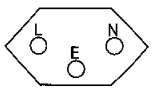
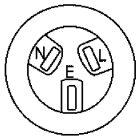
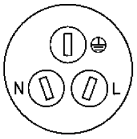
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  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

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SECTION 1
GENERAL INFORMATION

1-1. GENERAL

The TR6851 Digital Multimeter is a high-grade and high-speed multimeter which represents the culmination of many years of development of ADVANTEST's exclusive applied A/D converter technology, applied microprocessor technology, and high-stability thin-film resistor manufacturing technology, in addition to enhancement of multifunctional measurement techniques.

In addition to DC and AC voltage, resistance, and DC and AC current measuring functions, the TR6851 also includes a null operation capability for offset corrections and measurement of relative values, a smoothing operation function for stable measurement of noisy signals, and an external triggering function. And depending on the required measuring accuracy, 20 times/second (5-1/2 digits and 4-1/2 digits) and 100 times/second (4-1/2 digits and 3-1/2 digits) high-speed measurement is also enabled.

And by storing panel settings in internal memory, the measuring conditions set for each function can be preserved after the power is switched off.

Since the TR6851 has been designed for low power consumption, internally generated heat has very little effect on measurements, and the instrument can be operated by battery over long periods of time.

Use of the GPIB adapter and BCD data output accessory units permits remote setting of measuring functions and measuring ranges, and output of measured data.

To avoid the danger of the input cable becoming loose during operation and coming into contact with the operator, the exposed parts of the cable have been reduced to a minimum, and the cable designed with a locking mechanism to keep the cable securely connected has been optionally provided. Other safety precautions include a shutter for the power cable connector to prevent the connector from being touched during battery drive operations.

Together with the various accessory units listed below, the TR6851 has been designed to meet a wide range of applications including research & development, manufacturing lines, maintenance, etc.

1-2. TR6851 ACCESSORY UNITS

The following accessory units can be optionally connected to the TR6851.

(1) TR15802 Battery Unit
(2) TR13003A BCD Data Output Unit
(3) TR13206A GPIB Adapter Unit
(4) A01006 Input Cable (for 4-wire resistance measurements)
(5) TR1111 Terminal Adapter
(6) TR6198 Digital Recorder
(7) TR1116 DC High-Voltage Probe
(8) TR1109 Temperature Probe
(9) TR1321D/1321E DC High-Voltage Divider
(10) TR1640 Carrying Case
(11) A02016 Panel Mount Set
(12) A02226 JIS Rack Mount Set
(13) A02423 EIA Rack Mount Set
(14) A01204 Cable (for external trigger)

SECTION 2

SPECIFICATIONS

2-1. ELECTRICAL CHARACTERISTICS

2-1-1. DC Voltage Measurements

Range, maximum reading, resolution, and input resistance:

Range	Maximum reading (in 5-1/2 digit units)	Resolution			Input resistance
		5-1/2 digits	4-1/2 digits	3-1/2 digits	
20 mV	19.9999 mV	0.1 µV	1 µV	10 µV	1000 MΩ min.
200 mV	199.999 mV	1 µV	10 µV	100 µV	
2000 mV	1999.99 mV	10 µV	100 µV	1 mV	
20 V	19.9999 V	100 µV	1 mV	10 mV	10 MΩ ±1%
200 V	199.999 V	1 mV	10 mV	100 mV	
1000 V	1099.99 V	10 mV	100 mV	1 V	

Measuring accuracy and temperature coefficients (in 5-1/2 digit units):

Range	Measuring accuracy (+23°C ±5°C, six months)	Temperature coefficient*
20 mV	0.04 + 40 (smoothing OFF)	0.003 + 0.8 (4)
	0.04 + 22 (smoothing ON, 20 times using the NULL key)	
200 mV	0.013 + 5	0.0007 + 1.2 (1)
2000 mV	0.011 + 2	0.0006 + 0.5 (0.04)
20 V	0.012 + 2	0.0007 + 0.5 (0.06)
200 V	0.012 + 2	0.0007 + 0.5 (0.06)
1000 V	0.012 + 2	0.0007 + 0.5 (0.06)

±(% of rdg + digits) ±(% of rdg + digits)/°C

*: Values in brackets are ratings for 4-1/2 digit (high-speed) displays.

Measuring accuracy ratings are reduced by 1/10 in 4-1/2 and 3-1/2 digit displays, and is added by 1 in 4-1/2 digit (high-speed) displays.

Temperature coefficient ratings are reduced by 1/10 of 5-1/2 digit display value in 4-1/2 digit displays, and by 1/10 of 4-1/2 digit (high-speed) display value in 3-1/2 digit displays.

Maximum appliable voltage:

Across Hi and Lo terminals

In 20 mV, 200 mV, and 2000 mV ranges:

400 V (DC or AC peak) ... continuous

1100 V (DC or AC peak) ... for 10 seconds

In 20 V thru 1000 V ranges:

1100 V (DC or AC peak) ... continuous

Between ground and Hi/Lo terminal

±500 V peak ... continuous

Noise rejection ratios:

Digit count	Effective common mode noise rejection ratio (ECMRR)		Normal mode noise rejection ratio (NMRR)
	AC 50/60 Hz ±0.1%	DC	AC 50/60 Hz ±0.1%
5-1/2 and 4-1/2 digits	Approx. 120 dB	Approx. 120 dB	Approx. 60 dB
3-1/2 and 4-1/2 digits (high-speed)	Approx. 60 dB	Approx. 120 dB	Approx. 0 dB

2-1-2. AC Voltage Measurements

Range, maximum reading, resolution, input impedance, and maximum appliable voltage:

Range	Maximum reading (in 5-1/2 digits unit)	Resolution			Input impedance	Maximum appliable voltage
		5-1/2 digits	4-1/2 digits	3-1/2 digits		
200 mV	199.999 mV	1 µV	10 µV	100 µV	1 MΩ ±1%, 100 pF max.	400 Vrms, or 500 V peak between Hi and Lo terminals, 500 V peak between ground and Hi/Lo terminal
2000 mV	1999.99 mV	10 µV	100 µV	1 mV		
20 V	19.9999 V	100 V	1 mV	10 mV		
200 V	199.999 V	1 mV	10 mV	100 mV		
350 V	349.99 V	10 mV	100 mV	1 V		

Measuring method: True RMS method, AC coupling

Crest factor 3:1

Measuring accuracy: (+23°C ±5°C, six months)

Measuring accuracy	200 mV range	2000 mV thru 200 V ranges	350 V range
20 Hz to 45 Hz	1.0 + 160	1.0 + 100	1.1 + 100
45 Hz to 100 Hz	0.4 + 160	0.4 + 100	0.5 + 100
100 Hz to 20 kHz	0.28 + 160	0.28 + 100	0.3 + 100
20 kHz to 50 kHz	0.4 + 220	0.4 + 160	1.5 + 160
50 kHz to 100 kHz	1.0 + 660	1.0 + 600	——

±(% of rdg + digits)

Measuring accuracy is guaranteed for inputs above 1/10th of full scale. (But it is guaranteed for inputs above 100 V in 350 V range.)

Ratings are reduced by 1/10 in 4-1/2 and 3-1/2 digit displays, and that of 4-1/2 digit (high-speed) display equal to the 5-1/2 digit displays.

Temperature coefficient: (Measuring accuracy x 1/10)/°C within frequency range in each range.

Response time : 4 seconds max. (for rated accuracy to be attained in a fixed range)

2-1-3. Resistance Measurements

Range, maximum reading, resolution, and measuring current:

Range	Maximum reading (in 5-1/2 digit units)	Resolution			Measuring current
		5-1/2 digits	4-1/2 digits	3-1/2 digits	
200 Ω	199.999 Ω	1 mΩ	10 mΩ	100 mΩ	1 mA
2000 Ω	1999.99 Ω	10 mΩ	100 mΩ	1 Ω	
20 kΩ	19.9999 kΩ	100 mΩ	1 Ω	10 Ω	100 μA
200 kΩ	199.999 kΩ	1 Ω	10 Ω	100 Ω	10 μA
2000 kΩ	1999.99 kΩ	10 Ω	100 Ω	1 kΩ	1 μA
20 MΩ	19.9999 MΩ	100 Ω	1 kΩ	10 kΩ	100 nA
200 MΩ (Note)	199.99 MΩ	(10 kΩ)	10 kΩ	100 kΩ	10 nA

Note: The maximum reading of 200 MΩ range is a 4-1/2 digit display.

Measuring method: 4-wire or 2-wire

Measuring accuracy and temperature coefficients (in 5-1/2 digit units, 4-wire measurement):

Range	Measuring accuracy (+23°C ±5°C, six months)	Temperature coefficient
200 Ω	0.019 + 5	0.003 + 1.2
2000 Ω	0.019 + 3	0.0014 + 0.5
20 kΩ	0.019 + 3	0.0014 + 0.5
200 kΩ	0.019 + 3	0.0014 + 0.5
2000 kΩ	0.04 + 3	0.002 + 0.5
20 MΩ	0.12 + 3	0.02 + 0.5
200 MΩ	1.2 + 3	0.05 + 0.5

±(% of rdg + digits) ±(% of rdg + digits)/°C

Measuring accuracy ratings are reduced by 1/10 in 4-1/2 and 3-1/2 digit displays, and is added by 1 in 4-1/2 digit (high-speed) displays. 0.2 Ω is added in two-wire resistance measurement.

Temperature coefficient ratings are reduced by 1/10 in 4-1/2 digit and 4-1/2 digit (high-speed) displays, and by 1/100 in 3-1/2 digit displays.

0.02 Ω/°C is added in two-wire resistance measurement.

Maximum appliable voltage: Between Hi and Lo terminals, and SENSE Hi and Lo terminals: 120 Vac and 220 Vac rms continuous

Open circuit voltage: 6 V max.

2-1-4. DC Current Measurements

Range, maximum reading, resolution, resistance between input terminals, and maximum appliable current:

Range	Maximum reading (in 5-1/2 digit units)	Resolution			Resistance between input terminals	Maximum appliable current
		5-1/2 digits	4-1/2 digits	3-1/2 digits		
200 mA	199.999 mA	1 µA	10 µA	100 µA	1 Ω max.	2.5 A (fuse protection)
2000 mA	1999.99 mA	10 µA	100 µA	1 mA		

Measuring accuracy and temperature coefficients (in 5-1/2 digit units)

Range	Measuring accuracy (+23°C ±5°C, six months)	Temperature coefficient*
200 mA	0.06 + 30	0.003 + 20 (4)
2000 mA	0.07 + 6	0.003 + 2 (0.4)

±(% of rdg + digits) ±(% of rdg + digits)/°C

*: Values in brackets are ratings for 4-1/2 digit (high-speed) displays.

Measuring accuracy ratings are reduced by 1/10 in 4-1/2 and 3-1/2 digit displays, and added by 1 in 4-1/2 digit (high-speed) displays.

Temperature coefficient ratings are reduced by 1/10 of 5-1/2 digit display value in 4-1/2 digit displays, and by 1/10 of 4-1/2 digit (high-speed) display value in 3-1/2 digit displays.

2-1-5. AC Current Measurements

Range, maximum reading, resolution, resistance between input terminals, and maximum appliable current:

Range	Maximum reading (in 5-1/2 digit units)	Resolution			Resistance between input terminals	Maximum appliable current
		5-1/2 digits	4-1/2 digits	3-1/2 digits		
200 mA	199.999 mA	1 µA	10 µA	100 µA	1 Ω max.	2.5 A (fuse protection)
2000 mA	1999.99 mA	10 µA	100 µA	1 mA		

Measuring method: True RMS method (AC coupling)
Crest factor 3:1

Measuring accuracy (+23°C ±5°C, six months):

Range	Frequency range	Measuring accuracy
200 mA	20 Hz to 5 kHz	1.5 + 160
2000 mA		1.5 + 100

±(% of rdg + digits)

Measuring accuracy is guaranteed for inputs above 1/10th of full scale.

Ratings are reduced by 1/10 in 4-1/2 and 3-1/2 digit displays, and equals to 5-1/2 digit display in 4-1/2 digit (high-speed) displays.

Temperature coefficient: (Measuring accuracy x 1/10)/°C within frequency range in each range.

Response time : 4 seconds max. (for rated accuracy to be attained in a fixed range)

2-1-6. Number of Digits in Measurements, and Measuring Speed

Number of display digits	Maximum display	Integrating time
3-1/2 digits	1999	2 ms
4-1/2 digits (high-speed)	19999	
4-1/2 digits	19999	50 Hz 20 ms
5-1/2 digits	199999	60 Hz 16.667 ms

Measuring speed [Times/second] (smoothing OFF, in free-run mode): 1/2, 1/5, 1/10, 1/20, 1/50, and 1/100 of the following values can be set according to the rate setting.

(1) DC voltage measurements (all ranges)

Line frequency	3-1/2 digits	4-1/2 digits	5-1/2 digits
50 Hz	100	20 (100)	20
60 Hz	100	22 (100)	22

Values in brackets can only be set when in remote setting mode.

(2) Resistance measurements

- 200 Ω and 200 kΩ ranges: 1/2 DC voltage measurement speed
- 200 kΩ and 200 MΩ ranges: Same as in AC voltage measurements

(3) AC voltage measurements (all ranges)

Line frequecy	3-1/2 digits	4-1/2 digits	5-1/2 digits
50 Hz	100	20 (100)	2
60 Hz	100	22 (100)	2.5

Values in brackets can only be set when in remote setting mode.

(4) DC current measurements

- 200 mA range: Same as in AC voltage measurements
- 2000 mA range: Same as in DC voltage measurements

(5) AC current measurements

200 mA and 2000 mA ranges: Same as in AC voltage measurements

2-2. GENERAL SPECIFICATIONS

Measuring system : Integration type

Input system : Floating method

Maximum reading : 199999 (except in DC voltage 1000 V, AC voltage 350 V, and resistance 200 MΩ ranges)

Display : Decimal, 6-digit, 7-segment liquid crystal display
Units and other functions displayed by 5x7 dot matrix characters

Overload indication: OVER indicator for inputs in excess of measuring range

Low battery indication: BATT indicator if AC or Ni-Cd battery power drops below specified voltage

Range switching : Automatic and manual
Automatic range (up level: 200000, down level: 17999)

External trigger : Sampling start can be controlled externally if sampling is set to HOLD.

Signal levels : Negative logic pulses
High level : +2.7 V to +5.25 V
Low level : 0 V to +0.5 V
Pulse width: 100 µs min.

Filter function : Digital smoothing method
(Smoothing repetition count: 100 times max.)

NULL function : Output of value obtained by subtracting NULL setting from measured value.

Panel settings memory: Panel settings stored in non-volatile memory

Interfaces : Output of measured data, and remote setting of functions, ranges, sampling, and smoothing by TR13206A (GPIB adapter unit)
Output of measured data, and remote setting of functions and ranges, and external starting by TR13003A (BCD data output unit)

Operating environment:

Temperature : 0°C to +50°C (but 0°C to +40°C when using the TR15802 battery unit)

Humidity : 85% RH max.
Operating temperature restricted to 0°C to +35°C and humidity to 70% RH max. in 20 MΩ and 200 MΩ ranges, and during AC voltage and current measurements above 1 kHz.

Storage temperature range: -25°C to +70°C (but -20°C to +35°C when TR15802 battery unit is used)

Power supply : AC mains : 100 V ±10% (alterable as listed in the table below), 50/60 Hz
DC supply: Min. eight hours continuous operation with TR15802 battery unit.

AC power supply alteration:

Option no.	Standard	31	32	42	43	44
Power supply voltage (V)	100	115	120	220	230	240
Power supply fluctuation (%)	±10	±10	±10	±10	+8, -10	+4, -10

Power consumption : 5 VA max. (without accessory units)
7 VA max. (with accessory units)

Dimensions : Approx. 190 (W) x 70 (H) x 260 (D) mm

Weight : 2.2 kg max. (without accessory units)

2-3. ACCESSORIES SUPPLIED

Accessory	Model	Quantity
Power cable	MP-43	1
Input cable	A01001	1
Fuse	TMF51NR2 (250)	2
Fuse	EAWK 0.16 A (for 100, 115, and 120 V)	2
	EAWK 0.08 A (for 220, 230, and 240 V)	(2)
Instruction manual		1

MEMO

SECTION 3
OPERATING PROCEDURES

3-1. INSPECTION

After taking delivery of the TR6851, first check that it has suffered no damage during transportation. If damage has been detected, or if the multimeter fails to operate according to specifications, please contact your nearest ADVANTEST representative.

3-2. STORAGE

If the TR6851 is not going to be used for a long period of time, wrap it up in a vinyl cover, put it in a corrugated cardboard box, and store in a cool, dry place (away from direct sunlight). The storage temperature should be kept between $-25^{\circ}C$ and $+70^{\circ}C$.
If the TR15802 battery unit is also to be stored away for a long period of time, store it in the same way as the TR6851. The storage temperature range is $-20^{\circ}C$ to $+35^{\circ}C$.

3-3. PRELIMINARY PREPARATION AND PRECAUTIONS

(1) Always use the accessory power cable when operating the TR6851 by commercial AC mains power. The power rating in this case should be 100 Vac ±10% (or 115 V, 120 V, 220 Vac ±10%, 230 Vac +8%, −10%, or 240 Vac +4%, −10% as specified), with line frequency of 50/60 Hz. Always check that the POWER switch is OFF before connecting the TR6851 power cable to the AC power mains or when mounting the TR15802 battery unit.

(2) And always check that the POWER switch is OFF before mounting any of the accessory units into the TR6851.

(3) To attain the measuring accuracy described in Section 2, the TR6851 must be allowed to warm up for at least 30 minutes (when either AC mains or battery unit is used).

(4) The ambient temperature should be within the $0^{\circ}C$ to $+50^{\circ}C$ range, and the ambient humidity less than 85% RH.

Avoid using the TR6851 in direct sunlight, and make sure that the surrounding area is well ventilated.

(5) Protect the TR6851 from severe mechanical shock.

3-4. POWER CABLE

To prevent from an accidental electric shock when operating the TR6851 on commercial AC mains power, make sure that the center prong of the power connector is connected to ground. The center round prong of the 3-prong plug of the accessory power cable is for grounding. The gound connection is made automatically if this plug is connected directly to a 3-prong power socket.

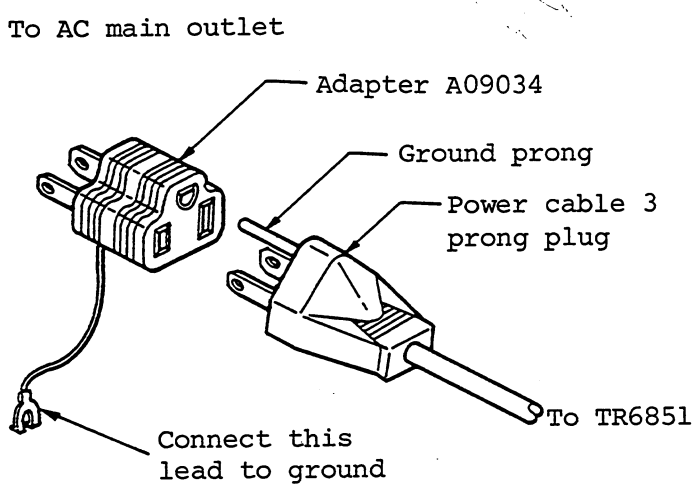


Fig. 3-1 Power cable

3-5. HANDLE OPERATION

The handle can be locked in the positions shown in Figure 3-2 for greater ease of operation.

The handle lock can be released by pulling the left and right hand sides of the handle outwards as shown in Figure 3-3. The handle can then be rotated freely to change in the desired position.

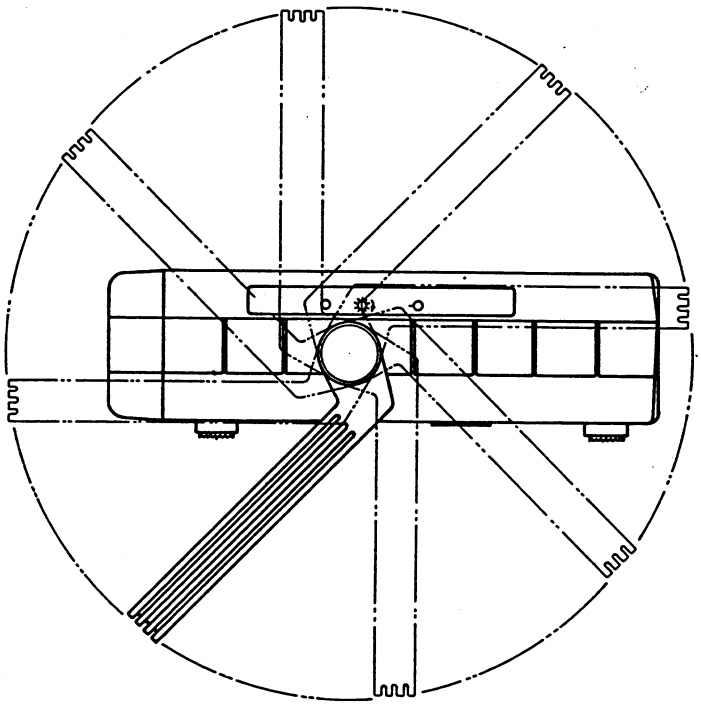


Fig. 3-2 Handle locking positions

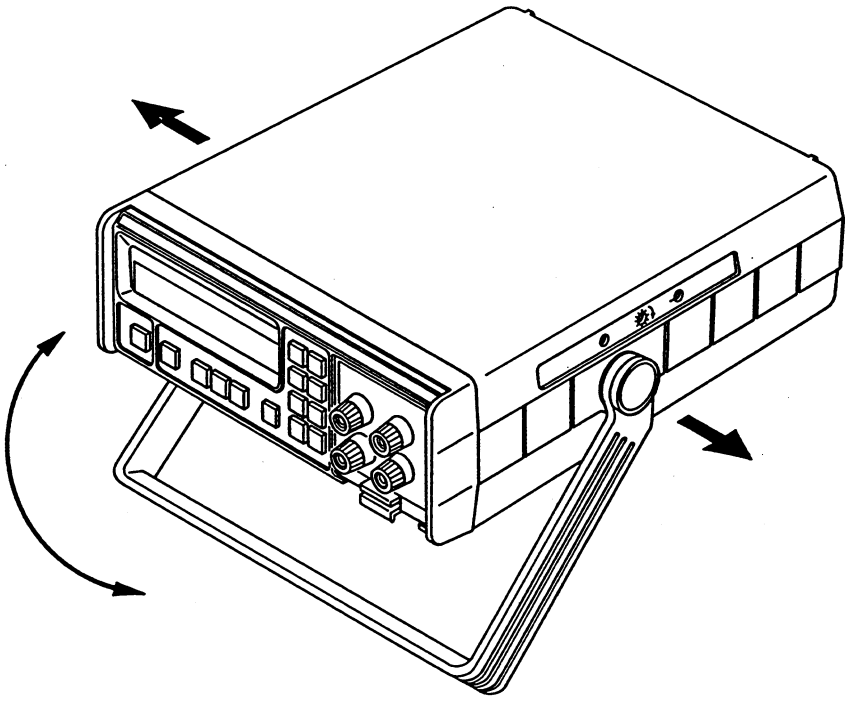
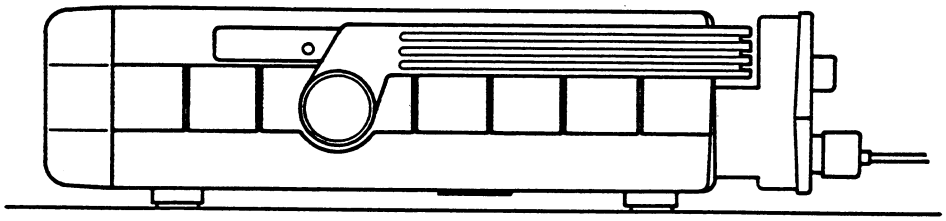
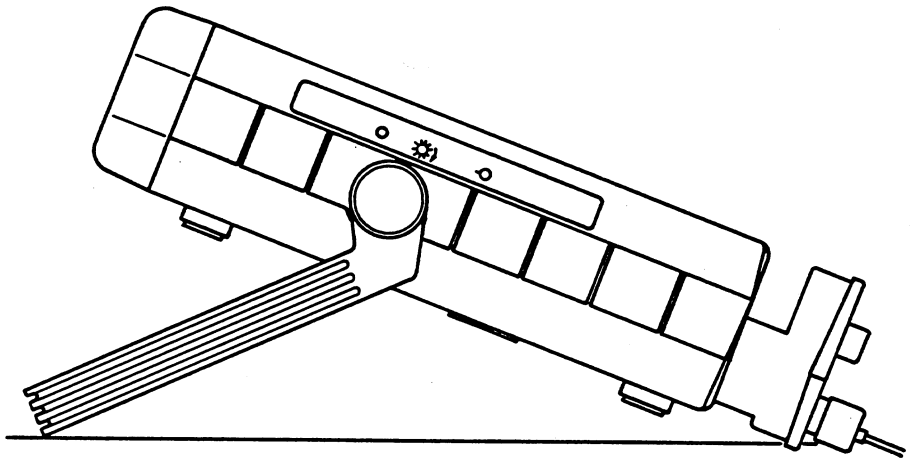


Fig. 3-3 Releasing the handle lock

When one of the accessory units (such as TR13003A or TR13206A) is connected to the TR6851, however, set the handle in the position shown in Figure 3-4(a). Setting to the position shown in Figure 3-4(b) can result in measuring failure due to the accessory unit case and connecting cable coming into contact with the desk top.



(a) Correct handle position

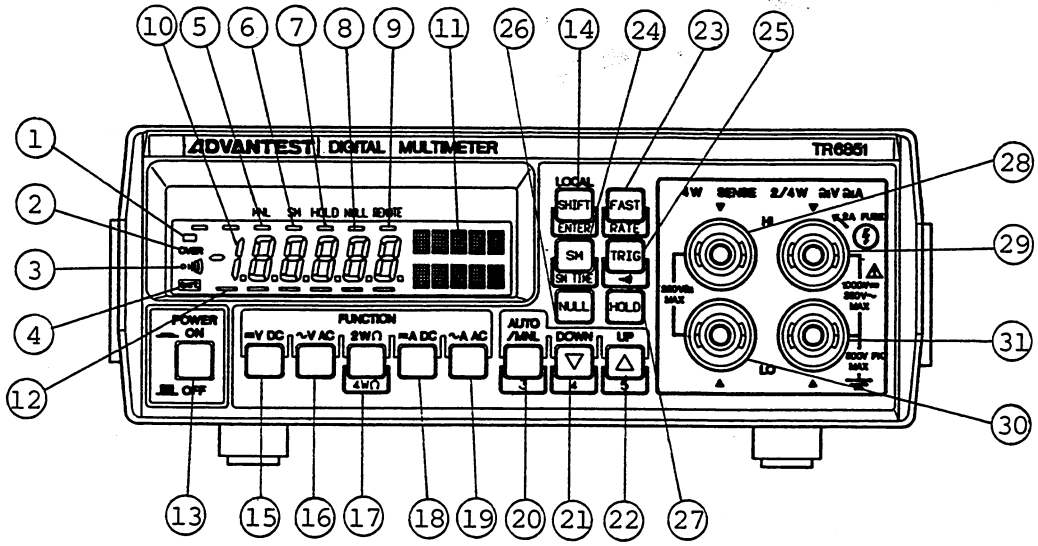


(b) Not recommended

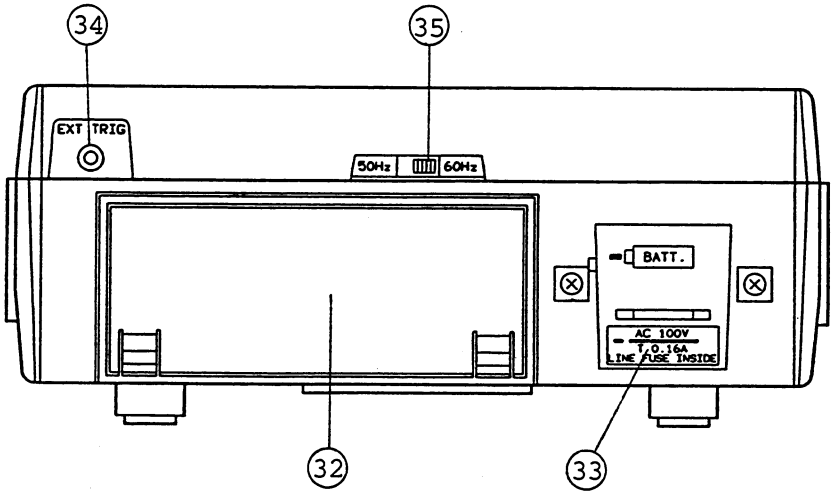
Fig. 3-4 Handle position when accessory unit is connected

3-6. PANEL DESCRIPTION

Front panel



Rear panel



Right side panel

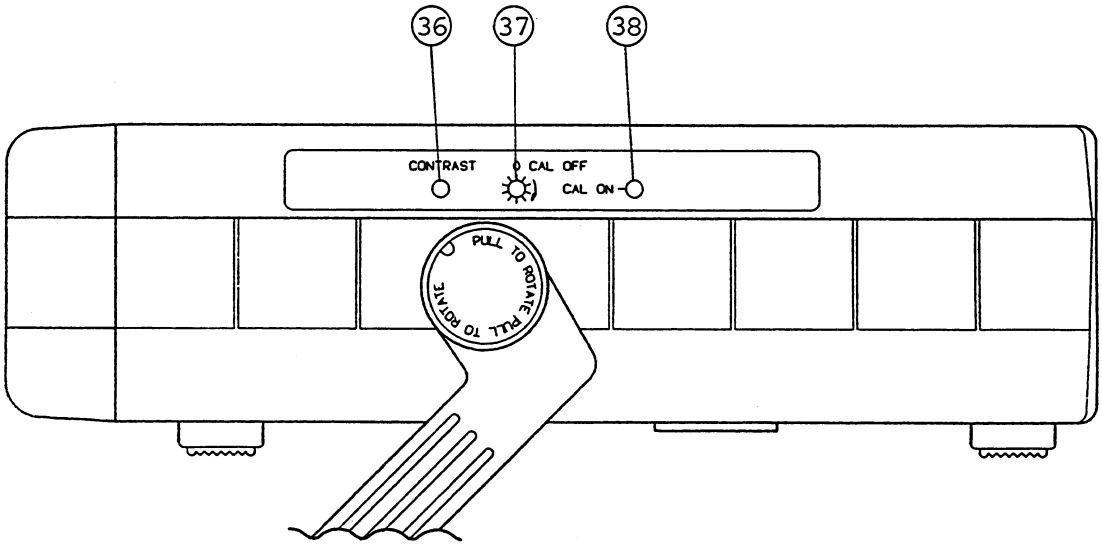


Fig. 3-5 Panel description

3-6-1. Description of Display Section

① Sampling indicator
Indicates that a measurement is in progress.

② OVER indicator
Indicates that the measured result or arithmetic operation result is beyond the limit of the measuring range.

③ Buzzer indicator
Indicates that a buzzer tone is to be generated.

④ Battery indicator
Indicates that the power supply voltage has dropped below the specified rating.

⑤ MNL indicator
Indicates that a measuring range has been selected.

⑥ SM indicator
Indicates that a smoothing operation is in grogress.

⑦ HOLD indicator
Indicates that the TR6851 is in sampling hold status.

⑧ NULL indicator
Indicates that a null operation is in progress.

⑨ REMOTE indicator
Indicates that the TR6851 is being controlled externally.

⑩ Numerals display section
5-1/2 digit digital display with maximum reading of 199999. The decimal point is set automatically according to the measuring range. Only minus signs are displayed.

⑪ Unit and function display section
Units, measuring functions, and other information is shown here according to the selected measuring function and range.

⑫ Cursor
Indicates the digit to be changed when calibrating.

3-6-2. Description of Operation Keys

⑬ POWER switch

Power is supplied to the internal circuits when this switch is depressed (ON), and switched off when released again (OFF). When the TR15802 is connected to the TR6851, power is supplied irrespective of the POWER switch position. (See Section 5).

⑭ 

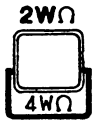
- During normal measurements: Setting and release of shift mode. When this key is pressed, shift mode is entered, and the panel key switches correspond to the functions indicated by green characters below the relevant keys. In this case, "shift" appears below the unit display to indicate that the multimeter is in shift mode. Shift mode is cancelled when this key is pressed a second time.
- When setting constants: When setting sampling rates and smoothing times, the displayed numerical value is set as a constant and the measuring operation is commenced.
- During remote operation: The multimeter is switched to local control mode where the panel keys are valid.

⑮ 

Measuring function is set to DC voltage measurement.
The measuring range selected is the previously set range.

⑯ 

Measuring function is set to AC voltage measurement.
The measuring range selected is the previously set range.

⑰ 

Measuring function is set to 2-wire resistance measurement. The measuring range selected is the previously set range. In shift mode, measuring function is set to 4-wire resistance measurement with the measuring range selected again being set to the previously set range.

⑱ 

Measuring function is set to DC current measurement. The measuring range selected is the previously set range.

⑲ 

Measuring function is set to AC current measurement. The measuring range selected is the previously set range.

⑳ 

Auto/manual switching of measuring range settings. When setting calibration values, this key is used to move the cursor. The display is set to a 3-1/2 digit display in shift mode.

㉑ 

- Pressing this key during auto-range measuring status results in a switch to manual range and a drop to the next lower range.
- Pressing this key during manual range measuring status results in a drop to the next lower range.
- Pressing this key in sampling rate setting status results in the sampling rate being dropped to the next lower setting.
- Pressing this key in smoothing count setting status results in the smoothing count being dropped to the next lower setting.
- The display is set to a 4-1/2 digit display in shift mode.

㉒ 

- Pressing this key during auto-range measuring status results in a switch to manual range and an increase to the next higher range.
- Pressing this key during manual range measuring status results in an increase to the next higher range.
- Pressing this key in sampling rate setting status results in the sampling rate being increased to the next higher setting.
- Pressing this key in smoothing times setting status results in the smoothing times being increased to the next higher setting.
- The display is set to a 5-1/2 digit display in shift mode.

㉓ 

Measurement is started with the sampling rate switched to FAST (maximum speed). In shift mode, the sampling rate setting status is entered.

[Setting procedure]

Start of measurement

↑

Display of rate prior to change

Rate is set by DOWN/UP keys

㉔ 

ON/OFF switching of smoothing operations.

The smoothing times setting status is entered in shift mode.

[Setting procedure]

Start of measurement

↑

Display of rate prior to change

Rate is set by DOWN/UP keys

㉕ 

Input of measurement start command during sampling hold status. Buzzer ON/OFF switching is executed in shift mode.

㉖ 

Relative display of the current display value as 0.

㉗ 

Sampling hold ON/OFF switching.

3-6-3. Description of Input Terminals

㉘ SENSE terminal HI
Input HI terminal for 4-wire resistance measurements. Connect to the HI connector (red) when using the 4-wire resistance measurement cable (A01006).

㉙ INPUT terminal HI
Input terminal for all measuring functions. Connect the HI (red) connector of the input cable.

㉚ SENSE terminal LO
Input LO terminal for 4-wire resistance measurements. Connnect to the LO connector (blue) when using the 4-wire resistance measurement cable (A01006).

㉛ INPUT terminal LO
Input terminal for all measuring functions. Connect the LO (black) connector of the input cable.

3-6-4. Description of Rear Panel

㉜ Accessory unit cover

Remove this cover to permit connection of the various optional accessory units.

Since the internal option connector input/output signals are not isolated from the measuring signal system, incorrect use of the multimeter can result in instability of measured results and damage to the internal circuitry. Therefore, no other equipment apart from the specified optional accessory units (TR13003A, TR13206A, TR15802) must be connected to the multimeter.

It is also risky to perform measurements without the cover in place. If no option is connected, always ensure to keep this cover properly in place.

㉝ Power connector

Connector for AC power supply. This connector is equipped with a safety shutter which is lifted to enable the power cable to be connected. Note, however, that the battery power drive circuit is disconnected if this shutter is opened with the TR15802 unit connected to the multimeter.

㉞ External trigger terminal

Input terminal for external trigger signals which can be used when the multimeter is in sampling hold status. Measurements can be started by external trigger signal.

㉟ 50 Hz/60 Hz selector switch

Set to the position corresponding to the local line frequency of the AC power supply to be used. An incorrect setting may result in a unstable display.

The set status is shown when the power is first switched on.

3-6-5. Description of the Right Hand Side Panel

㊱ CONTRAST control

Contrast adjustment of the liquid crystal display.

㊲ 0 CAL OFF

This rotary switch can be set to 10 different positions. All positions apart from "0" are indicated in the display section. The main positions are described below.

0: Measurements are performed on the basis of internal calibration data. Measurements are usually performed with the switch set in this position.

1: CAL 1

Set to this position when calibrating on the basis of an external reference signal source.

㊳ CAL ON switch

Pressing this key switch enables calibrated values to be set and calibration operations to be started.

3-7. BASIC OPERATIONS

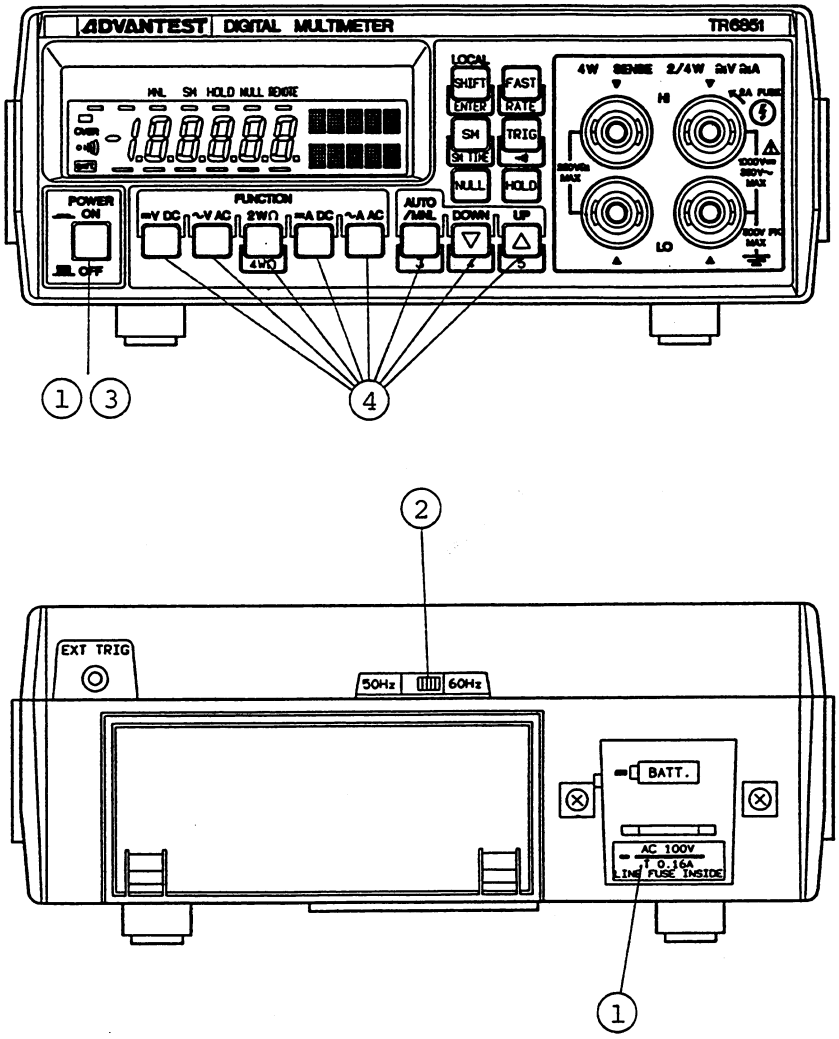


Fig. 3-6 Basic operations

Proceed with the following operations by referring to Figure 3-6.

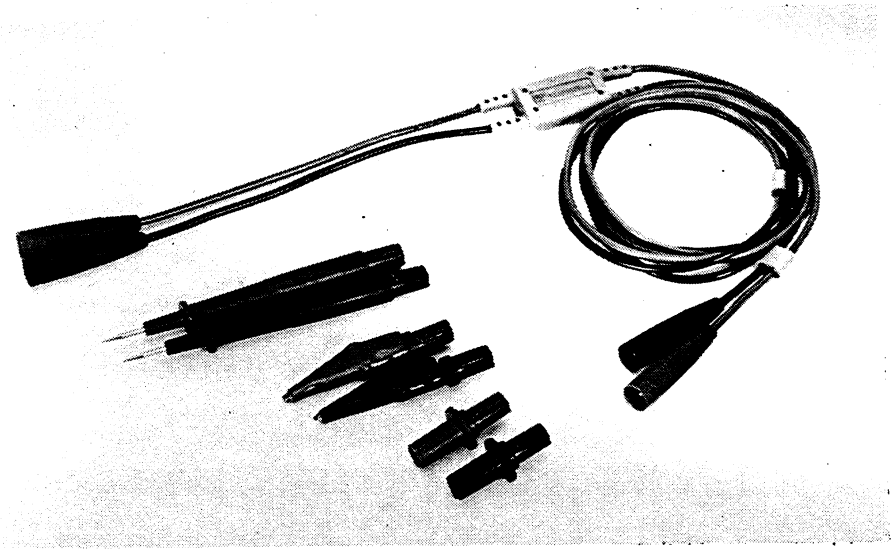
① After checking that the POWER switch is OFF, mount the TR15802 battery unit or connect the accessory power cable (MP-43) to the power connector.
It is essential that the voltage of the AC power mains to be used is the same as the voltage rating shown on the rear panel of the multimeter.

② Set the 50 Hz/60 Hz selector switch to the local line frequency of the AC power supply to be used. Even when the TR15802 unit is used, set the selector switch to the local line frequency of the power supply used by the peripheral equipment.

③ Press the POWER switch to the ON position. The set line frequency is displayed at this time.

④ Select the most suitable function for the signal to be measured.

⑤ Connect input cables according to the measuring function to be used. Note that the input cables are equipped with a lock mechanism to guard the operator from possible danger if a cable should happen to come loose while measuring a high voltage or current. The lock is engaged by inserting the connector with the lock section aligned with slits in the input terminal, and then turning the connector by about 70° clockwise. (See Figure 3-7.)



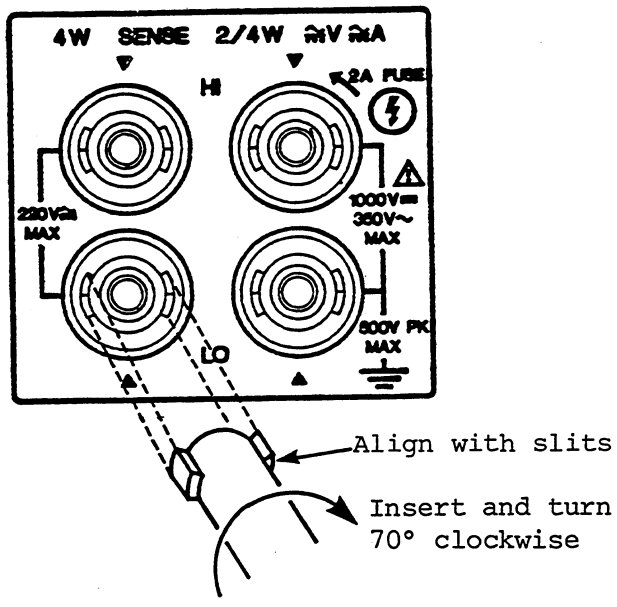


Fig. 3-7 Input cable lock mechanism

3-8. MEASURING PROCEDURES

3-8-1. DC Voltage Measurements

CAUTION

Maximum appliable voltage in each range are as follows:

20 mV, 200 mV, and 2000 mV ranges: 400 V (continuous)
1100 V (for 10 s max.)
(DC or AC peak)

20 V, 200 V, and 1000 V ranges : 1100 V (continuous)
(DC or AC peak)

These voltage limits must be exceeded under no circumstances.

① Press 

key to set DC voltage measurement function, and connect the input cable to the signal source to be measured.

② Input impedance requirements are:

1000 MΩ min. in 20 mV, 200 mV, and 2000 mV ranges.

10 MΩ ±1% in 20 V, 200 V, and 1000 V ranges.

Note that no overload indication is shown if a voltage greater than 1000 V is applied when set in the 1000 V range.

Since the respective resolution ratings in the 20 mV, 200 mV, and 2000 mV ranges are highly sensitive 0.1 μV, 1 μV, and 10 μV values, the use of a different metal at the terminal of the signal source to be measured (that is, different from the metal of the tip of the input cable), or a temperature difference between terminals will result in the generation of a thermoelectromotive force and the introduction of error into the measurements. Therefore, only cables with copper terminals should be used, and the use of a heat sink is considered to overcome any large temperature differences at the connecting points of the measuring system. If the connection points are exposed to air conditioner drafts, etc. cover the connections or change the position of the multimeter.

Immediately after measuring a large current, the input terminal section is in a state of thermal imbalance which results in the generation of a thermoelectromotive force and displacement of the zero point. Therefore, after completing this kind of measurement, wait about ten minutes for the thermal balance to be restored and for the zero point displacement to be corrected.

Do not use the multimeter near highly inductive equipment such as electric motors and transformers. If this is unavoidable, however, use a shielded input cable, or twist the cable, or consider other methods to suppress the effect of induction.

The device to be measured should be connected to ground to avoid the generation of a common mode voltage between the device and the multimeter. If a ground connection is not possible, see the specifications on effective noise rejection ratio of the TR6851.

3-8-2. AC Voltage Measurements

CAUTION

Maximum appliable voltage during AC voltage measurements are as follows:

400 Vrms (continuous)

500 V (peak)

These voltage limits must be exceeded under no circumstances.

① Press 

key to set AC voltage measurement function, and connect the input cable to the signal source to be measured.

② Input impedance requirements for all ranges is:

1 MΩ ±1% 100 pF max.

3-8-3. Resistance Measurements

CAUTION

- Maximum appliable voltage during resistance measurements are as follows:

  120 Vdc (continuous), 220 Vac rms (continuous)

  These voltage limits must be exceeded under no circumstances.
- Correct results cannot be obtained if a voltage is applied across both ends of the resistor to be measured.

  Prevent the generation of a thermoelectromotive force at the junction between the input cable and the resistor to be measured. Also take utmost precautions against possible induction from peripheral equipment.

① Set to resistance measurement function, and connect the input cable to the resistor to be measured.

Press 

key to set 2-wire resistance measurement, or press 

key followed by 

key to set 4-wire resistance measurement.

② The maximum voltage which may be applied between terminals when the input terminal is open is 6 V. And the measuring currents and voltages to be applied in each measuring range are as listed in the following table.

Table 3-1 Measuring currents and voltages to be applied

Measuring range	Measuring current	Measuring voltage
200 Ω	1 mA	0.2 V
2000 Ω	1 mA	2 V
20 kΩ	100 μA	2 V
200 kΩ	10 μA	2 V
2000 kΩ	1 μA	2 V
20 MΩ	100 nA	2 V
200 MΩ	10 nA	2 V

3-8-4. DC and AC Current Measurements

> **CAUTION**
>
> Maximum appliable current during current measurements are as follows:
>
> 200 mA and 2000 mA ranges: 2.5 Arms

If the protector fuse is blown by an excessively large input current, disconnect the HI input connector and replace the fuse (see Section 3-10).
Also make sure that the input cable is securely connected. If the cable become loose during a current measurement, not only will the measured circuit be effected, but the operator will be in considerable danger if a large power capacity device is being measured.

(1) Press 

key to set DC current measurement function.

Press 

key to set AC current measurement function.

(2) The resistance between input terminals should not exceed 1 Ω.

3-8-5. Sampling Control

(1) The maximum sampling speed (FAST) is determined by the measuring function and range, and the specified digits display (see Section 2-1-6). In free-run mode, the sampling speed can be set to six different levels in respect to FAST value.
In hold status, sampling can be controlled by the TRIG key or by external trigger signal. A single measuring operation can be executed by pressing the TRIG key or by detection of an external trigger signal.
The delay time (Td) prior to start of measurement after an external trigger signal has been applied can be set by the sampling rate.

Note: Measurements cannot be executed if the TRIG key is depressed and held.

(2) Sampling rate setting procedures

① Press the SHIFT key and then the RATE key. The resultant display is as indicated in Figure 3-8 below.

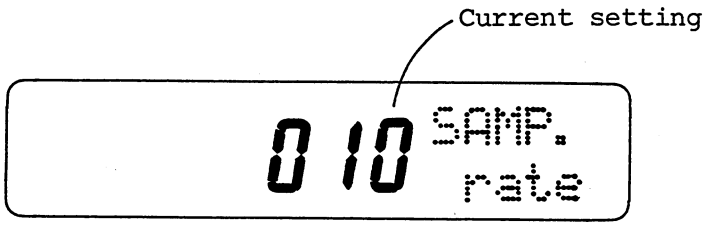


Fig. 3-8 Display when sampling rate is set

② Select the desired sampling rate by pressing the UP or DOWN key.

③ Press the ENTER key to set the sampling rate.
The rate can be set to six different levels: FAST value X2, X5, X10, X20, X50, and X100.

3-8-6. Smoothing Function

(1) The smoothing function is a digital filter function determined by computing the measured value in a running average for the specified number of times when noise is imposed on the measured signal. See Figure 3-9.

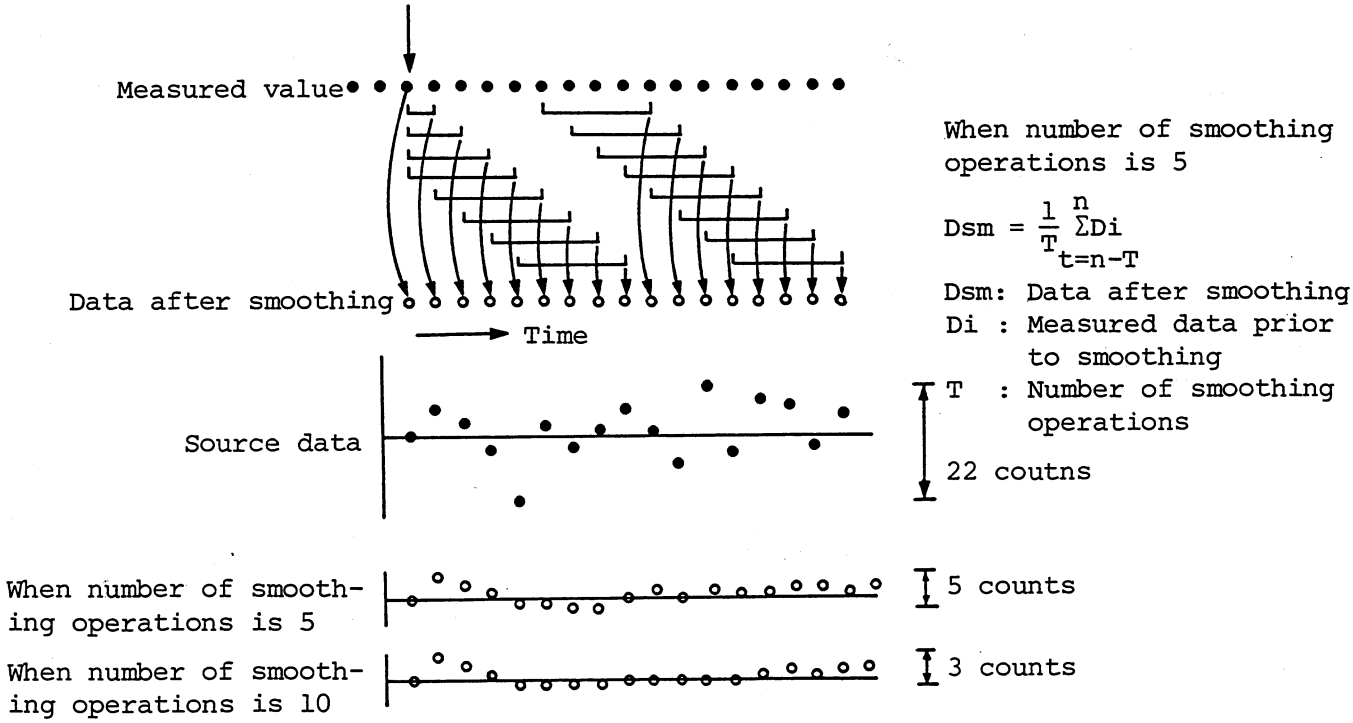


Fig. 3-9 Smoothing function operation

The number of smoothing operations (the number of data items averaged) can be set in seven steps in the 1 thru 100 range. See paragraph (2) below. Smoothing is executed by pressing the front panel SM key, and this results in the SM indicator coming on.

Once the smoothing has been started, the SM indicator blinks on and off until the measurement reaches the specified number of smoothing operations. That is, data should be read after the SM indicator stops blinking.

If the measuring function, measuring range, or number of display digits is changed during a smoothing operation, all smoothing data up to that time is cleared and the smoothing operation is commenced from the beginning again. In this case, the SM indicator commences to blink on and off to indicate that data is being stored. When the specified number of smoothing operations is reached, the SM indicator remains on (without blinking). See Figure 3-10.

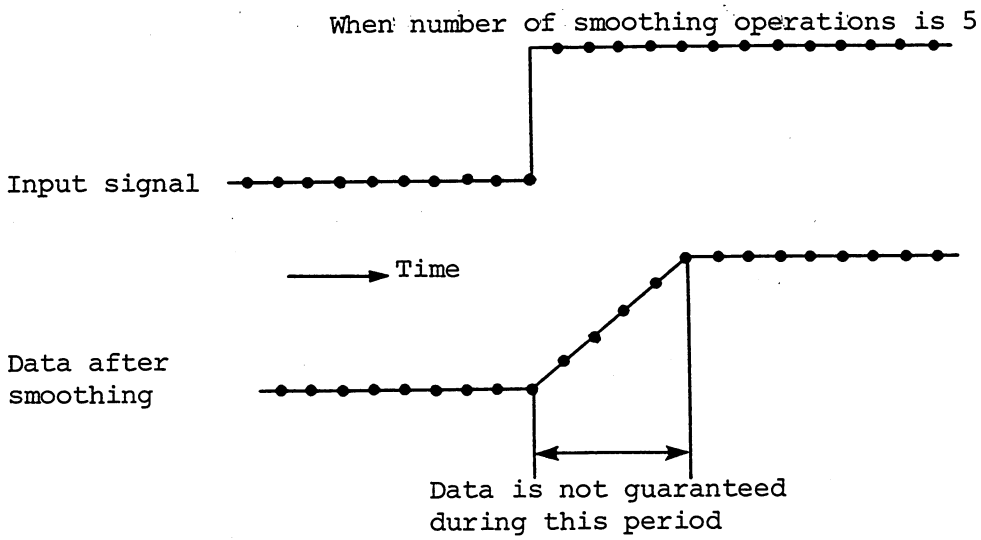


Fig. 3-10 Example where input signal is changed during smoothing operation

(2) Setting the number of smoothing operations

① Press the SHIFT key and then the SM TIME key. The display will be as indicated in Figure 3-11.

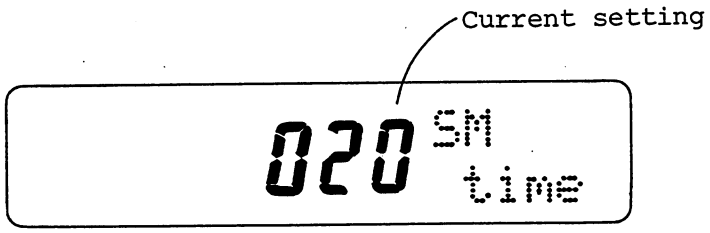
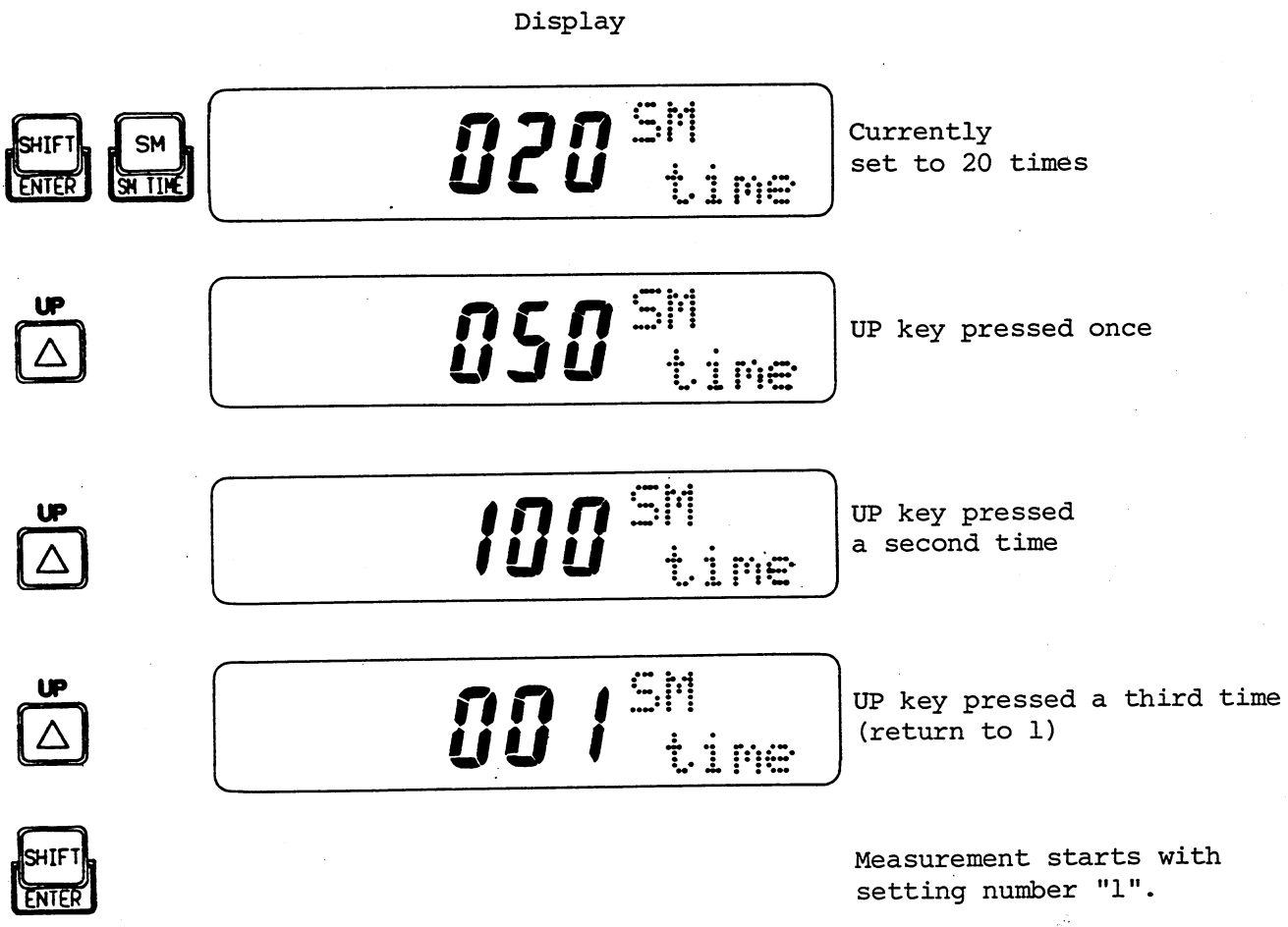


Fig. 3-11 Display when number of smoothing operations is set

② Select the desired number of smoothing operations by pressing the UP or DOWN key.

③ Press the ENTER key to set the smoothing number. This number can be set to 1, 2, 5, 10, 20, 50, or 100 times (7 levels).

Example:



3-8-7. NULL Operations

(1) NULL operations are executed by using a digital offset function where a set value is subtracted from the measured value in order to measure relative values in voltage and current measurements, or to compensate for lead wire resistance during resistance measurements.

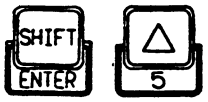
Note: If the multimeter is switched to the next lower range during a NULL operation, execution of that operation proceeds with the least significant digits of the NULL constant set to 0.

(2) NULL constant setting procedures

The current value when the NULL key is pressed is set as a constant.

Example: If the NULL key is pressed when "000.02 mV DC" is shown in the display section, the NULL function is switched on, and the display is changed to "000.00 mV DC". And 0.02 mV will be subtracted from all subsequent values measured.

3-8-8. Setting the Number of Display Digits

The number of digits in the measured result display can be changed (to 3-1/2, 4-1/2, or 5-1/2 digits) to enable measurements to be executed at optimum accuracy and speed.
See Section 2-1 for details on measuring speed.
To change the number of display digits, press the SHIFT key and then the desired number. For example, to set to 5-1/2 digits, press the keys 

.
If the number of display digits is changed during a smoothing operation, all smoothing data up to that time is cleared and the smoothing operation is recommenced from the beginning. And if the change is made during a NULL operation, the NULL function is switched off.

3-8-9. External Trigger Function

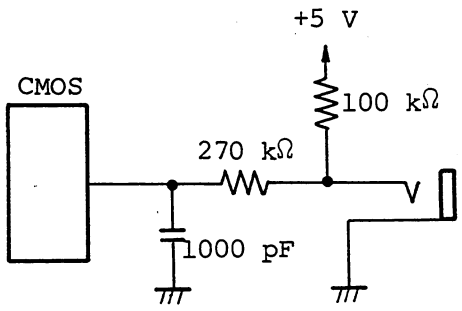
When the TR6851 is set to sampling hold status, external sampling start can be activated by any of the following three methods.

a. Press the front panel TRIG key.
b. Use the rear panel external trigger terminal.
c. Use a GPIB or BCD unit (see Sections 6 and 7).

Trigger signals applied to the rear panel external trigger terminal must conform with the following specifications.

Signal level: TTL level, negative pulse (pulse width 100 μs min.)
Trigger detection: Trailing edge

External trigger input circuit, pin assignment, and suitable plug

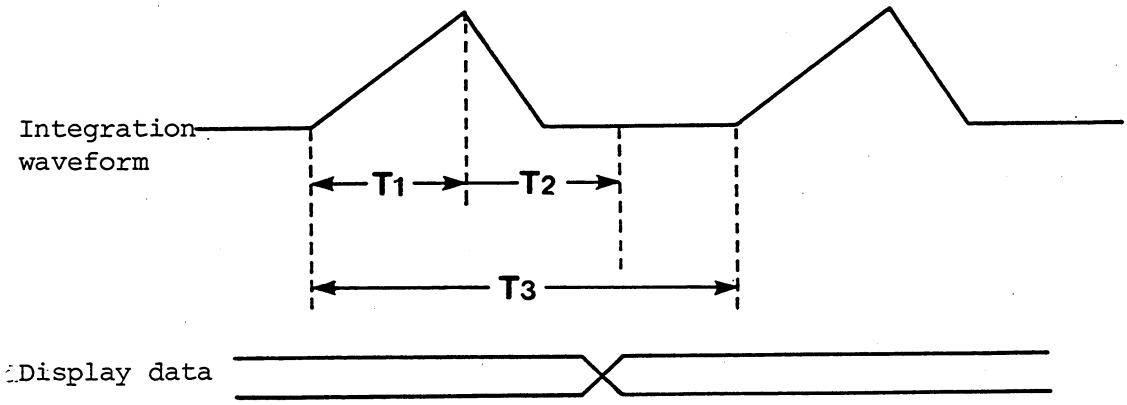


Use plugs specified in JIS C6560 Small Single Head Plugs (3.5 mm diam.).
Recommended model: NSP 0059-01-060 manufactured by Hoshi Electrics
The ADVANTEST's connecting plug which matches this connector is the A01204 (optional).

3-8-10. Measurement Timing

The relevant measuring sequence timing chart and timing table are outlined below.

When in free-run mode



For 3-1/2 digits and 4-1/2 digits high-speed operations

Function	T_1	T_2	T_3	Times/s
DC voltage	2 ms	8 ms	10 ms	100
DC current	2 ms	8 ms	10 ms	100
AC voltage	2 ms	8 ms	10 ms	100
AC current	2 ms	8 ms	10 ms	100
2-wire resistance (200 Ω thru 200 kΩ)	2 ms	8 ms	20 ms	50
2-wire resistance (2000 kΩ thru 200 MΩ)	2 ms	8 ms	10 ms	100
4-wire resistance (200 Ω thru 200 kΩ)	2 ms	8 ms	20 ms	50
4-wire resistance (2000 kΩ thru 200 MΩ)	2 ms	8 ms	10 ms	100

For 4-1/2 digits operations

Function	T_1		T_2		T_3		Times/s	
	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
DC voltage	20 ms	16 ms	30 ms	28 ms	50(130) ms	44(120) ms	20	22
DC current	20 ms	16 ms	30 ms	28 ms	50(130) ms	44(120) ms	20	22
AC voltage	20 ms	16 ms	30 ms	28 ms	50(130) ms	44(120) ms	20	22
AC current	20 ms	16 ms	30 ms	28 ms	50(130) ms	44(120) ms	20	22
2-wire resistance (200 Ω thru 200 kΩ)	20 ms	16 ms	30 ms	28 ms	100 ms	88 ms	10	11
2-wire resistance (2000 kΩ thru 200 MΩ)	20 ms	16 ms	30 ms	28 ms	50 ms	44 ms	20	22
4-wire resistance (200 Ω thru 200 kΩ)	20 ms	16 ms	30 ms	28 ms	100 ms	88 ms	10	11
4-wire resistance (2000 kΩ thru 200 MΩ)	20 ms	16 ms	30 ms	28 ms	50 ms	44 ms	20	22

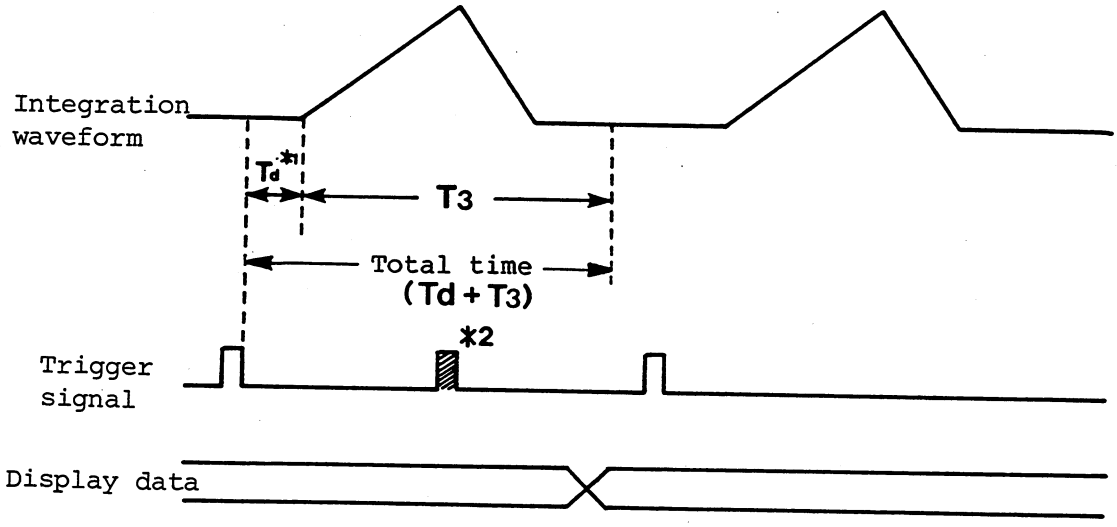
For 5-1/2 digits operations

Function	T_1		T_2		T_3		Times/s	
	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
DC voltage	20 ms	16 ms	30 ms	28 ms	50(130) ms	44(120) ms	20	22
DC current (2 A)	20 ms	16 ms	30 ms	28 ms	50(130) ms	44(120) ms	20	22
DC current (200 mA)	160 ms	128 ms	240 ms	224 ms	400(480) ms	352(428) ms	2	2
AC voltage	160 ms	128 ms	240 ms	224 ms	400(480) ms	352(428) ms	2	2
AC current	160 ms	128 ms	240 ms	224 ms	400(480) ms	352(428) ms	2	2
2-wire resistance (200 Ω thru 200 kΩ)	20 ms	16 ms	30 ms	28 ms	100 ms	88 ms	10	11
2-wire resistance (2000 kΩ thru 200 MΩ)	160 ms	128 ms	240 ms	224 ms	400 ms	352 ms	2	2.5
4-wire resistance (200 Ω thru 200 kΩ)	20 ms	16 ms	30 ms	28 ms	100 ms	88 ms	10	11
4-wire resistance (2000 kΩ thru 200 MΩ)	160 ms	128 ms	240 ms	224 ms	400 ms	352 ms	2	2.5

Figures in brackets refer to cases where auto-zero calibration is included.

Sampling speed can be set to FAST value X2, X5, X10, X20, X50, and X100 depending on the rate setting.

When in hold mode



*1: Td can add times of T_3 x (n-1) (where n = 1, 2, 5, 10, 20, 50, or 100) in respect to FAST value, depending on the rate setting.

*2: Invalid when external trigger terminal is used. Valid when the front panel TRIG key is used.

For 3-1/2 digits and 4-1/2 digits high-speed operations

Function	Td	T_3
DC voltage	1 to 10 ms	10 ms
DC current	1 to 10 ms	10 ms
AC voltage	1 to 10 ms	10 ms
AC current	1 to 10 ms	10 ms
2-wire resistance (200 Ω thru 200 kΩ)	1 to 20 ms	20 ms
2-wire resistance (2000 k, 20 M, 200 MΩ)	1 to 10 ms	10 ms
4-wire resistance (200 Ω thru 200 kΩ)	1 to 20 ms	20 ms
4-wire resistance (2000 k, 20 M, 200 MΩ)	1 to 10 ms	10 ms

For 4-1/2 digits operations

Function	Td		T_3	
	50 Hz	60 Hz	50 Hz	60 Hz
DC voltage	1 to 50(130) ms	1 to 44(120) ms	50(130) ms	44(120) ms
DC current	1 to 50(130) ms	1 to 44(120) ms	50(130) ms	44(120) ms
AC voltage	1 to 50(130) ms	1 to 44(120) ms	50(130) ms	44(120) ms
AC current	1 to 50(130) ms	1 to 44(120) ms	50(130) ms	44(120) ms
2-wire resistance (200 Ω thru 200 kΩ)	1 to 100 ms	1 to 88 ms	100 ms	88 ms
2-wire resistance (2000 k, 20 M, 200 MΩ)	1 to 50 ms	1 to 44 ms	50 ms	44 ms
4-wire resistance (200 Ω and 200 kΩ)	1 to 100 ms	1 to 88 ms	100 ms	88 ms
4-wire resistance (2000 k, 20 M, 200 MΩ)	1 to 50 ms	1 to 44 ms	50 ms	44 ms

For 5-1/2 digits operations

Function	Td		T_3	
	50 Hz	60 Hz	50 Hz	60 Hz
DC voltage	1 to 50(130) ms	1 to 44(120) ms	50(130) ms	44(120) ms
DC current (2 A)	1 to 50(130) ms	1 to 44(120) ms	50(130) ms	44(120) ms
DC current (200 mA)	1 to 400(480) ms	1-352(428) ms	400(480) ms	352(428) ms
AC voltage	1-400(480) ms	1-352(428) ms	400(480) ms	352(428) ms
AC current	1-400(480) ms	1-352(428) ms	400(480) ms	352(428) ms
2-wire resistance (200 Ω thru 200 kΩ)	1-100 ms	1- 88 ms	100 ms	88 ms
2-wire resistance (2000 k, 20 M, 200 MΩ)	1-400 ms	1-352 ms	400 ms	352 ms
4-wire resistance (200 Ω thru 200 kΩ)	1-100 ms	1- 88 ms	100 ms	88 ms
4-wire resistance (2000 k, 20 M, 200 MΩ)	1-400 ms	1-352 ms	400 ms	352 ms

Figures in brackets refer to cases where auto-zero calibration is included.

The timing table values are the values when the external trigger terminal is used.

The hand-shake time and 2 msec are both added to the above times when GP-IB is used.

3-9. USE OF INTERNAL BATTERY

The TR6851 is equipped with the TR15802 Battery Unit to enable operations to be powered by battery.

(1) General precautions

① When the BATT indicator comes on to indicate that the battery voltage has dropped below operating voltage level, switch over to AC power supply immediately to recharge the battery.

② The batery power supply circuit is automatically disconnected and the AC mains switched on when the power cable is connected to the power connector.

③ When the TR15802 is mounted and the TR6851 is connected to the AC mains by power cable, the battery is charged up irrespective of the POWER switch setting.

④ The TR15802 can be switched to FULL charging or TRICKLE charging mode by the FULL/TRICKLE switch on that unit. The switch should be set to TRICKLE charging mode to avoid overcharging after fully charging the batteries. (See Section 5, "TR15802 Battery Unit".)

(2) Battery unit mounting and dismounting

To mount the TR15802 (and any other optional accessory unit), remove the TR6851 rear panel accessory cover and insert the unit. (See Figures 3-12 and 3-13.)

The mounted option unit is unlocked and dismounted by pulling the lever in the bottom of the unit forwards. (See Figure 3-14.)

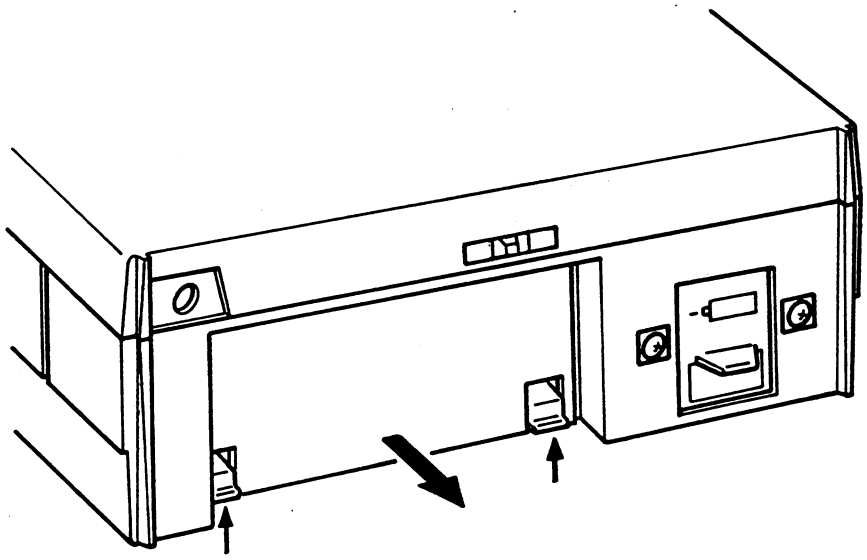


Fig. 3-12 Removing the accessory cover

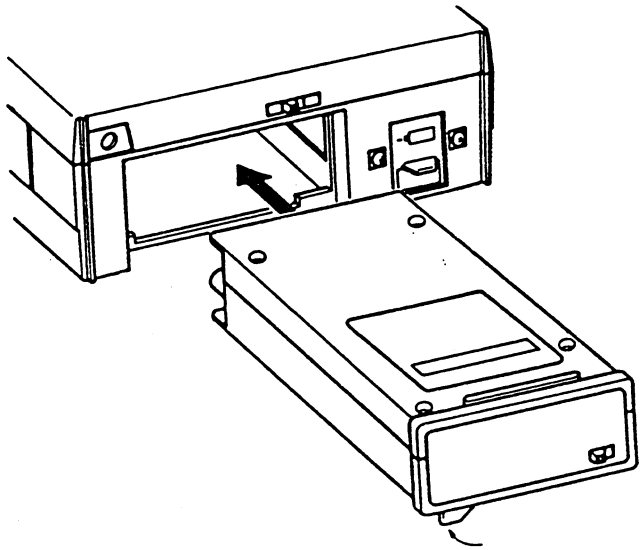


Fig. 3-13 Mounting an accessory unit

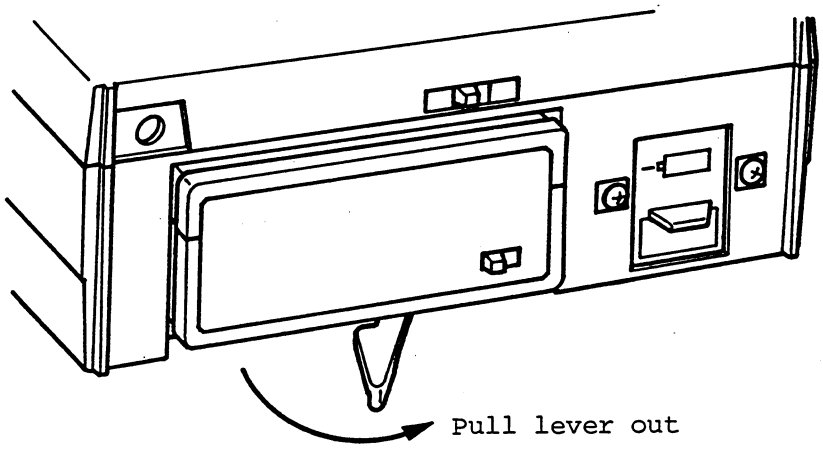


Fig. 3-14 Dismounting an accessory unit

3-10. FUSE REPLACEMENT

(1) If the multimeter fails to operate when the power is switched on, check to see whether the power fuse has blown or not. If it has, replace with a new fuse. The power fuse is a 0.16 A slow-blow fuse (for 100, 115, and 120 Vac) or 0.08 A slow-blow fuse (for 220, 230, and 240 Vac), and is replaced according to the following procedure.

① Disconnect the power cable from the power connector, and also remove any mounted accessory unit such as the TR15802. As long as the power cable is connected to the TR6851, the mains power is applied to the primary side of the power transformer irrespective of the POWER switch setting. Therefore, the power cable must always be disconnected before replacing a blown power fuse.

② Remove the case by undoing the two screws located near the rear panel power connector. Then after releasing the lock by pressing against the catch in the bottom of the multimeter with a screwdriver, hold the top and bottom of the front panel and remove the case. (See Figure 3-15.)

③ The power fuse is located near the transformer (see Figure 3-16). To remove the fuse, press in the direction of an arrow ① in Figure 3-17. Insert the new fuse by pressing in from above.

Note: The fuse cannot be checked visually. It should be checked by measuring the resistance. The fuse is normal if the resistance is less than 15 Ω.

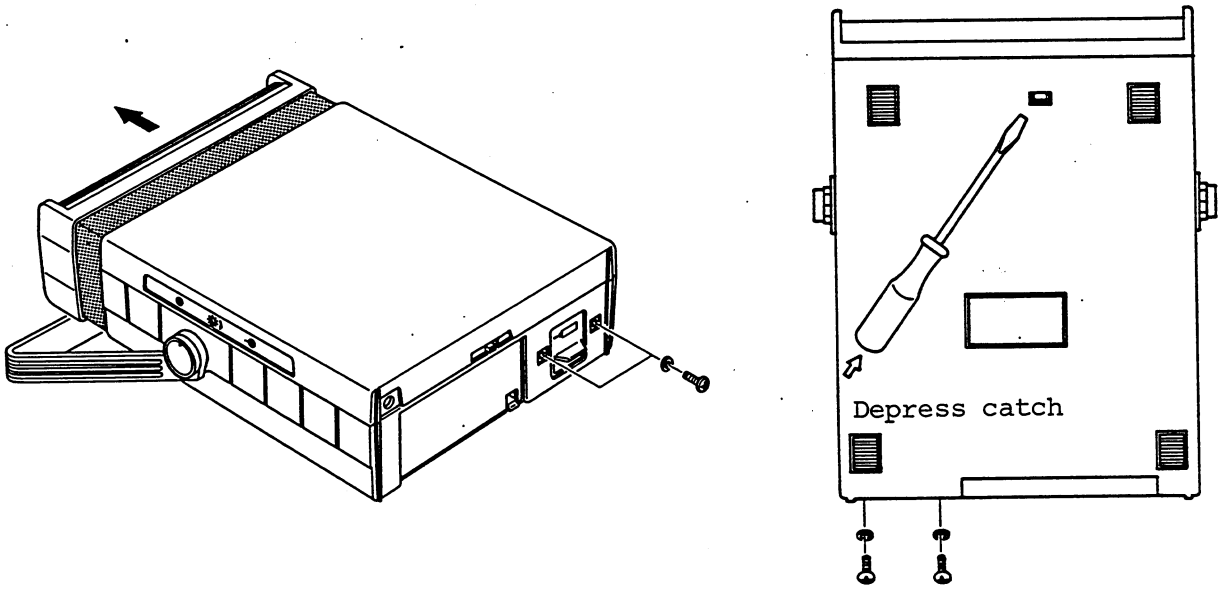


Fig. 3-15 Case removal

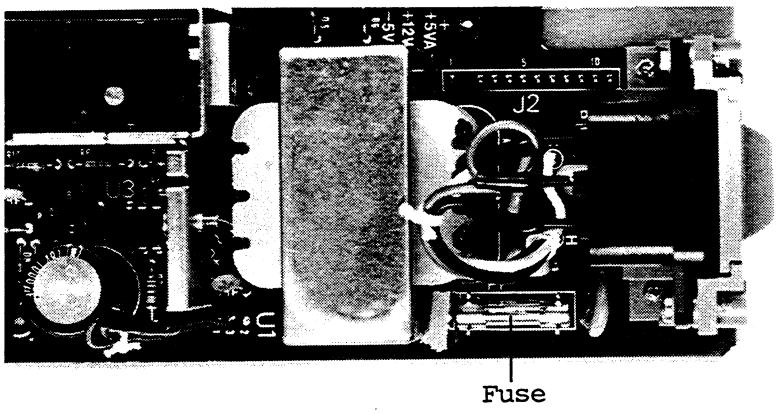


Fig. 3-16 Power fuse location

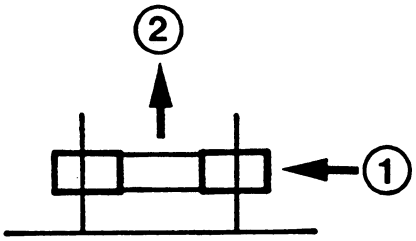


Fig. 3-17 Fuse removal

(2) Replacement of the current measurement protector fuse

If a current in excess of 2.5 A is applied to the input terminal during a DC or AC current measurement, a protector fuse is blown to protect the internal circuitry. To replace this fuse, first remove the input connector (together with the protector fuse) by pressing the terminal and turning counterclockwise by about 70°. The protector fuse is a regular normal blow 2.0 A fuse.

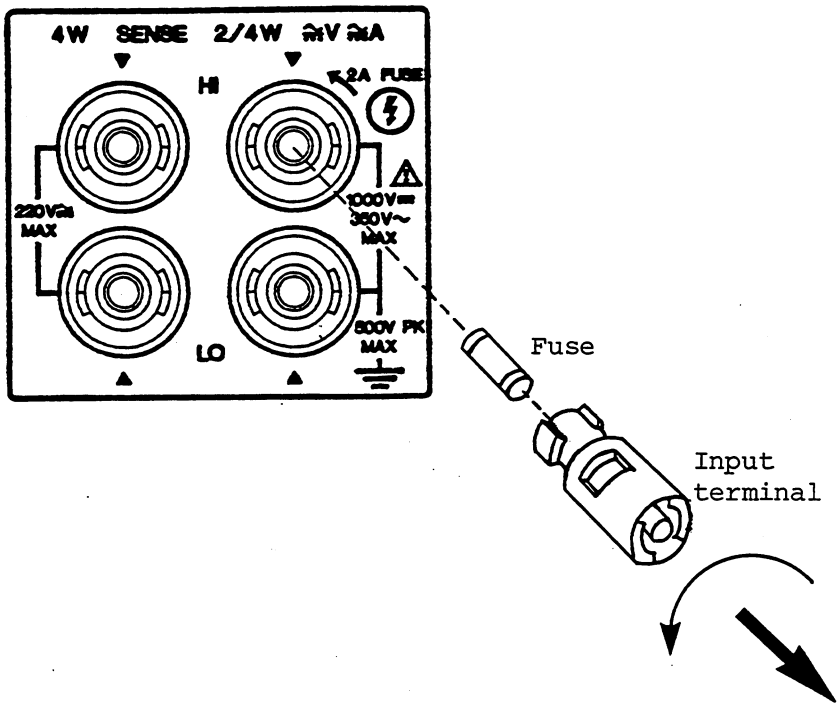


Fig. 3-18 Replacement of the current measurement protector fuse

3-11. EXTERNAL CONTROL BY ACCESSORY UNIT

The TR6851 measuring function, measuring range, etc. can be controlled externally by the TR13003A and TR13206A. During this control mode, the TR6851 cannot be operated by the front panel keys. See Sections 6 and 7 for details.

3-12. ERROR MESSAGES

Error message	Content	Error
FUNC ERROR	Inadequate measurement function	Parameter
RANGE ERROR	Inadequate measurement range	Parameter
RATE ERROR	Inadequate sampling rate	Parameter
SMtim ERROR	Inadequate smoothing times	Parameter
DIGIT ERROR	Inadequate measurement digits	Parameter
RATIO ERROR	Abnormal ratio of integral resistance	CAL data
R/W ERROR	Incapability of normal READ/WRITE to or from RAM	RAM
ROM ERROR	Abnormal ROM content, check sum error	ROM
CAL ERROR	Abnormal CAL data, check sum error	RAM

Parameter-related errors are RAM errors not prohibiting Read/Write operations. The system can be re-started by POWER ON operation with the NULL key pressed.

When CAL DATA error, RAM error, or ROM error, contact your nearest ADVANTEST representative.

SECTION 4
CALIBRATION

4-1. CALIBRATION PRECAUTIONS

(1) The power supply which may be used are:
as indicated on the rear panel (AC mains), with 50/60 Hz, or the TR15802 battery unit (DC supply).

(2) Allow the TR6851 to warm up for at least 30 minutes under continuous application of the power supply voltage selected in (1) above.

(3) Calibrations must be executed under the following environment.
Temperature: +23°C ±3°C
Humidity : 85% max.

(4) All standard equipment must also be allowed to warm up for the periods specified for the respective units.

(5) Execute calibration operations in a location free from dust, vibration, and noise.

(6) To ensure that the specified measuring accuracy is maintained, the TR6851 should be calibrated at least once every six months. Calibrate more frequently if necessary.

(7) After completing the calibration, it is advisable to clearly indicate the date of calibration and the deadline for the next calibration on a card or label.

(8) Calibrate the multimeter in the sequence described in this section.

4-2. STANDARD EQUIPMENT TO BE USED

Standard equipment	Operating range	Accuracy
DC voltage standard	0 V to 1000 V	20 ppm
Standard resistance	0 Ω to 200 MΩ	10 ppm
DC current standard	0 mA to 2 A	100 ppm
AC voltage standard	1.8 V to 1.9 Vrms	200 ppm
AC current standard	180 mA to 190 mArms	800 ppm

Also prepare an M2 screwdriver (minus head) for use in operating the CAL switch and CAL ON key.

4-3. CALIBRATION PROCEDURES

Calibration mode is activated by a calibration switch (CAL switch or CAL ON key) located on the right hand side of the instrument. The positions of these switches is shown in Figure 4-1.

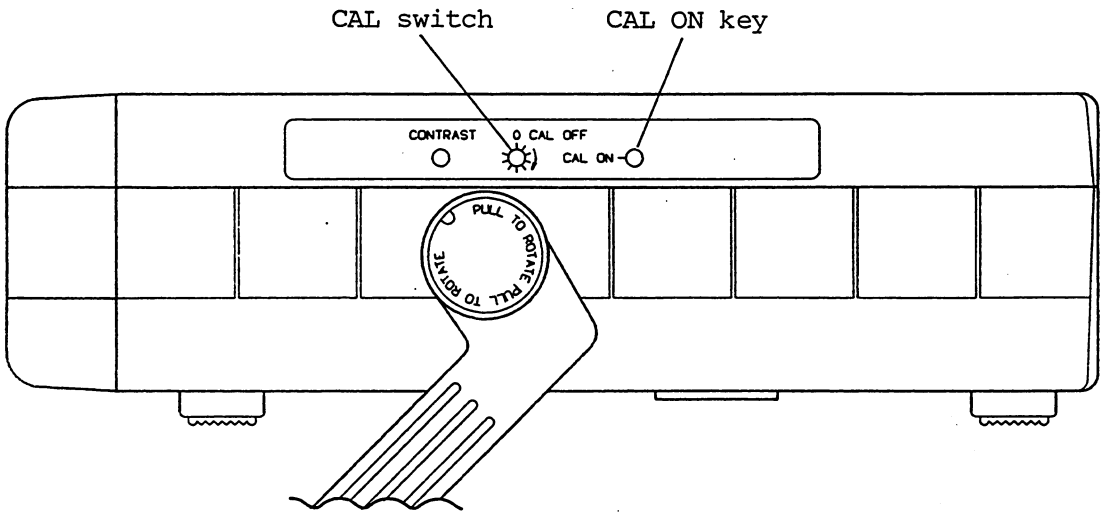


Fig. 4-1 CAL and CAL ON switch positions

Select the 5-1/2 digit display, and then calibrate each function and each range according to the following procedures.

4-3-1. Calibration of DC Voltage Measurement

Set to DC voltage measurement function. Turn the CAL switch and check that "CAL 1" appears in the lower right hand corner of the display section.

(1) Zero point calibration of each range

① Set to the range to be calibrated, and short circuit the input terminal.

② Press the CAL ON key. "CAL on" will appear in the display.

③ Press the SHIFT key. The cursor will appear in the display, and input of calibration values will be possible.

④ Using the UP and DOWN keys and the AUTO/MNL key (cursor movement), set each digit display to 0.

⑤ Press the SHIFT key a second time. The "CAL on" display will change to " # " to indicate the calibration is being executed.

⑥ The " # " display disappears when the calibration has been completed.

⑦ Calibrate the zero point in each range.

⑧ Press the CAL ON key a second time to clear the "CAL on" display.

(2) Full-scale calibration of each range

① Set to the range to be calibrated, and key in any value above 80% of full-scale within the measuring range.

② Press the CAL ON key. "CAL on" will appear in the display.

③ Press the SHIFT key. The cursor will appear in the display, and input of calibration values will be possible.

④ Using the UP and DOWN keys and the AUTO/MNL key (cursor movement), adjust each digit display to the calibration value. (Since the sign is determined automatically, only numerical values need be adjusted.)

⑤ Press the SHIFT key a second time. The "CAL on" display will change to " # " to indicate the calibration is being executed.

⑥ The " # " display disappears when the calibration has been completed.

⑦ Calibrate plus and minus full-scale in each range.

⑧ Press the CAL ON key a second time to clear the "CAL on" display.

Always reset the CAL switch to the 0 position upon completion of calibration.

4-3-2. Calibration of 2-wire Resistance Measurement

Set to 2-wire resistance measurement function. Turn the CAL switch and check that "CAL 1" appears in the lower right hand corner of the display section.

(1) Zero point calibration of each range

① Set to the range to be calibrated, and short circuit the input terminal.

② Press the CAL ON key. "CAL on" will appear in the display.

③ Press the SHIFT key. The cursor will appear in the display, and input of calibration values will be possible.

④ Using the UP and DOWN keys and the AUTO/MNL key (cursor movement), set each digit display to 0.

⑤ Press the SHIFT key a second time. The "CAL on" display will change to " # " to indicate the calibration is being executed.

⑥ The " # " display disappears when the calibration has been completed.

⑦ Calibrate the zero point in each range.

⑧ Press the CAL ON key a second time to clear the "CAL on" display.

(2) Full-scale calibration of each range

① Set to the range to be calibrated, and key in any value above 80% of full-scale within the measuring range.

② Press the CAL ON key. "CAL on" will appear in the display.

③ Press the SHIFT key. The cursor will appear in the display, and input of calibration values will be possible.

④ Using the UP and DOWN keys and the AUTO/MNL key (cursor movement), adjust each digit display to the calibration value.

⑤ Press the SHIFT key a second time. The "CAL on" display will change to " # " to indicate the calibration is being executed.

⑥ The " # " display disappears when the calibration has been completed.

⑦ Calibrate plus and minus full-scale in each range.

⑧ Press the CAL ON key a second time to clear the "CAL on" display.

Always reset the CAL switch to the 0 position upon completion of calibration.

4-3-3. Calibration of 4-wire Resistance Measurement

Set to 4-wire resistance measurement function. Turn the CAL switch and check that "CAL 1" appears in the lower right hand corner of the display section.

Note that there is no need to calibrate the zero point when calibrating 4-wire resistance measurement.

(1) Zero point calibration for the 200 Ω range (not required for other ranges)

① Set the range to 200 Ω to short-circuit the input terminal.

② Press the CAL ON key. "CAL on" will appear in the display.

③ Press the SHIFT key. The cursor will appear in the display, and input of calibration values will be possible.

④ Using the UP and DOWN keys and the AUTO/MNL key (cursor movement), adjust each digit display to zero.

⑤ Press the SHIFT key a second time. The "CAL on" display will change to "#" to indicate that the calibration is being executed.

⑥ The "#" display disappears when the calibration has been completed.

⑦ Press the CAL ON key a second time to clear the "CAL on" display.

(2) Full-scale calibration of each range

① Set to the range to be calibrated, and key in any value above 80% of full-scale within the measuring range.

② Press the CAL ON key. "CAL on" will appear in the display.

③ Press the SHIFT key. The cursor will appear in the display, and input of calibration values will be possible.

④ Using the UP and DOWN keys and the AUTO/MNL key (cursor movement), adjust each digit display to the calibration value.

⑤ Press the SHIFT key a second time. The "CAL on" display will change to " # " to indicate the calibration is being executed.

⑥ The " # " display disappears when the calibration has been completed.

⑦ Calibrate plus and minus full-scale in each range.

⑧ Press the CAL ON key a second time to clear the "CAL on" display.

Always reset the CAL switch to the 0 position upon completion of calibration.

4-3-4. Calibration of DC Current Measurement

Set to DC current measurement function. Turn the CAL switch and check that "CAL 1" appears in the lower right hand corner of the display section.

(1) Zero point calibration of each range

① Set to the range to be calibrated, and short circuit the input terminal.

② Press the CAL ON key. "CAL on" will appear in the display.

③ Press the SHIFT key. The cursor will appear in the display, and input of calibration values will be possible.

④ Using the UP and DOWN keys and the AUTO/MNL key (cursor movement), set each digit display to 0.

⑤ Press the SHIFT key a second time. The "CAL on" display will change to " # " to indicate the calibration is being executed.

⑥ The " # " display disappears when the calibration has been completed.

⑦ Calibrate the zero point in each range.

⑧ Press the CAL ON key a second time to clear the "CAL on" display.

(2) Full-scale calibration of each range

① Set to the range to be calibrated, and key in any value above 80% of full-scale within the measuring range.

② Press the CAL ON key. "CAL on" will appear in the display.

③ Press the SHIFT key. The cursor will appear in the display, and input of calibration values will be possible.

④ Using the UP and DOWN keys and the AUTO/MNL key (cursor movement), adjust each digit display to the calibration value. (Since the sign is determined automatically, only numerical values need be adjusted.)

⑤ Press the SHIFT key a second time. The "CAL on" display will change to " # " to indicate the calibration is being executed.

⑥ The " # " display disappears when the calibration has been completed.

⑦ Calibrate plus and minus full-scale in each range.

⑧ Press the CAL ON key a second time to clear the "CAL on" display.

Always reset the CAL switch to the 0 position upon completion of calibration.

4-3-5. Calibration of AC Voltage Measurement

Set to AC voltage measurement function. Turn the CAL switch and check that "CAL 1" appears in the lower right hand corner of the display section.

Note that there is no need to calibrate the zero point when calibrating AC voltage measurement. Nor does the calibration need to be repeated for each range.

① Apply a 1 kHz sinewave input in the 1.8 to 1.9 Vrms range.

② Press the CAL ON key. "CAL on" will appear in the display.

③ Press the SHIFT key. The cursor will appear in the display, and input of calibration values will be possible.

④ Using the UP and DOWN keys and the AUTO/MNL key (cursor movement), adjust each digit display to the calibration value.

⑤ Press the SHIFT key a second time. The "CAL on" display will change to " # " to indicate that the calibration is being executed.

⑥ The " # " display disappears when the calibration has been completed.

⑦ Press the CAL ON key a second time to clear the "CAL on" display.

Always reset the CAL switch to the 0 position upon completion of calibration.

4-3-6. Calibration of AC Current Measurement

Set to AC current measurement function. Turn the CAL switch and check that "CAL 1" appears in the lower right hand corner of the display section.

Note that there is no need to calibrate the zero point when calibrating AC current measurement. Nor does the calibration need to be repeated for each range.

① Apply a 1 kHz sinewave input in the 180 to 190 mArms range.

② Press the CAL ON key. "CAL on" will appear in the display.

③ Press the SHIFT key. The cursor will appear in the display, and input of calibration values will be posible.

④ Using the UP and DOWN keys and the AUTO/MNL key (cursor movement), adjust each digit display to the calibration value.

⑤ Press the SHIFT key a second time. The "CAL on" display will change to " # " to indicate the calibration is being executed.

⑥ The " # " display disappears when the calibration has been completed.

⑦ Press the CAL ON key a second time to clear the "CAL on" display.

Always reset the CAL switch to the 0 position upon completion of calibration.

SECTION 5

TR15802 BATTERY UNIT (OPTION)

5-1. INTRODUCTION

The TR15802 Battery Unit is a rechargeable battery unit designed for use in the TR6851 Digital Multimeter.

5-2. SPECIFICATIONS

Battery type	: Four rechargeable nickel-cadmium batteries
Continuous operation capacity:	Eight hours minimum
Charge-up time	: Approx. 15 hours when TRICKLE/FULL switch is set to FULL position.
Charging method	: Mount in TR6851 connected to AC power supply.
Dimensions	: Approx. 97(W) x 47(H) x 143(D) mm
Weight	: 370 g max.

5-3. PRELIMINARY PREPARATION AND PRECAUTIONS

(1) Always recharge by mounting the TR15802 in the TR6851.

(2) When the unit is purchased, or if it is not used for at least one month, set the TRICKLE/FULL switch (on the front panel of the TR15802) to the FULL position and recharge for approximately 15 hours.

(3) When the BATT indicator comes on to indicate a drop in battery voltage, immediately switch to another power supply or recharge the batteries.

(4) Recharge the batteries fully about once a month or after every 15 recharging cycles to ensure that the voltage of each individual battery is balanced.

(5) Ni-Cd battery reaches a maximum efficiency in the +20°C to +40°C range. And the batteries can be recharged at least 300 times before the battery capacity deteriorates below 80% of a nominal 1200 mAH.

(6) Batteries should be recharged within the 0°C to +45°C range, and may be used in the -20°C to +50°C range.

(7) Protect the Ni-Cd batteries from strong shock. Shock can result in electrode damage and short circuiting of internal electrodes.

(8) Leaving the TRICKLE/FULL switch in the FULL position after completing a full recharge operation can result in over-charging, and subsequent reduction of battery life. If recharging is to be continued after a full recharge operation, leave the switch in the TRICKLE position.

5-4. RECHARGING PROCEDURE

① Remove the TR6851 rear panel accessory unit cover and insert the TR15802, making sure that the lock lever is fully engaged.

② Connect the power cable to the TR6851 power connector to supply 100 Vac ±10% (or the voltage indicated on the rear panel of the TR6851), with line frequency of 50 or 60 Hz.

③ The TR15802 is recharged irrespective of the ON/OFF position of the TR6851 POWER switch.

④ When recharging after the BATT low-battery indicator comes on, recharging takes about 15 hours with the TRICKLE/FULL switch in the FULL position. When set to the TRICKLE position, recharging takes about three times longer.
If recharging is to be continued after completing a full recharge, always leave the switch in the TRICKLE position.

⑤ When the TR6851 is operated from AC mains power with the TR15802 mounted in the instrument, the TR15802 is usually left in TRICKLE mode. Not only does this compensate the self-discharging, but also ensures that over-charging does not occur.

5-5. FUSE REPLACEMENT

If there is no response at all when the POWER switch is switched ON, it is possible that the power fuse in the TR15802 Battery Unit has blown. If it has blown, it must be replaced.
The TR15802 fuse is a 0.8 A slow-blow fuse which can be replaced in the following way.

① Remove the TR15802 Battery Unit from the TR6851.

② Undo the four screws in the upper case, and remove the case (see Figure 5-1).

③ The fuse is mounted on the circuit board (see Figure 5-2). To remove the fuse, push in the direction indicated by the arrow in Figure 5-3. Insert the new fuse by pressing down from above.

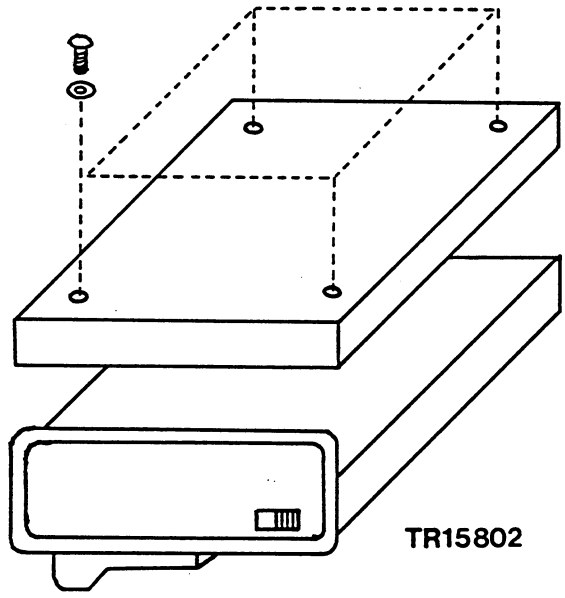


Fig. 5-1 Removing the case

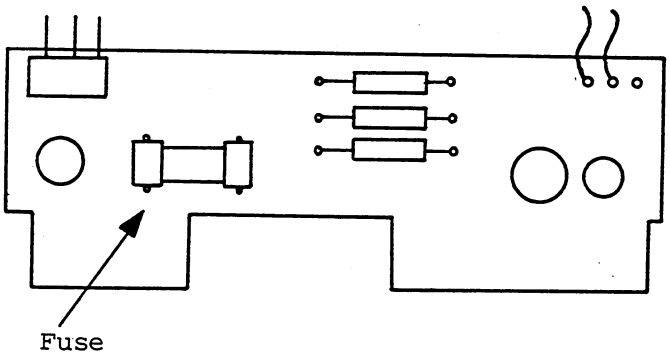


Fig. 5-2 Fuse position

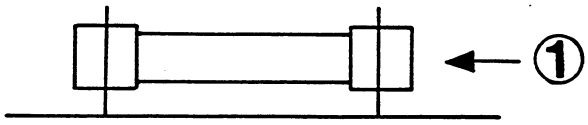


Fig. 5-3 Removing the fuse

SECTION 6

TR13003A BCD DATA OUTPUT UNIT (OPTION)

6-1. INTRODUCTION

When mounted in the TR6851, the TR13003A BCD Data Output Unit converts measured results (display values) into BCD parallel code for output to digital recorder and other external digital equipment.
This output unit is also capable of selecting TR6851 measuring functions and ranges by external controller, and remote control of the measurement start command.
The data output and remote control signals are electrically isolated from the TR6851 measurement input signal system to ensure that this unit has no effect on measured values even when a measuring system is constructed with the TR6851 connected to other external units.

6-2. SPECIFICATIONS

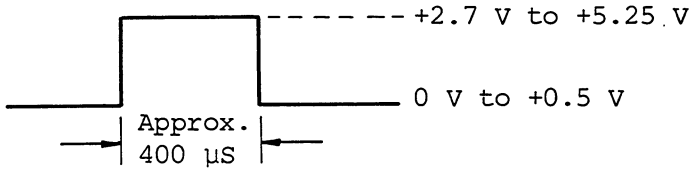
Data output:

Output code : BCD (Binary Coded Decimal) code

Type of data : Measured data, decimal point, sign, unit

Signal level : TTL level, positive logic (SN74LS04 or equivalent)
"1": +2.7 V to +5.25 V
"0": 0 V to +0.5 V

Printing command signal output: TTL level, positive pulse
(Pulse width: aprox. 400 µs)



Control signals : *FCA, *FCB, *FCC, *HOLD, *DGTA, *DGTB, *RCA, *RCB, *RCC, *RCD, and *RE
Total of 11 signals, TTL level, negative logic

External start signal A: TTL level, positive pulse
(Pulse width: 100 µs to 10 ms)
External start signal B: TTL level, negative pulse
(Pulse width: 100 µs to 10 ms)

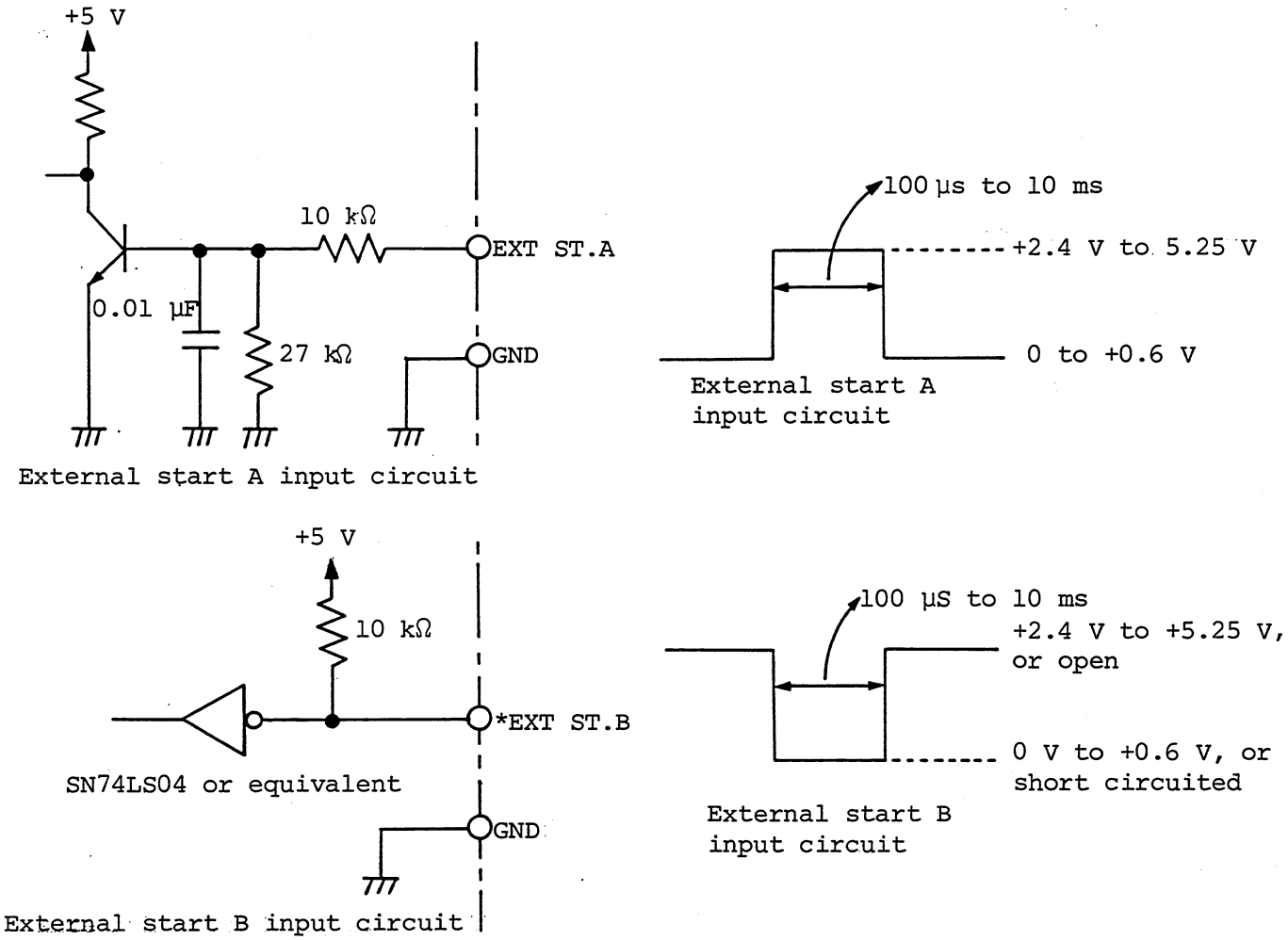


Fig. 6-1 External start input circuits and input pulses

If external start signal A is set to continued high level, or external start signal B is set to continued low level, measurements are executed continuously.
(* denotes negative logic signal.)

Data output codes:

Output name	Output signal	Code			
		8	4	2	1
Data	0	0	0	0	0
	1	0	0	0	1
	2	0	0	1	0
	3	0	0	1	1
	4	0	1	0	0
	5	0	1	0	1
	6	0	1	1	0
	7	0	1	1	1
	8	1	0	0	0
	9	1	0	0	1
	Space	1	1	1	1
Decimal point	10^0		0	0	0
	10^1		0	0	1
	10^2		0	1	0
	10^3		0	1	1
	10^4		1	0	0
Function (Note)	* (OVER)	0	0	0	0
	+	0	0	1	1
	-	0	0	0	1
	Space (AC)	0	0	1	0
	Space (OHM)	1	1	1	1
Unit	mV	0	0	0	0
	V	0	0	1	0
	Ω	0	1	0	0
	kΩ	0	1	0	1
	MΩ	1	0	1	1
	mA	1	0	1	0

Note: AC and OHM polarity is "space".
+ or - sign appears when a NULL operation is executed.

Data output connector:

Pin no.	Function	Pin no.	Function
1	GND	26	High level (Note 3)
2	1	27	
3	2 Data at 10^0 digit (Note 4)	28	
4	4	29	
5	8	30	
6	1	31	
7	2 Data at 10^1 digit (Note 4)	32	
8	4	33	
9	8	34	1 Function
10	1	35	2
11	2 Data at 10^2 digit	36	High level
12	4	37	
13	8	38	4 Function
14	1	39	8
15	2 Data at 10^3 digit	40	1 Unit
16	4	41	2
17	8	42	4
18	1	43	8
19	2 Data at 10^4 digit	44	1 Decimal point (Note 2)
20	4	45	2
21	8	46	4
22	1	47	Printing command signal
23	2 Data at 10^5 digit	48	EXT ST.A
24	4	49	NC (Note 1)
25	8	50	GND

Notes: 1) Although pin 49 "NC" is a vacant, it must not be used under any circumstances as a relay terminal.

2) The decimal point codes correspond to the display in the following manner.

Output signal 10^4 10^3 10^2 10^1 10^0

↓ ↓ ↓ ↓ ↓

1 9 . 9 . 9 . 9 . 9 .

3) 74LS04 (or equivalent) high level output

4) The 10^{10} and 10^1 columns are substituted by space in 3-1/2 digit displays, and the 10^{10} column is substituted by space in 4-1/2 digit displays.

Remote control setting code:

Remote control is valid only when RE is 1.

Set function	Setting code		
	*FCC	*FCB	*FCA
DC voltage	0	0	1
AC voltage	0	1	0
2-wire resistance	0	1	1
4-wire resistance	1	0	0
DC current	1	0	1
AC current	1	1	0

Set range					Code			
DC voltage	AC voltage	2/4-wire resistance	DC current	AC current	*RCD	*RCC	*RCB	*RCA
AUTO	AUTO	AUTO	AUTO	AUTO	0	0	0	0
-	-	-	-	-	0	0	0	1
20 mV	-	-	-	-	0	0	1	0
200 mV	200 mV	200 Ω	-	-	0	0	1	1
2000 mV	2000 mV	2000 Ω	-	-	0	1	0	0
20 V	20 V	20 kΩ	-	-	0	1	0	1
200 V	200 V	200 kΩ	200 mA	200 mA	0	1	1	0
1000 V	350 V	2000 kΩ	2000 mA	2000 mA	0	1	1	1
-	-	20 MΩ	-	-	1	0	0	0
-	-	200 MΩ	-	-	1	0	0	1

Number of measurement digits	*DGTB	*DGTA
4-1/2 digits high-speed operation	1	1
3-1/2 digits	1	0
4-1/2 digits	0	1
5-1/2 digits	0	0

Note: 1: Shorted to GND, or 0 V to +0.6 V (low level)
2: Open or +2.4 V to +5.25 V (high level)
X: 1 or 0

*HOLD

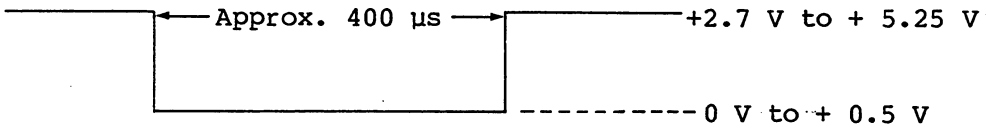
Hold : 1
Continuous operation (free run): 0

Remote control input connector:

Pin no.	Function	Pin no.	Function	Pin no.	Function
1	GND	9	*HOLD	17	- (Note)
2	*EXT ST.B	10	*DGTA	18	- (Note)
3	- (Note)	11	*DGTB	19	NC
4	- (Note)	12	GND	20	*RCA
5	- (Note)	13	GND	21	*RCB
6	*FCA	14	*RE	22	*RCC
7	*FCB	15	*END	23	*RCD
8	*FCC	16	NC	24	GND

Note: "-" denotes no function even though the pin has been connected to the internal circuitry.

Measurement completion output signal: *END



Power supply : Supplied by TR6851 Digital Multimeter
Operating ambient temperature: 0°C to +50°C
Operating ambient humidity: 85% RH max.
Storage temperature: -25°C to +70°C
Diemnsions : Approx. 97(W) x 70(H) x 182(D) mm
Weight : 420 g max.

6-3. PANEL DESCRIPTION

The TR13003A panel is described below. See Figure 6-2.

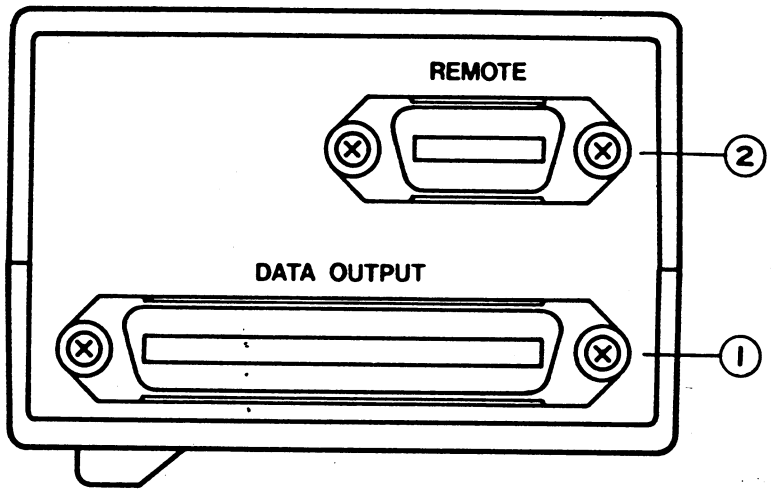


Fig. 6-2 Panel description

① DATA OUTPUT connector

Connector for data output purposes. (57FE-40500-20S manufactured by Dai-ichi Denshi Kogyo Co.) (Applicable connectors include 57-30500 and equivalent products from the same manufacturer.) Suitable connecting cables for connection to the ADVANTEST Digital Recorder include ADVANTEST MO-01 (option).

② REMOTE connector

Remote control input connector. (57FE-40240-20S manufactured by Dai-ichi Denshi Kogyo Co.) (Applicable connectors include 57-30240 and equivalent products from the same manufacturer.)
Suitable ADVANTEST connecting cables for this connector include MO-09 and MO-28 (options).

6-4. CONNECTION TO EXTERNAL UNITS

When transferring data to equipment apart from the TR6198, take note of the following points.

(1) Check the input level in the unit to be connected. The TR13003A output circuit is shown in Figure 6-3 below.

(2) Since output data is established at the printing command signal output timing, data transfer to external equipment uses the printing command signal as a strobe signal.

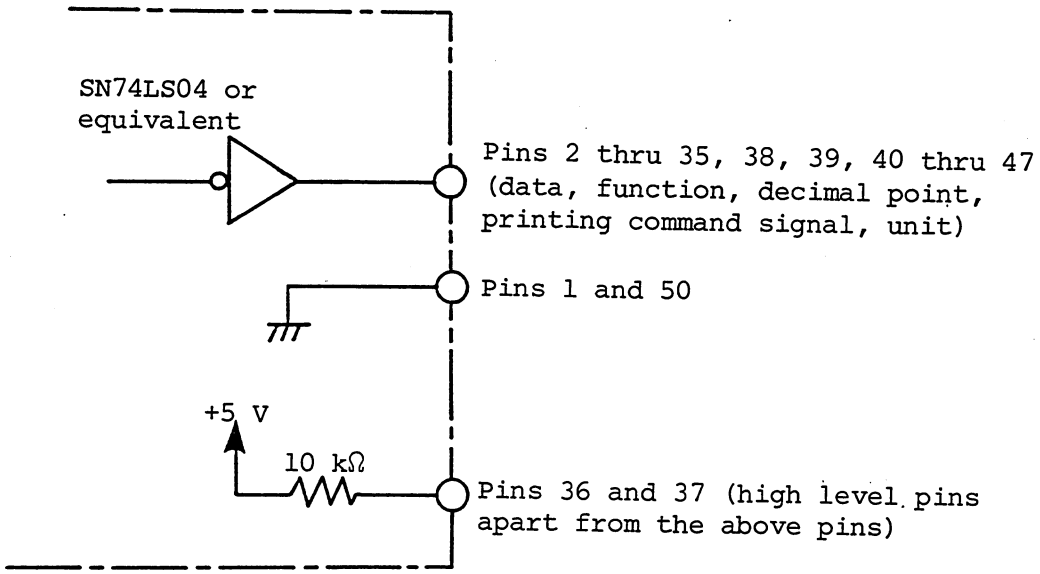


Fig. 6-3 TR13003A output circuit

6-5. REMOTE CONTROL

When the TR13003A is used in external control of the TR6851, the measuring function and range, the number of digits, and measurement start (external start) can be set.

To execute a remote setting, set the code of the function to be set, and set *RE (remote enable) to "1" (low level).

Since the *RE signal is a level signal, the "1" status must be maintained for the duration of the remote setting. The remote control mode is cancelled when *RE is set to "0" (high level), and the TR6851 can then be set by front panel operation.

Measuring functions are controlled by the REMOTE connector *EXT ST.B, *FCA, *FCB, *FCC, *HOLD, *DGTA, *DGTB, *RE, *RCA, *RCB, *RCC, and *RCD. Since each signal line is operated at negative logic, connect the pin of each signal line to GND (pins 1, 12, 13, and 24) or low level if "1" (true) is set. If "0" (false) is set, leave each signal line in open status (or set to high level).

The input circuit for *RCA, *RCB, *RCC, *RCD, and *RE is shown in Figure 6-4.

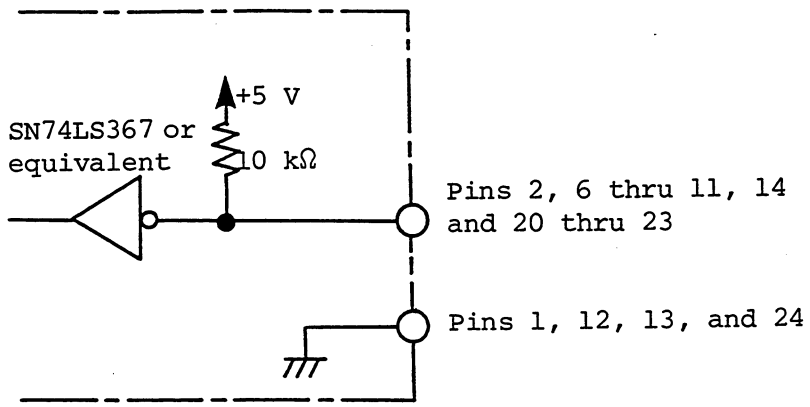


Fig. 6-4 Input circuit for remote control signals

CAUTION

When the TR13003A is used to set TR6851 measuring ranges, the range widths which can be set differ according to the measuring function (DC voltage, AC voltage, 2-wire and 4-wire resistance, DC current, and AC current). (See the remote control code table.) If the setting made lies outside the settable range for a particular measuring function, the setting relating to range will be ignored. In this case, first check the desired range and then repeat the setting.

6-6. EXTERNAL START

If the TR6851 is set to sampling hold mode, a sampling start signal can be applied from an external unit.
The external start signal can be applied via the REMOTE connector (pin 2) or the DATA OUTPUT connector (pin 48). Both pins are ORed internally. Starting is activated by applying a 100 µs to 10 ms pulse signal to either pin. (See Figure 6-1.)
External start is enabled irrespective of remote enable signal (*RE).

6-7. MEASURING TIMING

Timing charts for measuring sequences including the external start input signal and printing command signal are outlined below.
When the TR13003A is used to build the TR6851 into a measuring system, refer to the following timing charts to set system sequences.

6-7-1. Free Run Mode

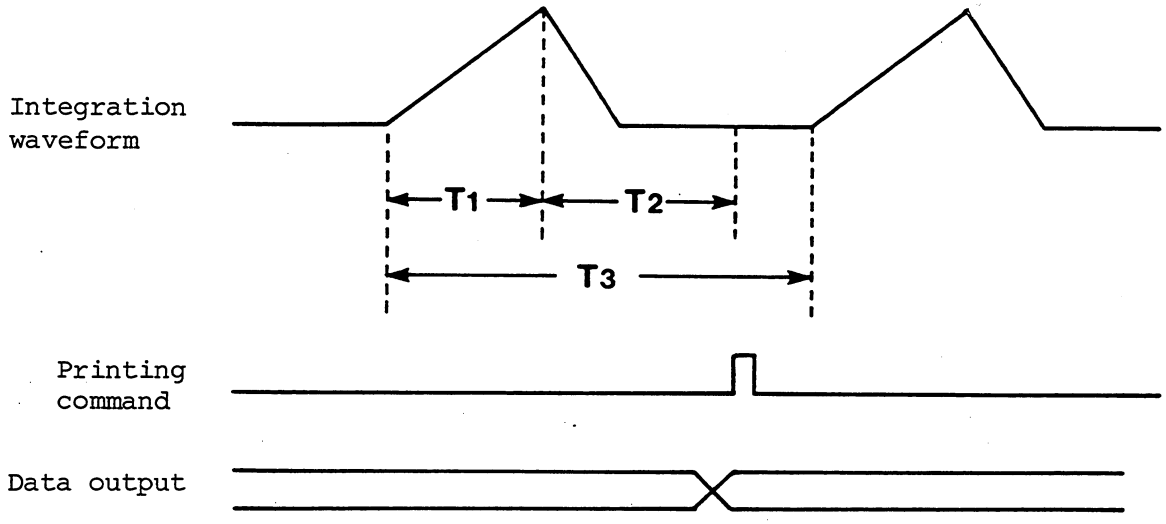


Fig. 6-5 Operation timing in the free run mode

6-7-2. Hold Mode

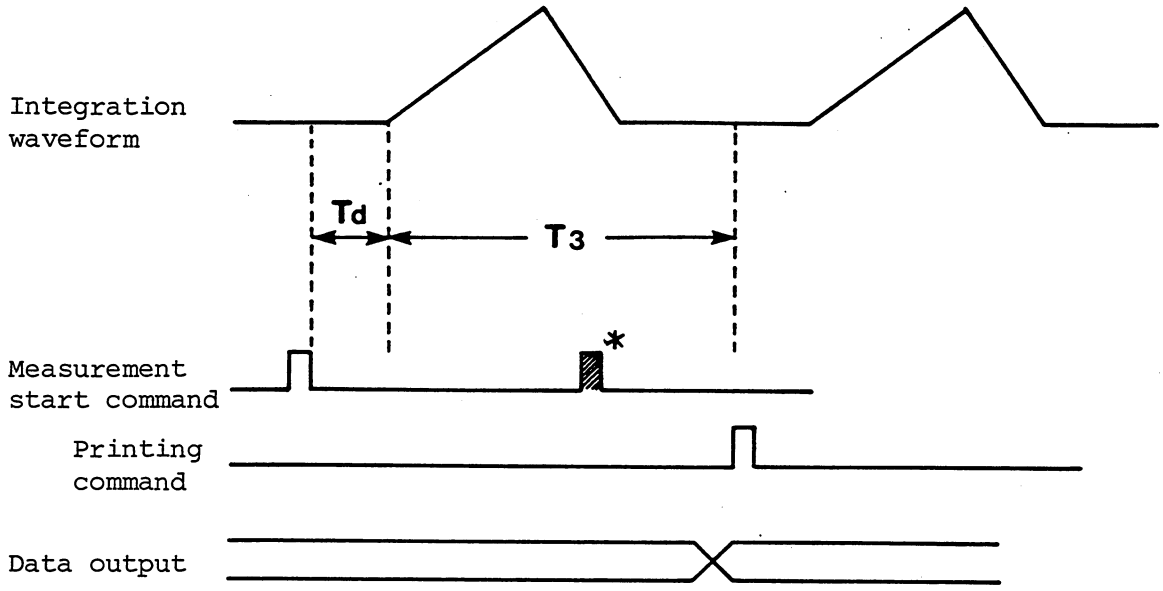


Fig. 6-6 Operation timing in the hold mode

*: Invalid during the interval in which the printing command is generated from the measurement start command. See the timing table in Section 3-8-10 for the T_1, T_2, T_3, and T_d times.

6-8. SWITCHING INTERVALS

Take at least the following intervals when the measurement is done with function switching or range switching.

Continue remote mode : The remote signal mode (RF) is kept "1".
Change to remote mode : The remote signal mode (RF) is changed from "0" to "1".

6-8-1. Function Switching Intervals (MAX)

	Continue remote mode	Change to remote mode
DCV ⟶ ACV	85 ms	0.93 s
ACV ⟶ DCV	85 ms	0.93 s
OHM ⟶ DCV	500 ms	1.31 s
DCM ⟶ OHM	900 ms	1.89 s
OHM ⟶ ACV	500 ms	1.31 s
ACM ⟶ OHM	1000 ms	2.59 s

6-8-2. Range Switching Intervals (MAX)

	Continue remote mode	Change to remote mode
DCU All ranges	0.05 s	0.61 s
ACU All ranges	0.40 s	1.31 s
OHM All ranges	0.40 s	1.79 s
DCI All ranges	0.40 s	1.31 s
ACI All ranges	0.40 s	1.31 s

6-8-3. Response Time in Remote Mode (MAX)

This is the time between external "start" signal input and data output after changing the function and range.

DCU All ranges	0.56 s
ACU All ranges	0.91 s
OHM 200Ω to 200kΩ	1.09 s
OHM 2MΩ to 200MΩ	1.39 s
ACV All ranges	0.91 s
ACI All ranges	0.91 s

SECTION 7

TR13206A GPIB ADAPTER UNIT (OPTION)

7-1. INTRODUCTION

The TR13206A is a GPIB interface adapter designed as an accessory unit to be mounted in the TR6851 Digital Multimeter. Since this unit enables reading of data measured by the TR6851, and setting of the measuring function and range, it can be used to build the TR6851 into a measuring system.

Note that the GPIB related signals from this unit are electrically isolated from the TR6851 measuring signal system.

7-2. GENERAL SPECIFICATIONS

Basic standards : IEEE standards 488-1978

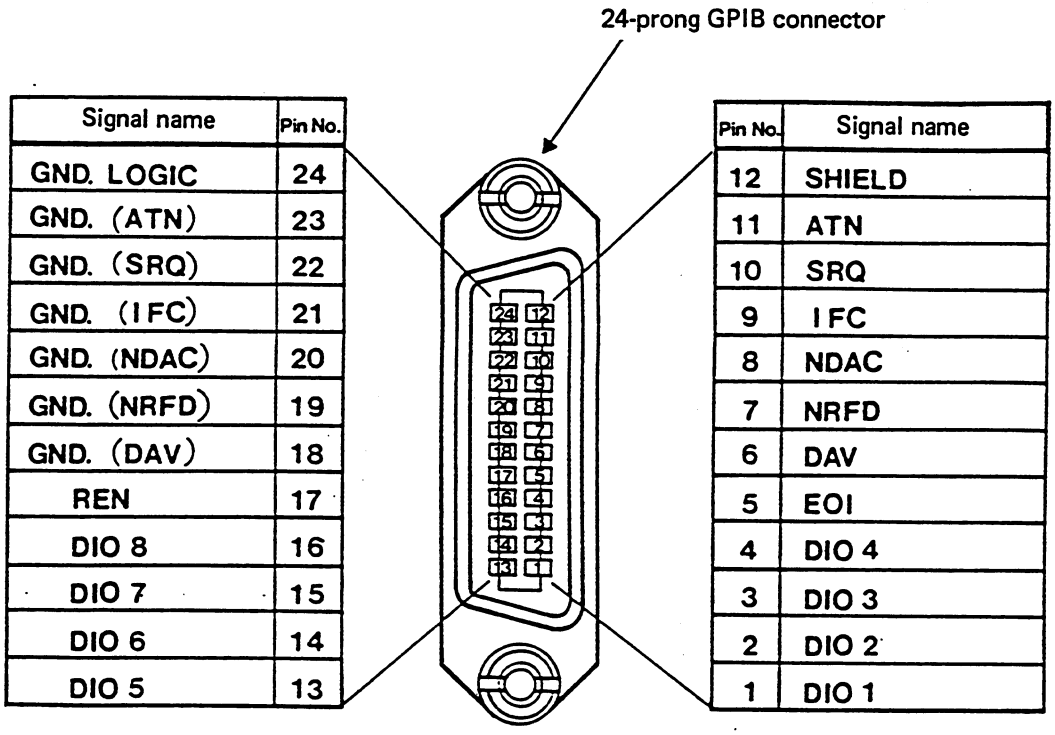
Interface functions: As listed in Table 7-1 below.

Table 7-1 Interface functions

Code	Function
SH1	Source handshake capability
AH1	Acceptor handshake capability
T5	Basic talker Talk only mode Serial poll Unaddressed to talk if addressed to listen
L4	Basic listener Unaddressed to listen if addressed to talk
SR1	Service request capability
RL1	Remote/local switching capability
PP0	No parallel poll capability
DC1	Device clear capability ("SDC" and "DCL" commands may be used)
DT1	Device trigger capability ("GET" command may be used)
C0	No controller capability
E2	Tristate output

Code: ASCII code

Connector pin assignment:



Signal name	Pin No.
GND. LOGIC	24
GND. (ATN)	23
GND. (SRQ)	22
GND. (IFC)	21
GND. (NDAC)	20
GND. (NRFD)	19
GND. (DAV)	18
REN	17
DIO 8	16
DIO 7	15
DIO 6	14
DIO 5	13

Pin No.	Signal name
12	SHIELD
11	ATN
10	SRQ
9	IFC
8	NDAC
7	NRFD
6	DAV
5	EOI
4	DIO 4
3	DIO 3
2	DIO 2
1	DIO 1

Logic levels: Logic 0 (high state): +2.4 V min.

Logic 1 (low state) : +0.4 V min.

Signal line termination: The 16-lead bus line is terminated as indicated in the following diagram.

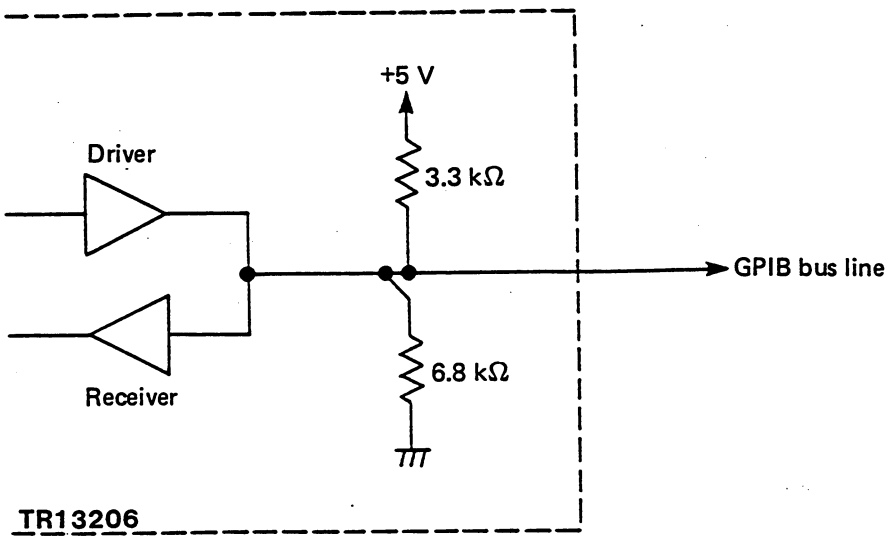


Fig. 7-1 Signal line termination

Driver specifications: Tristate system

Low state output voltage : 0.4 V max. 48 mA

High state output voltage: +2.4 V min. -5.2 mA

Receiver specifications: Low state : +0.6 V max.

High state: +2.0 V min.

Addressing : 31 different talker and listener addresses can be set by the address select switch.

Data transmission : Measured data of 8 to 13 bytes (differences due to number of digits in measured result and HEADER ON/OFF status) and delimiter can be transferred. (Delimiter can be updated by program code.)

Remote programming: Measuring function and range settings and external starting are possible.

Power supply : Supplied from TR6851 Digital Multimeter

Operating ambient temperature: $0^{\circ}C$ to $+50^{\circ}C$

Operating ambient humidity : 85% RH max.

Storage temperature : $-25^{\circ}C$ to $+70^{\circ}C$

Dimensions : Approx. 97(W) x 70(H) x 182(D) mm

Weight : 400 g max.

7-3. PANEL DESCRIPTION

See Figure 7-2. The functions are described in the numbered sequence.

① ADDRESS switch

This switch is used in device address setting and header switching. Bit 7 of this 7-bit DIP switch is used in header switching when transferring data. There is no header output when the 7th bit switch is set to OFF (0), while output of a 3-character alphabetic character code corresponding to the measured data is obtained when the switch is set to ON (1). Bits 1 thru 5 are used for addressing purposes.

31 different addresses can be set. Addressing from controller is possible when the 6th bit switch is set to ADDRESSABLE. But when set to ONLY, the unit is placed in the TALK ONLY mode where data is transferred irrespective of external addressing.

② GPIB connector

This is a 24-pin connector for IEEE-488 bus connections. Although this is a "piggy-back" connector where an additional standard bus cable can be connected to the same connector, the use of three or more connectors is not recommended.

③ GPIB status lamps

When the TR6851 is controlled via GPIB interface, these lamps indicate the device status.

The SRQ lamp indicates that a service request addressed to the controller has been generated. The TALK lamp indicates talker status where data is being sent. The LISTEN lamp indicates listener status where data is being received. The REMOTE lamp indicates the status where external control by program code is possible.

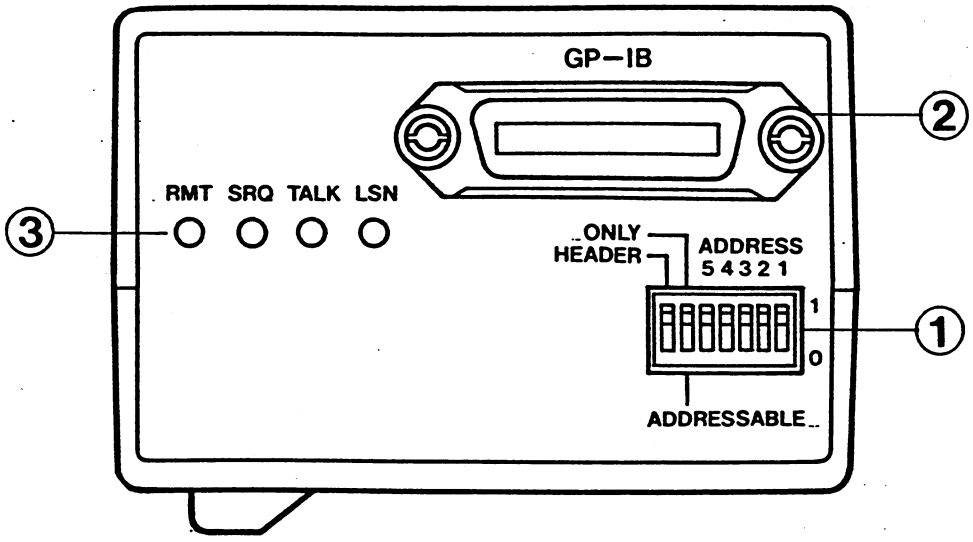


Fig. 7-2 Panel description

7-4. TALKER FORMAT

(1) Data format

oooooooooooooooCR LF
H D E L

H: Header (output of three alphabetic characters only when the HEADER switch is set to ON)

D: Mantissa (polarity, decimal point, and four to six columns of numerals)

E: Exponent (E, polarity, and a single numeral)

L: Delimiter (can be changed by program code)

(2) Header type (the header is sent in ASCII code)

ooo
Subheader
Main header

Note: There is no header output when the HEADER switch is set to OFF.

(3) Main header

DV: DC voltage measurement

AV: AC voltage measurement

DI: DC current measurement

AI: AC current measurement

R : 2-wire resistance measurement

R : 4-wire resistance measurement

(4) Subheader

O: Scale-over

N: Null operation

S: Smoothing operation

(5) Mantissa and exponent

The mantissa of a measured value is variable in length containing from six to eight columns including the polarity and decimal point (the difference being dependent on the number of digits in the displayed result). The decimal point is output at the position corresponding to the display in the TR6851. The polarity consists of output of a "␣" (space) code only for AC voltage/current and resistance measurements. In other measurements, the output sign is either "+" or "-".

The exponential data is determined by the measuring function and range since all measured data is displayed with the basic units V, A, and Ω.

Mantissa and exponential data under different measuring conditions when operated in 5-1/2 digits display is listed in Table 7-2.

Table 7-2 Mantissa and exponent parts

Range	Mantissa	Exponent	Function
20 mV	±oo.oooo	E-3	DC voltage
200 mV	±ooo.ooo	E-3	
2000 mV	±oooo.oo	E-3	
20 V	±oo.oooo	E+0	
200 V	±ooo.ooo	E+0	
1000 V	±oooo.oo	E+0	
200 mV	ooo.ooo	E-3	AC voltage
2000 mV	oooo.oo	E-3	
20 V	oo.oooo	E+0	
200 V	ooo.ooo	E+0	
350 V	ooo.ooo	E+0	
200 mA	±ooo.ooo	E-3	DC current
2000 mA	±oooo.oo	E-3	
200 mA	ooo.ooo	E-3	AC current
2000 mA	oooo.oo	E-3	
200 Ω	ooo.ooo	E+0	2-wire resistance 4-wire resistance
2000 Ω	oooo.oo	E+0	
20 kΩ	oo.oooo	E+3	
200 kΩ	ooo.ooo	E+3	
2000 kΩ	oooo.oo	E+3	
20 MΩ	oo.oooo	E+6	
200 MΩ	ooo.oo	E+6	

Note:
- The mantissa data shows data when 5-1/2 digit measurements are made. The least significant digit is not included in the output in 4-1/2 digit measurements, and the two least significant digits are excluded from 3-1/2 digit measurements.
- The AC and OHM polarity is a space, but a + or - sign appears when a NULL operation is executed.

(6) Delimiter

A delimiter indicates the end of one item of data. Three types of delimiters can be selected by program code.

① Output of two bytes of data "CR" (15_8) and "LF" (12_8) with the "LF" output being accompanied by the "EOI" single line message.

② Output of one byte of data "LF" (12_8).

③ Output of the "EOI" single line message together with the last byte of data.

(7) Output format

The output format is outlined in Figure 7-3.

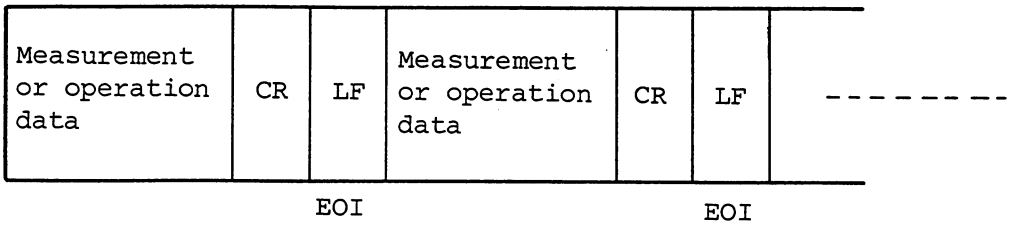


Fig. 7-3 Output format

7-5. LISTENER FORMAT

This unit is capable of setting measuring functions externally by controller.

(1) Measuring function ... "Fn" (initialized setting: "F1")

The measuring functions which can be set are listed in Table 7-3. n is set to a value 1 thru 6.

Table 7-3 Measuring function settings

Code	Function	Initialized setting
F1	DC voltage measurement	*
F2	AC voltage measurement	
F3	2-wire resistance measurement	
F4	4-wire resistance measurement	
F5	DC current measurement	
F6	AC current measurement	

(2) Measuring range ... "Rn" (initialized setting: "R0")

The measuring ranges which can be set are listed in Table 7-4. n is set to a value 0 thru 9.

Table 7-4 Range settings

Code	DC voltage	AC voltage	Resistance	DC current	AC current	Initialized setting
R0	AUTO	AUTO	AUTO	AUTO	AUTO	*
R1	-	-	-	-	-	
R2	20 mV	-	-	-	-	
R3	200 mV	200 mV	200 Ω	-	-	
R4	2000 mV	2000 mV	2000 Ω	-	-	
R5	20 V	20 V	20 kΩ	-	-	
R6	200 V	200 V	200 kΩ	200 mA	200 mA	
R7	1000 V	350 V	2000 kΩ	2000 mA	2000 mA	
R8	-	-	20 MΩ	-	-	
R9	-	-	200 MΩ	-	-	

(3) Constant settings

a. The number of smoothing operations

"PS n" (where n is any value from 1 thru 7)

n	No. of smoothing operations
1	1
2	2
3	5
*4	10
5	20
6	50
7	100

b. Sampling rate

"PR n" (where n is any value from 1 thru 7)

n	Rate
*1	x1 (FAST)
2	x2
3	x5
4	x10
5	x20
6	x50
7	x100

(4) Function settings

a. Sampling hold/free run

*M0 Free run

M1 Hold

b. Smoothing operation ON/OFF

*SM0 OFF

SM1 ON

c. Null operation ON/OFF

*NL0 OFF

NL1 ON

d. Buzzer ON/OFF

BZ0 OFF

*BZ1 ON

e. Delimiter mode

*DL0 Output of CR/LF and EOI as delimiter

DL1 Output of LF only as delimiter

DL2 Output of EOI only as delimiter

f. SRQ issuing mode

S0 SRQ issued

*S1 SRQ not issued

g. Setting of number of display digits

RE0 4-1/2 digit high-speed operation designation

RE3 3-1/2 digit operation designation

RE4 4-1/2 digit operation designation

*RE5 5-1/2 digit operation designation

h. Display ON/OFF setting

DS0 Display OFF (no display of measured data)

*DS1 Display ON (display of measured data)

(5) Calibration (valid when CAL switch is set to CAL 1)

PCoooooo

6-digit numeral (max. 199999)

(6) Other

a. E

Measurement start command

b. C

Initialization (same as switching the power on)

c. Z

Parameter initialization

Initialization to settings indicated by * above.

7-6. SERVICE REQUEST (SRQ)

When "S0" mode is specified, a service request (SRQ) addressed to the controller is issued upon completion of measurement or by reception of an undefined code.

When a service request is issued, a status byte is sent by serial polling from the controller.

And if "S1" mode is specified, the status byte is sent without issue of a service request.

(1) Service request issued upon completion of measurement

If the instrument is not addressed to talk when the measurement is completed, a service request is issued. Although the following status byte is sent when serial polling is executed, that byte is not cleared until the instrument is addressed to talk to send the measured data.

MSB							LSB
0	1	0	0	0	0	0	1

ASCII code: A

Decimal code: 65

(2) Service request issued by SYNTAX error

A service request is also issued when an undefined program code is received during remote programming. The status byte shown below is not cleared until the instrument is addressed to listen for remote setting purposes.

MSB							LSB
0	1	0	0	0	0	1	0

ASCII code: B

Decimal code: 66

Note: If a SYNTAX error is generated at the same time that a measurement is completed, the status byte is set in two bits. (ASCII code: C, decimal code: 67)

(3) Service request accompanying execution of smoothing operation

A service request is issued when smoothing operation data reaches "full" status.

MSB							LSB
0	1	0	0	0	1	0	1

ASCII code: E

BCD code: 69

Note: The smoothing full bit is always set together with the completion of measurement bit.
Clearing conditions are the same as apply upon completion of measurement.

If the above service request issue causes occur simultaneously, the status byte is set in all bits corresponding to those causes.

7-7. HANDLING PROCEDURES

(1) Insert the TR13206A into the TR6851.

(2) Addressing

The TR6851 talk and listen addresses in the GPIB operation are set by an address switch.

The five bits (positions) ADDRESS 1 thru 5 enable up to 31 different addresses to be set. For example, the 01110 setting shown in Figure 7-4 corresponds to 14 in decimal notation. And if the address is set in ASCII code (see Figure 7-5), the address is "N" if talker, and "." if listener.

Note that the set address is valid only if 6th bit is set to ADDRESSABLE. If this bit is set to ONLY, the instrument is fixed to TALK ONLY mode irrespective of the set address.

See Table 7-5 for the address code table.

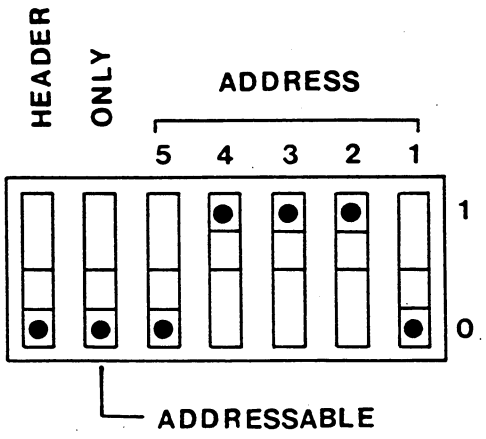


Fig. 7-4 Address switch

(3) Operation preparation

① Mount the TR13206A in the TR6851.

② Connect the TR13206A to the controller and other component equipment by bus cable, and then connect the AC power cord and ground lead.

③ Switch the power on for the TR13206A and the other component equipment, and set the address switch.

Table 7-5 Address code table

ADDRESS switch					Decimal code	ASCII code characters	
A5	A4	A3	A2	A1		LISTEN	TALK
0	0	0	0	0	0	SP	@
0	0	0	0	1	1	!	A
0	0	0	1	0	2	"	B
0	0	0	1	1	3	#	C
0	0	1	0	0	4	$	D
0	0	1	0	1	5	%	E
0	0	1	1	0	6	&	F
0	0	1	1	1	7	'	G
0	1	0	0	0	8	(	H
0	1	0	0	1	9	)	I
0	1	0	1	0	10	*	J
0	1	0	1	1	11	+	K
0	1	1	0	0	12	,	L
0	1	1	0	1	13	-	M
0	1	1	1	0	14	.	N
0	1	1	1	1	15	/	O
1	0	0	0	0	16	0	P
1	0	0	0	1	17	1	Q
1	0	0	1	0	18	2	R
1	0	0	1	1	19	3	S
1	0	1	0	0	20	4	T
1	0	1	0	1	21	5	U
1	0	1	1	0	22	6	V
1	0	1	1	1	23	7	W

Table 7-5 Address codd table (cont'd)

ADDRESS switch					Decimal code	ASCII code characters	
A5	A4	A3	A2	A1		LISTEN	TALK
1	1	0	0	0	24	8	X
1	1	0	0	1	25	9	Y
1	1	0	1	0	26	:	Z
1	1	0	1	1	27	;	[
1	1	1	0	0	28	<	/
1	1	1	0	1	29	=	]
1	1	1	1	0	30	>	∽

(4) General operational precautions

a. ONLY mode

To operate in ONLY mode, set 6th bit of the address switch to ONLY, and also set the address mode of other equipment connected via bus line to ONLY mode. In ONLY mode, however, do not use (operate) the controller simultaneously, since normal operation cannot be guaranteed in this case.

b. Changing the address switch setting during operation

Although the current operation is continued when the address is changed during that operation, any additional designation from the controller using the previous address will be disregarded. Therefore, it is necessary to also set the program to the new address.

c. When the power is switched on, or when a command is received, this instrument is switched to the corresponding status shown in Table 7-6.

Table 7-6 Status changes due to different commands

Command	Talker (lamp)	Listener (lamp)	SRQ (lamp)	Status	Transmit data
POWER ON	Clear	Clear	Clear	Clear	Clear
IFC	Clear	Clear			
"DCL", "SDC", or "C"			Clear	Clear	Clear
"GET" or "E"				Clear bit with transmit data	Clear
TR6851 addrssed to talk	Set	Clear			
Talker unaddressing	Clear				
TR6851 addressed to listen	Clear	Set			
Listener unaddressing		Clear			
Serial polling			Clear		

Note: Diagonal lines denote no change in previous condition
DCL: Device Clear
SDC: Selected Device Clear
GET: Group Execute Trigger

(5) Summary operation flowchart

A summary of operation is outlined in Figure 7-5 below.

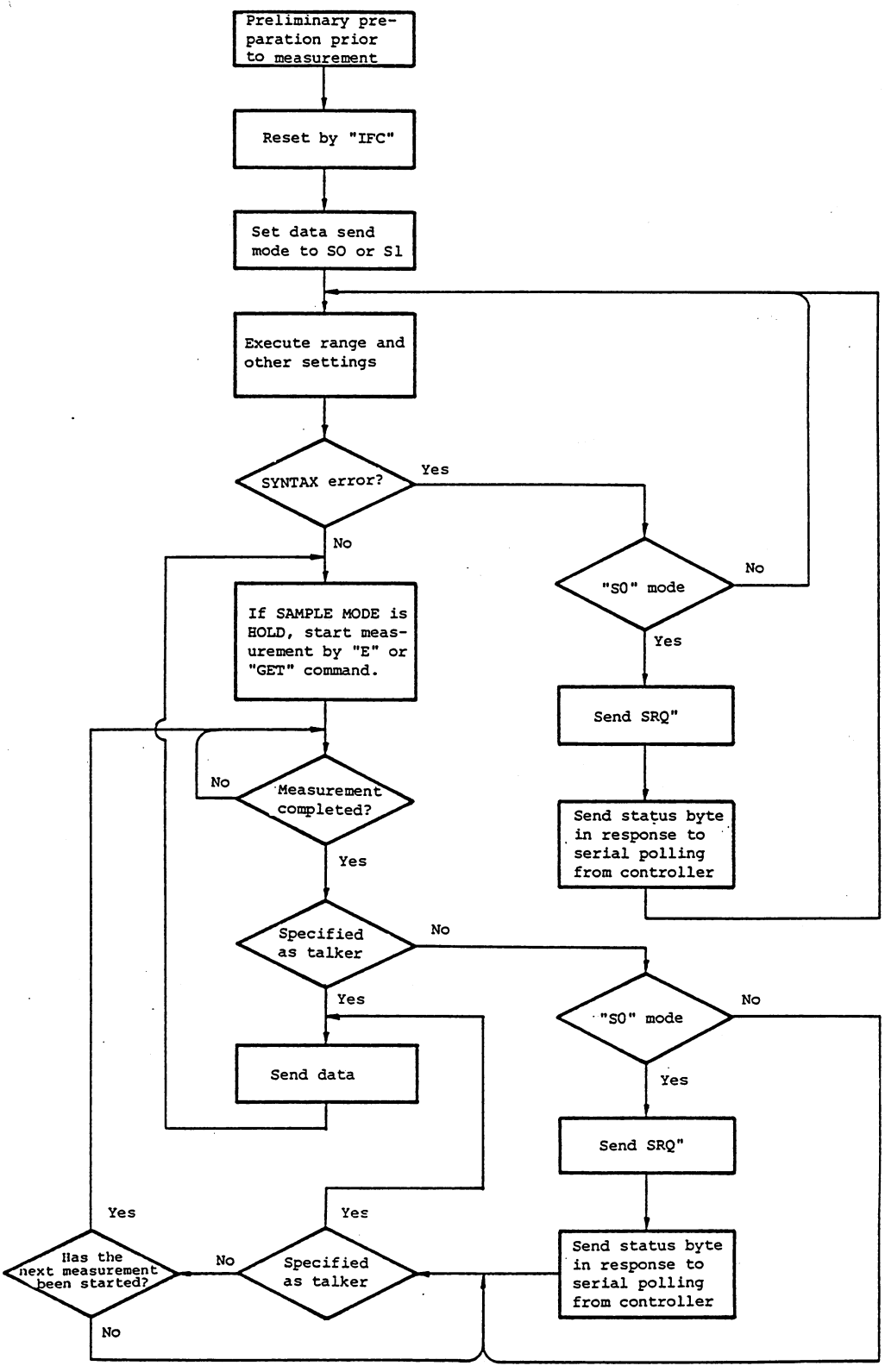


Fig. 7-5 GPIB operation flowchart

(6) Operational precautions

a. Operation during service request

When generating a program, note that the operation is performed as indicated in Figure 7-6 when a service request is issued upon completion of measurement or by a SYNTAX error.

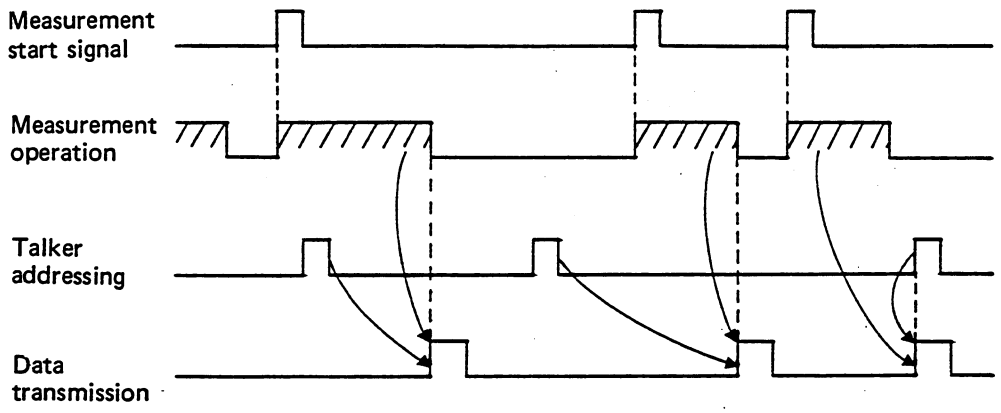
b. Operation when measurement is started by program code "E" or by "GET" command

See Section 6-7 "Measurement Timing" for details when measurement is started by program code "E" or by "GET" command with TR6851 sample mode set to HOLD.

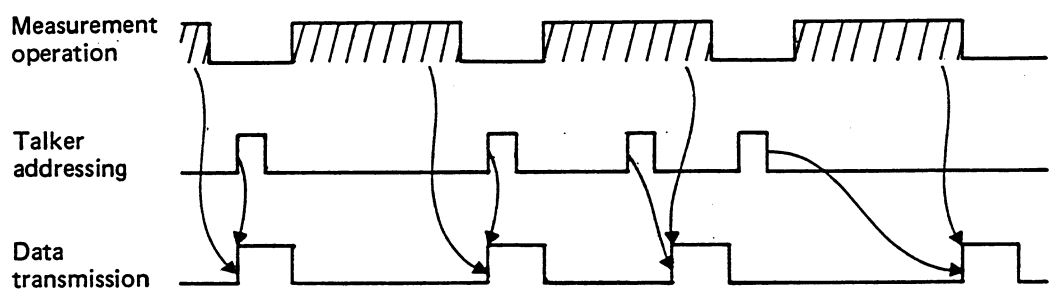
Note: The printing command signal in TR13003A corresponds to a service request due to completion of measurement in TR13206A.

c. Differences in send data due to talker addressing timing

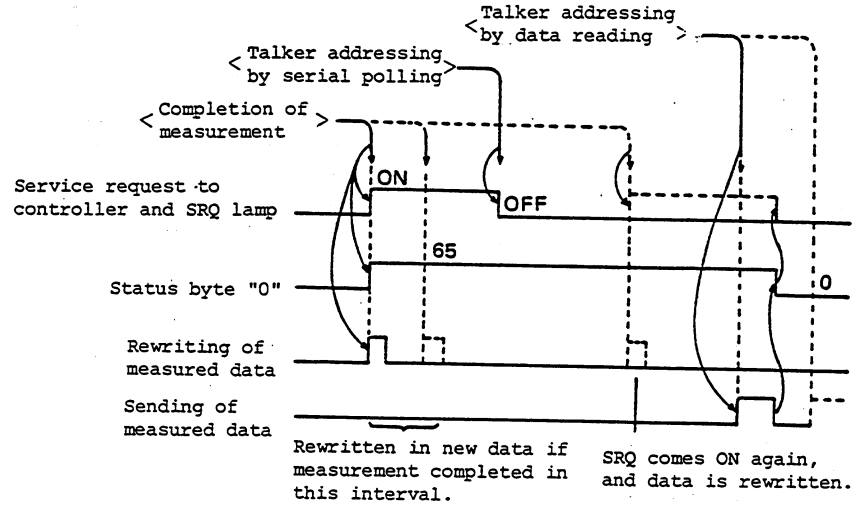
<When measurement is started by program>



<When measuring in free run mode>



a) When serial polling is used



b) When serial pollsing is not used

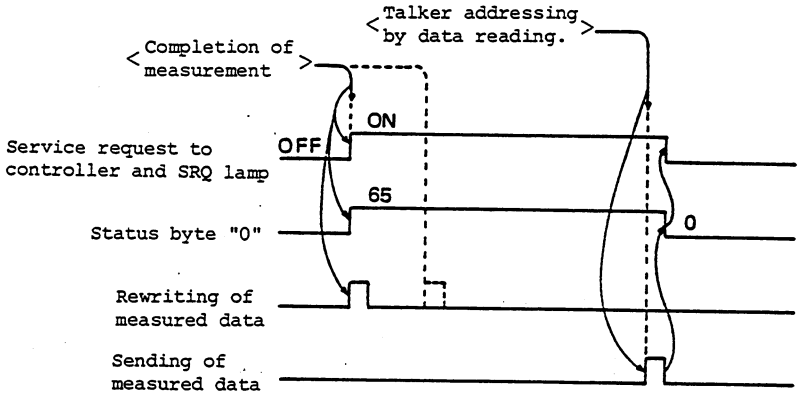


Fig. 7-6 Operation timing when a service request is generated

c) When a SYNTAX error is generated

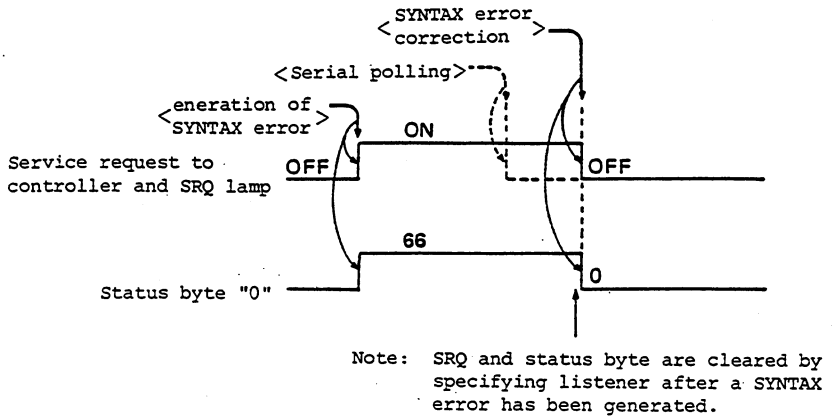


Fig. 7-6 Operation timing when a service request is generated (cont'd)

7-8. EXAMPLE OF PROGRAM

This section describes examples of program using HP-85, HP-200 (HP-9816/26/36) and HP-9845B.
In these examples, the device address of TR13206A is set to "1".

(1) Input an external measurement range for TR6851 with HP-85 and read the data without SRQ.

Example of Program

```
10 CLEAR 701
20 OUTPUT 701 ;"S1F4R0M1"
30 TRIGGER 701
40 ENTER 701 ; A$
50 PRINT A$
60 GOTO 30
70 END
```

Example of Output Data

```
R    103.425E+0
R    103.426E+0
R    103.426E+0
R    103.426E+0
R    103.426E+0
R    103.426E+0
R    103.426E+0
R    103.426E+0
R    103.426E+0
R    103.426E+0
R    103.426E+0
R    103.427E+0
R    103.427E+0
R    103.426E+0
```

Description of the program

10 : Initializes TR13206A.
20 : sets the SRQ transmitting mode to "S1" (SRQ is not transmitted), sets the function to "F4" (4WΩ), sets the range to "R0" (AUTO) or sets the sampling to "M1" (HOLD).
30 : Inputs the external "start" signal.
40 : Reads the data.
50 : Prints the data.
60 : Returns the operation to 30.

(2) Set the measurement function or range of TR6851 with external signal and display (and print) the average of one hundred data through HP-200 Series.

Example of Program

```
10    CLEAR 701
20    DIM A(100)
30    B=0
40    OUTPUT 701;"F1R0RE0DS0M1"
50    FOR N=1 TO 100
60    TRIGGER 701
70    ENTER 701;A(N)
80    B=B+A(N)
90    NEXT N
100   PRINT INT(B*100)/10000;"  V"
110   GOTO 30
120   END
```

Example of Output Data

```
 5.1688   V
 5.1689   V
 5.1687   V
 5.1685   V
 5.1688   V
 5.1688   V
 5.1688   V
 5.1688   V
 5.1683   V
 5.1682   V
 5.1688   V
 5.1688   V
```

Description of the program

10 : Initializes TR13206A.

20 : Defines the data area.

30 : Sets the initial value of B to "0".

40 : Sets the function to "F1" (DCV), sets the range to "R0" (AUTO), sets the number of digits to "RE0" ($4^{1/2}$ digit is driven quickly), sets the display mode to "DS0" or sets the sampling to "M1" (HOLD).

50 : Processes the program 100 cycles between "FOR N=1 TO 100" and "NEXT N".

60 : Inputs the external "start" signal.

70 : Reads the data.

80 : Transforms the one where the data is added to B to new B.

90 : Repeats the operation until this section.

100 : Displays (or print) the average and unit.

110 : Returns the operation to 30.

(3) Through HP-9845B, set the measurement function or range of TR6851 with external signal and display (and print) the data using SRQ parallelly if the smoothing is filled.

Example of Program

```
10      ON INT #7 GOSUB Srq
20      CLEAR 701
30      OUTPUT 701;"S0,F1,R4,PS4,SM1,M1"
40      CONTROL MASK 7;128
50      TRIGGER 701
60      CARD ENABLE 7
70      GOTO 70
80  Srq:    STATUS 701;S
90      IF NOT (S AND 1) THEN RETURN
100     IF S<>69 THEN 130
110     ENTER 701;A$
120     PRINT A$
130     TRIGGER 701
140     CARD ENABLE 7
150     RETURN
160     END
```

Example of Output Data

```
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
DVS+0000.00E-3
```

Description of the program

10 : Defines the interruption process routine.

20 : Initializes TR13206A.

30 : Sets the SRQ transmitting mode to "S0" (SRQ is transmitted), sets the function to "F1" (DCV), sets the range to "R4" (2000mV), sets the number of smoothing cycles to "PS4" (20 times) , sets the smoothing process mode to "SM1" (the smoothing operation is on) or sets the sampling to "M1" (HOLD).

40 : Permits the interruption by the SRQ signal.

50 : Inputs the external "start" signal.

60 : Does not permit the interruption from GPIB.

70 : The main routine is usually inserted here.

80 : Performs polling the interrupting routine name : TR13206A, and reads the status.

90 : Returns the operation to the main routine when an interruption is executed except TR13206A.

100 : Skips the operation to 130 if the smoothing is not filled.

110 : Reads the data.

120 : Displays (or print) the data.

130 : Inputs the external "start" signal.

140 : Does not permit the interruption from GPIB.

150 : Returns the operation to the main routine.

Note) The line "30" is the same as the following operation:

```
20     CLEAR 701
30     OUTPUT 701;"S0F1R4PS4SM1M1"
40     CONTROL MASK 7;128
```

The command in " " can be punctuated with a comma "," in HP-85 and HP-200 series.

While the main routine is usually place in the line "70", this example loops the program.

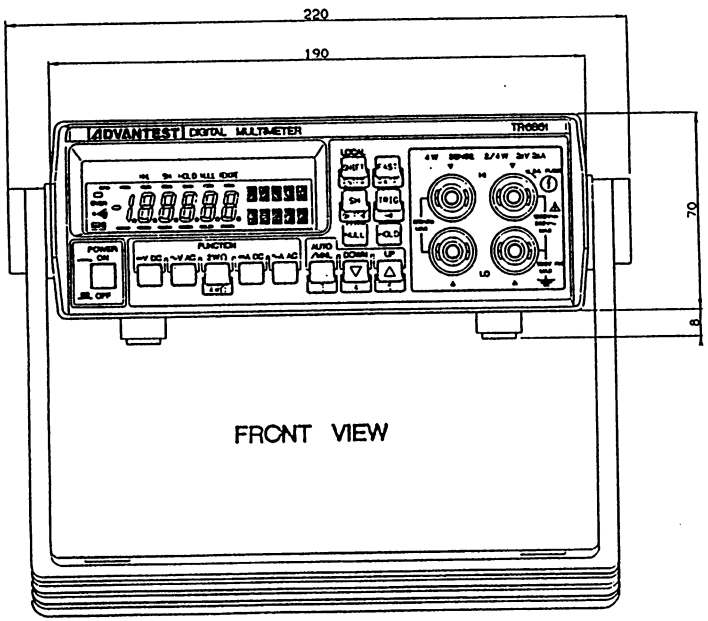
SECTION 8

BEFORE CALLING SERVICE PERSONNEL

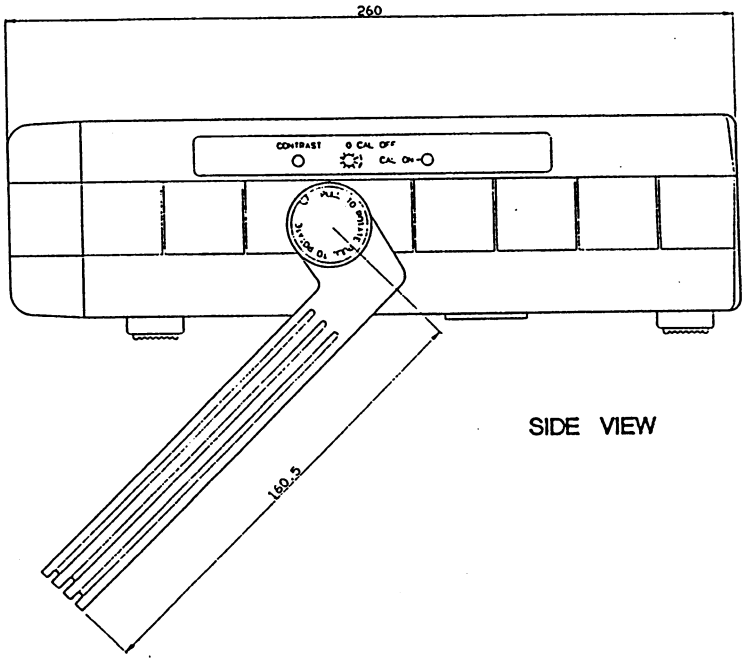
If the TR6851 should happen to malfunction at any stage, first check the following points before calling your nearest ADVANTEST representative. A list of addresses and telephone numbers is supplied inside the back cover. Note that if service personnel are requested to make repairs which could be handled within the scope of the following check points, the user may be charged for the repairs.

Problem	Cause	Countermeasure
BATT indicator comes on	o Drop in battery voltage when batteries are being used	o Recharge batteries as described in Section 5-4.
Display does not come on	o Blown power fuse	o Replace with the accessory fuse as described in Section 3-10.
	o Contrast not properly adjusted	o Adjust the CONTRAST control.
	o Battery voltage has dropped below operating level when TR15802 is being used	o Recharge as described in Section 5-4.
	o Although TR15802 has been mounted, the power cord has been connected to the multimeter and no AC power is being supplied.	o Disconnect the power cord from the multimeter and supply AC power.
Unsteady or abnormal measured value	o Incorrect function or range setting	o Check/correct function or range setting.
	o Incorrect 50/60 Hz selector switch setting	o Set to line frequency of AC power being used.
Applied input signal is not measured	o Cable connected to SENSE terminal when measuring voltage	o Connect input cable to INPUT terminal.
	o Matching conductors not used when measuring resistance	o Check type of conductors being used, and replace if necessary.
Display is generally too faint	o Contrast not properly adjusted	o Adjust the CONTRAST control.
Display is generally too bright	o Contrast not properly adjusted	o Adjust the CONTRAST control.

MEMO

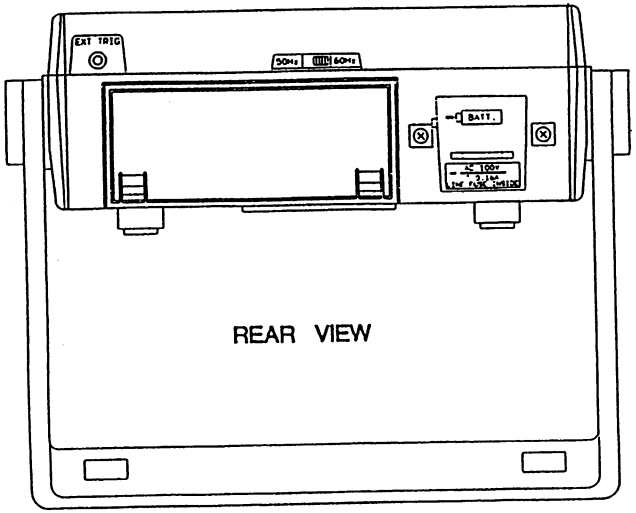


FRONT VIEW



SIDE VIEW

Unit: mm



REAR VIEW

TR6851
EXTERNAL VIEW

TR6851EXT1-406-A

TR6851
DISPLAY
BLC-011561

Parts No.	ADVANTEST Stock No.	Description
U1	SIM-44780	IC: LCD Controller Driver
U2	SIM-44100	IC: LCD Driver
R1	RMF-AC91KFJ	R: FXD Metal FLM 91kΩ ±1% 1/8W
R2 thru R5	RMF-AC6R8KFJ	R: FXD Metal FLM 6.8kΩ ±1% 2W
S1 thru S14	KSP-000250	Switch
S15	KSP-000428	Switch
J1	JCP-AQ025JX01	Connector
E1	NLC-000181	LCD

Parts No.	ADVANTEST Stock No.	Description
U1	SIA-TL072	IC: Low-Noise JFET-Input Operational Amplifier
U2	SIA-357-2	IC: JFET Input Amplifier Wide Band Decompensated
U3	SIA-DA536A	IC: True RMS to DC Converter
U4	SIA-40H374	IC: Octal D-Type Flip Flops
U5 thru U7	SIA-339	IC: Quad Comparator
Q1 thru Q6	SFT-A71	Transistor SI N-JFET, Dual
Q7	SFN-2N4393-18	Transistor SI N-JFET Selected
D1	SDS-1SS97	Diode SI
D2	SDS-1SS97	Diode SI
D3	SDS-1S953	Diode SI
D4	SDS-1S953	Diode SI
R1 thru R13	RCB-AG1M	R: FXD CAR 1MΩ
R14	RCB-AG47K	R: FXD CAR 47kΩ ±5% 1/8W
R15	RCB-AG220K	R: FXD CAR 220kΩ ±5% 1/8W
R16	RCB-AG220K	R: FXD CAR 220kΩ ±5% 1/8W
R17	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
R18	RMF-AB100KBJ	R: FXD Metal FLM 100kΩ ±0.1% 1/4W
R19	RCB-AG100K	R: FXD CAR 100kΩ ±5% 1/8W
R20	RCB-AG33K	R: FXD CAR 33kΩ ±5% 1/8W
R21	RCB-AG100K	R: FXD CAR 100KΩ ±5% 1/8W
R22	RCB-AG33K	R: FXD CAR 33kΩ ±5% 1/8W
R23	RCB-AG10	R: FXD CAR 10Ω ±5% 1/8W
R24	RCB-AG10	R: FXD CAR 10Ω ±5% 1/8W
R25 thru R29	RAY-AA100K4	R: FXD COM 100kΩ
R30	RAY-BJX0001	R: RESISTER NETWORK
R31	RCB-AG22K	R: FXD CAR 22kΩ ±5% 1/8W
C1	CMC-AB3PR5K	C: FXD DIPPED MICA 3pF ±0.5% 500V
C2	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C3	CTA-AC1U50V	C: FXD ELECT TANTAL 1μF ±20% 50V
C4	CMC-AB68PR3K	C: FXD DIPPED MICA 68pF ±5% 300V
C5	CTA-AA22U16V	C: FXD ELECT TANTAL 22μF ±20% 16V
C6	CTA-AA22U16V	C: FXD ELECT TANTAL 22μF ±20% 16V
C7	CTA-AC2R2U35V	C: FXD ELECT TANTAL 2.2μF ±20% 35V
C8	CFM-ASR047U50V	C: FXD Mylar 0.047μF ±10% 50V
C9	CFM-ABR1U50V	C: FXD Mylar 0.1μF ±10% 50V
C10	CFM-AH1U100V	C: FXD Mylar 1μF 100V
C11	CSM-ACR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C12	CSM-ACR01U50V	C: FXD CER 0.01μF +80, -20% 50V
C13	CCK-AB10U25V	C: FXD ELECT 10μF 25V
C14	CCK-AB10U25V	C: FXD ELECT 10μF 25V
C15	CTM-AF1R5P	C: VAR Polystyrene 1.5pF
C16	CMC-AB150PR3K-4	C: FXD DIPPED MICA 150pF ±5% 300V

Parts No.	ADVANTEST Stock No.	Description
J1	JCP-AR015PX01	Connector
J2	JCP-BL001PX03	Connector
J3	JCP-BL001PX05	Connector
J4	JCP-BL001PX06	Connector

Parts No.	ADVANTEST Stock No.	Description
U1	SIA-7805U	IC: Voltage Regulator
U2	SIA-NJM4193	IC: Switching Regulator
U3	SIA-442	IC: Dual JFET Input OPAMP
U4	SIA-NJM4193	IC: Switching Regulator
U5	SIA-393	IC: Dual Differential Comparator
U6	SIM-74HC02	IC: Quadruple 2-Input NOR Gate
U7	SIM-40H374	IC: Octal D-type Flip Flops
U8	SIM-40H367	IC: Hex Bus Buffer
U9	SIM-40H174	IC: Hex D-type Flip Flops
U10	SIM-40H174	IC: Hex D-type Flip Flops
U11	SIM-40H367	IC: Hex Bus Buffer
U12	SIM-40H174	IC: Hex D-type Flip Flops
U13	SIT-75468	IC: Darlington Transistor Arrays
U14	SIM-40H138	IC: 3 to 8 Line Decoder
U15	SIM-4051-18	IC: 8 Channel Analog Multiplexer, Selected
U16	SIA-LT1008CN8	IC: OP-AMP
U17	SIA-4053-19	IC: Triple 2-Channel Multiplexer, Selected
U18	SIA-4052-18	IC: Dual 4-Channel Analog Multiplexer, Selected
U19	SIA-LT1008CN8	IC: OP-AMP
U20	SIA-LT1008CN8	IC: OP-AMP
U21	SIA-442	IC: Dual JFET Input OP-AMP
U22	SIA-4053-19	IC: Triple 2-Channel Multiplexer, Selected
U23		Not assigned
U24	SIA-4053-19	IC: Triple 2-Channel Multiplexer, Selected
U25	SIA-4052-18	IC: Dual 4-Channel Analog Multiplexer, Selected
U26	SIA-442	IC: Dual JFET Input OP-AMP
U27	SIA-LT1008CN8	IC: OP-AMP
U28	SIA-LT1008CN8	IC: OP-AMP
U29	SHB-001308-1	IC: Zener diode ASSY
U30	SIM-4002	IC: Dual 4-Input Positive NOR Gate
U31	SIM-74HC107	IC: Dual J-K Master-Slave Flip Flop
U32	SIA-LT1008CN8	IC: OP-AMP
U33	SIA-LT1008CN8	IC: OP-AMP
Q1	STN-2SC815	Transistor SI NPN
Q2	STP-2SA1015	Transistor SI PNP
Q3	SFN-2SK141-18	FET Junction N-Channel, Selected
Q4	SFN-2SK33	FET Junction N-Channel
D1	SDP-W02	Diode SI
D2	SDP-PK14	Diode SI
D3	SDS-1S954	Diode SI
D4	SDS-1S954	Diode SI
D5	SDZ-D062	Zener Diode
D6	SDZ-D062	Zener Diode
D7 thru D16	SDS-1S953	Diode SI
D17	SDP-W02	Diode SI

Parts No.	ADVANTEST Stock No.	Description
D18 thru D25	SDS-LD1-19	Diode SI, Selected
D26	SDZ-H3-5	Zener Diode
D27	SDZ-H3-5	Zener Diode
D28	SDS-LD1-19	Diode SI, Selected
D29	SDS-LD1-19	Diode SI, Selected
D30	SDS-1S953	Diode SI
D31	SDS-1S953	Diode SI
D32	SDZ-H3-5	Zener Diode
D33	SDS-1S953	Diode SI
D34	SDP-SM1-2	Diode SI
D35	SDZ-D043	Zener Diode
D36	SDZ-D043	Zener Diode
D37 thru D40	SDS-1S953	Diode SI
D41	SDZ-LT1004CZ	Zener Diode
D42	SDS-1S953	Diode SI
D43	SDS-LD1	Diode SI
D44	SDS-LD1-19	Diode SI, Selected
D45	SDZ-W050	Zener Diode
R1	RCB-AH680K	R: FXD CAR 680kΩ ±5% 1/4W
R2	RMF-AR82KFK	R: FXD Metal FLM 82kΩ ±1% 1/4W
R3	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R4 thru R7	RMF-AR33KFK	R: FXD Metal FLM 33kΩ ±1% 1/4W
R8	RCB-AH680K	R: FXD CAR 680kΩ ±5% 1/4W
R9	RMF-AR82KFK	R: FXD Metal FLM 82kΩ ±1% 1/4W
R10	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R11	RMF-AR33KFK	R: FXD Metal FLM 33kΩ ±1% 1/4W
R12		Not assigned
R13	RCB-AH68K	R: FXD CAR 68kΩ ±5% 1/4W
R14	RCB-AH100K	R: FXD CAR 100kΩ ±5% 1/4W
R15	RCB-AH820K	R: FXD CAR 820kΩ ±5% 1/4W
R16	RCB-AH100K	R: FXD CAR 100kΩ ±5% 1/4W
R17	RMF-AR7R5KFK	R: FXD Metal FLM 7.5kΩ ±1% 1/4W
R18	RMF-AR36KFK	R: FXD Metal FLM 36kΩ ±1% 1/4W
R19	RMF-AR22KFK	R: FXD Metal FLM 22kΩ ±1% 1/4W
R20	RVR-CD20K	R: VAR CERMET 20kΩ
R21	RAY-AA100K4	R: FXD COM 100kΩ
R22	RAY-AA100K4	R: FXD COM 100kΩ
R23	RCB-AK220K	R: FXD CAR 220kΩ ±5% 1/2W
R24	RWR-ANR1QB	R: FXD WW 40.1Ω
R25	RCB-AH120K	R: FXD CAR 120kΩ ±5% 1/4W
R26	RCB-AH22K	R: FXD CAR 22kΩ ±5% 1/4W
R27	RCB-AK100K	R: FXD CAR 100kΩ ±5% 1/2W
R28	RCB-AH22K	R: FXD CAR 22kΩ ±5% 1/4W
R29	RCB-AK100K	R: FXD CAR 100kΩ ±5% 1/2W

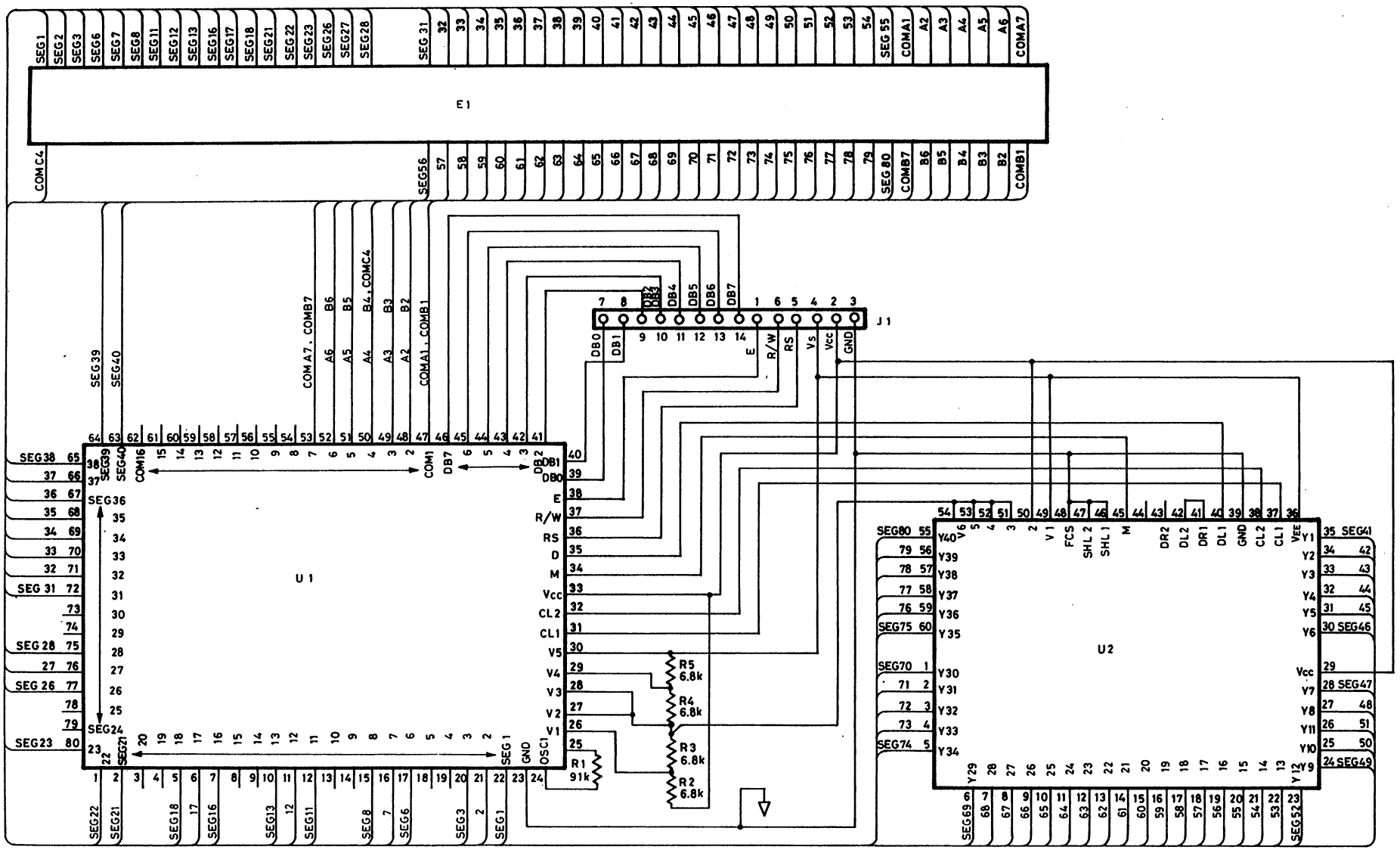
Parts No.	ADVANTEST Stock No.	Description
R30	RCB-AA100K	R: FXD CAR 100kΩ ±5% 2W
R31	RCB-AK1K	R: FXD CAR 1kΩ ±5% 1/2W
R32	RCB-AK22K	R: FXD CAR 22kΩ ±5% 1/2W
R33	RCB-AH3R3K	R: FXD CAR 3.3kΩ ±5% 1/4W
R34	RCB-AH3R3K	R: FXD CAR 3.3kΩ ±5% 1/4W
R35	RCB-AH120K	R: FXD CAR 120kΩ ±5% 1/4W
R36	RCB-AH10	R: FXD CAR 10Ω ±5% 1/4W
R37	RHB-000009	R: FXD COM
R38		Not assigned
R39	RCB-AH10K	R: FXD CAR 10kΩ ±5% 1/4W
R40	RMF-AR100KFK	R: FXD Metal FLM 100kΩ ±5% 1/4W
R41	RMF-AV10MJM	R: FXD Metal FLM 10MΩ ±5% 1/8W
R42	RCB-AH10K	R: FXD CAR 10kΩ ±5% 1/4W
R43	RCB-AH10K	R: FXD CAR 10kΩ ±5% 1/4W
R44	RMF-AR10KFK	R: FXD Metal FLM 10kΩ ±1% 1/4W
R45	RMF-AR100KFK	R: FXD Metal FLM 100kΩ ±1% 1/4W
R46	RCB-AH10K	R: FXD CAR 10kΩ ±5% 1/4W
R47	RCB-AH10K	R: FXD CAR 10kΩ ±5% 1/4W
R48	RCB-AH100K	R: FXD CAR 100kΩ ±5% 1/4W
R49	RCB-AK100K	R: FXD CAR 100kΩ ±5% 1/2W
R50	RCB-AH330	R: FXD CAR 330Ω ±5% 1/4W
R51	RCB-AH10K	R: FXD CAR 10kΩ ±5% 1/4W
R52	DSP-000016	R: Thermistor
R53	RHB-000007	R: FXD COM
R54	RAY-BBX0002	R: FXD COM Metal FLM 5kΩ, 44kΩ ±5% 1/4W
R55	RMF-AM600KBD	R: FXD Metal FLM 600kΩ ±0.1% 1/8W
R56	RMF-AC18KFJ	R: FXD Metal FLM 18kΩ ±1% 2W
R57	RMF-AC33KFJ	R: FXD Metal FLM 33kΩ ±1% 2W
R58	RCB-AH100K	R: FXD CAR 100kΩ ±5% 1/4W
R59	RCB-AH270K	R: FXD CAR 270kΩ ±5% 1/4W
R60	RCB-AH100K	R: FXD CAR 100kΩ ±5% 1/4W
R61		Not assigned
R62	RCB-AH22K	R: FXD CAR 22kΩ ±5% 1/4W
C1	CSM-AX1500P3K	C: FXD CER 1500pF ±10% 3kv
C2	CSM-AX1500P3K	C: FXD CER 1500pF ±10% 3kv
C3	CCK-AB1000U16V	C: FXD ELECT 1000µF 16V
C4	CSM-AC2200P50V	C: FXD CER 2200pF ±20% 50V
C5	CCK-AB470U16V	C: FXD ELECT 470µF 16V
C6	CMC-AB10PR5K	C: FXD DIPPED MICA 10pF ±5% 500V
C7	CCK-ANR33U16V	C: FXD ELECT 0.33µF 16V
C8	CCK-AB47U16V	C: FXD ELECT 47µF 16V
C9	CSM-AC150P50V	C: FXD CER 150pF ±10% 50V
C10 thru C15	CCK-AB47U16V	C: FXD ELECT 47µF 16V
C16	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C17	CCK-AB10U16V	C: FXD ELECT 10µF 16V
C18	CCK-ANR33U16V	C: FXD ELECT 0.33µF 16V

Parts No.	ADVANTEST Stock No.	Description
C19	CMC-AB10PR5K	C: FXD DIPPED MICA 10pF ±5% 500V
C20	CSM-AC150P50V	C: FXD CER 150pF ±10% 50V
C21	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C22	CCK-AB10U16V	C: FXD ELECT 10µF 16V
C23	CCK-ANR33U16V	C: FXD ELECT 0.33µF 16V
C24	CTA-AC3R3U16V	C: FXD ELECT TANTAL 3.3µF ±20% 16V
C25 thru C28	CCK-ANR33U16V	C: FXD ELECT 0.33µF 16V
C29	CTA-AC10U16V	C: FXD ELECT TANTAL 10µF ±20% 16V
C30	CSM-AWR01U400V	C: FXD CER 0.01µF +100% -0% 400V
C31	CFM-ACR22UR6K	C: FXD Mylar 0.22µF ±10% 6kv
C32	CSM-AX3300P1K	C: FXD CER 3300pF ±10% 1kv
C33	CFM-AB1000PR2K	C: FXD Mylar 1000pF ±10% 2kv
C34	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C35	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C36	CMC-AB300PR3K	C: FXD DIPPED MICA 300pF ±5% 300V
C37	CSM-AC1000P50V	C: FXD CER 1000pF +80, -20% 50V
C38	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C39	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C40	CSM-AC100P50V	C: FXD CER 100pF ±10% 50V
C41	CFM-BBR1U100V	C: FXD Mylar 0.1µF ±10% 100V
C42	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C43	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C44	CSM-AC68P50V	C: FXD CER 68pF ±10% 50V
C45	CFM-AB1000PR2K	C: FXD Mylar 1000pF ±10% 2kv
C46	CMC-AB100PR3K	C: FXD DIPPED MICA 100pF ±5% 300V
C47 thru C52	CTA-AC1U50V	C: FXD ELECT TANTAL 1µF ±20% 50V
C53	CSM-AC100P50V	C: FXD CER 100pF ±10% 50V
C54	CSM-AC100P50V	C: FXD CER 100pF ±10% 50V
C55	CSM-AC1000P50V	C: FXD CER 1000pF +80, -20% 50V
C56	CSM-AC1000P50V	C: FXD CER 1000pF +80, -20% 50V
C57	CFM-AB1000PR2K	C: FXD Mylar 1000pF ±10% 2kv
C58	CSM-ACR047U50V	C: FXD CER 0.047µF +80, -20% 50V
C59	CFM-AB1000PR2K	C: FXD Mylar 1000pF ±10% 2kv
C60	CFM-AB1000PR2K	C: FXD Mylar 1000pF ±10% 2kv
C61	CCK-AA100U10V	C: FXD ELECT 100µF 10V
C62	CSM-ACR047U50V	C: FXD CER 0.047µF +80, -20% 50V
C63 thru C65	CSM-AC1000P50V	C: FXD CER 1000pF +80, -20% 50V
C66	CFM-AHR1U250V	C: FXD Mylar 0.1µF 250V
C67	CSM-AC100P50V	C: FXD CER 100pF ±10% 50V
C68	CSM-AC100P50V	C: FXD CER 100pF ±10% 50V
L1	LCL-C00012	L: FXD Coil
L2	LCL-C00012	L: FXD Coil
L3	LCL-C00624	L: FXD Coil

Parts No.	ADVANTEST Stock No.	Description
L4 thru L9	LCL-C00012	L: FXD Coil
L10	ESM-000128	L: FXD Coil
L11	DNF-000986	L: FXD Coil
L12	ESM-000128	L: FXD Coil
E1	DEE-000382	Buzzer
F1	DFT-AAR16A	Fuse
F2	DFN-AA2A	Fuse
J1	JCD-AB003PX01	Connector
J2	JCP-AA012PX01	Connector
J3	DCB-QS0493	Connector
J4	JCB-AD048JX01	Connector
J5 thru J7	JCP-AR015JX01	Connector
J8	JCP-AQ025PX03	Connector
J9	JCI-AF004JX02	Connector
J10 thru J15	JCP-BL001PX01	Connector
J16	JCP-BL001PX07	Connector
K1 thru K4	KRL-000685	Relay
S1	KSP-000132	Switch
S2	KSE-000453	Switch
S3	KSL-000152	Switch
S4	KSR-000404	Switch
T1	LTP-000605	Transformer
VL1	DSP-000184-11	Thermistor
VL2 thru VL5	DSP-000603	Thermistor
C67	CSM-AC100P50V	C: FXD CER 100pF ±10% 50V
C68	CSM-AC100P50V	C: FXD CER 100pF ±10% 50V
J17	JCP-BL001PX06	Connector
J18	JCP-BL001PX04	Connector
J19	JCP-BL001PX08	Connector

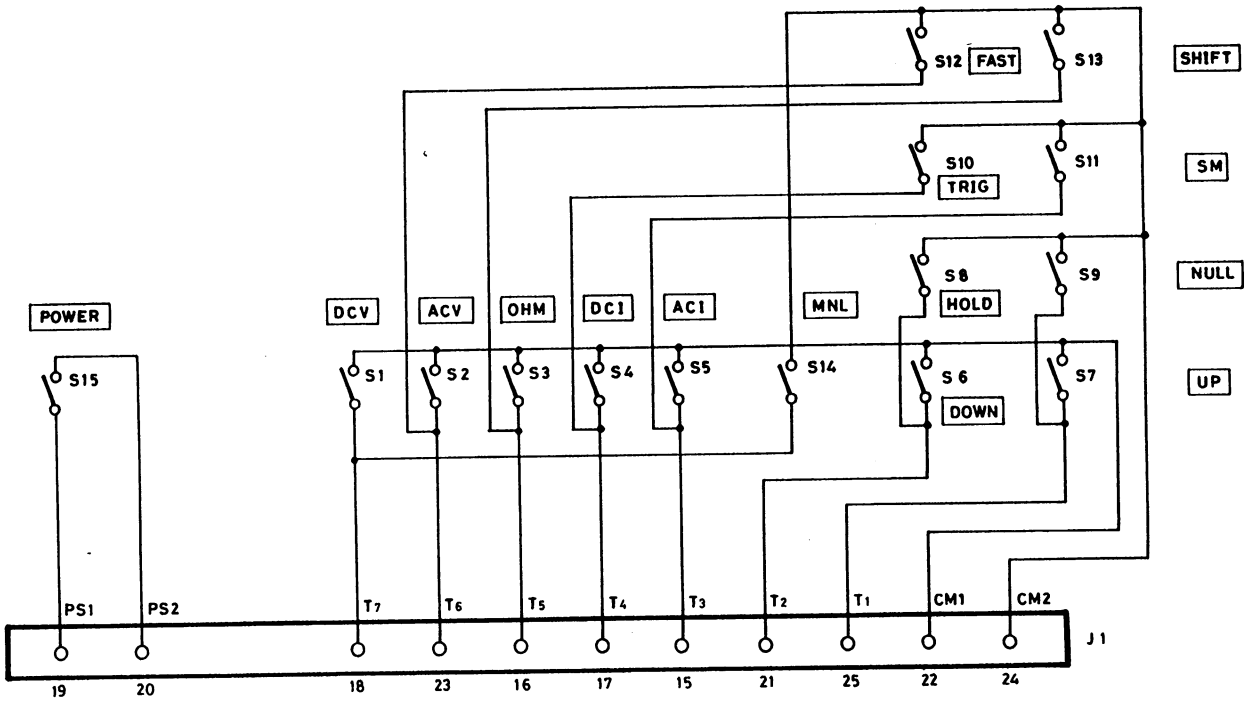
TR6851
CPU
BLC-011560

Parts No.	ADVANTEST Stock No.	Description
U1	SIM-74HC151	IC: 1-of-8 Data Selector/Multiplexer
U2	SIM-40H138	IC: 3 to 8 Line decoder
U3	SIS-001246A	IC: Programmed ROM
U4	SIM-40H000	IC: Quad 2-Input N and Gate
U5	SIM-6303	IC: CMOS MCU
U6	SMM-5517	IC: CMOS RAM 16k bit
U7	SIM-40H373	IC: Octal D-type Flip-Flops
D1	SDS-1S953	Diode SI
D2	SDS-1S2210	Diode SI
D3	SDS-1S2210	Diode SI
R1	RAY-AK100K4	R: FXD COM 100kΩ
R2	RCB-AG330K	R: FXD CAR 330kΩ ±5% 1/8W
R3	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
R4	RCB-AG10K	R: FXD CAR 10kΩ ±5% 1/8W
C1	CMC-AB20PR5K	C: FXD DIPPED MICA 20pF ±10% 500V
C2	CMC-AB20PR5K	C: FXD DIPPED MICA 20pF ±10% 500V
C3	CTA-AC3R3U16V	C: FXD ELECT TANTAL 3.3μF ±20% 16V
C4	CSM-ACR047U50V	C: FXD CER 0.047μF +80, -20% 50V
C5	CSM-ACR047U50V	C: FXD CER 0.047μF +80, -20% 50V
C6	CTA-ACR47U35V	C: FXD ELECT TANTAL 0.47μF ±20% 35V
X1	DXD-000168	Crystal 4MHz
J1	JCP-AR015PX01	Connector
J2	JCP-AR015PX01	Connector
J3	JCI-AD040JX01	IC Socket
J4	JCI-AD028JX02	IC Socket
E1	DBP-000829	Battery ER3 3.6V 650mAh



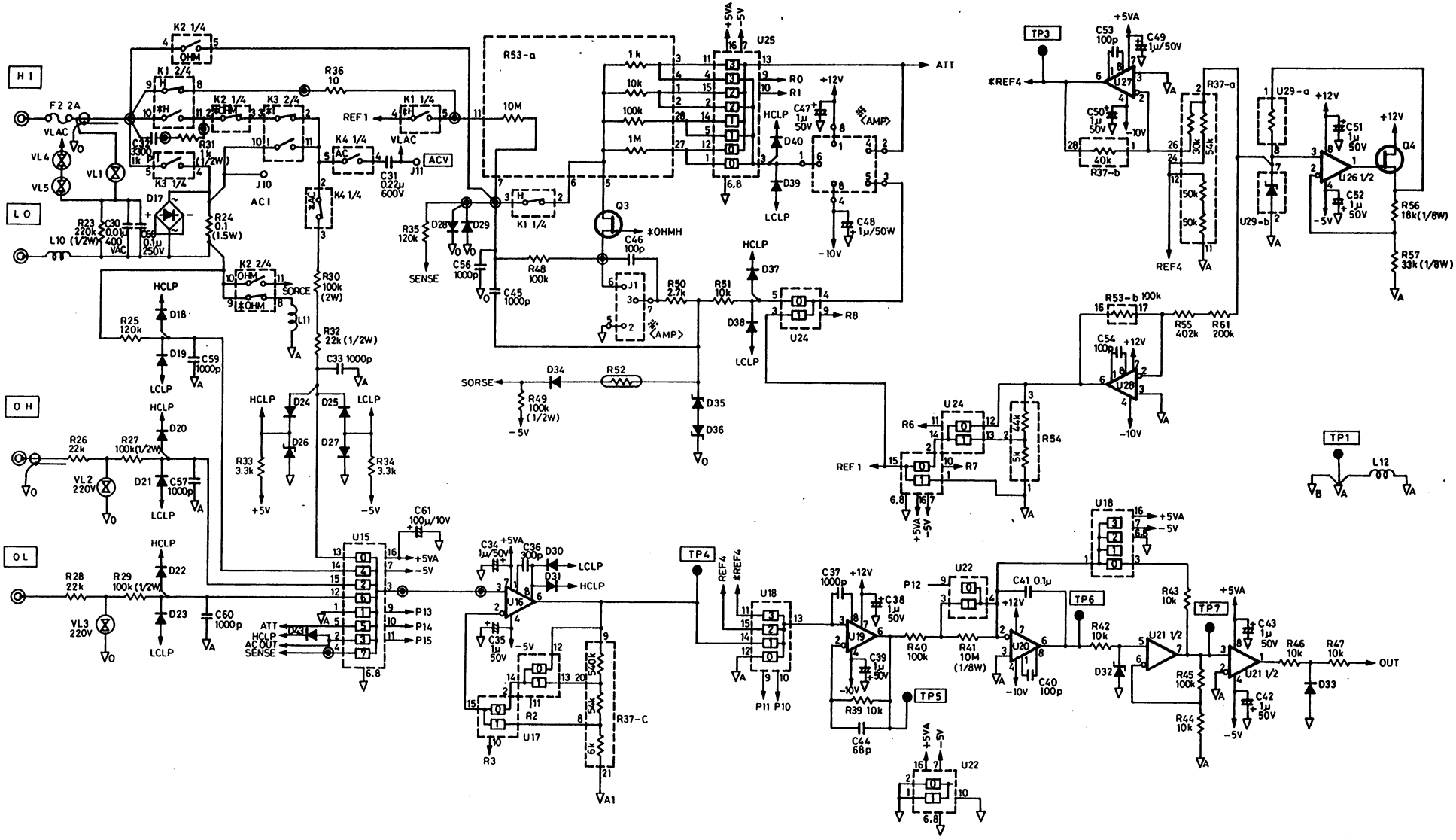
0426503 – 001 – A

TR6851
DISPLAY
BLC–011561 1/2



0426503-002- A

TR6851
DISPLAY
BLC-011561 2/2



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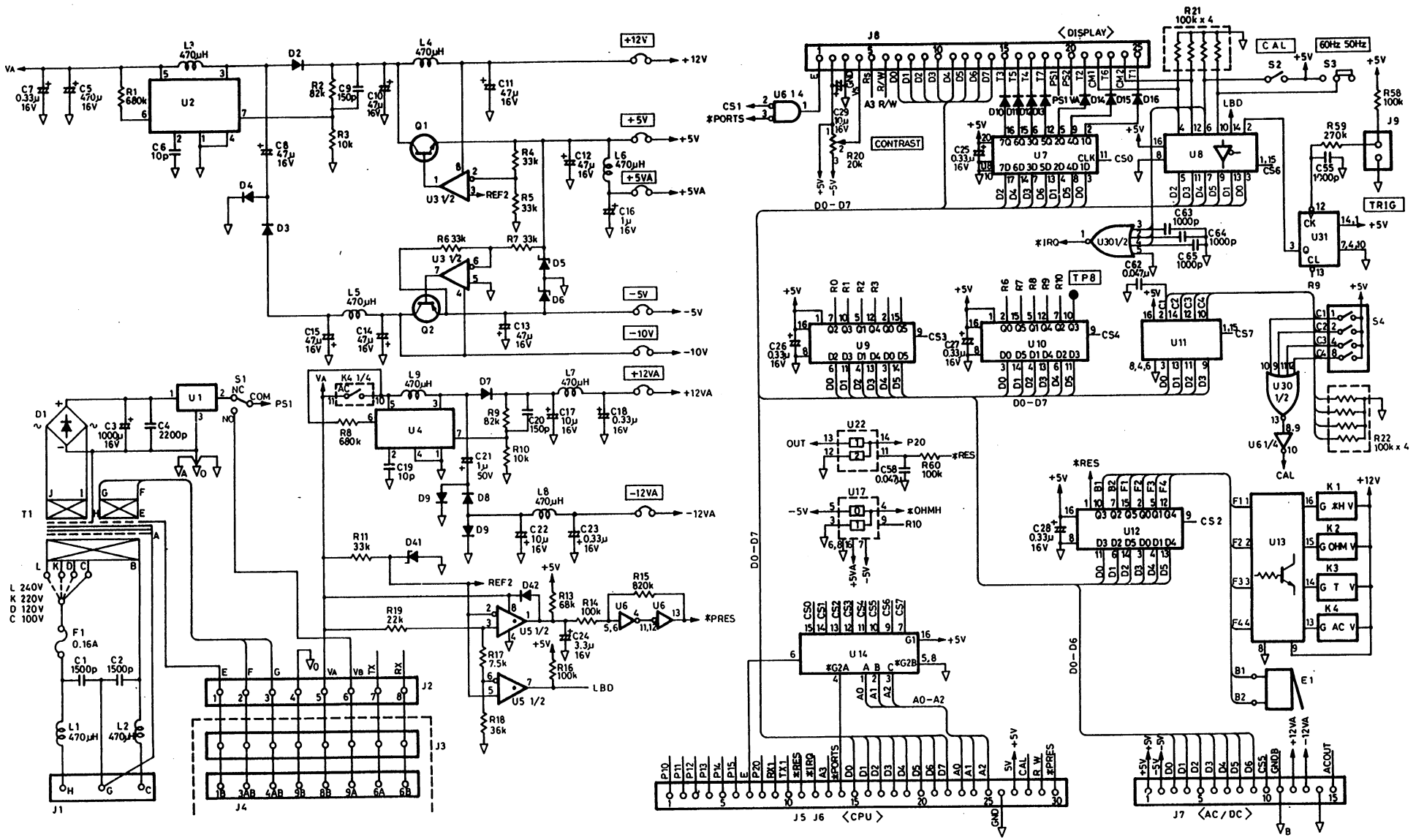
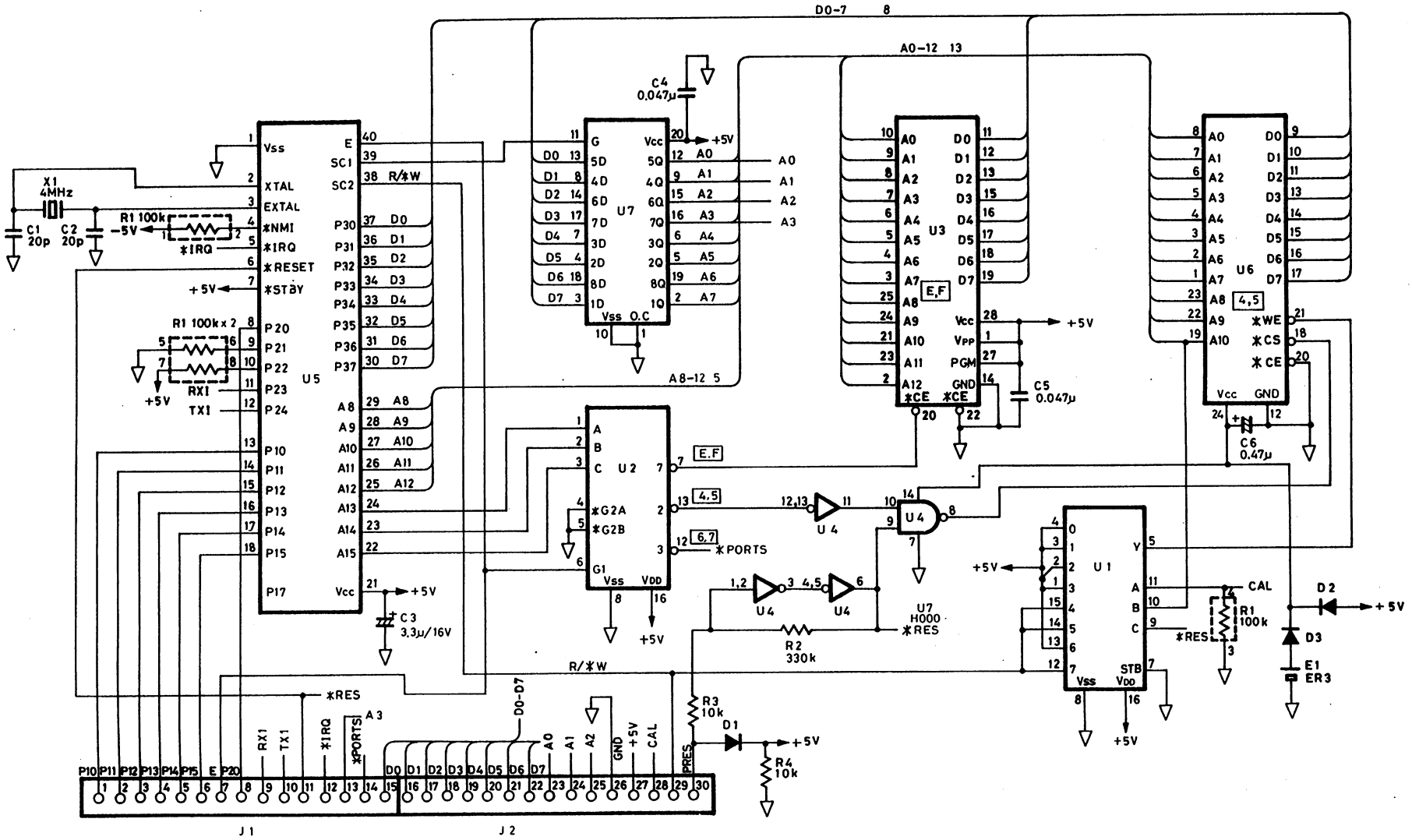
TR6851
MAIN
BLG-011562 1/2



0426503 - 004 - A

TR6851
MAIN
BLG-011562 2/2



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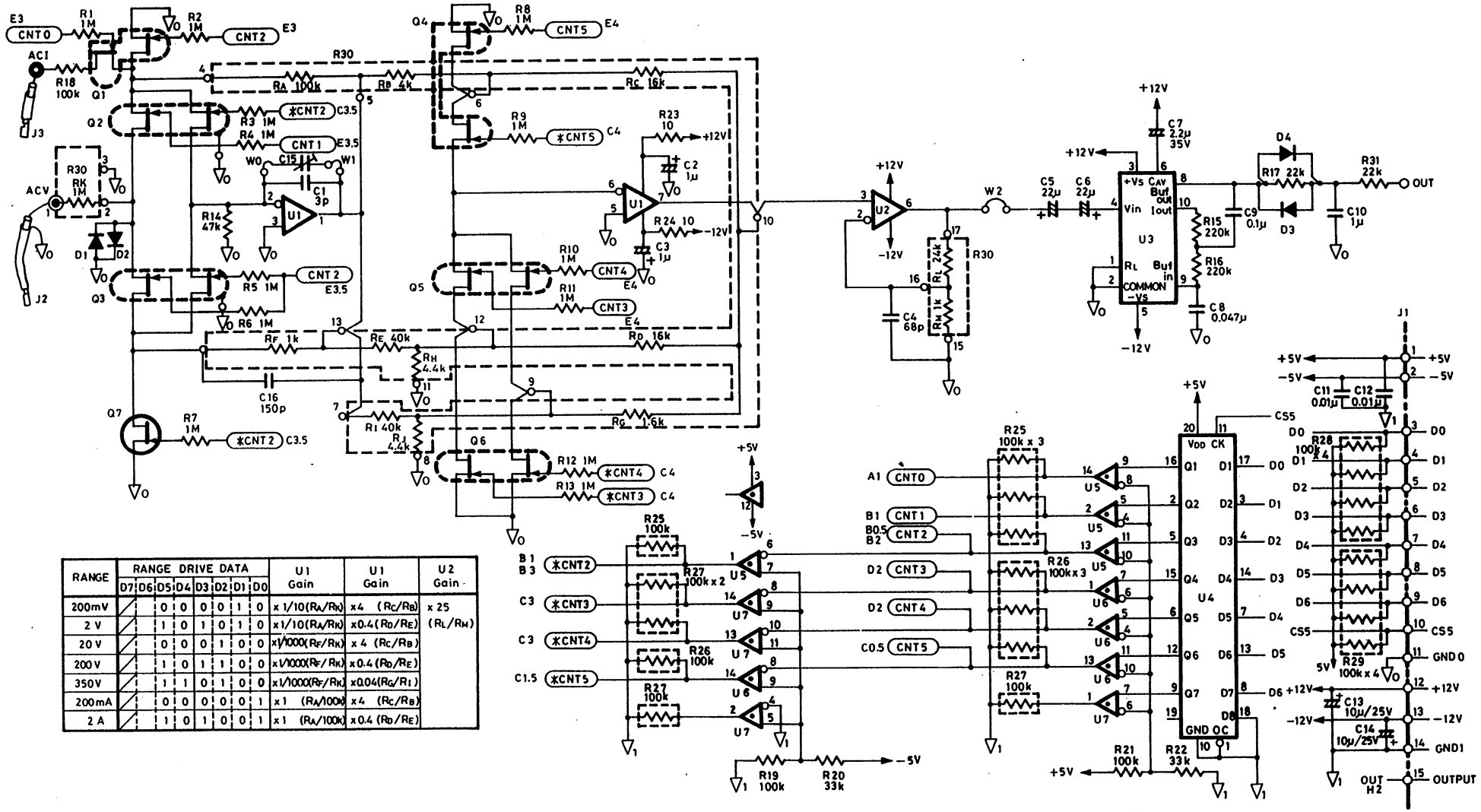
TR6851
CPU
BLC–011560



RANGE	RANGE DRIVE DATA								U1 Gain	U1 Gain	U2 Gain
	D7	D6	D5	D4	D3	D2	D1	D0			
200mV	/		0	0	0	0	1	0	x 1/10(R_A/R_K)	x4 (R_C/R_B)	x 25
2 V	/		1	0	1	0	1	0	x1/10(R_A/R_K)	x0.4(R_D/R_E)	(R_L/R_M)
20 V	/		0	0	0	1	0	0	x1/1000(R_F/R_K)	x 4 (R_C/R_B)	
200 V	/		1	0	1	1	0	0	x1/1000(R_F/R_K)	x0.4(R_D/R_E)	
350V	/		1	1	0	1	0	0	x1/1000(R_F/R_K)	x0.04(R_G/R_I)	
200mA	/		0	0	0	0	0	1	x1 (R_A/100k)	x4 (R_C/R_B)	
2 A	/		1	0	1	0	0	1	x1 (R_A/100k)	x0.4 (R_D/R_E)	

0426503-006-A

TR6851
AC/DC CONVERTER
BLC-011559

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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.

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   (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;

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

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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.

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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

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