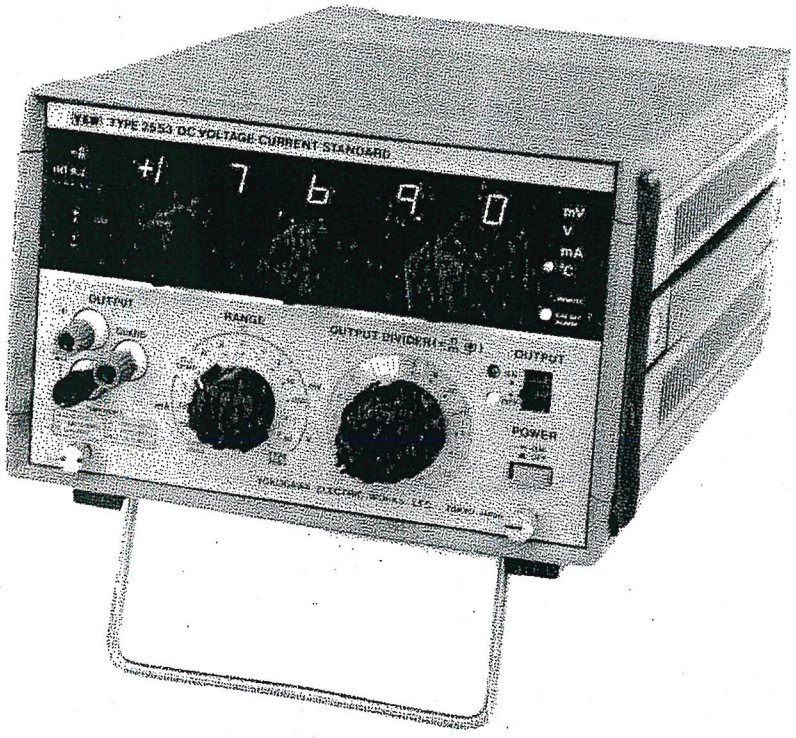
Instruction Manual

Type 2553
DC VOLTAGE/CURRENT STANDARD



YEW
YOKOGAWA HOKUSHIN ELECTRIC

4th Edition
IM 2553-41E

CERTIFICATION

Yokogawa Hokushin Electric Corporation (YEW) certifies that this instrument underwent stringent inspections and performance tests before it was shipped from the factory, and was found to meet the specifications given in the specifications section of this document.

YEW also certifies that its calibration measurements are traceable to the Electrotechnical Laboratory of the Ministry of International Trade and Industry (which maintains Japan's primary electrical standards) to the extent allowed by the organization's calibration facilities. Calibration measurements not traceable to that organization are traceable to the calibration facilities of other members of the International Electrotechnical Commission, or to those of International Organization for Standardization (ISO) members.

WARRANTY

YEW warrants this product, for one year from the date of delivery, against defects in materials and workmanship. YEW will repair or replace a product which proves defective during the warranty period due to materials or workmanship defects, provided that the product is returned to YEW or a YEW representative authorized to perform in-warranty repair of the product. YEW reserves the right to determine whether product failures are due to defective materials or workmanship, or to other causes not covered by this warranty. No other warranty is expressed or implied. YEW is not liable for consequential damages.

CONTENTS

1. GENERAL.

1-1. Description.

The YEW Type 2553 DC voltage/Current Standard delivers not only DC voltage or current, as set on the front panel dials, to an accuracy of ±0.2% but also "thermocouple" emf corresponding to the temperature set on the front panel dials to calibrate thermocouple thermometer inputs.

The instrument is suited for the calibration of various electronic instruments and thermocouple thermometer inputs.

1-2. Features.

(1) The instrument delivers DC voltage or current to 0.02% high accuracy.

(2) Emfs can be generated for calibrating Thermocouple thermometer inputs by setting the instrument dials according to JIS, ANSI and DIN type thermocouple temperature (°C).

(3) The dials can be set continuously.
The most-significant-digit decade dial can be either 0 (for setting up to 999) or 1 (for setting 1000). Noncontacting switches are used in the instrument dials.

(4) A divider function for meter calibration is furnished in the instrument. The voltage or current dial setting corresponds to the meter full scale. Other meter scale divisions are calibrated using the divider dial.

(5) The microprocessor used in this instrument enables not only thermocouple linearizers but also meter zero and full-scale to be calibrated, so the usual variable resistor adjustment is not necessary.

(6) GP-IB (General-purpose Interface Bus).
Type 255342 (GP-IB built-in) can be externally programmed.

NOTE

The instrument is not supplied with batteries installed, so CAL BAT ALARM will light when the POWER switch is turned ON, but this is normal.

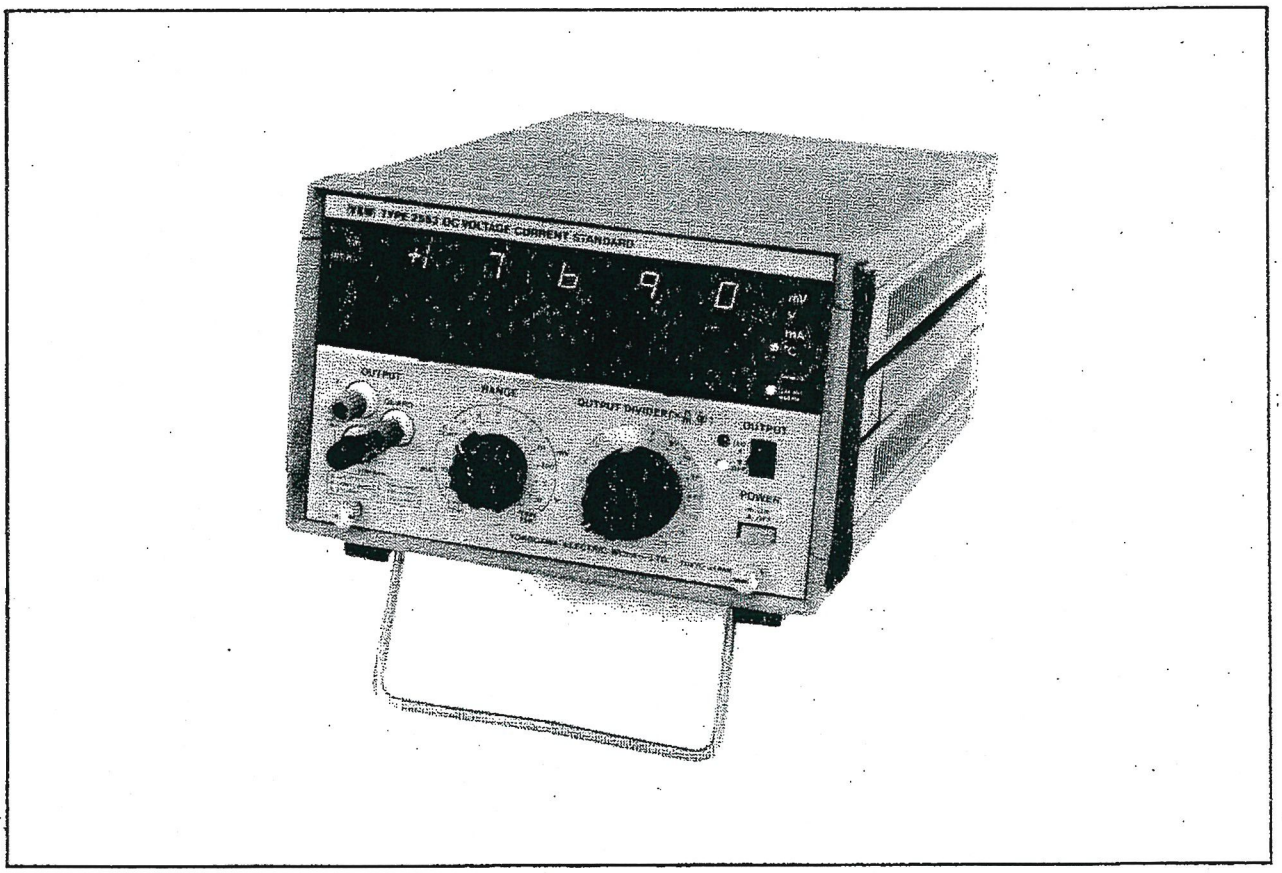


Figure 1-1. External View.

1-3. Specifications.

	Range		Setting Range	Accuracy		Minimum Resolution	Maximum Output	Internal Resistance
Voltage	10 mV		0 to ± 12.000 mV	±0.02% ±4 μV		1 μV		1.5 Ω Max.
	100 mV		0 to ±120.00 mV	±0.02%		10 μV		1.5 Ω Max.
	1 V		0 to ± 1.2000 V	±0.02%		100 μV	100 mA Min.	10 mΩ Max.
	10 V		0 to ± 12.000 V	±0.02%		1 mV	100 mA Min.	10 mΩ Max.
Current	1 mA		0 to ± 1.2000 mA	±0.02%		0.1 μA	12 V Min.	Approx. 10 MΩ
	10 mA		0 to ± 12.000 mA	±0.02%		1 μA	12 V Min. *1)	Approx. 10 MΩ
	100 mA		0 to ±120.00 mA	±0.02%		10 μA	9 V Min.	Approx. 1 MΩ
Temperature	JIS (°C)	R	0 to 1769.0°C	*2) ±2.76°C	*3) ±3.26°C	1.5°C Max.		1.5 Ω Max.
		K	−200.0 to 1200.0°C	±0.40°C (±0.94°C)	±0.47°C (±1.17°C)	0.15°C Max.		1.5 Ω Max.
	ANSI (°C)	E	0 to 700.0°C	±0.25°C	±0.31°C	0.15°C Max.		1.5 Ω Max.
		J	−200.0 to 600.0°C	±0.37°C (±0.69°C)	±0.44°C (±0.90°C)	0.15°C Max.		1.5 Ω Max.
		T	−200.0 to 200.0°C	±0.16°C (±0.35°C)	±0.25°C (±0.50°C)	equvalent 1 μV		1.5 Ω Max.
	DIN (°C)	PtRh — Pt	0 to 1600.0°C	*4) ±2.72°C	*5) ±3.26°C	1.5°C Max.		1.5 Ω Max.
		NiCr — Ni	0 to 1200.0°C	±0.40°C	±0.47°C	0.15°C Max.		1.5 Ω Max.
		NiCr — Konst	0 to 700.0°C	±0.25°C	±0.31°C	0.15°C Max.		1.5 Ω Max.
		Fe — Konst	−200.0 to 600.0°C	±0.37°C (±0.68°C)	±0.44°C (±0.90°C)	0.15°C Max.		1.5 Ω Max.
		Cu — Konst	−200.0 to 200.0°C	±0.20°C (±0.35°C)	±0.25°C (±0.50°C)	equvalent 1 μV		1.5 Ω Max.

*1) 15 V up to 50 mA, 9 V up to 120 mA.

*2) Temperature accuracies when the setting dials are set at 25°C x n (where n is a positive integer). Figures in parentheses show the accuracy when the setting dials are set to below 0°C.

*3) Temperature accuracy at any temperature (except those mentioned in note *1).

*4) Temperature accuracies when the setting dials are set at 50°C x n (where n is a positive integer). Figures in parentheses show the accuracy when the setting dials are set to below 0°C.

*5) Temperature accuracy at any temperature (except those mentioned in note *2).

Output Setting: Set with three dials (contactless dial switches using photocouplers).
first and second daials 16 step/1revolution
third dial . . . . . 32 step/1 revolution

Display: 5-digit, LED (Light-Emitting Diode) display.

Unit Marks: mV, V, mA and °C.

Divider Output Setting:
(Divider output) = (Setting dial indication) X n/m
m . . . . . 1, 2, ... ,15 (15 divisions)
n . . . . . 0, 1, 2, ... ,15 (where n ≤ m)

Temperature Coefficient: ±50ppm/°C between 5 and 40°C.

Ripple: Less than 0.01% of setting range (for frequency components below 60Hz) except for 10mV range and for 1mA range . . . . 0.05%.

Warm Up: Approx. 30 minutes.

Common Mode Rejection Ratio: For 0 to 60Hz
Output voltage Approx. 120dB
Output current Approx. 0.1μA/V

Overcurrent Protection: Approx. 200mA. Output current may be turned on again manually.

Overvoltage Protection: Approx. 15V. Output voltage may be turned on again manually.

Effect of Power Supply Voltage Fluctuation: ±0.02% of range for power supply voltage change of ±10%.

Operating Temperature Range: 5 to 40°C.

Operating Humidity Range:
5 to 95% relative humidity.

Power Source: 100V AC ±10% 47 to 63Hz (also 120, 200, 220 or 240V AC as required).

Power Consumption: Approx. 50VA.

Insulation Resistance: Greater than (100MΩ at 500V DC between case and GUARD terminal, and between case and power supply.

Dielectric Strength: 100V AC for 1 minute between case and GUARD terminal and 1500V AC for 1 minute between case and power supply.

Dimensions: Approx. 149 X 228 X 365mm (5-7/8 X 8-5/8 X 13-1/2").

Weight: Approx. 8kg (17.6 lb).

Accessories:
Power cord . . . . . 1 pc.
Fuse (1A or 0.5A) . . . . . 2 pcs
Instruction Manual . . . . . 1 copy

Semiconductor Sensor Type 257825 (option).

Measuring Range: −20°C to 60°C.

Accuracy: ±0.3°C when used with the Type 2553 voltage/current standard.

Dielectric Strength: 100V AC for 1 minute between terminal tip and the Type 2553 protective ground terminal.

Insultion Resistance: Greater than 100MΩ at 500V DC between terminal tip and the Type 2553 protective ground terminal.

Cord Length: Approx. 2m length.

Terminal: Material . . . . . copper
Shape . . . . . round

Accessory: Round tip . . . . . 5 pcs.

2. NAMES AND FUNCTIONS OF COMPONENTS.

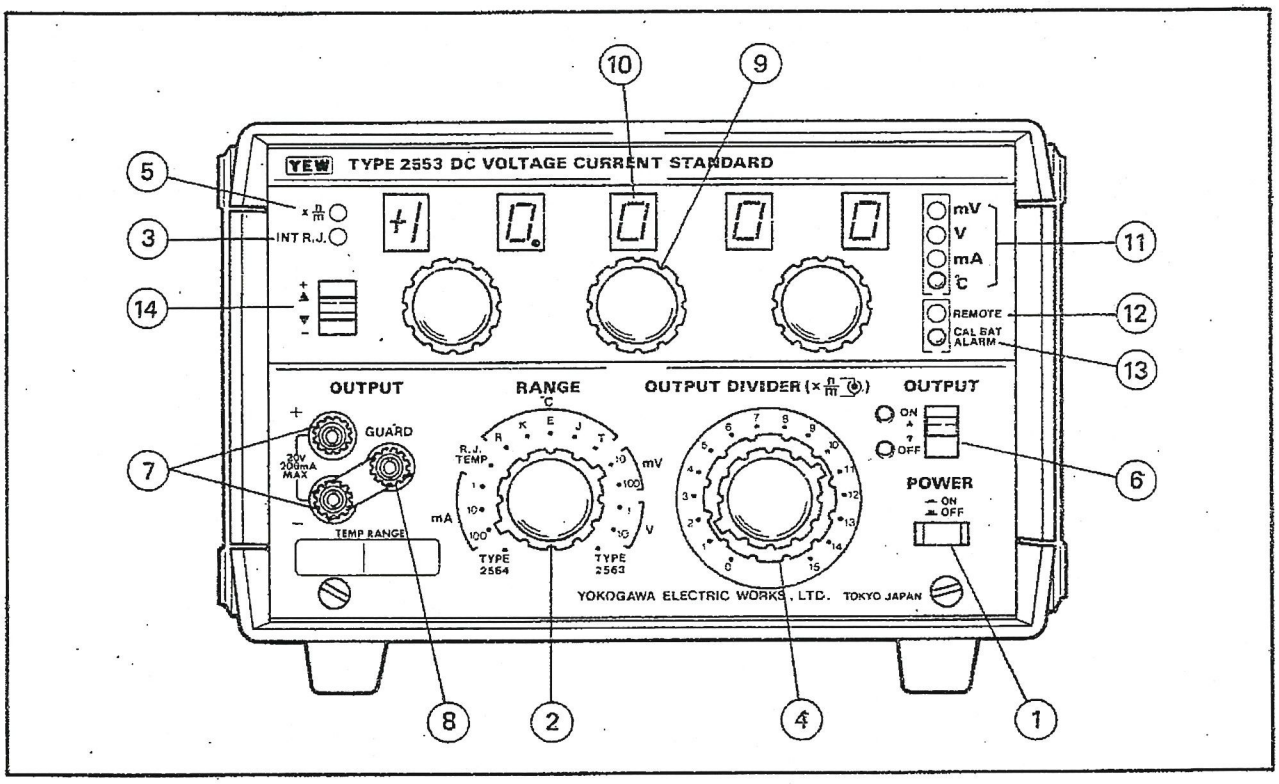


Figure 2-1. Front Panel.

■ Front Panel.

① **POWER Switch:**
Press to switch ON, press again to switch OFF.

② **RANGE Selector Switch:**
This switch is used to select one of the follwing ranges
Current range (mA); 1, 10 and 100mA.
Temperature range (°C); The instrument outputs the emf corresponding to JIS Type R, K, E, J or T thermocouple.
Voltage range (mV and V); 10, 100mV, 1 and 10V.
Type 2564; The range to select the Type 2564 Current Unit. 1.000 is indicated at the rated value, Direct reading not available.
Type 2563; The range to select the Type 2563 Voltage Unit which has 100V, 500V and 1000V ranges. The setting is determined according to the range switch position.
R.J. TEMP; When calibrating a thermocouple thermometer, the reference junction temperature compensated by the instrument is indicated. That is, the tip temperature of the transistor probe connected to the rear panel is indicated (if the temperature probe is not plugged in, + or −999.99°C is indicated).

③ **INT RJ Lamp:**
Lights when the transistor temperature probe is connected to the rear panel and its temperature is between −20°C and 60°C.

④ **OUTPUT DIVIDER:**
A divided output of n/m of dial setting value is delivered. The m is outside dial division and the n is inside dial division. When m = n the setting value itself is delivered.

⑤ **× n/m lamp:**
Lights when, on the output divider, n ≠ m.

⑥ **Output Switch:**
The setting value is delivered from the output terminals, and the green lamp positioned at the left side of the output switch lights. When the range is changed or when an overload (more than 120mA for voltage range, more than 15V for current range) occurs, the output voltage or current is cut off automatically.

⑦ **OUTPUT Terminal:**
The set current or voltage appears at these OUTPUT terminals.

⑧ **GUARD Terminal:**
The GUARD terminal is used when it is necessary to eliminate the indesirable influences of common mode voltages. For GUARD terminal wiring, refer to par. 3-4. WIRING.

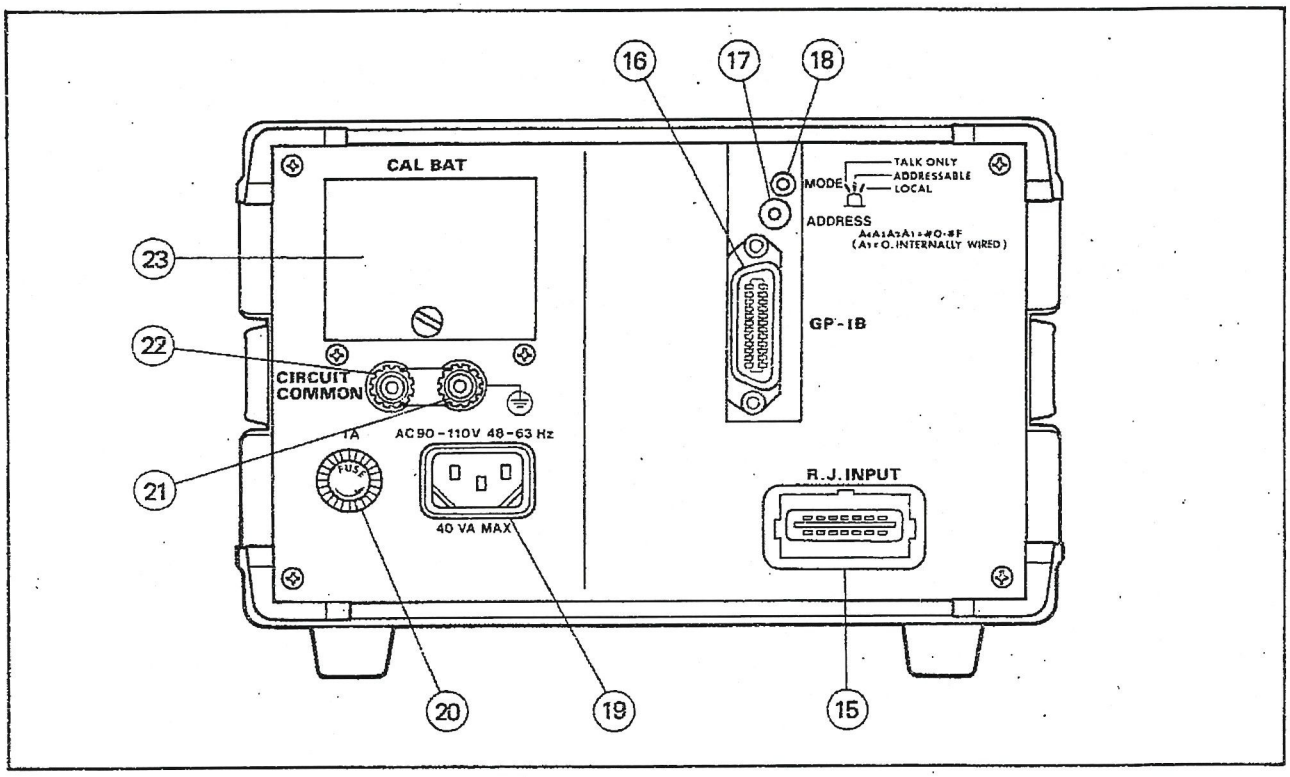


Figure 2-2. Rear Panel.

⑨ **Setting Dial:**
Three noncontacting switches are used for the setting dials. The dials can be set continuously.

⑩ **Dispaly:**
Setting value is indicated in five digits by LED's.

⑪ **Unit Indicator:**
Indicates mV, V, mA or °C depending on the setting of the Range Selector switch. When the Type 2654 current unit is selected, no units symbol is indicated.

⑫ **REMOTE Control Indicator:**
Lights when the instrument is controlled remotely through the GP-IB (General-purpose-Interface-Bus installedonly in the Type 255342).

⑬ **CAL BAT ALARM:**
Lights when the voltage of the battery built-in for the calibration memory drops. The instrument is not supplied with batteries installed, so CAL BAT ALARM will light when the POWER switch is turned ON, but this is normal.

⑭ **Polarity Selector:**
Changes the polarity of the input current or voltage.

Rear Panel.

⑮ **R.J Connector (reference junction connector):**
Used to connect the reference junction compensating transistor probe.

⑯ **GP-IB Connector (installed only in the Type 255342).**

⑰ **Mode Setting Switch (installed only in the Type 255342):**

⑱ **Address Setting Switch (installed only in the Type 255342):**

⑲ **POWER Supply Socket :**
Connect the instrument to the designated power source by supplied power cord. This is a three pin socket including ground lead.

⑳ **Fuse:**
Fuse rating is 1A for a 100 to 115V AC power supply, and 0.5A for 200, 215 and 230V AC power supplies. When replacing the fuse, first remove the power cord from the main supply and then turn the fuse cap anticlockwise to allow the fuse to be removed.

㉑ **Ground Terminal:**
Connected to case. Ground the instrument properly using this terminal. When the power cord has a 3-pin plug (with 1 pin grounded), It is unnecessary to ground this terminal.

㉒ **CIRCUIT COMMON Terminal:**

㉓ **CAL BAT:** (Batteries for calibration memory)
Batteries for protecting zero adjustment and span adjustment compensating memories. Two JIS SUM-3 (ANSI AA) type batteries are installed. These batteries also protect the setting value (see ⑨) when the power supply is interrupted.

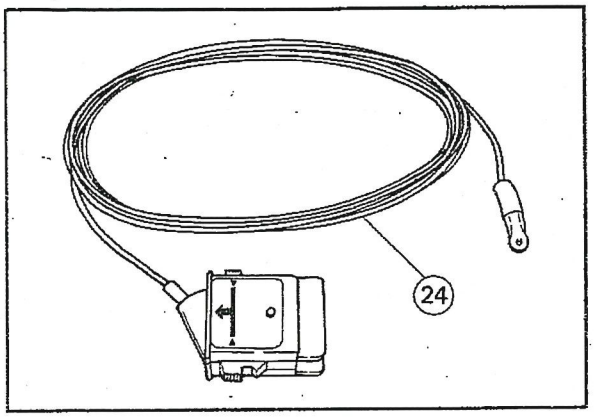


Figure 2-3.

■ Probe.

(24) **Reference Junction Compensating Transistor Probe:**
Used for the calibration of reference junction compensated thermocouple thermometer.

3. OPERATION.

3-1. Handling Cautions.

- Do not place anything on top of the instrument so as not to decrease the heat radiation from it.
- As the display window is made of thermoplastic resin, keep soldering irons away from it. Do not wipe the window with thinner, benzine, alcohol or the like.

3-2. Preparation.

Initially, setup as follows.

POWER Switch: OFF
OUTPUT DIVIDER: n/m = 1
Ground Terminal: Connect to a protective earth ground.
Power Cord: Plug the power cord into its socket on the rear panel of the instrument, then plug the other end of the power cord into an AC line outlet whose voltage correspond to that written on the rear panel.

3-3. Warmup.

Press to POWER switch ON and allow the instrument to warmup, for at least ten minutes. When the POWER switch is switched ON, the OUTPUT switch always turns OFF.

3-4. Wiring.

Connect load to the output terminals. The red terminal is plus and the black terminal is minus. The GUARD terminal should be connected according to the type of load as shown in Figure 3-1.

3-5. Output Current or Voltage Setting.

(1) Set the range and polarity selector switches to appropriate range and polarity respectively.
(2) Turn the setting dials to the desired value, while observing the display.
(3) Use the OUTPUT DIVIDER to divide the output current or voltage as required.

For example, if a 0 to 100mA DC ammeter with scale divisions at 100mA, 80mA, 60mA, 40mA and 20mA must be calibrated, set the RANGE to 100mA and set the OUTPUT DIVIDER outside and inside dials to 5 (m = n = 5). Then, when the inside dial is set to n = 4, 3, 2 and 1 in succession 80, 60, 40 and 20mA output currents flow through the output terminals.

NOTE

(1) The output current or voltage is interrupted (the OUTPUT switch turns OFF) automatically when the Range selector switch is turned, if the dial setting is non-zero. Be sure to set the setting switches to zero before turning the range selector switch.
(2) The OUTPUT switch turns OFF automatically for 150 and 200mA output current on the voltage range and 15 and 20V output voltage on the current range.

3-6. Temperature Range Setting.

As the instrument generates the emfs (mV) corresponding to various thermocouple temperatures, The thermocouple thermometer scale divisions can be calibrated by setting dials to temperature values directly.

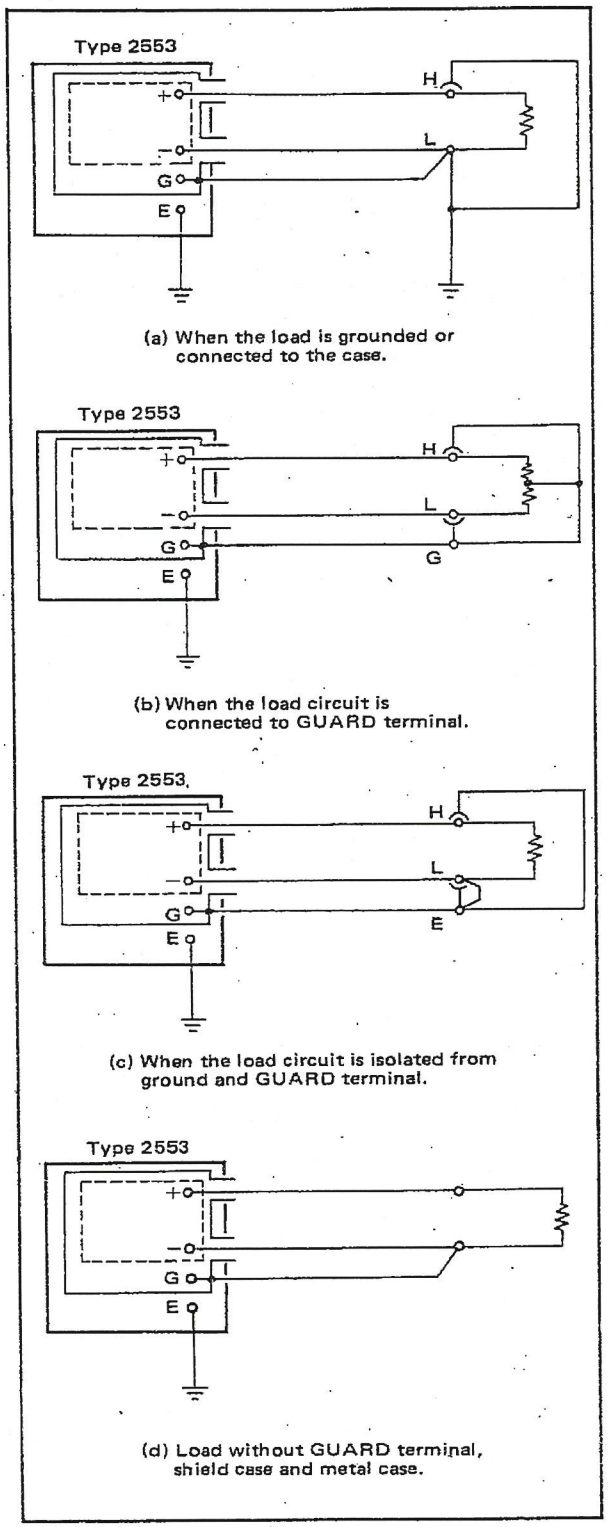


Figure 3-1. GUARD Terminal Connections.

3-6-1. Reference Junction Compensated Thermocouple Thermometer (when a reference junction compensating transistor probe is used).

(1) Connect the transistor probe to the instrument rear panel connector. Then confirm that the INT RJ lamp lights.

(2) Set the range selector switch to R.J. TEMP. and confirm that the instrument indicates the transistor probe temperature (room temperature).

(3) To detect terminal temperature of a thermometer under calibration with transistor probe, connect the thermometer to the instrument with copper lead wires as shown in Figure 3-2 and sense the instrument output terminal temperature using the transistor probe. Use the thermocouples corresponding to the range of the thermometer under calibration for lead wires as shown in Figure 3-3.

NOTE

If there is a temperature difference between the transistor probe sensor and the terminals under test, it may cause measurement error. So allow sufficient time for temperature equalization before measurement.

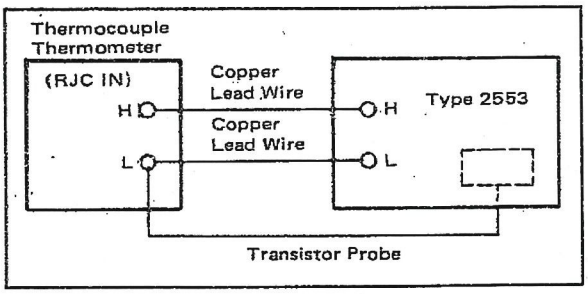


Figure 3-2.

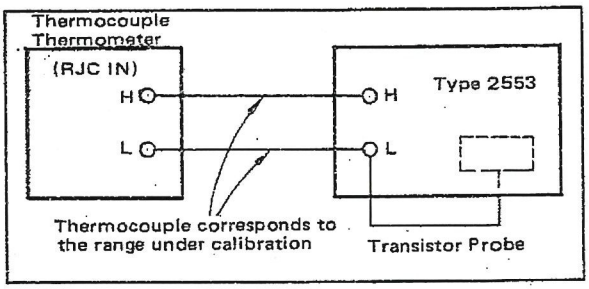


Figure 3-3.

3-6-2. Reference Junction Compensated Thermocouple Thermometer (when a thermos is used).

When a thermos is used to compensate reference junction, connect thermocouples as shown in Figure 3-4. Fill the thermos with finely crushed or shaved ice (use washed clear ice) and just enough pure water at 0°C to cover the ice. Use copper lead wires between the instrument and the thermos, and use thermocouple wire elements or extension wires between the thermos and the thermocouple thermometer under calibration.

3-6-3. Thermocouple Thermometer without Reference Junction Compensation.

If the range selector switch is set to the temperature range without connecting the transistor probe to the instrument, and the instrument generates the emf (according to JIS) corresponding to the temperature set on the setting dials.

Use copper lead wires for connection between the thermometer under test and the standard.

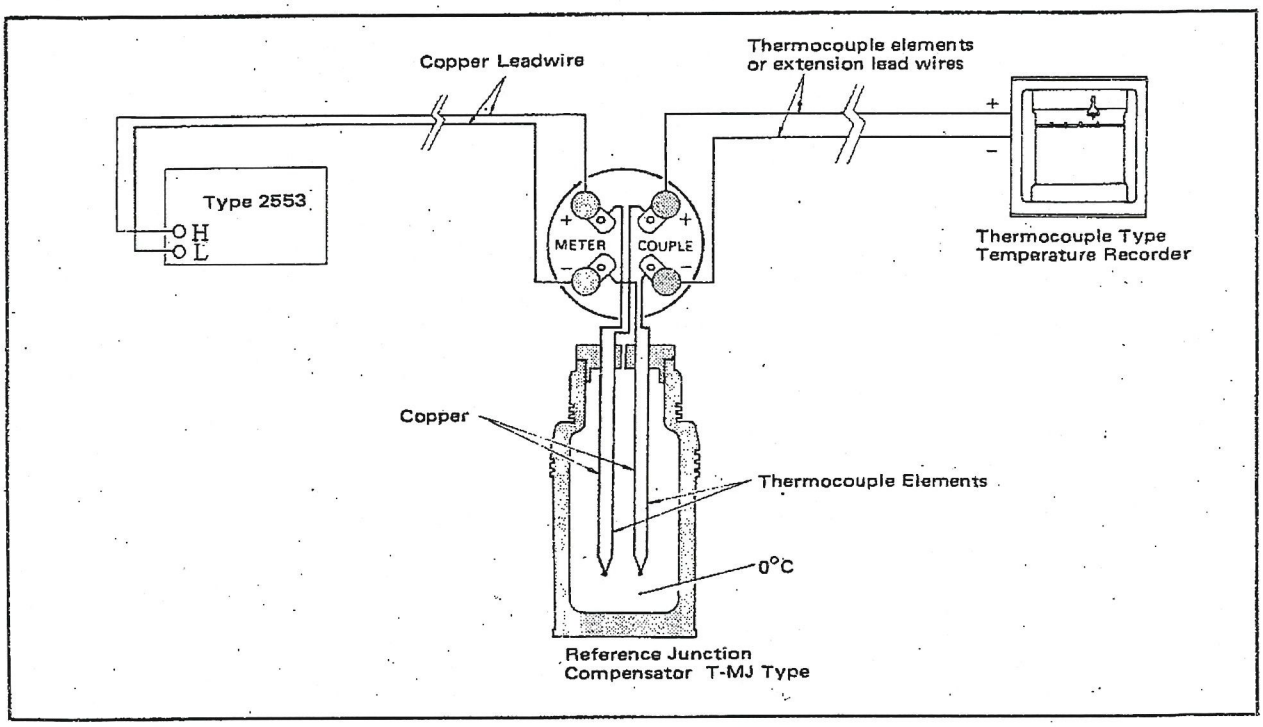


Figure 3-4.

4. GP-IB (installed only in the Type 255342).

The range, setting and polarity may be changed, output ON-OFF switch operated and voltage or current sweep initiated by GP-IB controller via the GP-IB.

The IEEE standard 488 1975 GP-IB (General Purpose Interface Bus) is an internationally-used interface bus employed for controlling digital instruments.

This manual describes the operation of the GP-IB installed in the Type 2553 DC voltage/current standard or in the Type 2560 DC calibration set (which is composed of the Type 2553 and voltage and current units).

4-1. Interface Function.

Table 4-1 and 4-2 show the interface functions of the DC voltage/current standard and the DC calibration set, respectively.

(1) Type 2553 alone.

Table 4-1.

Function	Description
SH1	Source Handshake-complete Capability
AH1	Acceptor Handshake-complete capability
T6	Basic Talker, Serial poll, unaddress if MLA (My Listen Address)
L4	Basic Listener, unaddress if MTA (My Talk Address)
SR1	Service Request-complete Capability
RL1	Remote Local-complete Capability
PP0	Parallel poll-no Capability
DC1	Device Clear-complete Capability
DT1	Device Trigger-complete Capability
C0	Controller-no Capability

(2) DC Calibration Set (Type 2553 combined with the voltage unit).

Table 4-2.

Function	Description
SH1	Source Handshake-complete Capability
AH1	Acceptor Handshake-complete capability
T5	Basic Talker, Serial poll, Talk only mode, unaddress if MLA (My Listen Address)
L4	Basic Listener, unaddress if MTA (My Talk Address)
SR1	Service Request-complete Capability
RL1	Remote Local-complete Capability
PP0	Parallel poll-no Capability
DC1	Device Clear-complete Capability
DT1	Device Trigger-complete Capability
C0	Controller-no Capability

4-2. Bus Driver.

An Open-collector type driver conforming to the GP-IB standard is used as a bus driver.

4-3. Remote Control.

Figure 4-1 shows the items that can be controlled via the GP-IB. Even in remote control mode, the SWEEP ON-OFF switch and sweep direction selector switch can be controlled directly on the Type 2553 front panel.

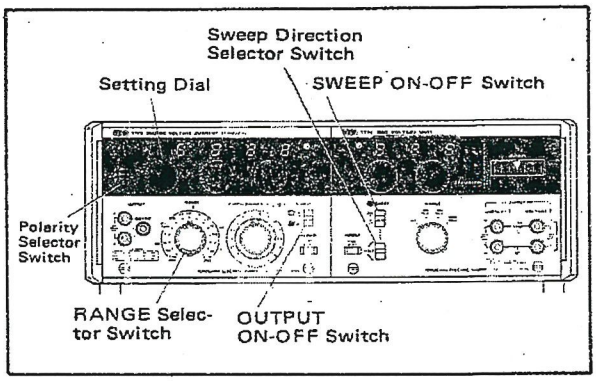


Figure 4-1. Type 256003 DC Calibration Set.

4-4. "MY Address" Switch.

Up to 15 instruments can be connected to the GP-IB, so each instrument's proper address must be set. For both types 2553 and 2560, the address can be set between 0 and 15 decimal. Set the address by turning the "MY address" switch on the rear panel with a screwdriver as shown in Figure 4-2. Table 4-3 shows the address codes.

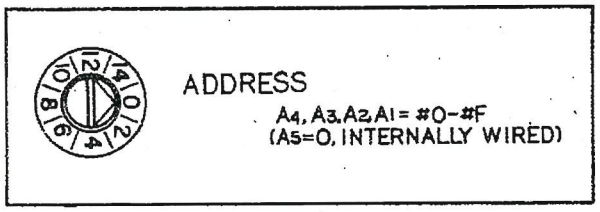


Figure 4-2.

CAUTION

Set or change the address with the instrument power switch turned OFF.

Table 4-3.

Address switch position	Address code				Address character	
	A4	A3	A2	A1	Listen	Talk
0	0	0	0	0	(sp)	(a)
•	0	0	0	1	!	A
2	0	0	1	0	"	B
•	0	0	1	1	#	C
4	0	1	0	0	$	D
•	0	1	0	1	%	E
6	0	1	1	0	&	F
•	0	1	1	1	'	G
8	1	0	0	0	(	H
•	1	0	0	1	)	I
10	1	0	1	0	*	J
•	1	0	1	1	÷	K
12	1	1	0	0	,	L
•	1	1	0	1	—	M
14	1	1	1	0	.	N
•	1	1	1	1	/	O

4-5. MODE Setting.

As shown in Figure 4-3, the instrument can be set to TALK ONLY mode using the MODE switch on the rear panel. And remote control status can be released by setting the MODE switch to LOCAL. However, the instrument can not be set to LOCAL status if the bus controller has set the instrument status to LOCAL LOCK OUT. When the controller is used, set the MODE switch to ADDRESSABLE mode.

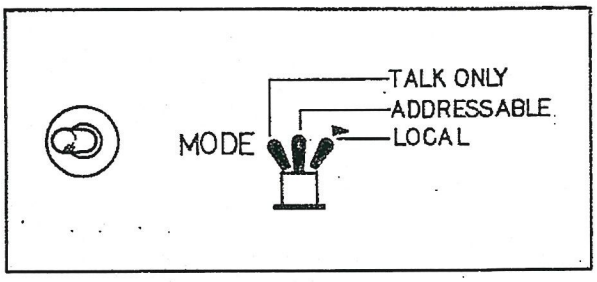


Figure 4-3.

4-6. Listener Function.

4-6-1. Program Data.

The program data corresponding to the setting dials and switches on the instrument front panel are shown in the following tables. ISO (ASCII) characters are used.

(a) Range

The program data corresponding to the RANGE selector switch settings.

Range	Program data	Range	Program data	Range	Program data
10 mV	V0	1 mA	A0	RJ TEMP	T0
100 mV	V1	10 mA	A1	R	T1
1 V	V2	100 mA	A2	K	T2
10 V	V3	*Type 2564	A3	E	T3
*Type 2563	V4			J	T4
				T	T5

* Valid when used as the Type 2560.

(b) Polarity

The program data corresponding to the polarity selector switch settings are:

Polarity	Program data
+	P0
—	P1

(c) Sweep Function

The program data corresponding to the SWEEP ON-OFF, and sweep direction selector switch settings are:

Function	Program data
HOLD	C0
	C1
	C2
SWEEP OFF	R0
FS / 16 sec	R1
FS / 32 sec	R2

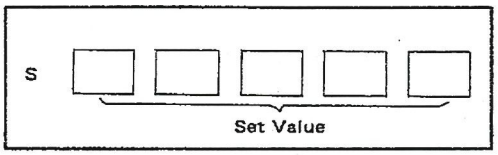
R0; used to release the sweep mode, if the OUTPUT switch is ON, the instrument delivers the setting value.

R1; Sweeps between zero and the setting value for approximately 16 seconds.

R2; Sweeps between zero and the setting value for approximately 32 seconds.

Note: If the sweep function is released while sweeping, the instrument delivers the setting value.

(d) Setting Value
The program data corresponding to dial settings are:



Always set the value using five characters-digits and space characters. The decimal point is fixed on each range, so decimal point setting is unnecessary.
Example) If 5 V is set on the 10 V range, set as follows:

S (Sp) 5000 or S 05000

(e) Mode
The program data corresponding to mode setting switch settings are:

Function	Program data
NORMAL MODE	D0
CAL MODE	D1

CAL MODE is used to calibrate the instrument in the YEW factory. Usually, use the program data D0 (NORMAL MODE).

(f) Output
The program data corresponding to the OUTPUT switch settings are:

Function	Program data
OFF	O0
ON	O1

4-6-2. Writing Programs.

For the Type 2553 the following programming rules are laid down to minimise mistakes. Keep these rules when writing programs.

(1) Program commands are delimited by (CR) (LF) delimiters,

and are executed after the (GET) (Group Execute Trigger) command is entered.

Example) To set 100 mV on the 100 mV range, proceed as follows.

V1S10000 (CR) (LF)
(GET)

here, (CR) denotes carriadge return and (LF) line feed.

(2) Do not combine the following operations in one command (delineated by (CR) (LF) and (GET)).

a) Do not combine range change and OUTPUT switch turn ON operations.
Example) To change to the 1 V range (V2) from another range proceed as follows:

V2O0(CR)(LF)
(GET)

When changing the range, always set the output to O0. Set the correct output in a separate command.

b) Always turn output ON before initiating sweep output.
Example) To execute an upwards sweep (from zero to setting value) for 16 seconds, proceed as follows:

O1(CR)(LF)
(GET)
C1 R1(CR)(LF)
(GET)

(3) Front panel settings are set and changed explicitly.
Example) When the setting is changed to 0.5000 V from 1.0000 V, the range 1 V (V1) is held as it was.

V1S10000(CR)(LF)
(GET)
S05000(CR)(LF)
(GET)

(4) In remote status (with REM lamp lit), the output for n/m = 1 is always delivered regardless of the front panel OUTPUT DIVIDER dial setting.

(5) In remote status, the deviation dial setting has no effect.

(6) When the instrument is used in the Type 2560, the voltage and current unit ranges can not be changed by GP-IB remote control. Voltage or current units can only be selected using the GP-IB.

(7) After activating the set value, polarity or output ON settings, the data bus is busy for about 0.2 seconds with communication data bus and the controller. That is, for the 0.2 seconds or so that controller takes to transmit the program data and GET command, the data bus (DIO1 to DIO8) cannot be used.

(8) When using the sweep function, the setting range limits should be as follows:

	When the polarity is positive	When the polarity is negative
Upwards sweeping (increase output)	• The start point can be set at any point between 0 and + (fullscale value) • The end point is the full scale value	• The start point can be set at any point between — (fullscale value) and 0 • The end point is — (fullscale value)
Downwards sweeping (decrease output)	• The start point can be set at any point between 0 and + (fullscale value) • The end point is 0	• The start point can be set at any point between — (fullscale value) and 0 • The end point is 0

Note: Sweep cannot be performed across the zero point from positive to negative or vice versa.

4-6-3. Program Data Format — Examples.

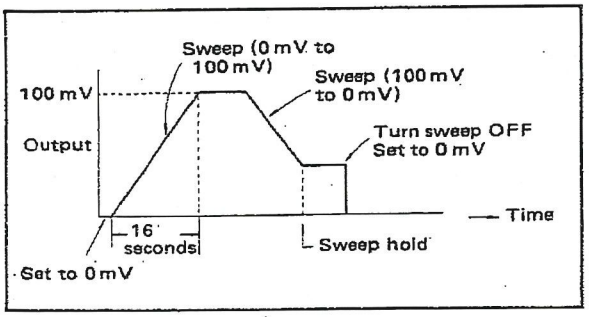
(1) To output +50.00 mV on the 100 mV range, proceed as follows:

V1P0S050000O0

(GET) . . . . Turn output OFF, change to 100 mV range set to 50 mV

O1(CR)(LF)
(GET) . . . . . Outputs 50 mV on the 100 mV range

(2) Make the following sweep on the 100 mV range.



V1P0S00000O0 (CR) (LF)
(GET)

Turns output OFF, sets to 000.00 mV on the +100 mV range.

O1(CR) (LF)
(GET)

Turn output ON.

S10000C1R1 (CR) (LF)
(GET)

Sweeps to increase output from 0 mV to 100 mV for about 16 seconds.

C2 (CR) (LF)
(GET)

Sweeps to decrease output from 100 mV towards 0 mV when the GET command is received.

C0 (CR) (LF)
(GET)

Stops the sweep to hold output when the GET command is received.

R0S00000 (CR) (LF)
(GET)

Turns output to 000.00 mV when the GET command is received.

4-6-4. Syntax Errors.

(1) If an undefined character (in the program data) is received, a syntax error is generated, and the received command is ignored.

(2) If an invalid commands are mixed with valid ones, only the valid commands are executed.

(3) After receiving an illegal program data or a set value exceeding the output setting range, a syntax error is generated and the previous settings are held.

4-7. Response to Interface Messages.

Responses to Interface commands are listed in the table below.

Command	Measuring	Action (Response)
IFC	Interface clear	Release Talker or Listener Function
SDC	Selected device clear	Output . . . . . OFF
DCL	Device clear	Sweep. . . . . OFF
GET	Group execute trigger	• Program data being transmitted becomes valid • After receiving a GET command, the 18 characters (the information showing the instrument status) are output when the Talker is addressed. Refer to par. 4-8 Talker Functions.

4-8. Talker Function.

4-8-1. Talker Functions.

In any of the following conditions, 18 characters showing talker status are output from the talker as byte serial data.

(1) When the talker is addressed after receiving a GET command.
(2) When the talker is addressed after receiving a print command contact input through the remote control connector of the voltage unit.
(3) When receiving a print command contact input through the remote control connector of the voltage unit with the rear panel switch set to TALK ONLY mode.

NOTE

TALK ONLY mode is possible only when using the Type 2553 together with the voltage unit.

4-8-2. Output Data Format.

NOTE

• In the CAL mode (when D1 is sent as the program data), data different from the above output format is output. Always ensure that the instrument is in NORMAL mode (D0).
• When the delimiter (LF) is sent, EOI turns "Ture".
• After the GET command is sent, do not excute serial polling till the data transmission is over. If serial polling is excuted before the data is transmitted, send the GET command again to retransmit the data.

Output Sequence / Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Set Value	S	U_2	U_1	±	D_6	D_5	D_4	D_3	D_2	D_1	,	I	E_3	.	E_2	E_1	(CR)	(LF)

	Output information	Output symbol
S	Output set information	(Sp) : When the output is ON and not in sweep mode N* : When the output is ON and in sweep mode E : When the output is OFF * Output data and output value may differ from each other because in sweep mode
U_2 U_1	Unit	See table below
D_6 to D_1	Output set value	The data correspond to the output display. The decimal point is included in any of D_6 to D_1. The output value of D_6 to D_1 in Local mode is dial set value x n/m.
$IE_3 \cdot E_2 E_1$	Deviation	The data correspond to the deviation value. I is (Sp) when the deviation is 0.00, in other case I is + or —. The decimal point position is fixed.

Unit	U2	U1	Unit	U2	U1
V	(Sp)	V	R	(Sp)	R
A	(Sp)	A	K	(Sp)	K
mV	M	V	E	(Sp)	E
mA	M	A	J	(Sp)	J
RJ TEMP	R	T	T	(Sp)	T

4-8-3. Status Byte Format.

The status byte format at the time of transmitting data in serial mode using the Type 2553 is shown in the Table below.

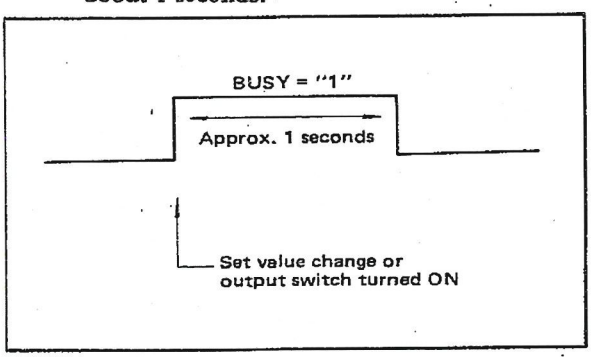
DIO8	0
DIO7	RQS
DIO6	ERROR
DIO5	BUSY
DIO4	OVER LOAD ALARM
DIO3	SYNTAX ERROR
DIO2	OUTPUT ON
DIO1	RJ-ON

(1) RQS
In the event of an ERROR, RQS = "1", SQR = "True" and an interrupt occurs in the controller. And after serial polling DIO7, DIO6, DIO4 and DIO3 turn "0".

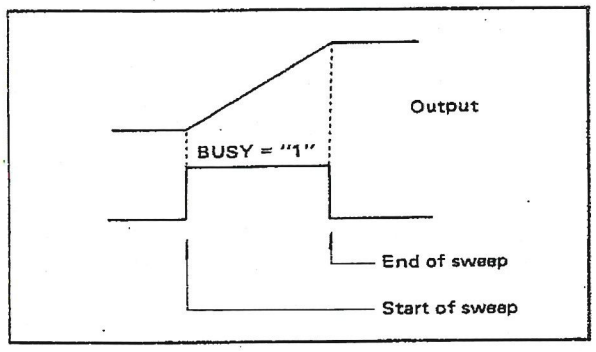
(2) ERROR
In the event of an ERROR, DIO6 turns "1", and DIO4 and DIO3 indicates the error cause.

(3) BUSY
In either of the following cases, BUSY turns "1".

a. After changing the set value or turning the OUTPUT switch ON, BUSY turns "1" for about 1 seconds.



b. BUSY tunrs "1" while the output is sweeping.



(4) OVERLOAD ALARM
Turns "1" when the output is OFF due to overload. Processing for abnormality. If an overload alarm occurs, eliminate the overload cause, send the SDC or DCL command (Section 4-7), then send "01" and GET to turn the output on. If sweeping, the sweep program mode should be set.

(5) SYNTAX ERROR
Turns "1" in the event of a syntax error. Some syntax errors are described below.

- If an undefined character is received.
- If the number of digits is incorrect.
- If the characters are in an invalid sequence.

If there is a syntax error, send the correct program data again.

(6) OUTPUT ON
Indicates output control status, and turns "1" at output ON.

(7) RJ-ON
Turns "1" when the detector temperature is within −20 to 60°C with the Type 257825 temperature probe connected to the RJ input connector on the instrument rear panel, and turns "0" when the detector temperature is outside the range −20 to 60°C or when the temperature probe is not connected to the instrument. On other than RJ TEMP and temperature setting ranges turns "0".

4-9. GP-IB Commands for Remote — Local Mode Switching.

The status of setting dials and switches is as described below.

(1) From Remote to Local
RANGE Selector Switch
OUTPUT DIVIDER (n/m) } . . . . . the states correspond to the front panel switch positions.
Polarity
Setting Dials } . . . the most recent remote settings
Sweep Switch . . . . . OFF
Output Switch . . . . . OFF

(2) From Local to Remote
RANGE Selector Switch
Polarity
Setting Dials } . . . . . the panel setting information just before changing to remote status
Sweep Switch . . . C0 (HOLD), R0 (SWEEP OFF)
OUTPUT DIVIDER 1/1
OUTPUT Switch . . . . . OFF

NOTE

When the POWER source is turned ON, the instrument operates in local mode.

4-10. Application Example.

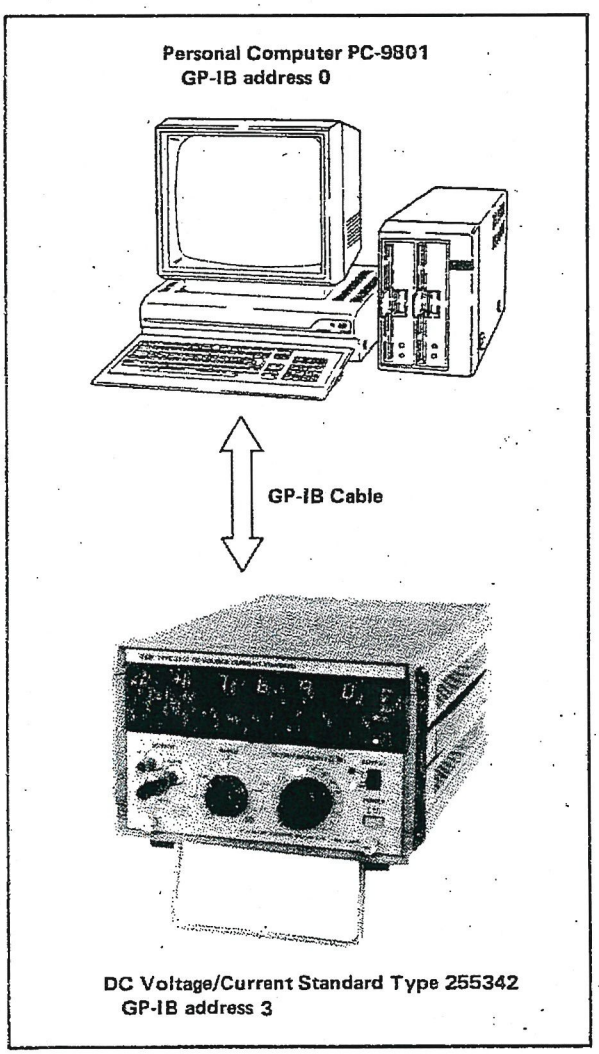
4-10-1. Sample Program 1 (using NEC PC-9801).

Some sample programs using the NEC PC-9801 personal computer are described below.

[Instruments Required]

Personal Computer	PC-9801
Display	PC-8851 or the like
GP-IB Interface Board	PC-9801-05
GP-IB Cable	
DC Voltage/Current Standard	Type 255342

(or DC Calibration Sets Type 256043 or 256044)



[Sample Programs]

(1) Type 2553 Range, Setting Value, Polarity, Output ON/OFF Controls and Setting Data Readout.

The following is a sample program to set the Type 2553 output range to 10 mV and set the output voltage to +5.000 mV (S05000P0) then turn the output switch ON (01) and – after approximately one second – reset the Type 2553 to remote mode.

```
100 '--- 2553 setting sample program ---
110  ISET IFC
120  ISET REN
130  CMD DELIM=0
140  PRINT @3;"00V1S05000":WBYTE 8;
150  PRINT @3;"01":WBYTE 8;
160  LINE INPUT @3;D$:PRINT D$
170  FOR I=0 TO 1000:NEXT I
180  IRESET REN
190  END
```

Line 110: Send interface clear command to initialize interface status.

120: Set remote enable to true and set interface to remote mode.

130: Designate C_R + L_F as delimiter.

140: Turn Type 2553 output OFF, send program data for setting 10 mV range and +5.000 mV and send group execute trigger (GET) command to enable the settings.

150: Send program data for turning output ON to Type 2553 and send group execute trigger (GET) command to enable the output ON setting.

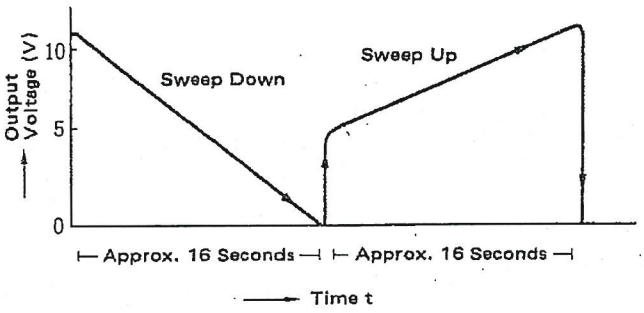
160: Read the setting data of Type 2553 and display them on the CRT screen.

170: Wait approximately one second.

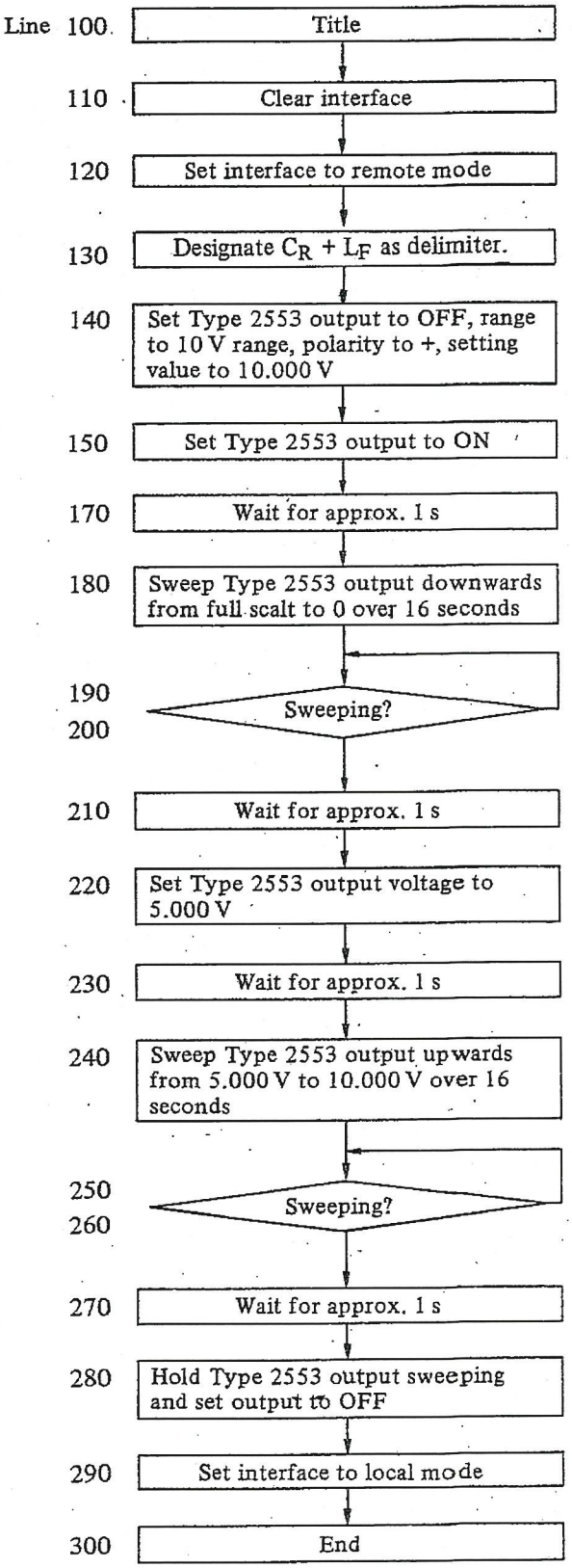
180: Set Type 2553 to local mode.

(2) Sweep Function Control.

A sample program to control Type 2553 output is shown below.



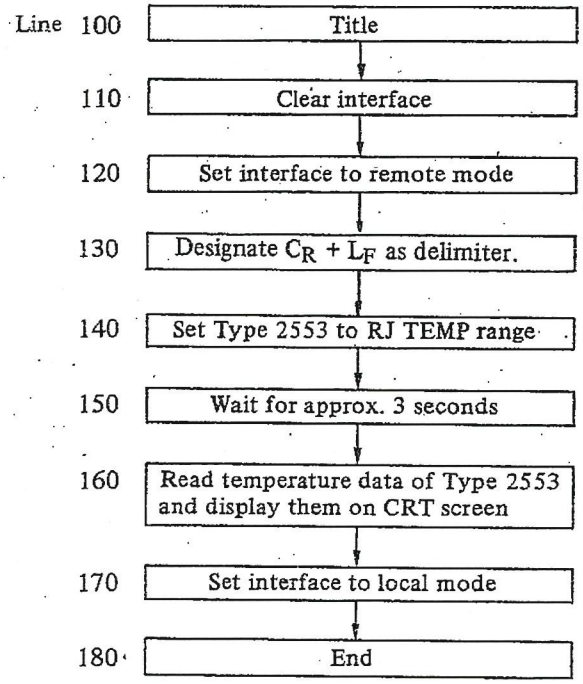

```
 100 '--- 2553 sweep control sample program ---
 110  ISET IFC
 120  ISET REN
 130  CMD DELIM=0
 140  PRINT @3;"00V3P0S10000":WBYTE 8;
 150  PRINT @3;"01":WBYTE 8;
 170  FOR I=0 TO 1000:NEXT I
 180  PRINT @3;"R1C2":WBYTE 8;
 190  POLL 3,A
 200  IF A=18 THEN 190
 210  FOR I=0 TO 1000:NEXT I
 220  PRINT @3;"S05000":WBYTE 8;
 230  FOR I=0 TO 1000:NEXT I
 240  PRINT @3;"S10000R1C1":WBYTE 8;
 250  POLL 3,A
 260  IF A=18 THEN 250
 270  FOR I=0 TO 1000:NEXT I
 280  PRINT @3;"R000":WBYTE 8;
 290  IRESET REN
 300  END
```



(3) RJ TEMP Range Data Readout.

A sample program to set the Type 2553 output range to RJ TEMP and — after the approximately 3 seconds — read the temperature data and display it on a CRT screen.

```
100  '--- 2553 RJ TEMP reading sample program---
110   ISET IFC
120   ISET REN
130   CMD DELIM=0
140   PRINT @3;"00T0":WBYTE 8;
150   FOR I=0 TO 3000:NEXT I
160   LINE INPUT @3;D$:PRINT D$
170   IRESET REN
180   END
```

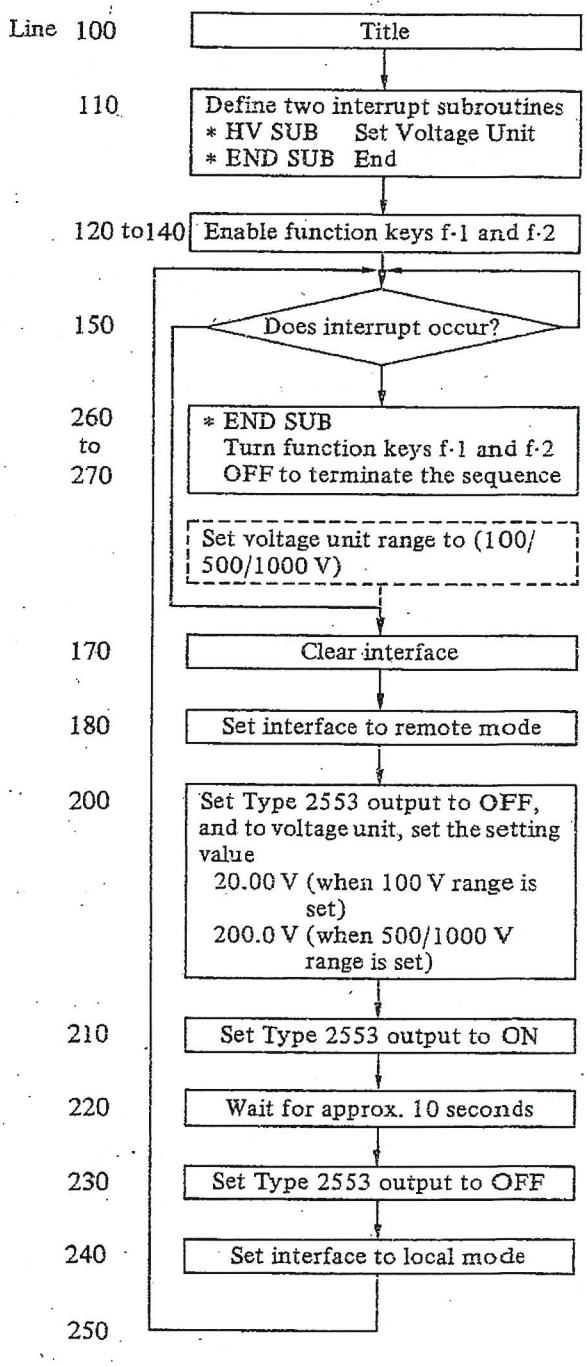


(4) Controlling Voltage Unit Setting Data and Output ON/OFF.

This sample program applies to the Type 2560 DC calibration sets, which are based on the Type 2553. The range setting for the voltage unit should be carried out manually, because it cannot be controlled using the GP-IB.

A sample program to control the setting values by interrupt operation — after the voltage unit range is set manually — is shown below.

```
100 '-- 2553 HV UNIT control sample program --
110   ON KEY GOSUB *HVSUB,*ENDSUB
120   FOR I=1 TO 2
130   KEY(I) ON
140   NEXT I
150   GOTO 150
160 *HVSUB
170   ISET IFC
180   ISET REN
190   CMD DELIM=0
200   PRINT @3;"00V4P0S02000":WBYTE 8;
210   PRINT @3;"01":WBYTE 8;
220   FOR I=1 TO 10000:NEXT I
230   PRINT @3;"00":WBYTE 8;
240   IRESET REN
250   RETURN
260 *ENDSUB
270   KEY OFF:END
```



4-10-2. Sample Program 2 (using HP Model 9825A).

An example of remote control using a personal computer Model 9825A (HP-manufactured) for a controller is described below.

[The Model 9825A Setting]

(1) The following Model 9825A ROMS are necessary.
- I/O control ROM
- Extended I/O control ROM
- Character string control ROM

(2) Set the select code of the HP-IB to be installed in the Model 9825A to 7, and set its address to 21.

[The Type 2553 and 2560 Setting]

(1) Set the Mode selector switch to ADDRESSABLE.

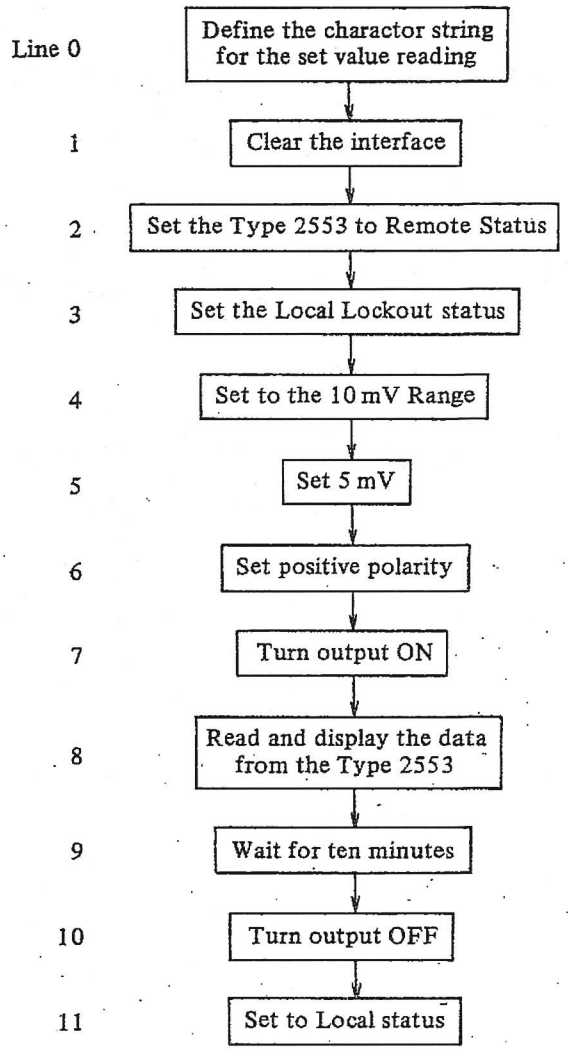
(2) Set the address to 4.

[Sample Program]

(1) **Setting the Range, Set Value, Polarity and Output of the Type 2553.**

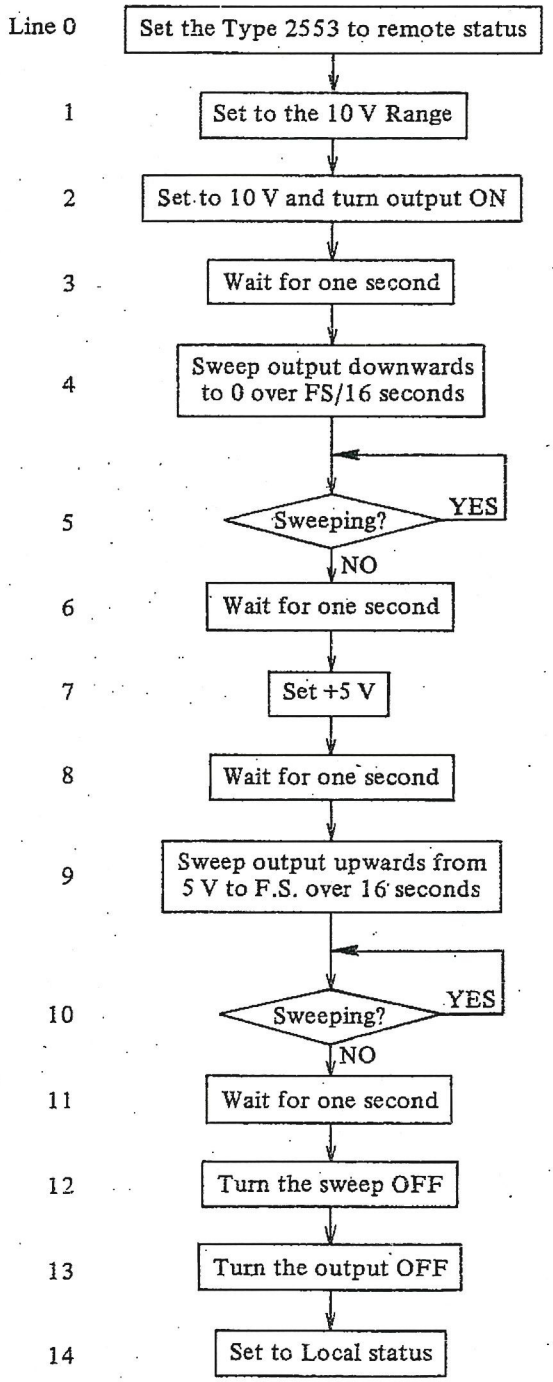
Using the GP-IB, set the Type 2553 range selector switch to 10 mV and set the output to +5 mV then turn the OUTPUT switch ON for ten seconds, read and display the data on the 9825A, then turn the OUTPUT switch to OFF to set the Type 2553 back to Local status.

```
 0 : dim D$[18]
 1 : cli 7
 2 : rem 704
 3 : llo 7
 4 : wrt 704, "O0V0" ; trg 704
 5 : wrt 704, "S05000" ; trg 704
 6 : wrt 704, "P0" ; trg 704
 7 : wrt 704, "O1" ; trg 704
 8 : red 704, D$ ; dsp D$
 9 : wait 10000
10 : clr 704
11 : lcl 704
12 : end
```



(2) Sweep Control.

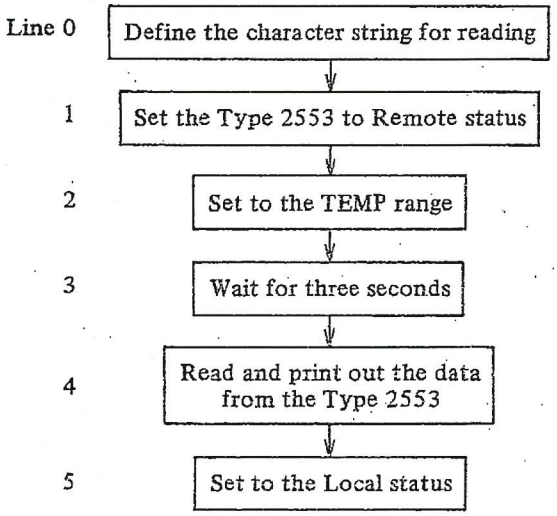
Set +10 V on the 10 V range. Turn the output switch ON and sweep from +10 V to 0 V over approximately 16 seconds. Then set the output to +5 V and sweep from +5 V to +10 V for approximately 16 seconds, set the sweep and output switches OFF and then reset Local status.




```
 0 : rem 704
 1 : wrt 704, "O0V3" ; trg 704
 2 : wrt 704, "P0S 10000O1" ; trg 704
 3 : wait 1000
 4 : wrt 704, "R1C2" ; trg 704
 5 : if bit (4, rds (704)) = 1 ; gto + 0
 6 : wait 1000
 7 : wrt 704, "S05000" ; trg 704
 8 : wait 1000
 9 : wrt 704, "S10000R1C1" ; trg 704
10 : if bit (4, rds (704)) = 1 ; gto + 0
11 : wait 1000
12 : wrt 704, "R0" ; trg 704
13 : wrt 704, "O0" ; trg 704
14 : lcl 7
15 : end
```

(3) TEMPERATURE Range Data Readout.

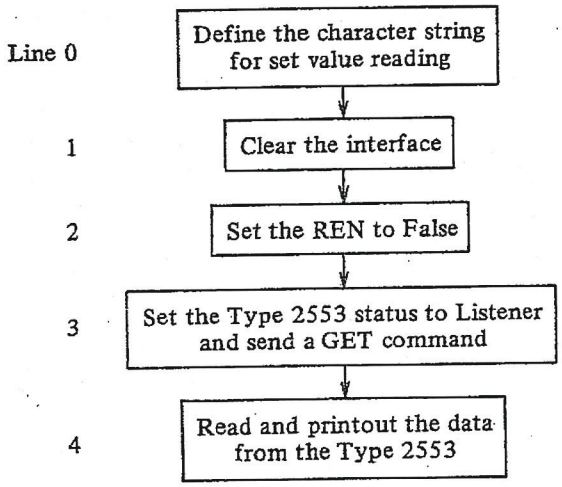
Set the Type 2553 to the TEMP range, wait for three seconds then read the temperature from the Type 2553 and print it out on the printer.




```
0: dim D$[18]
1: rem 704
2: wrt 704, "O0T0" ; trg 704
3: wait 3000
4: red 704, D$ ; prt 704
5: lcl 704
6: end
```

(4) Data Transmission in the Local Status.

Read the data from the Type 2553 in Local status, and print it out on the printer.

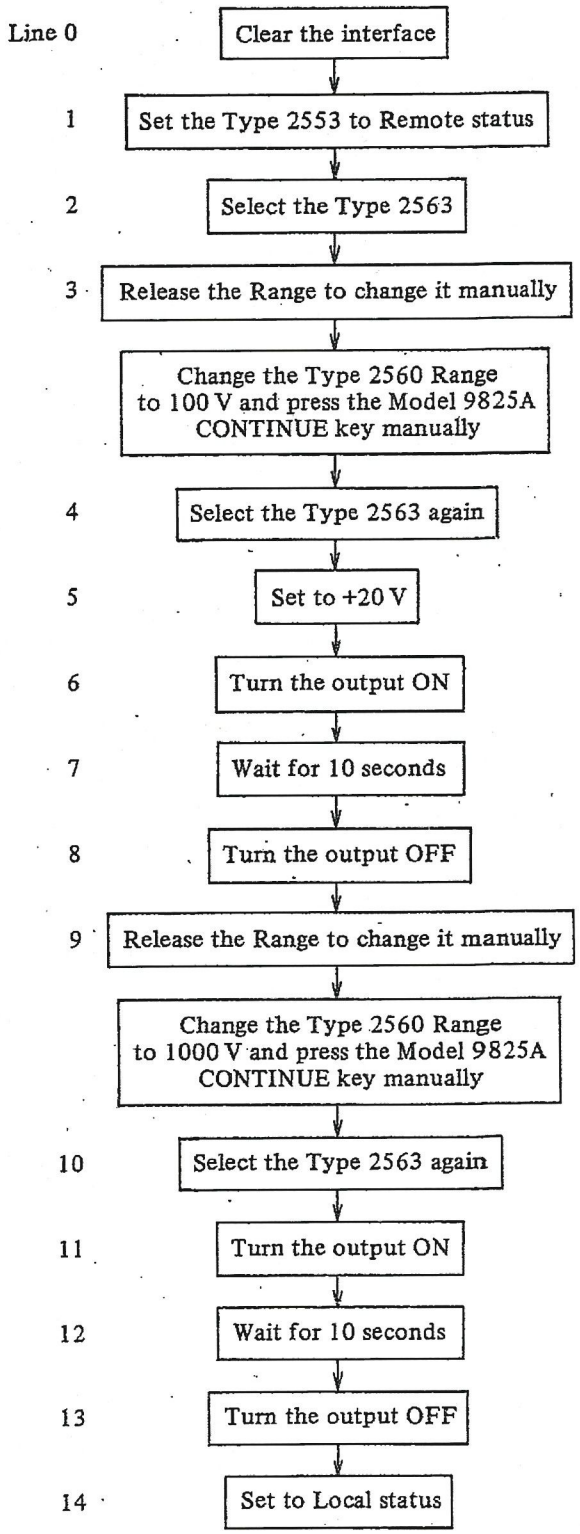



```
0: dim D$[18]
1: cli 7
2: lcl 7
3: trg 704
4: red 704, D$ ; prt D$
5: end
```

(5) Voltage Unit Range Change.

Select the Type 2563 voltage unit, set the 100 V range manually, set the output to +20.00 V and turn the output switch ON. After 10 seconds change the range to 1000 V and set the output switch ON for a further 10 seconds. Then set the output switch OFF and revert to Local status.

```
 0 : cli 7
 1 : rem 704
 2 : wrt 704, "O0V4" ; trg
 3 : stp
     Change the Type 2560 Range to 100 V and press
     the model 9825A CONTINUE key manually
 4 : wrt 704, "O0V4" ; trg 704
 5 : wrt 704, "P0S02000" ; trg 704
 6 : wrt 704, "O1" ; trg 704
 7 : wait 10000
 8 : wrt 704, "O0" ; trg 704
 9 : Stp
     Change the Type 2560 Range to 1000 V and press
     the model 9825A CONTINUE key manually
10 : wrt 704, "O0V4" ; trg 704
11 : wrt 704, "O1" ; trg 704
12 : wait 10000
13 : wrt 704 "O0" ; trg 704
14 : lcl 704
15 : end
```



5. MAINTENANCE.

5-1. Storage.

When storing the DC voltage/current standard avoid an area which is:

- Very humid.
- Subjects to direct sunlight.
- Near high temperature heat sources.
- Subject to strong vibration.
- Very dusty or contains corrosive gases.

If any troubles occur in the instrument, contact your nearest YEW service station or sales agent.

5-2. Periodical Calibration.

The compensations proportional to zero and span adjustments of each range are stored digitally in the built-in fusible PROM type nonvolatile memory as calibration constants (CAL. CONST.).

CAL. CONST. are written in the fusible PROM at the instrument shipment, new CAL. CONST. may be written in the built-in CMOS RAM. Therefore, during user's periodical calibration, the instrument can be easily calibrated.

The CMOS RAM is backed up by the instrument batteries for calibration memory even when the AC input is cut off, so the data written into the RAM are not destroyed; however, they will be destroyed if battery voltage falls. Therefore, if you use CAL. CONST. information stored in CMOS RAM, first install batteries. Then replace batteries once every year or every calibration period.

5-2-1. Battery Replacement.

(1) Press the instrument POWER switch to turn OFF.
(2) Open the rear panel CAL BAT lid. Then replace the batteries with two SUM-3 type batteries.
(3) Press the instrument power switch to turn ON, and before calibration allow the instrument to warm up for about 30 minutes.

CAUTION

(1) When replacing batteries, always press the POWER switch to turn OFF.
(2) The stored calibration values will be destroyed when the batteries are removed, so do not to remove batteries unnecessarily. Whenever the batteries are replaced, you must recalibrate the instrument.
(3) If the batteries must be replaced with the POWER source on, carry as follows.
i) Remove any lead wires connected to the output terminals.
ii) Ground the Ground Terminal.
iii) Connect the Ground Terminal to the Circuit Common Terminal.

5-2-2. Voltage and Current Range Calibration.

(1) Prepare the following instruments to calibrate the instrument.

Instrument	Specification	YEW Type No.
Digital Voltmeter	Accuracy ±0.01%	2501
Standard Resistor		2792

(2) Loosen two screws on the front panel lower part. Turn on the power to warm up the instrument with the main frame pulled out of the case.

WARNING

When power supply voltage is on, be careful to avoid electric shock.

(3) Select the range to be calibrated, and set the setting dials to the rated output. Set the output divider to n/m = 1.
(4) Connect a digital voltmeter to the output terminals. For current range calibration, pass current through a standard resistor and measure the voltage drop.
(5) Turn the OUTPUT switch ON, and turn the calibration switch (see Figure 5-1) to CAL. Adjust the setting dials so that the digital voltmeter indicates the rated output value.

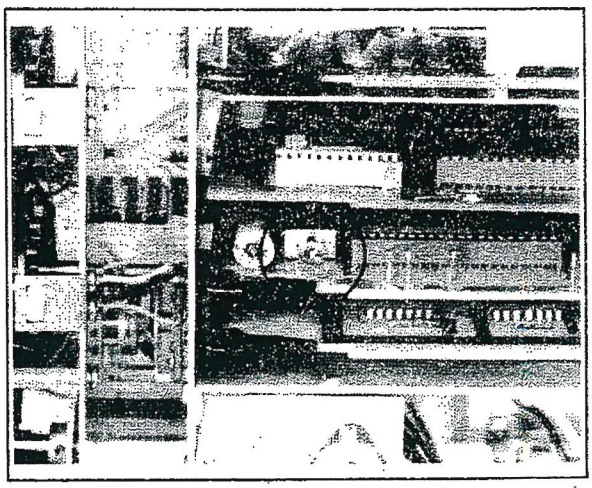


Figure 5-1.

(6) When the voltmeter indicates the rated value, turn the calibration switch to ENTRY. Then the constant proportional to the setting value is stored in the CMOS RAM, at the same time, the indication of the setting dial will be the rated value.
(7) Confirm that the instrument indication and the digital voltmeter indication are identical.
(8) Next, set the setting dials to zero, and adjust the setting dials so that the digital voltmeter indicates zero as above.
(9) When the digital voltmeter indicates zero, turn the calibration switch to ENTRY.
(10) Confirm that both instrument and digital voltmeter indicate zero.
(11) Write the calibration values for other ranges to be calibrated into CMOS RAM using the above method.
The calibration values written in fusible PROM will apply for the ranges not recalibrated by writing calibration values into the CMOS RAM. Only, recalibrate by writing values into the CMOS RAM if necessary.

5-2-3. Temperature Range Calibrations.

(1) The T range is calibrated automatically by 10 mV range calibration. For calibration of other temperature range except T range, calibrate the instrument self contained 50 mV range.
(2) Calibrate by setting the front panel range selector switch to R. Calibration is impossible on other ranges.
(3) The calibration method is same as for the above mV range calibration, but when the output voltage is rated 50mV the indication is 1000.0, and when the output voltage is 0.000mV the indication is 0.000mV.

6. PRINCIPLES OF OPERATION.

A block diagram of Type 2553 DC voltage/current standard is shown in Figure 6-1.

The reference voltage from the zener diode is applied to an integrating circuit and is integrated during the pulse width period corresponding to the value set by the front panel setting dials.

The integrator output is applied to a sample and hold circuit to hold the latest value.

The output voltage Vh is amplified to final output voltage. The pulse width in the circuit is generated by a crystal oscillator, so its linearity and stability with temperature changes is excellent.

Furthermore, zero and full scale are calibrated every sampling period, so the D-A convertor accuracy is high.

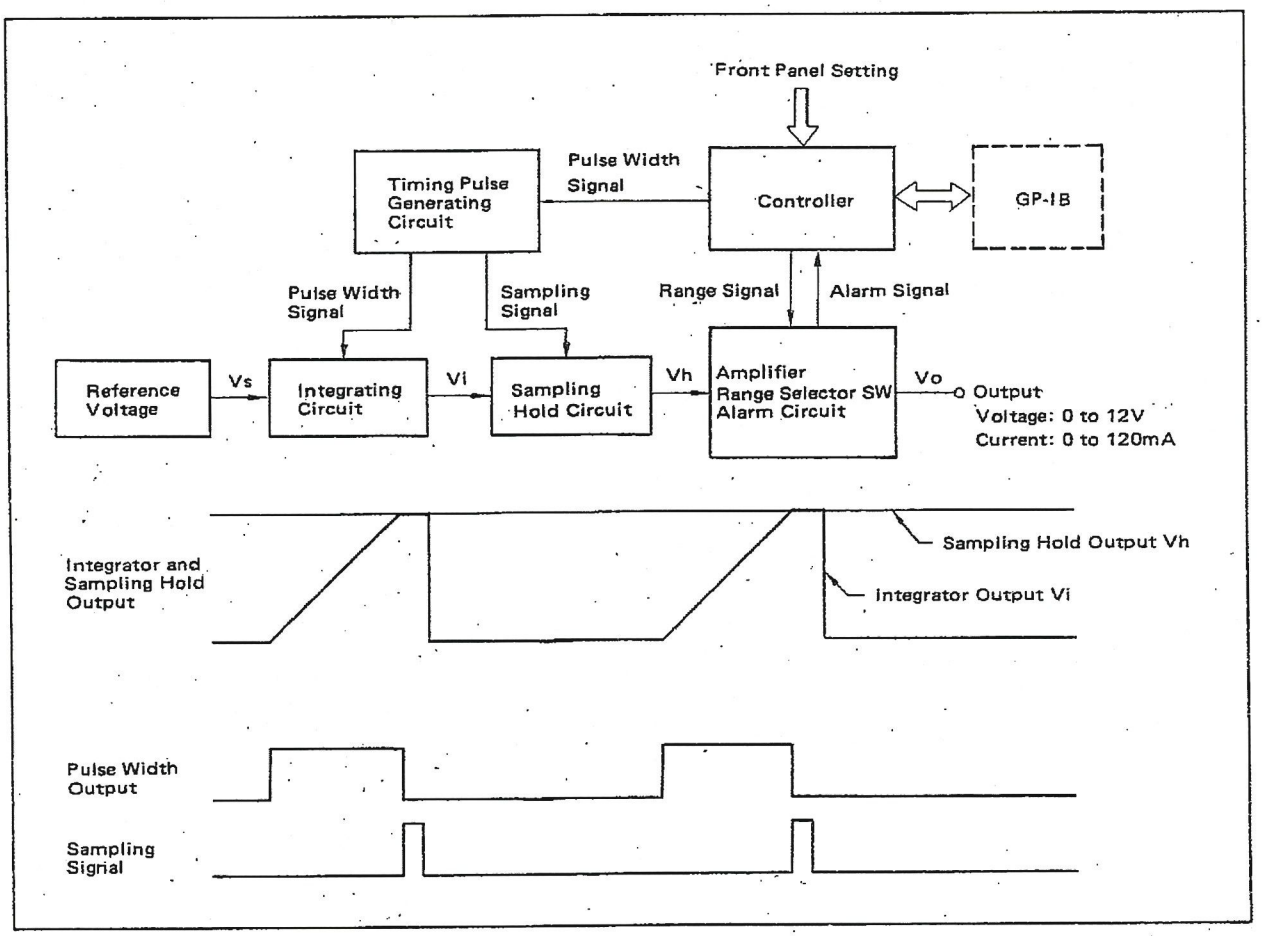


Figure 6-1.

YEW

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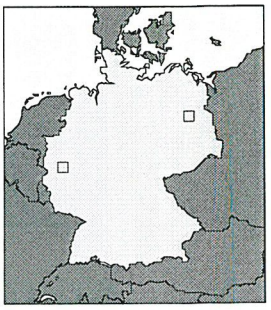

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