HIOKI

7005 & 7005-01 (GP-IB)

PROGRAMMABLE DC STANDARD

INSTRUCTION MANUAL

HIOKI E.E. CORPORATION

WARNING

This instrument is designed to prevent accidental shock to the operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely before making any measurement. Failure to follow directions can result in a serious or fatal accident.

CONTENTS

1. Outline 2

2. Feature 2

3. Specifications 3

4. Instrument Nomenclature & Description 6

4-1. Nomenclature 6
4-2. Description 7

5. Operating Procedure 9

5-1. Preliminary Precautions 9
5-2. Operating Instruction 10
5-3. Instrument protection Functions 12
5-4. Using the Memory Functions 13
5-5. Fuse Replacement 22

6. Operating Principle 23

7. Miscellaneous 24

7-1. Rack Mounting 24
7-2. Maintenance 25
7-3. Calibration 25
7-4. Precautionary Notes, Miscellaneous 25

8. 7005-01 ..... Enclosure

1. Outline

The Model 7005 is a programmable DC voltage and current calibrator capable of generating DC voltages of 0 to 120-volts, and DC currents from 0 to 1.2-amperes. Accuracy of the instrument is laboratory-grade.

The instrument also features a 99-step memory, pushbutton switches for one-touch setups, a dial setting method that allows the display digits to be raised or lowered independently, a 4-step selectable power limiter, coded annunciation of error conditions, and it is GP-IB compatible(7005-01).

The 7005 is suitable for a wide range of uses, including device production, cal lab, and R & D lab work.

2. Features

(1) Highly accurate.

Accuracy is ±0.02% or ±0.05% of reading, depending on range. (See specifications for details.)

(2) Wide range.

DC voltage output is 0~120V; DC current 0~1.2A, covered in five ranges respectively.

(3) 99-step memory function.

The output status (range, limiter & dial setting, polarity, output ON/OFF) can be held in a 99-step memory. In addition to the normal method of readout, memory data can also be read by the autoscan method. NiCad batteries protect memory contents for up to one month if power to the system is turned off.

(4) Easy-to-operate.

Most settings are made through pushbuttons. Continuously variable dials raise or lower the display digits.

(5) GP-IB compatible (7005-01).

Using a GP-IB interface allows the 7005 to be operated from a remote controller.

(6) High reliability.

A power limiter and other circuit protection is featured. Device errors (causing the protection circuit to activate) are reported through coded annunciators.

3. Specifications

	Range	Output Range	Reso-lution	Accuracy (23°C ±3°C)	Max. Output	Internal Resistance	Temperature Coefficient
Voltage	10mV	0~12.000mV	1μV	±(0.05%rdg+ 5μV)		Approx.1Ω	50 ppm
	100mV	0~120.00mV	10μV	±(0.02%rdg+ 20μV)		Approx.1Ω	50 ppm
	1 V	0~1.2000 V	100μV	±(0.02%rdg+ 200μV)	120mA	<0.5mΩ	50 ppm
	10 V	0~12.000 V	1mV	±(0.02%rdg+ 2mV)	120mA	<1mΩ	50 ppm
	100 V	0~120.00 V	10mV	±(0.05%rdg+ 20mV)	120mA	<10mΩ	100 ppm
Current	100μA	0~120.00μA	10nA	±(0.05%rdg+ 20nA)	120 V	$>10^9$Ω	100 ppm
	1mA	0~1.2000mA	100nA	±(0.02%rdg+ 200nA)	120 V	$>10^9$Ω	50 ppm
	10mA	0~12.000mA	1μA	±(0.02%rdg+ 2μA)	120 V	$>10^8$Ω	50 ppm
	100mA	0~120.00mA	10μA	±(0.02%rdg+ 20μA)	120 V	$>2x10^7$Ω	50 ppm
	1 A	0~1.2000 A	100μA	±(0.05%rdg+ 200μA)	12 V	>60kΩ	100 ppm

f i g A

Accuracy is specified for 23°C ±3°C, <85% RH, with a 30 minute power-on warmup, and guaranteed for 3 months under prescribed power source and load conditions.

- o Output Display
  LED, 12000 max. reading.
- o Output Setting
  Four dials used to set output value in display.
- o Unit Indicators
  V, mV, A, mA, μA.
- o Memory
  99-step internal, battery backup for 1 month (NiCads).
- o GP-IB (7005-01 only)
  Refer to the GP-IB Interface Instruction Manual.
- o Caliblation
  3 months.
- o Warmup time
  More than 30 minutes.
- o Output Noise & Ripple
  Voltage Range: ±0.01% of range ±10μV RMS or better.
  Current Range:
  Other than 1A Range...2μARMS or better (at load resistance of 1kΩ)
  1A Range ...2mARMS or better (at load resistance of 10Ω)
- o Response Time
  Rising edge, within 6ms to 0.1% of final value.
  Trailing edge, within 20ms.
- o Line Regulation (at AC 100V ±10%)
  Voltage Range: ±0.01% of range or better.

Current Range: ±0.02% of range or better.

- o Load Regulation (In addition to accuracy ranges : see fig A)
  Voltage Range: ±0.005% of range or better (except 10mV and 100mV range).
  Current Range: ±0.02% of range or better.
- o Limiter
  Current Limiting: 6, 12, 60, 120mA (in 1V, 10V, 100V range).
  Output Limiting Level... Limiter setting value (each limiter) ±(10% + 2mA of each limiter setting).
  Voltage limiting: 6, 12, 60, 120V (in 100μA, 1mA, 10mA, 100mA, range).
  6,12V (in 1A range).

Output Limiting Level

Range	Output Limiting Level
100μA	Each limiter setting value - output current x 2kΩ ±(3% + 0.6V of each limiter setting)
1mA	Each limiter setting value - output current x 2kΩ ±(3% + 0.6V of each limiter setting)
10mA	Each limiter setting value - output current x 200Ω ±(3% + 0.6V of each limiter setting)
100mA	Each limiter setting value - output current x 5Ω ±(3% + 0.6V of each limiter setting)
1A	Each limiter setting value - output current x 0.25Ω ±(3% + 0.6V of each limiter setting)

f i g B

- o Operating Temperature Range
  0 ~ 40°C.
- o Operating Humidity Range
  <85% RH.
- o Power Source
  AC 100V, 120V, 220V, 240V ±10%; 50/60Hz(specify at order).
- o Insulation Resistance
  Power source-to-case: over 100MΩ at 500V DC.
  Guard-to-case : over 100MΩ at 500V DC.
- o Dielectric Strength
  Power source-to-case: 1500V AC for 1 minute.
  Guard-to-case : 250V AC for 1 minute.
- o Power Consumption
  Max. 50VA (Approx. 53VA for 7005-01).
- o Dimentions
  149H x 228W x 363Dmm.
- o Weight
  Approx. 7.2kg (Approx. 7.5kg for 7005-01)
- o Accessories
  Power cable, 1 ea; Fuse, 1 ea (installed);

Instruction manual, 1 ea.

- Optional Accessories
  - 9151-01: GP-IB connector cable (1m)
  - 9151-02: GP-IB connector cable (2m)
  - 9151-04: GP-IB connector cable (4m)
  - 9402 : Full-width case (for mounting in JIS rack)

4. Instrument Nomenclature & Description

4-1. Nomenclature

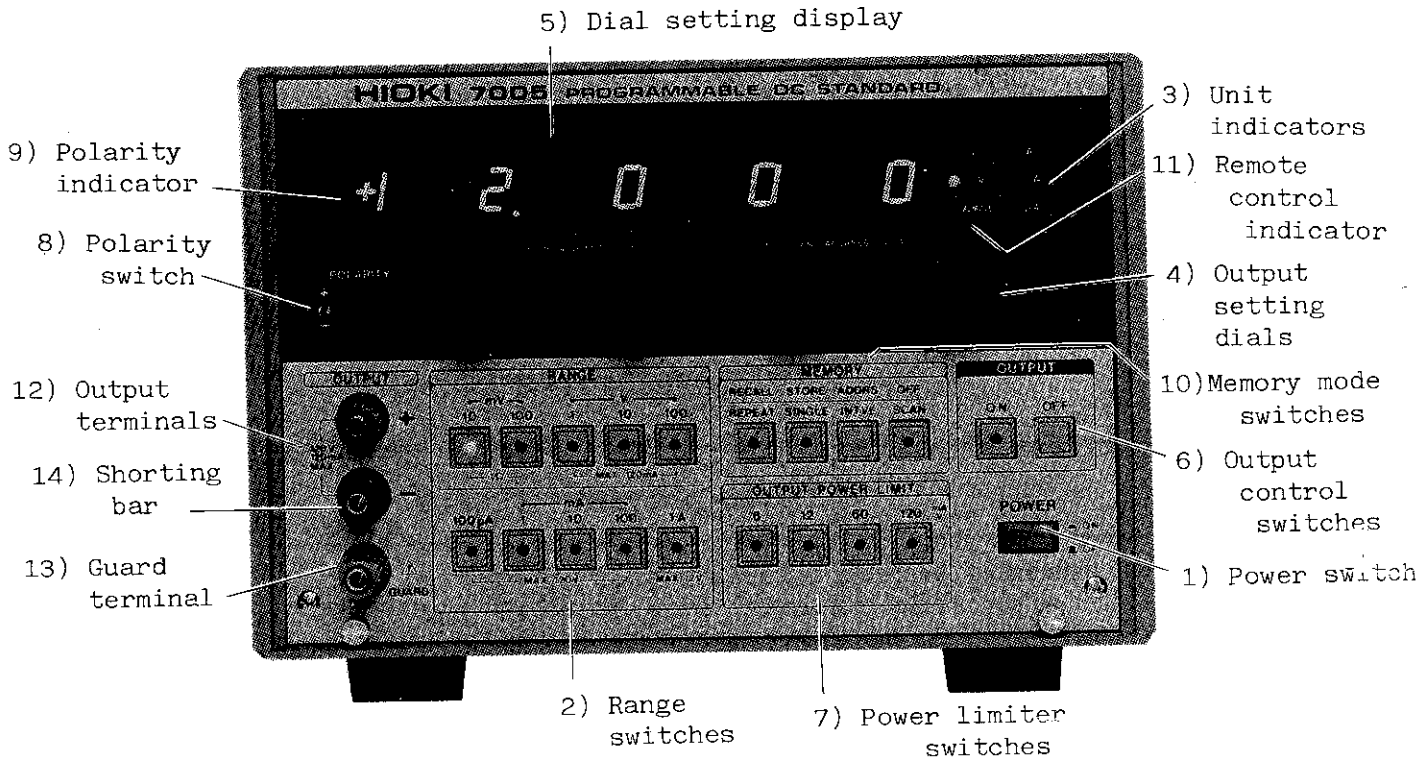


Fig. 1 Front Panel

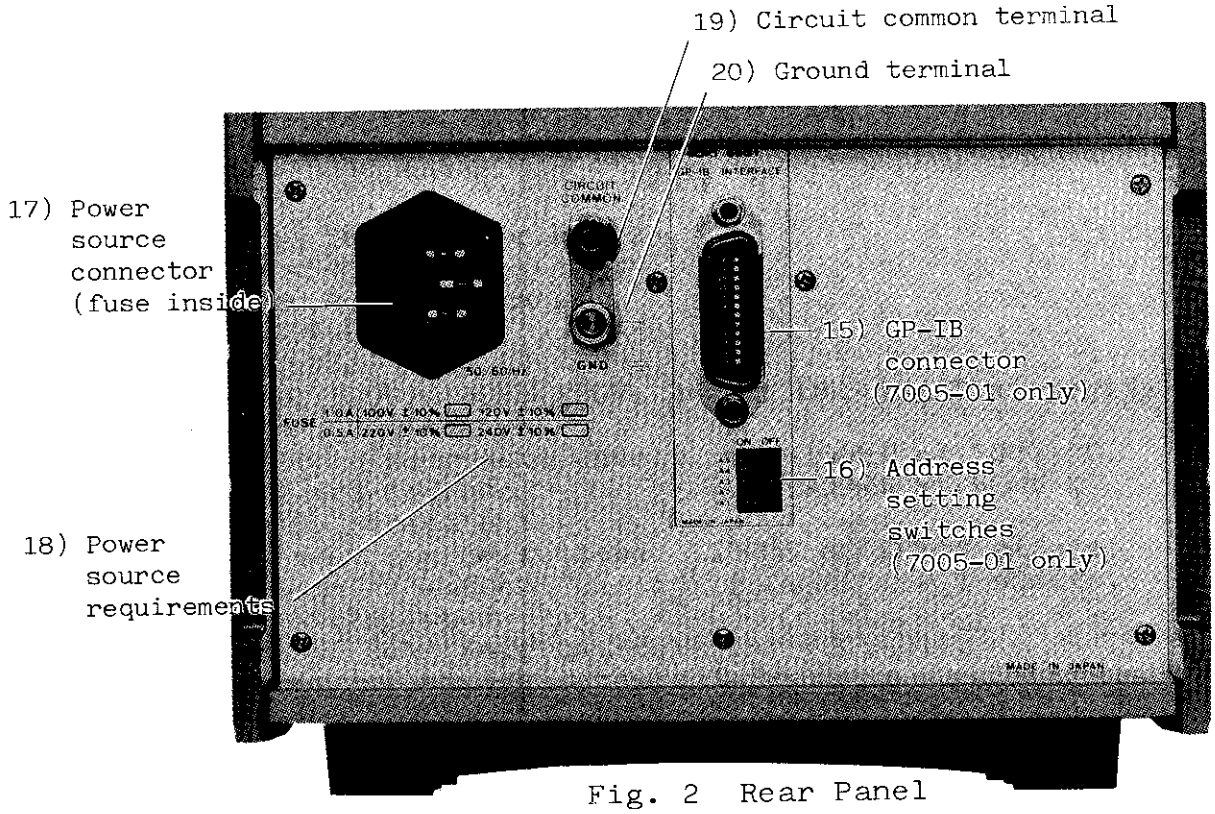


Fig. 2 Rear Panel

4-2. Description

1) Power switch

Used to turn power to the instrument ON and OFF.

2) Range switches

Used to select output range. Ranges include 10mV, 100mV, 1V, 10V, 100V, 100μA, 1mA, 10mA, 100mA, and 1A. The LED built into the switch lights to indicate range selection.

3) Unit indicators

Coupled to the range switches, indicates the units of range switch selection (mV, V, μA, mA, A).

4) Output setting dials

Digital switches eliminate the contact resistance typical in rotary switches. Setting method allows each digit to be raised or lowered independently.
Dials are designated from right to left as 1, 2, 3, and 4. In addition to use in making the normal output settings, these dials are also used for address setting in memory mode, and for scan interval settings.

5) Dial setting display

Indicates the dial setting on the 5-digit LED display.

6) Output control switch (Output ON/OFF)

Turns output ON and OFF. When output is enabled, the ON switch is illuminated.

7) Power limiter switches

Selects the limit of output power. Except for the 10mV and 100mV range, current limiting is applied for voltage ranges; voltage limiting is applied for current range operations. The LED in the selected switch lights to indicate setiing.

8) Polarity switch

Switches output to positive (+) or negative (-) polarity. Polarity selection is indicated at the head of display.

9) Polarity indicator

Indicates positive (+) or negative (-) output.

10) Memory mode switch

Consists of the four following switches.

- RECALL/REPEAT: Recall and repeat scan switch.

- o STORE/SINGLE: Store and single scan switch.
- o ADDRS/INTVL : Address and interval switch.
- o OFF/SCAN : Memory off and scan mode switch.

For further details, see section 5-4. covering memory usage.

11) Remote control indicator

With 7005-01, indicates the instrument is under remote control through the GP-IB.

12) Output terminal

Output selected by dial settings is obtained from these terminals. Do not apply voltage to these terminals.

13) Guard terminal

Used when common mode noise is a problem. (See section 5-2, note (8).)

14) Shorting bar

For normal applications, keep this shorting bar in place (short-circuiting circuit COM to the guard terminal).

15) GP-IB connector (7005-01 only)

Use the GP-IB cable to make the connection to the GP-IB bus.

16) Address setting switches (7005-01 only)

Used to address the instruments connected to the GP-IB bus.

17) Power connector (fuse inside)

Connect the power cord provided with the unit here. The connector accepts a line cord with a 3-prong plug. Replacement fuse specs are silk-screened on the rear panel along with voltage requirements.

18) Power source requirements

Indicates the power source voltage and fuse rating for the instrument.

19) Circuit common terminal

Common ground terminal for the internal circuits.

20) Ground terminal

Use to ground the instrument case. If the instrument is not grounded through the 3-prong plug power cord, connect this terminal to a good ground for safety

5. Operating Procedure

5-1. Preliminary Precautions

- o Power source

  Power source voltage is silk-screened on the rear panel. Use the power cord provided with the unit, and connect the instrument to a power source meeting those specifications.

- o Ground terminal

  As an added safety precaution, connect the GND terminal to a good ground.

- o Output terminal

  Do not connect any input to these terminals.

- o Environmental requirements

  Operating temperature is 0 to 40°C, with less than 85% relative humidity. Avoid locating the instrument in direct sunlight, dusty areas, where vibrations are present, or in a corrosive atmosphere.

- o Warm-up time

  All functions are usable immediately upon turning the power ON, however, specified accuracy can only be guaranteed after a 30 minute warm-up.

5-2. Operating Instructions

(1) Power ON

Press the power switch (1) ON (Fig. 3). At this time, the dial setting display (5) will indicate +0000.
Initial setting is as follows:

Range : OFF
Polarity: +
Memory : OFF
Power limiter: OFF
Output : OFF

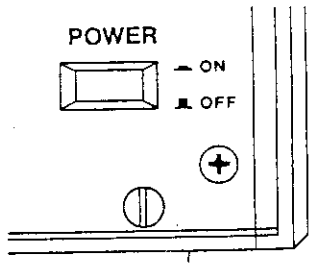


Fig. 3 Power ON

(2) Range

Press the range switch for desired output (Fig. 4). This will light the LED on the selected range switch. These switches should be pressed slowly and positively, pressing only one switch at a time. (Pressing them too fast, or more than one at a time can cause an improper setting.) When range is changed, output will automatically be disabled, but range changes should be made after output has been turned OFF.

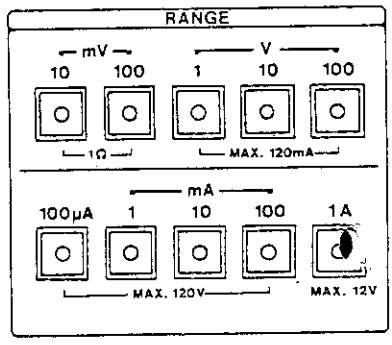


Fig. 4 Setting Range

(3) Power limiter

The power limiter functions to limit output current in the voltage ranges, and output voltage in the current ranges. The limiter takes effect when output exceeds approximately twice the setting value, protecting the load and the 7005. The LED in the switch pressed will light to indicate setting (Fig. 5).
However, settings cannot be made in the 10mV or 100mV range, or when a range has not been selected. Also, for 1A, only the 6 or 12 setting can be selected. When the limiter is in an OFF status (no range selection or 10mV or 100mV), and range is set to a value compatible with a limiter setting, the limiter is automatically set to 6. When the limiter is set to other than 6 or 12, and the 1A range is selected, the limiter will automatically be set to 6. Limiter settings should be made with output in an OFF status where possible.

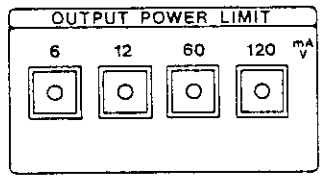


Fig. 5 Setting Power Limiter

(4) Polarity

Press the polarity switch (Fig. 6) to reverse the polarity presently indicated in the display (9). (Polarity is indicated by the + or - sign preceding

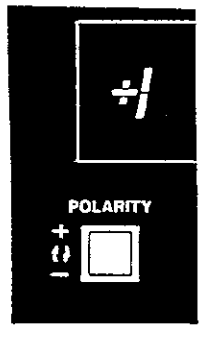


Fig. 6 Setting Polarity

the MSD in the display.) Polarity changes should be made with output in an OFF status where possible.

(5) Output settings

The desired output setting is made by turning the output setting dials (4) (Fig.7). This setting value is shown in the display (5). For all ranges, minimum setting value is 0000 and maximum setting is 12000.

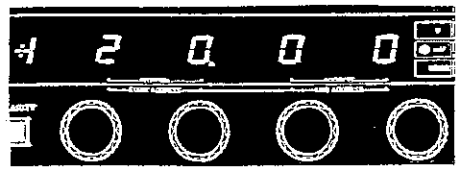


Fig. 7 Setting Output

(6) Connecting 7005 to load

The load is connected to 7005 through output terminals (12). Always make sure that output is OFF when connecting the load.

(7) Output control (ON/OFF)

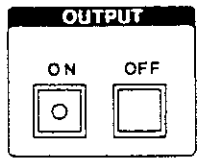


Fig. 8 Operating Output

Pressing the output control switch (6) ON produces output (according to preset value) from the output terminal. At the same time, the LED in the switch lights. Pressing the OFF switch stops output, and extinguishes the LED in the ON switch (Fig. 8).

(8) Using the guard terminal

When output is impressed with common mode noise, disconnect the shorting bar between the guard and negative (-) side terminal. Using a 2-conductor shielded cable, refer to the diagram in Fig.9, and connect the shield to 7005's guard terminal. Connect the other side of the shield to the low impedance side of the load.

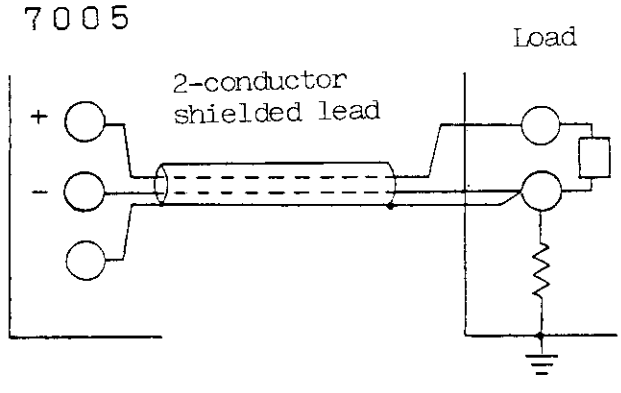


Fig. 9 Using the Guard Terminal

5-3. Instrument Protection Functions

When output is ON (and excluding memory error), output will automatically be disabled for any of the conditions shown in Table 1. At the same time, a coded error message will appear in the display (5), and all LEDs on the front panel (except the REMOTE indicator) will start blinking.

Fault Condition	Message Code
Current limiting activated	1 1 1 1
Voltage limiting activated	2 2 2 2
Power source voltage line fluctuating over ±15%	3 3 3 3
Instrument overheating	4 4 4 4
Combination of the above	5 5 5 5
Memory error or other fault	9 9 9 9

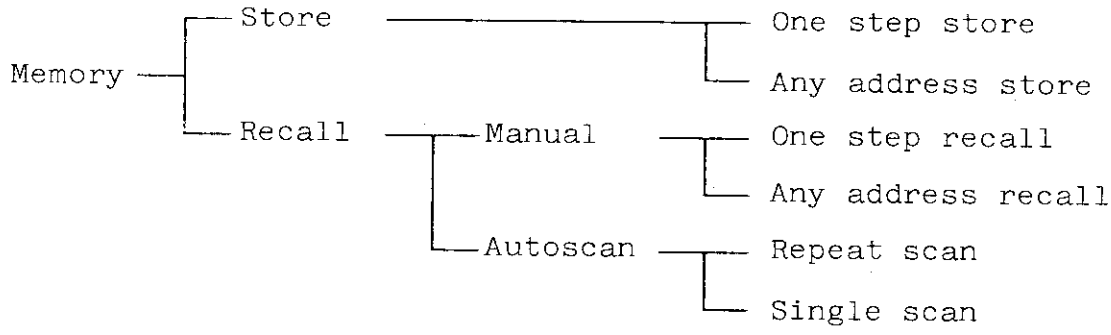
Table 1. Fault Conditions and Error Codes

When this is the case, pressing the output OFF switch (or sending an output OFF code through the GP-IB) will stop the LEDs blinking, and the initial setting will appear in the display (5). Note that an error message will only be given when output is ON (except for memory error), so if output is OFF, it will not be indicated even if there is a fault in the system. Consequently, if you suspect a problem, press the output ON switch to momentarily obtain output, and check whether a fault is present or not.

5-4. Using the memory Function

(1) Outline

Memory modes are made up basically as follows.



The function of the four memory switches is as follows.

- RECALL/REPEAT

  Special read-from-memory switch.
  Used for recall in the manual mode, and for repeat scan in the autoscan mode.
  Not used for takes other than recall.

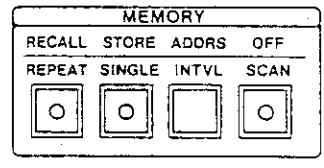


Fig. 10 Memory switches

- STORE/SINGL

  Special write-into-memory switch.
  Always used when storing data. Note, however, that when running a single scan in the autoscan mode, this switch functions as the start and pause switch for single scan recall operations.

- ADDRS/INTVL

  This switch functions to enable the address display when the address is to be specified by the operator in both recall and store mode operations.
  In the autoscan mode, it functions to set the start address, end address and scan interval prior to scan start. Following scan start, it becomes the address display switch.

- OFF/SCAN

  When in the memory mode, this switch functions as the memory OFF switch; when not in memory mode, it becomes the scan mode switch.

All data is held in a CMOS RAM, backed up by rechargeable NiCad batteries. Data will be held about one month with the power switch OFF, but note that if the 7005 has not been used over a long period of time, battery voltage may be too low to hold it. (This type of use also adversely affects battery

performance.) If the data has been lost, the display will be flashing and read "9999" (an error code) at recall

(2) Storage operations

Basically, store operations are divided into two categories; One Step Store, and Any Address Store.
The store operations flowchart is shown in Fig. 14, and the operational procedure is listed below.

------ One Step Store ------

1. Press the STORE switch (the LED lights).
2. Set up the condition that you would like to store.
3. Press the STORE switch. As soon as the switch is pressed, the setting condition will be stored in address 1, and the address will be displayed for 0.5 seconds.
4. Set up the next condition that you would like to store and press the STORE switch. This will be stored in address 2, and the display will briefly read "2".
5. As the above steps are repeated, each setting condition is stored sequentially in memory.
6. Pressing the memory OFF switch clears the store mode. At this time, output will automatically go OFF.

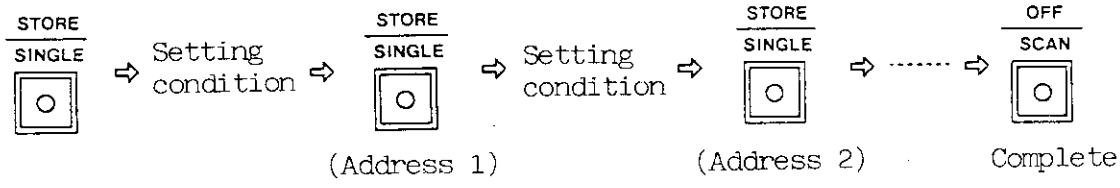


Fig. 11 One Step Store Operations

Fig. 12

------ Any Address Store ------

1. Press the STORE switch (the LED lights).
2. Press the ADDRS switch. The display will read as shown in Fig. 12.
3. Use dials 3 and 4 to set the desired address.
4. Press the ADDRS switch. The display will return to its previous reading.
5. Set up the condition that you would like to store.
6. Press the STORE switch. At this point the data will be stored in the address specified, and for 0.5 seconds, that address will appear in the display.
7. If there is additional data to be store at this point, pressing the STORE switch will store it in the address following the one that was used in step 6 above. If you wish to specify another address, repeat steps 2 thru 6.
8. After data has been stored in address 99, the memory mode will automatically go OFF. Also, pressing the memory OFF switch will turn the store mode OFF.

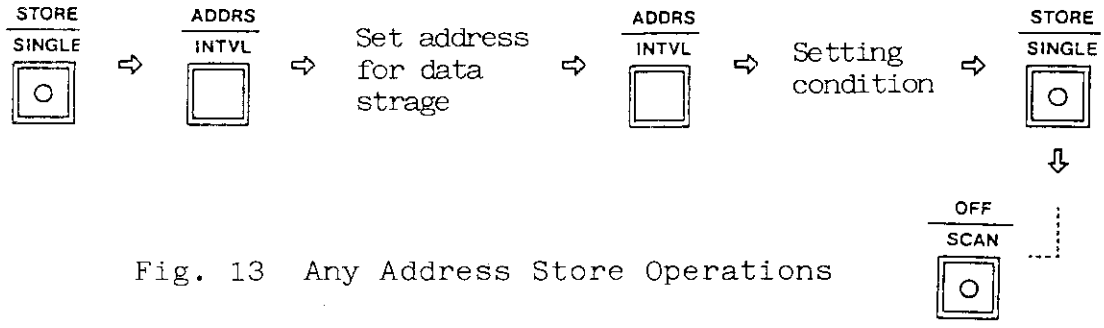


Fig. 13 Any Address Store Operations

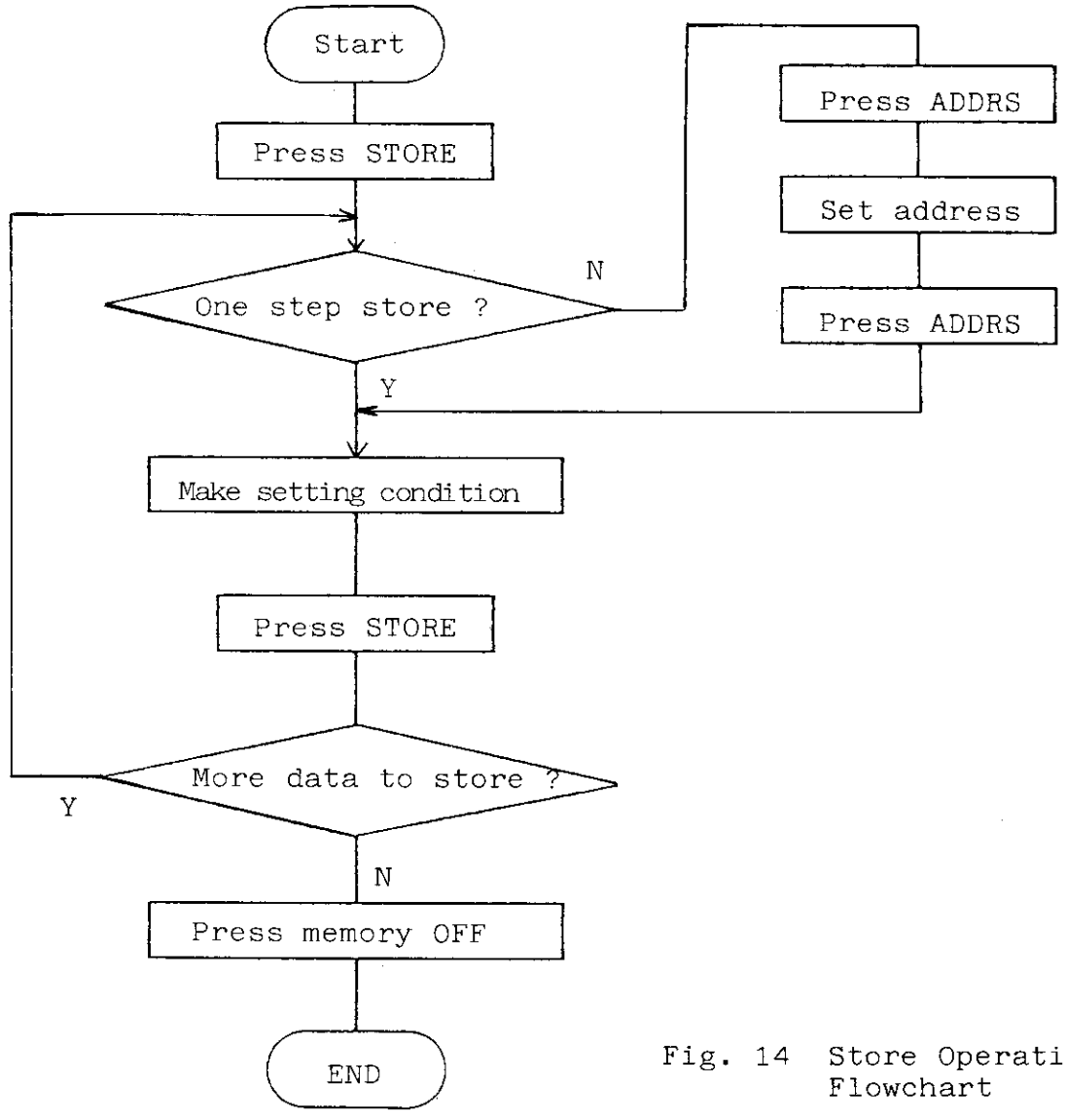


Fig. 14 Store Operations Flowchart

(3) Recall -- Manual

Basically. recall operations consist of two types; One Step Recall and Any Address Recall. The recall operations flowchart is shown in Fig. 18, and the operating procedure is described below.

------ One Step Recall ------

1. Press the RECALL switch (the LED lights). (At this time, nothing will be read from memory.)
2. Press the RECALL switch. At the point the switch is pressed. the setting condition in address 1 will be recalled and set on the instrument. At the same time, the display will read "1" for 0.5 seconds.
3. Press the RECALL switch. The setting condition in address 2 will be made, and "2" will be displayed.
4. The above procedure (pressing the RECALL switch) is used to recall the data from each address sequentially.
5. Press the memory OFF switch to turn the recall mode OFF.

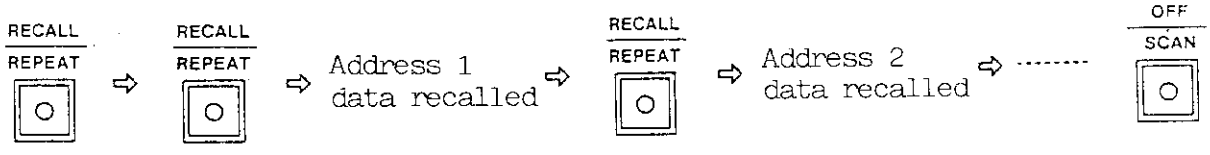


Fig. 15 One Step Recall Operations

------ Any Address Recall ------

Fig. 16

1. Press the RECALL switch.
2. Press the ADDRS switch. The display will read as shown in Fig. 16.
3. Use dials 3 and 4 to set the desired address.
4. Press the RECALL switch. At this point, the setting condition in the specified address will be recalled and used to setup the instrument.
5. From here, each time the RECALL switch is pressed, data from the next address will be recalled for instrument setting.
6. Press the memory OFF switch to turn the recall mode OFF.

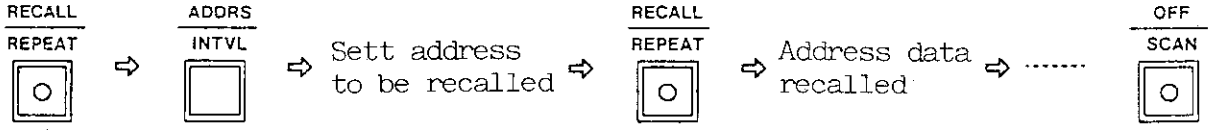


Fig. 17 Any Address Recall Operations

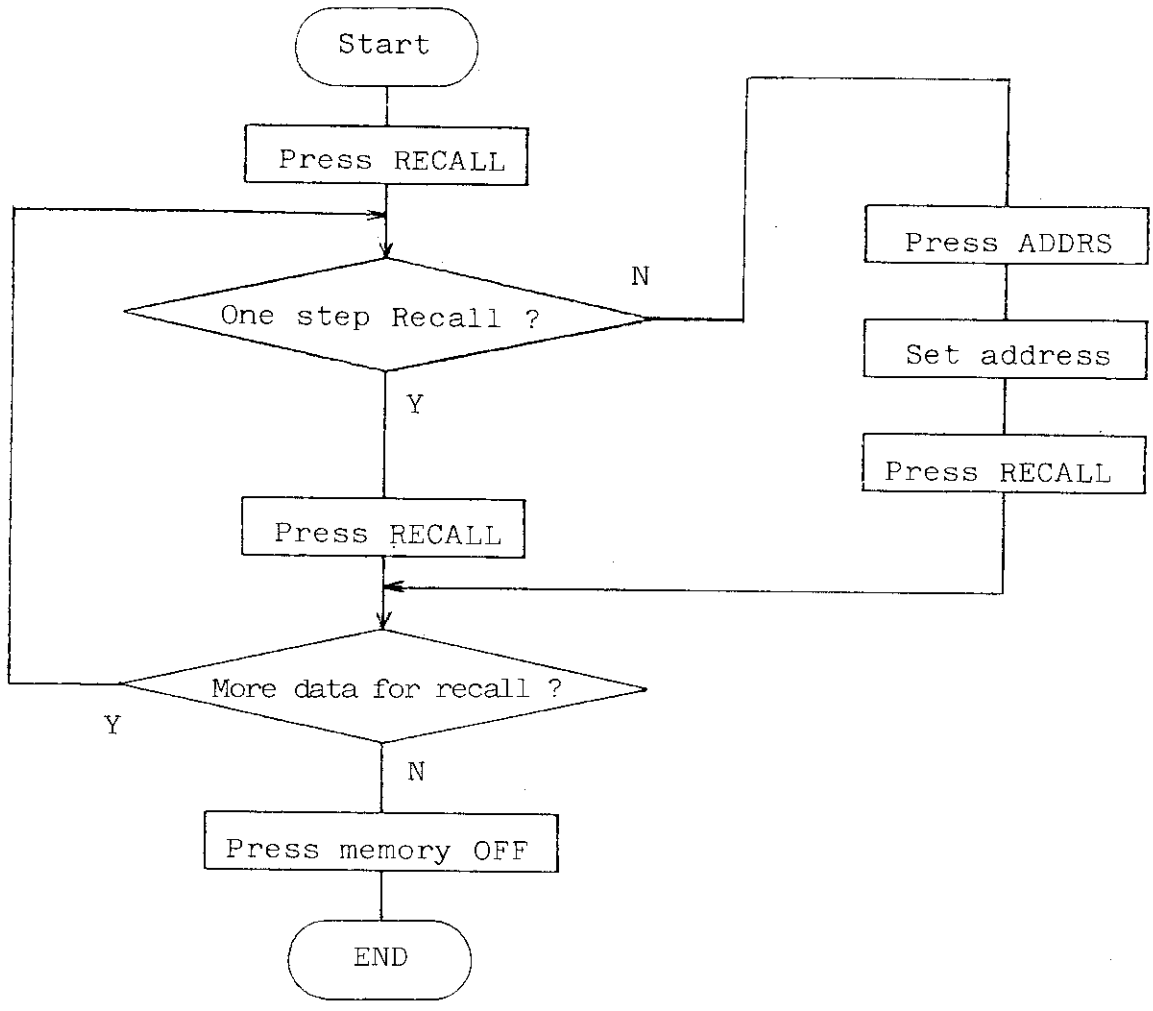


Fig. 18 Recall Operations Flowchart

(4) Recall Autoscan

Recall autoscan consists of two types of operations; Repeat Scan and Single Scan. The operational flowchart is shown in Fig.24, and operations are as follows.

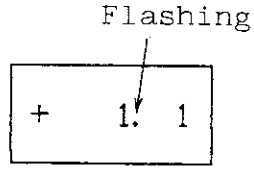


Fig. 19

1. Press the SCAN switch (the LED lights). The display is shown in Fig. 19. The start address (right side) and end address (left side) are both at the initial value of 1.
2. Use dials 3 and 4 to set the end address. (The dials are numbered 1, 2, 3, and 4 from the left.)
3. Use dials 1 and 2 to set the start address.
4. Press the INTVL switch. The display is shown in Fig. 20, and the initial value is 1 (sec).

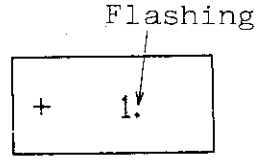


Fig. 20

5. Use dials 1 and 2 to set the interval (in seconds).

At this point, select either repeat scan or single scan operations.

------ Repeat Scan ------

6. Press the REPEAT switch (the LED lights).
7. Scan will start and run sequentially from the start address. The address will be shown in the display for 0.5 seconds. When the end address is reached, return will be made automatically to the start address, and scan will continue from there.
8. Pressing the REPEAT switch while scan is in progress initiates the pause status and causes the LED to flash. Pressing REPEAT again clears the pause status, and restarts scan operations.
9. To terminate scan operations, press the memory OFF switch to clear the scan mode. At this point, output will automatically be turned OFF.

------ Single Scan ------

10. Press the SINGLE switch (the LED lights).
11. Scan will start and run sequentially from the start address, and after completing the end address, scan will stop. The display will return to the address set in step 2. Output will automatically be turned OFF.
12. Pressing the SINGLE switch while scan is in progress initiates the pause status and causes the LED to flash. Pressing SINGLE again clears the pause status, and restarts scan operations.
13. To clear the scan mode, press the memory OFF switch.
14. During repeat or single scan operations, pressing and holding the ADDRS switch will display the address presently being scanned, but scan will be stopped while the switch is held down.
15. After scan has started, it is possible to operate the output ON/OFF and memory switch, but not any of the other switches.
16. Settings must meet the following criteria.
    $1 \leqq$ start address $\leqq$ end address $\leqq 99$
    $1 \leqq$ interval $\leqq 99$
17. When an error condition occurs during scan, the display will indicate an error condition, and scan operations will stop. After the error condition has been cleared, pause will be entered, At this time, pressing the switch with the flashing LED will restart scan.
18. The settings for start address, end address, and interval remain effective as long as the power switch is not turned OFF.

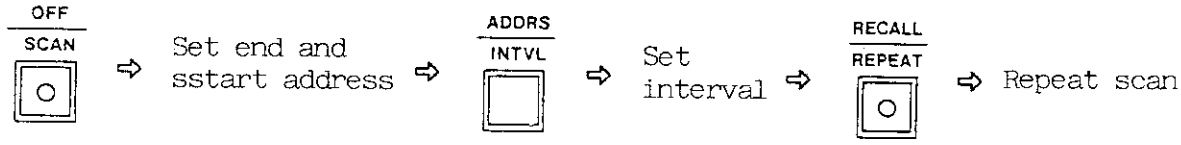
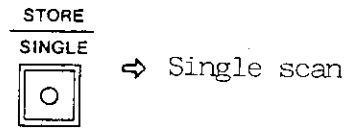


Fig. 21 RecallAutscan Operations



(5) Memory Use Examples

Example 1.

Store the following setting condition in address 1: 10V range, limiter setting 12, output value 10.000, (+) polarity, output ON.

1. Turn the power switch ON, and memory mode OFF.
2. Set range to 10V, limiter to 12, output value to + 10.000, and turn output ON.
3. Press the STORE switch. The switch LED will light.
4. Press the STORE switch. At this point, the setting condition will be stored in address 1, and as shown in Fig. 22, address 1 will appear in the display for 0.5 seconds.
5. Press OFF to complete the procedure.

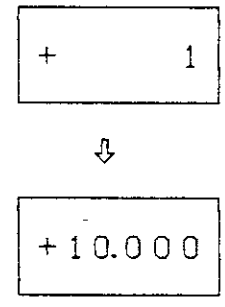


Fig. 22

Example 2.

Recall the data stored in example 1.

1. Memory mode OFF.
2. Set range and other functions as appropriate.
3. Press the RECALL switch. The switch LED will light, but at this time data will not be recalled.
4. Press the RECALL switch. At this point, 10V range, limiter setting 12, output value +10.000, and output ON will be set on the instrument. As shown in Fig. 23, for 0.5 seconds the display will indicate address 1, after which it will read +10.000.

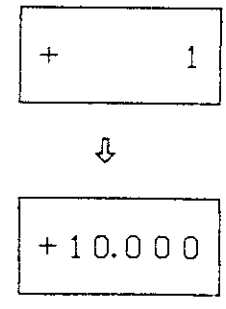


Fig. 23

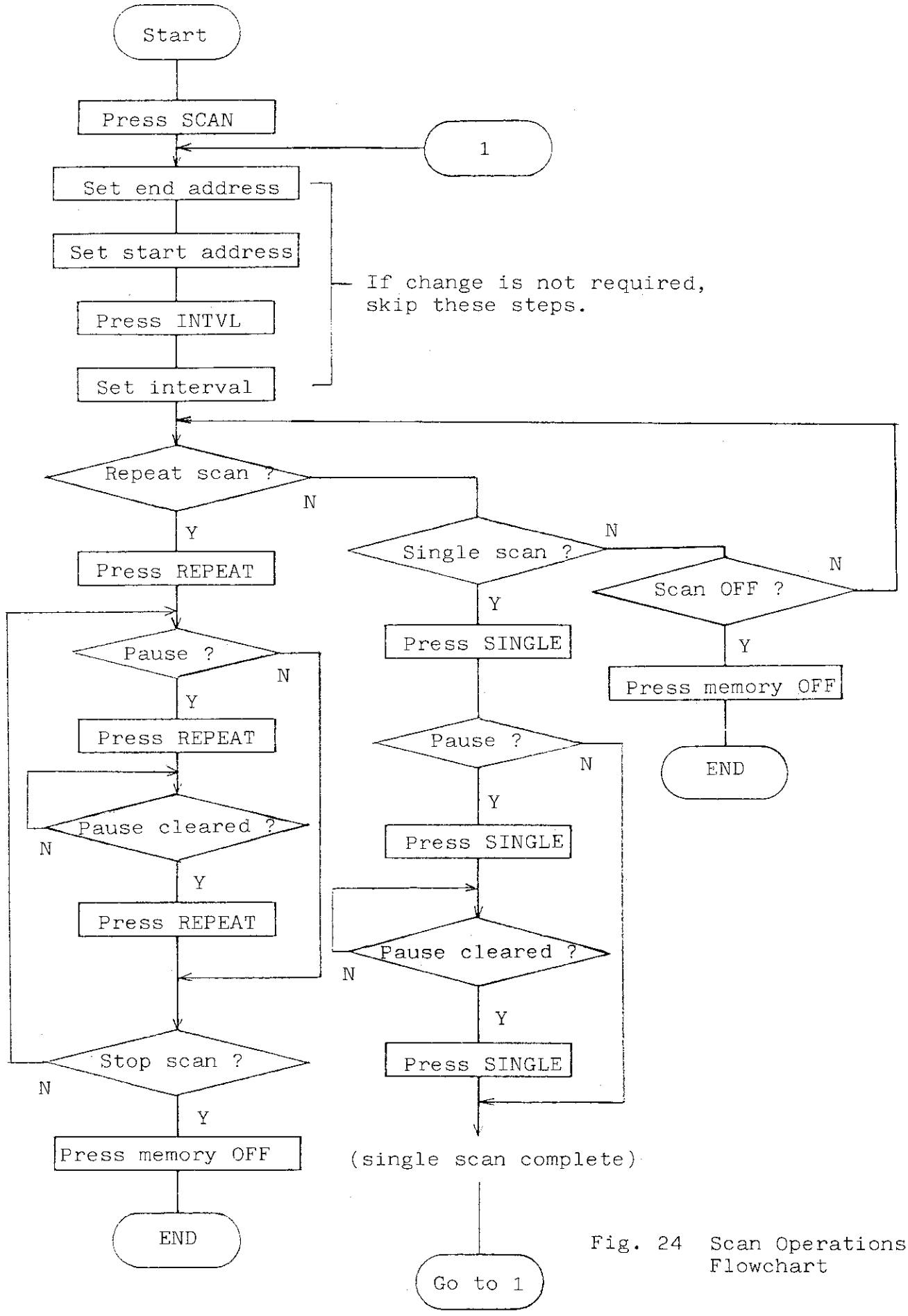


Fig. 24 Scan Operations Flowchart

Example 3.

Continuing with example 1, store output values from 9V to 0V (in 1V steps) in address 2 thru 11.

Fig. 25

1. Memory mode OFF.
2. Press the STORE switch.
3. Set range to 10V, limiter to 12, output value to +9.000, and turn output ON.
4. Press ADDRS. The display will read address 1.
5. Using dial 4, set address to 2 (Fig. 25)
6. Press ADDRS.
7. The display will return to +9.000 (Fig. 26).
8. Press STORE. This setting condition is now stored in address 2, and the display is as shown in Fig. 27.
9. Change output value to 8.000 and press STORE.
10. Change to 7.000 and press STORE.
11. Change to 6.000 and press STORE.

. . .

17. Change to 0.000 and press STORE.
18. Press OFF to complete the procedure.

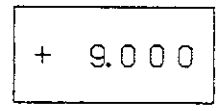


Fig. 26

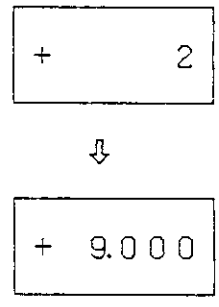


Fig. 27

Example 4.

Recall starting from address 1 the data stored in example 3.

1. Memory mode OFF.
2. Press RECALL.
3. Press RECALL. 10V will be set, output enabled. As shown in Fig. 28, address 1 will be displayed for 0.5 sec, then the display will read +10.000.
4. Press RECALL. 9V will be set, output enabled.
5. Press RECALL. 8V will be set, output enabled.

. . .

13. Press RECALL. 0V will be set, output enabled.
14. Press OFF to end procedure.

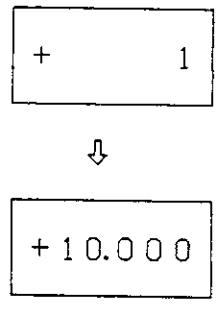


Fig. 28

Example 5.

Recall the data stored in example 3 using repeat scan.

1. Memory mode OFF.
2. Press SCAN. The display will appear as shown in Fig. 29.

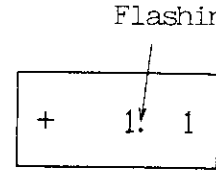


Fig. 29

3. Using dials 3 and 4, set the end address as 11.
4. Press INTVL.
5. Using dials 1 and 2, set an appropriate interval (approx. 3 sec.).
6. Press REPEAT. Scan will start and settings will be made automatically. As address 11 is complete, scan operations will return to address 1 and continue. (Fig. 29)

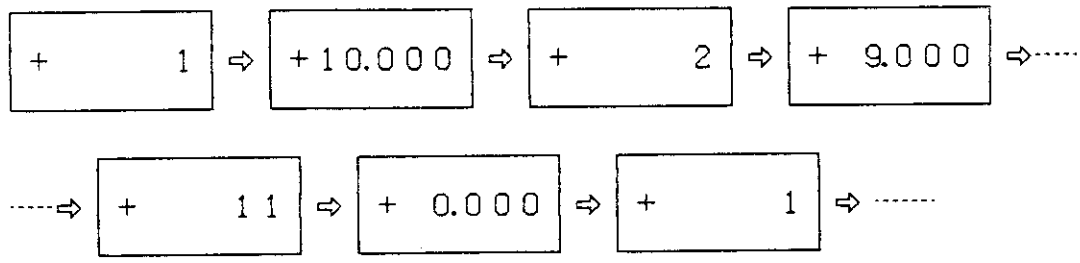
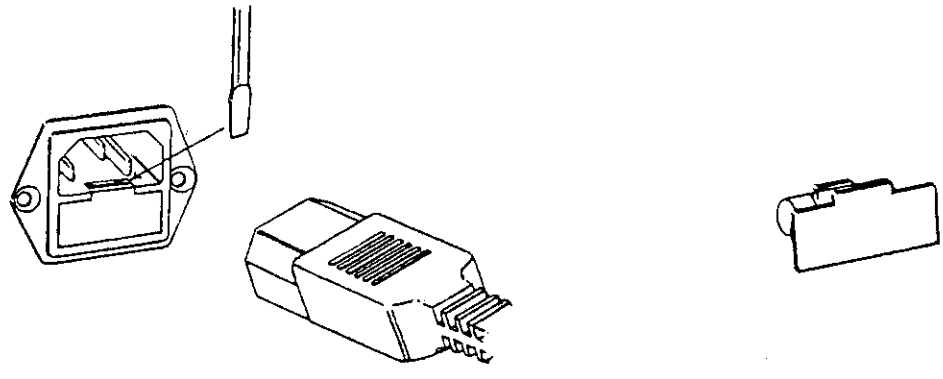


Fig. 30 Display During Scan Operations

7. Press REPEAT to stop scan operations
8. Press REPEAT to restart scan operations.
9. Press ADDRS. While the switch is held down, the present address will be displayed.
10. Press OFF to end the procedure.

5-5. Fuse Replacement

(1) Turn the instrument power switch OFF.
(2) Disconnect the power cord.
(3) Using a flat-blade screwdriver, or other suitable tool, pry out the fuse holder.
(4) If the fuse is blown, replace it with a new one. (The fuse is a midzet type; ratings are specified on the rear panel.)
(5) Install the fuse holder, and reconnect the power cord.



1. Disconnect power cord.

2. Remove fuse holder, check and replace blown fuse.

Fig. 31 Fuse Replaycement

6. Operating Principle

6-1. Model 7005 Block Diagram

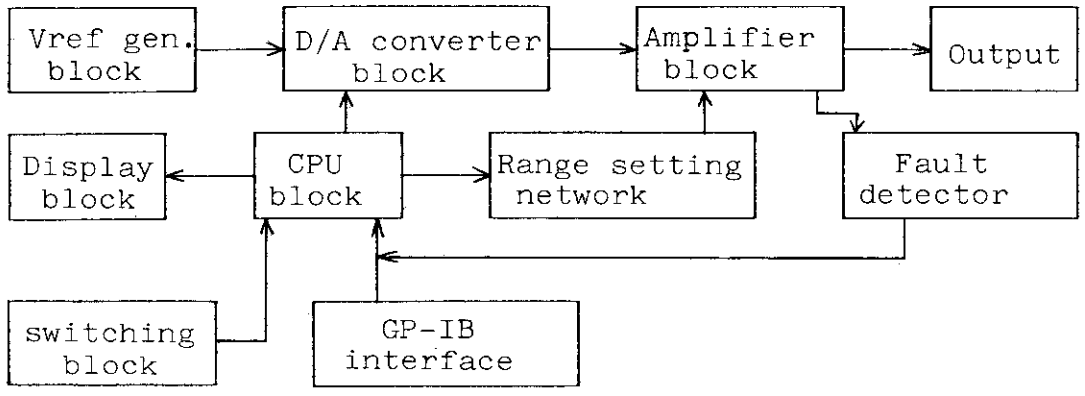


Fig. 32 7005 Block Diagram

6-2. Operating Section Description

(1) Vref generator block

Temperature-compensating network (temperature bus) senses ambient temperature, and zener diodes provide a stable voltage reference source.

(2) D/A converter block

Comverts Vref to a value proportionate to dial setting. The D/A converter is broken down into an upper 4-bit, and lower 10-bit section. The upper 4-bit section is a combination of precision resistors, and the lower 10-bit section consists of a high-precision D/A converter.

(3) CPU block

All digital signals are first entered into the CPU for processing, then transmitted to other sections from here. Erroneous data in the memory mode is detected here; as is determination of fault conditions in other modes.

(4) Switching block

Information from the panel switches is first read into the CPU for processing, then transmitted as control signals to other sections. Since digital switches are used, changes in switch contact resistance does not occur, and output remains accurate over a longer period of time.

(5) Display block

The display sends an interrupt signal to the CPU every 1.3ms (approx) requesting data output. Five interrupts constitute one cycle. The display is the LED type.

(6) Ranging network

This section receives the processed signals from the CPU, and change through relays and other switches.

(7) Amplifier block

The analog signal receives from the D/A converter is compared with the signal detected at output, amplified, then output.

(8) Fault detector

When output value exceeds the limiter setting, or when overheating occurs in the power source, the fault detector transmits a fault signal to the CPU.

(9) GP-IB interface

The GP-IB interface receives the signals passed to the 7005 by the GP-IB controller, processes them and sends this data to the CPU. When a PRT signal is trancemitted by 7005, the interface transmits this signal to the controller as an SPQ signal.

7. Miscellaneous

7-1. Rack Mounting

Details on the 9402 full-width case are as follows.

- o Designed to be mounted in a JIS standard rack (Fig. 33).
- o Weight: 3.8kg (approx)

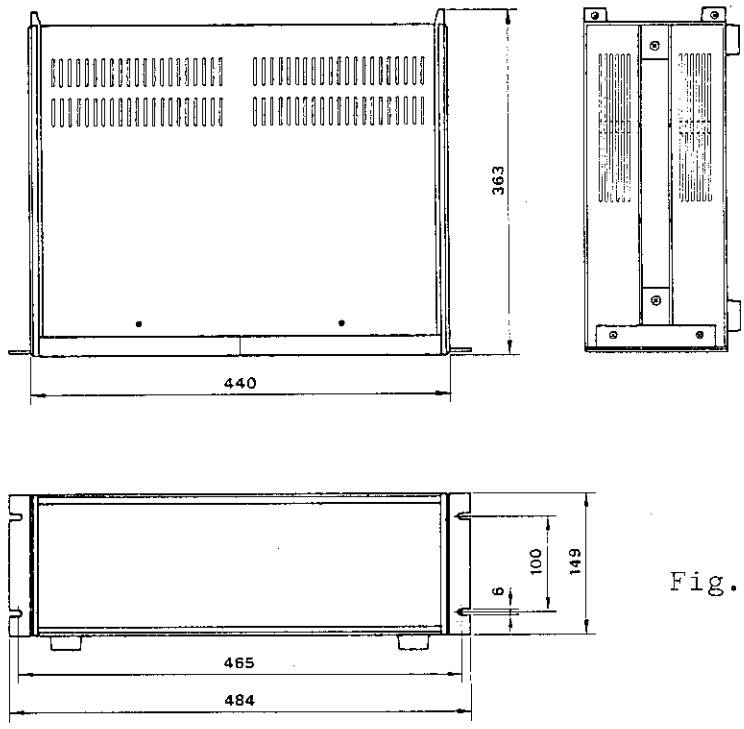


Fig. 33 9402 External Dimensions

In preparing the case for rack-mounting, the support feet on the bottom panel must be removed. (Fig. 34)

1. Slide out the moveable latch.
2. Pull up on the foot fixture to remove the fixed latch.
3. Twist the fixture slightly to disengage the moveable latch.

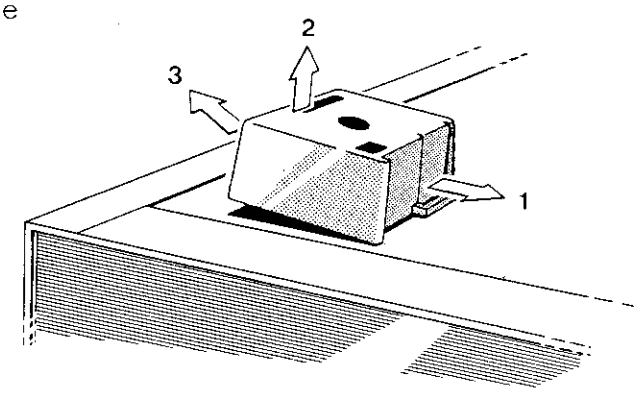


Fig. 34 Support Foot Removal

7-2. Maintenance

Below are some conditions that must be avoided in locating and using the 7005. Note particularly that high temperatures decrease performance of the memory back-up batteries, and should be avoided.

1. Locations where direct sunlight will strike it.
2. Near heat radiators.
3. Locations where rapid temperature changes occur.
4. High humidity.
5. Locations where vibrations are severe.
6. Locations where the atmosphere contains a high salt or other corrosive chemical content.
7. Dusty locations.

7-3. Calibration

- The calibration period for this instrument is 3 months.
- In cases where instrument accuracy does not meet your requirements, contact the company or its representative for calibration service.

7-4. Precautionary Notes, Miscellaneous

- If there is no display, or if output is not normal, turn the power switch OFF, then back ON and see if normal operations are restored. Also, check to see if the power cable is plugged in properly, and check for a blown fuse.
- In the voltage range with output in an open status, a flashing "1111" display indicates that the fuse on PC board 7005A303 has blown. Replace it with a standard 1.5A midzet fuse. (If this fuse cannot be obtained easily, contact a Hioki representative, sales office, or the company's service department.
- If output is left ON, and the instrument used extensively in the 100V or 1A range, note the following precautions.

100V range: Minimum output level (10V or less), and maximum output capacity (120mA).
1A range : Maximum output level (1.2A), and minimum output capacity. (1V or less).

If used over a long period of time (with output ON) in this condition, internal heat dissipation builds up causing the temperature of the power transistors to rise. If ambient temperature is high, after about 1 hour the thermal protection circuit will activate, resulting in a flashing "4444" display. In this case, allow the instrument time to cool before attempting to use it again.

- Do not apply voltage to the output terminals under any circumstances.

MODEL 7005-01

9501 GP-IB Interface Instruction Manual

CONTENTS

1. Outline

2. Interface Specifications

3. Listener Mode

 3-A. Programming Codes
 3-B. GP-IB Commands

4. Talker Mode

 4-A. Output Data Format
 4-B. Status Bytes

5. General Precautions

 5-A. Address Setting
 5-B. Remote-to-Local Switching Operations
 5-C. Delimiter Notes
 5-D. Troubleshooting
 5-E. Miscellaneous

6. Sample Program

1. Outline

The 9501 GP-IB interface is designed to allow function, range, polarity, limiter value, output value settings, and output ON/OFF control to be performed through an external GP-IB compatible controller.

As the listener, the interface can be easily programmed to perform the above and other functions; and as the talker, setups made by remote programming are output to the 7005.

2. Interface Specifications

The established standard for the 9501 is IEEE488-1978.

Interface Functions:

SH1	All SH functions.
AH1	All AH functions.
T6	Basic talker mode. Serial polling function. Talker-clear function through MLA. No talk-on-remote function.
L4	Basic listener mode. Listener-clear function through MLA. No listen-on-remote function.
SR1	All SR functions.
RL2	Remote-Local switching function. No local lock-out operations.
PP0	No PP functions.
DC1	All DC functions.
DT1	All DT functions.
C0	No controller functions.
E1	Open-collector driver.

3. Listener Function

3-A. Programming Codes

a) Functions

F0	----	------
F1	----	DCV
F2	----	DCA

b) Ranges

		(for DCV)	(for DCA)
R0	----	------	------
R1	----	10mV	100μA
R2	----	100mV	1mA
R3	----	1V	10mA
R4	----	10V	100mA
R5	----	100V	1A

c) Polarity

P0	----	+
P1	----	-

d) Output limiting

		(for DCV)	(for DCA)	*1)
L0	----	6mA	6V	
L1	----	12mA	12V	
L2	----	60mA	60V	*2)
L3	----	120mA	120V	*2)

e) Output

00	----	OFF
01	----	ON

f) Output setting value

D00000 thru D12000 *3)

*1) Specifying F1R1 or F1R2 results in 1-ohm output. Output limit setting not required in this case.

*2) Specifying F2R5, then specifying L2 or L3 will exceed maximum output capacity of 12VA, so this setting cannot be made.

*3) Normally input as a 5-digit decimal value, but if the MSD (only) is a 0, a space code may be used.

-- Programming Precautions --

1. When power is turned ON, or when a DCL or SDC command is received, the setting F0R0P000D00000 will be made. In this case, L0 thru L3 will not be set for output limit L.

2. F, R, P, L, and O must be accompanied by only one digit.

   Example 1) L32 -- L3 is effective, but 2 is disregarded.

   Example 2) FR1 -- Both F and R are ineffective; 1 is disregarded. F becomes a setting error.

3. When F, R, P, L, and O are used in any combination other than those noted in the programming codes (previous page) a setting error will result. A setting error causes that code to be initialized (power ON setting), and placed in internal memory as such.

4. Dial setting values are within the range of 00000 to 12000. Any settings outside this range will result in a setting error; but when over 5 digits are used, only the first five entered are effective. When a setting error occurs, for both this and the above precaution, the display will hold the last correct setting made.

5. Characters other than F, R, P, L, O, and D will be disregarded, but if placed in a space where a numerical value should be entered, that code will end up as a setting error.

   Example 1) F1H (CR) (LF)
   H is disregarded. No setting error.

   Example 2) FH1 (CR) (LF)
   The space following F is not a numerical digit. Setting error results.

6. Coding F1R1 or F1R2 calls for 1-ohm output, so output limiting need not be set. But in this case, an output limit setting of L0 thru L3 will not produce a setting error. (*1)

7. Coding F2R5, then an output limit of L2 or L3 will exceed the maximum allowable output of 12VA, so this setting cannot be made. This combination will result in a setting error. (*2)

8. The output value setting must be headed with a D, followed by five decimal digits. However, when the MSD (and only the MSD) is a 0, a space code can be used in its place. (*3)

   Example 1) D_9999
   ↑ This is the same as D09999.
   space code.

Example 2) D__100

The space code in the second digit column produces a setting error. Correct setting is D00100 or D_0100.

9. When a programming code of 01 or a GET command is received, if a setting error has not been made, output is started according to setting value. However, if a setting error has been made, correct the program and output will be started.

10. Program codes are read into the unit in the following sequence.

Example 1) "F1R5P0L201D10000"

a b c d e f

When output is specified in the DC 100V range, output limit of 60mA, with output value of DC +100V, changing the above a, b, c, d, e, and f sequence is acceptable. It is also okay to make the above settings one at a time.

Example 2) "F3R5P0L201D10000"

Here, since F3 is a setting error, the display on the 7005 does not change from its previous setting. However, if F1R5P0L201D10000 is the desired setting, only sending an F1 code will make the proper change for a correct setting.

3-B. GP-IB Commands

GET (Group Execute Trigger)

When 7005 receives this command, if a setting error has not been made in the programming codes, output is enabled. If an error has been made, the unit sends an SRQ (Service Request) signal.

SDC (Selected Device Clear)

When this command is received, 7005 clears its setting status to the power ON status (F0R0P000D00000, L not set).

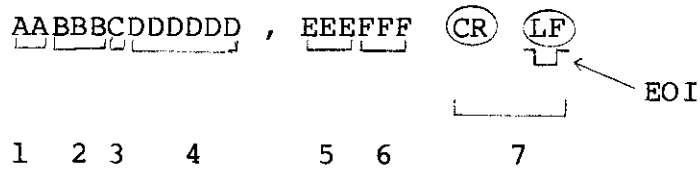
DCL (Device clear)

When this command is received while the unit is in the REMOTE mode, operations will be the same as for receiving an SDC command. When received in the LOCAL mode, the internal memory is initialized (stores FOR0P000D0000, without L setting), and the 7005 display does not change.

4. Talker Mode

When a setting error has been made in the programming codes, an SRQ signal notifies the operator that an error has been made. It does not inform him of the specific error, however. The function of the talker mode is to convert the programmed information into an easy-to-understand format for output. However, the talker mode is useful only for sending back information on the program; it does not give the operator any information on the status of actual output from 7005.

4-A. Output Data Format



1) Status codes

SE (Setting Error)

Indicates that a setting error has been made in the programming codes.

DE (Device Error)

Indicates there is a problem with the main unit (7005).

OF (OFF)

Indicates output is in an OFF status.

ON (ON)

Indicates output is in an ON status.

CL (Clear)

Indicates an initialized setting made directly following power ON, or having received a DCL or SDC command.

*) When 7005 is abnormal, the priority code is DE.

2) Functions and range

Function and range combinations produce the below listed character output.

DMV ---- coded by F1R1, F1R2
D_V ---- coded by F1R3, F1R4, F1R5
DUA ---- coded by F2R1
DMA ---- coded by F2R2, F2R3, F2R4
D_A ---- coded by F2R5

#2) U is used for micro- (μ); M for milli- (m) units.

The below listed codes are error codes.

FRF ---- FOR0
DRV ---- F1R0
DRA ---- F2R0

Other cases where an error code will be generated including using a disallowed programming code combination, when the numerical digit following R is larger than 5, or when using a code combination containing a disallowed numerical value.

*3) Error codes containing _R_ indicate that range cannot be set. Codes containing F__F indicate that function cannot be set.

*4) When a change is made from the last setting, the display will change in accordance with the sequence in which the change was made.

(Example)

F2R1 ------ DUA	F2R1 ------ DUA
R2 ------ DMA	F0 ------ FUF
F0 ------ FMF	R2 ------ FUF *)
F2 ------ DMA	F2 ------ DMA

*) The R2 setting will be stored, but since function cannot be set, the prior setting will be held. The next F2 will cause the setting to be F2R2.

3) Polarity

\+ ----- Coded by P0.
\- ----- Coded by P1.
_ ----- Setting error resulting from other than 0 or 1 following P.
↑ space

4) Setting value

X X X X X ----- Set correctly. Output produced as indicated by display.
(.) (.) (.)

(X's indicate numerical digits used for settings.)

0 0 0 0 0 0 ----- Status immediately after power ON, or immediately following receipt of DCL or SDC command.

0 X X X X X ----- Indicates that since function or range cannot be set, decimal point cannot be positioned.

9 9 9 9 9 9 ----- Indicates that following proram-
(.) (.) (.) ming code D, data other than 5 numerical digits (space used for MSD of 0 excepted) was transmitted, or that the 5 digits

exceeded 12000. Decimal point positioned by function and range.

5) Output limit units

Function and range combinations produce output of the following characters.

OHM	-----	Coded as F1-R1, R2 (for 1-ohm output.)
LMA	-----	Coded as F1-R3, R4, R5
L_V	-----	Coded as F2-R0 thru R5
L__	-----	Indicates that since function or range cannot be set, limit units cannot be set. This code passed immediately following power ON, or immediately following receipt of DCL or SDC command when function, range, and output limiting cannot be set.

6) Output limit value

001	-----	Coded as F1R1, F1R2 (for 1-ohm output.)
006	-----	Coded as L0
012	-----	Coded as L1
060	-----	Coded as L2
120	-----	Coded as L3
000	-----	1. Immediately after power ON, or receiving DCL or SDC command. 2. For cases other than F1R1, F1R2, a numerical digit other than 0 thru 3, or other disallowed coding combination used. 3. When L2 or L3 is received in conjuntion with F2R5. (Maximum allowable output exceeds 12VA and setting cannot be made.)

7) Delimiter

(CR) (Carriage Return) and (LF) (Line Feed) are output. Also, EOI is dropped low at the same time (LF) is transmitted.

-- Precautionary Notes --

Note 1: Immediately following power ON, or immediately after receipt of a DCL or SDC command, the following data string will be output when talker mode is specified.

CLFRF+000000, L__000 (CR) (LF)
EOI

Note 2: When 7005 malfunctions, or when a setting error is made, DE will be included in the priority code indicating fault status.

Note 3: When an error has been made in program coding, output data will include the following.

```
For function F:    SEFXFX0XXXXX, L__XXX

For range R:                      ┌for F1
                                 L
                   SEXRXX0XXXXX,   XXX
                                 L_V
                                    └for F2

For polarity P:    SEXXX_X   X    X    X    X, XXXXXX
                         (.)  (.)  (.)
                        space

For output limit L:   SEXXXXX   X    X    X    X, LXX000
                              (.)  (.)  (.)

For output O (*):   SEXXXXX   X    X    X    X, XXXXXX
                            (.)  (.)  (.)

For setting value D:   SEXXXX9   9    9    9    9, XXXXXX
                               (.)  (.)  (.)
```

In the above, X represents programming codes for proper setting, and (.) represents the decimal point positioning determined by function and range combinations.

(*) Even though a status code of SE is indicated, if an error has not been made in either function, range, polarity, setting value, output limit units, or output limiting value, you can suspect that an error has been made with the use of numerical 0's instead of the letter "O" in the programming code.

4-B. Status Bytes

The following status bytes are output in response to serial polling from the controller.

```
B7   B6   B5   B4   B3   B2   B1   B0

0    RQS  0    0    DS1  DS0  DE   SE
      |              \_____/   |    |
      |                 |      |    Indicates a setting error
      |                 |      |    has been made.
      |                 |      |
      |                 |   Indicates device (7005) malfunction.
      |                 |
      |          DS1   DS0
      |           0     0   --- Indicates initialized status
      |                         set after power ON, or DCL, SDC
      |                         command.
      |           0     1   --- Indicates output OFF status.
      |           1     0   --- Indicates output ON status.
      |
      Indicates a service request status.
```

a) When a setting error has been made in the program code:

```
01000001      = 65          = 41        = A
    (binary)     (decimal)    (Hex)       (ASCII)
```

b) When a device (7005) malfunction occurs:

01000010	= 66	= 42	= B
(binary)	(decimal)	(Hex)	(ASCII)

*) When a) and b) occur at the same time:

01000011	= 67	= 43	= C
(binary)	(decimal)	(Hex)	(ASCII)

c) At initialization:

00000000	= 0
(binary)	(decimal)

d) In output OFF status:

00000100	= 4
(binary)	(decimal)

e) In output ON status:

00001000	= 8
(binary)	(decimal)

*) A service request is not issued for c), d), and e).

-- Precautionary Notes --

Note 1: Since function, range, and output limiting cannot be set immediately after power ON, if proper programming codes have not been used for F, R, and L setting, a setting error results and a SRQ is issued.

Note 2: When a DCL or SDC command is received, the SRQ line and status byte are reset, and the status immediately after power ON is entered. In other words, like in Note 1, if programming codes related to F, R, and L settings are not correct, a setting error and SRQ is produced.

Note 3: The SRQ line and status byte is cleared with a IFC command.

Note 4: Service requests (based on setting errors) are issued after full determination has been made regarding the correct coding of F, R, P, L, O, and D items; this determination being made with the receipt of each programming code string and GET command. SRQ is also output in the same manner for a device malfunction, or when a previous malfunction has not been corrected. Consequently, until all causes of malfunctions have been corrected, the SRQ line will be set each time an attempt is made to transmit a program code string or a GET command.

Note 5: Service requests are issued for a device malfunction upon occurance of the fault. A device malfunction causes all front panel indicators to start blinking.

Transmission of a "00" programming code, or a DCL or SDC command is required to stop the LEDs from blinking.

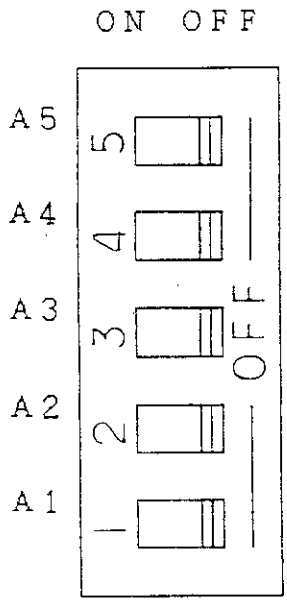
Note 6: The SRQ line is cleared through serial polling, but serial polling will not clear the status byte until the error has been corrected.

5. General Precautions

5-A. Address Setting

A set of switches on the interface panel allows addressing other instruments on the GP-IB from address 0 to address 30. (Note that each instrument or piece of equipment must have its own address.)

In the accompanying diagram, sliding the switch ON represents 1; OFF represents 0. Thus, various combinations of A5 thru A1 produce the addresses shown below.



Address	A5	A4	A3	A2	A1	Address	A5	A4	A3	A2	A1	Address	A5	A4	A3	A2	A1
0	0	0	0	0	0	11	0	1	0	1	1	22	1	0	1	1	0
1	0	0	0	0	1	12	0	1	1	0	0	23	1	0	1	1	1
2	0	0	0	1	0	13	0	1	1	0	1	24	1	1	0	0	0
3	0	0	0	1	1	14	0	1	1	1	0	25	1	1	0	0	1
4	0	0	1	0	0	15	0	1	1	1	1	26	1	1	0	1	0
5	0	0	1	0	1	16	1	0	0	0	0	27	1	1	0	1	1
6	0	0	1	1	0	17	1	0	0	0	1	28	1	1	1	0	0
7	0	0	1	1	1	18	1	0	0	1	0	29	1	1	1	0	1
8	0	1	0	0	0	19	1	0	0	1	1	30	1	1	1	1	0
9	0	1	0	0	1	20	1	0	1	0	0						
10	0	1	0	1	0	21	1	0	1	0	1				(*)		

(*) When all switches are positioned ON (11111), this would be equivalent to the UNL command in the listener mode, and UNT command in the talker mode. This address is thus not used.

Note) Address switches should be positioned while power is ON, or the addresses can be made effective on receipt of a IFC command. Consequently, when an address change is made, either transmit a IFC command, or turn the power switch OFF, then back ON.

5-B. Operations for Switching From Remote to Local Mode

a) Immediately after switching from local to remote...

1. The panel settings will remain as set for local mode status.
2. Settings made in the local status cannot be output in the talker mode.

3. Panel switch operations other than the power switch are not effective in the remote mode.
4. Immediately after power ON, to place the instrument in the remote mode requires a command accompanying listener mode designation (SDC or GET (*) command), or transmitting an appropriate programming code.
When transmitting a DCL command, the instrument will not go into the remote status, and a DE (Device Error) will be produced.

(*) With GET command, F, R, and L cannot be set, and a SE (Setting Error) results.

b) Immediately after switching from remote to local...

1. The panel settings made in the remote mode remain set.

c) Switching from remote to local to remote.

1. Immediately upon entering the remote mode, the local setting status remains effective.
2. Since the setting status made in the remote mode immediately prior to entering local is stored in memory, even though setting changes are made in the local mode, when the unit is placed in the remote mode again, these settings will combine with those made (in the remote mode) previously.

Example: Unit in remote mode; F1R5D12000P1L2
(DC 100V range, -120.000V,
60mA output limit setting.)

Switch to local mode, and set: DC 10mA range, +5mA, 12V output limit.
(equal to F2R3D05000P0L1)

Switching to remote mode, R4D02000 the setting becomes:
F1R4D02000P1L2 (DC 10V range, -2V, 60mA output limit)

Note that it does not become:
F2R4D02000P0L1 (DC 100mA range, +20mA, 12V output limit)

5-C. Notes on the Delimiter

a) Talker mode

When data is transmitted in the talker mode, a (CR) (Carriage Return) and (LF) (Line Feed) command will follow the data. EOI drops low for (LF).

d) Listener mode

When data is received in the listener mode, basically there will be a break for processing of the data received in the two following cases.

A) When EOI is received.
B) When (LF) is received.

(CR) is not interpreted as one of the programming codes, but is used in the following five cases to determine whether EOI has dropped to a low level simultaneously, and to determine whether an (LF) will follow. This is required for proper delimiter operations.

(1) EOI (2) (CR) + EOI (3) (LF) only (4) (CR) (LF)
(5) (CR) (LF) + EOI

For (CR) only, and when LACS (Listener Active State) is disabled, a break will occur in the incoming data transmission for internal processing.

(*) When (LF) and (CR) are received in reverse sequence, the break in transmission will occur as soon as (LF) is received, leaving (CR) hanging on the bus. This may cause a lockup in the following handshake, so should be avoided.

5-D. Notes on Device Malfunction (7005)

When a device malfunction occurs, the operator will be notified through a SRQ signal. The following factors can be considered in locating the fault.

1. For voltage output, current limiting set too high.
2. For current output, voltage limiting set too high.
3. Power source voltage fluctuating over ±15%.
4. Heat sink temperature abnormally high.

When a device malfunction occurs, the panel display will show a flashing fault code in the display.

To stop the flashing, transmitting a "00" programming code, or a DCL or SDC command is required. Note however, that if the fault is not corrected, the SRQ will continue to be issued.

5-E. Miscellaneous

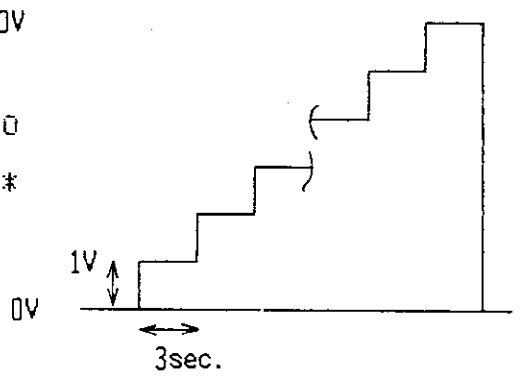
The panel memory function (7005) cannot be operated through the GP-IB interface.

6. Sample Program

The below program is written for use with a HP-85F controller.

Example 1: Set range to DC 10V, output limit to 6mA, and every three seconds, boost voltage in 1V steps from 0V to +10V. When +10V is reached, turn output OFF.

```
 10 CLEAR 701
 20 OUTPUT 701 ;"F1R4L0P001"
 30 FOR I=0 TO 10 STEP 1
 40 IF I=0 THEN D$="D00000" @ GO
    TO 70
 50 IF I<10 THEN D$="D0"&VAL$(I*
    1000) @ GOTO 70
 60 D$="D"&VAL$(I*1000)
 70 OUTPUT 701 ;D$
 80 WAIT 3000
 90 NEXT I
100 OUTPUT 701 ;"D00000000"
110 END
```



The above program lines are defined below.

10: Device initialization.
7 01
↑ ↑ Device address (1 in this case)
└ HP-85F's interface select code

20: Function set to F1 (DCV); range to R4 (10V); output limit to L0 (6mA); polarity to P0 (+); and output to O1 (ON). (Since initialization occurred in line 10, the present output setting is D00000.)

30: Specifies that the following steps are to be repeated in one step increments from 0 to 10.

40: Since the five spaces following the "D" data transmitted to 7005 must be filled with numerical digits, for 0V this will be "D00000".

50: A 1V step is equal to a setting value of 1000, hence when less than 10V, one 0 will follow "D", then four digits will follow.

60: When over 10V, multiplying by 1000 (one step) makes five digits, so only a "D" is required.

70: Output the setting value (7005).

80: Wait 3 seconds (3000msec).

90: As defined in line 30, repeat lines 40 thru 80 until

10V is reached.

100: When 10V is reached, set setting value to 0 and turn output OFF (O0).

Example 2: Using the available programming codes, make the various settings through keyboard input. If a setting error or device malfunction occurs, use SRQ to notify the operator.

```
 10 DIM A$[21]
 20 ON INTR 7 GOTO 160
 30 ENABLE INTR 7;8
 40 A0=1 @ A=A0+700 ! DEVICE ADD
    RESS
 50 DISP "SET FUNCTION:RANGE:LIM
    IT:POLARITY:OUTPUT:DATA ----
    --ex.F1R5L2P1O1D11999"
 60 INPUT M$
 70 OUTPUT A ;M$
 80 ! ANOTHER ROUTINE IS HERE!
 90 ENTER A ; A$ !
100 DISP A$ !
110 WAIT 3000 !
120 GOTO 50 !
130 END
140 !
150 !
160 STATUS 7,1 ; S
170 IF BIT(S,3)=0 THEN GOTO 220
180 P=SPOLL(A)
190 IF P=65 THEN GOTO 250
200 IF P=66 THEN GOTO 320
210 IF P=67 THEN GOTO 390
220 ENABLE INTR 7;8
230 GOTO 110
240 !
250 DISP "SETTING ERROR!!"
260 DISP "          SET AGAIN"
270 ENTER A ; A$
280 DISP A$
290 ENABLE INTR 7;8
300 GOTO 50
310 !
320 DISP "DEVICE ERROR!!"
330 DISP "      1:OVER CURRENT"
340 DISP "      2:OVER VOLTAGE"
350 DISP "      3:POWER LINE FAIL
    URE"
360 DISP "      4:OVER HEAT"
370 BEEP @ WAIT 100 @ GOTO 370
380 !
390 DISP "SETTING ERROR & DEVICE
     ERROR"
400 ENTER A ; A$
410 DISP A$
420 GOTO 330
430 END
```

-- Program Description --

10: Sets the character string length for data entry to 21 characters.

20: Specifies a jump to line 160 with an interrupt at the HP-85F interface card.

30: Sets SRQ as the effective interrupt in the HP-85F interface card's control register; and enables the interrupt.

40: Sets the device address. Here it is 1.

50: Instruction to diplay "SET FUNCTION: RANGE: LIMIT: POLARITY: OUTPUT: DATA --- ex. F1R5L2P101D11999"

60: Input from the keyboard the programming code character variables M$.

70: Output to device (A) the programming code (M$).

80 ∿ 120: These lines are used for programming connection of other devices to the bus, and for additional data processing. Here, line 90 calls for a setting status report (from 7005), calls for a CRT display (line 100), calls for a 3 sec. wait (line 110), and a jump to line 50 (line 120) to repeat the above process.

160: Enter the contents of the HP-85F interface card (code 7) and status register (code 1) as the numerical variable S.

170: If the third bit of S (indicating SRQ) is 0, jump to line 220.

180: If the third bit is 1, run a serial poll, and enter the status byte as numerical variable P.

190: If P is 65, then jump to line 250 to indicate a setting error.

200: If P is 66, then jump to line 320 to indicate a device error.

210: If P is 67, then jump to line 390 to indicate both a setting and device error.

220: When the cause of the interrupt is not an SRQ, or when the status byte is not 65, 66, or 67, enable another interrupt. Jump to line 110 (line 230).

250 300: Indicate setting error (line 250); instruct operator to correct setting (line 260).
Enter the setting status (line 270) and display it (line 280); enable another interrupt (line 290), and jump to line 50 (line 300).

320 ∿ 370: Display the fact that a device error has ocurred (line 320), display four possible causes (line 330 thru

360). Call for beeping alarm (line 370).

390 ∿ 420: Display the fact that both a setting and device error has occurred (line 390), enter the setting status (line 400) and display it (line 410). Jump to line 330 (line 420).

The following program is for use with the NEC PC-8001. It is essentially the same (operationally) as the program on the previous page.

PC-8001
SAMPLE 1

```
1  REM '7005'
2  DEFUSR0=&H6000
3  A=USR0(1)
4  ISET IFC
5  ISET REN
10 WBYTE &H3F,&H21,&H4;
20 PRINT@1;'F1R4L0P001'
30 FOR I=0 TO 10 STEP 1
40 IF I=0 THEN D$='D00000':GOTO 70
50  IF I<10 THEN D$='D0'+RIGHT$(STR$(I*1000),4):GOTO 70
60  D$='D'+RIGHT$(STR$(I*1000),5)
70  PRINT@1;D$
80  FOR J=0 TO1800:NEXT J
90  NEXT I
100 PRINT@1;'D0000000'
110 END
```

SAMPLE 2

```
1  REM '7005'
2  DEFUSR0=&H6000
3  A=USR0(1)
4  ISET IFC
5  ISET REN
10 DIM A$(13),B$(8)
20 ON SRQ GOSUB 160
30 SRQ ENABLE
40 A=1
50 PRINT'SET FUNCTION:RANGE:LIMIT:POLARITY:OUTPUT:DATA ------ex.F1R5L2P101D11999
'
60 INPUT M$
70 PRINT@A;M$
80 REM ! ANOTHER ROUTINE IS HERE !
90 INPUT@A;A$,B$
100 PRINT A$;',';B$
110 FOR J=0 TO1800:NEXT J
120 GOTO50
130 END
140 REM
150 REM
160 REM
170 REM
180 POLL A,P
190 IF P=65 THEN GOTO 250
200 IF P=66 THEN GOTO 320
210 IF P=67 THEN GOTO 390
220 SRQ ENABLE
230 RETURN
240 REM
250 PRINT'SETTING ERROR!!'
260 PRINT'         SET AGAIN'
270 INPUT@A;A$,B$
280 PRINT A$;',';B$
290 SRQ ENABLE
300 RETURN
310 REM
320 PRINT'DEVICE ERROR!!'
330 PRINT'      1:OVER CURRENT'
340 PRINT'      2:OVER VOLTAGE'
350 PRINT'      3:POWER LINE FAILURE'
360 PRINT'      4:OVER HEAT'
370 BEEP:SRQ ENABLE:RETURN
380 REM
390 PRINT'SETTING ERROR & DEVICE ERROR'
400 INPUT@A;A$,B$
410 PRINT A$;',';B$
420 GOTO330
430 END
```

HIOKI E.E. CORPORATION

P.O. Box1, Sakaki, Nagano, 389-06, JAPAN

TEL. 0268-82-3030 Fax. 0268-82-3215

7005E-89E-003U Printed in Japan