DUAL CHANNEL
PROGRAMMABLE FILTER

3624/3625

OPERATION & GPIB MANUAL

NF Corporation

D : 504711

OPERATION
FOR
3624/3625
DUAL-CHANNEL
PROGRAMMABLE FILTER

NF CORPORATION

1. General

This chapter mainly explains the operation on the panel. Refer to "Fig. 1-4 3624 Front/Rear panel" and Fig. 1-5 3625 Front/Rear panel".

The numbers ① to ㉔ are put on the panel figure. The numbers are quoted in the text of explanation. All settings backed up by the battery. The previous contents are set as they are when the power is on.

1.2 Each nomenclature and function

1.2.1 Front panel explanation

① FUNCTION: FUNCTION key

This is the key to select filter function. The filter functions vary as below whenever this key is pressed.

→ BEF → BPF → HPF → LP— PL→ LP— MF→ BEF →

Detail➡ "Refer to "1.7.2 Function setting".

② RANGE HOLD: RANGE HOLD lamp

This lamp is lighted when the range alteration of cutoff frequency is inhibited.

③ THRU: THRU key

This is the key to select if input signal is output without passing through the filter. Output the input without passing through the filter when THRU lamp is lighted. At this time FUNCTION lamp is put off and the cutoff frequency can not be altered even if " ㉔ MODIFY" dial is turned. Output the input signal passing through the filter when THRU lamp is put off. For cancelation of THRU, press THRU key once more or " ① FUNCTION" key. THRU is changed as below whenever this key is pressed.

→ Lighted(THRU)→ Put off →Lighted(THRU) →

④ x0.6(3624)/x0.5(3625):----

The lamp is lighted when the filter FUNCTION is set to

LP-PL. The 0.6(3624) or 0.5(3625) time of " ⑤ Numerical indicator" value is the frequency of the point attenuated by 3dB at LP-PL.

Refer to "1.7.2 FUNCTION set.

⑤ ____: Numerical indicator

Shows cutoff (center) frequency or GPIB addresss and delimiter. The cutoff (cetner) frequency can be read directly with "⑥ Unit indication lamp" when the frequency is indicated.

⑥ ____: Unit indication lamp

The lighted lamp shows the units of "⑤ Numerical indicator". The unit indication lamp of both channels is put off when GPIB address and delimiter are indicated.

⑦ GAIN INPUT: GAIN INPUT key

This is the key to select the gain of input amplifier. The lighted GAIN INPUT lamp shows the gain of input amplifier varies as below whenever this key is pressed.

→X1 →X2 →X5 →X1

When the MODE is set to CASCADE, GAIN INPUT lamp of CH-B is put off making the operation of this key at the same channel invalid.

⑧ GAIN OUTPUT: GAIN OUTPUT key

This is the key to select the gain of output amplifier. The lighted GAIN OUTPUT lamp shows the gain of output amplifier. The gain of output amplifier varies as below whenever this key is pressed.

→X1 →X2 →X5 →X1 →

When the MODE is set to CASCADE, GAIN OUTPUT lamp of CH-B is put off making the operation of this key at the same channel invalid.

⑨ MODE: MODE key

This is the key to select the mode. The lighted MODE lamp shows the MODE. When SEPARATE lamp is lighted, each of

CH-A and CH-B operates independently.

When the CASCADE lamp is lighted, cascade CH-A and CH-B. At this time, input connector of CH-A and output connector of CH-B is valid. The output from output connector of CH-A is invalid, and OUTPUT lamp is put off. The input lamp of CH-B is also put off in the same way. Whenever this key is pressed, MODE is changed as follows:

→ SEPARATE → CASCADE → SEPARATE →

Note: Refer to "1.7.1 Mode setting" for the details.

⑩ INPUT: INPUT key

This is the key to select input BNC connector. The input from input BNC connector on the front panel is valid. When REAR lamp is lighted, input from input BNC connector on the rear panel is valid. At this time, input to input connector on the front panel of CH-A and CH-B is invalid, and INPUT lamp is put off. Whenever this key is pressed, INPUT is changed as follows:

→ FRONT → REAR → FRONT →

⑪ RANGE HOLD: RANGE HOLD key

This is the key to select if the range alteration of cutoff (center) frequency should be inhibited. When the RANGE HOLD lamp is lighted, inhibit (range hold on) range alteration. When Hold LAMP IS put off, range alteration (range hold off) is possible. Whenever this key is pressed, RANGE HOLD is changed as follows:

→ ON → OFF → ON →

Note: Refer to "1.7.4 Cutoff (center) frequency setting".

⑫ COUPLED: COUPLED key

This is the key if the cutoff (center) frequency of CH-A and CH-B should be changed keeping a constant difference. When COUPLE lamp is lighted, set (couple off) the cutoff (center) frequency of CH-A and CH-B independently. Whenever this key is pressed, COUPLE is changed as follows:

→ ON(lighted) → OFF(put off) → ON(lighted) →

Note: Refer to "1.7.4 Cutoff (center) frequency setting"

⑬ LOCK: LOCK key

This is the key to inhibit operation on the panel. The operation on the panel except this key is inhibited (key lock off). When LOCK lamp is put off, all operations on the panel are are possible (key lock off). Whenever this key is pressed, LOCK is changed as follows:

→ ON → OFF → ON →

Also, when the cutoff (center) frequency is indicated on ⑤ Number indicator, number ON/OFF showing cursur location stops making LOCK to ON.

Note: refer to "1.7.2 Function setting".

⑭ REMOTE: REMOTE lamp

When remote control is made by GPIB, this lamp is lighted. The key operation except " ⑮ ADDRESS/LOCAL" key is inhibited in REMOTE status.

⑮ ADRS/LOCAL: ADDRESS/LOCAL key

The role of this key depends on the status of the unit.

❶ In LOCAL status

This is the key to select if cutoff (center) frequency or GPIB address and delimiter should be indicated on "⑤ Numerical indicator.

When the description of "Adr" is given on the Numerical indicator of CH-A, indication should be given by dividing GPIB address and delimiter in a decimal point on the Numerical indicator of CH-B. Indicate address on the left of the decimal point and delimiter on the right. Otherwise, indicate each cutoff (center) frequency on the numerical indicator of CH-A and CH-B. When this key is pressed, the indication of Numerical indicator is changed as follows:

→ GPIB address → Cutoff (center) frequency → GPIB

address →

- In Remote status

  This is the key to make a local status to be operated on the panel from remote control by GPIB.

  When this key is pressed in remote status, local status is obtained, and " ⑭ REMOTE" lamp is put off.

  However, when the setting is in local lock-out, local status is not be obtained even if this key is pressed.

⑯ INPUT: INPUT lamp

The lamp is lighted when the input to input BNC connector on the front panel is valid.

⑰ INPUT: Input BNC connector

The specification of input impedance is 1M Ω ± 2% with parallel capacity of 70pF or less.

The maximum input voltage is ± 10V with non-destructive maximum voltage of ± 100V. If more voltage exceeding this voltage is applied, the instrument may be damaged.

Special care should be noted.

⑱ FLOAT: FLOAT switch

This is the switch to select if "⑰ INPUT" is differential input. When the switch is set upward, differential input is obtained, while single-ended input is made in case of setting downward.

Note: Refer to "1.5 Signal ground".

⑲ ZERO: DC offset adjuster

This is dc offset adjuster of output.

⑳ OVER: OVER lamp

This is the lamp to be lighted when input and output amplifiers are saturated. The OVER lamp is lighted up for about a second when OVER occurs. Then, it keeps lighting until over status is canceled when OVER remains occurred. Adjust the amplitude of input signal and gain of input/output amplifiers so that this lamp may not turn

on and off.

㉑ OUTPUT: OUTPUT lamp

This lamp is lighted up when the output from output BNC connector on the front panel is valid. The lamp of CH-A goes out when "⑨ MODE" is set to CASCADE.

㉒ OUTPUT: Output BNC connector

This is the output BNC connector on the front panel. The output impedance is 50 Ω ± 2%. The maximum output voltage is ± 10V, and maximum output current is ± 100mA in total of front and rear panels. The minimum load resistance is 50 Ω at the maximum output voltage (± 10V). At this time ± 5V is output at both ends of load. When connecting load of low impedance to the output BNC connector, take notice that there is a gain error. The output connector of front and rear panels is connected in parallel enabling a simultaneous use. It will be convenient in use of main output for one side and monitor for another one.

㉓ CURSOR: CURSOR key

The role of this key depends on the status of this instrument.

- By the time when this instrument is lighted in full after the power is on.

  Set this instrument to an initial value by pressing CH-A/CH-B keys.

  Initial value: Refer to 1.6 Startup

- After the instrument is lighted in full

  This is the key to select the figure (cursor) to change "㉔ MODIFY" dial setting. The cursor moves to the left when ◀ key is pressed, while to the right when ▶ key is pressed.

  When indicating the cutoff (center) frequency on the numerical indicator, the cursor moves to the point

of the unit indicating lamp. When indicating the cutoff (center) frequency, the cursor moves to another channel by presssing CH-A/CH-B keys. When GPIB address and delimiter are indicated, CH-A/CH-B keys are invalid. There are several methods as below for cursor indication.

- When there is an indication on a certain digit of cursor. ➡ Indicate turning on and off the digit.
- When there is no indication ➡ Indicate turning on and off "_".
- When there is a digit to change the setting on the unit indicating lamp about the cursor, indicate turning on and off the unit indicating lamp.

The turning on and off the cursor can be put off by making LOCK on with " ⑬ LOCK" key.

㉔ FREQUENCY: MODIFY dial

This is the dial for the change of setting value about the cutoff (center) frequency, GPIB address and delimiter. The setting value varies by only 20 for one revolution. The setting value increases by turning clockwise, while it decreasess for a counterclockwise turn.

㉕ POWER: Power switch

This is the switch to turn on/off the main source. The power is applied when the switch is pressed upward.

1.2.2. Rear panel explanation

The explanation is given below about each nomenclature and function on the rear panel.

㉖ INPUT: Input BNC connector

This is the input BNC connector on the rear panel. The input impedance is 1M Ω ± 2%, and the parallel capacitance

is 80pF or lower. The maximum allowable input voltage is ± 10V, and ± 100V can be withstood without sustaining damage. Take notice that the voltage in excess of this limit can cause damage. The input BNC connector on the front and rear panels can be selected with "⑩ INPUT" key.

㉗ FLOAT: FLOAT switch

This is the switch to select if "㉖ INPUT" should be applied as differential input. The differential amplifier is given when the switch is pressed upward, while single-ended input is made for downward press.

Detail: Refer to 1.5 Signal ground.

㉘ _____: Name plate

The serial No. is described. For repairs, this number is also required. The maximum consumption power is also described.

㉙ OUTPUT: Output connector

This is the output connector on the rear panel. The output impedance is 50Ω ± 2%. The maximum output voltage is ± 10V, and the maximum output current is ± 100mA in total of the front and rear panels. The output connectors on the front and rear panels are connected in parallel.

㉚ ——: Air intake

This is the air intake for the cooling fan. Be sure to leave a 10-cm clearance behind this intake. The filter should be cleaned regularly so that it may not be clogged.

WARNING

The air filter should be attached or removed after the power is off.

㉛ LINE 48-62Hz: Power input connector and fuse

The power cable of the 3624/3625 is connected here. The power cable should be inserted securely so that it is not allowed to be pulled out. The fuse holder is under the connector. To remove the fuse, turn the cap with a Philips type driver in the state of power cord removed.

㉜ ——: Ground terminal

This ground terminal is connected here. It should be grounded as a safety measure both with respect to operating personnel and to prevent the effects of external noise.

㉝ VOLTAGE SELECTOR: Line voltage selector

This line voltage selector is used to select the voltage of the power line to be used. Be sure to replace the fuse with one of capacity adaptable for the line voltage.

WARNING

Do not select the line voltage while the power cord is put to the connector to avoid the damage. Be sure to use the fuse specified so that the damage or fire may not occur.

㉞ GPIB: GPIB connector

This is a 24-pin connector for GPIB connection.

1.3 Input connection

Connect the attached signal cable to the input connectior. The input on the front and rear is switchable. The input amplifier is switchable with single-ended(⏚)/differential (FLOAT). Press "⑩ INPUT" key for the selection of input on the front and rear. Whenever the key is pressed, the FRONT and REAR are selected with the corresponding lamp lighted. For the selection of Single-ended and Differential, use the switches of "⑱ FLOAT" on the front input or "㉗ FLOAT" on the rear input. This selection is not available for GPIB. The input impedance is 1M Ω paraliel, 70pF or lower for the front input. The cable capacity connected to the input and input capacity of 3624/3625 are added, making the load of the instrument connected to the input (coaxial cable has a capacity of about 100pF per meter). When this capacity is larger, the operation of the instrument connected to the input causes an unstable condition, or the frequency of characteristic in the higher ranges may be deteriorated. Try to shorten the input wiring.
When the coaxial cable of 1M is used, the input impedance for the signal frequency at 1kHz is about 620k Ω and about 79kΩ at 10k Ω as the input capacity is about 200pf and the input resistance is 1M Ω .

1.4 Output connection

The output of the 3624/3625 is unbalanced, and the output

characteristics are as follows:

Output impedance	50Ω ± 2%
Rated output voltage	± 10V
Maximum output current	± 100mA

The passband gain is specified for the no-load condition. The output voltage in the no-load contion ($\pm E_o$), minimum load resistance (R_L), and output voltage ($\pm E_R$) developed across R are related as follows:

$R_L = (E_o / 0.1) - 50 = 10(E_o - 5)$

$E_R = (E_o \times R_L / R_L + 50)$

The output circuit of the 3624/3625 is shown in Fig. 1-2. The output terminals on the front and rear panels are connected in parallel. When 2 or more termianls are used simultaneously, take notice that the output current may not exceed maximum current.
When the MODE is set to CASCADE, the CH-A input connector and CH-B output connector are used.

NOTE

When the signal is applied from the outside to the output terminal, the internal circuit is damaged. Never apply signal.

1.5 Signal ground

The signal ground of each channel is insulated from the case independently like "Fig. 1-3 Signal ground". The insulating impedance to the case of each ground is 1M Ω parallel, 5700pF and the insulating pressure resisting is 150Vpk,

100Hz or lower at the standard value. When more voltage is is applied, the internal balista will be in a conductive condition protecting the internal circuit. Take notice that the balista will be burned making a permanent conductive condition when the voltage added is large, continuous frequency is high, and the loss of balista exceeds allowable value.

WARNING

Do not apply an excessive voltage between the signal ground and chassis. The excessive voltage applied may cause a fire on the 3624/3625.

CAUTION

The signal ground between CH-A and CH-B is connected in the inside when the 3624/3625 is set to CASCADE. Do not set the instrument to CASCADE in a condition that each different voltage between the chassis is applied to CH-A and CH-B.

1.6 Startup

(1) Press the top of the power switch to power the unit on.

(2) When the power is applied, perform ROM check and RAM check as well as check of battery backed up data. The same setting as the last power-off is obtained for normal condition.

If there is a possible error when the power is applied, the following messages are displayed.

Er.1....This message appears when a checksum error occurs in ROM data.

Er.2....This message appears when Reading and Writing of RAM data are not available.

Er.3....This message appears when there is an error on the parameter of the battery backed up data in RAM.

When "Er.1 or Er.2" is displayed, the 3624/3625 is not usable. Contact the manufacturer or its distributor. When Er.3 is displayed, press either key on the front panel to set the unit to the initial value. The initial value is as follows:

CH-A	FUNCTION	LP-MF
	THRU	OFF
	CUTOFF (CENTER) FREQUENCY	159.9kHz
	RANGE HOLD	OFF
	GAIN INPUT	X1
	GAIN OUTPUT	X1
CH-B	FUNCTION	LP-MF
	THRU	OFF
	CUTOFF (CENTER) FREQUENCY	159.9kHz
	RANGE HOLD	OFF
	GAIN INPUT	X1
	GAIN OUTPUT	X1
	MODE	SEPARATE
	INPUT	FRONT
	COUPLED	OFF
	LOCK	OFF
	GPIB ADDRESS	2
	DELIMITER	CR/LF, E01 are sent out simultaneously

The battery backup time on a fully charged battery will depend somewhat on the ambient temperature but is generally approximately 60 days. Approximately 100 hours

of powered operation is required to fully charge a fully discharged battery. When the battery deteriorates, however, the backup time will shorten. If this becomes impractically short, the battery must be replaced by the manufacturer (at a charge).

1.7 Operation

1.7.1 Mode setting

Whenever " ⑨ key is pressed, the MODE is changed like SEPARATE ⟷ .

(1) SEPARATE

In this mode, CH-A and CH-B operate as independent filters.

(2) CASCADE

In this mode, CH-A and CH-B are connected in cascade. The input signal is applied to the input BNC connector of CH-A, and the output signal is obtained from the output BNC connector of CH-B. In this mode, the CH-A GAIN OUTPUT and CH-B GAIN INPUT settings are invalid. If the CH-A and CH-B FUNCTION and FREQUENCY are set the same, the attenuation slope will be 48dB/oct for the 3621 and 96dB/oct for the 3622. However, the attenuation at the cutoff frequency will be 6dB (for FUNCTION in the LT-MF and HPF modes).
However, the attenuation at the cutoff frequency will be 6dB (in the LT-MF and HPF modes). While the attenuation slope becomes sharp, the maximum attenuation is determined by the noise level. Compared to a single channel only (SEPARATE), the noise level is multiplied by apprximately $\sqrt{2}$.
If the FUNCTION of one channel is set to LP-MF, and that of the other channel is set to HPF, and the lowpass

filter cutoff frequency is set higher than the highpass filter frequency, it is possible to configure a bandpass a bandpass filter with any desired bandwidth.
When the cutoff frequency of both channels are set to the same frequency to obtain the narrowest possible bandwidth, the gain at the center frequency is an approximate attenuation of 6dB (LP-MF and HPF modes).
The center frequency of the bandpass filter (f_o) is defined as the point at which they phase difference between the input and the output is 0°. The cutoff frequency for a lowpass or highpass filter (f_{CL} and f_{CH}) and center center frequency (f_o) are related as follows:

$$f_o = \sqrt{f_{CL} \times f_{CH}}$$

f_{CL} : lowpass filter cutoff frequency
f_{CH} : highpass filter cutoff frequency

NOTE

In the "CASCADE" mode, the signal passing through the CH-A filtler is available at the CH-A output connectior. Also, in "CASCADE", the signal grounds of CH-A and CH-B are connected in the inside.
When the electric potential of signal ground differs in CH-A and CH-B, do not make "CASCADE" setting to avoid an excessive current.

1.7.2 FUNCTION settings

The filters for CH-A and CH-B can be set to the following functions independently. When "① FUNCTION" key is pressed, the FUNCTION is changed like → BEF → BPF → HPF → LP—PL→ LP —MF→ BEF →.

(1) LP-MF: Lowpass filter (maximum flatness)

This is a filter which has minimum attenuation within the passband. Since the delay time is not constant, when a squarewave is input, overshoot occurs. If squarewave response is important, the phase-linear filter described below should be used.

(2) LP-PL: Lowpass filter (phase-linear)

Compared to the maximum-flatness filter, this filter has smoother attenuation characteristics but constant delay time, so that a good squarewave response with little overshoot is obtained.

When LP-PL is selected the attenuation at the set cutoff frequency is approximately 8.4dB for the 3624 and approximately 15.3dB for the 3625. The 3dB attenuation point frequency is about 0.6-fold frequency of setting frequency for 3624 and about 0.5-fold for 3625.

At the LP-PL, the lamp of x0.6 (3624) or x0.5 (3625) is lighted on the front panel.

(3) HPF: Highpass filter (max flatness)

This is the filtler with the quantity of minimum attenuation in the passband.

(4) BPF: Banddpass filter (2nd order for 3624 and and 3rd-order for 3625)
The bandwidth is 1/3 octave (JIS C-1513 Ⅱ type for 3624 and JIS C-1513 Ⅲ type).

(5) BEF: Band elimination (1st-order)
Selectivity: 4.3 for Q

1.7.3 THRU setting

In this mode, the input and output amplifiers are directly connected without passing through a filter, so that the 3621/3622 operates as a variable-gain buffer amplifier. In addition, this setting can be used when the input signal is monitored directly. When "③ THRU" key is pressed, FUNCTION lamp is put out and THRU lamp is lighted. One more press is restored to the original FUNCTION.

1.7.4 Cutoff (center) frequency setting

(1) General

The frequency of 3624/3625 is covered by 5 ranges of 0.01Hz to 159.9kHz. The setting can be made in the range of 1 to 1599. However, the range is normally changed to the point automatically where the setting digit becomes maximum.

Refer to (3) RANGE HOLD.

(2) Setting method

The setting of cutoff (center) frequency is made with "㉓ CURSOR" key and "㉔ MODIFY" dial. The CH-A/CH-B, ◀,▶ keys specify the channel and digit to change the numerical value, and change the setting by turning MODIFY dial. The digit which can change the numerical value is displayed by numbers or turning on/off of "__" called CURSOR. There is the cursor in any digit of either channel of CH-A or Ch-B in the condition (refer to "⑮

ADDRESS/LOCAL" key) which displays cutoff (center) frequency at "⑤ Numerical indicator.

When moving the CURSOR, press CH-A/CH-B key if it is between CH-A and CH-B, while press ◀, ▶ key if it is within the numerical indicator.

When ▶ key is pressed repeatedly, the CURSOR moves to the right further from the first right digit of the numerical indicator to light up the unit indicating lamp. When the MODIFY dial is turned in this condition, all numerical values will be changed to 10 or 0.1 times. Also, the CURSOR indication (numerical turning on/off) can be stopped by making LOCK status.

(3) RANGE HOLD

When the frequency setting of 3624/3625 is made including a change of range scope, continuous change is possible from 0.01Hz to 159.9kHz by changing the range automatically. At the moment range is changed, an internal relay relay operates, so that the output signal will become temporarily unstable. For continuous settings that straddle ranges (e.g., 1599Hx to 1.60kHz), monotonous increase of frequency is not always guaranteed.

To avoid such a matter, the range hold can be set to on, and prevent an autoranging change. When the range hold is set to on, the setting range of the cutoff (center) frequency should be within the range (1 to 1599).

When the RANGE HOLD is desired to be on, press "⑪ RANGE HOLD" key. The RANGE HOLD key is designed to enable an individual setting of both channels with one key. It is valid to the channel of the CURSOR. Select the channel which sets the RANGE HOLD with " ㉓ CH-A/CH-B" key and then press the RANGE HOLD key. Whenever the RANGE HOLD key is pressed, on/off is changed by displaying " ② RANGE HOLD" lamp lighted in the case of on.

(4) COUPLED

In a normal condition, the cutoff (center) frequency of CH-A and CH-B can be set independently. The setting of both channels can also be set simultaneously by setting COUPLED to on.

Whenever "⑫ COUPLED" key is pressed, on/off is changed to light up COUPLED lamp in the case of on. If COUPLED is set to on and the cutoff (center) frequency of CH-A or CH-B is changed, another setting is also changed simultaneously so that the difference of cutoff (center) frequency in both channels may be constant. At this time, count fractions of 5 and over as a unit and disregard the rest for the value which does not satisfy the resolution of cutoff (center) frequency. This is a convenient capability in configuring a bandpass filter of constant bandwidth by setting MODE to "CASCADE" or for use in the same setting in both channels.

1.7.5 Gain setting

The 3624/3625 enables independent gain settings for the input and output amplifiers. Whenever "⑦ GAIN INPUT" and "⑧ GAIN OUTPUT" keys are pressed, the setting is changed like → X1 → X2 → X5. The input amplifier gain should be made as large as possible without causing the overload lamp to light, in order to provide as large as possible an input signal to the filter and therby obtain a good S/N ratio. The point at which the overload lamps light for both input and output is 110%± 10% (DC to 300kHz) of maximum voltage.

1.7.6 Input selection

The input connector of 3624/3625 is switchable on the front and rear panels. Whenever "⑩ INPUT" key is pressed, the input is changed like FRONT ← → REAR.

NOTE: Even though signal is applied to the input connector which is not selected, there is no trouble about the operation. However, there is a possibility that high signal frequency and large amplitude may occur. Do not apply the signal which is not selected to the input connector.

1.7.7 Cutoff (center) frequency and filter function selection

(1) Lowpass filter and highpass filter

For a simple use like elimination of unnecessary signals in case of normal lowpass and highpass filters, select the cutoff frequency between the signal components which are required and unnecessary. Refer to Data 1.

When the frequencies of required and unnecessary signals are close, 2-fold attenuation slope is available by by setting the highpass or lowpass filters to CASCADE. Refer to Data 2.

If there is a problem, two (2) selections of cutoff frequency are considered when CASCADE is not available.

The frist one is the case in which the attenuation quantity of required signals is desired to be lessened. At this time select the cutoff frequency so that the signal frequency may be located in the filter passband. In this case some unnecessary signals remain uncollapsed. Refer to Data 3.

The second one is the case in which the attenuation quantity of unnecessary signals is desired to be larger. At this time select the cutoff frequency so that the components of unnecessary signals may be located at the attenuation characteristics. In this case the required signals are also attenuated to some extent. Refer to Data 4.

(2) Bandpass filter

The bandpass filter is the one to pass through some specific frequency components only among unnecessary signals. The center frequency should be the same as the components required. Refer to Data 5.

The attenuation slope can be doubled by setting the bandpass filter to CASCADE like the lowpass filter.

(3) Band elimination filter

The band elimination filter is the one to pass through some specific frequency components only. The center frequency should be the same as unnecessary components. Refer to Data 6.

When the band elimination filter is set to CASCADE, attenuation quantity in the center frequency can be larger. However, attenuation quantity should be the largest by fine adjustment in the center frequency because of the setting error.

(4) Combination of each filter in CASCADE

It is already described that the same filters are used in CASCADE. Several applications are available by cascading different filter functions as shown in Data 7, 8 and 9.

1.8 DC offset voltage adjustment

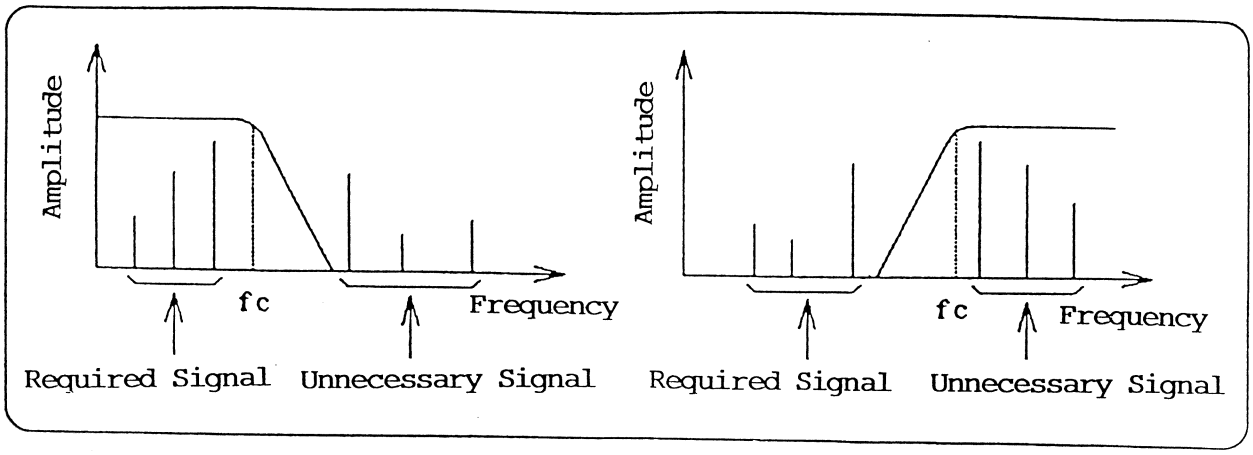
Wide variation in ambient temperature can cause problems with DC offset. If this occurs, adjust the offset adjuster "⑲ ZERO" on the front panel, follwing the procedure described below. This offset adjustment should be performed only after allowing at least one hour of warmup.

(1) Set up the 3624/3625 for actual operation.

(2) Short the input BNC connector and do not apply DC voltage to the input.

(3) Use a small screwdriver to turn the DC offset adjuster "⑲ ZERO" on the front panel so that the output is 0V.

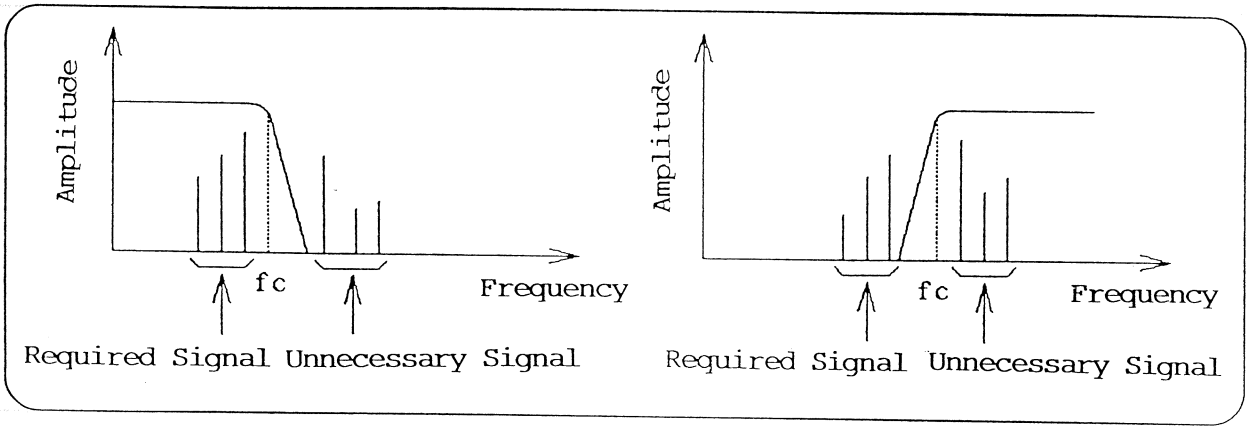
Data 1



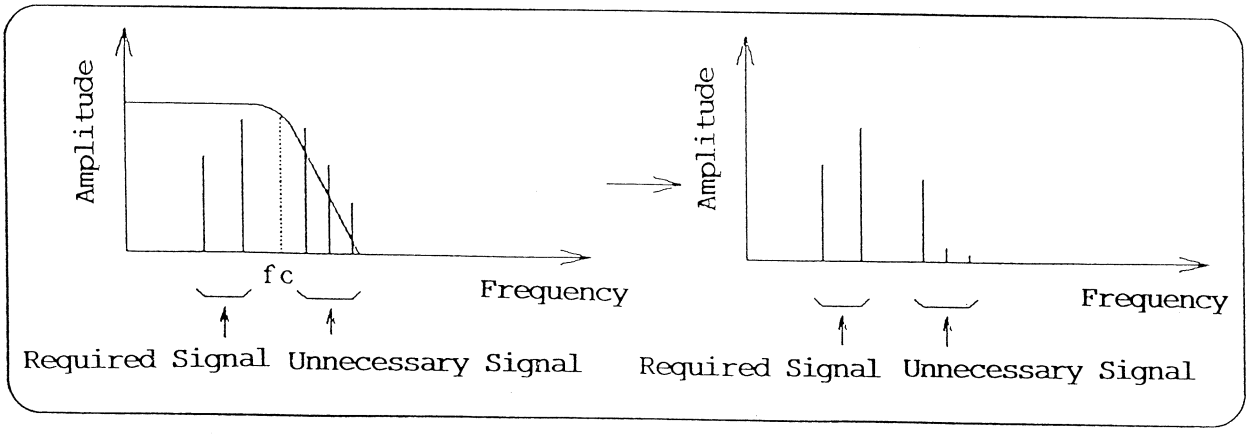
Lowpass Filter

Highpass Filter

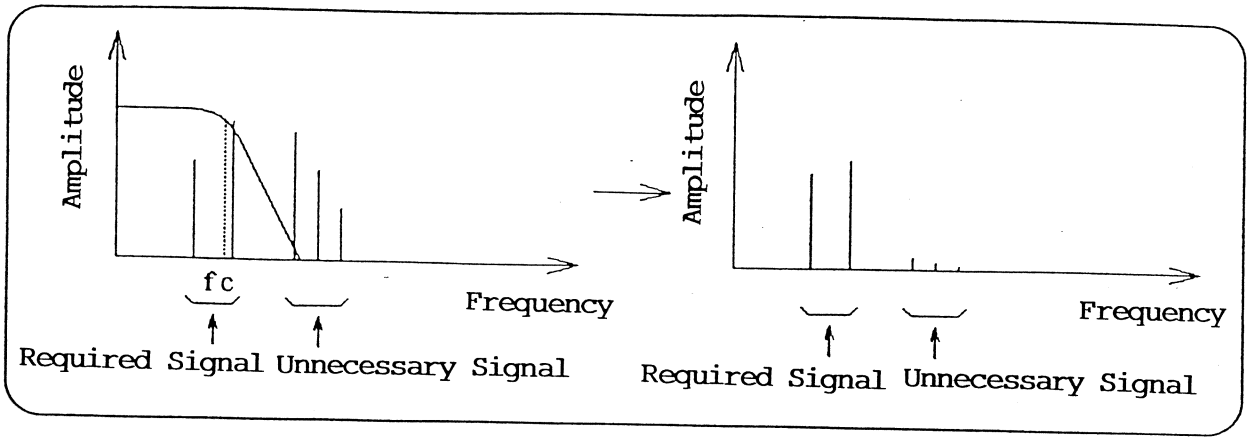
Data 2



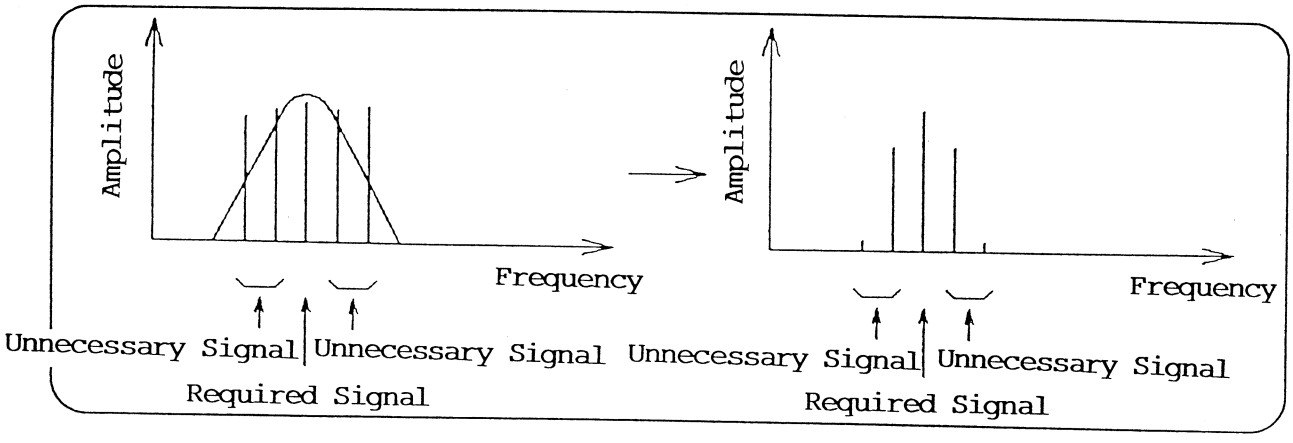
Data 3



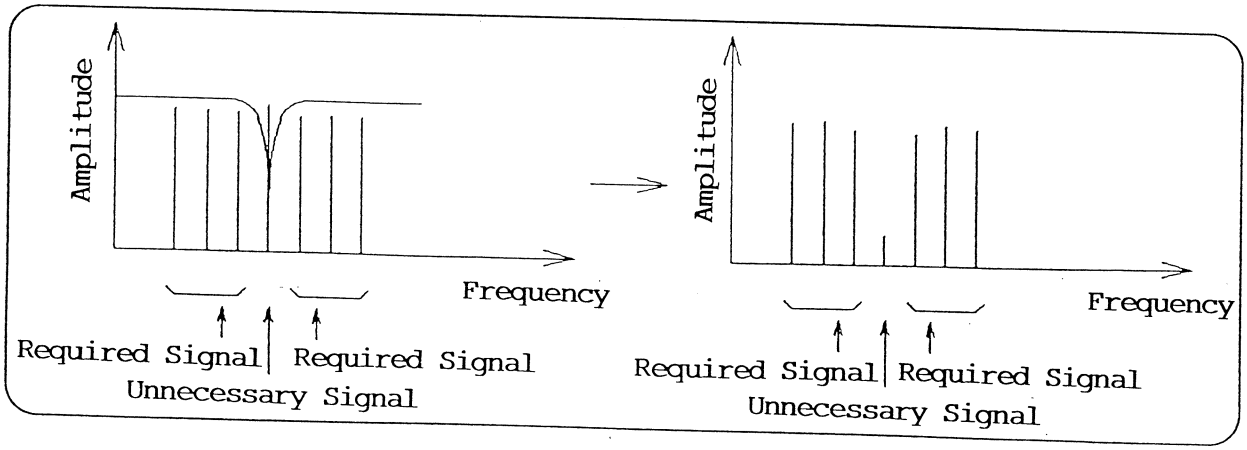
Data 4



Data 5

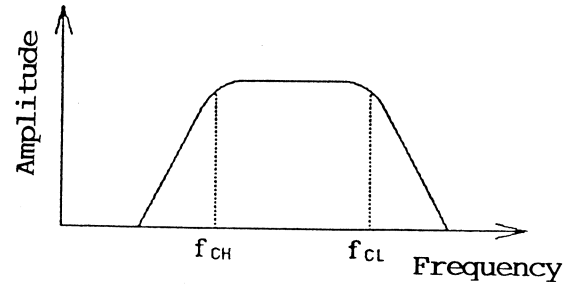


Data 6



Data 7

Lowpass Filter + Highpass Filter

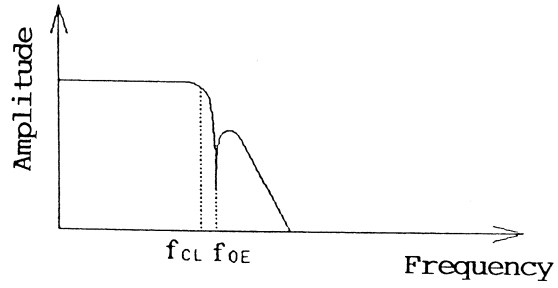


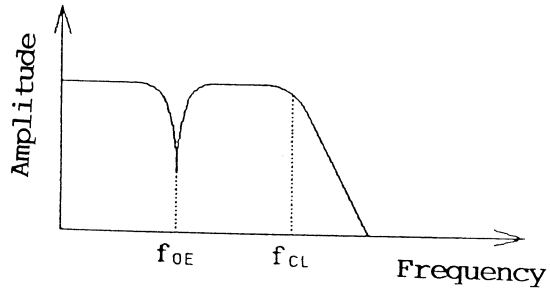
f_{CH} : Cutoff Frequency for Highpass Filter

f_{CL} : Cutoff Frequency for Lowpass Filter

Data 8

Lowpass(Highpass) Filter + Band Elimination Filter



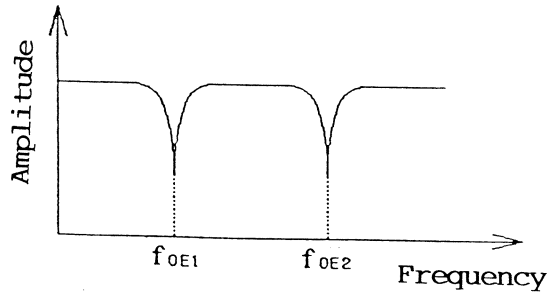


f_{CL} : Cutoff Frequency for Lowpass Filter

f_{OE} : Center Frequency for Band Elimination Filter

Data 9

Band Elimination Filter + Band Elimination Filter



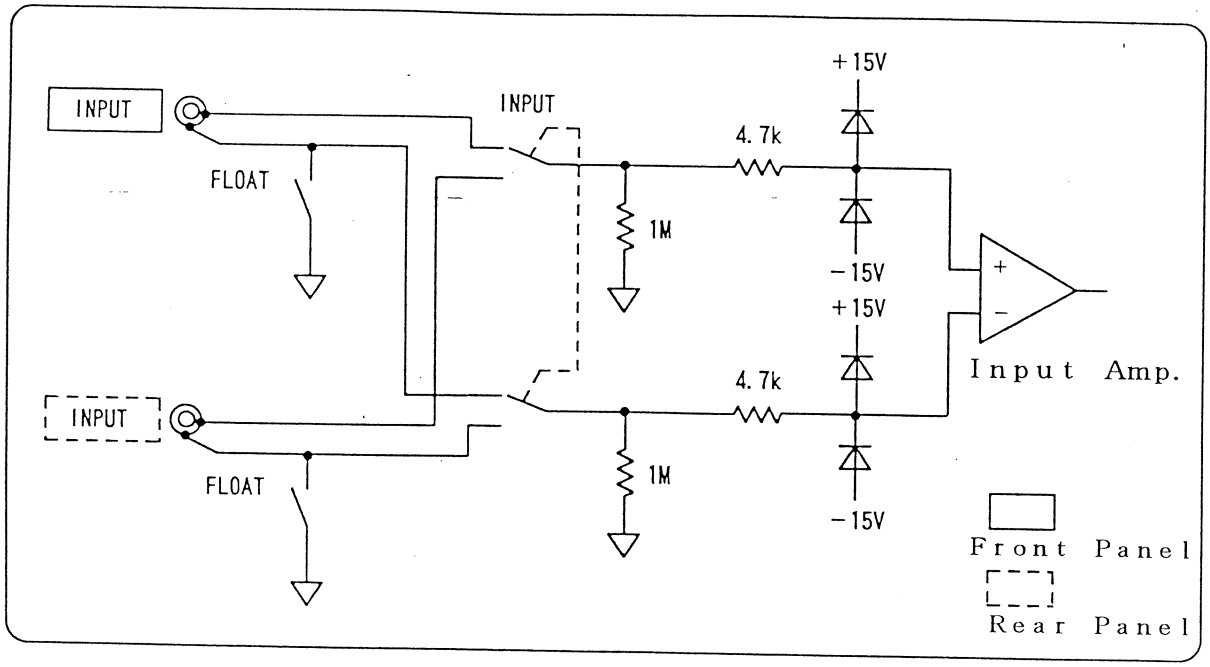


Fig. 1−1 Input Circuit

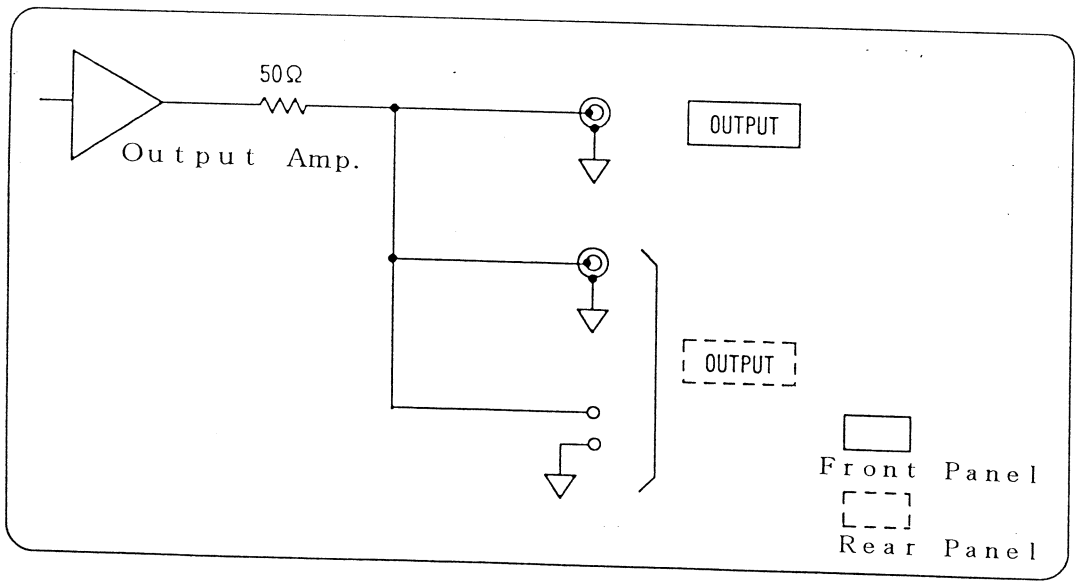


Fig. 1−2 Output Circuit

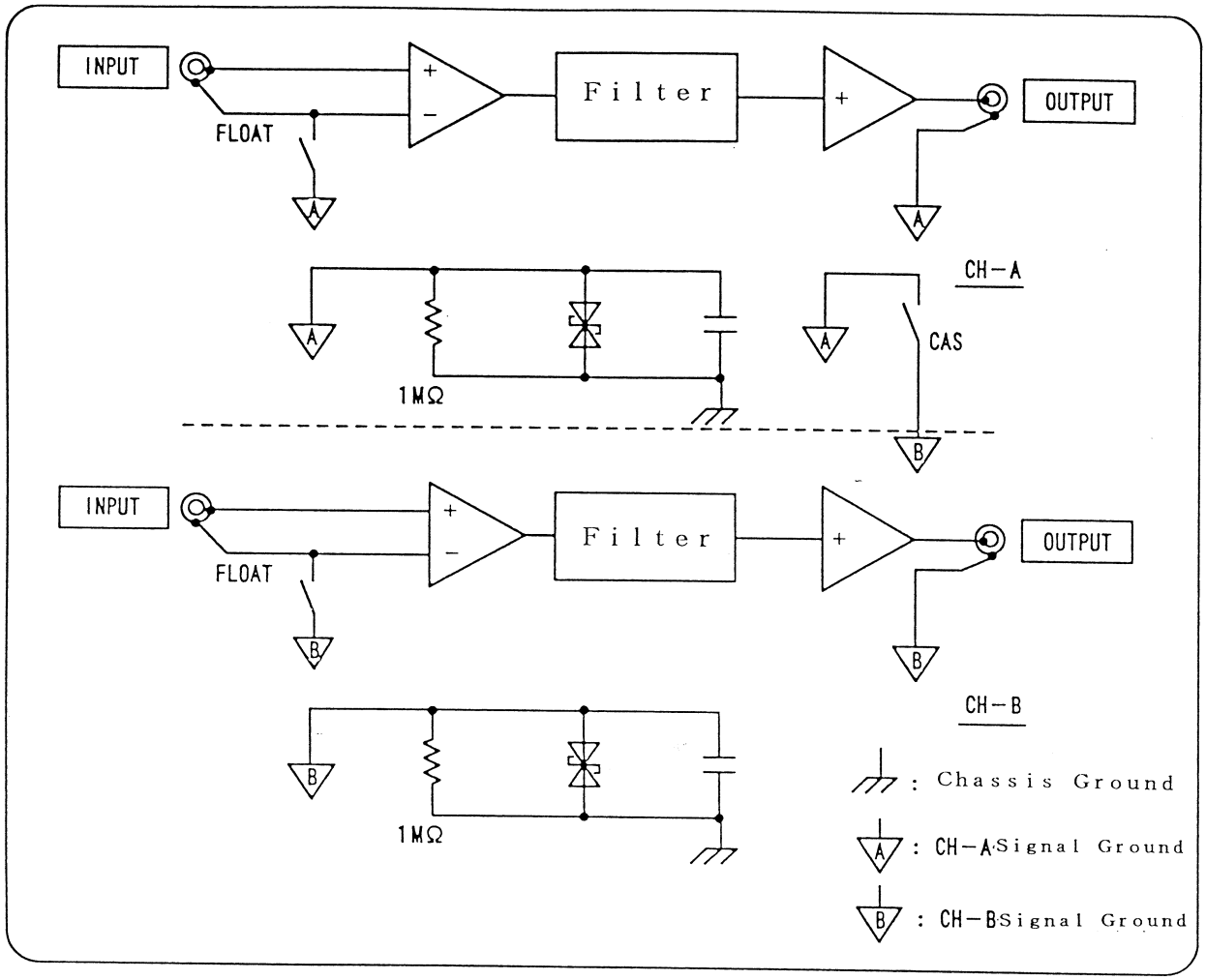
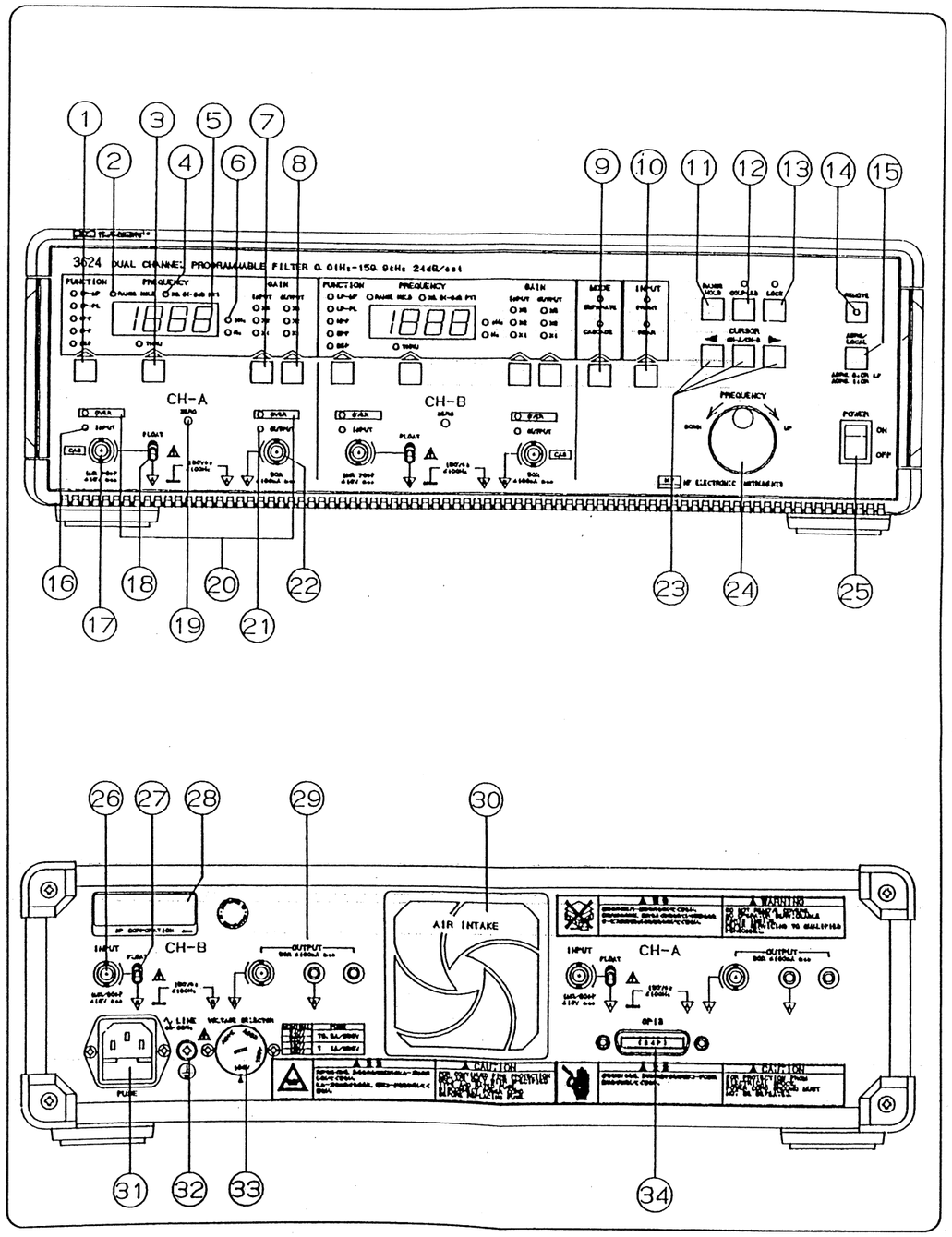


Fig. 1−3 Signal Ground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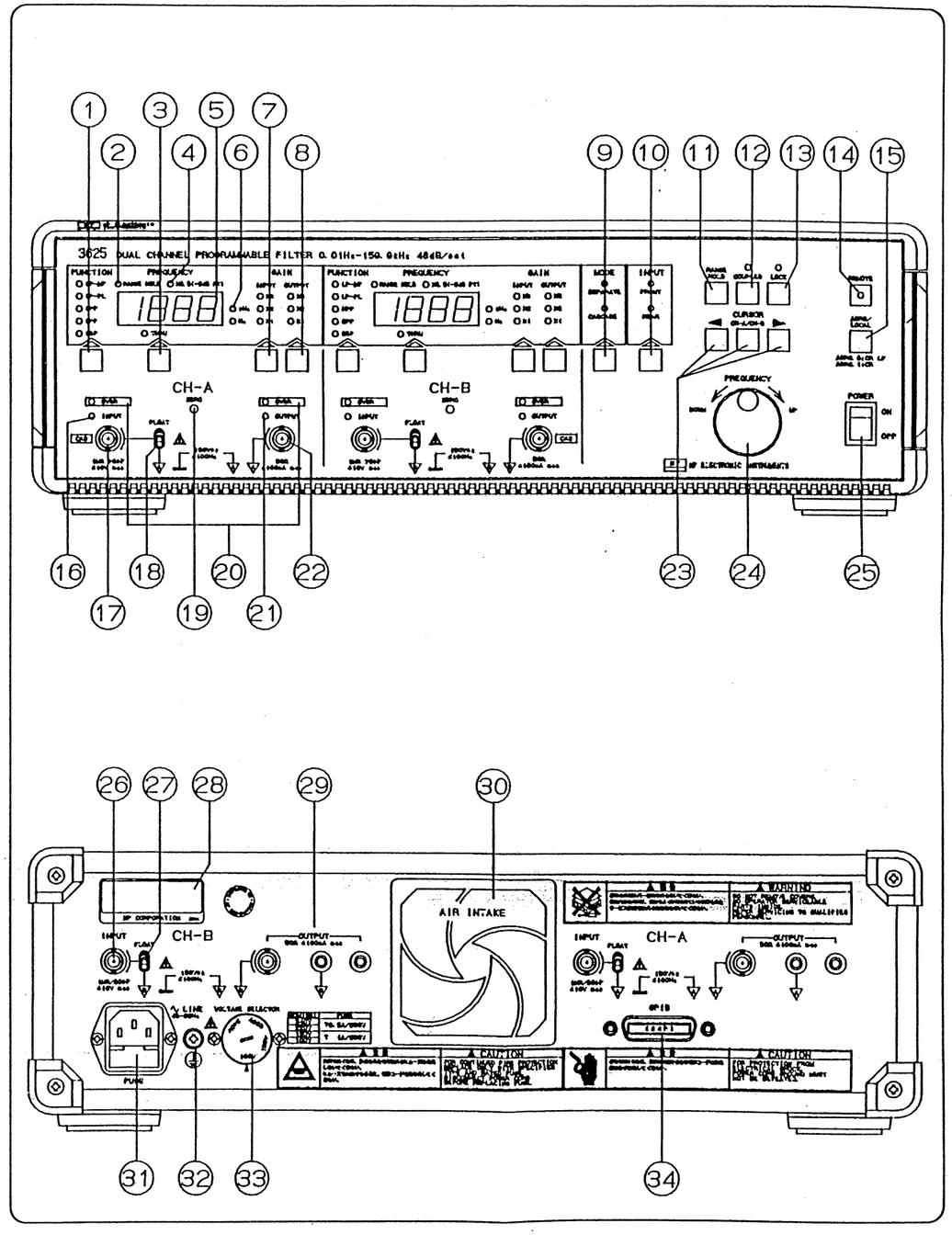
3624 DUAL CHANNEL PROGRAMMABLE FILTER 0.01Hz-150.9kHz 24dB/oct
FUNCTION
FREQUENCY
GAIN
MODE
INPUT
CURSOR
CH-A
CH-B
FREQUENCY
POWER
ON
OFF
AIR INTAKE
WARNING
CAUTION
LINE
VOLTAGE SELECTION
FUSE
GPIB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3625 DUAL CHANNEL PROGRAMMABLE FILTER 0.01Hz-150.0kHz 48dB/oct
FUNCTION
FREQUENCY
GAIN
MODE
INPUT
CURSOR
FREQUENCY
POWER
ON
OFF
CH-A
CH-B
AIR INTAKE
LINE
VOLTAGE SELECTOR
GPIB
CAUTION

GPIB INTERFACE
FOR
3624/3625
DUAL-CHANNEL
PROGRAMMABLE FILTER

NF CORPORATION

2. GPIB INTERFACE

2.1 Introduction

2.1.1 Outline

The GPIB Interface is a general-purpose interface bus sysytem recognized by the IEEE (Institute of Electrpmovd Engineers) in 1975 in the U.S. and is a method of standardizing the data input/output transfer between measuring instruments and peripherals including remote contnrol functions.
By building each controller and peripheral device into an interface conforming to this standard, it is possible to establish complete hardware compatibility at the interface connectors of each device.
Up to 15 devices may be connected to a single interface bus data transfer is performed by three handshake lines, enabling reliable data transfer between data sender and receivers having different data transfer rates.
Various names have been applied to the GPIB, including IEEE-IB, IEEE-488 bus, HP-IB, standard interface bus and byte serial bus. The official name, however, is the "IEEE Std 488-1978: IEEE Standard Digital Interface for Programmable Instrumentation".
It has virtually the same specifications as the IEC bus, although the connector differs, making it usable with this bus by means of adaptors.

2.1.2 Major GPIB Specifications

- Overall cable length ..... 20mm max
- Cable lenths between devices ..... 4m max

- Number of devices connectable (including controller) ..... 15 max.
- Transfer method ..... 3 Lines handshake
- Transfer rate ..... 1 Mbytes/s (max.)
- Data transfer ..... 8 Bits paralles
- Signal lines Data bus ..... 8 Liness
  Control bus ..... 8 Lines
  (including DAV, NRFD, and NDAC handshake lines and ATN, REN, IFC, SRQ and EOI control lines)
  Signal/system grounds ..... 8 Lines
- Signal logic Negative
  True(low-level) ..... 0.8V max.
  False (high-level) ..... 2.0V min.

2.1.3 Bus Line Signals and Operations

The GPIB bus line consists of 24 lines, including 8 data lines, 8 control lines and 8 signal/system ground lines.

(1) Data Bus (D101 to 8)

There are the data input/output lines which are also used to input and output both address and command information, the type of data present on these lines being distinguishable by means of the ATN line. D101 is the least significant bit (LSB).

(2) Handshake Bus (DAV, NRFD, NDAC)

These three lines are handshake line used to ensure reliable data transfer.

· DAV (DAta Valid)

This line indicates that the data on the DIO lines sent from a talker or the controller are valid.

· NRFD (Not Ready For Data)

This line indicates the condition of readiness of listeners to accept data on the DIO lines.

· NDAC (Not Data ACcepted)

This line indicates the condition of acceptance of data by listeners.

(3) Control Bus (ATN, REN, IFC, SRQ, EOI)

· ATN (ATteNtion)

This line is an output line from the controller which indicates whether the signals on the DIO bus are data signals or commands.

· REN (Remote ENable)

This output line from the controller switches devices between remote control and local control.

· IFC (InterFace Clear)

This output line from the controller clears the interface of devices.

· SRQ (Service ReQuest)

This control line is used to call the controller from a talker or a listener. The controller detects this signal and executes a serial or parallel poll operation.

· EOI (End Or Identify)

This is used to indicate the end of a multiple bytes transfer sequence or, in conjunction with ATN, to execute a parallel poll.

2.1.4 GPIB Handshaking

GPIB handshaking is performed by checking the status of all

the listeners and inhibiting the next data transfer until all listeners have completed the reception of data, so that the slowest device on the bus can perform data transfer reliably. The handshaking operations are executed by the following status signals.

NRFD = High level	All listeners are ready for accepting data.
DAV = Low level	A talker is outputting valid data to the data bus.
NDAC = High level	All listeners have completed data reception.

The handshaking timing diagram is shown in Fig. 2-2.

2.1.5 Data Transfer Example

Fig. 2-3 is a data transfer example using the three-line handshake process. In this example, the data "ABC" is sent, followed by the delimiter "CR/LF".

2.1.6 Basic Talker Functions

- Only one talker may exist on the GPIB at any time.
- When the controller ATN signal is high, data is sent to listeners.
- Source handshaking is performed automatically.
- A service request (SRQ) is sent to the controller.
- The talker function is enabled for both the local and remote modes.
- The talker function is canceled by any of the following.
  Whenever the talker address of an other deviece is is received.
  Whenever the device is specified as a listener.
  Whenever untalk (UNT) is received.

Whenever IFC is received.

2.1.7 Basic Listener Functions

- Two or more listeners may exist on the GPIB at any time.
- When the controller ATN signal is high, data is received from a talker.
- Acceptor handshake is performed.
- The listener function is canceled by any of the following.
  Whenever the device is specified as a talker.
  Whenever unlisted (UNL) is received.
  Whenever IFC is received.

2.1.8 Major Specifications of Controller Functions

- Only one controller can be active on GPIB.
- Sets the ATN signal to low to control the listener and talker specification and transmission of commands such as device clear.
- Outputs IFC and REN signals.

2.1.9 Multi-Line Interface Message

The multi-line interface message is the data output from the controller when the ATN signals is at low level. This is shown in Table 2-1.

2.2 GPIB interface of the 3624/3625

2.2.1 Introduction

The 3624/3625 has a wide range of GPIB interface functions, enabling remote setting of almost all parameters settable from

the front panel. In addition, set data and setting conditions can be transferred to an external device, enabling the easy configuration of an advanced automated measuring system. Setting data and setting conditions are output to the controller in the form of of ASCII character string.

2.2.2 Specifications

(1) Interface Functions

The 3624/3625 interface functions are shown in Table 2-2.

(2) Bus Drivers

The specifications of the bus drivers used in the 3624/3625 are shown in Table 2-3.

(3) Code Used

The code which the 3624/3625 can accept in the listener mode is the 7-bit ISO (ASCII) code, with the parity added as the MSB ignored. No distinction is made between lower-case and upper-case characters, each being interpreted in the same mananer. The space (20H), tab (09H), null (00H), and semicolon (3BH) are ignored.
The code sent in the talker mode is 7-bit ISO (ASCII) code, with no parity. All alphabet characters sent are upper case.

(4) Address

The address of the 3624/3625 is settable from the front panel. The setting value is held even when power is

switched off. For the setting method, refer to Section 1.2.1 ⑮. At the time of shipment, and address is set to 2.

(5) Delimiter

The delimiter for received code strings in the listener mode is <CR>, <LF>, or <EOI >, or any combination of these codes.
The delimiter for data strings transmitted in the talker mode can be set from the front panel. Selection is possible as either <CR> only or <CR><LF>, with the EOI signal output simultaneously. The selected value is held in battery backed up memory with the power switched to off. For the selection method, refer to Section 1.2.1 ⑮. At the time of shipment, this is set to CR/LF + EOI.

(6) Response to interface Messages

Refer to Table 2-4.

(7) Program Code

Program code usde to make various settings of the 3624/3625 is temporarily stored in the input buffer, and is interpreted in the sequence input when the delimiter is received. The input buffer is 256 characters (bytes) long, with the codes for space, tab, null, semicolon and the delimiter not input to the buffer.
If program codes exceeding 256 characters are received, an input buffer overflow occurs, the input buffer is cleared and program code is not executed.
At the completion of command interpretation and execution,

the input buffer is cleared and the next input is possible.

The program code is divided between the header and parameters, and it is possible to transmit code continuously up to the input buffer capacity.

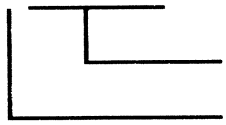
The header of setting program codes for the 3624/3625 consists of either one or two characters. The one-characters headers are provided to maintain upward compatibility at the GPIB level with the FV-664-665 manudfactured by NF CORPORATION. Normally 2-character headers are used.

Parameters consist of one of the following three formats, depending upon the type of program code.

· NR1 Format

The NR1 format is an integret format. (This format does not include a decimal point, with the decimal point position being taken as after the last digit.)

± DDDD



◎ Leading zeros and spaces are ignored.

◎ The sign is "+" and "-" and is assumed to be "+"if left out .

(Example) +01234

-500

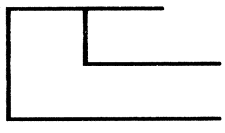
18

· NR2 Format

The NR2 format is a real format. (This is a value including a decimal point, with the decimal point indicated by a period. It is possible to leave out the places after the decimal point, and in this case places after the decimal point are assumed to be 0.)

In making settings, it is also possible to include an exponent as part of the NR2 format. In such cases, the format is treated the same way as the NR3 format.

± DDD.DD



◎ Leading zeros and spaces are ignored.

◎ The sign is "+" and "-" and is assumed to be "+" if left out.

(Example) +012.34

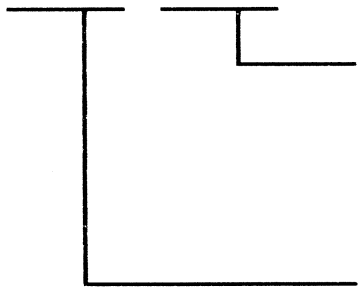
-50.0

1.8

· NR3 Format

The NR3 format is an exponential format. It is possible to level out the number after the capital E, in which case E+00 is assumed, and the formatted treated the same as the NR2 format.

± DD.DD E ± DD



◎ Leading zeros and spaces are ignored.

◎ The sign is "+" and "-" and is assumed to be "+"if left out.

◎ Same as NR2 format.

(Example) +012. 34

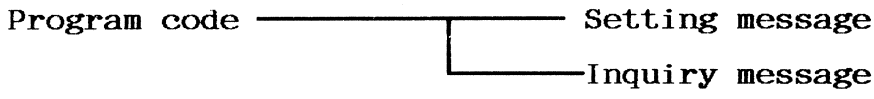
E+03

-50.0E-06

1.8E - 09

The program code format for sending is shown in Fig.2-4.

The program codes used with the 3624/3625 can be divided into messages that make settings and issue operational commands and inquiry messages that access conditions or setting value.



(8) Setting Messages

The basic formats for the setting messages are shown in Examples 1 and 2 below. The setting commands have a header of either one or two characters with 2-character headers used normally. (In these examplels, the CH-A cutoff frequency is set to 10kHz, and the CH-3 cutoff frequency is set to 1kHz.)

(Example 1)

FA 10.0E+03 ; FB 1.0E+03 ;
a b c bdb a b c bd

(Example 2)

D 1000 , 10000 ; R 23 ;
a b c e c bdb a b c d

a: This is the header, consisting of either one or two alphabet characters. Either lower-or upper case characters can be used.

b: This is a space inserted for readability, and can be any number of spaces or no spaces.

c: This is the parameter section, which consists of E

which indicates the exponents and a value. If the setting value is exceeded, the setting will not be made.

d: This is a semicolon inserted as a delimiter in the program for easy readability. Any number can be used, or the semicolon can be left out entirely.

e: This is a comma used to separate parameters for program codes requiring two parameters. It therefore must be used in such cases. The sequence of parameters is also specified explicitly.

The parameters for the setting messages have a free format, so that as long as the value is proper, formats NR1, NR2 or NR can be used.

(9) Inquiry messages are program codes which have a leading "?" character, these being used to access conditions and setting values.
With the exeception of some special messages, these correspond to similiar setting messages, and consists of the setting message with a prefixed "?". These messages inherently have no parameters.
After receiving an inquiry message, the 3624/3625 prepares to check the corresponding setting, and if specified as a talker, output the setting.
The output format of the response is format NR1 to NR3, and is specified for each of the items.
If several inquiries are received at once, only the last received request will be accepted, with others being ignored. If a new request is received before a response to the previous request is output, the latest received request will be valid. Refer to Fig. 2-5.

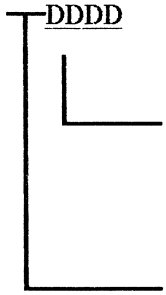
Notes

- It is possible to set the header output to on or off using the setting message HD 1HD 0. When power is applied (i.e., in the initialized condition), this is set to off (i.e., no header is output).
- It is possible to select the delimiter as CR/LF∧E01 or CRE01. The setting is made from the front panel, and is held in battery backed up memory when the power is switched off. For the setting method, refer to Section 1.2.1⑮.
  At the time of shipping, this is set to CR/LF + E01.

(10) Numerical format of the parameters corresponding to inquiry messages

Three format can be used below.

- NR1 Format
  The NR1 format is an integral format.



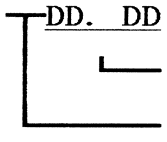
Leading zeros are 0, not space.
The signs + and - describe space and minus respectively.
The NR1 format parameters of the 3624/3625 are all plus. The character numbers of the parameter are constant about each output information.

(Example) MD 0
(Describes that MODE is set to SEPARATE.

Header: 2 characters, Space showing the sign: 1 chareacter, Numerical value of parameters: total of 1 character or 4 characters)

· NR2 Format

The NR2 format is an actual format.



Leading Zeros are 0, not space.

The signs + and - describe space and minus respectively.

The NR2 format parameters of the 3624/3625 are all plus. Includes a decimal point "." without fail. The character numbers of the parameter are constant about each output information.

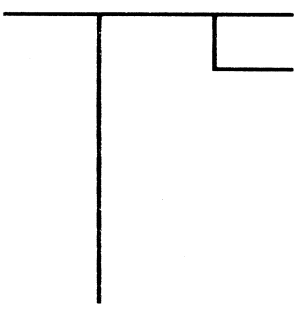
(Example) VR1.00

(Shows the version is 1.00.

Header: Space showing a characters and signs: Numerical value of the parameter including a decimal point: 7 characters in total of 4 characters)

· NR3 Format

The NR3 format is an exponential format.



Exponential section. The numerical value is a multiple of 3. The leading 0 is "0", not space. The whole composition is 4 characters consisting of "E" + polarity + 2 digit numbers. The

polarity is shown by "+" or "-".
In the response corresponding to the inquiry of the cutoff frequency, it is "E+00" when the unit is Hz, and "E+03" for kHz.

Temporary number section.
The location of the decimal point is the same as that of indication on the numerical indicator. When there is no indication of the decimal point, it is supposed that the decimal point is on the right side. It is the same as NR2 formal besides the above.

(Example) FA159.9E+03
(Shows the cutoff frequency of CH-A is set to 159.9kHz. Header: Space showing 2 characters and signs: Temporary number section of the parameter including the decimal point: 5 characters, exponential section of the parameter: 12 characters in total of 4 characters)

(11) Response digit corredponding to inquiry message
This digit does not show signs, decimal point, etc.
The NR2 will be as follows:
(Header: English 2 letters)
+ (Sign section: Space or "-" 1 character)
+ (Exponential point section: digit numbers)
he+ (Decimal point : "." 1 character
The NR3 will be as follows:
(Header: English 2 letters)
+ (Sign section of temporary number section: Space or

"-" 1 letter)

+ (Exponential section of temporary number section: digit numbers)
+ (Decimal point of temporary number section: "." 1 character)
+ ("E" 1 character showing the exponential section)
+ (Signal section of the exponential section : "+" or "-" 1 character)
+ (Numerical value section of the exponential section: 2 digit numbers)

(12) Service Request

When the 3624/3625 goes into the following described conditions, the service request (SRQ) signal line is driven low to generate an interrupt with respect to the controller.

- When an overflow occurs.
- When an error occurs.
- When the 3624/3625 is ready to make a response with respect to inquiry message.

The controller detects the SRQ from the 3624/3625, performs a serial poll, at which point the 3624/3625 transfer the next status byte to the controller, and drives the SRQ signal line high.

(13) Status Byte

The status byte is described in Table 2-5.
The status byte can be read out using a serial poll or "?ST". When the status byte is read out, bit 6(RQS),

bit 3(output data ready condition), bit 2(error), bit 1 (CH-B over) and bit 0(CH-A over) are reset to 0. But the reset is not available in the case of the serial poll without generating SRQ. The service request can mask the items which are not used. The setting is made as a decimal value of the status byte with the concerned bit to be 0 and other bits to be 1. For example, to generate SRQ by "output data ready condition" (bit 3) and "error" (bit 3), and to mask "CH-B over (bit 1) and "CH-A over" (bit 0), the following setting is made.

"SE12" (2 + 2 =12)

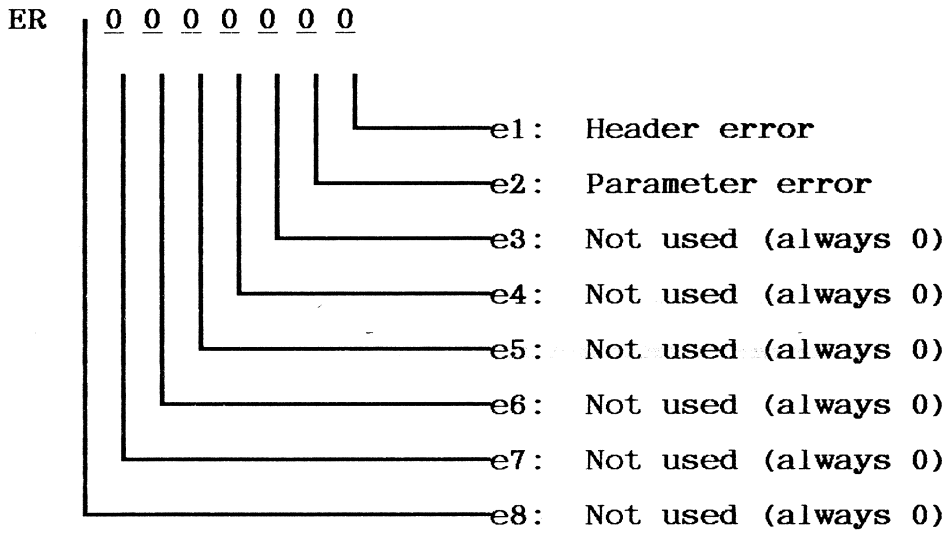
The SRQ is generated for output data ready and error only by doing the above setting. For bit 7(unused), bit 6 (RQS), bit 5(unused) and bit 4(unused), always mask (0) them as they are not factors of SRQ. The SRQ generation is made even if in the LOCAL condition when the SRQ is not masked. All SRQ factors are masked (SE0) in the initial condition when the power is on.
With SE set to 1, whenever the corresponding factor is 1 or changes from 0 to 1.

The service request is canceled under the following conditions.

- After output of the status byte in response to the serial poll.
- After output of the status byte in response to "?ST"
- When the service request factor is masked using "SE0".

(14) Error Codes

The error codes indicate what type of error has occurred. When an error occurs, the bit corresponding to the error factor (e1 thru e2) is set to 1. The error code can be read out by using the inquiry command "?ER".



The error code is cleared under the following conditions.

- Whenever the error code is read out using "?ER".
- Whenever DCL, SDC is received.

In this instance, the Bit 2(Error) of the Status Bite is also reset (0) simultaneoulsy. In the status of which error code is cleared, when the error codes are desired to be read out by "?ER", "ER-00000000" is repeated showing a clear condition.

(15) The Overload Status Byte

The Overload Status Byte of the 3624/3625 is shown in Table 2-6.

The Overload Status Byte shows that the excess was made by the input or output of either channel. The reset (1) is made during the time of excess occurred. It means

that the newest information of excess is always reset.
The Overload Status Byte can be read out by "?0V".
The Overload Status Byte can be cleared by the following.

- The Overload Status Byte can be read out by "?0V".
- DCL and SDC are received.

In this instance, Bit 1 (CH-1 over) and Bit 0 (CH-A over) of the Status Byte are also reset simultaneously.
When the Overload Status Byte is desired to to be read out by "?0V" in the condition of Overload Status Byte cleared, it shows it is cleared by "0V 00" returned.

2.3 Using the GPIB

2.3.1 Address and Delimiter Settings

In using the GPIB, always check the address, and if this is different than the address value set in the GPIB program, reset the value to the proper one. When controlling several devices, always check all the device addresses in the system. It is, of course, not possible to set two or more devices to the same address. The address of the 3624/3625 is set from the front panel, with the value of the setting held in backed up memory so that it is not lost when power is removed. For the setting method, refer to Section 1.2.1⑮.

2.3.2 Remote/Local Operation

The remote and local modes are referred to the modes in which a device is or is not controlled by an external controller via the GPIB.
When the3624/3625 is controlled by a controller, it is placed

by in the remote mode, in which case the LOCAL key LED lamp on the front panel is extinguished and panel operation is disabled. To return the 3624/3625 to the local mode in which front-panel operation is possible, press the LOCAL key LED lights, and operation from the front panel possible one again. When the 3624/3625 is placed in the local lockout (LLO) mode via controller, even the LOCAL key becomes inoperative. In this condition, the remote/local status of the 3624/3625 is only controllable by the controller. To escape from the local lockout mode, set the REN uniline message to high (false). Fig. 2-6 illustrates remote/local operation.

2.3.3 GPIB Operating Precautions

(1) Up to 15 devices, including a controller, can be connected in a GPIB system. The cable lengths observe the following limits.

- The overall cable length should be no greater than 2 m x (number of devices) or 20 m, whichever shorter.
- No cable should be longer than 4 m.

(2) Removal of GPIB connectors should be made only when power to the device is switched off.

(3) In using the GPIB, always turn the power supplies of all devices connected to the bus on.

(4) Carefully check GPIB addresses before making settings. In particular, if two devices in a system have the same talk address, damage can occur to the devices.

(5) Take sufficient precautions with the delimiter selected. If this is not uniform within the system, unexpected problem can arise.

(6) The GPIB interface is designed with the assumption of relatively good operating environment. Avoid, therefore,

operation with power line variations or in noisy locations.

2.4 Program Code Tables

2.4.1 Setting Message Table

The table 2-7-(a) shows an example of the parameter format. For setting messages, the parameter can be accepted in any of the formats NR1, NR2 and NR3.

2.4.2 Inquiry Message Table

The table 2-8 shows response examples with the header set to on (HD 1). If the header is set to off (HD 0), the leading two letters are eliminated leaving only the parameter. The parameter starts with a spacer or "-" (minus sign).

2.4.3 Using Settings and Inquiries Under GPIB Control

(1) The "BEF" of MODE is available to keep the compatibility with NF CORPORATION's FV-664/665.
When MODE is set to "BEF" ("MD 2" or "M 2"), make MODE to "CASCADE", and CH-A FUNCTION to "THRU". When the setting is made to other MODE ("SEPARATE" or "CASCADE") under this condition, FUNCTION of both channels will keep unchanged condition.

(2) When MODE is set to "BEF", it is not possible to change the setting of FUNCTION usisng "AF", "BF" or "F" commands. It will make header error. If an inquiry is made, "BEF" will be returned for CH-A and "THRU" will be returned for CH-B.
*1

"AF 5"

"BF 0" (at header on)

(3) Even if MODE is set to "CASCADE" or "BEF", it is possible to set or access GAIN OUTPUT of CH-A and GAIN INPUT of CH-B.

(4) Even if FUNCTION is set to "THRU", it is possible to set or access the cutoff frequency.

(5) When the range hold is off, the setting is made in which the best resolution of cutoff frequency is obtained for the setting of cutoff frequency with a 2-character header.

(6) When the range hold is on, it is not possible to make the setting which is out of the range in case of the setting of cutoff frequency with 2-character header. This will be a parameter error. When the range hold is off, the setting is changed to the range in which the best resolution is obtained in the cutoff frequency set at that time.

(Example) Range hold on → off
Cutoff frequency 0.10kHz (10kHz range) (100Hz range)

*1 When MODE is "BEF", the sending of "?MD" will give an answer of "MD 2" (at BEF, header on). However, when the power is off, and on again in this condition, the setting will be the previous MODE of MODE to "BEF".

2.5 Standard Practice Time

The practice time shown in Table 2-9 Standard Practice Time is the time from receipt of each command to the end of its practice. The 3624/3625 requires the time of approximately

1.5ms/byte for receipt of command from GPIB. The practice time in the table shows the one at the same time as the letter numbers of responding message when those of setting message are set to the initial value. The 3624/3625 requires the time of approximately 0.5ms/byte for the transfer of data as a talker.

2.6 Sample Programs

The sample programs given here use a personal computer (HP9816 or NEC PC-9801) as a controller. In these examplels, the 3624/3625 GPIB interface address is assumed to be set to 2, and the delimiter is assumed to be set to CR/LF (CR/LF and simultaneous E01 output).

In Sample Program 1, program codes input from the keyboard are transferred to the 3624/3625. If the program code includes "?", after the program code is transferred, the 3624/3625 is specified as a talker, setting data is read into the controller, and this is displayed on the CRT screen. When an error occurs, a serial poll is performed, the error code is read, and the type of error is displayed on the CRT screen.

Sample Program 2 consists of a subroutine which transfers the IFC, DCL, SDC, ILO, and GTL interface messages to the 3624/3625, and a subroutine which sets REN or True and False.

Sample Program 3 makes the following settings to the 3624/3625.

- MODE SEPARATE
- HEADER ON
- CH-A
  - FUNCTION LP-MF
  - FREQUENCY 400Hz
  - RANGE HOLE OFF (autorange)
  - GAIN INPUT X1
  - GAIN OUTPUT X1
- CH-B
  - FUNCTION LP-MF
  - FREQUENCY 1000Hz
  - RANGE HOLD OFF (autorange)
  - GAIN INPUT X2
  - GAIN OUTPUT x5

NOTE:

1. There is a case in N88BASIC of NEC, PC-9801 series computer in which the operation will not be made correctly if the next GPIB command is executed upon sending device clear. Try to give a proper waiting loop after device clear.
2. Pay the following attention in use of SRQ interrupt at N88BASIC of PC-9801.
   - When the program practice is interrupted by pressing STOP key, execute END sentence once before practicing the program next. Otherwise, there may be some

problems like an occurrence of SRQ interrupt without SRQ at the next practice of program.

- There are some cases in which SRQ does not work correctly even if the a bove operation is executed. In these cases, normal operation will be ensured by performing a serial poll within interrupt processing routine.
- When preparing the program, constitute algorithm so that any problem may not arise even if there is an occurrence of SRQ interrupt without SRQ. The sample program shown here excludes a false interrupt of RQS=0 by confirming RQS bit of status byte in interrupt processing routine.

● Sample Program 1 Description

	Lines 100 to 170	Initialize controller and 3624/3625.
a)	Line 100	Specified CRT display.
b)	Line 100	Sets controller delimiter to CR/LF.
	Line 110	Declares the size of string variable C$ as 80 characters.
	Line 120	Sets the timeout interrupt time to 20 s.
	Line 130	Sends IFC from the controller.
	Line 140, 150	Sends REN True and DCL from the controller.
	Line 160	Sends SE 4 to the 3624 /3625, and if an error occurs generates an SRQ.
	Line 170	If an SRQ interrupt occurs, excecutes subroutine starting at line 280.
	Lines 190- to 270	Loop that sends program codes to the 3624/3625.
	Line 190	Enables an SRQ interrupt to the controller.
	Line 200, 210	Inputs program code (C$).
	Line 220	Displays input program code.
	Line 230	Sends input program code to 3624/3625.
	Line 240	If "?" is included in the sent program code, executes the specified subroutine.
	Line 250, 260	Wait to reliably detect the SRQ.
	Line 270	Return to line 180.
a)	Lines 280 to 470	(b) Lines 280 to 420 SRQ interrupt processing subroutine.
a)	Line 300	Perform serial poll.
b)	Line 300	Perform serial poll. If an SRQ other than that from the 3624/3625 is generated, jump to line 470.
	Line 310	Shift to the designated line if false

interrupt of RQS=0 is generated.

Line 320, 330 Read error code (E$).

Line 340, 350 Read whether or not a header is included in the inquiry message (H$).

a) Lines 360 to 400 (b) Lines 360 to 380
Obtain error number (E).

a) Lines 410 to 460 (b) Lines 390 to 400
Display error according to value of error number (E).

a) Lines 480 to 500 Subroutine to perform display if timemout occurs.

a) Lines 510 to 540 (b) Lines 430
Subroutine to specify 3624/3625 as talker, read setting value (C$), and display.

b) Lines 470 to 490 If an SRQ other than that from the 3624/3625 is generated, display this on the CRT, sent UNT from the controller, and terminated program.

Sample Program 1 (a) (for HP 9816)

```
100  PRINTER IS 1
110  DIM C$ (80)
120  ON TIMEOUT 7.20 GOSUB 480
130  ABORT 7
140  CLEAR 7
150  REMOTE 702
160  OUTPUT 702 ; "SE 4"
170  ON INTR 7 GOTO 280
180    !
190  ENABLE INTR 7;2
200  INPUT "PROGRAM CODE",C$
210  PRINT
```

```
220  PRINT "COMMAND=", C$
230  OUTPUT 702;C$
240  IF POS (C$, "?") THEN GOSUB 510
250  FOR I=0 TO 500
260  NEXT I
270  GOTO 180
280  !
290  PRINT "** ERROR SERVICE ROUTINE **"
300  S=SPOLL (702)
310  IF BINAND (S, 64)=THEN 470
320  OUTPUT 702;"?ER"
330  ENTER 702;E$
340  OUTPUT 702;"?HD"
350  ENTER 702;H$
360  IF H$="HD 1" THEN
370    E=VAL(E$ [3, 11])
380  ELSE
390    E=VAL(E$)
400  END IF
410  SELECT E
420    CASE 1
430      PRINT " (ERROR 01) GPIB HEADER ERROR !"
440    CASE 10
450    PRINT " (ERROR 02) GPIB PARAMETER ERROR !
460  END SELECT
470  GOTO 190
480  !
490  PRINT "** GPIB Hang up **"
500  RETURN
510  !
520  ENTER 702;C$
530  PRINT " ANSWER = ", C$
540  RETURN
```

```
550  !
560  END
```

Sample Program 1 (b) (for NEC, PC-9801)

```
100  CMD DELIM = 0
110  DIM C$(80)
120  CMD TIMEOUT = 20
130  ISET IFC
140  ISET REN
150  WBYTE &H3F,&H14; :WAIT 201,64
160  PRINT @2;"SE 4"
170  ON SRQ GOSUB 280
180   '
190  SRQ ON
200  PRINT
210  INPUT "INPUT PROGRAM CODE ? ",C$
220  PRINT "COMMAND = ",C$
230  PRINT @2;C$
240  IF INSTR (C$,"?") THEN GOSUB 430
250  FOR I = 0 TO 500
260  NEXT I
270  GOTO 180
280   '
290  PRINT "** ERROR SERVICE ROUTINE  **
300  POLL 2,S : IF IEEE (5) <> 2 THEN 470
310  IF (S AND 64)=0 THEN 410
320  PRINT @2;"?ER"
330  INPUT @2;E$
340  PRINT @2;"?HD"
350  INPUT @2;H$
360  IF H$="HD 1" THEN 370 ELSE 380
370    E=VAL(RIGH$(E$,3):GOTO 390
```

```
380     E=VAL(E$)
390   IF E=1 THEN PRINT "   (ERROR 01)GPIB HEADER ERROR !
400   IF E=10 THEN PRINT " (ERROR 02) GPIB PARAMETER ERROR !"
410   SRQ ON
420   RETURN
430    '
440   INPUT @2;C$
450   PRINT " ANSWER = ",C$
460   RETURN
470    '
480   PRINT " SRQ From";IEEE(5);". Please RUN again !"
490   WBYTE &H5F;
500    '
510   END
```

Sample Program 2 (a) (for HP 9816)

```
100   !
110   !  *** IFC
120   ABORT 7
130   RETURN
140   !
150   !  *** DCL
160   CLEAR 7
170   RETURN
180   !
190   !  *** SDC
200   CLEAR 702
210   RETURN
220   !
230   !  *** LLO
240   LOCAL LOCKOUT 7
```

```
250  RETURN
260  !
270  !  *** GTL
280  LOCAL 702
290  RETURN
300  !
310  !  *** REN True
320  REMOTE 7
330  RETURN
340  !
350  !  *** REN False
360  LOCAL 7
370  RETURN
```

Sample Program 2 (b) (for NEC PC-9801)

```
100  '
110  '  *** IFC
120  ISET IFC
130  RETURN
140  '
150  '  *** DCL
160  WBYTE &H3F,&H14;
170  RETURN
180  '
190  '  *** SDC
200  WBYTE &H3F,&H22,&H4;
210  RETURN
220  '
230  '  *** LLO
240  WBYTE &H3f,&H11;
250  RETURN
260  '
```

```
270  '   *** GTL
280  WBYTE &H3F,&H22,&H1;
290  RETURN
300  '
310  '   *** REN True
320  ISET REN
330  RETURN
340  '
350  '   *** REN False
360  IRESET REN
370  RETURN
```

● Sample Program 3 Description

	Lines 100 to 160	Initializes controller and 3624/3625.
a)	Line 100	Specifies CRT display
b)	Line 100	Sets controller delimiter to CRT/LF.
	Line 110	Sets length of character C$ to 80 characters.
	Line 120	Sets the timeout interrupt time to 20 s.
	Line 130	Sends IFC from the controller.
	Line 140, 150	Sends REN True and DCL from controller.
	Line 160	Sends "HD 1" (header on) to 3624/3625.
	Line 170 to 500	Setting and display.
	Line 180	Sets MODE to SEPARATE, and accesses
	Line 190, 200	Reads and displays setting
	Line 210	Sets CH-A to autorange, and accesses setting.
	Lines 220, 230	Reads and displays setting
	Line 240	Sets CH-A FUNCTION to LP-MF and accesses setting.
	Lines 250, 260	Reads and Displays setting.

Line 270	Sets CH-A cutoff frequency to 400Hz, and accesses setting.
Lines 280, 290	Reads and displays setting.
Line 300	Sets CH-A IN-GAIN to X1, and accesses setting.
Line 310, 320	Reads and displays setting.
Line 330	Sets CH-A OUT-GAIN to X1, and accesses setting.
Lines 340, 350	Reads and displays settinfg.
Line 360	Sets CH-B autorange, and accesses setting.
Lines 370, 380	Reads and displays setting.
Line 390	Sets CH-B FUNCTION to LP-MF, and accesses setting.
Lines 400, 410	Reads and displays setting.
Line 420	Sets CH-B cutoff frequency to 1kHz, and accesses setting.
Line 420	Sets CH-A cutoff frequency to 1kHz, and and accesses setting.
Lines 430, 440	Reads and displays setting.
Line 450	Sets CH-B IN-GAIN to X2, and accesses setting.
Lines 460, 470	Reads and displays setting.
Line 480	Sets CH-B OUT-gain TO x5, and accesses setting.
Line 500	Reads and displays setting.

Sample Program 3 (a) (for HP 9816)

```
100  PRINTER IS1
110  DIM C$ [80]
120  ON TIMEOUT 7, 20 GOTO 520
130  ABORT 7
```

```
140  CLEAR 7
150  REMOTE 702
160  OUTOUT 702;"HD 1"
170  !
180  OUTPUT 702;"MD 0; ?MD"
190  ENTER 702;C$
200  PRINT "     ";c$
210  OUTPUT 702;"HA 0; ?HA
220  ENTER 702;C$
230  PRINT "     ";C$
240  OUTPUT 702;AF 1; ?AF"
250  ENTER 702;C$
260  PRINT "    ";C$
270  OUTPUT 702;"FA 400; ?FA"
280  ENTER 702;C$
290  PRINT "     ";C$
300  OUTPUT 702;"IA 0; ?IA"
310  ENTER 702;C$
320  PRINT "      ";C$
330  OUTPUT 702;"0A 0; ?0A"
340  ENTER 702;C$
350  PRINT "     ";C$
360  OUTPUT 702;"HB 0; ?HB"
370  ENTER 702;C$
380  PRINT "     ";C$
390  OUTPUT 702;"BF 1; ?BF"
400  ENTER 702;C$
410  PRINT "     ";C$
420  OUTPUT 702;"FB 1E3; ?FB"
430  ENTER 702;C$
440  PRINT "     ";C$
450  OUTPUT 702;"IB 1; ?IB"
460  ENTER 702;C$
```

```
470  PRINT "     ";C$
480  OUTPUT 702;"0B 2; ?0B"
490  ENTER 702;C$
500  PRINT "     ";C$
510  !
520  END
```

Sample Program 3 (b) (for NEC PC-9801)

```
100  CMD DELIM = 0
110  DIM C$(80)
120  CMD TIMEOUT = 20
130  ISET IFC
140  ISET REN
150  WBYTE &H3F,&H14; :WAIT 201,64
160  PRINT @2;"HD 1"
170  '
180  PRINT @2;"MD 0; ?MD"
190  INPUT @2;C$
200  PRINT "     ";C$
210  PRINT @2;"HA 0; ?HA"
220  INPUT @2;C$
230  PRINT "      ":C$
240  PRINT @2;"AF 1; ?AF"
250  INPUT @2;C$
260  PRINT "     ";C$
270  PRINT @2;"FA 400; ?FA"
280  INPUT @2;C$
290  PRINT "     ";C$
300  PRINT @2;"IA 0; ?IA"
310  INPUT @2;C$
320  PRINT "     ";c$
330  PRINT @2;"0A; ?0A"
```

```
340  INPUT @2;C$
350  PRINT "      "C$
360  PRINT @2;"HB 0; ?HB"
370  INPUT @;C$
380  PRINT"     ";C$
390  PRINT @2;"BF 1; ?BF"
400  INPUT @2;C$
410  PRINT "     ";C$
420  PRINT @2;"FB 1E3; ?FB"
430  INPUT @2;C$
440  PRINT "      ";C$
450  PRINT @2;"1; ?IB"
460  INPUT @2;C$
470  PRINT "     ";C$
480  PRINT @2;"PRINT @2;"0B 2; ?0B"
490  INPUT @2;C$
500  PRINT"     ";C$
510  '
520  END
```

Table 2-1 Multi-Line Interface Message

b7 b6 b5 / b4 b3 b2 b1 / COLUMN ROW	0 0 0 / 0	① MSG	0 0 1 / 1	MSG	0 1 0 / 2	MSG	0 1 1 / 3	MSG	1 0 0 / 4	MSG	1 0 1 / 5	MSG	1 1 0 / 6	MSG	1 1 1 / 7	MSG
0 0 0 0 / 0	NUL		DLE		SP	LISTENER ADDRESSES ASSIGNED TO DEVICES	0	LISTENER ADDRESSES ASSIGNED TO DEVICES	@	TALKER ADDRESSES ASSIGNED TO DEVICES	P	TALKER ADDRESSES ASSIGNED TO DEVICES	`	MEANING DEFINED BY PCG	p	MEANING DEFINED BY PCG
0 0 0 1 / 1	SOH	GTL	DC1	LLO	!		1		A		Q		a		q	
0 0 1 0 / 2	STX		DC2		"		2		B		R		b		r	
0 0 1 1 / 3	ETX		DC3		#		3		C		S		c		s	
0 1 0 0 / 4	EOT	SDC	DC4	DCL	$		4		D		T		d		t	
0 1 0 1 / 5	ENQ	PPC③	NAK	PPU	%		5		E		U		e		u	
0 1 1 0 / 6	ACK		SYN		&		6		F		V		f		v	
0 1 1 1 / 7	BEL		ETB		'		7		G		W		g		w	
1 0 0 0 / 8	BS	GET	CAN	SPE	(		8		H		X		h		x	
1 0 0 1 / 9	HT	TCT	EM	SPD	)		9		I		Y		i		y	
1 0 1 0 / 10	LF		SUB		*		:		J		Z		j		z	
1 0 1 1 / 11	VT		ESC		+		;		K		[		k		{	
1 1 0 0 / 12	FF		FS		,		<		L		\		l		|	
1 1 0 1 / 13	CR		GS		-		=		M		]		m		}	
1 1 1 0 / 14	SO		RS		.		>		N		^		n		~	
1 1 1 1 / 15	SI		US		/		?	UNL	O		_	UNT	o		DEL	

ADDRESS COMMAND GROUP (ACG) — UNIVERSAL COMMAND GROUP (UCG) — LISTENER ADDRESS GROUP (LAG) — TALKER ADDRESS GROUP (TAG)

PRIMARY COMMAND GROUP (PCG) — SECONDARY COMMAND GROUP (SCG)

NOTES 1 MSG IS THE INTERFACE MESSAGE

2 b_1 = D101 ... b_2 = D107;
D108 IS NOT USED

3 HAS SECONDARY COMMAND

4 IEC standard shows "/" and "¥" for JIS standard.

GTL ··· Go to Local
SDC ··· Selected Device Clear
PPC ··· Parallel Poll Configure
GET ··· Group Execute Trigger
TCT ··· Take Control

LLO ··· Local Lockout
DCL ··· Device Clear
PPU ··· Parallel Poll Unconfigure
SPE ··· Serial Poll Enable
SPD ··· Serial Poll Disable
UNL ··· Unlisten
UNT ··· Untalk

Table 2-2 Interface Functions

Functions	Subject	Description
Source handshake	SH1	Has all send handshake functions.
Acceptor handshake	AH1	Has all acceptor handshake functions.
Talker	T6	Has basic talker functions, serial polling, and talker canceled by MLA function.
Listener	L4	Has basic listener functions, listener canceled by MTA.
Service request	SR1	Has all service request functions.
Remote/local	RL1	Hal all remote/local functions.
Parallel poll	PP0	Has no parallel poll functions.
Device clear	DC1	Has all device clear functions.
Device trigger	DT0	Has no device trigger functions.
Controller	C0	Has no controller functions.

Table 2-3 Bus Driver Specifications

DI01 to 8 NDAC NRFD SRQ	Open connector
DAV EOI	Tri-state

Table 2-4 Response to Interface Messages

IFC	The GPIB interface is initialized. The specified listener or talker mode canceled.
DCL and SDC	The GPIB input/output buffer is cleared. The error status is cleared. The SRQ signal generation is cleared and the SRQ factor is reset. (The function of the 3627/3628 is not changed.
LLO	The LOCAL key on the front panel becomes inoperative.
GTL	The local condition is enabled.

Table 2-5 Status Byte (1/2)

Bit	Measuring	Setting (1) conditions	Reset (0) conditions
(MSB)7	0	(Not used; always 0)	(Not used;always 0)
6	RQS	When SRQ is generated.	· When the status byte is output. · When the serial poll is performed by sending SRQ. · When DCL, SDC are received. · When SRQ factor is disappeared.
5	0	(Not used;always 0)	(Not used;always 0)
4	0	(Not used;always 0)	(Not used;always 0)
3	Ready output (SRQ factor)	Data is ready for output with respect an inquiry.	· When the status byte is is output by "?ST". · When the serial poll is performed. · When the assignment is made as talker. · When DCL and SDC are received. · Next inquiry message.

Table 2-5 Status Byte (2/2)

Bit	Measuring	Setting (1) conditions	Reset (0) conditions
2	Error (SRQ factor)	When an error is generated.	· When an error code is output by "?ER". · When the status byte is output by "?ST". · When the serial poll is performed by sending SRQ. · When DCL and SDC are received.
1	CH-B Overload (SRQ factor)	When overload occurs on CH-B.	· When the overstatus is output by "?0V. · When the overstatus byte is output by "?ST" · When the serial poll is performed by sending SRQ. · When DCL and SDC are received.
(LSB) 0	CH-A Overload (SRQ factor)	When overload occurs CH-A.	· When the overstatus is output by "?0V. · When the status byte is output. · When the serial poll is performed by sending SRQ · When DCL and SDC are received.

Table 2-6 Overload Status Byte

Bit	Meaning	Setting(1)conditions	Reset(0) conditions
(MSB)7	0	(Not used;always 0)	(Not used;always 0)
6	0	(Not used;always 0)	(Not used;always 0)
5	0	(Not used;always 0)	(Not used;always 0)
4	0	(Not used;always 0)	(Not used;always 0)
3	CH-B output overload	· Overload of CH-B output amplifier	· Overload status read by "?0V" · DCL, SDC received
2	CH-B input overload	· Overload of CH-B output amplifier	
1	CH-A output overload	· Overload of CH-A output amplifier	
(LSB)0	CH-A input overload	· Overload of CH-A amplifier	

Table 2-7 (a) Setting Message Table (1/6)

Function	Program code		Operation and Setting range	Inquiry
	Header	Parameter		
MODE	MD	NR1	Mode setting 0:SEPARATE 1:CASCADE 2:BEF *1	Yes
FUNCTION CH-A CH-B	AF BF	NR1	Function setting 0:THRU 1:LP-MF 2:LP-PL 3:HPF 4:BPF 5:BEF	Yes
FREQ. CH-A CH-B	FA FB	NR3	Cutoff frequency setting (Frequency:Hz) Range:1E-02(0.01Hz) to 159.9E+03(159.9kHz) Resolution: 0.1kHz at 100kHz ranges 0.01khz at 10kHz ranges 1Hz at 1000Hz ranges 0.1Hz at 100Hz ranges 0.01Hz at 10Hz ranges	Yes

Table 2-7 (a) Setting Message Table (2/6)

Function	Program code		Operation and Setting range	Inquiry
	Header	Parameter		
GAIN INPUT CH-A CH-B OUTPUT CH-A CH-B	 IA IB 0A 0B	NR1	Gain setting 0:X1 1:X2 2:X5	Yes
RANGE HOLD ON/OFF CH-A CH-B	 HA HB	NR1	ON/OFF selection for range hold 0:OFF (range alteration is possible) 1:ON (range alteration is forbidden)	Yes
COUPLED ON/OFF	 CP	NR1	Selection of COUPLED ON/OFF 0:OFF (Disabled COUPLED) 1:ON (Enabled COUPLED)	Yes

*1 Refer to 2.4.3 Using serttings and Inquiries under GPIB control

Table 2-7 (a) Setting Message Table (3/6)

Function	Program code		Operation and setting range	Inquiry
	Header	Parameter		
SRQ ENABLE	SE	NR1	Setting of SRQ factor Range:00 to 15 8:Ready for output (8:Sending SRQ by "Ready for output" 0:Not sending SRQ by "Ready for output" 4:Error occurs (4:Sending SRQ by Error 0:Not sending SRQ by "Error 2:CH-B overload (2:Sending SRQ by CH-B over-load 0:Not sending SRQ by CH-B overload 1:CH-A overload (1:Sending SRQ by CH-A over-load 0:Not sending SRQ by CH-A overload) Enabled the total of SRQ fac. (Example) SE 12 (12=8+4:ready for output Sending SRQ by Error. Not sending SRQ by overload of CH-A and CH-B.	Yes

Table 2-7 (a) Setting Message Table (4/6)

FUNCTION	Program code		Operation and setting range	Inquiry
	Header	Parameter		
HEADER	HD	NR1	Selection of header on/off for response to inquiry message 0:Off (without header) 1:On (with header)	Yes
KEY LOCK ONF/OFF	KL	NR1	ON/OFF of forbidden key setting on the panel 0:OFF (possible key setting) 1:ON (forbidden key setting)	Yes
INPUT	IN	NR1	Selection of input BNC connector 0:Enables input BNC connector on the front panel 1:Enables input BNC connector on the rear panel	Yes

Table 2-7 (a) Setting Message Table (5/6)

Function	Program code		Operation and setting range	Inquiry
	Header	Parameter		
INITI-ALIZE	IT	NR1	Setting of initial value(i/v) 0:Setting that other than INPUT, KEY LOCK, GPIB add. and delimiter to i/v 1:Setting that other than KEY LOCK, GPIB add. & delimiter to i/v The initial value is as below. CH-A FUNCTION LP-MF THRU OFF FREQUENCY 159.9kHz RANGE HOLD OFF GAIN INPUT X1 GAIN OUTPUT X2 CH-B FUNCTION LP-MF THRU OFF FREQUENCY 159.9kHz RANGE HOLD OFF GAIN INPUT X1 GAIN OUTPUT X1 MODE:SEPARATE INPUT:FRONT COUPLED: OFF KEY LOCKK:OFF GPIB Address 2 Delimiter Sending CR/LF, E01 simultaneously	No

Table 2-7 (a) Setting Message Table (6/6)

Function	Program code		Operation and setting range	Inquiry
	Header	Parameter		
GROUND ON/OFF INPUT CH-A CH-B OUTPUT CH-A CH-B	 TA TB GA GB	NR1	Selection of on/off for input/output GND 0:off (GND cancel) 1:on (GND setting) Function for GND connection of input in input/output amp.	Yes

Table 2-7 (b) Setting Message Table (1/3)

This table is for the convertibility of NF Corporation's FV-664/665. Normally t here is no need.

Function	Program code		Operation and setting range	Inquiry
	Header	Parameter		
MODE	M	NR1	Mode setting 0:SEPARATE 1:CASCADE 2:BEF*1	No

Table 2-7 (b) Setting Message Table (2/3)

Function	Program code		Operation and setting range	Inquiry
	Header	Parameter		
FUNCTION	F	NR1	Function setting Parameter is a 2-digit integer with the 10's digit indicating the function for CH-A, and the 1's digit indicating the function for CH-B. 0:THRU 1:LP-MF 2:LP-MF 3:HPF 4:BPF *2 5:BEF *2	No
FREQ. DIGIT RANGE	D R	NR1,NR1 (CH-A, CH-B) NR1	Digit setting Takes 2 parameters. The first one displays the digit of CH-A and the second one shows the digit of CH-B. Range:1 to 1599 Range setting Parameter is a 2-digit integer with the 10's digit indicating the range for CH-A, and the 1'st digit indicating the range for CH-B. 0:0.01-15.99Hz 1:0.1-159.9Hz 2:1-1599Hz 3:0.01-15.99kHz 4:0.1-159.9kHz	No

Table 2-7 (b) Setting Message Table (3/3)

Function	Program code		Operation and setting range	Inquiry
	Header	Parameter		
GAIN	G	NR1	Gain setting Parameter is a 2-digit integer with 10's digit indicating the gain for CH-A, and the 1'st digit indicating the gain for CH-B. 0:Inputx1,Outputx1=Time 1 1:Inputx5,Outputx2=Times 10	No
SRQ ENABLE	S	NR1	Setting of SRQ factor 0:Not sending SRQ by the overload(equivalent to "SE 0") 1:Sending SRQ by the overload(equivalent to "SE 3")	No

*1 Refer to "2-4-3 Using Setting and Inquiries under GPIB control

*2 FV-664/665 does not have this function. This function works in this equipment.

Table 2-8 Inquiry Message Table (1/4)

Inquiry	Program code	Response	Setting
Inquiry of mode	?MD	NR1:1 digit Contents:same as setting message Example:MD 0 (SEPARATE)	Yes
FUNCTION CH-A CH-B Inquiry of function	 ?AF ?BF	NR1:1 digit Contents:same as setting message Example:AF 1 (CH-A LP-MF)	Yes
FREQUENCY CH-A CH-B Inquiry of cutoff frequency	 ?FA ?FB	NR3:4-digit mantissa 2-digit mantissa Example:FA 159.9E+03 (CH-A 159.9kHz)	Yes
GAIN INPUT CH-A CH-B OUTPUT CH-A CH-B Inquiry of GAIN	 ?IA ?IB ?0A ?0B	NR1:1 digit Contents:same as setting message Example:IA 1 (CH-A INPUTX2)	Yes

Table 2-8 Inquiry Message Table (2/4)

Inquiry	Program code	Response	Setting
RANGE HOLD CH-A CH-B Inquiry of RANGE HOLD on/off	 ?HA ?HB	 NR1:1-digit Contents:same as setting message Example:HA 0 (CH-A off)	 Yes
RANGE CH-A CH-B Inquiry of range	 ?RA ?RB	NR1:1 digit Responds the range already set 0: 10Hz range (0.01-15.99Hz) 1: 100Hz range (0.1-159.9Hz) 2:1000Hz range (1-1599Hz) 3: 10kHz range (0.01-15.99kHz) 4:100kHz range (0.1-159.9kHz) Example:RA 1 (CH-A 100Hz range)	 No
COUPLED Inquiry of coupled on/off	 ?CP	NR1:1-digit Contents:same as setting message Example:CP 0 (off)	 Yes
ERROR Inquiry of error status	 ?ER	NR1:8-digits Example:ER 00000000 (No error)	 No
OVER Inquiry of overload status	 ?OV	NR1:2-digits Example:0V 1 (CH-A input overlo overload)	 No

Table 2-8 Inquiry Message Table (3/4)

Inquiry	Program code	Response	Setting
SRQ ENABLE Inquiry of SRQ factor setting Refer to "2-2-2 (13) Status Byte	?SE	NR1:2-digits Contents:refer to the pages in setting. Example:SE 15(generates SRQ by all SRQ factors)	Yes
STATUS BYTE Read-out of status byte Refer to 2.2-2 (13)	?ST	digits Outputs 8 bit status byt as decimal letter lines. (Example:ST 1 (CH-A overload)	No
HEADER Inquiry for on/ off of Header responding to inquiry message	?HD	NR1:1 digit Contents:same as setting 2 kins below Example:HD 1 (at ON) 0 (at OFF)	Yes
KEY LOCK Inquiry for on/ off of forbidden key setting on the panel	?KL	NR1:1 digit Contents:same as setting Example:KL 1 (on)	Yes

Table 2-8 Inquiry Message Table (4/4)

Inquiry	Program code	Response	Setting
INPUT Inquiry of input BNC connector	?IN	NR1:1 digit Contents:same as setting Example:IN 1 (Valid for input BNC connector)	Yes
VERSION Inquiry of ROM version	?VR	NR2:3 digits Example:VR 1.00 (1.00)	No
GROUND INPUT CH-A CH-B OUTPUT CH-A CH-B Inquiry for on/off of input/output GND	 ?TA ?TB ?GA ?GB	NR1:1 digit Contents:same as setting Example:TA 1(GND setting of CH-A input	Yes

Table 2-9 Standard Practice Time (1/3)

Function	Setting message header	Standard practice time (ms)	Inquiry message	Standard practice time (ms)
Mode setting	MD	90	?MD	45
Function setting	AF BF	75	?AF ?BF	65
Cutoff frequency setting	FA FB	125	?FA ?FB	60
Gain setting	IA IB	60	?IA ?IB	55
	0A 0B	55	?0A ?0B	45
Range hold on/offut	HA HB	65	?HA ?HB	55
Range read-out	_____	_____	?RA ?RB	40
Error code read-out	_____	_____	?ER	60
Over status byte read-out	_____	_____	?0V	45

Table 2-9 Standard Prictice Time (2/3)

Function	Setting message header	Standard practice time (ms)	Inquiry message	Standard practice time (ms)
SRQ factor setting	SE	40	?SE	40
Status byte read-out	_____	_____	?ST	40
Header on/off	HD	55	?HD	55
On/off for forbidden key setting	KL	50	?KL	50
Setting of input BNC connector	IN	80	?IN	50
Initial value setting	IT	105	____	____
ROM version	_____	_____	?VR	30
On/off of input/ output GND	TA TB	45	?TA ?TB	35
	GA GB	65	?GA ?GB	55

Table 2-9 Standard Practice Time (3/3)

Function	Setting message header	Standard practice time (ms)	Inquiry message	Standard practice time (ms)
Mode setting	M	90	_____	_____
Function setting	F	85	_____	_____
Digit setting	D	120	_____	_____
Range setting	R	135	_____	_____
Gain setting	G	85	_____	_____
SRQ factor setting	S	40	_____	_____

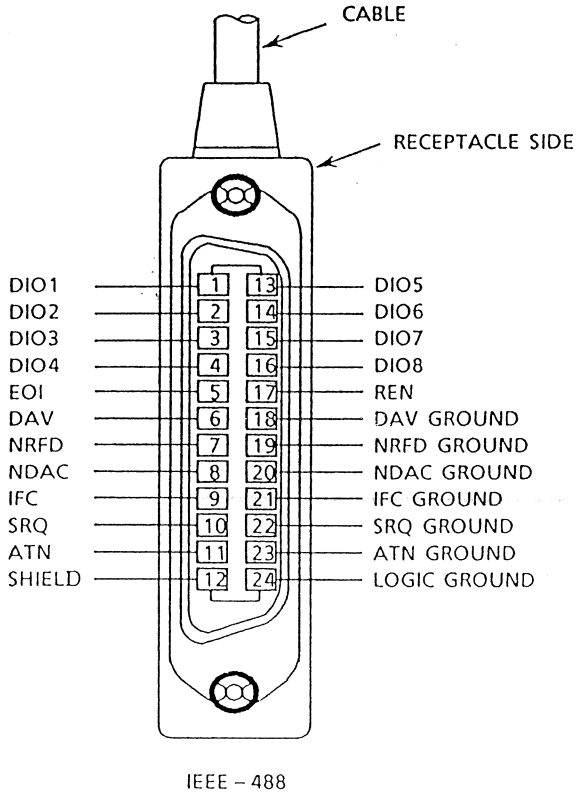


Fig. 2-1 Interface Connector

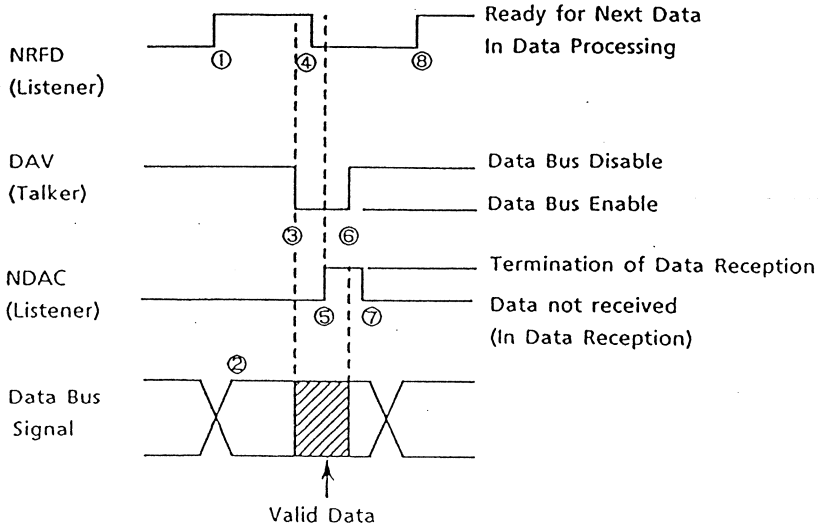


Fig. 2-2 Handshake Timing Diagram

Explanation for Fig. 2-2 Handshake Timing Diagram

① Indicates that all listeners are waiting for data.

② The talker outputs data to be sent to the data lines. May have already occurred.

③ The talker checks NRFD and if high, DAV is set to low to indicate to the listener that data is valid.

④ When the DAV changes to low level, the listener reads data and NRFD is set to low, indicating to the talker that data processing is in progress. Each listener sets NDAC to high at the completion of data input. The NDAC of the bus is the OR function of the NDACs from each listener.

⑤ When all listeners have completed receiving data, NDAC goes high (result of the OR output) indicating to the talker that data reception has been completed.

⑥ The talker sets DAV to high indicating to the listener that the data on the bus is not valid data.

⑦ The listener checks whether the DAV ishigh and sets NDAC to low, completing the handshake.

⑧ Indicats that all listeners have completed data processing and the next data is being waited for.

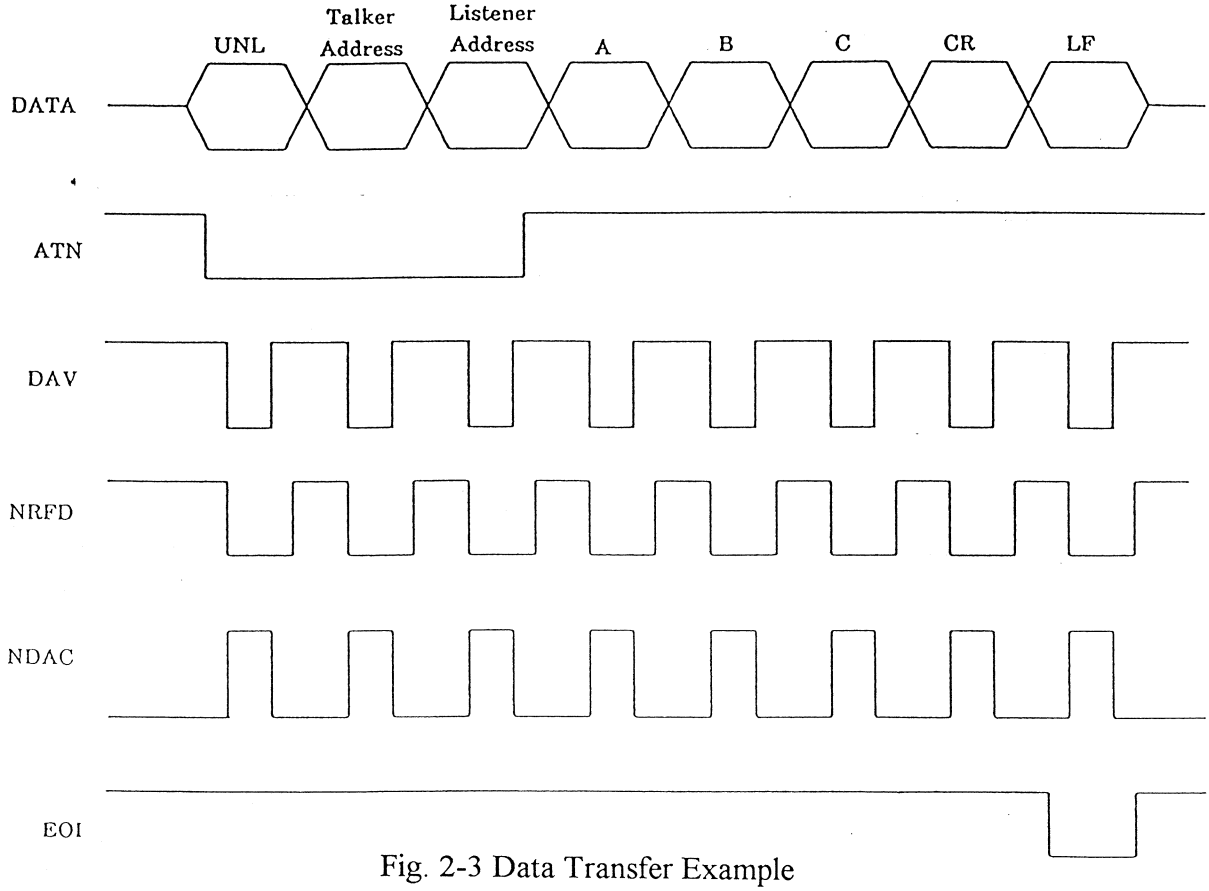


Fig. 2-3 Data Transfer Example

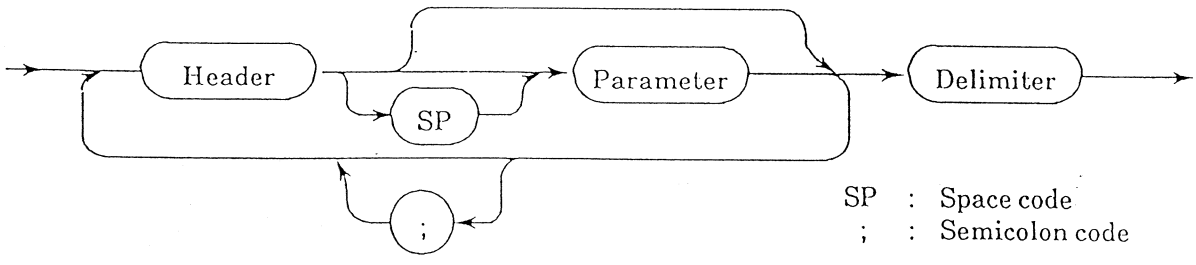


Fig 2-4 Program Code Format

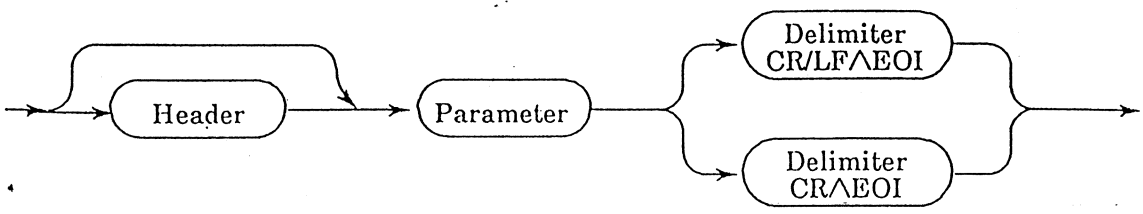


Fig 2-5 Response Output Format

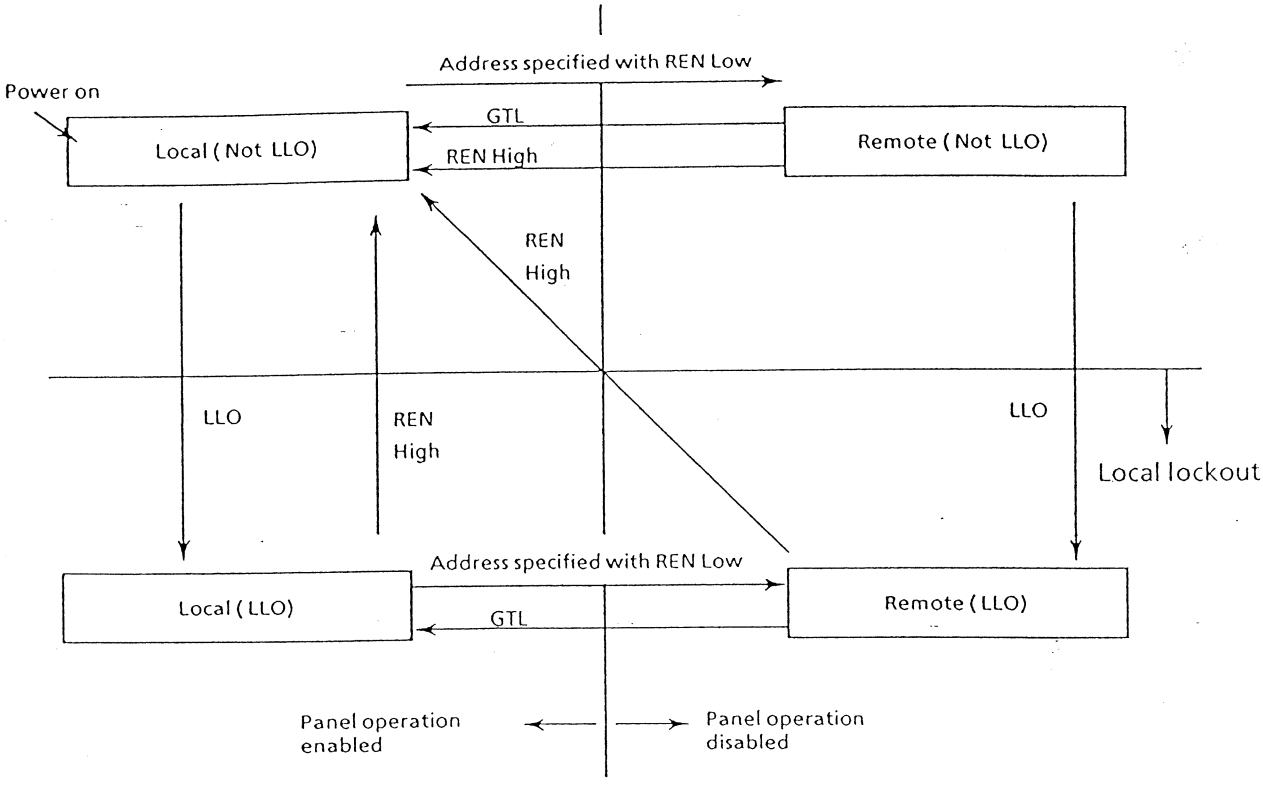


Fig. 2-6 Remote/Local Operation

WARRANTY

NF Corporation certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from our factory.

All **NF** products are warranted against defects in materials and workmanship for a period of one year from the date of shipment. During the warranty period of, **NF** will, at its option, either will repair the defective product without any charge for the parts and labor, or either repair or replace products which prove to be defective. For repair service under warranty, the product must be returned to a service center designated by **NF**. Purchaser shall prepay all shipping cost, duties, and taxes for the product to **NF** from another country, and **NF** shall pay shipping charge to returned the product to purchaser.

This warranty shall not apply to any defect, failure or damage caused by improper use, improper or inadequate maintenance and care or modified by purchaser or personnel other than **NF** representatives.

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