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April 1st, 2010
Renesas Electronics Corporation

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RENESAS

MOS INTEGRATED CIRCUIT

μPD17012GF-054

PLL FREQUENCY SYNTHESIZER AND CONTROLLER FOR FM/MW/LW TUNER (AUTOMOBILE APPLICATIONS)

The μPD17012GF-054 is a CMOS LSI chip designed for use in FM/MW/LW tuners utilizing a PLL frequency synthesizer design for worldwide applications.

The device incorporates a PLL frequency synthesizer controller, LCD controller/key scan driver, and IF counter. The device enables detachable stereo systems, and is ideal for use in electronic volume control circuits for automobile applications, high-performance FM/MW/LW tuners with a clock, and similar applications where compact dimensions are essential. The μPD17012GF-054 also supports non-detachable stereo systems.

FEATURES

- Capable of receiving broadcasts from stations in all of the world's FM and MW bands, as well as the European LW band
- Applicable to AM up-conversion
- Many preset functions including manual tuning, auto-tuning (seek, scan), and preset memory scanning
- Independent preset memory with six buttons: up to 18 FM stations (six stations, each enabling the setting of FM1, FM2, and FM3), up to 12 MW stations (six stations, each enabling the setting of MW1 and MW2), up to six LW stations, and six VF stations
- Last channel memory for three FM stations, two MW stations, one LW station, and one VF station
- DK-standby function and auto-tuning (SK signal search) for VF (traffic information) stations
- ST (stereo) display (The ST display is also supported for the MW band.)
- Display and control output of MTL (METAL), NR (noise reduction), and AMS (auto music search)
- Auto-preset memory function
- "Cd" (compact disc)/"TAPE" (cassette tape) display
- LOUD (loudness) control output and display
- Clock function for 12-hour or 24-hour clock display
- Internal LCD controller/key scan driver (capable of switching to the external LCD controller/key scan driver)
- Compatible with the external LCD controller/key scan driver (μPD17202AGF-011)
- Built-in IF counter
- Detachable key and LCD panel
- Electronic volume control function (compatible with the I^2C bus)

ORDERING INFORMATION

Part number	Package
μPD17012GF - 054 - 3BE	64-pin plastic QFP (14 × 20 mm)

The information in this document is subject to change without notice.

Document No. ID-3632
(O. D. No. ID-9082)
Date Published June 1995 P
Printed in Japan

Major changes in this revision are indicated by stars (*) in the margins.

FUNCTION OVERVIEW

FREQUENCY TO BE RECEIVED, CHANNEL SEPARATION, REFERENCE FREQUENCY, AND INTERMEDIATE FREQUENCY

Area	Band	Frequency to be received	Channel separation	Reference frequency	Intermediate frequency
Eastern Europe	FM	87.5 - 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	MW	522 - 1620 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
	LW	144 - 290 kHz	1 kHz	1 kHz	450 kHz/10.71 MHz
Western Europe	FM	87.5 - 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	MW	522 - 1620 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
	LW	144 - 290 kHz	1 kHz	1 kHz	450 kHz/10.71 MHz
China	FM	87.0 - 108.0 MHz	50 kHz	25 kHz	10.7 MHz
	MW	531 - 1602 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
Australia, Middle East	FM	87.5 - 108.0 MHz	100 kHz	25 kHz	10.7 MHz
	MW	531 - 1602 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz
U.S.A. 1	FM	87.5 - 108.0 MHz	100 kHz	25 kHz	10.7 MHz
	MW	530 - 1620 kHz	10 kHz	10 kHz	450 kHz/10.71 MHz
U.S.A. 2	FM	87.5 - 107.9 MHz	200 kHz	25 kHz	10.7 MHz
	MW	530 - 1620 kHz	10 kHz	10 kHz	450 kHz/10.71MHz
U.S.A. 3	FM	87.5 - 107.9 MHz	200 kHz	25 kHz	10.7 MHz
	MW	530 - 1710 kHz	10 kHz	10 kHz	450 kHz/10.71 MHz
Japan	FM	76.0 - 90.0 MHz	100 kHz	25 kHz	–10.7 MHz
	MW	522 - 1629 kHz	9 kHz	9 kHz	450 kHz/10.71 MHz

RADIO FUNCTIONS

(1) Manual tuning

Function	Description
Manual up Manual down	Carries out tuning in step-by-step or fast-forward mode.

(2) Auto-tuning

Function	Description
Seek up Seek down	Detects a station and retains the frequency.
Scan up Scan down	Tunes to broadcasts of different stations for five seconds each.

(3) Preset memory scanning: Tunes to broadcasts of stations held in preset memory for five seconds each.

(4) VF auto-tuning

Function	Description
SK seek up SK seek down	Detects a traffic information station and retains its frequency.
SK scan up SK scan down	Tunes to broadcasts of different traffic information stations for five seconds each.

(5) Preset memory
- FM band: FM1: Six stations, FM2: Six stations, FM3: Six stations
- MW band: MW1: Six stations, MW2: Six stations
- LW band: Six stations
- VF band: Six stations

(6) Last channel memory: One station each for FM1, FM2, FM3, MW1, MW2, LW, VF

(7) LOC (local) control output and display (The auto-local function can be selected.)

(8) ST (stereo) display function: Supported for the FM and VF bands. The display function is also supported for the MW band. (A switching function is supported.)

(9) Auto-storage

(10) DK-standby function, SK alarm function

TAPE FUNCTIONS

(1) Tape running direction display: Can be blinked at 2.5 Hz in fast-forward mode

(2) AMS (auto music search) control output and display

(3) MTL (METAL) control output and display

(4) NR (noise reduction) control output and display

(5) *"TAPE"* (cassette tape) display function

ELECTRONIC VOLUME CONTROL FUNCTIONS (ELECTRONIC VOLUME CONTROL A OR B IS SUPPORTED)

(1) Volume/bass/treble/balance/fader function

(2) *"VOL"/"bAS"/"TREb"/"bAL"/"FAd"* display on the LCD panel

(3) Mute function (In the mute state, the entire panel display blinks.)

(4) Loudness function (supported only for the electronic volume control A)

CLOCK FUNCTIONS

(1) Selectable 12-hour clock display (with AM/PM indication) or 24-hour clock display

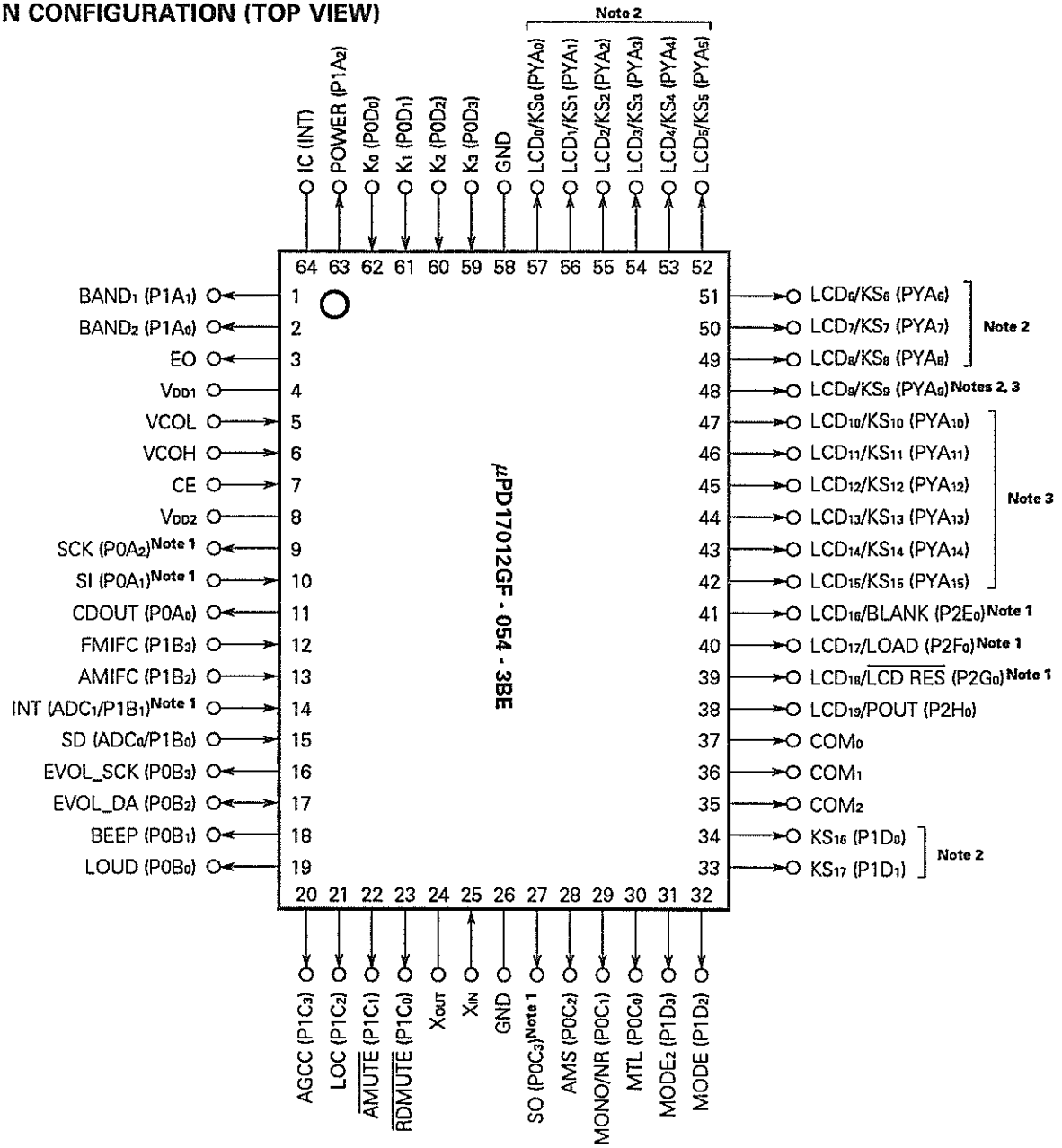
(2) Selectable colon (:) flashing (1 Hz)

(3) Capable of back-up with low current consumption (up to 10 μA) in no-clock mode

OTHERS

(1) LOUD (loudness) control output and display: Common to radio, tape, and CD modes
(2) Key acknowledge (beep) output: Performed if a valid momentary key is on
(3) Display switching function and privileged display function
(4) "CD" (compact disc) display
(5) Compatible with the external LCD controller/key scan driver (μPD17202AGF-011)
(6) Detachable key and LCD panel (only when the μPD17202AGF-011 is used)

PIN CONFIGURATION (TOP VIEW)



Notes 1. Pins used when the external LCD controller/key scan driver (μPD17202AGF-011) is used
2. Initial setting diode or transistor switch
3. Valid only for momentary keys when KLCD = 0 (internal LCD controller/key scan driver is used)

Caution Directly connect the IC pin to GND.

Remarks 1. IC indicates that the pin is internally connected.
2. Pin names on the μPD17012GF are given in parentheses.

CONTENTS

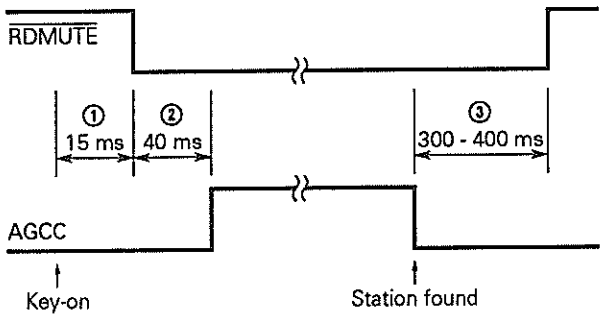
1. PIN FUNCTIONS

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O type</th></tr>
<tr><td>1
2</td><td>BAND1
BAND2</td><td>Band switching signal output</td><td>Output pin of the band switching signal in radio mode
The operation depends on the mode, as described below:
(1) In radio mode, radio-monitor tape mode, radio-monitor CD mode
If the band to be received is switched by pressing the band switching key, the output depends on the band, as listed below:
<table><tr><th>Pin / Band</th><th>BAND1</th><th>BAND2</th></tr><tr><td>MW</td><td>0</td><td>0</td></tr><tr><td>LW</td><td>0</td><td>1</td></tr><tr><td>FM</td><td>1</td><td>0</td></tr><tr><td>VF</td><td>1</td><td>1</td></tr></table>(0: Low, 1: High)
(2) In DK-receiving tape mode, DK-receiving CD mode, DK-standby tape mode, DK-standby CD mode
<table><tr><th>Pin / Band</th><th>BAND1</th><th>BAND2</th></tr><tr><td>VF</td><td>1</td><td>1</td></tr></table>(1: High)
(3) In tape mode, CD mode, power-off mode
The output goes low.</td><td>CMOS push-pull output</td></tr>
<tr><td>3</td><td>EO</td><td>Error out</td><td>Charge pump output pin of phase detector built into a PLL. If a divided oscillator frequency is higher than the reference frequency, the output of this pin goes high. If the divided oscillator frequency is lower, the output goes low. If the divided oscillator frequency agrees with the reference frequency, the output enters the floating state.</td><td>CMOS tristate output</td></tr>
<tr><td>4
8</td><td>VDD1
VDD2</td><td>Power supply</td><td>Power-supply pin of the device
This pin supplies a voltage of 5 V ±10% while the device is operating. The rise time (0 to 4.5 V) of VDD must not exceed 500 ms. If the rise time is significantly long or if the voltage falls below the operating voltage but is between 0 V and 3.5 V, the state of an initial setting diode switch may be read incorrectly. (If this occurs, re-read the state of the initial setting diode switch, using the CE pin.)
When VDD is input for the first time, the CE pin going high causes the lowest frequency of the FM band to be called.</td><td>—</td></tr>
</table>

Pin No.	Symbol	Pin name	Description	I/O type
5	VCOL	AM local oscillator input	Input pin of the local oscillator output (VCO) in the AM (MW, LW) band When tuned to broadcasts in the MW or LW band, this pin becomes active. Otherwise, the pin is internally pulled down. A frequency of between 0.58 and 30 MHz (0.3 V_{p-p}) can be input. To protect the built-in AC amplifier, block the flow of direct current with a capacitor, then input the frequency.	Input
6	VCOH	FM local oscillator input	Input pin of the local oscillator output (VCO) in the FM (FM, VF) band When tuned to broadcasts in the FM or VF band, this pin becomes active. Otherwise, the pin is internally pulled down. A frequency of between 9 and 150 MHz (0.3 V_{p-p}) can be input. Because an AC amplifier is incorporated, block the flow of direct current with a capacitor, then input the frequency.	Input
7	CE	Chip enable	Input pin of the device selection signal To operate the device normally (radio, tape, CD, clock display, etc.), set the input high. To disable the device, set the input low. A high or low state within a period of 165 μs is not accepted. A low on this pin causes the radio, tape, CD, and display to all be set to off, resulting in the data retention state. If the initial setting diode NOCLK is set to 1 (no-clock mode is selected by connecting the diode) in this state, the current consumption in the data retention state can be reduced. (See **Section 2.4.**)	Input
9	SCK	Serial clock output of the external LCD controller/key scan driver	Serial clock output pin for controlling the external LCD controller/key scan driver (μPD17202AGF-011)	CMOS push-pull output
10	SI	Serial data input of the external LCD controller/key scan driver	Serial data input pin for controlling the external LCD controller key scan driver (μPD17202AGF-011)	Input
11	CDOUT	CD mode output	CD mode output pin Each time the CD momentary key is pressed, the CDOUT output is inverted. In the following modes, the CDOUT output is always set low: ● When CE is low ● In power-off mode (when CE is high and the radio, tape, and CD are off) ● When the DTH transistor switch is set to off	CMOS push-pull output

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O type</th></tr>
<tr><td>12</td><td>FMIFC</td><td>FM intermediate frequency input</td><td>Input pin of the intermediate frequency (IF) in the FM or AM (MW, LW) band when the initial setting diode IFAM is set to 1
A frequency of between 5 and 15 MHz (0.3 V_{p-p}) can be input.
To protect the built-in AC amplifier, block the flow of direct current with a capacitor, then input the frequency.
If the ENFMIF initial setting diode is set to 1, the pin is used to detect whether a station is found by means of auto-tuning.
If the input frequency range and conditions listed below are satisfied, it is judged that a station has been found.
<table><tr><th>Item / Band</th><th>Input frequency range ①</th><th>Input frequency range ②</th></tr><tr><td>FM, VF</td><td>10.7 MHz ±50 kHz</td><td>10.7 MHz ±12.5 kHz</td></tr><tr><td>MW</td><td>10.71 MHz ±5 kHz</td><td>10.71 MHz ±2 kHz</td></tr><tr><td>LW</td><td>10.71 MHz ±5 kHz</td><td>10.71 MHz ±1 kHz</td></tr></table>A frequency within input frequency range ① must be input within 20 ms of the PLL being locked. If a frequency is included in both input frequency ranges ① and ②, it is judged that a station has been found. Auto-tuning is stopped.</td><td>Input</td></tr>
<tr><td>13</td><td>AMIFC</td><td>AM intermediate frequency input</td><td>Input pin of the intermediate frequency (IF) in the AM (MW, LW) band when the initial setting diode IFAM is set to 0
A frequency of between 0.3 and 1.0 MHz (0.3 V_{p-p}) can be input.
To protect the built-in AC amplifier, block the flow of direct current with a capacitor, then input the frequency.
If the initial setting diode ENAMIF is set to 1, this pin is used to detect whether a station is found in auto-tuning.
If the input frequency range and conditions listed below are satisfied, it is judged that a station has been found.
<table><tr><th>Item / Band</th><th>Input frequency range ① [kHz]</th><th>Input frequency range ② [kHz]</th></tr><tr><td>MW</td><td>450 ±5</td><td>450 ±2</td></tr><tr><td>LW</td><td>450 ±5</td><td>450 ±0.5</td></tr></table>A frequency within input frequency range ① must be input within 20 ms of the PLL being locked. If a frequency is included in both input frequency ranges ① and ②, it is judged that a station has been found. Auto-tuning is stopped.</td><td>Input</td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O type</th></tr>
<tr><td>14</td><td>INT</td><td>Key scan complete input of the external LCD controller/ key scan driver</td><td>Pin of the key scan complete input from the external LCD controller/key scan driver (μPD17202AGF-011)
The input level depends on the key scan state, as listed below:
<table><tr><td>Key scan state</td><td>Input level</td></tr><tr><td>Key scan in progress</td><td>Low</td></tr><tr><td>Key scan complete</td><td>High</td></tr></table></td><td>Input</td></tr>
<tr><td>15</td><td>SD</td><td>SD input</td><td>SD (station detector) signal input pin
If the following voltage is applied to this pin, it is judged that an SD is found.
<table><tr><th rowspan="2">Band</th><th rowspan="2">LOCAL/DX mode</th><th rowspan="2">Voltage by which the presence of an SD is assumed</th><th>When V_{DD} is set to 5 V</th></tr><tr><td></td></tr><tr><td rowspan="2">FM
VF</td><td>LOCAL</td><td>$\frac{28.5}{64} \times V_{DD}$ or higher</td><td>2.227</td></tr><tr><td>DX</td><td>$\frac{12.5}{64} \times V_{DD}$ or higher</td><td>0.977</td></tr><tr><td rowspan="2">MW
LW</td><td>LOCAL</td><td>$\frac{15.5}{64} \times V_{DD}$ or higher</td><td>1.211</td></tr><tr><td>DX</td><td>$\frac{12.5}{64} \times V_{DD}$ or higher</td><td>0.977</td></tr></table>The SD signal is used to judge whether a station is found.</td><td>Input</td></tr>
<tr><td>16</td><td>EVOL_SCK</td><td>Clock output of electronic volume control</td><td>Clock output pin of electronic volume control</td><td>CMOS push-pull output</td></tr>
<tr><td>17</td><td>EVOL_DA</td><td>Data input/ output of electronic volume control</td><td>Data input/output pin of electronic volume control</td><td>Input/output
CMOS push-pull output</td></tr>
<tr><td>18</td><td>BEEP</td><td>Beep output</td><td>Beep sound output pin that functions when a momentary key is pressed
If a momentary key is pressed, square waves (duty cycle 50%) of 3 kHz are output for about 40 ms. This period agrees with the period of the preceding mute.
A beep sound is output if a press of a momentary key causes the LCD panel display or output port state to be changed, or if a hold period of five seconds ends during scanning or preset memory scanning.
The beep sound output can be used as an SK alarm in the DK-standby mode. If this output is not used, leave the pin open.</td><td>CMOS push-pull output</td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O type</th></tr>
<tr><td>19</td><td>LOUD</td><td>Loudness output</td><td>Output pin of the loudness control signal
The output goes high in the loudness-on state.</td><td>CMOS push-pull output</td></tr>
<tr><td>20</td><td>AGCC</td><td>AGC cut output</td><td>AGC (auto gain control) cut signal output pin in radio mode
The output goes high in auto-tuning, as shown below.
 

① : Waiting for key-on chattering
② : Preceding mute
③ : Following mute</td><td>CMOS push-pull output</td></tr>
<tr><td>21</td><td>LOC</td><td>Local signal output</td><td>Local signal output pin in radio mode
The operation depends on the mode, as described below:
(1) In radio mode, radio-monitor tape mode, radio-monitor CD mode, DK-receiving tape mode, DK-receiving CD mode, DK-standby tape mode, DK-standby CD mode
The LOC output goes high only in auto-tuning in the local state.
The level of the LOC output depends on both the tuning state and LOCAL/DX state. The relationships are listed below:
<table>
<tr><th>Auto-tuning state</th><th>LOCAL/DX state</th><th>LOC output level</th></tr>
<tr><td rowspan="2">In progress</td><td>LOCAL</td><td>High</td></tr>
<tr><td>DX</td><td>Low</td></tr>
<tr><td>Not performed</td><td>Don't care</td><td>Low</td></tr>
</table>
(2) In other modes
The output goes low.</td><td>CMOS push-pull output</td></tr>
</table>

Pin No.	Symbol	Pin name	Description	I/O type
22	$\overline{\text{AMUTE}}$	Audio mute output	Output pin of the tape or CD mute signal The operation depends on the mode, as described below: **(1) In radio mode, radio-monitor tape mode, radio-monitor CD mode, DK-receiving tape mode, DK-receiving CD mode, power-off mode** The output goes low. **(2) In CD mode, tape mode, DK-standby CD mode, DK-standby tape mode** The output goes high. See **Chapter 5** for details.	CMOS push-pull output
23	$\overline{\text{RDMUTE}}$	Radio mute output	Output pin of radio mute signal The operation depends on the mode, as described below: **(1) In radio mode, radio-monitor tape mode, radio-monitor CD mode, DK-receiving tape mode, DK-receiving CD mode; at radio-on, radio-off; at band switching; at switching of the frequency to be received** The output goes low. **(2) In CD mode, tape mode, DK-standby CD mode, DK-standby tape mode** The output method can be selected by setting the initial setting diode MUTESEL. (See **Section 2.4**) If the DK-standby or radio-monitor function is used, set MUTESEL to 0 and bring the output low. See **Chapter 5** for details.	CMOS push-pull output
24	X_{OUT}	Crystal	Pin for connecting a crystal	—
25	X_{IN}		A 4.5-MHz crystal is connected.	Input
26 58	GND	Ground	Ground pin Connect pins No. 26 and No. 58 to an identical potential.	—
27	SO	Serial data output of the external LCD controller/key scan driver	Serial data output pin for controlling the external LCD controller/key scan driver (μPD17202AGF-011)	N-ch open-drain output

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O type</th></tr>
<tr><td>28</td><td>AMS</td><td>AMS signal output</td><td>AMS (auto music search) signal output pin
The output level depends on the AMS state, as listed below:
<table><tr><th>AMS state</th><th>Output level</th></tr><tr><td>ON</td><td>High</td></tr><tr><td>OFF</td><td>Low</td></tr></table>If the TPSET switch is set to on, the output level depends on the AMS state, regardless of the current mode.</td><td>CMOS push-pull output</td></tr>
<tr><td>29</td><td>MONO/NR</td><td>MONO output or noise reduction signal output</td><td>MONO signal output pin or noise reduction signal output pin
The operation depends on the mode, as described below:
(1) In radio mode, radio-monitor tape mode, radio-monitor CD mode, DK-receiving tape mode, DK-receiving CD mode
This pin functions as a MONO signal output pin.
The output level depends on the selected band and the MONO state, as listed below:
<table><tr><th>Selected band</th><th>MONO state</th><th>Output level</th></tr><tr><td>FM</td><td>ON</td><td>High</td></tr><tr><td>VF</td><td>OFF</td><td>Low</td></tr><tr><td>LW</td><td>Don't care</td><td>Low</td></tr></table>If the MW band is selected, the output level depends on the setting of the initial setting diode MWS, as listed below:
<table><tr><th>MWS</th><th>MONO state</th><th>Output level</th></tr><tr><td rowspan="2">1</td><td>ON</td><td>High</td></tr><tr><td>OFF</td><td>Low</td></tr><tr><td>0</td><td>Don't care</td><td>Low</td></tr></table>(1: Closed by the diode, 0: Open)
(2) In tape mode, DK-standby tape mode
The pin functions as an output pin of the noise reduction signal. The output level depends on the NR state, as listed below:
<table><tr><th>NR state</th><th>Output level</th></tr><tr><td>ON</td><td>High</td></tr><tr><td>OFF</td><td>Low</td></tr></table>(3) In CD mode, DK-standby CD mode, power-off mode
The output goes low.</td><td>CMOS push-pull output</td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin name</th><th>Description</th><th>I/O type</th></tr>
<tr><td>30</td><td>MTL</td><td>METAL signal output</td><td>IMETAL signal output pin
The output level depends on the METAL state, as listed below:
<table><tr><th>METAL state</th><th>Output level</th></tr><tr><td>ON</td><td>High</td></tr><tr><td>OFF</td><td>Low</td></tr></table>If the TPSET switch is set to on, the output level depends on the METAL state, regardless of the current mode.</td><td>CMOS push-pull output</td></tr>
<tr><td>31
32</td><td>MODE2
MODE</td><td>Mode signal output</td><td>Mode switching signal output pin
The output depends on the mode, as listed below:
<table><tr><th>Mode</th><th>MODE</th><th>MODE2</th></tr><tr><td>When CE is low</td><td>0</td><td>0</td></tr><tr><td>When CE is high and the radio, tape, and CD are off (power-off mode)</td><td>0</td><td>0</td></tr><tr><td>In radio mode</td><td>1</td><td>0</td></tr><tr><td>In tape mode</td><td>0</td><td>0</td></tr><tr><td>In CD mode</td><td>0</td><td>1</td></tr><tr><td>In DK-standby tape mode</td><td rowspan="2">1</td><td>0</td></tr><tr><td>In DK-standby CD mode or DK-receiving CD mode</td><td>1</td></tr><tr><td>In radio-monitor tape mode</td><td rowspan="2">1</td><td>0</td></tr><tr><td>In radio-monitor CD mode</td><td>1</td></tr></table>(0: Low, 1: High)</td><td>CMOS push-pull output</td></tr>
<tr><td>33
34</td><td>KS17
KS16</td><td>Key source signal output</td><td>Output pin of the key source signal of the key matrix</td><td>CMOS push-pull output</td></tr>
<tr><td>35
|
37</td><td>COM2
|
COM0</td><td>LCD common signal output</td><td>Common signal output pin. The signal is sent to the LCD panal.</td><td>CMOS tristate output</td></tr>
<tr><td>38</td><td>LCD19/POUT</td><td>LCD segment signal output or detachable panel state signal output</td><td>Output pin of the segment signal to the LCD panel, or the detachable panel state signal output pin
The operation depends on the state of the KLCD initial setting diode.
(1) When KLCD = 0
The pin outputs the segment signal to the LCD panel.
(2) When KLCD = 1
When the DTH switch is set to off, the pin outputs the detachable panel state signal, having a frequency of 1 Hz and a duty cycle of 1/2.</td><td>CMOS push-pull output</td></tr>
</table>

Pin No.	Symbol	Pin name	Description	I/O type
39	LCD_{18}/ $\overline{\text{LCD RES}}$	LCD segment signal output or reset signal output of the external LCD controller/key scan driver	Pin to output the segment signal to the LCD panel or the reset signal of the LCD controller/key scan driver (μPD17202AGF-011) The operation depends on the state of the KLCD initial setting diode. **(1) When KLCD = 0** The pin outputs the segment signal to the LCD panel. **(2) When KLCD = 1** The pin outputs the reset signal to the external LCD controller/key scan driver (μPD17202AGF-011). When the output goes low, the external LCD controller/key scan driver enters the reset state.	N-ch open-drain output
40	LCD_{17}/LOAD	LCD segment signal output or load signal output of the external LCD controller/key scan driver	Pin to output the segment signal to the LCD panel or output the load signal for controlling the external LCD controller/key scan driver (μPD17202AGF-011). **(1) When KLCD = 0** The pin outputs the segment signal to the LCD panel. **(2) When KLCD = 1** The pin outputs the load signal to the external LCD controller/key scan driver (μPD17202AGF-011).	CMOS push-pull output
41	LCD_{16}/BLANK	LCD segment signal output or blank output of the external LCD controller/ key scan driver	Pin to output the segment signal to the LCD panel or the control signal to the LCD controller/key scan driver (μPD17202AGF-011) to turn on or off the LCD. The output level depends on the LCD display state, as listed below; LCD display state / Output level: Lit / Low; Not Lit / High **(1) When KLCD = 0** The pin outputs the segment signal to the LCD panel. **(2) When KLCD = 1** The pin outputs the blank signal to the external LCD controller/key scan driver (μPD17202AGF-011).	N-ch open-drain output

Pin No.	Symbol	Pin name	Description	I/O type
42 I 57	LCD_{15}/KS_{15} I LCD_0/KS_0	LCD segment signal output or key source signal output	Pin to output the segment signal to the LCD panel or output the key source signal of the key matrix. These pins are used to output both the key source signal of the key matrix and the LCD segment signal. Therefore, when used as the key source signal output pin, a diode must be connected to the pin to prevent backward current.	CMOS push-pull output
59 I 62	K_3 I K_0	Key return signal input	Input pin of the key return signal of the key matrix The pins which output key source signals are also used to output LCD segment signals. Do not connect pull-down resistors to the key return signal input pins.	Input
63	POWER	Power output	The output is inverted each time the POWER key is pressed. Use this pin to turn the power on or off.	CMOS push-pull output
64	IC	IC	Internally connected pin. Directly connect the pin to GND.	—

2. KEY MATRIX STRUCTURE

2.1 KEY MATRIX PLACEMENT

Input pin (pin number) / Output pin (pin number)	K_3 (59)	K_2 (60)	K_1 (61)	K_0 (62)
KS_{17} (33)	ENFM	DISFM3	ENMW2	DISLW
KS_{16} (34)	RDON	AREA3	AREA2	AREA1
LCD_{15}/KS_{15} (42)	M6	M5	M4	M3 (TP3)
LCD_{14}/KS_{14} (43)	M2 (TP2)	M1 (TP1)	MTL	LOC
LCD_{13}/KS_{13} (44)	LOUD	P.SCAN	DISP	ME
LCD_{12}/KS_{12} (45)	VF	BAND	SCAN UP	SEEK UP
LCD_{11}/KS_{11} (46)	MAN DWN	MAN UP	RDMONI	NR
LCD_{10}/KS_{10} (47)	AMS	MONO	SCAN DWN	SEEK DWN
LCD_9/KS_9 (48)	CD	MUTE	VOL DWN	VOL UP
LCD_8/KS_8 (49)	VOL SEL	POWER	SK	DK
LCD_7/KS_7 (50)	RDSET	ST	DTH	CDSET
LCD_6/KS_6 (51)	FF	RL	TPSET	VKYSEL
LCD_5/KS_5 (52)	VOLATT_L	VOLATT_H	EVOLSEL	KLCD
LCD_4/KS_4 (53)	IFAM	M2S	VF1	MWS
LCD_3/KS_3 (54)	AUTO500	MUTESEL	AUTOLOC	FAD_SEL
LCD_2/KS_2 (55)	CKHLT	KAMS	KNR	KMTL
LCD_1/KS_1 (56)	NOCLK	CLKDISP	FLASH	DISAMEMO
LCD_0/KS_0 (57)	ENFMIF	ENAMIF	PRIO2	PRIO1

: Initial setting diode

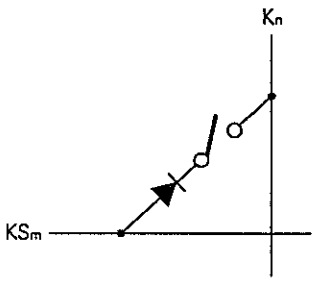
: Alternation or transistor switch

: Momentary key

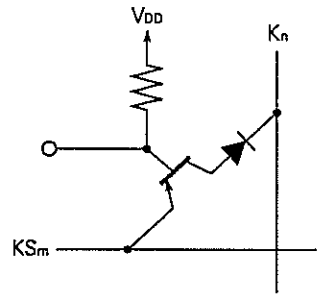
Remark Momentary keys are effective only when KLCD = 0 (see **Section 2.4**).

2.2 SWITCH CONNECTION

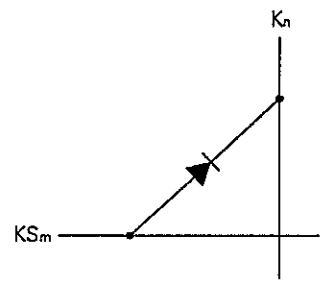
Alternation switch



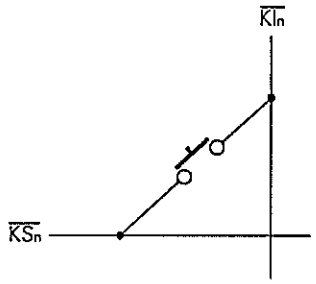
Transistor switch



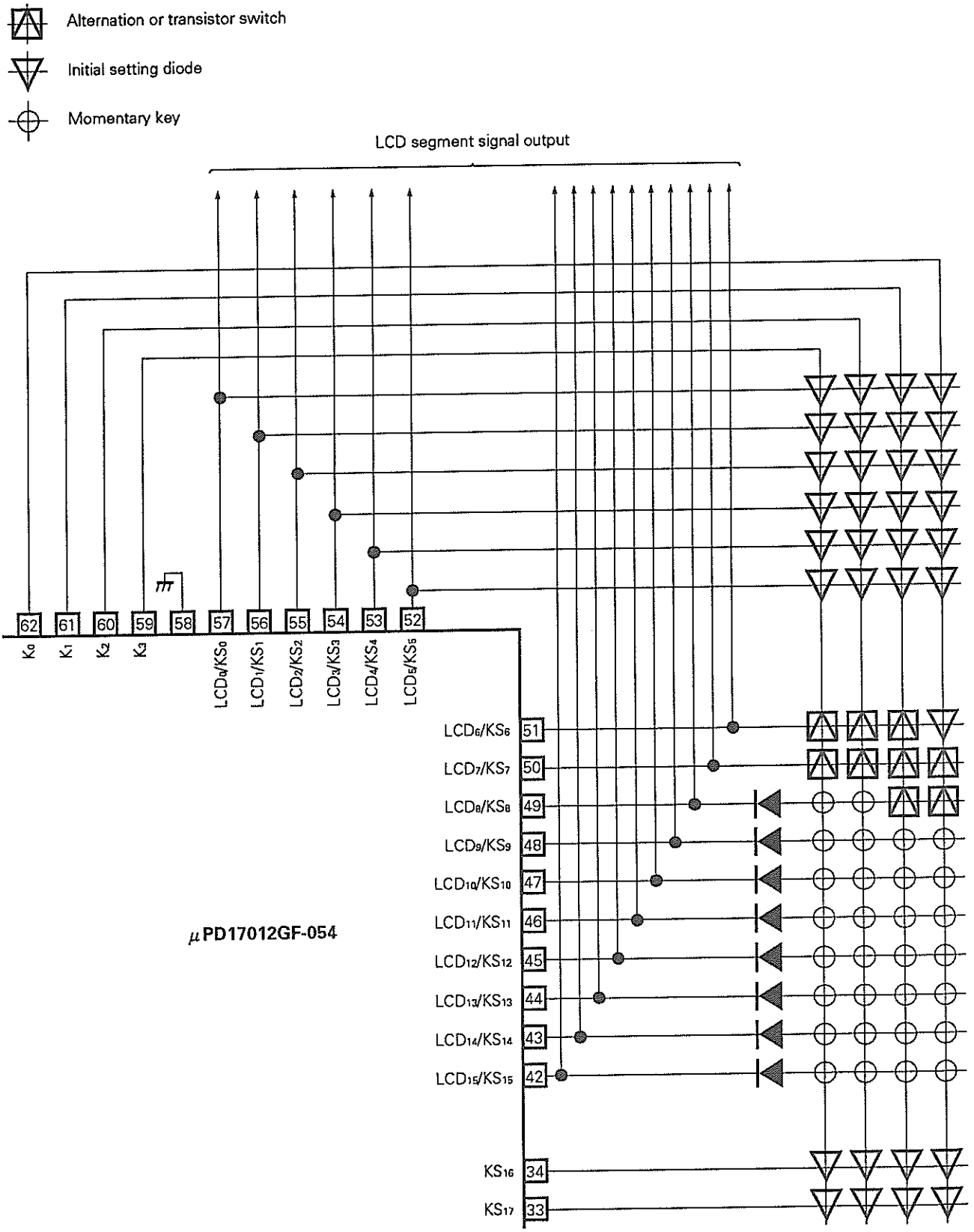
Initial setting diode



Momentary key



2.3 KEY MATRIX CONNECTION



Remark Momentary keys are effective only when KLCD = 0.

2.4 INITIAL SETTING DIODE MATRIXES

The μPD17012GF-054 has the following 21 initial setting diode matrixes. When the V_{DD} is supplied with power for the first time (at a power-on reset) or when the CE pin goes from a low level to a high level (at a CE reset), the states of the diodes in these matrixes are read in. In all other occasions, they are ignored.

(1) Switch to specify the reception area
AREA1, AREA2, and AREA3

(2) Switch to specify the reception band
DISFM3, ENMW2, DISLW, and ENFM

(3) Switch to specify whether to use the auto-storage function
DISAMEMO

(4) Switch to specify whether to use the frequency counter for detecting broadcasting stations
ENFMIF and ENAMIF

(5) Switch to specify preset memory operation
M2S

(6) Switch to specify tuning operation
AUTO500

(7) Switch to specify display priority
PRIO1 and PRIO2

(8) Switch to specify whether to switch on or off the radio
RDON

(9) Switch to specify the clock function
NOCLK, CLKDISP, and FLASH

(10) Switch to specify the tape function
KAMS, KNR, and KMTL

(11) Switch to specify the mute output
MUTESEL

(12) Switch to specify the local operation
AUTOLOC

(13) Switch to specify the intermediate frequency for the AM (MW, LW) band
IFAM

(14) Switch to specify whether the VF band auto-retuning function (to trigger a seek-up operation automatically upon detection of deteriorated reception state) is available
VF1

(15) Switch to specify whether the MW band stereo reception function is available
MWS

(16) Switch to specify that the standby mode has no clock
CKHLT

(17) Switch to specify whether the electronic volume control fader function is available
FAD_SEL

(18) Switch to specify which key (VOL UP/VOL DWN or MAN UP/MAN DWN) is used for electronic volume control
VKYSEL

(19) Switch to specify the electronic volume control
EVOLSEL

(20) Switch to specify the LCD controller/key scan driver to be used
KLCD

(21) Switch to specify the attenuator of the preamplifier incorporated in the electronic volume control (only when electronic volume control A is used)
VOLATT_H
VOLATT_L

To set these switches, short-circuit or keep open the diodes in each matrix. The functions of the initial setting diode matrixes are summarized below.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>AREA1
AREA2
AREA3</td><td>These switches are used to specify the reception area.
The following table lists the settings of the switches and the corresponding reception areas.
See the summary of functions for the reception frequencies in each reception area.
<table>
<tr><th>AREA3</th><th>AREA2</th><th>AREA1</th><th>Area</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>Western Europe</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Australia
Middle and Near East</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Japan</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>USA 1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>USA 2</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>Eastern Europe</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>USA 3</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>China</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
<tr><td>DISFM3
ENMW2
DISLW
ENFM</td><td>These switches are used to specify the reception band.
Each switch has the following functions.
○ DISFM3: When set to 1, disables the FM3 band.
○ ENMW2: When set to 1, enables the MW2 band.
○ DISLW: When set to 1, disables the LW band for Western Europe and Eastern Europe. This switch is ineffective in the other areas.
○ ENFM: When set to 1, enables only the FM band.
The following table lists the settings of these switches and the corresponding reception bands in each area.
<table>
<tr><th>Area</th><th>ENFM</th><th>DISFM3</th><th>ENMW2</th><th>DISLW</th><th>Reception band</th></tr>
<tr><td rowspan="8">Western Europe
Eastern Europe</td><td>1</td><td>0</td><td>—</td><td>—</td><td>FM1, FM2, FM3</td></tr>
<tr><td>1</td><td>1</td><td>—</td><td>—</td><td>FM1, FM2</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>FM1, FM2, FM3, MW1, LW</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>FM1, FM2, FM3, MW1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>—</td><td>FM1, FM2, FM3, MW1, MW2</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>FM1, FM2, MW1, LW</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>FM1, FM2, MW1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>—</td><td>FM1, FM2, MW1, MW2</td></tr>
<tr><td rowspan="8">The other areas</td><td>1</td><td>0</td><td>—</td><td>—</td><td>FM1, FM2, FM3</td></tr>
<tr><td>1</td><td>1</td><td>—</td><td>—</td><td>FM1, FM2</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>—</td><td>FM1, FM2, FM3, MW1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>—</td><td>FM1, FM2, FM3, MW1, MW2</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>—</td><td>FM1, FM2, MW1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>—</td><td>FM1, FM2, MW1, MW2</td></tr>
</table>
(1: Shorted by the diode; 0: Open; —: Don't care)</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>M2S</td><td>This switch specifies the method to write to the preset memory as follows:
<table>
<tr><th>M2S</th><th>Writing method</th></tr>
<tr><td>0</td><td>Press the [ME] key to enable writing to the preset me-mory for 5 seconds, then the [M1 (TP1)] to [M6] key.</td></tr>
<tr><td>1</td><td>Keep the [M1 (TP1)] to [M6] key pressed for at least 2 seconds.</td></tr>
</table>
(1: Shorted by the diode; 0: Open)
See the descriptions of the [ME] and the [M1 (TP1)] to [M6] keys for details.</td></tr>
<tr><td>AUTO500</td><td>This switch specifies the function of the [MAN UP] and [MAN DWN] keys. With the AUTO500 switch, it is possible to use the [MAN UP] and [MAN DWN] keys also for auto-tuning (seek operation), as follows.
<table>
<tr><th>AUTO500</th><th>[MAN UP] and [MAN DWN] key function</th></tr>
<tr><td>0</td><td>Only manual tuning is performed.
Each time the key is pressed, the frequency counter is incremented or decremented by one channel. Keeping the key pressed for at least 0.5 seconds triggers manual fast increment/decrement.</td></tr>
<tr><td>1</td><td>Both manual and auto-tuning are performed.
Each time the key is pressed, the frequency counter is incremented or decremented by one channel. Keeping the key pressed for at least 0.5 seconds causes auto-tuning (seek operation) to begin at the next channel.
The [SEEK UP] and [SEEK DWN] keys become ineffective.</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
<tr><td>AUTOLOC</td><td>This switch specifies the local function, as follows:
<table>
<tr><th>AUTOLOC</th><th>Local function</th></tr>
<tr><td>0</td><td>Either the local or DX mode is selected according to a key entry (no auto-local function available).
Each time the [LOC] key is pressed, switching occurs between the local and DX modes.
The local output is high in the local mode during auto-tuning (seek, scan, or auto-store).</td></tr>
<tr><td>1</td><td>The auto-local function is performed (if available).
The [LOC] key becomes ineffective.
Keeping the [SEEK UP], [SEEK DWN], [SCAN UP], [SCAN DWN] or [P.SCAN] key for at least 2 seconds triggers auto-tuning, turns on the "LOC" display, and makes the local output high. After one cycle of auto-tuning is completed, a search begins in the DX mode (with the "LOC" display off and local output at a low level).
In modes other than auto-tuning , the "LOC" display is off and the local output is low. If a key for the same operation (for example, the [SEEK UP] key during seek operation) is pressed in the local mode during auto-tuning, a search begins in the DX mode at the same frequency used when auto-tuning began. If the key is pressed during the DX mode, auto-tuning stops, and the frequency that was selected when auto-tuning began is reselected.
The same operation as above occurs when the AUTO500 is set to 1 (by keeping the [MAN UP] or [MAN DWN] key pressed for at least 0.5 seconds).</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>PRIO1
PRIO2</td><td>
These switches specify a privileged display. The term privileged display means the display which is resumed in five seconds after any other display is selected, if no key is pressed.
The PRIO1 and PRIO2 switches can determine the privileged display only when the NOCLK initial setting diode = 0 (with a clock). If NOCLK = 1 (without a clock), the states of these switches are ignored.
<table>
<tr><th>PRIO1</th><th>PRIO2</th><th>Privileged display</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>None</td><td>
Display switching occurs when the DISP key or a preset number key is pressed.
○ During the radio mode
Each time the DISP key is pressed, switching occurs between the frequency and clock displays.
Pressing a preset number key during clock display causes the frequency display to appear.
○ During the tape mode
Each time the DISP key is pressed, switching occurs between the "TAPE" and clock displays.
○ During the CD mode
Each time the DISP key is pressed, switching occurs between the "Cd" and clock displays.
○ During the DK-standby tape and radio-monitor tape modes
Each time the DISP key is pressed, switching occurs among the "TAPE", frequency, and clock displays.
Pressing the preset number key during "TAPE" or clock display causes the frequency display to appear.
The DK-standby tape and radio-monitor tape modes begin with the frequency display.
○ During the DK-standby CD and radio-monitor CD modes
Each time the DISP key is pressed, switching occurs among the "Cd", frequency, and clock displays.
Pressing a preset number key during "Cd" or clock display causes the frequency display to appear.
The DK-standby CD and radio-monitor CD modes begin with the frequency display.
○ During the DK-receiving tape and DK-receiving CD modes
Usually the frequency display appears and remains. The DISP key is ineffective.
</td></tr>
</table>
(0: Open)
</td></tr>
</table>

Symbol	Description
PRIO1 PRIO2	

PRIO1	PRIO2	Privileged display	Description
1	0	Frequency *Cd* *TAPE*	In 5 seconds after the DISP key is pressed to shift from the frequency, "*Cd*", or "*TAPE*" display to the clock display, the previous display is resumed if no other key is pressed. ○ **During the radio mode** Usually the frequency display appears and remains. Pressing the DISP key causes the clock display to appear for 5 seconds. Pressing the DISP key or a preset number key within this 5-second period of the clock display resumes the frequency display. ○ **During the tape mode** Usually the "*TAPE*" display appears and remains. Pressing the DISP key causes the clock display to appear for 5 seconds. Pressing the DISP key again within this 5-second period of clock display resumes the "*TAPE*" display. ○ **During the CD mode** Usually the "*Cd*" display appears and remains. Pressing the DISP key causes the clock display to appear for 5 seconds. Pressing the DISP key again within this 5-second period of the clock display resumes the "*Cd*" display. ○ **During the DK-standby tape and radio-monitor tape modes** Usually the "*TAPE*" display appears and remains. Pressing the DISP key causes the frequency display to appear for 5 seconds. Pressing the DISP key again within this 5-second period of the frequency display causes the clock display to appear. Pressing the DISP key again within this 5-second period of the clock display causes the "*TAPE*" display to appear. Pressing a preset number key during "*TAPE*" or clock display causes the frequency display to appear for 5 seconds. ○ **During the DK-standby CD and radio-monitor CD modes** Usually the "*Cd*" display appears and remains. Pressing the DISP key causes the frequency display to appear for 5 seconds. Pressing the DISP key again within this 5-second period of the frequency display causes the clock display to appear. Pressing the DISP key again within this 5-second period of the clock display causes the "*Cd*" display to appear. Pressing a preset number key during "*Cd*" or clock display causes the frequency display to appear for 5 seconds. ○ **During the DK-receiving tape and DK-receiving CD modes** Always the frequency display appears and remains. The DISP key is ineffective.

(1: Shorted by the diode; 0: Open)

Symbol	Description
PRIO1 PRIO2	

PRIO1	PRIO2	Privileged display	Description
0	1	Clock	The clock display has precedence over the other displays. ○ **During the radio mode** Usually the clock display appears and remains. Pressing the [DISP] key causes the frequency display to appear for 5 seconds. Pressing the [DISP] key again within this 5-second period of frequency display resumes the clock display. ○ **During the tape mode** Usually the clock display appears and remains. Pressing the [DISP] key causes the "TAPE" display to appear for 5 seconds. Pressing the [DISP] key again within this 5-second period of "TAPE" display resumes the clock display. ○ **During the CD mode** Usually the clock display appears and remains. Pressing the [DISP] key causes the "Cd" display to appear for 5 seconds. Pressing the [DISP] key again within this 5-second period of the "Cd" display resumes the clock display. ○ **During the DK-standby tape and radio-monitor tape modes** Usually the clock display appears and remains. Pressing the [DISP] key causes the "TAPE" display to appear for 5 seconds. Pressing the [DISP] key again within this 5-second period of the "TAPE" display causes the frequency display to appear. Pressing the [DISP] key again within this 5-second period of the frequency display causes the clock display to appear. Pressing a preset number key during "TAPE" or clock display causes the frequency display to appear for 5 seconds. ○ **During the DK-standby CD and radio-monitor CD modes** Usually the clock display appears and remains. Pressing the [DISP] key causes the "Cd" display to appear for 5 seconds. Pressing the [DISP] key again within this 5-second period of the "Cd" display causes the frequency display to appear. Pressing the [DISP] key again within this 5-second period of the frequency display causes the clock display to appear. Pressing a preset number key during "Cd" or clock display causes the frequency display to appear for 5 seconds. ○ **During the DK-receiving tape and DK-receiving CD modes** The frequency display appears and remains. The [DISP] key is ineffective.
1	1	—	Do not select this mode.

(1: Shorted by the diode; 0: Open)

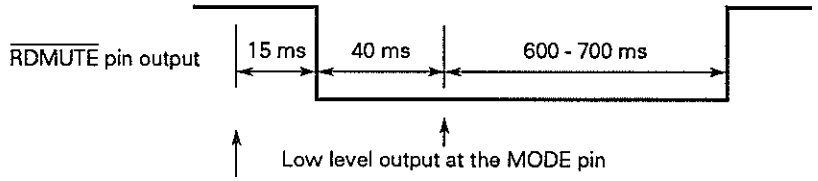
<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>PRIO1
PRIO2</td><td>If a clock is unavailable (NOCLK = 1), one of the displays listed below appears depending on what the current mode is, regardless of the states of the PRIO1 and PRIO2 switches. The [DISP] key is ineffective.
<table>
<tr><th>Mode</th><th>Display</th></tr>
<tr><td>Radio mode</td><td>Frequency</td></tr>
<tr><td>Tape mode</td><td>TAPE</td></tr>
<tr><td>CD mode</td><td>Cd</td></tr>
<tr><td>● DK-standby tape mode
● DK-standby CD mode
● DK-receiving tape mode
● DK-receiving CD mode
● Radio-monitor tape mode
● Radio-monitor CD mode</td><td>Frequency</td></tr>
</table></td></tr>
<tr><td>RDON</td><td>This switch specifies the method to switch on and off the radio, as follows:
<table>
<tr><th>RDON</th><th>Method to switch on and off the radio</th></tr>
<tr><td>0</td><td>Turn on the RDSET switch.</td></tr>
<tr><td>1</td><td>Set the CE pin to a high level. The RDSET switch is ineffective.</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
<tr><td>NOCLK</td><td>This switch specifies whether a clock is available.
<table>
<tr><th>NOCLK</th><th>Clock</th></tr>
<tr><td>0</td><td>Available</td></tr>
<tr><td>1</td><td>Unavailable</td></tr>
</table>
(1: Shorted by the diode; 0: Open)
If a clock is unavailable, setting the CE pin to a low level makes it possible to back up the circuit with a low current of 10 μA (maximum).</td></tr>
<tr><td>CLKDISP</td><td>This switch specifies the clock display system (12/24) as follows:
<table>
<tr><th>CLKDISP</th><th>Clock display system</th></tr>
<tr><td>0</td><td>12-hour system
→ AM12 : 00 → AM11 : 59 →
← PM11 : 59 ← PM12 : 00 ←</td></tr>
<tr><td>1</td><td>24-hour system
→ 0 : 00 → 23 : 59 →</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
</table>

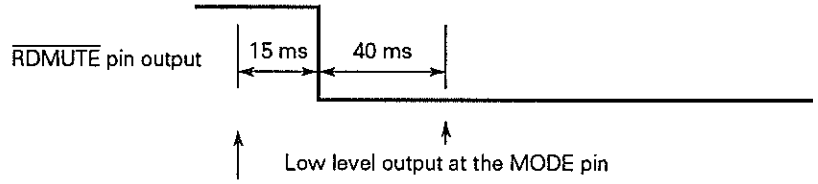
<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>FLASH</td><td>This switch specifies how a colon (:) is used in the clock display, as follows:
<table>
<tr><th>FLASH</th><th>Colon (:) display</th></tr>
<tr><td>0</td><td>Stays on.</td></tr>
<tr><td>1</td><td>Blinks.
● Frequency: 1 Hz
● Duty cycle: 6 on and 4 off</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
<tr><td>CKHLT</td><td>When the NOCLK initial setting diode = 1, and CE = low, the CKHLT switch specifies which standby mode is to be used, STOP or HALT.
<table>
<tr><th>CKHLT</th><th>CE = low</th></tr>
<tr><td>0</td><td>STOP mode</td></tr>
<tr><td>1</td><td>HALT mode</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>KAMS
KNR
KMTL</td><td>
These keys are used to assign tape functions (such as AMS, NR, and MTL) to the radio function keys. The shared keys are selected as follows:
<table>
<tr><th rowspan="2">KAMS</th><th rowspan="2">KNR</th><th rowspan="2">KMTL</th><th colspan="3">Shared key</th></tr>
<tr><th>M1 (TP1)</th><th>M2 (TP2)</th><th>M3 (TP3)</th></tr>
<tr><td>1</td><td>1</td><td>1</td><td>AMS</td><td>NR</td><td>MTL</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>AMS</td><td>NR</td><td>—</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>AMS</td><td>MTL</td><td>—</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>AMS</td><td>—</td><td>—</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>NR</td><td>MTL</td><td>—</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>NR</td><td>—</td><td>—</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>MTL</td><td>—</td><td>—</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>—</td><td>—</td><td>—</td></tr>
</table>
(1: Shorted by the diode; 0: Open)
When these tape functions are used, the M1 (TP1) to M6 keys function in the DK-standby tape mode as follows:
<table>
<tr><th>KAMS</th><th>KNR</th><th>KMTL</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>The M1 (TP1) to M6 keys are used to access a preset memory and enable or disable writing to it (radio function).</td></tr>
<tr><td colspan="3">When any switch is 1:</td><td>Any of the M1 (TP1) to M6 keys has no radio function. The M1 (TP1) to M3 (TP3) have the tape functions.</td></tr>
</table>
(1: Shorted by the diode; 0: Open)
Regardless of the states of the KAMS, KNR, and KMTL switches, the M1 (TP1) to M6 keys are used to access a preset memory and enable or disable writing to it.

DK-receiving tape mode
Radio-monitor tape mode
DK-receiving CD mode
DK-standby CD mode
Radio-monitor CD mode

</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>MUTESEL</td><td>This switch specifies how the state of the $\overline{\text{RDMUTE}}$ pin output is to change during the tape and CD modes, as follows:
<table>
<tr><th>MUTESEL</th><th>$\overline{\text{RDMUTE}}$ pin output</th></tr>
<tr><td>1</td><td>The mute function is disabled during the tape and CD modes.
 

When MUTESEL = 1, do not use the DK standby and radio monitor functions.</td></tr>
<tr><td>0</td><td>The mute function remains turned on during the tape and CD modes.
 
</td></tr>
</table>
(1: Shorted by the diode; 0: Open)
See Chapter 5 for details.</td></tr>
<tr><td>ENFMIF
ENAMIF</td><td>These switches specify whether to use the frequency counter to detect a broadcasting station, as follows:
<table>
<tr><th rowspan="2">ENFMIF</th><th rowspan="2">ENAMIF</th><th colspan="2"></th></tr>
<tr><th>Band</th><th>Method to detect a station</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">1</td><td>FM,VF</td><td>Frequency counter and SD method</td></tr>
<tr><td>MW, LW</td><td>Frequency counter and SD method</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">0</td><td>FM, VF</td><td>Frequency counter and SD method</td></tr>
<tr><td>MW, LW</td><td>SD method</td></tr>
<tr><td rowspan="2">0</td><td rowspan="2">1</td><td>FM, VF</td><td>SD method</td></tr>
<tr><td>MW, LW</td><td>Frequency counter and SD method</td></tr>
<tr><td rowspan="2">0</td><td rowspan="2">0</td><td>FM, VF</td><td>SD method</td></tr>
<tr><td>MW, LW</td><td>SD method</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
<tr><td>DISAMEMO</td><td>This switch is used to inhibit the auto-storage function, as follows:
<table>
<tr><th>DISAMEMO</th><th>Description</th></tr>
<tr><td>0</td><td>The auto-storage function is enabled.
Keeping the P.SCAN key pressed for at least 2 seconds triggers the auto-storage operation.</td></tr>
<tr><td>1</td><td>The auto-storage function is disabled.
The P.SCAN key can be used only for the preset scan function.</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>IFAM</td><td>This switch specifies the intermediate frequency for the AM band (MW and LW), as follows:
<table>
<tr><th>IFAM</th><th>Intermediate frequency</th></tr>
<tr><td>0</td><td>450 kHz</td></tr>
<tr><td>1</td><td>10.71 MHz</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
<tr><td>VF1</td><td>This switch specifies whether to enable the VF band auto-retuning function (to perform an automatic seek-up operation upon deteriorated reception state), as follows:
<table>
<tr><th>VF1</th><th>Description</th></tr>
<tr><td>1</td><td>The VF band auto-retuning function is enabled.</td></tr>
<tr><td>0</td><td>The VF band auto-retuning function is disabled.
However, a seek-up operation is performed to detect a traffic information station if one has not been received when the VF band is selected.</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
<tr><td>MWS</td><td>This switch specifies whether to enable the MW band stereo reception function, as follows:
<table>
<tr><th>MWS</th><th>Description</th></tr>
<tr><td>1</td><td>The MW band stereo reception function is enabled.</td></tr>
<tr><td>0</td><td>The MW band stereo reception function is disabled.</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>FAD_SEL</td><td>This switch specifies whether to enable the electronic volume control fader function, as follows:
<table>
<tr><th>FAD_SEL</th><th>Description</th></tr>
<tr><td>0</td><td>The fader function is enabled.
Pressing the [VOL SEL] key switches the electronic volume control mode as shown below.
Volume → Bass → Treble
Fader ← Balance ←</td></tr>
<tr><td>1</td><td>The fader function is disabled.
Pressing the [VOL SEL] key switches the electronic volume control mode as shown below.
Volume → Bass
Balance ← Treble ←</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
<tr><td>VKYSEL</td><td>This switch specifies what keys are used for volume control in each electronic volume control mode, as follows:
<table>
<tr><th>VKYSEL</th><th>Description</th></tr>
<tr><td>0</td><td>The [VOL UP] and [VOL DWN] keys are used for volume control in each electronic volume control mode.</td></tr>
<tr><td>1</td><td>The [MAN UP] and [MAN DWN] keys are used for volume control in each electronic volume control mode. The [VOL UP] or [VOL DWN] key is unusable for volume control.</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
<tr><td>EVOLSEL</td><td>This switch specifies the electronic volume control as follows:
<table>
<tr><th>EVOLSEL</th><th>Description</th></tr>
<tr><td>0</td><td>Electronic volume control A is used.</td></tr>
<tr><td>1</td><td>Electronic volume control B is used.</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
<tr><td>KLCD</td><td>This switch specifies the LCD controller/key scan driver to be used, as follows:
<table>
<tr><th>KLCD</th><th>Description</th></tr>
<tr><td>0</td><td>The internal LCD controller/key scan driver is used. Momentary keys are read by the μPD17012GF-054.</td></tr>
<tr><td>1</td><td>The external LCD controller/key scan driver (μPD17202AGF-011) is used. Momentary keys are read by the μPD17202AGF-011.</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>VOLATT_H
VOLATT_L</td><td>These switches specify the attenuator of the preamplifier incorporated in the electronic volume control (only when electronic volume control A is used).
<table>
<tr><th>VOLATT_H</th><th>VOLATT_L</th><th>Volume attenuator (dB)</th></tr>
<tr><td>0</td><td>0</td><td>11.25</td></tr>
<tr><td>0</td><td>1</td><td>7.5</td></tr>
<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>3.75</td></tr>
</table>
(1: Shorted by the diode; 0: Open)</td></tr>
</table>

2.5 ALTERNATION OR TRANSISTOR SWITCH

In the following table, a statement that a switch is on (off) means that a high (low) level is input.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>CDSET</td><td>This switch selects the CD mode. It is effective only when the CE pins is at a high level. Setting this switch to on selects the CD mode.</td></tr>
<tr><td>TPSET</td><td>This switch selects the tape mode. It is effective only when the CE pins is at a high level. If the CDSET switch is off, setting the TPSET switch to on selects the tape mode.</td></tr>
<tr><td>RDSET</td><td>This switch selects the radio mode. It is effective only when the CE pin is at a high level. If both CDSET and TPSET switches are off, setting the RDSET switch to on selects the radio mode. The RDSET switch is effective if the RDON initial setting diode = 0. It is ineffective if RDON = 1.</td></tr>
<tr><td>FF</td><td>This is the fast forward signal input switch for the tape mode.
The tape run direction indicator (◀ ▶)may light depending on the state of the RL switch as listed below.
<table>
<tr><th>FF</th><th>RL</th><th>Indicator</th></tr>
<tr><td rowspan="2">0</td><td>0</td><td>◀ ▷</td></tr>
<tr><td>1</td><td>◁ ▶</td></tr>
<tr><td rowspan="2">1</td><td>0</td><td>◀ ▷</td></tr>
<tr><td>1</td><td>◁ ▶</td></tr>
</table>
(▷: Does not light ▶: Lights ▶: Blinks (at 2.5 Hz)
0 : Off 1 : On)</td></tr>
<tr><td>RL</td><td>This is the forward run signal input switch for the tape mode. The tape run direction indicator (◀ ▶) is controlled according to the state of the FF switch. See the description of the FF switch for the state of the indicator.</td></tr>
</table>

Symbol	Description
DTH	This is the input switch to specify whether the detachable panel is attached. When this switch is off, it indicates that the panel is detached.
ST	This switch is a stereo signal input switch for the radio mode. For the FM and VF bands during the radio mode, setting this switch to on turns on the "ST" display. If the stereo reception function is available for the MW band (initial setting diode MWS = 1), setting the ST switch to on with the MW band selected turns on the "ST" display. However, the display is turned off in the monaural state.
DK	DK signal input switch of a VF station If the input on this switch is kept high for two seconds or longer in the DK-standby tape mode or DK-standby CD mode, traffic information is received. The mode is changed to the DK-receiving tape mode or DK-receiving CD mode.
SK	SK signal input switch of a VF station If the input goes high when it is judged that a station is found in the FM or VF band (the judging method depends on the setting of the initial setting diode ENFMIF), the presence of a traffic information station is assumed. In the VF band, this input is used as the auto-tuning stop signal. The input is checked 400 ms after a station is found while auto-tuning in the VF band. If the input is high, it is judged that a traffic information station has been found. Auto-tuning is stopped.

2.6 MOMENTARY KEYS

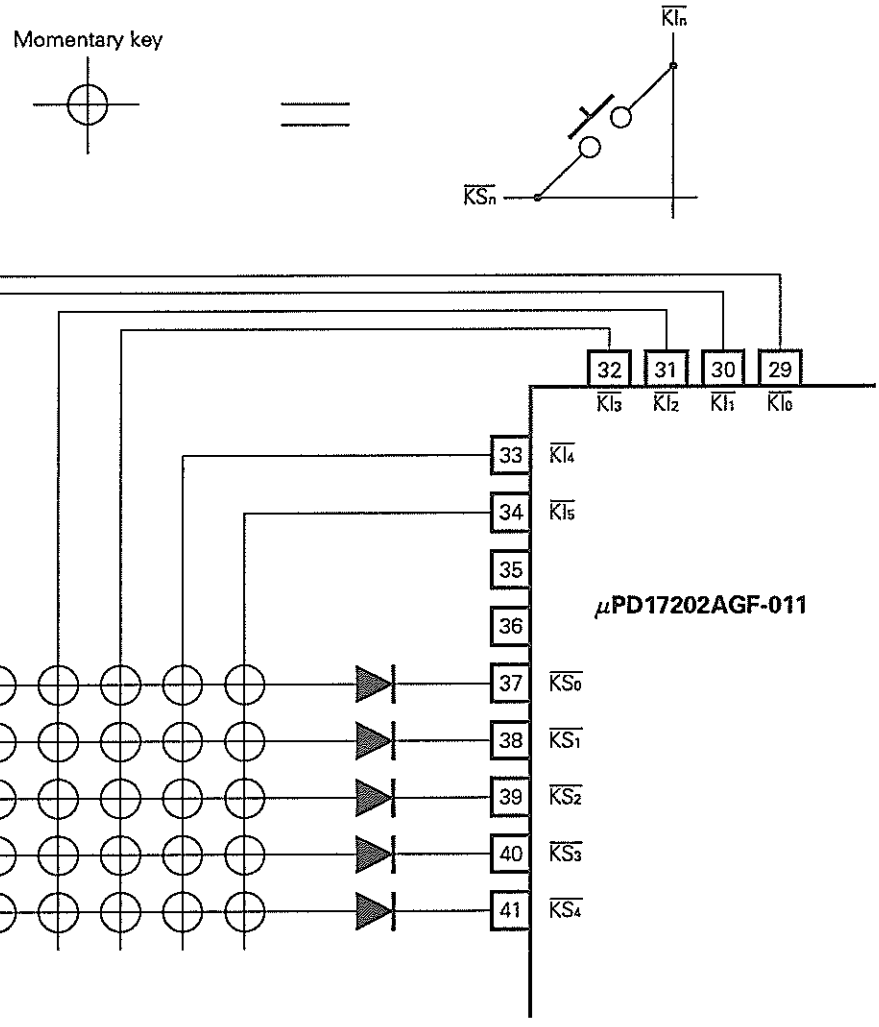
2.6.1 Momentary Key Matrix Placement (When KLCD = 1 (The μPD17202AGF-011 Is Used)

Key return (pin number) / Key source (pin number)	$\overline{KI_5}$ (34)	$\overline{KI_4}$ (33)	$\overline{KI_3}$ (32)	$\overline{KI_2}$ (31)	$\overline{KI_1}$ (30)	$\overline{KI_0}$ (29)
$\overline{KS_0}$ (37)	M1 (TP1)	M2 (TP2)	M3 (TP3)	M4	M5	M6
$\overline{KS_1}$ (38)	ME	DISP	P. SCAN	LOUD	LOC	MTL
$\overline{KS_2}$ (39)	MAN UP	MAN DWN	SEEK UP	SCAN UP	BAND	VF
$\overline{KS_3}$ (40)	SEEK DWN	SCAN DWN	MONO	AMS	NR	RDMONI
$\overline{KS_4}$ (41)	POWER	VOL SEL	VOL UP	VOL DWN	MUTE	CD

Remarks 1. $\overline{KI_0}$ to $\overline{KI_5}$ and $\overline{KS_0}$ to $\overline{KS_4}$ are the pins of the μPD17202AGF-011.

2. See **Section 2.4** for details of KLCD.

2.6.2 Momentary Key Matrix Connection (When KLCD = 1 (The μPD17202AGF-011 Is Used))



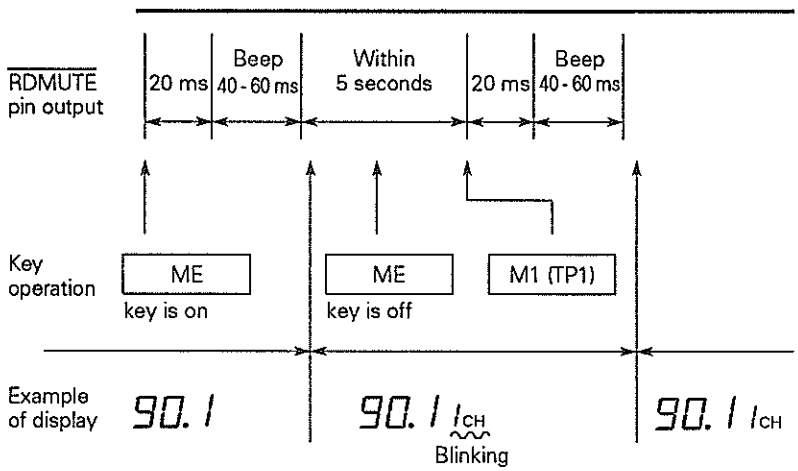
2.6.3 Description of the Momentary Keys (When KLCD = 0 (Internal LCD Controller/Key Scan Driver Is Used) or KLCD = 1 (the μPD17202AGF-011 Is Used))

Symbol	Description
M1(TP1) M2(TP2) M3(TP3) M4 M5 M6	During the radio mode, these keys are used to access a preset memory and control whether to enable writing to it. During the tape mode, the keys are used for a tape function depending on the settings of the KAMS, KNR, and KMTL initial setting diodes.

(1) During the radio, DK-standby tape, DK-standby CD, DK-receiving tape, DK-receiving CD, radio-monitor tape, and radio-monitor CD modes

The M1 (TP1) to M6 keys are used to access a preset memory and control whether to enable writing to it. Each key can be set to the FM1, FM2, FM3, VF, MW1, MW2 and LW bands (up to six bands) separately.

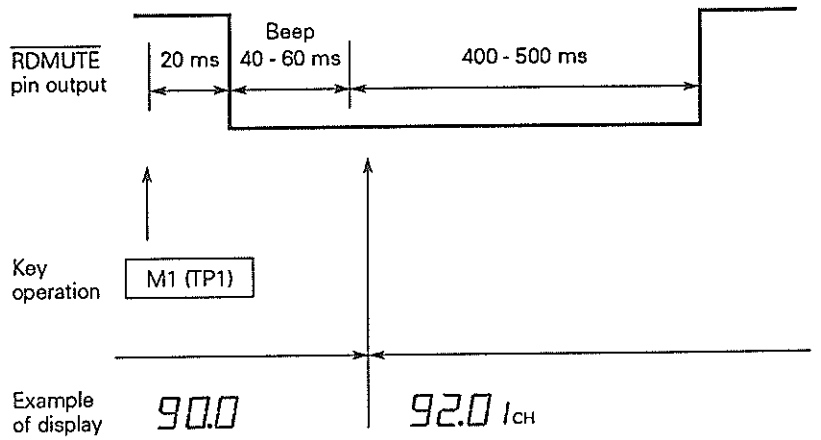
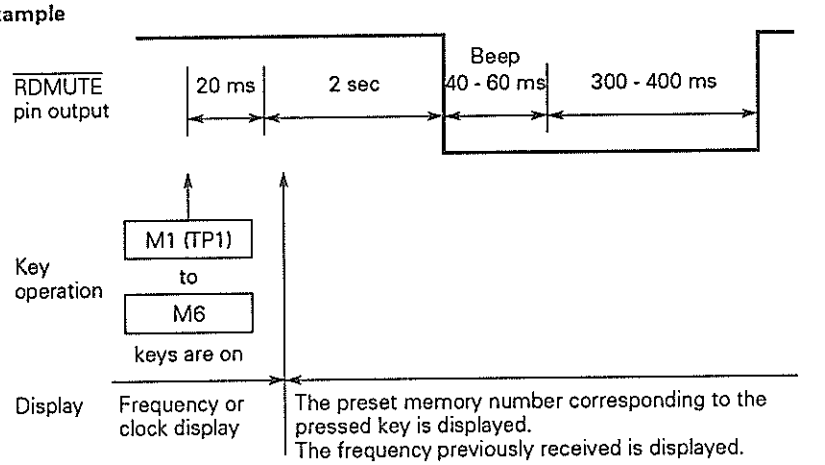
The functions of these keys vary depending on the state of the M2S initial setting diode, as follows:

M2S		Description
0	Writing	Pressing the ME key during frequency display enables writing to the preset memories for 5 seconds. Pressing one of the M1 (TP1) to M6 keys during this 5-second period writes the frequency being currently received to the preset memory corresponding to the pressed key. If the ME key is kept pressed, writing to the preset memories is disabled. The radio mute signal is not output during writing. The "CH" display and preset number (if displayed) blink at 1 Hz with a duty cycle of 1/2. **Example**  When the frequency recorded in the currently selected preset memory is being received, pressing the key corresponding to this preset memory does not output a beep except during clock display. During clock display, pressing the key not only generates a beep but also switches to the frequency display.

(0: Open)

Symbol	Description

Symbol: M1(TP1), M2(TP2), M3(TP3), M4, M5, M6

M2S		Description
0	Calling	When writing to the preset memory is inhibited, pressing one of the M1 (TP1) to M6 keys calls the content of the preset memory corresponding to the pressed key. **Example**  When the frequency recorded in the currently selected preset memory is being received, pressing the key corresponding to this preset memory does not trigger any operation except during clock display. During clock display, pressing the key not only generates a beep but also switches to the frequency display. Pressing the key, however, does not generate the radio mute signal.
1	Writing	Keeping one of the M1 (TP1) to M6 keys pressed for at least 2 seconds writes a frequency to the preset memory corresponding to the pressed key. When writing to the preset memory is completed, the radio mute signal is output as acknowledgment. **Example**  When the frequency recorded in the currently selected preset memory is being received, pressing the key corresponding to this preset memory does not trigger any operation except during clock display. During clock display, pressing the key not only generates a beep but also switches to the frequency display. Pressing the key, however, does not generate the radio mute signal. During the seek operation, pressing the key immediately accesses the preset memory (without waiting 2 seconds).

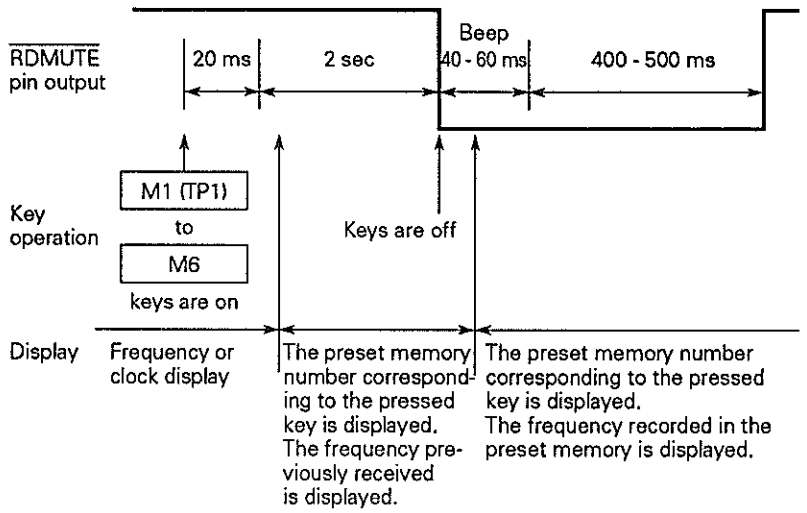
(1: Shorted by the diode; 0: Open)

Symbol	Description

M1(TP1)
M2(TP2)
M3(TP3)
M4
M5
M6

M2S		Description
1	Calling	Pressing one of the M1 (TP1) to M6 keys and releasing it within 2 seconds calls the content of the corresponding preset memory when the key is released.

Example



When the frequency recorded in the currently selected preset memory is being received, pressing the key corresponding to this preset memory does not trigger any operation except during clock display. During clock display, pressing the key not only generates a beep but also switches to the frequency display. Pressing the key, however, does not generate the radio mute signal.
During the seek operation, pressing the key immediately accesses the preset memory (without waiting 2 seconds).

(1: Shorted by the diode)

When power is applied, the frequencies listed below are written to the M1 to M6 preset memories for convenience of set adjustment.

Area \ Memory / Band		M1	M2	M3	M4	M5	M6
Eastern Europe Western Europe	FM1(MHz)	87.5	87.7	92.3	96.3	105.9	87.5
	MW1(kHz)	522	603	954	1386	522	522
	MW2(kHz)	522	621	1098	1530	522	522
	LW(kHz)	144	155	208	256	144	144
USA 1, USA 2, and USA 3	FM1(MHz)	87.5	87.9	97.1	105.1	87.5	87.5
	MW1(kHz)	530	620	1010	1490	530	530
Australia Middle and Near East	FM1(MHz)	87.5	87.9	97.1	105.1	87.5	87.5
	MW1(kHz)	531	612	963	1395	531	531
Japan	FM1(MHz)	76.0	76.4	85.6	76.0	76.0	76.0
	MW1(kHz)	522	603	954	1386	522	522
China	FM1(MHz)	87.0	87.7	92.3	87.0	87.0	87.0
	MW1(kHz)	531	540	585	531	531	531

The lowest frequency for each area is written to the M1 to M6 preset memories for the MW2 band for the areas other than Europe 1 or Europe 2 and for the FM2, FM3, and VF bands.

○ **Operation during the tape mode**

Some of the M1 to M6 keys may also be used as the tape function keys depending on the states of the KAMS, KNR, and KMTL initial setting diodes. See **Section 2.4** for details. For the operation of each of these keys, see the descriptions of the AMS, NR, and MTL keys.

Symbol	Description
VF	This key selects the VF (traffic information) band. The operation triggered by this key varies depending on the state of the VF1 initial setting diode. **(1) When VF1 = 0 (with no auto-retuning function)** Each time the VF key is pressed, the reception band is switched as follows: VF band ⟷ FM, MW, or LW band (whichever band was in use before the VF band was selected) If the VF band is selected, the "VF" display appears. When the VF band is selected, it is checked whether a VF station is being received. If a station is received (with an SD), and the SK signal is received, the tuner is set to the VF station reception state. When the VF band is selected, but no VF station is being received, an automatic seek-up operation occurs to search for a VF station. See the description of the SEEK UP and SEEK DWN keys for the seek-up operation. During VF station reception, an attempt is made to detect the SD and SK signals at every 40 ms. If it turns out that the SD or SK signal is off more than 256 times at 512 attempts, a beep with 100 ms on and 100 ms off is generated five times. During VF station reception, either of the following operations occurs depending on the state of the DK signal. (a) **When the DK signal input remains high for at least 2 seconds** (checked at every 100 ms): Reception of a traffic information station is assumed. (b) **When the DK signal input remains low for at least 3 seconds** (checked at every 100 ms): It is assumed that a traffic information station is off. **(2) When VF1 = 1 (with no auto-retuning function)** Each time the VF key is pressed, the reception band is switched as follows: VF band ⟷ FM, MW, or LW band (whichever band was in use before the VF band was selected) If the VF band is selected, the "VF" display appears. When the VF band is selected, it is checked whether a VF station is being received. When the VF band is selected, but no VF station is being received, an automatic seek-up operation occurs to search for a VF station. See the description of the SEEK UP and SEEK DWN keys for the seek-up operation. During VF station reception, an attempt is made to detect the SD and SK signals at every 40 ms. If it turns out that the SD or SK signal is off more than 256 times at 512 attempts, it is assumed that no VF station is being received, and a seek-up operation occurs. During VF station reception, either of the following operations occurs depending on the state of the DK signal. (a) **When the DK signal input remains high for at least 2 seconds** (checked at every 100 ms): Reception of a traffic information station is assumed. (b) **When the DK signal input remains low for at least 3 seconds** (checked at every 100 ms): It is assumed that a traffic information station is off.

Symbol	Description
P.SCAN	This key functions as a preset scan and auto-storage key. The operation triggered by the key varies depending on the state of the DISAMEMO initial setting diode. **(1) When DISAMEMO = 0 (with the auto-storage function):** The operation varies depending on the timing at which the key is operated. **(a) If the key is released within 2 seconds:** The preset scan operation begins immediately when the key is released. **(b) If the key is pressed for at least 2 seconds:** The auto-storage operation begins when 2 seconds elapse. **(2) When DISAMEMO = 1 (without the auto-storage function):** The preset scan operation begins immediately when the key is pressed. The preset scan and auto-storage functions are described below. ○ Preset scan operation The contents of each preset memory are called for 5 seconds each time automatically. If a frequency other than those in the preset memories is being received, calling begins at M1. If a frequency recorded in a preset memory is being received, calling begins at the preset memory numbered one higher than that preset memory (for example, at the M4 preset memory if a frequency recorded in the M3 preset memory is being received). This operation is illustrated below. **Example** If the FM1 band is being received: FM1 → M1 → M2 → M3 → M4 → M5 → M6 → The same operation occurs for the MW (MW1 and MW2) and LW bands. When the next preset memory is accessed after a 5-second hold period, a beep is generated. During each 5-second period, the preset memory number display blinks at 1 Hz (with a duty cycle of 50%). The "CH" display does not blink. To stop preset memory scanning during a 5-second hold period, press the P. SCAN key again or a preset memory key that corresponds to the preset memory being currently accessed. It is possible to write to a preset memory when another preset memory is on hold (for example, write to the M5 when the M1 is on hold). When a write operation is completed, the preset scan operation ends. During preset scanning, writing to the preset memory is performed as follows:

M2S	Description
0	Pressing the ME key enables writing to the preset memories for 5 seconds. When the preset memories are write-enabled, the functions of the M1 (TP1) to M6 keys vary depending on what the current mode is, as follows: **(1) During the radio, radio-monitor tape, radio-monitor CD, and DK-standby CD modes** A frequency is written to the preset memory corresponding to the pressed key, and the preset scan ends.

(0: Open)

Symbol	Description
P.SCAN	

M2S	Description
0	(2) **During the DK-standby tape mode** The operation triggered by the P. SCAN key varies depending on the states of the KAMS, KNR, and KMTL initial setting diodes. (a) **When any of the KAMS, KNR, and KMTL switches is on** (when some preset memory keys also have the tape functions) Pressing any of the M1 (TP1) to M6 keys does not trigger writing to the preset memories. The preset scan continues. (b) **When all the KAMS, KNR, and KMTL switches are off** (when preset memory keys do not have the tape functions) Pressing a preset memory key triggers writing to the preset memory corresponding to the pressed key, and the preset scan ends. If any of the M1 (TP1) to M6 keys is not pressed during 5 seconds of preset memory write-enabled state, the preset scan restarts, and the next preset memory is accessed. If the ME key is pressed during 5 seconds of preset memory write-enabled state, writing to the preset memories is inhibited, and the next preset memory is accessed in five seconds after the key is pressed.
1	Keeping one of the M1 (TP1) to M6 keys pressed for at least 2 seconds writes a frequency being currently received to the preset memory corresponding to the pressed key. The preset scan ends when the key is pressed.

(1: Shorted by the diode; 0: Open)

During the preset scan, each key functions as follows:

Key	Description
P.SCAN	The scan operation stops, and the current frequency is received.
SCAN UP SCAN DWN SEEK UP SEEK DWN MAN UP MAN DWN VF	The scan operation stops, the operation corresponding to the pressed key begins at the frequency being currently received.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>P.SCAN</td><td>
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>BAND</td><td>Either of the following operations occurs depending on what the current mode is.
(1) During the radio, radio-monitor tape, and radio-monitor CD modes
The scan operation stops, and the operation corresponding to the pressed key begins at the frequency being currently received.
(2) During the DK-standby tape and DK-standby CD modes
The scan operation continues. The BAND key becomes ineffective.</td></tr>
<tr><td>RDMONI</td><td>Either of the following operations occurs depending on what the current mode is.
(1) During the radio mode
The scan operation continues. The RDMONI key becomes ineffective.
(2) During the DK-standby tape, DK-standby CD, radio-monitor tape, and radio-monitor CD modes
The scan operation stops, and the operation corresponding to the pressed key begins at the frequency being currently received.</td></tr>
<tr><td>LOUD
POWER</td><td>The scan operation continues. The operation corresponding to the pressed key begins.</td></tr>
<tr><td>LOC</td><td>Either of the following operations occurs depending on the state of the AUTOLOC initial setting diode.
(1) When AUTOLOC = 0:
The scan operation continues. The operation corresponding to the LOC key begins.
(2) When AUTOLOC = 1:
The scan operation continues. The LOC key becomes ineffective.</td></tr>
<tr><td>MONO</td><td>The scan operation continues. The operation corresponding to the MONO key begins.</td></tr>
<tr><td>M1(TP1)
M2(TP2)
M3(TP3)
M4
M5
M6</td><td>The operations triggered by these keys vary depending on the state of the M2S initial setting diode.
(1) When M2S = 0:
(a) During the radio, radio-monitor tape, radio-monitor CD, and DK-standby CD modes
The scan operation stops, and the frequency recorded in the preset memory corresponding to the pressed key is received.
(b) During the DK-standby tape mode
○ When any of the KAMS, KNR, and KMTL switches is on:
The scan operation continues. If the pressed key also has a tape function, it works as a tape function key. If the key has no tape function, it becomes ineffective.
○ When all the KAMS, KNR, and KMTL switches are off:
The scan operation stops. A frequency recorded in the preset memory corresponding to the pressed key is received.</td></tr>
</table>
</td></tr>
</table>

Symbol	Description
P.SCAN	

Key	Description
M1(TP1) M2(TP2) M3(TP3) M4 M5 M6	**(2) When M2S = 1:** **(a) During the radio, radio-monitor tape, radio-monitor CD, and DK-standby CD modes** The scan operation stops. The other operations vary depending on the timing at which the key is released. ● **If the key is released within 2 seconds:** The preset memory corresponding to the pressed key is accessed. ● **If the key is kept pressed for at least 2 seconds:** A frequency being currently received is written to the preset memory corresponding to the pressed key. **(b) During the DK-standby tape mode** ○ **When any of the KAMS, KNR, and KMTL switches is on:** The scan operation continues. If the pressed key also has a tape function, it works as a tape function key. If the key has no tape function, it becomes ineffective. ○ **When all the KAMS, KNR, and KMTL switches are off:** The scan operation stops. The other operations vary depending on the timing at which the key is released. ● **If the key is released within 2 seconds:** The preset memory corresponding to the pressed key is accessed. ● **If the key is kept pressed for at least 2 seconds:** A frequency being currently received is written to the preset memory corresponding to the pressed key.

○ Auto-storage function

Broadcasting stations are searched for automatically. The frequency of a detected station is written to a preset memory. A method used to detect a station is determined according to the states of the ENFMIF and ENAMIF initial setting diodes. A broadcasting station search begins at the frequency being currently received and is performed through the frequencies in the ascending order.

When a station is detected, its frequency is written to a preset memory.

For the VF band, only when a VF broadcasting station is received, its frequency is written to the preset memory. (The VF station is a station with the SK signal on.)

For the voltage with SD, see the description of the SD in **Chapter 1.**

The auto-storage operation varies depending on the state of the AUTOLOC initial setting diode as follows:

(1) When AUTOLOC = 0 (with no auto-local function):

The auto-storage function varies depending on which mode has been selected, local or DX, when the function begins.

Symbol	Description
P.SCAN	**(a) If the DX mode has been selected when the auto-storage function starts:** A search beings at the frequency being currently received and continues in the ascending order of the frequency. When all frequencies are searched through, the search operation ends. If the P. SCAN key is pressed during the search operation, the auto-storage operation ends, and the frequency selected when the auto-storage operation began is received. When all frequencies are searched through, if at least one station is detected, the contents of the preset memories are updated, and the preset scan begins at the M1 preset memory. How the contents of the preset memories are updated varies depending on the number of stations detected. ○ **If six or more stations are detected:** If six or more stations are detected, six stations with a higher SD input are selected and written to the preset memories. A lower frequency is written to a lower-numbered preset memory. ○ **If less than six stations are detected:** If less than six stations are detected, lower frequencies are written to lower-numbered preset memories. The contents of a preset memory will not be changed if there is no frequency corresponding to it. **(b) If the local mode has been selected when the auto-storage function starts:** A search begins in the local mode at the frequency being currently received and continues in the ascending order of the frequency. When all frequencies are searched through, if six or more stations are not detected, the search switches to the DX mode and continues in it. If six or more stations are detected in the local mode, or all frequencies are searched through in the DX mode, the auto-storage operation ends. Pressing the P. SCAN key during the search operation stops the auto-storage operation, and causes the frequency selected when the auto-storage memory began to be received. If six or more stations are detected in the local mode, or all frequencies are searched through in the DX mode, the auto-storage operation ends. If at least one station is detected, the contents of the preset memories are updated, and the preset scan begins with the M1 preset memory. How the contents of the preset memories are updated varies depending on the number of stations detected, as follows: ○ **If six or more stations are detected in the local mode:** If six or more stations are detected, six stations with a higher SD input are selected and written to the preset memories. A lower frequency is written to a lower-numbered preset memory ○ **If less than six stations are detected in the local mode and some are detected in the DX mode, resulting in a total of six or more stations being detected:** Stations detected in the DX mode with higher SD input levels are selected and added to the number of stations detected in the local mode so that the total becomes six. In this case, the stations detected in the local mode are excluded from those detected in the DX mode. The frequencies of the six stations are written to the preset memories, with a lower frequency written to a lower-numbered preset memory.

Symbol	Description
P.SCAN	○ **If less than six stations are detected in the local mode and some are detected in the DX mode, resulting in a total of less than six stations being detected:** If the same station is detected in the DX and local modes, the station detected in the DX mode is deleted so that the same frequency will not be written to two preset memories. The frequencies of the less than six stations detected are written to the preset memories, with a lower frequency written to a lower-numbered preset memory. The contents of a preset memory will not be changed if there is no frequency corresponding to it. **(2) When AUTOLOC = 1 (with the local function):** A search begins in the local mode at the frequency being currently received and continues in the ascending order of the frequency. When all frequencies are searched through, if six or more stations are not detected, the search switches to the DX mode and continues in it. If six or more stations are detected in the local mode, or all frequencies are searched through in the DX mode, the auto-storage operations ends. Pressing the P. SCAN key in the local mode switches to the DX mode, and restarts the search operation at the frequency selected when the previous search began. Any stations detected in the local mode are made ineffective. (Stations detected in the local mode are excluded during preset memory updating.) Pressing the P. SCAN key in the DX mode ends the auto-storage operation, and causes the frequency selected when the auto-storage operation began to be received. If six or more stations are detected in the local mode, or all frequencies are searched through in the DX mode, the auto-storage operation ends. If at least one station is detected, the contents of the preset memories are updated, and the preset scan begins with the M1 preset memory. How the contents of the preset memories are updated varies depending on the number of stations detected, as follows: ○ **If six or more stations are detected in the local mode:** If six or more stations are detected in the local mode, six stations with a higher SD input are selected and written to the preset memories, with a lower frequency written to a lower-numbered preset memory. ○ **If less than six stations are detected in the local mode, and some are detected in the DX mode, resulting in a total of six or more stations being detected:** Stations detected in the DX mode with higher SD input levels are selected and added to the number of stations detected in the local mode so that the total becomes six. In this case, the stations detected in the local mode are excluded from those detected in the DX mode. The frequencies of the six stations are written to the preset memories, with a lower frequency written to a lower-numbered preset memory.

Symbol	Description
P.SCAN	○ **If less than six stations are detected in the local mode and some are detected in the DX mode, resulting in a total of less than six stations being detected:** If the same station is detected in the DX and local modes, the station detected in the DX mode is deleted so that the same frequency will not be written to two preset memories. The frequencies of the less than six stations detected are written to the preset memories, with a lower frequency written to a lower-numbered preset memory. The contents of a preset memory will not be changed if there is no frequency corresponding to it. During the auto-storage operation, each key function as follows:

Key	Description
P.SCAN	The auto-storage operation stops, the frequency selected when the auto-storage operation began is received. If the auto-local function is being used, the local mode is selected.
BAND	Either of the following operations occurs depending on what the current mode is. **(1) During the radio, radio-monitor tape, and radio-monitor CD modes** The auto-storage operation stops, the operation corresponding to the BAND key begins at the frequency selected when the auto-storage operation began. **(2) During DK-standby tape and DK-standby CD modes** The auto-storage operation continues. The BAND key becomes ineffective.
SCAN UP SCAN DWN SEEK UP SEEK DWN MAN UP MAN DWN VF	The auto-storage operation stops, the operation corresponding to the pressed key begins at the frequency selected when the auto-storage operation began.
RDMONI	Either of the following operations occurs depending on what the current mode is. **(1) During the DK-standby tape, DK-standby CD, radio-monitor tape, and radio-monitor CD modes** The auto-storage operation stops, the operation corresponding to the RDMONI key begins at the frequency selected when the auto-storage operation began. **(2) During the radio mode** The auto-storage operation continues. The RDMONI key becomes ineffective.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>P.SCAN</td><td>
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>LOUD
POWER</td><td>The auto-storage operation continues. The operation corresponding to the pressed key begins.</td></tr>
<tr><td>LOC</td><td>Either of the following operations occurs depending on the state of the AUTOLOC initial setting diode.
(1) When AUTOLOC = 0:
Switching occurs between the local and DX modes. All stations detected so far are canceled.
(2) When AUTOLOC = 1:
The auto-storage operation continues. The LOC key becomes ineffective.</td></tr>
<tr><td>MONO</td><td>The auto-storage operation continues. The operation corresponding to the MONO key begins.</td></tr>
<tr><td>M1(TP1)
to
M6</td><td>One of the following operations occurs depending on the states of the KAMS, KNR, and KMTL initial setting diodes and what the current mode is.
<table>
<tr><th>KAMS
KNR
KMTL</th><th>Mode</th><th>Operation</th></tr>
<tr><td rowspan="2">Note 1</td><td>● Radio mode
● Radio-monitor tape mode
● Radio-monitor CD mode
● DK-standby CD mode</td><td>The auto-storage operation stops, and a frequency recorded in the preset memory corresponding to the pressed key is received.</td></tr>
<tr><td>DK-standby tape mode</td><td>The auto-storage operation continues. If a pressed key also has a tape function, it works as a tape function key. If the key has no tape function, it becomes ineffective.</td></tr>
<tr><td>Note 2</td><td>—</td><td>The auto-storage operation stops, and a frequency recorded in the preset memory corresponding to the pressed key is received.</td></tr>
</table>
Notes 1. When any of the switches are on:
2. When all switches are off:</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>SEEK UP
SEEK DWN</td><td>
The SEEK UP and SEEK DWN keys are used for auto-tuning (seek operation).
Pressing the SEEK UP key (SEEK DWN key) increases (decreases) the frequency by one channel space and checks whether there is a broadcasting station at each reception frequency (by a method determined depending on the states of the ENFMIF and ENAMIF initial setting diodes). If a broadcasting station (for the VF band, a VF broadcasting station) is detected, the seek operation ends.
The seek operation performed varies with the state of the AUTOLOC initial setting diode as follows:
(1) When AUTOLOC = 0 (with no auto local function):
A search operation begins at the frequency currently being received.
The search operation continues in the local or DX mode whichever has been selected when the search operation starts, until a station (for the VF band, a VF station) is detected.
(2) When AUTOLOC = 1 (with an auto local function):
A search operation begins at the frequency being currently received in the local mode. When all frequencies are searched through in the local mode, a search operation is switched to the DX mode and continues until a station is detected. If the SEEK UP key or SEEK DWN key is pressed during the local mode, the DX mode is selected, and a search operation restarts with the same frequency as for the previous search. If the SEEK UP key or SEEK DWN key is pressed during a search in the DX mode, the search operation ends, and the frequency at which the search operation began is selected.

When using the SEEK UP key or SEEK DWN key, set the AUTO500 initial setting diode to 0.
Setting it to 1 disables the SEEK UP and SEEK DWN keys.
The SEEK UP and SEEK DWN keys function during the search operation as follows:
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>SEEK UP
SEEK DWN</td><td>
● When the SEEK UP key is pressed during the seek-up mode or the SEEK DWN key is pressed using seek-down mode:
The seek operation stops, and the frequency at which the search operation began is selected. If the auto local function is being used when the key is pressed, the local mode is switched.
● When the SEEK DWN key is pressed during the seek-up mode or the SEEK UP key is pressed during the seek-down mode:
A search operation begins at the frequency that is in the frequency counter when the key is pressed, in the mode corresponding to the pressed key (for example, in the seek-down mode if the SEEK DWN key is pressed during the seek-up mode).
</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>SEEK UP
SEEK DWN</td><td>
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>MAN UP
MAN DWN</td><td>One of the following operations occurs depending on the state of the AUTO500 initial setting diode.
(1) When AUTO500 = 0:
A manual tuning operation begins at the frequency that is in the frequency counter when the key is pressed.
(2) When AUTO500 = 1:
(a) If the MAN UP key is pressed during the seek-up mode, or the MAN DWN key is pressed during the seek-down mode:
The seek operation stops, and the frequency that was selected when the seek operation began is reselected. If the auto-local function is being used, the local mode is switched.
(b) If the MAN DWN key is pressed during the seek-up mode, or the MAN UP key is pressed during the seek-down mode:
The seek operation of the mode corresponding to the pressed key (for example, seek-down mode if the MAN DWN key is pressed during the seek-up mode) begins at the frequency that is in the frequency counter when the key is pressed.</td></tr>
<tr><td>SCAN UP
SCAN DWN
P.SCAN</td><td>The seek operation stops, and the operation corresponding to the pressed key begins at the frequency that was selected when the key was pressed.</td></tr>
<tr><td>VF</td><td>The seek operation stops. The frequency that was selected when the seek operation began is reselected, and the operation corresponding to the pressed key begins.</td></tr>
<tr><td>BAND</td><td>Either of the following operations occurs according to what the current mode is.
(1) During the radio, radio-monitor tape, and radio-monitor CD modes
The seek operation stops. The frequency that was selected when the seek operation began is reselected, and the operation corresponding to the pressed key begins.
(2) During the DK-standby tape and DK-standby CD modes
The seek operation continues, and the key becomes an ineffective key.</td></tr>
<tr><td>RDMONI</td><td>Either of the following operations occurs according to what the current mode is.
(1) During the DK-standby tape, DK-standby CD, radio-monitor tape, and radio-monitor CD modes
The seek operation stops. The frequency that was selected when the seek operation began is reselected, and the operation corresponding to the pressed key begins.
(2) During the radio mode
The seek operation continues, and the key becomes an ineffective key.</td></tr>
</table>
</td></tr>
</table>

Symbol	Description
SEEK UP SEEK DWN	

Key	Description
LOUD POWER	The seek operation continues, and the operation corresponding to the pressed key begins.
LOC	Either of the following operations occurs depending on the state of the AUTOLOC initial setting diode. **(1) When AUTOLOC = 0:** The seek operation continues, and the operation corresponding to the key begins. **(2) When AUTOLOC = 1:** The seek operation continues, and the pressed key becomes invalid.
MONO	The seek operation continues, and the operation corresponding to the key begins.
M1(TP1) to M6	One of the following operations occurs depending on the states of the KAMS, KNR, and KMTL initial setting diodes and what the current mode is.

KAMS KNR KMTL	Mode	Operation
Note 1	● Radio mode ● Radio-monitor tape mode ● Radio-monitor CD mode ● DK-standby CD mode	The seek operation stops, and the tuner is set to the frequency held in the preset memory that corresponds to the pressed key.
	DK-standby tape mode	The seek operation continues. If the pressed key also has a tape-related function, it begins to work as the tape-related function. If the pressed key has no tape-related function, it becomes an ineffective key.
Note 2	—	The seek operation stops, and the tuner is set to the frequency held in the preset memory that corresponds to the pressed key.

Notes 1. When any of the switches are on.
2. When all switches are off.

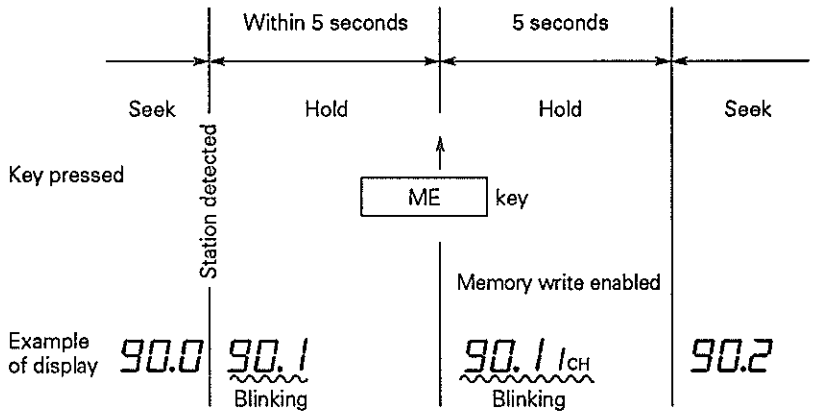
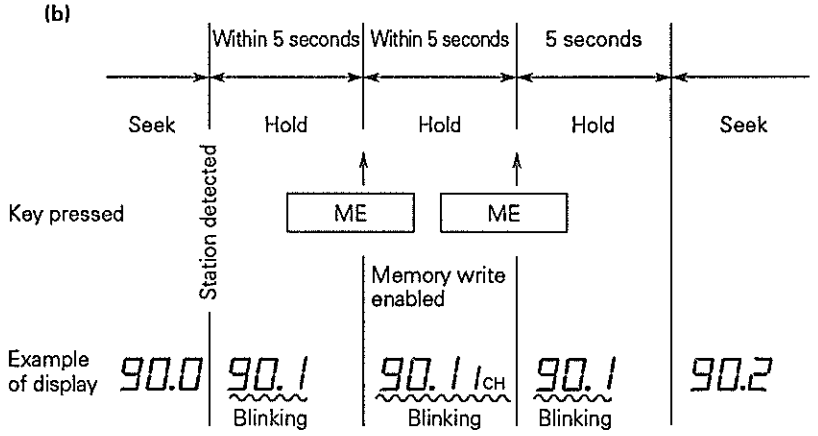
<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>SCAN UP
SCAN DWN</td><td>
The SCAN UP and SCAN DWN keys are used for auto-tuning (scan operation).
Pressing the SCAN UP key (SCAN DWN key) increases (decreases) the frequency by one channel space and checks whether there is a broadcasting station at each reception frequency (frequency counter and SD signal). If a broadcasting station is detected, the corresponding frequency is held for five seconds. For the VF band, a check is made for the SK signal in the same way as for the seek operation. If no key is pressed within this hold time of five seconds, the seek operation restarts. If another broadcasting station is detected, the corresponding frequency is held in the frequency counter for five seconds. This operation is repeated (scan operation) sequentially.
The frequency display blinks at 1 Hz (with a duty cycle of 50%) during the five-second hold time. A beep occurs at the end of the hold time.
The seek operation here is the same as one performed with the SEEK UP or SEEK DWN key.
The following table lists the operation corresponding to each key pressed during the seek operation (except the hold time).
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>SCAN UP
SCAN DWN</td><td>
● If the SCAN UP key is pressed during the scan-up mode, or the SCAN DWN key is pressed during the scan-down mode:
The scan operation stops, and the frequency that was selected when the scan operation began is reselected. If the auto-local function is being used, the local mode is switched.
● If the SCAN DWN key is pressed during the scan-up mode, or the SCAN UP key is pressed during the scan-down mode:
The operation corresponding to the pressed key begins at the frequency that is selected when the key is pressed.
</td></tr>
<tr><td>SEEK UP
SEEK DWN
MAN UP
MAN DWN
P.SCAN</td><td>The scan operation stops, and the operation corresponding to the pressed key begins at the frequency that is selected when the key is pressed.</td></tr>
<tr><td>VF</td><td>The scan operation stops. The frequency that was selected when the seek operation began is reselected, and the operation corresponding to the pressed key begins.</td></tr>
<tr><td>BAND</td><td>
Either of the following operations occurs depending on what the current mode is.
(1) During the radio, radio-monitor tape, and radio-monitor CD modes
The scan operation stops. The frequency that was selected when the scan operation began (or the frequency on hold if a broadcasting station has been detected during the scan operation) is reselected, and the operation corresponding to the pressed key begins.
(2) During the DK-standby tape and DK-standby CD modes
The seek operation continues, and the key becomes an ineffective key.
</td></tr>
<tr><td>RDMONI</td><td>
Either of the following operations occurs depending on what the current mode is.
(1) During the DK-standby tape, DK-standby CD, radio-monitor tape, and radio-monitor CD modes
The scan operation stops. The frequency that was selected when the scan operation began (or the frequency on hold if a broadcasting station has been detected during the scan operation) is reselected, and the operation corresponding to the pressed key begins.
(2) During the radio mode
The seek operation continues, and the key becomes an ineffective key.
</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>SCAN UP
SCAN DWN</td><td>
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>LOUD
POWER</td><td>The scan operation continues, and the operation corresponding to the pressed key begins.</td></tr>
<tr><td>LOC</td><td>Either of the following operations occurs depending on the state of the AUTOLOC initial setting diode.
(1) When AUTOLOC = 0:
The scan operation continues, and the operation corresponding to the key begins.
(2) When AUTOLOC = 1:
The scan operation continues, and the key becomes invalid.</td></tr>
<tr><td>MONO</td><td>The scan operation continues, and the operation corresponding to the key begins.</td></tr>
<tr><td>M1(TP1)
to
M6</td><td>One of the following operations occurs depending on the state of the KAMS, KNR, and KMTL initial setting diodes and what the current mode is.
<table>
<tr><th>KAMS
KNR
KMTL</th><th>Mode</th><th>Operation</th></tr>
<tr><td rowspan="2">Note 1</td><td>● Radio mode
● Radio-monitor tape mode
● Radio-monitor CD mode
● DK-standby CD mode</td><td>The scan operation stops, and the tuner is set to the frequency held in the preset memory that corresponds to the pressed key.</td></tr>
<tr><td>DK-standby tape mode</td><td>The scan operation continues. If the pressed key also has a tape-related function, it begins to work as the tape-related function.
If the pressed key has no tape-related function, it becomes an ineffective key.</td></tr>
<tr><td>Note 2</td><td>—</td><td>The scan operation stops, and the tuner is set to the frequency held in the preset memory that corresponds to the pressed key.</td></tr>
</table>
Notes 1. When any of the switches are on.
2. When all switches are off.</td></tr>
</table>
</td></tr>
</table>

Symbol	Description
SCAN UP SCAN DWN	Each key functions during the five-second hold time as follows:

Key	Description
SCAN UP SCAN DWN	● **If the SCAN UP key is pressed during the scan-up mode, or the SCAN DWN key is pressed during the scan-down mode:** The scan operation stops, and the frequency counter is set to the frequency on hold. ● **If the SCAN DWN key is pressed during the scan-up mode, or the SCAN UP key is pressed during the scan-down mode:** The operation corresponding to the pressed key begins.
SEEK UP SEEK DWN MAN UP MAN DWN P.SCAN VF	The scan operation stops, and the operation corresponding to the pressed key begins at the frequency on hold.
BAND	Either of the following operations occurs depending on what the current mode is. **(1) During the radio, radio-monitor tape, and radio-monitor CD modes** The scan operation stops. The operation corresponding to the pressed key begins at the frequency on hold. **(2) During the DK-standby tape and DK-standby CD modes** The scan operation continues, and the key becomes an ineffective key.
RDMONI	Either of the following operations occurs depending on what the current mode is. **(1) During the DK-standby tape, DK-standby CD, radio-monitor tape, and radio-monitor CD modes** The scan operation stops. The operation corresponding to the pressed key begins at the frequency on hold. **(2) During the radio mode** The seek operation continues, and the key becomes an ineffective key.
LOUD POWER	The scan operation continues. The operation corresponding to the pressed key begins.
LOC	Either of the following operations occurs depending on the state of the AUTOLOC initial setting diode. **(1) When AUTOLOC = 0:** The scan operation continues, and the operation corresponding to the pressed key begins. **(2) When AUTOLOC = 1:** The scan operation continues, and the pressed key becomes an ineffective key.

Symbol	Description
SCAN UP SCAN DWN	

Key	Description
MONO	The scan operation continues, and the operation corresponding to the pressed key begins.
ME	Either of the following operations occurs depending on the state of the M2S initial setting diode. **(1) When M2S = 1:** The scan operation continues, and the pressed key becomes an ineffective key. **(2) When M2S = 0:** Each time the key is pressed, writing to the memory is enabled or disabled. **(a)**  **(b)** 
M1(TP1) to M6	Either of the following operations occurs depending on the state of the M2S initial setting diode. **(1) When M2S = 0:** Either of the following operations occurs depending on whether writing to the memory is enabled, whether the hold state is selected, and the states of the KAMS, KNR, and KMTL initial setting diodes, and what the current mode is.

Symbol	Description
SCAN UP SCAN DWN	

Key	Description
M1(TP1) to M6	

(a) Operation during the hold mode

KAMS KNR KMTL	Mode	Operation
Note 1	● Radio mode ● Radio-monitor tape mode ● Radio-monitor CD mode ● DK-standby CD mode	The scan operation stops, and the tuner is set to the frequency held in the preset memory that corresponds to the pressed key.
	DK-standby tape mode	The scan operation continues. If the pressed key also has a tape-related function, it begins to work as the tape-related function. If the pressed key has no tape-related function, it becomes an ineffective key.
Note 2	—	The scan operation stops, and the tuner is set to the frequency held in the preset memory that corresponds to the pressed key.

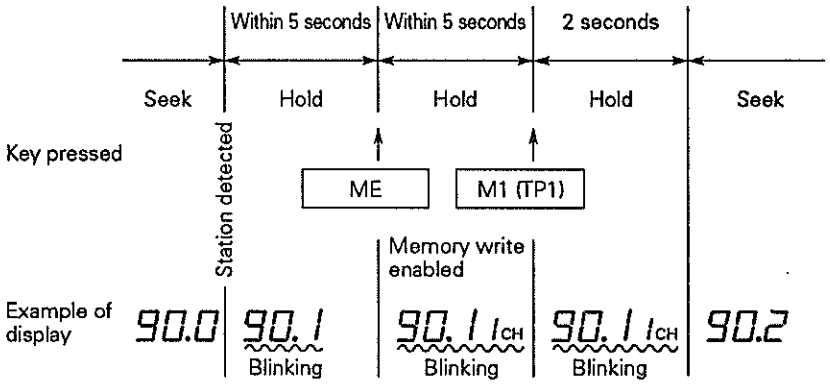
Notes 1. When any of the switches are on.
2. When all switches are off.

(b) Operation during the memory write enabled state

KAMS KNR KMTL	Mode	Operation
Note 1	● Radio mode ● Radio-monitor tape mode ● Radio-monitor CD mode ● DK-standby CD mode	The frequency currently received is written to the preset memory that corresponds to the pressed key. Two seconds later, the scan operation restarts.
	DK-standby tape mode	The memory remains write-enabled. If the pressed key also has a tape-related function, it begins to work as the tape-related function. If the pressed key has no tape-related function, it becomes an ineffective key.
Note 2	—	The frequency being currently received is written to the preset memory that corresponds to the pressed key. Two seconds later, the scan operation restarts.

Notes 1. When any of the switches are on.
2. When all switches are off.

Symbol	Description
SCAN UP SCAN DWN	

Key	Description
M1(TP1) to M6	**Example**  **(2) When M2S = 1** One of the following operations occurs depending on the states of the KAMS, KNR, and KMTL initial setting diodes and what the current mode is.

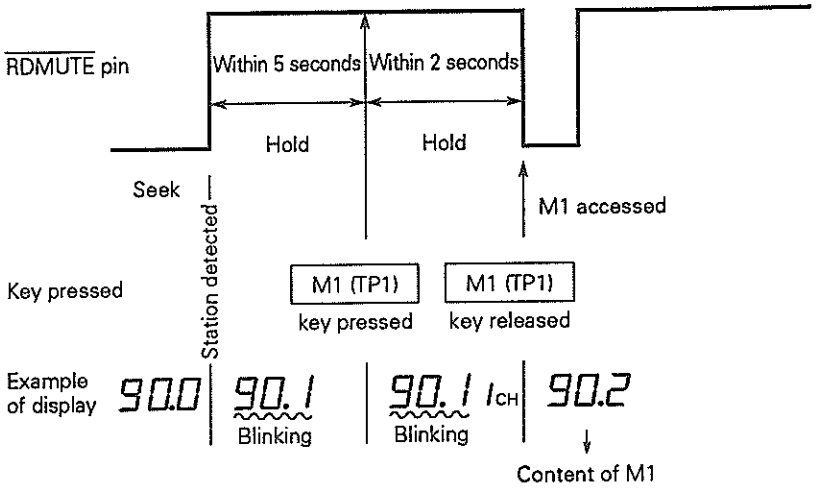
KAMS KNR KMTL	Mode	Operation
Note 1	● Radio mode ● Radio-monitor tape mode ● Radio-monitor CD mode ● DK-standby CD mode	The scan operation stops. Either of the following operations occurs depending on the timing at which the key is released. ○ **If the key is released within 2 seconds:** A preset memory corresponding to the pressed key is accessed. ○ **If the key is held pressed for at least 2 seconds:** The frequency being currently received is written to the preset memory corresponding to the pressed key.
	DK-standby tape mode	The scan operation continues. If the pressed key also has a tape-related function, it begins to work as the tape-related function. If the pressed key has no tape-related function, it becomes an ineffective key.
Note 2	—	The scan operation stops. Either of the following operations occurs depending on the timing at which the key is released. ○ **If the key is released within 2 seconds:** A preset memory corresponding to the pressed key is accessed. ○ **If the key is held pressed for at least 2 seconds:** The frequency being currently received is written to the preset memory corresponding to the pressed key.

Notes 1. When any of the switches are on.
2. When all switches are off.

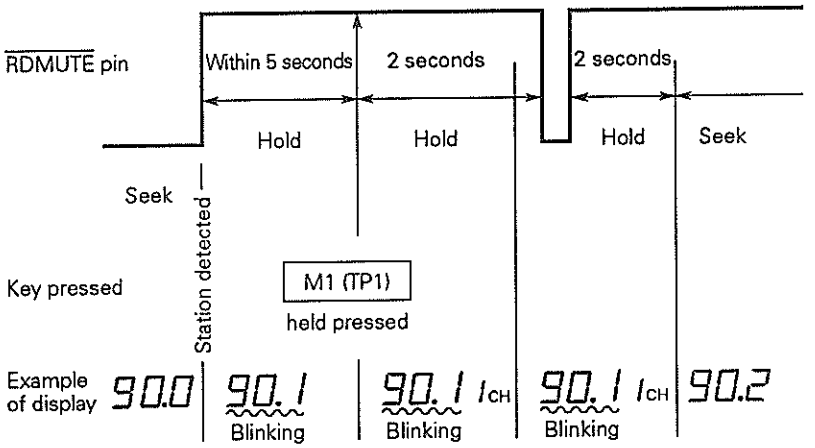
Symbol	Description

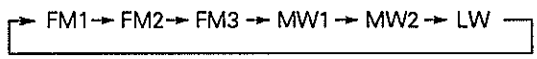
SCAN UP
SCAN DWN

Key	Description
M1(TP1) to M6	**Example 1.** If the key is released within 2 seconds: The tuner is set to the frequency in the preset memory corresponding to the pressed key when the key is released. The scan operation is canceled.



2. If the key is pressed for at least 2 seconds: When the key is pressed for 2 seconds, the frequency on hold is written to the preset memory corresponding to the pressed key. The hold state is released 2 seconds after the writing to the preset memory, and a search (seek operation) for another station begins.



<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>BAND</td><td>
The [BAND] key is used to switch the reception band.
This key is effective when the current mode is the radio, radio-monitor tape, or radio-monitor CD mode.
When the key is pressed, the reception band is switched sequentially as follows.


However, inhibited bands are skipped. They are specified by the AREA1, AREA2, and AREA3 initial setting diodes (to specify reception areas) and the ENFM, DISFM3, ENMW2, and DISLW initial setting diodes (to specify reception bands).
The band display and last channel vary during band switching within the same type of band (FM1 → FM2 → FM3, MW1 → MW2).
If the [BAND] key is pressed during VF band reception in the radio mode, the VF band is released, and the band that was selected before the VF band reception is reselected.
The [BAND] key becomes ineffective in the tape, CD, DK-standby tape, DK-standby CD, DK-receiving tape, and DK-receiving CD modes.
</td></tr>
<tr><td>ME</td><td>
The [ME] key is used to enable or disable writing to the preset memories during frequency display in the radio mode. During clock display (when the CE pin is at a high level), the [ME] key is used to adjust the clock in connection with the [MAN UP] and [MAN DWN] keys.
The operations that occur here vary depending on the state of the M2S initial setting diode.
(1) When M2S = 0:
The [ME] key is used to enable or disable writing to the preset memories and to adjust the clock.
(a) When the frequency is displayed:
The [ME] key is used to enable or disable writing to the preset memories.
Pressing the [ME] key enables writing to the preset memories for five seconds. During the preset memory write enabled state, the CH display blinks at 1 Hz (with a duty cycle of 50%). If the frequency recorded in a preset memory is being received, the preset memory number display also blinks. The key becomes ineffective during the seek operation (including the seek operation in the scan mode). However, it is effective during the five-second hold time in the scan operation and preset scan operation.
The other keys function as listed below during the preset memory write enabled state.
<table>
<tr><th>Key</th><th>Description</th></tr>
<tr><td>[SCAN UP]
[SCAN DWN]
[SEEK UP]
[SEEK DWN]
[MAN UP]
[MAN DWN]
[VF]
[P.SCAN]</td><td>Writing to the preset memories is inhibited, and the operation corresponding to the pressed key occurs.</td></tr>
</table>
</td></tr>
</table>

Symbol	Description
ME	

Key	Description
BAND	Either of the following operations occurs depending on what the current mode is. **(1) During the radio, radio-monitor tape, and radio-monitor CD modes** Writing to the preset memories is inhibited, and the operation corresponding to the pressed key occurs. **(2) During the DK-standby tape, DK-standby CD, DK-receiving tape, and DK-receiving CD modes** Writing to the preset memories remains enabled, and the key becomes an ineffective key.
RDMONI	Either of the following operations occurs depending on what the current mode is. **(1) During the DK-standby tape, DK-standby CD, DK-receiving tape, DK-receiving CD, radio-monitor tape, and radio-monitor CD modes** Writing to the preset memories is inhibited, and the operation corresponding to the pressed key occurs. **(2) During the radio mode:** Writing to the preset memories remains enabled, and the key becomes an ineffective key.
LOUD POWER	Writing to the preset memories remains enabled, and the operation corresponding to the key occurs.
LOC	Either of the following operations occurs depending on the state of the AUTOLOC initial setting diode. **(1) When AUTOLOC = 0:** Writing to the preset memories remains enabled, and the operation corresponding to the key occurs. **(2) When AUTOLOC = 1:** Writing to the preset memories remains enabled, and the key becomes an ineffective key.
MONO	Writing to the preset memories remains enabled, and the operation corresponding to the key occurs.

Symbol	Description
ME	

Key	Description
M1(TP1) to M6	One of the following operations occurs depending on the states of the KAMS, KNR, and KMTL initial setting diodes and what the current mode is.

KAMS KNR KMTL	Mode	Operation
Note 1	● Radio mode ● Radio-monitor tape mode ● Radio-monitor CD mode ● DK-receiving tape mode ● DK-receiving CD mode ● DK-standby CD mode	The frequency being currently received is written to the preset memory that corresponds to the pressed key, then writing to the preset memories is inhibited.
	DK-standby tape mode	The preset memories remain write-enabled. If the pressed key also has a tape-related function, it begins to work as the tape-related function. If the pressed key has no tape-related function, it becomes an ineffective key.
Note 2	—	The frequency being currently received is written to the preset memory that corresponds to the pressed key, then writing to the preset memories is inhibited.

Notes 1. When any of the switches are on.
2. When all switches are off.

When the preset memories are write-enabled, if the radio is turned off and on again, or if the tape or CD mode is switched, writing to the preset memories is inhibited.

(b) During tape display or "Cd" display

The [ME] key becomes ineffective.

(c) During clock display

The [ME] key is used to adjust the clock.

The minute and hour displays are adjusted by pressing the [MAN UP] and [MAN DWN] keys with the [ME] key held pressed, as follows:

- **Hour adjustment**
  Each time the [MAN DWN] key is pressed, the hour display is incremented by one. Keeping the key pressed for at least 0.5 seconds increments the hour display at a rate of four per second (one per 250 ms). The continuous increment continues until the key is released. The minute display, second count, or pointer movement is not affected.
- **Minute adjustment**
  Each time the [MAN UP] key is pressed, the minute display is incremented by one. Keeping the key pressed for at least 0.5 seconds increments the minute display at a rate of eight per second (one per 125 ms). The continuous increment continues until the key is released. No carry-over occurs to the hour display. The second count is reset to 0 at each adjustment.

Symbol	Description
ME	**(2) When M2S = 1** The ME key is used to switch the display and adjust the clock. **(a) During frequency, tape, or "Cd" display** The ME key is ineffective if NOCLK initial setting diode = 1. It is also ineffective in the DK-receiving tape and DK-receiving CD modes. When NOCLK = 0, pressing and releasing the ME key switches the display. See the description of the DISP key for details of display switching. **(b) During clock display in any mode** The ME key is used to adjust the clock. The minute and hour displays are adjusted by pressing the MAN UP and MAN DWN keys with the ME key held pressed, as follows: ● **Hour adjustment** Each time the MAN DWN key is pressed, the hour display is incremented by one. Keeping the key pressed for at least 0.5 seconds increments the hour display at a rate of four per second (one per 250 ms). The continuous increment continues until the key is released. The minute display, second count, or pointer movement is not affected. ● **Minute adjustment** Each time the MAN UP key is pressed, the minute display is incremented by one. Keeping the key pressed for at least 0.5 seconds increments the minute display at a rate of eight per second (one per 125 ms). The continuous increment continues until the key is released. No carry-over occurs to the hour display. The second count is reset to 0 at each adjustment. Releasing the ME key without adjusting the clock switches the display. See the description of the DISP key for details of display switching.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>MAN UP
MAN DWN</td><td>
The MAN UP and MAN DWN keys are used to increment and decrement the reception frequency during the radio mode, respectively. During clock display, they are also used in connection with the ME key to adjust the clock. They are again used to increase/decrease the volume of sound during electronic volume control if VKYSEL = 1.
(1) During the radio, radio-monitor tape, radio-monitor CD, DK-standby tape, DK-standby CD, DK-receiving tape, and DK-receiving CD modes
Either of the following operations occurs depending on the state of the AUTO500 initial setting diode.
<table>
<tr><th>AUTO500</th><th>Description</th></tr>
<tr><td>0</td><td>Each time the MAN UP or MAN DWN key is pressed, the frequency counter is incremented (MAN UP key) or decremented (MAN DWN key) by one step (one channel space).
Keeping the key pressed for at least 0.5 seconds speeds the increment/decrement to a rate of one step per 50 ms.</td></tr>
<tr><td>1</td><td>Each time the MAN UP or MAN DWN key is pressed, the frequency counter is incremented (MAN UP key) or decremented (MAN DWN key) by one step (one channel space).
Keeping the key pressed for at least 0.5 seconds triggers a seek operation in the seek-up (MAN UP key) or seek-down mode (MAN DWN key). This seek operation is the same as that triggered by the SEEK UP or SEEK DWN key.</td></tr>
</table>
(1: Shorted by the diode; 0: Open)
(2) During "TAPE" display in a tape mode or "Cd" display in a CD mode
The MAN UP and MAN DWN keys are ineffective.
(3) During clock display
While the ME key is held pressed during clock display, pressing the MAN UP and MAN DWN keys enables adjusting the minute and hour displays, respectively. See the description of the ME key for how to adjust the minute and hour displays.
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>MAN UP
MAN DWN</td><td>
(4) When the electronic volume control function is effective and VKYSEL = 1:
The MAN UP and MAN DWN keys are used to adjust (increase and decrease) the volume of sound in the electronic volume control mode selected using the VOL SEL key.
Once an electronic volume control mode is selected using the VOL SEL key, the MAN UP and MAN DWN keys function in the same way as the VOL UP and VOL DWN keys.
In a mode other than an electronic volume control mode, the MAN UP or MAN DWN key does not function as a volume control.
Pressing the MAN UP key works for each electronic volume control mode as follows:
<table>
<tr><th>Mode</th><th>Function</th></tr>
<tr><td>Volume</td><td>Increases the main sound volume.</td></tr>
<tr><td>Bass</td><td>Increases the bass.</td></tr>
<tr><td>Treble</td><td>Increases the treble.</td></tr>
<tr><td>Balance</td><td>Emphasizes the sound volume from the right-side speaker.</td></tr>
<tr><td>Fader</td><td>Emphasizes the sound volume from the front speaker.</td></tr>
</table>
Pressing the MAN DWN key works for each electronic volume control mode as follows:
<table>
<tr><th>Mode</th><th>Function</th></tr>
<tr><td>Volume</td><td>Decreases the main sound volume.</td></tr>
<tr><td>Bass</td><td>Decreases the bass.</td></tr>
<tr><td>Treble</td><td>Decreases the treble.</td></tr>
<tr><td>Balance</td><td>Emphasizes the sound volume from the left-side speaker.</td></tr>
<tr><td>Fader</td><td>Emphasizes the sound volume from the rear speaker.</td></tr>
</table>
</td></tr>
<tr><td>LOUD</td><td>
The LOUD key controls the loudness of sound. It is effective in the radio, tape, and CD modes. Each time the LOUD key is pressed, the control of loudness and the electronic volume control loudness function are switched on or off.
The following table lists the states of loudness, "LOUD" display, the LOUD pin output, and the electronic volume control IC.
<table>
<tr><th>Loudness state</th><th>"LOUD" display</th><th>LOUD pin</th><th>Electronic volume control IC state</th></tr>
<tr><td>ON</td><td>Lights</td><td>High level</td><td>Loudness ON mode</td></tr>
<tr><td>OFF</td><td>Does not light</td><td>Low level</td><td>Loudness OFF mode</td></tr>
</table>
Switching the radio, tape, or CD mode does not affect the state of loudness.
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>LOC</td><td>
The LOC key controls the local (local/DX) mode.
The key is effective when the current mode is the radio, radio-monitor CD, DK-standby CD, DK-receiving CD, radio-monitor tape, DK-standby tape, or DK-receiving tape mode and when AUTOLOC initial setting diode = 0.
Each time the key is pressed, switching occurs between the local and DX modes.
The following table lists the local/DX mode, the state of the "LOC" display, and LOC pin output.
<table>
<tr><th>Local mode</th><th>"LOC" display</th><th>LOC pin</th></tr>
<tr><td>LOCAL</td><td>Lights</td><td>High level[Note]</td></tr>
<tr><td>DX</td><td>Does not light</td><td>Low level</td></tr>
</table>
Note A high level is output only during auto-tuning. The LOC pin is always at a low level during a tuning type other than auto-tuning.
</td></tr>
<tr><td>MONO</td><td>
The MONO key controls the MONO (monaural)/STEREO mode.
The key is effective, when the current mode is the radio, radio-monitor CD, DK-standby CD, DK-receiving CD, radio-monitor tape, DK-standby tape, or DK-receiving tape mode and the FM, VF, or MW band is selected. (For the MW band, the key is effective if the MWS initial setting diode = 1 and the tuner has a stereo capability.)
Each time the key is pressed, switching occurs between the MONO and STEREO modes.
The following table lists the MONO/STEREO mode, the state of the "ST" display, and MONO/NR pin output.
<table>
<tr><th>MONO/
STEREO mode</th><th>"ST" display</th><th>"MONO" display</th><th>MONO/NR pin</th></tr>
<tr><td>MONO</td><td>Does not light</td><td>Lights</td><td>High level</td></tr>
<tr><td>STEREO</td><td>Lights</td><td>Does not light</td><td>Low level</td></tr>
</table>
</td></tr>
<tr><td>MTL</td><td>
The MTL key controls the MTL (METAL) mode. It is effective when the current mode is radio, DK-standby tape, DK-receiving tape, or radio-monitor tape mode. Each time the key is pressed, the METAL mode is switched on or off.
The following table lists the METAL mode on/off, the states of the "METAL" display, and METAL pin output.
<table>
<tr><th>METAL mode</th><th>"METAL" display</th><th>METAL pin</th></tr>
<tr><td>ON</td><td>Lights</td><td>High level</td></tr>
<tr><td>OFF</td><td>Does not light</td><td>Low level</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>NR</td><td>The NR key is used to control noise reduction (NR). It is effective when the current mode is the tape, DK-standby tape, DK-receiving tape, or radio-monitor tape mode. Each time the key is pressed, the NR mode is switched on or off.
The following table lists the NR mode on/off, the state of the "NR" display, and NR/MONO pin output.
<table><tr><th>NR mode</th><th>"NR" display</th><th>NR/MONO pin</th></tr><tr><td>ON</td><td>Lights</td><td>High level[Note]</td></tr><tr><td>OFF</td><td>Does not light</td><td>Low level[Note]</td></tr></table>Note In the DK-receiving tape or radio-monitor tape mode, the NR/MONO pin functions as the MONO/STEREO mode output pin, and its output level corresponds to the MONO/STEREO mode.</td></tr>
<tr><td>AMS</td><td>The AMS key controls the auto music search (AMS). It is effective in the tape, DK-standby tape, DK-receiving tape, or radio-monitor tape mode. Each time the key is pressed, switching occurs between the AMS on/off states.
The following table lists the states of AMS on/off, "AMS" display, and AMS pin output.
<table><tr><th>AMS state</th><th>"AMS" display</th><th>AMS pin</th></tr><tr><td>ON</td><td>Lights</td><td>High level</td></tr><tr><td>OFF</td><td>Does not light</td><td>Low level</td></tr></table></td></tr>
<tr><td>RDMONI</td><td>The RDMONI key controls radio monitoring. It is effective in the tape, DK-standby tape, DK-receiving tape, CD, DK-standby CD, DK-receiving CD, radio-monitor tape, or radio-monitor CD mode. Each time the key is pressed, the radio monitor mode is set or reset. During the radio monitor mode, the "RDMONI" display on the LCD panel lights.
During the radio monitor mode, tuning is enabled for all bands, the radio mute function ($\overline{\text{RDMUTE}}$ pin) is switched off, and the audio mute function ($\overline{\text{AMUTE}}$ pin) is switched on.
The radio monitor mode is reset by:
● Change in the TPSET switch state
● Change in the CDSET switch state
● Change at the CE pin from high level to low level</td></tr>
</table>

Symbol	Description
DISP	The DISP key is used to switch the display. It is effective when NOCLK initial setting diode = 0 (with a clock). However, if it is ineffective in the DK-receiving tape and DK-receiving CD mode even if a clock is available. Display switching occurs as follows: **(1) During the radio mode** Each time the key is pressed, the display switches between the frequency and clock. The DISP key is ineffective during seek-scanning and auto-preset scanning. The operation depends on the states of the PRIO1 and PRIO2 initial setting diodes as follows:

PRIO1	PRIO2	Privileged display	Description
0	0	None	Each time the DISP key is pressed, the display switches between the frequency and clock.
1	0	Frequency display	Pressing the DISP key during frequency display causes the clock display to appear for 5 seconds. Pressing the DISP key during the 5-second period of clock display causes the frequency display to appear again.
0	1	Clock display	Pressing the DISP key during clock display causes the frequency display to appear for 5 seconds. Pressing the DISP key during the 5-second period of frequency display causes the clock display to appear again.

(1: Shorted by the diode; 0: Open)

When the radio mode is selected, the display begins with the frequency.

(2) During the tape mode

Each time the DISP key is pressed, the display switches between *"TAPE"* and the clock.

The operation depends on the states of the PRIO1 and PRIO2 initial setting diodes as follows:

PRIO1	PRIO2	Privileged display	Description
0	0	None	Each time the DISP key is pressed, the display switches between the frequency and clock.
1	0	*"TAPE"* display	Pressing the DISP key during *"TAPE"* display causes the clock display to appear for 5 seconds. Pressing the DISP key during the 5-second period of clock display causes the *"TAPE"* display to appear again.
0	1	Clock display	Pressing the DISP key during clock display causes the *"TAPE"* display to appear for 5 seconds. Pressing the DISP key during the 5-second period of *"TAPE"* display causes the clock display to appear again.

(1: Shorted by the diode; 0: Open)

When the radio mode is selected, the display begins with the *"TAPE"* display.

Symbol	Description
DISP	**(3) During the CD mode** Each time the DISP key is pressed, the display switches between "Cd" and the clock. The operation depends on the states of the PRIO1 and PRIO2 initial setting diodes as follows:

PRIO1	PRIO2	Privileged display	Description
0	0	None	Each time the DISP key is pressed, the display switches between "Cd" and clock.
1	0	"Cd" display	Pressing the DISP key during "Cd" display causes the clock display to appear for 5 seconds. Pressing the DISP key during the 5-second period of clock display causes the "Cd" display to appear again.
0	1	Clock display	Pressing the DISP key during clock display causes the "Cd" display to appear for 5 seconds. Pressing the DISP key during the 5-second period of "Cd" display causes the clock display to appear again.

(1: Shorted by the diode; 0: Open)

When the CD mode is selected, the display begins with the "Cd".

(4) During the radio-monitor tape and DK-standby tape modes

Each time the DISP key is pressed, the display switches among "TAPE", frequency, and clock.
The operation depends on the states of the PRIO1 and PRIO2 initial setting diodes as follows:

PRIO1	PRIO2	Privileged display	Description
0	0	None	Each time the DISP key is pressed, the display is toggled as follows: → "TAPE" → frequency → clock →
1	0	"TAPE" display	Each time the DISP key is pressed, the display is toggled as follows: → "TAPE" → frequency → clock → If no key is pressed during frequency or clock display, the "TAPE" display appears again after 5 seconds.
0	1	Clock display	Each time the DISP key is pressed, the display is toggled as follows: → "TAPE" → frequency → clock → If no key is pressed during frequency or "TAPE" display, the clock display appears again after 5 seconds.

(1: Shorted by the diode; 0: Open)

When the radio-monitor tape or DK-standby tape mode is selected, the display begins with the frequency.

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>DISP</td><td>

(5) During the radio-monitor CD and DK-standby CD modes

Each time the DISP key is pressed, the display switches among "Cd", frequency, and clock. The operation depends on the states of the PRIO1 and PRIO2 initial setting diodes as follows:

<table>
<tr><th>PRIO1</th><th>PRIO2</th><th>Privileged display</th><th>Description</th></tr>
<tr><td>0</td><td>0</td><td>None</td><td>Each time the DISP key is pressed, the display is toggled as follows:
→ "Cd" → frequency → clock →</td></tr>
<tr><td>1</td><td>0</td><td>"Cd" display</td><td>Each time the DISP key is pressed, the display is toggled as follows:
→ "Cd" → frequency → clock →
If no key is pressed during frequency or clock display, the "Cd" display appears again after 5 seconds.</td></tr>
<tr><td>0</td><td>1</td><td>Clock display</td><td>Each time the DISP key is pressed, the display is toggled as follows:
→ "Cd" → frequency → clock →
If no key is pressed during frequency or "Cd" display, the clock display appears again after 5 seconds.</td></tr>
</table>

(1: Shorted by the diode; 0: Open)

When the radio-monitor CD or DK-standby CD mode is selected, the display begins with the frequency.

</td></tr>
<tr><td>POWER</td><td>

The POWER key is used to control the power-on/off of the radio in the momentary key mode. It is effective when the CE pin is at a high level. Pressing this key inverts the output of the POWER pin. When the POWER pin output is set to low (the power is turned off), the tape recorder, CD player and radio are forced to be turned off even when they have been in the power-on state. In this case, they are turned off with or without clock display, according to whether they were in clock mode or noclock mode.

The power-on mode varies as follows according to the state of the RDSET, TPSET, and CDSET switches.

Mode	REDSET	TPSET	CDSET
Radio mode	ON	OFF	OFF
Tape mode	ON/OFF	ON	OFF
CD mode	ON/OFF	ON/OFF	ON

Cautions 1. At the initial power-on, the POWER pin outputs the high level. When the level of CE pin changes from low to high, the POWER pin outputs the level which have been set before CE becomes low, until the primary power supply is turned off.

2. Do not turn the power on or off when diode switch RDON is set to 1. Doing this may cause malfunction. When RDON is set to 1, turn the power on or off by switching CE between low and high.

</td></tr>
</table>

Symbol	Description
VOL SEL	The VOL SEL key is used to select an electronic volume control mode. There are five electronic volume control modes as listed below:

Mode	Function	Panel display (initial setting)
Volume	Controls the main sound volume.	VOL 16
Bass	Controls the bass.	bAS 0
Treble	Controls the treble.	TREb 0
Balance	Controls the sound volume from the right- and left-side speakers.	bAL 0
Fader	Controls the sound volume from the front and rear speakers.	FAd 0

Either of the modes listed below is selected depending on the state of the VKYSEL initial setting diode.
Each time the VOL SEL key is pressed, the mode switches as listed below.

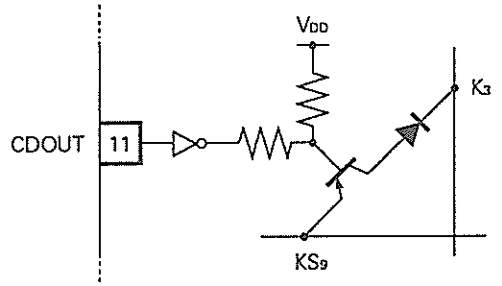
VKYSEL	Description
0	The first mode selected is the bass mode. VOL SEL 1 PUSH START → Bass → Tremble → Balance ↓ Volume ← Fader
1	The first mode selected is the volume mode. VOL SEL 1 PUSH START → Volume → Bass → Treble ↓ Fader ← Balance

(1: Shorted by the diode; 0: Open)

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>VOL UP</td><td>
The VOL UP key is used to adjust the volume of sound in each electronic volume control mode. The operation depends on the state of the VKYSEL initial setting diode.
<table>
<tr><th>VKYSEL</th><th>Description</th></tr>
<tr><td>0</td><td>
Pressing the VOL UP key in a mode other than an electronic volume control mode selects the volume mode and increases the volume of sound.
During an electronic volume control mode selected by the VOL SEL key, pressing the VOL UP key activates the operation corresponding to the selected mode as follows:
<table>
<tr><th>Mode</th><th>Function</th></tr>
<tr><td>Volume</td><td>Increases the main sound volume.</td></tr>
<tr><td>Bass</td><td>Increases the bass.</td></tr>
<tr><td>Treble</td><td>Increases the treble.</td></tr>
<tr><td>Balance</td><td>Emphasizes the sound volume from the right-side speaker.</td></tr>
<tr><td>Fader</td><td>Emphasizes the sound volume from the front speaker.</td></tr>
</table>
Keeping the VOL UP key pressed for at least 0.5 seconds controls the volume continuously.
If no key is pressed for at least 3 seconds, the mode previous to the current electronic volume control mode is reselected.
</td></tr>
<tr><td>1</td><td>
The VOL UP key is ineffective. After an electronic volume control mode is selected using the VOL SEL key, the MAN UP key can be used to perform the same adjustment that would be performed using the VOL UP key.
Pressing the MAN UP key in a mode other than an electronic volume control mode does not select a volume mode. See the descriptions of the MAN UP and MAN DWN keys for details.
</td></tr>
</table>
(1: Shorted by the diode; 0: Open)
</td></tr>
</table>

<table>
<tr><th>Symbol</th><th>Description</th></tr>
<tr><td>VOL DWN</td><td>
The VOL DWN key is used to adjust the volume of sound in each electronic volume control mode. The operation depends on the state of the VKYSEL initial setting diode.
<table>
<tr><th>VKYSEL</th><th>Description</th></tr>
<tr><td>0</td><td>
Pressing the VOL DWN key in a mode other than an electronic volume control mode selects the volume mode and increases the volume of sound.
During an electronic volume control mode selected by the VOL SEL key, pressing the VOL DWN key activates the operation corresponding to the selected mode as follows:
<table>
<tr><th>Mode</th><th>Function</th></tr>
<tr><td>Volume</td><td>Decreases the main sound volume.</td></tr>
<tr><td>Bass</td><td>Decreases the bass.</td></tr>
<tr><td>Treble</td><td>Decreases the treble.</td></tr>
<tr><td>Balance</td><td>Emphasizes the sound volume from the left-side speaker.</td></tr>
<tr><td>Fader</td><td>Emphasizes the sound volume from the rear speaker.</td></tr>
</table>
Keeping the VOL DWN key pressed for at least 0.5 seconds controls the volume continuously.
If no key is pressed for at least 3 seconds, the mode previous to the current electronic volume control mode is reselected.
</td></tr>
<tr><td>1</td><td>
The VOL DWN key is ineffective. After an electronic volume control mode is selected using the VOL SEL key, the MAN DWN key can be used to perform the same adjustment that would be performed using the VOL DWN key.
Pressing the MAN DWN key in a mode other than an electronic volume control mode does not select a volume mode. See the descriptions of the MAN UP and MAN DWN keys for details.
</td></tr>
</table>
(1: Shorted by the diode; 0: Open)
</td></tr>
<tr><td>MUTE</td><td>
The MUTE key controls the electronic volume control mute function. Pressing the MUTE key in a mode other than the mute mode selects the mute (silent) mode. During the mute mode, the volume value is displayed, and the display is caused to blink.
The mute function is reset under the following conditions.

When an effective key other than the DISP key is pressed
When the mode is changed
When a station is detected during a seek or scan operation, with the MUTE pressed.
When the MUTE key is pressed during muting

</td></tr>
<tr><td>CD</td><td>
Each time the CD key is pressed, the output of the CDOUT pin (pin 11) is inverted.
Using the CDOUT output makes it possible to implement an application such as described below:
Turning on/off a transistor switch connected to the CDSET pin according to the CDOUT output can switch on/off the CD mode according to the state of the CD key.


</td></tr>
</table>

3. MODE TRANSITION

With the μPD17012GF-054, two methods are available to turn on and off the radio set.

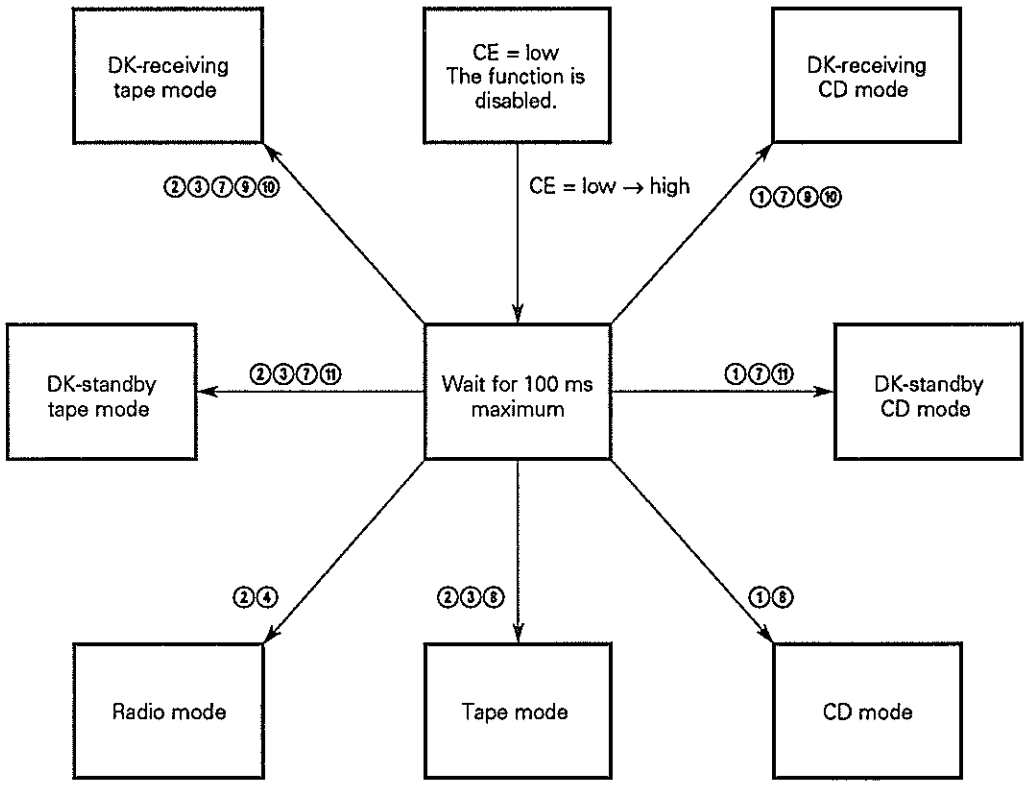
(1) After the initial setting diode RDON is set to 1, the radio set can be turned on or off by switching the CE pin state.
(2) After the initial setting diode RDON is set to 0, the radio set can be turned on or off by turning on or off the transistor or alternative switch RDSET with the CE pin held high.

Sections 3.1 and 3.2 describe the state transition diagrams of each method.

3.1 MODE TRANSITION WHEN THE INITIAL SETTING DIODE RDON IS SET TO 1 (TURNING ON OR OFF THE RADIO SET BY SWITCHING THE STATE OF THE CE PIN)

The radio set is turned on or off by switching the state of the CE pin.
The TPSET and CDSET switches are enabled only when the CE pin is high.
The RDSET is disabled.
When the CE pin is made low, clock display is not provided regardless of state of the initial setting diode NOCLK. However, when NOCLK = 0 (for using the clock), the clock operates.

(1) Mode transition when the CE pin is raised from low to high

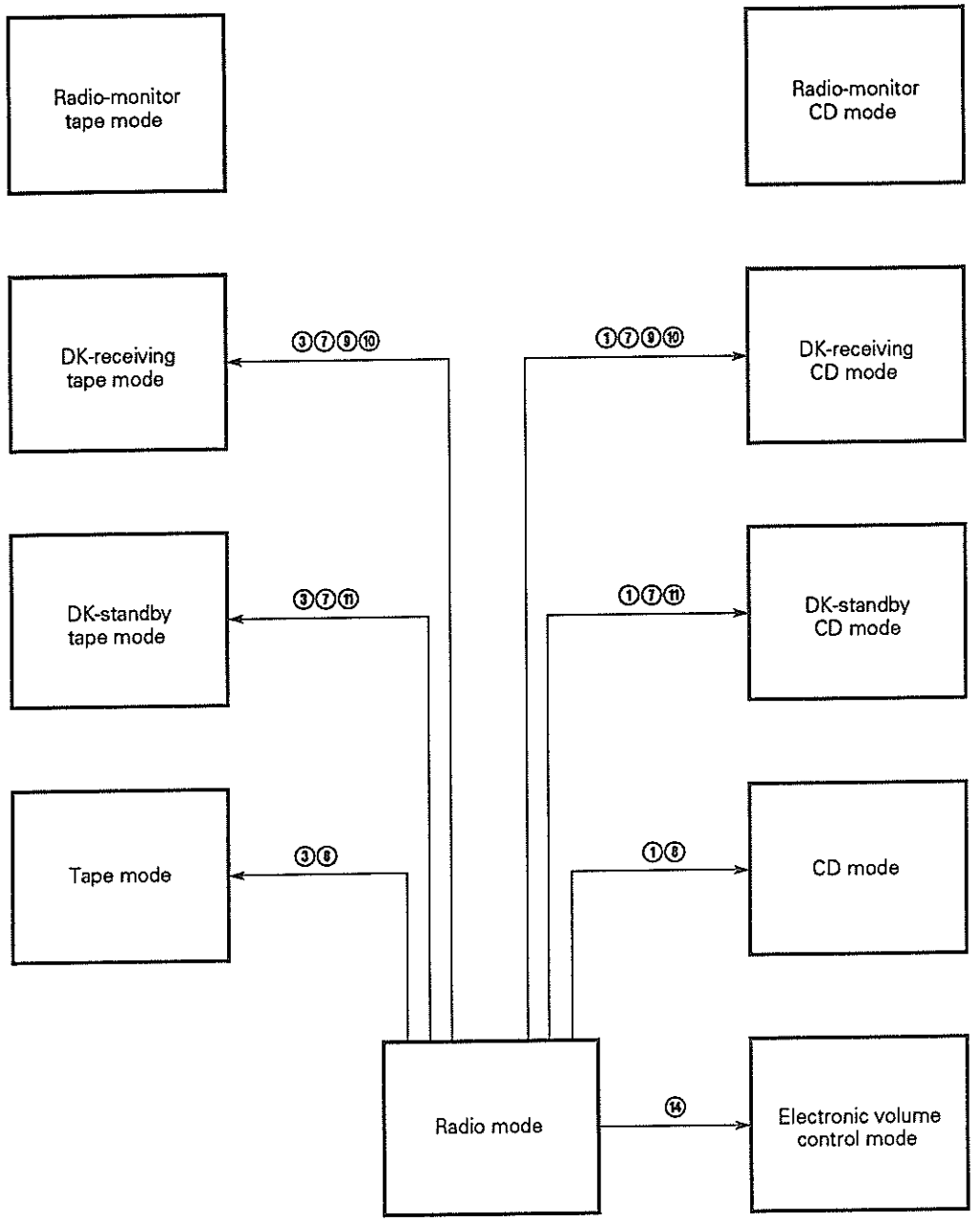


Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: [RDMONI] key on
- ⑥: [VF] key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off

(2) Mode transition when the CE pin is held high

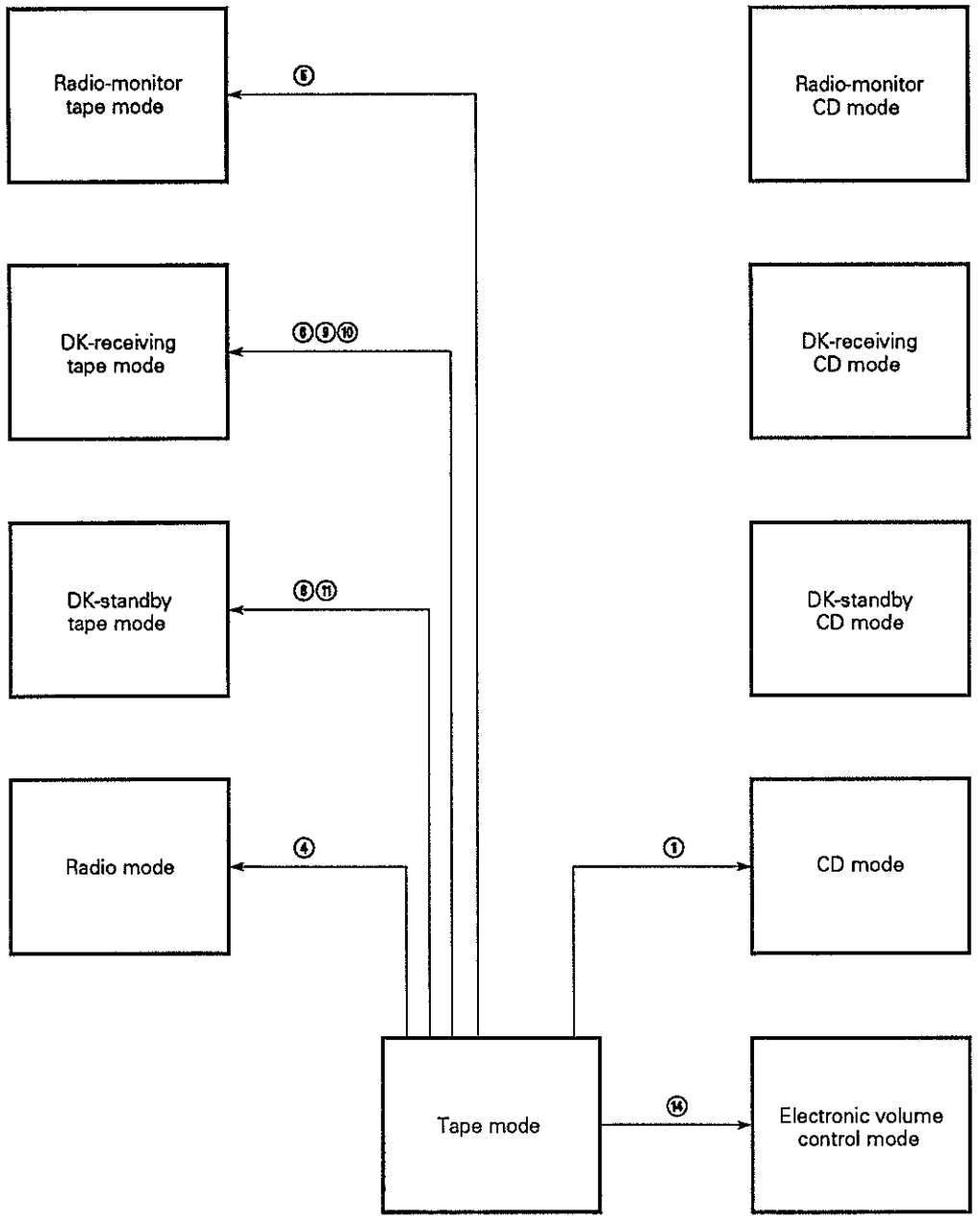
(a) Transition from the radio mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

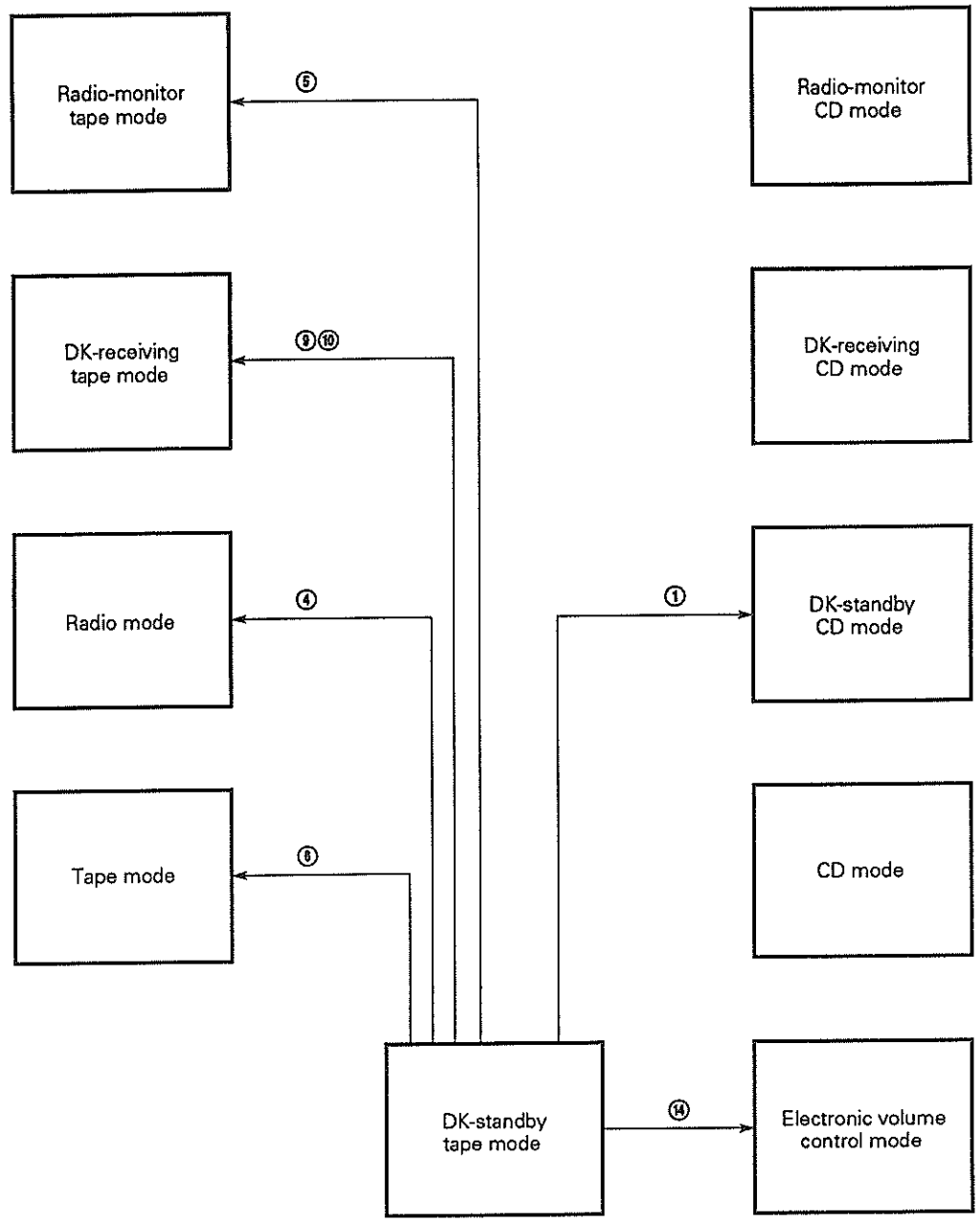
(b) Transition from the tape mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMON! key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

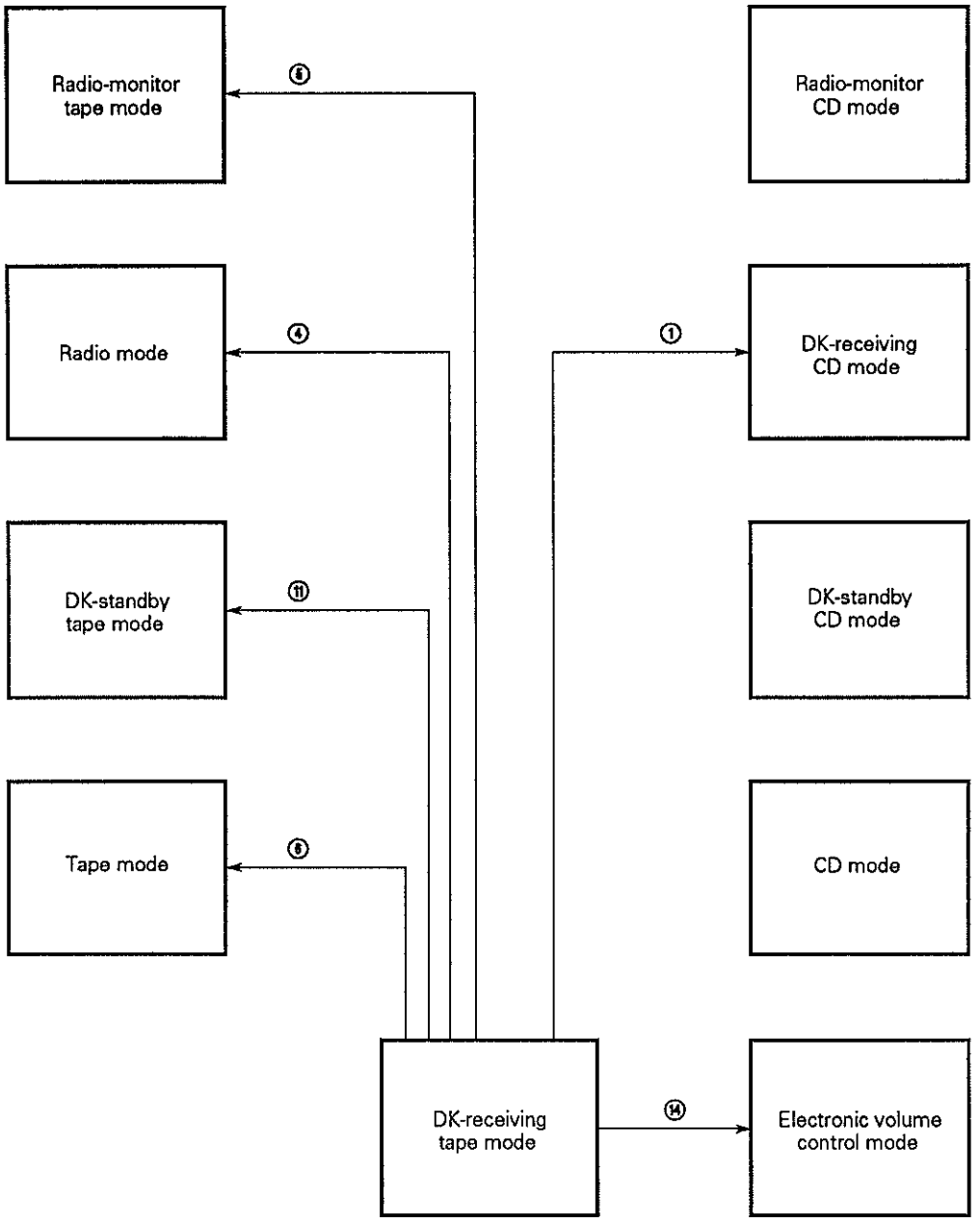
(c) Transition from the DK-standby tape mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

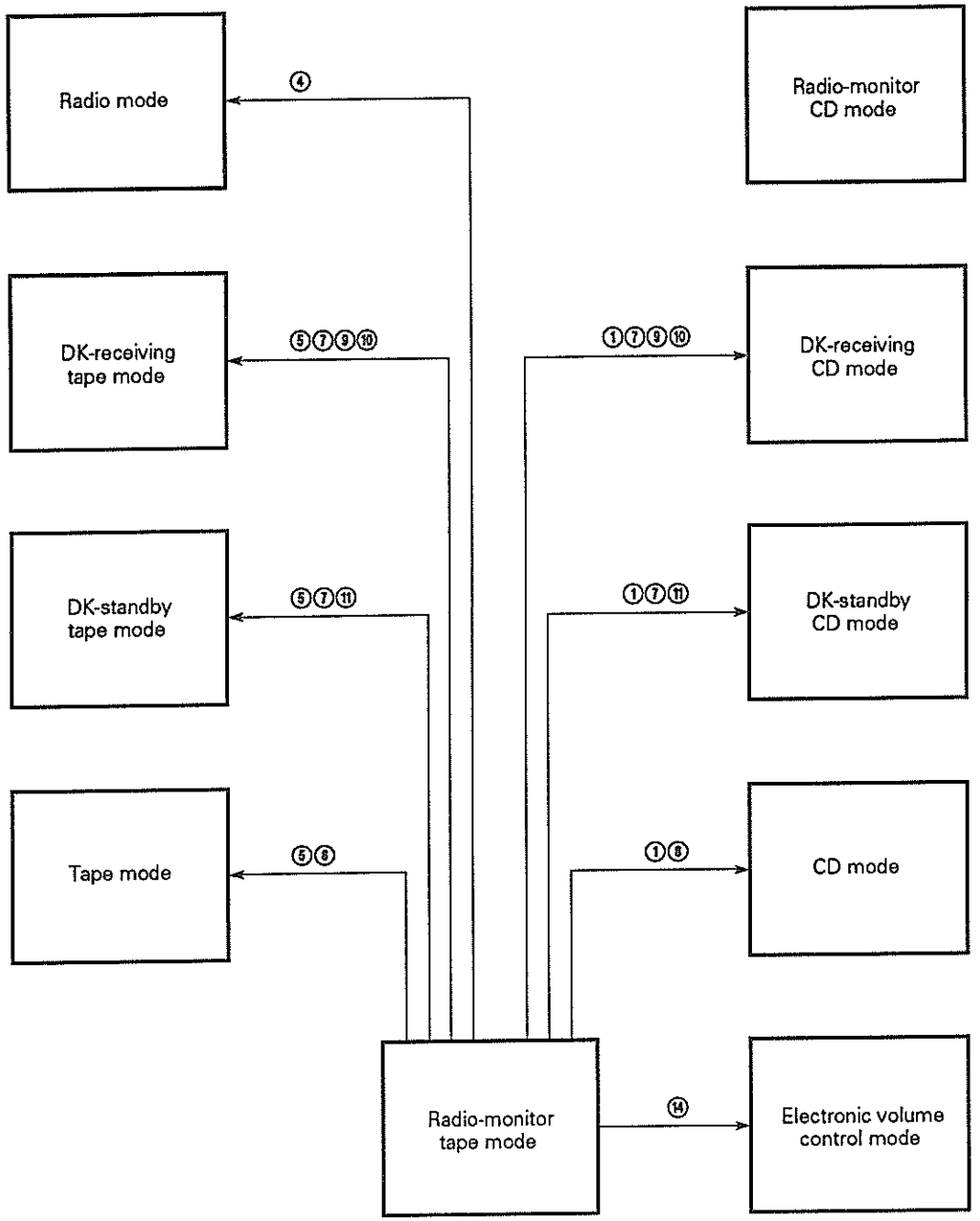
(d) Transition from the DK-receiving tape mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

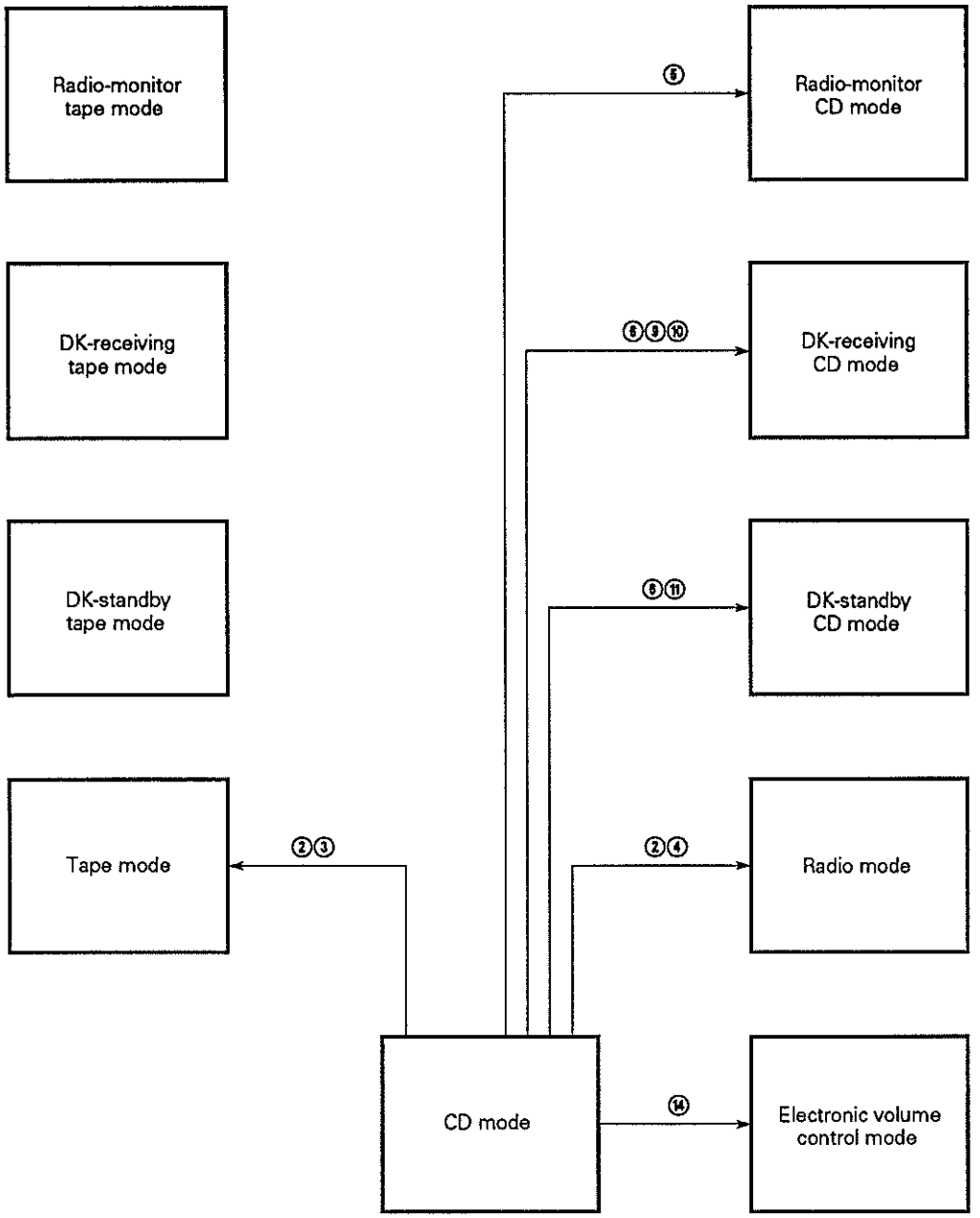
(e) Transition from the radio-monitor tape mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

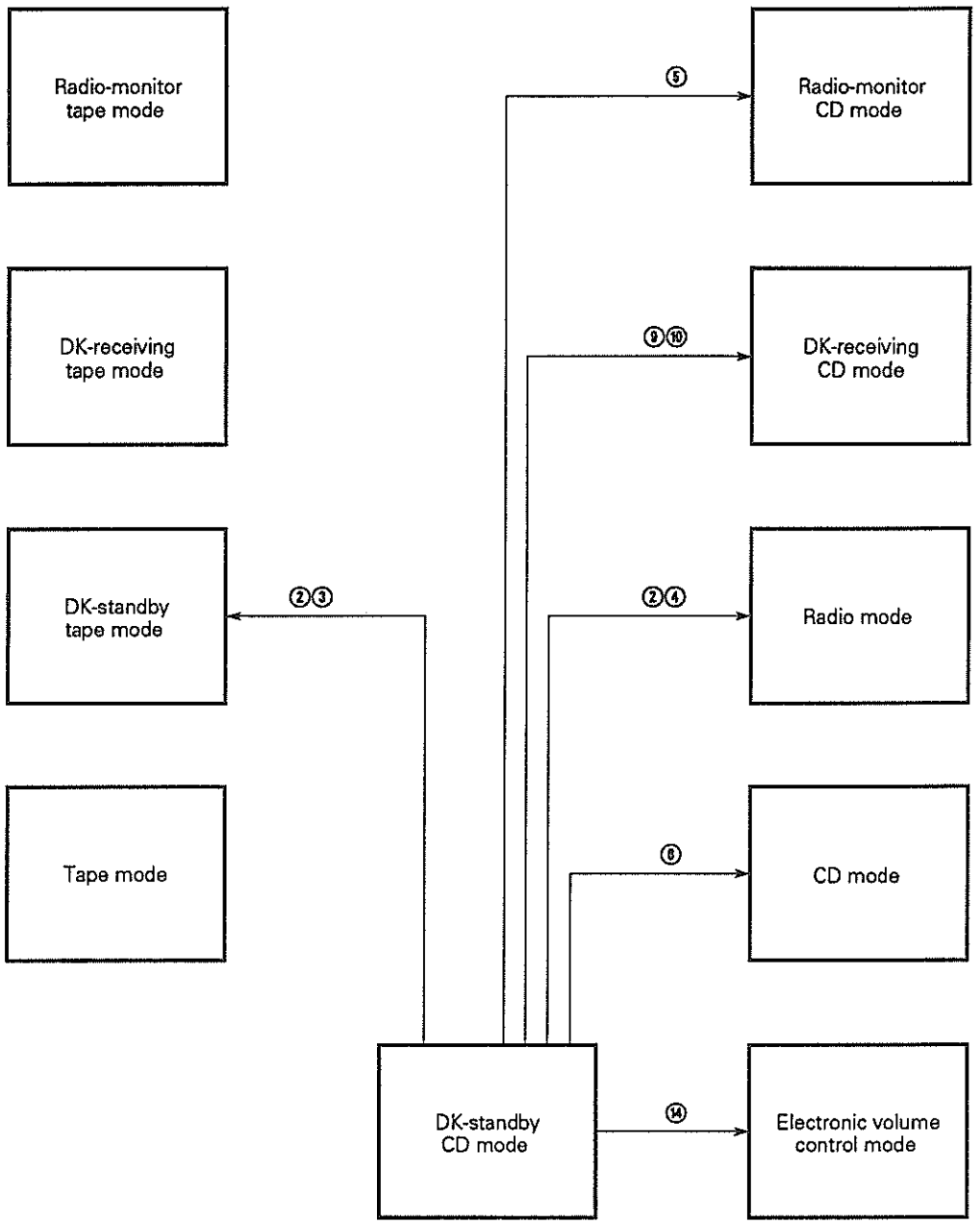
(f) Transition from the CD mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

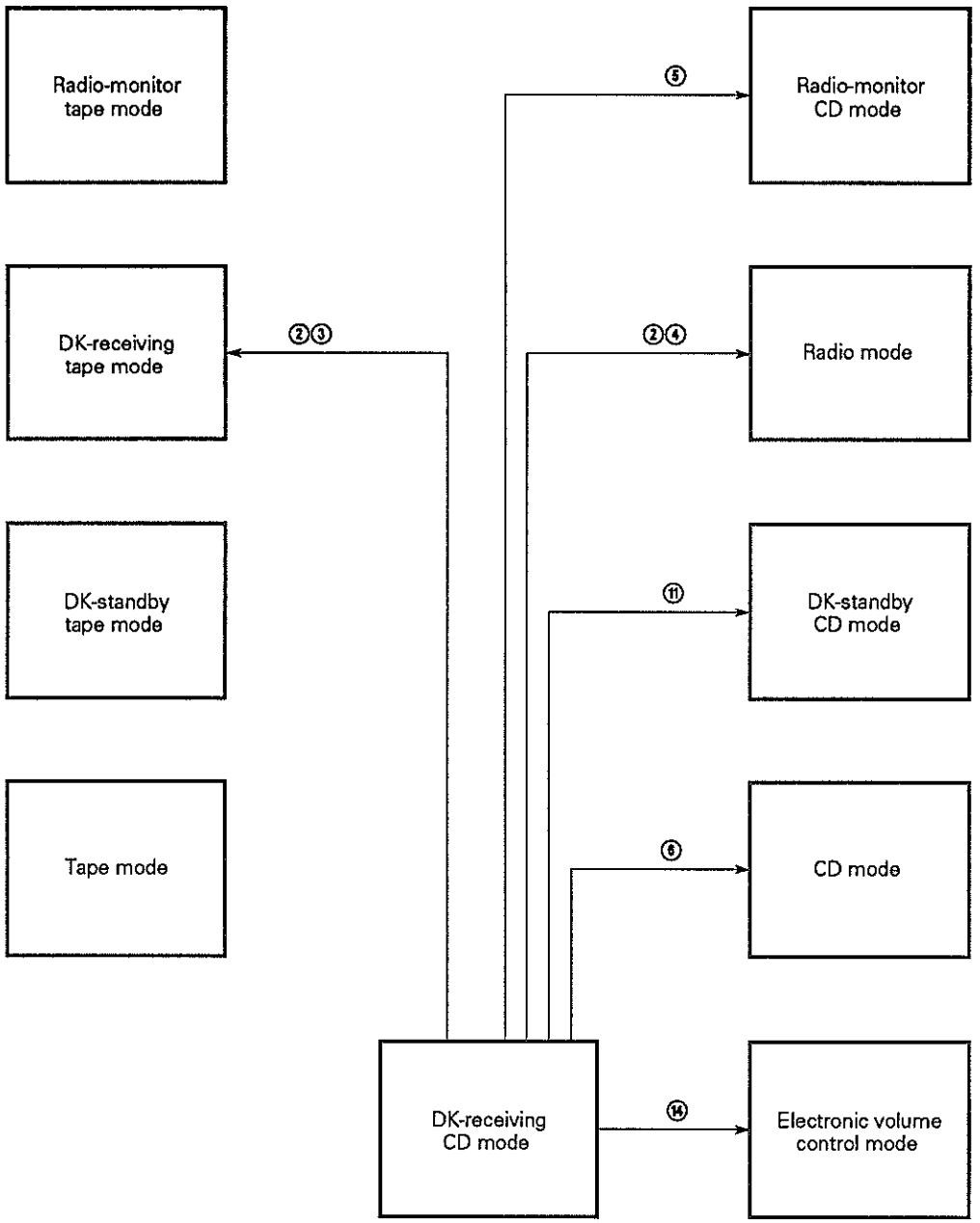
(g) Transition from the DK-standby CD mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

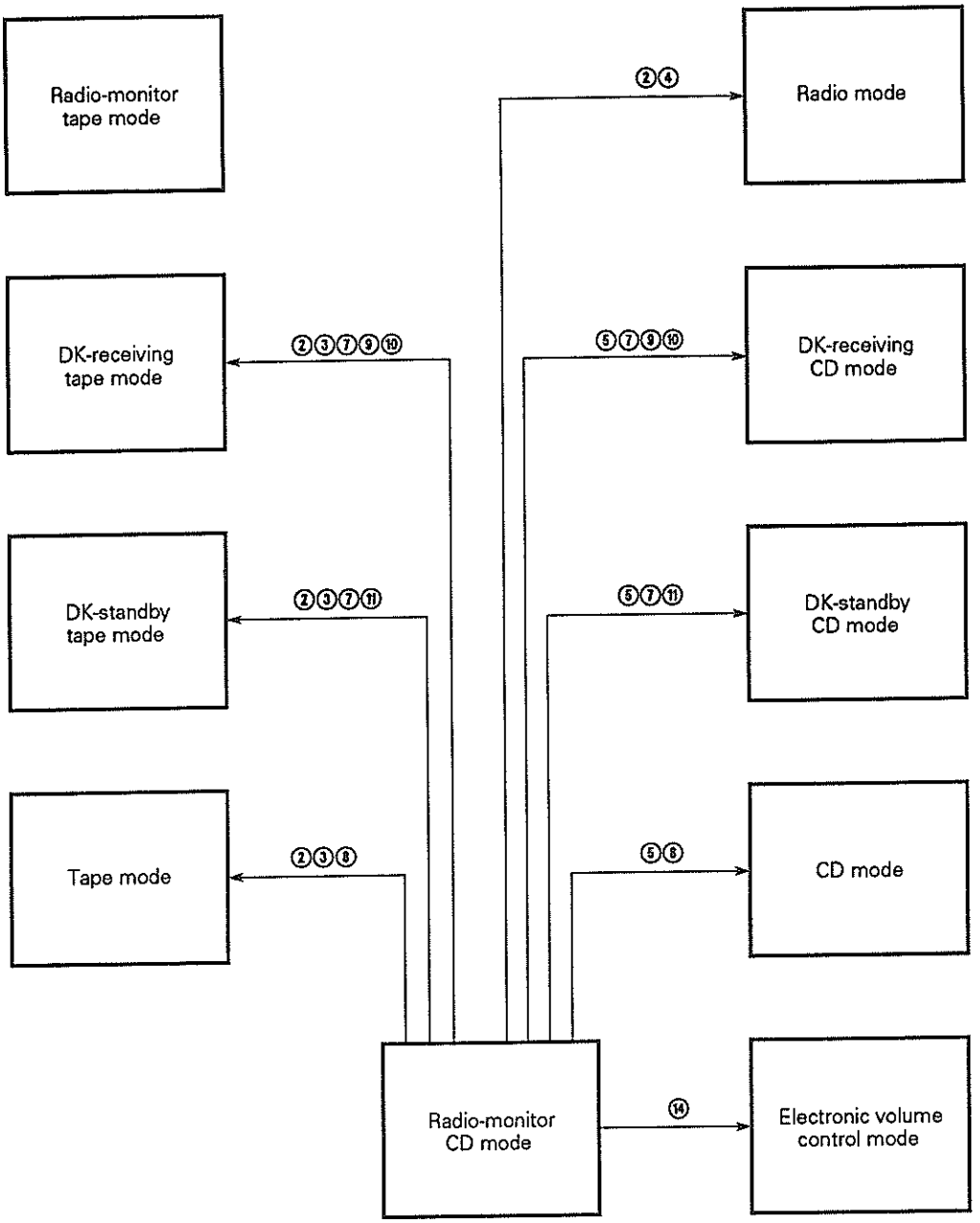
(h) Transition from the DK-receiving CD mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

(i) Transition from the radio-monitor CD mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: [RDMONI] key on
- ⑥: [VF] key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

3.2 MODE TRANSITION WHEN THE INITIAL SETTING DIODE RDON IS SET TO 0 (TURNING ON OR OFF THE RADIO SET BY SWITCHING THE RDSET SWITCH)

The radio set is turned on or off by switching the RDSET switch.

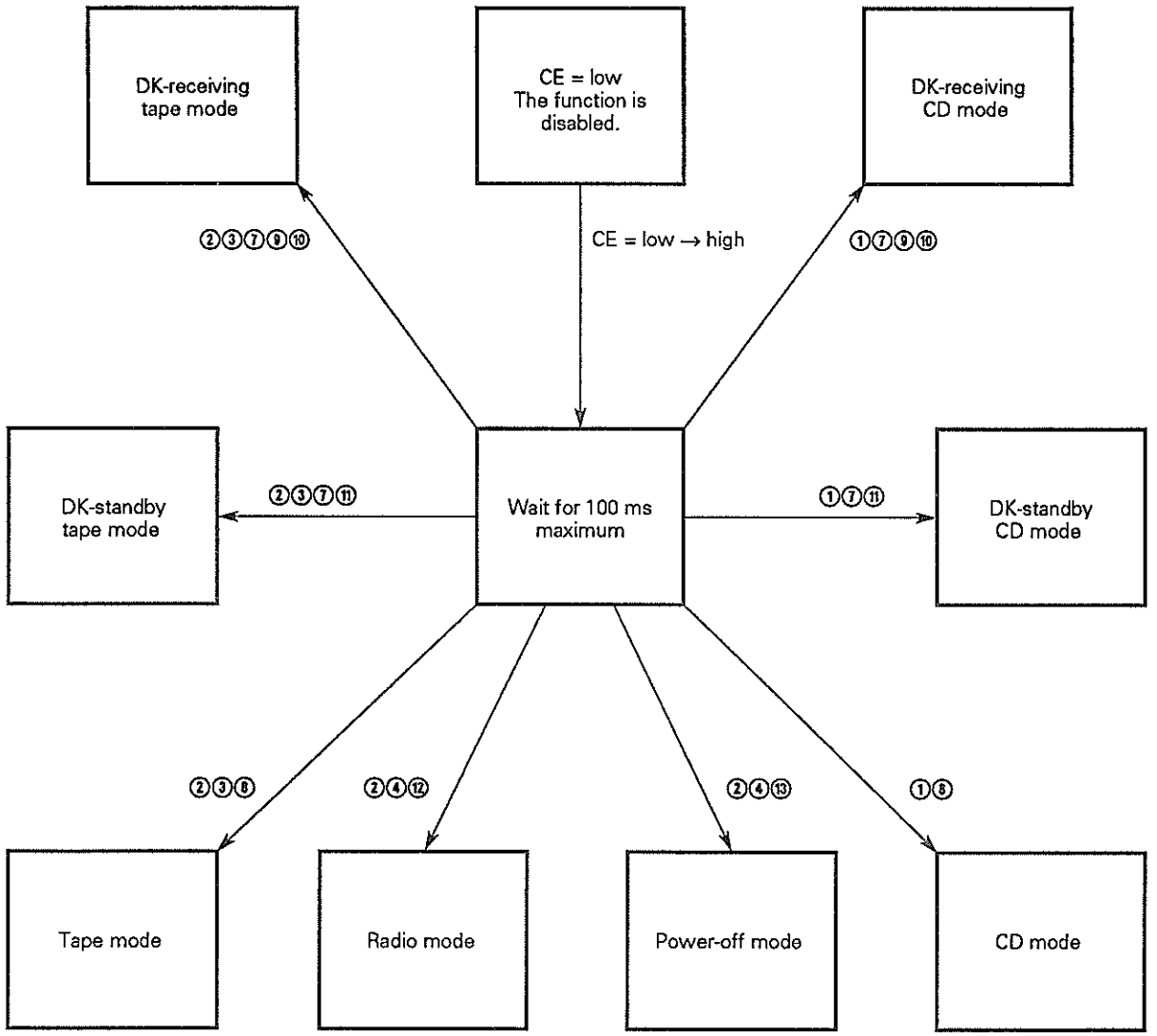
The RDSET, TPSET, and CDSET switches are enabled only when the CE pin is high.

When the CE pin is made low, clock display is not provided regardless of state of the initial setting diode NOCLK. However, when NOCLK = 0 (for using the clock), the clock operates.

(1) Mode transition when the CE pin is raised from low to high

The RDSET switch is used to turn on or off the radio mode.

The TPSET and CDSET switches are used to switch to the tape mode and CD mode.

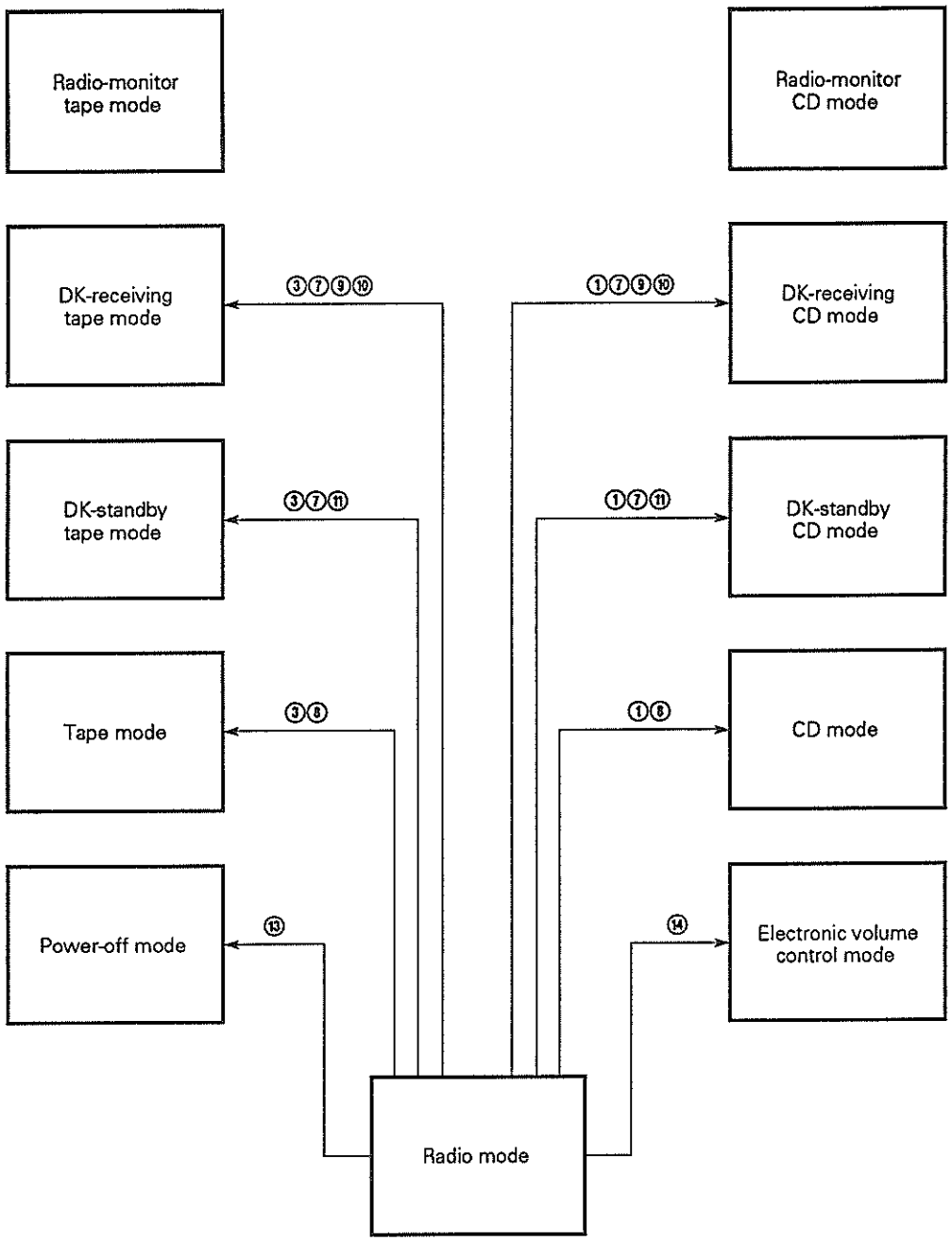


Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off

(2) Mode transition when the CE pin is held high

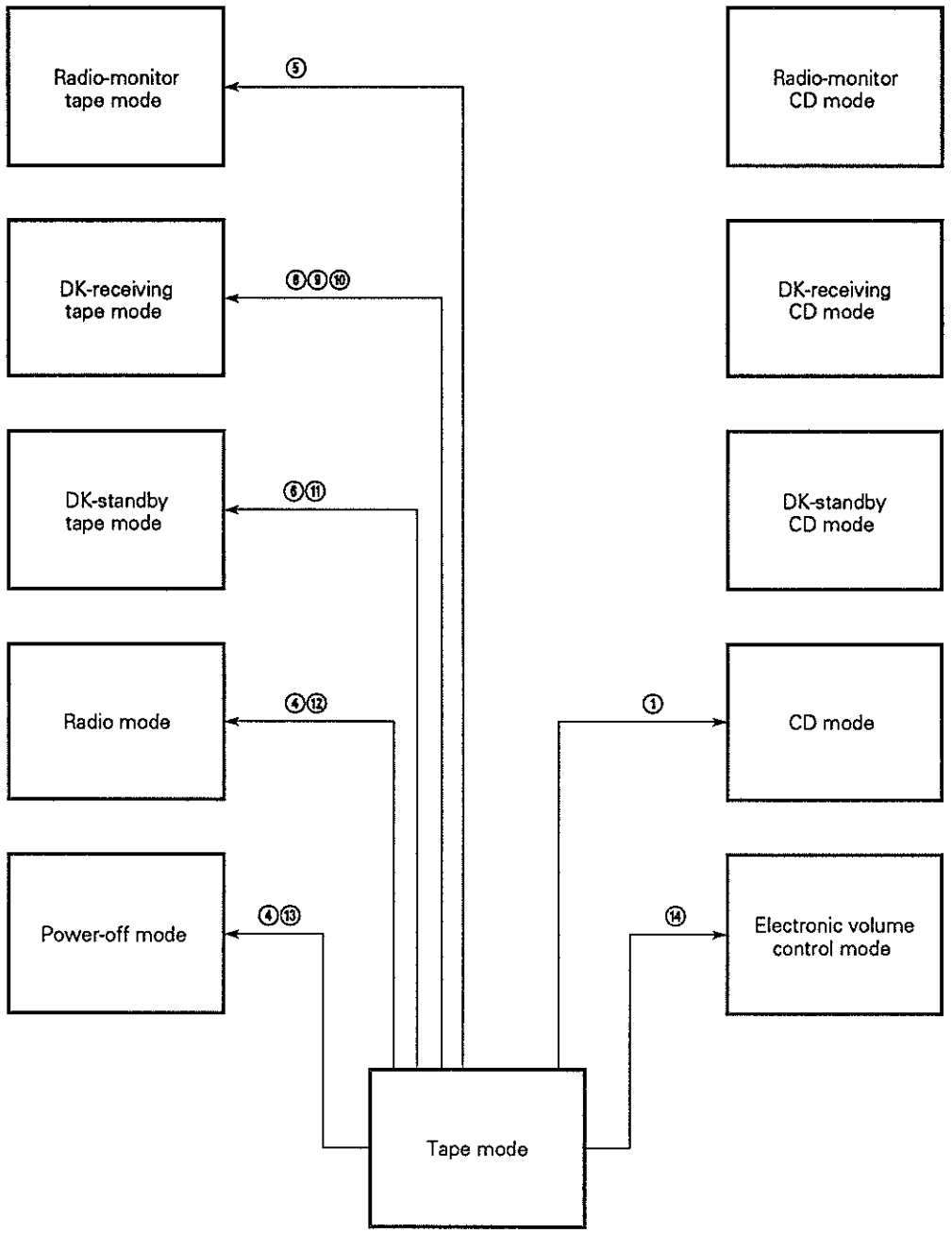
(a) Transition from the radio mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

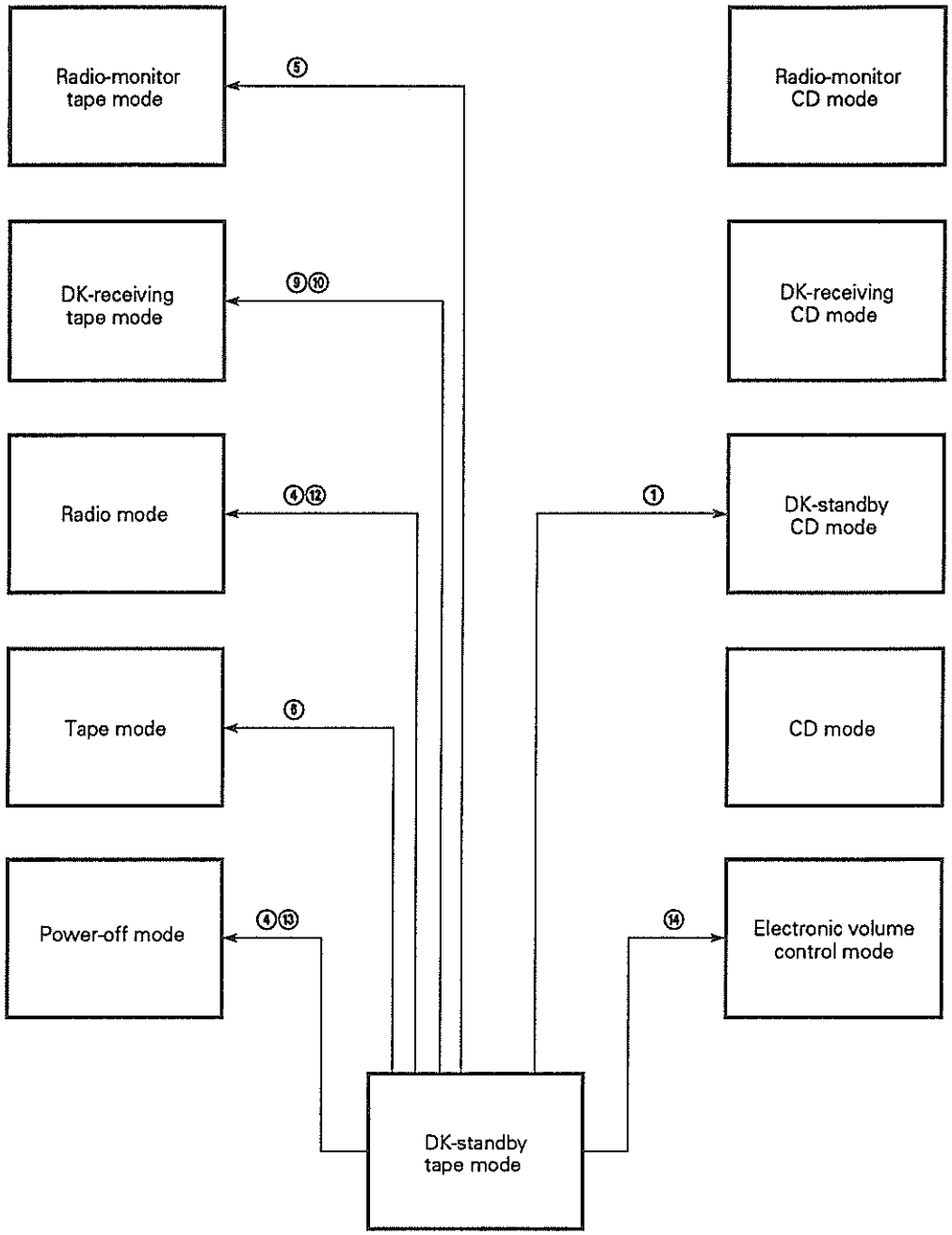
(b) Transition from the tape mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

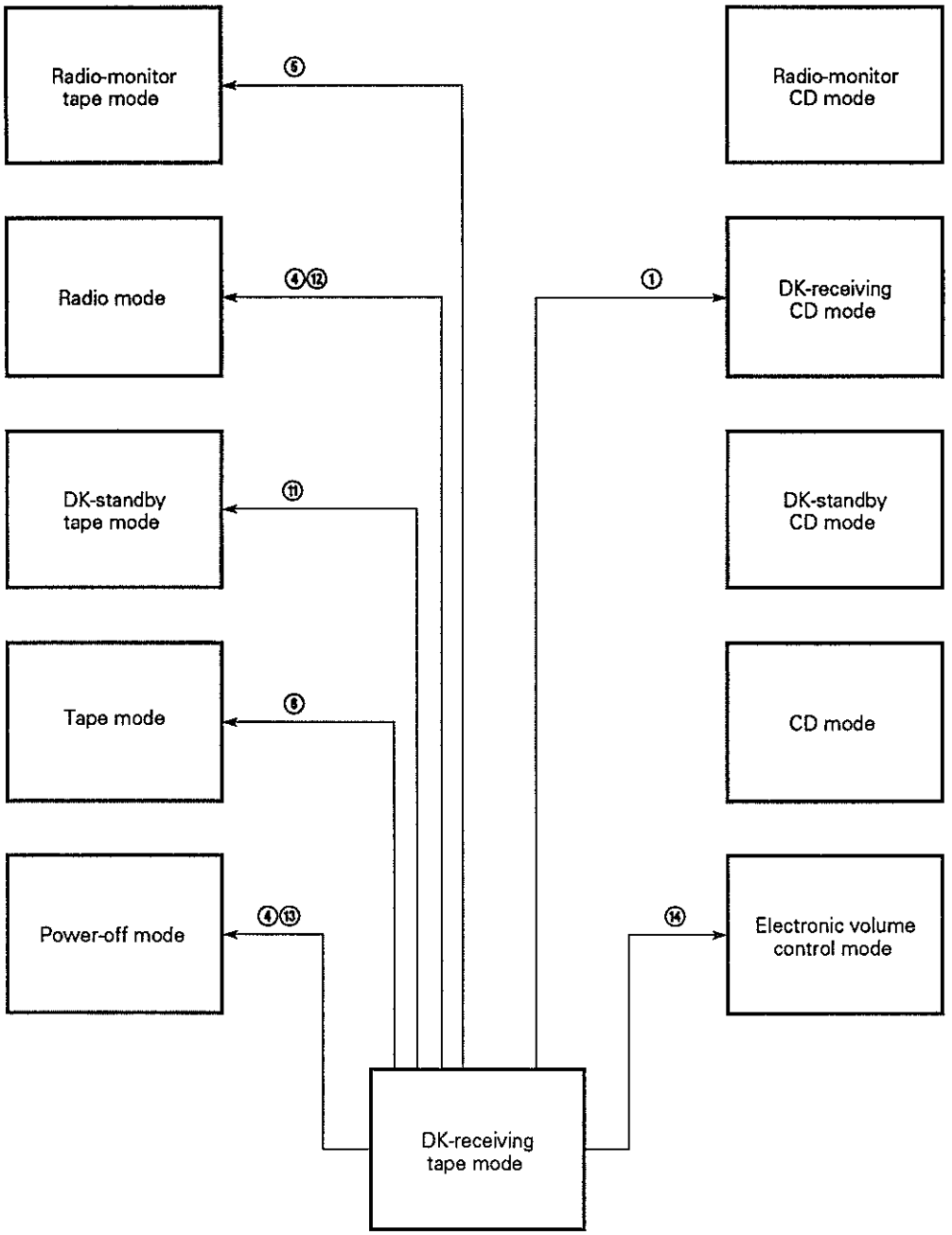
(c) Transition from the DK-standby tape mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

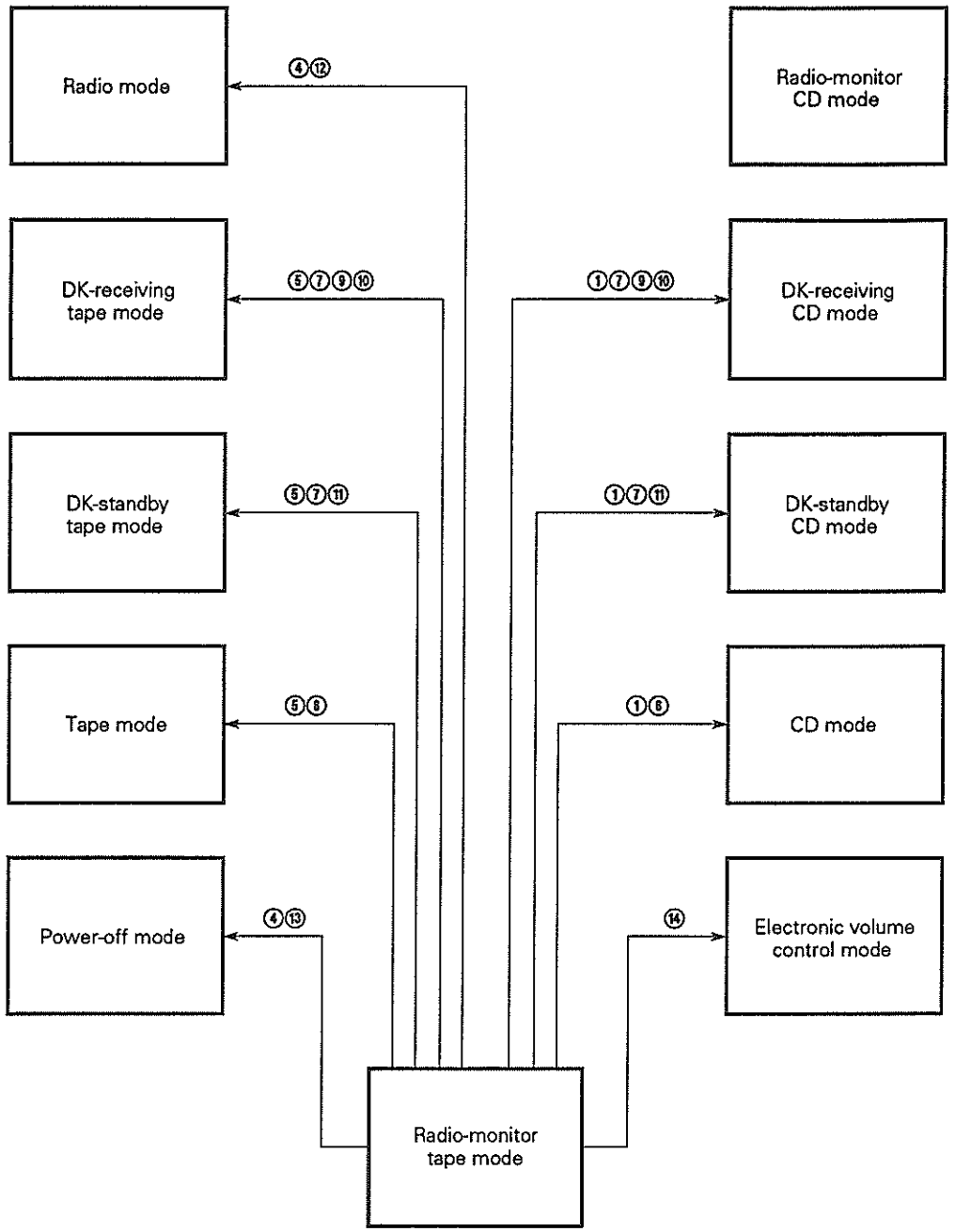
(d) Transition from the DK-receiving tape mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

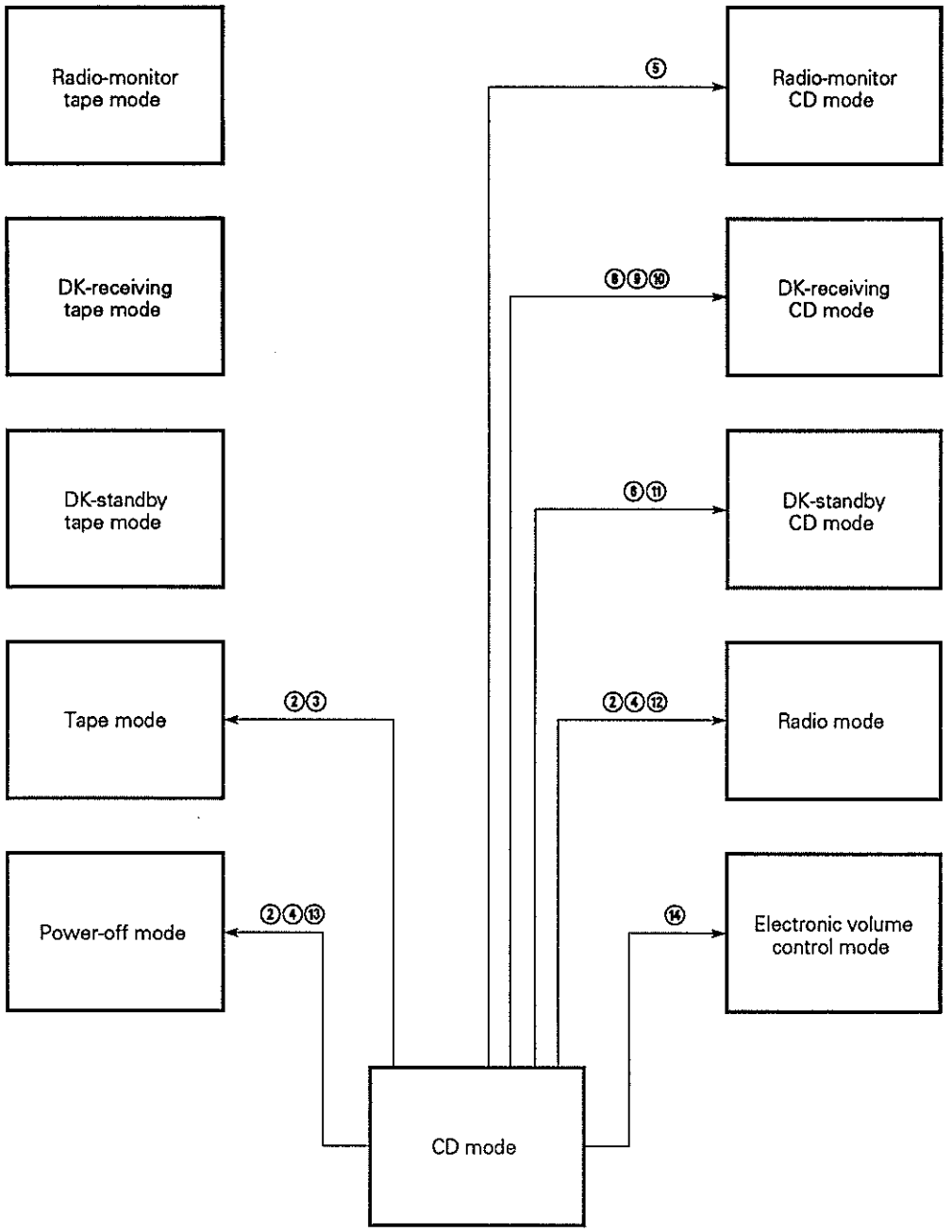
(e) Transition from the radio-monitor tape mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

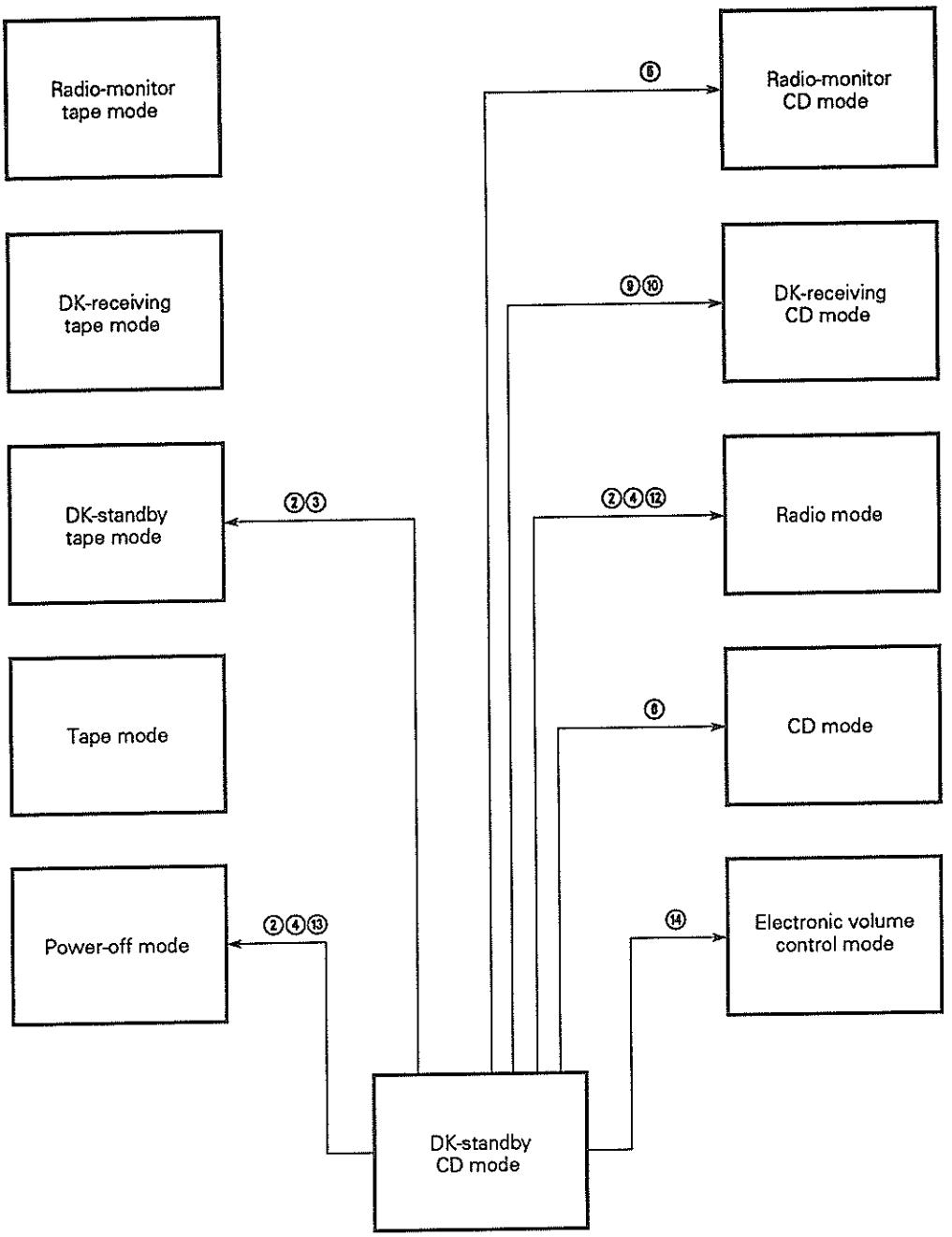
(f) Transition from the CD mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMON! key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

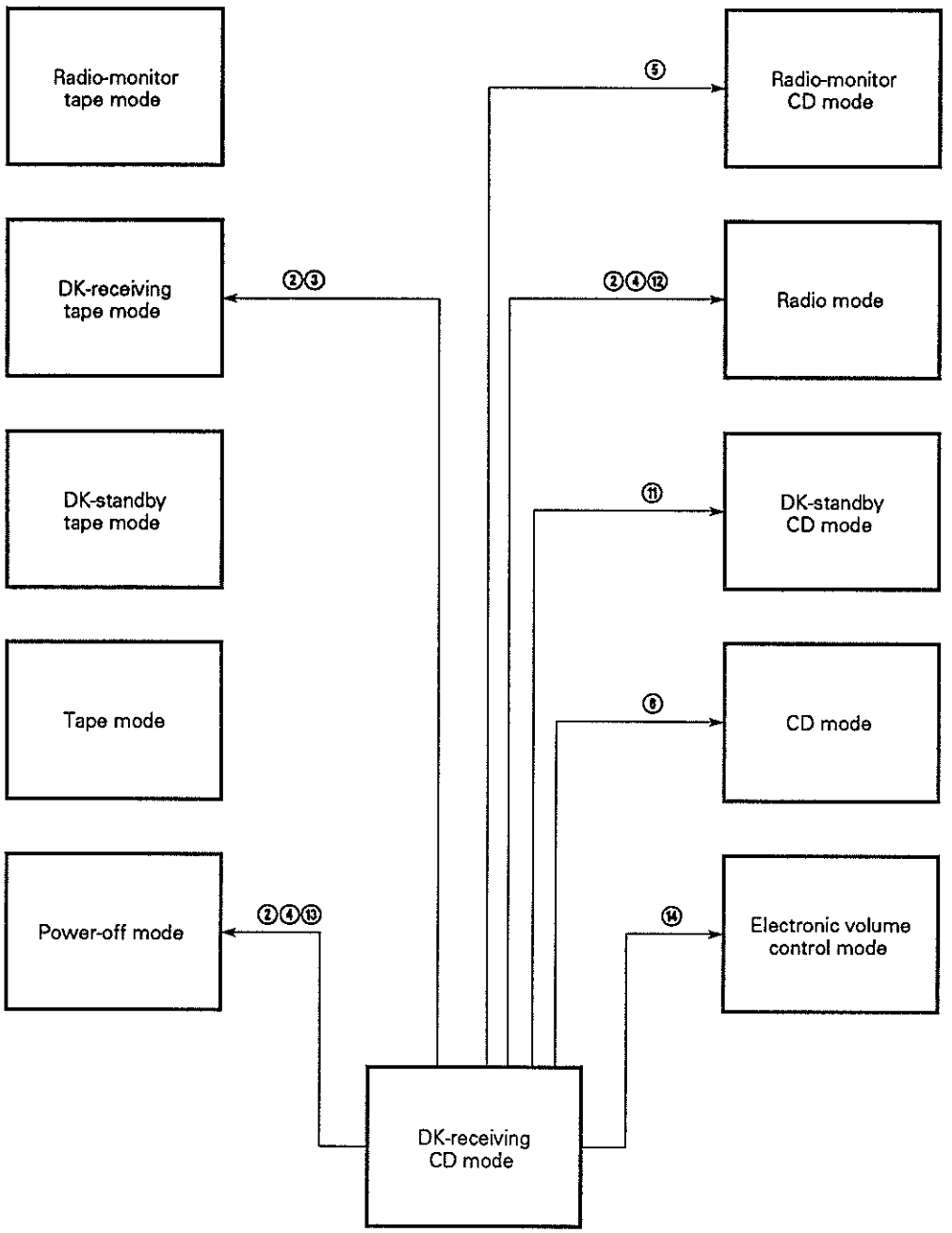
(g) Transition from the DK-standby CD mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

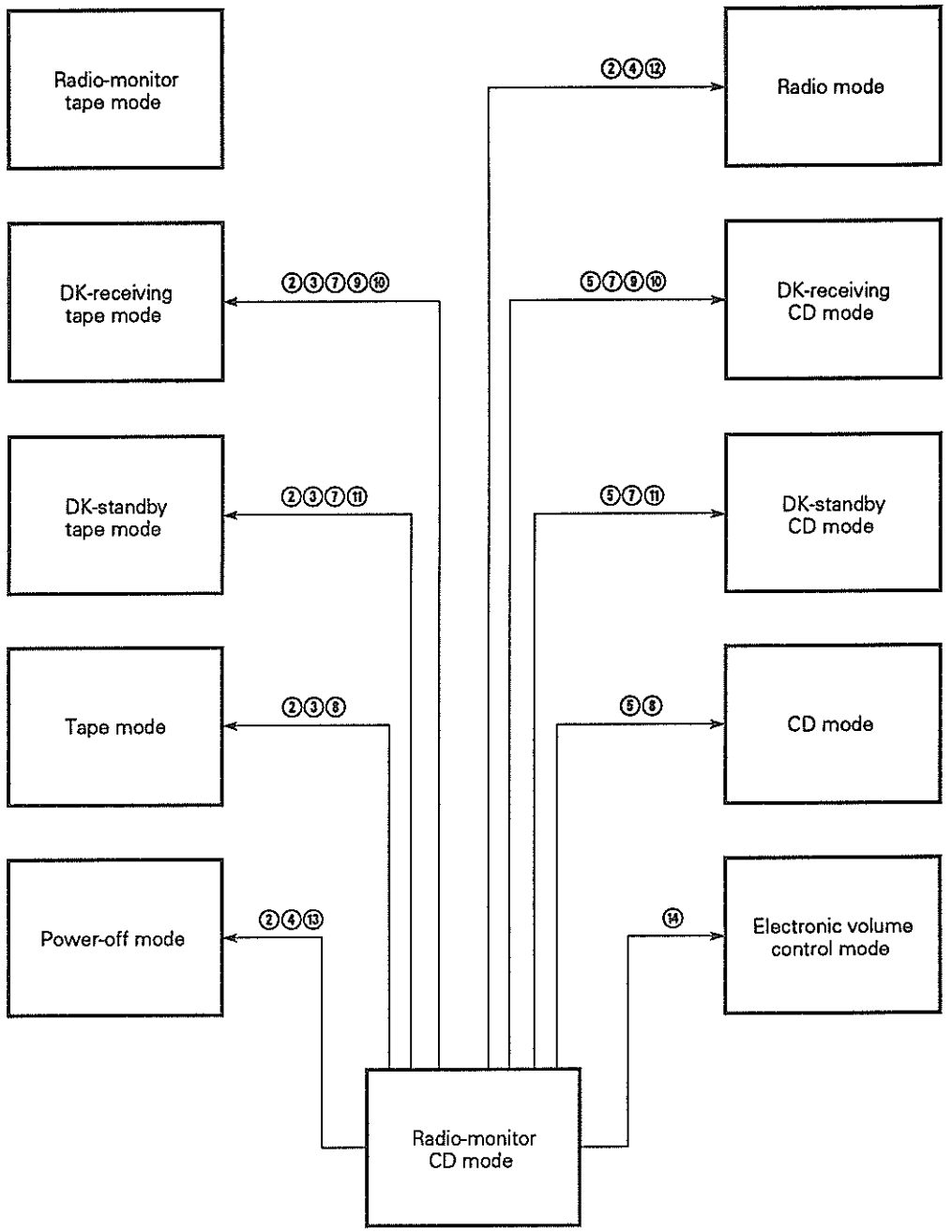
(h) Transition from the DK-receiving CD mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

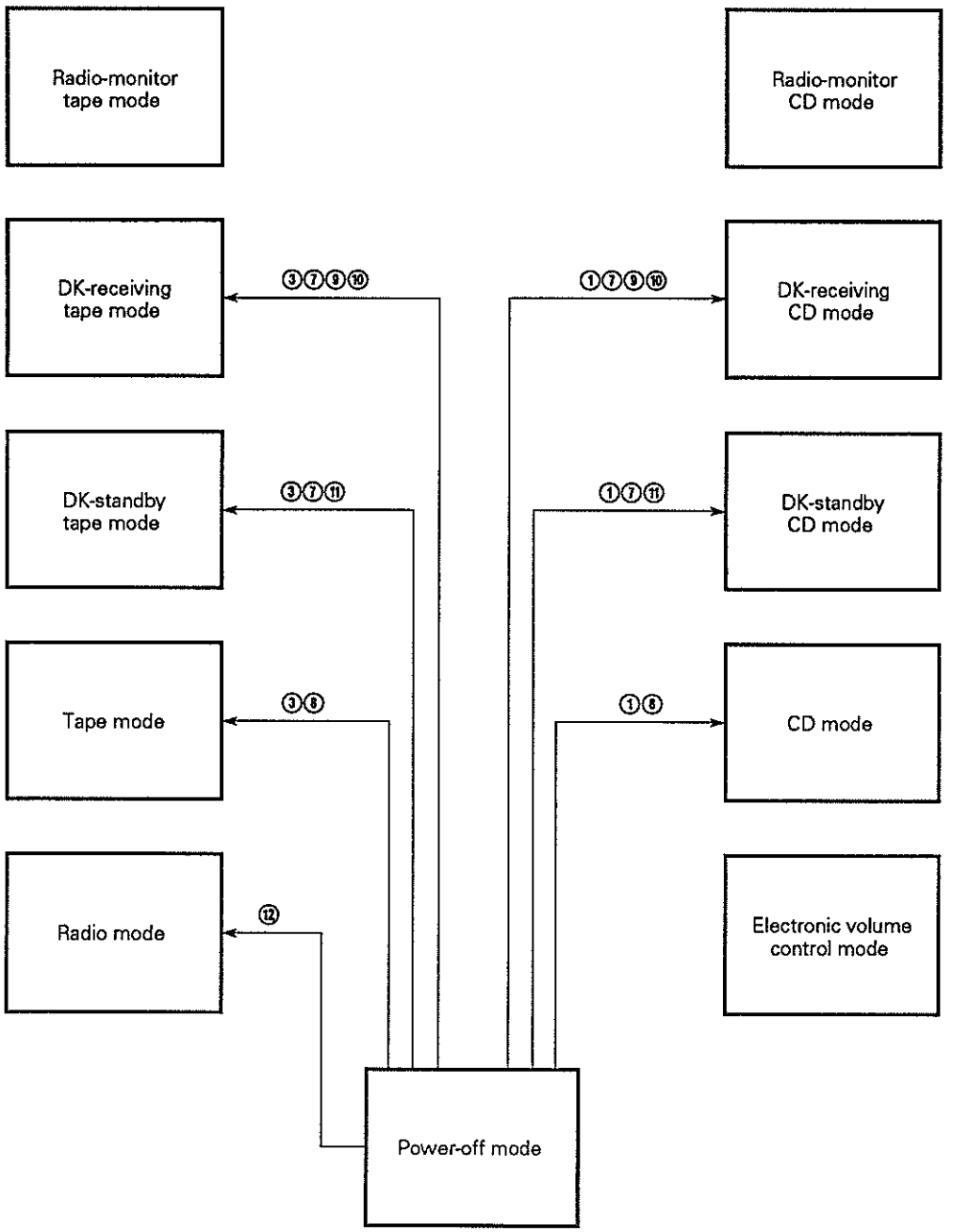
(i) Transition from the radio-monitor CD mode to another mode



Remark The circled numbers represent the following:

- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

(j) Transition from the power-off mode to another mode

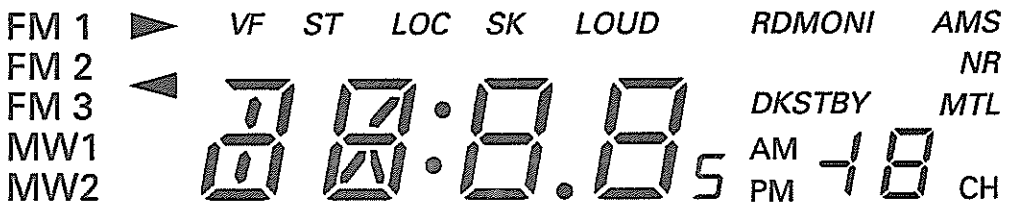


Remark The circled numbers represent the following:

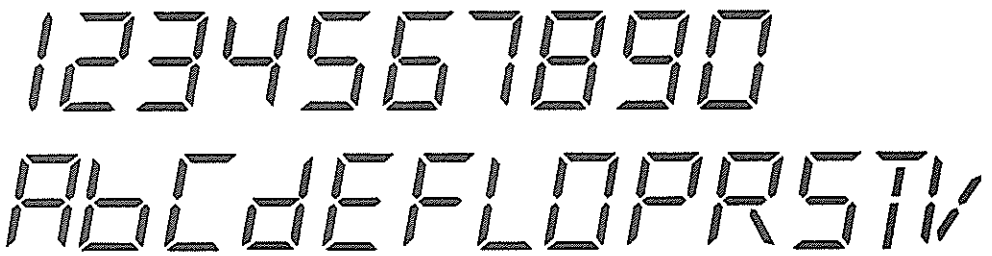
- ①: CDSET switch on
- ②: CDSET switch off
- ③: TPSET switch on
- ④: TPSET switch off
- ⑤: RDMONI key on
- ⑥: VF key on
- ⑦: Reception of the VF band
- ⑧: Reception of bands other than the VF band
- ⑨: Reception from traffic information stations
- ⑩: DK switch on
- ⑪: Reception from broadcasting stations disabled, SK switch off, or DK switch off
- ⑫: RDSET switch on
- ⑬: RDSET switch off
- ⑭: Electronic volume control key on

4. DISPLAY

4.1 LCD PANEL

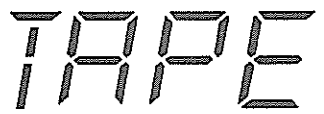


4.2 CHARACTER STYLE



4.3 EXAMPLES OF DISPLAY

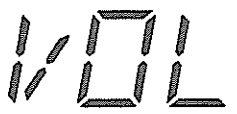
(1) Tape mode



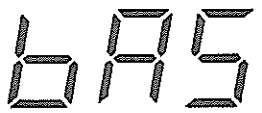
(2) CD mode

(3) Auto-storage

(4) Volume mode

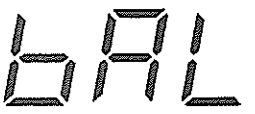


(5) Bass mode



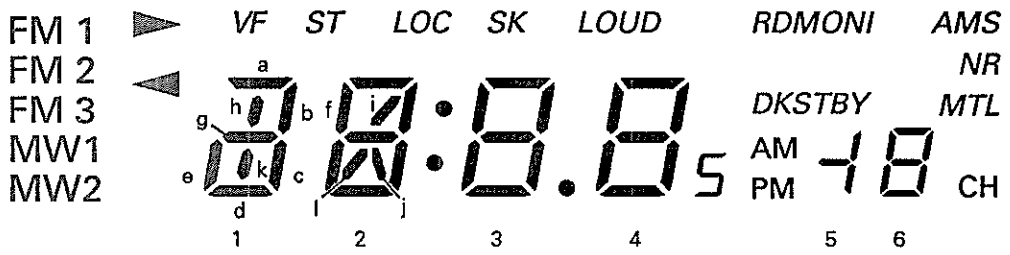
(6) Treble mode

(7) Balance mode



(8) Fader mode

4.4 LCD ASSIGNMENT



4.5 LCD ASSIGNMENT TABLE

4.5.1 Table of LCD Assignment for the Internal LCD Controller/Key Scan Driver

Pin name (pin number) / Pin name (pin number)	COM_0 (37)	COM_1 (36)	COM_2 (35)
LCD_0 (57)	MW2	MW1	FM3
LCD_1 (56)	FM2	1d, 1e,1g	1a
LCD_2 (55)	1c	1k, 1h	1b
LCD_3 (54)	2e	2l, 2i	2f
LCD_4 (53)	2d	2g	2a
LCD_5 (52)	2c	2j	2b
LCD_6 (51)	:	FM1	▶
LCD_7 (50)	3e	◀	3f
LCD_8 (49)	3d	3g	3a
LCD_9 (48)	3c	.	3b
LCD_{10} (47)	4e	ST	4f
LCD_{11} (46)	4d	4g	4a
LCD_{12} (45)	4c	VF	4b
LCD_{13} (44)	LOC	5	SK
LCD_{14} (43)	PM	AM	LOUD
LCD_{15} (42)	RDMONI	5g	DKSTBY
LCD_{16} (41)	AMS	NR	5b, 5c
LCD_{17} (40)	6e	MTL	6f
LCD_{18} (39)	6d	6g	6a
LCD_{19} (38)	6c	CH	6b

Remark The numbers in parentheses are the pin numbers of the μPD17012GF-054.

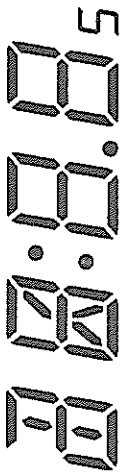
4.5.2 Table of LCD Assignment for the External LCD Controller/Key Scan Driver (μPD17202AGF-011)

Pin name (pin number) / Pin name (pin number)	COM_0 (62)	COM_1 (63)	COM_2 (64)
LCD_0 (25)	MW2	MW1	FM3
LCD_1 (24)	FM2	1d, 1e,1g	1a
LCD_2 (23)	1c	1k, 1h	1b
LCD_3 (22)	2e	2l, 2i	2f
LCD_4 (21)	2d	2g	2a
LCD_5 (20)	2c	2j	2b
LCD_6 (19)	:	FM1	▶
LCD_7 (18)	3e	◀	3f
LCD_8 (17)	3d	3g	3a
LCD_9 (16)	3c	.	3b
LCD_{10} (15)	4e	ST	4f
LCD_{11} (14)	4d	4g	4a
LCD_{12} (13)	4c	VF	4b
LCD_{13} (12)	LOC	5	SK
LCD_{14} (11)	PM	AM	LOUD
LCD_{15} (10)	RDMONI	5g	DKSTBY
LCD_{16} (9)	AMS	NR	5b, 5c
LCD_{17} (8)	6e	MTL	6f
LCD_{18} (7)	6d	6g	6a
LCD_{19} (6)	6c	CH	6b

Remark Blank: Not used. The numbers in parentheses are the pin numbers of the μPD17202AGF-011.

4.6 DESCRIPTION OF DISPLAY

Display	Description
VF	Indicates that the VF band is selected. **(1) In the CD mode and tape mode** This indication is off. **(2) In other modes** This indication is on when the VF band is selected.
SK	Indicates that a traffic information station is selected for reception. **(1) In the CD mode and tape mode** This indication is off. **(2) In other modes** This indication is on when the FM or VF band is selected or in the traffic information station reception state. The traffic information station reception state is the state where the SK switch is on in the station reception state.
ST	Indicates that a stereo broadcast is currently received. **(1) In the CD mode or tape mode** This indication is off. **(2) In other modes** This indication is on when the FM, VF, or MW band is selected, the ST switch is on in the station reception state, and the MONO-off state is set. (For the MW band, this indication is on only when the initial setting diode MWS = 1, and the stereo reception function is enabled.) This indication is off during tuning operation regardless of which band is selected.
LOC	Indicates that the local state is set. **(1) In the CD mode and tape mode** This indication is off. **(2) In other modes** This indication is on in the local state.
LOUD	Indicates that the loudness-on state is set. This indication is on in the loudness-on state, regardless of which mode is set.
MTL	Indicates that the METAL-on state is set. **(1) In the tape mode, DK-standby tape mode, DK-receiving tape mode, and radio-monitor tape mode** This indication is on in the METAL-on state. **(2) In other modes** This indication is off.
NR	Indicates that the NR-on state is set. **(1) In the tape mode, DK-standby tape mode, DK-receiving tape mode, and radio-monitor tape mode** This indication is on in the NR-on state. **(2) In other modes** This indication is off.
RDMONI	Indicates that the radio-monitor state is set.

Display	Description
DKSTBY	Indicates that the DK-standby state or the DK-on state is set. **(1) In the CD mode and tape mode** This indication is on in the DK-standby state or the DK-on state. **(2) In other modes** This indication is off.
▶ ◀	Indicates a tape running direction. **(1) In the tape mode, DK-standby tape mode, DK-receiving tape mode, and radio-monitor tape mode** A tape running direction is displayed according to the state of the RL switch. A tape running direction blinks when the FF switch is on. **(2) In other modes** This indication is off.
FM1 FM2 FM3 MW1 MW2	Indicates a band received. **(1) In the CD mode and tape mode** This indication is off. **(2) In other modes** The band currently received is displayed.
	Displays a receive frequency, "AP.", "Cd", "TAPE", "VOL", "bAS", "TREb", "bAL", "FAd", and the clock. When the entire panel is blinking while "VOL" is displayed, the mute state is set.
AMS	Indicates that the Auto Music Search (AMS) state is set. **(1) In the tape mode, DK-standby tape mode, DK-receiving tape mode, and radio-monitor tape mode** This indication is on in the AMS-on state. **(2) In other modes** This indication is off.
AM PM	Indicates AM (before noon) or PM (after noon) when the 12-hour system is used for display.
	Indicates a preset memory number or electronic volume control value. When a preset memory is written to or called, the preset memory number is displayed together with "CH." In the electronic volume control mode, the value of the volume control is displayed; the "CH" is turned off in this case. This indication is on when a frequency is displayed; this indication is off when the clock is displayed. When preset memory write operation is enabled, "CH" blinks at a frequency of 1 Hz. When a preset memory is being scanned, the preset memory number blinks at a frequency of 1 Hz.

5. MUTE OUTPUT TIMING CHARTS

The circled numbers ① through ⑥ in this chapter represent the following:

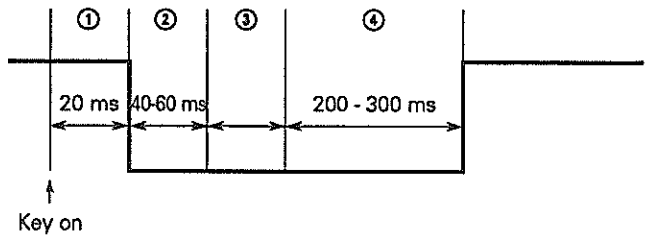
①: Key-on chattering protection
②: Preceding mute and beep output
③: Updating of the frequency division ratio setting and indication
④: Following mute
⑤: Scan time
⑥: Wait for PLL locking

5.1 RADIO MUTE ($\overline{\text{RDMUTE}}$ PIN) OUTPUT TIMING CHARTS

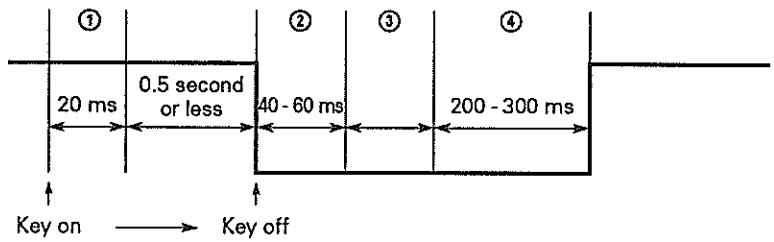
(1) Manual up/down

(a) 1-channel up/down

(i) When AUTO500 switch = 0



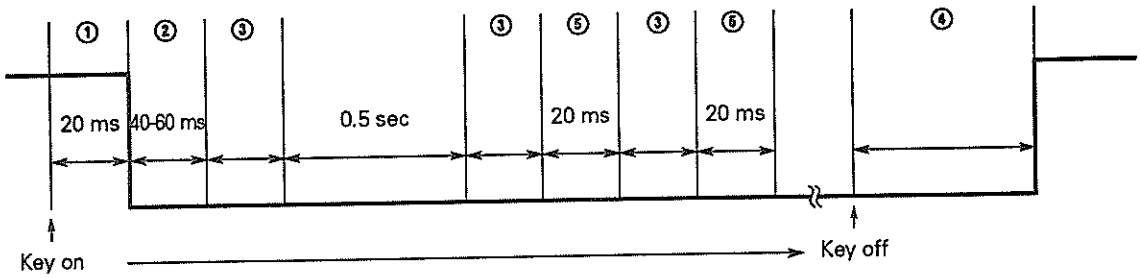
(ii) When AUTO500 switch = 1



In either case (i) or case (ii), the time of ④ is 600 ms to 700 ms at the band edges (lowest frequency ⇄ highest frequency).

(b) Continuous up/down

(i) When AUTO500 switch = 0



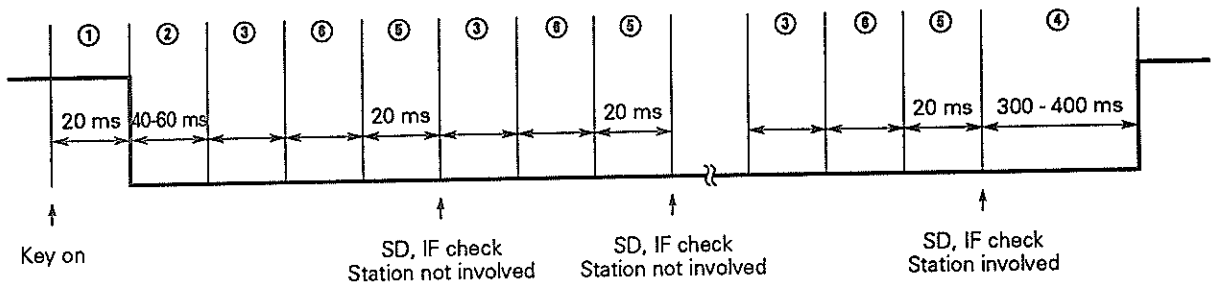
At the band edges, the time of ⑤ is 500 ms, and the time of ④ is 600 ms to 700 ms.

(ii) When AUTO500 switch = 1

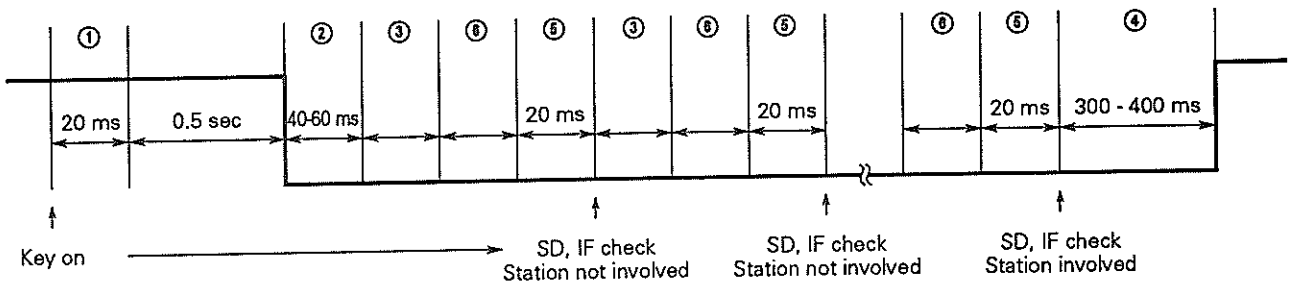
The auto-tuning function is enabled by holding down the key for 0.5 second or more, so that continuous up/down operation is not performed.

(2) Automatic up/down

(a) SEEK UP, SEEK DWN, SCAN UP, or SCAN DWN key



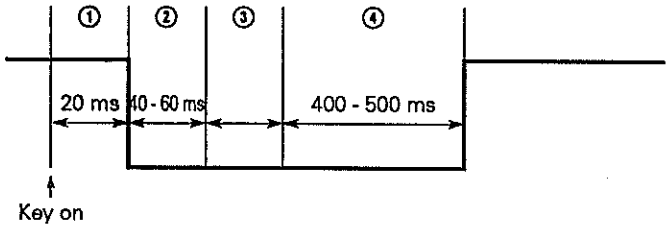
(b) When the MAN UP or MAN DWN key is held down for 0.5 second or more when AUTO500 switch = 1



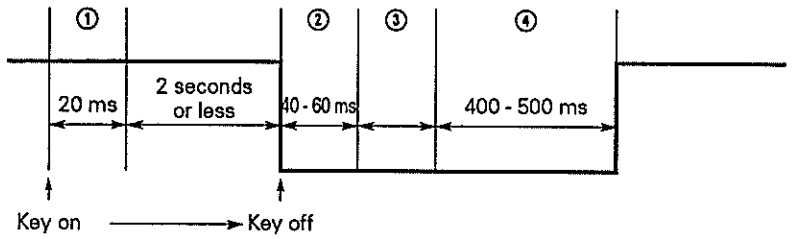
In either case (a) or case (b), the time of ⑤ is 540 ms at the band edges.
An IF check is made twice in the FAST mode and SLOW mode.

(3) Calling a preset memory

(a) When M2S switch = 0

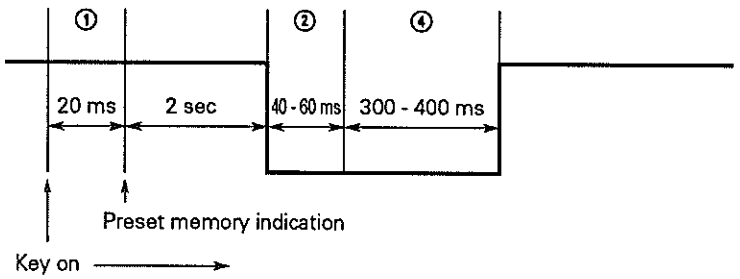


(b) When M2S switch = 1



(4) Write to a preset memory

(a) When M2S switch = 0

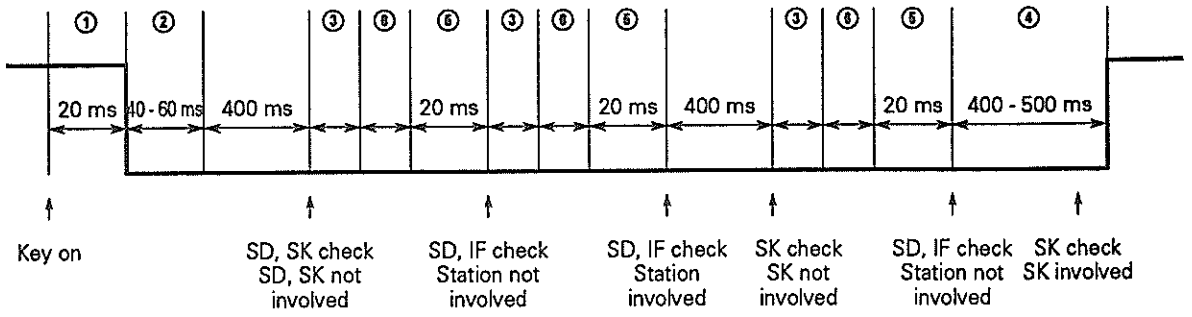


(b) When M2S switch = 1

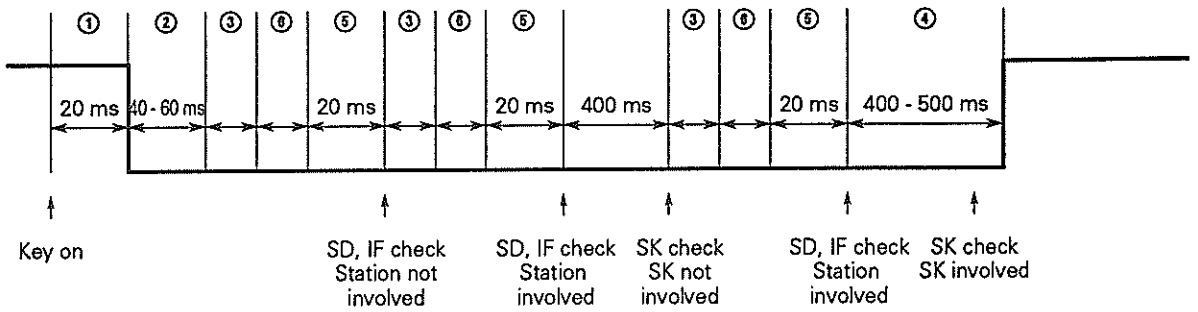
Mute output operation is not performed.

(5) VF mode

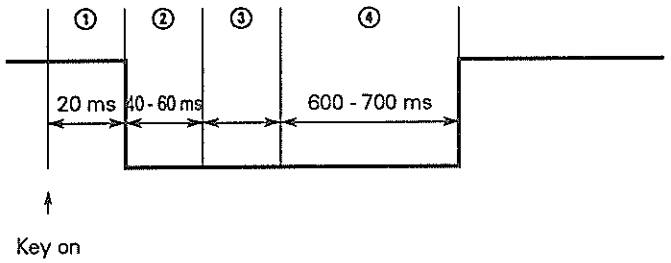
(a) When the VF mode is set with the [VF] key on



(b) Seek and scan operation in the VF mode

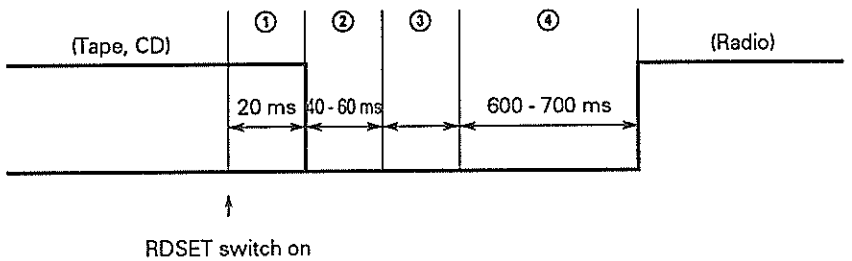


(6) Band switching

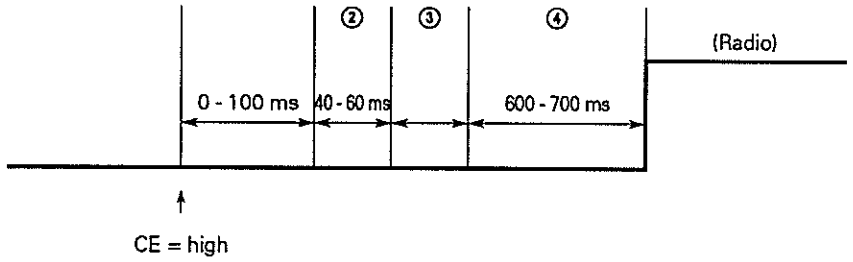


(7) Turning on or off the radio set

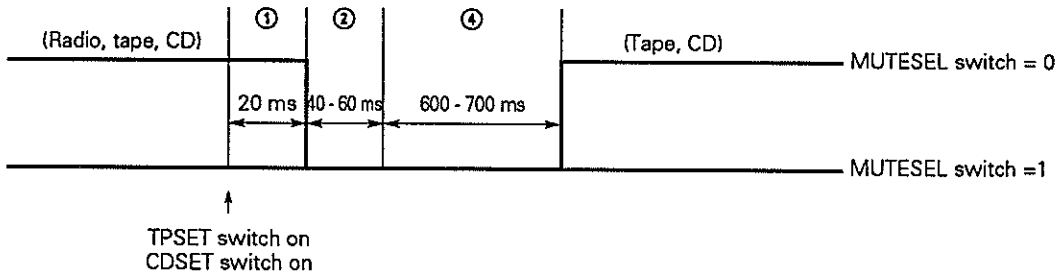
(a) When the RDSET switch is used



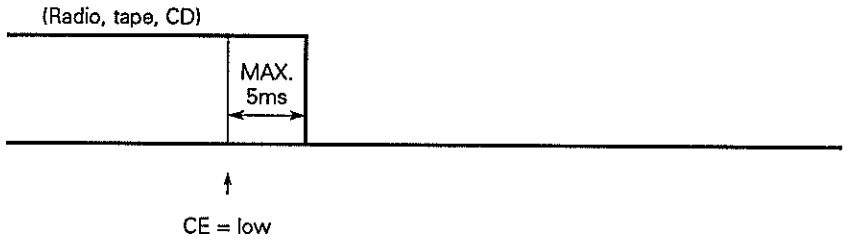
(b) When the CE pin is raised from low to high with the RDON switch set to 1



(8) Turning on or off the tape or CD

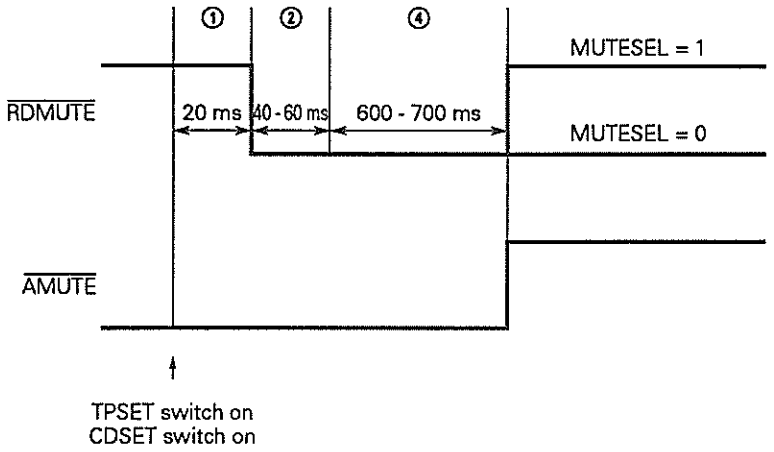


(9) Pulling the CE pin from high to low

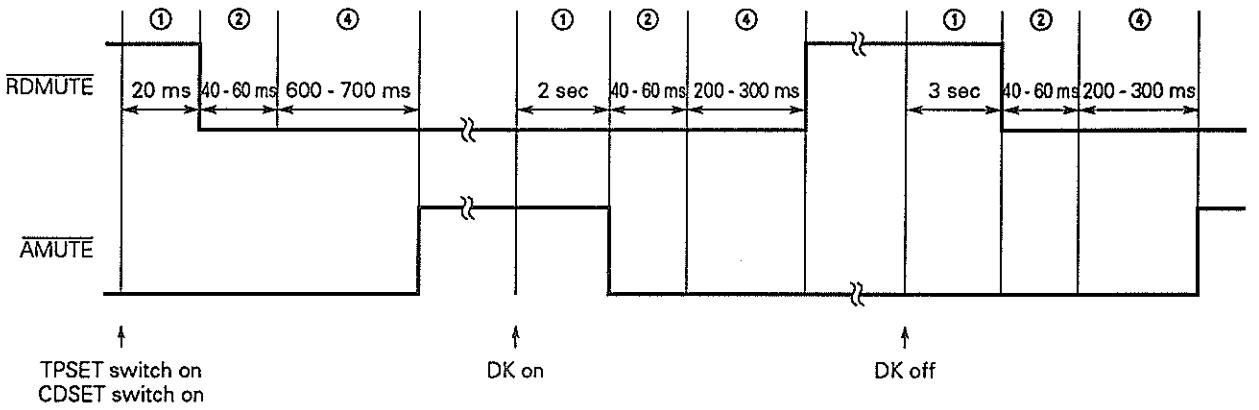


5.2 RADIO MUTE ($\overline{\text{RDMUTE}}$ PIN) AND AUDIO MUTE ($\overline{\text{AMUTE}}$ PIN) OUTPUT TIMING CHARTS

(1) When the mode is switched from the radio mode to the tape or CD mode

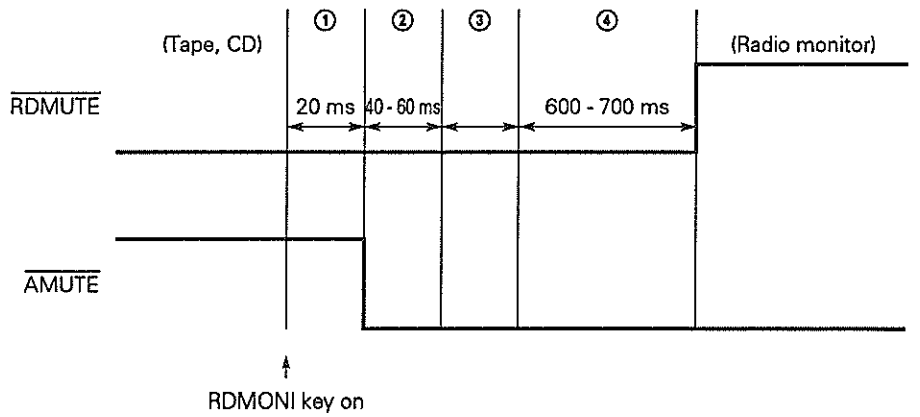


(2) When the mode is switched from the VF band to the tape or CD mode (Set MUTESEL to 0.)

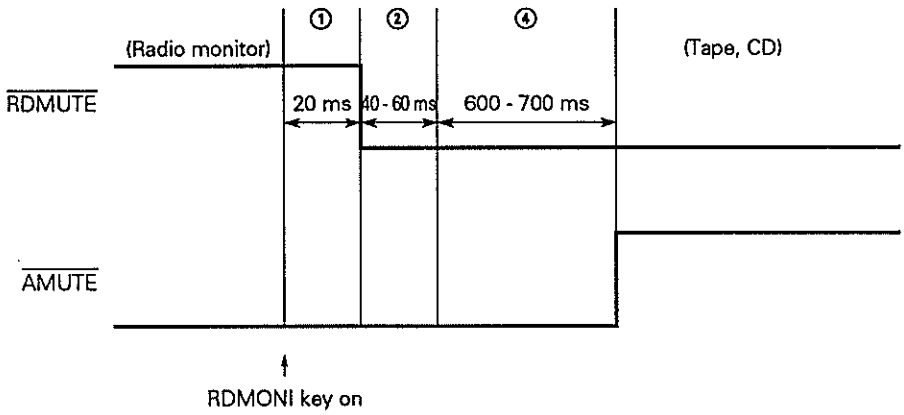


(3) When the radio monitor function is used (Set MUTESEL to 0.)

(a) Switching the radio monitor function from off to on



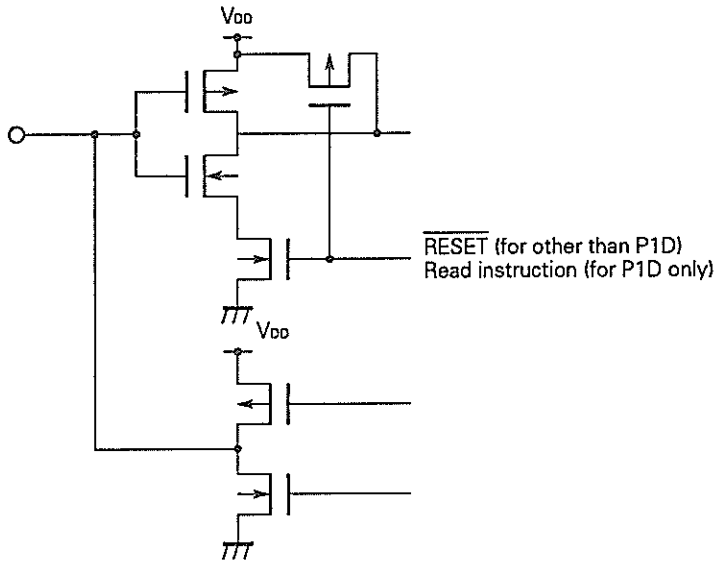
(b) Switching the radio monitor function from on to off



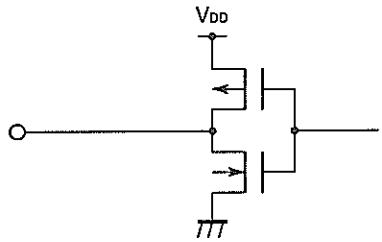
6. PIN I/O CIRCUITS

The I/O circuit of each pin of the μPD17012GF-054 is illustrated below in a simplified form.

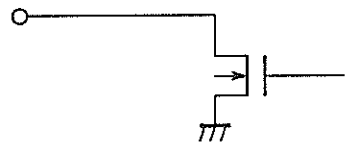
(1) P0A (P0A0/CDOUT, P0A1/SI, P0A2/SCK)
P0B (P0B3/EVOL_SCK, P0B2/EVOL_DA, P0B1/BEEP, P0B0/LOUD)
P1A (P1A2/POWER, P1A1/BAND1, P1A0/BAND2)
P1D (P1D3/MODE2, P1D2/MODE, P1D1/KS17, P1D0/KS16) } (I/O)



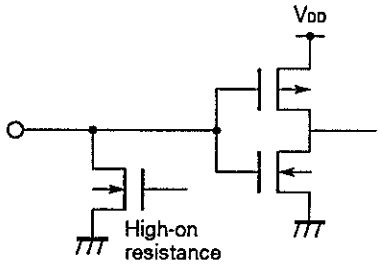
(2) P1C (P1C3/AGCC, P1C2/LOC, P1C1/$\overline{\text{AMUTE}}$, P1C0/$\overline{\text{RDMUTE}}$)
P2E0/LCD16/BLANK, P2F0/LCD17/LOAD
P2G0/LCD18/$\overline{\text{LCD RES}}$, P2H0/LCD19/POUT
PYA15/LCD15/KS15-PYA0/LCD0/KS0 } (Output)



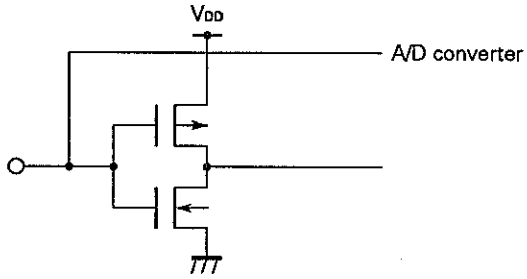
(3) P0C (P0C3/SO, P0C2/AMS, P0C1/MONO/NR, P0C0/MTL) (Output)



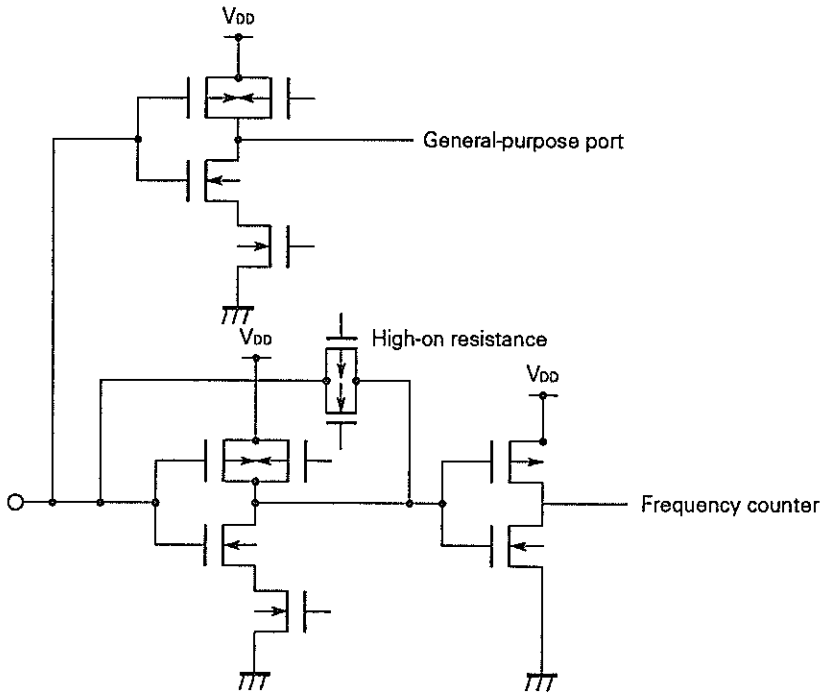
(4) POD (POD3/K3-POD0/K0) (Input)



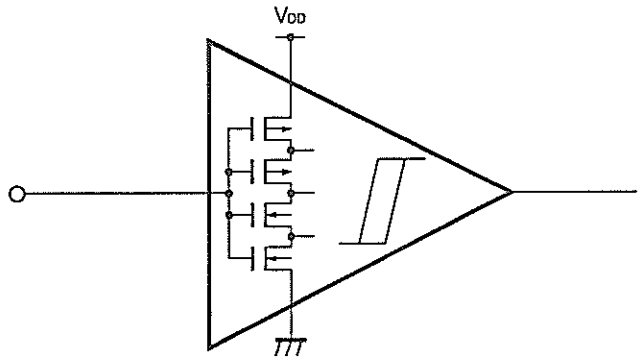
(5) P1B (P1B1/ADC1/INT, P1B0/ADC0/SD) (Input)



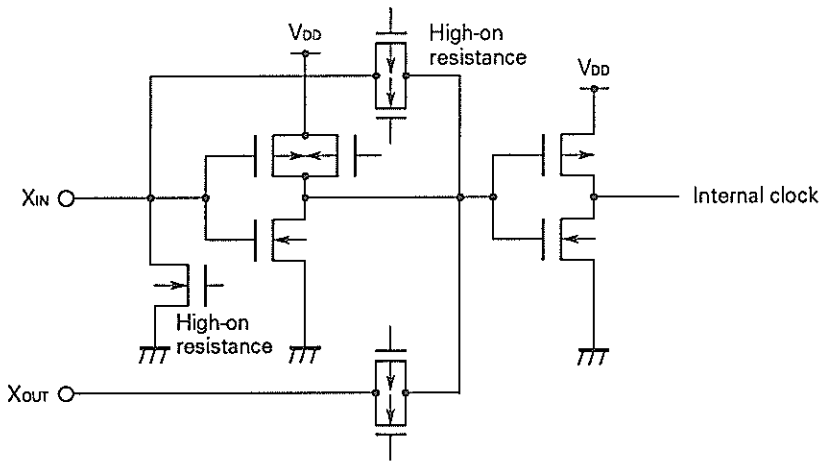
(6) P1B (P1B3/FMIFC, P1B2/AMIFC) (Input)



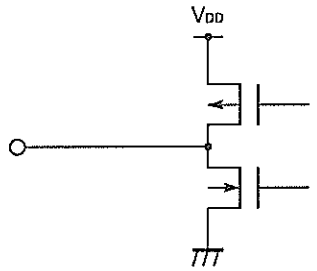
(7) CE (Schmitt-triggered input)



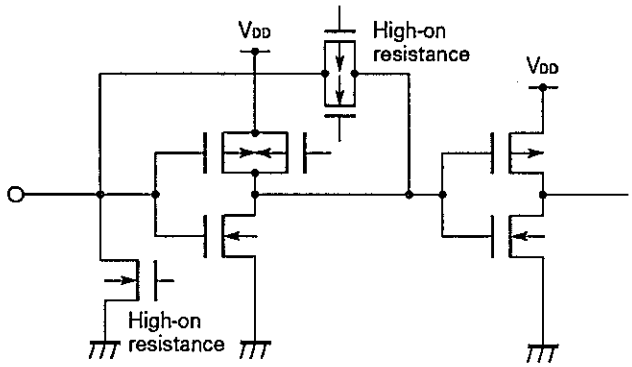
(8) XOUT (Output), XIN (Input)



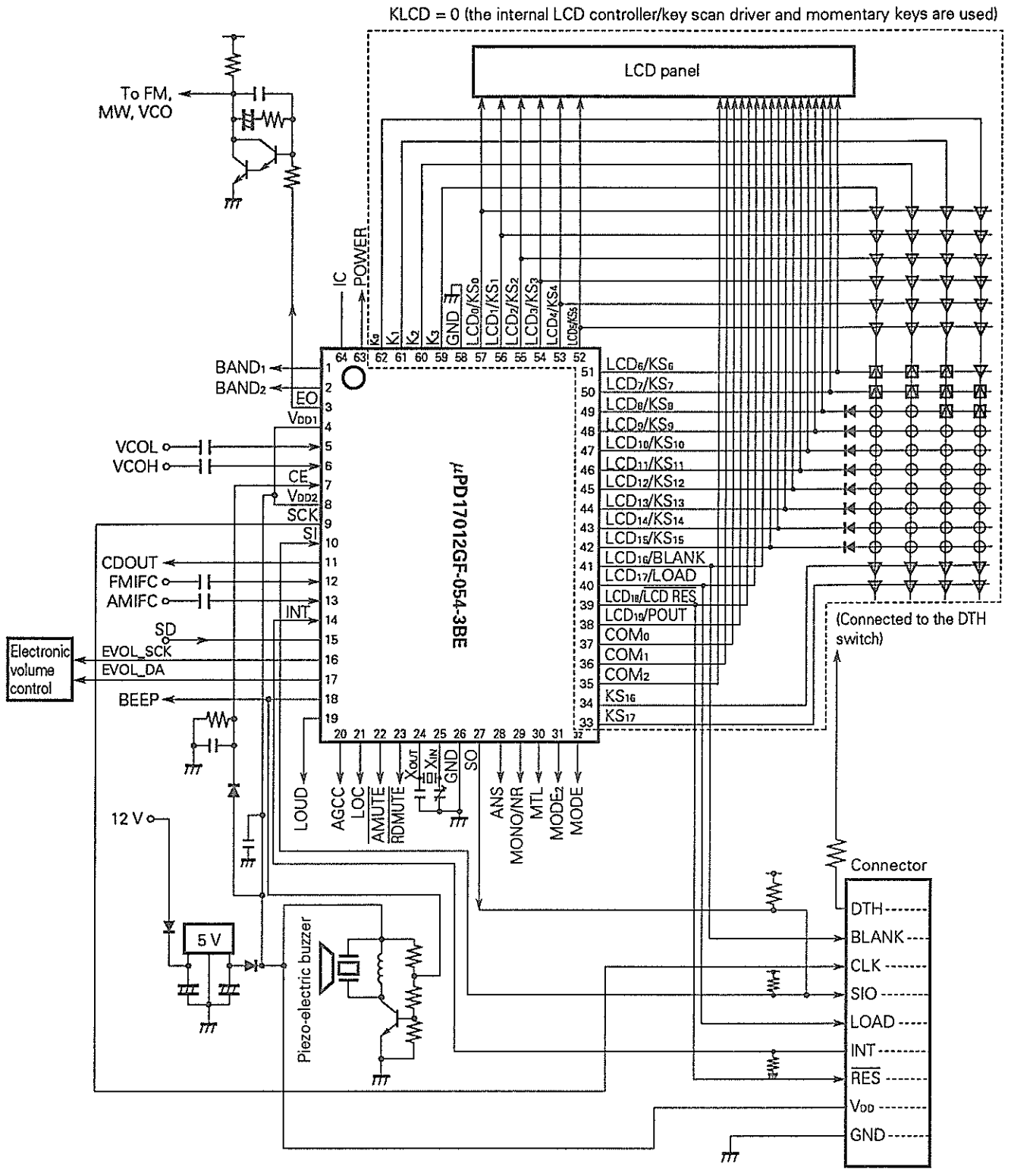
(9) EO (Output)



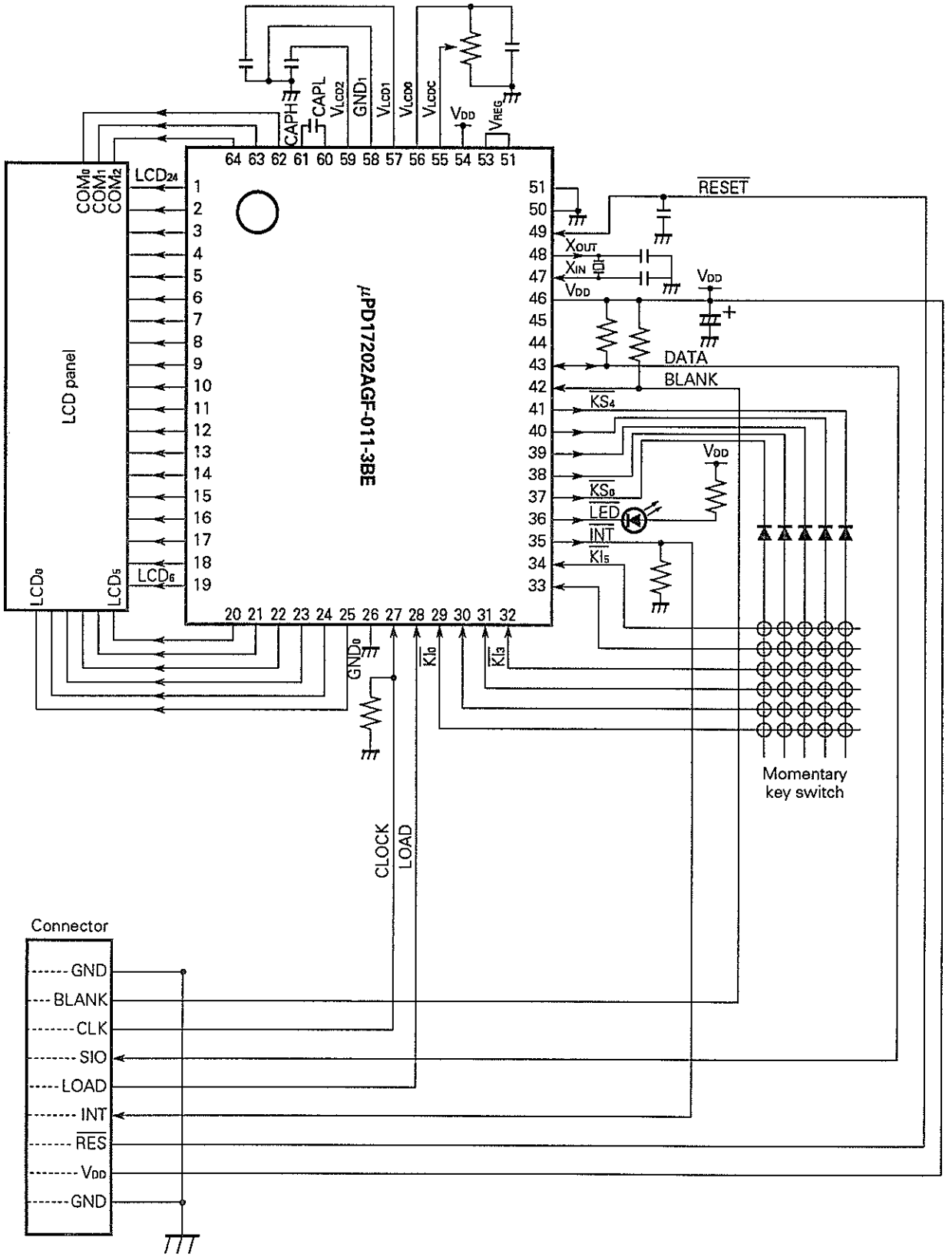
(10) VCOH
VCOL } (Input)



7. SAMPLE APPLICATION CIRCUITS



KLCD = 1 (Momentary keys of the external LCD controller/key scan driver are used)



8. ELECTRICAL CHARACTERISTICS (PRELIMINARY)

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Parameter	Symbol	Conditions	Rated value	Unit
Supply voltage	V_{DD}		−0.3 to +6.0	V
Input voltage	V_I		−0.3 to V_{DD} +0.3	V
Output voltage	V_O	Except for $P0C_0$ to $P0C_3$	−0.3 to V_{DD} +0.3	V
Output high current	I_{OH}	Each pin	−12.0	mA
		Total for all pins	−20.0	mA
Output low current	I_{OL}	Each pin	15.0	mA
		Total for all pins	30.0	mA
Output withstand voltage	V_{BDS}	$P0C_0$ - $P0C_3$	10.0	V
Total loss	P_t		400	mW
Operating ambient temperature	T_A	When the entire chip is operating	−40 to +85	°C
Storage temperature	T_{stg}		−55 to +125	°C

Caution Absolute maximum ratings are rated values beyond which physical damage may be caused to the product; if any of the parameters in the table above exceeds its rated value, even momentarily, the quality of the product may deteriorate. Therefore, ensure that the product is used within the rated values.

RECOMMENDED OPERATING RANGES (T_A = −40 to +85 °C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD1}	When the entire chip is operating	4.5	5.0	5.5	V
	V_{DD2}	When the CPU is operating, but the PLL is not	3.5	5.0	5.5	V
Data hold voltage	V_{DDR}	When the crystal oscillator is stopped	2.3		5.5	V
Output withstand voltage	V_{BDS}	$P0C_0$ - $P0C_3$			9.0	V
Rise time of supply voltage	t_{rise}	V_{DD} : 0 → 4.5 V			500	ms

DC CHARACTERISTICS (T_A = –40 to +85 °C, V_{DD} = 5 V ±10%)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Supply current	I_{DD1}	When the CPU is operating but the PLL is not, with a sinusoidal wave applied to the X_{IN} pin (f_{IN} = 4.5 MHz, V_{IN} = V_{DD})			2.0	3.0	mA
	I_{DD2}	When the CPU is operating but the PLL is not, with a sinusoidal wave applied to the X_{IN} pin (f_{IN} = 4.5 MHz, V_{IN} = V_{DD}) When the HALT instruction is issued			0.5	1.0	mA
Data hold voltage	V_{DDR1}	When the crystal oscillator is operating	With timer FF for interruption detection	3.5			V
	V_{DDR2}	When the crystal oscillator is stopped	With timer FF for interruption detection	2.3			V
	V_{DDR3}		For holding data memory	2.0			V
Data hold current	I_{DDR1}	When the crystal oscillator is stopped	V_{DD} = 5 V, T_A = 25 °C		2.0	4.0	μA
	I_{DDR2}				2.0	20.0	μA
	I_{DDR3}		V_{DD} = 2.3 V, T_A = 25 °C		1.0	2.0	μA
	I_{DDR4}		V_{DD} = 2.3 V		1.0	10.0	μA
Input high voltage	V_{IH1}	$P0A_1$, $P0B_0$ - $P0B_3$, $P1A_0$ - $P1A_2$, $P1B_0$ - $P1B_3$, $P1D_0$ - $P1D_3$		0.7V_{DD}		V_{DD}	V
	V_{IH2}	$P0A_0$, $P0A_2$, CE, INT		0.8V_{DD}		V_{DD}	V
	V_{IH3}	$P0D_0$ - $P0D_3$		0.6V_{DD}		V_{DD}	V
Input low voltage	V_{IL1}	$P0A_1$, $P0B_0$ - $P0B_3$, $P0D_0$ - $P0D_3$, $P1A_0$ - $P1A_2$, $P1B_0$ - $P1B_3$, $P1D_0$ - $P1D_3$				0.2V_{DD}	V
	V_{IL2}	$P0A_0$, $P0A_2$, CE, INT				0.2V_{DD}	V
Output high current	I_{OH1}	$P0A_0$ - $P0A_2$, $P0B_0$ - $P0B_3$, $P1A_0$ - $P1A_2$, $P1C_0$ - $P1C_3$, $P1D_0$ - $P1D_3$	V_{OH} = V_{DD} – 1 V	–1.0			mA
	I_{OH2}	PYA_0 - PYA_{15}, $P2G_0$, EO	V_{OH} = V_{DD} – 1 V	–1.0			mA
Output low current	I_{OL1}	$P0A_0$ - $P0A_2$, $P0B_0$ - $P0B_3$, $P1A_0$ - $P1A_2$, $P1C_0$ - $P1C_3$, $P1D_0$ - $P1D_3$	V_{OL} = 1 V	1.0			mA
	I_{OL2}	PYA_0 - PYA_{15}, $P2G_0$, EO	V_{OL} = 1 V	1.0			mA
	I_{OL3}	$P0C_0$ - $P0C_3$	V_{OL} = 1 V	10			mA
Input high current	I_{IH1}	When the VCOH pin is pulled down	V_{IH} = V_{DD}	0.1			mA
	I_{IH2}	When the VCOL pin is pulled down	V_{IH} = V_{DD}	0.1			mA
	I_{IH3}	When the X_{IN} pin is pulled down	V_{IH} = V_{DD}	0.1			mA
	I_{IH4}	When the $P0D_0$ to $P0D_3$ pins are pulled down	V_{IH} = V_{DD}	10		150	μA
Output-off leakage current	I_{L1}	$P0C_0$ - $P0C_3$	V_{OH} = 9 V			1.0	μA
	I_{L2}	EO	V_{OH} = V_{DD}, V_{OL} = 0 V			±1.0	μA

AC CHARACTERISTICS (T_A = −40 to +85 °C, V_{DD} = 5 V ±10%)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating frequency	f_{IN1}	VCOL pin in MF mode, with a sinusoidal wave applied at V_{IN} = 0.3 V_{p-p}	0.58		30	MHz
	f_{IN2}	VCOL pin in HF mode, with a sinusoidal wave applied at V_{IN} = 0.3 V_{p-p}	5		40	MHz
	f_{IN3}	VCOH pin in VHF mode, with a sinusoidal wave applied at V_{IN} = 0.3 V_{p-p}	30		250	MHz
	f_{IN4}	AMIFC and FMIFC pins in AMIF count mode, with a sinusoidal wave applied at V_{IN} = 0.3 V_{p-p}	0.3		1.0	MHz
	f_{IN5}	AMIFC pin in AMIF count mode, with a sinusoidal wave applied at V_{IN} = 0.1 V_{p-p}	0.44		0.46	MHz
	f_{IN6}	FMIFC pin in FMIF count mode, with a sinusoidal wave applied at V_{IN} = 0.3 V_{p-p}	5		15	MHz
	f_{IN7}	FMIFC pin in FMIF count mode, with a sinusoidal wave applied at V_{IN} = 0.1 V_{p-p}	10.5		10.9	MHz

A/D CONVERTER CHARACTERISTICS (T_A = −40 to +85 °C, V_{DD} = 5 V ±10%)

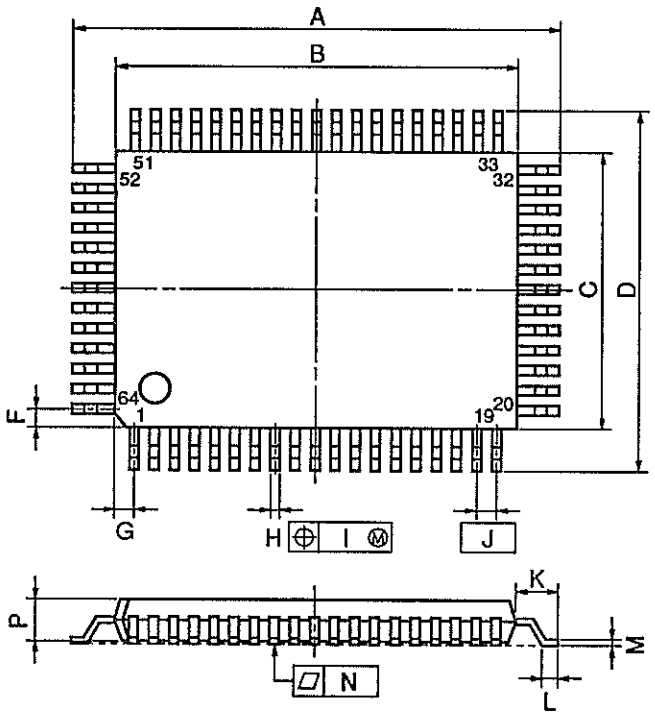
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Resolution of A/D conversion					6	bit
Total error in A/D conversion		T_A = −10 to +50 °C		±1.0	±1.5	LSB

OTHER CHARACTERISTICS (T_A = +25 °C, V_{DD} = 5.0 V, for reference purposes only)

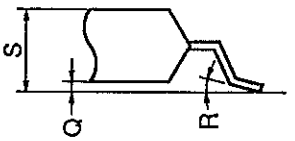
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply current	I_{DD3}	When the CPU and PLL are operating, with a sinusoidal wave applied to the VCOH pin (f_{IN} = 130 MHz, V_{IN} = 0.3 V_{p-p})		15		mA
	I_{DD4}	When the CPU and PLL are operating, with a sinusoidal wave applied to the VCOH pin (f_{IN} = 250 MHz, V_{IN} = 0.3 V_{p-p})		18		mA

9. PACKAGE DRAWING

64 PIN PLASTIC QFP (14×20)



detail of lead end



NOTE

Each lead centerline is located within 0.20 mm (0.008 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	23.2±0.2	$0.913^{+0.009}_{-0.008}$
B	20.0±0.2	$0.787^{+0.009}_{-0.008}$
C	14.0±0.2	$0.551^{+0.009}_{-0.008}$
D	17.2±0.2	0.677±0.008
F	1.0	0.039
G	1.0	0.039
H	0.40±0.10	$0.016^{+0.004}_{-0.005}$
I	0.20	0.008
J	1.0 (T.P.)	0.039 (T.P.)
K	1.6±0.2	0.063±0.008
L	0.8±0.2	$0.031^{+0.009}_{-0.008}$
M	$0.15^{+0.10}_{-0.05}$	$0.006^{+0.004}_{-0.003}$
N	0.12	0.005
P	2.7	0.106
Q	0.125±0.075	0.005±0.003
R	5°±5°	5°±5°
S	3.0 MAX.	0.119 MAX.

S64GF-100-3B8, 3BE-2

10. RECOMMENDED SOLDERING CONDITIONS

The conditions listed below shall be met when soldering the μPD17012GF-054.

For details of the recommended soldering conditions, refer to our document *SMD Surface Mount Technology Manual* (IEI-1207).

Please consult with our sales offices in case any other soldering process is used, or in case soldering is done under different conditions.

Table 10-1 Soldering Conditions for Surface-Mount Devices

μPD17012GF-054-3BE: 64-pin plastic QFP (14 × 20 mm)

Soldering process	Soldering conditions	Symbol
Infrared ray reflow	Peak package's surface temperature: 235 °C Reflow time: 30 seconds or less (at 210 °C or more) Maximum allowable number of reflow processes: 2 Exposure limit [Note]: 7 days (20 hours of pre-baking is required at 125 °C afterward.) <Cautions> (1) Do not start reflow-soldering the device if its temperature is higher than the room temperature because of a previous reflow soldering. (2) Do not use water for flux cleaning before a second reflow soldering.	IR35-207-2
VPS	Peak package's surface temperature: 215 °C Reflow time: 40 seconds or less (at 200 °C or more) Maximum allowable number of reflow processes: 2 Exposure limit [Note]: 7 days (20 hours of pre-baking is required at 125 °C afterward.) <Cautions> (1) Do not start reflow-soldering the device if its temperature is higher than the room temperature because of a previous reflow soldering. (2) Do not use water for flux cleaning before a second reflow soldering.	VP15-207-2
Wave soldering	Temperature in the soldering vessel: 260 °C or less Soldering time: 10 seconds or less Number of soldering processes: 1 Pre-heating temperature: 120 °C max. (package surface temperature) Exposure limit[Note]: 7 days (20 hours of pre-baking is required at 125 °C afterward.)	WS60-207-1
Partial heating method	Terminal temperature: 300 °C or less Flow time: 3 seconds or less (for each side of device)	–

Note Exposure limit before soldering after dry-pack package is opened.
Storage conditions: Temperature of 25 °C and maximum relative humidity at 65% or less

Caution Do not apply more than a single process at once, except for "Partial heating method."

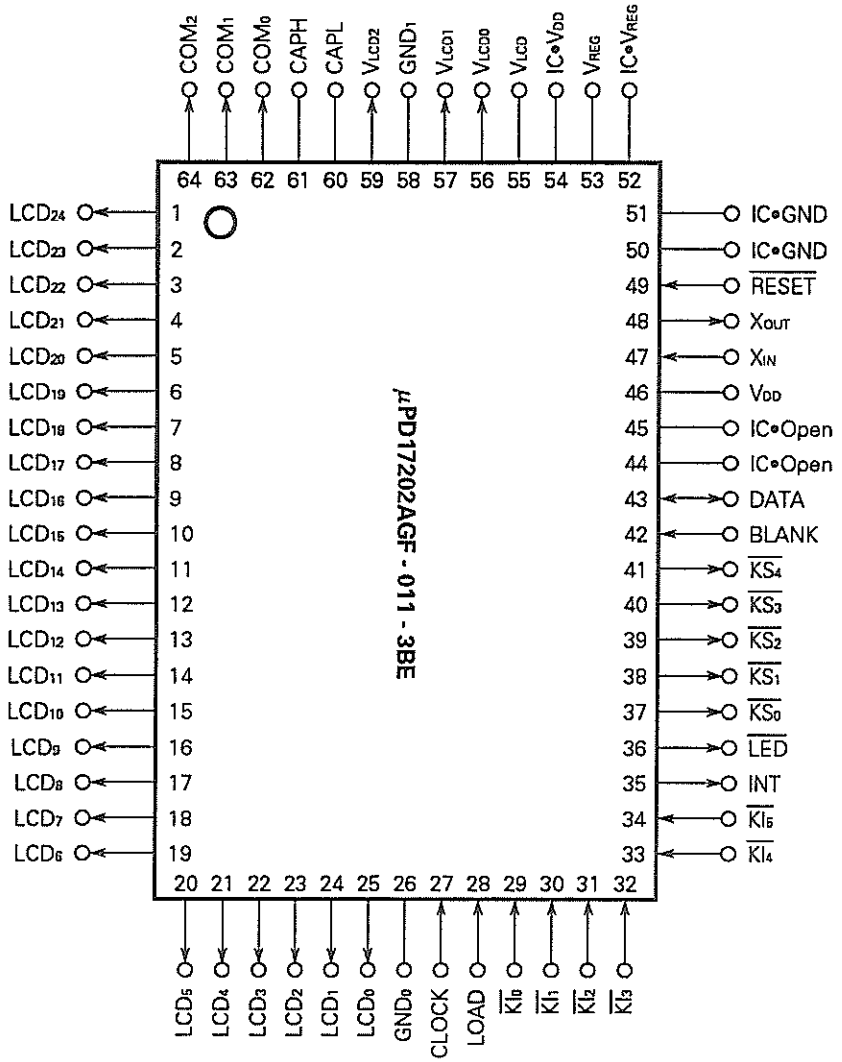
APPENDIX A LCD CONTROLLER/KEY SCAN DRIVER (μPD17202AGF-011)

The μPD17202AGF-011 is a CMOS 4-bit single-chip microcontroller for the front panel of car stereo systems. The package is 64-pin plastic QFP. The μPD17202AGF-011 contains an LCD controller/key scan driver and key scan driver and can thus minimize the wiring between the master microcontroller and front panel.

Features

- LCD controller/key scan driver (1/3 duty, 1/3 bias, frame frequency of 325.5 Hz, display consisting of up to 75 segments.)
- Key scan driver which can read up to 30 (5 × 6) keys
- One LED output
- Three-wire serial interface for communication with the master microcontroller (CLOCK, DATA, and LOAD)
- Supply voltage: 5.0 V ±10%
- System clock: 8 MHz

Pin configuration (top view)



Cautions 1. Leave the IC•Open pin open.

2. Connect the IC•GND pin directly to GND.

3. Connect the IC•V_{REG} pin directly to V_{REG}.

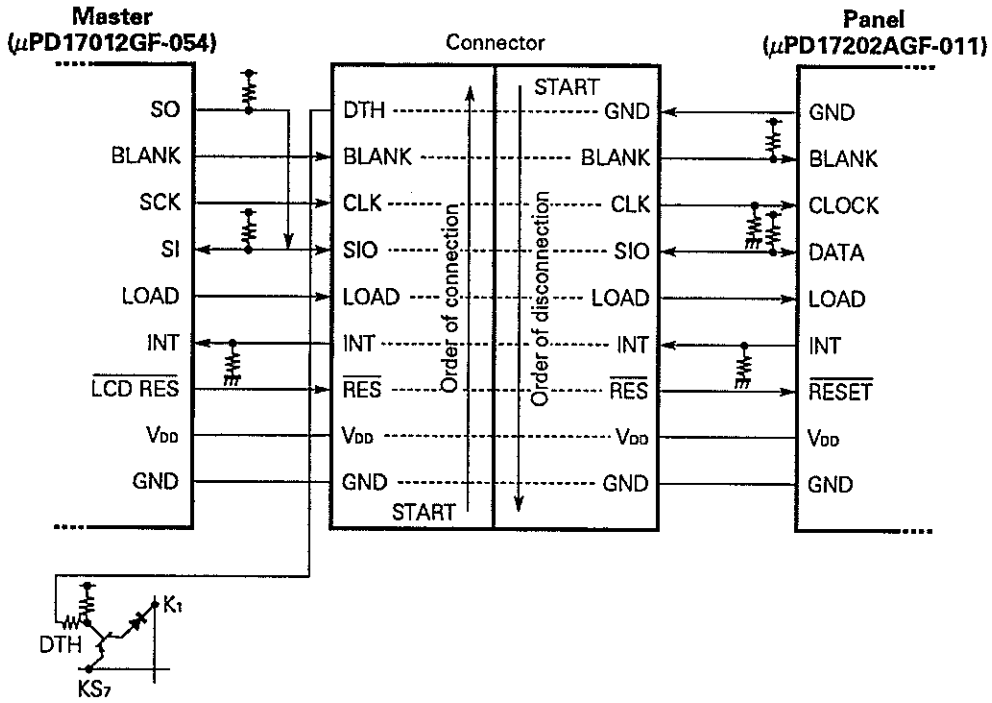
4. Connect the IC•V_{DD} pin directly to V_{DD}.

Remark IC: Internally connected

APPENDIX B COMMUNICATION

(1) Signal lines between the master (μPD17012GF-054) and panel (μPD17202AGF-011)

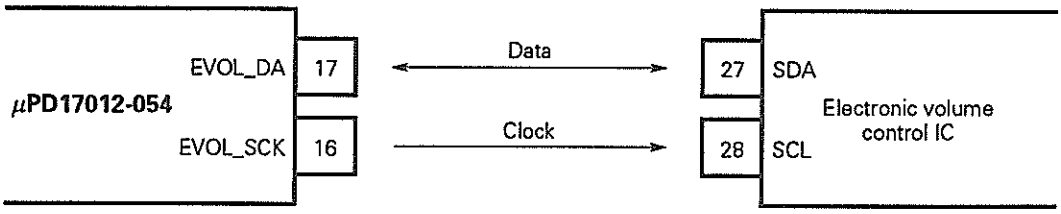
Connect pull-up and pull-down resistors as follows:



(2) Communication with electronic volume control IC (I^2C bus interface)

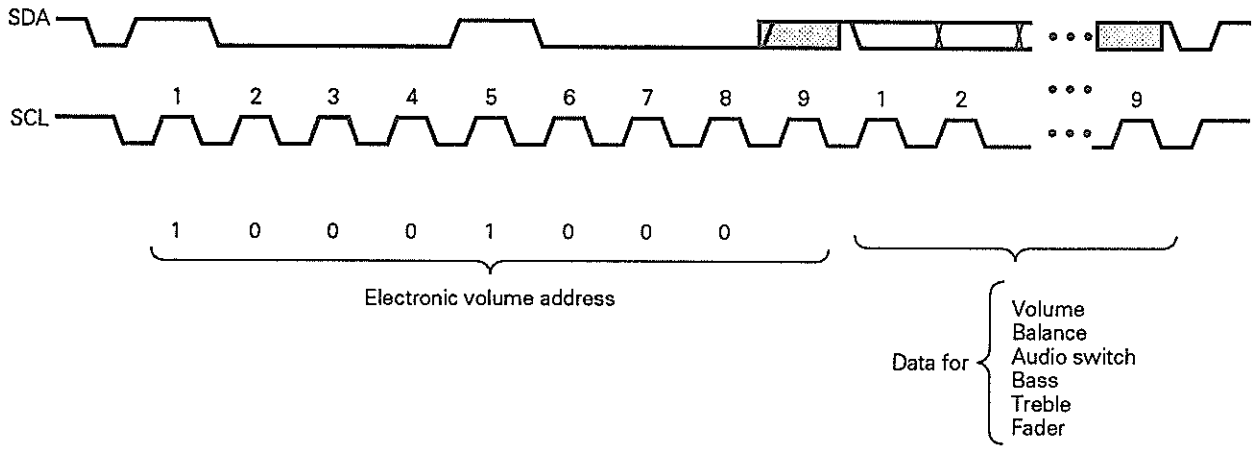
The μPD17012-054 sends specified data, such as volume and balance data, to the electronic volume control IC. Two buses, the data bus and clock bus, are necessary to output data to the electronic volume control IC. Data and clock signals are output from the EVOL_DA pin (pin 17) and EVOL_SCK pin (pin 16) of the μPD17012-054.

Fig. B-1 Pin Connections (Electronic Volume Control)



Electronic volume control data consists of nine bits (eight bits for data and a check bit). The electronic volume address (nine bits) and control data (nine bits) are sequentially transferred N times, where N is the number of transferred data items, such as the volume and balance data.

Fig. B-2 Data Transfer Format (Electronic Volume Control)



[MEMO]

Cautions on CMOS Devices

① **Countermeasures against static electricity for all MOSs**

Caution **When handling MOS devices, take care so that they are not electrostatically charged.**
Strong static electricity may cause dielectric breakdown in gates. When transporting or storing MOS devices, use conductive trays, magazine cases, shock absorbers, or metal cases that NEC uses for packaging and shipping. Be sure to ground MOS devices during assembling. Do not allow MOS devices to stand on plastic plates or do not touch pins. Also handle boards on which MOS devices are mounted in the same way.

② **CMOS-specific handling of unused input pins**

Caution **Hold CMOS devices at a fixed input level.**
Unlike bipolar or NMOS devices, if a CMOS device is operated with no input, an intermediate-level input may be caused by noise. This allows current to flow in the CMOS device, resulting in a malfunction. Use a pull-up or pull-down resistor to hold a fixed input level. Since unused pins may function as output pins at unexpected times, each unused pin should be separately connected to the V_{DD} or GND pin through a resistor.
If handling of unused pins is documented, follow the instructions in the document.

③ **Statuses of all MOS devices at initialization**

Caution **The initial status of a MOS device is unpredictable when power is turned on.**
Since characteristics of a MOS device are determined by the amount of ions implanted in molecules, the initial status cannot be determined in the manufacture process. NEC has no responsibility for the output statuses of pins, input and output settings, and the contents of registers at power on. However, NEC assures operation after reset and items for mode setting if they are defined.
When you turn on a device having a reset function, be sure to reset the device first.

Caution This product contains an I^2C bus interface circuit.
When using the I^2C bus interface, notify its use to NEC when ordering custom code. NEC can guarantee the following only when the customer informs NEC of the use of the interface:
Purchase of NEC I^2C components conveys a license under the Philips I^2C Patent Rights to use these components in an I^2C system, provided that the system conforms to the I^2C Standard Specification as defined by Philips.

The application circuits and their parameters are for references only and are not intended for use in actual design-in's.

M4 94.11