

# MOS DIGITAL INTEGRATED CIRCUIT

# $\mu$ PD1704C-011

## PLL FREQUENCY SYNTHESIZER AND CONTROLLER FOR AM/FM TUNER

The  $\mu$ PD1704C-011 is a single chip AM and FM band PLL frequency synthesizer plus controller for the U.S.A., Europe and Japan with a 24-Hour clock and three source-programmable timers. By using  $\mu$ PD1987C (remote control transmitter) and  $\mu$ PD1937C (remote control receiver) as peripherals, the  $\mu$ PD1704C-011 can be remote-controlled through infrared ray.

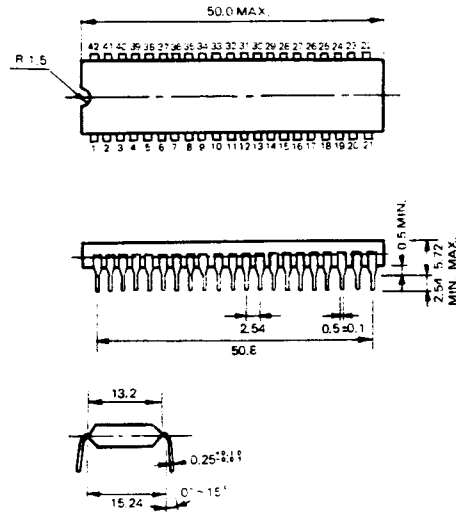
Since the  $\mu$ PD1704C-011 employing pulse-swallowing method in FM band tuning by using  $\mu$ PB553AC prescaler, the reference frequency of FM is as high as 25 kHz. Therefore, the  $\mu$ PD1704C-011 can constitute a multifunctional high performance AM/FM digital tuning system for home stereos and receivers.

The  $\mu$ PD1704C-011 is fabricated with advanced CMOS process and is packaged in 42-pin DIP.

### FEATURES

- Single chip PLL + Controller
- Single power supply; +5 V $\pm$ 10 %
- Compatible with AM and FM band receivers for the U.S.A., Europe and Japan
- FM reference frequency is as high as 25 kHz (the pulse swallowing method is employed)
- Built-in 24 hour clock
- Built-in three sets of source programmable timers. (ONCE, EVERYDAY 1 and 2)
- Sixteen preset channel memories (8 for AM and 8 for FM)
- Two last channel memories; AM(1) + FM(1)
- Auto up/down seek tuning (Saw-tooth mode)
- Manual up/down tuning (Saw-tooth mode)
- Auto preset channel scanning (Holding 5 sec for each preset)
- Compatible with remote control system of  $\mu$ PD1986C and  $\mu$ PD1937C
- Source selector function (PHONO, TAPE, AUX)
- FM intermediate frequency compensating capability (4 ways by 25 kHz step)
- Wide variety of function selectability by diode matrix; FM ONLY, NO CLOCK etc.
- FIP (Fluorescent Indicator Panel) direct drive capability. (Segment lines only)
- 5-digit frequency display
- 10-key clock adjusting
- Low-power battery back up capability ( $\leq 10\mu$ A : only in No CLOCK mode).
- 42-pin DIP package

## PACKAGE DIMENSIONS in millimeters



Note: Typical values are shown unless other use specified.

## ABSOLUTE MAXIMUM RATINGS

Power Supply Voltage	$V_{DD}$	-0.3 to +6.0	V
Input Voltage	$V_I$	-0.3 to + $V_{DD}$	V
Output Voltage	$V_O$	-0.3 to + $V_{DD}$	V
Output Absorbing Current	$I_O$	10	mA
Operation Temperature	$T_{opt}$	-35 to +75	°C
Storage Temperature	$T_{stg}$	-55 to +125	°C
Output Breakdown Voltage	$V_{BDS}$	-35 across Sa - Sg terminals (drain-source voltage)	V

## RECOMMENDED OPERATION CONDITIONS

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Power Supply Voltage	$V_{DD}$	4.5	5.0	5.5	V	
Data (RAM) Retention Voltage	$V_{RAM}$	2.5		5.5	V	CE=0, CKSTP Instruction Executed
Oscillation Stop Voltage	$V_{OSS}$		3.2	3.8	V	
Output Breakdown Voltage	$V_{BDS}$			-30	V	$I_{OH} = -5 \mu A$ Across Sa-Sg Terminals (Drain-Source Voltage)
Rise Time of Power Supply Voltage	Trise			500	ms	$V_{DD} = 0 \rightarrow 4.5 V$

**ELECTRICAL CHARACTERISTICS ( $V_{DD}=4.5$  to  $5.5$  V,  $T_a=-35$  to  $+75$  °C)**

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
High-Level Input Voltage	$V_{IH1}$	$0.8 V_{DD}$		$V_{DD}$	V	SD, $\overline{RMC}$ Terminals
"	$V_{IH2}$	$0.7 V_{DD}$		$V_{DD}$	V	I/O Ports, CE Terminal (Note)
"	$V_{IH3}$	$0.6 V_{DD}$		$V_{DD}$	V	K <sub>0</sub> to K <sub>3</sub> Terminal
Low-Level Input Voltage	$V_{IL1}$	0		$0.3 V_{DD}$	V	I/O Ports, CE Terminal
"	$V_{IL2}$	0		$0.2 V_{DD}$	V	K <sub>0</sub> to K <sub>3</sub> , SD, $\overline{RMC}$ Terminals
High-Level Output Voltage	$V_{OH1}$	4.0			V	EO <sub>1</sub> , EO <sub>2</sub> Terminals $I_{OH}=-0.3$ mA
"	$V_{OH2}$	4.0			V	$\overline{D}_1$ to $\overline{D}_6$ , MUTE, I/O Ports $I_{OH}=-0.2$ mA
"	$V_{OH3}$	4.0			V	PSC Terminal $I_{OH}=-0.1$ mA
"	$V_{OH4}$	3.0			V	S <sub>a</sub> to S <sub>g</sub> Terminals. $I_{OH}=-0.5$ mA
Low-Level Output Voltage	$V_{OL1}$			0.5	V	EO <sub>1</sub> , EO <sub>2</sub> Terminals, I/O Ports. $I_{OL}=0.5$ mA
"	$V_{OL2}$			0.5	V	$\overline{D}_1$ to $\overline{D}_6$ , MUTE, PSC Terminals $I_{OL}=0.2$ mA
High-Level Input Current	$+I_{IH2}$	10	40	100	$\mu$ A	K <sub>0</sub> to K <sub>3</sub> Terminals $V_{IN}=V_{DD}=5.5$ V
"	$+I_{IH2}$		300		$\mu$ A	X <sub>1</sub> Terminal (during pull down) $V_{IN}=V_{DD}=5.0$ V
Low-Level Input Current	$-I_{IL1}$		300		$\mu$ A	AM, FM Terminals (during pull up) $V_{IN}=0, V_{DD}=5.0$ V
Output Leakage Current	$I_L$		10 <sup>-3</sup>	1	$\mu$ A	EO <sub>1</sub> , EO <sub>2</sub> Terminals, $T_a=25$ °C
Response Frequency	$f_{AM}$	0.5		2.5	MHz	AM Terminal, $V_{in}=1.0$ V <sub>p-p</sub> (Mim.), Dc Cut
"	$f_{FM}$		3		mA	FM Terminal, $V_{in}=0.8$ V <sub>p-p</sub> (Mim.), Rectangular wave, Dc Cut
Operation Current	$I_{DD1}$		3		mA	Input/Output Currents from Input/Output Terminals Excluded
Data (RAM) Retention Current	$I_{DD2}$		10	10	$\mu$ A	CE=0, CKSTP instruction executed, $T_a=25$ °C, $V_{DD}=5.0$ V
Clock Operation Current	$I_{DD3}$		600		$\mu$ A	CE=0 $V_{DD}=5.0$ V

Note: I/O ports include AC OUT, FM/AM, selection terminals (AUX, TAPE, PHONO, TUNER) A to D,  $\overline{DP}$ , and COLON.

**FUNCTIONAL OUTLINE**

Receiving frequency range, channel spacing, reference frequency, and intermediate frequency.

		Frequency Range	Channel Spacing	Reference Frequency	Intermediate Frequency
U.S.A.	AM	530–1620 kHz	10 kHz	10 kHz	450 kHz
	FM	87.9–107.9 MHz	200 kHz	25 kHz	10.650, 10.675, 10.700, 10.725 MHz
Europe	AM	522–1611 kHz	9 kHz	9 kHz	450 kHz
	FM	87.50–108.00 MHz	50 kHz	25 kHz	10.650, 10.675, 10.700, 10.725 MHz
Japan	AM	522–1611 kHz	9 kHz	9 kHz	450 kHz
	FM	76.1–89.9 MHz	100 kHz	25 kHz	10.675, 10.700, 10.725, 10.750 MHz

**Channel Selection****(1) Auto tuning (saw-tooth wave mode)**

Auto up-channel tuning . . . . . Channel once received is held.

Auto down-channel tuning

**(2) Manual tuning (saw-tooth wave mode)**

Manual up-channel tuning . . . . . Stepwise action through momentary switch. When held depressed for 0.5 second or more, fast action continued until the switch is released.

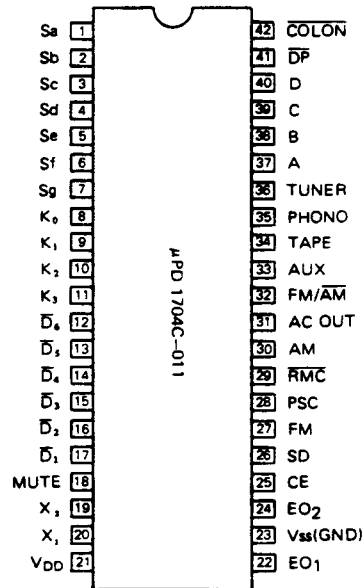
Manual down-channel tuning

**(3) Preset scan** . . . . . Preset channels from 1CH. to 8CH. are repeatedly scanned with holding for 5 seconds at each channel. To stop scanning at the currently received station, press the preset station key currently selected.**(4) Recall preset memory** . . . . . 8 channels each for AM and FM through 8 button switches.**Timer****(1) EVERYDAY (for two systems)** . . . . . By setting both ON and OFF time with a source, the specified source is switched ON at the ON-time and the whole system is switched OFF at the OFF-time. These action will be repeatedly performed everyday.**(2) ONCE (for one system)** . . . . . By setting both ON and OFF-time with a source, the specified source is switched ON at the ON-time, and the whole system is switched OFF at the OFF-time. In this case, the timer action is performed only once. And after the action, the ONCE-Timer data are cleared.

**Remote Control**

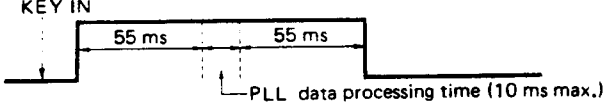
By attaching μPD1986C (transmitter) and μPD1937C (receiver), functions including power ON/OFF, AM/FM switching, preset channel call, and source selection can be remote controlled by infrared ray.

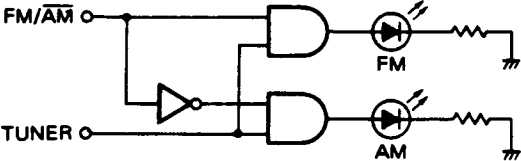
**TERMINAL CONFIGURATION (Top View)**



**DESCRIPTION OF TERMINALS**

Terminal Number	Symbol	Terminal Name	Description
1-7	Sa-Sg	Segment Outputs	Terminals for display segment signals and for key return signal source; active high. (For details, see 1. KEY MATRIX CONFIGURATION.) These terminals are open-drain outputs and it is provided with dielectric strength of -30 V max. So it can be directly connected to segment terminals of FIP (fluorescent indicator panel) with pull-down resistances. (For the connections, see 3-1. Display Connection Diagram)
8-11	K <sub>0</sub> -K <sub>3</sub>	Key Return Signal Inputs	Input terminals for key return signals from externally connected key matrix. As the key return signal sources, segment terminals Sa-Sg and AND signal of TUNER and PHONO terminals are used. (See 1. KEY MATRIX CONFIGURATION.)
12-17	D̄ <sub>1</sub> -D̄ <sub>6</sub>	Digit Outputs	Display digit signal outputs; active low. To interface to a FIP (fluorescent indicator panel), single stage buffers using PNP transistors (2SA733 or equivalent) should be inserted between them. (For details, see 3-1. Display Connection Diagram.)

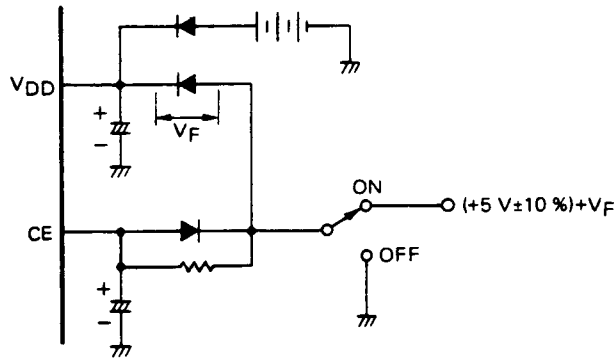
18	MUTE	mute	<p>Muting signal output to cancel shock noises when PLL is momentarily unlocked; active high.</p> <p>This line goes high before 55 ms to PLL data (content of programmable counter) changes, and it goes low after 55 ms from the completion of the data change.</p> <p>Mute signal is issued while in either of the following cases.</p> <ul style="list-style-type: none"> <li>○ AM/FM and selector switchings</li> <li>○ MANUAL UP/DOWN</li> <li>○ AUTO UP/DOWN</li> <li>○ Preset memory call (including preset scan)</li> <li>○ Switching from CLOCK set to RADIO.</li> </ul>  <p>The signal is continuously issued in either of the following cases.</p> <ul style="list-style-type: none"> <li>○ OFF key is depressed. (OFF mode)</li> <li>○ When the following mode is set through MODE SW; TIMER READ, TIMER WRITE, TIMER CANCEL</li> <li>○ CE terminal is forced low.</li> </ul>
19 20	X1 X2	X'tal	<p>Terminal to which crystal oscillator is connected. The oscillation frequency of the crystal should be 4.5 MHz. (Type TQC-231A-8S manufactured by Tōyō Tsūshinki is recommended.)</p>
21	VDD	Power Supply	<p>Terminal for power supply to the device. (5 V±10 %.) The voltage can be lowered to 2.5 V in data retention mode. (When device CLOCK is stopped, i.e, when NONCLOCK is specified through the diode matrix and CE=0). The rise time of VDD should be 500 ms or less (for 0→4.5 V). If the rise time is excessively long, the initialization will not operate properly.</p>
22 24	EO1 EO2	Error Out	<p>Output terminals of charge pump in the phase detector of PLL section (3-state). Comparing the reference frequency with the oscillation frequency divided by the programmable divider, these terminals go high if the divided oscillation frequency is higher than the reference frequency. And go low if it is lower than the reference frequency. If they are the same, these outputs becomes high-impedance. Since EO1 and EO2 output the same signal at the same time, either of them can be connected to the LPF (low pass filter) of either AM or FM.</p>
23	GND	Ground	<p>Terminal to be connected to system ground.</p>
25	CE	Chip Enable	<p>Terminal for input selection signal to device. The terminal voltage has to be high level to operate the device normally and low level to leave the device idle.</p> <p>(1) When NONCLOCK is set through the initial setting diode matrix.</p> <ul style="list-style-type: none"> <li>CE = High . . . . . normal operation.</li> <li>CE = Low . . . . . display OFF, PLL operation stopped, internal clock generator stopped; current consumption 10 μA or less, VDD = 5 V.</li> </ul> <p>(2) When NONCLOCK is not set through the initial setting diode matrix.</p> <ul style="list-style-type: none"> <li>CE = High . . . . . normal operation</li> <li>CE = Low . . . . . display OFF, PLL operation stopped; current consumption 500 μA typical, VDD = 5 V.</li> </ul>

			High level or low level for 134 μs or shorter cannot be accepted. When NONCLOCK is selected through the initial setting switch, CE terminal should be forced to high level after the rise up of V <sub>DD</sub> , and forced to low level 200 ms before V <sub>DD</sub> falls. (See Note 1.)
26	SD	Station Detector	Input terminal of station detection for auto tuning (AUTO UP/DOWN). The auto tuning is stopped on receiving high level. To avoid missing the station, this input should be forced to high level within 50 ms after PLL is locked.
27	FM	FM Local Oscillator Signal Inputs	Input terminal of FM programmable counter. This terminal is normally connected to the output of the two-modulus prescaler μPB553AC. Since an ac amplifier is employed inside, the input signal should be fed through a dc-cut capacitor.
28	PSC	Pulse Swallow Control	Terminal for output signal to switch frequency dividing ratio of prescaler when pulse swallowing method is used in frequency dividing (i.e. for FM signal reception). Connect to PSC terminal of special prescaler μPB553AC. The frequency dividing ratios of μPB553AC are 1/16 and 1/17.
29	RCM	Remote Control Inputs	Input terminal of remote control signal. Connect to CHU OUT terminal of receiving remote control IC μPD1937C. The remote control action is discriminated by the number or input pulses to this terminal. (For details, see 2—4. Transistor Switch)
30	AM	AM Local Oscillator Signal Inputs	Input terminal of AM programmable counter. It accepts the output signal (VCO) from AM local oscillator. Since an ac amplifier is employed inside, the input signal should be fed through a dc-cut capacitor.
31	ACOUT	AC Outlet Control	Terminal for AC service outlet control. This terminal is used to control the cut-out relay for the main power supply of the receiver set. This goes high level whenever either one of the source selector terminals (TUNER, PHONO, TAPE, and AUX) is to be turned on. When the OFF key is pressed, it becomes low level. Since this terminal becomes high impedance when the CE terminal is shifted to low level under the NONCLOCK conditions, a pull-down resistor should be used if NONCLOCK specification is required. (See Note 3.)
32	FM/AM	FM/AM Power Supply Control	Terminal for switching power supply to tuner's FM or AM section. High level output is issued to operate FM and low level output to operate AM. This is also used in conjunction with the TUNER terminal to issue an ACKNOWLEDGE signal of AM and FM source selection in TIMER READ and TIMER WRITE modes. The schematic of the ACKNOWLEDGE signal generator is as follows. 

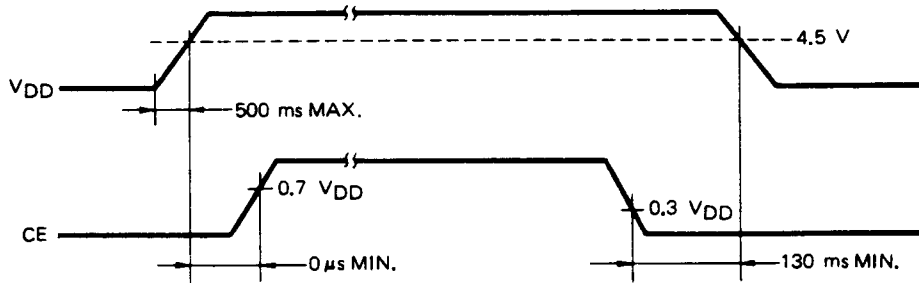
			<p>When FM or AM key is depressed in TIMER WRITE mode with the circuit shown above, the LED corresponding to the specified band will be turned on for 50 ms.</p> <p>In TIMER READ mode, the LED, corresponding to the band set in WRITE mode, will be turned on for 5 seconds.</p>																																																		
33 34 35 36	AUX TAPE PHONO TUNER	Source Selector Outputs	<p>Source selector outputs for TUNER, PHONO, TAPE, and AUX. TUNER terminal goes to high level when FM, AM, or preset key is depressed, and PHONO, TAPE, and AUX terminals goes to high level when PHONO, TAPE, and AUX keys are depressed, respectively.</p> <p>When OFF key is depressed, all terminals are forced to low level. (See Note 3.)</p>																																																		
37-40	A B C D	Preset Station Indicator Outputs	<p>Output terminals of BCD signals to indicate the preset channel memories. The output combinations for preset stations are shown in the table below.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>PRESET STATION</th> <th>D</th> <th>C</th> <th>B</th> <th>A</th> </tr> </thead> <tbody> <tr> <td>NON PRESET</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>P1</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>P2</td> <td>0</td> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>P3</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>P4</td> <td>0</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>P5</td> <td>0</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>P6</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>P7</td> <td>0</td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td>P8</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> </tr> </tbody> </table> <p style="margin-left: 20px;">1: High level Output 0: Low Level Output</p> <p>By connecting <math>\mu</math>PB74LS42 (BCD-to-decimal decoder) to these terminals, the dot pattern display of preset station can be made with LEDs. (See Note 3.)</p>	PRESET STATION	D	C	B	A	NON PRESET	0	0	0	0	P1	0	0	0	1	P2	0	0	1	0	P3	0	0	1	1	P4	0	1	0	0	P5	0	1	0	1	P6	0	1	1	0	P7	0	1	1	1	P8	1	0	0	0
PRESET STATION	D	C	B	A																																																	
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P8	1	0	0	0																																																	
41	$\overline{DP}$	Decimal Point	<p>Terminal to output a decimal point indication signal to the display for FM frequency; active low.</p> <p><math>\overline{DP}</math> as well as COLON terminals cannot be directly connected to fluorescent indicator panel. Insert a buffer for the purpose. (See Note 3.)</p>																																																		
42	$\overline{COLON}$	COLON	<p>Terminal to output a colon indication signal in CLOCK display mode; active low. (See the discription of DP terminal above.)</p>																																																		



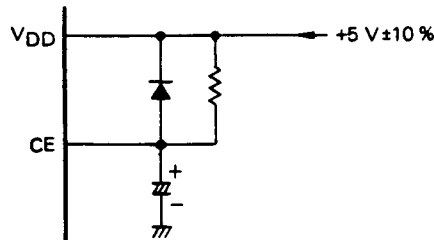
(Note 1) When no clock function is necessary, turn the NONCLOCK switch ON. And if, in this mode of operation, low-power-data-retention is required while radio is off, do not use OFF key, which will be described later, to turn system power supply off, but use CE terminal. The example circuit is shown below.



The value of CR connected to CE terminal should be set so that the following condition is satisfied.



(Note 2) If NONCLOCK is not specified, CE terminal should be connected to VDD as shown below.



(Note 3) AC OUT, A, B, C, D, AUX, TAPE, PHONO, TUNER, and DP terminals are shifted to low level or high impedance status dependent on the internal conditions when CE terminal is changed to low level under the NONCLOCK (refer to 2. Description of Key Matrix) conditions.

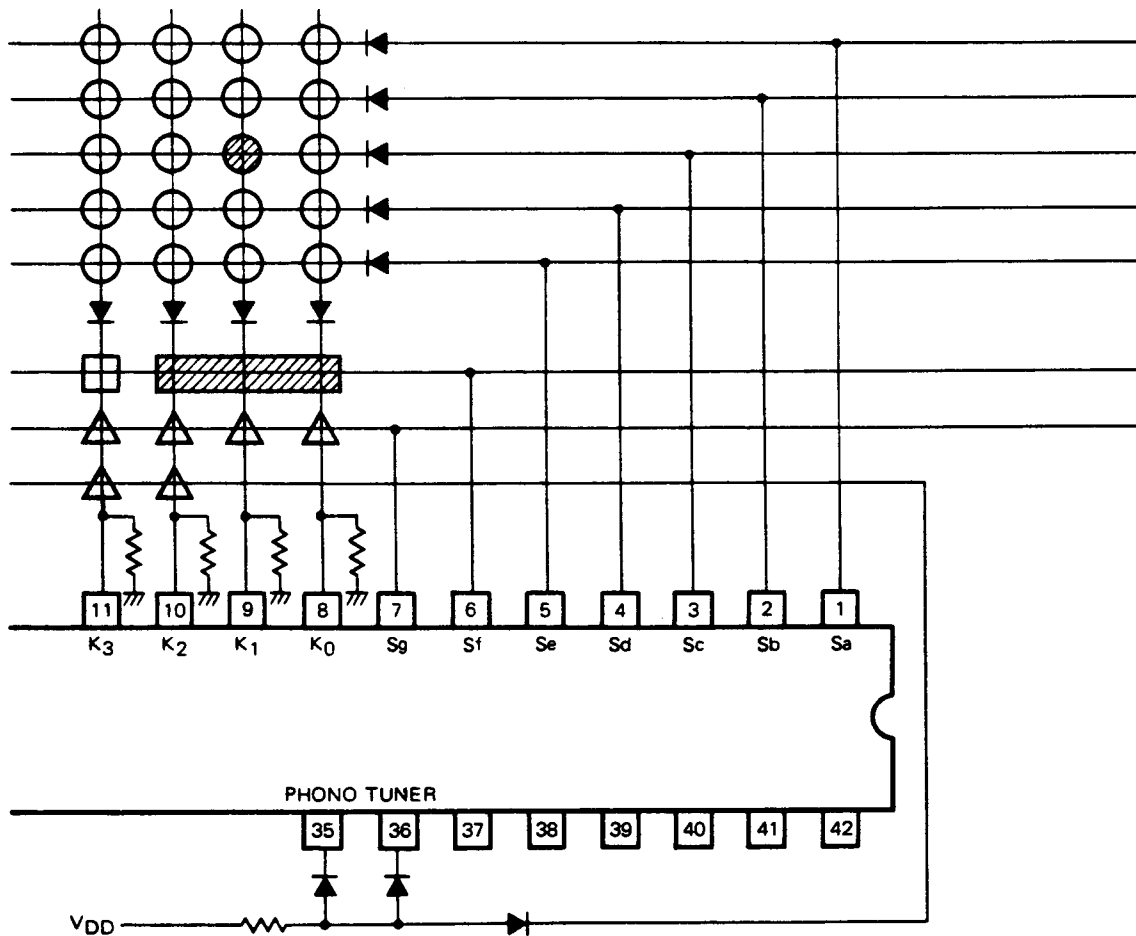
# 1. KEY MATRIX CONFIGURATION

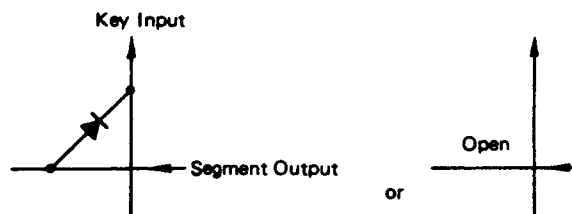
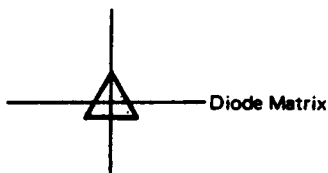
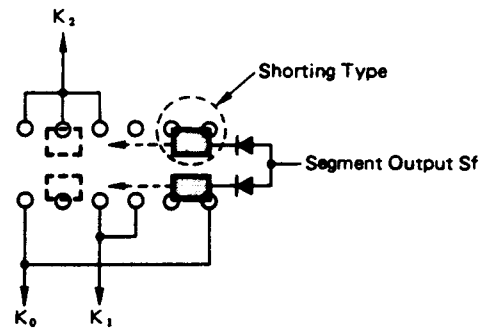
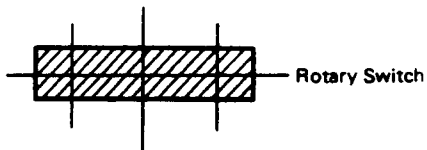
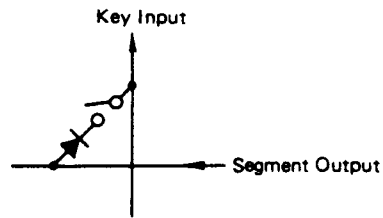
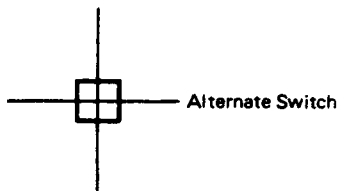
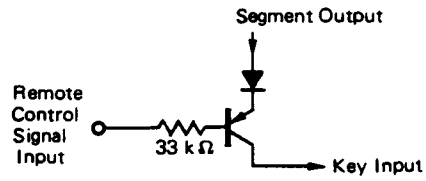
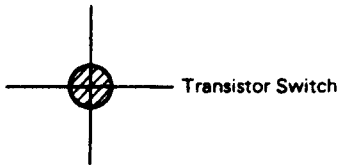
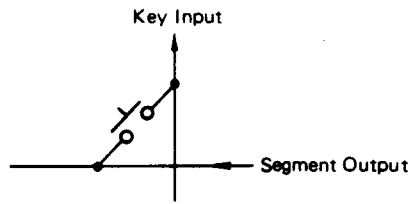
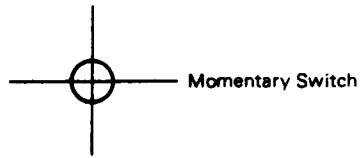
## 1-1. Key Matrix Configuration

	K <sub>3</sub> (11)	K <sub>2</sub> (10)	K <sub>1</sub> (9)	K <sub>0</sub> (8)	Type of Key
Sa(1)	0 (AM)	1 EVERYDAY1 ON	2 EVERYDAY1 OFF	3 (EVERYDAY2 ON)	Momentary (Normally OFF)  * Transistor Switch
Sb(2)	4 (EVERYDAY2 OFF)	5 (ONCE ON)	6 (ONCE OFF)	7	
Sc(3)	8	9 (FM)	REMCN*	OFF	
Sd(4)	CLK CALL	CH SCAN	DOWN	UP	
Se(5)	MEMORY	PHONO	TAPE	AUX	
Sf(6)	AUTO/MANUAL	MODSW2 (note)	MODSW1 (note)	MODSW0 (note)	MODSW . . . Rotary Switch AUTO /MANUAL ... Alternate Switch
Sg(7)	IF0	IF1	BAND1	BAND0	Initially Set Diode Matrix
TUNER & PHONO	NONCLOCK	FM ONLY			

(Note) Rotary switch to be used as mode switch should be of shorting type.

## 1-2. Connection of Keys and Switch Types on Key Matrix





## 2. DESCRIPTION OF KEY MATRIX

### 2-1. Initial Setting Diode Matrix

There are four types of initial setting matrices as described below. They are read in when V<sub>DD</sub> is first fed with power (initializing) or when CE terminal is forced to high level from low level.

(1) Switches for setting IF offset value of FM.

IF1, IF0

(2) Switches to specify the BAND range for the target area. (American, European, or Japanese)

BAND1, BAND0

(3) Switch to kill the clock function.

NONCLOCK

(4) Switch to meet the FM single receiver.

FM ONLY

These settings are done by shorting with a diode or by opening the crosspoint on key matrix. (In the following table, ON means short-circuiting with a diode and OFF means opening.)

Symbol	Functional Description																									
IF1 IF0	<p>Switches to set IF offset value of FM. Intermediate frequency can be set in for ways, 25 kHz apart from each other, without changing the frequency displayed.</p> <table border="1"> <thead> <tr> <th>IF1</th> <th>IF0</th> <th>American band</th> <th>European band</th> <th>Japanese band</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>10.700 MHz</td> <td>10.700 MHz</td> <td>10.700 MHz</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>10.725</td> <td>10.725</td> <td>10.675</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>10.650</td> <td>10.650</td> <td>10.750</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>10.675</td> <td>10.675</td> <td>10.725</td> </tr> </tbody> </table>	IF1	IF0	American band	European band	Japanese band	OFF	OFF	10.700 MHz	10.700 MHz	10.700 MHz	OFF	ON	10.725	10.725	10.675	ON	OFF	10.650	10.650	10.750	ON	ON	10.675	10.675	10.725
IF1	IF0	American band	European band	Japanese band																						
OFF	OFF	10.700 MHz	10.700 MHz	10.700 MHz																						
OFF	ON	10.725	10.725	10.675																						
ON	OFF	10.650	10.650	10.750																						
ON	ON	10.675	10.675	10.725																						
BAND1 BAND0	<p>Switches to specify the BAND range for the target area. Either American, European, or Japanese band can be selected.</p> <table border="1"> <thead> <tr> <th>BAND1</th> <th>BAND0</th> <th>Found Area</th> </tr> </thead> <tbody> <tr> <td>OFF</td> <td>OFF</td> <td>American band</td> </tr> <tr> <td>OFF</td> <td>ON</td> <td>Japanese band</td> </tr> <tr> <td>ON</td> <td>OFF</td> <td>European band</td> </tr> <tr> <td>ON</td> <td>ON</td> <td>Prohibited *</td> </tr> </tbody> </table> <p>* Do not turn both BAND1 and BAND0 ON. If both are turned ON, receiving band cannot be set duly.</p>	BAND1	BAND0	Found Area	OFF	OFF	American band	OFF	ON	Japanese band	ON	OFF	European band	ON	ON	Prohibited *										
BAND1	BAND0	Found Area																								
OFF	OFF	American band																								
OFF	ON	Japanese band																								
ON	OFF	European band																								
ON	ON	Prohibited *																								
NONCLOCK	<p>Switch to kill the clock function. When no clock function is required, make this switch ON. Then, data retention is capable with a low current consumption (10 μA or less). (Refer to Notes 1 and 2 of Terminal Descriptions.) ON ..... With Clock Function OFF ..... With Clock Function</p>																									
FM ONLY	<p>Switch to set receiving band to FM only. When this switch is ON, AM band is not received even if '0(AM)' key is pressed. Then band switching keys 'FM' and 'AM' can be accepted only as '9' and '0' for time adjustment. ON ..... FM only OFF ..... FM and AM</p>																									

2-2. Alternate Switches

There are two kinds of alternate switches. They can be switched any time.

(1) Switch to select auto tuning or manual tuning.

AUTO/MANUAL

(2) Programmable mode switches to specify operation modes; CLOCK SET, TIMER WRITE, TIMER CANCEL, etc. MODSW2, MODSW1, MODSW0

Symbol	Description of Function																												
<p>AUTO/ MANUAL</p>	<p>Switch to select auto tuning or manual tuning.                      ON . . . . . Auto Tuning                      OFF . . . . . Manual Tuning                      Auto or manual tuning starts when the momentary switch of UP or Down is pressed after the setting of this switch.                      In the auto tuning operation, the frequency is scanned step by step after confirming that the PLL system is locked. Therefore, in the long lock-up time PLL system, the scanning speed will be slower than the short one. And if the PLL feedback loop is malfunctioned and the PLL is never locked, the scanning will not be started or be stopped.</p>																												
<p>MODSW2 MODSW1 MODSW0</p>	<p>Programmable mode switches to specify modes such as CLOCK SET, TIMER WRITE, TIMER CANCEL.                      Use shorting-type rotary switch with two circuits and six positions for these switches. (For connections, see 1-2 "Connection of Keys and Switch Types for Key Matrix".)</p> <table border="1" data-bbox="330 866 1144 1149"> <thead> <tr> <th>MODSW2</th> <th>MODSW1</th> <th>MODSW0</th> <th>Programmable Mode</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0</td> <td>1</td> <td>CLOCK SET</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>RADIO</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>TIMER OPERATION</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>TIMER READ</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>TIMER WRITE</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>TIMER CANCEL</td> </tr> </tbody> </table> <p>(Note) 1 and 0 in the table means ON (short) and OFF (open) respectively. Since the mode switch code is modified gray code, the sequence of the codes cannot be changed to others than the above.</p> <p>1. CLOCK SET mode                      Mode to set present time.                      μPD1704C-011 is provided with a 24-hour clock system(0:00-23:59). The time can be set by the following procedure.</p> <p>① Set time in 4-digit input using ten-key 0-9.                      (Ex. Setting to 8:15 A.M.)</p> <div data-bbox="413 1460 1338 1522" style="text-align: center;"> </div> <p>(Note) If some wrong key was pressed, finish the 4-digit keying and then start keying again from the first digit.</p> <p>② Turn the programmable mode switch to RADIO coincidentally to time signal. The clock function starts to operate at the moment of switching over to RADIO.                      (Note 1) If clock setting is performed while listening to the radio, radio broadcast frequency is indicated when the mode switch is returned to RADIO.                      If the similar process is followed in PHONO, TAPE, or AUX mode, the time is indicated, but zero (0) in the most significant digit will be suppressed to blank as shown below.</p>	MODSW2	MODSW1	MODSW0	Programmable Mode	1	0	1	CLOCK SET	1	0	0	RADIO	1	1	0	TIMER OPERATION	0	1	0	TIMER READ	0	0	0	TIMER WRITE	0	0	1	TIMER CANCEL
MODSW2	MODSW1	MODSW0	Programmable Mode																										
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1	1	0	TIMER OPERATION																										
0	1	0	TIMER READ																										
0	0	0	TIMER WRITE																										
0	0	1	TIMER CANCEL																										

- 2) At the time when  $V_{DD}$  ( $5\text{ V} \pm 10\%$ ) is supplied to the device, "E" is indicated.

- 3) When the mode switch is in the position of CLOCK SET mode, the internal clock stops functioning. The clock starts functioning when the mode switch is turned to another, and the value of second is set to "0" internally.

## 2. RADIO mode

In this mode, the tuner functions such as write and call of AM/FM preset memory, UP/DOWN tuning in AUTO/MANUAL, and preset memory scan etc.) and source selection (PHONO, TAPE, or AUX) can be performed.

## 3. TIMER OPERATION mode

Mode for executing instructions of time and source (AM, FM, PHONO, TAPE, or AUX) specified in TIMER WRITE mode.

Each of three timer systems, EVERYDAY1, EVERYDAY2, and ONCE, is respectively executed (ON or OFF) at the programmed time. Once programmed in ON/OFF-time and source, EVERYDAY1 and EVERYDAY2, repeat the ON and OFF operation to the programmed source everyday at the programmed time, while ONCE is automatically erased after the execution of ON and OFF operation and it will not be executed next day.

Among these three systems, the priority sequence ONCE, EVERYDAY2, EVERYDAY1 is established. (For details, see 4 Description of Programmable Timer Performance)

When timer is executed, one of the following terminals is to be activated corresponding to the programmed source.

Programmed Source	Terminals to be activated
FM	FM/ $\overline{\text{AM}}$ =High, TUNER=High, AC OUT=High
AM	FM/ $\overline{\text{AM}}$ =Low, TUNER=High, AC OUT=High
PHONO	PHONO=High, AC OUT=High
TAPE	TAPE=High, AC OUT=High
AUX	AUX=High, AC OUT=High

If the timer of either one of the systems is ON, all key and remote controlled inputs in this mode cannot be accepted because of protection against wrong operations. Such a manual input operation should be done after switching to RADIO mode if desired.

## 4. TIMER READ mode

Mode to confirm ON/OFF time and source programmed in TIMER WRITE mode. The procedure is as follows;

- ① Set the programmable mode switch to TIMER READ mode. Then source selector terminals (TUNER, PHONO, TAPE, and AUX) and AC OUT terminal are forced to low level, and the present time is indicated.
- ② Press ON key of either of EVERYDAY1, EVERYDAY2, or ONCE, Programmed ON-time, source selector terminal and the preset station are indicated for about 5 seconds. After that, the present time indication is recovered.
- ③ Press OFF key of EVERYDAY1, EVERYDAY2, or ONCE. Programmed OFF time is indicated for about 5 seconds. After that, the present time indication is recovered.

(Note) If ON or OFF time is not programmed, only colon (:) is indicated for about 5 seconds.

## 5. TIMER WRITE mode

Mode for programming ON and OFF times and source to be operated. Note that OFF-time must be set whenever the ON-time is to be set. If OFF-time is not set, timer-ON action will never be performed and the ON-time which was set alone will be erased. This function is provided to avoid accidents caused by the timer which will never be turned off. Since such a

MODSW2  
MODSW1  
MODSW0

MODSW2  
MODSW1  
MODSW0

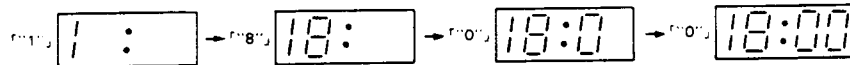
OFF-time checking is performed when the ON-time is encountered, OFF-time should be set at least before the ON-time.

In otherwise, if only OFF-time is set, the timer-OFF action will function properly. That is, OFF-time has a higher priority than the ON-time.

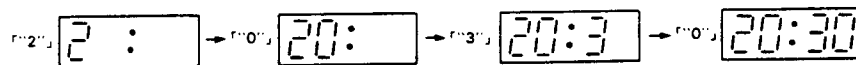
Five sources, AM, FM, PHONO, TAPE, and AUX, are programmable. The programming procedure is as follows.

- ① Set programmable mode switch to TIMER WRITE mode. Then the present time is indicated.
- ② Press the desired ON-key of EVERYDAY1, EVERYDAY2, or ONCE. Then the colon is displayed, and a preset station indicator LED corresponding to the depressed ON-key turns on for about 60 ms.
- ③ Set time in 4-digit input by using ten-keys 0–9 of momentary switches just similar to the clock set.

(Ex.) Setting 6:00 p.m.



- ④ Press key corresponding to the desired source (FM, AM, PHONO, TAPE, or AUX). (Even if FM ONLY is specified, you must input FM.)  
In cases that PHONO, TAPE, or AUX key is pressed, the corresponding source selector terminal goes High for about 500 ms.  
In cases that FM or AM key is pressed, TUNER terminal goes High and FM/AM terminal is activated until a preset station key (1–8) is pressed. By using the statuses of the TUNER and FM/AM terminals, source selection ACKNOWLEDGE signal can be generated (refer to description of AM/FM terminal).  
When PHONO, TAPE, or AUX key is pressed, present time will be indicated after about 500 ms (the source selector terminal goes High level for that 500 ms), whereas the programmed ON time is indicated until preset station key is pressed when FM or AM key is pressed.
- ⑤ When FM or AM is selected as a source in ④, the next step to press the desired preset station key (1–8) is required. Then, preset station indicator LED corresponding to the pressed key turns on for about 60 ms. After that, the display will be changed from the programmed ON time to the present time.  
(Note) If any wrong time is set or wrong source is selected, switch the programmable mode switch to another mode, and, restart programming from ① or restart programming from ② after finishing ④ or ⑤.
- ⑥ Press OFF key that corresponds to the ON key pressed in ②.  
Then, only colon is indicated. The preset station indicator LED corresponding to the pressed OFF key turns on for about 60 ms.
- ⑦ Set time in 4-digit number by using ten-keys 0–9 of momentary switch.  
(Ex.) Setting 8:30 p.m.



When the input of the fourth digit is over, the above display is changed to the present time indication.

(Note) When any key is wrongly pressed, finish the process up to the fourth digit and then restart the process from ⑥.

- ⑧ Set programmable mode switch to TIMER-OPERATION. Then the present time is indicated.

(Note) If timer operation is desired, be sure to set programmable mode switch to TIMER OPERATION. Otherwise timer does not function.

#### 6. TIMER CANCEL mode

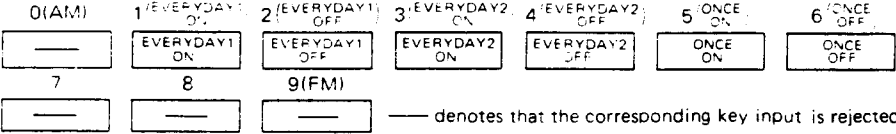
Mode for canceling programmed times ON/OFF times and source. Follow the process described below.

MODSW2 MODSW1 MODSW0	<ol style="list-style-type: none"> <li>① Set programmable mode switch to <b>TIMER CANCEL</b>. Then the present time is indicated.</li> <li>② Press the <b>ON</b> key of timer to be canceled. (<b>EVERYDAY1</b>, <b>EVERYDAY2</b>, or <b>ONCE</b>). Then colon is indicated momentarily, the programmed <b>ON</b> time and source are canceled, and, immediately, the present time indication is recovered.</li> <li>③ Press <b>OFF</b> key that corresponds to the <b>ON</b> key pressed in procedure ②. As in ②, colon is indicated momentarily, the programmed <b>OFF</b> time is canceled, and, immediately, the present time indication is recovered.</li> </ol>
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**2.3. Momentary Switches**

Symbol	Description of Function																																																																																																																																												
0-9	<p>These keys are multiple function keys. Their functions varies dependent on the positions of programmable mode switches (MODSW0,1,2).</p> <p>(1) In the <b>CLOCK SET</b> mode.</p> <table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: none;">0(AM)</td> <td style="border: none;">1<sup>(EVERYDAY1)</sup> ON</td> <td style="border: none;">2<sup>(EVERYDAY1)</sup> OFF</td> <td style="border: none;">3<sup>(EVERYDAY2)</sup> ON</td> <td style="border: none;">4<sup>(EVERYDAY2)</sup> OFF</td> <td style="border: none;">5<sup>(ONCE)</sup> ON</td> <td style="border: none;">6<sup>(ONCE)</sup> OFF</td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 20px;">0</td> <td style="border: 1px solid black; width: 30px; height: 20px;">1</td> <td style="border: 1px solid black; width: 30px; height: 20px;">2</td> <td style="border: 1px solid black; width: 30px; height: 20px;">3</td> <td style="border: 1px solid black; width: 30px; height: 20px;">4</td> <td style="border: 1px solid black; width: 30px; height: 20px;">5</td> <td style="border: 1px solid black; width: 30px; height: 20px;">6</td> </tr> <tr> <td style="border: none;">7</td> <td style="border: none;">8</td> <td style="border: none;">9(FM)</td> <td colspan="4"></td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 20px;">7</td> <td style="border: 1px solid black; width: 30px; height: 20px;">8</td> <td style="border: 1px solid black; width: 30px; height: 20px;">9</td> <td colspan="4"></td> </tr> </table> <p>When <b>CLOCK SET</b> mode is selected, the keys are used as ten-keys for setting time.</p> <p>(2) In the <b>RADIO</b> mode</p> <table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: none;">0(AM)</td> <td style="border: none;">1<sup>(EVERYDAY1)</sup> ON</td> <td style="border: none;">2<sup>(EVERYDAY1)</sup> OFF</td> <td style="border: none;">3<sup>(EVERYDAY2)</sup> ON</td> <td style="border: none;">4<sup>(EVERYDAY2)</sup> OFF</td> <td style="border: none;">5<sup>(ONCE)</sup> ON</td> <td style="border: none;">6<sup>(ONCE)</sup> OFF</td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 20px;">AM</td> <td style="border: 1px solid black; width: 30px; height: 20px;">1</td> <td style="border: 1px solid black; width: 30px; height: 20px;">2</td> <td style="border: 1px solid black; width: 30px; height: 20px;">3</td> <td style="border: 1px solid black; width: 30px; height: 20px;">4</td> <td style="border: 1px solid black; width: 30px; height: 20px;">5</td> <td style="border: 1px solid black; width: 30px; height: 20px;">6</td> </tr> <tr> <td style="border: none;">7</td> <td style="border: none;">8</td> <td style="border: none;">9(FM)</td> <td colspan="4"></td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 20px;">7</td> <td style="border: 1px solid black; width: 30px; height: 20px;">8</td> <td style="border: 1px solid black; width: 30px; height: 20px;">FM</td> <td colspan="4"></td> </tr> </table> <p>When <b>RADIO</b> mode is selected, the keys are used for <b>AM/FM</b> band switching and as preset station keys.</p> <p>(3) In the <b>TIMER OPERATION</b> mode.</p> <table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: none;">0(AM)</td> <td style="border: none;">1<sup>(EVERYDAY1)</sup> ON</td> <td style="border: none;">2<sup>(EVERYDAY1)</sup> OFF</td> <td style="border: none;">3<sup>(EVERYDAY2)</sup> ON</td> <td style="border: none;">4<sup>(EVERYDAY2)</sup> OFF</td> <td style="border: none;">5<sup>(ONCE)</sup> ON</td> <td style="border: none;">6<sup>(ONCE)</sup> OFF</td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 20px;">AM</td> <td style="border: 1px solid black; width: 30px; height: 20px;">1</td> <td style="border: 1px solid black; width: 30px; height: 20px;">2</td> <td style="border: 1px solid black; width: 30px; height: 20px;">3</td> <td style="border: 1px solid black; width: 30px; height: 20px;">4</td> <td style="border: 1px solid black; width: 30px; height: 20px;">5</td> <td style="border: 1px solid black; width: 30px; height: 20px;">6</td> </tr> <tr> <td style="border: none;">7</td> <td style="border: none;">8</td> <td style="border: none;">9 (FM)</td> <td colspan="4"></td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 20px;">7</td> <td style="border: 1px solid black; width: 30px; height: 20px;">8</td> <td style="border: 1px solid black; width: 30px; height: 20px;">FM</td> <td colspan="4"></td> </tr> </table> <p>The functions of the keys are almost the same as those in the <b>RADIO</b> mode. Only difference is that the keys are not accepted during timer operation.</p> <p>(4) In the <b>TIMER READ</b> mode.</p> <table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: none;">0(AM)</td> <td style="border: none;">1<sup>(EVERYDAY1)</sup> ON</td> <td style="border: none;">2<sup>(EVERYDAY1)</sup> OFF</td> <td style="border: none;">3<sup>(EVERYDAY2)</sup> ON</td> <td style="border: none;">4<sup>(EVERYDAY2)</sup> OFF</td> <td style="border: none;">5<sup>(ONCE)</sup> ON</td> <td style="border: none;">6<sup>(ONCE)</sup> OFF</td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 20px;">—</td> <td style="border: 1px solid black; width: 30px; height: 20px;">EVERYDAY1 ON</td> <td style="border: 1px solid black; width: 30px; height: 20px;">EVERYDAY1 OFF</td> <td style="border: 1px solid black; width: 30px; height: 20px;">EVERYDAY2 ON</td> <td style="border: 1px solid black; width: 30px; height: 20px;">EVERYDAY2 OFF</td> <td style="border: 1px solid black; width: 30px; height: 20px;">ONCE ON</td> <td style="border: 1px solid black; width: 30px; height: 20px;">ONCE OFF</td> </tr> <tr> <td style="border: none;">7</td> <td style="border: none;">8</td> <td style="border: none;">9(FM)</td> <td colspan="4"></td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 20px;">—</td> <td style="border: 1px solid black; width: 30px; height: 20px;">—</td> <td style="border: 1px solid black; width: 30px; height: 20px;">—</td> <td colspan="4">— denotes that the corresponding key input is rejected.</td> </tr> </table> <p>When <b>TIMER READ</b> mode is selected, only <b>ON/OFF</b> keys of <b>EVERYDAY1</b>, <b>EVERYDAY2</b>, and <b>ONCE</b> are in effect to confirm programmed timer times and source.</p> <p>(5) In the <b>TIMER WRITE</b> mode</p> <table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: none;">0(AM)</td> <td style="border: none;">1<sup>(EVERYDAY1)</sup> ON</td> <td style="border: none;">2<sup>(EVERYDAY1)</sup> OFF</td> <td style="border: none;">3<sup>(EVERYDAY2)</sup> ON</td> <td style="border: none;">4<sup>(EVERYDAY2)</sup> OFF</td> <td style="border: none;">5<sup>(ONCE)</sup> ON</td> <td style="border: none;">6<sup>(ONCE)</sup> OFF</td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 20px;">0(AM)</td> <td style="border: 1px solid black; width: 30px; height: 20px;">1<sup>(EVERYDAY1)</sup> ON</td> <td style="border: 1px solid black; width: 30px; height: 20px;">2<sup>(EVERYDAY1)</sup> OFF</td> <td style="border: 1px solid black; width: 30px; height: 20px;">3<sup>(EVERYDAY2)</sup> ON</td> <td style="border: 1px solid black; width: 30px; height: 20px;">4<sup>(EVERYDAY2)</sup> OFF</td> <td style="border: 1px solid black; width: 30px; height: 20px;">5<sup>(ONCE)</sup> ON</td> <td style="border: 1px solid black; width: 30px; height: 20px;">6<sup>(ONCE)</sup> OFF</td> </tr> <tr> <td style="border: none;">7</td> <td style="border: none;">8</td> <td style="border: none;">9(FM)</td> <td colspan="4"></td> </tr> <tr> <td style="border: 1px solid black; width: 30px; height: 20px;">7</td> <td style="border: 1px solid black; width: 30px; height: 20px;">8</td> <td style="border: 1px solid black; width: 30px; height: 20px;">9(FM)</td> <td colspan="4"></td> </tr> </table> <p>When <b>TIMER WRITE</b> mode is selected, the functions of the keys are differently dependent on the sequence of key operation. (For details, see 2-2. Alternate Switches)</p> <p>(6) In the <b>TIMER CANCEL</b> mode.</p>	0(AM)	1 <sup>(EVERYDAY1)</sup> ON	2 <sup>(EVERYDAY1)</sup> OFF	3 <sup>(EVERYDAY2)</sup> ON	4 <sup>(EVERYDAY2)</sup> OFF	5 <sup>(ONCE)</sup> ON	6 <sup>(ONCE)</sup> OFF	0	1	2	3	4	5	6	7	8	9(FM)					7	8	9					0(AM)	1 <sup>(EVERYDAY1)</sup> ON	2 <sup>(EVERYDAY1)</sup> OFF	3 <sup>(EVERYDAY2)</sup> ON	4 <sup>(EVERYDAY2)</sup> OFF	5 <sup>(ONCE)</sup> ON	6 <sup>(ONCE)</sup> OFF	AM	1	2	3	4	5	6	7	8	9(FM)					7	8	FM					0(AM)	1 <sup>(EVERYDAY1)</sup> ON	2 <sup>(EVERYDAY1)</sup> OFF	3 <sup>(EVERYDAY2)</sup> ON	4 <sup>(EVERYDAY2)</sup> OFF	5 <sup>(ONCE)</sup> ON	6 <sup>(ONCE)</sup> OFF	AM	1	2	3	4	5	6	7	8	9 (FM)					7	8	FM					0(AM)	1 <sup>(EVERYDAY1)</sup> ON	2 <sup>(EVERYDAY1)</sup> OFF	3 <sup>(EVERYDAY2)</sup> ON	4 <sup>(EVERYDAY2)</sup> OFF	5 <sup>(ONCE)</sup> ON	6 <sup>(ONCE)</sup> OFF	—	EVERYDAY1 ON	EVERYDAY1 OFF	EVERYDAY2 ON	EVERYDAY2 OFF	ONCE ON	ONCE OFF	7	8	9(FM)					—	—	—	— denotes that the corresponding key input is rejected.				0(AM)	1 <sup>(EVERYDAY1)</sup> ON	2 <sup>(EVERYDAY1)</sup> OFF	3 <sup>(EVERYDAY2)</sup> ON	4 <sup>(EVERYDAY2)</sup> OFF	5 <sup>(ONCE)</sup> ON	6 <sup>(ONCE)</sup> OFF	0(AM)	1 <sup>(EVERYDAY1)</sup> ON	2 <sup>(EVERYDAY1)</sup> OFF	3 <sup>(EVERYDAY2)</sup> ON	4 <sup>(EVERYDAY2)</sup> OFF	5 <sup>(ONCE)</sup> ON	6 <sup>(ONCE)</sup> OFF	7	8	9(FM)					7	8	9(FM)				
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0(AM)	1 <sup>(EVERYDAY1)</sup> ON	2 <sup>(EVERYDAY1)</sup> OFF	3 <sup>(EVERYDAY2)</sup> ON	4 <sup>(EVERYDAY2)</sup> OFF	5 <sup>(ONCE)</sup> ON	6 <sup>(ONCE)</sup> OFF																																																																																																																																							
AM	1	2	3	4	5	6																																																																																																																																							
7	8	9(FM)																																																																																																																																											
7	8	FM																																																																																																																																											
0(AM)	1 <sup>(EVERYDAY1)</sup> ON	2 <sup>(EVERYDAY1)</sup> OFF	3 <sup>(EVERYDAY2)</sup> ON	4 <sup>(EVERYDAY2)</sup> OFF	5 <sup>(ONCE)</sup> ON	6 <sup>(ONCE)</sup> OFF																																																																																																																																							
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7	8	9(FM)																																																																																																																																											
—	—	—	— denotes that the corresponding key input is rejected.																																																																																																																																										
0(AM)	1 <sup>(EVERYDAY1)</sup> ON	2 <sup>(EVERYDAY1)</sup> OFF	3 <sup>(EVERYDAY2)</sup> ON	4 <sup>(EVERYDAY2)</sup> OFF	5 <sup>(ONCE)</sup> ON	6 <sup>(ONCE)</sup> OFF																																																																																																																																							
0(AM)	1 <sup>(EVERYDAY1)</sup> ON	2 <sup>(EVERYDAY1)</sup> OFF	3 <sup>(EVERYDAY2)</sup> ON	4 <sup>(EVERYDAY2)</sup> OFF	5 <sup>(ONCE)</sup> ON	6 <sup>(ONCE)</sup> OFF																																																																																																																																							
7	8	9(FM)																																																																																																																																											
7	8	9(FM)																																																																																																																																											



0-9	 <p>— denotes that the corresponding key input is rejected.</p> <p>When <b>TIMER CANCEL</b> mode is selected, depressing <b>ON/OFF</b> keys of <b>EVERYDAY1</b>, <b>EVERYDAY2</b>, or <b>ONCE</b> cancels the programmed timer times and sources.</p>
OFF	<p>This is the key to cut off power supply relay. By depressing this key, <b>AC OUT</b> terminal and select or terminals (<b>AUX</b>, <b>TAPE</b>, <b>PHONO</b>, and <b>TUNER</b>) are forced to low level and get indication of time on the display.</p> <p>To turn on the power Supply relay, depress one of the <b>AM</b>, <b>FM</b>, preset station keys (1-8) or source selector keys (<b>TAPE</b>, <b>PHONO</b> or <b>AUX</b>) in the <b>RADIO</b> mode.</p>
CLKCAL	<p>Key to call present clock time during frequency display. When this key is pressed, the present clock time is indicated for five seconds and then the frequency display is recovered.</p>
CHSCAN	<p>Key to scan preset channels.</p> <p>When this keys is pressed, the memorized preset stations (1-8) are in turn scanned from "1", holding for 5 sec at each preset station. To stop scanning at the currently received station, press the preset station key currently selected.</p>
UP DOWN	<p>Keys for auto and manual tunings. When either key is pressed, the following functions are performed.</p> <p>(1) When <b>AUTO/MANUAL</b> switch is set to <b>AUTO</b>.</p> <p>Keying of <b>UP</b> increases frequency in saw-tooth wave mode. If the <b>SD</b> terminal is forced to high level during this process, the automatic upward searching is stopped. Keying of <b>DOWN</b> brings about automatic downward searching.</p> <p>Function of the <b>DOWN</b> key is almost the same as that of the <b>UP</b> key. Only difference is that the <b>DOWN</b> key decreases the frequency.</p> <p>*1 Automatic upward or downward searching is performed at the rate of 60 ms/step (MIN). This rate will varies depending on the lock-up time of the PLL system.</p> <p>*2 If <b>UP</b> or <b>DOWN</b> key is pressed during automatic searching is carried on, the automatic upward/downward searching is kept going on.</p> <p>(2) When <b>AUTO/MANUAL</b> switch is set to <b>MANUAL</b>.</p> <p>When <b>UP</b> or <b>DOWN</b> key is momentarily pressed, frequency is shifted by one step (channel space) upward or downward.</p> <p>When <b>UP</b> or <b>DOWN</b> key is kept pressed for 0.5 second or more, the frequency shift is continued upward or downward at the rate of 60 ms/step (TYP.) until the key is released.</p> <p>(Note) Even if the <b>AUTO/MANUAL</b> switch is turned to <b>MANUAL</b> during auto process, the auto tuning is not intercepted. If the auto-tuning is required to be stopped immediately by switching to <b>MANUAL</b>, formulate the system in such a way that <b>SD</b> terminal is forced to high level whenever the <b>AUTO/MANUAL</b> Switch is turned to <b>MANUAL</b>.</p>
MEMORY	<p>Key used to write currently received frequency into a preset memory. When either of keys 1-8 is depressed within 5 seconds after this key is pressed, the currently received frequency is written into the memory corresponding to the keyed-in switch (1-8).</p> <p>The memory write-enable state lasts 5 sec. from the time when the <b>MEMORY</b> key is pressed. To cancel this state within the 5 sec., press a key other than preset channel keys (1-8) or change the mode switches (<b>MODSW0</b>, 1, 2).</p>
PHONO TAPE AUX	<p>Keys to select a source. When programmable mode switches (<b>MODSW0</b>, 1, 2) are set to <b>RADIO</b>, keying one of these switch will force <b>AC OUT</b> terminal and the source select or terminal corresponding to the pressed key to high level. When programmable mode switches are set to <b>TIMER WRITE</b>, the deying-in of either switch will shift the corresponding select terminal to high level for about 500 ms.</p>

### 2-4. Transistor Switch

Remote control signal is input to this switch. (For configuration, see 1-2, Connection of Keys and Switch Types on Key Matrix.) The remote control signal should also be input to the RMC terminal at the same time.

Fig. 1 shows the wave form of remote control signal. The first 10 ms low level stands for initializing signal. The number of the following pulses determines the type of operation.

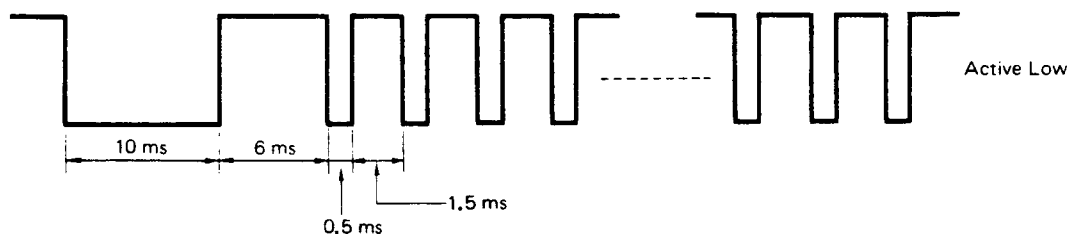


Fig. 1 Timing Waveform of Remote Control Signal

The signal discriminated by key input ( $K_1$  terminal) via the transistor switch is the initializing signal only. The following pulse train is discriminated by  $\overline{RMC}$  terminal.

Table 1 shows the correspondence between pulse counts and operations.

Table 1 Number of Pulses and Related Operation

Number of Pulses	Operation
0-7	Preset CH (1-8)
8-10	Don't care
11	AUX
12	PHONO
13	FM
14	TAPE
15	AM

## 3. DESCRIPTION OF DISPLAY

### 3-1. Display Connection Diagram

Fig. 2 shows the connection of the display.  $\overline{D1-D6}$ ,  $\overline{Sa-Sg}$ , COLON, and  $\overline{DP}$  (decimal point) correspond to digit terminals ( $\overline{D1-D6}$ ), segment terminals ( $\overline{Sa-Sg}$ ), COLON terminal, and  $\overline{DP}$  terminal of  $\mu$ PD1704C-011, respectively.

Since the segment terminals of  $\mu$ PD1704C-011 have breakdown voltage of 30 V (corresponding to Pch open drain output voltage), they can be directly connected to FIP (fluorescent indicator panel). Digits ( $\overline{D1-D6}$ ), COLON, and  $\overline{DP}$  are complementary outputs and they are output in active low. Hence one stage of buffer (with PNP transistor 2SA733 or equivalent) is required.

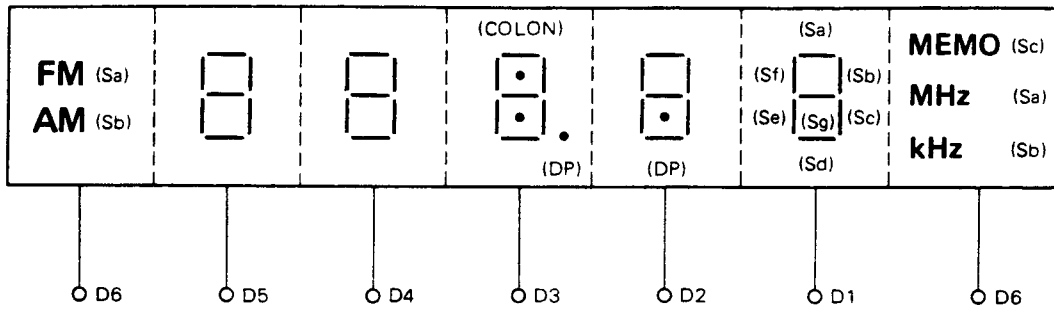


Fig. 2 Example of Indicator Display

### 3-2. Examples of Displays

The typical displays are as follows.

(1) FM in the U.S.A.

FM 103.7 MHz

(2) FM in Europe

FM 89.45 MHz

(3) FM in Japan

FM 76.1 MHz

(4) AM in the U.S.A.

AM 1620 MEMO\*  
kHz

(5) AM in Europe or in Japan

AM 5 3 1 kHz

(6) Clock display

23 : 59

\* Display of MEMO is turned on for 5 seconds when the momentary key MEMORY is pressed, i.e. when the key is pressed in order to write the current frequency into the memory. If preset key either of 1–8 is pressed within that 5 seconds, the new frequency is memorized and the indication MEMO goes off.

#### 4. DESCRIPTION OF PROGRAMMABLE TIMER OPERATIONS

There are three sets of programmable timers; EVERYDAY1, EVERYDAY2, and ONCE.

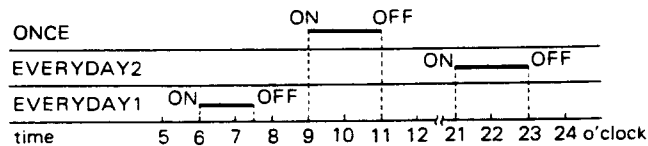
Once programmed with ON/OFF times and source, EVERYDAY1 and EVERYDAY2, execute everyday ON and OFF of the programmed source at the programmed ON/OFF times.

While, in ONCE, programmed source and ON/OFF times are canceled after the source ON/OFF execution is performed.

The priority of these timers is in the sequence of ONCE, EVERYDAY2, and EVERYDAY1. In each timer system, OFF has higher priority than ON. Hence the following performance patterns are realized according to the timing relationship.

① ON and OFF times are not crossed over.

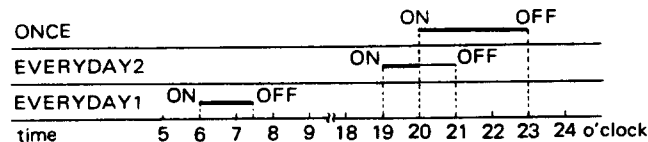
	ON time	OFF time
ONCE	9:00	11:00
EVERYDAY2	21:00	23:00
EVERYDAY1	6:00	7:30



(Note) — Denotes timer in operation.

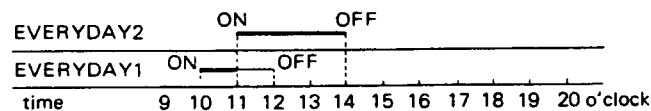
② ONCE goes ON during EVERYDAY2 is in operation.

	ON time	OFF time
ONCE	20:00	23:00
EVERYDAY2	19:00	21:00
EVERYDAY1	6:00	7:30



③ EVERYDAY2 goes ON during EVERYDAY1 is in operation.

	ON time	OFF time
EVERYDAY2	11:00	14:00
EVERYDAY1	10:00	12:00



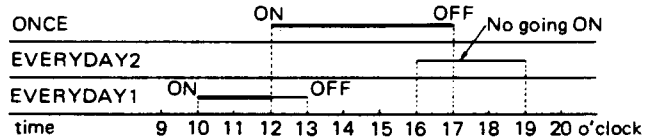
④ EVERYDAY2 goes ON during ONCE is in operation.

	ON time	OFF time
ONCE	10:00	14:00
EVERYDAY2	12:00	17:00



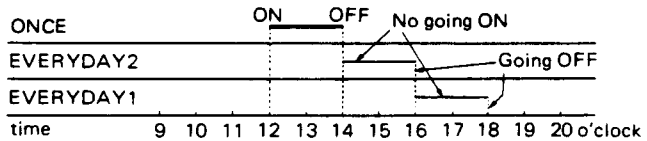
⑤ ONCE goes ON during EVERYDAY1 is in operation, and, EVERYDAY2 goes ON during ONCE is in operation.

	ON time	OFF time
ONCE	12:00	17:00
EVERYDAY2	16:00	19:00
EVERYDAY1	10:00	13:00



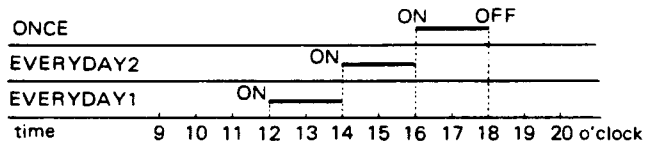
⑥ Continuously programmed in the sequence of ONCE, EVERYDAY2, and EVERYDAY1.

	ON time	OFF time
ONCE	12:00	14:00
EVERYDAY2	14:00	16:00
EVERYDAY1	16:00	18:00



⑦ Reversed sequence of ⑥

	ON time	OFF time
ONCE	16:00	18:00
EVERYDAY2	14:00	16:00
EVERYDAY1	12:00	14:00



5. TYPICAL APPLICATIONS

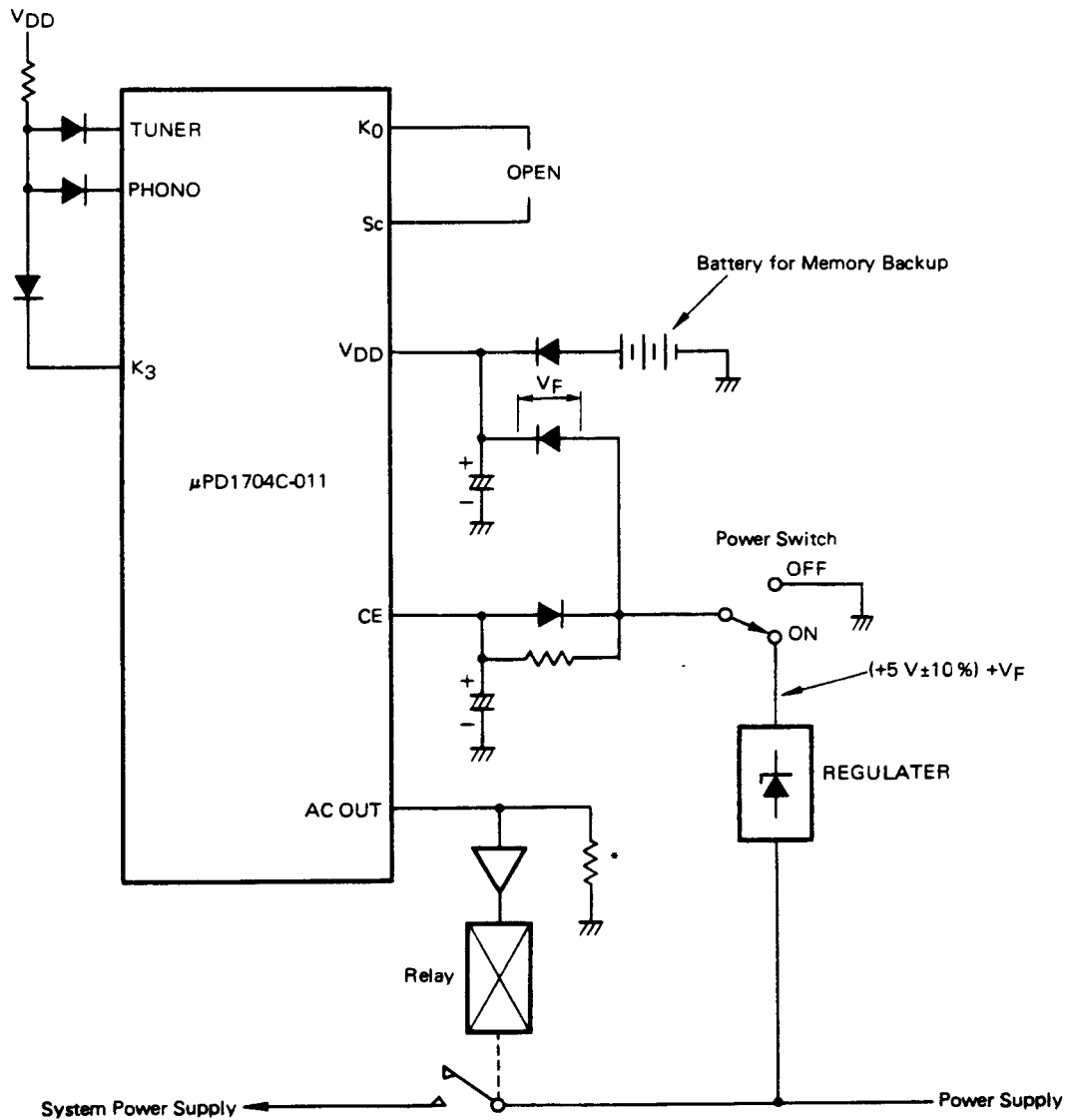
A wide variety of set models can be developed by combining initial setting diode matrix, NONCLOCK and FM ONLY and remote control function. The following table shows some examples of the variations and effective keys on each variation.

LEGEND on symbols

- (key) ○ : Function effective
- : All the key functions diffictive
- FM : Only FM effective
- x : Function ineffective
- AM : Only AM effective
- : Ineffective (prohibited)

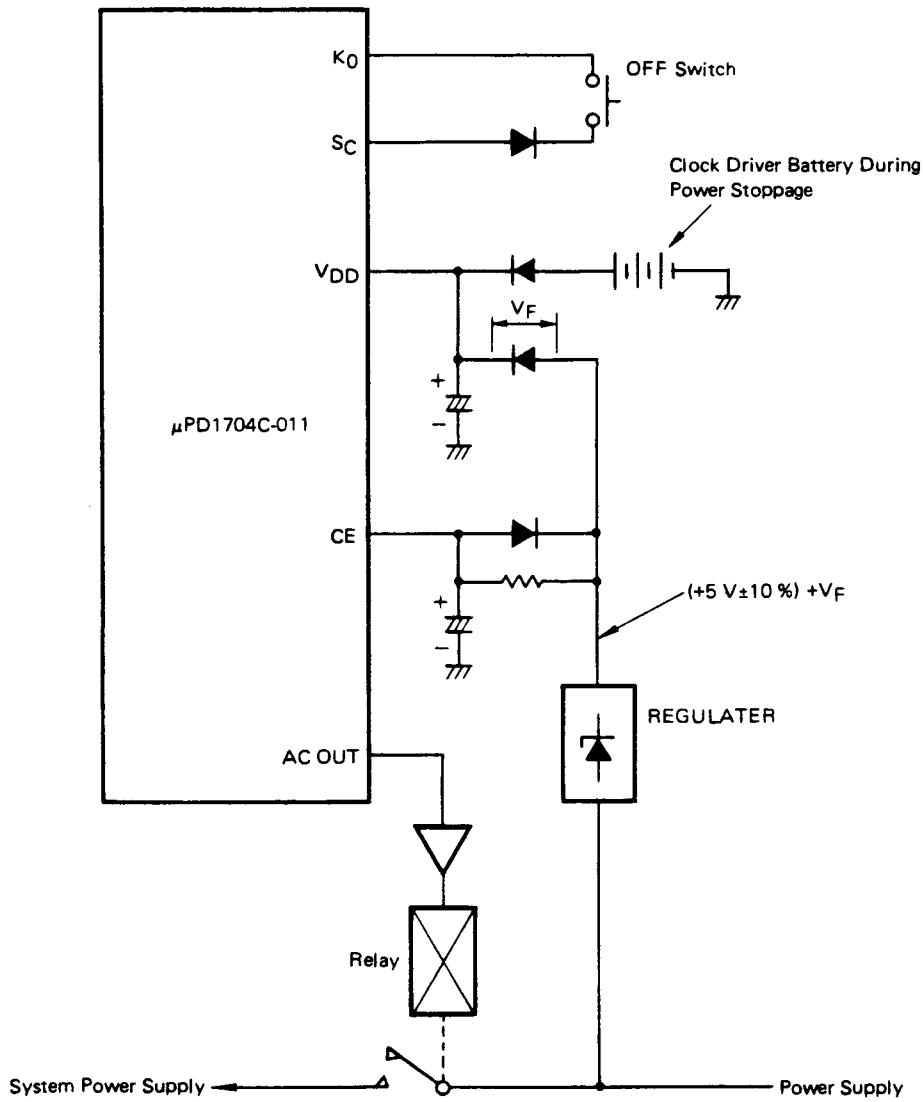
KEY		Type Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Initial Setting Switch	NONCLOCK		ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
	FM ONLY		OFF												ON											
Function	BAND		Both AM and FM												FM Only											
	Remote Control		x						○						x						○					
	Source Selector		x		○		x		○		x		○		x		○		x		○		x		○	
	Clock		x	○	x	○	x	○	x	○	x	○	x	○	x	○	x	○	x	○	x	○	x	○	x	○
	Timer		x	x	○	x	x	○	x	x	○	x	x	○	x	x	○	x	x	○	x	x	○	x	x	○
	Effective Keys or Switches	0 (AM)	AM	●	AM	●	AM	●	AM	●	AM	●	-	0	-	0	-	0	-	0	-	0	-	0	-	0
	1 (EVERYDAY1 ON)	1	●	1	●	1	●	1	●	1	●	1	●	1	●	1	●	1	●	1	●	1	●	1	●	
	2 (EVERYDAY1 OFF)	2	●	2	●	2	●	2	●	2	●	2	●	2	●	2	●	2	●	2	●	2	●	2	●	
	3 (EVERYDAY2 ON)	3	●	3	●	3	●	3	●	3	●	3	●	3	●	3	●	3	●	3	●	3	●	3	●	
	4 (EVERYDAY2 OFF)	4	●	4	●	4	●	4	●	4	●	4	●	4	●	4	●	4	●	4	●	4	●	4	●	
	5 (ONCE ON)	5	●	5	●	5	●	5	●	5	●	5	●	5	●	5	●	5	●	5	●	5	●	5	●	
	6 (ONCE OFF)	6	●	6	●	6	●	6	●	6	●	6	●	6	●	6	●	6	●	6	●	6	●	6	●	
	7		7																							
	8		8																							
	9 (FM)	FM	●	FM	●	FM	●	FM	●	FM	●	-	9	●	-	9	●	-	9	●	-	9	●	-	9	●
	REMCON		-						●						-						●					
	OFF		-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●
	CLKCAL																									
	CHSCAN																									
	UP																									
	DOWN		●																							
	MEMORY																									
	PHONO																									
	TAPE		-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●
	AUX																									
MODESW	CLOCK SET		-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●
	RADIO		●																							
	TIMER OPE																									
	TIMER READ																									
	TIMER WRITE		-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●	-	●
	TIMER CANCEL																									

**5-1. Example of types without remote control nor clock**  
 (Corresponding type numbers : 1, 4, 13, and 16)



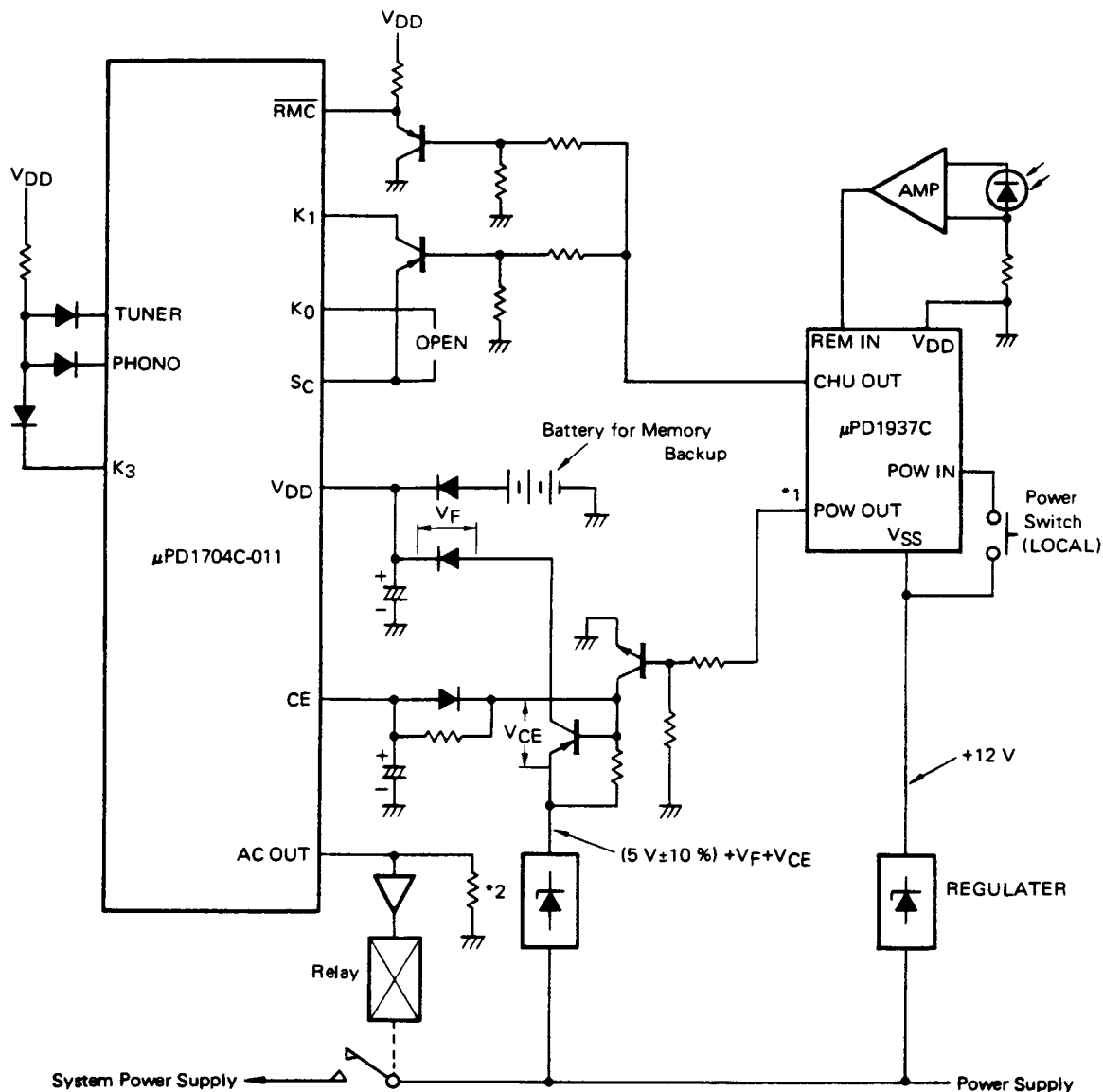
\* AC OUT terminal might become high impedance when power switch is OFF. Hence be certain to insert a pull-down resistance.

5-2. Example of types with clock but without remote control  
(Corresponding type numbers : 2, 3, 5, 6, 14, 15, 17, and 18)



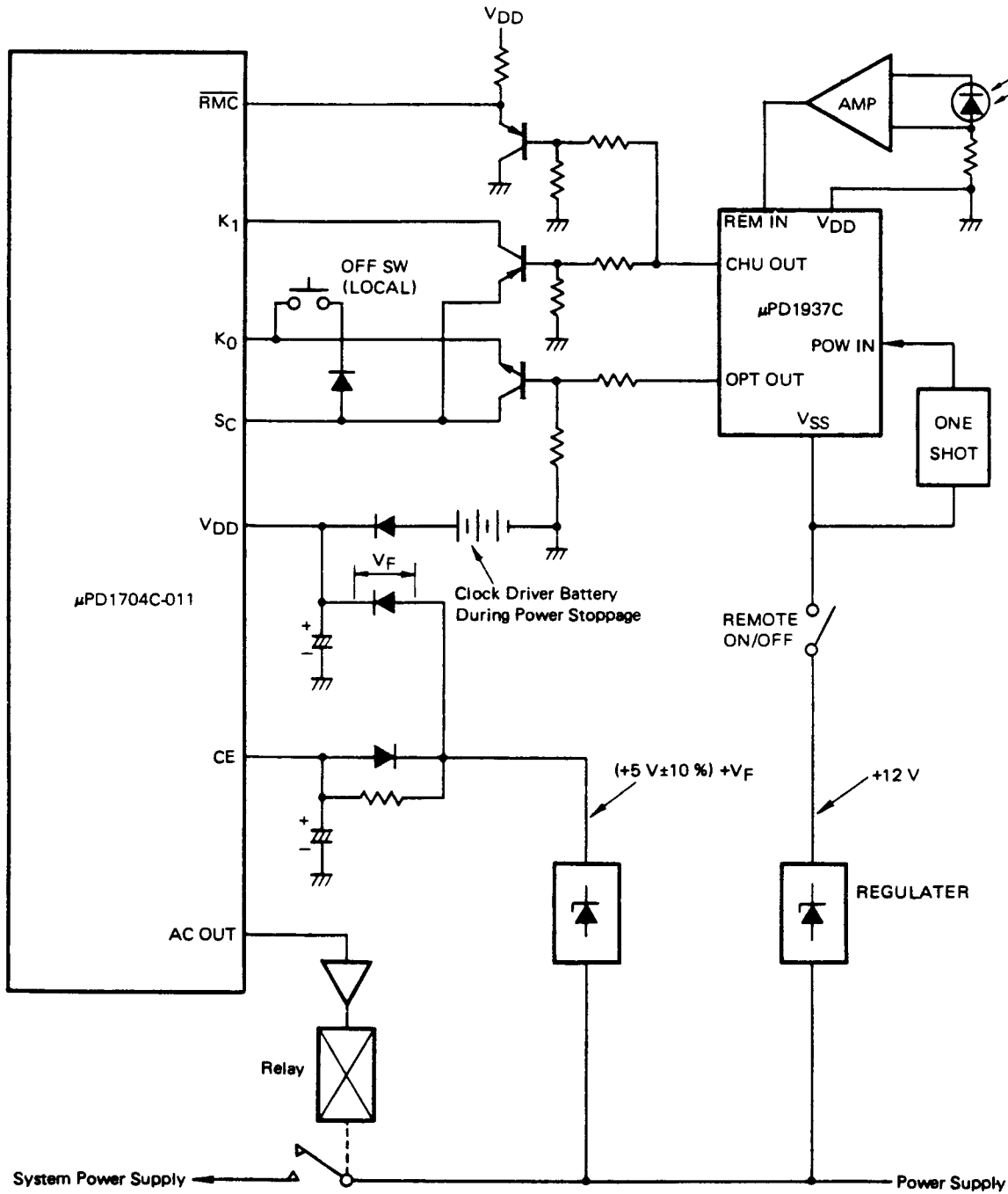


**53. Example of types with remote control but without clock**  
(Corresponding type numbers : 7, 10, 19, 22)



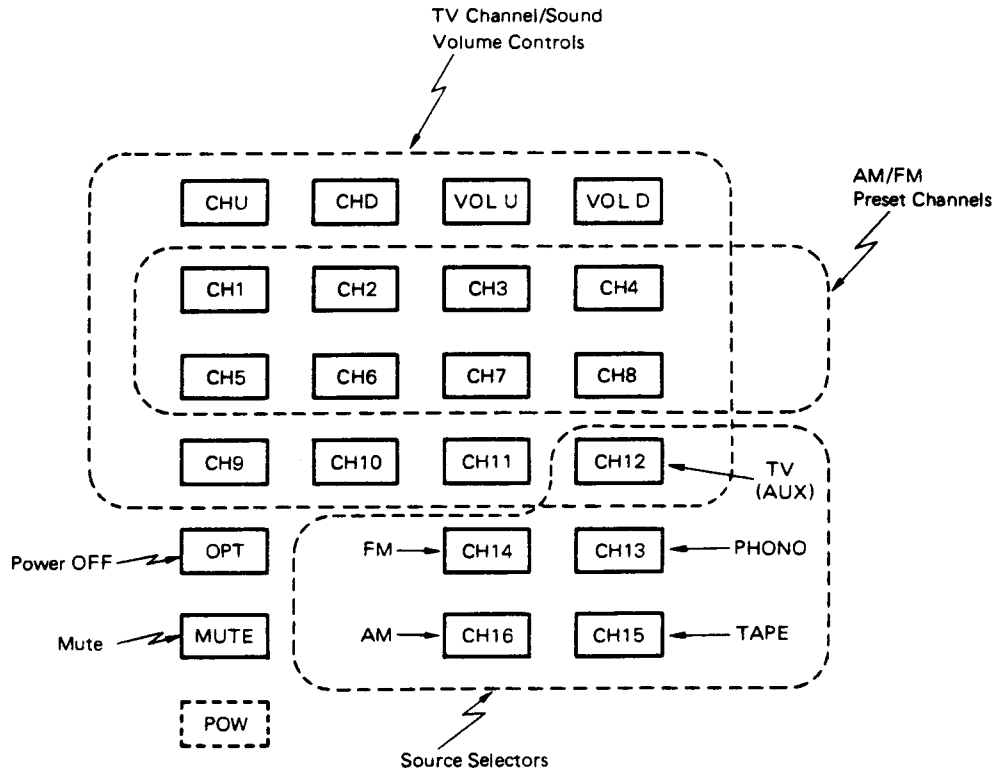
- \* Note 1.) To turn system ON/OFF by remote control, use POW switch of transmitter (μPD1986C)
- 2.) AC OUT terminal might become high impedance when power switch is OFF. Hence be certain to insert a pull-down resistance.

5-4. Example of type with both remote control and clock  
(Corresponding type numbers : 8, 9, 11, 12, 20, 21, 23, 24)



Note) To turn system OFF by remote control, use OPT switch of transmitter (μPD1986C). Never use POW switch.

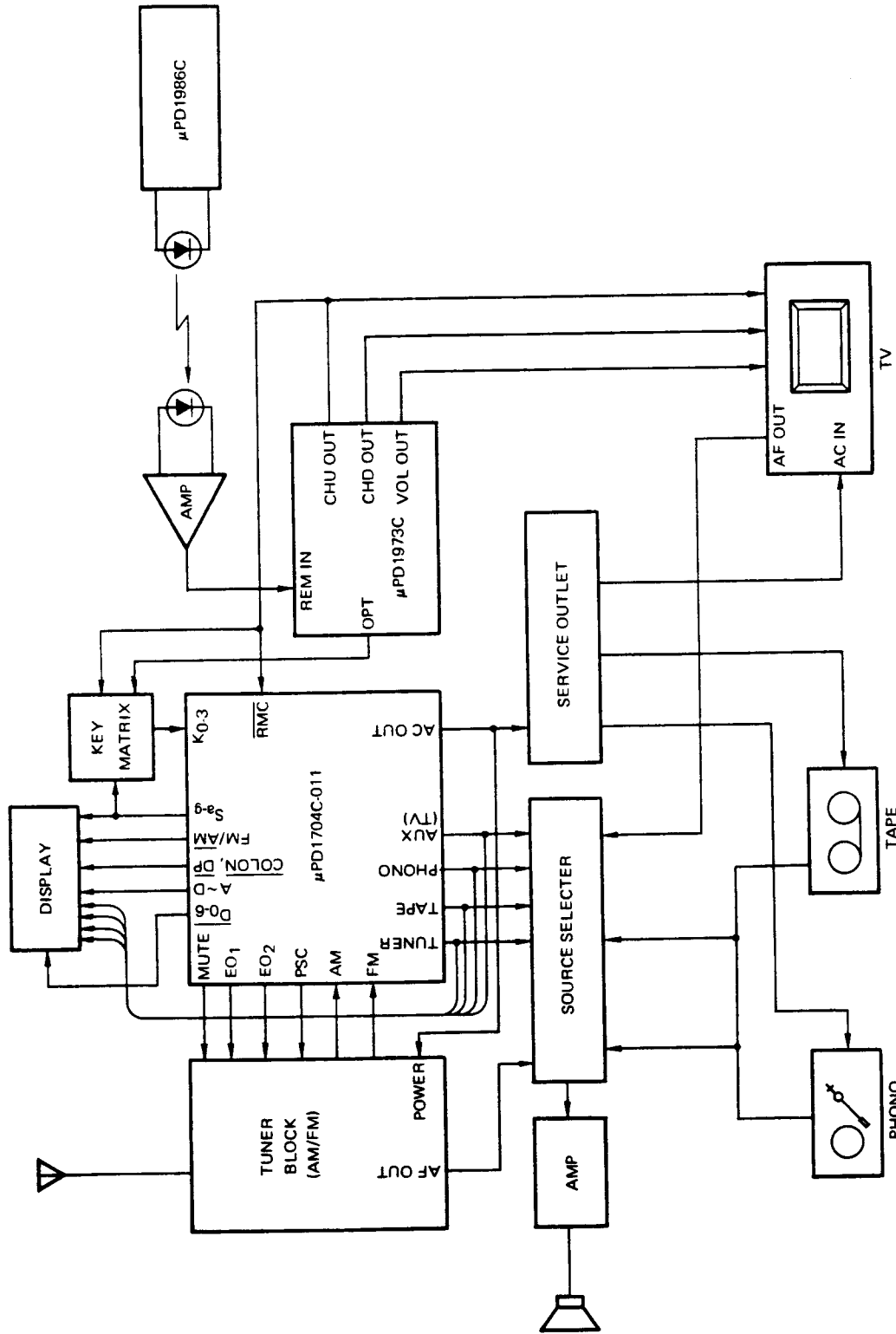
5-5. Key Allocation for Remote Control Transmitter (μPD1986C)  
 (To be used in model types with clock)



Note 1) In models with clock, POW switch of the remote control transmitter is not used. In models without clock, POW switch is used instead of OPT switch shown in the diagram.

Note 2) The symbols inside the square (□) are those used in the specification of μPD1986C.

5-6. Multiplexed Stereo Sound TV Receiver Model with Remote Control/Clock  
Example of application to music center



**APPLICATION EXAMPLE OF CIRCUIT DIAGRAM**

