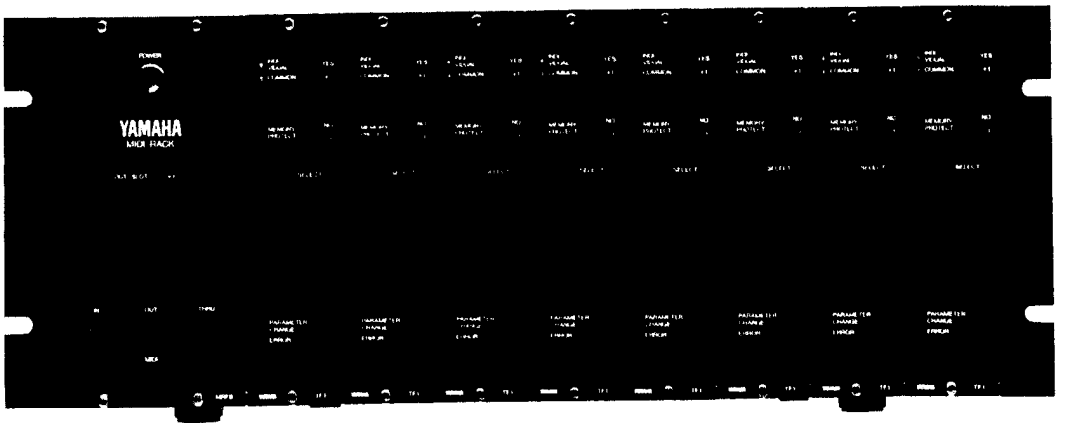
FM TONE GENERATOR SYSTEM

TX216/TX816

SERVICE MANUAL



TX816

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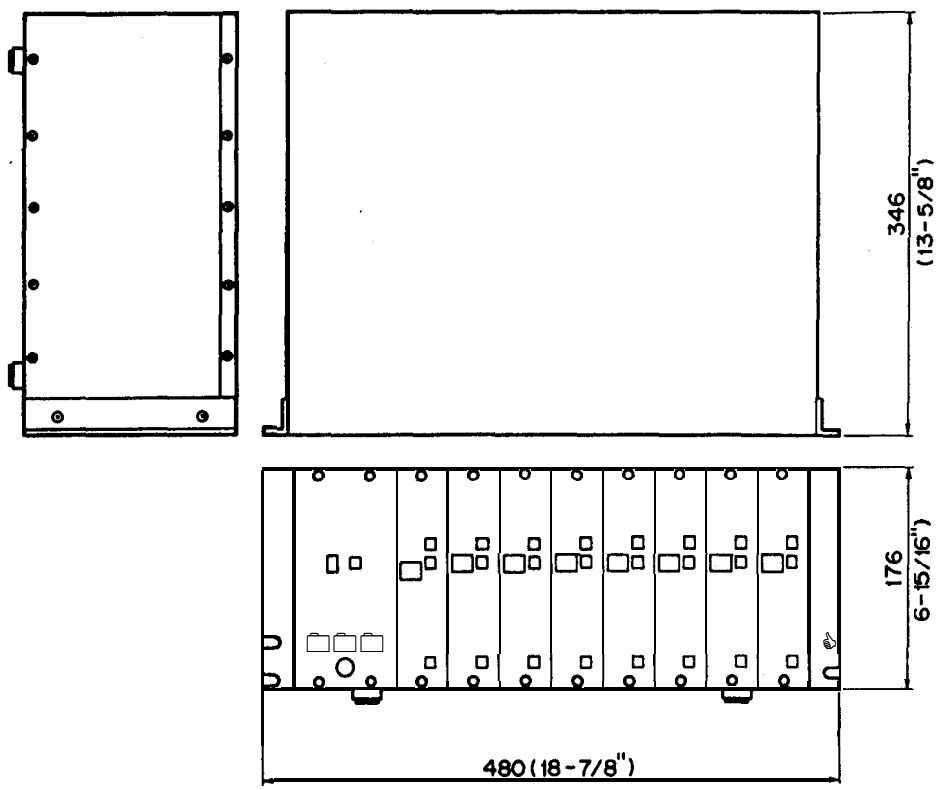
WARNING: **Static discharges can destroy expensive components. Discharge any static electricity your body may have accumulated by grounding yourself to the ground buss in the unit (heavy gauge black wires connect to this buss).**

IMPORTANT: **Turn the unit OFF during disassembly and parts replacement. Recheck all work before you apply power to the unit.**

DIMENSIONS



Unit : mm (Inch)

Specifications

	TX216	TX816
CONFIGURATION	MIDI RACK FRAME TFI FM Tone Generator x 2	MIDI RACK FRAME TFI FM Tone Generatorx8
POWER REQUIREMENTS **U.S/Canadianmodels** **(G e n e r a l model)**	 120 V (60Hz) 1OO- 12O/220-240 V (50/60 Hz)	 120 V (160 Hz) 100- 120/220-240 V (50/60 Hz)
POWER CONSUMPTION	2 2 W	70 w
DIMENSIONS (WxHxD)	480x 176x346 mm (18-7/8"x6-15/16"x13-5/8")	480x176x346 mm (18-7/8"x6-15/16,x13-5/8")
WEIGHT	10 kg (22 lbs.)	12 kg (26 lbs. 6 oz.1
STANDARD ACCESSORIES	MIDI cable 11.5 m (5 ft.)x2) MIDI cable (5 m (16.4 ft.11 Socket wrench	MIDI cable (I.5 m (5 ft.)x8) MIDI cable (5 m (16.4 ft.11 Socket wrench

MIDI RACK FRAME

TERMINALS	MIDI IN, MIDI OUT, MIDI THRU (5-pin DIN)
CONTROLS	Power ON/OFF, MIDI Out Slot select
MASTER CLOCK RATES	9.4265 MHz
DIMENSIONS **(WxHxD)**	486x 176x346 mm (19-1/8"x6-15/16"x13-5/8")
WEIGHT	8 kg (17 lbs. 10 oz.1

TFI

SOUNDSOURCE	FM Tone Generator (6 Operators)
SIMULTANEOUS NOTES **OUTPUT**	Polyphonic-16 (first note priority) Monophonic-l (last note priority)
INTERNAL MEMORY	32 program (32 voice + 32 function)
PANEL CONTROLS	Individual/Common or YES/+ 1 Memory Protect ON/OFF or N o / - l Mode Select
LEDS	Individual; Common; Memory Protect; Parameter Change; Error
NUMERIC LED DISPLAY	Program number, numeric data, etc.
TERMINALS	MIDI IN, MIDI THRU (5-pin DIN) Line Out (XLB-3-32 type)
OUTPUT LEVEL	– 10 dBm, 600 ohms
DIMENSIONS **(WxHxD)**	480x176x346 mm (18-7/8"x6-15/16"x13-5/8")
WEIGHT	600 g (1 lbs. 5 oz.)
STANDARD ACCESSORIES	MIDI Cable (I.5 m (5 ft.11 Socket wrench

All specifications are subject to change without notice.

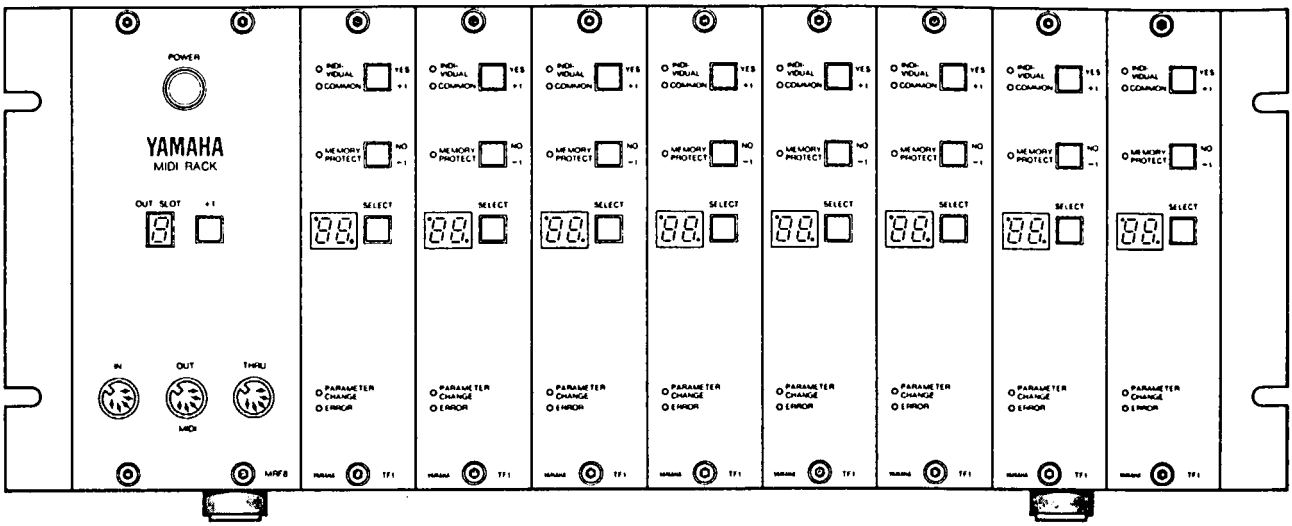
ERROR DISPLAYS

A number of error displays are built into each TFl to let you know if any internal problems are occurring. The red Error LED will light, and a number will appear in the LED Display to inform you of the type of problem. You can cancel the error display by pressing any of the three keys on the front of the module.The following chart lists the ten types of errors, and how to deal with them.

LED DISPLAY	ERROR	REMEDY
1	Data Receive Error	Indicates that data has not been properly received. Adjust the data at the source and transmit data agair
2	Receive Buffer Full	
3	Bulk Data Check Sum Error	
4	Low Battery Level	Replace Battery
5	ROM Hardware Error	These errors are all caused by a fault in the internal circuitry the TFl, and you will need to contact Your nearest Yamaha dealer.
6	RAM1 Hardware Error	
7	RAM2 Hardware Error	
6	RAM3 Hardware Error	
9	RAM4 Hardware Error	
10	Trap Error	

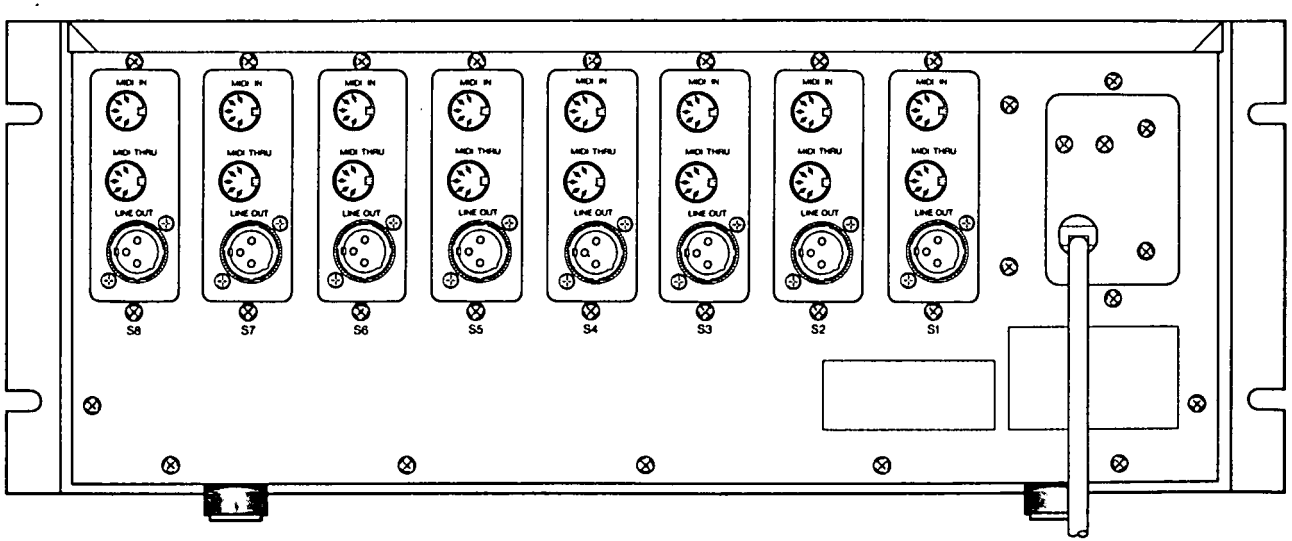
■ PANEL LAYOUT

- FRONT PANEL



TX816

- REAR PANEL



TX816

■TX816 BRIEF DESCRIPTION

1. TX816 Configuration

The TX816 consists of an MIDI rack main frame and eight TF1 FM tone modules. The TF1 is similar to the DX7, excluding the keyboard. The TF1 rear panel is equipped with the MIDI IN and THRU jacks and an XLR balanced output connector. The MIDI rack main frame is equipped with a power supply unit, MIDI IN, OUT, and THRU jacks, and MIDI out slot selector. When the TF1 "INDIVIDUAL" LED is on, the TF1 receives an MIDI message through the TF1 rear panel MIDI IN. If the "COMMON" LED is on, the TF1 receives messages through the front panel MIDI IN. The MIDI OUT transmits a TF1 MIDI message with a number which is displayed on the OUT SLOT LED. The power supply unit is very similar to the one used in the DX1.

2. TF1 circuit

The TF1 MPU is HD6303X. This MPU contains Asynchronous Communications Interface Adapter (ACIA), I/O port, and RAM. The ACIA is used for MIDI message transmission/reception, and the I/O port is used for switch on/off detection and LED lighting. The FM tone generator LSIs (EGS and OPS) are the same as those used in the DX7.

2.1 MPU (HD6303X)

- Vcc and Vss
  Vcc represents a +5V supply voltage, and Vss represents a GND terminal.

- XTAL and EXTAL
  A 4 MHz crystal resonator is connected between these two terminals. The 4 MHz clock is divided by four and becomes a 1 MHz system clock.

- MP_0 and MP_1
  These terminals are used to set the MPU operation mode, that is, MP_0 = "High" and MP_1 = "Low".

- $\overline{RES}$
  This terminal is used to reset the MPU.

- $\overline{STBY}$
  This terminal is used to set the MPU in a standby mode. However, this is not used in this circuit, and its fixed to "High" logic level.

- $\overline{NMI}$
  This is a nonmaskable interrupt terminal. However, this is not used in this circuit, and its fixed to "High" logic level.

- Port 2
  The ports P_{20} through P_{27} are used for the following purposes in this circuit:
  P_{20} (out): MIDI IN INDIVIDUAL/COMMON changeover
  P_{21} (out): "INDIVIDUAL" LED lighting
  P_{22} (out): "COMMON" LED lighting
  P_{23} (in): MIDI message receiving
  P_{24} (out): MIDI message transmission
  P_{25} (out): "MEMORY PROTECT" LED lighting
  P_{26} (out): "PARAMETER CHANGE" LED lighting
  P_{27} (out): "ERROR" LED lighting

- Port 5
  Ports P_{50} through P_{57} are used for the following purposes in this circuit:
  - P_{50} (in): Battery voltage detection
  - P_{51} (in): MIDI OUT slot switching
  - P_{52} (in): This is a memory ready terminal to lengthen the E (enable) clock "High" period. This terminal is fixed to "High" logic level, so the E clock is a normal continuous clock.
  - P_{53} (in): This is a HALT terminal to stop execution of the command and open the bus. This terminal is fixed to "High", so the halt mechanism cannot be initiated.
  - P_{54} (in): This is fixed to "High" logic level because it is not used.
  - P_{55} (in): "INDIVIDUAL/COMMON" switch detection
  - P_{56} (in): "MEMORY PROTECT" switch detection
  - P_{57} (in): "SELECT" switch detection

- Port 6
  The ports P_{60} through P_{67} are connected to the HA17408 Digital to Analog Converter (IC10), which outputs the data for the level attendator and battery voltage comparator.

- Bus
  A_0 through A_{15} represent the address bus, and D_0 through D_7 represent the data bus.

- BA
  This is a bus available terminal will outputs "High" logic level when the MPU receives a $\overline{\text{HALT}}$ command and the buses become available. This terminal is not used in this circuit.

- $\overline{\text{LIR}}$
  This terminal indicates whether the command operation code is loaded in the data bus. This terminal is not used in this circuit.

- R/$\overline{\text{W}}$
  This outputs a "High" logic level when the MPU is in the read mode, and a "Low" logic level when the MPU is in the write mode.

- $\overline{\text{WR}}$
  This outputs a "Low" logic leve when the MPU is in the write mode.

- $\overline{\text{RD}}$
  This outputs a "Low" logic level when the MPU is in the read mode.

- E
  This is an enable terminal to output the system clock.

2.2 System reset

When power is on, IC20 (PST518) generates a system reset signal. Pin 12 (IC20) outputs a RES signal, and Pin 10 (IC20) outputs a $\overline{\text{RES}}$ signal. The $\overline{\text{RES}}$ signal is sent to the EGS, the battery backup circuit and the output muting circuit.

2.3 MIDI IN

The MIDI IN is provided with a rear panel INDIVIDUAL MIDI jack and a front panel COMMON MIDI jack. If the MIDI IN is switched to INDIVIDUAL with the INDIVIDUAL/COMMON switch, the MPU port P_{21} will be "Low" and LED 1 will light. Simultaneously, the MPU port P_{20} will be "Low" and the MIDI message which is input to the panel MIDI IN jack will be input to the MPU port P_{23}. If the MIDI IN is switched to COMMON, port P_{22} will be "Low" and LED 2 will light. And simultaneously port P_{20} will be "High" and the MIDI message is input from the panel MIDI IN jack to port P_{23}. The received MIDI message is written in the intra-MPU ACIA receive shift register.

2.4 MIDI OUT

If a "Low" logic level is input to the MPU port P_{51} with the panel OUT SLOT switch, the MIDI message which is read by the intra-MPU ACIA transmit shift register is output from port P_{24} and then sent to the front panel MIDI OUT jack.

2.5 Digital to analog (D/A) converter

MPU Port 6, 8 bits of data is converted into an analog current by the IC10, and into an analog voltage by the IC32. This analog voltage is generally used to drive the level attenuator photocoupler, but, in the case of the UTILITY mode, it is used for comparison with battery voltage so that the backup battery voltage can be displayed. The current through the photocoupler LED will then be reduced instantly. But this poses no problems with audibility, due to slow photocoupler response speed.

2.6 Address decoder and address map

The IC13 (74LS138 decoder) decodes higher order 5 bits of the address, and selects ROM or I/O ICs. The address map is listed below.

0000-001F: Intra-MPU register
0040-00FF: Intra-MPU RAM
4000-47FF: RAM 1 (IC5)
4800-4FFF: RAM 2 (IC6)
5000-57FF: RAM 3 (IC7)
5800-5FFF: RAM 4 (IC8)
6000-60FF: EGS (IC2)
6800-6801: OPS (IC3)

77FF: Display data latch (IC11)
7800: Display data latch (IC12)
C000-FFFF: ROM (IC4)

2.7 Tone generator

The intra-EGS registers are selected by addresses A0 through A7, and data to produce sound is written into each register. The EGS terminals E1 through E12 send envelope data to the OPS, and the F1 through F14 terminals send frequency data to the OPS. Data which is output from the OPS terminals DA1 through DA12 is converted into an analog current by the D/A converter, and into an analog voltage by IC24. The intra-OPS output register consists of 16 bits. However, because a 12-bit D/A converter is used, the OPS outputs shifted 12-bit data in case of a lower level.

This means that lower level bits are expanded and output from the IC24. Then IC26 returns the expanded level to the original level by switching to different points of the resistive ladder. The output of IC25 does not form a complete waveform. This waveform is divided into two parts by the IC27 and IC28 to be sampled and held, and then mixed by IC30 to form a stair step waveform. This waveform then passes through the low pass filter to form a complete analog signal. This analog signal is output from the XLR connector, through the photo-coupler level attenuator and electronic balanced circuit.

3. MIDI rack main frame circuit

The MIDI rack main frame cireuitry consists of the MIDI out slot switching circuit, clock generator and power supply.

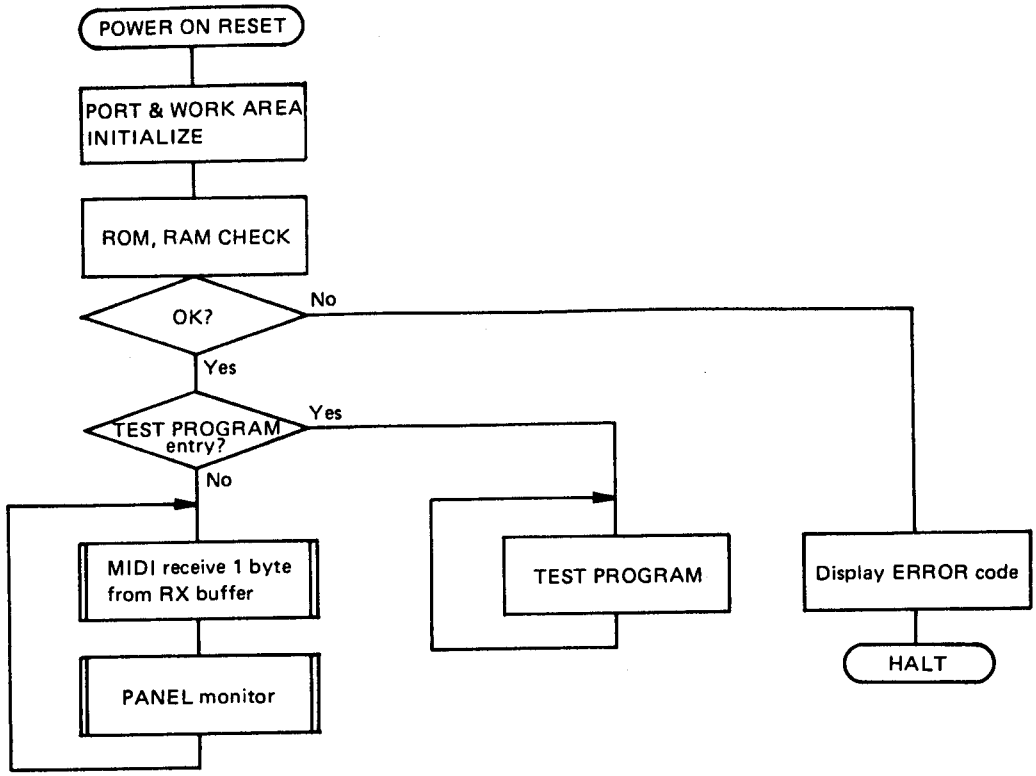
3.1 Out slot switching circuit

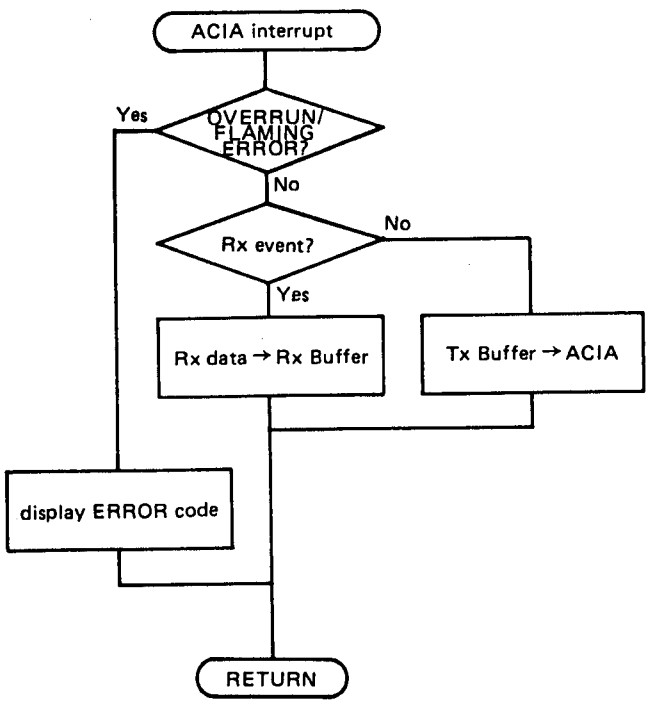
Pressing the +1 switch (main frame front panel) increments the count data of IC1 (74LS293 counter) IC2 (74LS138 decoder) decodes this data to select one of the eight TF1 MIDI OUTs. This data is then added with "1" by IC3 (74LS283 adder), decoded and driven by IC4 (74LS247 7 segment decoder/driver), and displayed on the LED.

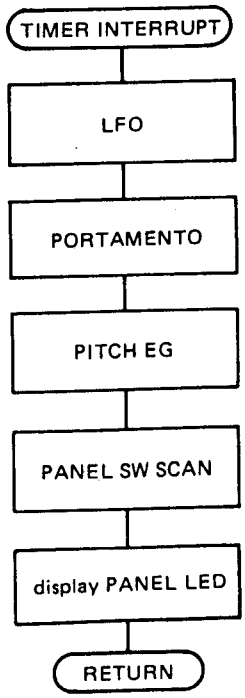
3.2 Clock generator

The CB circuit board provides with a 9.4265 MHz clock generator. The TX816 divides the 9.4265 MHz clock by two, which is then used by the EGS and OPS as $\phi 1$ and $\phi 2$ clock sources.

■TX816 FLOW CHART



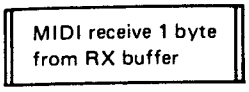




The fundamental structure of the TX816 is exactly the same as DX7.

1. Main routine

Data stored in the receive buffer is fetched and interpreted one byte at a time through the ACIA interrupt routine. When the message is complete, an operation which corresponds to it is executed.



The panel switch event which is detected by the timer interrupt routine changes the mode/submode and executes the job.

Note: An initial ROM/RAM chack is performed every time the unit is turned on and it is part of the main routine.

2. ACIA interrupt routine

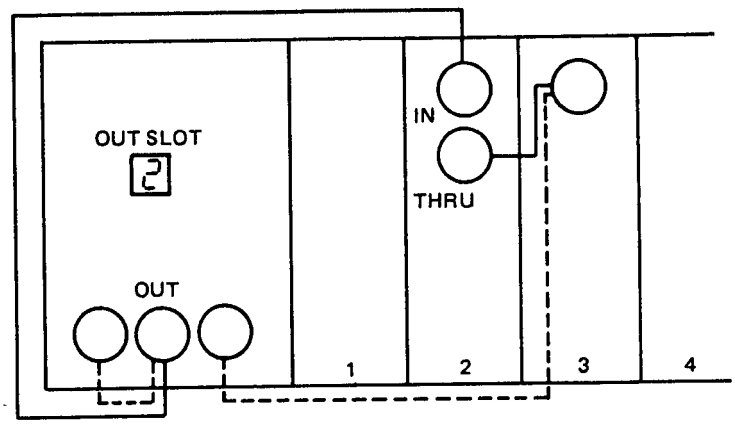
When one byte of data is received in the ACIA, the ACIA interrupt is generated, and this routine is initiated. Data is read from the ACIA, and is stored temporarily in the receive buffer.

3. Timer interrupt routine

- Realtime sound source control --- Calculates data such as LFO, PORTAMENTO, and PITCH EG, which vary from moment to moment, and loads it to the sound source.
- Panel switch scan --- Scans the panel switches at a fixed interval, and performs auto-repeat processing.
- Panel LED drive --- Performs LED lighting, time sharing display, and blinking.
  This routine is activated by the built-in timer every 2.6 sec.

■TEST PROGRAM

1) To enter the test program, the three TF1 panel switches must be depressed and held down during power-up. The display reads [F 1] indicating test entry. To exit the test program, turn the Power off.
   Check whether the common panel out-slot is set to 1.
2) Depress the YES/+1 switch and program will advance to the first test.
3) Use the YES/+1 switch to increment to the next test. Use the NO/–1 switch to decrement back to the previous test.
4) TEST 1 Output level and pitch check
   When you enter this test, the display reads [1 1].
   During Test 1 the module (TF1) under test outputs a 440.1 Hz ± 0.1 Hz sine wave which has an output level of –4 dBm ± 3 dBm.
5) TEST 2 LED lighting test
   The LED indicators and numeral LED segments light successively.
6) TEST 3 RAM read/write test
   When you enter this test, the display leads [F 3].
   When this test is conducted, the internal memory data is not erased.
   OK: The green indicator (paramenter change LED) lights.
   Error: The red indicator (error LED) lights, and the error number is displayed on the LED display.
7) TEST 4 Auto-scaling
   When you enter this test the display reads [F 4].
   Scaling C_1 through C_6 is repeated. At the same time, a voice message is output from the MIDI OUT in a pitch higher by 2 notes. Check the input/output function of the MIDI signal.
   The signal is output on the MIDI OUT only when the OUT SLOT number is set to the appropriate TF1 module.



—— SLOT 2 test ---- COMMON test

The COMMON/INDIVIDUAL LED indicator of the module which receives the channel voice message flashes. COMMON/INDIVIDUAL can be switched by the SELECT button.

8) TEST 5 Photocoupler
   When you enter this test the display reads [F 5].
   Check whether the level can be changed by the SELECT button as listed in the following table.

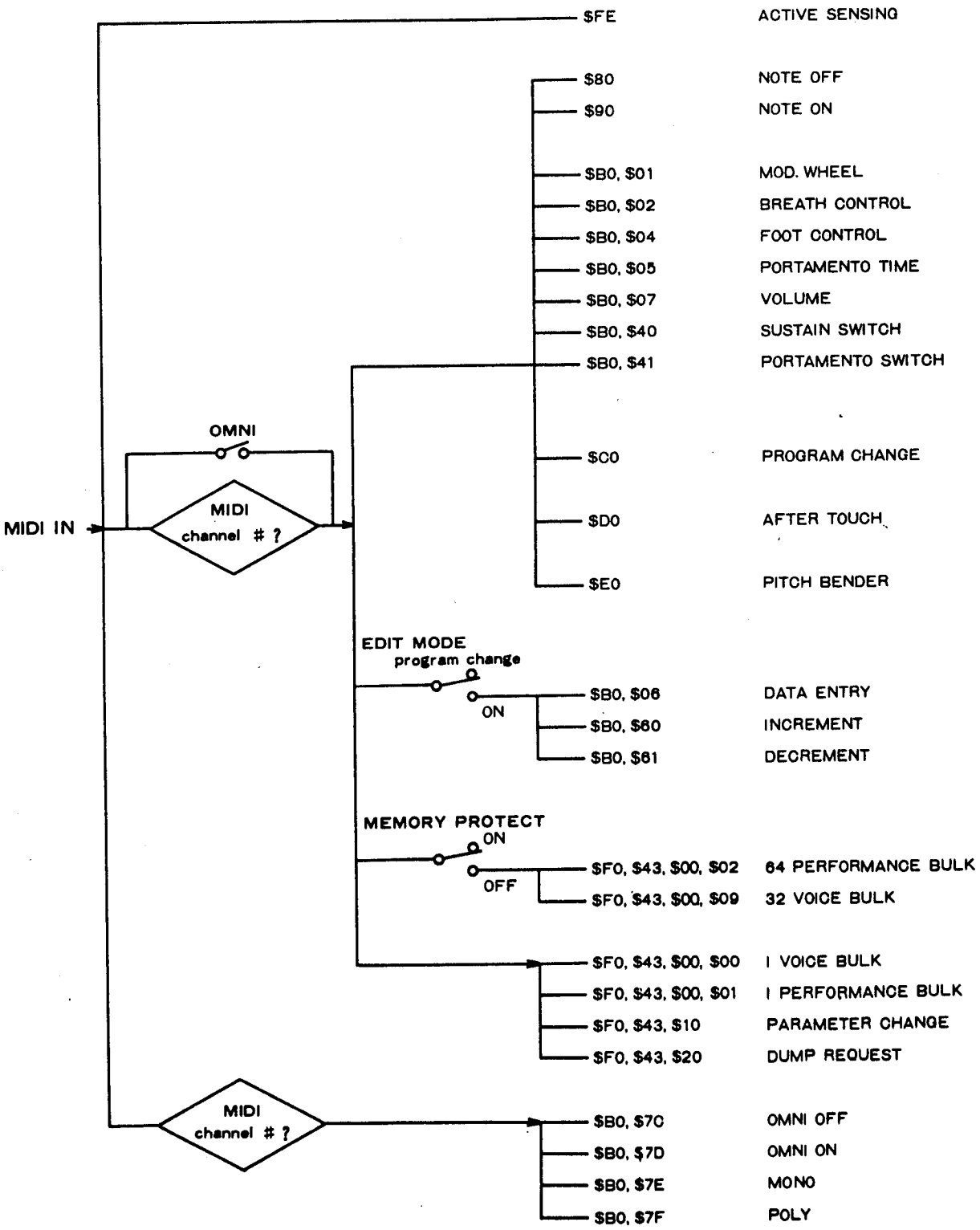
OUTPUT LEVEL ATTENUATE	L7	L6	L5	L4	L3	L2	L1	L0
Output Level (dBm)	–4 ± 2	(–9)	(–14)	(–20)	(–26)	(–34)	(–41)	–48 ± 8

Reference values indicated in parentheses

■TX816 MIDI DATA FORMAT

1.-RECEPTION CONDITIONS

This chart shows the all the reception signals that can be received by the TF1. All byte numbers are expressed in hexadecimal form.



2. RECEPTION DATA

NOTE: The meaning of letters used in byte numbers will only be given once, to save repetition. For example, the letter n in byte number 1000nnnn (Key Off Status) means MIDI channel number and will mean the same when it appears in all other byte numbers.

2-1. Reception Channel and Omni

When the TF1 is in the Play mode, you can use the keys on the front panel to set the MIDI input channel (from 1 to 16) and switch the Omni function on or off. The Omni function permits the TF1 to receive MIDI signals on all of the 16 channels. The MIDI channel and Omni settings are memorized by the TF1, and will not change even if the power is turned off.

2-2. Channel Voice Message

When MIDI channel voice messages are received, either the INDIVIDUAL or the COMMON LED will rapidly turn off then on, depending on whether the signal is input at the COMMON or INDIVIDUAL MIDI IN terminal.

2-2-1. Key Off

Status	1000nnnn n = MIDI channel number
Note Number	0kkkkkkk k= 0 (note C-2) to 127 (note G8)
Key Velocity	0vvvvvvv v:ignore

2-2-2. Key On/OFF

Status	1001nnnn
Note Number	0kkkkkkk k= 0 (note C-2) to 127 (note G8)
Key Velocity	0vvvvvvv v= 0 (key off) v= 1 - 127 (key on)

2-2-3. Control Change

Status	1011nnnn
Control Number	0ccccccc C= 0 - 127
Control Value	0vvvvvvv v= 0 - 127

(a) Control Numbers For Fixed Input

C = 1	Modulation Wheel	v = 0 - 127
C = 2	Breath Control	v = 0 - 127
C = 3	Foot Control	v = 0 - 127
C = 5	Portamento	v = 0 - 127
C = 7	Volume	v = 0 - 127
C = 64	Sustain Switch	v = 0, 127
C = 65	Portamento Switch	v = 0, 127

(b) Control Numbers For Front Panel Settings

These control numbers apply to the following sub-modes only: Tune Master Pitch (Play mode), Select Program Number For Edit, and Attenuate Output Level (Edit mode).

A: Tune Master Pitch
B: Select Program Number for Edit
C: Attenuate Output Level

			A	B	C
c=6	Data Entry	v=0-127	yes	yes	yes
c=96	Increment	v:neglect	yes	yes	no
c=97	Decrement	v:neglect	yes	yes	no

In the Select Program sub-mode you can alter voice or function parameters selected with Parameter Change in system exclusive..

2-2-4. Program Change

Status	1100nnnn
Program Number	0ppppppp Ignore the first two bits. Select 1 to 32.

2-2-5. After Touch

Status	1101nnnn
Pressure	0vvvvvvv

2-2-6. Pitch Bend

Status	1110nnnn	
Value (LSB)	0uuuuuuu	
Value (MSB)	0vvvvvvv	8 bits resolution. MS 8 bits are recognized.

2-3. Channel Mode Message

Status	1101nnnn	
	0ccccccc	
	0vvvvvvv	

C = 124	V=0	Omni Mode OFF/ALL NOTES OFF
C = 125	V=0	Omni Mode OFF/ALL NOTES OFF
C = 126	V=0	Mono Mode OFF/ALL NOTES OFF
C = 127	V=0	Poly Mode OFF/ALL NOTES OFF

Omni status (ON/OFF) is controlled on the front panel (in the Omni ON/OFF sub-mode) and has final priority. Changes in mode are accompanied by a compulsory voice dump and cleaning of the Key Assigner.

2-4. System Real Time Message

Status	11111110	Active Sensing

When this code is received, sensing begins. If neither status nor data is received over an interval of 300 mS, the TF1 will stop sensing after first dumping all voices and clearing the Key Assigner.

2-5. System Exclusive Message

2-5-1. Bulk Dump
(i) 1 Voice Bulk Data

Status	11110000	
I.D.	01000011	
Sub-status/Ch.	0000nnnn	
Format Number	00000000	
Byte Count	00000001	
Byte Count	00011011	
Data	0ddddddd	
	⋮	155 bytes of voice data sent d=0 to 127
	0ddddddd	
Check Sum	0eeeeeee	
EOX	11110111	

This format is for the input of the data of a single voice. The green Parameter Change LED flashes when data is received. The 155 bytes of voice data go into the Edit buffer, replacing any existing data there.

(ii) 1 Performance Bulk Data

Status	11110000	
I.D.	01000011	
Sub-status/Ch.	0000nnnn	
Format Number	00000001	
Byte Count	00000000	
Byte Count	01011110	
Data	0ddddddd	
	⋮	94 bytes of function data sent
	0ddddddd	
Check Sum	0eeeeeee	
EOX	11110111	

This format is for the input of the function data of a single voice. The green Parameter Change LED flashes when data is received. Out of the 94 bytes sent, only the data corresponding to the TF1 goes into the Edit Buffer, altering the function data of any voice currently in the Edit Buffer.

(iii) 64 Performance Bulk Data

Status	11110000	
I.D.	01000011	
Sub-status/Ch.	0000nnnn	
Format Number	00000010	
Byte Count	00100000	
Byte Count	00000000	
Data	0ddddddd	
	⋮	4096 bytes of data sent

	0ddddddd
Check Sum	0eeeeeee
EOX	11110111

This format is for loading function data in to the TF1 Memory. It can only be input when the Memory Protect is OFF. When data. is input, the Memory Protect LED will light for about 2 seconds. Only the first 32 of the 64 batches of data are function data, and they are loaded in order into the function memories of program destinations 1 thru 32.

(iv) 32 Voice Bulk Data

Status	11110000
I.D.	01000011
Sub-status/Ch.	0000nnnn
Format Number	00001001
Byte Count	00100000
Byte Count	00000000
Data	0ddddddd
	⋮ 4096 bytes of data sent
	0ddddddd
Check Sum	0eeeeeee
EOX	11110111

This format is for loading voice data only into the TF1 memory. It can only be input when the Memory Protect is OFF. When data is input, the Memory Protect LED will light for about 2 seconds. The voice data for all 32 progams will be changed.

2-5-2. Parameter Change

Status	11110000	
I.D.	01000011	
Sub-status/Ch.	0001nnnn	
Parameter Group Number	ogggggghh	g = 0, 1, 2, 3
Parameter No.	0ppppppp	p = 0 - 127
EOX	11110111	

The green Parameter Change LED will flash when data is received, and voice or function data in the Edit Buffer will be changed.

2-5-3. Dump Request

Status	11110000
I.D.	01000011
Sub-status/Ch.	0010nnnn
Format Number	0ffffffff
	f = 0, 1, 2, 9, 125
EOX	11110111

The corresponding bulk data will be dumped through the MIDI OUT terminal.

3. OUTPUT DATA

Data is only output when a dump request signal is received from an external source or by direct panel switching. Since the only output is the COMMON MIDI OUT terminal, you must select the OUTPUT SLOT number corresponding to the number of the module from which you are outputting data. Data is always sent via MIDI channel 1 and consists of voice and function data in System Exclusive.

3-1. Output Conditions

(a) Output for Dump Request

The following five kinds of data dump can be done, according to the selected format number ().

f = 0 1 Voice Bulk Data
Outputs voice data in the Edit Buffer
f = 1 1 Performance Bulk Data
Outputs function data in the Edit Buffer
f = 2 64 Performance Bulk Data
Outputs all function data from programs 1 thru 32 in order.
f = 9 32 Voice Bulk data
Outputs all voice data from programs 1 thru 32

(Formatting for the above is the same as for input).

f = 125 Condition Acknowledge

Status	11110000
I.D.	01000011
Sub-status/Ch.	00000000
Format Number	01111101
Byte Count	00000000
Byte Count	00010000
Data	0ddddddd
	⋮
	0ddddddd
Check Sum	0eeeeeee
EOX	11110111

(b) Output in the Program Change sub-mode

When you select a program using the front panel keys, the corresponding voice and function data will be output in the following order:

1. 1 Performance Bulk Data
2. 1 Voice Bulk Data

(c) Output in the Dump sub-mode

Data is output in the following order when you press the "YES" key (SW1):

1. 32 Voice Bulk Data
2. 64 Performance Bulk Data

4. SYSTEM EXCLUSIVE DATA FORMAT

4-1. DX7 Voice Parameter Change (g=0)

Sub-group Number h	Parameter Number p	Parameter	Data	Notes
0	0	OP6 EG RATE 1	0 ~ 99	
	1	OP6 EG RATE 2	0 ~ 99	
	2	OP6 EG RATE 3	0 ~ 99	
	3	OP6 EG RATE 4	0 ~ 99	
	4	OP6 EG LEVEL 1	0 ~ 99	
	5	OP6 EG LEVEL 2	0 ~ 99	
	6	OP6 EG LEVEL 3	0 ~ 99	
	7	OP6 EG LEVEL 4	0 ~ 99	
	8	OP6 KEYBOARD LEVEL SCALING BREAK POINT	0 ~ 99	* 1
	9	OP6 KEYBOARD LEVEL SCALING LEFT DEPTH	0 ~ 99	
	10	OP6 KEYBOARD LEVEL SCALING RIGHT DEPTH	0 ~ 99	
	11	OP6 KEYBOARD LEVEL SCALING LEFT CURVE	0 ~ 3	* 2
	12	OP6 KEYBOARD LEVEL SCALING RIGHT CURVE	0 ~ 3	* 2
	13	OP6 KEYBOARD RATE SCALING	0 ~ 7	
	14	OP6 AMPLITUDE MODULATION SENSITIVITY	0 ~ 3	
	15	OP6 KEY VELOCITY SENSITIVITY	0 ~ 7	
	16	OP6 OPERATOR OUTPUT LEVEL	0 ~ 99	
	17	OP6 OSCILLATOR MODE	0 ~ 1	* 3
	18	OP6 OSCILLATOR FREQUENCY COARSE	0 ~ 31	* 4
	19	OP6 OSCILLATOR FREQUENCY FINE	0 ~ 99	* 4
	20	OP6 OSCILLATOR DETUNE	0 ~ 14	* 5
	21 ~ 41	OP5		
	42 ~ 62	OP4		
	63 ~ 83	OP3		
	84 ~ 104	OP2		
	105 ~ 125	OP1		
1	126	PITCH EG RATE 1	0 ~ 99	
	127	PITCH EG RATE 2	0 ~ 99	
	0 (128)	PITCH EG RATE 3	0 ~ 99	
	1 (129)	PITCH EG RATE 4	0 ~ 99	
	2 (130)	PITCH EG LEVEL 1	0 ~ 99	
	3 (131)	PITCH EG LEVEL 2	0 ~ 99	
	4 (132)	PITCH EG LEVEL 3	0 ~ 99	
	5 (133)	PITCH EG LEVEL 4	0 ~ 99	
	6 (134)	ALGORITHM SELECT	0 ~ 31	
	7 (135)	FEEDBACK	0 ~ 7	
	8 (136)	OSCILLATOR KEY SYNC	0 ~ 1	
	9 (137)	LFO SPEED	0 ~ 99	
	10 (138)	LFO DELAY	0 ~ 99	
	11 (139)	LFO PITCH MODULATION DEPTH	0 ~ 99	
	12 (140)	LFO AMPLITUDE MODULATION DEPTH	0 ~ 99	
	13 (141)	LFO KEY SYNC	0 ~ 1	
	14 (142)	LFO WAVE	0 ~ 5	* 6
	15 (143)	LFO PITCH MODULATION SENSITIVITY	0 ~ 7	
	16 (144)	TRANSPOSE	0 ~ 48	Concert pitch at 24
	17 (145)	VOICE NAME 1	ASCII	
	↓ ↓	↓	↓	
	26 (154)	VOICE NAME 10	ASCII	
1	27 (155)	OPERATOR ON/OFF	xeeeeee	* 7
	28 (156)	OPERATOR SELECT	0 ~ 5	* 8

*1 BREAK POINT

BREAK POINT	0	1	2	3	4	5	15	27	39	51	63	75	87	99
MIDI NOTE #	21	22	23	24	25	26	36	48	60	72	84	96	108	120
NOTE	A -1	A -1 #	B -1	C0	C0 #	D0	C1	C2	C3	C4	C5	C6	C7	C8

*2 KEYBOARD LEVEL SCALING CURVE

	0	1	2	3
CURVE	−LIN	−EXP	+EXP	+LIN

*3 OSCILLATOR MODE

* 0 *·····frequency ratio

* 1 *·····fixed frequency

*4 FREQUENCY COARSE/FINE

i) For Frequency Ratio

When FINE=0

COARSE	0	1	2	3	10	30	31
FREQUENCY RATIO	0.5	1	2	3	10	30	31

When Coarse=1

FINE	0	1	2	3	10	50	99
FREQUENCY RATIO	1.00	1.01	1.02	1.03	1.10	1.50	1.99

ii) For Fixed Frequency

When FINE=0

COARSE	0	1	2	3	4	5	6	7		31
FREQUENCY(Hz)	1	10	100	1000	1	10	100	1000		1000

When COARSE=0

FINE	0	1	2	3	4	5	10	20	50	99
FREQUENCY(Hz)	1.000	1.023	1.047	1.072	1.096	1.122	1.259	1.585	3.162	9.772

*5 DETUNE

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
DETUNE	−7	−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6	7

*6 LFO WAVE

	0	1	2	3	4	5
WAVE	TRIANGLE	SAW DOWN	SAW UP	SQUARE	SINE	SAMPLE/HOLD

*7 OPERATOR ON/OFF

Bit	b 5	b 4	b 3	b 2	b 1	b 0
OP	OP1	OP2	OP3	OP4	OP5	OP6

Bit Map

* 0 *···OFF * 1 *···ON

*8 OPERATOR SELECT

	0	1	2	3	4	5
OPERATOR	OP6	OP5	OP4	OP3	OP2	OP1

4-2. DX Performance Parameter Change (g=1) (h=0)

Parameter Number p	Parameter	Data	Notes
0			
1	SOURCE SELECT	1 ~ 16	※3
2	POLY/MONO	0 ~ 1	
3	PITCH BEND RANGE	0 ~ 12	
4	PITCH BEND STEP	0 ~ 12	
5	PORTAMENTO TIME	0 ~ 99	
6	PORTAMENTO/GLISSANDO	0 ~ 1	
7	PORTAMENTO MODE	0 ~ 1	※1
8			
9	MODULATION WHEEL SENSITIVITY	0 ~ 15	
10	MODULATION WHEEL ASSIGN	0 ~ 7	※2
11	FOOT CONTROLLER SENSITIVITY	0 ~ 15	
12	FOOT CONTROLLER ASSIGN	0 ~ 7	※2
13	AFTER TOUCH SENSITIVITY	0 ~ 15	
14	AFTER TOUCH ASSIGN	0 ~ 7	※2
15	BREATH CONTROLLER SENSITIVITY	0 ~ 15	
16	BREATH CONTROLLER ASSIGN	0 ~ 7	※2
17			
18			
19			
20			
21			
22			
23			
24			
25			
26	AUDIO OUTPUT LEVEL ATTENUATOR	0 ~ 7	
27			
28			
29			
30			
31			
32			
33			
34			
↓			
63			Concert Pitch at 64
64	MASTER TUNING	0 ~ 127	

※1 PORTAMENTO MODE

* 0 *···sustain-key pitch retain
* 1 *···sustain-key pitch follow

※2 EFFECT ASSIGN

Bit	b_2	b_1	b_0
ASSIGN	EG BIAS	AMPLITUDE	PITCH

※3 SOURCE SELECT

Selects MIDI receive channel 1 to 16

4-3. Function Parameter Change (g=2) (h=0)

Parameter Number p	Parameter	Data	Notes
64	POLY/MONO	0 ~ 1	
65	PITCH BEND RANGE	0 ~ 12	
66	PITCH BEND STEP	0 ~ 12	
67	PORTAMENTO MODE	0 ~ 1	
68	PORTAMENTO/GLISSANDO	0 ~ 1	
69	PORTAMENTO TIME	0 ~ 99	
70	MODULATION WHEEL SENSITIVITY	0 ~ 99	※1
71	MODULATION WHEEL ASSIGN	0 ~ 7	
72	FOOT CONTROLLER SENSITIVITY	0 ~ 99	※1
73	FOOT CONTROLLER ASSIGN	0 ~ 7	
74	BREATH CONTROLLER SENSITIVITY	0 ~ 99	※1
75	BREATH CONTROLLER ASSIGN	0 ~ 7	
76	AFTER TOUCH SENSITIVITY	0 ~ 99	※1
77	AFTER TOUCH ASSIGN	0 ~ 7	

※1 EFFECT SENSITIVITY

Data received over a range of 0-99 is in the memory on a scale of 0-15

4-4. DX9 Function Parameter Change (g=3) (h=0)

Parameter Number p	Parameter	Data	Notes
64			
65	MASTER TUNE	0 ~ 127	
66	POLY/MONO	0 ~ 1	
67	PITCH BEND RANGE	0 ~ 12	
68	PORTAMENTO MODE	0 ~ 1	
69	PORTAMENTO TIME	0 ~ 99	
70	MODULATION WHEEL SENSITIVITY	0 ~ 99	※1
71	MODULATION WHEEL ASSIGN : PITCH	0 ~ 1	
72	MODULATION WHEEL ASSIGN : AMPLITUDE	0 ~ 1	
73	MODULATION WHEEL ASSIGN : EG BIAS	0 ~ 1	
74	BREATH CONTROLLER SENSITIVITY	0 ~ 99	※1
75	BREATH CONTROLLER ASSIGN : PITCH	0 ~ 1	
76	BREATH CONTROLLER ASSIGN : AMPLITUDE	0 ~ 1	
77	BREATH CONTROLLER ASSIGN : EG BIAS	0 ~ 1	

4-5. TX Function Parameter Change (g=4) (h=1)

Parameter Number p	Parameter		Data	Notes
0				
1				
2				
3				
4				
5	NOTE LIMIT LOW		0 ~ 127	
6	NOTE LIMIT HIGH		0 ~ 127	
7	TF1 MEMORY PROTECT OFF/ON		0, 127	
8	TF1 TEST PROGRAM ENTRY	FOR	127	
9	TF1 MIDI IN INDIVIDUAL	FACTORY TEST	127	
10	TF1 MIDI IN COMMON		127	

4-6. 1 Voice Bulk Data

155 bytes of data. The arrangement of this data is the same as in diagram 4-1, parameters 0 thru 154.

4-7. 1 Performance Bulk Data (f=1)

Address	Parameter	Data	Notes
0			
1			
2	VOICE A POLY/MONO	0 ~ 1	
3	VOICE A PITCH BEND RANGE	0 ~ 12	
4	VOICE A PITCH BEND STEP	0 ~ 12	
5	VOICE A PORTAMENTO TIME	0 ~ 99	
6	VOICE A PORTAMENTO/GLISSANDO	0 ~ 1	
7	VOICE A PORTAMENTO MODE	0 ~ 1	
8			
9	VOICE A MODULATION WHEEL SENSITIVITY	0 ~ 15	
10	VOICE A MODULATION WHEEL ASSIGN	0 ~ 7	
11	VOICE A FOOT CONTROLLER SENSITIVITY	0 ~ 15	
12	VOICE A FOOT CONTROLLER ASSIGN	0 ~ 7	
13	VOICE A AFTER TOUCH SENSITIVITY	0 ~ 15	
14	VOICE A AFTER TOUCH ASSIGN	0 ~ 7	
15	VOICE A BREATH CONTROLLER SENSITIVITY	0 ~ 15	
16	VOICE A BREATH CONTROLLER ASSIGN	0 ~ 7	
17			
18			
19			
20			
21			
22			
23			
24			
25			
26	VOICE A AUDIO OUTPUT LEVEL ATTENUATOR	0 ~ 7	
27			
28			
29			
30			
↓	VOICE B		
59			
60			
61	VOICE MEMORY SELECT FLAG	0 ~ 1	
62			
63			
64	PERFORMANCE NAME 1	ASCII	
65	PERFORMANCE NAME 2	ASCII	
↓	↓	ASCII	
92	PERFORMANCE NAME 29	ASCII	
93	PERFORMANCE NAME 30	ASCII	

4-8. 64 Performance Bulk Data (f=2)

Data are listed in order for the 64 performances in units of 64 bytes (64 per performance). The TF1 uses the first 32 performances.

Address	6	5	4	3	2	1	0	Parameter	Data	Parameter	Data
0	P/M							VOICE A POLY/MONO	0 ~ 1		
1	PBS(LO)			PBR				VOICE A P. BEND STEP	0 ~ 12	PITCH BEND RANGE	0 ~ 12
2	PTIM							VOICE A PORTA. TIME	0 ~ 99		
3						M	GL	VOICE A PORTA. MODE	0 ~ 1	PORTAMENTO/GLISSANDO	0 ~ 1
4	MWA			MWS				VOICE A MOD. WHEEL ASN.	0 ~ 7	MOD. WHEEL SENS.	0 ~ 15
5	FCA			FCS				VOICE A FOOT CONT. ASN.	0 ~ 7	FOOT CONT. SENS.	0 ~ 15
6	ATA			ATS				VOICE A AFTER TOUCH ASN.	0 ~ 7	AFTER TOUCH SENS.	0 ~ 15
7	BCA			BCS				VOICE A BREATH CON ASN.	0 ~ 7	BREATH CON. SENS.	0 ~ 15
8											
9											
10											
11											
12											
13											
14							ATN	VOICE A ATTENUATION	0 ~ 7		
15	PBS (HI)							VOICE A PITCH B. STEP	(MSB)		
16											
↓	VOICE B										
31											
32						VMS	KMOD	VOICE MEMORY SELECT	0 ~ 1	KEY ASSIGN MODE	0 ~ 2
33											
34	PNAM 1							PERFORMANCE NAME 1	ASCII		
↓	↓							↓ ↓	ASCII		
63	PNAM 30							PERFORMANCE NAME30	ASCII		
	6	5	4	3	2	1	0				

With the Key Assign in Single mode(KMOD=0) Voice B are loaded with VMS.

4-9. 32 Voice Bulk Data (f=9)

Data are listed in order for the 32 programs in units of 128 bytes.

Address	6 5 4 3 2 1 0	Parameter	Data	Parameter	Data
0	R 1	OP6 EG RATE1	0 ~ 99		
1	R 2	OP6 EG RATE2	0 ~ 99		
2	R 3	OP6 EG RATE3	0 ~ 99		
3	R 4	OP6 EG RATE4	0 ~ 99		
4	L 1	OP6 EG LEVEL 1	0 ~ 99		
5	L 2	OP6 EG LEVEL 2	0 ~ 99		
6	L 3	OP6 EG LEVEL 3	0 ~ 99		
7	L 4	OP6 EG LEVEL 4	0 ~ 99		
8	B P	SCALING BREAK P.	0 ~ 99		
9	L D	SCALING LEFT DEPTH	0 ~ 99		
10	R D	SCALING RIGHT DEPTH	0 ~ 99		
11	RC LC	SCALING RIGHT CURVE	0 ~ 3	LEFT CURVE	0 ~ 3
12	PD RS	OSCILLATOR DETUNE	0 ~ 14	RATE SCALING	0 ~ 7
13	KVS AMS	KEY VELOCITY SENS.	0 ~ 7	AMPLITUDE MOD. SENS.	0 ~ 3
14	O L	OUTPUT LEVEL	0 ~ 99		
15	F C M	FREQUENCY COARSE	0 ~ 31	OSCILLATOR MODE	0 ~ 1
16	F F	FREQUENCY FINE	0 ~ 99		
17 ~ 33	O P 5				
34 ~ 50	O P 4				
51 ~ 67	O P 3				
68 ~ 84	O P 2				
85 ~ 101	O P 1				
102	P R 1	PITCH EG RATE 1	0 ~ 99		
103	P R 2	PITCH EG RATE 2	0 ~ 99		
104	P R 3	PITCH EG RATE 3	0 ~ 99		
105	P R 4	PITCH EG RATE 4	0 ~ 99		
106	P L 1	PITCH EG LEVEL 1	0 ~ 99		
107	P L 2	PITCH EG LEVEL 2	0 ~ 99		
108	P L 3	PITCH EG LEVEL 3	0 ~ 99		
109	P L 4	PITCH EG LEVEL 4	0 ~ 99		
110	ALS	ALGORITHM SELECT	0 ~ 31		
111	OKS FB	OSCILLATOR KEY SYNC	0 ~ 1	FEEDBACK	0 ~ 7
112	L F S	LFO SPEED	0 ~ 99		
113	L F D	LFO DELAY	0 ~ 99		
114	L P M D	LFO PITCH MOD DEPTH	0 ~ 99		
115	L A M D	LFO AMP MOD DEPTH	0 ~ 99	WAVE	0 ~ 5
116	LPMS LFW LFKS	LFO PITCH MOD SENS.	0 ~ 7	KEY SYNC	0 ~ 1
117	T R N P	TRANSPOSE	0 ~ 48		
118	V N A M 1	VOICE NAME 1	ASCII		
119	V N A M 2	VOICE NAME 2	ASCII		
120	V N A M 3	VOICE NAME 3	ASCII		
121	V N A M 4	VOICE NAME 4	ASCII		
122	V N A M 5	VOICE NAME 5	ASCII		
123	V N A M 6	VOICE NAME 6	ASCII		
124	V N A M 7	VOICE NAME 7	ASCII		
125	V N A M 8	VOICE NAME 8	ASCII		
126	V N A M 9	VOICE NAME 9	ASCII		
127	V N A M 10	VOICE NAME 10	ASCII		
	6 5 4 3 2 1 0				

4-10. Condition Acknowledge (f = 126)

Address	Parameter	Data	Notes
0	CLASSIFICATION ASCII 'L'	$4C	
1	CLASSIFICATION ASCII 'M'	$4D	
2	CLASSIFICATION ASCII '␣'	$20	
3	CLASSIFICATION ASCII '␣'	$20	
4	MODEL NAME ASCII '8'	$38	
5	MODEL NAME ASCII '9'	$39	
6	MODEL NAME ASCII '5'	$35	
7	MODEL NAME ASCII '0'	$30	
8	MODEL NAME ASCII '␣'	$20	
9	MODEL NAME ASCII '␣'	$20	
10	SOFTWARE VERSION #	V	
11	SOFTWARE REVISION #	R	
12	CONDITION DATA 1 ✱1		
13	CONDITION DATA 2 RECEIVE CH	0 ~ 15	
14	CONDITION DATA 3 BATTERY VOLT		1 unit=
15	CONDITION DATA 4	0	0.1 volts

✱1: Bit Arrangement

bit	Parameter	Data	Notes
b0	PERFORMANCE ECHO BACK MODE	0	
b1	COMPUTER COMMUNICATION MODE	1	
b2	VOLUME CONTROL BY DATA ENTRY LEVER	0	
b3	CONTROL CHANGE RECEIVE	1	
b4	OMNI MODE	0 / 1	
b5	MEMORY PROTECT	0 / 1	
b6	DATA ENTRY RECEIVE	0 / 1	✱2

✱2: "1" for Program Change sub-mode only; "0" at all other times.

[FM tone generator] Date : 6/16, 1983

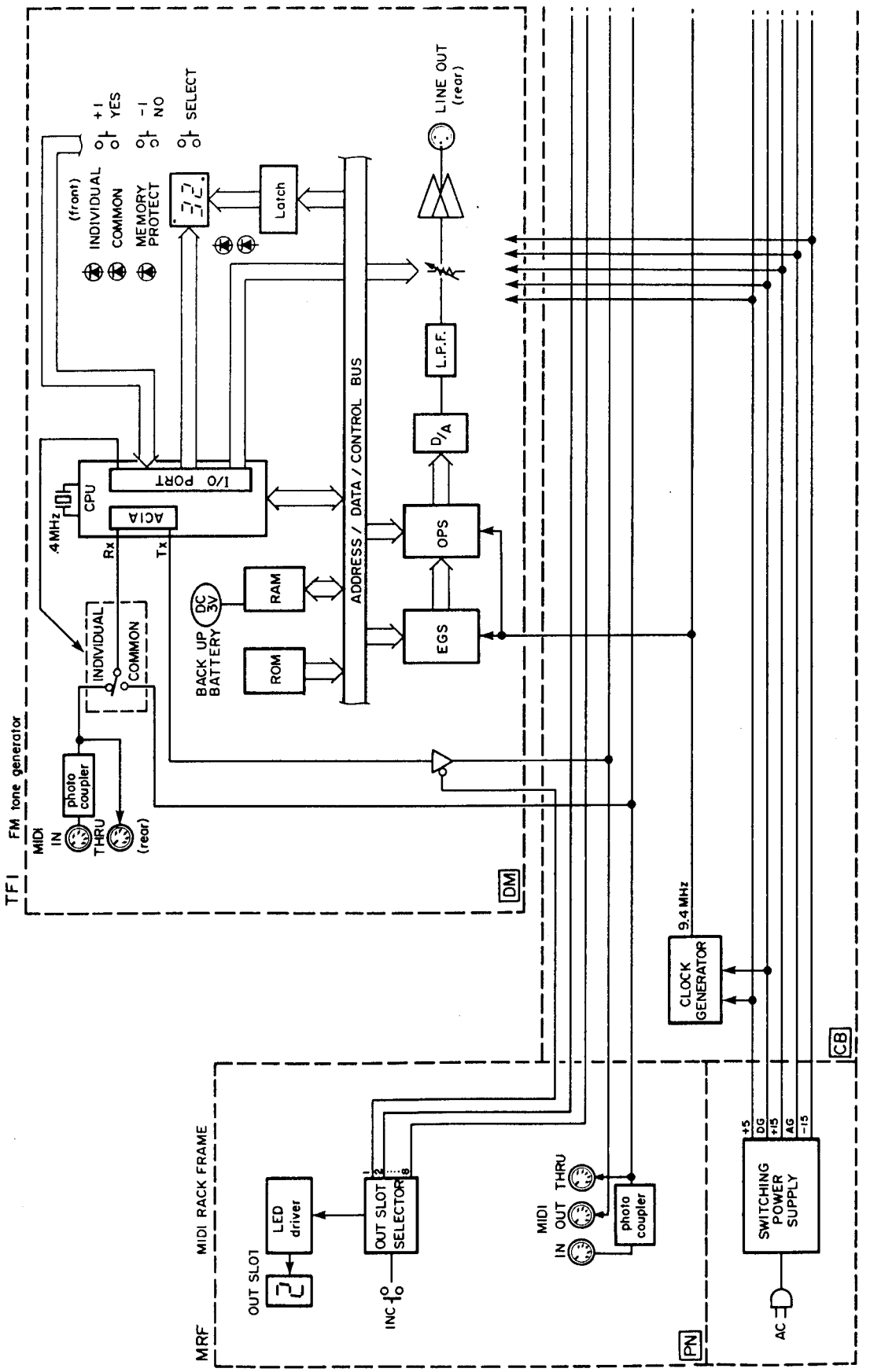
Model TF1 MIDI Implementation Chart Version : 0.1

Function ...		Transmitted	Recognized	Remarks
Basic	Default	x	1 - 16 *	* memorized
Channel	Changed	x	1 - 16 *	
Mode	Default	x	1,2,3,4 *	
	Messages	x	POLY,MONO(M=1)	
			OMNIon,OMNIoff	not altered
Note Number		x	0 - 127	
	True voice	**********	0 - 127	
Velocity	Note ON	x	o	
	Note OFF	x	x	
After Touch	Key's	x	x	
	Ch's	x	o	
Pitch Bender		x	o	
Control Change	1	x	o	Modulation wheel
	2	x	o	Breath control
	4	x	o	Foot controller
	5	x	o	Portamento time
	6	x	o	Data entry knob
	7	x	o	Volume
	64	x	o	Sustain foot sw
	65	x	o	Portamento f sw
	96	x	o	Data entry +1
	97	x	o	Data entry -1
Prog Change		x	o 0 - 127	
	True #	**********	0 - 31	
System Exclusive		o	o	Voice parameters
System Common	Song Pos	x	x	
	Song Sel	x	x	
	Tune	x	x	
System Real Time	Clock	x	x	
	Commands	x	x	
Aux Mes- sages	Local ON/OFF	x	x	
	All Notes OFF	x	x	
	Active Sense	x	o	
	Reset	x	x	
Notes				

Mode 1 : OMNI ON, POLY Mode 2 : OMNI ON, MONO o : Yes

Mode 3 : OMNI OFF, POLY Mode 4 : OMNI OFF, MONO x : No

■BLOCK DIAGRAM



TF1

■CIRCUIT BOARDS & ELECTRICAL PARTS

	Ref. No.	Part No.	Description		部品名	Remarks	Common Model	Markets	ランク
※		NA 81 38 10	*DM Circuit Board*	#92190	DMシート				460
		FZ 00 41 10	Semiconductive Ceramic Cap.	0.1μF 16V	半導体セラコン				010
		Fi 36 42 20	Electro Magnetic Interference	0.022μF 50V	エミフィル				020
		FP 33 71 00	Tantalum Capacitor	10μF 16V	タンタルコン				020
※		GE 30 06 10	Ferrite Bead	BL02RN1	フェライトビーズ				010
		UK 44 64 70	Bipolar Electrolytic Cap.	4.7μF 25V	BPケミコン				010
		UK 13 81 00	〃	100μF 16V	〃				020
		FT 55 21 20	Polypropylene Cap.	120pF 50V	ポリプロコン				030
		FT 55 24 70	〃	470pF 50V	〃				031
		HU 07 55 60	Metal Film Resistor	560Ω 1/4W	金属皮膜抵抗				021
		HU 07 61 00	〃	1kΩ 1/4W	〃				021
		HU 07 62 00	〃	2kΩ 1/4W	〃				021
		HZ 00 31 90	Module Resistor	4.7kΩ×8	モジュール抵抗				010
		Hi 20 99 90	Trimmer Potentiometer	10MΩ	ソリッドVR				010
		HT 37 00 80	〃	B20kΩ	〃				021
		iA 10 15 70	Transistor	2SA1015(O,Y)	トランジスタ				031
		iC 18 15 80	〃	2SC1815(Y,GR)	〃				031
		iC 21 20 00	〃	2SC2120(O,Y)	〃				031
		iF 00 34 50	Diode	1SS133	ダイオード				010
		iF 00 56 40	〃	0A95	〃				010
※		iF 00 84 10	LED	SLC-22VR3	LED	RED			020
※		iF 00 84 20	〃	SLC-22DU3	〃	YELLOW			020
※		iF 00 84 30	〃	SLC-22MG3	〃	GREEN			020
※		iF 00 74 10	LED Digital Display	LA-301VB	7セグメントLED				050
		iG 00 16 90	IC	TC4016BP	IC				050
		iG 00 12 70	〃	TC4066BP	〃				051
		iG 09 64 00	〃	TC40H008P	〃	Quad 2 Input AND			030
		iG 05 11 00	〃	TC40H074P	〃	Dual D Type Flip Flop			040
		iG 02 70 10	〃	HD74LS04P	〃	Hex Inverter			041
		iG 10 64 00	〃	M74LS32P	〃	Quad 2 Inqut OR			030
		iG 04 42 00	〃	HD74LS138P	〃	3 to 8 Line Deceder			041
		iG 07 86 00	〃	TC40H374P	〃	Octal D Type Flip Flop			070
		iG 05 26 00	〃	HD74LS05P	〃	Hex Inverter with DC			031
※		iG 14 06 00	〃	HD6303X	〃	8 Bit MPU			140
		iG 04 38 00	〃	HD7417P	〃	Hex Buffer 15V OC			030
		iG 13 49 00	〃	IR9311	〃	Comparator			040
		iG 00 13 90	〃	NJM4558DV	〃	OP Amp			030
		iG 10 62 00	〃	M5M5118P-15	〃	16k S-RAM			120
		iG 10 60 00	〃	BA9221	〃	12 Bit DAC			100
		iG 07 95 00	〃	iG079500	〃	Clock Buffer	X		050
※		iG 10 71 00	〃	LF356N	〃	OP Amp			050
※		iN 01 04 20	〃	HN4827128G-30	〃	ROM			190
		iG 08 19 00	〃	HA17408P	〃	D-A Converter			070
		iG 11 62 00	〃	PST518B	〃	System Reset	X		040
		iG 10 70 00	〃	NJM072D	〃	Dual OP Amp			040
		iG 04 25 00	〃	NJM4556DV	〃	OP Amp			040
		iR 00 14 00	〃	TC74HC14P	〃	Hex Inverter Schmitt	Trigger		050
		iT 21 28 00	〃	YM2128	〃	OPS			200
		iT 21 29 00	〃	YM2129	〃	EGS			170
		iK 00 02 60	Photo Conductor	P873-G35-201B	フォトカプラー				070
		iK 00 04 70	〃	TLP552	〃				060
		QU 00 48 00	Ceramic Oscillator	4MHz	セラロック				030
		PC 90 00 40	Lithium Battery	CR2032T	リチウム電池				042

※New Parts (新規部品)

ランク：Japan only

	Ref. No.	Part No.	Description		部品名	Remarks	Common Model	Markets	ランク
		KA 90 69 30	Momentary Key Switch		キースイッチ				010
		KC 00 13 00	Relay	RZ-12	リレー				070
		LB 50 05 20	DIN Jack	5P	DINジャック	MIDI			031
※		LB 30 23 40	Cannon Connector	XLB-3-32	キャノンソケット	LINE OUT			060
		LB 60 73 30	IC Socket	28P	ICソケット				050
		LB 00 90 40	Connector Housing	4P	コネクタハウジング	XH			010
		LB 10 11 30	Contact Pin		コンタクトピン	〃			010
		GE 30 07 10	Line Filter		フェライトリング				070
		LB 91 80 40	Connector Base Pin	4P	コネクタベースピン	XH			010
※		LB 02 12 20	Connector	22P	カードフィットコネクタ	ZIF V-type			040
※		LB 60 73 60	〃	22P	〃	〃 H-type			040
※		***NA 81 38 20***	***CB Circuit Board***	#92200	CBシート				180
		FZ 00 41 10	Semiconductive Ceramic Cap.	0.1μF 16V	半導体セラコン				010
		iG 05 10 00	IC	TC40H004P	IC	Hex Inverter			030
		QU 00 52 00	Quarz Crystal Unit	9.4265MHz	水晶振動子				050
		LB 60 31 30	Connector Base Pin	12P	コネクタベースピン	NH			031
		LB 60 81 20	Connector	8P	モレックスコネクタ				030
※		LB 60 76 00	〃	20P	カードエッジコネクタ				050
		Ei 33 01 06	Bind Head Tapping Screw	3×10	バインドタッピングネジ				010
※		***NA 81 38 30***	***PN Circuit Board***	#92210	PNシート				160
		FZ 00 41 10	Semiconductive Ceramic Cap.	0.1μF 16V	半導体セラコン				010
		GE 30 06 00	Ferrite Bead		フェライトビーズ				010
		iF 00 00 40	Diode	1S1555	ダイオード				010
		iF 00 74 10	LED Digital Display	LA-301VB	7セグメントLED				050
		iR 00 14 00	IC	TC74HC14	IC	Hex Inverter Schmitt Trigger			050
		iG 05 26 00	〃	HD74LS05P	〃	Hex Inverter with DC			031
		iG 04 42 00	〃	HD74LS138P	〃	3 to 8 Line Decoder			041
※		iG 14 41 00	〃	HD74LS247	〃	BCD to 7-segment Decoder			040
		iG 11 54 00	〃	HD74LS283P	〃	4 Bit Full Adder			040
		iG 05 03 00	〃	HD74LS293P	〃	4 Bit Binary Counter			040
		iK 00 04 70	Photo Conductor	TLP552	フォトカプラー				060
※		KA 90 69 90	Momentary Key Switch		キースイッチ				010
※		LB 50 03 80	DIN Jack	5P	DINジャック	MIDI			020
		LB 50 03 70	Connector Base Pin	5P	コネクタベースピン	NH			020
		LB 60 30 10	〃	8P	〃	〃			030
※		Mi 80 33 50	CP Wire	8P	CPジャンパー				020
※		CB 83 50 50	Spacer, Isolator		絶縁スペーサー				020
※		CB 83 50 60	Ground Sheet		アースシート				030
※		***NA 81 38 40***	***AC Circuit Board***	#92220	ACシート			J	140
※		***NA 81 38 50***	〃	#92220	〃			U,C	
※		***NA 81 38 60***	〃	#92220	〃			G,WG	
		FZ 00 28 50	Ceramic Cap.	0.0022μF AC125V	セラコン			J,U,C	020
		Fi 38 32 20	〃	0.0022μF AC125V	〃			G,WG	
		Fi 38 34 70	〃	4700pF	〃			G,WG	
		FR 16 42 20	Multiple Components	0.022μF 250V	スパークキラーコン				040
		FZ 00 51 10	Metalized Plastic Cap.	0.047μF	メタライズドプラスチックコン			J,U,C	030
		FT 42 44 70	Metalized Polyester Cap.	0.047μF	メタライズドポリエステルコン			G,WG	
		GE 90 13 70	Coil	SC-05-100	コイル				050
		GE 90 13 80	〃	GP-5 Core	〃				070
※		KA 80 48 20	Power Switch	SDGA3P	パワースイッチ				050

※New Parts (新規部品)

ランク : Japan only

	Ref. No.	Part No.	Description		部品名	Remarks	Common Model	Markets	ランク
		KB 00 03 80	Fuse	4A 250V	ヒューズ			J	010
		KB 00 26 40	〃	4A 250V	〃			U,C	
		KB 00 26 20	〃	T1.6A 250V	〃			G,WG	
		LA 00 36 90	Ground Lug	B4S	歯付アースラグ				010
		LB 20 15 30	Fuse Holder Pin		ヒューズホルダーピン				010
		LA 00 44 00	Terminal		エース用ファストン				010
		LB 30 14 70	Cap,3P	LB-03TV	3Pキャップ				020
✱		*NP 80 90 00*	*Power Supply Unit*		電源ユニット			J,U,C	460
✱		*NP 81 00 00*	〃		〃			G,WG	
✱	T1	XX 80 29 10	Inverter Transformer	3900111E	インバータトランス				16✱
✱	[illegible]	XX 80 29 20	Choke Coil	SC-02-300	チョークコイル				06✱
✱	[illegible]	XX 80 29 30	〃	SKP-2-50	〃				05✱
	L3	XX 80 28 60	〃	831035E	〃				070
	D1	iX 80 06 10	Bridge Rectifier	S4VB40	ブリッジダイオード				050
	D2	iX 55 00 50	Diode	1S953	ダイオード				010
	D3	iX 00 02 50	〃	F114B	〃				030
	D6,7	iX 00 02 70	〃	F114F	〃				040
	D8,9,11	iX 80 06 20	〃	U19B	〃				030
	D12	iX 80 06 30	〃	ESAC82-004	〃				050
	D13	iX 80 06 40	〃	ESAD83-004	〃				080
	D14,15	iX 55 02 60	〃	SM-1A-02	〃				010
	D4,5	iF 00 17 00	Zener Diode	RD15EB2	ツェナーダイオード				010
	D19	iF 00 34 40	〃	RD6.2EB	〃				010
	D20	iF 00 16 70	〃	RD6.8EB2	〃				010
	D21	iX 80 06 50	〃	RD2.7EB	〃				01✱
	Q1	iX 80 06 70	Transistor	2SA1152	トランジスタ				030
	Q2	iX 80 06 80	〃	2SC2721	〃				030
	Q7	iX 55 04 10	〃	2SC2719	〃				031
	Q3,9	iX 80 06 90	FET	2SK319	FET				080
	[illegible]	iX 80 07 00	IC	YD-020	IC				090
	[illegible]	iG 06 39 00	〃	μPC7815H	〃				050
	IC3	iG 07 75 00	〃	μPC7915H	〃				050
	PC1,2	iX 80 07 10	Photo Conductor	PC-511	フォトカプラー				050
	CR1	iX 80 07 20	Triac	AC08DGM	トライアック				070
	CR2	iX 80 07 30	SCR	8P2M	サイリスタ				070
	RV1	HX 80 02 10	Trimmer Potentiometer	PN822H301V	ソリッドVR	300Ω			02✱
	C3	FR 15 52 20	Metalized Paper Cap.	0.22μF 250V	MPコン				050
	C4,37	FT 17 51 00	Polypropylene Cap.	0.1μF 100V	ポリプロコン				032
	C11,12	FT 17 31 00	〃	1000pF 100V	〃				030
	R1	HX 80 02 30	Metal Film Resistor	680kΩ 1/2W	金属皮膜抵抗				02✱
	R4,46 48	HU 07 61 00	〃	1kΩ 1/4W	〃				021
	R5	HU 57 72 20	〃	22kΩ 1/2W	〃				021
	R6	HU 07 65 60	〃	5.6kΩ 1/4W	〃				021
	R7	HU 07 71 00	〃	10kΩ 1/4W	〃				021
	R8	HU 07 68 20	〃	8.2kΩ 1/4W	〃				021
	R14~17 24,45	HU 07 41 00	〃	10Ω 1/4W	〃				021
	R21	HU 07 72 70	〃	27kΩ 1/4W	〃				021
	R22	HU 07 64 70	〃	4.7kΩ 1/4W	〃				021
	[illegible] 24	HU 07 74 70	〃	47kΩ 1/4W	〃				021
	[illegible] 27	HX 80 02 60	〃	56Ω 1/2W	〃				02✱
	R31	HU 57 62 20	〃	22Ω 1/2W	〃				021
	R32~34	HU 07 62 20	〃	2.2kΩ 1/4W	〃				021

✱New Parts (新規部品)

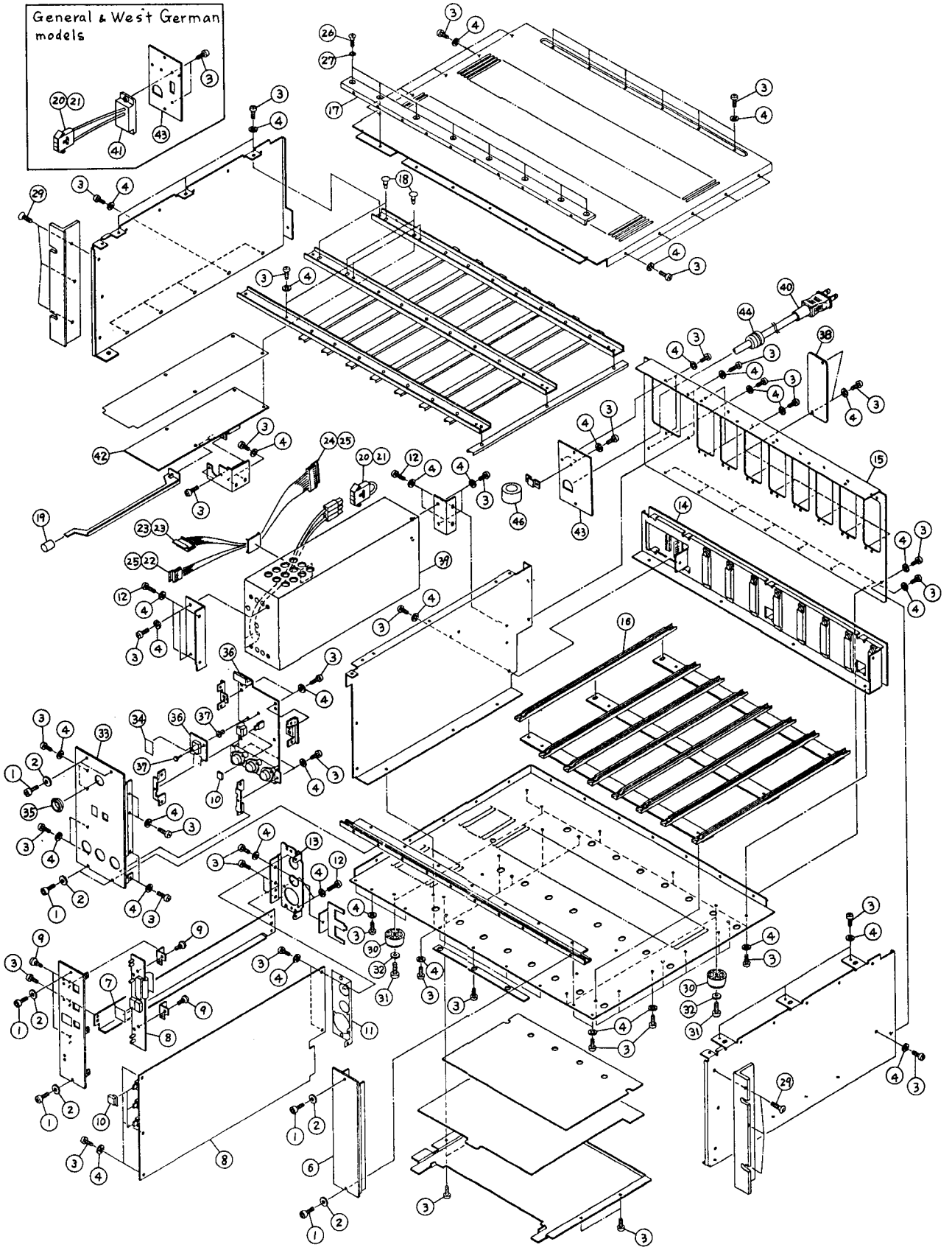
ランク：Japan only

Ref. No.	Part No.	Description		部品名	Remarks	Common Model	Markets	ランク
R49	HU 07 61 80	Metal Film Resistor	1.8kΩ 1/4W	金属皮膜抵抗				021
R50	HU 07 53 30	〃	330Ω 1/4W	〃				021
R51	HU 07 43 30	〃	33Ω 1/4W	〃				021
R52,53	HU 07 51 00	〃	100Ω 1/4W	〃				021
R9	HL 32 52 20	Metal Oxide Film Resistor	220Ω 2W	酸化金属皮膜抵抗				010
R10,47	HL 31 61 00	〃	1kΩ 1W	〃				010
R11~13	HX 80 02 50	〃	15kΩ 5W	〃				01＊
R18,19	HL 32 51 00	〃	100Ω 2W	〃				010
R20	HL 32 22 20	〃	0.22Ω 2W	〃				010
R35	HL 31 62 20	〃	2.2kΩ 1W	〃				010
R2	HM 57 41 00	Wire Wound Resistor	10Ω 10W	セメント抵抗				020
R3	HM 55 24 70	〃	0.47Ω 5W	〃				021
R44	HZ 00 29 60	〃	0.05Ω 5W	〃				020

＊New Parts（新規部品）

ランク：Japan only

EXPLODED VIEW



	Ref. No.	Part No.	Description		部品名	Remarks	Common Model	Markets	ランク
	1	EX 80 04 90	Bolt with Hexagonal Hall	M3×6 Bl	六角穴付ボルト				01*
	2	EV 20 30 36	Flat Washer	3S Bl	平座金				010
	3	ED 33 00 66	Bind Head Screw	M3×6 Bl	バインド小ネジ				010
	4	EV 41 30 36	Toothed Lock Washer	A3S Bl	歯付座金				010
※	5	BA 80 99 20	TF1 Panel		TF1パネル				080
※	6	BA 81 02 00	Blank Panel A		ブランクパネルA	TX116/216			080
※	7	CB 83 49 80	Filter,LED		LEDフィルター				040
※	8	NA 81 38 10	DM Circuit Board	#92190	DMシート				460
	9	CB 06 88 80	Plastic Rivet		プラスチックリベット				010
※	10	CB 83 64 70	Push Button		プッシュボタン				010
※	11	CB 83 50 20	Earth Sheet		アースシート				020
	12	ED 33 01 06	Bind Head Screw	3×10 Bl	バインド小ネジ				010
	13	AA 83 22 20	TF1 Rear Panel		TF1リアパネル				060
※	14	NA 81 38 20	CB Circuit Board	#92200	CBシート				180
※	15	AA 83 23 20	Back Panel		バックパネル				100
	16	CB 83 50 00	Rail,Guide		ガイドレール				030
※	17	BA 80 99 60	Pannel Rail		パネルレール				080
	18	CB 83 29 30	Spacer,Locking Card		ロッキングカードスペーサー				010
	19	CB 06 65 10	Push Button		プッシュボタン				010
	20	LB 30 11 50	Connector Housing	3P Red	コネクタハウジング				010
	21	LB 10 06 80	Contact Pin		コンタクトピン				010
	22	LB 50 02 40	Connector Housing	5P	コネクタハウジング	NH			010
	23	LB 60 24 80	〃	8P	〃	〃			010
	24	LB 60 29 20	〃	12P	〃	〃			010
	25	BB 00 44 30	Contact Pin		コンタクトピン				010
	26	EB 33 00 66	Flat Head Screw	3×6 Bl	皿小ネジ				010
※	27	EV 44 00 30		3S Bl	皿歯付座金				01*
※	28	AA 83 23 40	Top Cover		トップカバー				130
	29	EB 34 00 86	Flat Head Screw	4×8 Bl	皿小ネジ				010
	30	CB 07 28 70	Leg		脚				010
	31	ED 34 01 06	Bind Head Screw	4×10 Bl	バインド小ネジ				010
	32	EV 41 30 46	Toothed Lock Washer	A4S Bl	歯付座金				010
※	33	BA 80 99 30	MRF Panel		MRFパネル				090
※	34	CB 83 49 90	Filter,LED		LEDフィルター				040
	35	CB 81 92 00	Switch Escutcheon		スイッチエスカッション				020
※	36	NA 81 38 30	PN Circuit Board	#92210	PNシート				160
※	37	CB 83 50 70	PB Rivet		PBリベット				010
※	38	AA 83 34 80	Blank Panel B		ブランクパネルB	TX116/216			030
※	39	NP 80 90 00	Power Supply Unit		電源ユニット			J,U,C	460
※	〃	NP 81 00 00	〃		〃			G,WG	
	40	MG 00 06 10	Power Supply Cord		電源コード			J	060
	〃	MG 00 01 00	〃		〃			U	
	〃	MG 00 02 70	〃		〃			C	
	〃	MG 00 11 10	〃		〃			G	
	〃	MG 00 04 50	〃		〃			WG	
	41	KA 40 08 30	Voltage Selector		電圧切替器			G,WG	
※	42	NA 81 38 40	AC Circuit Board	#92220	ACシート			J	140
※	〃	NA 81 38 50	〃	#92220	〃			U,C	
※	〃	NA 81 38 60	〃	#92220	〃			G,WG	
※	43	AA 83 23 50	AC Panel		ACパネル			J,C	050
※	〃	AA 83 23 60	〃		〃			U	
※	〃	AA 83 23 70	〃		〃			G,WG	
	44	CB 80 68 50	Cord Stopper	6N3-4	コードストッパー			J,C	021

*New Parts（新規部品）

ランク：Japan only

	Ref. No.	Part No.	Description		部品名	Remarks	Common Model	Markets	ランク
	44	CB 81 12 30	Cord Stopper	6N-4	コードストッパー			U	
	〃	CB 07 27 50	〃	4N-4	〃			G	
	〃	CB 03 28 40	〃	5N-4	〃			WG	
	45	Ei 33 00 66	Bind Head Tapping Screw	3×6 BI	バインドタッピングネジ			G,WG	
	46	GE 30 07 10	Line Filter		フェライトリング				070
※		Mi 80 33 60	MIDI Cable	1.5m	MIDIケーブル	Accessory			080
		TX 90 09 50	Allen Wrench		六角レンチ	〃			020

※New Parts (新規部品)

ランク：Japan only