

YAMAHA

FM sound Synthesizer Unit

SFG-01

SERVICE MANUAL

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SINCE 1887



YAMAHA

NIPPON GAKKI CO., LTD. HAMAMATSU, JAPAN

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Retrocomputing

● SPECIFICATIONS

POWER SUPPLY

+ 5V ± 0.5%	: 200 mA
+ 12V ± 10%	: 30 mA
- 12V ± 10%	: 20 mA

OUTPUT IMPEDANCE (SOUND)

LINE OUT : 1.8 k Ω
BUS OUT : 1.0 k Ω

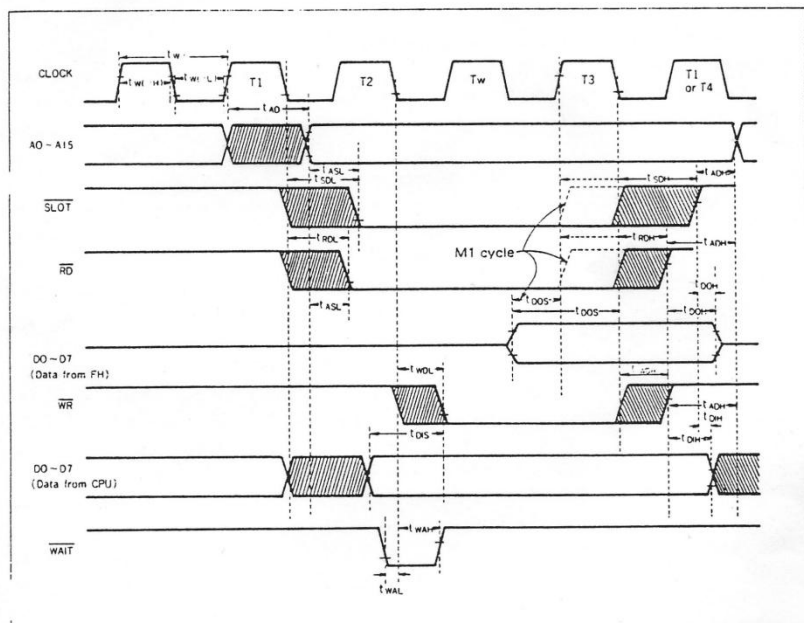
MEASUREMENT

126 (W) x 27 (H) x 150 (D)

WEIGHT

330 q

●TIMING CHART



●Audio Output Level

OUTPUT LEVEL	1 sound	4 sound	8 sound
LINE OUT (L, R)	-16 ± 2 dBm	-11 ± 2 dBm	-9 ± 2 dBm
SIDE SLOT BUS (59 PIN)	-17 ± 2 dBm	-12 ± 2 dBm	-10 ± 2 dBm

At FLUT Sound selected, KEY 440 Hz ~ 880 Hz 1 ~ 8 sound.

●LSI FUNCTION

1) OPM (YM2151)

FM sound generator and, when used with a D/A converter (DAC), 8 tones audio signal can be obtained to R and L channels.

8 notes are available equipped with noise generator, vibrato oscillator, amplitude modulation circuit, tonal effect generator and timer 2 sets of timers are prepared and when a timer overflows an interrupt request takes place.

2) DAC (YM3012)

As related in OPM section, this is a D/A converter to produce 2 channel audio signal on R and L channels.

3) ROM (YM2270-2)

Program is written to control MKS and OPM and located in SLOT #3 000H ~ 3F7FH.

4) MKS (YM2148)

MKS has a MIDI function, keyboard scan function and supports MODE 2 IRQ for CPU.

MIDI is a synchronous serial data transfer of 31.25 K baud transfer rate. Keyboard scan is a function to handle keyboard ON/OFF data of the connected music keyboard.

When MODE 2 IRQ takes place, due to demand by CPU, VECTOR ADDRESS goes out to DATA BUS.

●INSTALLATION OF FM SOUND UNIT

Fix the FM Sound Synthesizer Unit into the computer by replacing the side slot cover fixing screw.

Make sure the unit, and fixing screw, are firmly in place to ensure proper operation of the FM Sound Synthesizer Unit.

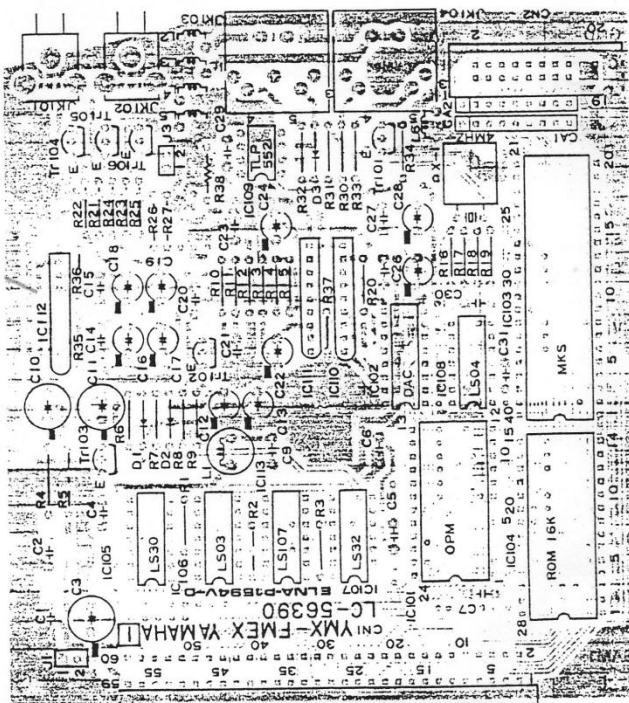
●FM Sound Unit ADDRESS MAP

AD- DRESS	INPUT						OUTPUT	INTERNAL RESISTERS
	CS0	RD	WT	A 2	A 1	A 0	OPM	
	1	/	/	/	/	/	1	/
	/	1	1	/	/	/	0	OPM STATUS REGISTER * YM2195(OPM)
3FF0H	0	0	1	0	0	0	0	OPM ADDRESS REGISTER "
	0	1	0	0	0	0	0	OPM DATA REGISTER "
3FF1H	0	0	1	0	0	1	0	OPM DATA REGISTER "
	0	1	0	0	0	1	0	ST0 ~ ST7 OUTPUT DATA REGISTER
3FF2H	0	1	0	0	1	0	0	SD0 ~ SD7 INPUT DATA REGISTER
	0	0	1	0	1	0	0	MIDI IRQ VECTOR ADDRESS REGISTER
3FF3H	0	1	0	0	1	1	0	
	/	0	1	0	1	1	0	EXTERNAL IRQ VECTOR ADDRESS REGISTER
3FF4H	0	1	0	1	0	0	1	
	/	0	1	1	0	0	1	MIDI UART DATA READ BUFFER
3FF5H	0	0	1	1	0	1	0	MIDI UART DATA WRITE BUFFER
	0	1	0	1	0	1	0	MIDI UART STATUS REGISTER
3FF6H	0	0	1	1	1	0	0	MIDI UART COMMAND REGISTER
	0	1	0	1	1	0	0	
3FF7H	/	/	/	1	1	1	1	

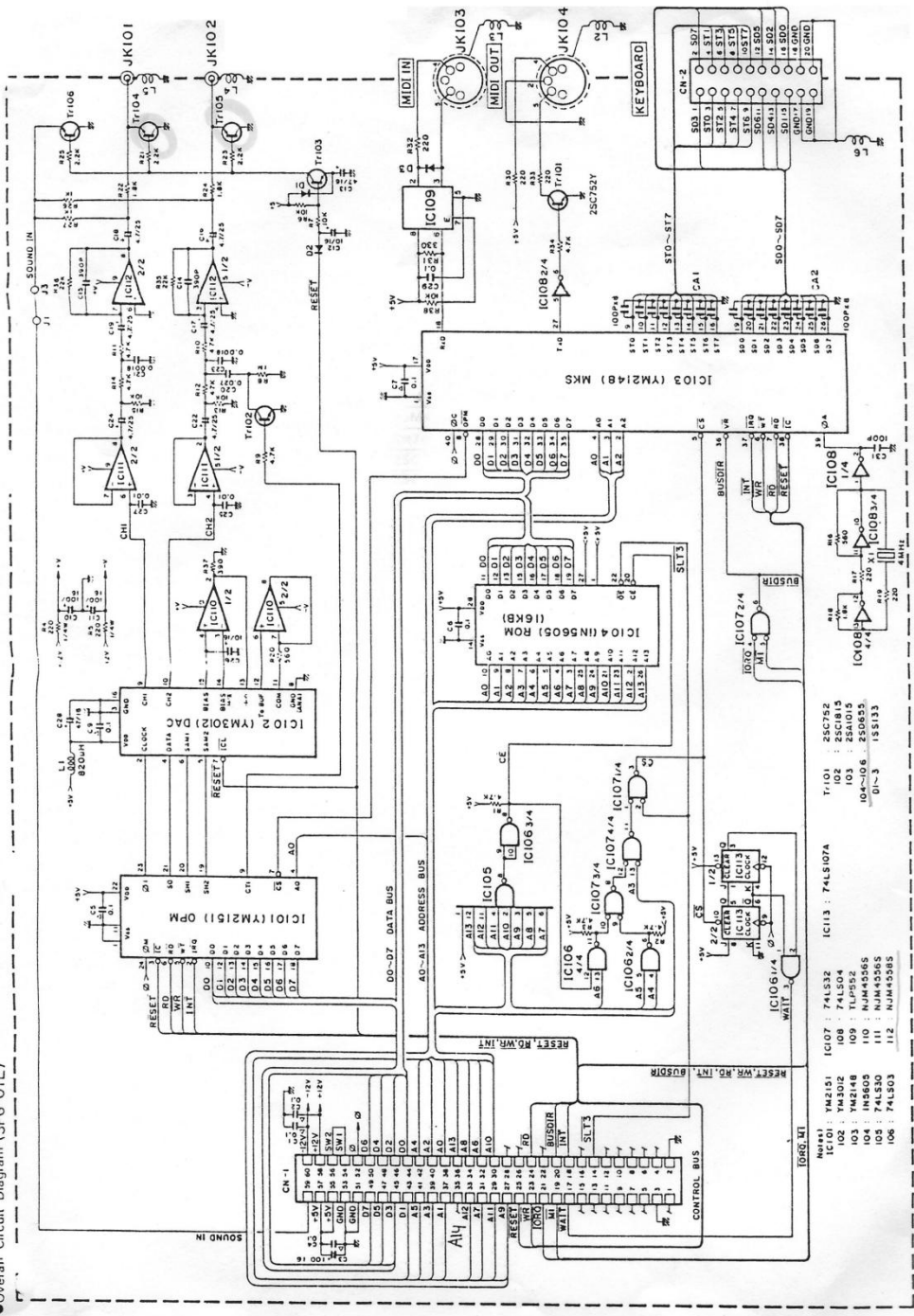
● LSI DATA TABLE
YM2148 MKS

Pin No.	Pin Name	I/O	Function
1	VSS	—	Ground
2	A ₀	I	} Selection data for internal registers
3	A ₁	I	
4	A ₂	I	
5	$\overline{CS}$	I	Chip select
6	$\overline{WT}$	I	Write request signal
7	$\overline{RD}$	I	Read request signal
8	$\overline{OPM}$	O	Address decode out to OPM
9	ST ₀	O	} (Latch port in 2nd address) Use as strobe output to musical keyboard
15	1	1	
16	ST ₇	O	
17	VDD	—	Power Supply + 5V DC
18	RxD	I	MIDI serial data
19	SD ₀	I	} Input port from musical keyboard if keyboard
20	1	1	
26	SD ₇	I	
27	TxD	O	MIDI serial data
28	D ₀	I/O	} I/O port for 3-state data bus
29	1	1	
35	D ₇	I/O	
36	$\overline{VR}$	I	VECTOR ADDRESS REQUEST / for Z80 MODE 2 IRQ
37	$\overline{IRQ}$	O	Interrupted request data when MIDI data transmission
38	$\overline{IC}$	I	"L" reset data $\overline{IRQ} \rightarrow "H"$, $\overline{OPM} \rightarrow "H"$
39	ϕA	I	Baud-rate setting clock for MIDI transmission
40	ϕ	I	Master clock

SFG-01 Circuit Board



Overall Circuit Diagram (SFG-01E)



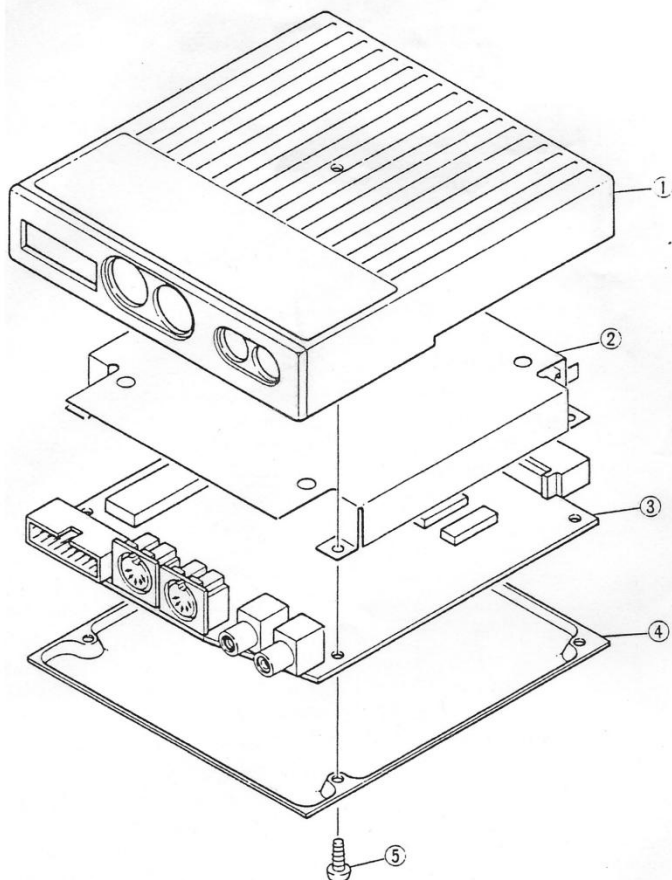
■Parts List

Electronic Components

Ref. No.	Part No.	Description	品 名	Remarks
	NA 55-2630			
	NA 55-12-10	Circuit Board, FM Sound.	F M 音 源 シ ー ト	
	IT 21 51 00	IC	IC	IC101 (OPM)
	IT 30 12 00	"	"	IC102 (DAC)
	IT 21 48 00	"	"	IC103 (MKS)
	IT 22 70 20	"	"	IC104 (128KROM)
	IG 04 97 50	"	"	IC105
	IG 09 06 00	"	"	IC106
	IG 04 98 50	"	"	IC107
	IG 02 70 20	"	"	IC108
	IK 00 04 70	" フォトカプラー MIDI	"	IC109
	IG 07 74 00	"	"	IC110,111
	IG 07 68 00	"	"	IC112
	IG 07 13 00	"	"	
	IC 07 52 20	"	"	Tr101
	IC 18 15 50	Transistor	ト ラ ン ジ ス タ	Tr101,102
	IA 10 15 80	"	"	Tr103
	ID 06 55 00	"	"	Tr104-106
	IF 00 34 50	Diode	ダ イ オ ー ド	D1-3
	HJ 35 52 20	" R28FSL 1/4W 220Ω	カーボン抵抗	R4,5
	HF 85 64 70	Carbon Resistor RD16ST52 1/6W 4.7KΩ	カーボン抵抗	R1-3,9-12,14,34
	HF 85 71 00	" " 1/6W 10KΩ	"	R6,7,13,15
	HF 85 91 00	" " 1/6W 1MΩ	"	R8
	HF 85 55 60	" " 1/6W 560Ω	"	R16,20
	HF 85 52 20	" " 1/6W 220Ω	"	R17,19,30,32,33
	HF 85 61 80	" " 1/6W 1.8KΩ	"	R18,22,24
	HF 85 62 20	" " 1/6W 2.2KΩ	"	R21,23,25
	HF 85 61 00	" " 1/6W 1KΩ	"	R26,27
	HF 85 52 70	" " 1/6W 270Ω	"	R31
	HF 85 72 20	" " 1/6W 22KΩ	"	R35,36
	HF 85 53 90	" " 1/6W 390Ω	"	R37
	HF 85 53 30	" " 1/6W 330Ω	"	
	FS 68 51 00	Ceramic Cap	半導体セラコン	C1,2,4-7,9
	UJ 13 74 70	Electrolytic Cap.	小型ケミコン	C3,13,28
	UJ 13 81 00	"	"	C10,11
	UJ 13 71 00	"	"	C12,26
	FG 21 23 90	Ceramic Cap.	セラコン	C14,15
	UJ 14 64 70	Electrolytic Cap.	小型ケミコン	C16-19,22,24
	FA 15 42 70	Mylar Cap.	マイラーコン	C20
	FA 15 31 80	"	"	C21,23
	FA 15 31 00	"	"	C25,27
	FZ 00 66 80	C-ARY	"	CA1,CA2
	GE 90 09 60	Coil	固定コイル	L1
	QU 00 05 00	Quartz Oscillator	水晶発振子	X1
	LB 20 27 20	Jack, Pin(with Switch)	スイ/チ付ピンジャック(白)	JK101
	LB 20 27 30	" , Pin(with Switch)	" (赤)	JK102
	LB 50 06 50	" , DIN-5P	SP. DIN ジャック	JK103,104
	LB 60 68 30	Connector	コネクター	CN1
	LB 60 54 30	"	コネクター	CN2

◆ New Parts

● External Components



Ref. No.	Part No.	Description	品名	Remarks
* 1	CB 55 39 10	Upper Case	Metallic	上 ケ ー ス CX5MU,G,S
* 2	CB 55 29 40	"	Black	" CX5ME,A,F
* 3	AA 55 32 30	Shield	シールド板	
* 4	NA 55 16 30	Circuit Board,FM sound (for Metallic)	SFG-EX シート	
* 5	NA 55 16 50	" " (for Black)	SFG-EX CD シート	
4	AA 55 32 20	Lower Case	下 ケ ー ス	
5		Pan Head Tapping Screw	3×12	ナベタッピンネジ
	CB 55 30 80	MKC Cover	M K L カバ ー	
	CB 55 39 80	CAUTION Label	注 意 書	
	CB 55 40 00	Label	ラ ベ ル	

+ New Parts