ARBITRARY FUNCTION GENERATOR

SFG-830/830G

Service MANUAL

GW INSTEK PART NO.

ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

May 2008 edition

The information in this manual was correct at the time of printing. However, Good Will continues to improve its products and therefore reserves the right to change the specifications, equipment, and maintenance procedures at any time without notice.

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SAFETY INSTRUCTIONS

This chapter contains important safety instructions which should be followed when operating the instrument and keeping it in storage. Read the following before operating this instrument to ensure safety and to keep the instrument in best condition.

Safety Symbols

These safety symbols may appear in this manual or on the instrument.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the instrument or to other objects.
	DANGER High Voltage
	Attention: Refer to the Manual
	Protective Conductor Terminal
	Earth (ground) Terminal

Safety Guidelines

General guidelines

 CAUTION

- Do not place any heavy object on the instrument.
- Avoid severe impacts or rough handling that leads to damaging the instrument.
- Do not discharge static electricity to the instrument.
- Do not block or obstruct the cooling fan vent opening.
- Do not perform measurement at circuits directly connected to Mains (see note below).
- Do not disassemble the instrument unless you are a qualified service technician.

(Continues to the next page)

(Note) EN 61010-1:2001 specifies the measurement categories and their requirements as follows. This instrument falls under category II.
Measurement category IV is for measurement performed at the source of low-voltage installation. Measurement category III is for measurement performed in the building installation. Measurement category II is for measurement performed on the circuits directly connected to the low voltage installation.

Power supply


WARNING

- AC Input voltage: 100V/120V/220V/240V ±10%, 50/60Hz
- Connect the protective grounding conductor of the AC power cord to an earth ground, to avoid electrical shock.

Fuse


WARNING

- Main fuse type:
  AC 90V to 132V: T0.8A/250V
  AC 198V to 250V: T0.5A/250V
- Internal fuse type:
  F101 and F102: T1A/250V
  F103 and F104: T2A/250V
- To ensure fire protection, replace the fuse only with the specified type and rating.
- Disconnect the power cord before fuse replacement.
- Before replacing the fuse, make sure the cause of fuse blowout has been fixed.

Cleaning the instrument

- Disconnect the power cord before cleaning the instrument.
- Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid.
- Do not use chemicals or cleaners containing harsh products such as benzene, toluene, xylene, and acetone.

Operating environment

- Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (note below)
- Relative Humidity:
  < 90% (0°C to 35°C)
  < 70% (35°C to 40°C)
- Altitude: < 2000m
- Temperature: 0°C to 40°C

(Note) EN 61010-1:2001 specifies the pollution degrees and their requirements as follows. This instrument falls under degree 2.
Pollution is defined as “addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction in dielectric strength or surface resistivity”.
Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.
Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally,

however, a temporary conductivity caused by condensation can be expected. Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to the expected condensation. In such conditions, while the equipment is normally protected against exposure to direct sunlight, precipitation, and strong draughts, neither temperature nor humidity is controlled.

Storage environment

- Location: Indoor
- Relative Humidity: < 70%
- Temperature: −10°C to 70°C

Power cord for the United Kingdom

When using the instrument in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead / appliance must only be wired by competent persons

⚠WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)

As the colours of the wires in mains leads may not correspond with the colour markings identified in your plug/appliance, proceed as follows:
The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with the letter E or by the earth symbol ⏚ or coloured Green or Green & Yellow.
The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.
The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.
If in doubt, consult the instructions provided with the equipment or contact the supplier.
This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, cable of 0.75mm² should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.
Any moulded mains connector that requires removal /replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if a engaged in live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

Declaration of Conformity

We
GOOD WILL INSTRUMENT CO., LTD.
(1) No.7-1, Jhongsing Rd., Tucheng City, Taipei County, Taiwan
(2) No. 69, Lu San Road, Suzhou City (Xin Qu), Jiangsu Sheng, China
declare, that the below mentioned product
Type of Product: Arbitrary Signal Generator
Model Number: SFG-830/SFG-830G
are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (2004/108/EC, 89/336/EEC, 92/31/EEC, 93/68/EEC) and Low Voltage Directive (73/23/EEC, 93/68/EEC).
For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Directive, the following standards were applied:

◎ **EMC**

EN50081-1: Electromagnetic compatibility - (1992) Generic emission standard Part 1: Residential, commercial and light industry	EN50082-1: Electromagnetic compatibility - (1992) Generic immunity standard Part 1: Residential, commercial and light industry
Conducted Emission Radiated Emission EN 55022: Class A 1994	Electrostatic Discharge IEC 1000-4-2: 1995
Current Harmonics EN 61000-3-2 + A12: 1996	Radiated Immunity IEC 1000-4-3: 1995
Voltage Fluctuations EN 61000-3-3: 1995	Electrical Fast Transients IEC 1000-4-4: 1995
Electrostatic Discharge EN 61000-4-2: 1995 + A1:1998	Surge Immunity IEC 1000-4-5: 1995
Radiated Immunity EN 61000-4-3: 1996 + A1: 1998	Voltage Dip/ Interruption IEC 1000-4-11: 1994
EN50081-1: Electromagnetic compatibility - (1992) Generic emission standard Part 1: Residential, commercial and light industry	
Conducted Emission Radiated Emission EN 55011: Class A 1991	

◎ **Safety**

Low Voltage Equipment Directive 73/23/EEC
Safety Requirements IEC/EN 61010-1: 1993 + A2 (1995)

OVERVIEW OF THIS MANUAL

If you are not sure what type of service operation you should choose, read the *Service Operation List* section and find the chapter which suits your needs. The *Summary of Each Chapter* section gives you an overview of this service manual's contents.

Shortcuts to Major Operations

See the following list, decide which operation you might need, and jump to the introduced chapter.

I want to…	Go to…	Page
Learn how to set the instrument and operate it	The *Setting up and Operating the Instrument* chapter.	Page15
Verify the specifications of the instrument	The *Specifications and Appearance* chapter.	Page13
Verify the specifications and adjust the instrument	The *Verifying and Adjusting the Instrument* chapter. We recommend you to verify all listed items at once.	Page21
Disassembly the instrument	The *Disassembling the Instrument* chapter.	Page65
Replace the fuse	The *Replacing the Fuse* chapter.	Page53
Troubleshoot the instrument	The *Troubleshooting the Instrument* chapter.	Page73
Order a part	The *Ordering the Parts* chapter.	Page96

Summary of Each Chapter

This document consists of the following chapters.

Safety Instructions (page6)	Describes the important safety instructions that should be followed before, during, and after operating the instrument.
Overview of this Manual (page10)	Provides the summary of each chapter in this service manual and shows where to read for various service operations. • List of service operations • Summary of each chapter
Specifications and Appearance (page13)	Lists the specifications and front/rear panel overview to help engineers verify the functions and performance of the instrument. • Specifications • Front panel • Rear panel
Setting up and Operating the Instrument (page15)	Describes how to properly set up the instrument. A brief operation procedure, necessary for the service operations, is listed. Also listed is all the required tools for various service operations. Required tools are also listed in the chapters that follow. • Setting up the instrument • Operating the instrument
Calibrating the instrument (page21)	Describes how to calibrate the instrument's major functionalities. • Attenuator • Amplitude • Symmetry • DC gain • Offset
Verifying and Adjusting the	Describes how to verify and/or adjust the instrument's major functionalities.

instrument (page34)	• Preparations • Clock output • D/A reference • Filter • Frequency accuracy • Sub-harmonics • Phase noise • Symmetry • Remote control • Verification log • Frequency doubler • Amplitude • Harmonic distortion • DC offset • Harmonic distortion • Rise time • Envelope distortion
Changing the Options (page53)	Describes how to replace the optional items. • GPIB module • AC mains voltage setting • Primary fuse • Secondary fuse
Disassembling the instrument (page65)	Shows how to remove major PCBs from the instrument. • Outer casing • Top PCB • Bottom PCB • GPIB module
Troubleshooting the instrument (page73)	Shows the operation theory together with the circuit diagrams to help service engineers locate and diagnose problematic locations in the instrument. • Operation theory • Block diagrams • Circuit diagrams
Ordering the Parts (page96)	Shows the replacement parts list for the PCB components used in the instrument, along with the PCB layout diagrams. • PCB layout • Parts list

SPECIFICATIONS AND APPEARANCE

This chapter lists the functions and performance of the instrument. The front and rear panel diagrams introduce how the panel items are called.

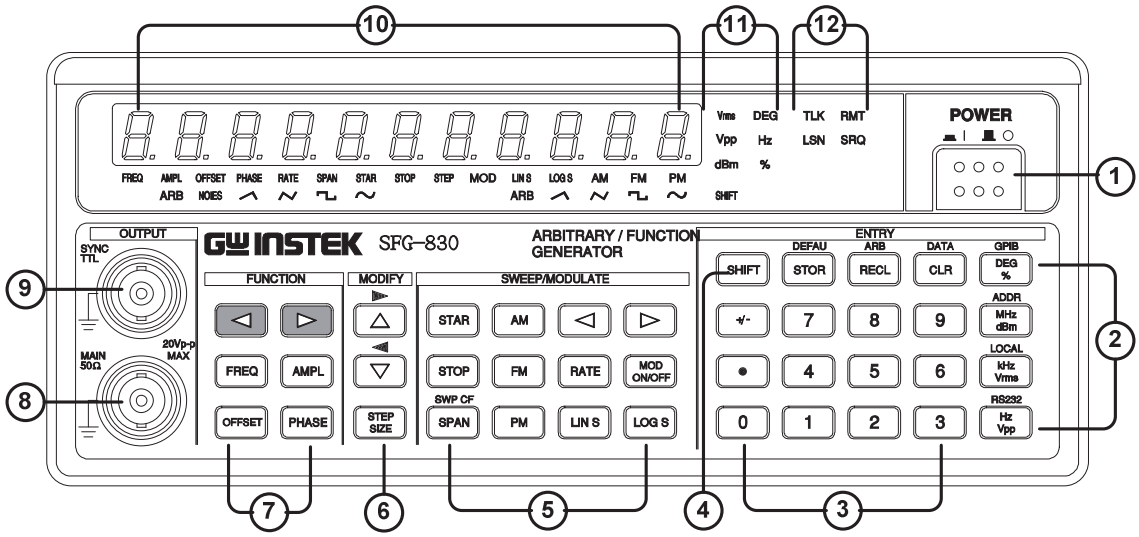
Specifications

The following specifications apply when the instrument is powered on for at least 30 minutes within +18°C to +28°C.

Output Function	Sine, Triangle, Ramp, Square, Sync Output, Arbitrary Wave	
Frequency Range	Sine	20mHz to 30MHz
	Square	20mHz to 30MHz
	Triangle	100mHz to 100kHz
	Ramp	100mHz to 100kHz
Frequency Resolution	Sine	20mHz
	Square	20mHz
	Triangle	10mHz
	Ramp	10mHz
Frequency Accuracy	±10ppm	
Frequency Aging	±5ppm/year	
Output Impedance	Source Impedance	50Ω±10%
Amplitude	Range	10mV to 10Vpp (into 50Ω) 8 amplitude range, |Vac peak| + |Vdc| ≤ 5V
	Resolution	3 digits
	Accuracy	±0.5dB (±5mVrms, sine out) ±12% (±5mVrms, square out) ±5% (±5mVrms, triangle out) ±5% (±5mVrms, arbitrary out)
DC Offset	Range	±5V (into 50Ω) |Vac peak| + |Vdc| ≤ 5V
	Resolution	3 digits
	Accuracy	±1.5% of setting + 1mV
Sync Output	Sync Output	TTL levels
	Sync Fan-Out	> 10 TTL load
Sine Output	Harmonics	DC to 100kHz: -50dBc 0.1MHz to 1MHz: -40dBc 1MHz to 10MHz: -30dBc 10MHz to 30MHz: -25dBc

Square Output	Rise/Fall Time	≤ 15ns
	Overshoot	≤ 5% (at full scale output)
	Asymmetry	± 1% of period + 4ns
Triangle and Ramp Output	Linearity	± 0.1% of full scale output
Arbitrary Waveforms	Sample Rate	42.949600MHz / N, N = 8, 10, 12……2^{15}
	Waveform Length	12000 points max
	Vertical Resolution	12 bits
Sweep	Sweep Functions	Lin or Log
	Sweep Range	20mHz to 30MHz
	Sweep Time	0.001s to 1000s
AM Modulation	Function	External, internal (sine, triangle, ramp, square)
	Modulation Rate	10mHz to 10kHz, internal ≤ 50kHz, external
	Modulation Span	0 to 100%
	External Input	± 5V for 100% modulation
Ext Input Impedance	100kΩ	
FM Modulation	Function	Sine, triangle, ramp, square
	Modulation Rate	10mHz to 10kHz
	Modulation Span	30MHz (100kHz for triangle, ramp)
PM Modulation	Modulation Span	360°
	Modulation Rate	20mHz to 10kHz
Operation Environment	Indoor use, Altitude < 2000m Ambient temperature: 0℃ to 40℃ Relative humidity: 80% (maximum) Installation category II, Pollution degree 2	
Storage Environment	Ambient temperature: -10℃ to 70℃ Relative humidity: 70% (maximum)	
Power Source	100V/120V/220V/240V ± 10% 50/60Hz	
Accessories	User Manual x 1, Test Lead GTL-110 x 1	
Dimensions	214(W) ×89(H) ×370(D) mm	
Weight	Approx. 6.5kg	

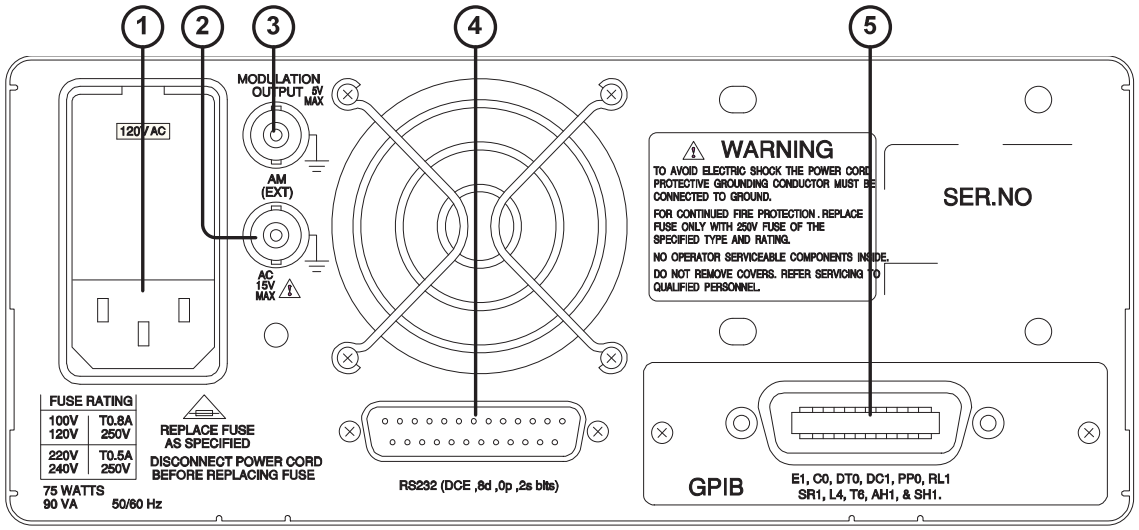
Front Panel



1	Power button	Turns the instrument on or off.
2	Unit keys	In the 'Normal' mode, the Unit keys assign the unit and set the entered value. In the 'Store' or 'Recall' mode, the Unit keys work as 'Enter' keys.
3	Entry keys	[0] ~ [9], [.], and [±] keys input numerical value. A unit key should be pressed to confirm the entered value. [CLR] key cancels the edit and brings back the previously entered value. [STOR] key stores system settings into the memory. [RECL] key recalls system settings from the memory.
4	Shift key	Selects the shift mode. The SHIFT LED will also lights up. For example, pressing [SHIFT] + [DEFAU] can recall the default value of the instrument.
5	Sweep / Modulation keys	Control sweep and modulation. [<] and [>] keys select carrier waveform. [AM], [FM], and [PM] keys set modulation mode. [LIN] and [LOG] keys set sweep method. [MOD ON/OFF] key initiates the sweep or modulation function. For details regarding [STAR], [STOP], [SPAN], and [RATE]

		keys, refer to the user manual.
6	Modification keys	Set the size and step mode, increasing or decreasing.
7	Function keys	Control the output functions. [<] and [>] keys select the output signal from arbitrary wave (ARB), sine wave, triangle wave, etc. [FREQ] key sets the output frequency. [AMPL] key sets the output amplitude. [OFFSET] key sets the output DC offset level. [PHASE] key sets the phase in the PSK modulation mode.
8	Main output BNC terminal	Outputs all main signals. Output resistance is 50Ω.
9	Sync output BNC terminal	Outputs TTL-level sync signal.
10	Interface LEDs	Indicate the current status when the instrument is remotely controlled via the GPIB interface bus.
11	Parameter display	Presents the parameter values and the current status.
12	Unit/Function LED	Indicate the unit of the figures on the display and the functions that are currently being used.

Rear Panel

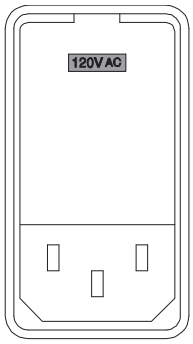
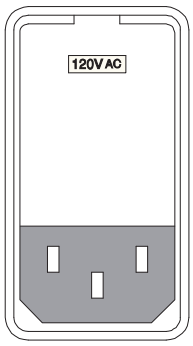
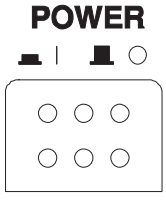


1	AC socket	Accepts the AC input within line voltage±10%, 50/60Hz.
2	EXT AM modulation BNC input	Accepts external amplitude modulation input. The modulation index is 100% at ±5V input. The input resistance is 100kΩ.
3	Sweep / Modulation output	Outputs the modulated waveform that is synchronous with the Sweep / Modulation function (±5Vpp Max.)
4	RS232C connector	Accepts the serial RS232 interface. The DCE and Baud rate range is 300 to 19.2k.
5	GPIB connector	Accepts the GPIB (IEEE488.2 and SCPI) communication interface.

SETTING UP AND OPERATING THE INSTRUMENTS

This chapter describes how to properly set up the instrument. Basic operation procedures are also listed to help service engineers run various service operations. For more detailed operation procedures, refer to the user manual downloadable from GWInstek website.

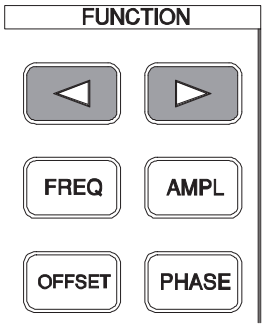
Setting up the Instrument

Checking the AC rating	Before connecting the power cord, check the AC rating through the window on the fuse holder on the rear. If necessary, change the AC rating. See page62 for details.	
Connecting the power cord	Connect the power cord to the AC socket.	
Turning the power on	Press the Power switch on the front to turn the power on. The display also turns on.	

Operating the Instrument

Selecting the output function

Use the two buttons [<] or [>] in the FUNCTION column on front panel to select an output waveform. Available waveforms are arranged in sequence SINE, SQU, TRIG, RAMP, and ARB (from left to right).



Setting the output frequency

1. Press the [FREQ] key.
2. Key in the desired frequency.
3. Press a proper unit key.

Example: To set frequency at 25Hz, press [FREQ] first; then key in [2], [5], and press [Hz].

(Example)

Setting the output amplitude

1. Press the [AMPL] key.
2. Key in the desired amplitude.
3. Press a proper unit key.

Example: To set amplitude at 5Vpp, press [AMPL] first, then key in [5] and press [Vpp].

(Example)

Setting up the DC offset

1. Press the [OFFSET] key.
2. Key in the desired offset.
3. Press a proper unit key.

Example: To set offset at 1Vpp, press [OFFSET] first, then key in [1] and press [Vpp].

(Example)

Displaying the sweep frequency

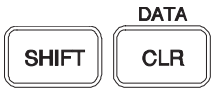
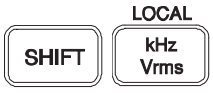
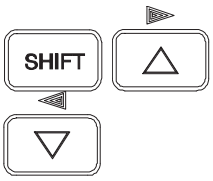
[SHIFT] + [SWP CF]

Displays the sweep center frequency.

Recalling the default status

[SHIFT] + [DEFAU]

Recalls the default status of the SFG-830.

Setting up the ARB compiler	[SHIFT] + [ARB] Sets up the arbitrary-wave compiler.	
Displaying the last received ASCII data	[SHIFT] + [DATA] Displays the last 256 byte of ASCII data received by the SFG-830.	
Recalling the GPIB settings	[SHIFT] + [GPIB] Recalls GPIB settings on the display. The arrow keys in the MODIFY section turns the GPIB on/off.	
Selecting the GPIB address	[SHIFT] + [ADDR] Selects the GPIB address, 0 to 30.	
Switching from the remote mode to local mode	[SHIFT] + [LOCAL] Switches the remote status between RMT(remote) and LOCAL mode.	
Turning on the RS-232C	[SHIFT] + [RS232] Turns the RS232 on/off and allows setting the baud rate.	
Switching cursor point in ARB compiling mode	[SHIFT] + [▲] or [▼] When compiling an arbitrary wave, switches the blinking position between number and cursor point.	

CALIBRATING THE INSTRUMENTS

The Calibration chapter describes how to make sure the instrument is operating properly by calibrating its major functionalities.

Preparing for Calibrations

Note	In order to ensure performance accuracy, we recommend you to calibrate all items listed in this chapter at once.
Calibration items	• Attenuator • Square wave symmetry • Offset • Waveform amplitude • Waveform DC gain
When to run calibrations	• When using the instrument in a new environment • After completing verification, adjustment, and parts replacement.
Calibration Environments	• Location: Indoor, no direct sunlight, dust free • Relative Humidity: < 80% • Temperature: +18°C~+28°C • Warm-up time: ≥ 30 minutes
Calibration procedure	1. Calibrate an item and record the result into the log (page39). 2. If the calibration does not meet the accepted range, verify and/or adjust the item according to page37. 3. If the adjustment does not resolve the problem or the adjustment procedure does not exist, send the instrument back to the factory for repair.
Default settings	• Output on, sine wave • Modulation off • DC offset off • Sweep off

List of Equipments

Here is the list of all equipments used in the service operations.

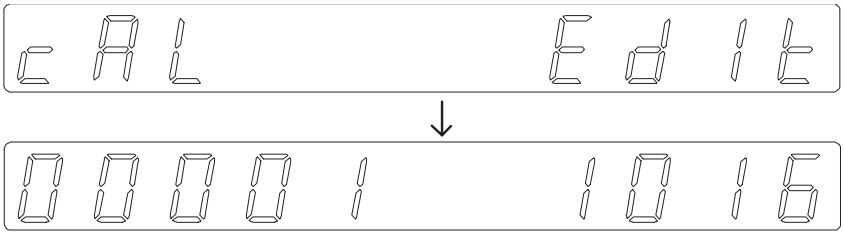
Item	Requirements	Recommended
Voltmeter (Multimeter)	• AC & DC Voltage Accuracy: < ±0.1%	• GDM-8246 • Fluke 8842
Oscilloscope	• Frequency : ≥ 30MHz	• GDS-1062
Distortion meter	• Distortion accuracy : < 0.01%	• NF DM155B

Entering the Calibration Mode

Entering the calibration mode

Press the Shift key followed by the number "0830". The display will show the "CAL EDIT" message and then enter into the calibration mode. The left digits shows the calibration ID and the right digits the corresponding value.

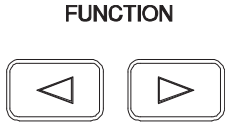
(Display)



(Calibration ID) (Value)

Moving the cursor

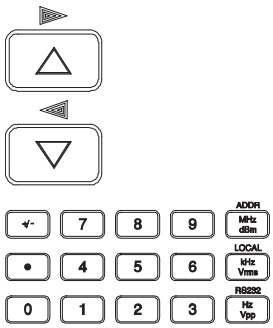
Use the Right/Left keys in the Function keys to change the location of the editing cursor (flashing point).



Changing the calibration ID or value

Move the cursor (flashing point) to the calibration ID or value and:

- Press the Up/Down keys OR
- Directly enter the calibration ID using the numerical keys (for example, pressing "123" followed by one of the unit keys changes the ID to 00123.



Calibration Log

Print out these pages and record the results. Keep it with the instrument.

Model name SFG-830/830G Serial number _____

Date Year_____ Month_____ Date_____

Verified by Name_____

Company/Contact_____

Environment Temperature_____°C Humidity_____%

Attenuator

ID	Min limit	Result	Max limit	Pass/Fail
1	38.9mV	_____mV	39.1mV	☐ Pass ☐ Fail
2	77.5mV	_____mV	78.5mV	☐ Pass ☐ Fail
3	155mV	_____mV	157mV	☐ Pass ☐ Fail
4	311mV	_____mV	313mV	☐ Pass ☐ Fail
5	623mV	_____mV	627mV	☐ Pass ☐ Fail
6	1.24V	_____V	1.26V	☐ Pass ☐ Fail
7	2.49V	_____V	2.51V	☐ Pass ☐ Fail
8	5.005V	_____V	5.025V	☐ Pass ☐ Fail
9	-39.1mV	_____mV	-38.9mV	☐ Pass ☐ Fail
10	-78.5mV	_____mV	-77.5mV	☐ Pass ☐ Fail
11	-157mV	_____mV	-155mV	☐ Pass ☐ Fail
12	-313mV	_____mV	-311mV	☐ Pass ☐ Fail
13	-627mV	_____mV	-623mV	☐ Pass ☐ Fail
14	-1.26V	_____V	-1.24V	☐ Pass ☐ Fail
15	-2.51V	_____V	-2.49V	☐ Pass ☐ Fail
16	-5.025V	_____V	-5.005V	☐ Pass ☐ Fail

Sine wave amplitude (even ID: 3.54Vrms ± 0.01V, odd ID: 1.77 ± 0.005Vrms)

ID	Result	Pass/Fail	ID	Result	Pass/Fail
114	_____Vrms	☐ Pass ☐ Fail	115	_____Vrms	☐ Pass ☐ Fail
116	_____Vrms	☐ Pass ☐ Fail	117	_____Vrms	☐ Pass ☐ Fail
118	_____Vrms	☐ Pass ☐ Fail	119	_____Vrms	☐ Pass ☐ Fail
120	_____Vrms	☐ Pass ☐ Fail	121	_____Vrms	☐ Pass ☐ Fail
122	_____Vrms	☐ Pass ☐ Fail	123	_____Vrms	☐ Pass ☐ Fail
124	_____Vrms	☐ Pass ☐ Fail	125	_____Vrms	☐ Pass ☐ Fail
126	_____Vrms	☐ Pass ☐ Fail	127	_____Vrms	☐ Pass ☐ Fail
128	_____Vrms	☐ Pass ☐ Fail	129	_____Vrms	☐ Pass ☐ Fail
130	_____Vrms	☐ Pass ☐ Fail	131	_____Vrms	☐ Pass ☐ Fail
132	_____Vrms	☐ Pass ☐ Fail	133	_____Vrms	☐ Pass ☐ Fail
134	_____Vrms	☐ Pass ☐ Fail	135	_____Vrms	☐ Pass ☐ Fail
136	_____Vrms	☐ Pass ☐ Fail	137	_____Vrms	☐ Pass ☐ Fail
138	_____Vrms	☐ Pass ☐ Fail	139	_____Vrms	☐ Pass ☐ Fail
140	_____Vrms	☐ Pass ☐ Fail	141	_____Vrms	☐ Pass ☐ Fail
142	_____Vrms	☐ Pass ☐ Fail	143	_____Vrms	☐ Pass ☐ Fail
144	_____Vrms	☐ Pass ☐ Fail	145	_____Vrms	☐ Pass ☐ Fail
146	_____Vrms	☐ Pass ☐ Fail	147	_____Vrms	☐ Pass ☐ Fail
148	_____Vrms	☐ Pass ☐ Fail	149	_____Vrms	☐ Pass ☐ Fail
150	_____Vrms	☐ Pass ☐ Fail	151	_____Vrms	☐ Pass ☐ Fail
152	_____Vrms	☐ Pass ☐ Fail	153	_____Vrms	☐ Pass ☐ Fail
154	_____Vrms	☐ Pass ☐ Fail	155	_____Vrms	☐ Pass ☐ Fail
156	_____Vrms	☐ Pass ☐ Fail	157	_____Vrms	☐ Pass ☐ Fail
158	_____Vrms	☐ Pass ☐ Fail	159	_____Vrms	☐ Pass ☐ Fail
160	_____Vrms	☐ Pass ☐ Fail	161	_____Vrms	☐ Pass ☐ Fail
162	_____Vrms	☐ Pass ☐ Fail	163	_____Vrms	☐ Pass ☐ Fail

Sine wave amplitude (even ID: 3.54Vrms ± 0.01V, odd ID: 1.77 ± 0.005Vrms)

ID	Result	Pass/Fail	ID	Result	Pass/Fail
164	_____Vrms	☐ Pass ☐ Fail	165	_____Vrms	☐ Pass ☐ Fail
166	_____Vrms	☐ Pass ☐ Fail	167	_____Vrms	☐ Pass ☐ Fail
168	_____Vrms	☐ Pass ☐ Fail	169	_____Vrms	☐ Pass ☐ Fail
170	_____Vrms	☐ Pass ☐ Fail	171	_____Vrms	☐ Pass ☐ Fail
172	_____Vrms	☐ Pass ☐ Fail	173	_____Vrms	☐ Pass ☐ Fail
174	_____Vrms	☐ Pass ☐ Fail	175	_____Vrms	☐ Pass ☐ Fail
176	_____Vrms	☐ Pass ☐ Fail	177	_____Vrms	☐ Pass ☐ Fail
178	_____Vrms	☐ Pass ☐ Fail	179	_____Vrms	☐ Pass ☐ Fail
180	_____Vrms	☐ Pass ☐ Fail	181	_____Vrms	☐ Pass ☐ Fail
182	_____Vrms	☐ Pass ☐ Fail	183	_____Vrms	☐ Pass ☐ Fail
184	_____Vrms	☐ Pass ☐ Fail	185	_____Vrms	☐ Pass ☐ Fail
186	_____Vrms	☐ Pass ☐ Fail	187	_____Vrms	☐ Pass ☐ Fail
188	_____Vrms	☐ Pass ☐ Fail	189	_____Vrms	☐ Pass ☐ Fail
190	_____Vrms	☐ Pass ☐ Fail	191	_____Vrms	☐ Pass ☐ Fail
192	_____Vrms	☐ Pass ☐ Fail	193	_____Vrms	☐ Pass ☐ Fail
194	_____Vrms	☐ Pass ☐ Fail	195	_____Vrms	☐ Pass ☐ Fail
196	_____Vrms	☐ Pass ☐ Fail	197	_____Vrms	☐ Pass ☐ Fail
198	_____Vrms	☐ Pass ☐ Fail	199	_____Vrms	☐ Pass ☐ Fail
200	_____Vrms	☐ Pass ☐ Fail	201	_____Vrms	☐ Pass ☐ Fail
202	_____Vrms	☐ Pass ☐ Fail	203	_____Vrms	☐ Pass ☐ Fail
204	_____Vrms	☐ Pass ☐ Fail	205	_____Vrms	☐ Pass ☐ Fail
206	_____Vrms	☐ Pass ☐ Fail	207	_____Vrms	☐ Pass ☐ Fail
208	_____Vrms	☐ Pass ☐ Fail	209	_____Vrms	☐ Pass ☐ Fail
210	_____Vrms	☐ Pass ☐ Fail	211	_____Vrms	☐ Pass ☐ Fail
212	_____Vrms	☐ Pass ☐ Fail	213	_____Vrms	☐ Pass ☐ Fail

Sine wave amplitude (even ID: 3.54Vrms ± 0.01V, odd ID: 1.77 ± 0.005Vrms)

ID	Result	Pass/Fail	ID	Result	Pass/Fail
214	_____Vrms	☐ Pass ☐ Fail	215	_____Vrms	☐ Pass ☐ Fail
216	_____Vrms	☐ Pass ☐ Fail	217	_____Vrms	☐ Pass ☐ Fail
218	_____Vrms	☐ Pass ☐ Fail	219	_____Vrms	☐ Pass ☐ Fail
220	_____Vrms	☐ Pass ☐ Fail	221	_____Vrms	☐ Pass ☐ Fail
222	_____Vrms	☐ Pass ☐ Fail	223	_____Vrms	☐ Pass ☐ Fail
224	_____Vrms	☐ Pass ☐ Fail	225	_____Vrms	☐ Pass ☐ Fail
226	_____Vrms	☐ Pass ☐ Fail	227	_____Vrms	☐ Pass ☐ Fail
228	_____Vrms	☐ Pass ☐ Fail	229	_____Vrms	☐ Pass ☐ Fail
230	_____Vrms	☐ Pass ☐ Fail	231	_____Vrms	☐ Pass ☐ Fail
232	_____Vrms	☐ Pass ☐ Fail	233	_____Vrms	☐ Pass ☐ Fail
234	_____Vrms	☐ Pass ☐ Fail	235	_____Vrms	☐ Pass ☐ Fail
236	_____Vrms	☐ Pass ☐ Fail	237	_____Vrms	☐ Pass ☐ Fail
238	_____Vrms	☐ Pass ☐ Fail	239	_____Vrms	☐ Pass ☐ Fail
240	_____Vrms	☐ Pass ☐ Fail	241	_____Vrms	☐ Pass ☐ Fail
242	_____Vrms	☐ Pass ☐ Fail	243	_____Vrms	☐ Pass ☐ Fail
244	_____Vrms	☐ Pass ☐ Fail	245	_____Vrms	☐ Pass ☐ Fail
246	_____Vrms	☐ Pass ☐ Fail	247	_____Vrms	☐ Pass ☐ Fail
248	_____Vrms	☐ Pass ☐ Fail	249	_____Vrms	☐ Pass ☐ Fail
250	_____Vrms	☐ Pass ☐ Fail	251	_____Vrms	☐ Pass ☐ Fail
252	_____Vrms	☐ Pass ☐ Fail	253	_____Vrms	☐ Pass ☐ Fail
254	_____Vrms	☐ Pass ☐ Fail	255	_____Vrms	☐ Pass ☐ Fail
256	_____Vrms	☐ Pass ☐ Fail	257	_____Vrms	☐ Pass ☐ Fail
258	_____Vrms	☐ Pass ☐ Fail	259	_____Vrms	☐ Pass ☐ Fail
260	_____Vrms	☐ Pass ☐ Fail	261	_____Vrms	☐ Pass ☐ Fail
262	_____Vrms	☐ Pass ☐ Fail	263	_____Vrms	☐ Pass ☐ Fail

Sine wave amplitude (even ID: 3.54Vrms ± 0.01V, odd ID: 1.77 ± 0.005Vrms)

ID	Result	Pass/Fail	ID	Result	Pass/Fail
264	_____Vrms	☐ Pass ☐ Fail	265	_____Vrms	☐ Pass ☐ Fail
266	_____Vrms	☐ Pass ☐ Fail	267	_____Vrms	☐ Pass ☐ Fail
268	_____Vrms	☐ Pass ☐ Fail	269	_____Vrms	☐ Pass ☐ Fail
270	_____Vrms	☐ Pass ☐ Fail	271	_____Vrms	☐ Pass ☐ Fail
272	_____Vrms	☐ Pass ☐ Fail	273	_____Vrms	☐ Pass ☐ Fail
274	_____Vrms	☐ Pass ☐ Fail	275	_____Vrms	☐ Pass ☐ Fail
276	_____Vrms	☐ Pass ☐ Fail	277	_____Vrms	☐ Pass ☐ Fail
278	_____Vrms	☐ Pass ☐ Fail	279	_____Vrms	☐ Pass ☐ Fail
280	_____Vrms	☐ Pass ☐ Fail	281	_____Vrms	☐ Pass ☐ Fail
282	_____Vrms	☐ Pass ☐ Fail	283	_____Vrms	☐ Pass ☐ Fail
284	_____Vrms	☐ Pass ☐ Fail	285	_____Vrms	☐ Pass ☐ Fail
286	_____Vrms	☐ Pass ☐ Fail	287	_____Vrms	☐ Pass ☐ Fail
288	_____Vrms	☐ Pass ☐ Fail	289	_____Vrms	☐ Pass ☐ Fail
290	_____Vrms	☐ Pass ☐ Fail	291	_____Vrms	☐ Pass ☐ Fail
292	_____Vrms	☐ Pass ☐ Fail	293	_____Vrms	☐ Pass ☐ Fail
294	_____Vrms	☐ Pass ☐ Fail	295	_____Vrms	☐ Pass ☐ Fail
296	_____Vrms	☐ Pass ☐ Fail	297	_____Vrms	☐ Pass ☐ Fail
298	_____Vrms	☐ Pass ☐ Fail	299	_____Vrms	☐ Pass ☐ Fail
300	_____Vrms	☐ Pass ☐ Fail	301	_____Vrms	☐ Pass ☐ Fail
302	_____Vrms	☐ Pass ☐ Fail	303	_____Vrms	☐ Pass ☐ Fail
304	_____Vrms	☐ Pass ☐ Fail	305	_____Vrms	☐ Pass ☐ Fail
306	_____Vrms	☐ Pass ☐ Fail	307	_____Vrms	☐ Pass ☐ Fail

Square wave amplitude (10±1Vpp)

ID	Result	Pass/Fail	ID	Result	Pass/Fail
308	_____Vpp	☐ Pass ☐ Fail	309	_____Vpp	☐ Pass ☐ Fail
310	_____Vpp	☐ Pass ☐ Fail	311	_____Vpp	☐ Pass ☐ Fail
312	_____Vpp	☐ Pass ☐ Fail	313	_____Vpp	☐ Pass ☐ Fail
314	_____Vpp	☐ Pass ☐ Fail	315	_____Vpp	☐ Pass ☐ Fail
316	_____Vpp	☐ Pass ☐ Fail	317	_____Vpp	☐ Pass ☐ Fail
318	_____Vpp	☐ Pass ☐ Fail	319	_____Vpp	☐ Pass ☐ Fail
320	_____Vpp	☐ Pass ☐ Fail	321	_____Vpp	☐ Pass ☐ Fail
322	_____Vpp	☐ Pass ☐ Fail	323	_____Vpp	☐ Pass ☐ Fail
324	_____Vpp	☐ Pass ☐ Fail	325	_____Vpp	☐ Pass ☐ Fail
326	_____Vpp	☐ Pass ☐ Fail	327	_____Vpp	☐ Pass ☐ Fail
328	_____Vpp	☐ Pass ☐ Fail	329	_____Vpp	☐ Pass ☐ Fail
330	_____Vpp	☐ Pass ☐ Fail	331	_____Vpp	☐ Pass ☐ Fail
332	_____Vpp	☐ Pass ☐ Fail	333	_____Vpp	☐ Pass ☐ Fail
334	_____Vpp	☐ Pass ☐ Fail	335	_____Vpp	☐ Pass ☐ Fail
336	_____Vpp	☐ Pass ☐ Fail	337	_____Vpp	☐ Pass ☐ Fail
338	_____Vpp	☐ Pass ☐ Fail	339	_____Vpp	☐ Pass ☐ Fail
340	_____Vpp	☐ Pass ☐ Fail	341	_____Vpp	☐ Pass ☐ Fail
342	_____Vpp	☐ Pass ☐ Fail	343	_____Vpp	☐ Pass ☐ Fail
344	_____Vpp	☐ Pass ☐ Fail	345	_____Vpp	☐ Pass ☐ Fail
346	_____Vpp	☐ Pass ☐ Fail	347	_____Vpp	☐ Pass ☐ Fail
348	_____Vpp	☐ Pass ☐ Fail	349	_____Vpp	☐ Pass ☐ Fail
350	_____Vpp	☐ Pass ☐ Fail	351	_____Vpp	☐ Pass ☐ Fail
352	_____Vpp	☐ Pass ☐ Fail	353	_____Vpp	☐ Pass ☐ Fail
354	_____Vpp	☐ Pass ☐ Fail	355	_____Vpp	☐ Pass ☐ Fail
356	_____Vpp	☐ Pass ☐ Fail	357	_____Vpp	☐ Pass ☐ Fail

Square wave amplitude (10±1Vpp), Triangle wave amplitude (10Vpp)

ID	Result	Pass/Fail	ID	Result	Pass/Fail
358	_____Vpp	☐ Pass ☐ Fail	359	_____Vpp	☐ Pass ☐ Fail
360	_____Vpp	☐ Pass ☐ Fail	361	_____Vpp	☐ Pass ☐ Fail
362	_____Vpp	☐ Pass ☐ Fail	363	_____Vpp	☐ Pass ☐ Fail
364	_____Vpp	☐ Pass ☐ Fail	365	_____Vpp	☐ Pass ☐ Fail
366	_____Vpp	☐ Pass ☐ Fail	367	_____Vpp	☐ Pass ☐ Fail
368	_____Vpp	☐ Pass ☐ Fail	369	_____Vpp	☐ Pass ☐ Fail
370	_____Vpp	☐ Pass ☐ Fail	371	_____Vpp	☐ Pass ☐ Fail
372	_____Vpp	☐ Pass ☐ Fail	373	_____Vpp	☐ Pass ☐ Fail
374	_____Vpp	☐ Pass ☐ Fail	375	_____Vpp	☐ Pass ☐ Fail
376	_____Vpp	☐ Pass ☐ Fail	377	_____Vpp	☐ Pass ☐ Fail
378	_____Vpp	☐ Pass ☐ Fail	379	_____Vpp	☐ Pass ☐ Fail
380	_____Vpp	☐ Pass ☐ Fail	381	_____Vpp	☐ Pass ☐ Fail
382	_____Vpp	☐ Pass ☐ Fail	383	_____Vpp	☐ Pass ☐ Fail
384	_____Vpp	☐ Pass ☐ Fail	385	_____Vpp	☐ Pass ☐ Fail
386	_____Vpp	☐ Pass ☐ Fail	387	_____Vpp	☐ Pass ☐ Fail
388	_____Vpp	☐ Pass ☐ Fail	389	_____Vpp	☐ Pass ☐ Fail
390	_____Vpp	☐ Pass ☐ Fail	391	_____Vpp	☐ Pass ☐ Fail
392	_____Vpp	☐ Pass ☐ Fail	393	_____Vpp	☐ Pass ☐ Fail
394	_____Vpp	☐ Pass ☐ Fail	395	_____Vpp	☐ Pass ☐ Fail
396	_____Vpp	☐ Pass ☐ Fail	397	_____Vpp	☐ Pass ☐ Fail
398	_____Vpp	☐ Pass ☐ Fail	399	_____Vpp	☐ Pass ☐ Fail
400	_____Vpp	☐ Pass ☐ Fail	401	_____Vpp	☐ Pass ☐ Fail
402	_____Vpp	☐ Pass ☐ Fail	403	_____Vpp	☐ Pass ☐ Fail
404	_____Vpp	☐ Pass ☐ Fail	405	_____Vpp	☐ Pass ☐ Fail

Square wave symmetry (406 to 438: 50% ± 1%, 438 to 460: 48% ± 1%)

ID	Result	Pass/Fail	ID	Result	Pass/Fail
406	_____%	☐ Pass ☐ Fail	407	_____%	☐ Pass ☐ Fail
408	_____%	☐ Pass ☐ Fail	409	_____%	☐ Pass ☐ Fail
410	_____%	☐ Pass ☐ Fail	411	_____%	☐ Pass ☐ Fail
412	_____%	☐ Pass ☐ Fail	413	_____%	☐ Pass ☐ Fail
414	_____%	☐ Pass ☐ Fail	415	_____%	☐ Pass ☐ Fail
416	_____%	☐ Pass ☐ Fail	417	_____%	☐ Pass ☐ Fail
418	_____%	☐ Pass ☐ Fail	419	_____%	☐ Pass ☐ Fail
420	_____%	☐ Pass ☐ Fail	421	_____%	☐ Pass ☐ Fail
422	_____%	☐ Pass ☐ Fail	423	_____%	☐ Pass ☐ Fail
424	_____%	☐ Pass ☐ Fail	425	_____%	☐ Pass ☐ Fail
426	_____%	☐ Pass ☐ Fail	427	_____%	☐ Pass ☐ Fail
428	_____%	☐ Pass ☐ Fail	429	_____%	☐ Pass ☐ Fail
430	_____%	☐ Pass ☐ Fail	431	_____%	☐ Pass ☐ Fail
432	_____%	☐ Pass ☐ Fail	433	_____%	☐ Pass ☐ Fail
434	_____%	☐ Pass ☐ Fail	435	_____%	☐ Pass ☐ Fail
436	_____%	☐ Pass ☐ Fail	437	_____%	☐ Pass ☐ Fail
438	_____%	☐ Pass ☐ Fail	439	_____%	☐ Pass ☐ Fail
440	_____%	☐ Pass ☐ Fail	441	_____%	☐ Pass ☐ Fail
442	_____%	☐ Pass ☐ Fail	443	_____%	☐ Pass ☐ Fail
444	_____%	☐ Pass ☐ Fail	445	_____%	☐ Pass ☐ Fail
446	_____%	☐ Pass ☐ Fail	447	_____%	☐ Pass ☐ Fail
448	_____%	☐ Pass ☐ Fail	449	_____%	☐ Pass ☐ Fail
450	_____%	☐ Pass ☐ Fail	451	_____%	☐ Pass ☐ Fail
452	_____%	☐ Pass ☐ Fail	453	_____%	☐ Pass ☐ Fail
454	_____%	☐ Pass ☐ Fail	455	_____%	☐ Pass ☐ Fail

Square wave symmetry (438 to 460: 48% ± 1%, 461 to 486: 45% ± 1%, 487 to 502: 40% ± 1%)

ID	Result	Pass/Fail	ID	Result	Pass/Fail
456	_____%	☐ Pass ☐ Fail	457	_____%	☐ Pass ☐ Fail
458	_____%	☐ Pass ☐ Fail	459	_____%	☐ Pass ☐ Fail
450	_____%	☐ Pass ☐ Fail	461	_____%	☐ Pass ☐ Fail
462	_____%	☐ Pass ☐ Fail	463	_____%	☐ Pass ☐ Fail
464	_____%	☐ Pass ☐ Fail	465	_____%	☐ Pass ☐ Fail
466	_____%	☐ Pass ☐ Fail	467	_____%	☐ Pass ☐ Fail
468	_____%	☐ Pass ☐ Fail	469	_____%	☐ Pass ☐ Fail
470	_____%	☐ Pass ☐ Fail	471	_____%	☐ Pass ☐ Fail
472	_____%	☐ Pass ☐ Fail	473	_____%	☐ Pass ☐ Fail
474	_____%	☐ Pass ☐ Fail	475	_____%	☐ Pass ☐ Fail
476	_____%	☐ Pass ☐ Fail	477	_____%	☐ Pass ☐ Fail
478	_____%	☐ Pass ☐ Fail	479	_____%	☐ Pass ☐ Fail
480	_____%	☐ Pass ☐ Fail	481	_____%	☐ Pass ☐ Fail
482	_____%	☐ Pass ☐ Fail	483	_____%	☐ Pass ☐ Fail
484	_____%	☐ Pass ☐ Fail	485	_____%	☐ Pass ☐ Fail
486	_____%	☐ Pass ☐ Fail	487	_____%	☐ Pass ☐ Fail
488	_____%	☐ Pass ☐ Fail	489	_____%	☐ Pass ☐ Fail
490	_____%	☐ Pass ☐ Fail	491	_____%	☐ Pass ☐ Fail
492	_____%	☐ Pass ☐ Fail	493	_____%	☐ Pass ☐ Fail
494	_____%	☐ Pass ☐ Fail	495	_____%	☐ Pass ☐ Fail
496	_____%	☐ Pass ☐ Fail	497	_____%	☐ Pass ☐ Fail
498	_____%	☐ Pass ☐ Fail	499	_____%	☐ Pass ☐ Fail
500	_____%	☐ Pass ☐ Fail	501	_____%	☐ Pass ☐ Fail
502	_____%	☐ Pass ☐ Fail			

Attenuator

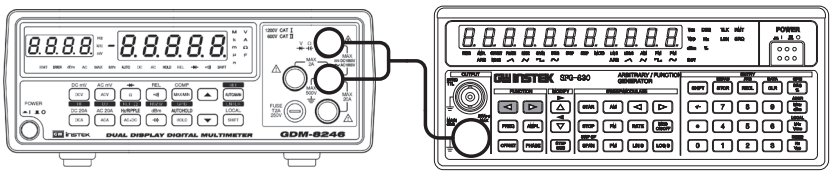
Accepted range	ID	Value	ID	Value
	1	39 ± 0.1mV	9	–39 ± 0.1mV
	2	78 ± 0.5mV	10	–78 ± 0.5mV
	3	156 ± 1mV	11	–156 ± 1mV
	4	312 ± 1mV	12	–312 ± 1mV
	5	625 ± 2mV	13	–625 ± 2mV
	6	1.25V ± 10mV	14	–1.25V ± 10mV
	7	2.5V ± 10mV	15	–2.5V ± 10mV
	8	5.015V ± 10mV	16	–5V ± 10mV

Equipment

- Voltmeter (Multimeter)

Configurations

- Voltmeter: DCV



Multimeter / Voltmeter SFG-830

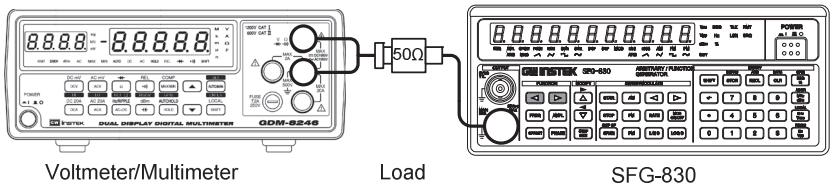
Calibration procedure

Adjust the calibration value until the voltmeter shows the value within the accepted range.

Calibrating the attenuator is completed: move to the next step.

Sine Wave Amplitude

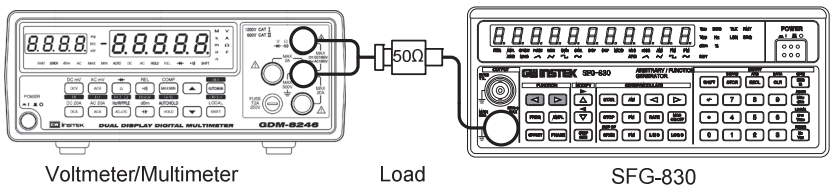
Accepted range	Even ID	Value	Odd ID	Value
	114 to 306	3.54 ± 0.01Vrms	115 to 307	1.77 ± 0.005Vrms
Equipment	• Voltmeter (Multimeter)		• 50Ω load	
Configurations	• Voltmeter: ACV • SFG-830 output → 50Ωload → Voltmeter input			
Calibration procedure	Adjust the calibration value until the voltmeter shows the value within the accepted range.			



Calibrating the sine wave amplitude is completed: move to the next step.

Square Wave Amplitude

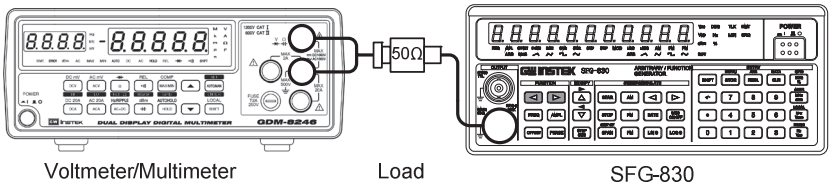
Accepted range	ID	Value		
	308 to 404	10 ± 1Vpp		
Equipment	• Voltmeter (Multimeter)		• 50Ω load	
Configurations	• Voltmeter: DCV • SFG-830 output → 50Ωload → Voltmeter input			
Calibration procedure	Adjust the calibration value until the voltmeter shows the value within the accepted range.			



Calibrating the square wave amplitude is completed: move to the next step.

Triangle Wave Amplitude

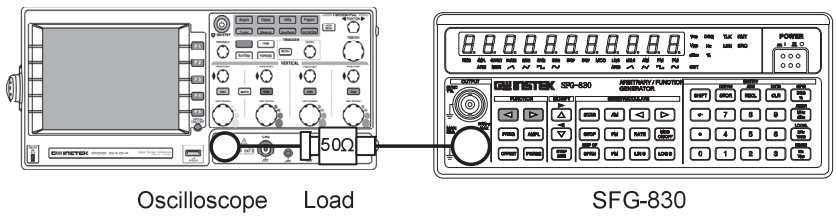
Accepted range	ID	Value
	405	10Vpp
Equipment	• Voltmeter (Multimeter)	• 50Ω load
Configurations	• Voltmeter: DCV • SFG-830 output → 50Ω load → Voltmeter input	
Calibration procedure	Adjust the calibration value until the voltmeter shows the value within the accepted range.	



Calibrating the triangle wave amplitude is completed: move to the next step.

Square Wave Symmetry

Accepted range	ID	Value	ID	Value
	406 to 437	50% ± 1%	438 to 460	48% ± 1%
	461 to 486	45% ± 1%	487 to 502	40% ± 1%
Equipment	• Oscilloscope		• 50Ω load	
Configurations	• SFG-830 output → 50Ω load → Oscilloscope input			
Calibration procedure	Adjust the calibration value until the voltmeter shows the value within the accepted range.			



Calibrating the square wave symmetry is completed: move to the next step.

DC Gain and Offset

Accepted range	ID	Value
	503 (Sine wave)	N/A (automatic calibration)
	504 (Square wave)	N/A (automatic calibration)
	505 (Triangle wave)	N/A (automatic calibration)
	506 to 602 (Offset)	N/A (automatic calibration)
Equipment	• N/A	
Configurations	• N/A	
Calibration procedure	Press Shift + 1830 to get into the automatic calibration mode. The instrument starts and finishes calibrating the above mentioned items automatically.	

Calibrating the DC gain and offset are completed. This concludes the calibration.

VERIFYING AND ADJUSTING THE INSTRUMENTS

The Verification chapter describes how to make sure the instrument is operating properly by verifying and adjusting its major functionalities. Verifications are intended for full performance inspection to complete service operations such as repair, component replacements, or adjustments.

After verifying and adjusting the instrument, running a calibration (page21) is strongly recommended.

Preparing for Verifications

Note ⚠	In order to ensure performance accuracy, we recommend you to verify all items listed in this chapter at once.
Verification and adjustment items	• Clock output • D/A reference • Filter • Frequency • DC offset • Phase noise • Square wave symmetry • Remote control • Frequency doubler • Amplitude • Harmonic distortion • Waveform amplitude • Sub-harmonics • Square wave rise time • Envelope distortion
When to run verifications	• When using the instrument in a new environment • After replacing one of the major internal modules, such as front panel or instrument PCB • When you need to make sure that the instrument is malfunctioning or not
Verification Environments	• Location: Indoor, no direct sunlight, dust free • Relative Humidity: < 80% • Temperature: +18°C~+28°C • Warm-up time: ≥ 30 minutes
Verification procedure	1. Verify an item and record the result into the log (page39). 2. If the result does not meet the accepted range, adjust the item if adjustment procedure exists. 3. If the adjustment does not resolve the problem or the adjustment procedure does not exist, send the instrument back to the factory for repair.
Default settings	• Output on • Modulation off • Offset off • Sine wave • Sweep off

List of Equipments

Here is the list of all equipments used in the service operations.

Item	Requirements	Recommended
Voltmeter (Multimeter)	• AC & DC Voltage Accuracy: < ±0.1%	• GDM-8246 • Fluke 8842
Frequency Counter (Multimeter)	• Frequency accuracy: < 1Hz • Frequency range: ≥ 30MHz	• GDM-8246
Oscilloscope	• Frequency : ≥ 30MHz	• GDS-1062
Spectrum analyzer	• Frequency : ≥ 1GHz	• GSP-830
Distortion meter	• Distortion accuracy : < 0.01%	• NF DM155B
Phillips screwdriver	• #3	• N/A
Minus screwdriver	• 1.0mm	• N/A

Verification Log

Print out these pages and record the results. Keep it with the instrument.

Model name SFG-830/830G Serial number _____

Date Year_____ Month_____ Date_____

Verified by Name_____

Company/Contact_____

Environment Temperature_____°C Humidity_____%

Clock output

Item	Min limit	Result	Max limit	Pass/Fail
Output frequency	10MHz-20Hz	_____MHz	10MHz+20Hz	☐ Pass ☐ Fail

Frequency doubler

Item	Min limit	Result	Max limit	Pass/Fail
U303 pin6 output	N/A	_____	N/A	☐ Pass ☐ Fail

D/A reference

Item	Min limit	Result	Max limit	Pass/Fail
Sine wave symmetry	N/A	_____	N/A	☐ Pass ☐ Fail

Amplitude (100Hz)

Item	Min limit	Result	Max limit	Pass/Fail
Square wave	N/A	_____	N/A	☐ Pass ☐ Fail

Amplitude (10kHz)

Item	Min limit	Result	Max limit	Pass/Fail
Square wave	N/A	_____	N/A	☐ Pass ☐ Fail

Amplitude (500kHz-1)

Item	Min limit	Result	Max limit	Pass/Fail
Square wave	N/A	_____	N/A	☐ Pass ☐ Fail

Amplitude (500kHz-2)

Item	Min limit	Result	Max limit	Pass/Fail
Square wave	N/A	_____	5% overshoot	☐ Pass ☐ Fail

Filter

Item	Min limit	Result	Max limit	Pass/Fail
Ripple	N/A	_____	N/A	☐ Pass ☐ Fail

Harmonic distortion

Item	Min limit	Result	Max limit	Pass/Fail
Distortion	N/A	_____	N/A	☐ Pass ☐ Fail

Frequency accuracy

Item	Min limit	Result	Max limit	Pass/Fail
Frequency deviation	10MHz-40Hz	_____MHz	10MHz+40Hz	☐ Pass ☐ Fail

Sine wave amplitude (3.54Vrms)

Item	Min limit	Result	Max limit	Pass/Fail
100Hz amplitude	3.33Vrms	_____Vrms	3.74Vrms	☐ Pass ☐ Fail
1kHz amplitude		_____Vrms		☐ Pass ☐ Fail
10kHz amplitude		_____Vrms		☐ Pass ☐ Fail
1MHz amplitude		_____Vrms		☐ Pass ☐ Fail

Sine wave amplitude (1Vrms)

Item	Min limit	Result	Max limit	Pass/Fail
100Hz amplitude	0.94Vrms	_____Vrms	1.06Vrms	☐ Pass ☐ Fail
1kHz amplitude		_____Vrms		☐ Pass ☐ Fail
10kHz amplitude		_____Vrms		☐ Pass ☐ Fail
1MHz amplitude		_____Vrms		☐ Pass ☐ Fail

Square wave amplitude

Item	Min limit	Result	Max limit	Pass/Fail
100Hz amplitude		_____Vpp		☐ Pass ☐ Fail
1kHz amplitude		_____Vpp		☐ Pass ☐ Fail
10kHz amplitude		_____Vpp		☐ Pass ☐ Fail
1MHz amplitude		_____Vpp		☐ Pass ☐ Fail
2MHz amplitude		_____Vpp		☐ Pass ☐ Fail
4MHz amplitude		_____Vpp		☐ Pass ☐ Fail
6MHz amplitude		_____Vpp		☐ Pass ☐ Fail
8MHz amplitude		_____Vpp		☐ Pass ☐ Fail
10MHz amplitude		_____Vpp		☐ Pass ☐ Fail
12MHz amplitude	8.8Vpp	_____Vpp	11.2Vpp	☐ Pass ☐ Fail
14MHz amplitude		_____Vpp		☐ Pass ☐ Fail
16MHz amplitude		_____Vpp		☐ Pass ☐ Fail
18MHz amplitude		_____Vpp		☐ Pass ☐ Fail
20MHz amplitude		_____Vpp		☐ Pass ☐ Fail
22MHz amplitude		_____Vpp		☐ Pass ☐ Fail
24MHz amplitude		_____Vpp		☐ Pass ☐ Fail
26MHz amplitude		_____Vpp		☐ Pass ☐ Fail
28MHz amplitude		_____Vpp		☐ Pass ☐ Fail
30MHz amplitude		_____Vpp		☐ Pass ☐ Fail

Triangle wave amplitude

Item	Min limit	Result	Max limit	Pass/Fail
100Hz amplitude	9.5Vpp	_____Vpp	10.5Vpp	☐ Pass ☐ Fail
1kHz amplitude		_____Vpp		☐ Pass ☐ Fail
10kHz amplitude		_____Vpp		☐ Pass ☐ Fail
1MHz amplitude		_____Vpp		☐ Pass ☐ Fail

DC offset accuracy

Item	Min limit	Result	Max limit	Pass/Fail
5V offset	4.925V	_____V	5.075V	☐ Pass ☐ Fail
-5V offset	-5.075V	_____V	-4.925V	☐ Pass ☐ Fail
0V offset	-1mV	_____V	1mV	☐ Pass ☐ Fail

Sub-harmonics

Item	Min limit	Result	Max limit	Pass/Fail
102kHz sine	N/A	_____dBm	-21.02dBm	☐ Pass ☐ Fail
1.001MHz sine		_____dBm		☐ Pass ☐ Fail
10.001MHz sine		_____dBm		☐ Pass ☐ Fail
20.001MHz sine		_____dBm		☐ Pass ☐ Fail
30.0MHz sine		_____dBm		☐ Pass ☐ Fail

Harmonic distortions (≤100kHz)

Item	Min limit	Result	Max limit	Pass/Fail
100Hz sine wave	N/A	_____dBc	-50dBc	☐ Pass ☐ Fail
1kHz sine wave		_____dBc		☐ Pass ☐ Fail
10kHz sine wave		_____dBc		☐ Pass ☐ Fail
50kHz sine wave		_____dBc		☐ Pass ☐ Fail
100kHz sine wave		_____dBc		☐ Pass ☐ Fail

Harmonic distortions (≥500kHz)

Item	Min limit	Result	Max limit	Pass/Fail
500Hz sine wave	N/A	_____dBc	-40dBc	☐ Pass ☐ Fail
5MHz sine wave		_____dBc	-30dBc	☐ Pass ☐ Fail
15MHz sine wave		_____dBc	-25dBc	☐ Pass ☐ Fail
30MHz sine wave		_____dBc	-25dBc	☐ Pass ☐ Fail

Phase noise

Item	Min limit	Result	Max limit	Pass/Fail
Power @ 10MHz	N/A	_____dBc	N/A	☐ Pass ☐ Fail
10MHz + 15kHz	N/A	_____dBc	N/A	☐ Pass ☐ Fail
Power difference	N/A	_____dBc	-50dBc	☐ Pass ☐ Fail

Square wave rise time

Item	Min limit	Result	Max limit	Pass/Fail
Rise time	N/A	_____ns	15ns	☐ Pass ☐ Fail
Overshoot	N/A	_____Vpp	500mVpp	☐ Pass ☐ Fail
Undershoot	N/A	_____Vpp	500mVpp	☐ Pass ☐ Fail

Square wave symmetry

Item	Min limit	Result	Max limit	Pass/Fail
Symmetry	49:51	_____	51:49	☐ Pass ☐ Fail

AM envelope distortion

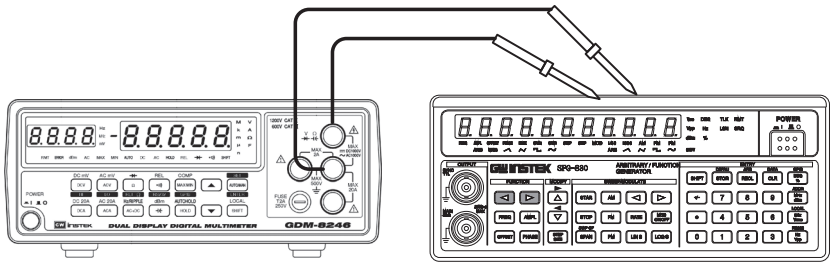
Item	Min limit	Result	Max limit	Pass/Fail
Base wave power	N/A	_____dBm	-35dBm	☐ Pass ☐ Fail
Side wave power	N/A	_____dBm	_35dBm	☐ Pass ☐ Fail

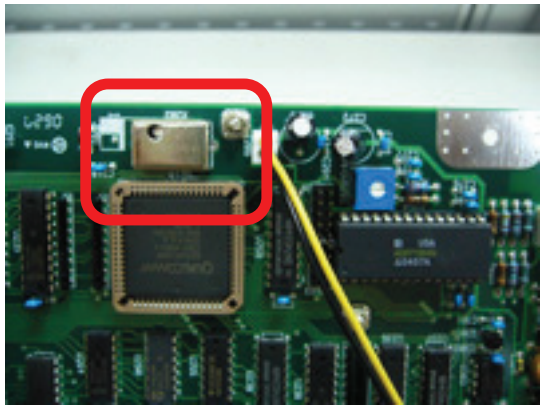
Remote control

Item	Min limit	Result	Max limit	Pass/Fail
GPIB	N/A	_____	N/A	☐ Pass ☐ Fail
RS-232C	N/A	_____	N/A	☐ Pass ☐ Fail

Clock Output

Accepted range	10MHz ± 20Hz
Equipment	• Frequency counter • #1 Phillips screwdriver
Configurations	• SFG-830: Sine wave, 10MHz, 5Vpp, Modulation off • Frequency Counter probe → SFG-830 top PCB

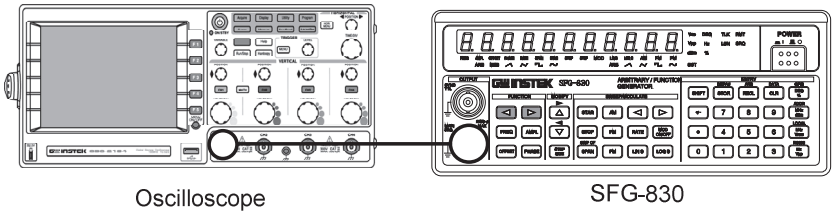


Verification procedure	Measure the output frequency of X202 using the frequency counter. Adjust X202 if necessary.
X202 location: Top PCB	
Close-up	

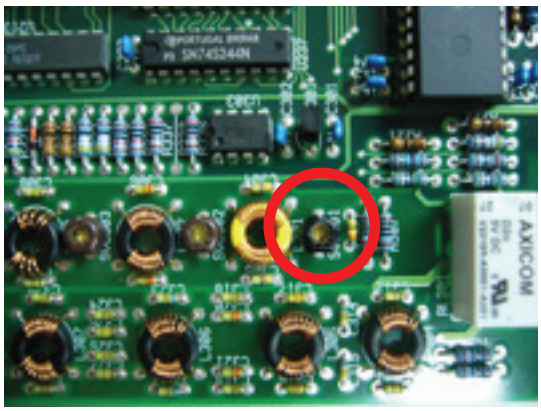
Verifying/adjusting the clock output is completed

Frequency Doubler

Accepted range	N/A (flat DC signal)
Equipment	• Oscilloscope • #1 Phillips screwdriver
Configurations	• SFG-830: Sine wave, 10kHz, 10Vpp • SFG-830 Main output → Oscilloscope CH1 input
Verification procedure	Make sure the output of U303, pin1 is a flat DC signal. Adjust SVR301 if necessary.
SVR301 location: Top PCB	
Close-up	

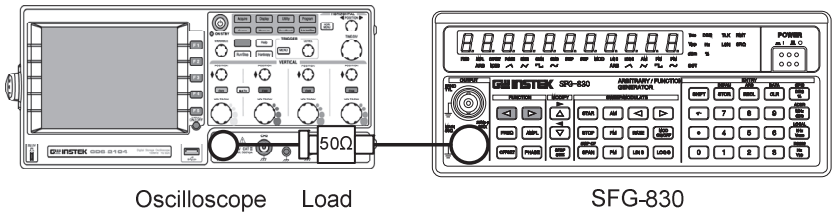


Oscilloscope SFG-830



Verifying/adjusting the frequency doubler is completed

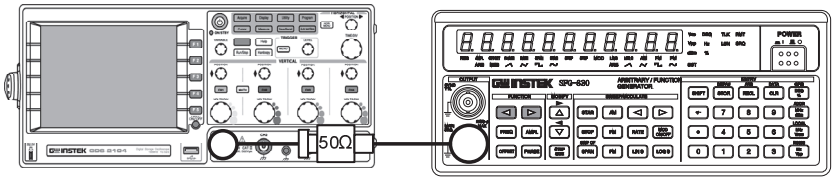
D/A Reference

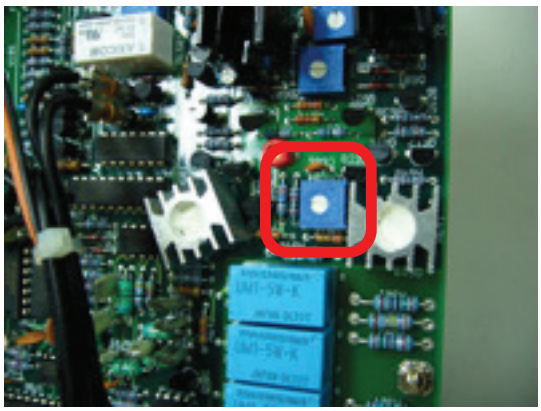
Accepted range	N/A (flat DC signal)
Equipment	• Oscilloscope • 50Ω load • #1 Phillips screwdriver
Configurations	• SFG-830: Sine wave, 1kHz, 10Vpp • SFG-830 Main output → 50Ω load → Oscilloscope CH1 input 
Verification procedure	Make sure the output sine wave becomes symmetrical. Adjust SVR201 if necessary.
SVR201 location: Top PCB	
Close-up	

Verifying/adjusting the D/A reference is completed

Amplitude (100Hz)

Accepted range	N/A (flat DC signal)
Equipment	• Oscilloscope • 50Ω load • #1 Phillips screwdriver
Configurations	• SFG-830: Square wave, 100Hz, 8Vpp • Oscilloscope: 2V/div, 5ms/div • SFG-830 Main output → 50Ω load → Oscilloscope CH1 input
Verification procedure	Make sure the square wave becomes flat. Adjust SVR604 if necessary.
SVR604 location: Bottom PCB	
Close-up	

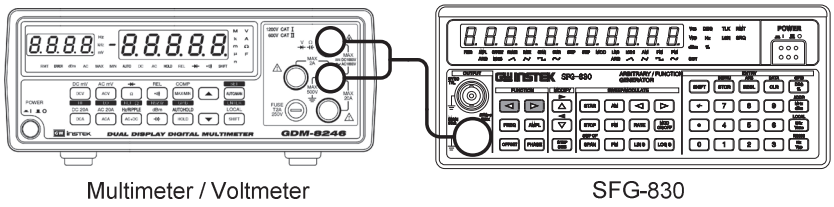


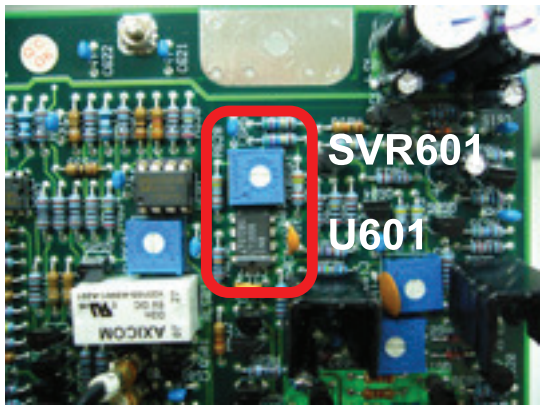


Verifying/adjusting the Amplitude (100Hz) is completed

Amplitude (10kHz)

Accepted range	N/A (flat DC signal)
Equipment	• Multimeter or Voltmeter • #1 Phillips screwdriver
Configurations	• SFG-830: Square wave, 10kHz, 8Vpp • Multimeter: DCV • SFG-830 Main output → Multimeter input
Verification procedure	Make sure the square wave becomes flat. Adjust SVR601 if necessary.
SVR601 location: Bottom PCB	
Close-up	

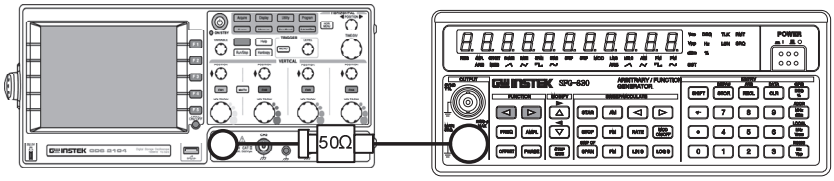


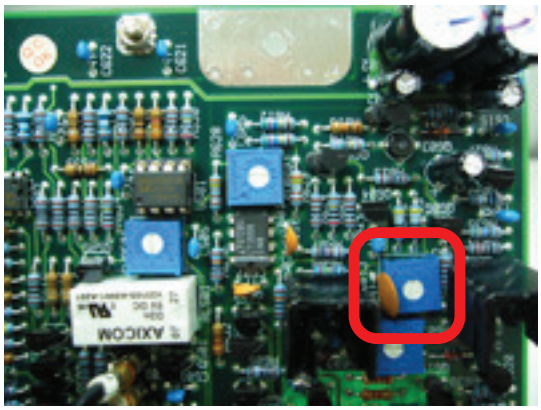


Verifying/adjusting the Amplitude (10kHz) is completed

Amplitude (500kHz – 1)

Accepted range	N/A (flat DC signal)
Equipment	• Oscilloscope • 50Ω load • #1 Phillips screwdriver
Configurations	• SFG-830: Square wave, 500kHz, 8Vpp • Oscilloscope: 2V/div, 1us/div • SFG-830 Main output → 50Ω load → Oscilloscope CH1 input

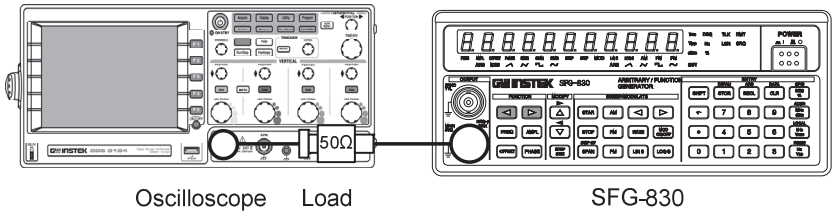


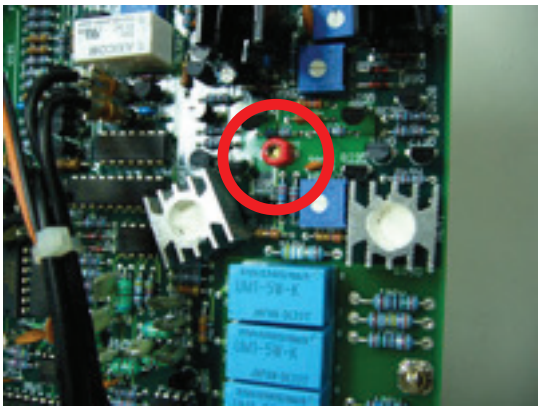
Verification procedure	Make sure the square wave becomes flat. Adjust SVR602 if necessary.
SVR602 location: Bottom PCB	
Close-up	

Verifying/adjusting the Amplitude (500kHz – 1) is completed

Amplitude (500kHz - 2)

Accepted range	The amount of overshoot: < 5% at the fastest rise time
Equipment	• Oscilloscope • 50Ω load • #1 Phillips screwdriver
Configurations	• SFG-830: Square wave, 500kHz, 8Vpp • Oscilloscope: 2V/div, 200ns/div (or fastest rise time) • SFG-830 Main output → 50Ω load → Oscilloscope CH1 input

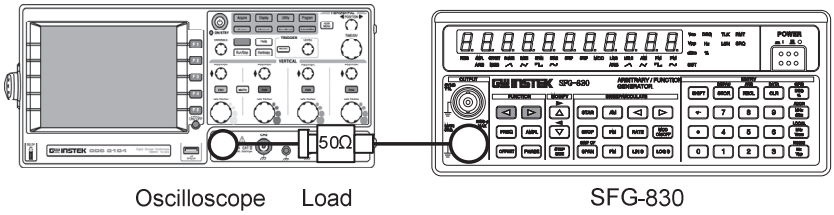


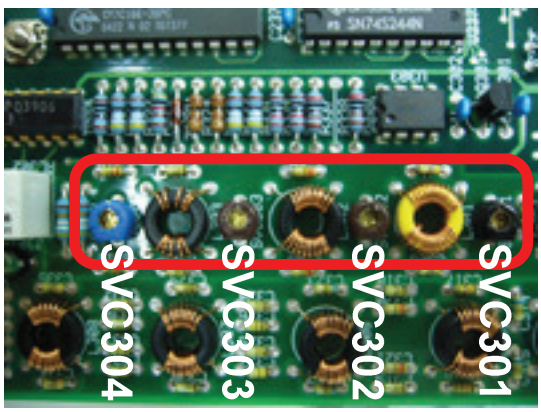
Verification procedure	Make sure the amount of overshoot stays within 5% at the fastest rise time. Adjust SVC601 if necessary.
SVC601 location: Bottom PCB	
Close-up	

Verifying/adjusting the Amplitude (500kHz - 2) is completed

Filter

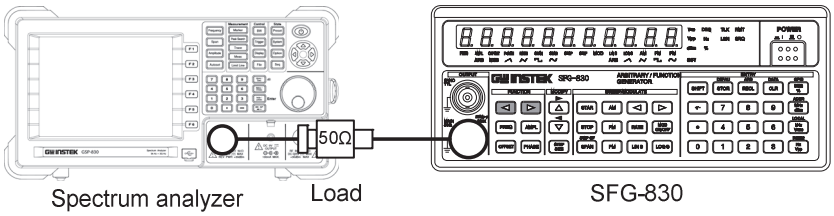
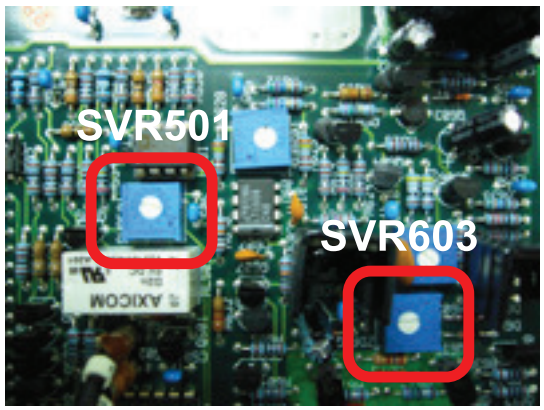
Accepted range	N/A (smallest peak to peak ripple)
Equipment	• Oscilloscope • 50Ω load • #1 Phillips screwdriver
Configurations	• SFG-830: ARB wave, 2MHz (sampling freq), 8Vpp • Oscilloscope: 2V/div, 200ns/div (or fastest rise time) • SFG-830 Main output → 50Ω load → Oscilloscope CH1 input
Verification procedure	Make sure the amount of peak to peak ripple stays minimum. Adjust SVC301, 302, 303, 304 in this order if necessary.
SVC301, 302, 303, 304 location: Top PCB	
Close-up	





Verifying/adjusting the Filter is completed

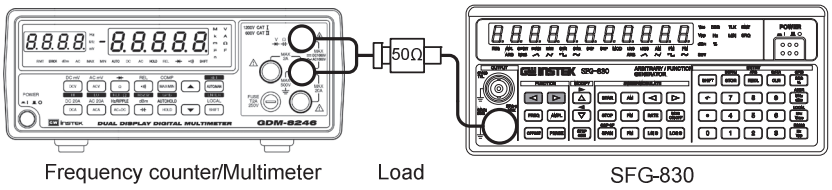
Harmonic Distortion

Accepted range	N/A (smallest distortion)
Equipment	• Spectrum analyzer • 50Ω load • #1 Phillips screwdriver
Configurations	• SFG-830: Sine wave, 15kHz, 8Vpp • Spectrum analyzer: start 0kHz, stop 100kHz • SFG-830 Main output → 50Ω load → Oscilloscope CH1 input 
Verification procedure	Make sure the amount of distortion stays minimum. Adjust SVR501 (second harmonics) and SVR603 (third and fifth harmonics) if necessary.
SVR501, 603 location: Top PCB	
Close-up	

Verifying/adjusting the Harmonic Distortion is completed

Frequency Accuracy

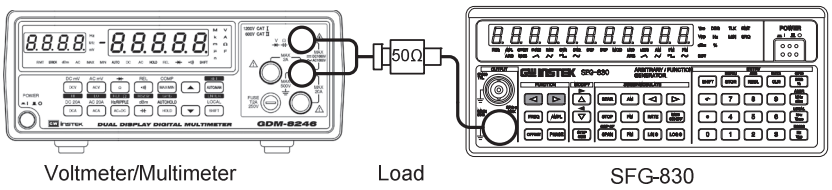
Accepted range	10MHz ± 40Hz
Equipment	• Frequency counter or multimeter • 50Ωload
Configurations	• SFG-830: Sine wave, 10MHz, 1Vpp • SFG-830 Main output → 50Ω load → Frequency counter input
Verification procedure	Check that the amount of frequency deviation stays within ±40Hz.



Verifying the Harmonic Distortion is completed

Sine Wave Amplitude (3.54Vrms)

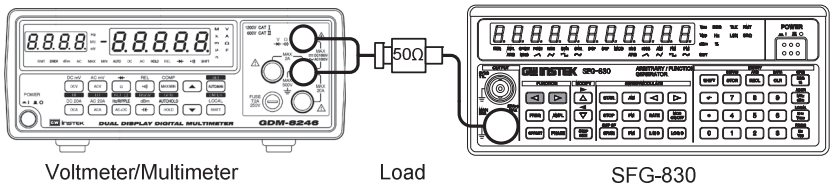
Accepted range	3.33Vrms – 3.74Vrms
Equipment	• Voltmeter or multimeter • 50Ω load
Configurations	• SFG-830: Sine wave, 100Hz, 10Vpp (3.54Vrms) • Voltmeter: ACV range • SFG-830 Main output → 50Ω load → Voltmeter input
Verification procedure	Check the amplitude stays between 3.54Vrms±0.2V. Repeat verification for 1kHz, 10kHz, 100kHz, and 1MHz.



Verifying the Sine wave amplitude (3.54Vrms) is completed

Sine Wave Amplitude (1Vrms)

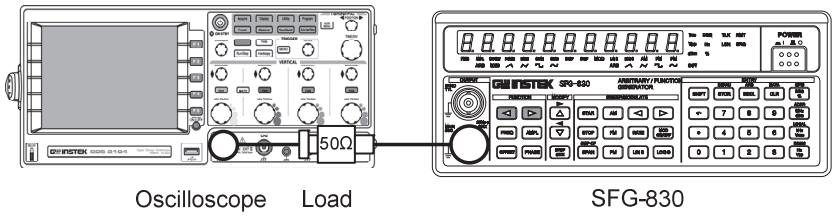
Accepted range	0.94Vrms – 1.06Vrms
Equipment	• Voltmeter or multimeter • 50Ω load
Configurations	• SFG-830: Sine wave, 100Hz, 1Vrms • Voltmeter: ACV range • SFG-830 Main output → 50Ω load → Voltmeter input
Verification procedure	Check the amplitude stays between 1.0Vrms±0.06V. Repeat verification for 1kHz, 10kHz, 100kHz, and 1MHz.



Verifying the Sine wave amplitude (1Vrms) is completed

Square Wave Amplitude

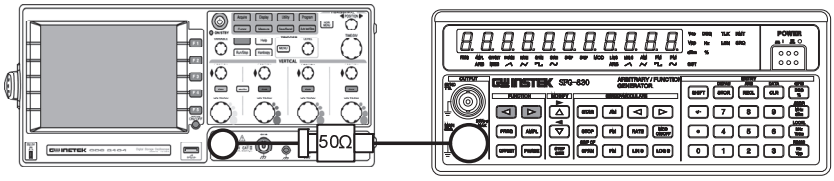
Accepted range	8.8Vpp – 11.2Vpp
Equipment	• Oscilloscope • 50Ω load
Configurations	• SFG-830: Square wave, 100Hz, 10Vpp • SFG-830 Main output → 50Ω load → Oscilloscope input
Verification procedure	Check the amplitude stays between 10Vpp±1.2V. Repeat verification for 1kHz, 10kHz, 100kHz, 1MHz, and 2MHz to 30MHz in 2MHz step.



Verifying the Square wave amplitude is completed

Triangle Wave Amplitude

Accepted range	9.5Vpp – 10.5Vpp
Equipment	• Oscilloscope • 50Ω load
Configurations	• SFG-830: Triangle wave, 100Hz, 10Vpp • SFG-830 Main output → 50Ω load → Oscilloscope input

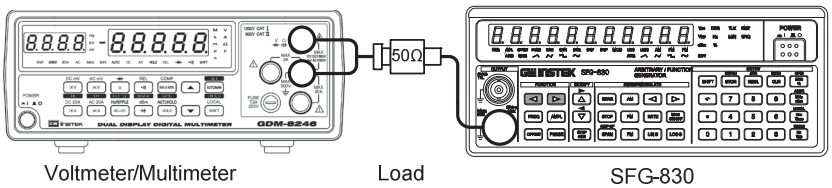


Verification procedure	Check the amplitude stays between 10Vpp±0.5V. Repeat verification for 1kHz, 10kHz, 100kHz, and 1MHz.

Verifying the Triangle wave amplitude is completed

DC Offset Accuracy

Accepted range	5.0V±0.075V, −5.0V±0.075V, 0V±1mV
Equipment	• Voltmeter or multimeter • 50Ω load
Configurations	• SFG-830: Sine wave, 1kHz, 0Vpp, DC Offset 5V • Voltmeter: ACV range • SFG-830 Main output → 50Ω load → Voltmeter input

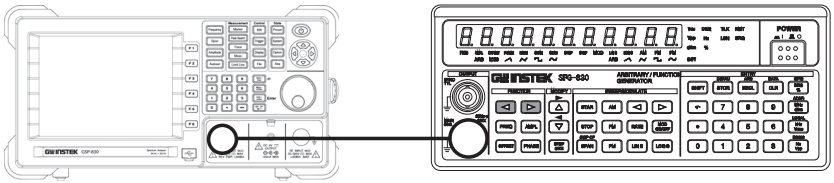


Verification procedure	Check the offset level stays between 5V±0.075V. Repeat verification for –5V offset (-5.0V±0.075V) and 0V offset (0V ± 1mV).

Verifying the DC offset is completed

Sub-Harmonics

Accepted range	< −21.02dBm
Equipment	• Spectrum analyzer
Configurations	• SFG-830: Sine wave, 102kHz, 10Vpp, DC Offset 0V • Spectrum analyzer: center frequency 51kHz • SFG-830 Main output → Spectrum analyzer input
Verification procedure	Check the harmonics at 51kHz is smaller than -21.02dBm. Repeat verification for 1.001MHz (center 501kHz), 10.001MHz (center 5.001MHz), 20.001MHz (center 10.001MHz), and 30.0MHz (center 15.0MHz).

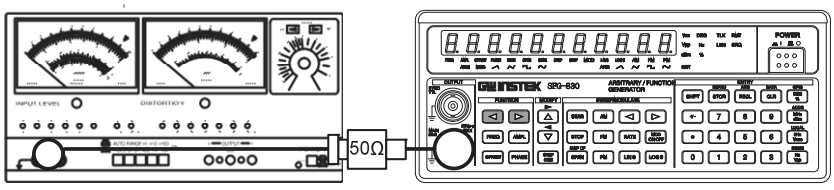


Spectrum analyzer SFG-830

Verifying the Sub-harmonics is completed

Harmonic Distortions (≤100kHz)

Accepted range	< –50dBc (0.31%)
Equipment	• Distortion Meter • 50Ω load
Configurations	• SFG-830: Sine wave, 100Hz, 1Vpp • SFG-830 Main output → 50Ω load → Distortion meter
Verification procedure	Check the distortion is smaller than –50dBc (0.31%). Repeat the verification for 1kHz, 10kHz, 50kHz, and 100kHz wave.

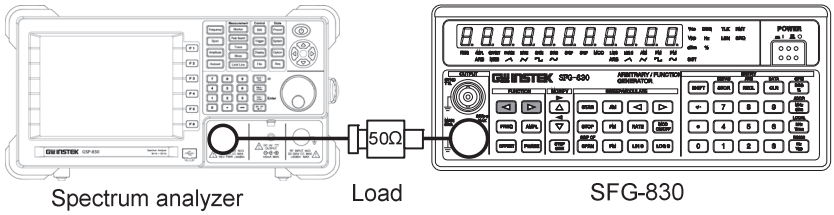


Distortion meter Load SFG-830

Verifying the Harmonic distortions (≤100kHz) is completed

Harmonic Distortions (≥500kHz)

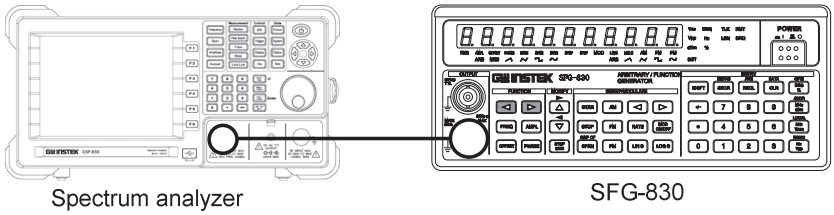
Accepted range	< –40dBc (500kHz), < −30dBc (5MHz), < −25dBc (15MHz), < −25dBc (30MHz)
Equipment	• Spectrum analyzer • 50Ω load
Configurations	• SFG-830: Sine wave, 500kHz, 1Vpp • SFG-830 Main output → 50Ω load → Spectrum analyzer
Verification procedure	Check the distortion is smaller than –40dBc. Repeat the verification for 5MHz (-30dBc), 15MHz(–25dBc), and 30MHz(-25dBc) wave.



Verifying the Harmonic distortions (≥500kHz) is completed

Phase Noise

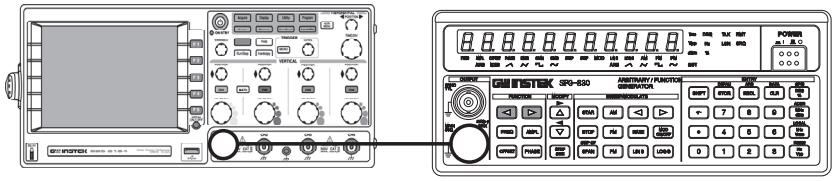
Accepted range	Power difference between 10MHz and 10MHz + 15kHz: < –50dBc
Equipment	• Spectrum analyzer
Configurations	• SFG-830: Sine wave, 10MHz, 13dBm • Spectrum analyzer: center 10MHz, span 100kHz • SFG-830 Main output → Spectrum analyzer
Verification procedure	Check that the power difference between 10MHz and 10MHz + 15kHz is < –50dBc.



Verifying the Phase Noise is completed

Square Wave Rise Time

Accepted range	Rise time < 15ns, overshoot/undershoot < 500mVpp
Equipment	• Oscilloscope • 50Ω load
Configurations	• SFG-830: Square wave, 1MHz, 10Vpp • SFG-830 Main output → Oscilloscope input
Verification procedure	Check the rise time < 15ns, overshoot/undershoot < 500mVpp.

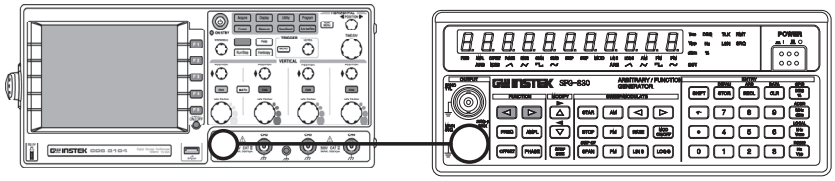


Oscilloscope SFG-830

Verifying the Square wave rise time is completed

Square Wave Symmetry

Accepted range	Between 49:51 and 51:49
Equipment	• Oscilloscope • 50Ω load
Configurations	• SFG-830: Square wave, 1MHz, 15Vpp • SFG-830 Main output → Oscilloscope input
Verification procedure	Check the symmetry is between 49:51 and 51:49.

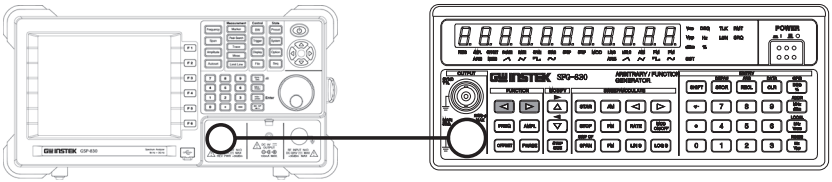


Oscilloscope SFG-830

Verifying the Square wave symmetry is completed

AM Envelope Distortion

Accepted range	Base wave and side wave power < –35dBm
Equipment	• Spectrum analyzer
Configurations	• SFG-830: Sine wave, 1MHz, 10Vpp, modulation on • SFG-830 modulation: AM, sine wave, 1kHz, 80% • Spectrum analyzer: center 1MHz, span 20kHz • SFG-830 Main output → Spectrum analyzer input
Verification procedure	Check the base wave and side wave power are less than –35dBm.



Spectrum analyzer SFG-830

Verifying the AM envelope distortion is completed

Remote Control Settings

Accepted range	No error after conducting auto-testing
Equipment	• GPIB cable (for SFG-830G) • RS-232C cable • PC with GPIB terminal • PC with RS-232C terminal
Configurations	• SFG-830: GPIB and RS-232C activated • GPIB: device, NI GPIB 0, address 8, Dev8 • RS-232C: 9600, Com2 port, no parity, data bit 8, stop bit 1 • SFG-830 GPIB/RS-232C terminals → PC terminal
Verification procedure	1. For GPIB, make sure the "National car and device DEV8 found" message is displayed. 2. Select AUTO to run auto-testing. Make sure the message "GPIB OK" appears as the sign of success. 3. Run the same auto-testing for RS-232C.

Verifying the remote control settings is completed

CHANGING THE OPTIONS

This chapter describes how to change replacable components such as GPIB module, fuse, and mains voltage.

List of Equipments

Here is the list of all equipments used in the service operations.

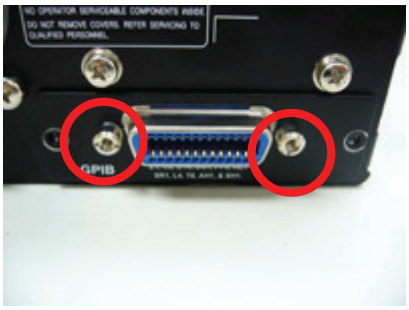
Item	Requirements	Used in
Phillips screwdriver	• #3	• Adjustments • Disassembly
Minus screwdriver	• 2.4mm	• Adjustments
Plier	• N/A	• Disassembly
Soldering kit	• N/A	• Disassembly

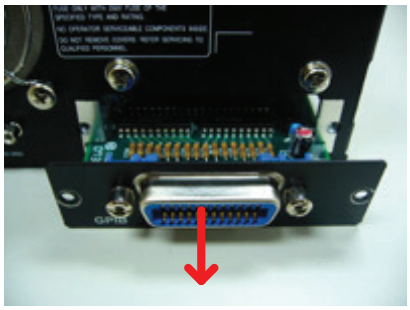
Installing/Removing the GPIB Module

⚠ WARNING Before accessing the GPIB module, disconnect the power cord from the instrument.

Procedure

1. Remove two screws from the side of the GPIB module (or cover).
2. Slide the GPIB module out.





Note

If the GPIB module is tightly inserted, accessing the module from the bottom after removing the bottom casing might help. See page65 for how to remove the casing.

Installing/Removing the GPIB module is completed

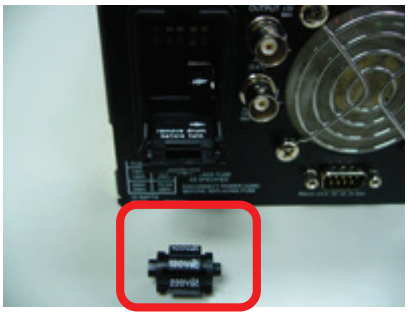
Changing the AC Mains Voltage

Procedure

1. Pull the power cord out and then open the top of the fuse holder using a minus driver.

2. The AC rating drum is located at the top.

3. Take the AC rating drum out, rotate it, and place it back so that the target rating fits into the fuse holder opening.



4. Put the fuse holder cover and make sure that the target AC mains voltage is visible from the opening.

Changing the AC mains voltage is completed

Replacing the Mains Fuse

⚠ WARNING	Before replacing the fuse, make sure the cause of fuse blowout has been fixed.		
Rating	Model	AC110/120V	AC220V/230V
	SFG-830/830G	T0.8A/250V	T0.5A/250V

Procedure

1. Pull the power cord out and then open the top of the fuse holder using a minus driver.

2. The fuse holder is located below the AC rating drum.

3. Pull the fuse holder out.

4. Replace the glass tube fuse inside the fuse holder and then put it back into the fuse holder.

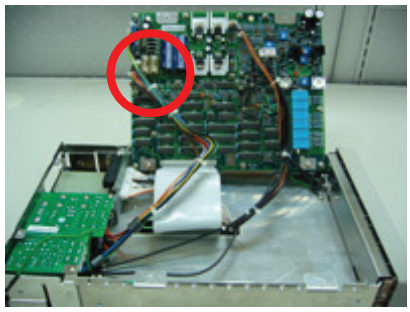
Replacing the main fuse is completed

Replacing the Internal Fuse

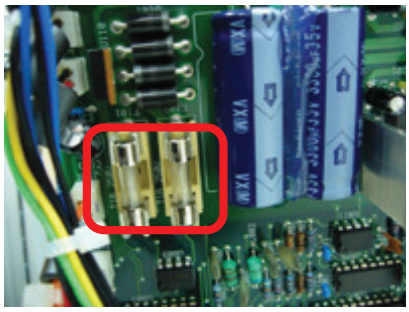
⚠ WARNING	Before replacing the fuse, make sure the cause of fuse blowout has been fixed.	
Rating	F101, F102	T1A/250V
	F103, F104	T1A/250V

Procedure (F101/F102)

1. Remove the bottom casing and open the bottom PCB (details in page69).

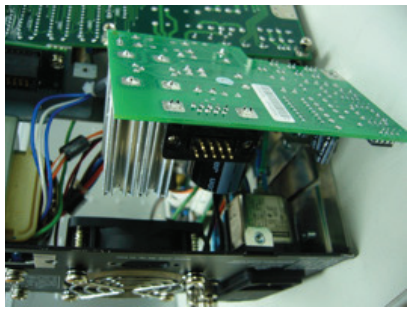


2. Replace the fuses, F101 and/or F102, on the bottom PCB.

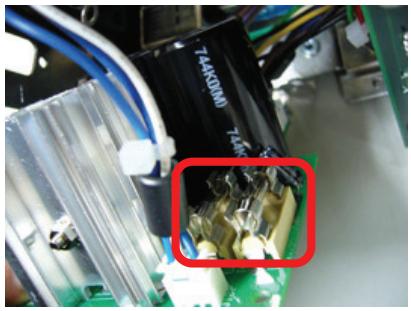


Procedure (F103/F104)

1. Remove the power supply PCB (details in page72).



2. Replace the fuses, F103 and/or F104, on the power supply PCB.



Replacing the internal fuses is completed

DISASSEMBLING THE INSTRUMENT

The Disassembly chapter shows how to remove the PCBs, panels, and outer casing from the instrument. The procedures described in this chapter are intended for parts replacement and board adjustment. The PCB diagrams included in the *Ordering the Parts* chapter (page73) shows more details about the mechanical structures of the instrument and thus can also be used as a reference.

List of Equipments

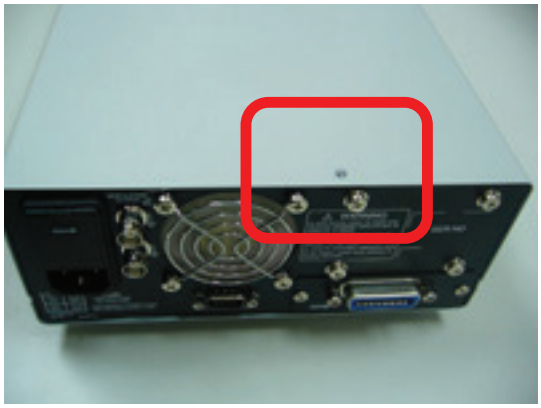
Here is the list of all equipments used in the service operations.

Item	Requirements	Used in
Phillips screwdriver	• #3	• Adjustments • Disassembly
Minus screwdriver	• 2.4mm	• Adjustments
Plier	• N/A	• Disassembly
Soldering kit	• N/A	• Disassembly

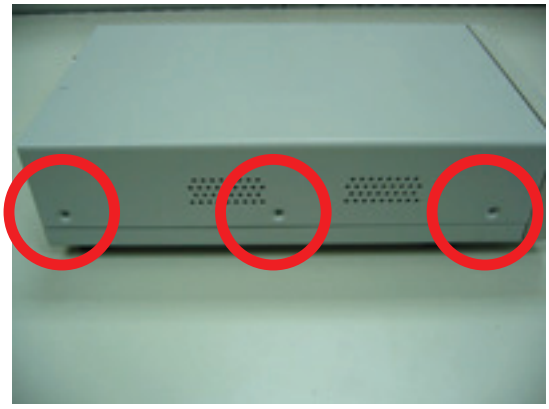
Top Outer Casing

1. Remove four screws from the left side of the instrument.

2. Remove one screw from the top bottom side of the instrument.



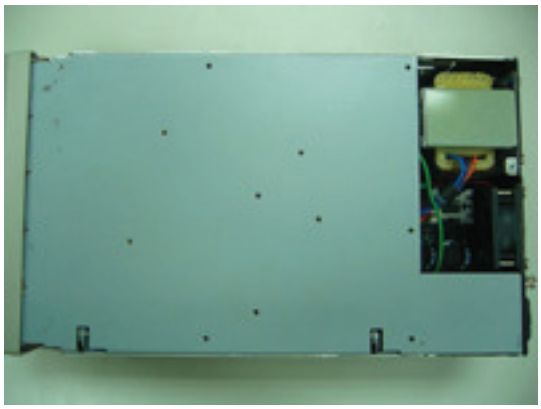
3. Remove three screws from the right side of the instrument.



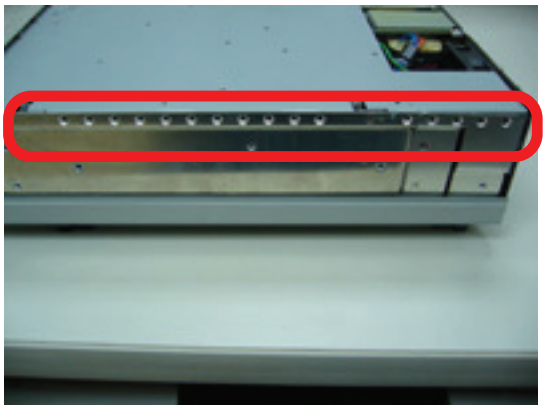
4. Slide the outer casing to the back and remove it from the instrument.

5. Remove one screw to disconnect the ground cable connected to the top chassis.

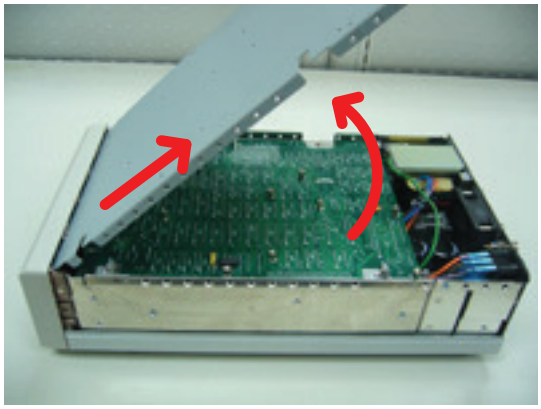
6. Remove all the screws from the top side of the inner chassis.



7. Remove all the screws from the right and left side of the inner chassis, except for two screws connecting the hinges.

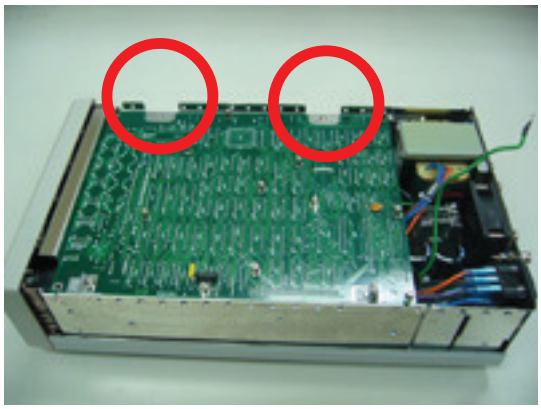


8. Pull the inner chassis backward, lifting its back.

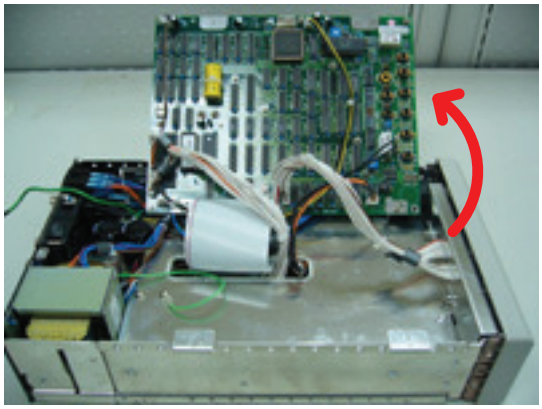


9. The top PCB is revealed.

10. To access the adjustment points on the top PCB, first remove two screws on the right edge of the PCB.



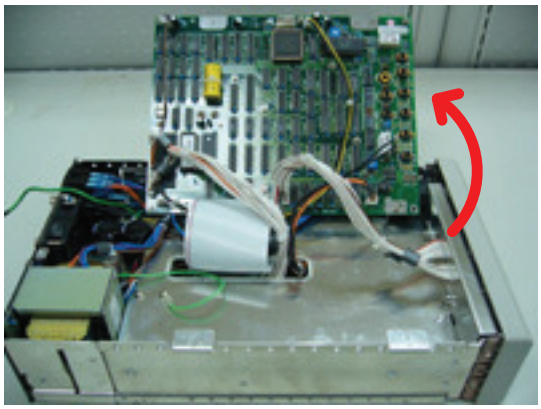
11. Open the PCB. For details regarding adjusting the instrument, see page37.



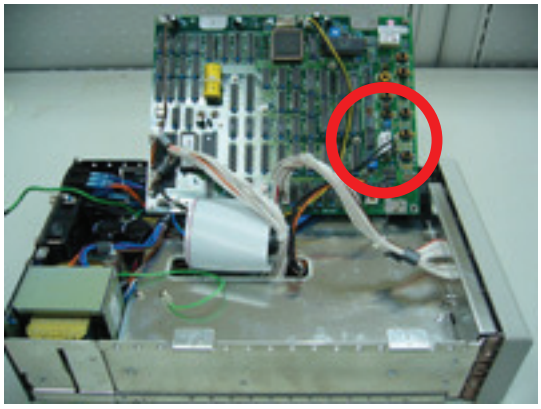
Disassembling the top outer casing is completed

Top PCB

1. Remove the outer casing (see page66) and open the top PCB.

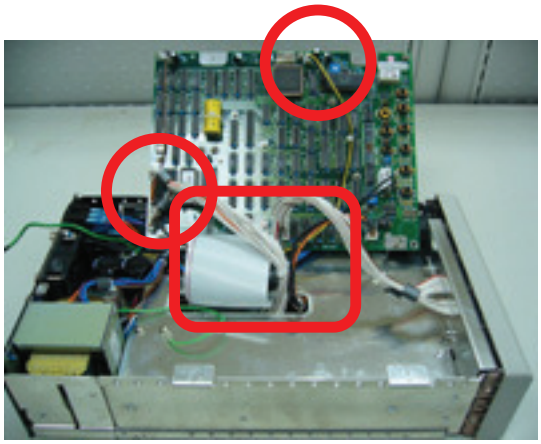


2. The two RF cables connected to the front side of the PCB must be disconnected first, with care.

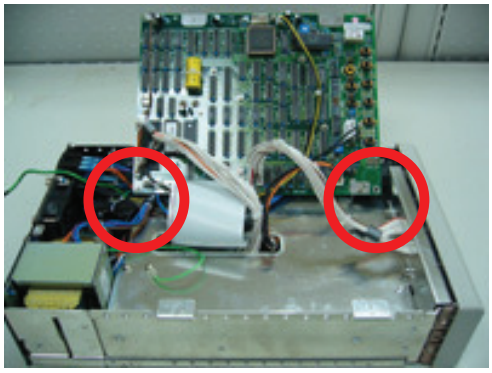


3. Grasp the upper metal terminal with a plier and gently pull the two RF cables out.

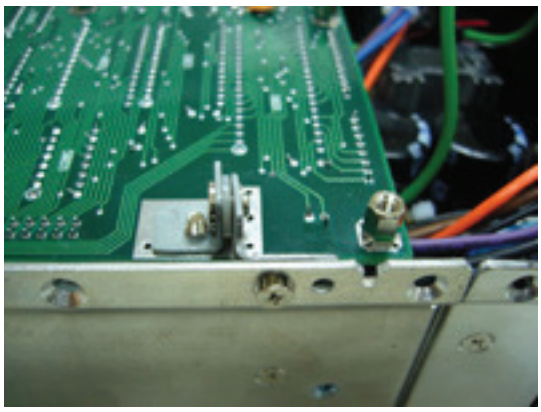
4. Then, disconnect the rest of the cables from the top PCB.



5. Finally, remove the two screws that connect the top PCB to the inner chassis through metal hinges.



(Close-up of a hinge)



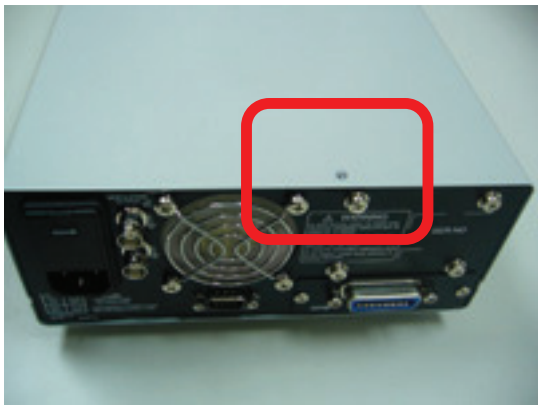
Disassembling the top PCB is completed

Bottom Outer Casing

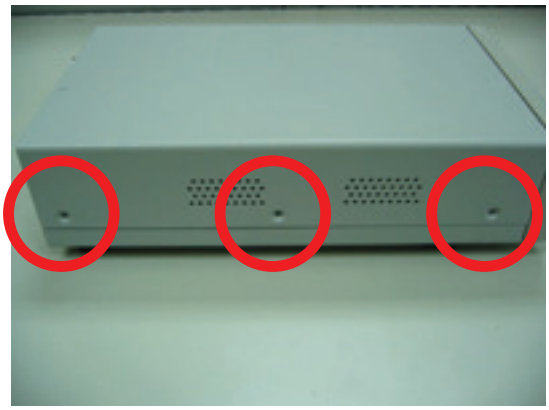
If the top casing has not been removed

1. Remove four screws from the left side of the instrument.

2. Remove one screw from the top bottom side of the instrument.



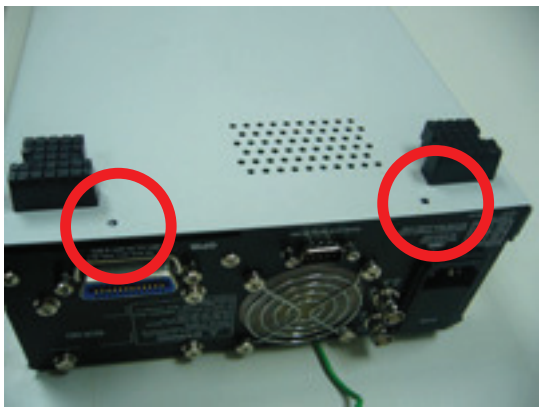
3. Remove three screws from the right side of the instrument.



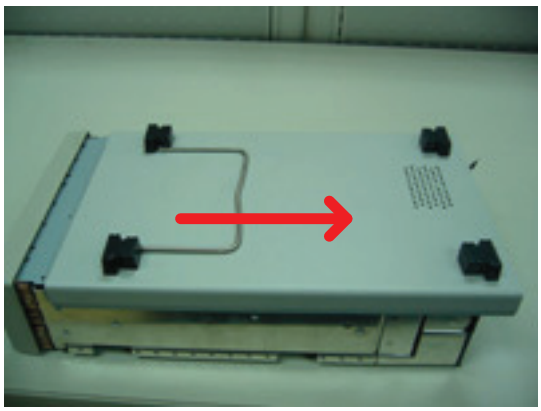
4. Go to the next steps, “If the top casing has already been removed”.

If the top casing has already been removed

1. Remove two screws from the back of the bottom chassis.

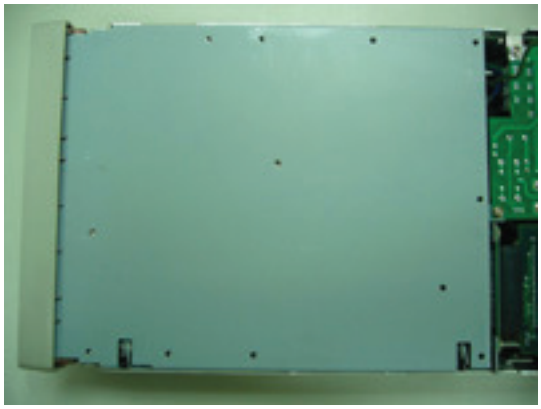


2. Remove all the screws from the top side of the inner chassis.

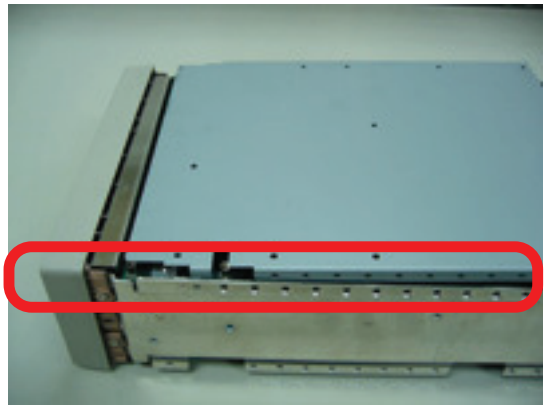


3. Disconnect the ground cable connected to the bottom chassis.

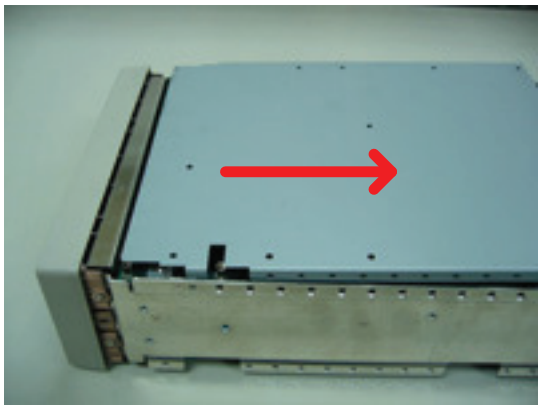
4. Remove all the screws from the bottom side of the inner chassis.



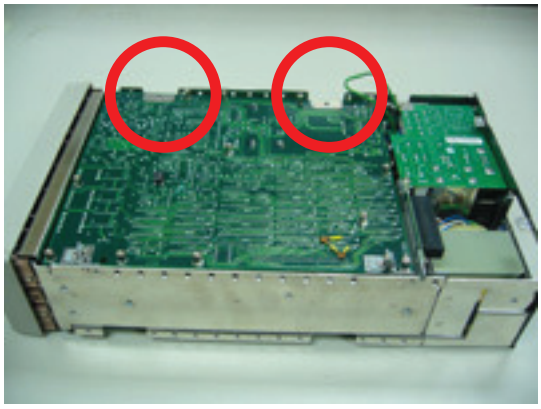
5. Remove all the screws from the right and left side of the inner chassis.



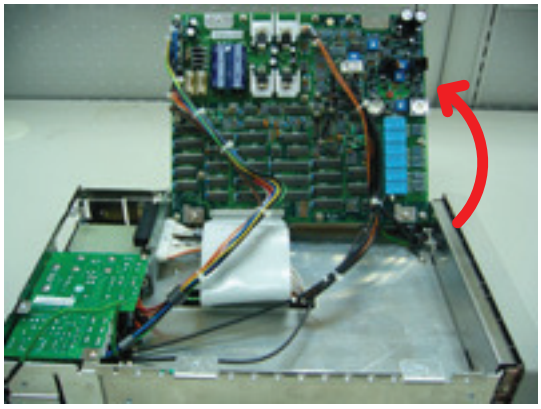
6. Pull the inner chassis backward, lifting its back.



To access the adjustment points on the bottom PCB, first remove two screws on the right edge of the PCB.



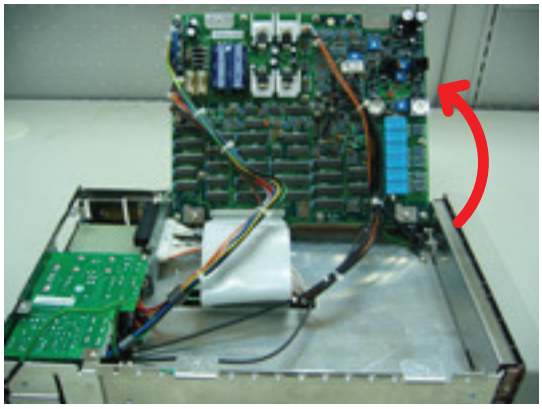
Then, open the PCB. For details regarding adjusting the instrument, see page37.



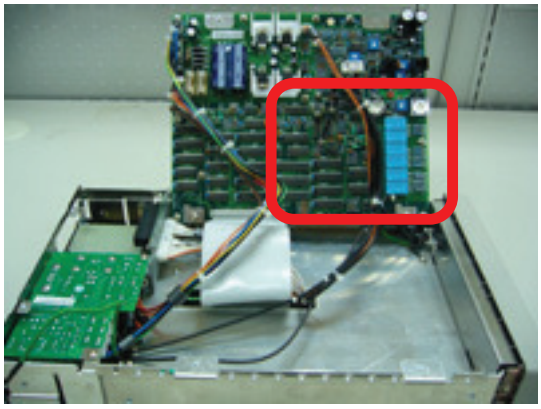
Disassembling the bottom outer casing is completed

Bottom PCB

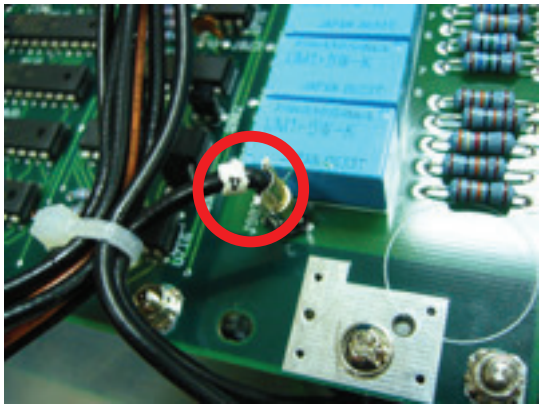
1. Remove the outer casing and open the bottom PCB. For details, see page69.



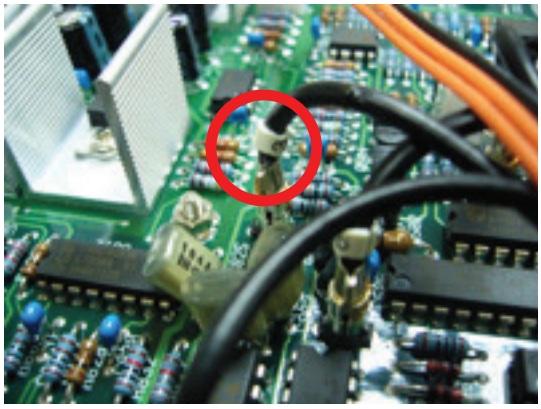
2. The six RF cables connected to the center and right of the PCB must be disconnected first, with care.



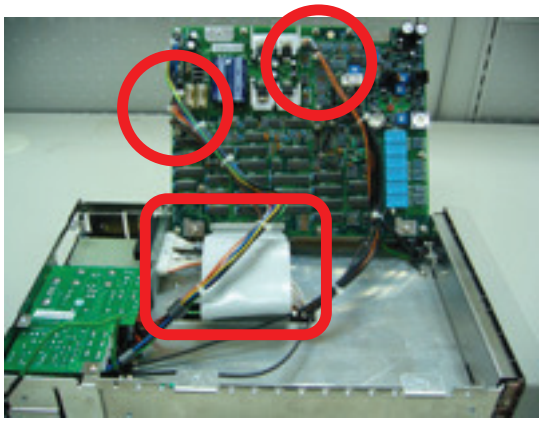
3. (Right side) Grasp the upper metal terminal with a plier and gently pull the RF cable out.



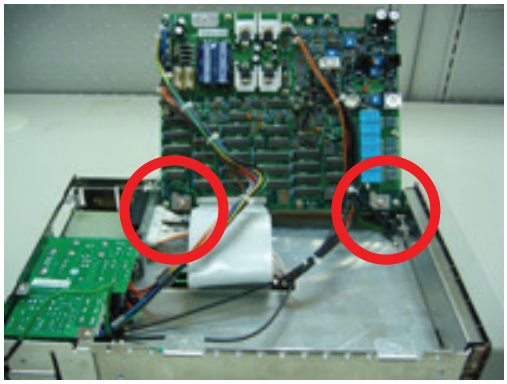
4. (Center) Grasp the upper metal terminal with a plier and gently pull the RF cables out.



5. Then, disconnect the rest of the cables from the bottom PCB.



6. Finally, remove the two screws that connect the PCB to the inner chassis through metal hinges.



Disassembling the bottom PCB is completed

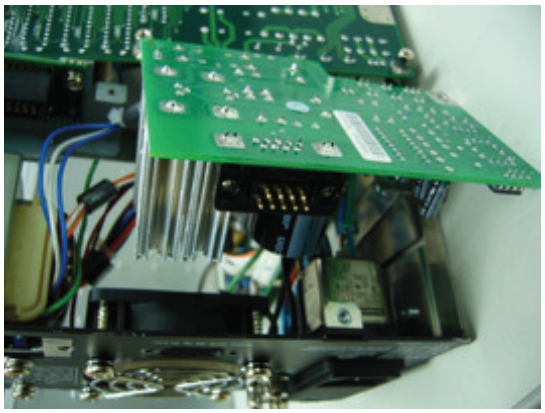
Power Supply PCB

1. Remove the bottom casing and reveal the bottom PCBs. See page69 for detail.

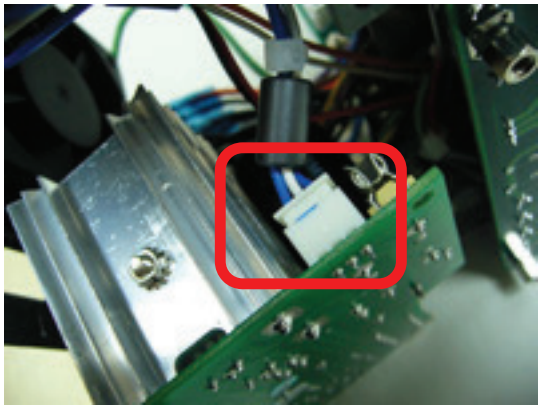
2. Remove two screws that connect the power supply PCB to the internal chassis.

3. Remove the nuts holding the RS-232C connector to its position.

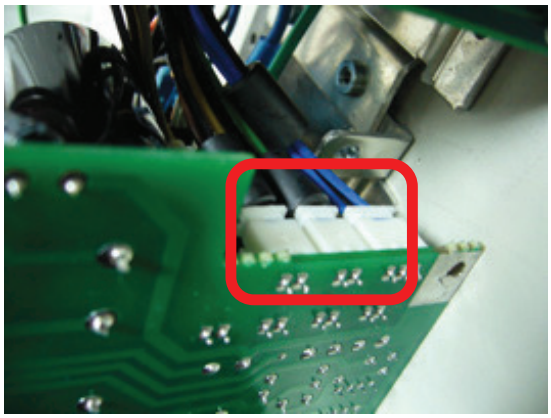
4. The power supply PCB can be lifted from its original position.



5. Disconnect a cable next to the heatsink.



6. Disconnect the cables next to the capacitors.



Disassembling the power supply PCB is completed

TROUBLESHOOTING THE INSTRUMENT

This chapter shows the operation theory of the instrument alongside the relevant circuit diagrams, which make tracking the problem source easy.

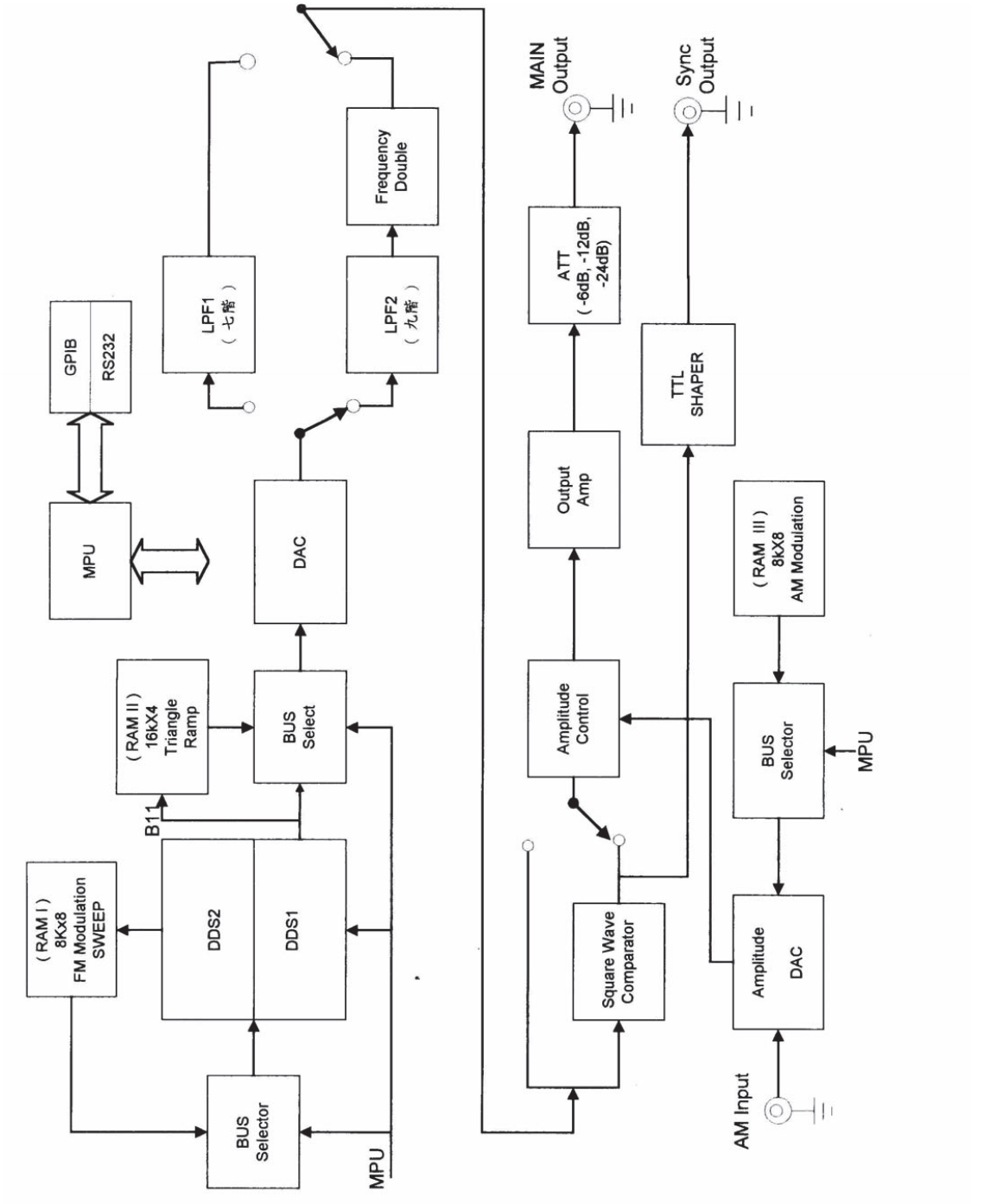
After problematic locations are discovered, the *Ordering the Parts chapter* may be used for securing replacement parts.

List of Equipments

Here is the list of all equipments used in the service operations.

Item	Requirements	Used in
Digital Multimeter	• AC & DC Voltage Accuracy: < ±0.1% • DC Current Range: ≥ 6A • DC Current Accuracy: <±0.1% • Recommended model: GDM-8246	• All items
Electronic Load	• DC Voltage Range: ≥ 60V • DC Current Range: ≥ 6A • Short Mode • Recommended model: Agilent N3305	• Output current
Phillips screwdriver	• #3	• Adjustments • Disassembly
Minus screwdriver	• 2.4mm	• Adjustments
Plier	• N/A	• Disassembly
Soldering kit	• N/A	• Disassembly

System Block Diagram



Operation Theory

Overview	The previous page shows the block diagram of SFG-830 system, which consists of a microprocessor unit (MPU), a direct digital synthesizer (DDS), a digital to analog converter (DAC), a RAM module, a low pass filter (LPF), a frequency double (F.D.), a square waveform comparator, a amplitude control, an output amplitude, an attenuator (ATT), etc. The principles of generating waveforms are stayed as follows:
Sine Waveform	The data of waveform is stored in the lookout table of DDS (Q-2334). The output frequency can be altered by solely changing the control word K (please refer to Chapter 2). The digital output passes the DAC and be converted to a step-shape analog signal. This signal will then be filtered by a 9-level LPF2, and becomes a pure sine wave. Due to the frequency response of DDS and the points of the output waveform, the sine wave should pass the F.D. circuit (U301 and AD834), the amplitude control, the output amplitude, ATT, and output through the Main Out terminal. • U301 is located on the Top PCB.
Square Waveform	The procedure of generating square waveforms is similar to that of generating sine waveforms. The only difference is that the signal will pass a square wave comparator circuit between the F.D. circuit and the amplitude control.
Triangle Waveform	When the user input a frequency, the MPU will calculate the correspondent data then save it in RAM(II) (U211-U213), and save the number of the data in the Up/Down Counter (U215-U218) 74F193. As the Up/Down counter is controlled by the B11 in DDS1 through 74F193 CLK Input, the desired frequency value can be obtained by changing the counter's reading frequency, i.e., the frequency of CLK. The output frequency of triangle waveform is lower that that of sine waveform and square waveform due to the different paths. The triangle wave passes a 7- level LPF1 and does not go through F.D. • U211-213, U215-218 are located on the Top PCB.
Ramp Waveform	The procedure of generating ramp is the same as that of generating triangle waveforms.

AM Modulation	This includes internal modulation and external modulation with the same operation procedure. Take internal modulation for example, the input data will be calculated by MPU and be written in RAM(III) (8k×8); the Up/Down Counter will then read out the data in RAM and send it to the Amplitude Control (U501, AD834) via DAC. Different input voltages can change the output voltages of Amplitude Control, thus achieve the modulation effect. • U501 is located on the Bottom PCB.
Sweep (Sine and Square Wave)	As to the sine wave sweep, the input data will be calculated by MPU and be written in RAM(I) (8k×8); DDS2 will then send a fixed frequency to read the sweep data from RAM(I), and send it to DDS1 through the Bus Selector. The digital sine wave signal generated from DDS1 will pass DAC, 9-level LPF, F.D., Amplitude Control, Output Amplitude, ATT, then output via DUT. The procedure of square wave sweep is similar to the above one, except that the digital signal generated from DDS1 passes a Square Waveform Comparator between the F.D. and Amplitude Control.
Sweep (Triangle and Ramp Wave)	The input data will be calculated by MPU and be written in RAM(II); DDS1 will then send a B11 control frequency to read the sweep data from RAM(II). Afterwards, the signal will pass the Bus Selector, DAC, 7-level LPF, Amplitude Control, Output Amplitude, ATT, then output via OUT BNC.
FM Modulation	The principle of FM modulation is the same as that of Sweep, except that the data stored in RAM (I) is relevant to FM modulation.

DDS Technology Overview

Overview

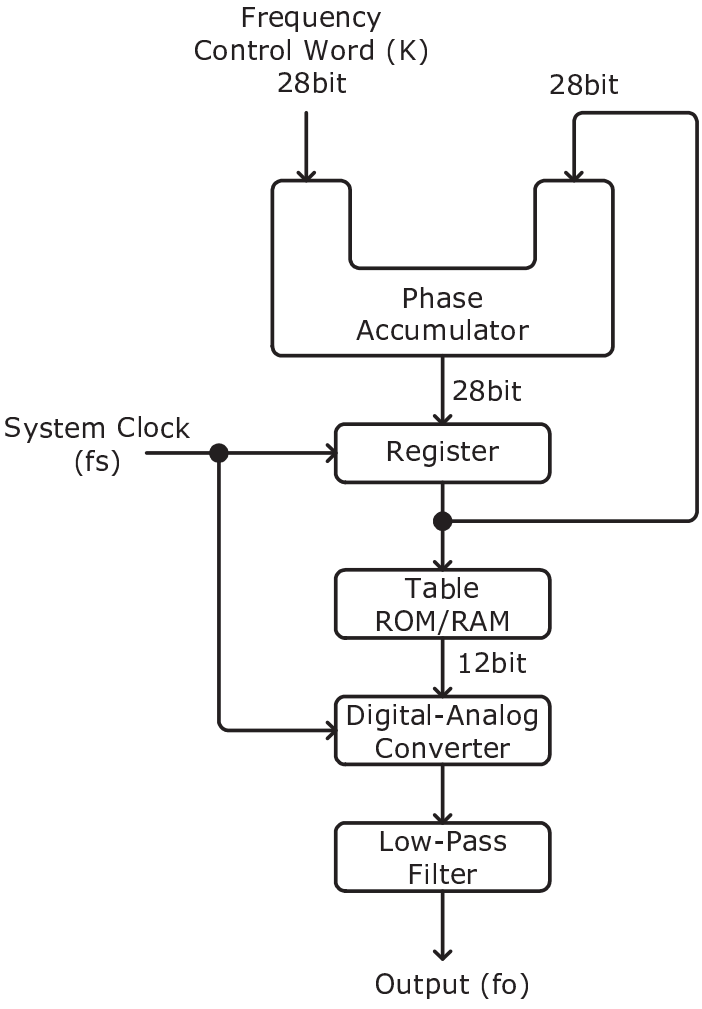
SFG-830 series uses the latest Direct Digital Synthesis (DDS) technology to generate stable, high resolution output frequency.

In DDS, the waveform data is contained in and generated from a memory. A clock controls the counter which points to the data address. The memory output is converted into analog signal by a digital to analog converter (DAC) followed by a low pass filter. The resolution is expressed as fs/2k where fs is the frequency and k is the control word, which contains more than 28bits. Because the frequency generation is referred to clock signal, this achieves much higher frequency stability and resolution than the traditional function generators.

Block diagram

DDS synthesizer consists of Phase accumulator (counter), lookout table data (ROM), Digital-to-analog converter (DAC), and Low-pass filter (LPF).

The phase accumulator adds the frequency control word K at every clock cycle fs. The accumulator output points to a location in the Table ROM/RAM. The DAC converts the digital data into an analog waveform. The LPF filters out the clock frequency to provide a pure waveform.



PCB Locations

Top PCB (FG01P030)

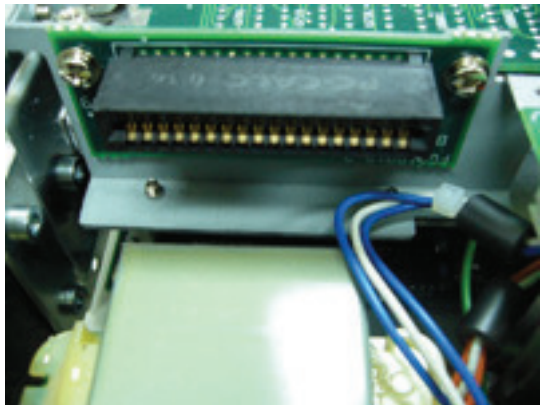
DC Power Supply PCB (FG01P020)

Bottom PCB (FG01P050)

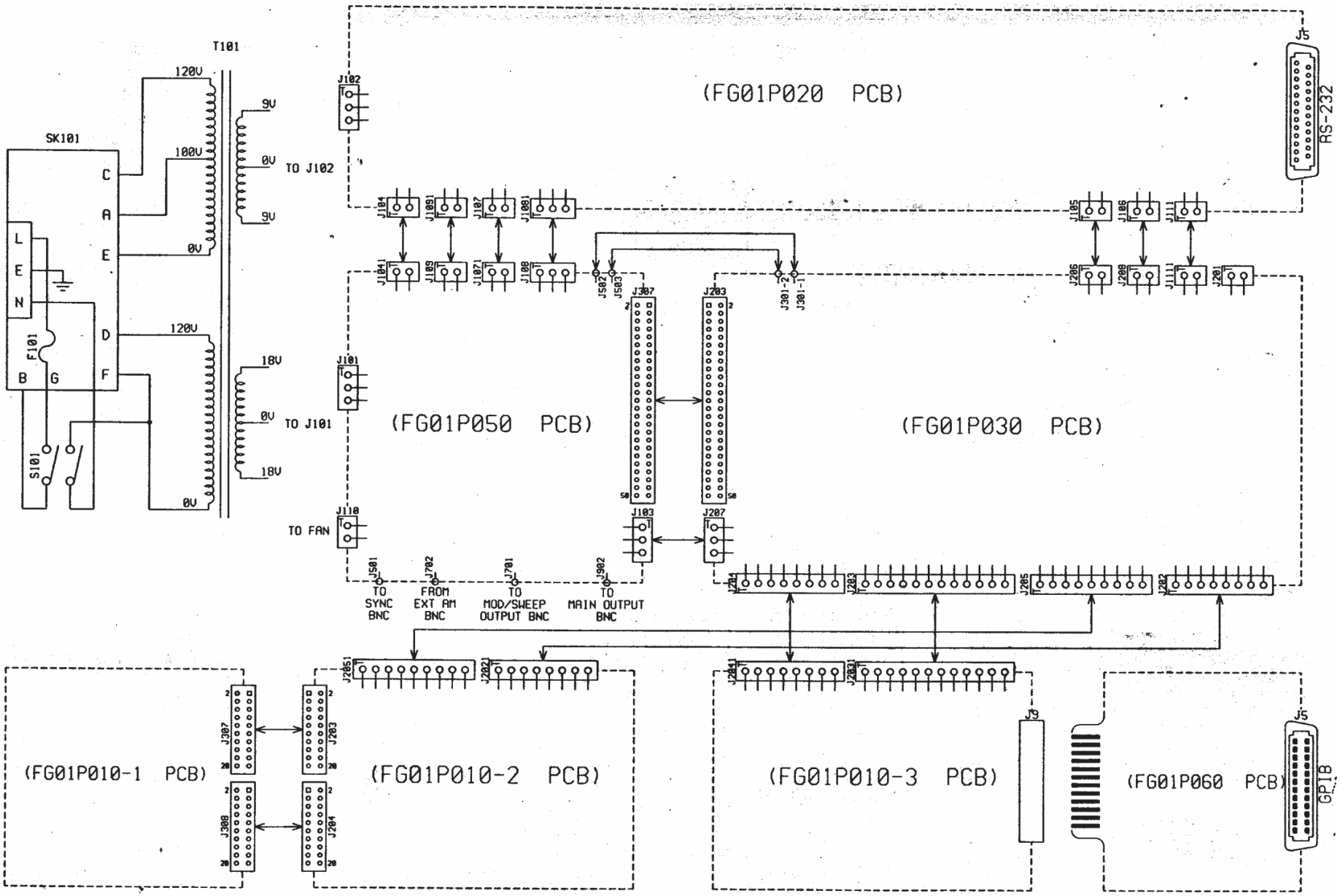
Front Panel PCB (FG01P010-1, -2)

GPIB PCB (FG01P060)

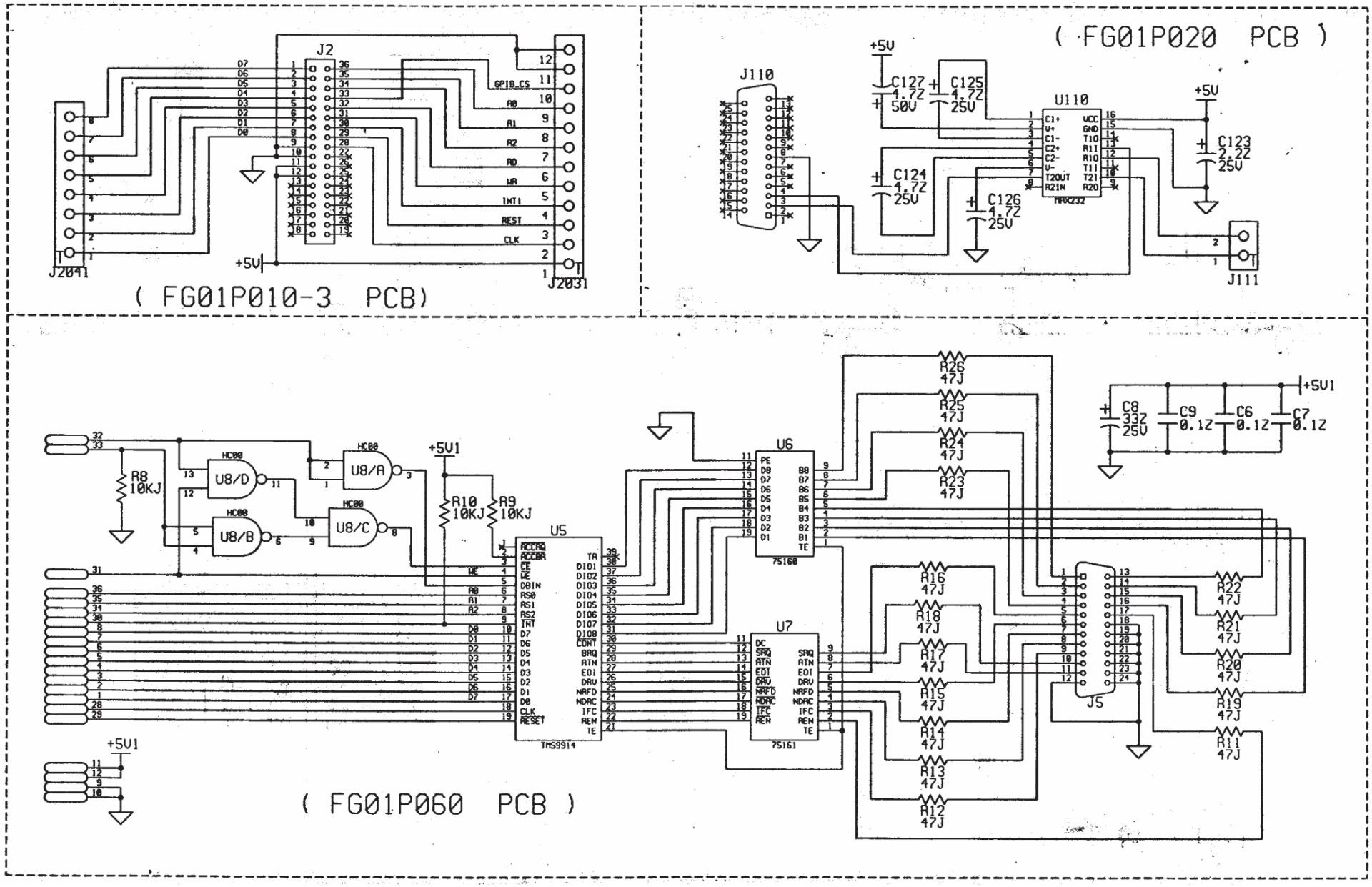
GPIB Connector PCB (FG01P010-3)



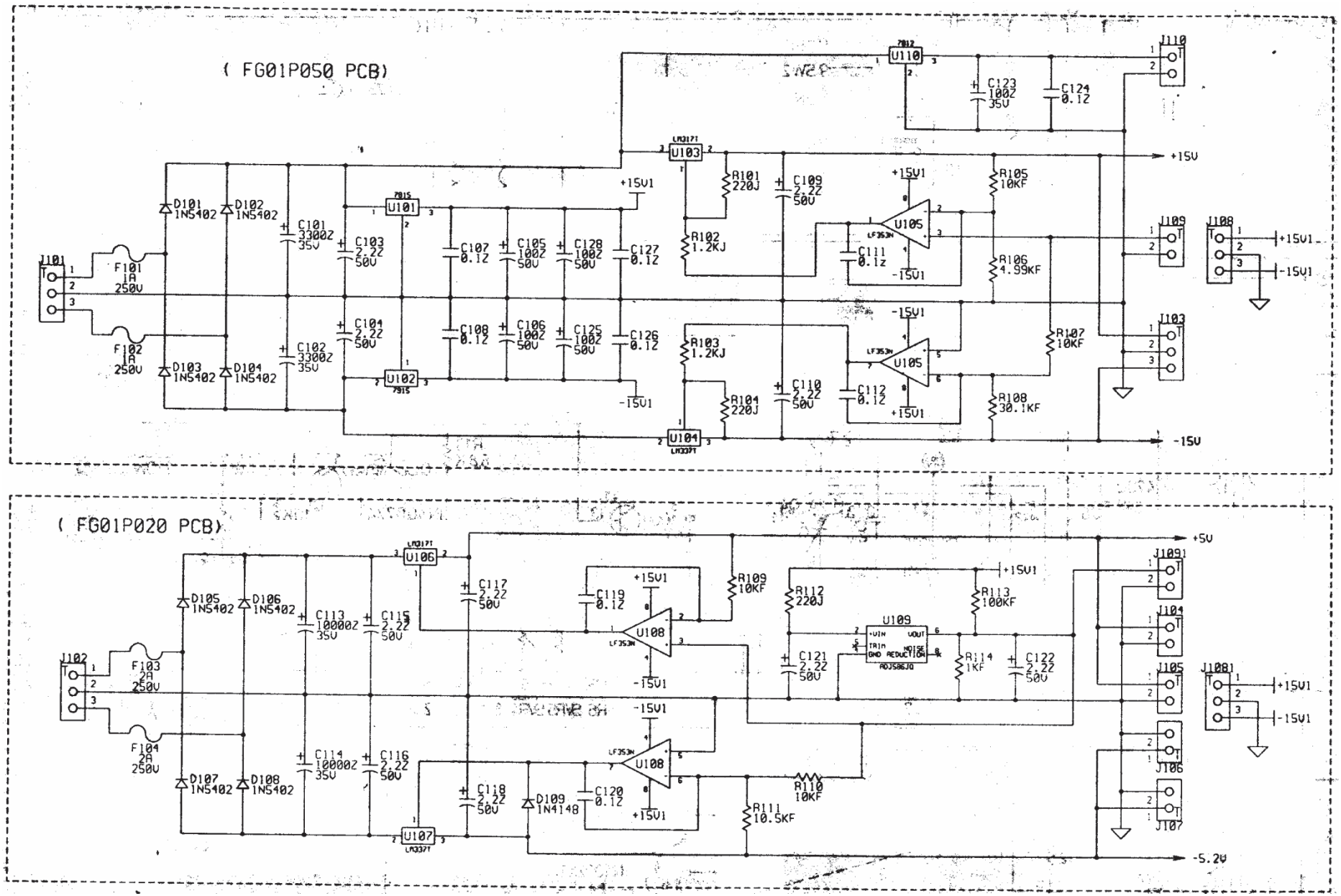
Block Diagram



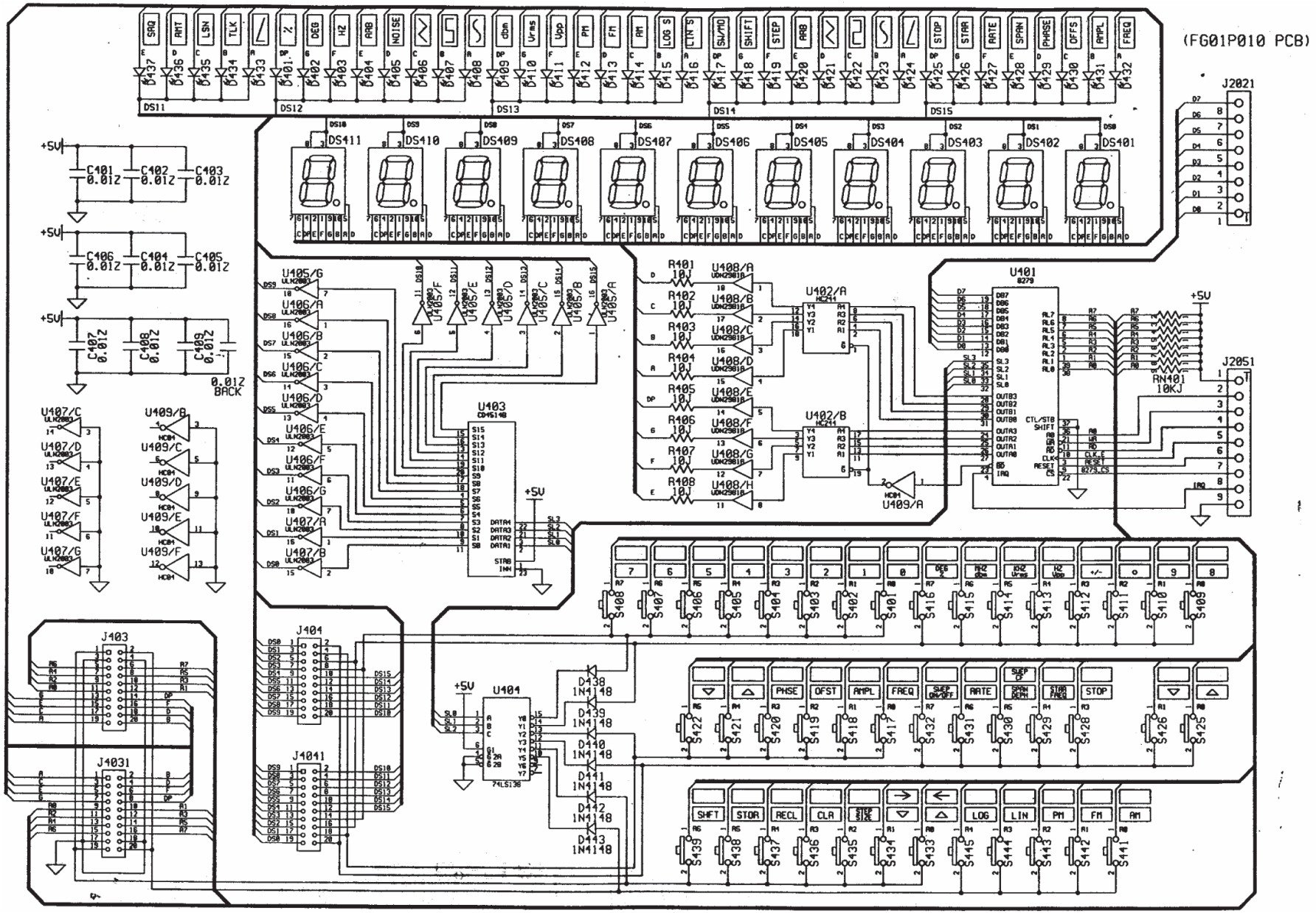
RS-232C/GPIB PCB (FG01P010-3, FG01P020, FG01P060)



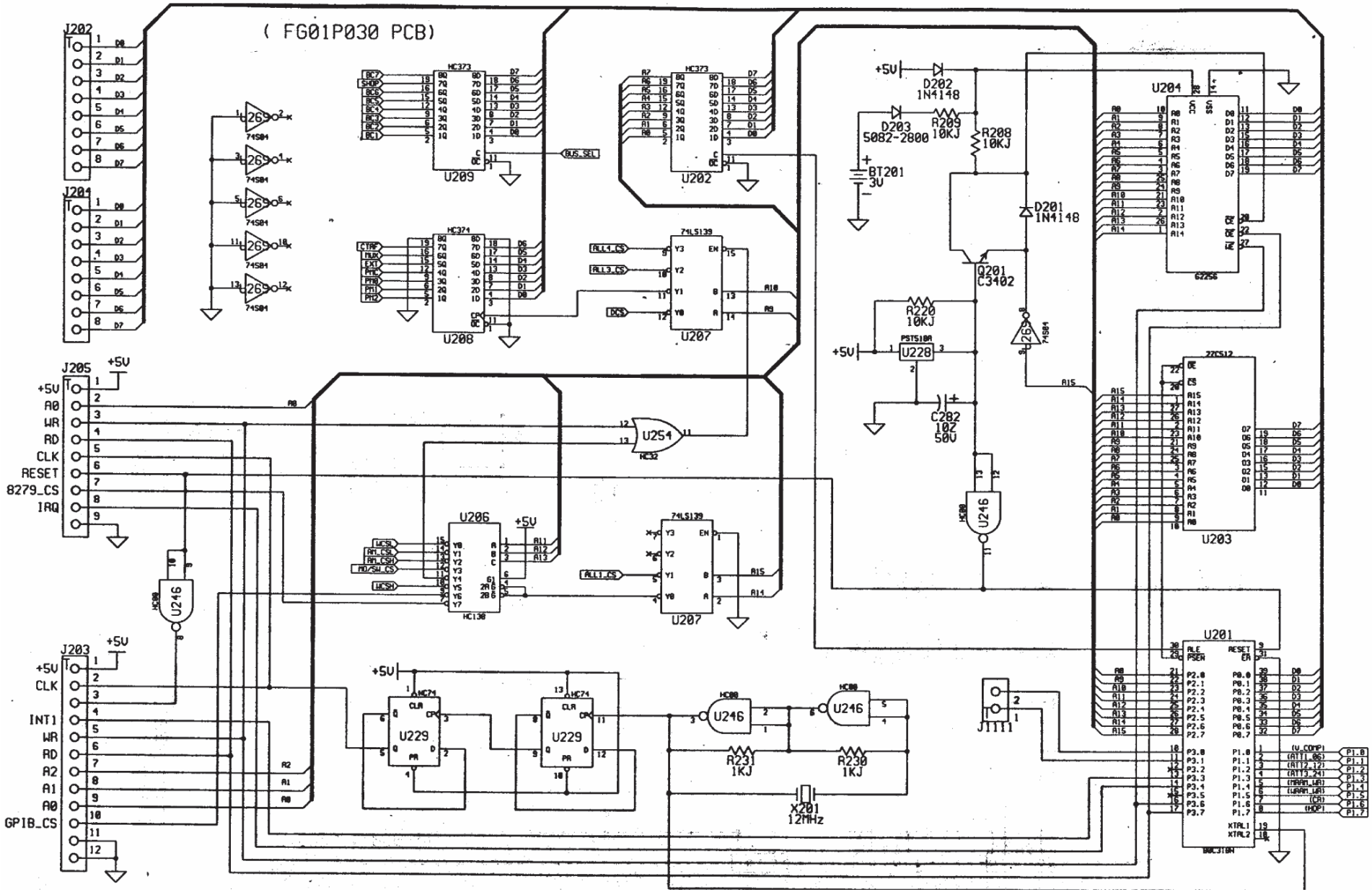
DC Power Supply PCB (FG01P020)



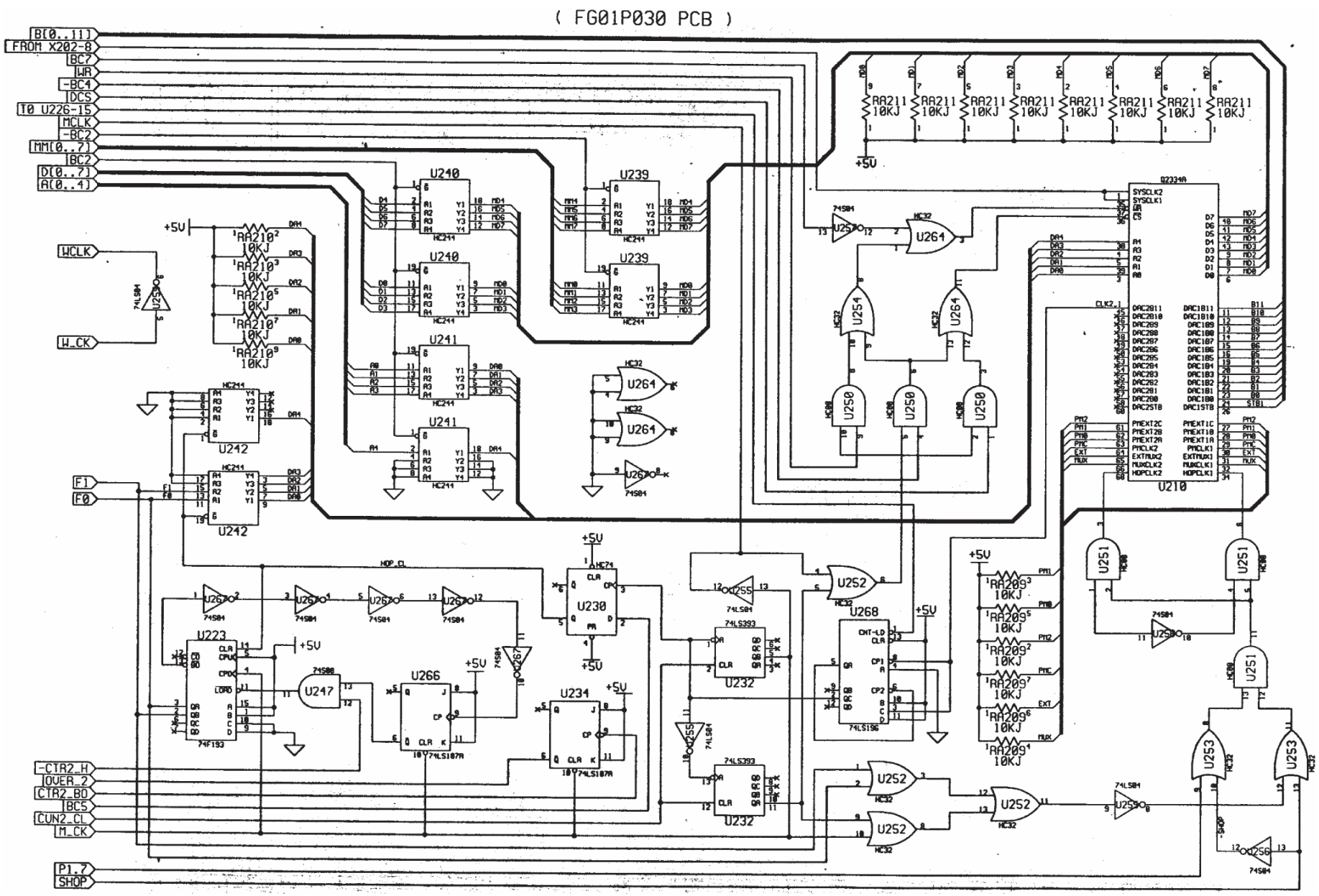
Front Panel PCB (FG01P010)



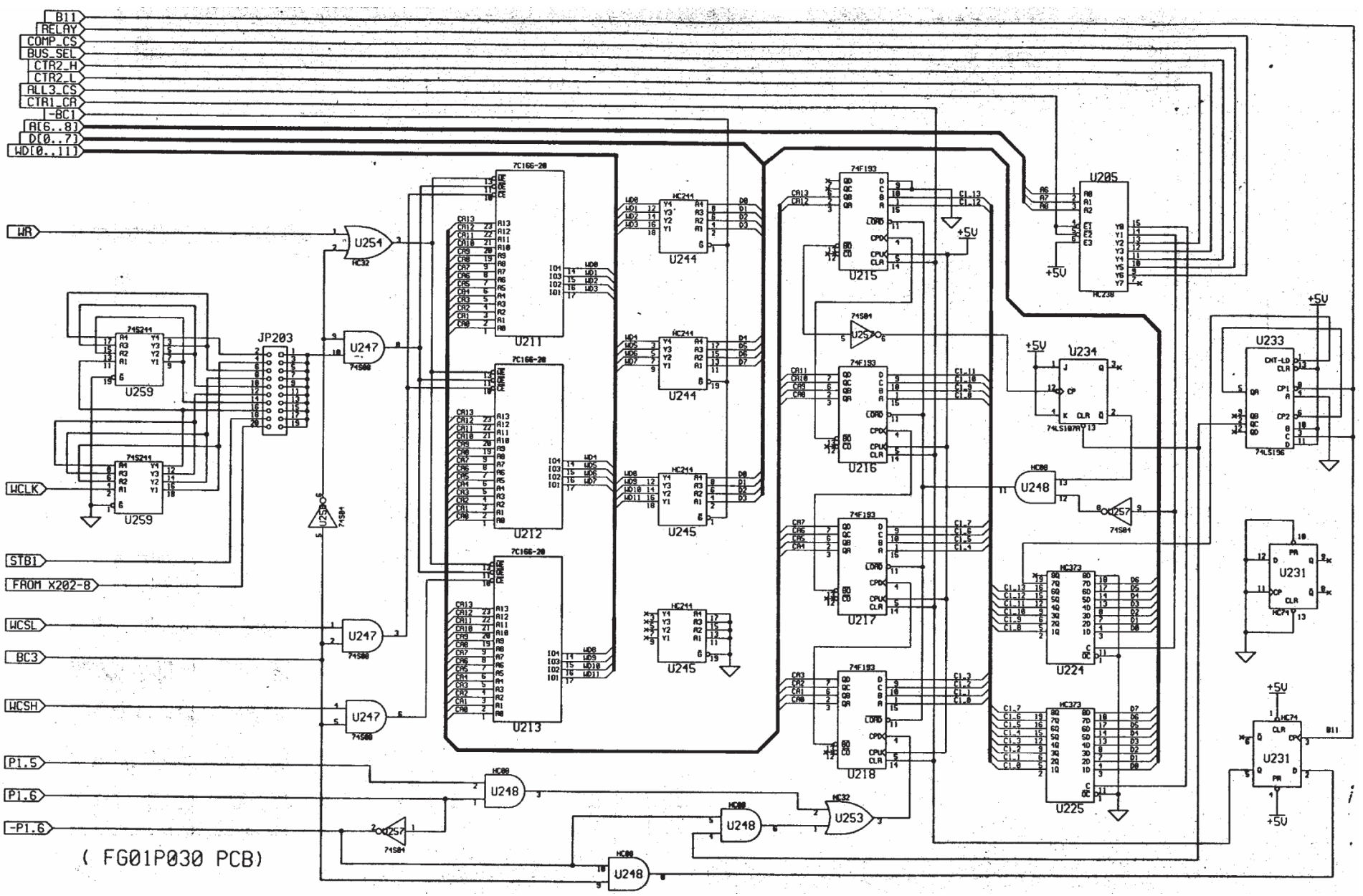
Top PCB (FG01P030) 1/6



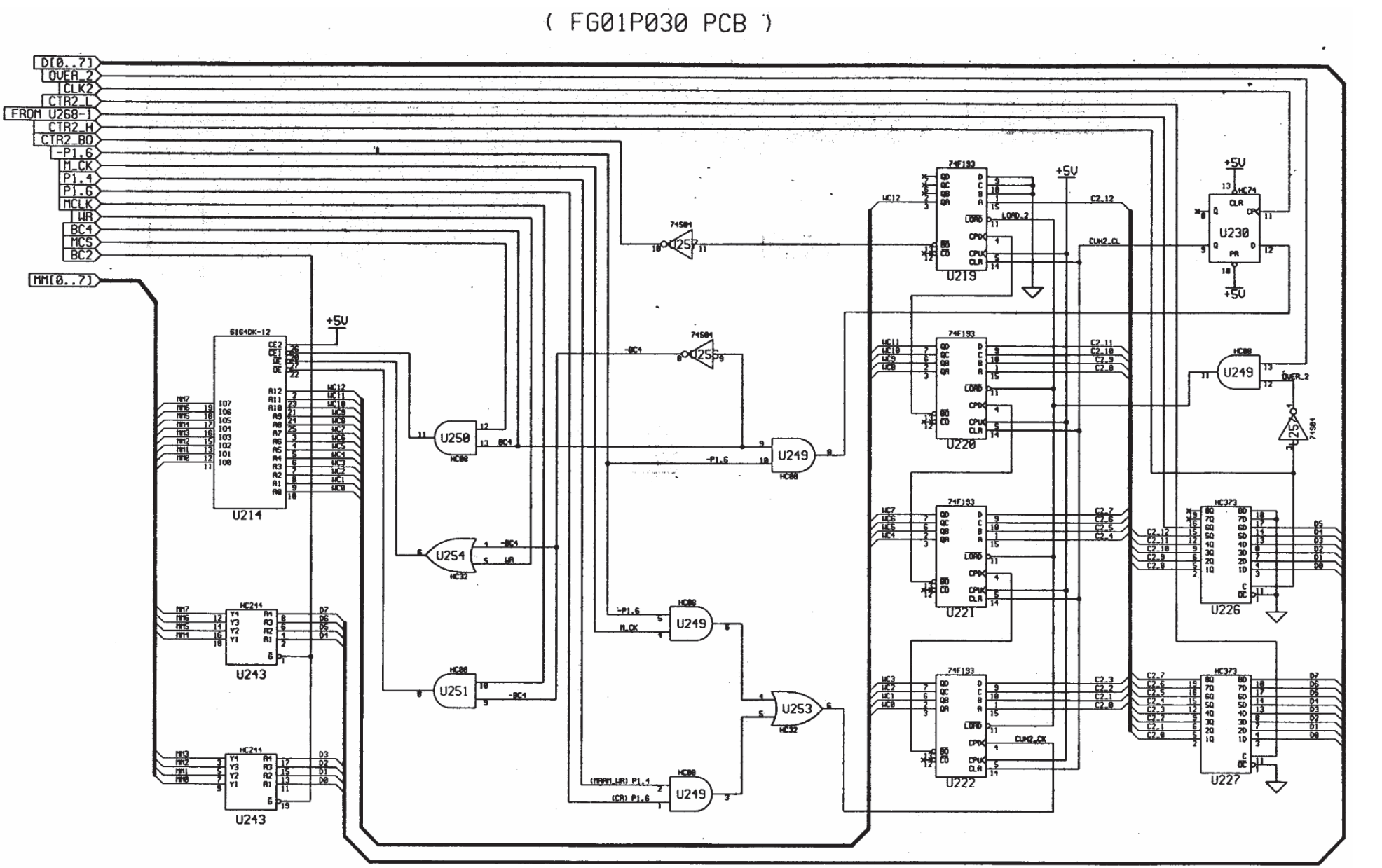
Top PCB (FG01P030) 2/6



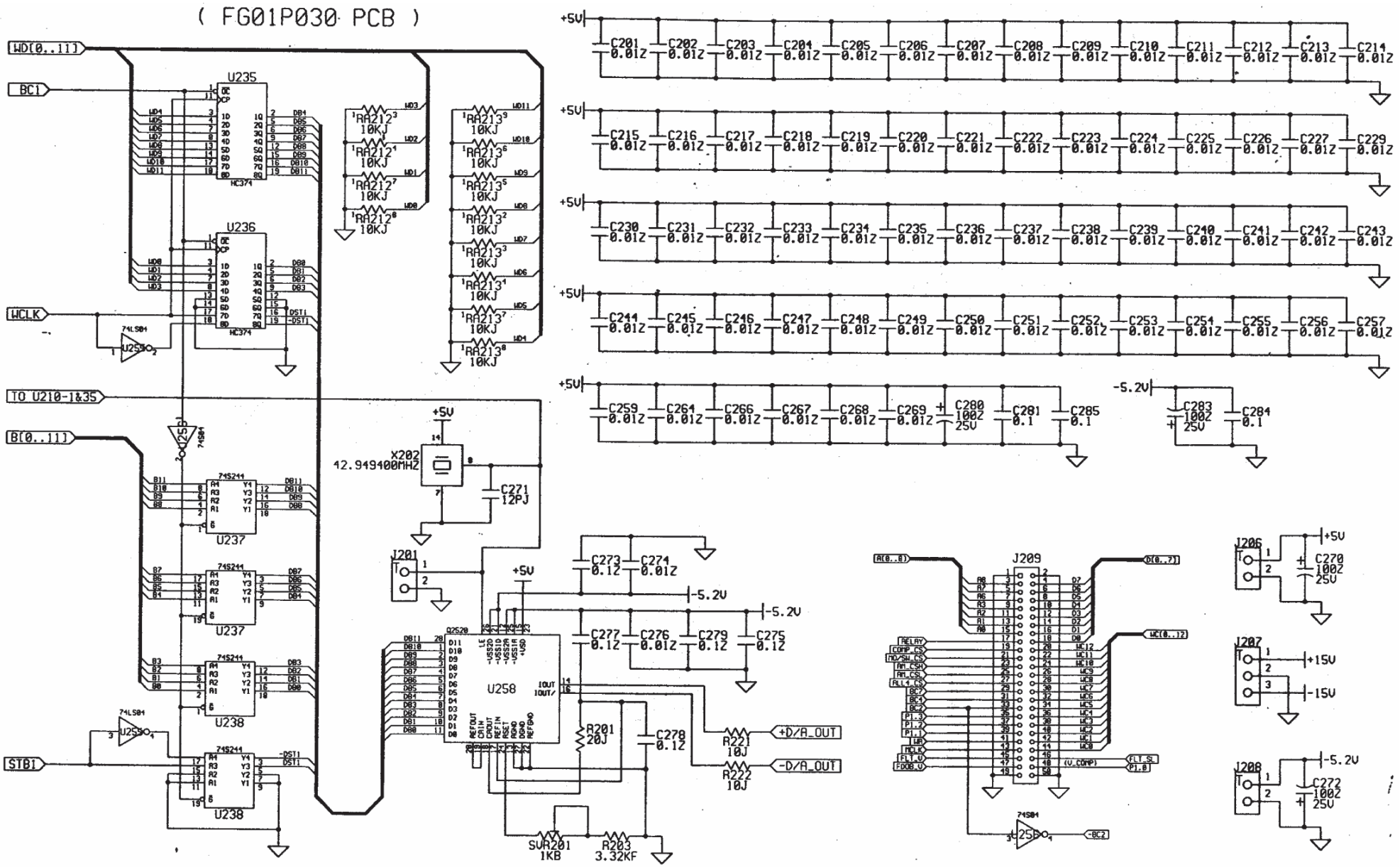
Top PCB (FG01P030) 3/6



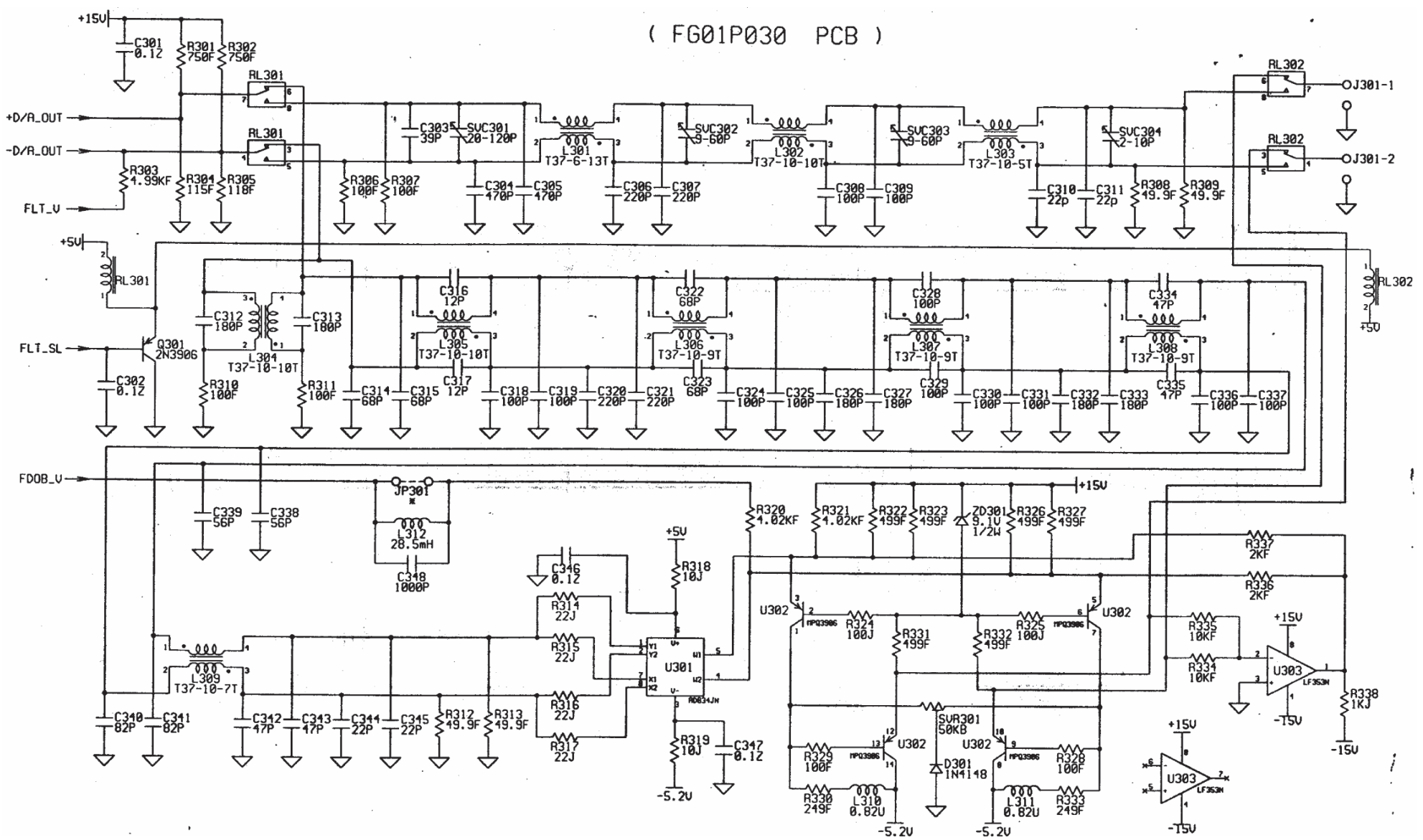
Top PCB (FG01P030) 4/6



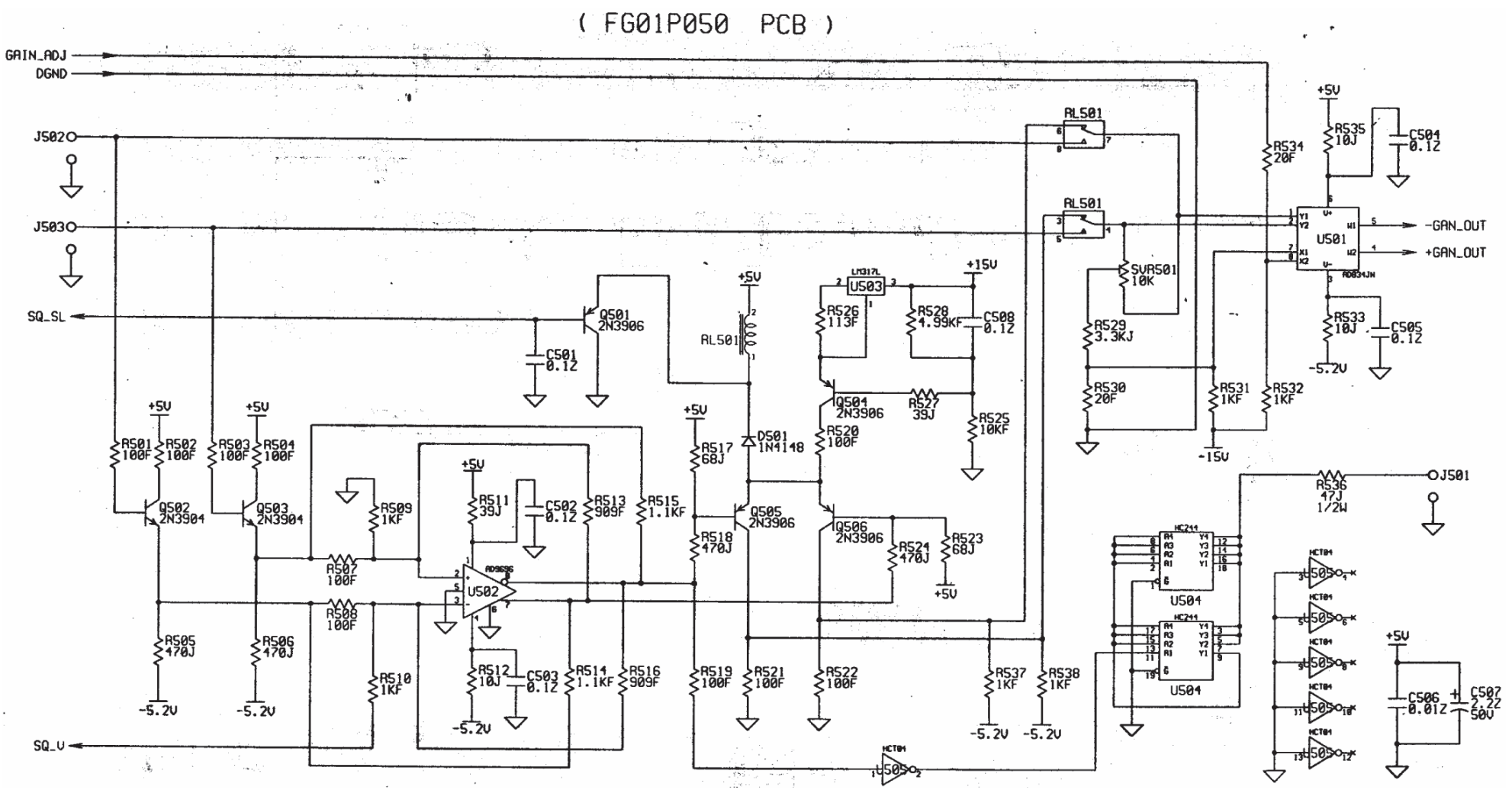
Top PCB (FG01P030) 5/6



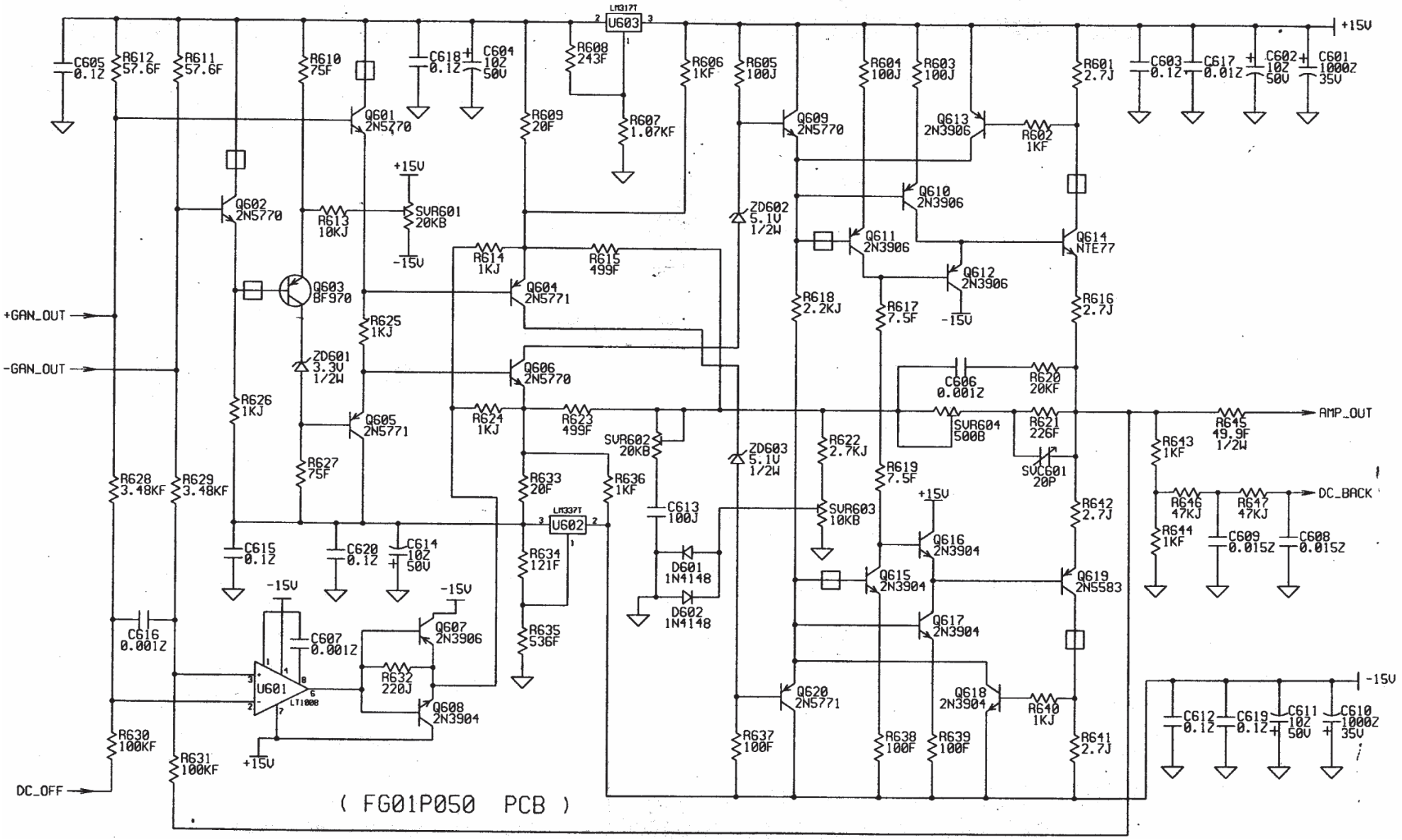
Top PCB (FG01P030) 6/6



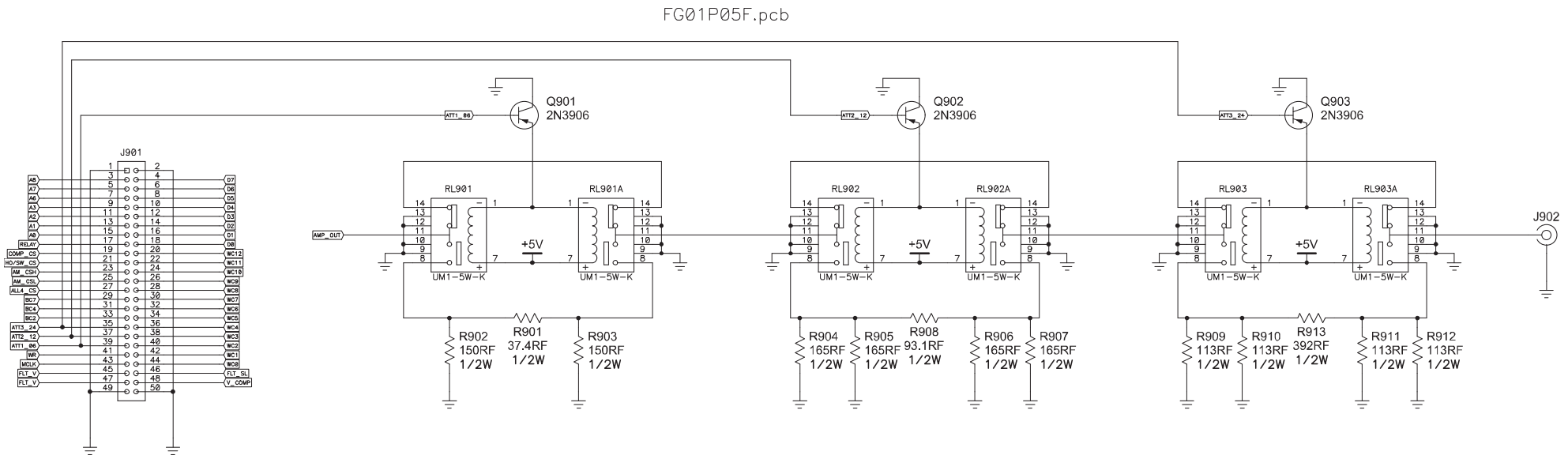
Bottom PCB (FG01P050) 1/5



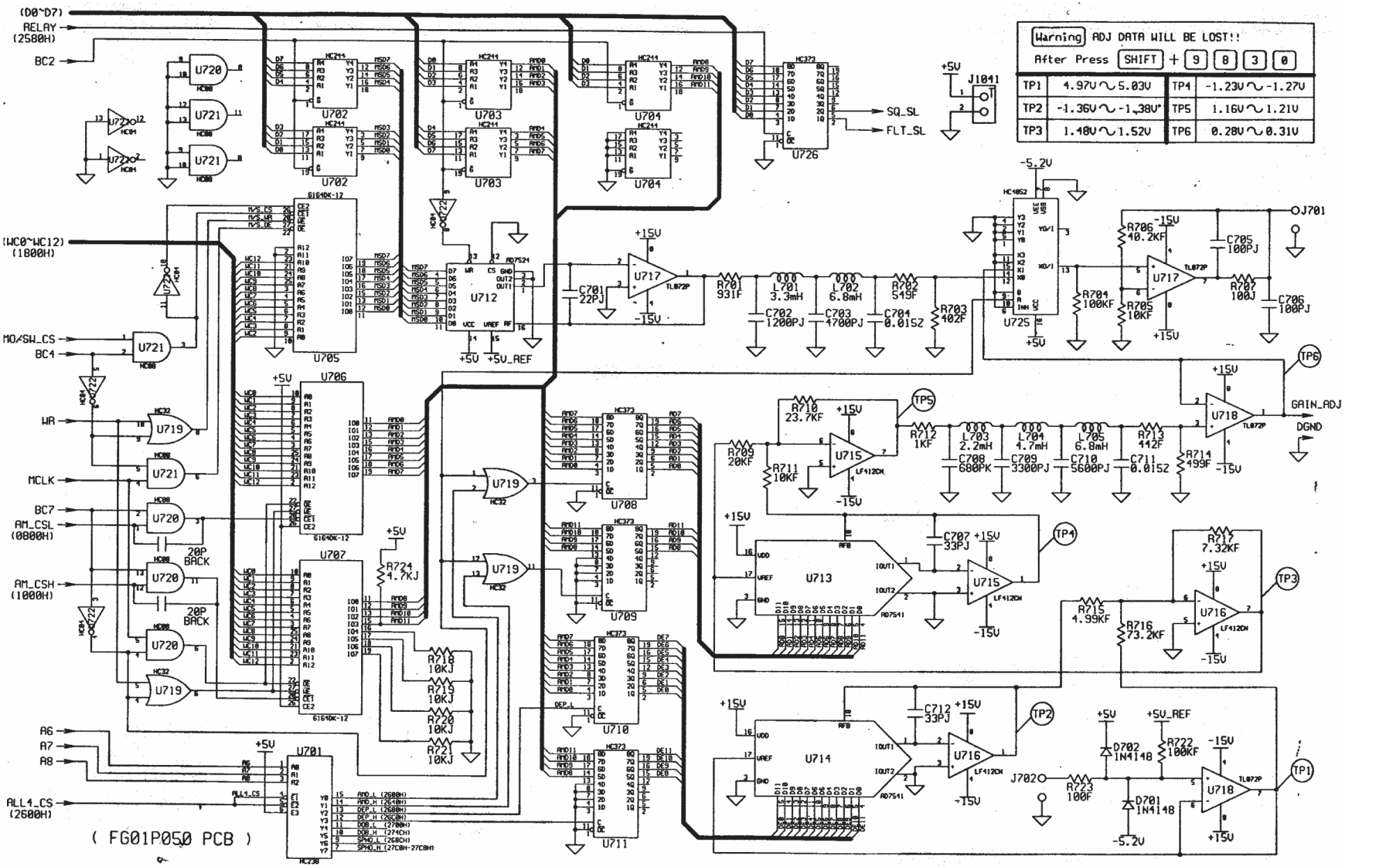
Bottom PCB (FG01P050) 2/5



Bottom PCB (FG01P050) 3/5



Bottom PCB (FG01P050) 4/5



Bottom PCB (FG01P050) 5/5