

**SERIES  
67XXB  
SWEPT FREQUENCY SYNTHESIZER  
MAINTENANCE MANUAL**

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P/N: 10370-10242  
REVISION: A  
PRINTED: FEBRUARY 1990  
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# TABLE OF CONTENTS

## ***Tab / Section Title***

### **1 GENERAL INFORMATION**

Section 1 contains a general description of the WILTRON Series 67XXB Swept Frequency Synthesizer, its identification number, related manuals, and options. Information is included concerning level of maintenance, replaceable subassemblies and components, exchange assembly program, preventive maintenance, firmware, and schematics. Static-sensitive component handling precautions and lists of recommended test equipment and exchangeable assemblies are also included.

### **2 SYSTEM DESCRIPTION AND TROUBLESHOOTING**

Section 2 contains system and subsystem level descriptions and maintenance troubleshooting information for all models of the Series 67XXB Swept Frequency Synthesizer. It is made up of a front section and 13 subsections, 2A thru 2M. The front section provides system level theory of operation for the synthesizer, a generic 67XXB block diagram, and system level maintenance troubleshooting. The troubleshooting portion contains a listing of hidden-key routines useful for maintenance troubleshooting and a summary listing of error codes with probable causes. A detailed table of contents for the subsections, 2A thru 2M, is also included.

### **2A DETAILED SUBSYSTEM DESCRIPTIONS**

**thru** The subsections 2A through 2M contain detailed information on the individual subsystems  
**2M** that comprise the Series 67XXB Swept Frequency Synthesizer. Each subsection contains detailed circuit descriptions, block diagrams, schematic diagrams, and parts locator diagrams for the PCBs that make up a particular subsystem.

### **3 DISASSEMBLY AND REPAIR PROCEDURES**

Section 3 contains the procedures necessary to gain access to the major 67XXB assemblies and PCBs for troubleshooting and maintenance. All necessary diagrams are provided.

### **4 SPECIAL OPTIONS**

Section 4 is reserved for a listing and description of any special options that are provided with your model 67XXB Swept Frequency Synthesizer.

### **5 PARTS LISTS**

Section 5 contains parts lists for all major assemblies and printed circuit board assemblies of the Series 67XXB Swept Frequency Synthesizer (including RF microwave deck components). The parts lists for the major assemblies include photo and line art illustrations for ease of component identification.

# SECTION I GENERAL INFORMATION

CONTENTS		
Paragraph	Title	Page
1-1	SCOPE OF THE MANUAL . . . . .	1-3
1-2	INTRODUCTION . . . . .	1-3
1-3	DESCRIPTION . . . . .	1-3
1-4	IDENTIFICATION NUMBER . . . . .	1-3
1-5	RELATED MANUALS . . . . .	1-3
1-6	OPTIONS . . . . .	1-4
1-7	LEVEL OF MAINTENANCE . . . . .	1-4
1-8	REPLACEABLE SUBASSEMBLIES AND PARTS . . . . .	1-4
1-9	EXCHANGE ASSEMBLY PROGRAM . . . . .	1-5
1-10	PREVENTIVE MAINTENANCE . . . . .	1-5
1-11	STATIC-SENSITIVE COMPONENT HANDLING PRECAUTIONS . . . . .	1-5
1-12	FIRMWARE . . . . .	1-5
1-13	SCHEMATICS . . . . .	1-5
1-14	RECOMMENDED TEST EQUIPMENT . . . . .	1-5



**Figure 1-1.** Typical Series 67XXB Swept Frequency Synthesizer

# SECTION 1 GENERAL INFORMATION

## 1-1 SCOPE OF THE MANUAL

This manual provides general information, service data (circuit descriptions, troubleshooting data, schematics, and block diagrams) and parts lists for all models of the Series 67XXB Swept Frequency Synthesizer. The majority of the information in this manual applies to all 67XXB models. Specific model number references are made where the information presented is unique to that model only.

## 1-2 INTRODUCTION

Section 1 provides a general description of the synthesizer, its identification number, related manuals, and options. Information is included concerning level of maintenance, replaceable subassemblies and components, exchange assembly program, preventive maintenance, firmware, and schematics. Static-sensitive component handling precautions and lists of recommended test equipment and exchangeable assemblies are also provided.

## 1-3 DESCRIPTION

The Series 67XXB Swept Frequency Synthesizers (Figure 1-1) are microprocessor-controlled synthesized signal sources that generate swept and CW frequencies in one or more frequency bands between 10 MHz and 60 GHz. All models are controllable via the IEEE-488 Bus (GPIB). The series, which will expand as additional frequency ranges are added, presently consists of 30 models covering a variety of frequency and power ranges. Table 1-1 lists all models presently available, their frequency range, and their output power level.

## 1-4 IDENTIFICATION NUMBER

All WILTRON instruments are assigned a unique six-digit ID number, such as "405001." Each 67XXB has two ID numbers assigned – one for the basic frame and one for the RF microwave deck. The ID number for the RF microwave deck is affixed to the outside of the rear panel, while that for the basic frame is affixed to chassis floor, below the swing-out RF microwave deck. The RF microwave deck ID number, on the outside, is the primary number.

**Table 1-1. 67XXB Series  
Swept Frequency Synthesizers**

<b>67XXB Model</b>	<b>Frequency (GHz)</b>	<b>Output Power</b>
6709B 6709B-40	0.01 to 2.0	+10 dBm +16 dBm
6717B 6717B-20	0.01 to 8.4	+10 dBm +13 dBm
6719B	2.0 to 8.4	+13 dBm
6721B 6721B-20	2.0 to 12.4	+10 dBm +13 dBm
6722B 6722B-20	0.01 to 12.4	+10 dBm +13 dBm
6728B 6728B-40	8.0 to 12.4	+13 dBm +16 dBm
6729B 6729B-20	8.0 to 20	+10 dBm +13 dBm
6730B 6730B-40	12.4 to 20	+13 dBm +16 dBm
6736B	18.0 to 26.5	+7 dBm
6737B 6737B-20	2.0 to 20.0	+10 dBm +13 dBm
6740B	26.5 to 40.0	+10 dBm
6745B	0.01 to 18.0	+10 dBm
6747B 6747B-20	0.01 to 20.0	+10 dBm +13 dBm
6753B 6753B-10	2.0 to 26.5	+10 dBm, ≤20 GHz +5 dBm, >20 GHz +10 dBm
6759B 6759B-10	0.01 to 26.5	+10 dBm, ≤20 GHz +5 dBm, >20 GHz +10 dBm
6760B	12.4 to 40.0	+5 dBm
6763B	2.0 to 40.0	+10 dBm, ≤20 GHz +5 dBm, >20 GHz
6769B	0.01 to 40.0	+10 dBm, ≤20 GHz +5 dBm, >20 GHz
6772B	40.0 to 60.0	0 dBm

\* Optional attenuators reduce rated power by 3 to 4 dB.

Please use it when ordering parts or corresponding with the WILTRON Customer Service department.

## 1-5 RELATED MANUALS

This is one of a three manual set that consists of an Operating Manual (OM), a Test and Calibration Manual (T&C), and a Maintenance Manual (MM).



The OM and MM provide coverage for all models in the 67XXB series. Conversely, the T&Cs contain model-dependent information. Because of this model dependency there are nineteen different T&Cs—one for each frequency model.

**Operating Manual (OM).** The OM provides general, installation, and operation information for all 67XXB models. The WILTRON part number for the OM is 10370-10202.

**Test and Calibration Manual (T&C).** The T&C supplies performance verification test procedures, calibration and adjustment procedures, and test records for a specific 67XXB model. The WILTRON part numbers for all T&Cs are listed in Table 1-2.

**Maintenance Manual (MM).** The WILTRON part number for the MM is 10370-10242.

**Table 1-2.** Test & Calibration Manual Part Numbers

67XXB Model Number(s)	Manual Part Number
6709B & 6709B-40	10370-10204
6717B & 6717B-20	10370-10206
6719B	10370-10208
6721B & 6721B-20	10370-10210
6722B & 6722B-20	10370-10212
6728B & 6728B-40	10370-10214
6729B & 6729B-20	10370-10216
6730B & 6730B-40	10370-10218
6736B	10370-10220
6737B & 6737B-20	10370-10222
6740B	10370-10224
6745B	10370-10226
6747B & 6747B-20	10370-10228
6753B & 6753B-10	10370-10230
6759B & 6759B-10	10370-10232
6760B	10370-10240
6763B	10370-10234
6769B	10370-10236
6772B	10370-10238

## 1-6 OPTIONS

The following standard instrument options are available.

**Option 1, Rack Mount.** A kit is available containing mounting brackets and chassis track slides.

**Option 2A, 110 dB Step Attenuator.** Each synthesizer comes supplied with a 110 dB Step Attenuator installed. Rated output power is reduced

by 3 dB. This option is available for all models having an upper frequency of  $\leq 20$  GHz.

**Option 2B, 110 dB Step Attenuator.** Each synthesizer comes supplied with a 110 dB Step Attenuator installed. Rated output power is reduced by 3 dB. This option is available for all models having an upper frequency limit of 26.5 GHz.

**Option 2C, 110 dB Step Attenuator.** Each synthesizer comes supplied with a 110 dB Step Attenuator installed. Rated output power is reduced by 4 dB. This option is available for all models having an upper frequency limit of 40 GHz.

**Option 9K, K Connector.** Each synthesizer comes supplied with a rear panel K Connector<sup>®</sup> RF Output instead of the type of connector that would normally be installed on the front panel. The front panel connector is deleted. Rated output power, flatness, and SWR are slightly degraded.

## 1-7 LEVEL OF MAINTENANCE

Maintenance of the 67XXB synthesizer consists of:

- troubleshooting the instrument to a replaceable subassembly or RF component.
- repair by replacing the failed subassembly or RF component.

The 67XXB synthesizer contains firmware that generates hidden-key routines and error codes to aid in troubleshooting instrument failures to the replaceable subassembly or RF component. Section 2- System Description and Troubleshooting contains lists of these maintenance-related hidden-key routines and error codes.

The 67XXB synthesizer may require calibration or adjustment after repair. Refer to Section 3 of the T&C manual for your specific 67XXB model for calibration/adjustment procedures.

## 1-8 REPLACEABLE SUBASSEMBLIES AND PARTS

Table 1-3 is a *partial* listing of replaceable subassemblies and RF components for the 67XXB series of synthesizers. It lists those replaceable subassemblies and RF components that are presently covered by the WILTRON exchange assembly program (see paragraph 1-9).

<sup>®</sup> K Connector is a registered trademark of WILTRON Company

Section 5—Parts Lists provides a complete parts breakdown for the 67XXB series of synthesizers. It contains figures and parts lists for the main components of each major 67XXB assembly. Parts lists of all replaceable components for each PCB assembly (A1–A29) are also included.

### 1-9 EXCHANGE ASSEMBLY PROGRAM

WILTRON maintains an exchange assembly program for selected synthesizer subassemblies and RF components (Table 1-3). If a malfunction occurs in one of these subassemblies or RF components, the defective item can be exchanged. Upon request and typically within 24 hours, WILTRON will ship the exchange subassembly or RF component. The customer then has 30 days in which to return the defective item. All exchange subassemblies or RF components are warranted for 90 days from the date of shipment or for the balance of the original equipment warranty—whichever is longer.

For more information on this program, contact your local sales representative or call the WILTRON Customer Service department at (408) 778-2000.

### 1-10 PREVENTIVE MAINTENANCE

The rear panel fan on the 67XXB has a two-part air filter. The exterior filter element should be periodically checked and cleaned as needed. The interior honeycomb element should also be checked and cleaned each time the exterior element is removed.

### 1-11 STATIC-SENSITIVE COMPONENT HANDLING PRECAUTIONS

The 67XXB synthesizer contains components that can be damaged by static electricity. Figure 1-2 contains a list of precautions for handling static-sensitive components. If followed, these precautions will minimize the possibilities of static-shock damage to these components.

### 1-12 FIRMWARE

The descriptions in this manual of synthesizer circuitry operation, hidden-key routines, self test routines, and error codes are based on using version 8.03 operating firmware. If your particular instrument contains an older version of firmware, these descriptions may not accurately reflect its operation. You may wish to upgrade your synthesizer's operating firmware to the latest available version.

Contact the WILTRON Customer Service department at (408) 778-2000 for assistance with firmware problems or for firmware upgrade details.

### 1-13 SCHEMATICS

The schematics in this manual are the most current version in use at the time of publication. They may not accurately reflect the circuitry in your particular 67XXB synthesizer. Contact the WILTRON Customer Service department at (408) 778-2000 for assistance in resolving schematic differences.

The schematic conventions used in this manual are described below.

- Signal flow is from left to right. All signals entering the PCB do so on the left of the page and those exiting the PCB do so on the right of the page.
- The arrow points of the signal flags indicate the direction of signal flow.
- The lettering in the signal flags indicate the sheet and grid coordinates of the signal destination (for outputs), or the point of signal origination (for inputs). The sheet number is designated first.
- The arrow points on the end of connector lines indicate plugs. The arrow tails on the end of connector lines indicate jacks.
- Signal lines are identified by a distinctive name, mnemonic symbol, or voltage value. The letters "H" and "L" in front of digital signal lines indicate the line's active state—H for TTL high and L for TTL low. The "(-)" symbol that follows certain analog signals lines indicates a negative value.

### 1-14 RECOMMENDED TEST EQUIPMENT

Table 1-4 provides a list of recommended test equipment for maintenance troubleshooting of the 67XXB synthesizer.

Contact the WILTRON Customer Service department at (408) 778-2000 for help regarding test equipment compatibility.



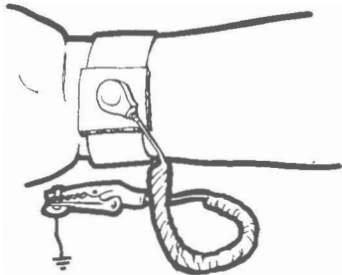
1. Do not touch exposed contacts on any static sensitive component.



2. Do not slide static sensitive components across any surface.



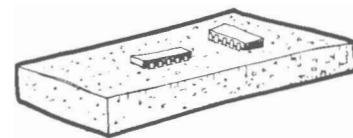
3. Do not handle static sensitive components in areas where the floor or work surface covering is capable of generating a static charge.



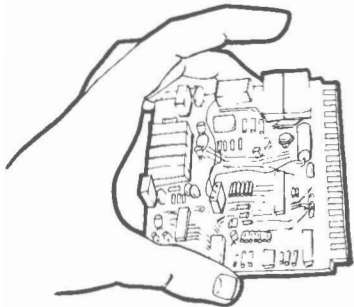
4. Wear a static-discharge wristband when working with static sensitive components.



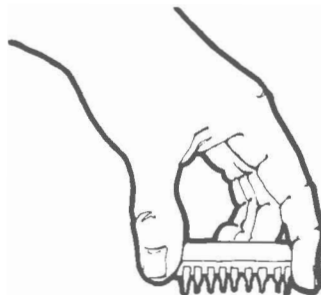
5. Label all static sensitive devices.



6. Keep component leads shorted together whenever possible.



7. Handle PCBs only by their edges. Do not handle by the edge connectors.



8. Lift and handle solid state devices by their bodies - never by their leads.



9. Transport and store PCBs and other static sensitive devices in static-shielded containers.

10. ADDITIONAL PRECAUTIONS:

- Keep workspaces clean and free of any objects capable of holding or storing an electric charge.
- Connect soldering tools to an earth ground.
- Use only special anti-static suction or wick-type desoldering tools.

Figure 1-2. Static-Sensitive Component Handling Precautions

Table 1-3. Replaceable Subassemblies and RF Components

SUBASSEMBLY OR PART NAME	WILTRON PART NUMBER	SUBASSEMBLY OR PART NAME	WILTRON PART NUMBER
<b>Printed Circuit Board Assemblies</b>		<b>Control Modulators</b>	
A1, A2 Front Panel Assy	ND35656	2 to 8 GHz Control Modulator	D19960
A3 Coarse Loop Mixer PCB Assy	C31703-4	8 to 12.4 GHz Control Modulator	D19970
A4 Coarse Loop Osc. PCB Assy	D31914-3	12.4 to 20 GHz Control Modulator	D19980
A5 Reference Osc. PCB Assy	D31805-4	18 to 26.5 GHz Control Modulator	D19990
A6 Coarse Loop Divider PCB Assy	D31806-3	<b>Down Converters</b>	
A7 Reference Divider PCB Assy	C31707-4	Low Power Down Converter	B31996
A8 Serial I/O PCB Assy	D31708-3	Low Power Down Converter, cabled	D19450
A9 Fine Loop Osc. PCB Assy	C31709-4	High Power Down Converter	ND36035
A10 Reference Buffer PCB Assy	C31710-4	High Power Down Converter, cabled	D19460
A11 Fine Loop Divider PCB Assy	D31711-4	<b>RF Amplifiers</b>	
A12 YIG Phase Detector PCB Assy	D31712-4	2 to 8 GHz Amplifier	B21260
A13 Pulse Generator PCB Assy	D31913-3	2 to 8 GHz Amplifier	C21270
A15 ALC PCB Assy	D31915-3	8 to 12.4 GHz Amplifier	ND19072
A16 FM PCB Assy	D31716-5	12.4 to 20 GHz Amplifier	B18730
A17 Analog Instruction PCB Assy	D31717-3	18 to 26.5 GHz Amplifier	C20552
A18 YIG Driver PCB Assy	ND34071-1	18 to 26.5 GHz Amplifier	C18965
A19 YIG Driver PCB Assy	ND34072	<b>PIN Switches</b>	
A20 YIG Driver PCB Assy	ND34073	SP4T, 26.5 GHz, Output PIN Switch, cabled	A31956 D18630
A21 YIG Driver PCB Assy	ND34075	SP4T, 26.5 GHz, Sampler PIN Switch, cabled	A31957 D18360
A22 Regulator Interface PCB Assy	ND34075	DPDT, PIN Switch, cabled	A31997 D22166
A23 Microprocessor PCB Assy	D31723-3	SP4T, 40 GHz, Output PIN Switch, cabled	A31998 D19900
A24 GPIB PCB Assy	D31724-3	<b>Step Attenuators</b>	
A25 Power Supply PCB Assy	D31925-3	Step Attenuator, 110 dB, 20 GHz	4422K
A27 Auxiliary I/O PCB Assy	C31840-3	Step Attenuator, 110 dB, 26.5 GHz	4522K
A29 Rear Panel Interface PCB Assy	D31829-3	Step Attenuator, 110 dB, 40 GHz	4622K
<b>Miscellaneous RF Components</b>			
RF Take-off	D9970		
Coupler, 20 GHz	D21450		
Coupler, 26.5 GHz	D21451		
Coupler, 40 GHz	D21452		
Switched Filter	C31755-3		
A31 Power Amplifier Assy	B31867-1		
10 MHz Crystal Oscillator	C31755-3		
Output Connector Assy, 20 GHz	ND34998		
Output Connector Assy, 40 GHz	ND35898		
A30 Sampler/IF Amplifier Assy	C36025		
Doubler Amplifier/Modulator	60-59		
<b>YIG-Tuned Oscillators</b>			
2 to 8 GHz Oscillator, cabled	C31752-3		
8 to 12.4 GHz Oscillator, cabled	C31751-3		
12.4 to 20 GHz Oscillator, cabled	C31754-3		
18 to 26.5 GHz Oscillator, cabled	C31753-3		

**Table 1-4.** Recommended Test Equipment for Maintenance Troubleshooting

<b>INSTRUMENT</b>	<b>CRITICAL SPECIFICATION</b>	<b>RECOMMENDED MANUFACTURER/MODEL</b>
Spectrum Analyzer, with Diplexer and External Mixers	<i>Frequency:</i> 0.01 to 60 GHz <i>Resolution:</i> 10 Hz	Tektronix, Model 494P, with External Mixers: WM 490K (18 to 26.5 GHz) WM 490A (26.5 to 40 GHz) WM 490U (40 to 60 GHz) Diplexer PN: 015-3085-00
Frequency Counter, with External Mixers	<i>Frequency:</i> 0.01 to 60 GHz <i>Input Impedance:</i> 50Ω <i>Resolution:</i> 1 Hz <i>Other:</i> Ext Time Base Input	EIP Microwave, Inc., Model 578A, with External Mixers: Option 91 (26.5 to 40 GHz) Option 92 (40 to 60 GHz)
Power Meter, with Power Sensors	<i>Power Range:</i> -30 to +20 dBm	Hewlett-Packard, Model 436A, with Power Sensors: HP 8484A (0.01 to 20 GHz) HP 8485A (0.01 to 26.5 GHz) HP R8486A (26.5 to 40 GHz)
Digital Voltmeter	<i>Resolution:</i> 4-1/2 digits (to 20V) <i>DC Accuracy:</i> 0.002% +2 counts <i>DC Input Impedance:</i> 10 MΩ <i>AC Accuracy:</i> 0.07% +100 counts (to 20 kHz) <i>AC Input Impedance:</i> 1 MΩ	John Fluke, Inc., Model 8840A, with Option 8840A-09 (True RMS AC)
Oscilloscope	<i>Bandwidth:</i> dc to 150 MHz <i>Sensitivity:</i> 2 mV <i>Horizontal Sensitivity:</i> 50 ns/division	Tektronix, Model 2445
Cables	<i>Connectors:</i> 50Ω BNC	Any common source

# SECTION 2

## SYSTEM DESCRIPTION AND TROUBLESHOOTING

### CONTENTS

Paragraph	Description	Page
<b>2-SYSTEM DESCRIPTION AND TROUBLESHOOTING</b>		
2-1	INTRODUCTION . . . . .	2-11
2-2	INSTRUMENT MECHANICAL LAYOUT . . . . .	2-11
2-3	CIRCUIT SUBSYSTEMS . . . . .	2-11
2-3.1	Power Supply (A22, A25, A26 PCBs and p/o A28 PCB) . . . . .	2-11
2-3.2	Digital Control/GPIB Interface (A8, A23, and A24 PCBs) . . . . .	2-11
2-3.3	Front Panel Assembly (A1 and A2 PCBs) . . . . .	2-12
2-3.4	Inputs/Outputs (A27 PCB and p/o A29 PCB) . . . . .	2-12
2-3.5	Frequency Synthesis Subsystem-RF Casting (A3-A7, A9-A12, A16 PCBs and A30, A31 Assys) . . . . .	2-12
2-3.6	Analog Instruction (A17 PCB) . . . . .	2-12
2-3.7	YIG Drivers (A18-A21 PCBs) . . . . .	2-12
2-3.8	ALC/Pulse Modulation (A13, A15, PCBs and p/o A29 PCB) . . . . .	2-12
2-3.9	RF Microwave Deck . . . . .	2-13
2-3.10	Motherboard/Interconnections (A28 PCB) . . . . .	2-13
2-4	FREQUENCY SYNTHESIS CIRCUITS, FUNCTIONAL DESCRIPTION . . . . .	2-13
2-4.1	Overall Operation . . . . .	2-13
2-4.2	RF Outputs 0.01 to 60 GHz . . . . .	2-15
2-4.3	FM Modulation . . . . .	2-15
2-4.4	Sweep Mode of Operation . . . . .	2-15
2-5	ALC AND MODULATION CIRCUITS, FUNCTIONAL DESCRIPTION . . . . .	2-16
2-5.1	ALC Loop Operation . . . . .	2-16
2-5.2	A13 Pulse Generator PCB Operation . . . . .	2-17
2-6	SYSTEM TROUBLESHOOTING . . . . .	2-21
2-6.1	Hidden-Key Routines . . . . .	2-21
2-6.2	Troubleshooting Faults That Do Not Produce Error Codes . . . . .	2-21
2-6.3	Error Codes . . . . .	2-21
2-6.4	Master Reset Function . . . . .	2-21