



# 9911 9913

## Operator Handbook

Courtesy of:-

**G4ILN**

And

Racal\_Dana user group



[Click to join Racal\\_Dana](#)

Please enjoy responsibly ☺

G0RSQ  
11/2/12

**OPERATORS HANDBOOK**  
**For**  
**VHF FREQUENCY METERS**  
**9911 and 9913**

Racal Moditel Ltd.  
Test Equipment Maintenance Department

Location: -

ID 0947

91

**OPERATORS HANDBOOK  
FOR  
VHF FREQUENCY METERS  
9911 and 9913**

**RACAL-INSTRUMENTS LIMITED**

Duke Street  
Windsor, Berks  
England

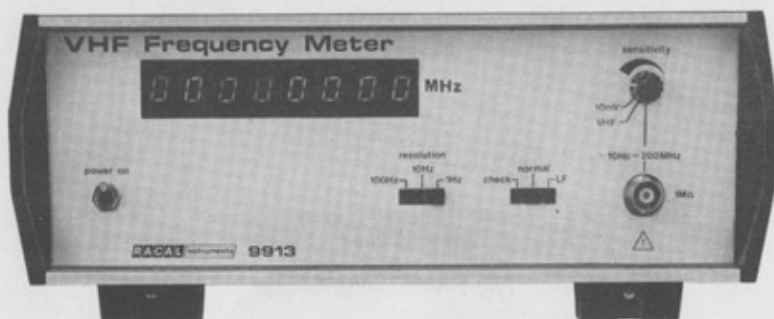
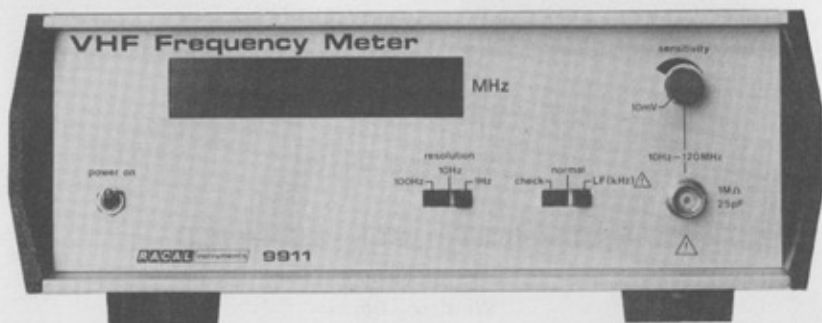
Tel. Windsor 69811  
Telex 847013

Prepared by Central Handbooks  
Racal Group Services Limited

**RACAL**  
*The Electronics Group*

Ref: WOH 6127  
Issue: 4.4.78-300

Printed in England



## CONTENTS

	<u>Page</u>
	FRONTISPIECE
	TECHNICAL SPECIFICATION
CHAPTER 1	GENERAL DESCRIPTION
	Introduction
	Frequency Standard
	Power Supply
	Description of Controls and Connections
CHAPTER 2	PREPARATION FOR USE
	Removal of Covers
	Transformer Voltage Selection
	Power Fuse
	Power Lead
	Self-Check
	Connection of external frequency standard
	Data Output Connections
	Appendix 1
	Data, Time Base and Control Principles
	Timing Diagrams
CHAPTER 3	OPERATING INSTRUCTIONS
	Initial Settings
	Frequency Measurement
	Normal Range
	L.F. Option

## TECHNICAL SPECIFICATION

### 1. DISPLAY

Format:	9911 Seven digit in line LED 7 segment display. 9913 Eight digit in line LED 7 segment display.
Latch:	Previous measurement is displayed during period required to complete new measurement. Display is automatically up dated at end of each measurement.
Reset:	Automatic.
Display Time:	Approximately equal to gate time plus 1 ms.
Self Check:	Reads 1 MHz.

### 2. INPUT

Frequency Range:	9911 10 Hz to 120 MHz. 9913 10 Hz to 200 MHz.
Sensitivity:	9911 Better than 10 mV. 9913 Better than 10 mV to 150 MHz, 50 mV to 200 MHz.
Input Impedance:	1 M $\Omega$ in parallel with 25 pF.
Level:	Adjustable by front panel potentiometer.
Damage Overload Levels:	250V r.m.s. up to 10 kHz. 50V r.m.s. up to 100 kHz. 10V r.m.s. above 100 kHz. 400V d.c.

### 3. FREQUENCY MEASUREMENT

Range:	9911 10 Hz to 120 MHz (prescaled by 2). 9913 HF 10 Hz to 30 MHz (directly gated). VHF 10 MHz to 200 MHz (prescaled by 4).
--------	---

### 3. FREQUENCY MEASUREMENT (Cont'd.)

Accuracy:  $\pm 1$  count  $\pm$  frequency standard accuracy

Gate Times: 9911 20 ms, 200 ms and 2s.  
9913 HF 10 ms, 100 ms and 1s.  
VHF 40 ms, 400 ms and 4s.

Resolution: 100 Hz, 10 Hz and 1 Hz.

L.F. Multiplier: See Option 09.

### 4. FREQUENCY STANDARD

Frequency: 5 MHz.

Ageing Rate:  $\pm 1$  part in  $10^6$  per month.

Temperature Stability:  $\pm 8$  parts in  $10^6$  over temperature range  $0^{\circ}\text{C}$  to  $55^{\circ}\text{C}$ .  
 $\pm 3$  parts in  $10^6$  over temperature range  $+20^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ .

Alternative Timebases: See Options 04A and 04B.

### 5. STANDARD FREQUENCY OUTPUT

Frequency: 9911 500 kHz (via data output connector).  
9913 1 MHz (via rear panel BNC socket).

Level: Standard TTL output.

Waveform: Approximately rectangular.

### 6. EXTERNAL STANDARD INPUT

Frequency: 1 MHz.

Minimum Level: 100 mV r.m.s. into 1 k $\Omega$ .

Maximum Level: 10V r.m.s. 400V d.c.

Input Impedance: Approximately 200 ohms (a.c. coupled)

## 7. DATA OUTPUTS

Display, Function  
and Control

Serial BCD output is provided at standard TTL logic levels giving 8 digits and decimal points. Static timebase and overflow outputs with timing controls are provided. (See page 2-5, also Option 01).

## 8. POWER REQUIREMENTS

Supply:

94V to 265V r.m.s., 45 to 450Hz, a.c.

Voltage Ranges:

Eight ranges selected by transformer connection and link. Refer to Fig. 1 on page 2-2.

Consumption:

17VA approximately.

## 9. ENVIRONMENTAL AND SAFETY SPECIFICATION

Operating Temperature:

0°C to +55°C

Storage Temperature:

-40°C to +70°C

Humidity:

95% r.h. at +40°C

Mechanical:

In accordance with IEC 68.

Safety:

Meets IEC 348 (BS4743).

## 10. MECHANICAL

Dimensions:

Height	Width	Depth
96.5 mm	240 mm	268 mm

Weight:

Approximately 2 kg.

Accessories Supplied:

Operators Manual, Spare Fuses and Supply Voltage Label.

## 11. OPTION 01 SERIAL TO PARALLEL INTERFACE

Data and Control  
Information:

This unit provides an interface between the 28-way data output of the 9911 or 9913 and a 50-way connector to a printer, or remote display. It converts the serial b.c.d. data to parallel format and transfers the following information.

Up to eight decades of data in 4 line BCD, weighted 1248; 3 line decimal point position, print command, print hold, reset, overflow and time-base information. All logic levels t.t.l. compatible.



12. OPTION 04A FREQUENCY STANDARD 9442

Frequency:	5MHz.
Ageing Rate:	$\pm 3$ parts in $10^9$ /day after 3 months continuous operation.
Warm-Up Time:	Better than $\pm 2$ part in $10^7$ within 6 minutes.
Temperature Stability:	Better than $\pm 3$ parts in $10^9$ per $^{\circ}\text{C}$ over the range $-10^{\circ}\text{C}$ to $+45^{\circ}\text{C}$

13. OPTION 04B FREQUENCY STANDARD 9421

Frequency:	5MHz.
Ageing Rate:	$\pm 5$ parts in $10^{10}$ per day after 3 months continuous operation.
Warm-Up Time:	Better than $\pm 1$ part in $10^7$ within 20 minutes.
Temperature Stability:	Better than $\pm 6$ parts in $10^{10}$ per $^{\circ}\text{C}$ over the range $-10^{\circ}\text{C}$ to $+45^{\circ}\text{C}$ .

14. OPTION 09 LF FREQUENCY MULTIPLIER

Function:	To increase measurement resolution at low frequencies.
Frequency Range:	10Hz to 5kHz.
Multiplication:	x 100
Sensitivity:	10mV.
Resolution:	0.01Hz on longest gate time.

15. OPTIONAL ACCESSORIES

Padded Case:	Part No. 15-0444
Rigid Case:	Part No. 15-0450
Rack Mounting Kit:	Part No. 11-1126
Data Output Connector:	Part No. 23-5747

## CHAPTER 1

### GENERAL DESCRIPTION

#### INTRODUCTION

1.1 The V.H.F. Frequency Meters 9911 and 9913 are compact lightweight instruments providing convenient and accurate measurement at moderate cost. The instruments are identical in basic design construction and performance but differ in frequency range and display, as follows:-

9911: The frequency range is 10 Hz to 120 MHz. Inputs are prescaled by a factor of two and the measurements displayed on a seven digit readout.

9913: Frequency coverage is 10 Hz to 200 MHz in two ranges. The basic (HF) range is 10 Hz to 30 MHz with direct gating. The VHF range is 10 MHz to 200 MHz, prescaled by 4. The display is eight digits.

1.2 An optional 'L.F.' facility enables both instruments to measure low frequencies, using a technique which multiplies the input signal frequency by 100.

1.3 Three gate times are available, the switch positions are marked in the resolution provided. The latched display employs seven-segment light-emitting diode (LED) indicators, with automatic positioning of the decimal point.

#### FREQUENCY STANDARD

1.4 A discrete component 5 MHz oscillator is fitted in the basic versions of both instruments, but at customer's option a high stability fast-warm-up oscillator from the Racal range may be fitted. This precision unit should be serviced only by Racal Instruments or authorized agent. An aperture in the rear panel provides access for calibration of the optional oscillator.

1.5 A rear panel socket permits the use of an external frequency standard input. Also available is a reference signal output, derived from the frequency standard in use. This reference output is available via the Data Output socket on the 9911, and via a BNC socket on the 9913.

#### POWER SUPPLY

1.6 The instruments operate from a.c. supplies of 94-132V and 188-265V, 45-450 Hz. The correct tapping must be made on the internal mains transformer to conform with the local a.c. supply voltage. (See paragraph 2-2).

#### DATA OUTPUT

1.7 Details of facilities at the 28-way rear panel connector are given in Table 2 at the end of Chapter 2, together with an explanation of the data output format and coding.

## MAINTENANCE MANUAL

1.8 Technical details and maintenance instructions are contained in the Maintenance Manual, available from Racal Instruments Limited, at the address on the title page.

## DESCRIPTION OF CONTROLS AND CONNECTIONS

### FRONT PANEL

- POWER ON/OFF Switch:** A single pole switch which switches the internal d.c. supply.
- RESOLUTION Switch:** This 3-position switch selects the required timing signal from the time base to give the required gate time. Generally, the switch will be set so that the measurement just fills the display. The resolution is indicated by the switch marking.
- CHECK/NORMAL/  
L.F. Switch:** In the CHECK position a reference signal derived from the frequency standard is fed to the counter-display circuits to provide a 1 MHz readout. The NORMAL position is for operational use, giving a readout in MHz. The L.F. position is an optional facility for measurement of very low frequencies, giving a readout in kHz.
- SENSITIVITY (variable control):** This is a potentiometer providing manual variation of sensitivity in the input amplifier. The most sensitive condition is fully anti-clockwise (10 mV position).
- 9913 Only In the 9913, the SENSITIVITY switch has a switched position marked 'V.H.F.' In this position the input signal is prescaled by a factor of 4, thus providing a measurement range of 10 MHz to 200 MHz with fixed sensitivity.
- Input Socket** The signal to be measured is connected to the high impedance BNC socket on the front panel. The symbol  $\triangle$  advises the user to consult the handbook for further details.

## REAR PANEL ITEMS

- POWER Connection: The power cable is attached to the instrument.
- POWER FUSE: A cartridge-type anti-surge fuse must be fitted. Correct fuse ratings are marked on the rear panel.
- EXT. STD. INPUT  
Socket: This BNC socket accepts a 1 MHz external frequency standard. The instrument will automatically inhibit the internal oscillator signal when the external standard is applied.
- OSC. ADJUST: This aperture provides access to the calibration adjustment in the 5 MHz oscillator, except for some early models in which the standard oscillator is mounted on the main p.c.b. Calibration must be carried out in accordance with the instructions in the maintenance manual.
- DATA OUTPUT  
Connector: A 28-way edge connector is accessible at the rear panel. The connection details are listed in Table 2 on page 2-5. This outlet includes a 1 MHz reference output in the 9913 and a 500 kHz reference in the 9911. An external Hold facility can be applied.
- Internal Standard  
Output: In the 9911 a 500 kHz reference is available at the Data Output connector.
- In the 9913 a 1 MHz reference is available at the Data Output connector and also via a BNC socket on the rear panel.

## CHAPTER 2

### PREPARATION FOR USE

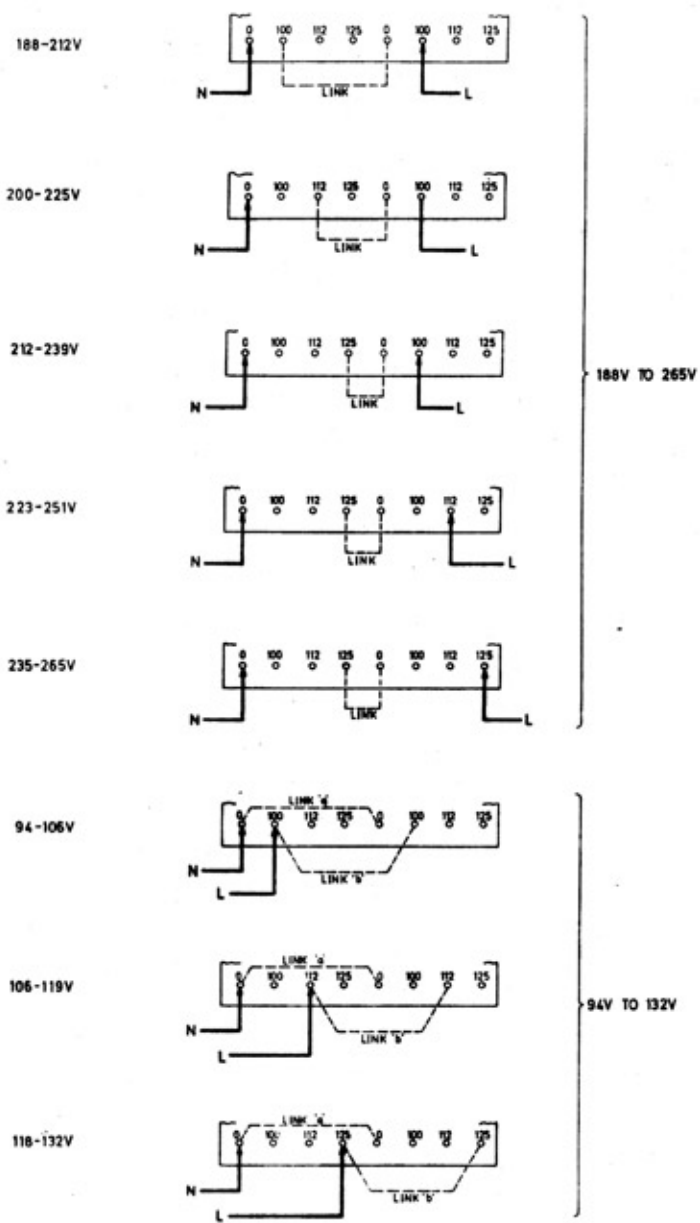
#### REMOVAL OF COVERS

**WARNING:** DANGEROUS AC VOLTAGES ARE EXPOSED WHEN COVERS ARE REMOVED WITH AC SUPPLY CONNECTED.

- 2.1
- (1) Set the POWER switch to 'off', switch off the a.c. supply at the supply point and unplug the power lead.
  - (2) Remove 4 screws from the bottom cover. Remove the rubber plugs (located near to the rear end) from both side panels of the instrument and slacken, by about two turns, the screws revealed.
  - (3) Grip the rear panel assembly and ease it back from the main case to the maximum extent available (about 5 mm).
  - (4) The rearedge of either cover can now be lifted and the cover withdrawn outwards and rearwards. To replace the covers reverse the above procedure.

#### TRANSFORMER VOTAGE SELECTION

- 2.2
- The instrument will normally be dispatched with the transformer primary tapping set to the 223V to 251V range. To check the selection proceed as follows.
- (1) Unplug the power cable from the supply and remove the top cover (see previous paragraph).
  - (2) Refer to the diagrams on the next page and:-
    - (a) Note the diagram which corresponds to the local a.c. supply voltage.
    - (b) Connect the correct link(s) and make the required line lead (L) connection as indicated in the appropriate diagram.
  - (3) Verify that the label on the rear panel indicates correctly the selected voltage range. Alternative labels are provided with the instrument for ranges other than 223V to 251V.
  - (4) Replace the top cover.



Mains Transformer  
Voltage Selection Diagrams

Fig. 1

## POWER FUSE

- 2.3 Check that the power fuse on the rear panel is correctly rated for the supply voltage, as follows. The fuse is a glass cartridge type, 5 x 20 mm.

<u>Supply Range</u>	<u>Fuse Rating</u>	<u>Racal Part No.</u>
188V - 265V	100 mA anti-surge	23 - 0033
94V - 132V	200 mA anti-surge	23 - 0027

## POWER LEAD

- 2.4 Fit a suitable plug to the power lead in accordance with the standard colour code:-

Brown .....	Line
Blue .....	Neutral
Green/Yellow .....	Earth (Ground)

## SELF CHECK

- 2.5 (1) Connect the power supply and set the POWER switch to ON.
- (2) Set the CHECK/NORMAL switch to CHECK.
- (3) The 1 MHz reference frequency is now being fed through the counting and display circuits. Move the RESOLUTION switch through all three positions and verify that the decimal point moves correctly, as follows:-

TABLE 1  
CHECK READOUT

Resolution Switch Setting	Display ( $\pm 1$ count)	
	9911	9913
100 Hz	001.0000	0001.0000
10 Hz	01.00000	001.00000
1 Hz	1.000000	01.000000

## CONNECTION OF EXTERNAL FREQUENCY STANDARD

- 2.6 The requirements for the external reference source are given in the Technical Specification. It should be borne in mind that the accuracy of measurement is directly related to the accuracy of the frequency standard used.
- 2.7 When the external frequency standard is fed into the rear panel socket, EXT STD I/P, the instrument will automatically change to external standard operation.

## REFERENCE FREQUENCY OUTPUT

- 2.8 The 1 MHz reference output (9913) and 500 kHz reference (9911) are available via pin J of the rear panel Data Output connector. These outputs are TTL. In the 9913 the 1 MHz reference is also available via a rear panel BNC socket.



## DATA OUTPUT CONNECTIONS

Data and Command information is available via a 28-way edge connector accessible by removing a cover on the rear panel. The facilities and pin connections are listed in Table 2 below and supplementary information is given in the Appendix to this Chapter.

**TABLE 2**  
Data Output Connector

Pin	Facility	Pin	Facility
1	-5V (nominal)	A	0V
2	+5V (nominal)	B	Not used
3	Key way	C	Key way
4	$\bar{4}$ (BCD) 9911 <u>overflow</u>	D	$\bar{1}$ (BCD)
5	$\bar{8}$ (BCD) 9913 <u>overflow</u>	E	$\bar{2}$ (BCD)
6	<u>External Hold Input</u>	F	See NOTE 1
7	Not used	H	<u>Main Gate</u>
8	Not used	J	See NOTE 2
9	$\bar{c}$ ) Function	K	$\bar{z}$ ) Time Base
10	$\bar{b}$ ) Information	L	$\bar{y}$ ) Information
11	$\bar{a}$ ) (logic '1')	M	$\bar{x}$ ) See Table 3
12	$\bar{R}_0$	N	Not used
13	Not used	P	Not used
14	Not used	R	Not used

NOTE 1: Pin F output is the display synchronising signal, which is 5 kHz in the 9911 and 10 kHz in the 9913.

NOTE 2: Pin J output is a 500 kHz frequency standard reference output in the 9911 and a 1 MHz reference output in the 9913.

NOTE 3: All facilities are outputs, except pin 6. Refer to paragraph A5 on page 2-7 for External Hold information.

## APPENDIX 1

### DATA, TIME BASE AND CONTROL PRINCIPLES

#### FUNCTION AND TIME BASE CODES

A1. The function and time base requirements are applied internally to the C.D.I. chip on a six-line code. The inverse states of this code are fed out to the rear Data Output connector. As the 9911 and 9913 are single function instruments the  $\bar{a}$ ,  $\bar{b}$ ,  $\bar{c}$  'function' lines are held permanently at logic '1'. The time base coding is given in Table 3.

**TABLE 3**  
Time Base Control Coding

Code			Gate Times		
$\bar{x}$	$\bar{y}$	$\bar{z}$	9911	9913 (HF)	9913 (VHF)
0	1	1	20 ms	10 ms	40 ms
1	0	1	200 ms	100 ms	400 ms
0	0	1	2s	1s	4s

NOTE: When the optional LF multiplier facility is selected the resolution is increased x 100.

#### DATA OUTPUT FORMAT

A2. The b.c.d. output data is available at the 28-way edge connector in a bit parallel byte serial form. The data is sequenced by a 5 kHz synchronising signal in the 9911 and a 10 kHz signal in the 9913. The data presentation is delayed 0.5  $\mu$ s from the negative edge of the synchronising signal. An additional synchronising pulse ( $R_0$ ) determines the first state ( $10^0$  digit). See Figure 2.

A3. There are ten output states, as follows:-

<u>States</u>	<u>Facility</u>
1 to 8	Digit (display) information.
9	Overflow for $10^3$ , $10^4$ , $10^6$ and $10^7$ digits on pins D, E, 4 and 5 respectively
10	Decimal point position in kHz units, plus overflow information for $10^5$ digit, via pin 5.

## Timing Diagrams

A4. Figure 2 shows the timing sequence for the ten states in the 9913. The 9911 is similar except that the synchronising signal and  $R_0$  timings are doubled. Figure 3 shows the control sequence (the diagrams are not drawn to scale).

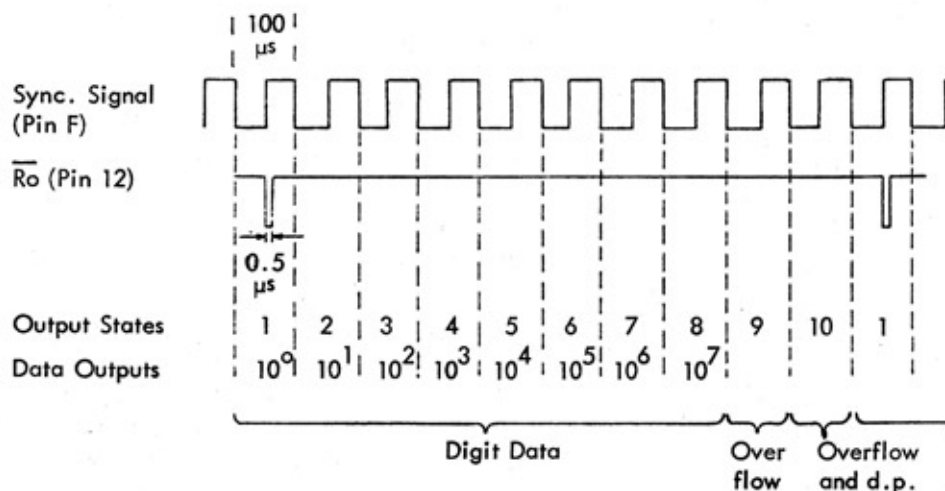


Fig. 2 Data Sequence Diagram

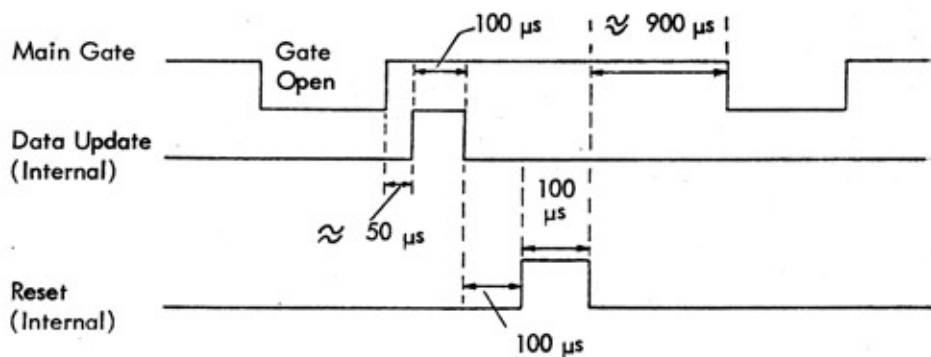


Fig. 3 Control Sequence Diagram

## External Hold

A5. If, when used with external circuitry, it is required to extend the cycle time, the external hold, (logic '0', pin 6) must be applied within the gate time or up to 100  $\mu\text{s}$  (9913) after gate closure. In order to initiate a new cycle of measurement the external hold must go 'high' for not less than 200  $\mu\text{s}$  (9913). The respective times in the 9911 are 200  $\mu\text{s}$  and 400  $\mu\text{s}$ .

## CHAPTER 3

### OPERATING INSTRUCTIONS

- NOTES 1: Before using the instrument for the first time, or at a new location, check the power supply as described in paragraphs 2.2 and 2.3.
- 2: The description of controls in Chapter 1 will assist the user in correct use of the instrument.

#### INITIAL SETTINGS

- 3.1 (1) Set the POWER switch to ON. If the instrument is fitted with the optional fast-warm-up oscillator the appropriate warm up time should be allowed.
- (2) Set the CHECK/NORMAL/LF switch to NORMAL.

#### FREQUENCY MEASUREMENT (Normal Range)

- 3.2 (1) Set the variable SENSITIVITY control as follows:-
- (i) 9911: Initially fully clockwise, or as required if input level is known.
- (ii) 9913: For frequencies in the range 30 MHz to 200 MHz set the SENSITIVITY control to the V. H. F. (switched) position. In this position the sensitivity is fixed.

NOTE: The V. H. F. range may be used from 10 MHz upwards if preferred.

- (2) Connect the external signal to the input socket (high impedance). The maximum and minimum input levels are as follows:-

#### Maximum

250V r.m.s. up to 10 kHz  
50V r.m.s. up to 100 kHz  
10V r.m.s. above 100 kHz

#### Minimum

10 mV up to 120 MHz (9911)  
10 mV up to 150 MHz ) (9913)  
50 mV above 150 MHz)

- (3) If not on 'VHF', the variable SENSITIVITY control may be adjusted as required for the signal conditions. The most sensitive condition is anti-clockwise as indicated by the '10 mV' engraving.
- (4) Set the RESOLUTION switch as required. Generally this switch should be set to a position which allows the measurement to just fill the display. The readout is in MHz.

### FREQUENCY MEASUREMENT (L.F. OPTION)

- 3.3
- (1) Set the SENSITIVITY control fully clockwise.
  - (2) Set the CHECK/NORMAL/LF switch to 'LF (kHz)'.
  - (3) Connect the external signal to the input socket (high impedance).
  - (4) Set the RESOLUTION switch as required. Note that the selected resolution is multiplied by 100 by the LF facility.
  - (5) Adjust the SENSITIVITY control, as required, for steady counting. The readout is in kHz.

NOTE: When no input signal is applied it is normal for the instrument to show a few counts.

