



WATKINS - JOHNSON COMPANY

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YIG FILTER OPERATING INSTRUCTIONS

Watkins-Johnson Company YIG filters are carefully manufactured, inspected and tested to the specification for each model type. Data are included with each unit showing its performance at several discrete frequencies across the specified tuning range. The following comments, procedures and precautions are offered to aid the user in obtaining the same performance. Once properly installed a YIG filter will perform almost indefinitely.

INSTALLATION DC Connections

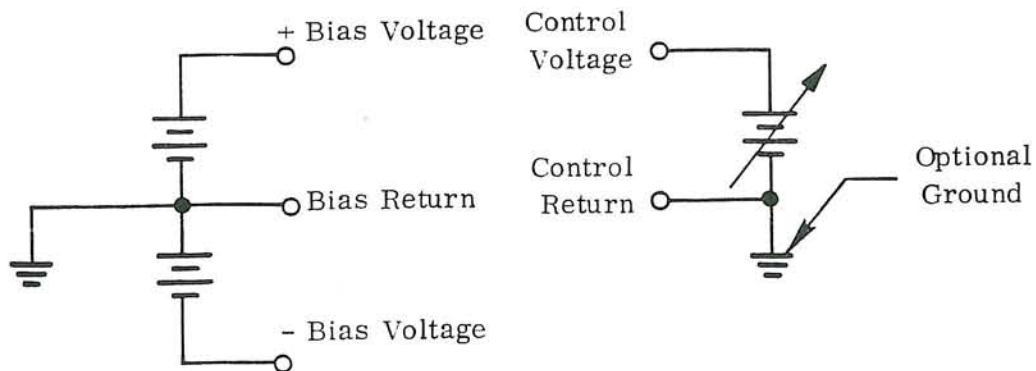
The proper dc connections are given on the outline drawing packed with the units.

Tuning Coil

On units supplied without a driver, care should be taken to observe the correct tuning coil polarity on each unit since either coil terminal may be marked positive. If the polarity is reversed from that on the label, a degraded passband may result; but the unit will not be damaged.

Driver

Some units are supplied with Drivers for the tuning coil. The following circuit is recommended to separate bias voltage from control voltage circuits.



The control voltage return must be connected directly to the control voltage supply. Do not combine the control return and the bias return at the driver. If a separate lead is not used for the control return, frequency setting with the control voltage will be inaccurate because of the IR drop in the common return lead.

Maximum bias current required is given in the specification for each type of unit.

Heaters

Heaters are often included in the filter to minimize such temperature dependent effects as frequency drift and power output variation. Two types of heaters are used depending on the application. A passive semiconductor chip heater guaranteed to maintain the YIG sphere assembly within $\pm 30^{\circ}\text{C}$ over the military temperature range (-54°C - $+85^{\circ}\text{C}$) is used for standard applications. An active hybrid IC heater guaranteed to maintain the YIG sphere assembly within $\pm 10^{\circ}\text{C}$ over the military temperature range is used in devices where control of temperature dependent characteristics is critical.

Both types of heaters are self regulating and may be operated from an unregulated voltage within 22 to 30 volts. The semiconductor chip heater may be operated DC (either polarity) or AC. The hybrid heater must be operated from a DC voltage and in the polarity indicated on the interface control drawing or marked on the unit. Accidental reversal of the "+" and "-" leads, however, will not damage the heater. Hybrid heaters are screened to MIL-STD-883B.

RF Connections

The YIG filter is normally a reciprocal device, however specified bandpass performance is guaranteed only for RF energy flow into the port labeled "IN" or "INPUT".

CAUTION should be used in mating to the filter connectors. The filter jack center pins are captured. A properly aligned plug that conforms to MIL-C-39012 will not damage the filter. However, it is possible to dislodge this pin if an extra long or misaligned plug center contact is forced against it.

In this event the damage to the filter RF structure is not repairable.

Mounting

The filter may be mounted in any orientation. The filter (particularly units that tune above 4 GHz) should be mounted to a heat sink capable of dissipating up to 5 watts without raising the temperature at the base of the unit adjacent to the heat sink above the specified operating temperature range.

OPERATION

Tuning the Coil

The YIG filter assembly is current tuned device which conforms closely to the linear relation $f = A + SI$ where

f is the passband center frequency

A is a small constant that varies from unit to unit and typically ranges between 100 and 200 MHz

S is the sensitivity shown approximately in the specification

I is the current passing through the tuning coil

The test data provided with each unit gives the current required to tune the device over the operating range. The point to note is that the filter must be driven from a current regulated source so that changes in the coil resistance do not effect the control current.

Driver Tuning

When properly biased, the driver converts the YIG filter to a voltage tuned device where a control voltage of 0 to 10 volts tunes the filter over the specified output frequency range. Less than one milliamp is required from the control power supply. At 0 and 10 volts the bandpass frequency is normally set to be a few MHz outside the guaranteed tuning range so that it will always be possible to cover the guaranteed range.

For further information on the "Dynamic (Swept) Tuning Characteristics of YIG Devices" see Application Note 100328 or 100343 available from Watkins-Johnson.

RF Matching

The YIG filter is matched to 50 ohms at the center of the passband and is nearly a short circuit out of the passband region. The effect of this mismatch on system performance should be considered.

The filter passband characteristics are strongly effected by mismatches. The VSWR of the input load should be less than 1.3:1 in critical applications and less than 1.5:1 for any application where a well shaped passband is needed.

See Application Note 100360 "Electronically Tunable YIG Filter for Wideband Microwave Systems" for further details on the theory and application of YIG filters.

FINAL DATA SHEET
YIG FILTER

WJ TYPE 5224-3 SERIAL NUMBER 4227 DATE 5/2/81
 O172-3-1117-002 WJ QA 02106 TESTED BY Mag R Chin

START CURRENT 106-120 mA.	Tuning Linear Current mA	-40°C						+25°C						+70°C					
		f (MHz)		3 dB Bandwidth	Inser. Loss.		3 dB Bandwidth	f (MHz)		3 dB Bandwidth	Inser. Loss.		3 dB Bandwidth	f (MHz)		3 dB Bandwidth	Inser. Loss.		
		-2 dB Point	+2 dB Point		-2 dB Point	+2 dB Point		-2 dB Point	+2 dB Point		-2 dB Point	+2 dB Point							
	11.20	31	19	30	30	56	26	23	3.0	3.0	53	22	23	3.3	50				
		34	18	30	30	55	30	20	3.0	3.0	56	24	18	3.2	49				
		37	18	30	30	59	31	19	2.8	2.8	57	26	26	3.0	52				
		38	19	27	27	60	31	24	2.8	2.8	58	26	22	2.8	52				
		29	19	2.5	2.5	60	29	24	2.5	2.5	58	25	25	2.8	55				
		27	22	2.5	2.5	63	29	27	2.5	2.5	61	26	29	2.8	58				
		36	25	2.7	2.7	67	30	29	2.5	2.5	64	27	30	2.8	62				
		36	28	2.6	2.6	72	32	31	2.4	2.4	67	28	32	2.8	64				
		38	32	2.4	2.4	74	34	33	2.3	2.3	70	30	32	2.8	67				
		39	33	2.2	2.2	78	35	34	2.2	2.2	74	32	34	2.8	72				
		26	36	2.2	2.2	82	37	36	2.2	2.2	77	35	35	2.7	74				
HEATER I		115 mA						70 mA						35 mA					

NOTE: Insertion Loss shown in minimum value within passband.

OFF-RESONANCE ISOLATION
 At F_h +310 MHz >70 dB (+25°C) (Δ 70) At F_h +80 MHz >10 dB (+25°C)
 At F_h +310 MHz >70 dB (-40°C) (>70) At F_h +80 MHz >10 dB (-40°C)
 At F_h +310 MHz >70 dB (+70°C) (>70) At F_h +80 MHz >10 dB (+70°C) (Δ -10dB)
 Limiting Level greater than >0 dBm(0) (For engineering info. only.)
 Limiting Level greater than >0 dBm(0@-40°C)
 End Point Tuning Correction Factor F_L -4.5 MHz, F_H -1.5 MHz (For engineering info. only.)

OFF-RESONANCE SPURIOUS
 Coil Resistance 9.0 OHMS (<10 OHMS)
 Coil Inductance 107 mH (<125 mH)
 Grounding Isolation (Pass/Fail) (>10dB)
 Tuning Sensitivity 17.7 MHz/mA (170±0.5)
 Hysteresis 8 MHz (<12 MHz)

VSWR 1.22 (Worst Case <2.0:1)

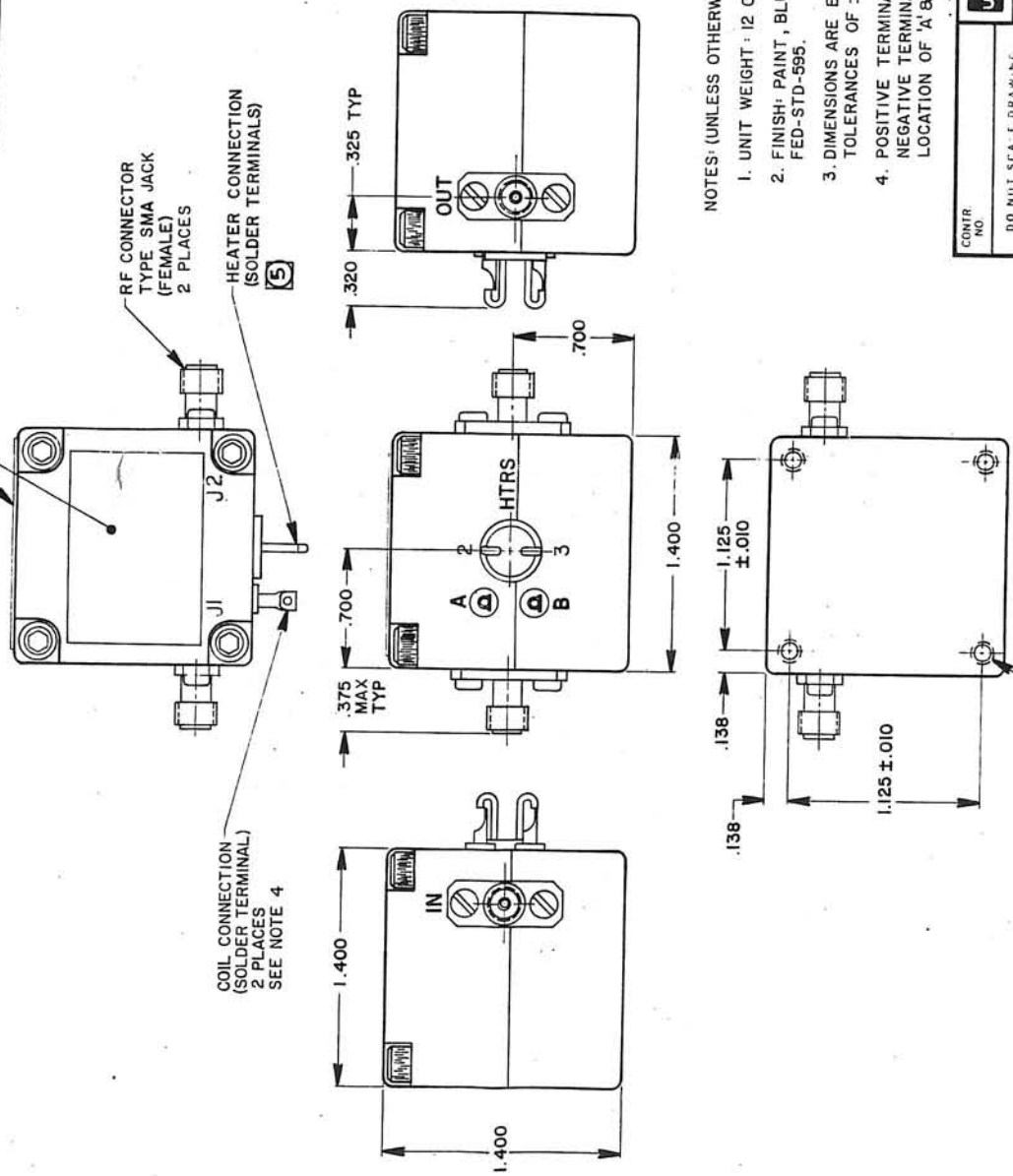


WATKINS-JOHNSON COMPANY
ELECTRON DEVICES, ELECTRONIC SYSTEMS
PALO ALTO, CALIFORNIA

SIZE A	CODE IDENT NO 14482	DWG NO 131514
SCALE	DIV 21	REV C
SHEET 31		

REVISIONS		ECO	DATE	APPROVAL
A	REV PER ECO	7163	122377	JK
B	REMOVED DATE CODE LABEL; REV	7449	6677	SK/JFH
C	DWG CHANGES			JK/JFH

PRODUCT LABEL AREA



RF CONNECTOR
TYPE SMA JACK
(FEMALE)
2 PLACES

HEATER CONNECTION
(SOLDER TERMINALS)
⑤

COIL CONNECTION
(SOLDER TERMINAL)
2 PLACES
SEE NOTE 4

- NOTES: (UNLESS OTHERWISE SPECIFIED)
1. UNIT WEIGHT: 12 OUNCES MAX (340.2 GRAMS).
 2. FINISH: PAINT, BLUE (COLOR NO. 25109) PER FED-STD-595.
 3. DIMENSIONS ARE EXPRESSED IN INCHES WITH TOLERANCES OF ±.015
 4. POSITIVE TERMINAL IS MARKED 'A'
NEGATIVE TERMINAL IS MARKED 'B'
LOCATION OF 'A' & 'B' MAY BE REVERSED.

- NOTES: CONT.
- ⑤ HEATERS ARE 28 VOLTS,
POSITIVE TERMINAL IS MARKED "2"
NEGATIVE TERMINAL IS MARKED "3"

WATKINS-JOHNSON COMPANY		SCALE: 2 X	DIVISION: 21	SHEET: 01
DO NOT SCALE DRAWING				
DR	G. BROOKE	9-28-76		
CHK				
APPD				
APPD				
APPD				
MOUNTING HOLE 6-32 UNC-28 X .26 ± .02 DEEP 4 PLACES				
YIG TUNED FILTER				
SIZE	CODE IDENT NO	295973		REV
C	14482			C