September/18/97

MFJ 259B TEST PROCEDURE

1.-MFJ259B PCB initial precalibration procedure

It is assumed that the unit is working on basic conditions.

1.) Set to the TEST mode by pressing the **gate time** and **mode** switch buttons while turning the power On. The different **testing** steps are selected with the **mode** switch button .

2.) **T8>H** : Verify that the signal selected for the frequency counter is the external. **T8** should be high (4-5 V). Verify that the voltage supply for the oscillator **T16** is disabled.

3.) **T16>12V** : Verify that the voltage supply for the oscillator **T16** is around 10.5V. Verify that the power supply for the prescaler and the op-amps **T15** is disabled.

4.) **T7>H**: Verify that the internal generator selection signal **T7** is high (4-5 V) and that the +5V power supply for the prescaler and the op-amps **T15** is enabled.

5.) The internal oscillator frequency will be displayed. Eight bit AD conversion from Vr, Vs and Vz too " **Rxxx Sxxx Zxxx**".

6.) Set the wiper of the trimmer resistor R28 (AGC reference) to get 3 Vdc over **T1** .

7.) Set the wiper of the trimmer resistor R84 (harmonic suppression adjustment) to get ~~4.3~~ 3,7 Vdc over **T9**.

8.) Band Overlapping

The unit has to cover continuously from 170 to 1.8 MHz.
- Set the maximum frequency (rotary switch all the way at the left and plates of the capacitor completely open) over the 114-170 MHz band (b6)..
- Adjust L6 (#22, two turns inductance) to get a frequency reading exceeding 170 MHz in , at least, 300 kHz .
- Set the to the 1.8 - 4 MHz band (b1).
- Set the maximum frequency in this band. Adjust L9 until the reading exceeds 200 kHz to 4 MHz .
- Set the 4 - 10 MHz band (b2).

- Set the minimum frequency in this band. Adjust L2 until the frequency reading is 200 kHz lower than the minimum frequency (4 MHz) .
- Verify that the maximum frequency exceeds the maximum frequency (10 MHz) .
- Repeat the three previous points for the 10 - 27 MHz band (b3) and the 27-70 MHz band (b4).
- Check that the frequency overlaps in the 70-114 MHz band (b5).
- If the frequency overlapping is not possible for b5 readjust b6 to get a frequency reading exceeding 170 MHz in , at least, 1 MHz

9.) Since the bridge voltages can be read in the LCD adjustment steps could be implemented with TH resistive loads. Set the unit to the minimum frequency (1.8MHz).

10.) Hook up a 150 ohm resistance load and adjust the voltage reading calibrating :
- Vr (reflected voltage) with R53
- Vz (voltage drop in the load) with R72
- Vs (voltage drop in the resistor in series with the load) with R73

to get Vr = 128, Vz = 191, Vs = 64.

11.) Set the **impedance** mode verifying the correct reading for the 150 ohm resistance load .

12.) Hook up several loads and verify the approximate readings. The AD voltage conversion could be watched while pressing **gate time**.

R (ohms)	Vs (binary)	Vz (binary)	Vr (binary)
24	172	83	89
50	127-128	127-128	0
100	85	170	85
150	64	191	128

13.) Prepare a 3 feet RG58A load with the end open. Hook it up and trace for a short (Z=0-2) at VHF (a particular freq. around 150 MHz).

14.) Set to the freq. counter mode. Provide an RF signal to the pad J2 (freq. counter PCB input). Verify the reading.

15.) Set the Z or the **SWR** mode to adjust the bias in the counter module:
- Set the 27 - 70 MHz range.
- Connects the frequency counter input to the analyzer with an scope probe.
- Adjust if necessary the trimmer capacitor C2 until the reading in the internal module match the frequency counter in the kHz.

2.- MFJ 259B TEST & CALIBRATION PROCEDURE

2.1. Introduction

The box can be tested completely after assembling with the battery holder initially unassembled. An initial PCB precalibration procedure is assumed.
The operations indicated in the procedure can be followed under normal conditions (getting oscillations impedance and SWR meter working), otherwise some troubleshooting can be required.
A multimeter, a scope (optional), a frequency counter, a tuning tool, a coaxcable, quick connectors and another analyzer will be required.

2.2 Procedure

2.2.1 Operations after assembly

- Check appearance of box; if any defects inform the assembly persons.
- Set the unit in test mode by pressing the mode and the gate time switch buttons in the power on.
- Recheck that the unit is able to oscillate before performing any other operation.

2.2.1.1 Adjusting the RF amplifier bias

- Check that the wiper of the trimmer resistor R84 (harmonic suppression adjustment) was set to get 4.3 Vdc over T9.

2.2.1.2 Setting the AGC

- Set the maximum frequency (rotary switch all the way at the left and plates of the capacitor completely open).
- Check that T1 gets 3 Vdc .If it is necessary set the wiper of the trimmer resistor R56 (AGC reference) to get the 3 Vdc (3V < T1 < 3.2V).
- Set the lowest frequency band using the rotary switch (all the way at the right). Using the variable capacitor, cover slowly the band looking for a consistent frequency reading in the counter module. Notify, if an erratic behavior is observed.
- Repeat the previous operation to cover all the bands.

2.2.1.3 Band Overlapping

The unit has to cover continuously from 170 to 1.8 MHz. Check that the band overlapping realized in the PCB precalibration is still correct. Readjust the setting where necessary.

2.2.1.4 SWR and Z

- Set the unit in the 1.8 - 4 MHz band (b1) to 4 MHz.
- Use the 100 ohms "dummy load" over the antenna output.
  - Read the AD conversions (directly or pressing the **gate time** switch button if necessary).
  - Setting **R53** adjust **Vr** to 85
  - Setting **R72** adjust **Vz** to 170
  - Setting **R73** adjust **Vs** to 85
  - Adjust **R56** to read an SWR of 2 in the needle meter.
  - Set the unit at the **impedance** mode.
  - Adjust **R67** to read an impedance of 100 ohms over the **impedance** diddle meter.
- Use the 50 ohms "dummy load" over the antenna output.
  - Read the AD conversions (pressing the **gate time** switch button).
  - Verify a **0 Vr** reading.
  - Verify a close to 127 **Vs** reading .
  - Verify a close to 127 **Vz** reading
  - Verify an SWR reading of 1 in the needle meter.
  - Verify a close reading to 50 ohms in the meters. If necessary readjust R67 to read a compromising impedance of 50 ohms in the needle meter.
- Use the 24 ohms "dummy load" over the antenna output.
  - Read the AD conversions (pressing the **gate time** switch button).
  - Verify a close to 89 **Vr** reading.
  - Verify a close to 172 **Vs** reading .
  - Verify a close to 83 **Vs** reading
  - Verify an SWR reading of 2 in the needle meter.
  - Verify a close reading to 24 ohms in the meters..

- Use the 150 ohms "dummy load" over the antenna output.
  - Read the AD conversions (pressing the **gate time** switch button).
  - Verify a 128 **Vr** reading (SWR= 3.01).
  - Verify a close to 64 **Vs** reading .
  - Verify a close to 191 **Vs** reading
  - Verify an SWR reading of 3 in the needle meter. 3 SWR
  - Verify a close reading to 150 ohms in the meters.

2.2.1.6 Last bridge verification

- Connect a 3 feet RG58A load. Trace for a short reading (Z=0-2) at VHF (a particular freq. around 150 Mhz).
- Connect the 50 ohms "dummy load" over the antenna output. Verify the reading (Z=50, SWR=1).

2.2.1.5 Frequency counter mode .

- Set the **frequency counter** mode.
- Connect the cable running from the test station analyzer to the frequency input of the unit being tested.
- Verify the frequency reading.
- Disconnect cable from unit

2.2.1.6 Battery leads test . - turn off power

- Set the battery charger jumper off.
- Assembly the battery holder.
- Apply 12 Vdc to the battery leads considering the polarity.

3. MFJ259V- TEST mode.

Test mode is set up if the **mode** and the **gate time** switch buttons are pressed in the power on. If just the **mode** switch button is pressed the **sleep mode** is disabled (customer option).
If enabled **TEST** will appear in the LCD.
The **TEST** mode provide with the unit basic test procedure. The actual four testing steps could be used for troubleshooting. This mode provide with the bridge AD readings necessary for calibration (4 Th. step).
Pressing the **mode** button the different test steps will be performed

3.1.) Test point definition

These test point are labeled on the PCB as follow (numbers and test points could be revised and they will be print out in the solder side)

T1 : Forward voltage - amplified - (Vf)
T2 : Reflected voltage - amplified - (Vr)
T3 : Voltage drop over Rs in series with the load - amplified - (Vs)
T4 : Voltage drop over the load - amplified - (Vz)
T5 : Signal coming conditioner to microcontroller.
T6 : Buffer Oscillator signal to prescaler
T7 : Internal generator selection (GEN_I)
T8 : External signal selection signal (GEN_E)
T9 : Osc. amplifier output (osc. signal and + 5.x V). mode 2.5 osc mod
T10 : AGC control voltage in Q3 gate → 1.7 F
T11 : Forward voltage - detector - (Vf-) → 1.3 V
T12 : Reflected voltage - detector - (Vr-)
T13 : Voltage drop over Rs in series with the load - detector - (Vs-)
T14 : Voltage drop over the load - detector - (Vz-)
T15 : +5 V power supply for prescaler and op-amps. (+5VSLP).

T16 : + Vdd for oscillator
T17 : +5 V digital
T18 : External voltage supply
T19 : Enable counter
T20 : Testing voltage for battery level checking
T21 : Signal from prescaler amplified
T22: Input signal for prescaler
T23: Control for the internal oscillator supply

3.2.) Test mode.

By pressing the **mode** button the different test steps will be performed.

TEST #	Vf	Vr	Vs	Vz	/.8	Presc. in	gen_i	gen_e	signal amp.	Vagc	Vf-	Vr-
	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
1 ("T8>H")	-	-	-	-	-	-	L	H	-	H	-	-
2 ("T16>12V")	-	-	-	-	-	-	L	L	-	-H	-	-
3 ("T7>H")	S	S	S	S	ON	ON	H	L	ON	S	S	S

TEST #	Vs-	Vz-	+5VSLP	+12VRF	+5V D	Vcc	Enable	Vb test	pres. OUT	pres. IN 2	gen_ct
	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23
1 ("T8>H")	-	-	5 V	-	5 V	V	-	V	-	-	-
2 ("T16>12V")	-	-	-	11 V	5 V	V	-	V	-	-	H
3 ("T7>H")	S	S	5 V	11 V	5 V	V	-	V	ON	S	H

H <> +5V DC
S <> DC voltage
ON <> AC signal

1.) - TST1: T8>H will be seen in the LCD. Control signal to enable the external source preamplifier.
2.) - TST2: T16>12V displayed. Internal oscillator will get power.
3.) - TST3: T7>H displayed. AGC trimmer control should be adjusted to get T1 with 3 Vdc in this step. Internal oscillator will be running being Vagc= Vf- (T11 = T10)
4.) - TST4 oscillator frequency will be displayed. Eight bit AD conversion from Vr, Vs and Vz too Rxxx Sxxx Zxxx. Since voltages can be read in LCD adjustment steps should be implemented.

If **mode** button is pressed from the TST4 Step the unit will get the regular operation status. In addition if the **gate time** is pressed in any mode (except the swr and freq. counter mode) the LCD will display the eight bit conversion for the Vr, Vs and Vz voltages.

MFJ-259 PARTS LIST

Part Designator	Description	MFJ Part Number
BH1	Battery Holder, 4-AA	730-2342
BS1	Battery, Snap, 9v, 8"	730-3005
C1	Capacitor, Disc Ceramic, 50v, 20%, 22 pF	200-0018
C11,C13,C14,C16, C19	Capacitor, Disc Ceramic, 25/50v, 20%, .01 µF	200-0004
C17,C18,C24	Capacitor, Disc Ceramic, 50/100v, 20%, .1 µF	200-0005
C2,C3,C4,C15,C6, C7,C8	Capacitor, Disc Ceramic, 25/50v, 20%, .01 µF	200-0004
C20,C21,C25,C26, C27	Capacitor, Disc Ceramic, 25/50v, 20%, .01 µF	200-0004
C22,C23,C40,C39	Capacitor, Disc Ceramic, 25/50v, 20%, .01 µF	200-0004
C28	Capacitor, Electrolytic, Radial, 25v, 100 µF	203-0015
C29	Capacitor, Disc Ceramic, 500v, 20%, 75 pF	200-1011
C30	Capacitor, Disc Ceramic, 1 kV, 20%, 470 pF	200-2023
C31	Capacitor, Disc Ceramic, 1 KV, 20%, 33 pF	200-2016
C32	Capacitor, Electrolytic, Radial, 50v, 1 µF	203-0006
C33,C36,C10	Capacitor, Disc Ceramic, 25/50v, 20%, .01 µF	200-0004
C38	Capacitor, Electrolytic, Radial, 35v, 220 µF	203-0019
C44	Cap, Air Var, 6-200pf	204-5160
D2-D4	Diode, Germanium, 1N34A	300-8001
For C44, SW1	Knob, 1/4" Shaft	760-0033
For IC1	Socket, IC, Low Profile, 14 Pin	625-0031
For SW2	Knob, Plastic, Push-Button, Red	760-2140
IC1	IC, Op-amp, Quad Op-amp, 14 Pin, Lm324n	311-0040
IC2	Voltage Regulator, TO-220, 1 Amp, 7805T	307-1011
J2	Connector, Header, 90, 3 Pos	612-0103
J3	Connector, Socket, Dual Row, 7 Pos	612-3307
J4	Connector, UHF, 4-hole Mount, SO-239	610-2005
J5	Jack, 2.1 mm, DC Coaxial Jack	601-6021
J6	Connector, BNC, Chassis Mt., Female, UG-625/U	610-1016
JMP1-JMP3	Wire, Jumper, 1/4"-2"	870-5000
L1	Inductor, Var, 66 µH	402-3412
L2	Inductor, Xformer, 1 7.8 µH	402-3406
L3	Inductor, Xformer, 1.8 µH	402-3402
L4	Inductor, .211 µH	402-2728
L5	PCB Coil, Air Wound, 4 Turn	10-01014
L6	PCB Coil, Air Wound, .5 Turn	10-01011
L7	Pick-up Coil, #61 Pre-wound	10-01003
M1	Meter, 100 uA, SWR Meter	400-0035
M2	Meter, Resistance	400-0045
MOD1	Counter Module, LCD	50-247-3

Part Designator	Description	MFJ Part Number
P2	Connector, IDC, Socket, 3 Positions	612-2003
PCB	PCB, 2-side, MFJ-259	862-0249
Q1,Q2,Q4	Transistor, FET, To-92, Siliconix, J310	305-6310
Q3	Transistor, FET, Switching, VN10KM	305-6005
Q5	Transistor, HF Wide Band, To-39, NPN, 2N5109	305-0017
R1	Resistor, 1/4 Watt, 5%, Film, 18 Ohm	100-1180
R10	Resistor, 1/4 Watt, 5%, Film, 39k Ohm	100-4390
R15,R24,R29,R30	Resistor, 1/4 Watt, 5%, Film, 10.0k Ohm	100-4100
R17,R32	Resistor, Trimpot, Sub. Horz., 10 K	133-4100
R18	Resistor, Trimpot, Sub. Horz., 100 K	133-5100
R2,R21,R22	Resistor, 1/4 Watt, 5%, Film, 1M Ohm	100-6100
R26,R27,R28	Resistor, 1/8 Watt, 1%,49.9 Ohm	102-1499
R3,R8	Resistor, 1/4 Watt, 5%, Film, 100 Ohm	100-2100
R33	Resistor, 1/4 Watt, 5%, Film, 620 Ohm	100-2620
R4,R7	Resistor, 1/4 Watt, 5%, Film, 10 Ohm	100-1100
R5,R6	Resistor, 1/4 Watt, 5%, Film, 1.0k Ohm	100-3100
R9	Resistor, 1/4 Watt, 5%, Film, 100k Ohm	100-5100
SW1	Switch, Rotary, 2p6p	500-1565
SW3,SW4	Switch, Push Button, spst	504-1003
SW2	Switch, Push-Button, 2p2p	504-0022

TECHNICAL ASSISTANCE

If you have any problem with this unit first check the appropriate section of this manual. If the manual does not reference your problem or your problem is not solved by following the manual you may call MFJ toll-free at 1-800-647-TECH (8324) or FAX to 601-323-6551, or TELEX 53 4590 MFJ STKV. Outside of the continental U.S.A. 601-323-5869. You will be best served if you have your unit, manual and all information on your station handy so you can answer any questions the technicians may ask.

You can also send questions to MFJ Enterprises, INC., P.O. Box 494, Mississippi State, MS 39762. Send a complete description of your problem, an explanation of exactly how you are using your unit and a complete description of your station.

OPTOELECTRONICS, INC.
UTC151 OPERATOR'S MANUAL

Version 1.0
July 21, 1995

INTRODUCTION

This document describes the operation of the Optoelectronics, Inc. Model UTC151 Frequency Counter Module. The UTC151 counts frequencies up to 175 MHz, and provides two inputs and four gate times.

EXTERNAL CONNECTIONS

All connections to the UTC151 Frequency Counter Module are made through a 14-pin male double-row header, located on the rear panel. The signals available on the connector are summarized in Table 1 below. Following the table is a description of each of the signals.

Table 1. Connector Pinout.

PIN	SIGNAL	TYPE
1	GND	Power
2	GND	Power
3	OSC-EN*	Output
4	OE30-PWRDWN*	Output
5	INPUT*	Input
6	GATE*	Input
7	GATE-SEL0*	Input
8	GATE-SEL1*	Input
9	N.C.	N/A
10	INPUT-B	Input
11	INPUT-A	Input
12	GND	Power
13	+5VDC	Power
14	GND	Power

GND

These four connector pins provide the ground reference for the power supply, as well as all input and output signals.

OSC-EN*

This TTL output signal allows the UTC151 to control an external oscillator. When input A is selected, the UTC151 enables the external oscillator by asserting this signal (TTL low). When input B is selected, or when the UTC151 is in SLEEP mode, the UTC151 disables the external oscillator by negating this signal (TTL high). The electrical specifications for this signal are as follows:

TTL low: 0.4 V max., 1.6 mA max. sink current
TTL high: 3.8 V min., 0.4 mA max. source current

OE30-PWRDWN*

This TTL output signal, when asserted (TTL low), indicates that the OE30 counter chip is in power down mode. This occurs when the UTC151 is in SLEEP mode. When the UTC151 is in normal operation, this signal is negated (TTL high). The electrical specifications for this signal are as follows:

TTL low: 0.4 V max., 1.6 mA max. sink current
TTL high: 3.8 V min., 0.4 mA max. source current

INPUT*

This TTL input signal selects between counter inputs A and B. This signal is fully debounced, and a weak pull-up is provided internally. Therefore, a normally-open, momentary push-button switch can be connected between this signal and ground. Each time the push-button switch is pressed and released, the opposite input is selected. The currently selected input is indicated by the corresponding annunciator on the display. This signal can also be driven by TTL logic. However, due to the debounce logic, the minimum duration of any input state is 60 milliseconds. The electrical specifications for this signal are as follows:

TTL low: 0.8 V max., 250 µA max. load current
TTL high: 3.9 V min., 2 µA max. load current

GATE*

This TTL input signal selects the gate time, and hence the measurement resolution, of the counter. This signal is fully debounced, and a weak pull-up is provided internally. Therefore, a normally-open, momentary push-button switch can be connected between this signal and ground. The UTC151 has four gate settings. Each time the push-button switch is pressed and released, the next gate setting is selected. The currently selected gate setting is indicated by the position of the decimal point on the frequency display. The four gate settings supported are summarized in Table 2 below. This signal also has an alternate function. When the UTC151 is turned on while pressing and holding the GATE push-button switch, the five-minute SLEEP mode timeout function is disabled. This signal can also be driven by TTL logic. However, due to the debounce logic, the minimum duration of any input state is 60 milliseconds. The electrical specifications for this signal are as follows:

TTL low: 0.8 V max., 250 µA max. load current
TTL high: 3.9 V min., 2 µA max. load current

Table 2. UTC151 Gate Settings.

GATE SETTING	GATE TIME	MEASUREMENT TIME	MEASUREMENT RESOLUTION	EXAMPLE (MHz)
1	10 mS	25 mS	100 Hz	162.5500
2	100 mS	130 mS	10 Hz	162.55000
3	1 S	1 S	1 Hz	162.550000
4	10 S	10 S	0.1 Hz	162.5500000

GATE-SEL0*
GATE-SEL1*

These TTL input signals select the power-up default gate setting of the counter. These signals are read once at power-up, and are ignored at all other times. A weak pull-up is provided internally. Therefore, leaving the signals open is interpreted as a TTL high, and grounding the signals is interpreted as a TTL low. The four power-up default gate settings supported are summarized in Table 3 below. These signals can also be driven by TTL logic. The electrical specifications for these signals are as follows:

TTL low: 0.8 V max., 250 µA max. load current
TTL high: 3.9 V min., 2 µA max. load current

Table 3. UTC151 Power-up Default Gate Settings.

GATE SETTING	GATE-SEL0*	GATE-SEL1*
1	TTL high	TTL high
2	TTL low	TTL high
3	TTL high	TTL low
4	TTL low	TTL low

INPUT-A

This input is the direct AC coupled input to the frequency counter. Signals up to 175 MHz can be counted through this input. The amplitude of signals presented to this input should not exceed 2.5 volts peak-to-peak.

INPUT-B

This input is the 50Ω AC coupled input to the frequency counter. This input provides a 50Ω amplifier stage. When counter input A is selected, the amplifier is disabled. Signals up to 175 MHz can be counted through this input. The amplitude of signals presented to this input should not exceed 2.5 volts peak-to-peak.

+5VDC

DC power is supplied to the UTC151 through this connector pin. The supply voltage range is 4.75 - 5.25 VDC, 100 mA max.

FRONT PANEL DISPLAY

The UTC151 front panel display consists of a ten-digit Liquid Crystal Display (LCD) module. The results of all frequency measurements are displayed here, as well as various annunciators.

FRONT PANEL INDICATOR

The UTC151 has one Light-Emitting Diode (LED) front panel indicator. This indicator LED flashes each time a measurement is successfully completed. The amount of time between flashes of the indicator LED is equal to the currently selected measurement time (see Table 2). At the shortest measurement time, the indicator LED will flash so fast that, to the human eye, it will appear to be on continuously.

POWER-UP

When the UTC151 is turned on by applying DC power to the +5VDC pin, a display self-test is performed by illuminating all front panel display segments for approximately two seconds. "MFJ" is then displayed for an additional two seconds. The UTC151 then begins normal operation with the currently selected power-up default gate setting, and the five-minute SLEEP mode timeout function enabled. To disable the five-minute SLEEP mode timeout function, press and hold the GATE push-button switch before turning on the UTC151. Once the display self-test begins, release the GATE switch.

SLEEP MODE

The UTC151 has an internal five-minute SLEEP mode timer. Each time the INPUT or GATE push-button switch is pressed, the timer is reset to five minutes. If five minutes have elapsed since the last time either push-button switch was pressed, the UTC151 automatically enters SLEEP mode, and "SLEEP-----" is displayed on the front panel display. In "SLEEP" mode, the OE30 counter chip, the 50Ω amplifier, and the external oscillator are disabled to conserve battery power. Once in SLEEP mode, pressing either the INPUT or GATE push-button switch causes the UTC151 to resume normal operation. The SLEEP mode timeout function can be disabled as described above.