

**INSTRUCTION**

**MANUAL**

**YC-601B**

**DIGITAL DISPLAY UNIT**

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**YAESU MUSEN CO., LTD.**

TOKYO JAPAN.

# DIGITAL DISPLAY UNIT WITH FREQUENCY COUNTER YC-601B

For direct frequency readout on  
FT-101/277 and FTdx401/501 Series



## GENERAL

The model YC-601B Digital Display Unit/Frequency Counter provides digital readout of the operating frequency for the FT-101/277 and the FTdx401/501 series of transceivers.

The full operating frequency is displayed on the YC-601B, with resolution to 100 Hz. As well, the YC-601B may be used as a frequency counter in the range 100 Hz – 35 MHz, with accuracy to 20 ppm.

Construction is fully solid state, making extensive use of integrated circuits, for high reliability and compactness of design.

## SPECIFICATIONS

### GENERAL

Display digits	: 6
Clock frequency	: 1.31072 MHz
Ambient temperature	: 0° – 40° C
Power requirements	: 100/110/117/200/220/234 VAC, 50/60 Hz
Power consumption	: 7 VA nominal
Size	: 220(W) x 80(H) x 235(D) mm
Weight	: 2.5 kg

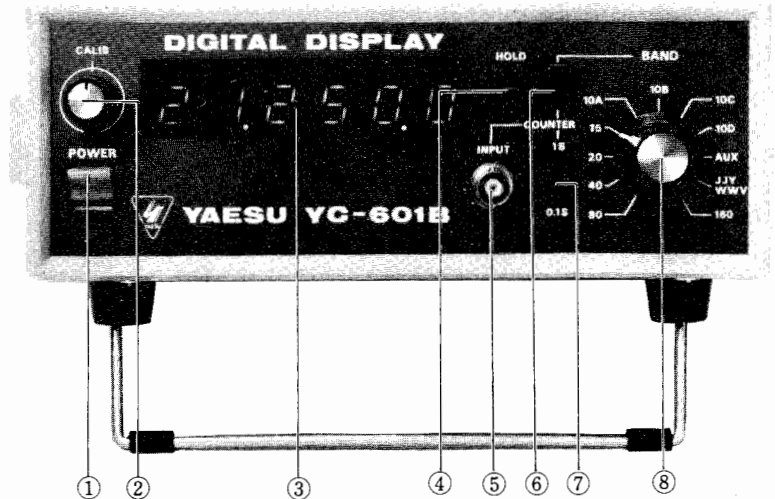
### DIGITAL DISPLAY

Frequency coverage	: Amateur bands within the range 1.5000 MHz – 29.9999 MHz
Input frequency	: 8700 kHz – 9200 kHz @ 100 mV RMS
Gate time	: 0.1 sec.
Display time	: 0.2 sec.

### COUNTER

Frequency range	: 100 Hz – 35 MHz
Input requirements	: 100 Hz: 180 mV 1 kHz – 10 MHz: 30 mV 35 MHz: 90 mV
Maximum input voltage	: DC : 100 Volts AC 2 Volts RMS
Input resistance	: 1 M ohm
Input capacitance	: Less than 30 pf.
Gate time	: 0.1 sec. for 100 Hz resolution 1 sec. for 10 Hz resolution
Clock accuracy	: ± 20 PPM at 25° C

## CONTROLS AND SWITCHES



**(1) POWER**

This is the main power switch for the YC-601B.

**(2) CALIB**

This is the calibration control. Use with the transceiver 25/100 kHz crystal calibrator to align the display for the exact frequency being received.

**(3) DISPLAY**

The digital display reads out the frequency in this window.

**(4) HOLD**

This switch will hold the display on the frequency being read out.

**(5) INPUT**

This is the input terminal for the frequency counter.

**(6) MODE (BAND/COUNTER)**

In the BAND position, the YC-601B is used as a digital display for your transceiver. In the COUNTER position, the YC-601B functions as a frequency counter.

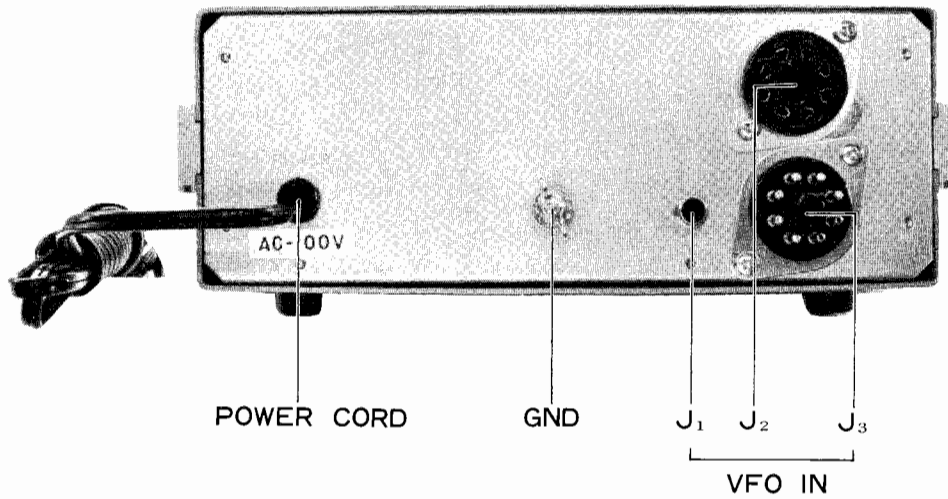
**(7) GATE TIME**

This switch selects a gate time of 0.1 seconds for 100 Hz resolution, or 1 second for 10 Hz resolution, on the counter.

**(8) BAND**

The BAND switch should be set to the same position as the transceiver bandswitch.

## REAR PANEL CONNECTIONS



### VFO (J1, J2, J3)

As shown in the drawings, these jacks are parallel-connected for VFO input. Connect your transceiver to the jack most convenient for this interface.

### GND

It is essential that the YC-601B be bonded to the transceiver via the supplied ground strap. Make the connection to the post marked GND on the rear panel.

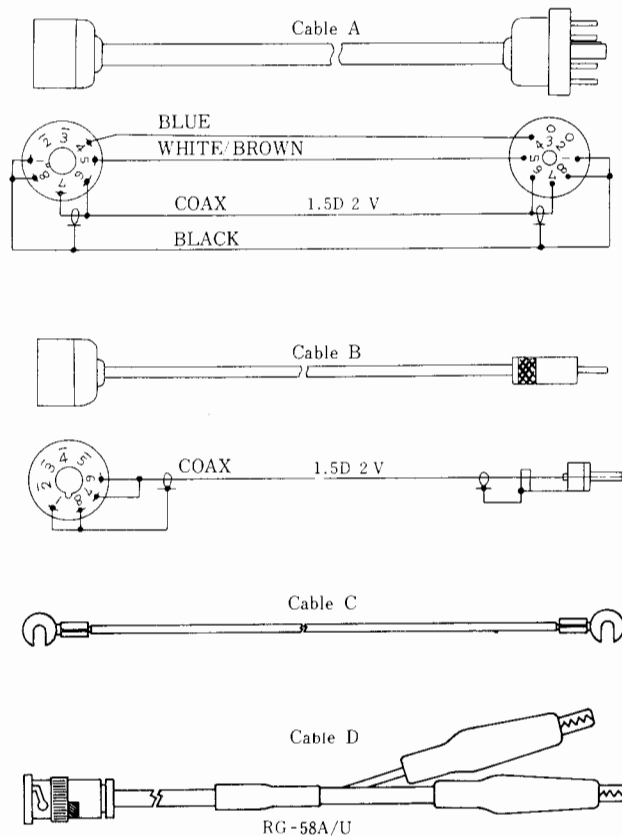


Figure 1

## INTERCONNECTIONS

The YC-601B may be connected to the transceiver or external VFO in your station by the following means:

### (1) FT-101 and YC-601B

Connect the FT-101 EXT VFO socket to J3 of the YC-601B, using cable A, supplied with the YC-601B. Refer to Figure 2.

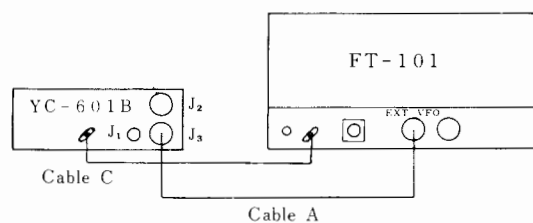


Figure 2

### (2) FT-101, FV-101, and YC-601B

Remove the connection cable between the FT-101 and the FV-101 from the FT-101 EXT VFO jack; reconnect this end of the cable to J2 of the YC-601B. Then connect Cable A between J3 of the YC-601B and the FT-101 EXT VFO jack. Refer to Figure 3.

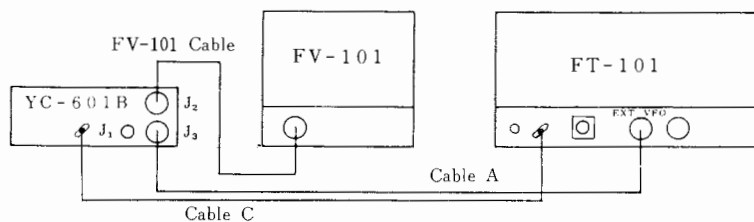


Figure 3

**(3) FT-401 and YC-601B**

Connect the FT-401 VFO jack to J3 of the YC-601B, using the RCA plug/8-pin socket Cable B, supplied with the YC-601B. Refer to Figure 4.

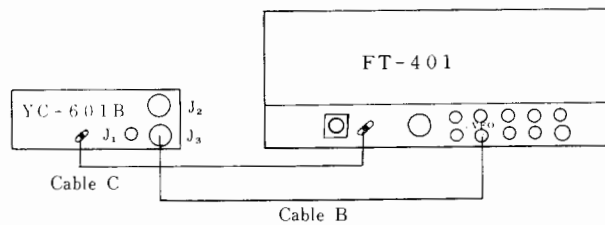


Figure 4

**(4) FT-401, FV-401, and YC-601B**

Remove the connection cable between the FT-401 and the FV-401 from the FT-401 VFO jack, and reconnect it to J1 of the YC-601B. Connect the VFO jack of the FT-401 to J3 of the YC-601B, using Cable B. Refer to Figure 5.

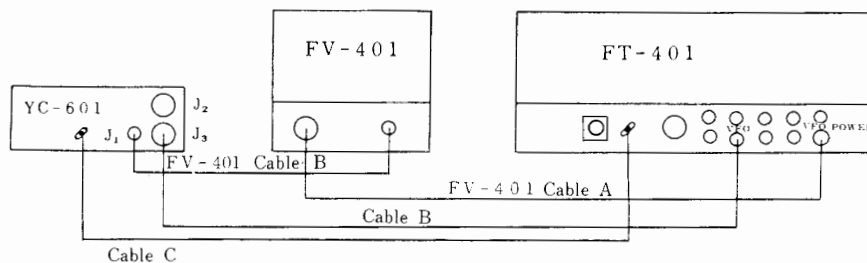


Figure 5

(5) FR-101 and YC-601B

When the FR-101 is to be used with the FT-101 or the FL-101, the YC-601B may be used, if the modification shown in Figure 7 is performed to the FR-101. Connect a coaxial cable as shown: center conductor between pin 8 of MJ-4 and center pin of AUX jack, and shield between pin 6 of MJ-4 and shield of the AUX jack. Pin 6 should be connected to ground, as shown.

Then connect Cable B between J3 on the YC-601B and the AUX connector of the FR-101.

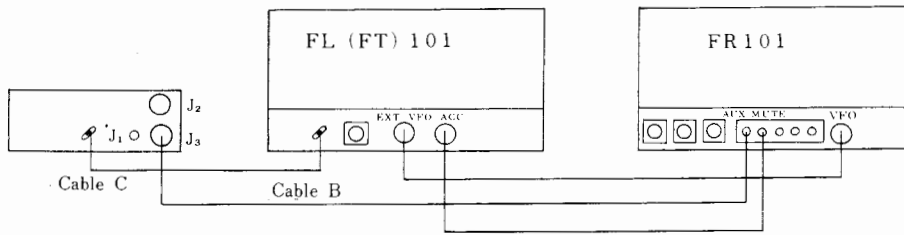


Figure 6

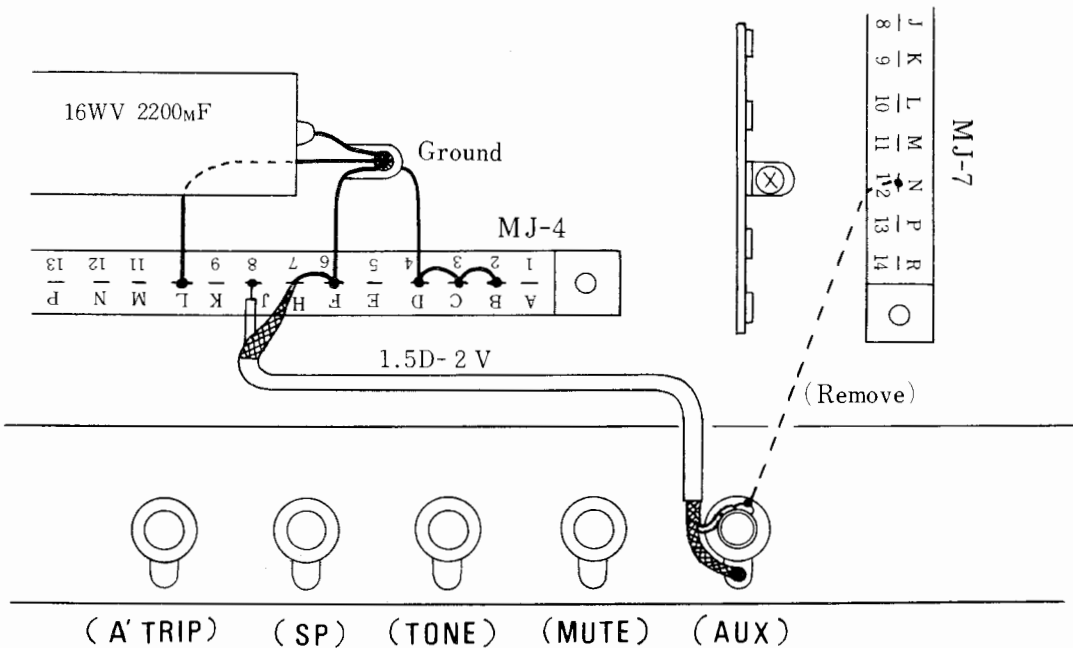


Figure 7



## INSTALLATION AND OPERATION

The YC-601B may be used in practically any location. However, it is recommended that extremely hot locations within the operating room (e.g. on top of a transceiver in an enclosure, or on top of an amplifier) be avoided. Moreover, it is recommended that no partition be placed over the transceiver in hopes of avoiding heat transfer to the YC-601B; this may restrict the air flow around the transceiver.

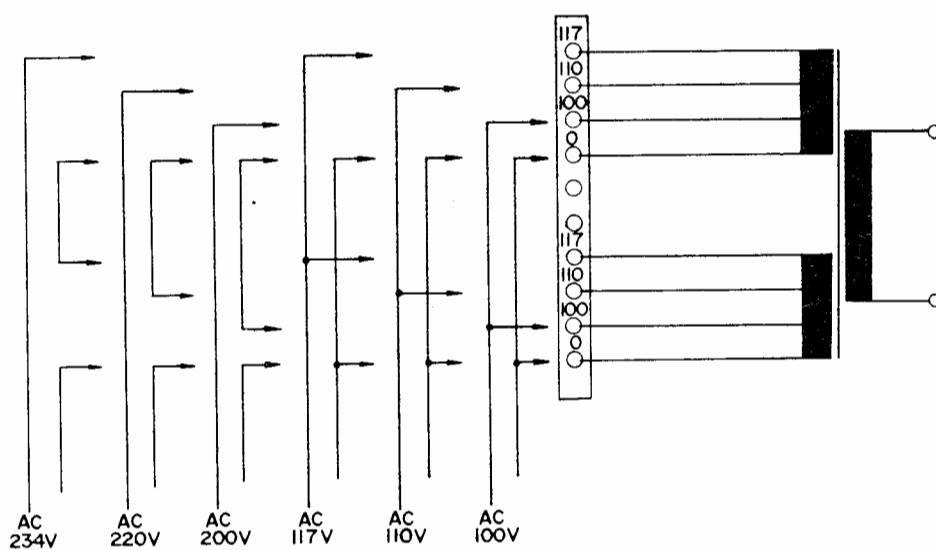
The YC-601B is designed for use in many areas of the world, and hence is capable of operation with a variety of AC supply voltages. Therefore, be sure that the voltage specifications marked on the rear panel of the YC-601B matches the supply voltage you are using. If you move to an area with different supply voltage, rewire the transformer connections as shown below.

When replacing fuses, be absolutely certain that you replace the blown fuse with one of the proper rating. For 100/110/117 VAC, use a 1 amp fuse, and for 200/220/234 VAC, use a 1/2 amp fuse.

**WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER FUSE REPLACEMENT.**

### CAUTION

**PERMANENT DAMAGE WILL RESULT IF IMPROPER AC SUPPLY VOLTAGE IS APPLIED TO THE YC-601B. WARRANTY DOES NOT COVER DAMAGE CAUSED BY APPLICATION OF INCORRECT SUPPLY VOLTAGE. IF YOU HAVE ANY DOUBT ABOUT THE WIRING OF THE TRANSFORMER, INSPECT THE CONNECTIONS BEFORE APPLYING AC POWER.**



POWER TRANSFORMER PRIMARY CONNECTIONS

Figure 8

## A. DIGITAL DISPLAY OPERATION

Set the switches as follows:

POWER    OFF  
BAND     Set to the same band as the  
          transceiver, receiver, or trans-  
          mitter.

Check to see that the interconnections have been correctly made, and then set the POWER switch to ON. The frequency is indicated directly on the digital display. The first and second digits from the left represent MHz, the third, fourth, and fifth represent kHz, and the sixth digit represents the 100 Hz increment.

The accuracy of the frequency readout depends on the tolerance of the transceiver crystals, and upon the mode of operation. It is recommended that the YC-601B be calibrated using the transceiver calibrator signal, as described below:

- (1) Set the BAND switch to the same band as that of the transceiver.
- (2) Set the transceiver mode switch to the desired mode, and activate the internal calibrator in the transceiver. Calibrate the transceiver against the marker zero beat signal, in the usual manner.
- (3) Adjust the CALIB control of the YC-601B until the digital display indicates precisely the calibration frequency of step (2).
- (4) For the CW mode, calibrate the transceiver and YC-601B in the USB mode. Because the CW transmit frequency is shifted 800 Hz higher than the USB carrier frequency, adjust the CALIB control on the YC-601B for a reading that is 800 Hz higher than the zero beat frequency. For example, if the zero beat frequency is 14.050.0 MHz, align the YC-601B to indicate 14.050.8 MHz. This method results in the TRANSMIT frequency being displayed, thus minimizing the chance of out-of-band operation near the band edges.

## B. FREQUENCY COUNTER OPERATION

The YC-601B may be used as a frequency counter as follows. There is no need to remove the interconnection cables for use of the YC-601B as a digital display unit, as the MODE switch makes the necessary changes internally. Set the MODE switch to the COUNTER position and use the cable supplied with alligator clips (Cable D) for sampling the signal.

**EXTREME CARE MUST BE TAKEN TO ENSURE THAT THE INPUT TO THE COUNTER DOES NOT EXCEED 2 VAC RMS OR 100 VOLTS DC.**

Selection of the desired gate time will affect the resolution of the counter. With one second gate time, resolution is to 10 Hz, and with 0.1 second it is 100 Hz. For example, the measurement of 14.235.12 MHz will be displayed as follows:

GATE TIME	FREQUENCY DISPLAYED
0.1 second	14.235.1
1.0 second	4.235.12

## THEORY OF OPERATION

The MHz range is programmed by a diode matrix circuit consisting of Q<sub>127</sub> (MSL980Y5) and Q<sub>128</sub> (MSL980Y6), which indicates the MHz frequency when the BAND switch is set properly.

The VFO frequency (8700 to 9200 kHz), applied through one of the input receptacles on the rear panel (J2, J3, or J4), is amplified by Q<sub>108</sub> (3SK40M). The amplified signal is applied to an 8700–9200 kHz bandpass filter to Q<sub>109</sub> (2SK-19GR), and then fed to the mixer, Q<sub>110</sub> (SN-76514N). The heterodyne oscillators Q<sub>106</sub> and Q<sub>107</sub> (both 2SC945) oscillate at either 22.2 MHz or 21.7 MHz, and selection of the appropriate oscillator is made by Q<sub>104</sub> and Q<sub>105</sub> (2SC945). The heterodyne signal is passed to Q<sub>110</sub> for mixing with the VFO signal.

The frequency of the heterodyne oscillator is shifted slightly by varying the capacitance of the crystal via the front panel CALIB control, thus allowing precise calibration of the YC-601B.

The output signal from the mixer is fed through wave shaper Q<sub>111</sub> and Q<sub>112</sub> (both 2SC785) to counter gate Q<sub>118</sub> (SN74LS51N).

The crystal controlled clock oscillator Q<sub>113</sub> (MSM5564) generates a 1.31072 MHz signal, divides it by  $2^{18}$  and thus produces a 5 Hz pulse. This pulse is delivered to Q<sub>118</sub> to be used as a gate pulse. This pulse is also divided by ten to generate an 0.5 Hz pulse to be used for a 1 second gate time.

The output from Q<sub>118</sub> is applied to Q<sub>119</sub> (SN-74LS90N), which counts 10 Hz and delivers a pulse every 100 Hz to Q<sub>120</sub> (MSM5501). Q<sub>120</sub> counts 1 kHz, 10 kHz, and 100 kHz, and its output is applied to LED drivers Q<sub>121</sub> (MSM561) and Q<sub>122</sub> (MC1416P) for illumination of the LED's.

When the YC-601B is used as a frequency counter, Q<sub>118</sub> selects the input signal. Q<sub>115</sub> (SN74LS04N), Q<sub>116</sub> (SN7404N), and Q<sub>117</sub> (SN7400N) generate the reset and set signals.

## POWER SUPPLY

The power transformer has a dual primary winding for operation from 100/110/117/200/220/234 VAC.

The AC 9 Volt winding supplies 9 VAC to bridge-connected rectifier diodes D1–D4 (all V06P). The 9.5 VDC is regulated at 5 Volts by Q<sub>129</sub> ( $\mu$ PC-14035) and supplied to the semiconductors, with the exception of Q<sub>110</sub> (SN76514N), which receives 9 VDC.

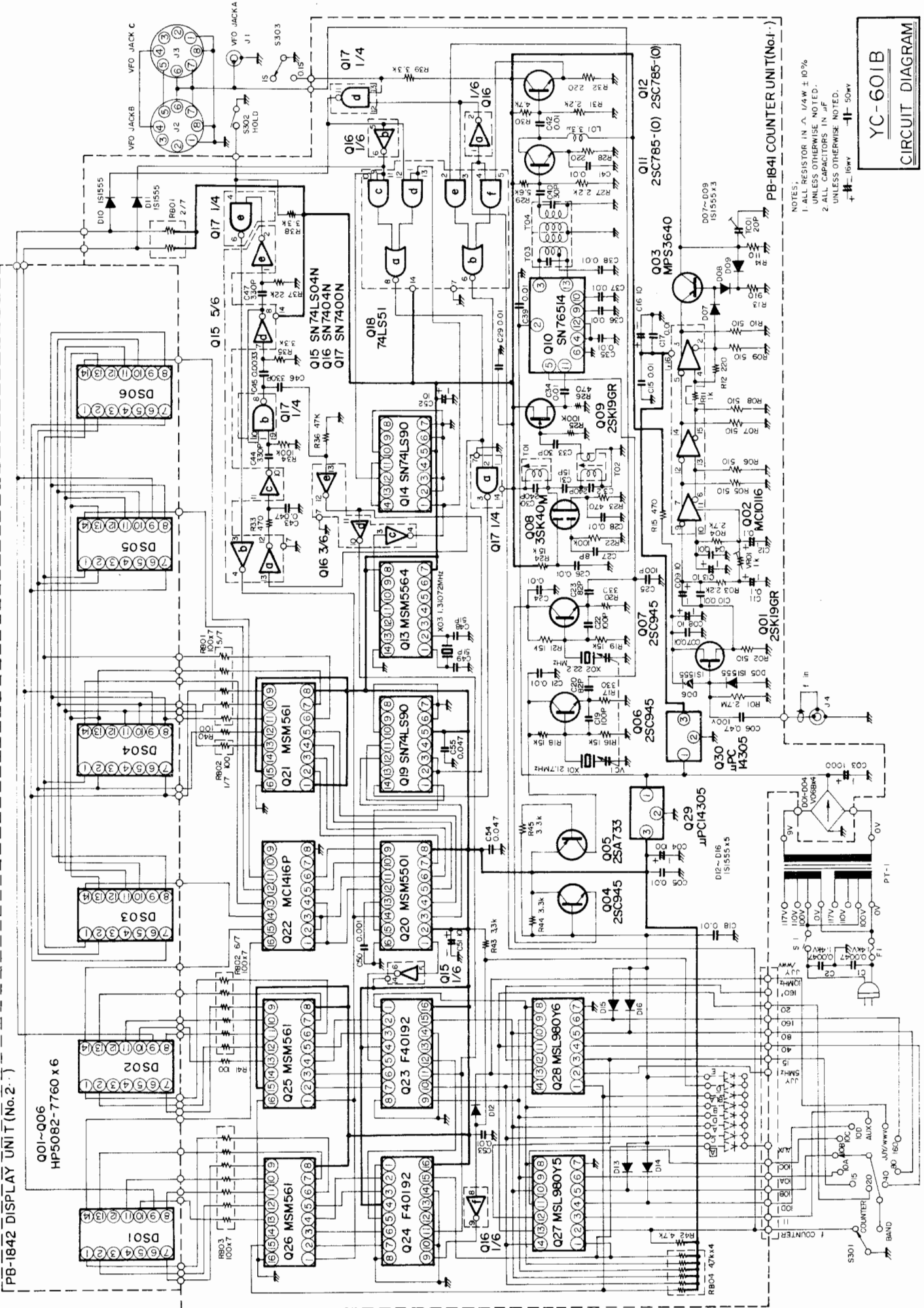
## MAINTENANCE

The YC-601B has been carefully aligned and tested at the factory prior to shipment. With normal usage, it should not require other than the normal attention given to electronic equipment.

## CAUTION

APPLICATION OF ANY SIGNAL OTHER THAN THAT FROM THE TRANSCEIVER VFO WILL RESULT IN SEVERE DAMAGE TO THE DIGITAL DISPLAY. EXCEEDING THE VOLTAGE SPECIFICATIONS FOR THE FREQUENCY COUNTER WILL, LIKEWISE RESULT IN SEVERE DAMAGE.

Most difficulties encountered with the YC-601B will be traced to a misconnection of the cables between it and the transceiver. The frequency counter requires highly specialized test equipment for troubleshooting, and, should repairs be necessary, the equipment should be returned to the dealer for service.



YC-601B  
CIRCUIT DIAGRAM

NOTES:  
1. ALL RESISTOR IN  $\Delta$  1/4W  $\pm 10\%$   
UNLESS OTHERWISE NOTED.  
2. ALL CAPACITORS IN  $\mu$ F  
UNLESS OTHERWISE NOTED.  
+ — 15WV — — 50WV

## PARTS LIST

MAIN CHASSIS			Q129,130	25000109	IC	$\mu$ PC14305
Symbol Number	Parts Number	Description	Q101,109	22700195	FET	2SK19GR
		CAPACITOR	Q108	23800401	"	3SK40M
C1,2	30240472	1.4KV ECK-DDI.472ZE 0.0047 $\mu$ F	Q103	22390004	Transistor	MPS3640
			Q111,112	22307853	"	2SC785-(O)
			Q104,106,107	22309450	"	2SC945
			Q105	22107330	"	2SA733
		VARIABLE CAPACITOR				
VC1	39000072	TSN-120SX 10PF $\times$ 2				
					DIODE	
			D101~104	21090022	Silicon Diode	V06B
		POWER TRANSFORMER	D105~116	21015550	"	1S1555
PT1	52000064	52-64 #230017				
					CRYSTAL	
		SWITCH	X101	71800109	HC-18/U 21.7MHz	$\approx$ 210074-1
SW1	64000052	8H2011	X102	71800110	" 22.2MHz	$\approx$ 210074-2
SW1	62000019	ESRE11CR15Z	X103	71600033	HC-6/W 1.31072MHz	$\approx$ 210005
		CONNECTOR			RESISTOR	
J1	68020001	CN-7017J	R140,141,122	40143101	Carbon Film $\frac{1}{4}$ W VJ ERD25V 100 $\Omega$	
J2	67080003	SI-0507	R114	40143111	" " " " " 110 $\Omega$	
J3	68080001	SB-0611	R112,128,132	40143221	" " " " " 220 $\Omega$	
J4	68000005	UG-625B/U	R117,120	40143331	" " " " " 330 $\Omega$	
P1 with wire	68170001	5047-17 #240082	R115,123,126,133	40143471	" " " " " 470 $\Omega$	
			R102,105~110	40143511	" " " " " 510 $\Omega$	
			R113	40143911	" " " " " 910 $\Omega$	
			R111	40143102	" " " " " 1K $\Omega$	
		FUSE	R103,127,131	40143222	" " " " " 2.2K $\Omega$	
F1	73000011	0.5A	R104	40143272	" " " " " 2.7K $\Omega$	
			R135,138,139, R143~145	40143332	" " " " " 3.3K $\Omega$	
			R130,142	40143472	" " " " " 4.7K $\Omega$	
		FUSE HOLDER	R129	40143562	" " " " " 5.6K $\Omega$	
FH1	69030003	F-3294	R116,118,119,121,124	40143153	" " " " " 15K $\Omega$	
			R137	40143223	" " " " " 22K $\Omega$	
			R136	40143473	" " " " " 47K $\Omega$	
			R101,125,134	40143104	" " " " " 100K $\Omega$	
COUNTER UNIT						
Symbol Number	Parts Number	Description				
PB-1841	60418410	Printed Circuit Board				
	018410AZ	PCB with components			BLOCK RESISTOR	
			RB101,102,103	47000008	7 $\times$ 100 $\Omega$ RA-100 $\Omega$ K7E	
			RB104	47000004	6 $\times$ 4.7K $\Omega$ RK1/16B8R 4.7K $\Omega$ K	
		IC, FET & TRANSISTOR				
Q102	25000070	IC MC10116				
Q110	25000104	" SN76514N			POTENTIOMETER	
Q113	25000054	" MSM5564	VR101	49800082	PN822H102H 1K $\Omega$	
Q114,119	25000072	" SN74LS90N				
Q115	25000141	" SN74LS04N				
Q116	25000005	" SN7404N				
Q117	25000001	" SN7400N				
Q118	25000167	" SN74LS51N			CAPACITOR	
Q120	25000084	" MSM5501	C133,140	31829300	Ceramic Disc 50WV 30PF SL	
Q121,125,126	25000085	" MSM561	C120,123	31820820	" " " 82PF CH	
Q122	25000143	" MC1416P	C125	31820101	" " " 100PFCH	
Q123,124	25000144	" F40192	C119,122	31827101	" " " 100PFUJ	
Q127	25000168	" MSL980Y5	C127,150	30820102	" " " 0.001 $\mu$ F	
Q128	25000169	" MSL980Y6	C105,107,110,114,115	30820103	" " " 0.01 $\mu$ F	

## PARTS LIST

				SW UNIT		
Symbol Number	Parts Number	Description				
C117,118,121,124, C126,128,129, C134~139,141,142, C153	30820103	Ceramic Disc 50WV 8PF		PB-1843	60418430 018430AZ	Printed Circuit Board PCB with components
C131	33824150	Dipped Mica " 15PF				
C148,149	33824510	" " " 51PF				
C130,132	33824241	" " " 240PF				
C145	36825332	Mylar " 0.0033μF				SWITCH
C143	36825473	" " " 0.047μF	SW301~303	64000103		SLE62251
C111,112	36226104	Tantalum 16WV 0.1μF				
C108,109,113,116,151	36226106	" " " 10μF				
C144,146,147	36824331	Styrol 50WV 330PF				
C106	36134474	Polycarbonate 100WV 0.47μF				
C152	35220106	Electrolytic 16WV TW 10μF				
C104	35220107	" " " 100μF				
C103	35220108	" " " 1000μF				
		ACCESSORIES				
Symbol Number	Parts Number	Description				
				96000027	Connection cable(A) #240001	
				68080006	Octal plug(F) SI-1107	
				67080001	Octal plug(M) SI-0401	
		TRIMMER CAPACITOR		96000028	Connection cable(B) #240005	
TC101	39000011	ECV-1ZW 20×53 20PF		68080006	Octal plug(F) SI-1107	
				67020001	RCA plug(M) CN-7017J	
				96000029	Connection cable(C) #240025	
				67000005	BNC plug UG-88/AU	
		INDUCTOR		79000008	Alligator clip Red	
L101	53020025	Micro Inductor F1.5H 33μH		79000007	" Black	
				96000031	Ground connection cable #240085-1	
		TRANSFORMER				
T101,102	55002990		#220042			
T103,104	55003218		#220306			
		MULTI JACK				
MJ101	68360003	1150-036-029				
		PLUG				
J101	67170001	5048-17A				
	91100008	Wrapping terminal C				
		DISPLAY UNIT				
Symbol Number	Parts Number	Description				
FB-1842	60418420 018420AZ	Printed Circuit Board PCB with components				
		DISPLAY				
Q201~206	21090146	LED HL5082-7760				
		IC SOCKET				
QS201~206	68140005	314AG37D				



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