

**INSTRUCTION  
MANUAL  
FC 902**

**YAESU MUSEN CO. LTD.**

BOX 1500

TOKYO JAPAN

## THE FC-902 ANTENNA COUPLER



The FC-902 antenna coupler is designed for low and medium power applications in the HF amateur bands from 160 through 10 meters. It is designed to minimize the adverse effects of high SWR on a coaxial line or wire antenna which may result in difficulty in tuning a transmitter designed to work into a resistive 50 ohm load.

The FC-902 comes equipped with three UHF-type female coax receptacles, and a threaded terminal to accept a single-wire antenna.

The front panel controls include a bandswitch for selecting proper impedance values for matching, TUNE and LOAD controls for adjustment of the capacitive coupling, and a POWER & SWR switch for setting the meter sensitivity for the power being used. The ANT SELECT switch chooses among any of four antennas to be matched, and if it is desired to feed an antenna directly through the coupler to the transmitter without any matching done by the coupler, a position of the BAND switch will accomplish this.

High-quality low-loss components are used throughout the FC-902 antenna coupler, and the matching function it performs means your transmitter will always "see" the resistive termination it was designed for. The inherent selectivity of the FC-902 matching circuitry helps attenuate harmonics, too, thus reducing harmonic-related TVI or out-of-band emission.

## FC-902 SPECIFICATIONS

FREQUENCY COVERAGE	160mL	1.8-2.0 MHz
	160mH	1.9-2.4 MHz
	80m	3.5 -4.0 MHz
	40m	7.0- 7.5 MHz
	30m	10.0-10.5 MHz
	20m	14.0-14.5 MHz
	17m	18.0-18.5 MHz
	15m	21.0-21.5 MHz
	12m	24.5 -25.0 MHz
	10m	28.0-29.7 MHz
Input impedance	50-75 ohms	
Max. variation in load impedance	50 ohm in:	10-250 ohms
	75 ohm in:	18-300 ohms
Maximum transmitter power	500 W PEP @ 50 ohms	
Power meter calibration scales	25 W, 250 W, 500 W	
Insertion loss	0.5 dB max.	
Rear panel antenna connections	3 coaxial "UHF" type 1 single wire terminal	
Dimensions	208 (L)x152(H)x324(D) mm.	
Weight	6.5 kg.	
SWR calibration	To 4:1 SWR	

## FRONT PANEL CONTROLS



### TUNE

The TUNE control is a dual capacitor to provide capacitive adjustment of the coupling between the transmitter and the impedance established by the BAND switch and the LOAD control. The TUNE and LOAD controls are adjusted for minimum SWR.

### BAND switch

The BAND switch selects the inductance required to accomplish matching on the band in question. The operator should select the BAND switch position which best covers the portion of the band being used. The DIRECT position of the BAND switch connects the transmitter directly to the antenna, bypassing the FC-902 matching circuitry, but permitting measurement of the SWR on the line at that point.

### SWR SET

This control is used to calibrate the SWR METER: the SWR may be read accurately by adjusting the SWR SET control for full deflection of the FWD POWER meter with the POWER & SWR switch in the SWR SET position.

### LOAD

The LOAD control is connected to a variable capacitor which adjusts the coupling between the antenna feedline and the impedance presented by the BAND switch inductor and the TUNE control.

## ANT SELECT

This switch selects the antenna to be matched. The operator has the choice of one of three coax-fed antennas or a single wire antenna.

## POWER & SWR switch

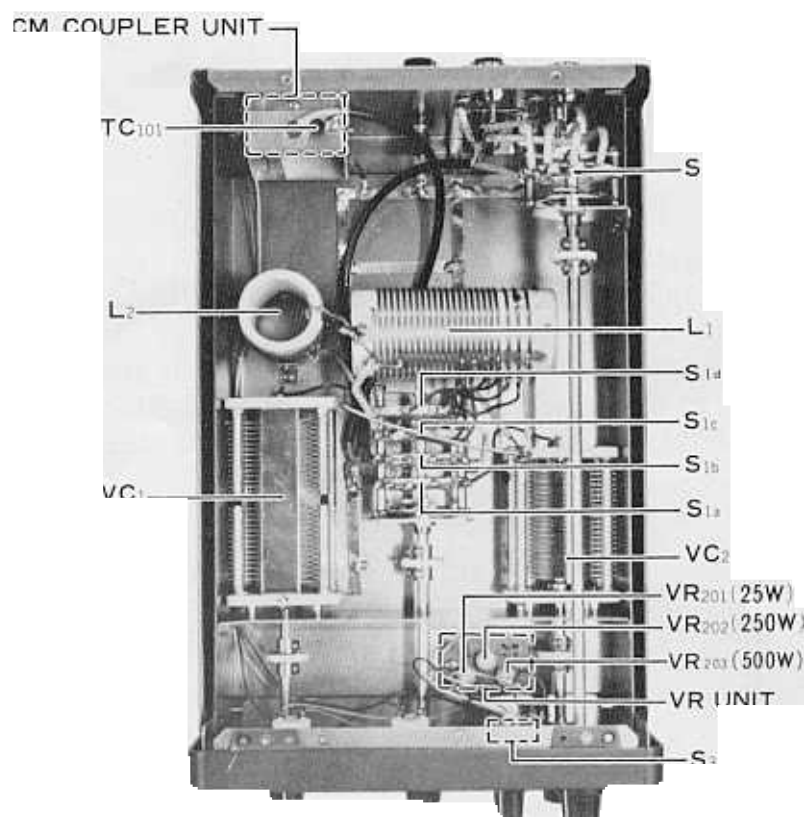
This switch is used to select the proper sensitivity of the FWD POWER meter for the power being used, and to provide calibration for the measurement of SWR.

## FWD POWER meter

The FWD POWER meter reads the output power on three scales of 25 watts, 250 watts, and 500 watts maximum.

## SWR meter

When calibrated, this meter provides accurate measurement of SWR for purposes of adjusting the LOAD and TUNE controls for the best match.



## REAR PANEL CONNECTIONS

### ANT 1, ANT 2, ANT 3

These three female UHF-type connectors will accept the coaxial feedline from the antenna. As well, a dummy load such as the YAESU YP-150 may be attached to one of these connectors for tuning or test purposes.

### WIRE

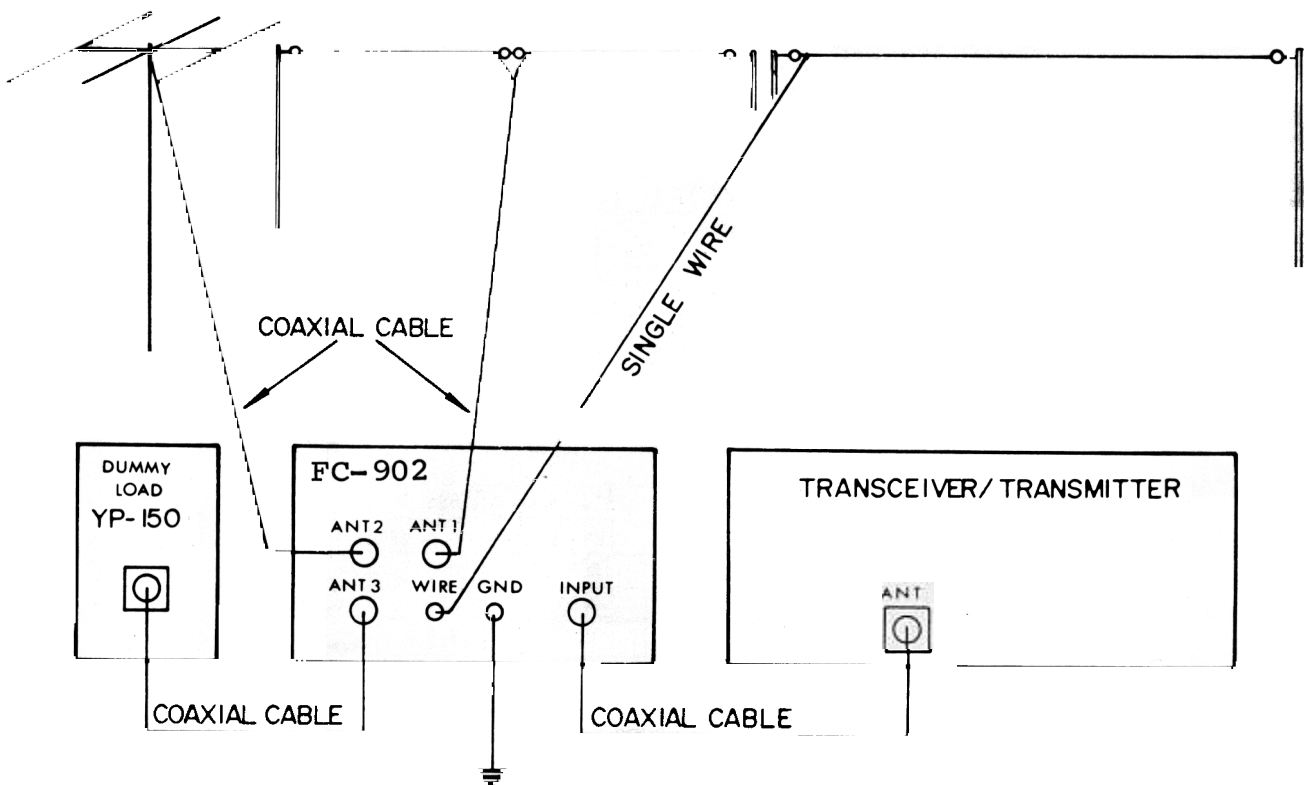
This threaded terminal accepts a single-wire antenna such as the "Windom" type.

### GND

This terminal should be connected to a good earth ground so as to provide a DC path to ground for stray currents, and to reduce "RF in the shack" and ground loops, etc., that may make antenna matching difficult. This is particularly important in the case of certain types of single-wire antennas.

### INPUT

The INPUT connector is another female UHF receptacle for connection between the FC-902 and the RF output connector of the transmitter or transceiver.



## ANTENNA MATCHING PROCEDURE

IT IS STRONGLY RECOMMENDED THAT THE FOLLOWING SECTION BE READ IN ITS ENTIRETY BEFORE ANY MATCHING OF ANTENNAS IS ATTEMPTED. WHILE A STRAIGHTFORWARD PROCEDURE, ANTENNA MATCHING WITH A COUPLER SUCH AS THE FC-902 INVOLVES A LOGICAL PROGRESSION OF STEPS, AND FAMILIARITY WITH THE TOTALITY OF THE FOLLOWING SECTION WILL CLARIFY THE PROCEDURE IMMENSELY.

To summarize the procedure that is followed in using the FC-902 antenna coupler to match a feedline to the transmitter, the following process takes place:

- 1) The proper inductance is chosen using the Band switch.
- 2) The LOAD and TUNE controls are adjusted to secure a minimum SWR. Thses two controls should be adjusted one at a time, so as to avoid confusion as to the effect of any particular adjustment. A typical procedure to follow would be to apply power, adjust the TUNE control for minimum SWR, then adjust the LOAD direction either to the right or left. Once the LOAD control has been changed, the TUNE control should again be adjusted for minimum SWR; if this procedure improves the SWR, it should be continued by further moving the LOAD control in the same direction, but if the initial change in the LOAD control worsens the SWR, one should try moving the LOAD control in the opposite direction. It will be clear to the operator when the LOAD control is being adjusted in the right direction.

BAND	FREQ	TUNE	LOAD
160L	1.8MHz	3.5	6
160H	2.0MHz	3.5	6
80	3.5MHz	5.5	7
80	4.0MHz	6.5	8
40	7.0MHz	6.5	8
40	7.5MHz	7	8
30	10.0MHz	7	8.5
30	10.5MHz	7.5	8.5
20	14.0MHz	7.5	8.5
20	14.5MHz	8	8.5
17	18.0MHz	6.5	8.5
17	18.5MHz	6.5	8.5
15	21.0MHz	4	8.5
15	21.5MHz	4	8.5
12	24.5MHz	2	9
12	25.0MHz	3	8.5
10A	28.0MHz	3.5	9
110D	30.0MHz	4.5	9

Figure 1

The reader is referred to Fig. 1, which contains the approximately correct positions of the BAND, LOAD, and TUNE controls for a 50 ohm load impedance, such as that presented by a dummy load. A dummy load is extremely useful for tuning up a transmitter in preparation for adjustment of matching of an antenna. If the control positions shown in Fig. 1 are utilized in conjunction with a 50 ohm dummy load, only very minor adjustments of the TUNE and LOAD controls will be necessary for a perfect match. Of course, a 50-ohm dummy load should require no matching for a perfect match to a 50-ohm transmitter output, but this information is presented because the control positions in Fig. 1 represent useful starting points for matching unknown impedances.

The following, then, is a step-by-step procedure to follow for the matching of an antenna feedline that has not been matched previously.

1) Tune up the transmitter in the normal way into a 50-ohm dummy load (if 50 ohm coax is used between the transmitter and the FC-902) or other resistive 50 ohm termination. Reduce the gain control on the transmitter to a minimum, and place the transmitter in "standby" for the moment.

2) Place the BAND, LOAD, and TUNE controls in the positions indicated in Fig. 1 for the frequency at which the line is to be matched. Place the ANT SELECT switch in the position which corresponds to the rear panel connector of the antenna to be matched. Place the POWER & SWR switch in the SWR SET position, and place the SWR SET knob in the 12:00 position.

3) It is desirable to make preliminary matching adjustments with as little transmitter output power as possible. Place the transmitter in the "transmit" condition, and slowly advance the output level until deflection of the FWD POWER meter is observed. Adjust the SWR SET control to line up the meter needle of the FWD POWER meter with the SWR SET position at the far right end of the FWD POWER meter, using the minimum power necessary to accomplish this. With the needle in the SWR SET mark of the FWD POWER meter, the SWR meter will accurately read the SWR.

4) Adjust the TUNE control for minimum reading on the SWR meter. If necessary, adjust the SWR SET control and/or transmitter power to ensure proper calibration. Once the "dip" has been found using the TUNE control, move the LOAD control either to the left or right, by a small amount. Adjust the TUNE control for a "dip" again, and if the SWR improves (again, make sure that you are reasonably well calibrated) move the LOAD control slightly more in the same direction. Again "dip" the TUNE control, and continue this procedure until no further improvement is noted. If the initial direction of adjustment of the LOAD control worsened the SWR, move it an equal direction from the starting point IN THE OPPOSITE DIRECTION and follow the above procedure with successive adjustment of the TUNE and LOAD controls.



5) Once the initial procedure has been followed to yield a near-perfect match, the POWER & SWR switch may be placed in the position which most closely corresponds to the transmitter output power expected. The transmitter may then be adjusted for full power (some adjustment of the transmitter load and tune controls may be necessary during matching adjustments), and the FC-902 LOAD and TUNE controls may be adjusted to yield zero deflection of the SWR meter. When the POWER & SWR switch is not calibrated with the SWR SET controls, the SWR meter will not accurately read the SWR, but it will indicate minimum reflected power.

#### NOTES ON ANTENNA MATCHING

1) It is very important that the maximum time limits during tune-up conditions for the transmitter are not exceeded. This is particularly important when the transmitter is being used at full power.

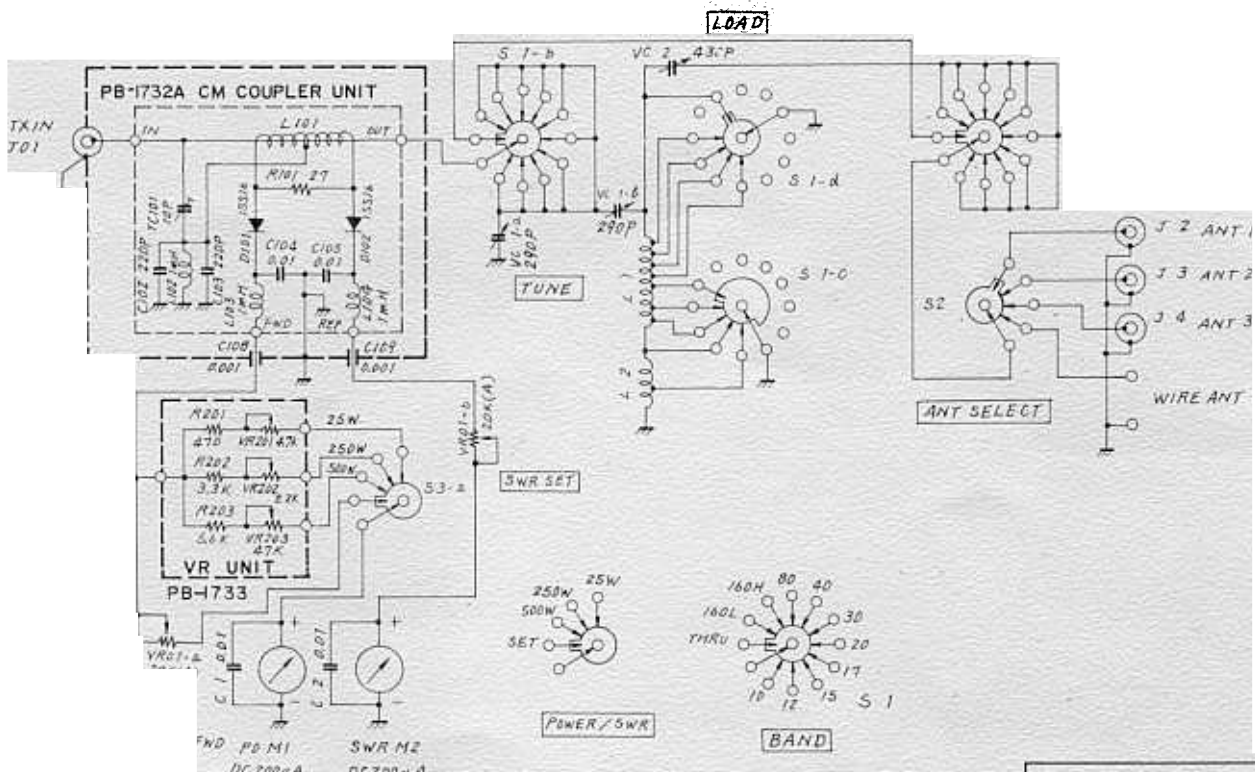
2) It should be noted that any matching performed by the FC-902 in the shack will have no effect on the losses due to SWR on the coaxial line between the FC-902 coupler and the antenna. The operator should consult one of the popular antenna handbooks to determine whether or not matching between the coaxial line and the antenna must be performed at the antenna. For example, a 100-foot length of RG8A/U coax typically has a loss (with 1:1 SWR between it and antenna) of less than 1 dB at 21 MHz. If this line is operated with a 3:1 SWR due to a low or high antenna impedance, the loss due to SWR will increase roughly 0.5 dB, an imperceptible degradation as compared to the 1:1 condition. In this case, attempts to reduce the 3:1 SWR at the antenna end would serve no useful purpose as far as reducing losses in the coax, through matching with the FC-902 would improve the impedance presented to the transmitter output circuitry. However, if a 500-foot length of the above coax were used instead of only 100 feet, somewhat more than 1 dB of loss would occur in the coax due to the 3:1 SWR, possibly justifying further matching attempts at the antenna.

3) When using a transceiver such as the FT-301D which has protection for the output transistors against high SWR, it can be seen that the matching action of the FC-902 will ensure that a 50 ohm load is presented to the output circuitry, thus ensuring full transmitter power.

4) It may be useful for the operator to record in a notebook the proper TUNE and LOAD positions for a particular antenna for quick reference. Alternatively, appropriate labels may be fabricated and applied to the FC-902 front panel showing the proper positions of the TUNE and LOAD controls.

# PARTS LIST

MAIN CHASSIS			TRIMMER CAPACITOR		
Symbol No.	Parts No.	Description	TC101	K91G00019	ECV-12W 10x40 10pF
		<b>RESISTOR</b>			
R1	J01245332	Carbon Film 1/4W TJ 3.3k $\Omega$			<b>MICRO INDUCTOR</b>
			L102-104	L1190017	1mH
		<b>CAPACITOR</b>			
C1,C2	K13170103	Ceramic Disc 50WV 0.01 $\mu$ F	L101	L0020301A	<b>CM COUPLER</b>
		<b>VARIABLE CAPACITOR</b>			
VC1(Tune)	K90000021	KV-255-290pFx2			<b>CONNECTOR</b>
VC2(Load)	K90000022	KV-255-430pF	J1	P1090028	M-BR-06D
				Q4000002	Through Terminal A-339
		<b>INDUCTOR</b>		Q5000011	Wrapping Terminal C
L1(80m-10m)	L0020299A			R0041270B	Case
L2(160m)	L0020300A			R0041290B	Case Cover A
		<b>SWITCH</b>		R0041300	Case Cover B
S1(Band)	N0050050			R0041280A	Shield Board
S2(ANT Select)	N0050013	1-1-4			
S3(SWR Power)	N0190008	ESR-E124R 25W			
			VR UNIT		
		<b>METER</b>	Symbol No.	Parts No.	Description
M1(Power)	M0290009	AP-170 POWER	PB-1733	F0001733	Printed Circuit Board
M2(SWR)	M0290010	AP-170 SWR		C0017330	P.C.B. with Components
		<b>POTENTIOMETER</b>			
VR1	J68800001	EW-5LAS25A24 20KA/20KA	R201	J00245471	Carbon Film 1/4W VJ 470 $\Omega$
			R202	J00245332	Carbon Film 1/4W VJ 3.3k $\Omega$
			R203	J00245562	Carbon Film 1/4W VJ 5.6k $\Omega$
		<b>CONNECTOR</b>			
J2-J4	P1090028	M-BR-06D			<b>POTENTIOMETER</b>
J5	Q5000001	T3 (Red)	VR201	J51723472	SR-19R 4.7k $\Omega$ B
J6	Q5000002	T3 (Black)	VR202	J51723223	SR-19R 22k $\Omega$ B
			VR203	J51723473	SR-19R 47k $\Omega$
				Q5000011	Wrapping Terminal C
CM COUPLER UNIT			ACCESSORY		
Symbol No.	Parts No.	Description	Symbol No.	Parts No.	Description
PB-1732A	F0001732A	Printed Circuit Board			
	C0017320	P.C.B. with Components			
		<b>DIODE</b>			
D101,102	G2090038	1SS16		T9100160A	Coaxial Cable with UHF Type Connectors
		<b>RESISTOR</b>			
R101	J10276270	Carbon Composition 1/2W GK 27 $\Omega$			
		<b>CAPACITOR</b>			
C102,103	K30176331	Dipped Mica 50WV 330pF			
C104,105	K13170103	Ceramic Disc 50WV 0.01 $\mu$ F			
C106,107	K21170102	Ceramic Feed Thru 0.001 $\mu$ F			



**FC-902**  
**CIRCUIT DIAGRAM**

