

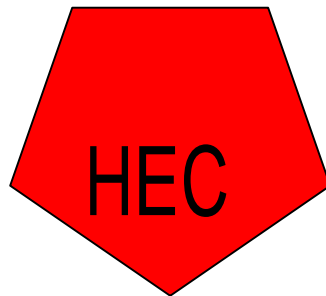
7085-UE2

UHF

DATA TRANSCEIVERS

PLL SYNTHESIZED (EEPROM)

Service Manual



HERMES ELECTRONICS CO., LTD.

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1. SPECIFICATION

GENERAL SPECIFICATIONS

POWER SOURCE	+12VD.C. nominal(+10.8 to +15.6V)		
TEMPERATURE RANGE			
STORAGE	80	maximum	-40 min.
	25	nominal	
OPERATING	70	maximum	-20 min.
ANTENNA IMPEDANCE	50		
FREQUENCY CONTROL	PLL SYNTHESISER		
FREQUENCIES OF OPERATION	450-470MHZ		
FREQUENCY TOLERANCE AND STABILITY	±1.5PPM		
HIGH HUMIDITY	90 %		
CHANNEL CAPABILITY	1		
NOMINAL DIMENSIONS	134 mm(L)X60 mm(W)X20 mm(H)		
WEIGHT	136g		

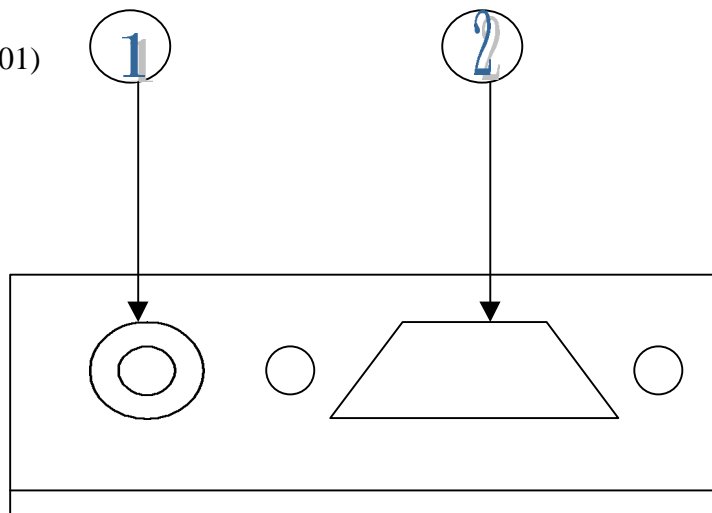
RADIO DATA TRANSCEIVER NOMINAL PERFORMANCE

PERFORMANCE SPECIFICATIONS	ECC		
RF OUTPUT POWER	2W~3W		
MODULATION TYPE	FM		
INTERMEDIATE FREQUENICES	21.4 MHZ		
	455 KHZ		
CHANNEL SPACING	12.5KHZ		
TRANSMIT ATTACK TIME	< 25 mS		
CURRENT CONSUMPTION			
TRANSMIT	700mA@3W		
RECEIVE	85mA		

EXTERNAL CONNECTIONS

1- 50 BNC SOCKET

2- 9WAY " D " TYPE PLUG(J501)



2. CONNECTIONS AND OPERATION

D-TYPE INTERCONNECTIONS

PIN	FUNCTION	TYPE	RANGE	DESCRIPTION
J501-1	DATA_IN	ANALOGUE	106mV	EXTERNAL MODULATION INPUT
J501-2	DATA_OUT	ANALOGUE	250~350mV	RECEIVER AF OUTPUT
J501-3	PTT	INPUT	0V/+5V	TRANSMIT ENABLE
J501-4	GND	GND	0V	GND
J501-5	B+	V+	+13.8V	POWER SUPPLY
J501-6	CDS	OUTPUT	OPEN/SHORT	RF CARRIER DETECT
J501-7	NC			
J501-8	PGM_DATA	INPUT	0V/NC	PROGRAMMER DATA INPUT
J501-9	PGM_ENB	INPUT	0V/5V	PROGRAMMING ENABLE

3. CIRCUIT DESCRIPTION

TRANSMITTER

The transmitter is comprised of:

- Audio amplifier connections from J1 pin 1
- Frequency Synthesizer
- Transmitter
- Automatic Power Control

Audio frequency connections

Processed data from the IC201 is applied to the VCO via R316

Frequency synthesizer circuit

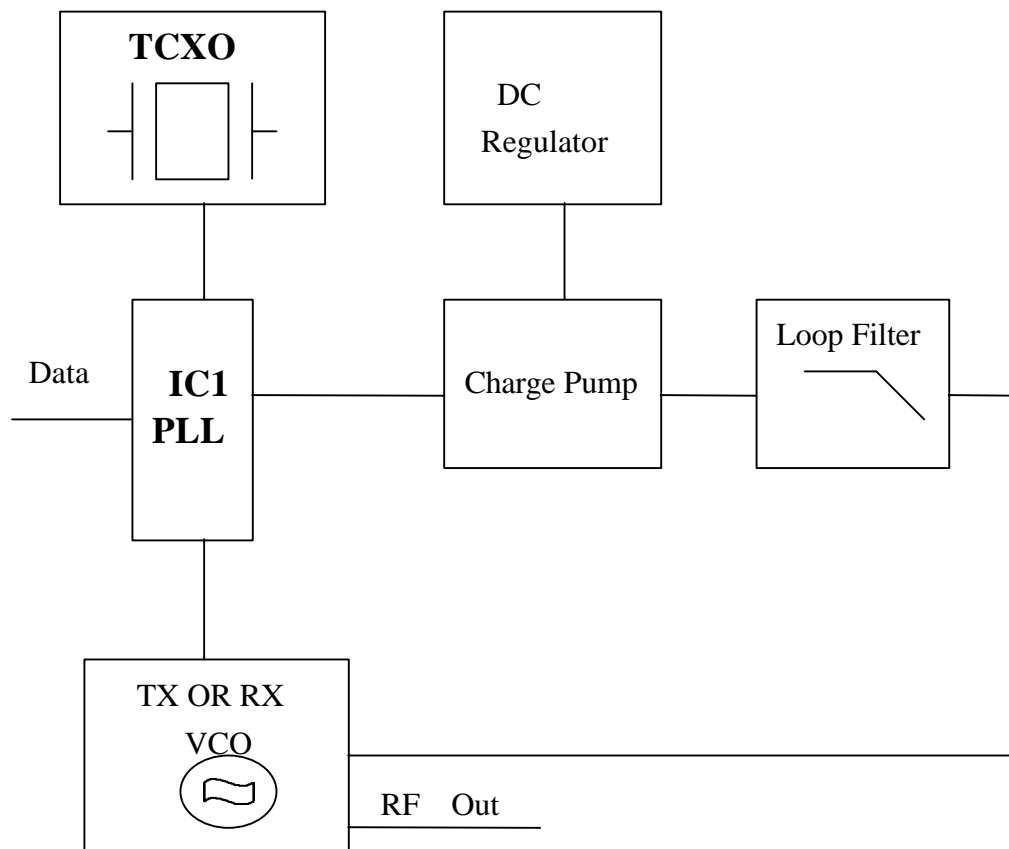
With data received from the EEPROM (IC5) the frequency synthesizer circuit controls and Produces the RF carrier frequency for the transmitter during transmit and the local oscillator frequency for the receiver. The frequency synthesizer circuit is comprised of:

- 12.8 MHZ Tcxo
- Voltage Controlled Oscillator (VCO) module
- Charge Pump and Loop Filter
- PLL Frequency Synthesizer
- Dual Modulus Prescaler

PLL Synthesizer

The PLL synthesizer circuit is common to both the transmitter and receiver,

The synthesizer comprises:



12.8 MHZ TCXO

X1 is VCTCXO, which provide stable oscillator of 12.8 MHZ to PLL IC.

Frequency adjustment is provided by VR1.

.Voltage controlled oscillator module(VCO)

The module produces carrier frequencies during transmit and local oscillator frequencies During receive.

The module contains one VCO and three outputs. One for producing carrier frequencies during Transmit and one for producing the local oscillator frequency during receive and the other Output is for PLL IC(IC1) Fin.

The module also has Rx and TX powerline filters.

RX and TX power line filters

Transistor Q301 is configured as a 5v power supply ripple filter. The filter reduces the noise on the carrier and local oscillator signals.

VCO

The VCO comprises Q302, Coil L304, and varactor D301 D304 and is configured as a Colpits oscillator. D301 D304 produces a change in frequency with a change in DC voltage and is controlled by the tuning voltage signal present at the cathode. The local oscillator programmable dividers. DATA is received by IC1 at pin 10 from pin 11 of IC3.

The RF signal at the collector of Q302 is applied to an amplifier/buffer Q305. The amplified signal from Q305 passes to the prescaler, IC1 pin 8. The RF signal at the collector of Q302 also drives the cascode amplifier/buffer formed by Q304.

When D201 is forward biased (TX ON), carrier frequencies at the collector of Q304 pass to the power amplifier and harmonic filter. When D303 is forward biased (RX), local oscillator frequencies at the collector of Q304 pass to the first mixer. VC1 adjusts the tuning voltage of the VCO to the correct operating point.

PLL IC

The reference frequency from the TCXO, at 12.8 MHz, is connected to pin 1 of IC1 (MB1504)

REFDIV divides the 12.8 MHz to produce a reference frequency (F_r) of 5 or 6.25 kHz dependent upon channel spacing selected. VARDIV divides the prescaled VCO frequency to produce a variable frequency (F_v). F_v and F_r are fed to the phase detector.

Phase detector

When $F_v = F_r$, the phase detector output (pins 15 and 16, IC1) produces narrow negative pulses. And F_v and F_r pulse widths are identical. When $F_v > F_r$ pin 15 (V) pulses negative with pin 16 (R) remaining high. When $F_v < F_r$ pin 16 (R) pulses negative with pin 15 (V) remaining high. The signal at pin 15 and 16 is smoothed by the loop filter and applied to the VCO.

Out-of-lock detector

The out-of-lock detector produces a series of logic level pulses when the loop is out of lock at pin 7 of IC1. The pulses at pin 7 of IC1 are buffered by Q6 and then integrated by R17 and C19. The product of the integrating circuit is fed to the base of Q201.

Charge Pump and Loop Filter

Transistors Q2,Q4,Q10 , and associated resistors and capacitors form the charge pump and loop Filter . The phase detector output from IC1 pins 15 and 16 are combined by the charge pump to Produce a 0 to 8V tuning voltage signal.

The signal is filtered by the loop filter (R13,C15 and C20) to remove any residual reference Frequency harmonics from the signal.. After filtering the signal is applied to the voltage controlled Oscillator module.

DC REGULATOR

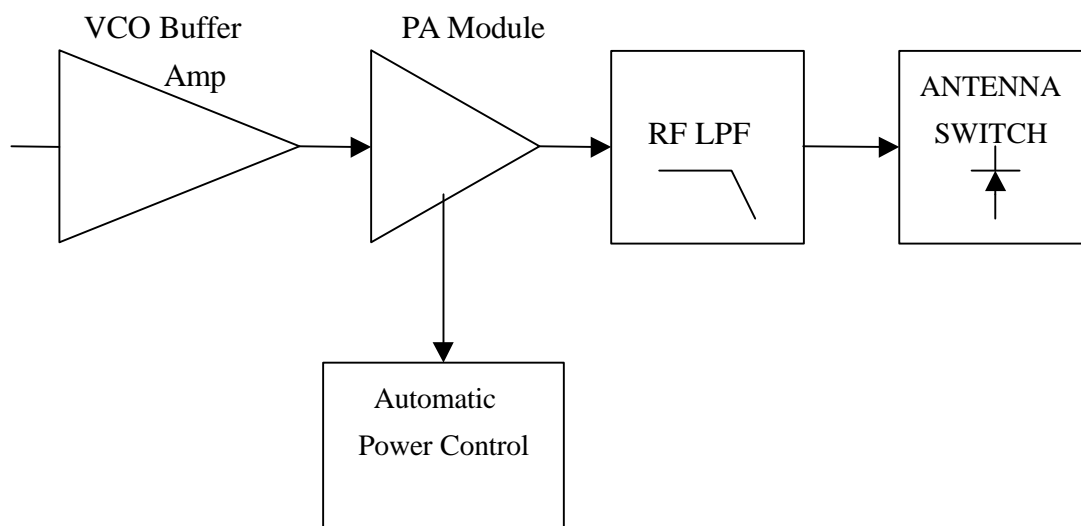
The DC Regulator IC2, converts the +13.6 V to a 8V supply . This is used to provide the Tuning voltage for the VCO . A wide voltage range is required to allow for the wideband operation Of the radio .

Dual modulus prescaler

The prescaler divides the VCO frequency by 64 or 65.

Transmitter

The transmitter comprises:



Buffer

When the radio is in transmit mode the diode D201 is forward biased enabling the modulated RF signal from the VCO to pass to the buffer/pre-amplifier Q204 and associated components.

The output signal is passed from Q204 to Q205 via a matching network consisting of Inductor L201 and C208.

PA module

The signal is then amplified for transmission by Q207, which is a power amplifier module.

Low pass filter

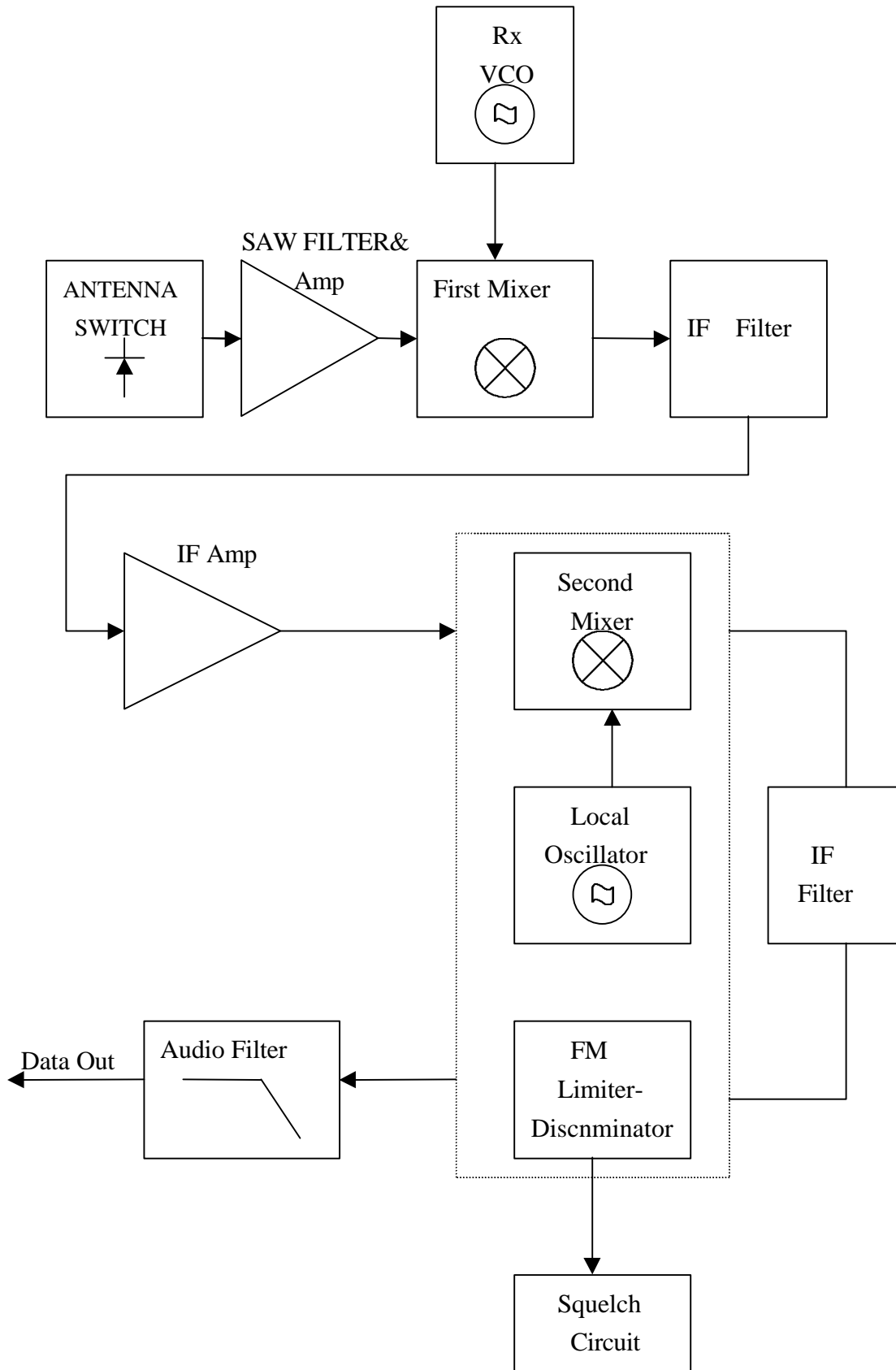
The amplified RF signal is passed through the stripline coupler and is fed to the harmonic low pass filter, comprising L213 to L214 and C232-C234 and then to the antenna connector (ANT).

Antenna Switch

When transmitting, the diodes D205 are forward biased, the RF pass to the antenna. D205 is shorted to ground which makes L212 look open circuit (1/4 wave tuned stub). This prevents the TX signal from passing to the receiver stage.

Receiver

The receiver comprises:



Antenna Switch

In receive, the diode D205 are reverse biased. L212 is now in circuit, passing the signal from the antenna to the SAW filter of F101.

SAW FILTER

The receiver signal is routed to pin 4 of the F101. It passes through the band pass filter .

The input signal is coupled to the base of Q101 which serves as an RF amplifier. The output of Q101 is then coupled to the first mixer.

First Mixer

Q102, 2-pole crystal filters XF1 and coils L103 and C120 form the First Mixer and First IF Filter.

The RF signal, from the SAW filter and amplifier Q101 is applied to the VCO local oscillator signal to make mixer.

The difference frequency of 21.4 MHz is taken from Q102 and is filtered by the crystal filters XF1. The tuned circuits L103 and C120 and associated components provide matching of the crystal filters to ensure a good pass-band response and selectivity.

The IF signal is amplified by Q104 and passed to the FM Detector IC.

Second mixer, Second IF, FM detector

The output of the IF amplifier is fed into the narrowband FM IF Integrated Circuit, IC101 (MC3361). This is a single conversion FM receiver which contains the second mixer, second IF amplifier, and FM detector.

Crystal X101, connected to pin 1 of IC101, determines the second local oscillator frequency. In this case the crystal has a frequency of 20.945MHz. The first IF signal is applied to the mixer and resultant frequency of 455KHz, is the difference between the IF signal and second local oscillator.

The 455KHz IF signal is output from pin 3 and is applied to a 455KHz band-pass filter CF1.

The output of CF1 is passed via pin 5 to a high gain IF amplifier coupled to the adjustable quadrature detector T2. Any detected signal is produced at pin 9 of IC101 and applied to the Receiver Audio Circuit and the Mute (Squelch) Circuit.

Squelch (MUTE) Circuit

Any noise signal is amplified by IC101 internal noise amplifier .

Signal is applied to pin 10 of IC101. The squelch trigger output (pin 12, IC101) is applied to the pin 6 of J1.

When noise is present, the voltage at pin 12 of IC101 exceeds than 0.7V. The squelch trigger output is open, It's make pin 6 of J1 open state.

When no noise is present, the voltage at pin 12 of IC101 less 0.7v and pin 13 of IC101 is HI voltage. This make pin 6 of J1 short state.

VR101 is set to tuning squelch when 25khz channel space is present.

Carrier Detect

A Carrier Detect (MUTE DETECT) output is available on pin 6 of J1 .

AF Output Low Pass Filter

A low pass filter formed by R108 and C110 removes any extraneous 455kHz energy from the AF output of the FM receiver chip (pin 9 of IC101).

The filtered signal is passed to pin 2 of J1.

Microcontroller

The PIC16C57C04 microcontroller IC controls the programmable features and frequency synthesizer Data.

Programming Mode

The programming mode allows the user to retrieve or program TX/RX frequencies, when pin 9 of J1 is set to ground. Programming mode will Inhibit , Serial communications can then be made in order to read/program the on- board EEPROM (IC5)which contains radio- specific data.

EEPROM

Relevant channel information, such as Rx/ Tx frequencies, is stored in the EEPROM(IC5) which is a 93C46. This information may be programmed and erased via the D- type socket. The EEPROM has 1024 (8x128) capacity and is written serially.

Power supply circuit

The data radio is supplied with a nominal + 13.8V dc power supply input from external equipment which is filtered using C33. This supply is converted into 8V voltage levels on the board using the regulator IC2 and associated components .

The +5V VCC is regulated by Zener diode D1 and filtered using C9 and Q9. This +5V line is fed to the CPU circuit .

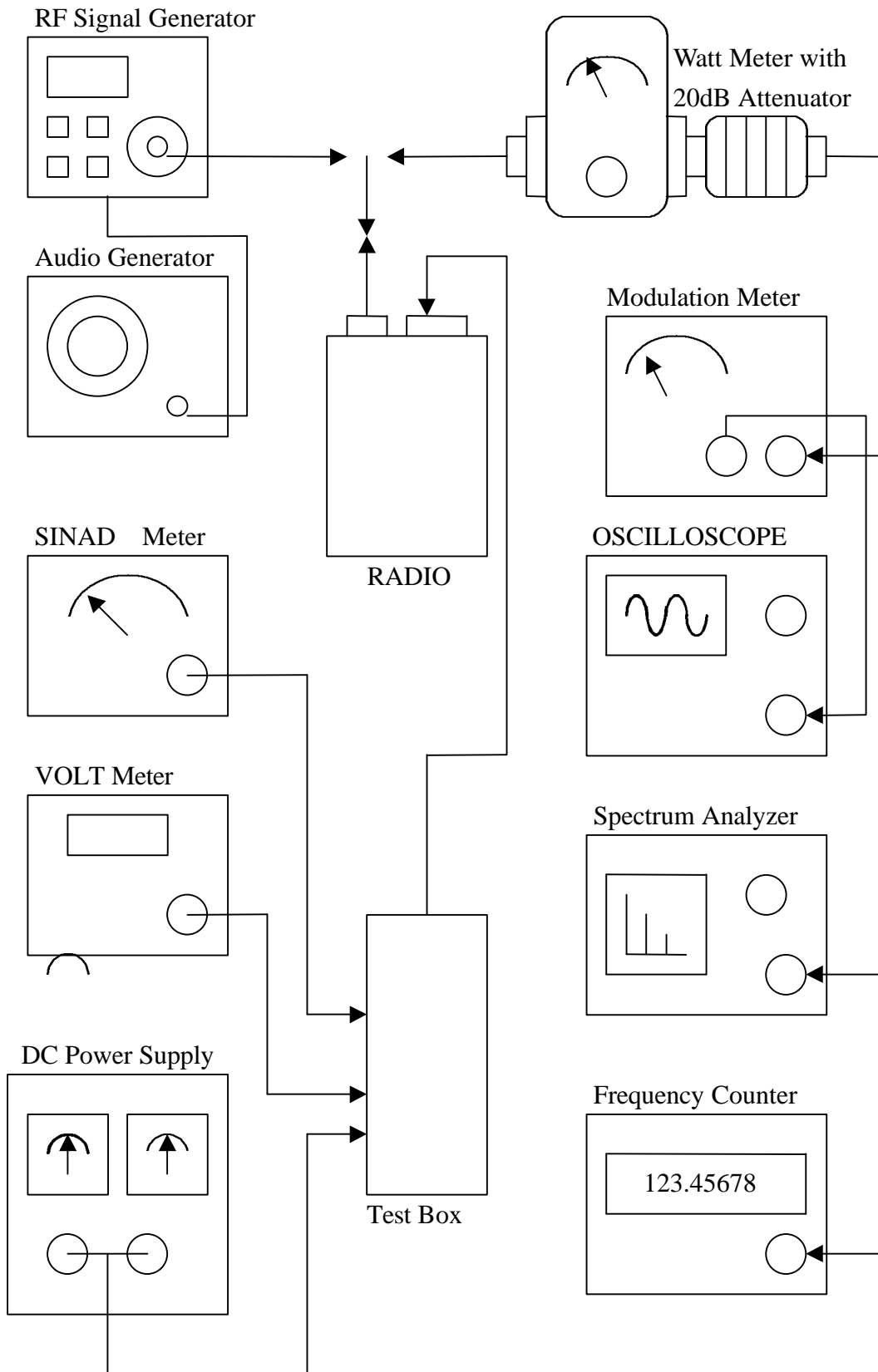
4. PERFORMANCE TEST AND ALIGNMENT

The alignment and performance test procedures assume the use of the following equipment.

Discrete test equipment

Volt Meter	Spectrum Analyser and notch filter(option)
RF Power Meter.	Coupler (20dB isolation)
DC Power Supply, 0-15V 2A min	Distortion Meter
Oscilloscope, 20 MHz dual beam	
RF Frequency Counter, 100 kHz - 600 MHz	
AF Signal Generator 0 – 20 kHz	
RF Signal Generator	
SINAD Meter	
Modulation Meter	
Audio Power Meter	

5. TEST EQUIPMENT CONFIGURATION.



Test Equipment Configuration

6. TRANSMITTER PERFORMANCE TESTS

Power Output

1. Set the power supply voltage to 13.8V dc. and monitor the voltage during transmit.
2. Switch data radio TX and check and record the output power. The nominal output power is adjustable between 2 to 3W .
3. Set the PTT switch to OFF .

Peak Deviation

1. Connect the oscilloscope to the output of the modulation meter.
2. Set the AF signal generator to 1000 Hz at 106mV and connect to DATA _IN Line (pin 1 of J1)
3. Switch data radio to TX and observe the oscilloscope display to check that the 1000Hz tone is a sine wave and adjust VR201 to make deviation is about 3.5KHZ.
4. Using the AF signal generator, sweep from 100 Hz to 3 kHz and record the peak deviation.
5. Check the peak deviation for appropriate channel spacing as follows :
For 12.5 kHz channel spacing, Peak deviation is not greater than 2.5 kHz.
For 20 kHz channel spacing, Peak deviation is not greater than 4 kHz.
For 25 kHz channel spacing, Peak deviation is not greater than 5 kHz.

Spectrum Test

It may be necessary to notch the fundamental signal during this test.

1. Connect a spectrum analyser and RF power meter to the antenna socket.
2. Switch data radio to TX. Observe the output spectrum on the spectrum analyser.
3. Adjust notch filter to minimise the carrier. All spurious and harmonics signals should be below- 36 dBm up to 1 GHz and below -30 dBm between 1 and 4 GHz.
4. Switch off the data radio transmit control.

Receiver Performance Tests

Sensitivity

The SINAD performance test may be used to test the sensitivity of the receiver.

1. Connect the RF signal generator to the data radio BNC antenna connector.
2. Set the RF signal generator to the receive frequency .
3. Connect the leads of the SINAD meter between 0 V and pin 2 on J1.
4. Set the deviation to 60 % of the peak system deviation.
5. Set the AF generator to 1 kHz.
6. Adjust the RF signal generator level until the SINAD Meter reads 12 dB.
7. Check that the signal generator RF level is less than 0.35uV pd (-116dBm).

Transmitter Alignment

Automatic Power Adjustment

Transmit periods longer than 3 minutes are to be avoided.

1. Switch to data radio to TX.
2. make the transmit power between 2 to 3W.
3. Switch the data radio to transmitter OFF.

Frequency accuracy

1. Whilst transmitting, measure the transmit frequency using the RF frequency counter.
2. Adjust VR1 so that frequency is as close as possible to the exact required transmit frequency. Ideally it should be within 100 Hz at room temperature.

Receiver Alignment

Important note : Before setting up the receiver it is important to check the frequency accuracy alignment is correct as described in the transmitter alignment section.

RF tuning

1. Connect an RF signal generator and SINAD voltmeter.
2. Set the RF signal generator to the receive channel frequency and set to 60 % deviation.
3. Set the AF signal to 1 kHz.
4. Set the RF level to 1 mV pd (- 47.0 dBm)
5. Adjust T2 for maximum AF output about 250mV to 350mV and lowest distortion, the distortion normally less than 5 % .
6. Check for an RF voltage signal level of 0.35uV pd (- 116dBm) and a SINAD meter Reading greater than 12 dB.

Squelch Carrier Detect Adjustment

1. Set the RF signal generator to the receiver frequency with 60 % deviation. Set the AF Signal to 1 kHz
2. Set RF input level to give -112 dBm.
3. Adjust VR101 until CDS J1 pin 6 changes state from “HIGH” to “LOW”.
4. Reduce RF input level to -120dBm and check that CDS line goes HIGH . Switch off the RF generator and disconnect the test equipment.

Modulation Deviation Adjustment

1. Connect a power meter, modulation meter and oscilloscope to radio.
2. The radio should be programmed to contain a channel with a frequency in the middle the band of interest with an RF power setting of 2 W.
3. Switch the data radio ON.
4. Inject a 106mVrms SINE wave signal at a frequency of 1000Hz into pin 1 of J1, Set the data radio to TX Observe the oscilloscope display to check that the 1000Hz tone is a sine wave by tuning VR201 and set deviation is 3.5KHZ.
5. Using the AF signal generator, sweep from 100 Hz to 3 kHz and record the peak deviation.

Check the peak deviation for appropriate channel spacing as follows :

12.5 kHz channel spacing \leq 2.5 kHz dev

20 kHz channel spacing \leq 4 kHz dev

25 kHz channel spacing \leq 5 kHz dev

6. Switch to RX.

7. TROUBLESHOOTING

The section includes voltage which should assist the engineer to isolate and repair the fault.

Voltage measurements should be made using a high-impedance voltmeter and the values given are with respect to ground.

Careful alignment, using suitable test equipment, and quality interface cables should ensure that the radio meet their specified performance.

Voltage Charts

Measurement Condition: 465MHZ,13.8V supply, RX Carrier Present.

Transistors .

Ref. No.	RX			TX		
	B	C	E	B	C	E
Q1	4.31	4.98	4.99	4.31	4.98	4.99
Q2	8.1	2.33	8.1	7.8	5.5	7.8
Q4	0	2.33	0	0	5.5	0
Q6	4.91	0	4.93	4.9	0	4.92
Q7	0	8.1	0	4.93	0.02	0
Q9	5.64	8.1	4.99	5.63	7.8	4.96
Q10	4.16	8.1	3.76	4.15	7.8	3.75
Q11	5.62	8.1	4.92	5.62	7.8	4.92
Q14	8.1	0.2	8.1	7.08	7.63	7.8
Q15	7.56	8.1	6.84	0.62	7.8	0
Q101	0.74	3.93	0	0	0	0
Q102	0.57	6.67	0	0	0	0
Q103	5.21	0	0	0	11.9	0
Q104	0.68	5.13	0	0	0	0
Q201	0	0.34	0	0	0.72	0
Q202	0.34	0.31	0	0.73	0	0
Q203	0.31	0	0.3	0	7.36	7.62
Q204	0	0	0	0.75	7.35	0
Q205	0	0	0	0.7	7.36	0.25
Q206	0	12.36	0	0.56	6.28	0
Q207	0	13.6	0	0	13.6	0
Q301	4.87	4.92	4.2	4.87	4.92	4.2
Q302	1.63	3.99	0.92	1.63	3.99	0.92
Q304	0.74	2.77	0	0.74	2.77	0
Q305	2.32	4.93	1.69	2.32	4.93	1.69

Integrated Circuits

RECEIVER										
Pin	IC1	IC2	IC3	IC4	IC5	IC101	IC201			
1	2.35	13.6	0	5	0	5.59	0			
2	2.39	8.1	5	5	0	5.05	0			
3	1.63	8.1	0	0	5	5.28	0			
4	4.93	6.86	0	5	0	5.63	0			
5	0	0	0	5	0	4.43	0			
6	0	8.1	5		4.08	4.43	0			
7	4.92	8.1	4.96		0	4.43	0			
8	3.52	0	0		5	5.63	0			
9	0		0			2.15				
10	0		0			0.78				
11	0		0			1.59				
12	4.9		0			0.58				
13	0		0			5.21				
14	0		0			0				
15	3.76		0			0				
16	0		0			1.71				
17			5							
18			0							
19			5							
20			5							
21			0							
22			0							
23			5							
24			5							
25			5							
26			2.07							
27			2.59							
28			5							

Integrated Circuit Voltages (Receive)

Integrated Circuits

TRANSMIT										
PIN	IC1	IC2	IC3	IC4	IC5	IC101	IC201			
1	2.35	13.6	0	0.58	0	0	1.16			
2	2.39	8.1	5	0.58	0	0	0			
3	1.65	8.1	0	0	5	0	0			
4	4.93	6.86	0	0.34	0	0	0			
5	0	0	0	5	0	0	2.43			
6	0	8.1	0.34		4.08	0	5.03			
7	4.92	8.1	4.92		0	0	2.48			
8	3.52	0	0		5	0	1.17			
9	0		0			0				
10	0		0			0				
11	0		0			0				
12	4.91		0			0				
13	0		0			0				
14	0		0			0				
15	3.76		0			0				
16	0		0			0				
17			4.98							
18			4.95							
19			4.98							
20			0							
21			0							
22			0							
23			4.98							
24			4.98							
25			4.98							
26			2.07							
27			2.59							
28			5							

Integrated Circuit Voltages (Transmit)

6. PARTS LIST

52-7085UE2

Revision:

Bill Of Materials

Item	Quantity	Reference	Part
1	19	C1, C40, C47, C48, C49, C51, C52, C106, C201, C216, C217, C218, C221, C225, C227, C235, C244, C247, C250	470P
2	11	C2, C108, C317, C550, C551, C552, C553, C554, C555, C556, C558	1U/Y5V 0805
3	5	C4, C127, C224, C232, C234	5P
4	16	C5, C7, C8, C12, C44, C103, C107, C121, C126, C203, C207, C236, C245, C307, C312, C322	102P
5	1	C9	475P/0805
6	1	C11	105P 25V/1206
7	16	C13, C19, C29, C36, C37, C41, C42, C46, C53, C67, C102, C111, C112, C117, C251, C546	104P
8	1	C15	0.33U/T
9	2	C16, C17	103P/X7R
10	1	C18	106P/1206
11	1	C20	473P/X7R 0805

Bill Of Materials

Item	Quantity	Reference	Part
12	1	C21	103P
13	7	C30, C31, C32, C115, C122, C308, C524	100P
14	1	C33	47U/16V/EC/SMT
15	1	C34	100U/16V/EC/SMT
16	1	C35	4.7U/1206
17	4	C43, C50, C120, C223	22P
18	3	C45, C116, C523	47P
19	1	C101	1P
20	2	C104, C252	1U/1206
21	1	C105	104P/X7R
22	1	C110	223P/X7R
23	2	C118, C241	10U/1206
24	3	C123, C214, C323	15P
25	5	C124, C125, C212, C220, C311	2P
26	2	C202, C242	10U/T
27	2	C204, C302	18P

Bill Of Materials

Item	Quantity	Reference	Part
28	1	C205	335P/1206
29	1	C206	6P
30	4	C208,C213,C228,C314	3P
31	2	C210,C233	10P
32	4	C211,C230,C305,C306	7P
33	1	C222	12P
34	2	C243,C248	104P/0805
35	1	C246	223P
36	5	C300,C301,C309,C324,C325	220P
37	1	C303	9P
38	2	C304,C321	8P
39	1	CF1	CFU455E
40	3	D1,D5,D103	RLZ5.6B
41	4	D2,D3,D101,D202	RLS4148
42	1	D4	RLZ4.3B
43	2	D6,D507	RLZ3.0B
44	1	D102	1SS226

Bill Of Materials

Item	Quantity	Reference	Part
45	1	D201	1SS314
46	1	D203	PTZ3.9A
47	2	D205 ,D303	HVU131
48	1	D206	RLZ5.1B
49	2	D301 ,D304	1SV229
50	1	F101	SAW FILTER
51	1	IC1	MB1504 SMT
52	1	IC2	UTC7808
53	1	IC3	PIC16C57C04 SMT
54	1	IC4	ELM7S32
55	1	IC5	93C46 SMT
56	1	IC101	MC3361 SMT
57	1	IC201	LM386D
58	1	IC504	TL064CD SMT
59	1	J1	CONNECTOR DB9 HM
60	1	J101	BNC
61	1	L101	12NH

Bill Of Materials

Item	Quantity	Reference	Part
62	1	L102	56NH
63	1	L103	2.2UH/BEAD
64	3	L201 , L203 , L303	27NH
65	1	L202	15NH
66	3	L204 , L212 , L213	0.45*1.5*5T
67	2	L205 , L206	6.8NH/0603
68	1	L207	14UH
69	2	L208 , L214	0.45*1.5*6T
70	1	L210	0.65*1.1*4T
71	1	L216	125MH
72	2	L300 , L301	1UH/BEAD
73	1	L304	18NH/SPRING COIL
74	2	Q1 , Q6	A1037K
75	2	Q2 , Q14	BCW68G
76	8	Q4 , Q9 , Q10 , Q11 , Q15 , Q201 , Q202 , Q301	BC847B
77	2	Q7 , Q103	DTC114EK

Bill Of Materials

Item	Quantity	Reference	Part
78	1	Q101	2SC4226
79	6	Q102, Q204, Q205, Q302, Q304, Q305	2SC5226
80	1	Q104	MMBTH10
81	1	Q203	DTA123JK
82	1	Q206	BFR96TS
83	1	Q207	MRF555
84	9	R1, R17, R50, R201, R205, R308, R518, R521, R524	10K
85	8	R3, R47, R118, R516, R523, R525, R528, R531	100K
86	1	R4	OR
87	2	R5, R11	910R
88	6	R8, R20, R30, R103, R221, R318	2K2
89	3	R9, R22, R224	820R
90	7	R10, R19, R101, R215, R222, R315, R316	100R
91	1	R13	3K

Bill Of Materials

Item	Quantity	Reference	Part
92	2	R14, R15	6K8
93	2	R16, R111	33K
94	3	R23, R225, R304	150R
95	5	R24, R41, R45, R107, R307	4K7
96	1	R29	12K
97	7	R40, R46, R51, R52, R202, R223, R317	1K
98	5	R48, R49, R117, R204, R216	470R
99	2	R53, R102	1M
100	8	R60, R61, R526, R527, R532, R533, R534, R546	47K
101	1	R104	220K
102	3	R105, R208, R220	22K
103	1	R106	1.5M
104	3	R108, R212, R311	2K7
105	3	R110, R112, R113	560R
106	2	R114, R314	1K2

Bill Of Materials

Item	Quantity	Reference	Part
107	2	R115,R217	470K
108	3	R116,R211,R213	22R
109	1	R203	27K
110	1	R206	1.5K
111	1	R207	220R
112	1	R210	3K3
113	1	R214	22R/0805
114	1	R301	10R
115	1	R302	5K6
116	1	R303	3K9
117	1	R306	33R
118	1	R309	330R
119	1	R312	270K
120	1	R313	56R
121	1	R517	15K
122	1	R545	680R
123	2	RV501, RV502	10KB SMT

Bill Of Materials

Item	Quantity	Reference	Part
124	1	T2	0766
125	1	VC1	20PVC
126	1	VR1	100KB SMT
127	1	VR101	47KB/SMT
128	1	VR201	10KB/SMT
129	1	X1	12.8MHZ TCX0/SMT
130	1	X2	3.58MHZ 3X9
131	1	X101	20.945MHZ UM1
132	1	XF1	21M08B
128	2	SCREW	M2X4 F.E.G NI
129	4	SCREW	M2X3 BH NI
130	4	SCREW	M3X3 BH NI
131	1	CABLE	RG178-50
132	1	SHIELD	VCO
133	1	PRINT CIRCUIT BOARD	110x55x1.0 m/m FR4
134	1	CASE	TOP
135	1	CASE	BOTTOM

Welcome to PC Programmer.

Please Read this file, before you first use the software.

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2. Before Installing
3. Install PC Programmer
4. INSTRUCTIONS
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1. Brief introduction

Welcome to PC Programmer. This program is designed to be used with the Interface Adapter.

The following equipment will be needed to program the Device:

- A. A computer to install this program with at least 2 MB available space in hard disk and a 9-pin male RS-232 serial port.
- B. Win 95, Win 98, Win ME or Win 2000 Operation System.
- C. Part of the Programming Kit
 - 1) An interface Adapter.
 - 2) A CD disk with the program, PC Programmer files

2. Before Installing

Before You Run Setup, make sure that your computer meets the minimum requirements mentioned above, and read the Readme file(this file).

NOTE: If you firstly install PC Programmer in you system, the setup may update some system files on your computer , so you may run the setup again after your system be updated. Please follow the installation instruction on the screen.

3. Install

TO install PC Programmer on your computer

- 1) Insert the CD.
- 2) Run Setup.exe
- 3) Follow the installation instruction on the screen.

Important: You cannot simply copy files from the CD to your hard disk and run PC Programmer . You must use the Setup program, which decompresses and installs the files in the appropriate directories.

4. INSTRUCTIONS

4.1 Connection

4.2 Start up PC Programmer

4.3 Edit Configuration

4.3.1 Open/Recall/Upload Configuration file

4.3.2 Edit Channel data

4.3.3 Set Option item

4.3.4 (Block)Cut/Copy/Delete/Paste

4.3.5 Auto-Frequency edit

4.3.6 Save a Configuration to disk

4.3.7 Download Configuration to device

4.3.8 Print a Configuration

4.4 Exit PC Programmer

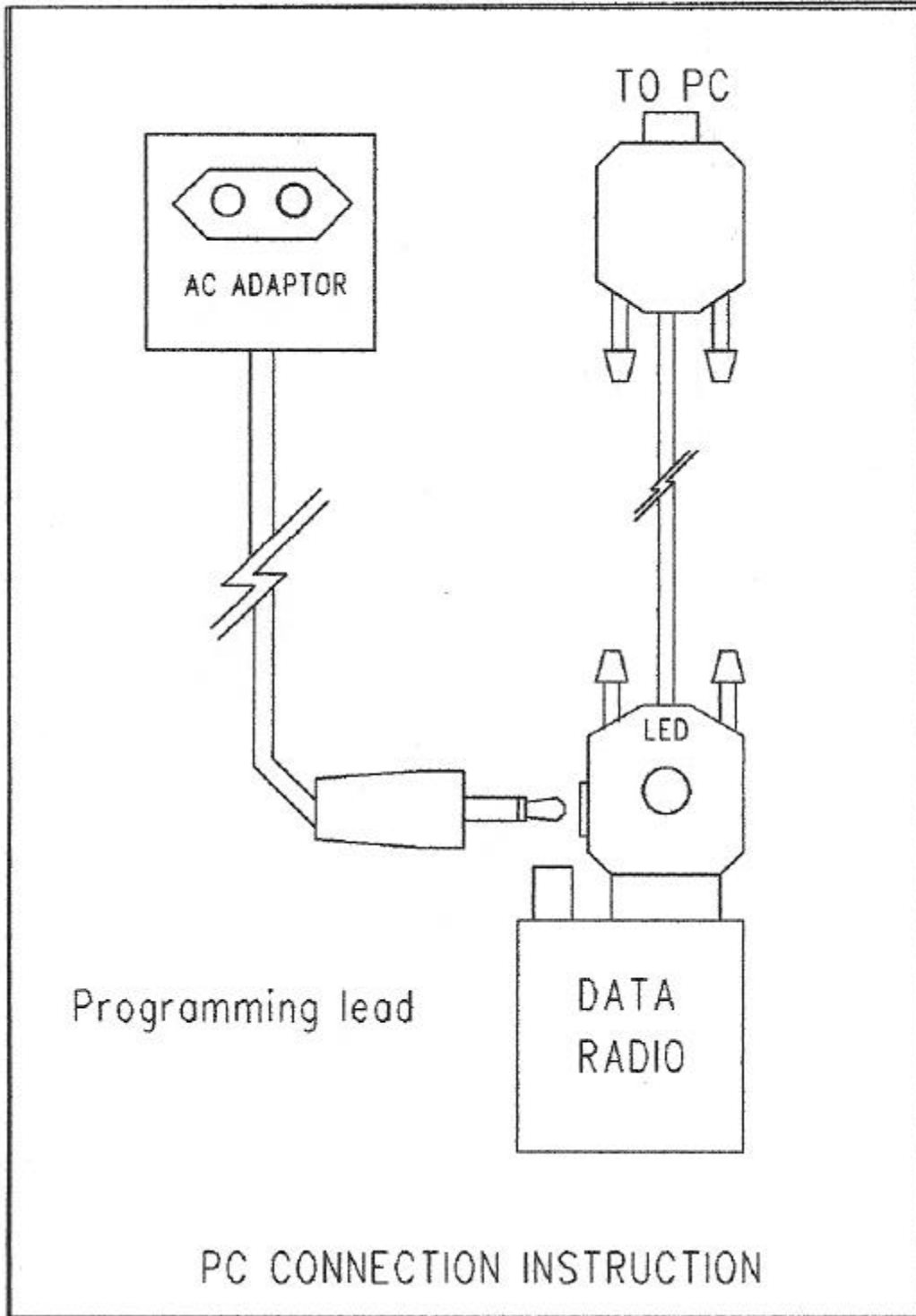
4.1 Connection

1. Connect one side of Interface Adapter to the computer's serial port.

Never care the port number, the PC Programmer will locate it automatically.

2. Connect the other side of Interface Adapter to the Device's 9-pin male RS-232 port.

3. Connect power supply to device and LED will be light. The device will into PC_programming mode automatically, please see the picture of below.



4.2 Start up PC Programmer

1. Select 'Start', choose 'Programs', click on the '*** Serial PC Programmer' program.
2. When HD Serial PC Programmer is started, a main form will be shown after a greeting form.
3. There has a menu bar at the top of the main form, and a message box at the bottom.

NOTE: The program is menu driven for all pertinent commands. All the commands can be accessed by either key board or the left mouse button.

Access keys mainly used are:

'Tab' or 'Arrow' to move focus(or cursor)

'Enter' to active a focused command

4.3 Edit Configuration

4.3.1 Open/Upload Configuration file

To edit the configuration, please either

1) Recall an Existing Configuration by click on the 'Open' item in the File Menu, select the configuration file by click on or input its name then press 'Enter' key.

OR 2) Upload configuration data from a device by click on 'Upload' item in the Device menu. to a Configuration window .

Different Model's device Configuration can be opened and edited.

There are two fields in each Configuration window: system data and Channel data.

OR 3) Open an existing Configuration by click on the 'OPEN' item in the File Menu. A pop up window will be shown, select a file by arrow key or mouse then click 'OK'.

4.3.2 Edit Channel data

1) Set focus to the Channel data field by move the mouse pointer.

2) Select a particular channel number to be edited by either the arrow key or click on it.

3) Pop up input window by either press 'Enter' key or double click on the selected channel number.

4) Use computer's cursor keys, Tab key, Enter key, arrow key or mouse to renew the channel data.

5) Click 'OK' button on the input window to accept the change or 'Cancel' to not change, and return back to Configuration Window.

4.3.3 Edit Option item

1) To Edit Channel Option, Select a particular channel number in the Option View Window by either the arrow key or click on it, then Pop up the input window for Channel Option, 'Enter' key or double click on the selected channel number.

- 2) To Edit System Option, Pop up input window for System Option, click "SYSTEM" in the 'OPTION' menu.
- 3) To Edit Advanced Option, Pop up input window for Advanced Option, click "ADVANCED OPTION" in the 'OPTION' menu.
- 4) Use computer's cursor keys, Tab key, Enter key, arrow key or mouse to renew the Option Item.
- 5) Click 'OK' button on the input window to accept the change or 'CANCEL' to not change, and return back to Configuration Window.

4.3.4 (Block)Cut/Copy/Delete/Paste

To select a block of channel data as source by either

- 1) Select start channel by arrow key, then while press 'Shift' key select end channel number by arrow key.
 - 2) Click on start channel, then while press 'Shift' key click on end channel number
 - 3) Press the left mouse button on start channel then move the mouse until reach the end channel number, release left mouse button.
 - A) To Cut selected (block) Channel(s) either press 'Ctrl'+ 'X' or click 'CUT' item in Edit menu.
 - B) To Copy selected (block) Channel(s) either press 'Ctrl'+ 'C' or click 'COPY' item in Edit menu.
 - C) To Delete selected (block) Channel(s) either press 'Del(Delete)' key or click on 'DELETE' item in Edit menu.
- After Cut or Copy, the data can be pasted to where you want.
- D) To Paste , select a channel as the start number of target , then either press 'Ctrl'+ 'V' or click on 'PASTE' item in Edit menu.

NOTE: Paste operation allows you to export data to any Configuration window opened.

4.3.5 Auto-Frequency edit

This feature provide you with a quick Frequency set function.

To use this command after either

- 1) Click 'EDIT' Menu
- 2) Click on 'AUTOFREQ' item in 'EDIT' menu to pop up a input window.
- 3) Use computer's cursor keys, Tab key, Enter key, arrow key or mouse to set data.
- 4) Click 'OK' button on the input window to accept the change or 'CANCEL' to not change, and return back to Configuration Window.

4.3.6 Save a Configuration to disk

- 1) Different configuration can be saved to disk.
- 2) Click on 'SAVE' item in 'FILE' Menu will overwrite an existing configuration file on your disk by current configuration.
- 3) Select 'SAVE AS' from 'FILE' Menu will save the current configuration by a name as you prefer.

4.3.7 Download to device

To Download current Configuration to device, select 'DOWNLOAD' from sub menu under 'DEVICE' menu.

4.3.8 Print a Configuration

Click on 'PRINT' item in 'FILE' Menu will send current Configuration to printer.

4.4 Exit PC Programmer

To Exit PC Programmer, click on 'EXIT' item in 'FILE' Menu.

5. UnInstall PC Programmer

To uninstall PC Programmer from your hard disk, select 'Start', choose 'Settings', click on the 'Control Panel', then find 'Add/Remove Programs' icon from the pop up window then double click on it, then find '*** Serial PC Programmer' from application list and click on it, then click on 'Add/Remove' button under application list, then follow the instructions on your screen.

Federal Communication Commission Interference

Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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FEDERAL COMMUNICATIONS COMMISSION

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiated radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter