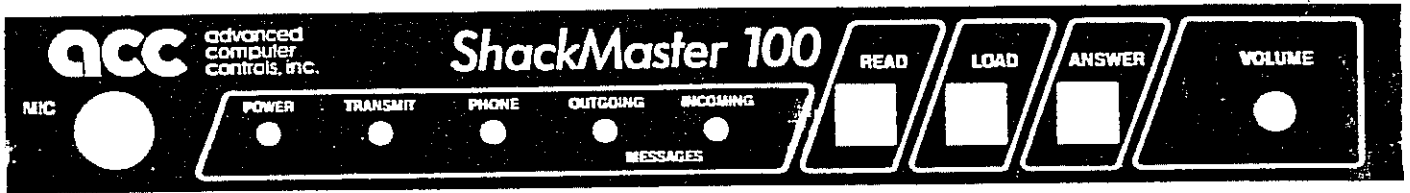
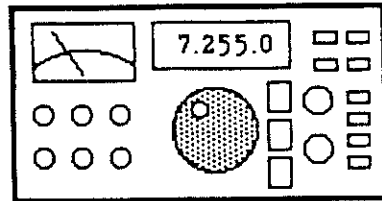
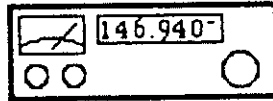
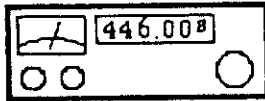


CROSSBAND LINKING

HF XCVR

PRIMARY XCVR

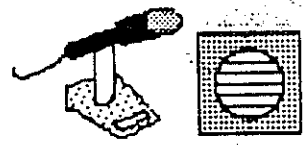
SECONDARY XCVR



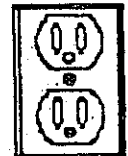
TELEPHONE ACCESS
PERSONALPATCH



ELECTRONIC
MAILBOX



SHACKPATCH



SHACK CONTROL

8

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8

8

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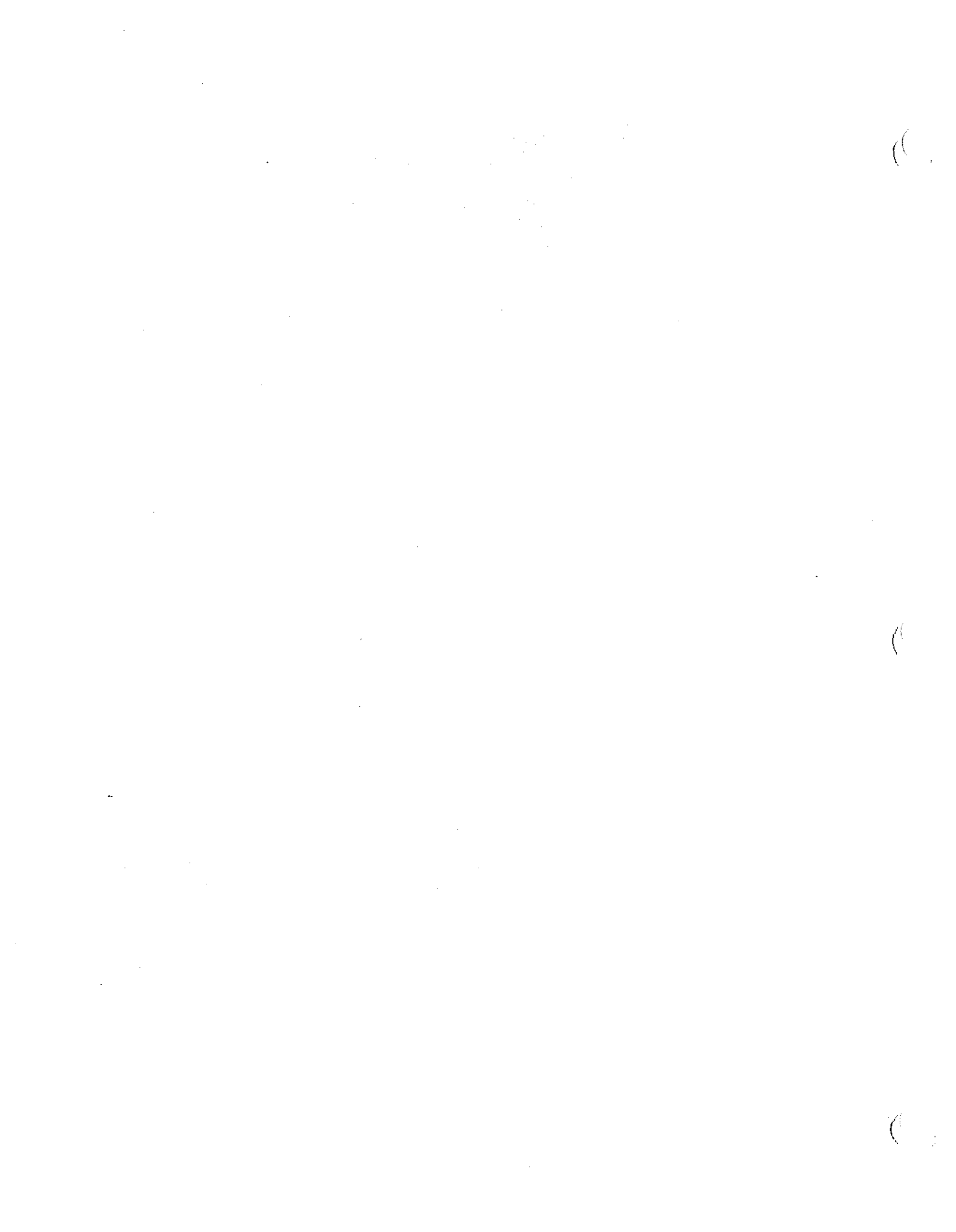
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Chapter 1

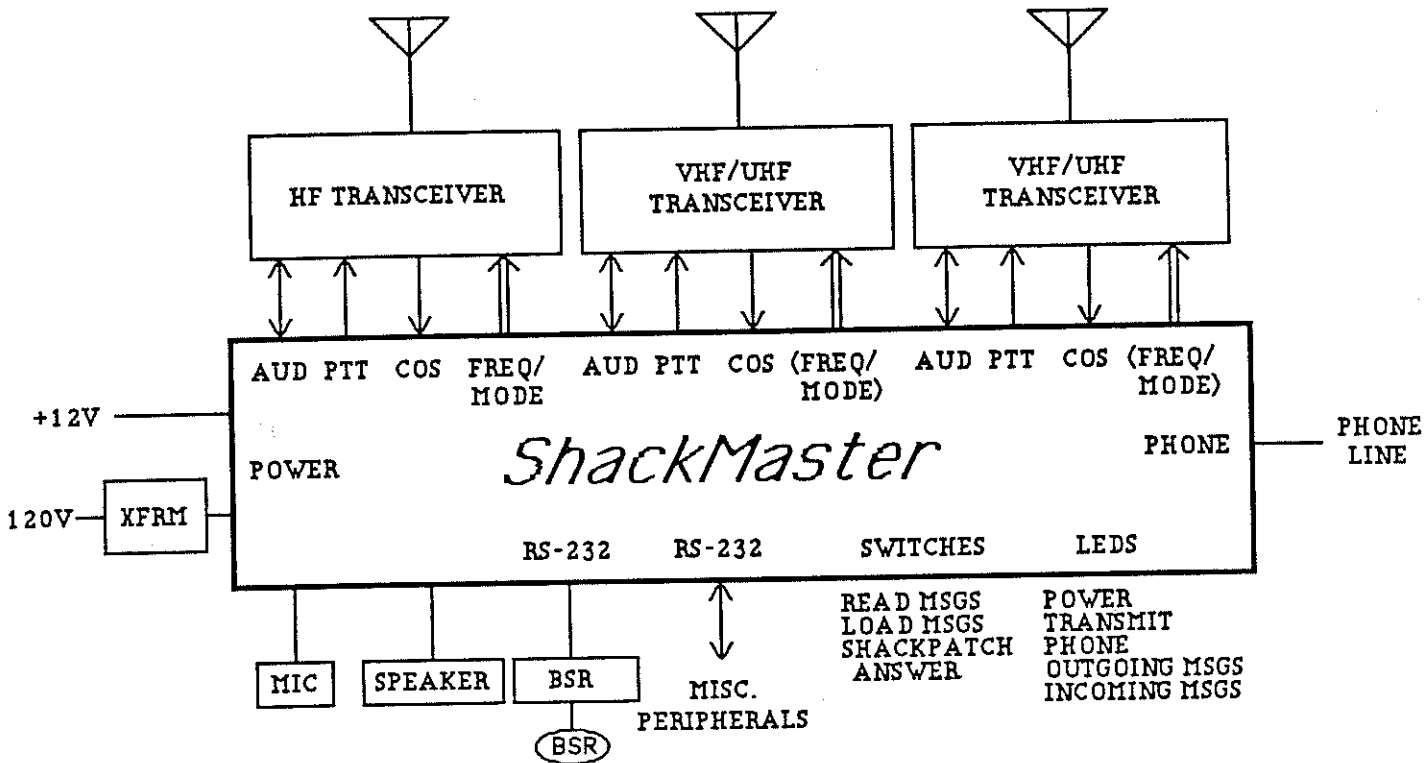
Introduction

Congratulations! You're now the owner of a product which will enhance the value of all your amateur radio equipment by making it work *together*. It will make amateur radio more fun, add a new dimension to your operation, and make the most of your equipment, every day!

Every amateur station must have a control operator. The control operator function may be performed locally, as is most commonly the case, or it may be performed remotely. The remote control link may be by wire or radio. ShackMaster lets you *remotely control your home station*, over the air or over the phone, letting you operate your home station in voice modes from anywhere!

ShackMaster is a station controller which ties together your home equipment, your telephone, and various ac line operated devices for remote control and operation. It also allows you to leave electronic messages in its mailbox and remotely control an intercom into your shack. The principal features of ShackMaster are

- Crossband Linking
- Telephone Access to your equipment
- Antenna Rotor Control
- Electronic Mailbox
- X-10 Shack Control
- ShackPatch - intercom into the shack
- PersonalPatch - simplex autopatch



Chapter 2

How It All Fits Together

ShackMaster may connect to one or two VHF/UHF transceivers and one HF transceiver. It may also connect to your telephone line, a speaker and microphone, and a X-10 appliance control system.*

ShackMaster may be controlled from either VHF/UHF rig and from the telephone. Certain activities may also be controlled from ShackMaster's front panel. You command ShackMaster over the air from your mobile or portable rig, or from the telephone, with simple Touch-Tone sequences. ShackMaster responds to you in its own synthesized voice.

The front panel switches allow your family to easily enter, read, and erase Electronic Mailbox messages, and to answer ShackPatch - the remotely controlled intercom.

ShackMaster interconnects the various equipment, providing logic control, audio switching and mixing, Touch-Tone command decoding and voice response, and I/O for interfacing to certain transceivers and station equipment. Several accessory boards are available for frequency control of some transceivers, rotor control, and additional remote control functions.

ShackMaster doesn't originate transmissions on its own - it responds to your commands, operating under your remote control. It can listen happily for you on any frequency without interfering with communications in progress.

*Heathkit GD-1530 or X-10 Powerhouse required for X-10 support.

Chapter 3

A Guided Tour

Crossband Linking

ShackMaster can control up to three transceivers for voice mode crossband linking. Its control abilities include detecting signal present (from a squelch open or carrier-operated-switch logic signal), controlling transmitter on/off (push-to-talk), and switching and mixing receive and transmit audio sources. It is also capable of controlling the frequency and mode of many externally controllable transceivers. All control is in response to your Touch-Tone commands, and ShackMaster keeps you informed of the system's status with its synthesized voice.

ShackMaster can link either VHF/UHF rig to the other or to the HF transceiver. Crossband linking gives you access to your home station HF and high performance VHF/UHF equipment, while mobile or portable, on a simplex frequency or through a repeater.

Telephone Access

ShackMaster's telephone interface lets you control and operate your home station from any Touch-Tone telephone. Any of the three transceivers may be controlled, and you may listen and transmit on them.

Also accessible from the telephone are the X-10 Shack Control (remote control of ac line operated devices), and the Electronic Mailbox.

ShackMaster shares your existing phone line, and is compatible with answering machines.

Antenna Rotor Control

An optional Rotor Control Board is available which mounts inside many standard rotor boxes. The RCB-2 board is compatible with the Telex/Hygain CD-45-II, Ham IV, and Tailtwister rotors and similar units. With the Rotor Control Board, you may send ShackMaster Touch-Tone commands to interrogate the current direction and rotate it to any specified direction. Feedback is always provided to you in ShackMaster's synthesized voice.

Electronic Mailbox

The mailbox allows you to exchange "notes" with your family when it isn't convenient to talk directly over the patch.

The mailbox messages are synthesized speech phrases. Several predefined messages are available which cover most typical situations. Three general purpose messages are also included, and you can assign your own meaning to each one.

ShackMaster is capable of storing "incoming" messages entered with Touch-Tone commands from either of the VHF/UHF rigs. "Outgoing" messages may be loaded from ShackMaster's front panel push-buttons or from the telephone. Messages can be read and erased from the rigs, telephone, or the front panel.

The presence of incoming or outgoing messages is indicated on ShackMaster's front panel LEDs.

X-10 Shack Control

ShackMaster allows remote control of ac line operated devices through its link to X-10 lamp and appliance control modules. Touch-Tone commands entered through the VHF/UHF control transceiver or the telephone cause ShackMaster to send signals to turn equipment on and off.

The X-10 system consists of a number of lamp, appliance, and wall switch modules which connect to the power line. A control unit commands the modules with ultrasonic signalling injected onto the power line. ShackMaster interfaces to either a Heathkit or X-10 control unit.

The appliance and lamp modules are available from a number of sources, including Heath, Sears, Radio Shack, and electronics stores.

ShackPatch

ShackMaster allows you, through either VHF/UHF transceiver, to remotely perform the control operator function for your home station. In a manner analogous to an autopatch, ShackPatch lets you communicate with third parties - it just doesn't use the phone! ShackPatch is an alternative to repeater and simplex autopatches for communicating with your family at home.

You may activate ShackPatch from over the air with Touch-Tone commands from your mobile or portable, on a simplex frequency, or through a repeater. ShackPatch "rings" in the local speaker in your shack and may be answered by someone at home by their pressing the "Answer" button on ShackMaster's front panel.

The conversation may proceed through the local microphone and speaker. A periodic control window keeps you in complete control of your home station remotely.

PersonalPatch

ShackMaster offers a simplex autopatch which allows you to make phone calls from your portable or mobile.

PersonalPatch may be operated as a VOX assisted patch. In either mode, a programmable control window assures you of complete control of your home station. Timing associated with the patch is programmable to suit your preferences and the characteristics of your base station transceiver.

PersonalPatch regenerates the phone number to be dialed into the phone line using DTMF or rotary signalling. A programmable speed-dial number is available to make it easy to call the highway patrol or local police to report traffic accidents and disabled motorists.

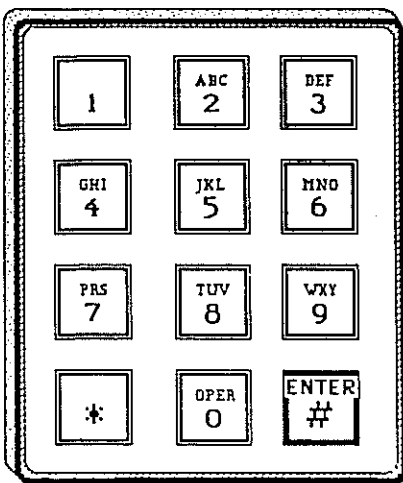
Commanding ShackMaster

Normally, all commands to ShackMaster are preceded by *your special command prefix* - one or more digits which you program, unique to your ShackMaster. Your unique code provides security for your system and prevents someone else from accidentally activating your station when operating their own ShackMaster on the same frequency.

A second alternate programmable code may be selected *remotely* if it becomes necessary for security reasons.

You may bypass the code prefix entirely for simpler commanding if your system is inherently secure.

A Control Operator command set with its own separate programmable command prefix allows enabling and disabling of ShackMaster's various capabilities.



Touch-Tone commands entered from the telephone are terminated with #, which acts as an "Enter" key. Commands entered over the air don't normally need the Enter key since ShackMaster knows you're done entering the command when you unkey your rig. When operating through a repeater with a long hang time, however, the # is also needed to terminate the command.

For additional security, you may selectively require COP selectable PL (subaudible tone) to be present for ShackMaster to accept Touch-Tone commands. An external PL decoder, such as a Communications Specialist TS-32, is required, and should be installed in the control transceiver. The connection to ShackMaster is the PL decoder's logic output.

Odds and Ends

ShackMaster IDs your home station for you with your call sign in its synthesized voice. It will announce your call sign periodically while you're using ShackMaster, and again when you're done, to comply with FCC requirements.

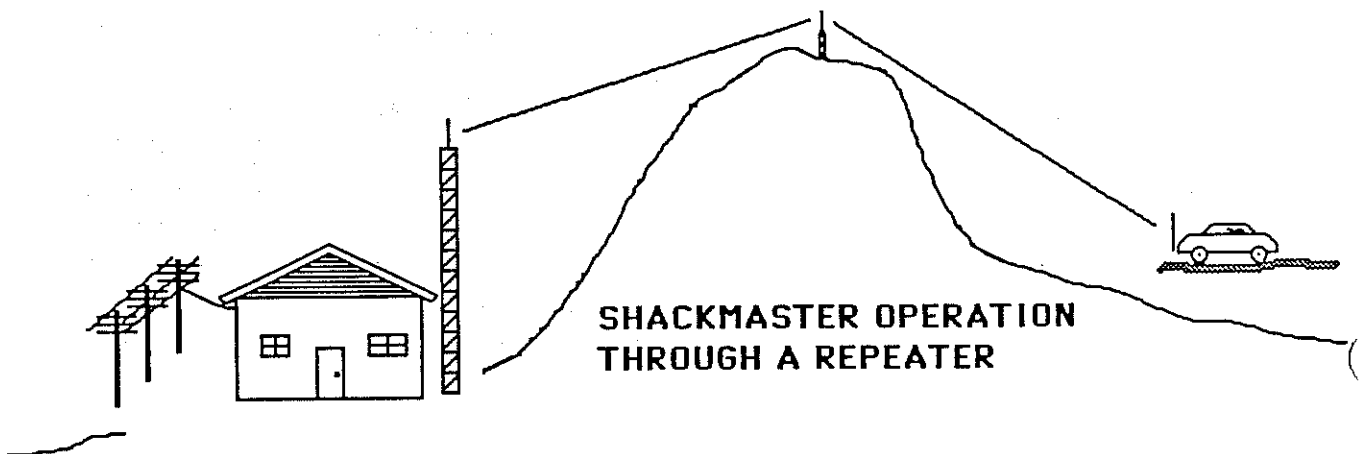
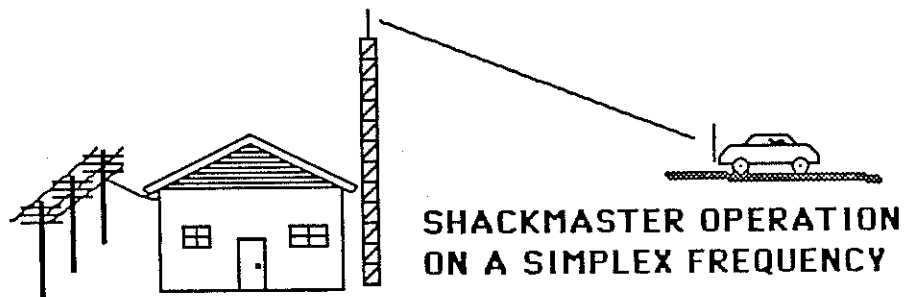
You program your callsign into ShackMaster's non-volatile memory using a Touch-Tone command sequence described in Chapter 13, "Programming ShackMaster".

ShackMaster can be operated on VHF/UHF simplex frequencies and through repeaters.

Operation on a simplex frequency maximizes your system's security and privacy when you're within range of your home station. The ability to operate through repeaters greatly increases the range, making your station available to you from distances up to hundreds of miles.

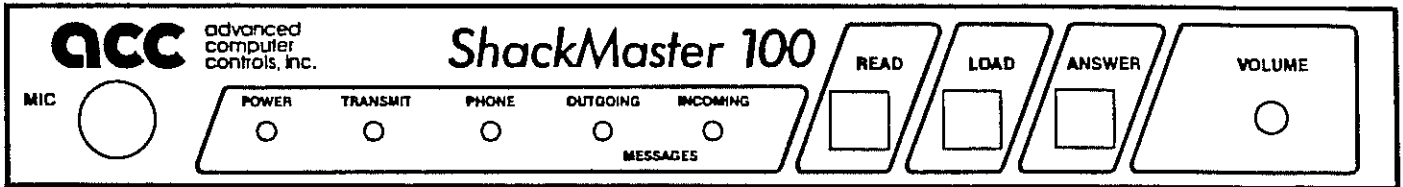
While controlling your home station over the air, you may tell ShackMaster to QSY the control channel if frequency control is supported by your hardware connections. The ability to move from a repeater to a quiet simplex frequency, or to other repeaters, assures access to your equipment. Two frequency memories in ShackMaster make it easy to QSY between your favorite frequencies, or you may tell it to meet you anywhere on the band.

Finally, when you're *at home* operating your home station, there's no need to unplug ShackMaster from your equipment. You can leave the local microphone and speaker connected, and operate your transceivers through ShackMaster in its local mode.



Front Panel

ShackMaster's front panel provides three push buttons, five LED indicators, a microphone jack, and volume control.



BUTTONS. The buttons operate the Electronic Mailbox and ShackPatch and are used for entering and leaving local operation and programming modes.

READ - Pressing briefly causes any incoming mailbox messages to be read out (ShackMaster either reads the messages or says, "empty"). Pressing and holding for at least two seconds causes incoming messages to be erased (ShackMaster says, "Messages Cancel").

Pressing and holding for at least five seconds enters ShackMaster into local operation of the primary transceiver (says, "P").

LOAD - Pressing briefly *n* times causes message number *n* to be loaded as an outgoing message (ShackMaster reads the message). Pressing and holding for at least two seconds causes outgoing messages to be erased (ShackMaster says, "Messages Cancel").

Pressing and holding for at least five seconds enters ShackMaster into local operation of the secondary transceiver (says, "S").

ANSWER - When ShackPatch has been activated over the air and is ringing in the shack, pressing briefly "answers" ShackPatch (says, "Go!").

Pressing and holding for at least five seconds enters ShackMaster into local operation of the HF transceiver (says, "HF").

Pressing and holding for at least ten seconds unlocks ShackMaster, entering it into its programming mode (says, "UL").

*Using the
local microphone
press LOAD -* →

ANY BUTTON - While in a local operation mode or in the programming mode, pressing briefly any button returns ShackMaster to its normal remote control mode (says, "Remote control").

INDICATORS.

POWER - (Red) Indicates power applied.

TRANSMIT - (Red) Indicates that one of the three transmitters is keyed.

PHONE - (Red) Indicates that the phone is offhook, either because of an incoming or outgoing call.

OUTGOING - (Red) Indicates outgoing mail present in the Electronic Mailbox.

INCOMING - (Green) Indicates incoming mail present in the Electronic Mailbox.

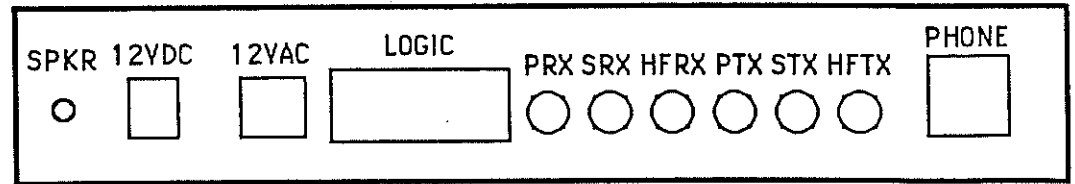
MICROPHONE JACK. The microphone is used for ShackPatch and local station operation. A Touch-Tone microphone may be used for programming, but is not necessary because programming may be done from a handheld transmitting into the control transceiver.

The MIC jack is directly compatible with the ICOM HM-7, HM-8, and SM-6 microphones. Other microphones with internal preamps may be accommodated, but rewiring of the microphone plug may be necessary.

VOLUME CONTROL. The volume control affects the audio level through the local speaker. The local speaker is used for ShackPatch and local station operation.

Rear Panel

Connectors on the rear panel accommodate power, audio, and logic signals.



SPKR - Sub-miniature phone jack for 8 Ω speaker.

12VDC - Molex 2 pin connector (supplied). Power input from dc supply.

12VAC - Molex 3 pin connector (supplied). Power input from ac transformer.

LOGIC - DB-25 female connector (mating male connector supplied). For connection of logic signals.

PRX - Phono jack. Primary (VHF/UHF) transceiver receiver audio.

SRX - Phono jack. Secondary (VHF/UHF) transceiver receiver audio.

HFRX - Phono jack. HF transceiver receiver audio.

PTX - Phono jack. Primary (VHF/UHF) transceiver transmitter audio.

STX - Phono jack. Secondary (VHF/UHF) transceiver transmitter audio.

HFTX - Phono jack. HF transceiver transmitter audio.

PHONE - Telephone modular jack. For connection to phone line.

Chapter 4 Hookup

ShackMaster's various features require equipment connected in order to implement them.

Below is a table of what needs to be hooked up to use ShackMaster's various features. In this chapter, we'll cover connection of power, a speaker, a microphone, the telephone line, and the primary and secondary VHF/UHF transceivers. You may not use some of the information presented here initially, but remember that it's here.

Later chapters will cover the addition of other equipment and accessories, such as the Frequency Control Board, the Rotor Control Board, and the X-10 controller.

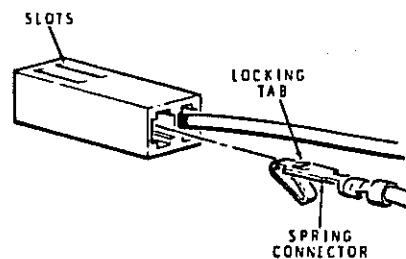
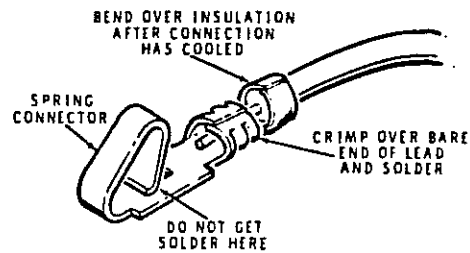
FEATURE	PWR	SPKR	MIC	PHONE	PRIM	SEC	HF	RCB	X-10	FC-1
Crossband Linking	X				X	OPT	OPT	OPT	OPT	
Telephone Access	X			X	OPT	OPT	OPT	OPT	OPT	
Antenna Rotor Control	X			OPT	OPT	OPT	OPT	X		
Electronic Mailbox	X	X		OPT	X	OPT				
X-10 Shack Control	X			OPT	OPT	OPT			X	
ShackPatch (intercom)	X	X	X		X	OPT				
PersonalPatch (simpatch)	X			X	X	OPT				
Local transceiver operation	X	X	X		OPT	OPT	OPT			
Programming from local mic	X	X	TT							
Programming from HT	X	X			X					
Freq. control - VHF/UHF	X				OPT	OPT				BCD
Freq. control - HF	X						X			IC751
Where's hookup info? (page)	16	17	17	21	18	18	20	IX-1	41	IV-1

Power

ShackMaster may be powered by a +12 volt dc supply. DC power may be applied to the "12VDC" connector on the rear panel and may be obtained from an existing 12 volt station supply. A current of 500 mA is consumed.

Alternatively, a 12-16 volt wall mount transformer may be connected to the "12VAC" connector.

Prepare your power cable terminating in the supplied 2 conductor (dc) or 3 conductor (transformer) Molex connector as shown below.



Microphone and Speaker

The local microphone and speaker are required for use of ShackPatch or for local operation of your equipment through ShackMaster. Only the speaker is required for use of the Electronic Mailbox. Neither is required for use of PersonalPatch (simplex autopatch), or Telephone Access.

A *Touch-Tone* microphone is necessary only for *programming from the mic* - all programming can be done from your handheld transceiver instead.

The microphone connector is compatible with several off-the-shelf microphones available with and without Touch-Tone pads. Several microphones which may plug in directly include

- ICOM HM-7 hand-held microphone
- ICOM HM-8 hand-held microphone (TT)
- ICOM SM-6 desk microphone

Other microphones from other manufacturers may be compatible as well. They should have a built-in preamp and be electrically similar to the above and may require connector rewiring.

The speaker may be any 8 ohm type with a subminiature phone plug. The speaker plugs in the "SPKR" jack on the rear panel.

Try it ...

- 1) Plug speaker into subminiature phone jack.
- 2) Apply power. ShackMaster should say, "SM100, V..., This is WA6...". Adjust volume control if necessary.
- 3) Press the "Load" button five times to load mailbox message 5. ShackMaster should say, "Messages 5, I will be home on time. Messages enter". The "Outgoing" LED should indicate presence of outgoing mail in the Electronic Mailbox.
- 4) If you have a compatible Touch-Tone microphone, try the Touch-Tone Pad Test. Key the mic and press "5 123". ShackMaster should say, "One two three".

Primary and Secondary VHF/UHF Transceivers

PRIMARY TRANSCEIVER	
Transmitter Audio	Phono PTX
Transmitter PTT	Logic - 2
Receiver Audio	Phono PRX
Receiver COS	Logic - 10
Increase Rx Sens.	R37
COS Logic Sense Cmd	*112(1/H, 0/L)

SECONDARY TRANSCEIVER	
Transmitter Audio	Phono STX
Transmitter PTT	Logic - 15
Receiver Audio	Phono SRX
Receiver COS	Logic - 22
Increase Rx Sens.	R61
COS Logic Sense Cmd	*113(1/H, 0/L)

The primary and secondary VHF/UHF transceivers may be 6 meter, 2 meter, 220 MHz, 440 MHz, 900 MHz, 1200 MHz, or other rig.* Connections to the transceivers include transmitter audio, transmitter push-to-talk (PTT), receiver audio, and receiver squelch open or carrier-operated-squelch (COS) logic signal. These connections may be made permanently to the rig while keeping it available for normal use through ShackMaster with its own local speaker and microphone.

Transmit audio and PTT may connect to the transceiver directly at its microphone connector. Some transceivers have auxiliary connectors on their rear panels which are also suitable entry points. You may want to make sure that audio from the rig's microphone is not mixed with the auxiliary audio when using transmit audio supplied to an auxiliary connector.

ShackMaster's audio output is internally level adjustable, and PTT is a solid-state contact closure to ground, directly compatible with most rigs. If the rig's keying line contains a *negative* voltage, buffer PTT with a small relay. Primary transmitter audio is available at phono jack PTX (Primary Transmit), and PTT at Logic connector pin 2 (pre-wired with the orange wire). Secondary transmitter audio is at phono jack STX, and PTT at Logic connector pin 15.

Receiver audio may be taken from the transceiver's external speaker jack. Audio at this point will be dependent on the rig's volume control setting. If you'd like receiver audio to be independent of its volume

* Certain features involve Auxiliary operation which are limited to frequencies above 220.5 MHz. See Chapter 15, "ShackMaster and the Rules".

control setting, it can be obtained in some cases inside the radio, at the top of the volume control pot. Audio to ShackMaster must be de-emphasized and squelched. If you're not sure that audio from an internal point of the transceiver is suitable, take it from the speaker jack.

Primary receiver audio is applied to phono jack PRX (Primary Receive) and should be in the range of .5 to 2 volts peak-to-peak (170 mV to 700 mV).

Secondary receiver audio is applied to phono jack SRX.

If the audio available is too low in level, the input sensitivity may be increased by inserting a 47K resistor at R37 (primary) or R61 (secondary).

The receiver COS or squelch signal tells ShackMaster when you're transmitting to it from your mobile or portable, or when a crossbanded signal is present.

In some cases, a COS or squelch signal is brought to a rear panel connector, or even to the mic jack of the transceiver.

Otherwise, the COS signal appears inside the receiver, following the squelch noise detector. The signal internally gates receiver audio on and off. Appendix III shows the location of a usable COS signal from a variety of radios.

The COS signal must be lower than .8 volts in the low state and greater than 2.4 volts in the high state. It may be either high true or low true. Be sure to measure the voltage from your transceiver in both states *with ShackMaster connected.*

The primary COS is applied to the Logic connector, pin 10 (pre-wired to the green

CARRIER
OPERATED
Squelch

wire). The secondary COS is applied to pin 22. The black wire from the pre-wired logic connector should connect to the transceiver's ground.

As supplied from the factory, ShackMaster assumes the COS signals are high true - that is, a logic high state indicates squelch open. If the COS signal from your receiver is low true, see Chapter 13, "Programming ShackMaster" to change the logic sense.

HF Transceiver

HF TRANSCEIVER	
Transmitter Audio	Phono HFTX
Transmitter PTT	Logic - 3
Receiver Audio	Phono HFRX
Receiver COS	Logic - 9
Increase Rx Sens.	R48
COS Logic Sense Cmd	*114 (1/H, 0/L)

This section will cover general connection of the HF transceiver to ShackMaster. Refer to the appendices for details of connecting specific transceivers and for accomplishing frequency, mode, and memory control.

Connections to the HF transceiver include transmitter audio, transmitter push-to-talk (PTT), receiver audio, and optionally, a squelch, or COS logic signal.

HF transmitter audio is available at phono jack HFTX (HF Transmit), and PTT at Logic connector pin 3.

HF receiver audio is applied to phono jack HFRX (HF Receive) and should be in the range of .5 to 5 volts peak-to-peak. If the audio is too low in level, the input sensitivity may be increased by inserting a 47K resistor at R48.

The HF receiver squelch signal is optional. All-mode squelches generally don't perform well with remotely located HF equipment because of the variability of noise and signal levels on different bands and at different times of day. HF crossbanding is generally done with the control link continuously transmitting HF activity. This is accomplished by not connecting an HF COS (ShackMaster's input is internally pulled low) and

programming ShackMaster for low true HF COS. In that way, ShackMaster always sees the HF COS as active, keeping up the crossband link.

If you do use an HF COS, connect it to Logic connector, pin 9.

As supplied from the factory, ShackMaster assumes the HF COS signal is low true.

Telephone Line

The phone line is used for the Telephone Access and PersonalPatch features, and for entry and retrieval of Mailbox messages by phone.

The telephone line connects to ShackMaster through its modular jack on the rear panel. Plug a modular cable into the jack on the rear of ShackMaster and into the wall jack.

Local Operation through ShackMaster

ShackMaster allows you to connect it permanently to your transceivers without the need to plug and unplug when you want to use your equipment directly in the shack. ShackMaster can be commanded to connect its microphone and speaker to any of the three transceivers.

To select either of the transceivers you've just connected (the primary or secondary transceiver) for local operation, press the "Read" or "Load" button on the front panel and hold it in for five seconds - until ShackMaster acknowledges your request by saying, "P" or "S".

To resume normal remote control operation of ShackMaster, press either the "Read", "Load", or "Answer" buttons briefly. ShackMaster will also return automatically to remote control operation after a half hour of no transmit activity (just in case you forget).

ShackMaster is normally in its remote control mode, available to you over the air or the phone. Understanding the local control mode is important here because it will assist us in making audio level adjustments.

Audio Level

Adjustments

DESCRIPTION	POT
✓ Primary Rx Audio Level	R102
✓ Secondary Rx Audio Level	R103
✓ HF Rx Audio Level	R101
✓ Primary Tx Audio Level	R106
✓ Secondary Tx Audio Level	R107
✓ HF Tx Audio Level	R108
✓ Local Mic Audio Level	R104
* Phone Audio Level	R105
Speech Synthesizer Pitch	R110

Check #105
Telephone

Audio levels to and from the transceivers, microphone, and phone line need to be adjusted inside ShackMaster. The necessary adjustments are described below. You may make preliminary audio adjustments now, then "fine tune" them later when your complete setup is functioning.

Primary Receiver Audio Level: Press the "Read" button for five seconds to select local operation through the primary transceiver. Activate a Touch-Tone pad test to hear the audio level of the speech synthesizer. Adjust pot R102 so that the receiver audio level in the local speaker is the same as the speech synthesizer level. If the level is too low even with R102 all the way up, install a 47K resistor at R37 to increase ShackMaster's audio input sensitivity.

Secondary Receiver Audio Level: Press the "Load" button for five seconds to select local operation through the secondary transceiver. Activate a Touch-Tone pad test to hear the audio level of the speech synthesizer. Adjust pot R103 so that the receiver audio level in the local speaker is the same as the speech synthesizer level. If the level is too low even with R103 all the way up, install a 47K resistor at R61 to increase ShackMaster's audio input sensitivity.

HF Receiver Audio Level: Press the "Answer" button for five seconds to select local operation through the HF transceiver. Adjust pot R101 so that the receiver audio level in the local speaker is the same as the speech synthesizer level. If the level is too low even with R101 all the way up, install a 47K resistor at R48 to increase ShackMaster's audio input sensitivity.

Primary Transmitter Audio Level: Press any front panel button momentarily to return to the remote control mode. From a rig transmitting on the frequency that the primary transceiver is listening on, enter "123 5 1234567890". ["123" is the normal command prefix as shipped from the factory, "5" is the Pad Test command, and 1..0 are the keys being tested.] Adjust pot R106 so that the transmitted level of the speech synthesizer is comparable to other amateur signals received on other frequencies, or about 4-5 kHz deviation. If ShackMaster does not key the transceiver and read back the numbers, there may be difficulty in decoding your Touch-Tone commands.

POT 107

Secondary Transmitter Audio Level: After reading Chapter 10, "Crossband Linking", try crossbanding to the secondary transceiver. Adjust R107 so that the transmitter modulates at about 4-5 kHz deviation.

HF Transmitter Audio Level: After reading Chapter 10, "Crossband Linking", try crossbanding to HF. Adjust R108 so that the ALC meter on the HF transceiver indicates normal transmitter modulation.

LOCAL MIC
POT 104

Local Microphone Level: If you have a local microphone connected, select local control mode for the primary control transceiver again by pressing the "Read" button for five seconds. Press the local mic PTT, talk into the microphone, and adjust pot R104 so that the transmitted audio level is about 4-5 kHz deviation.

POT 105

Phone Audio Level: The telephone audio level should be pre-adjusted at the factory, however you may check the level. Activate PersonalPatch by entering "123 6 (desired phone number)" from over the air. ["123" is the normal command prefix, "6" is the PersonalPatch command, and the phone number is entered directly.] After ShackMaster dials the number, and the phone is ringing, adjust pot R105 so that the transmitted audio level is about 4-5 kHz deviation. Hang up PersonalPatch with #.

Speech Synthesizer: The speech synthesizer should not require adjustment, but its pitch may be adjusted with R108. It should be set for a "normal" sounding male voice.

Chapter 5

The Electronic Mailbox

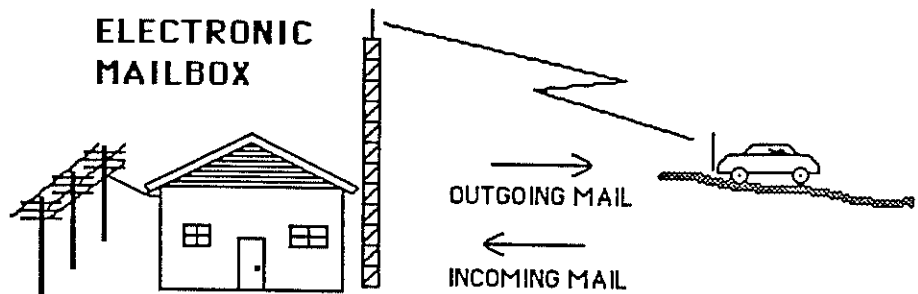


Mailbox messages may be loaded and read from over the air, from the phone, or from the shack. Outgoing messages are directed from the phone or shack to the mobile/portable. Incoming messages originate from the mobile/portable.

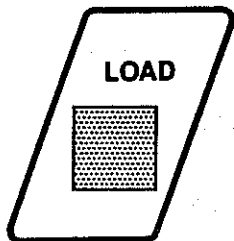
ShackMaster contains ten predefined mailbox messages.

- 1 - Will you be home late?
- 2 - Please call home.
- 3 - Are you going home?
- 4 - I will be home late.
- 5 - I will be home on time.
- 6 - All is OK.
- 7 - Please cancel our meeting.
- 8 - Message green.
- 9 - Message yellow.
- 10 - Message red.

Messages 8, 9, and 10 are general purpose messages which may have any meaning you'd like to assign to them.



Loading Outgoing Messages from Front Panel



To load message 3 as an outgoing message, simply press the "Load" button 3 times. ShackMaster responds through the local speaker with the message number, the actual synthesized speech message, and indicates that it's entered. The "Outgoing" message LED is lit, and the message may be read from over the air. Any message is loaded by pressing the "Load" button the proper number of times.

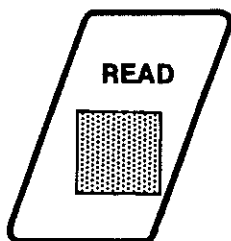
More than one message may be loaded and stored in memory. For example, you may load messages 3, 4 and 6, one at a time. All three will be read when the outgoing mailbox is interrogated.

Example: To load messages 3 and 4, first press the Load button 3 times. ShackMaster will respond by saying, "Messages 3. Are you going home? Messages enter". Now press the Load button 4 times. ShackMaster will repeat the procedure for Message #4. The Outgoing Messages indicator will be on.

Reading Incoming Messages from the Front Panel

At any time when incoming messages are in the mailbox, the "Incoming" message LED will be lit. The messages may be read by pressing the "Read" button. ShackMaster reads out all the incoming messages pending through the local speaker. If no messages are present, ShackMaster will say, "Empty".

Erasing Messages from Front Panel



The incoming messages may be erased by holding down the "Read" button for about two seconds, until ShackMaster says, "Messages cancel". It then removes the messages from memory and turns off the incoming messages LED.

All outgoing messages may be similarly cancelled from the front panel by holding down the "Load" button for two seconds.

Reading Messages Over the Air

Outgoing messages may be read over the air with the command

[user prefix] 3 [#]

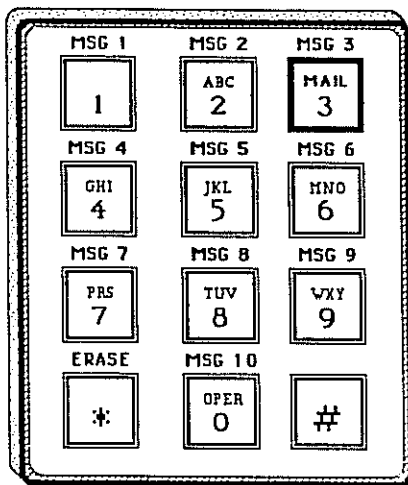
ShackMaster responds by reading all the messages which are in its outgoing memory, or by saying, "Empty" if no messages are present. (The # is only necessary if you're operating through a repeater with a long hang time or commanding from the phone.)

Example: If your command prefix is 123, read messages by entering "123 3". ShackMaster reads back all messages in its outgoing memory.

Loading Messages Over the Air

Messages may be loaded into ShackMaster's memory over the air with the command

[user prefix] 3 [message 1-9, 0(10)] [#]



ShackMaster responds by saying, "Messages enter" and the message. The word "Messages" is spoken in the local speaker, and the "Incoming Messages" LED is turned on.

Any combination of messages may be loaded and stored in memory. (Message 10 is loaded with key 0.)

Messages may be previewed without loading them with the command

[your prefix] 3 * [1 - 9, 0 (10)] [#]

Example: If your command prefix is 123, load messages 4 and 7. First enter "123 3 4". ShackMaster verifies your command entry by reading back the message. Next enter "123 3 7". ShackMaster repeats the process for the second message. Both messages are in ShackMaster's incoming memory, and the Incoming Messages indicator is lit.

Erasing Messages Over the Air

All outgoing and incoming messages may be erased from over the air with the command

[user prefix] 3 * * [#]

ShackMaster responds by saying, "Messages cancel", removes messages from memory, and turns off the Incoming and Outgoing LEDs on the front panel.

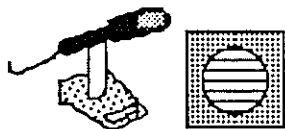
Example: If your command prefix is 123, erase all messages in the mailbox by entering "123 3**".

Operation from the Phone

Outgoing messages may be loaded and incoming messages may be read from the phone. Operation from the phone is similar to operation from over the air, except that a "#" key is required to terminate each command. Operation is reviewed in Chapter 8, "Telephone Access, Part 1".

Chapter 6

ShackPatch

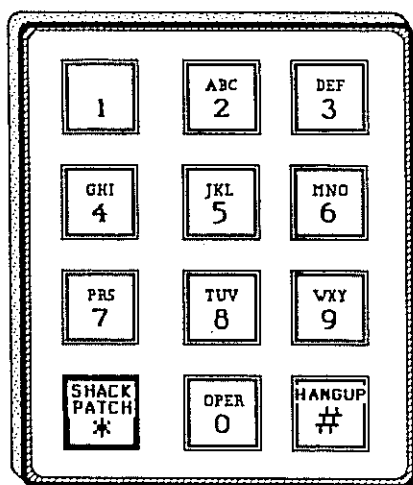


ShackPatch is the remotely controlled intercom into your shack. You remotely control your home station through the VHF/UHF rig and talk with third parties just as with an autopatch but without the phone. ShackPatch can be used on a simplex frequency or through a repeater.

Activating ShackPatch

ShackPatch is activated from over the air with the Touch-Tone command

[user prefix] * [#]

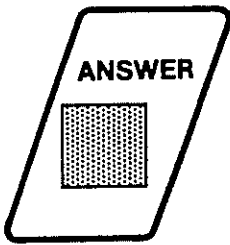


When activated, ShackMaster acknowledges the command over the air, and a ringing sound is produced in the speaker in your shack. The # "Enter" key is only needed when activating ShackPatch through a repeater which has a long hang time.

ShackPatch can only be activated by you from over the air. It can't be activated from the shack, since that would involve transmissions initiated by non-licensed persons. It also cannot be activated from the phone.

Example: If your command prefix is 123, activate ShackPatch from over the air with "123 *". ShackMaster acknowledges your command by saying, "Enter" and rings in your shack.

Answering ShackPatch

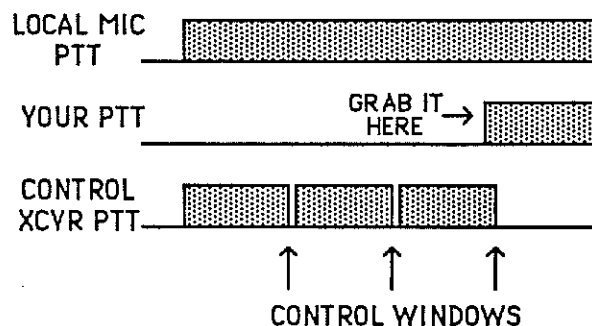


ShackPatch may be answered in the shack by pressing the "Answer" button. ShackMaster says, "Go", then connects receiver audio to the local speaker, and the local microphone is enabled (under your supervision through ShackMaster). The back and forth exchange may take place using the local microphone's PTT switch.

Although the person in the shack presses the PTT switch, actual control is retained by you from your remote control point. If the person in the shack holds down the PTT switch for more than a few seconds at a time, ShackMaster creates a control window to listen for your control transmission.

The Control Window

The control window is an interruption in the transmission from your home station's control transceiver, which gives you the opportunity to perform control functions over the air. During the control window, ShackMaster listens for you to break in. If you don't, it resumes transmitting. If you do, ShackMaster continues to listen for your entire transmission, during which you may talk and/or enter Touch-Tone commands. For example, you may want to terminate the patch in case something inappropriate is said.



The timing of the control window may be modified to suit your preferences as described in Chapter 13, "Programming ShackMaster". The control window keeps you in control of your home station at all times. It allows you to terminate transmissions from your home station with a reaction time identical to that if you were located at your home transmitter standing over the shoulder of the non-amateur.

ShackMaster notifies you just before the control window by sending a short "beep". The indication allows you to easily grab the control window to exercise control while preventing loss of information by operating with a narrow window.

Normally, ShackMaster knows you've broken in during the control window by sensing the COS signal from the control transceiver. What if you're operating through a repeater which has a hang time? In this case, you should have terminated the ShackPatch command with the # "Enter" key so ShackMaster knows! In this case, it uses its internal VOX detector to look for you during the control window. To exercise control when operating through a repeater, simply key down at the beep and talk.

Hanging Up

If no one answers ShackPatch within one minute, ShackMaster responds with "Patch cancel" over the air and terminates the ringing.

The patch is normally ended by you over the air with the Touch-Tone command

#

The Hangup command is *always* #, regardless of your command prefix.

You can kill the patch while it's still ringing or when you're finished with the conversation. When the patch is ended, the local speaker is muted and the local microphone is disabled.

Example: Your command prefix is 123. After entering the ShackPatch command, end the ShackPatch at any time by entering “#” (or “##” when operating through a repeater). ShackMaster responds by saying, “Seventy three”.

Timers

Two timers operate during the patch. An *overall* timer limits the duration of the patch while the *activity* timer is “refreshed” by your transmissions. The activity timer ends the patch more quickly in case you drive out of range. If either timer is allowed to time out, the patch is automatically terminated. The timers assist in complying with regulations regarding malfunction of the control link.

Before the overall timer times out, a warning message “30 seconds left” is announced. At that time, the timer may be extended from over the air to continue past the predefined time limit. The command is

[user prefix] * * [#]

The timer has now been extended by one minute. The timer values may be modified as described in Chapter 13, “Programming ShackMaster”.

Example: If your command prefix is 123, after hearing the “30 seconds left” message during a ShackPatch, extend the timer by entering “123 * *”.

Chapter 7

PersonalPatch



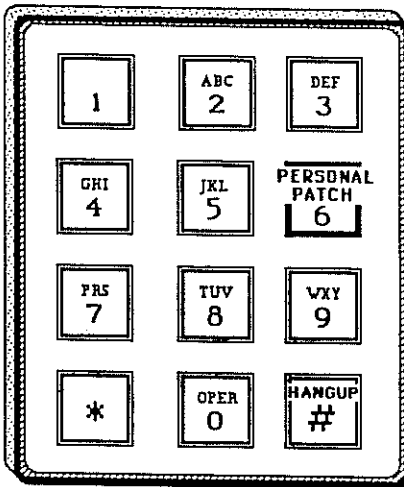
PersonalPatch is a simplex autopatch which allows you, when mobile or portable, to originate telephone calls through your home phone line. It can be used on a simplex frequency or through a repeater.

PersonalPatch is a VOX assisted patch and offers the best features of both VOX and sampling. It offers complete control to the mobile/portable station while maintaining an easy and natural style of conversation, the ability to operate through repeaters, and the ability to use an rf power amplifier at your station.

Activating Personal Patch

Personal Patch is activated over the air with the Touch-Tone command:

[user prefix] 6 [phone number] [#]



ShackMaster acknowledges your command by saying, "Autopatch", waits briefly for dial tone, then dials the number for you in either DTMF or dial pulse (see Chapter 13, "Programming ShackMaster" for making the selection).

Example: If your command prefix is 123, call telephone number 727-3330 by entering "123 6 7273330". ShackMaster automatically dials the number for you.

ShackMaster does not support a "reverse patch" feature, which would allow PersonalPatch to be activated from the telephone side. Such a feature would allow non-licensed persons to initiate amateur transmissions.

Operation

Transmissions from your base station are controlled by ShackMaster's VOX detector listening to the other party on the phone. Your home station transmits only when the other person is talking and you're not.

In a way similar to ShackPatch, if the person on the phone speaks continuously for more than several seconds, the transmission is interrupted to allow you the opportunity to break in to perform control functions. (See the "Control Window" description in Chapter 6.) The control window's timing may be modified as described in Chapter 13, "Programming ShackMaster", to suit your preferences and to work well with your transceiver.

If PersonalPatch was brought up terminated with the # "Enter" key, ShackMaster assumes you're operating through a repeater and listens for your audio with its VOX detector during the control window, rather than sampling for the COS signal.

Hanging Up

The patch is ended by you over the air with the Touch-Tone command

#

The Hangup command is *always* # (or ## if operating through a repeater) regardless of your command prefix.

Example: Your command prefix is 123. To hang up PersonalPatch, enter "#" (or "##" if operating through a repeater). ShackMaster responds by saying, "Seventy three".

Timers

Two timers are associated with PersonalPatch and operate identically to the overall and activity timers of ShackPatch (see Chapter 6, "ShackPatch").

The overall timer may be extended from over the air to continue past the predefined time limit. The command is

[user prefix] * * [#]

The timer values may be modified as described in Chapter 13, "Programming ShackMaster".

Autodial

A phone number may be stored in ShackMaster's non-volatile memory for easy access while driving. For example, the number may be that of the highway patrol or local police for easy reporting of traffic accidents or disabled motorists.

The command for activating the autodial number is

[user prefix] 6* [#]

Chapter 13, "Programming ShackMaster", describes how the autodial number is programmed into ShackMaster's memory.

Example: If your command prefix is 123, command PersonalPatch to dial the number prestored in its autodial memory by entering "123 6 *". ShackMaster responds by saying, "Autodial", and dials the number for you.

Toll Restrict

Telephone numbers beginning with a 0 or 1, or those longer than seven digits are normally not permitted to be dialed through ShackMaster. The toll restrict may be removed as shown in Chapter 14, "Selecting ShackMaster Operational Modes".

Chapter 8

Telephone Access - Part 1



ShackMaster allows you to call your home station on the phone and operate through your equipment using the phone's Touch-Tone commands. This section describes telephone access to the mailbox and to the fixed frequency, single transceiver hookup we performed in Chapter 4, "Hook-Up". In Chapter 11, "Telephone Access - Part II", we'll see how to control additional transceivers, including frequency control. Telephone access to X-10 Shack Control system is described in Chapter 9, "X-10 Shack Control".

Calling ShackMaster

ShackMaster may share your existing telephone line even if you have an answering machine. Two modes of operation are available - the *Normal* mode and the *Answering Machine* mode. (See Chapter 13, "Programming ShackMaster", for changing the mode.)

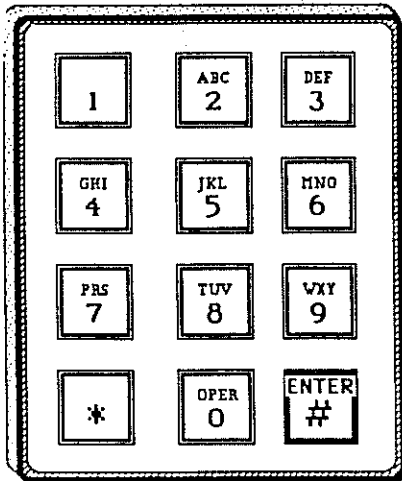
When your phone begins to ring, a 45 second timing cycle is started.

In the Normal mode, at the end of the 45 second cycle, ShackMaster will answer only if the phone is still ringing. If the phone was already answered, or the caller hung up, ShackMaster will not answer the telephone.

In the Answering Machine mode, ShackMaster will answer at the end of the 45 second cycle even if the phone was answered by your Answering Machine, allowing you to gain access to ShackMaster when the machine's message is completed.

ShackMaster will not answer the phone while you're operating it from over the air to avoid interfering with your operation. When you're done using it over the air, it's again available for phone calls following the "clean-up ID".

Commanding from the Phone



Electronic Mailbox

ShackMaster is controlled from the phone with Touch-Tone command sequences. Its command decoder needs to know when you're done entering a command so it can interpret it. *Commands entered from the phone must be terminated with the # key.*

Telephone Command = [regular command] + #

When calling ShackMaster on the phone, you may want to "bypass" the command prefix with the Control Operator level command to simplify user commands while you're on line. See Chapter 14, "Selecting Operational Modes".

Outgoing mail (to the mobile/portable) may be entered and incoming mail may be retrieved from the phone. Outgoing messages are loaded with the command

[user prefix] 3 [message 1- 9 or 0(10)] #

Note that Message 10 is loaded with key 0. Incoming messages are retrieved with the command

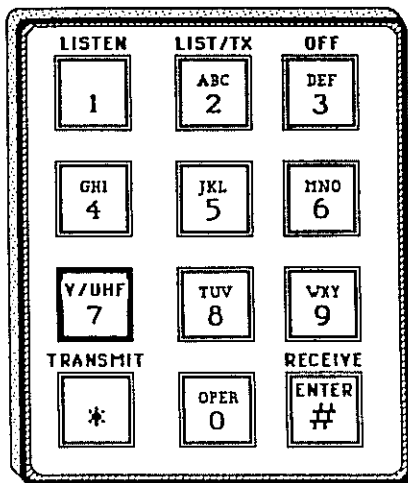
[user prefix] 3 #

All outgoing and incoming messages may be erased with the command

[user prefix] 3 * * #

Example: If your command prefix is 123, to load Message 6 from the phone, enter "123 3 6 #". ShackMaster responds over the phone by reading the message, and loads it in the outgoing memory to be retrieved from over the air.

Controlling the Primary VHF/UHF Rig



You may listen and transmit over your primary VHF/UHF transceiver from the phone. (Access to the other rigs is described in Chapter 10, "Crossband Linking".) To place ShackMaster in "Listen Only", enter

[user prefix] 7 1 #

Audio from the receiver is supplied to the phone. When audio is present, a very brief "hole" in the audio allows ShackMaster to listen for a Touch-Tone command from you once a second. (Without the window, ShackMaster wouldn't be able to reliably decode your tones in the presence of receiver audio pumped into the phone.) When you enter commands while in the listen mode when receive audio is present, the first key should be synchronized to the hole, or held down long enough to ensure "grabbing" ShackMaster's attention. At that point, receive audio is muted until your command entry is completed.

If you decide to place ShackMaster in the "Listen/Transmit" mode, enter

[user prefix] 7 2 #

ShackMaster is now capable of transmitting as you operate the "PTT". From the phone, * is equivalent to pushing PTT, and # to releasing PTT.

Key down	*
Release	#

Remember that while listening when there's receiver activity, ShackMaster looks for commands at the once-a-second window, so either synchronize the first digit to catch the window, or hold down the first key long enough to grab its attention.

ShackMaster waits for you to unkey the * before turning on the transmitter, and the # at the end is muted, so that you sound like an ordinary station over the air. While transmitting, you may pass Touch-Tone keys through to the transmitter, for example, to control a repeater. Only # cannot be passed to the transmitter since # tells ShackMaster to unkey.

To exit the Listen/Transmit mode and return to the Listen Only mode, enter any single key, other than * or #, followed by #. While *not transmitting*, enter

[any single key except * or #] #

To turn off ShackMaster's VHF/UHF transceiver telephone access while in the Listen Only mode (it can't be turned off directly from Listen/Transmit mode), enter

[your prefix] 7 3 #

Timers

ShackMaster limits your transmissions to a maximum of three minutes. If you're disconnected from the phone, the transmitter is automatically disabled within three minutes. Just remember to limit your transmissions to three minutes or ShackMaster will hang up.

ShackMaster would like to hear from you occasionally to be assured that you're still on the line. Enter any valid command, or #, at least every three minutes to reassure ShackMaster. If you don't, it assumes that you've been disconnected and it will hang up. To reassure ShackMaster that you're still there, enter any valid command or a # at least every three minutes.

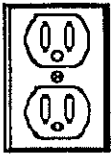
Hanging Up

To hang up the phone after a session with ShackMaster, enter

##.

Chapter 9

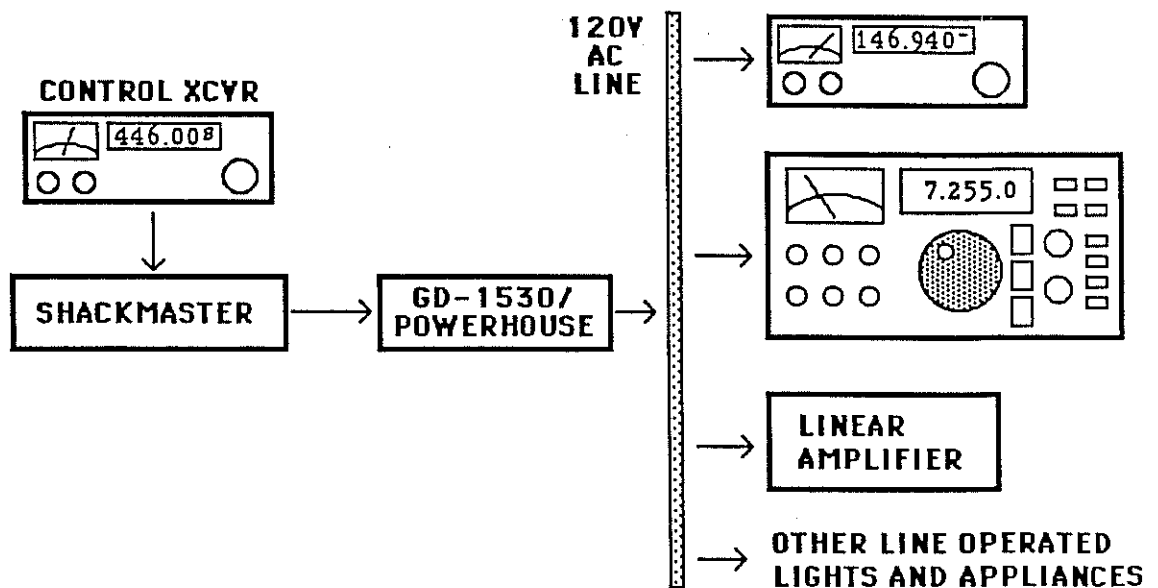
X-10 Shack Control



AC line operated equipment and appliances may be controlled by ShackMaster in conjunction with the X-10 Home Control System and the X-10 "Powerhouse Computer Interface" or Heathkit "X-10 to RS-232 Interface". This capability allows you to remotely control equipment in your shack with Touch-Tone commands over the air either on a simplex frequency or through a repeater, or from the phone. The equipment can include transceivers, linear amplifiers, fans, lights, etc.

The X-10 system consists of a variety of modules which may plug into wall sockets around the house. Various equipment and appliances may plug into these modules. Each module is assigned a particular "unit" code. A central command unit sends signalling over the power lines to the modules located around the house to turn the appliances off and on and even dim and brighten incandescent lamps.

ShackMaster provides a link in the interface between your rf equipment (or the telephone) and the X-10 system.



What You Need

To use ShackMaster's X-10 Shack Control capabilities, you need either the Heathkit GD-1530 "X-10 to RS-232 Interface", or the X-10 "Powerhouse Computer Interface", and various lamp and appliance modules. You *don't* need an X-10 command console, although you may want one anyway for local control around the house.

The Heathkit GD-1530 sells for approximately \$100 as a kit from Heathkit retail stores and mail order. The X-10 Powerhouse (newer than the Heathkit unit) is available as low as \$19.95. Check DAK Industries (800-272-3200) and local electronics stores for availability. Lamp and appliance modules, and optional command consoles, are also available at Radio Shack (under the name Plug-N-Power), Sears, and other retailers.

The Heathkit GD-1530 X-10 to RS-232 Interface

The Heathkit GD-1530 accepts RS-232 ASCII commands as input and injects signals into the ac power line to control the lamp and appliance modules located throughout the house.

ShackMaster interprets your Touch-Tone commands and sends appropriate ASCII commands to the GD-1530.

The GD-1530 serial port connects to ShackMaster Serial Output Port #1. Connect ShackMaster's Logic connector pin 16 to the GD-1530 serial input, and Logic connector pin 13 or 25 to the GD-1530 ground. The jumper inside the GD-1530 should select 300 baud operation.

Note: In order for the RS-232 driver to better handle the heavy load of the GD-1530's input, change the photo-transistor collector resistor R10 in the GD-1530 from 2200 Ω to 10K.

The X-10 Powerhouse Computer Interface

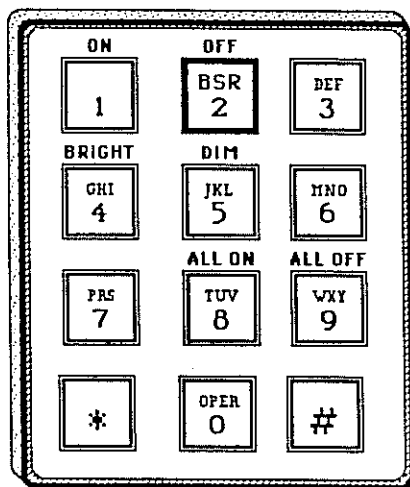
The Powerhouse control unit may operate similarly to the Heathkit GD-1530, but, in addition, it offers more sophisticated modes of operation. It can be connected to a computer for programming purposes, then operated on a scheduled basis off-line, freeing the computer for other uses. In the ShackMaster application, however, it operates as a dedicated slave.

The Powerhouse serial port (DIN connector pin 2) connects to ShackMaster Serial Output Port #1 (Logic connector pin 16). Ground from the Powerhouse (DIN connector pin 3) connects to ShackMaster's ground (Logic connector pin 13 or 25).

House Code

ShackMaster initially assumes House Code "A". Chapter 13, "Programming ShackMaster", describes how to modify the House Code to any code from A-P.

Commanding the X-10 System



The X-10 modules are commanded by sending Touch-Tone commands to ShackMaster. Up to 16 unit codes are supported for off, on, dim, and bright. In addition, all lamps may be turned on and all devices may be turned off. The Touch-Tone commands are

ON	[your prefix] 2 [unit code] 1
OFF	[your prefix] 2 [unit code] 2
BRIGHT	[your prefix] 2 [unit code] 4
DIM	[your prefix] 2 [unit code] 5
ALL ON	[your prefix] 2 8
ALL OFF	[your prefix] 2 9

ShackMaster responds to your command by saying the unit code and "on", "off", "B", "D", or "all on" or "all off".

Example: Suppose your command prefix is 123. To turn on your HF rig on an appliance module assigned unit code 3, enter 123 2 3 1. The response is "BSR Three, on".

Control from the Phone

The X-10 Shack Control system may be commanded from the phone with the same commands available over the air. The only difference is that the commands must be terminated with the # key.

[same as above] #

Keeping It Off

The X-10 system is compatible with normal use of lights and appliances. If the X-10 system had commanded a lamp off, you could turn the lamp back on with the normal lamp switch. The module is capable of sensing the fact that you're trying to turn it on, and kicks itself on.

Unfortunately, many appliances, when commanded *off* through the X-10 system, produce a kickback effect which appears like you're trying to *turn it back on locally*.

This effect can be eliminated by connecting two modules in series to such troublesome appliances. Whenever you command a module on, ShackMaster automatically sends the on command *twice*, which will turn on *both* modules.

Chapter 10

Crossband Linking

ShackMaster supports linking of the two VHF/UHF and the HF transceivers for crossband operation. This section describes the *commands* for operating the transceivers crossband.

VHF/UHF Listen/Transmit/Off

Commands for placing the *other* VHF/UHF rig in the "Listen Only" or "Listen/Transmit" modes are

↑
VHF/UHF Listen Only [your prefix] 7 1 [#]
VHF/UHF Listen/Trans. [your prefix] 7 2 [#]
VHF/UHF Off [your prefix] 7 3 [#]

When in VHF/UHF Listen/Transmit mode, you must return to VHF/UHF Listen Only by entering any single Touch-Tone key except * or #. (From the *telephone* or when operating *through a repeater*, you would enter any single key plus #.) At that point, you may enter the command to turn VHF/UHF Off.

HF Listen/Transmit/Off

Commands for placing the HF rig in the "Listen Only" or "Listen/Transmit" modes are

HF Listen Only [your prefix] 7 4 [#]
HF Listen/Transmit [your prefix] 7 5 [#]

When in HF Listen Only mode, the following commands apply

HF Listen/Transmit * [your prefix] 7 5 [#]
HF Off * [your prefix] 7 6 [#]

When in HF Listen/Transmit mode, you must return to HF Listen Only by entering any single Touch-Tone key. (From the *telephone* or when operating *through a repeater*, you would enter any single key plus #.) At that point, you may enter the command to turn HF Off.

Transmit Mode

When in a Listen/Transmit mode, the control window beep is changed to a high pitch as an indication of the transmit mode.

Only one of the two rigs may be activated at a time for crossband operation (either the *other* VHF/UHF rig or the HF rig). When transmit is enabled, ShackMaster keys the crossbanded rig when it detects your transmissions by the control transceiver's COS signal.

If activated through a repeater (with the # as an enter key), the * and # keys are used to push and release PTT, as with telephone access. In this mode, the control window is automatically widened to allow the VOX detector to detect your presence during the window.

Touch-Tone Muting

Touch-Tone commands to ShackMaster are muted through the crossband link so that you sound like a normal station to users on the crossbanded frequency. To pass Touch-Tone through the link, precede the sequence to be sent with the # key. For example, to send "12345" through the link, enter "# 12345". The sequence is ignored by ShackMaster, and the 12345 are allowed to pass. If the crossband transceiver was brought up with the # key, it is not possible to unmute Touch-Tones. When using a transceiver from the phone, all Touch-Tones except # are passed to the transmitter.

Changing VHF/UHF Transceiver Frequency

When crossbanding from one VHF/UHF transceiver to the other one, the frequency of the crossband rig may be changed if supported by your hardware. The commands are available when crossbanding in the Listen Only mode.

The means for controlling the transceiver frequency include

- 1) BCD data supplied by one of up to two FC-1 Frequency Control Boards,
- 2) Pulses applied to the up/down control at the transceiver's microphone jack, and
- 3) Serial ASCII data supplied to the transceiver.

FC-1 Frequency Control. The frequency is changed with the command

[your prefix] 7 MHTOF

"MHTOF" is the frequency representation as MHz, Hundreds kHz, Tens kHz, Ones kHz, and Offset. The Offset digit commands the transmitter frequency offset and is 1= minus, 2 = simplex, 3 = plus. ShackMaster responds by saying the new frequency and offset. This command is available only when in VHF/UHF Listen Only mode.

If a *second* FC-1 Frequency Control Board is cascaded to frequency control a second BCD controllable transceiver, then the command for changing the frequency of that transceiver is

[your prefix] 7 * MHTOF

Since either FC-1 can be wired to either transceiver, the appropriate frequency command isn't determined by Primary or Secondary transceiver, but rather by which FC-1 is wired to which transceiver.

Example: If your command prefix is 123, to command the crossband transceiver to 146.940-MHz, enter "123 769401". ShackMaster says, "Six point nine four, minus" and changes frequency.

Microphone Up/Down Control. The transceiver can be commanded to pulse up or down by a specified number of pulses. This is equivalent to pressing the up or down button on the microphone that number of times.

[your prefix] 7 1 (0-99) Pulse down 0-99 pulses
[your prefix] 7 3 (0-99) Pulse up 0-99 pulses

Serial ASCII Control. If the transceiver supports an ASCII serial connection to ShackMaster, the frequency, mode, and memories may be controlled. Refer to the appendix which details the interface to your specific transceiver.

Controlling the HF Transceiver

ShackMaster directly interfaces to several popular, externally controllable HF transceivers. A programming command (Chapter 13, "Programming ShackMaster") allows you to tell ShackMaster which transceiver you have connected. See the appendices for the specific hardware connections to various transceivers.

The HF Listen Only mode is unique in that a variety of commands are accessed without a command prefix, whether or not the user command prefix has been "bypassed". These include frequency, mode, and memory commands. While in HF Listen Only, all other commands may be accessed by preceding them with *.

While in the HF or VHF Listen/Transmit modes, any single Touch-Tone key except * or # returns ShackMaster to the HF Listen Only mode.

Changing HF Transceiver Frequency

Frequency control of the HF rig includes provisions for direct frequency entry, scanning up and down, and bumping frequency up and down in small increments. The commands available in HF Listen Only mode are

Direct Frequency	(x)xxxx(.)x
Scan Up Slow	3
Scan Up Medium	33
Scan Up Fast	333
Scan Down Slow	1
Scan Down Medium	11
Scan Down Fast	111
Stop Scan	2 (or just key down)
Bump Up 20 Hz	A
Bump Down 20 Hz	B
Bump Up 100 Hz	6
Bump Down 100 Hz	4
Bump Up 500 Hz	9
Bump Down 500 Hz	7
VFO A/B Alternate	5
Split	5x
Normal	5x
Interrogate Frequency	8
Access To All Others	* [other]

Direct frequency entry should include the 100's Hz digit - i.e. 7.255 MHz is entered as "72550". Resolution to 20 Hz is available using the "Bump" commands.

Multiple "Bump" commands may be entered in a single transmission. For example, entering 99999 moves the frequency up 2500 Hz.

While scanning, the control window period is automatically changed to 2 seconds to allow stopping near a desired signal. Operating full duplex allows stopping scanning instantly.

Changing Transceiver Mode

If supported by the selected rig and your hardware connection, the rig's mode may be changed when in HF Listen Only with the command

1 [mode]

2 = AM narrow

3 = FM

4 = AM

5 = LSB

6 = CW narrow

7 = RTTY

8 = USB

9 = CW wide.

Selecting Transceiver Memory

When supported by the selected rig and its hardware interface, the rig's memories may be recalled with the command

2 [memory 0-99]

The transceiver's memories may store frequency, mode, and other parameters depending on the rig and the hardware connection. To return to VFO after a memory is recalled, enter the VFO A/B command.

Storing Transceiver Memory

When supported by the selected rig and its hardware interface, the current frequency (or frequencies), mode, and other parameters may be stored into a memory with the command

2 * [memory 0-99]

Timers

ShackMaster's timeout timer will time out during crossband linking if either transmitter transmits continuously for three minutes (excluding control windows). Approaching timeout is indicated by changing of the beep just before the control window from a single beep to three beeps. When operating full duplex, a series of beeps indicate impending timeout.

If allowed to time out, all transmitters are disabled, and the timeout condition must

7.288.00

be cleared by entering any Control Operator level command. See Chapter 14, "Selecting Operational Modes", for examples of Control Operator level commands.

When listening to continuous crossbanded activity, you must grab a control window at least every three minutes, or ShackMaster will assume a failure of the control link and time out. If *you* transmit continuously for three minutes, ShackMaster will time out as well.

Modifying the Control Window

The control window timing may be modified with a Touch-Tone command. It may be desirable to reduce the frequency of the window during a period of extended casual listening. The command while in HF Listen Only mode is

0 (seconds, 1-60)

Example: To extend the window to once every 15 seconds, enter "0 15".

Specifying the "Return to Listen Only" Key

This capability is used only if your voice tends to false ShackMaster's Touch-Tone decoder, inadvertently returning you to Listen Only mode. Whenever in a Listen/Transmit mode, it's necessary to return to Listen Only in order to enter further commands. You may enter any single key except * or # to return to Listen Only. In order to avoid inadvertently getting out of the transmit mode, you may specify a particular digit instead. The digit selected should be one which your voice does not false. You can use the Pad Test feature to help determine which key or keys your voice tends to false. Specify the "Return to Listen Only" key with the command

[your prefix] 7 * [key] [#]

Half Duplex and Full Duplex

Crossband linking operation normally would take place on a simplex frequency, or through a repeater, into the control transceiver at your shack. With one control transceiver, you couldn't transmit and receive at the same time - you'd be in *half duplex* operation.

While ShackMaster is transmitting crossband activity from your station, it can't also listen at the same time. A "control window" is therefore generated by ShackMaster, similar to ShackPatch and PersonalPatch operation. While ShackMaster is transmitting crossband activity, it interrupts its transmission every few seconds to allow you to break in to enter commands. Of course, if there's no crossband activity, such that ShackMaster isn't transmitting at the moment, it's listening for your commands.

A *full duplex* mode for HF operation is supported by ShackMaster as well. If you have two VHF/UHF transceivers at your station, this mode allows you to take advantage of both. In the full duplex mode, the secondary transceiver retransmits HF crossband activity continuously without inserting a control window. The primary transceiver always listens for your commands, and for you, to be retransmitted over the HF rig.

For example, full duplex operation could involve a 440 MHz primary link for sending commands and your crossbanded transmissions to ShackMaster, while a secondary 220 MHz channel lets you listen to the HF receiver continuously.

Selecting full duplex HF operation is done with a Control Operator level command described in Chapter 14, "Selecting Operational Modes". ShackMaster powers

up in the half duplex mode. Full or half duplex may be selected with the command

Full duplex [COP prefix] 24 [#]
Half duplex [COP prefix] 23 [#]

Sample Crossband Session

Let's go through a typical operating session, linking from our control transceiver on a simplex channel to HF.

Bring up HF in Listen Only (prefix 7 4)
Go to 40 meters 7.240 MHz (72400)
Scan down medium (11)
Stop when we hear a desired signal (2)
Ask where we are (8)
Bump up a few hundred Hertz (666)
Enable HF Listen/Transmit (* 7 5)
Call and work the station
Return to Listen Only (5 or any key)
Go to 20 meters 14.210 MHz (142100)
Select USB (1 8)
Change antenna select r/c output (* 9 11)
Rotate beam west (* 4 270)
Enable HF Listen/Transmit (* 7 5)
Call CQ and work a station
Return to Listen Only (5 or any key)
Turn off HF link (* 7 6)

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. This is essential for ensuring the integrity of the financial statements and for providing a clear audit trail.

2. The second part of the document outlines the various methods used to collect and analyze data. These methods include interviews, surveys, and focus groups, each of which has its own strengths and limitations.

3. The third part of the document describes the process of identifying and measuring the variables of interest. This involves a careful selection of indicators that are both relevant and reliable.

4. The fourth part of the document discusses the importance of ensuring the validity and reliability of the data. This requires a thorough understanding of the measurement process and the potential sources of error.

5. The fifth part of the document outlines the various statistical techniques used to analyze the data. These techniques include regression analysis, factor analysis, and cluster analysis, among others.

6. The sixth part of the document discusses the importance of interpreting the results of the analysis in a meaningful way. This requires a clear understanding of the limitations of the data and the methods used.

Chapter 11

Telephone Access - Part 2

All three transceivers connected to ShackMaster may be operated from the phone. Chapter 8, "Telephone Access - Part 1", described fixed frequency operation of the primary VHF/UHF transceiver from the phone. The secondary VHF/UHF rig, and the HF rig, may be operated as well (although only one may be selected at a time).

Commands

The Touch-Tone commands which control the selected transceiver are similar to those described in Chapter 10, "Crossband Linking". Normally, after calling ShackMaster, you would "bypass" the user command prefix, simplifying command entry. The commands for activating the rigs are

Primary Listen Only	[your prefix] 7 1 #
Primary Listen/Trans.	[your prefix] 7 2 #
Primary Off	[your prefix] 7 3 #
Secondary Listen Only	[your prefix] 7 7 #
Secondary Listen/Trans.	[your prefix] 7 8 #
Secondary Off	[your prefix] 7 9 #

When in Primary or Secondary Listen/Transmit mode, you must return to the Listen Only mode by entering any single Touch-Tone key except * or #, and a #. At that point, you may enter the command to turn Primary or Secondary Off.

HF Listen Only	[your prefix] 7 4 #
HF Listen/Transmit	[your prefix] 7 5 #

coop 27 BP
71#

*

When in HF Listen Only mode, the following commands apply

HF Listen/Transmit	* [your prefix] 7 5 #
HF Off	* [your prefix] 7 6 #
Access To All Others	* [other] #

When in Listen/Transmit modes, the * and # keys function as the PTT switch. Key PTT by pressing *, and release it by pressing #. You must return to HF Listen Only by entering any one Touch-Tone key and a #. At that point, you may enter the command to turn HF Off.

When in HF Listen Only mode, the frequency, mode, and memory commands are available, but are always terminated with #.

After turning off the transceiver, you may hang up with ShackMaster by entering

#.

Chapter 12

Other Goodies

A variety of additional remote control and diagnostic capabilities are provided by ShackMaster.

Touch-Tone Pad Test

Since all remote commands are entered into ShackMaster using Touch-Tone, it's important to verify that your pad encodes Touch-Tone properly and that ShackMaster can decode it. The Touch-Tone Pad Test instructs ShackMaster to read back a sequence of digits which you send. The Pad Test command is

[your prefix] 5 [any sequence] [#]

Example: If your command prefix is 123, to check your Touch-Tone pad, enter 123 5 123456789*0#. ShackMaster should read back the entire sequence except the #.

Talking S-Meter

While operating ShackMaster remotely over the air, particularly simplex, it can be helpful to know how well you're getting into your home station. You may connect an S-meter signal voltage from the control transceiver to ShackMaster at the logic connector, pin 20. You may read back your S-meter reading with the command

[user prefix] 8 [#]

The S-meter is calibrated from S0 to S9, corresponding to an input voltage of zero to five volts dc.

Example: If your command prefix is 123, to read back your S-meter reading into your home station, enter "123 8". ShackMaster responds by saying your meter reading, such as "S8".

Asking ShackMaster to QSY

The frequency of the control transceiver can be changed remotely if supported by the hardware interface. You might normally want ShackMaster to be listening on your favorite repeater. But what if you drive to an area not covered by that repeater? You may want to tell ShackMaster to listen elsewhere for you. Or perhaps you're near home and don't want to tie up the repeater - ShackMaster can QSY to a simplex frequency and wait for you there.

The command for changing the frequency of the control transceiver is

[your prefix] 7 MHTOF [#]

ShackMaster responds by saying, "(your call), QSY", and expects to hear from you on the new frequency with any valid command. If it doesn't hear you within two minutes, it'll return to the original frequency.

If a second FC-1 Frequency Control Board is connected to ShackMaster to frequency control a second BCD controllable transceiver, then the command for changing the frequency of that transceiver is

[your prefix] 7 * MHTOF [#]

Two favorite frequencies may be programmed into ShackMaster's memory for easy QSY. They are called the "Home" and "Alternate" frequencies. Loading the frequency memories is described in Chapter 13, "Programming ShackMaster". ShackMaster *powers up* to the Home frequency. The memories are selected for QSY by the commands

Home [your prefix] 7 7 [#]
Alternate [your prefix] 7 8 [#]

Examples: Assuming your command prefix is 123, you may command your control transceiver to QSY to 223.5 MHz simplex with the command "123 7 35002". The command to QSY to the alternate frequency memory is "123 7 8".

Changing Control Transceiver between Primary and Secondary

Normally, the primary transceiver is considered the control transceiver - commands are entered and responses provided over that rig. You may command ShackMaster to switch control to the other transceiver (primary to secondary, or secondary to primary) with the command

[your prefix] 7 9 [#]

ShackMaster expects to hear from you on the other rig (with any valid command). If it doesn't hear from you within two minutes, it'll return to the original rig as the control transceiver.

Alternate and Abbreviated Command Codes

Normally, commands to ShackMaster consist of your unique command prefix followed by digits which tell ShackMaster exactly what to do. The command prefix offers you security for your system and allows many ShackMasters to be listening on the same frequency without accidentally activating the wrong one.

If it should become necessary, you can remotely select an alternate command prefix. Both prefixes may be programmed to any sequence you'd like, as described in Chapter 13, "Programming ShackMaster".

If your system is inherently secure, or there are no command interference problems, or when operating from the phone, you may simplify operation by eliminating the need for the prefix as part of the command.

These are Control Operator level selections, described in more detail in Chapter 14, "Selecting ShackMaster Operational Modes". The prefix options may be selected with the commands

[COP prefix] 25 Select normal prefix
[COP prefix] 26 Select alternate prefix
[COP prefix] 27 Bypass prefix

General Purpose Remote Control

ShackMaster offers logic outputs available for Touch-Tone remote control. This capability is useful for remotely switching antennas, turning on a power amp, or controlling other equipment in your shack.

Three outputs (expandable to eight with the optional FC-1 Frequency Control Board) are available directly at ShackMaster's logic connector, while additional outputs are made available using the FC series control boards. The commands for controlling the remote control logic outputs are

[your prefix] 9 [output 1-8] [1 on,0 off] [#]

Example: If your command prefix is 123, command output 4 on with "123 9 4 1". ShackMaster responds by saying, "Remote control four, on".

The outputs may be interrogated with

[your prefix] 9 [output 1-8] [#]

An alternate mode may be selected (with a programming command) which causes outputs 5-8 to function somewhat differently than direct command. In the alternate mode, outputs 5 and 6 may be commanded off immediately with #. Outputs 7 and 8 are on while ShackMaster is decoding Touch-Tone C and D, respectively. These alternative control outputs are useful for controlling special

equipment, like a transceiver with limited external control capability.

Antenna Rotor Control

An antenna rotor may be controlled remotely through ShackMaster, using Touch-Tone commands. The RCB-2 Rotor Control Board may interface to several popular rotor control units.

The commands supported by ShackMaster through the RCB-2 include

Left	[your prefix] 4 1 [#]
Right	[your prefix] 4 3 [#]
Stop	[your prefix] 4 2 [#]
Go	[your prefix] 4 (degrees) [#]
Interrogate	[your prefix] 4 [#]

Example: Assuming your command prefix is 123, you may command the rotor to northeast (45°) with the command "123 4 45". Rotate left (ccw) with "123 4 1", and stop with "123 4 2".

Manual ID

ShackMaster handles the ID task for the control transceiver operating from home. It will always generate a "cleanup ID" within several minutes of completion of your activity. If you'd like to "put ShackMaster to bed", or otherwise cause an ID to be generated, enter the command

[your prefix] 1 [#]

584

Remember that ShackMaster will not answer the phone when you're using it from over the air. It considers you to be done following an automatic "cleanup ID", or following a manually requested ID.

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Chapter 13

Programming ShackMaster

ShackMaster contains a non-volatile memory capable of remembering customized information such as your call sign for IDs, your choice of command code prefixes, and other options.

The information is programmed into ShackMaster's memory with simple Touch-Tone commands from a local Touch-Tone microphone, or through the control transceiver. For security, the information cannot be changed remotely.

All of ShackMaster's Programming Commands result in storage in its non-volatile memory. The information is stored permanently until changed with another programming command.

Unlocking ShackMaster

To enable the programming mode, press the Answer button on the front panel for ten seconds - until ShackMaster responds with "UL" (unlock). While unlocked, commands to ShackMaster are interpreted as *programming* commands - user and Control Operator level commands are not recognized.

ShackMaster may be locked back up by entering # from the local microphone or through the control transceiver. If you forget to lock it back up, it will automatically lock after a minute of no valid programming commands.

Call Sign ID

The ID message produced over the control transceiver is generated in synthesized speech and may be up to 8 characters, including "This is", remote, base, and letters and numbers. The Touch-Tone representation of the letters and numbers is based on their position on a normal telephone keypad. For example, "W" is represented by 91, since it's on key 9 and is the first letter on the key. "A" is represented by 21. The number "6" is represented by 06.

To load your call sign with ShackMaster "unlocked", enter *100 followed immediately by the Touch-Tone representation of your call sign message from the local microphone or through the control transceiver. When you unkey, ShackMaster should read back your ID.

Call Sign *100 (Touch-Tone digits)

Example: To load the ID message "This is WA6AXX, remote", press the Answer button until ShackMaster says, "UL". From the Touch-Tone local microphone or into the control transceiver (from another rig such as a handheld) enter "*100 30 91 21 06 21 92 92 40" all as one transmission. ShackMaster should read back "This is WA6AXX, remote".

A	21	R	72	8	08
B	22	S	73	9	09
C	23	T	81		
D	31	U	82	Pause	20
E	32	V	83		
F	33	W	91		
G	41	X	92	This is	30
H	42	Y	93		
I	43	Z	90		
J	51	0	00	Remote	40
K	52	1	01		
L	53	2	02		
M	61	3	03	Base	50
N	62	4	04		
O	63	5	05		
P	71	6	06		
Q	70	7	07		

Command Codes

Three command code prefixes may be stored in ShackMaster's memory. They are the Normal User command prefix, the Alternate User command prefix, and the Control Operator level prefix. The Normal User and Alternate prefixes may be one to six digits, and the Control Operator prefix may be one to eight digits. They may include any Touch-Tone keys except #.

With ShackMaster unlocked, enter the prefix by entering the programming command immediately followed by the desired prefix.

Normal User Cmd. Prefix *101(prefix)
Alternate User Cmd. Prefix *102(prefix)
Control Op Command Prefix *103(prefix) = 100

Example: Define the Normal User command prefix to be 123. Unlock ShackMaster by pressing the Answer button until it says, "UL". Enter "*101 123". ShackMaster should say, "CMD 123" in the local speaker.

PersonalPatch Autodial Number

While ShackMaster is unlocked, the autodial number is entered with the command *104 followed immediately by the telephone number. The phone number may be up to 8 digits.

***104(phone number)**

Example: Load phone number 727-3330. With ShackMaster unlocked, enter "*104 7273330". ShackMaster should respond by saying "Autodial 7273330".

Timers

The patch overall and activity timers, and the control window delay and period timers may be changed. The overall and activity timers and the control window delay timers are programmed in seconds, while the control window period timer is programmed in milliseconds.

A typical patch overall timer might be 3 minutes, with the activity timer at 45 or 60 seconds. The control window *delay* timer determines how frequently you're given the opportunity to grab ShackMaster's attention when your station is transmitting during a ShackPatch or PersonalPatch, or during crossband linking. The control window *period* should be set long enough to allow the control transceiver to reliably switch to receive and produce a COS signal if a signal is present on the receive frequency.

Patch Overall Timer *105(seconds)
Patch Activity Timer *106(seconds)
Control Window Delay *107(seconds)
Control Window Period *108(ms)

Example: Set the control window period to 300 ms. With ShackMaster unlocked, enter "*108 300". ShackMaster responds by saying, "C W P Timer".

Control Transceiver Memories

The control transceiver home and alternate memories can be programmed with the commands *109 or *110, followed by the frequency and offset.

Home Frequency *109(MHTOF)
Alternate Frequency *~~109~~(MHTOF)
*110

Example: Program the "Home" frequency memory to 440.025 MHz with a plus transmit offset. Enter "*109 00253". ShackMaster should respond by saying, "Home frequency, 0 point 025, plus".

X-10 House Code

The X-10 system House Code may be changed to any value from A-P with the command *111xx, where xx represents the letter A-P as defined for editing the call sign ID message.

*111(xx)

Example: To change the BSR House Code to D with ShackMaster unlocked, enter "*111 31". ShackMaster responds by saying, "BSR, D".

Receiver COS Sense

The COS logic sense (high true or low true) of each of the receivers may be selected. A 1 selects high true, a 0 selects low true.

Primary *112(1/High,0/Low)
Secondary *113(1/High,0/Low)
HF *114(1/High,0/Low)

Example: To set the secondary transceiver COS logic sense to low true with ShackMaster unlocked, enter "*113 0".

Phone Answer Mode

The Normal Mode or Answering Machine Mode may be selected (see Chapter 8, "Telephone Access, Part 1").

***115(1/Ans. Mach., 0/Normal)**

Example: To set the Answering Machine Mode with ShackMaster unlocked, enter "*115 1".

Remote Control Mode

The Normal or Alternate Mode for the remote control logic outputs may be selected when using the FC-1 Frequency Control Board. Otherwise, three outputs are available directly at ShackMaster's logic connector.

***116(2/At Logic Connector,
1/FC-Alternate,0/FC-Normal)**

Example: To set the Alternate Mode with ShackMaster unlocked, enter *116 1".

Telephone Signalling

The signalling into the phone line by PersonalPatch may be programmed to be DTMF (Touch-Tone) or dial pulse. If your phone is a Touch-Tone phone, select DTMF, otherwise select dial pulse.

***117(1/DTMF,0/Dial Pulse)**

HF Transceiver Select

The HF transceiver supported by ShackMaster is selected with this command. Refer to the appendix describing the hardware interface for the particular rig used.

- *118 (0 / ICOM IC751(A)**
- 1 / Yaesu FT757GX**
- 2 / Yaesu FT980**
- 3 / ICOM Bus**
- 4 / Kenwood TS440S/TS940S**
- 5 / Yaesu FT767**
- 6 / ICOM IC735)**

Example: Select the Yaesu FT757GX as the HF transceiver. Enter "*118 1". ShackMaster responds by saying, "FT757GX".

Programming Command Summary

<u>Command</u>	<u>Description</u>
*100	Call Sign
*101(prefix) 4 444	Normal Command Code Prefix
*102(prefix) 4	Alternate Command Code Prefix
*103(prefix) 4 44	Control Operator Command Prefix
*104(phone number)	PersonalPatch Autodial Number
*105(seconds)	Patch Overall Timer (seconds)
*106(seconds)	Patch Activity Timer (seconds)
*107(seconds)	Control Window Delay (sec.) —
*108(milliseconds)	Control Window Period (ms)
*109(freq., MHTOF)	Control Transceiver "Home" Freq.
*110(freq., MHTOF) 145.730 \$	Control Transceiver "Alt." Freq.
*111(XX)	BSR House Code (A-P)
*112(1/High,0/Low)	Primary Transceiver COS Logic Sense
*113(1/High,0/Low)	Secondary Transceiver COS Logic Sense
*114(1/High,0/Low)	HF Transceiver COS Logic Sense
*115(1/Ans. Mach.,0/Normal)	Phone Answer Mode
*116(2/At connector, 1/FC-1 Alternate, 0/FC-1)	Remote Control Logic Output Mode
*117(1/DTMF,0/Dial Pulse)	Telephone Signalling
*118 (0 / ICOM IC751(A)	HF Transceiver Select
1 / Yaesu FT757GX	
2 / Yaesu FT980	
3 / ICOM Bus	
4 / Kenwood TS440S/TS940S	
5 / Yaesu FT767	
6 / ICOM IC735)	

Chapter 14

Selecting Operational Modes

Many of ShackMaster's features may be enabled and disabled remotely to allow you, the Control Operator, comprehensive remote control of your home station. The transmitters, patches, and overall user level commands may be remotely enabled and disabled.

The Control Operator level commands consist of

[Control Op command prefix] [root code] [#]

The prefix is programmable as described in the previous chapter and the root codes are defined below. As always, the # terminator is required only over the phone or through a repeater with a long hang time.

The Control Op level commands are used relatively infrequently. The codes should be at your disposal in case they're needed, but obviously don't need to be memorized. The most often used commands would probably be "Select normal/alternate/bypass command prefix" and perhaps "Half/Full Duplex HF operation". Normal operation on a secure channel may be done in the "bypass command prefix" mode. This means that **[Your prefix]** is not needed, shortening the various commands and making ShackMaster easier to use.

**Control Operator
Command Summary**

<u>Root Code</u>	<u>Response</u>	<u>Description</u>
01	PE	PersonalPatch enable †
02	PD	PersonalPatch disable
03	TE	PersonalPatch and ShackPatch timer enable †
04	TD	PersonalPatch and ShackPatch timer disable
05	TR	PersonalPatch toll restrict †
06	TE	PersonalPatch toll enable
07	SE	ShackPatch enable †
08	SD	ShackPatch disable
09	CE	User Command enable †
10	CD	User Command disable
11	1E	Control from primary enable †
12	1D	Control from primary disable
13	2E	Control from secondary enable †
14	2D	Control from secondary disable
15	PE	Primary transmitter enable †
16	PD	Primary transmitter disable
17	SE	Secondary transmitter enable †
18	SD	Secondary transmitter disable
19	HE	HF transmitter enable †
20	HD	HF transmitter disable
21	TE	Telephone answer enable †
22	TD	Telephone answer disable
23	HD	Half duplex HF operation †
24	FD	Full duplex HF operation
25	NP	Select normal command prefix †
26	AP	Select alternate command prefix
27	BP	Bypass command prefix - 4
28	CC	Carrier control (non-PL) †
29	PC	PL for control op commands
30	PL	PL for all commands

† - Powerup default condition.

Chapter 15

ShackMaster and the Rules

Operation of ShackMaster involves several aspects of amateur radio new to many hams, such as remote control, auxiliary operation, radio control operation, and third party traffic. This chapter points you to the Part 97 FCC rules which relate to ShackMaster's features. Remember that the rules change from time to time. An excellent reference to the entire Part 97 rules is The FCC Rule Book from the ARRL.

Control Operator

Every amateur station must have a control operator who is responsible for the proper operation of the amateur station.

Most stations must be *manually* controlled - that is, the control operator must be present at all times at the control point of the station. (Certain stations are authorized to operate under *automatic* control, including repeaters, beacons, and stations operating digital modes above 50 MHz. The control operator need not be present at the control point of such stations.)

Two forms of manual control exist - *local* control and *remote* control (§97.3(m)):

(1) *Local control*. Manual control, with the control operator monitoring the operation on duty at the control point located at a station transmitter with the associated operating adjustments directly accessible.

(2) *Remote control*. Manual control, with the control operator monitoring the operation on duty at a control point located elsewhere than at the station transmitter, such that the associated operating adjustments are accessible through a control link.

The control link between the remote control point and the station transmitter may be effected by radio or wire. With ShackMaster, your remotely controlled home station operates under *remote, manual control*, with a radio or phone control link.

Auxiliary Operation

If your home station operates under remote, manual control while you're controlling it over the air, then what's *your* mode of operation? Radio remote control of another amateur station is called *auxiliary* operation. It's defined as (§97.3(l)):

Radio communication for remotely controlling other amateur radio stations, for automatically relaying the radio signals of other amateur radio stations in a system of stations, or for intercommunicating with other amateur radio stations in a system of amateur radio stations.

You're in auxiliary operation when you're controlling you home station or communicating through it. The control transmitter at your home station is also in auxiliary operation when communicating with you at your remote control point.

§97.86(d) All amateur frequency bands above 220.5 MHz, except 431-433 MHz and 435-438 MHz, are available for auxiliary operation.

Since you're physically located at the controls of your control transceiver, you're in *manual, locally controlled, auxiliary* operation.

Operation of a Station by Remote Control

Certain simple procedures are required by the rules when operating your home station remotely, as through ShackMaster.

§97.88 Operation of a station by remote control.

An amateur radio station may be operated by remote control only if there is compliance with the following:

(a) A photocopy of the license for the remotely controlled station shall be posted in a conspicuous place at the station location.

(b) The name, address, and telephone number of the remotely controlled station licensee and at least one control operator shall be posted in a conspicuous place at the remotely controlled transmitter location.

(c) ... a control operator shall be on duty when the station is being remotely controlled. Immediately before and during the periods the remotely controlled station is in operation, the frequencies used for emission by the remotely controlled station shall be monitored by the control operator. The control operator shall terminate all transmissions upon any deviation from the rules.

(d) Provisions must be incorporated to limit transmission to a period of no more than 3 minutes in the event of malfunction in the control link.

...

(f) The station records shall include during any period of operation:

(1) The names, addresses, and call signs of all persons authorized by the station licensee to be control operators; and

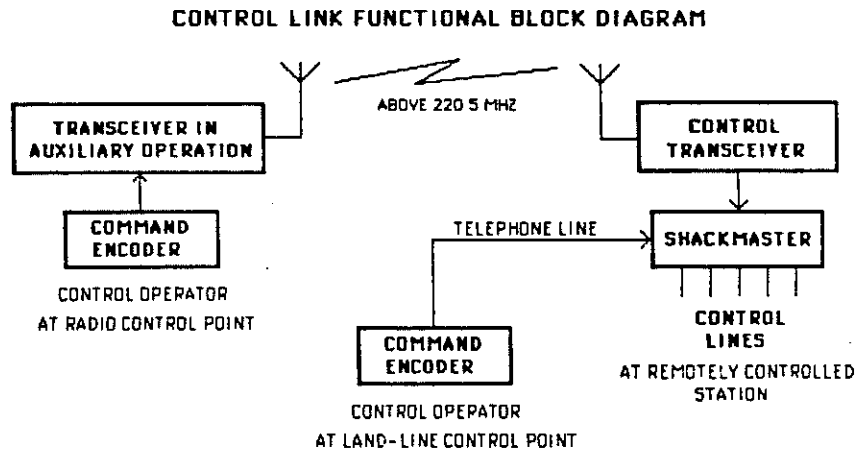
(2) A functional block diagram of the control link and a technical explanation sufficient to describe its operation

(g) Each remotely controlled station shall be protected against unauthorized station operation, whether caused by activation of the control link, or otherwise.

§97.90 System network diagram required.

When a station has one or more associated stations, that is stations in repeater or auxiliary operation, a system network diagram shall be included in the station records during any period of operation.

A typical functional block diagram of a control link is shown below.



Radio Control Operation

The rules permit the use of "one-way radio communication for remotely controlling objects or apparatus other than amateur radio stations", defined as *radio control operation*. Such operation is specifically permitted in §97.89 (Point of Communications):

(b) Amateur radio stations may transmit one-way signals to receiving apparatus while in beacon operation or radio control operation.

It is excluded from prohibition in §97.113 (Broadcasting ...):

- ✓ (d) The following one-way amateur transmissions are not considered broadcasting:
 - (1) Beacon or radiocontrol operation; ...

Note that this form of one-way communication is specifically permitted, and is not considered broadcasting, which is prohibited.

Third Party Traffic

Third party traffic is permitted in amateur radio, with several exceptions (certain international traffic, traffic involving material compensation, and business communications). Third party traffic is defined as (§97.3(v)):

Amateur radio communication by or under the supervision of the control operator at an amateur radio station to another amateur radio station on behalf of anyone other than the control operator.

In ShackMaster related operation, the first and second parties to the communications are your mobile/portable station and your home station. The third party is the person other than the control operator on whose behalf the communication takes place.

There are three forms of third party traffic - messages, participation through phone-line interconnection, and direct third party participation.

ShackMaster's Electronic Mailbox handles third party messages. They are originated by or for a third party and are transmitted by your amateur station on a delayed basis.

PersonalPatch is an example of third party participation through phone-line interconnection.

ShackPatch is a form of third party direct participation. You, as control operator, supervise the third party and make transmitter adjustments to ensure proper operation. Section §97.114 says:

(c) The licensee of an amateur radio station may not permit any person to participate in traffic from that station as a third party if:

(1) The control operator is not present at the control point and is not continuously monitoring and supervising the third-party participation to ensure compliance with the rules; ...

When operating ShackPatch, you, the control op, are present at the (remote) control point of your home station, insuring compliance with the rules though the control link. (Requirements of the control operator are that he be present at a *control point* of the station.)

The intent of the third party participation provision is "to allow persons who are not licensed Amateur radio operators to experience the benefits of this service and to stimulate their interest in Amateur radio" (Kowalski, 1984). Allowing family members to participate in amateur communications through ShackPatch should be accompanied by encouragement to ultimately obtain amateur licenses of their own.

Due to the technological limitations of synthesized speech, several of ShackMaster's mailbox messages are general purpose in nature, allowing you to preassign meanings. These messages

might be considered codes or ciphers, which are in general prohibited. However, depending on their intent, they are specifically permitted by the rules (§97.117).

"... generally recognized abbreviations ... are permissible as are any other abbreviations or signals where the intent is not to obscure the meaning but only to facilitate communications."

It would be good practice to record in your station records the meanings assigned to the general purpose messages, if used.

Crossband Linking Operation

The rules address the automatic retransmission of amateur radio signals, defined as (§97.3(x))

Retransmission of signals by an amateur radio station whereby the retransmitting station is actuated solely by the presence of a received signal through electrical or electro-mechanical means, i.e., without any positive action by the control operator.

For example, ShackMaster's crossband linking capability is considered automatic retransmission, while an amateur holding the microphone of a 20 meter transmitter to the speaker of a two meter receiver would be manual retransmission.

Your remotely controlled home HF transmitter, crosslinked from VHF/UHF, is *not* in auxiliary operation. Allowing a friend to be retransmitted through the control transceiver to another band requires his station to be shown on the system network diagram.

§97.126 Retransmitting radio signals.

(a) An amateur radio station, except a station in repeater operation or auxiliary operation, shall not automatically retransmit the radio signals of other amateur radio stations.

(b) A remotely controlled station, other than a remotely controlled station in repeater operation or auxiliary operation, shall automatically retransmit only the radio signals of stations in auxiliary operation shown on the remotely controlled station's system network diagram.

When operating crossband to HF, you are the control operator for your remotely controlled home station. Aside from the question of retransmitting radio signals, another point is significant regarding allowing others in auxiliary operation to operate your station crossband. Anyone other than the *control operator* of the home station is a third party, which means that amateurs other than the control operator may not work foreign stations in countries which don't have a third-party-traffic agreement with the U.S. Of course, if they're assigned to be control op's, and are shown on the system network diagram, they may.

Summary

ShackMaster's features, and the types of operation involved, are summarized below.

Crossband Linking

Home station: Crossband linked transmitter is in manual, remote control by radio link. Control transmitter is in auxiliary operation.

Remote station: Manual, locally controlled auxiliary operation.

Telephone Access

Home station: Manual, remote control by wire link.

Electronic Mailbox (accessed over the air)

Third party traffic, messages. Also auxiliary operation when home station confirms command entry or reads outgoing mail.

BSR Shack Control Radio control operation.

Also auxiliary operation when home station confirms command entry.

ShackPatch Third party traffic, direct participation. Also auxiliary operation.

PersonalPatch Third party traffic, telephone interconnection. Also auxiliary operation.

Guidelines

The ARRL offers guidelines which apply to phone patches and autopatches. Quoting portions:

"It is the policy of the American Radio Relay League to safeguard the prerogative of amateurs to interconnect their stations, including repeaters, to the public telephone system. An important element of this defense is encouraging amateurs to maintain a high standard of legal and ethical conduct in their patching activities. It is to this end that these guidelines are addressed."

"Phone patches or autopatches involving the business affairs of any party must not be conducted at any time. The content of any patch should be such that it is clear to any listener that business communications is not involved."

"Phone patches and autopatches should never be made solely to avoid telephone toll charges. Phone patches and autopatches should never be made when normal telephone service could just as easily be used."

"Phone patches and autopatches must be terminated immediately in the event of any illegality or impropriety."

"Phone patches and autopatches should be kept as brief as possible, as a courtesy to other amateurs; the amateur bands are intended to be used primarily for communication among radio amateurs."

Glossary

- activity timer** Timer that operates during a ShackPatch or PersonalPatch and which times out the patch when no signal is received on the control channel for a period of time.
- automatic control** The use of devices and procedures for control so that a control operator does not have to be present at the control point at all times. Does not apply to ShackMaster operation.
- auxiliary operation** Radio communication for remotely controlling other amateur radio stations, for automatically relaying the radio signals of other amateur radio stations in a system of stations, or for intercommunicating with other amateur radio stations in a system of amateur radio stations.
- BSR** Manufacturer of home appliance control system.
- control** Techniques used for accomplishing the immediate operation of an Amateur Radio station.
- control link** Apparatus for effecting remote control between a control point and a remotely controlled station.
- control operator** An amateur radio operator designated by the licensee of an amateur radio station to also be responsible for the emissions from that station.
- control point** The operating position of an amateur radio station where the control operator function is performed.
- control transceiver** The primary or secondary VHF/UHF transceiver connected to ShackMaster which serves as the control link.
- control window** A brief interruption in the control transceiver transmission from the home station during ShackPatch, PersonalPatch, or crossband linking activity, which allows the Control Op to be recognized by ShackMaster for exercising control.
- COS** Carrier-operated-switch. Logic signal from a receiver which indicates the presence of a received signal.
- Crossband Linking** ShackMaster's capability which allows operation on other frequency bands through a radio link.
- duplex** Two-way radio operation on a pair of frequencies.
- Electronic Mailbox** ShackMaster's function for handling third party messages through your amateur station on a delayed basis.
- full duplex** The ability to transmit and receive simultaneously.
- half duplex** The ability to transmit or receive, but not simultaneously.
- high true** Logic characteristic where the high state indicates active function.
- incoming mail** Third party traffic message sent by the mobile/portable to the shack or telephone through the Electronic Mailbox.
- local control** Manual control, with the control op monitoring the operation on duty at the control point located at a station transmitter with the associated operating adjustments directly accessible.
- locked** ShackMaster's normal state when its programming commands are not accessible.

low true Logic characteristic where the low state indicates active function.

mail Third party traffic messages handled through ShackMaster's Electronic Mailbox.

mailbox see Electronic Mailbox

MHTOF VHF/UHF frequency representation as MHz, hundreds kHz, tens kHz, ones kHz, and offset (1=minus, 2=simplex, 3=plus).

outgoing mail Third party traffic message sent from the shack or telephone to the mobile/portable through the Electronic Mailbox.

overall timer Timer which operates during ShackPatch or PersonalPatch which limits the overall duration of the patch.

PersonalPatch ShackMaster's simplex autopatch capability.

PL Private Line. Subaudible signalling tone.

primary transceiver A VHF/UHF transceiver which may be connected to ShackMaster.

PTT Push-to-talk. Transmitter on/off control input.

QSY Change frequency.

radio control operation One-way communication for remotely controlling objects or apparatus other than amateur stations.

remote base Remotely controlled amateur radio base station.

remote control Manual control, with the control operator monitoring the operation on duty at a control point located elsewhere than at the station transmitter, such that the associated operating adjustments are accessible through a control link.

secondary transceiver A second VHF/UHF transceiver which may be connected to ShackMaster.

ShackPatch ShackMaster's remotely controlled intercom into the shack.

simplex Two-way radio operation on a single frequency.

simplex autopatch A radio telephone interconnect which operates on a single frequency.

squelch Circuit which mutes receiver audio when no signal is present.

Telephone Access ShackMaster's capability for allowing operation of the home station remotely from a Touch-Tone telephone.

third party traffic Amateur radio communication by or under the supervision of the control operator at an amateur radio station to another amateur radio station on behalf of anyone other than the control operator.

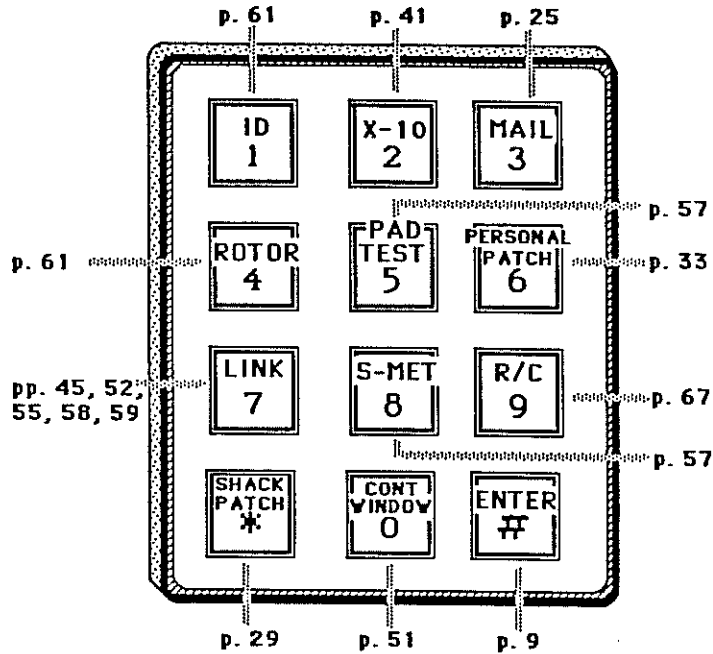
unlocked ShackMaster's programming mode.

vox Voice actuated operation.

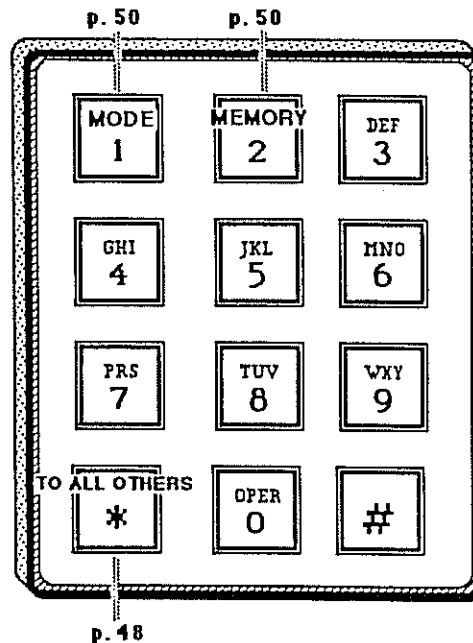
X-10 BSR's trade name for its home appliance control system.

Appendix I Command Summary

User Command Summary



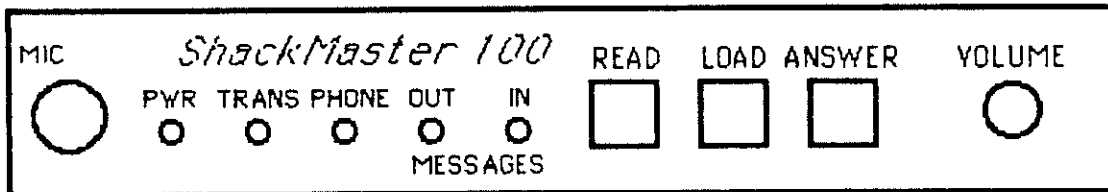
HF Listen Only Command Summary



(see p. 49 for frequency, scan, bump, etc.)

Appendix II Controls, Indicators, Connectors, Schematic

FRONT PANEL CONTROLS, INDICATORS, CONNECTORS



Local microphone jack

Power

Transmit

Phone offhook

Outgoing messages present

Incoming messages present

Read messages / Primary local

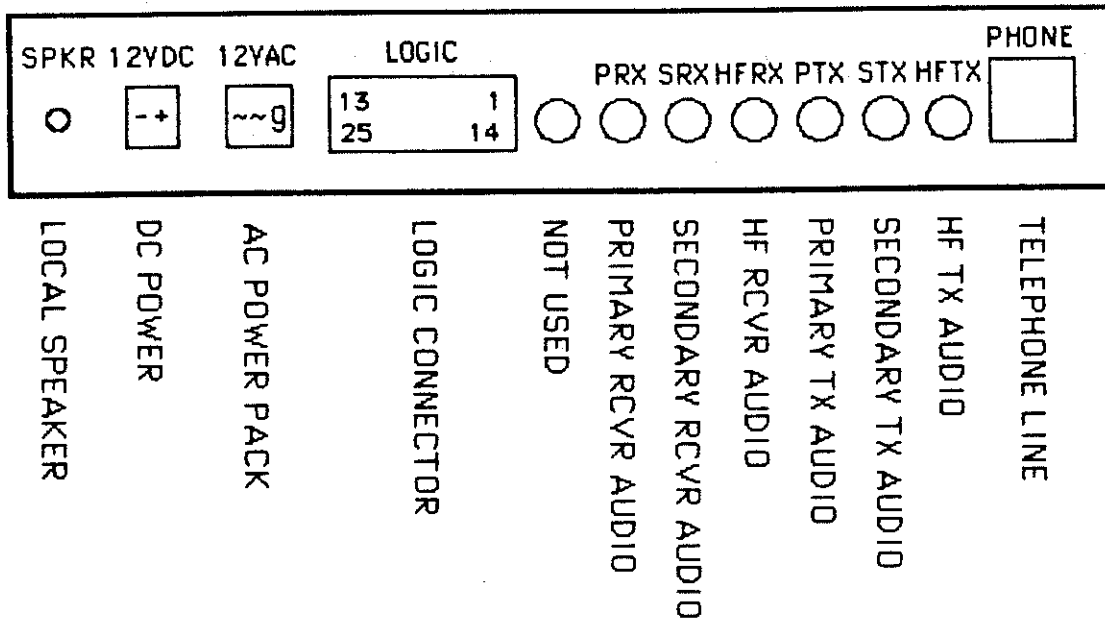
Load messages / Secondary local

ShackPatch answer / HF local / unlock

Local speaker volume control

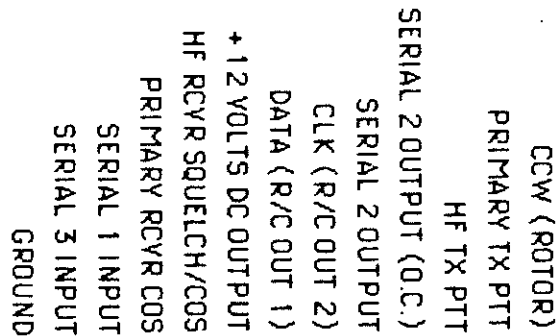
Microphone Connector		
Pin	PCB Conn.	Description
1	2	Transmit audio
2	1	+9 volts
5	3	PTT
6	5	PTT ground
7	4	Audio ground

REAR PANEL CONNECTORS

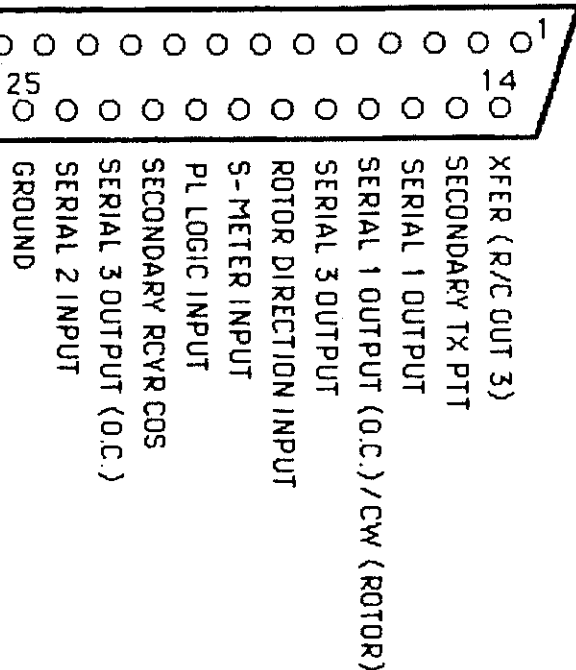


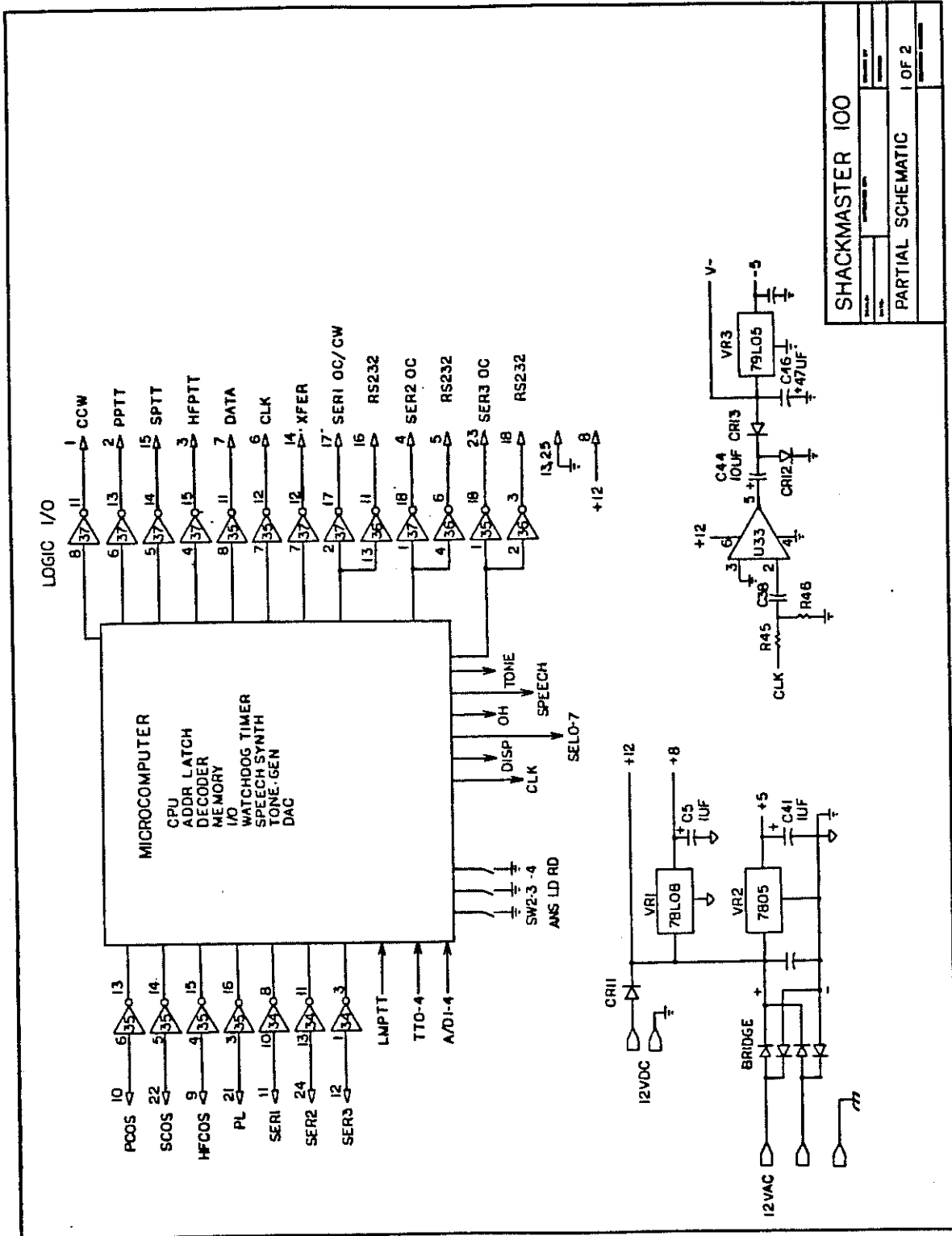
SIGNAL SPECIFICATIONS		
TYPE	I/O	SPECIFICATION
O.C.	OUTPUT	Open collector, 30V/100mA
RS-232	OUTPUT	RS-232C compatible
POWER	OUTPUT	8V, 50 mA, available for accessories
LOGIC	INPUT	Low=0-.8V, High=2.4-15V, Rin=10K
RS-232	INPUT	RS-232C compatible
ANALOG	INPUT	0-5V (12 volts abs. max.)

LOGIC CONNECTOR PINOUT



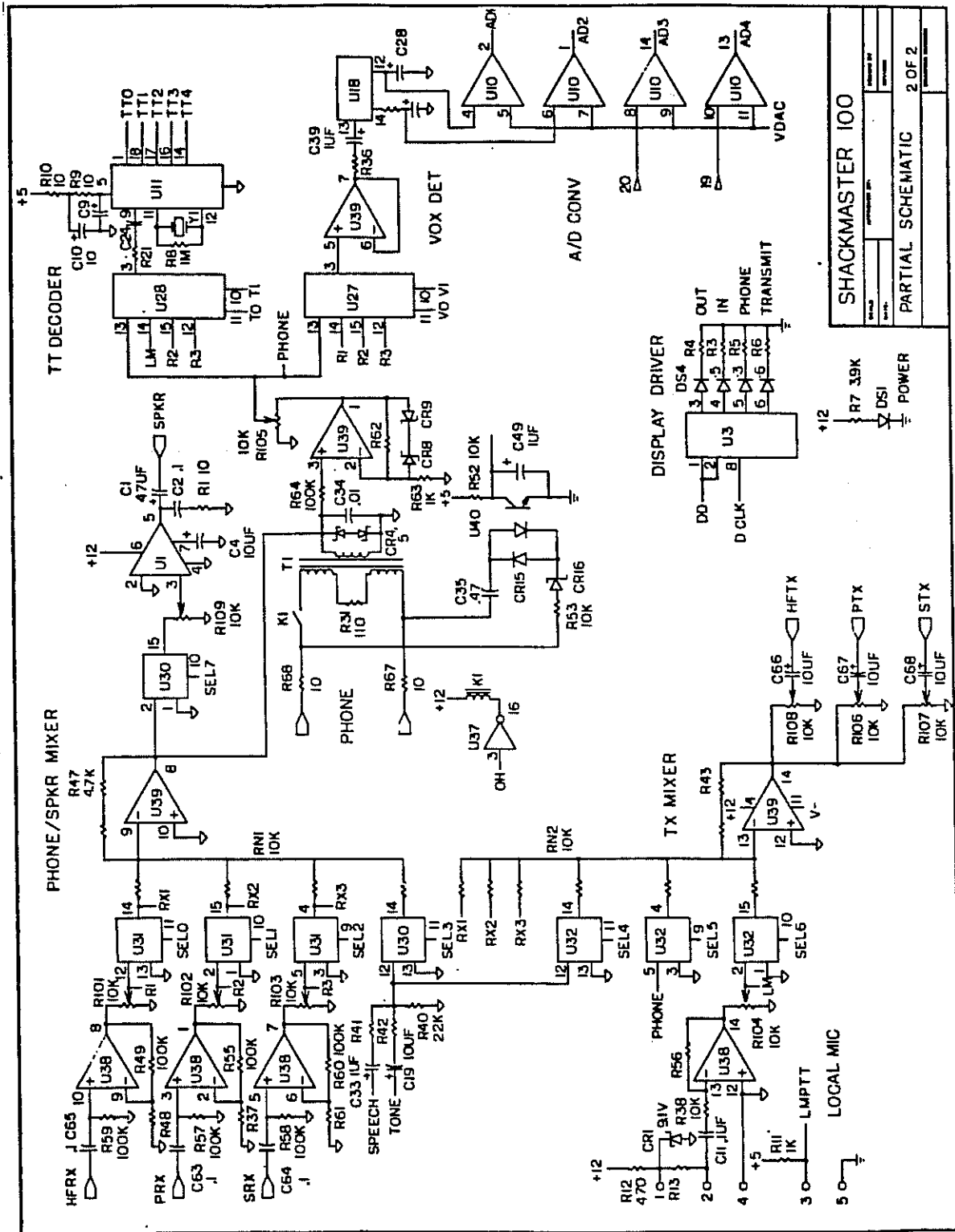
LOGIC CONNECTOR PINOUT			
PIN	INPUT	OUTPUT	DESCRIPTION
1		O.C.	Rotor Control CCW Output
2		O.C.	Primary TX PTT
3		O.C.	HF TX PTT
4		O.C.	Open Collector Serial Port #2 Output
5		RS-232	RS-232 Serial Port #2 Output
6		O.C.	Remote Control Output 2 (or CLK)
7		O.C.	Remote Control Output 1 (or DATA)
8		POWER	+8 Volts @ 50 mA
9	LOGIC		HF RX COS
10	LOGIC		Primary RX COS
11	RS-232		RS-232 Serial Port #1 Input
12	RS-232		RS-232 Serial Port #3 Input
13	-	-	Ground
14		O.C.	Remote Control #3 Output (or XFER)
15		O.C.	Secondary TX PTT
16		RS-232	RS-232 Serial Port #1 Output
17		O.C.	Open Collector Serial Port #1 Output or Rotor Control CW Output
18		RS-232	RS-232 Serial Port #3 Output
19	ANALOG		Rotor Control Direction Input
20	ANALOG		S-Meter Input
21	LOGIC		PL Logic Input
22	LOGIC		Secondary RX COS
23		RS-232	Open Collector Serial Port #3 Output
24	RS-232		RS-232 Serial Port #2 Input
25	-	-	Ground





SHACKMASTER 100

PARTIAL SCHEMATIC | OF 2



Appendix III

Finding a Squelch Signal

The squelch, or COS (carrier-operated-switch) signal from the receiver indicates when an rf signal is present at the receiver input. It serves several purposes in ShackMaster operation:

- The trailing edge of COS from the control transceiver tells ShackMaster to evaluate any Touch-Tone commands sent during the transmission.
- The COS signal is sampled by ShackMaster during the control window to see if you want to grab control during ShackPatch, PersonalPatch, or crossband linking.
- The COS signal activates the appropriate transmitter PTT during crossband linking operation.

[Operation without a COS signal connected to ShackMaster is possible, but the COS signal allows the most positive control. Without the COS signal, commands are evaluated following the # "enter" key; the VOX detector is checked during control windows; and crossband linked transmitters are controlled by */transmit and #/receive.]

In FM receivers, the squelch detect circuitry follows the discriminator, selectively amplifying high frequency noise which is present when no rf signal is at the receiver input. The high frequency noise is rectified to form a dc control signal, or COS logic signal. The signal internally gates the audio stages to mute audio to the speaker when no rf signal is present. In some transceivers, the signal is brought to an accessory connector - in others it must be brought out to be made available.

Many HF transceivers also have a squelch function, which is usually agc operated. In these rigs, the COS or squelch signal is usually available externally at an accessory connector.

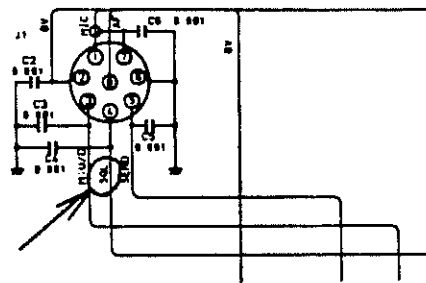
The COS or squelch signal will either go high or low when the receiver's squelch is open. A programming command allows you to tell ShackMaster which type of signal is available. High true means logic high when squelch open, low true is the opposite.

SAT 1 High

Several examples of common VHF/UHF transceivers are shown on the following pages, with appropriate pickoff points for a COS logic signal to drive ShackMaster.

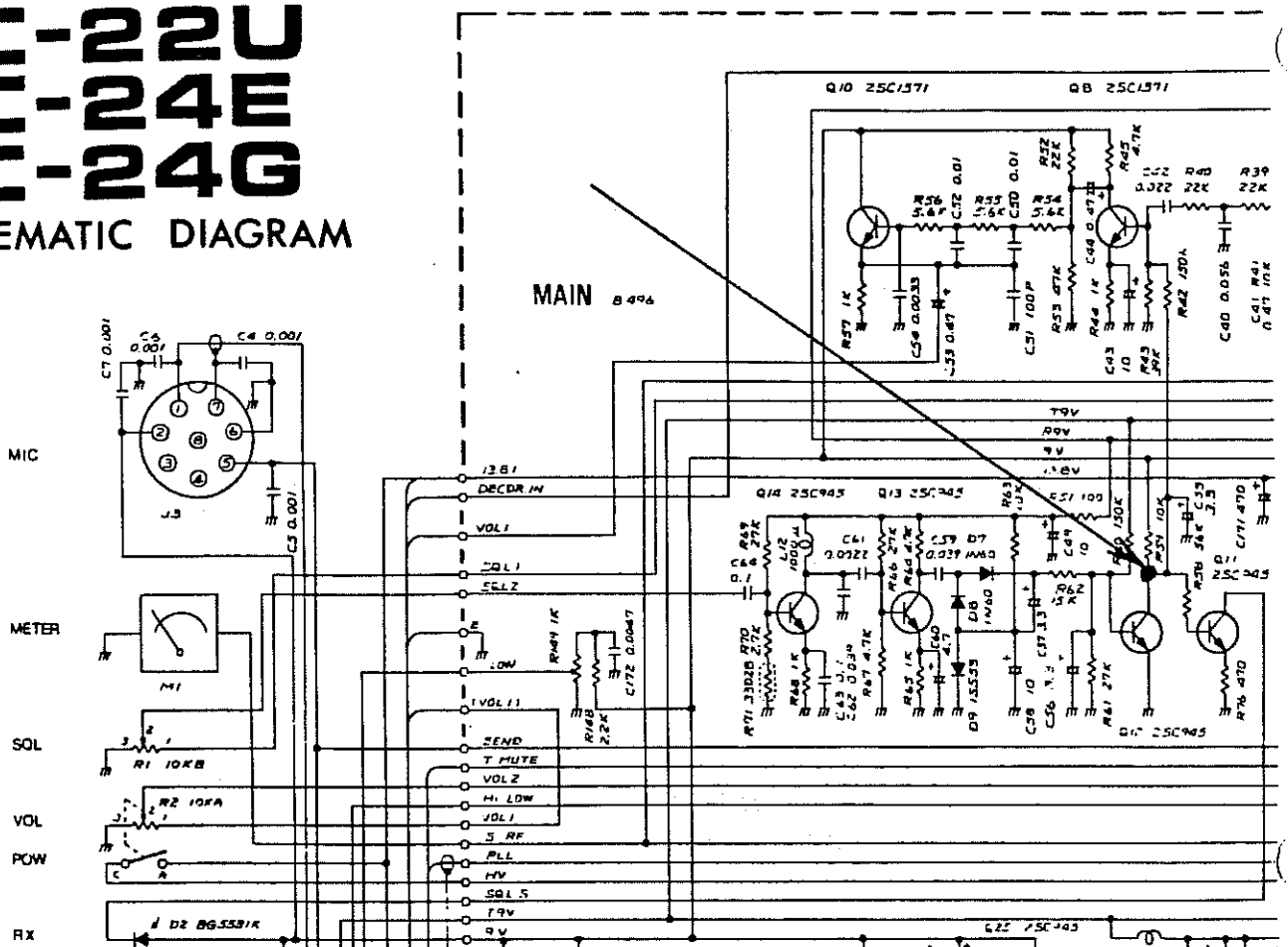
IC-120

SCHEMATIC DIAGRAM

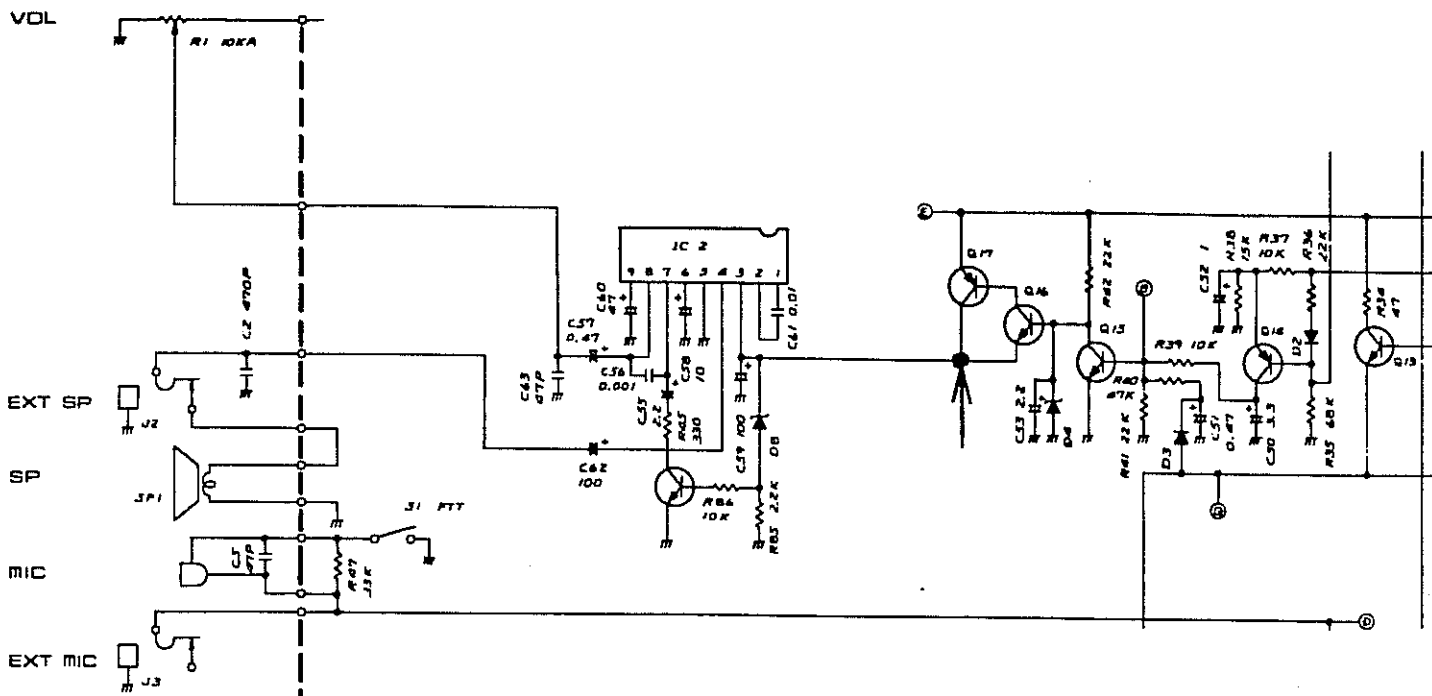


IC-22U IC-24E IC-24G

SCHEMATIC DIAGRAM



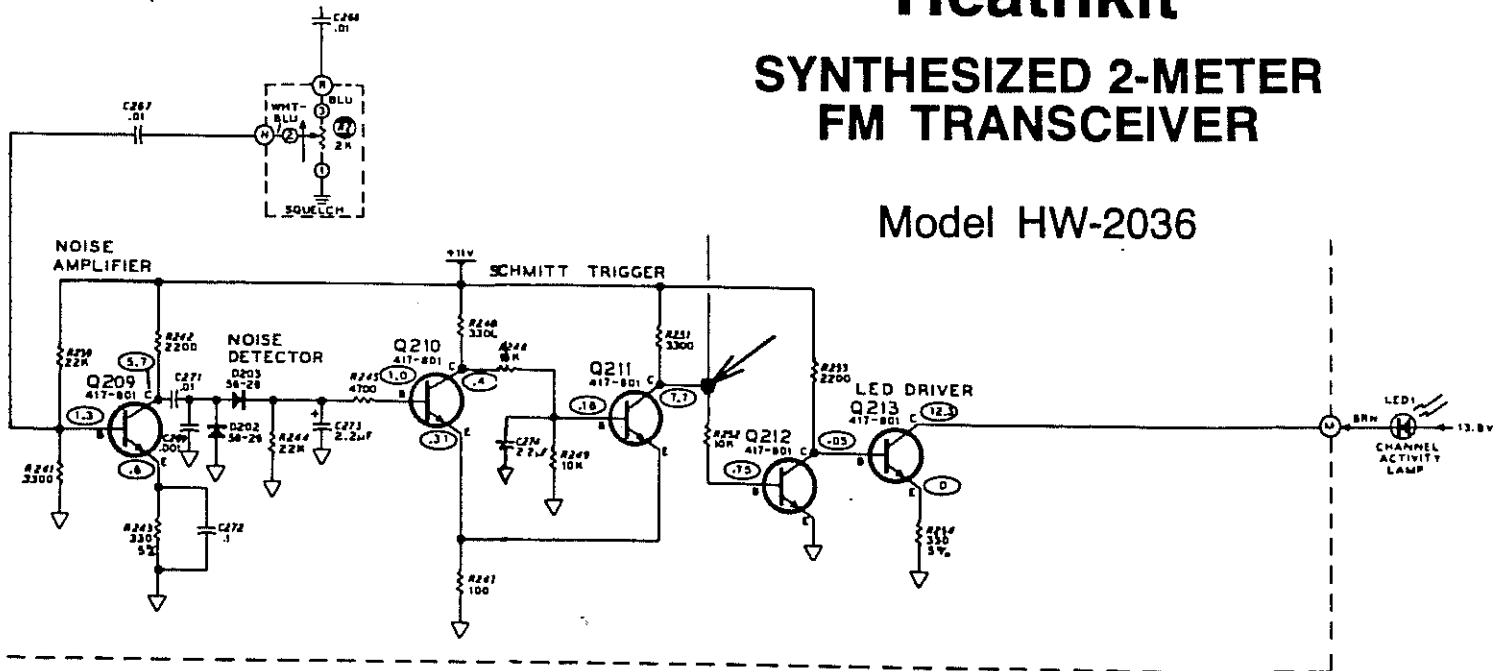
IC-4AT



Heathkit®

SYNTHESIZED 2-METER FM TRANSCEIVER

Model HW-2036



Appendix IV

Frequency Control of a Thumbwheel Synthesized Transceiver with the FC-1 Frequency Control Board

ShackMaster 100 with Version 1 firmware supports frequency control of one thumbwheel programmed (BCD) transceiver. The transceiver may be either the primary or secondary control transceiver. Examples of controllable transceivers are the ICOM IC-2/3/4A, ICOM IC-22U, Kenwood TR-7400, Tempo S1/2/5, Midland 13-513, Heathkit HW-2036, and many others.

Frequency control of the control transceiver allows you to command it to QSY, to crossband link to it, and to operate it from the phone on any frequency.

(Future firmware releases will support simpler serial interfaces to transceivers with computer ports as they become available. Remember that frequency control of the control transceiver is great but not necessary!)

The FC-1

The FC-1 Frequency Control Board recovers from ShackMaster's serial data stream three BCD frequency digits plus offset information. The FC-1 may interface directly to the IC-2/3/4A transceiver, and with minor modifications, to many others. This interface is in addition to supporting the IC-751 through its external frequency controller port and eight general purpose remote control outputs.

The FC-1 board may be mounted in any way convenient in your installation, but it is designed to fit directly into a Unibox 130 standard enclosure manufactured by Amerex, P.O. Box 2815, Riverside, CA 92516 (714)-686-1400. Unibox's are available from many electronic suppliers.

Control of IC-2/3/4A Transceiver

The ICOM IC-2/3/4A transceivers are low cost synthesized handheld rigs which are easily controllable with external BCD frequency and offset logic signals.

The FC-1 board receives the serially encoded frequency and offset information from ShackMaster, performs the serial to parallel conversion and provides the logic to interface to the transceiver's offset circuitry.

The +5 volt operating supply for the FC-1 may be obtained from the IC-751 through the ribbon cable, or it may be obtained from inside the IC-2/3/4A.

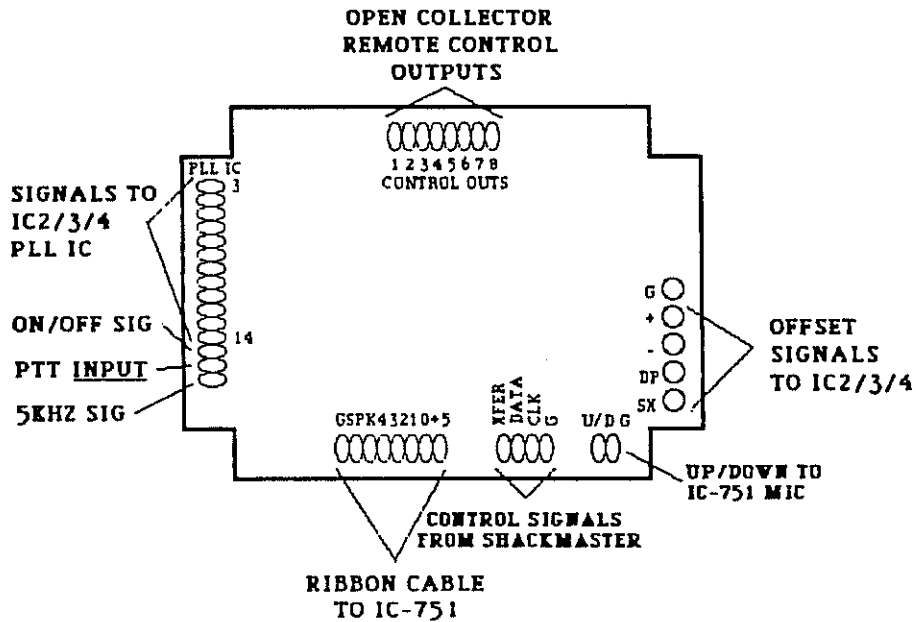
The PLL IC outputs from the FC-1 drive the PLL IC inside the radio directly. These are the BCD frequency control signals developed in response to commands to ShackMaster. Additional logic develops the offset signals required on transmit. They connect inside the radio as described below. The BCD signals may connect directly to the PLL IC underneath the pc board. The offset switches in the radio may be removed to open the internal paths for the offset signals. The thumbwheel switches should be set to all 0's.

Note that the PTT signal must be connected to the ShackMaster output driving the radio PTT to activate the offset circuitry. Otherwise, the transmitter will be inhibited.

The low true open collector PTT signal from ShackMaster should drive the radio through a resistor (around 2.2K) to the base of the switching transistor (IC2A - Q23, IC3A - Q23, IC4A - Q26).

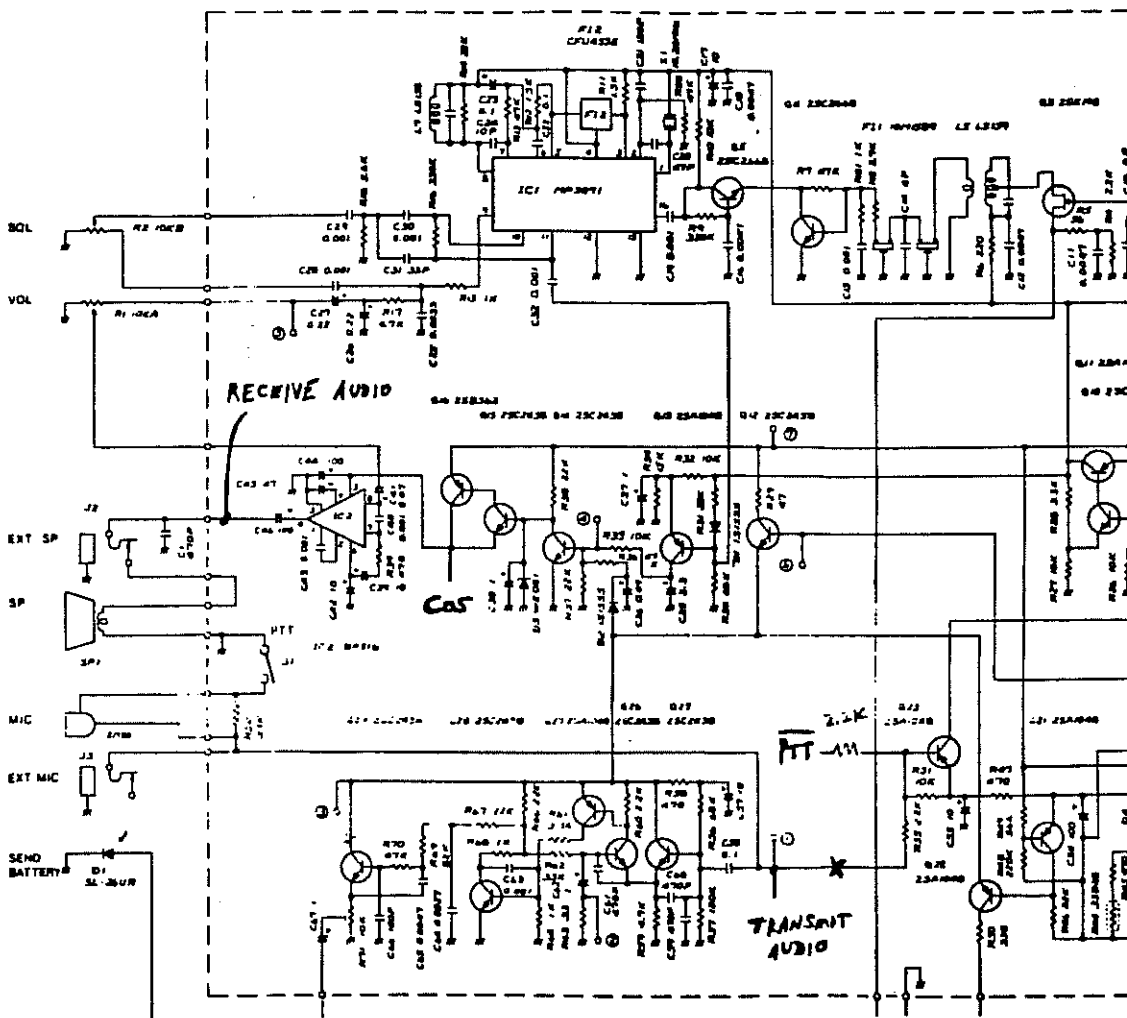
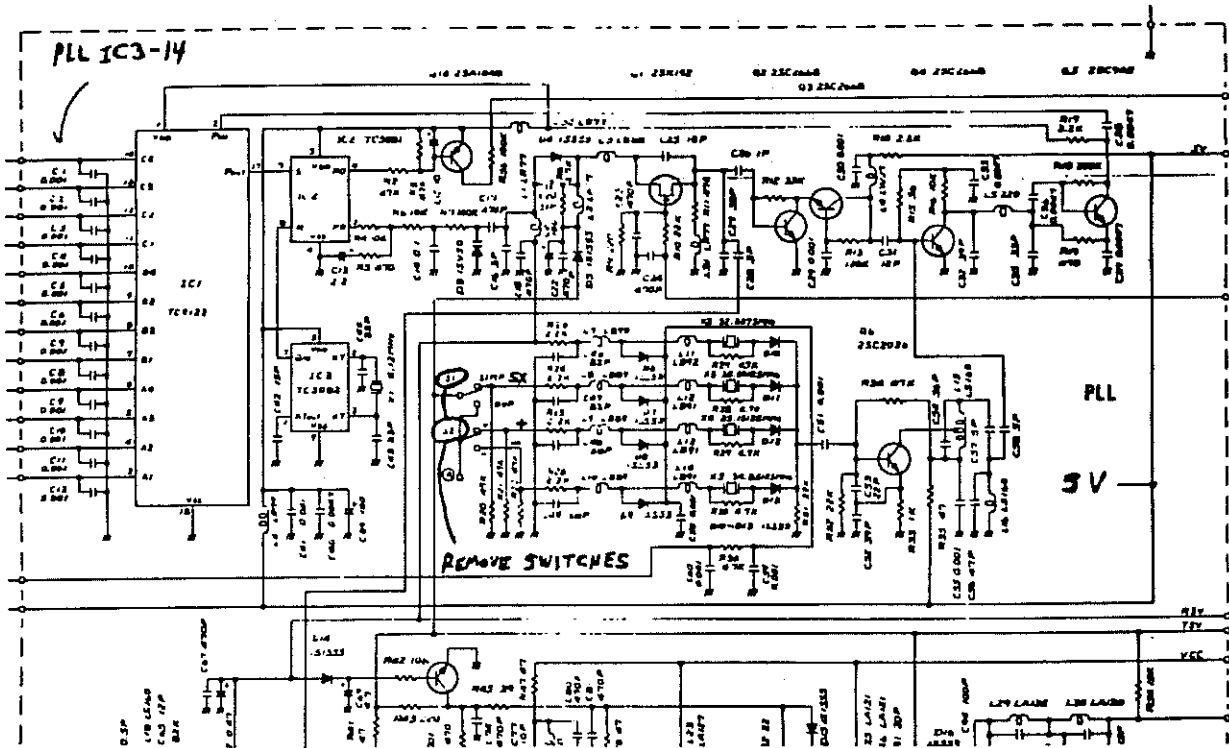
The high true COS signal is available from the audio stage - the audio output amp is powered up only when a signal is received. This switched supply voltage becomes the COS available to ShackMaster at the collector of IC2A - Q16, IC3A - Q16, IC4A - Q17.

Receive audio to ShackMaster is easily obtained from the top of the volume control pot in the receiver. Transmit audio from ShackMaster should drive the external mic input.



FC-1	IC2A	IC3A	IC4A
PLL3-14	PLL IC pins 3-14		
On/off	not used		
PTT	through 2.2K to base Q23		(Q26)
	and to controller PTT		
0/5 KHz	S2	nc	S2
Simplex	R24	R30	R25
+	R25	nc	R62
-	R26	nc	R24
+5V	internal "5V"		
Ground	ground		
ShackMaster			
COS	Coll Q16	Coll Q16	Coll Q17
Rcvr audio	top of volume pot or speaker		
Tx audio	external mic input		

IC-2A/AT/E SCHEMATIC DIAGRAM



IC-2A schematic - see appropriate schematic for your transceiver

Control of the ICOM IC-22U

The FC-1 board may be modified slightly to control the IC-22U 2 meter transceiver. The logic circuitry inside the IC-22U operates at nine volts rather than the five volt levels of the IC-2/3/4A. Therefore, the FC-1 needs to operate at nine volts as well, requiring a change of two of the IC's. The offset logic also operates somewhat differently.

The modifications required to operate the FC-1 with the IC-22U transceiver include:

Replace U8 74HC08 with 74C00 (yes that's 74C00), U7 74HC02 with 74C02 (for proper offset logic sense and to allow operating the board at 9 volts)

Reverse polarity of CR1 and CR2

Lift U7 pin 10 from socket and jumper pins 8, 9, and 10 together (don't want inversion of 5 kHz signal)

Ground PTT input to FC-1 (so offset circuitry always enabled)

Clip out R6 and R7 (so they don't load down pullup resistors)

Operate board from 9 volts obtained from IC-22U instead of 5 volts

The FC-1 BCD outputs may connect to the IC-22U BCD control lines as shown below:

<u>FC-1 "PLL IC-1"</u>	<u>IC-22U Connector</u>
10	J3-5
9	J3-6
8	J3-7
7	J2-1
6	J2-2
5	J2-3
4	J2-4
3	J2-5
14	---
13	---
12	J3-3
11	J3-4
"-600"	J1-2
"+600"	J1-3

IC-22U connector J2-6 should connect to FC-1 +5V, the DUP pin should be left open, and SEND should connect to PTT/.

Interfacing Two FC-1's for Control of Two BCD Transceivers

ShackMaster's firmware supports independent commands for control of two separate FC-1's which allows BCD control of both the primary and secondary transceivers. The second board may be "cascaded" on the first so that the shift registers simply form a longer chain.

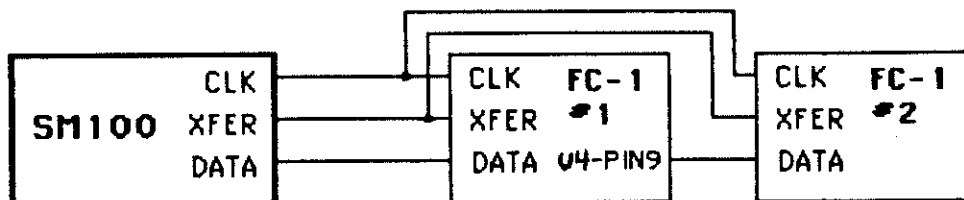
The commands for controlling the second FC-1 are similar to other frequency control commands except that a * is added in the command. The commands for controlling the crossbanded rig frequency when in crossband operation are:

[your prefix] 7 MTHOF First FC-1 board (as described in
body of manual)
[your prefix] 7 * MTHOF Second "cascaded" FC-1

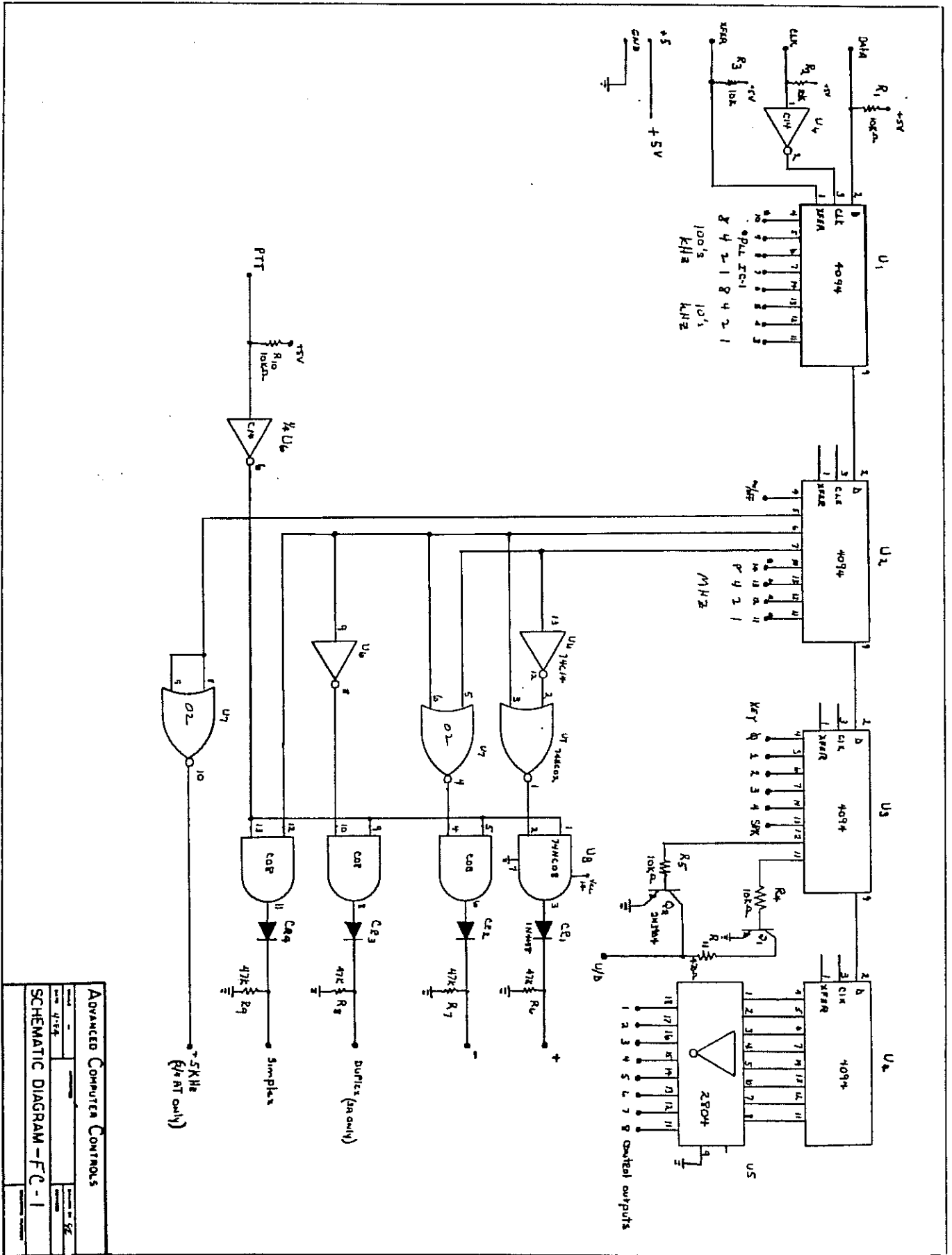
These same commands operate as control transceiver QSY commands when not in crossband operation. It's your responsibility to remember which command controls which transceiver (primary or secondary), and it depends on how you have them wired.

The second FC-1 powers up to ShackMaster's "alternate" memory frequency. (The first FC-1 powers up to the "home" memory as described in the body of the manual.)

The two boards may be interconnected as shown below, assuming that both transceivers operate from the same internal voltages (such as the IC-2A and IC-4A).



CASCADING TWO FC-1 FREQUENCY CONTROL BOARDS



ADVANCED COMPUTER CONTROLS
 SCHEMATIC DIAGRAM - FC-1

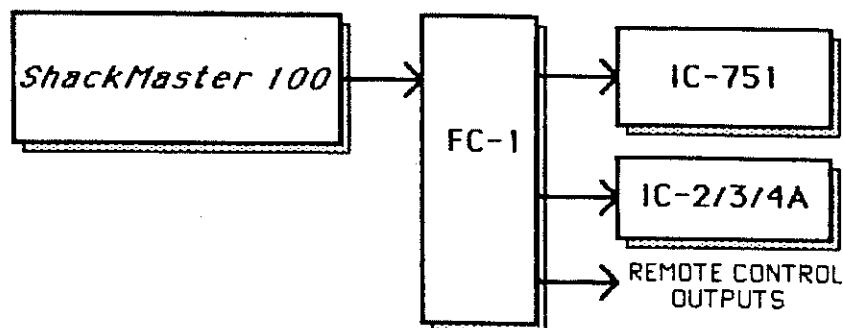
Appendix V

Interface to the ICOM IC-751

This section describes the interface to the ICOM IC-751 HF transceiver through the external frequency controller connector and the mic connector. It isn't necessary to get inside or modify the transceiver.

What You Need

The FC-1 Frequency Control Board is required for the interface to the IC-751. The FC-1 interfaces through four wires to ShackMaster's logic connector, and to the '751 external controller connector (underneath the transceiver) and the mic connector. Audio, PTT, and COS interface through the mic connector and the accessory connector on the rear of the '751. The FC-1 can also frequency control an ICOM IC2/3/4A as the primary or secondary control transceiver and provide eight general purpose remote control outputs.

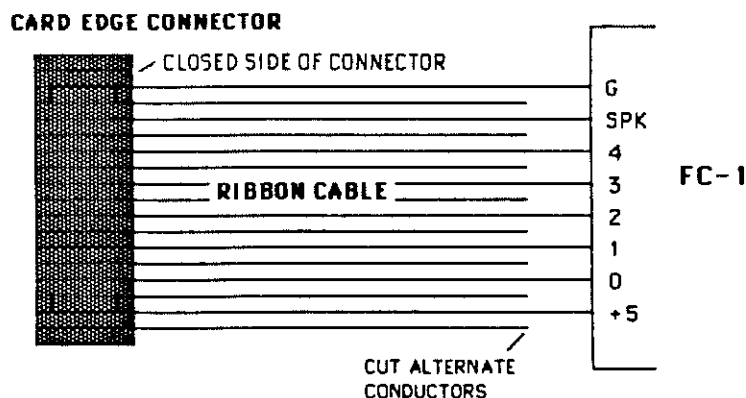
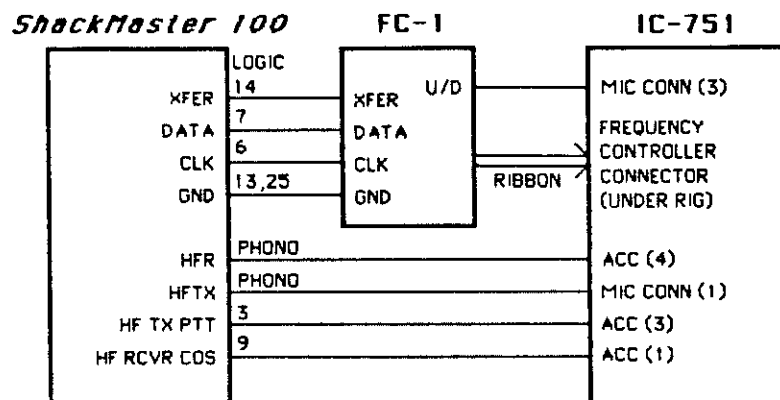


Connections

The pc card edge connector and ribbon cable must be wired to the FC-1 as shown below. Wire the Up/Down signal and ground from the FC-1 to a mic connector plug (Up/Down to pin 3, ground to pin 6). Wire the XFER, DATA, CLK, and GND signals from the FC-1 to ShackMaster's logic connector.

Using shielded audio cable with phono plugs on one end, connect ShackMaster's HFR jack to pin 4 of the Accessory Socket (fixed audio output), and the HFTX jack to pin 1 of the mic connector (shield to pin 7). Wire the Accessory Socket pin 3 (PTT) to ShackMaster logic connector pin 3. If you'd like to use the 751's all mode squelch, wire Accessory Socket pin 1 (squelch logic signal) to ShackMaster logic connector pin 9.

Prepare the ribbon cable supplied as shown below, soldering every other conductor to the FC-1. Be sure the connector is oriented with the closed side facing you and that you use the proper conductors as shown. The card edge connector should be plugged into the socket underneath the transceiver *with the ribbon cable exiting toward the front of the radio.*



Setup

ShackMaster should be programmed to expect the IC-751 (unlock, enter *118 0). The HF Transceiver COS logic sense should be programmed Low True (unlock, enter *114 0). These programming commands are stored in ShackMaster's non-volatile memory and need be done only once.

The IC-751 must be operated in the memory mode. Frequency is controlled by ShackMaster directly through the external frequency controller port. Mode is controlled by scanning up/down from the mic jack through memories which contain pre-stored mode information.

Modes must be stored as follows:

Memory	Mode	Memory	Mode
x	LSB	x+6	FM
x+1	LSB	x+7	FM
x+2	USB	x+8	AM
x+3	USB	x+9	AM
x+4	CW	x+10	RTTY
x+5	CW	x+11	RTTY

(X may be any memory. For example, load 10 & 11 = USB, 12 & 13 = USB, etc.)

Other required settings include:

Memory mode (VFO/M)

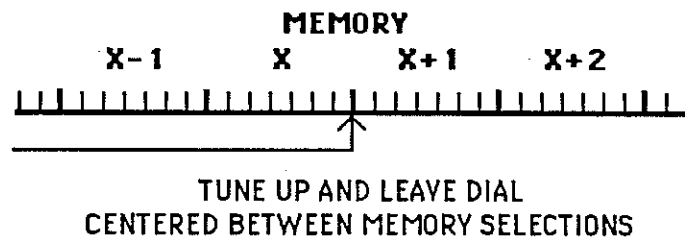
Initialize to memory x

TS, DFS, BAND switches out

Dial lock out

Other settings as desired

The selection of memory **x** must be done carefully to ensure ShackMaster's synchronization to the '751's internal memory scan operation. Note that rotating the tuning knob causes the memory to be incremented at the rate of one memory per seven notches. Tune halfway between memory **x** and **x+1**, such that you tune about 7 notches after the rig steps into memory **x**, centering its "brain" between those memories.



Since the IC-751 must be operated in the memory mode, and since it normally powers up to VFO A, *power may not be shut off* to the transceiver when you are operating remotely.

Adjustments

Bring up the HF link in Listen Only mode (your prefix 7 4). Adjust ShackMaster pot R101 for proper deviation from the control transmitter. Go to transmit (* 7 5) and adjust ShackMaster pot R108 to allow a comfortable mic gain setting.

Operation

ShackMaster supports the commands described in Chapter 10, Crossband Linking, with certain exceptions. Since frequency resolution through the external frequency controller port is 100 Hz, the Up/Down 20 Hz commands have no direct effect. The VFO A/B command is not supported since the '751 must operate in the memory mode for us to allow operating mode change. The memory selection commands are not supported since information flows only from ShackMaster to the transceiver, therefore, although the rig would know the new frequency, ShackMaster would not. The receive modes supported include LSB, USB, FM, AM narrow, CW wide, and RTTY. Practical transmit modes include all voice modes.

Appendix VI

Interface to the Yaesu FT-757GX

This section describes the interface to the Yaesu FT-757GX HF transceiver through its serial input port and jacks.

What You Need

ShackMaster's serial port may connect directly to the FT-757 serial input with a single wire, allowing remote control of frequency of the transceiver. Provisions are available for controlling the mode of the rig, but they require getting inside the very compact transceiver to access five mode control points. These are connected to outputs of ShackMaster's FC-1 Frequency Control Board option. If you don't want to mess around inside the rig, fully practical control of frequency is available with a single wire connecting the serial ports. The mode may be left on the one expected to be used (i.e. LSB for 40 and 75 meter operation).

Connections

The interconnections between ShackMaster and the FT-757 include transmit audio, receive audio, push-to-talk, and serial port for frequency control. No COS or squelch logic signal is available from the '757.

Using shielded audio cable with phone plugs on each end, connect ShackMaster's HFR jack to the AF OUT jack on the '757. Similarly, connect ShackMaster's HFTX jack to the PATCH/AFSK jack on the '757. Wire the ShackMaster logic connector pin 3 - PTT - to the PTT phono jack on the rear of the '757.

Connect Serial Port 2 open collector output (logic connector pin 4) to the SI serial input of the REMOTE connector on the '757.

Setup

ShackMaster should be programmed to expect the FT-757GX (unlock, enter *118 1). Since we don't have a COS available from the HF receiver, we want to set ShackMaster's HF COS logic sense to Low True (unlock, enter *114 0).

Controlling Mode

The '757 does not allow control of the transceiver operating mode from its serial port. Mode is selected with the four section rotary switch on the front panel. The four sections apply 8 volts, transmit 8 volts, and receive 8 volts to various points on the local unit and the rf unit. The switch may be simulated with external relays if desired.

ShackMaster supplies mode information to the optional FC-1 at outputs KEY 0 - 4. All outputs except one are low. KEY0 is set high for LSB, KEY1/USB, KEY2/CW, KEY3/FM, KEY4/AM. These outputs may drive relay drivers connected to the rotary switch points for partial or complete mode control. (The FC-1 is not needed for frequency control of the '757.)

Adjustments

Bring up the HF link in Listen Only mode (your prefix 7 4). Adjust ShackMaster pot R 101 for proper deviation from the control transmitter. Go to transmit (* 7 5) and adjust ShackMaster pot R108 to allow a comfortable mic gain setting.

Operation

ShackMaster supports the commands described in Chapter 10, Crossband Linking, with certain exceptions. Frequency selection, scan, bump and interrogate are available. Mode control is available as described above. Practical transmit modes include all voice modes.

Appendix VIII

Controlling VHF/UHF Transceivers With Up/Down Microphones

Many transceivers have convenient provisions for scanning up and down, controlled from switches on the microphone. The up/down features of various rigs operate differently, but ShackMaster can provide remote frequency control of certain of these rigs.

Commands

In addition to the frequency control command set described in the body of the manual, additional commands are available when crossband linking or telephone accessing the VHF/UHF rig, or when asking ShackMaster to QSY the control transceiver. The additional commands are:

[your prefix] 7 1 (0-99) Scan down 0-99 pulses
[your prefix] 7 3 (0-99) Scan up 0-99 pulses

When a primary or secondary crossband link is up, or when telephone accessing, the commands are interpreted as commands to change the frequency of the transceiver (similar to the 7 MTHOF command).

When entered from over the air with no crossband link up, the commands are interpreted as QSY commands for the control transceiver. ShackMaster expects to hear from you on the new frequency (with any Touch-Tone command) within two minutes or it will return to the original frequency.

Where the Signals Appear

ShackMaster generates the specified number of up or down pulses which appear on the FC-1 Frequency Control Board.

If the HF transceiver selected is not the IC-751, the up/down signal appears at the U/D pin of the FC-1. This output is compatible with the ICOM transceiver up/down pin on the microphone jack. An up signal grounds the pin and a down signal grounds it through a 470 ohm resistor.

If the IC-751 is the selected HF transceiver, this circuitry is needed for its interface, so the up and down signals appear at control outputs 7 (up) and 8 (down) of the FC-1. The outputs switch to ground when pulsed.

Compatible Rigs

The interface assumes that the up/down pin of the transceiver's microphone can receive pulses at approximately 20 pulses per second and that each pulse reliably steps the frequency one notch. Because the transceivers are not designed with external control in mind, no feedback is available to ShackMaster to confirm proper frequency shift.

Some transceivers work fairly well with this approach. Particularly, the ICOM IC-45A (and its family) work with about 99% accuracy. Other rigs such as the IC-37A (and its family) miss about 10% of the pulses applied.

Be particularly careful when commanding the control transceiver to QSY in this way. It may land one or two channels away from the frequency expected, and if it doesn't hear from you in two minutes and returns, it may not land back where you were.

This approach is best applied to the non-control transceiver, so that if you get lost, you can find yourself and get back on track.

Conclusion

Control of a VHF/UHF transceiver frequency is possible using its up/down microphone pin. Depending on the rig, this approach can offer an extremely simple hardware connection - a single wire from the FC-1 board to the mic jack of the transceiver.

Appendix IX

Rotor Control Interface (RCB-2)

ShackMaster may control an antenna rotor through the RCB-2 Rotor Control Board interfaced to a Hygain/Telex CD-45-II, HAM IV or T²X Rotor System control unit. The rotor control board mounts inside the control unit and simulates operation of the clockwise, counter clockwise, and brake switches in response to Touch-Tone commands sent to ShackMaster. The control unit remains available for normal use locally when ShackMaster is not being used. ShackMaster's software is set up for north center operation.

Commands available through ShackMaster include rotate clockwise (right), rotate counter clockwise (left), stop, interrogate direction, rotate to a particular direction in degrees, and "budge" clockwise or counter clockwise. ShackMaster always knows the direction of the rotor by measuring the potentiometer voltage from the control unit. An adjustable delay on the board keeps the brake released for several seconds to allow the rotor to coast to a stop.

Installing the Rotor Control Board

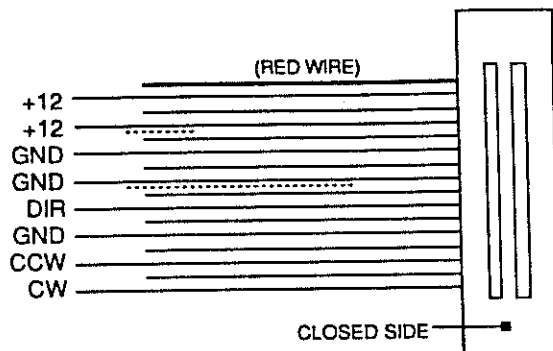
The RCB-2 board is designed to mount inside the bottom of the control unit. Unplug the control unit from the ac line. Remove the mounting hardware for the smaller of the two transformers and mount the rotor control board using the spacers and screws supplied with it. Position the board so that the card edge connector is oriented toward the back of the control unit. Wire the points from the RCB-2 to points inside the rotor control unit as follows:

- "2" CW and CCW switches common terminal, to rear panel term. 2
- "5" CW switch terminal, to rear panel terminal 5
- "6" CCW switch terminal, to rear panel terminal 6
- "3 or 7" "15" on p.c. board, to rear panel terminal 3
- "GND" Ground lug on top at small transformer
- "110V" Brake release switch terminals (two wires)

Several signals must be connected from the RCB-2 to ShackMaster. In addition, a 12V supply signal, which is *not* available from the ShackMaster logic connector, must be obtained.

These signals appear at the RCB-2 card edge connector which mates to the supplied ribbon cable. Prepare the ribbon cable as shown below. Note that every other lead carries a signal. The cable will be folded at a 90° angle near the connector and will be brought out the back of the control unit. Provide some means of insulation, so that the ribbon wire is not pinched by the metal back. The connector should be plugged into the board with the cable exiting the connector *away* from the chassis, although plugging it in wrong will not cause any harm (it just won't work).

Prepare the end of the ribbon cable and make the connections to the ShackMaster Logic connector. Obtain +12 volts directly from your 12 volt supply. You may partially peel away the ribbon wire pair carrying the 12 volts and ground if they need to go in another direction.



- "CW" Logic connector pin 17
- "CCW" Logic connector pin 1
- "GND" Logic connector pin 13 or 25
- "DIR" Logic connector pin 19
- "GND" To 12 volt power supply ground
- "+12" To 12 volt power supply, minimum 100 mA capacity; do not obtain from ShackMaster logic connector

The RCB-2 Rotor Control Board will now allow you to control your antenna rotor through ShackMaster.

Adjustments

Two pots on the RCB-2 board allow calibration of the rotor direction voltage and adjustment of the brake release time.

First calibrate the rotor control unit as described in its manual, independent of the RCB-2. Now turn the rotor using the control unit switches to exactly 90 degrees as indicated on the meter. Read back the direction through ShackMaster (Touch-Tone "4" if bypassed, or "[prefix] 4" if not bypassed). Adjust pot R101 on the rotor control board for a synthesized speech readback of 90 degrees.

Turn the rotor using ShackMaster commands "41" (left) or "43" (right). Stop with "42". Notice that when stopping, the brake relay hangs in for a period of time (you should be able to hear the second relay drop out). Adjust pot R102 for the desired hang time - typically two or three seconds - which should depend on the size of the antenna array you're rotating.

Commands

ShackMaster controls the rotor through several Touch-Tone commands. They include:

Left (ccw)	[your prefix] 4 1 [#]
Right (cw)	[your prefix] 4 3 [#]
Stop	[your prefix] 4 2 [#]
Budge Left (ccw)	[your prefix] 4 4 [#]
Budge Right (cw)	[your prefix] 4 6 [#]
Go to direction	[your prefix] 4 (degrees - 0-360) [#]
Interrogate	[your prefix] 4 [#]

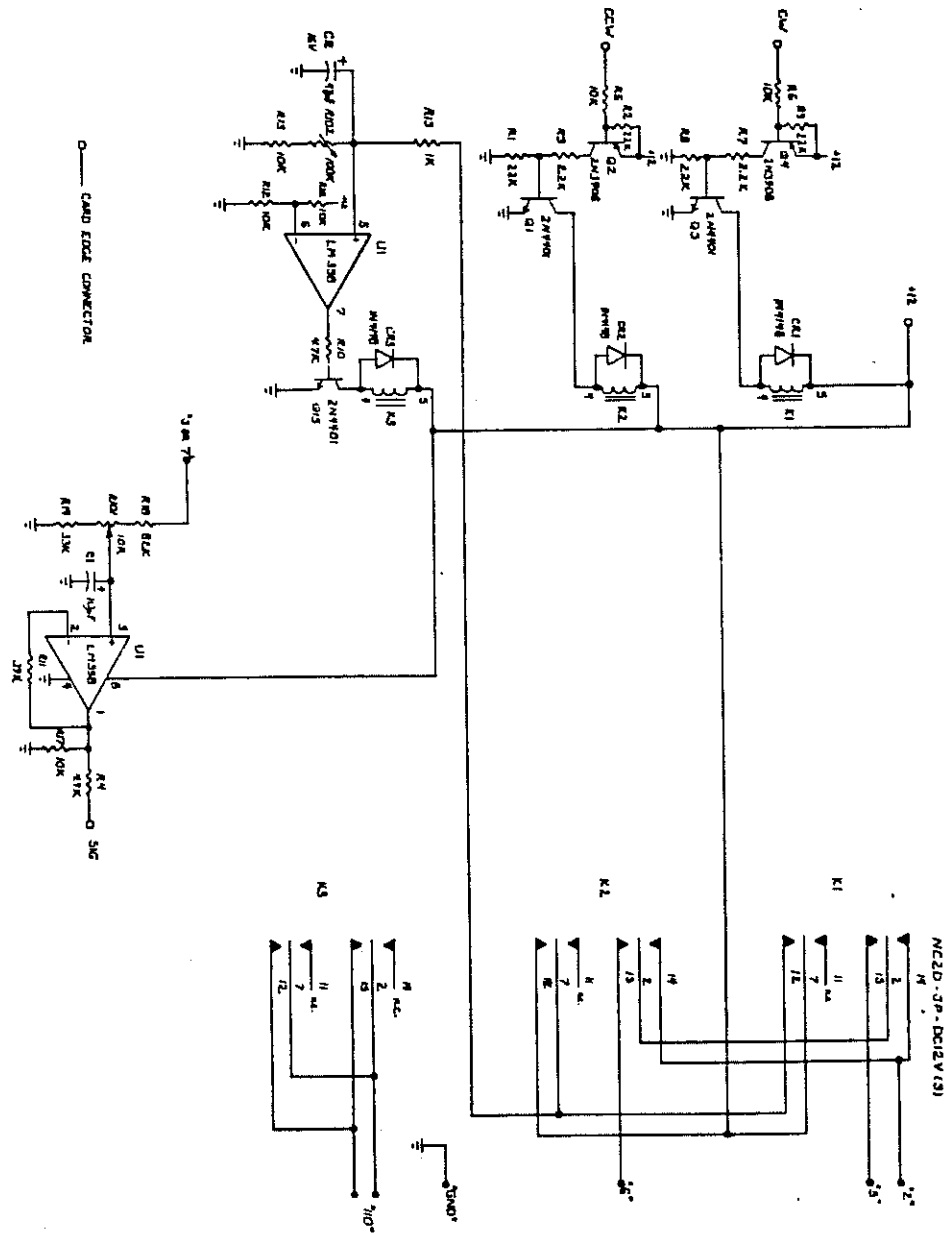
The Left and Right commands cause the rotor to turn continuously until stopped. ShackMaster stops the rotor automatically at approximately 195 degrees when turning left, and 165 degrees when turning right, to prevent excessive twisting when the rotor hits the stopper. The Stop command may be entered at any time.

The Budge Left and Budge Right commands apply power to the rotor for a half second to cause the rotor to turn slightly in either direction. After coasting, ShackMaster reads back the new rotor direction.

The Go command causes the rotor to turn to a particular direction specified in the command. Directions from 165 to 195 are ignored by this command since they are dangerously near the ends. When the desired direction is reached, the actual direction measured is spoken by ShackMaster. There may be a small error because the rotor will coast for a short time after power is removed. ShackMaster intentionally "undershoots" by about eight degrees to allow for coasting. While rotating in response to the Go command, other Touch-Tone commands may not be sent to ShackMaster.

The Interrogate command causes ShackMaster to read back the current rotor direction. In addition, it reads back "Right" or "Left" if the rotor is currently turning.

Schematic



REVISIONS		
REV	DESCRIPTION	DATE

PART NUMBERING SYSTEM FUNCTIONAL GROUP 1 PROJECT NUMBER 2 DRAWING NUMBER 3 REVISION NUMBER 4 SHEET NUMBER 5		RCB-2 ROTOR CONTROL BOARD	DATE DRAWING NO. SHEET
APPROVALS DESIGNER CHECKER ENGINEER	SCALE C DO NOT SCALE DRAWING		

Operation from over the air ...

PersonalPatch...

PersonalPatch vox dropout timer is lengthened to 1 second – smooths out patch operation.

Patch Timer Extend command reloads patch timer value (not 30 seconds); may be reloaded any time the patch is up.

PersonalPatch timeout warning waits until the transmitter is keyed so you will be sure to hear it.

Crossbanding...

Over the air control timer is programmable – allows extended c/b listening without grabbing control window.

HF control window can be lengthened to 90 seconds for longer listening between dropouts.

Timed-out condition is cleared with any Touch-Tone (COP level command not required) to simplify operation.

When operating full duplex using an HF transceiver COS, command responses will properly key secondary transmitter.

Control of TS-440/940 allows return to VFO after accessing a memory.

General Control...

X-10 Powerhouse control unit is supported (all functions except bright/dim).
Connect SM logic connector pin 18 to X-10 DIN connector pin 2 and SM logic connector pin 13 or 25 to X-10 DIN connector pin 3. Select X-10 unit with Programming command (above). Housecode is A.

With control from secondary, control no longer returns to primary after hanging up ShackPatch or PersonalPatch allowing continued control from the secondary.

When QSYing control xcvr to alternate memory, it's immediately ready to accept commands.

If the RCB is not installed, ShackMaster will ignore direction commands (use Programming command above.)

Entry of 7* and 70 will not cause ShackMaster to reset.

FT-757GX Owners Note: HF scanning up and down with the '757 can result in a random switching of the transceiver into memory mode. We haven't been able to isolate this problem to ShackMaster. Use scanning with the '757 with care.

ShackMaster Version 1.6 Specification

User Commands

HF Listen-Only Mode

- 5 VFO A/B Alternate (VFOA->VFOB, VFOB->VFOA, Memory->VFOA)
- 5* Split On
- 50 Split Off

Notes: Split turns off when turning HF crossband off or selecting an HF memory.

Swapping VFOs when split is on causes response of VFOAB or VFOBA, with the first letter indicating the receiver VFO, the second indicating the transmitter VFO.

(keyup during control window) HF scanning and rotor turning stop

Normal Mode

- 1 Reverse Patch activate (from telephone)
- 6 Reverse Patch answer (from over the air)

Notes: Reverse patch will ring out the control transceiver for 60 seconds or until answered. When answered, operation is identical to PersonalPatch.

- 7* Clears crossbanding "Return to receive" digit selected with 7*(digit)

Control Operator Commands

- 11 RE Reverse Patch Enable†
- 12 RD Reverse Patch Disable

† Powerup state.

Programming Commands

- | | |
|------------------------------|-----------------------------------|
| *119(0/RCB installed, 1/not) | Rotor Control Board Installed/Not |
| *120(seconds) | Phone Line Control Timer |
| *121(seconds) | Over the Air Control Timer |
| *122(0/Heathkit,1/X-10 BSR) | BSR Unit Select |

Note: Normal, Alternate, and COP prefixes are now limited to 4 digits maximum.

Other Improvements

Operation from the phone ...

Phone will not answer in response to transients on the phone line such as pickup and hangup of another phone or dial pulses.

Phone line control timer is programmable – allows extended listening without needing to enter Touch-Tone.

A warning announcement is provided indicating pending phone control timer timeout -- it says "Time's up" and will hang up in three seconds if no Touch-Tone is entered.

When keying a transmitter with */#, the transmitter is not keyed until the end of the * command so the * doesn't go out over the air.

Most Often Asked Questions (and Answers) About ShackMaster™

I don't understand about the commands - normal, alternate, control op, programming, bypass mode, etc. Please explain.

There are three levels of commands used in ShackMaster.

Programming commands are used to load your callsign, select timer values, etc. ShackMaster must be unlocked to enter programming commands - it's unlocked by holding down the Answer button until it says, "UL". These commands aren't used very much once you're set up.

Control Op commands give you control over what's enabled and disabled. They also let you select the format of the User level commands. These commands also aren't used very much.

User level commands activate ShackMaster's features, like the patches, the mailbox, crossbanding, etc. A Touch-Tone command prefix applies to each user level command. The command prefix provides security and allows many ShackMasters to be listening on one frequency without all responding to your command. With Control Op commands, you can select one of two prestored User level prefixes - *normal* or *alternate*, or you may *bypass* the need for the prefix for User level commands for easiest operation on a secure channel.

Programming Commands

Unlock ShackMaster (p. 63)

Enter commands in manual (p. 64 - 68)

Lock ShackMaster (p. 63)

Control Op Level Commands

=[Control Op prefix](command root in manual, p. 69)

Example - if your Control Op prefix has been programmed to 789, then 78908 = ShackMaster disable

User Level Commands

=[Normal prefix](command root)

or

[Alternate prefix](command root)

or

just (command root)

- selected by Control Op commands 25, 26, and 27.

Example - if your Normal prefix = 123 and Alternate prefix = 456, then check the mailbox by entering "1233", "4563", or just "3" respectively.

I tried to enter commands from my HT, and they were coming through ShackMaster OK, but it wouldn't respond.

Be sure ShackMaster isn't in the local mode. If you placed it in "local" to make sure it was hooked up right, return it to "remote control" before operating it from over the air. It doesn't accept Touch-Tone commands from the receivers while it's in local.

Do I have to put ShackMaster in "remote control" before I use it?
ShackMaster's normal state is remote control. You can put it local, or unlock it, or call it on the phone, but it will always return to "remote control" if you forget to manually put it back.

I tried to program in my call sign but it wouldn't take it. What's wrong?
First, make sure ShackMaster is unlocked by holding the Answer button down for about 10 seconds - until it says, "UL". Remember that it will time out in about a minute if it doesn't see any valid programming commands.

Chances are that you tried to include too many characters in your ID. The message can have up to eight characters. More than that will overflow and ShackMaster will ignore your command.

The Touch-Tone Pad Test work OK but it won't read back #.
The # key is always interpreted as an enter key - even with the pad test.

I get hum on my transmitted audio. Why?
ShackMaster generates no hum on the audio sent to the transmitters. If properly installed, ShackMaster provides outstanding audio through the entire system.

Hum can be a result of 60 cycle pickup or improper grounding. Be sure all audio cables are shielded.

Buzz can result, depending on the radios, from ground loops or improper grounding. Rigs with multiplexed LED displays draw dc power with a heavy ac component due to the LEDs instantaneously turning off and on. If you're driving the mic input of the transmitter and it normally uses a mic without a preamp, its input sensitivity may be 10 or 20 mV - it doesn't take much ground resistance to develop noise voltage that is comparable.

Use a direct, low impedance ground from each radio to the system power supply ground. Wire around any fuses in the ground lines - you don't want the added resistance. *Solder the connections* - don't rely on twisted wires or alligator clips. Use short, direct wires from the supply +12 volts to the radio (with any fuses intact, of course, for protection).

Ground drop *inside* the radio may still cause buzz in transmitted audio. A common practice in audio systems is to ground only one end of shielded cables - try this with transmit and receive audio from the radio to ShackMaster. It's easy to try by partially unplugging the phono plugs at ShackMaster. This can make sure the only return path for supply current is the one you intend - not your audio cables!

I've hooked up the HF rig but it seems to transmit even when I don't want it to.

Chances are you've got the rig's VOX enabled. Turn off its VOX. When ShackMaster is transmitting through the primary transceiver, the same transmit audio is present at all the transmitters - but only the proper one is keyed.

My IC-751 powers up scanning.

The FC-1 is powered with +5 volts from the 751. When you turn on the 751, the logic on the FC-1 comes on in a random state. The sequence should be (1) turn on the 751, then (2) turn on ShackMaster. ShackMaster initializes the FC-1 and 751 on powerup, and of course whenever you enter HF commands.

I still can't get ShackMaster to control the 751.

Try removing and reinserting the connector from underneath the radio. For some reason, the connector needs to be plugged in just right for the card edge to mate properly to the connector. We're using the same Fujitsu gold card edge connector as ICOM uses on their RC-10.

If you still have a problem, be sure the cable is wired correctly to the FC-1 and that it's plugged into the radio the right way.

When I went to crossbanded transmit mode, I couldn't get out of that mode.

When in Listen/Transmit mode, hitting any one Touch-Tone key (except * or #) gets you back to Listen Only. This must be done before turning off the crossband link.

It seems to operate funny through a repeater. The control window stretched out longer than I thought I programmed it for.

When activating any functions through a repeater, you need to use the # as an "Enter" key. This tells ShackMaster two things - (1) evaluate your command without waiting for the repeater to drop (for COS to go away), and (2) during any of the functions that use the control window, instead of looking for your COS during the window, use the internal VOX detector to listen for your voice or tones to grab it.

What happened in your case was that you brought it up without the # "Enter" key. ShackMaster thought you grabbed it during the control window, but actually the repeater's hang time grabbed it and held it until the repeater dropped.

Appendix X

Interface to the Kenwood TS-440S / TS-940S

This section describes the interface to the Kenwood transceivers through their serial ports and other interface jacks.

What You Need

In addition to your Kenwood rig and ShackMaster you need:

TS-440S - The IC-10 IC kit (Intel or equivalent 8251A, RCA or equivalent CD4040B)

TS-940S - The IF-10B Computer Interface

You do not need the IF-232C level translator, as ShackMaster is happy to work at TTL levels, but it may be used if desired for additional isolation.

Connections

The interconnections between ShackMaster and the TS-440/940S include transmit audio, receive audio, push-to-talk, and serial port for control. No COS or squelch signal is used.

Using shielded audio cable with phono plugs on each end, connect the HFR jack on ShackMaster to the AFSK OUT jack on the Kenwood rig. Similarly, connect ShackMaster's HFTX jack to the AFSK IN jack. Wire the ShackMaster logic connector pin 3 - HF FTT - to an appropriate keying line, such as the TS-440S ACC2 jack pin 13 or the REMOTE connector "From standby switch".

Connect ShackMaster's Serial Port 2 open collector output (logic connector pin 4) to the rig's serial input port. (TS-440S without IF-10B - ACC 1 jack pin 3 (bottom pin).)

Setup

ShackMaster should be programmed to expect the Kenwood TS-440/940S (unlock, enter *118 4). Since we don't have a COS available from the HF receiver, we want to set ShackMaster's HF COS logic sense to Low True (unlock, enter *114 0).

Adjustments

Bring up the HF link in Listen Only mode (your prefix 7 4). Adjust ShackMaster pot R101 for proper deviation from the control transmitter. Go to transmit (*7 5) and adjust ShackMaster pot R108 to allow comfortable mic gain setting.

Operation

ShackMaster supports the commands described in Chapter 10, Crossband Linking. Frequency selection, bump and interrogate, along with mode selection, are available. In addition, memories can be recalled which simplifies some operations including 10 meter FM. While in HF Listen Only, a memory may be selected by entering "2" and the two digit memory location (00 - 99). You may return to VFO A by entering "5".

ShackMaster is shipped with

Normal prefix = 123

Alternate prefix = 123456

Control Op prefix = 789

Remember: for simplest operation, "bypass" [your prefix] by entering 78927.

