MIDLAND LMR
LAND MOBILE RADIO
SYNTECH™-II
SERVICE MANUAL

PART ONE

GENERAL SERVICING AND INSTALLATION

SYNTHESIZED TWO—WAY LAND—MOBILE RADIO

MANUAL NO. 70-340381
09-3400/3800-SM-6/88-1.5M.

SYN-TECH II SERVICE MANUALS

SYN-TECH II service information is published in three separately-bound parts. Redundant information is segmented out so that numerous copies of the same material need not be purchased to acquire a library of various MIDLAND transceivers models.

Part One contains general servicing and installation information that is common to the entire SYN-TECH line.

Part Two contains technical data and drawings for the SYN-TECH II Control Heads. Two versions of this section exists: one for the Deluxe Control Head, and one for the Standard Control Head plus the Small-Remote Control Head.

Part Three contains technical data and drawings for SYN-TECH II TX/RX units. Versions of this section are nearly as numerous as SYN-TECH II models.

This service-manual section is Part One, and it contains information and procedures common to all SYN-TECH II series land-mobile transceivers. As necessary, service manual supplements will be published and distributed on the following forms:

Manual Addition (MA): For supplemental information useful in equipment alignment, service, or improvement. Printed on BLUE paper.

Change Notice (CN): For circuitry change details made during production by model and serial number. Printed on YELLOW paper.

Manual Correction (MC): For correcting literature errors not related to production changes. Printed on GREEN paper.

Technical Bulletin (TB): For solutions to field problems and tips for performance improvement. Printed on PINK paper.

Many useful facts and tips are provided in the text. If the reader intends to service several of the transceivers described herein, spending time to read applicable text will save time in the end.

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Section 1

SYN-TECH II RADIOS

DESCRIPTION

MIDLAND SYN-TECH II radios are versatile FM land-mobile transceivers equipped with many features built in to accommodate many applications. SYN-TECH II radios utilize modern frequency synthesis techniques and each contains a microcomputer that governs all radio activity. Specifics of radio operation are completely programmable using Electrically Erasable Programmable Read-Only Memory (EEPROM) that provides programmability without extracting a memory device — a programming unit is simply connected directly to the radio with an umbilical-like cord to re-program the EEPROM.

The SYN-TECH II control panel has many optional pushbutton and indicator positions available for easy expansion. Built-in interfaces and connections, all of which are programmable, accomodate optional add-on circuits; thereby making SYN-TECH II versatility almost limitless.

Channel frequency spread of SYN-TECH II radios is band wide; therefore tuning is not necessary after installing or changing customer frequencies. Simply program the unit, test it, then install it. When and if repairs are necessary, a technician can use the SYN-TECH II Programmer as a remote-control device to manually manipulate frequencies and functions of the radio.

Generally, the SYN-TECH II is comprised of two parts: a TX/RX Unit, which is the major portion of the radio; and a detachable Control Head. Compact SYN-TECH II radios can be mounted under a vehicle dashboard; but, if available space is limited, the SYN-TECH II radio can be purchased with its control panel detached so that the bulk of the equipment can be mounted under a seat or in the trunk; thus, only the control panel need be mounted in the operator's reach. If an under-dash configuration is purchased, the TX/RX Unit is shipped with the Control Panel attached to it. The TX/RX Unit of the trunk-mount configuration has a cable-interface board and handle assembly mounted in place of the Control Head. A cable-interface board and rear cover are also added to the Control Head. The two units must be connected together with the multi-conductor Control Cable (provided) when installed.

Three type of Control Heads are available: Standard, Deluxe, and Small-Remote. The Standard Control Head has a three-digit numeric display, six to eight push buttons, and an internal speaker. The Deluxe Control Head can display two rows of six alphanumeric digits on its liquid-crystal display, but does not contain an internal speaker; therefore, an external speaker is included. The Small-Remote Control Head is a trunk-mount-only Standard Control Head without an internal speaker, and it also requires an external speaker.

The chassis of the SYN-TECH II TX/RX Unit is constructed of cast aluminum with sectional cavities that house three major printed circuit boards. The RF Board contains transmitter, receiver, and synthesizer circuitry, and is located on the underside of the radio. Mounted on

the chassis topside, the Logic Board contains the microcomputer and interface circuitry. Another unused cavity is located on the radio topside to accommodate optional circuit boards. The third PC board is located inside the rear heat sink which comprises the PA Module. The PA Board is accessible by removal of the heat sink cover.

SYN-TECH II MODEL NUMBERS

MODEL	FREQUENCY BAND	MOUNTING	OUTPUT POWER	TX/RX UNIT
70-050x	30-50 MHz	UNDER-DASH	50 Watts	70-0500
70-052x		UNDER-DASH	110 Watts	70-0520
70-055x		TRUNK-MOUNT	50 Watts	70-0500
70-056x		TRUNK-MOUNT	110 Watts	70-0520
70-060x	A= 66-77 MHz	UNDER-DASH	40 Watts	70-0600
70-066x	B= 77-88 MHz	TRUNK-MOUNT	40 Watts	70-0600
70-342x	A= 136-160 MHz	UNDER-DASH	40 Watts	70-3400
70-385x	B= 150-174 MHz	UNDER-DASH	110 Watts	70-3800
70-442x		TRUNK-MOUNT	40 Watts	70-3400
70-485x		TRUNK-MOUNT	110 Watts	70-3800
70-530x	A= 406-430 MHz	UNDER-DASH	30 Watts	70-5300
70-565x	B= 450-470 MHz	UNDER-DASH	90 Watts	70-5600
70-630x	C= 470-494 MHz	TRUNK-MOUNT	30 Watts	70-5300
70-665x	D= 494-520 MHz	TRUNK-MOUNT	90 Watts	70-5600
70-915x	806-870 MHz	UNDER-DASH	15 Watts	70-9100
70-935x		UNDER-DASH	35 Watts	70-9300
70-970x		TRUNK-MOUNT	15 Watts	70-9100
70-980x		TRUNK-MOUNT	35 Watts	70-9300

x: 1= Standard Control Head
2= Deluxe Control Head
7= Small Remote Control Head

ACCESSORIES

70-0021	DUAL CONTROL HEAD ADAPTER

A Y-cable assembly that connects two Control Heads, via their respective Control Cables, to the front of a trunk-mount SYN-TECH II TX/RX Unit; thereby providing dual control of many radio functions. Squelch and Volume can be adjusted over a limited range from either head. Other functions can be controlled from one or the other head, with appropriate display showing at both heads. NOTE: Both Control Heads must be the Deluxe type, or both must be the Standard type -- the Small-Remote Control Head is equivalent to and compatible with the Standard Control Head.

70-1081	CLONING CABLE

An interconnect cable that provides electrical connection between Programming Ports of two radios, or between a Port of one radio and the 70-1082 Data Module. The SYN-TECH II radio is capable of cloning (copying) its own programming Data through its Programming Port, and the Cloning Cable serves as the medium for the transfer.

70-1082	DATA MODULE

A small data storage unit that can semi-permanently store the entire programming Data Packet of the SYN-TECH II radio. This facilitates field-programming by providing a means of transporting the programming Data Packet between a 70-1080 SYN-TECH II Programmer at one location and a SYN-TECH II radio at another location, or two SYN-TECH II radios at different locations. The Data Module can retain data for up to ten years, and while loading and unloading, it derives power from the radio to which it is connected. Connection to a radio must be made with a 70-1081 Cloning Cable.

70-2928	IGNITION-SENSE KIT

A fused wire to connect pin 11 of the radio Accessory Jack to the vehicle ignition-switch circuit. This provides automatic radio power-down when the vehicle is turned off without loss of last-operating status.

70-2980	LOCK KIT
A key-lock that slips onto one radio mounting rail behind the under-dash mounting bracket, to deter theft.	

REPLACEMENT ACCESSORIES	
Standard Hand Microphone	70-2326
Hand Microphone with DTMF Keypad	70-2103B
Hand Microphone with DTMF Keypad and ANI	70-2104B
Desk-Top Microphone	70-2305B
External Speaker	70-2355
All-Weather Speaker	70-2365
2-meter, Round Control Cable	70-0012
4-meter, Round Control Cable	70-0014
6-meter, Round Control Cable	70-0016
2-meter, Flat Control Cable	70-0022
4-meter, Flat Control Cable	70-0024
6-meter, Flat Control Cable	70-0026
2-meter, Medium Gauge, DC Power Cord (P506)	70-0032
6-meter, Medium Gauge, DC Power Cord (P506)	70-0036
2-meter, High-Power, DC Power Cord (P506)	70-0042
6-meter, High Power, DC Power Cord (P506)	70-0046
Under-Dash Radio Mounting Bracket	70-2985
Trunk-Mount Radio Mounting Tray	70-2987

CABLING SPARE PARTS		
Control Cable:	* Flat cable connector kit	70-0018
	* bulk flat cable	70-0020
Accessory Plug P319, P505:	* Blank housing	70-159448
	* Female pins	70-151866
Accessory Jack J319, J505:	* Blank housing	70-159449
	* Male pins	70-151865
Power Plug P506:	* Blank housing	70-159450
	* Male pins	70-151867
Power Jack J506:	* Blank housing	70-159451
	* Female pins	70-151868
Power Cord Fuse	* 15 Amp (low power)	70-204065
	* 30 Amp (high power)	70-204064

CHASSIS OPTIONS

Optional Key Functions: If applicable keys and indicators mentioned do not exist on your radio, they must be added to the Control Panel. Refer to the SYN-TECH II Capabilities Guide for details.

70-2910	PRIVATE SQUELCH

Combines Voice Inversion Scrambling with CTCSS or DCS to prevent the casual listener from evesdropping on conversations. Private Squelch can be programmed on a per-channel basis and can be programmed independently of CTCSS or DCS programming. If compatibility with the 70-2102-7 SYN-TECH I is desired, simply program a CTCSS tone on Private Squelch channels. If the radio is equipped with the P/C key and CLR indicator, the P/C key will select clear (unscrambled) audio when a channel that is programmed Private is active. The CLR indicator will illuminate to show clear status.

The Private Squelch option consists of a small printed-circuit board that solders into the Logic Board. Radio re-programming is required. If the P/C key and CLR indicator is to be added, the Control Panel trim plate must be changed to Type 3 or Type 4 configuration.

70-2912	TWO-TONE SEQUENTIAL DECODER

This Decoder decodes the standard slow format tones between 275 and 1800 Hz, and has group-call capability. As with all SYN-TECH II selective signaling decoders, operation is activated by pressing the front panel SET key. The SET indicator illuminates to show status. When the correct tone-sequence is decoded, the front panel CALL indicator illuminates and blinks until the decoder is reset. Other responses that can be enabled by programming are: audio mute until decode, audio alert, and transpond (DTMF sequence or single Burst Tone). If the 70-2940 PA/Horn Relay Option is installed and enabled by the HORN key, the horn relay is activated at decode time. Normally open contacts of the relay route to Accessory Jack pins 1 and 9 for connection to the vehicle horn circuit.

Consists of a printed-circuit board that mounts in the option area and connects to the Logic Board by a ribbon cable. The radio Control Panel must be changed to Type 1, 2, or 4; and re-programming is required.

70-2913	DTMF DECODER

Decodes a sequence of up to ten DTMF standard tone-pairs and 5 seconds of continuous # or * for All-Call and Remote-Decoder Reset, respectively. All sixteen DTMF tone-pairs (0-9, *, #, A, B, C, and D) are valid. The specific code is programmed along with other radio parameters and can be different for each Channel-Group programmed in the radio. As with all selective signaling decoders, operation is activated by pressing the front-panel SET key. The SET indicator illuminates to show status. When the correct DTMF sequence is decoded, the front panel CALL indicator illuminates and blinks until the decoder is reset. Other responses that can be enabled by programming are: audio mute until decode, audio alert, and transpond (DTMF or single Burst Tone). If the 70-2940 PA/Horn Relay Option is installed and enabled by the HORN key, the horn relay is activated at decode time. Normally-open contacts of the relay route to Accessory Jack pins 1 and 9 for connection to the vehicle horn circuit.

Consists of a small printed-circuit board that mounts in the option area and attaches to the Logic Board by a ribbon cable. The radio Control Panel must be changed to Type 1, 2, or 4 configuration and re-programming is required.

70-2919	REVERSE BURST KIT

This circuit holds the transmitter on for 150 milliseconds after un-key while inverting the phase of CTCSS tone modulation, to eliminate squelch tail in listening receivers. Channels on which Reverse Burst is enabled is determined by radio programming.

The 70-2919 Kit is compatible with the 70-2912 and 70-2913 selective signaling Decoders. Consists of a PC board that mounts in the option area of the chassis and connects to the Logic Board by a ribbon cable. Radio re-programming is necessary.

70-2925	MEMORY BACKUP KIT

A supercapacitor that applies voltage to the RAM of the main microcomputer while power is off, so that last operating status of the radio (channel selection, mode, etc.) can be maintained for up to two days (nominally). The 70-2925 kit contains the supercapacitor, a mounting clip, and hook-up wire for connecting to the Logic Board.

CONTROL-HEAD OPTIONS

70-2941	LED KIT

A set of four Light Emitting Diodes and chip resistors to fill optional indicator holes in the SYN-TECH II Control Heads when Types 1, 2, 3, or 4 trim plates are used. LED's colors are: yellow (2), green, and red.

70-2945	EXTRA PUSHBUTTON KIT

A set of four SYN-TECH II Control Panel pushbuttons to fill option holes in the 70-0001 Standard Control Head or the 70-0007 Small Remote Control Head. One button is blank and the rest are labeled "PA", "SET", and "P/C", respectively.

70-2947	MONENTARY CHANNEL-KNOB KIT

A momentary rotary knob that replaces the continuous-rotary CHANNEL KNOB in the SYN-TECH II transceivers. This switch imitates the CHANNEL KNOB used in the SYN-TECH I radio. Incremental channel or group selection is made by rotating the knob to the UP or DOWN position and releasing. If held in the UP or DOWN position for longer than one second, the displayed channel or group begins scrolling and continues until the knob is released. Radio re-programming is necessary for proper knob operation.

70-2965	MIL-810C RAIN/DUST/SALT-FOG KIT, 70-0007 C/H

A set of gaskets, boots, and hardware that can be added for adapting the 70-0007 Small Remote Control Head to meet Military Specification MIL-810C for Hazardous Environment.

70-2986	CONTROL-HEAD CONVERSION KIT

The back cover, Cable Interface Board, and mounting bracket for adapting the 70-0001 and 70-0002 Control Heads to trunk-mount configuration. This assembly is part of all trunk-mount SYN-TECH II configurations.

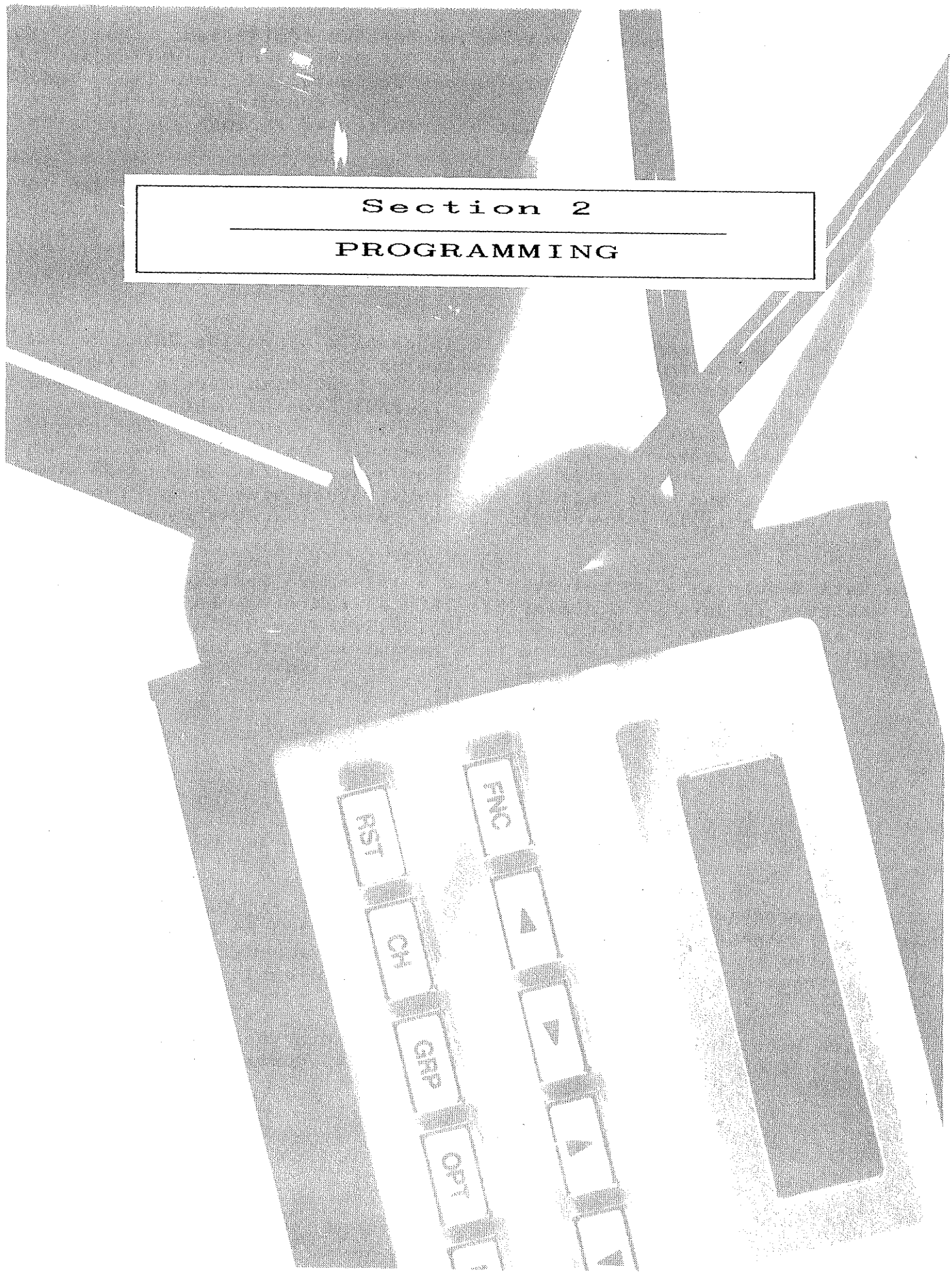
70-2997	AUTO-DIM KIT
A light sensor and other components that can be installed in the 70-0001/-0007 Control Heads to provide automatic intensity control of the display, L.E.D. indicators, and push-button backlighting. Compatible with the 70-2998 Manual Dim Kit.	

70-2998	MANUAL-DIM KIT
A set of components that can be installed in the Control Head to provide low intensity selection of channel display, L.E.D. indicator, and pushbutton backlighting. Fits in all control heads and can be installed with the 70-2997 Auto-Dim Kit; in which case, brightness of the normal and low intensities will vary with ambient light. The appropriate trim plate must be ordered separately if not already installed.	

NOTES

Section 2

PROGRAMMING



The SYN-TECH II transceiver is microcomputer controlled; thus, its operation can be programmed. Detailed definitions of operation and of many optional features must therefore be installed into the radio before it can be used. To do so, a burst of computer data that contains operating definitions must be transferred through the Programming Port of the SYN-TECH II radio.

The Programming data burst, or Data Packet, must be created by the 70-1080 SYN-TECH II Programmer, which is another computer that asks the technician pertinent questions necessary to assemble the Data Packet. The Programmer connects directly to the radio Programming Port for installing a Data Packet into the radio or extracting a Data Packet out of the radio.

The SYN-TECH II transceiver itself is capable of moving Data Packets through its Programming Port. Programming data can be copied from one transceiver to another or copied to the 70-1082 Data Module for semi-permanent storage. In any case, the 70-1081 Cloning Cable is required for electrical connection. The Data Module is very useful for copying a Data Packet between two radios at distant locations. Because the Data Module does not require its own power source (it only needs power to move data, and when that is necessary, it obtains power from the radio to which it is connected), it can retain the Data Packet for up to ten years.

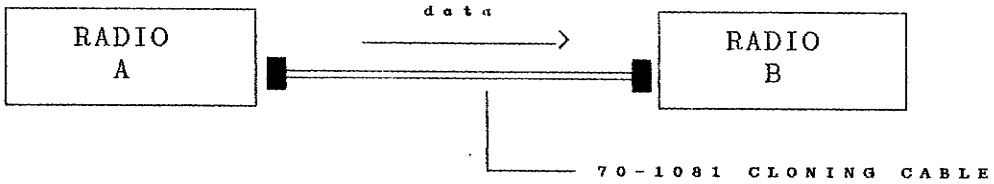
The Data Module is also valuable to a multi-radio customer who wishes to change a feature of his many SYN-TECH II radios — he only needs to re-program one unit, then use the 70-1081 Cloning Cable and 70-1082 Data Module to copy the revised Data Packet into all his other radios.

CLONING PROCEDURES

Once appropriate equipment is connected to the Port, Data-Packet transfer outward (from the radio) can be initiated by holding the [ADD] button while turning on the transceiver power switch. Data-Packet transfer inward can be initiated by holding the [DEL] button, instead.

The Data Module derives its power from the radio when in use. It has no controls and does not require batteries nor power adaptors.

TRANSFERRING CONFIGURATION DATA FROM ONE RADIO TO ANOTHER



The Configuration Data of one SYN-TECH II radio can be copied to a similar SYN-TECH II model as follows:

1. Connect the 70-1081 Cloning Cable between the Programming Ports of both radios.

2. INITIATING THE TRANSFER PROCESS:

   METHOD A

   A.1 Turn on Radio-A power (sending unit). "SCI" blinks in its display to indicate that a cable is plugged into its Programming Port and that it is ready for data transfer.

   A.2 Press and hold the [DEL] button (labeled [CLR/DEL] on the Deluxe Control Panel) on Radio-B (receiving unit).

   A.3 Turn on Radio-B power. "SCI" will appear in the display and the power-up beep will sound. Do not release the [DEL] button until a second beep sounds (within one second). The displays of both radios will glow steady while Configuration Data is transferred to Radio-B.

   METHOD B

   B.1 Turn on Radio-B power (receiving unit). "SCI" blinks in its display to indicate that a cable is plugged into its Programming Port and that it is ready for data transfer.

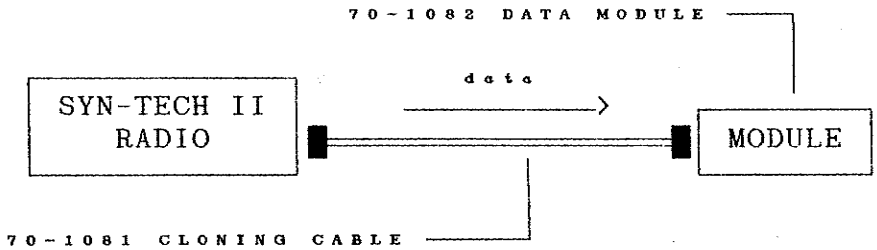
   B.2 Press and hold the [ADD] button (labeled [ENT/ADD] on the Deluxe Control Panel) on Radio-A (sending unit).

   B.3 Turn on Radio-A power. "SCI" will appear in the display and the power-up beep will sound. Do not release the [ADD] button until a second beep sounds (within one second). The displays of both radios will remain steady while the Configuration Data is transferred to Radio-B.

3. When the transfer is complete, a beep will sound and the radio displays will resume blinking. Disconnect the Cloning Cable from both radios.

4. Press any pushbutton on each radio to initiate self-reset and normal operation.

UPLOADING CONFIGURATION DATA FROM A RADIO TO A DATA MODULE



*** * CAUTION * ***

WHEN USING THE DATA MODULE, NEVER CONNECT OR DISCONNECT THE CLONING CABLE FROM THE RADIO OR THE DATA MODULE WHILE THE RADIO IS TURNED ON.

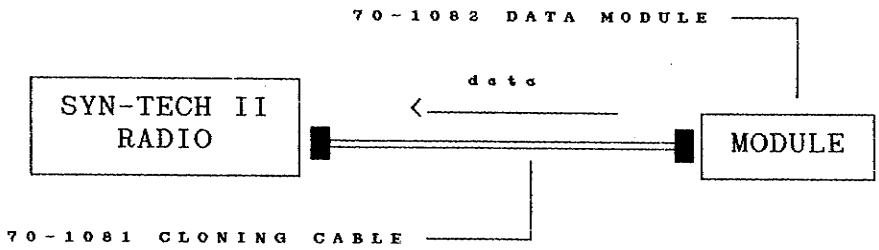
1. Turn off the radio, then connect the 70-1081 Cloning Cable between the Programming Port of the radio and the 70-1082 Data Module. Each plug is keyed with a small tab, which must fit into the slot on one side of its receptacle.

2. Press and hold the [ADD] button (labeled [ENT/ADD] on the Deluxe Control Panel).

3. Turn on Radio power. The LED on the Data Module will illuminate and "SCI" will appear in the radio display, plus the radio power-up beep will sound. Do not release the [ADD] button until a second beep sounds (within one second). Configuration Data transfer will commence automatically.

4. When the transfer is complete, another beep will sound and the radio display plus the Module's LED will begin blinking. Turn off the radio, then disconnect the loaded Data Module and Cloning Cable.

DOWNLOADING CONFIGURATION DATA FROM A DATA MODULE TO THE RADIO



1. Turn off the radio, then connect the 70-1081 Cloning Cable between the Programming Port of the radio and the 70-1082 Data Module. Each plug is keyed with a small tab, which must fit into the slot on one side of its receptacle.

2. Press and hold the [DEL] button (labeled [CLR/DEL] on the Deluxe Control Panel).

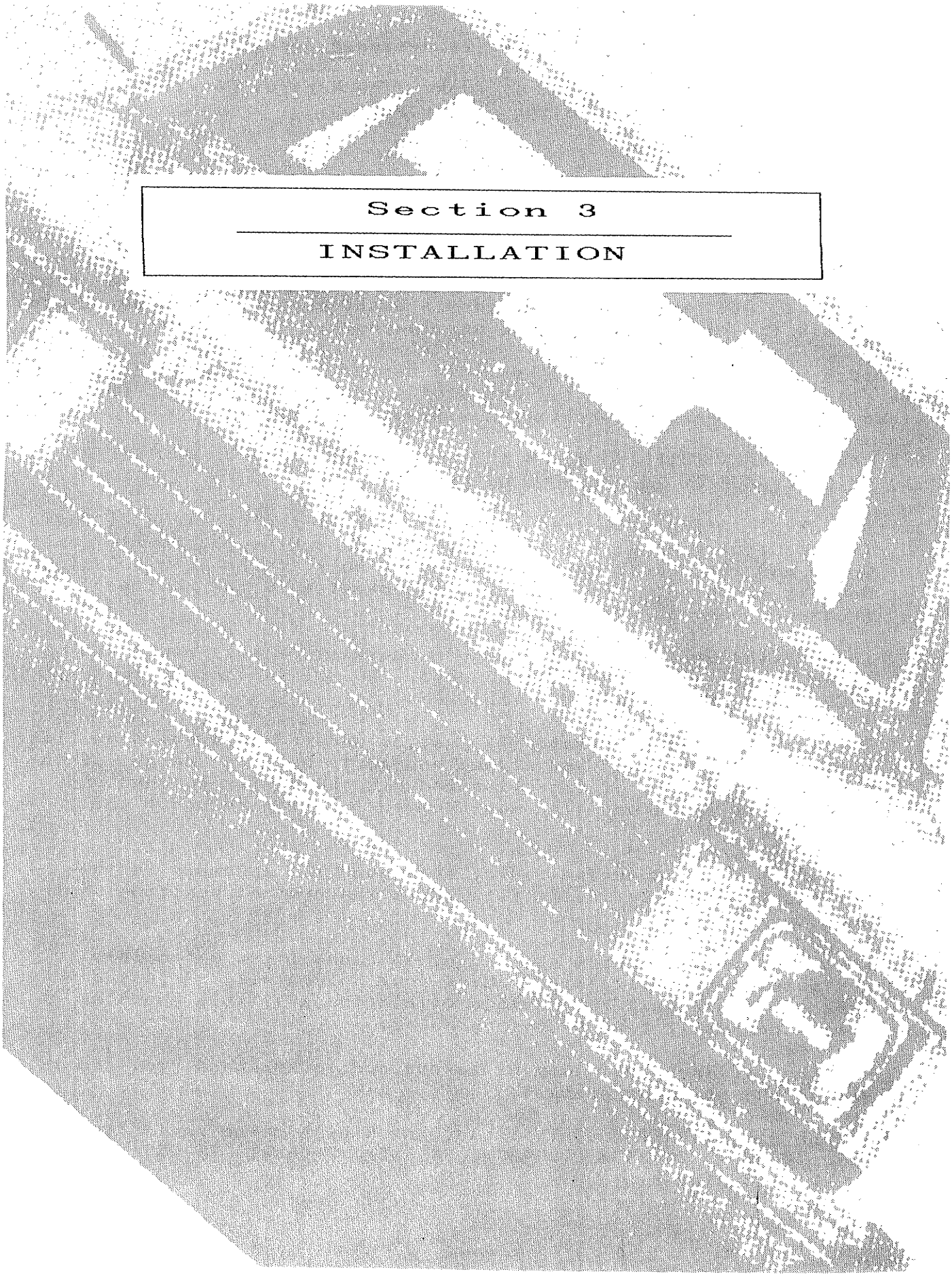
3. Turn on Radio power. The LED on the Data Module will illuminate and "SCI" will appear in the radio display, plus the radio power-up beep will sound. Do not release the [DEL] button until a second beep sounds (within one second). Configuration Data transfer will commence automatically.

4. When the transfer is complete, another beep will sound and the radio display plus the Module's LED will begin blinking. Turn off the radio, then disconnect the Data Module and Cloning Cable. When the radio is turned back on, it will operate according to its new programming.

NOTES

Section 3

INSTALLATION



The SYN-TECH II mobile transceiver is designed for use in vehicles and is shipped in one of two physical configurations: for mounting under a dashboard or for mounting in a trunk. The Control Panel and radio unit are separated in the latter configuration.

UNDER-DASH

Configured for under-dash mounting, the SYN-TECH II mobile radio is in a single housing with operator controls and pushbuttons on the front of the unit. It can be secured under a dashboard or some other location where the radio controls are easily reached by the operator.

Although methods of mounting the radio depend greatly on the layout of the vehicle interior and the operator's preferences; the following steps outline general installation without options:

USE CAUTION WHEN DRILLING HOLES AND CONNECTING WIRES TO AVOID PERSONAL INJURY OR DAMAGE TO THE VEHICLE OR RADIO.

1. Unpack all items that need to be installed: the SYN-TECH II radio, its mounting bracket and hardware, its Hand-Microphone, its Power Cord, and the Remote Speaker (provided only if the Deluxe Control Head is enclosed). An antenna that operates in the customer's frequency band is also needed.

2. Inspect the vehicle and plan where these items will mount and where wiring will route and connect. DO NOT INSTALL THE SYN-TECH II IN POSITIVE-GROUND VEHICLES.

3. Position the radio, first. It must be secured to a somewhat flat surface that is solid and strong enough to hold the weight of the radio under stress of vibration and also be easily reached and seen by the operator. The most common location is under the dashboard.

4. Place the bracket on the radio, then hold the assembly in the desired location to verify fit. Mark the bracket position on the mounting surface.

5. Remove the bracket from the radio, then use it as a template for marking the bolt holes. Mark four hole positions in the largest square pattern possible within the available mounting area, then drill four 9/64-inch holes.

6. Use the 3/8-inch self-tapping screws and lockwashers provided to secure the mounting bracket.

HIGH POWER RADIOS: If you are installing a high power radio (models 70-052x, 70-056x, 70-385x, 70-485x, 70-565x, 70-665x, 70-935x, or 70-980x), skip to step 8.

7. LOW POWER RADIOS ONLY (models 70-050x, 70-055x, 70-060x, 70-066x, 70-342x, 70-442x, 70-530x, 70-630x, 70-915x, or 70-970x):

7.1 Find the fuse block of the vehicle. In most passenger cars, it is located under the dashboard on the driver's side, against the firewall. Find an unused terminal lug that connects to the battery circuit. Use a voltmeter to verify that 12 Volts is present with the vehicle ignition switch off. Avoid splicing into wires under the dashboard because they may lead to an item that produces much electrical noise, such as a fan. If an unused terminal cannot be found on the fuse block, it is best to connect directly to the positive (+) battery wire under the hood.

7.2 Locate a good ground connection. Vehicle chassis should be ground, and a large bolt that secures large metal framework to more metal framework often is an adequate connection to the chassis. NOTE: If you must connect the red positive wire to the battery, connect the black negative wire to the negative (-) terminal of the battery.

7.3 Unwrap the DC Power Cord and position the plug so that it will reach its receptacle on the radio with six extra inches of wire length. Route the wires away from electronic and electro-mechanical equipment and respective wiring so that noise pick-up is minimized.

7.4 Bring the black wire to the ground bolt and cut to needed length. Attach a ring-lug to the wire, then secure it under the bolt. Bring the red wire to the battery-circuit terminal found earlier, attach the appropriate lug on the red wire, and mate.

If you must connect directly to the battery, find a feed-hole in the firewall that does not have other cabling passing through it (for avoiding noise pickup) where you can route both black and red radio wires into the engine compartment. Twist the wires together, then route them through the feed-hole to the battery. If the wires must cross sides, pass them along the front of the engine compartment to maintain distance from the firewall where most noise-generating electronic equipment is mounted.

7.5 Splice the red wire to the positive (+) battery wire — do not attach it to the battery post where corrosion exists. Attach a ring-lug to the black wire and secure it under the bolt that holds the battery-to-body connecting wire.

7.6 Skip to step 9.

8. HIGH POWER RADIOS ONLY:
Because of high-current requirements, the DC Power Cord is made of heavier wires that must be connected directly to the vehicle battery as follows:

8.1 Unwrap the DC Power Cord and position the plug so that it will reach its receptacle on the radio with six extra inches of wire length. Route the wires away from electronic and electro-mechanical equipment and respective wiring so that noise pick-up is minimized.

8.2 Find a feed-hole in the firewall that does not have other electrical wires passing through it (for avoiding noise pickup), where you can route both black and red radio wires into the engine compartment. Continue routing the wires to the battery. If the wires must cross sides, pass them along the front of the engine compartment to maintain distance from the firewall where most noise-generating electronic equipment is mounted.

8.3 Splice the red wire to the positive (+) battery wire — do not attach it to the battery post where corrosion exists. Attach a ring-lug to the black wire and secure it under the bolt that holds the battery-to-body connecting wire.

9. Find the best location for the antenna. This depends greatly on the type of antenna used and appearance limitations. Best performance is obtained when the antenna is mounted on the largest and highest horizontal metallic surface, such as the rooftop center. The center of an automobile trunklid is second best. A rule-of-thumb: find a horizontal metal surface that spreads in all directions as far as the antenna is high, but away from the engine.

10. Mount the antenna in accordance to instructions provided with it, and route its wire to the radio. If the antenna is mounted on the trunklid; route its wire behind the rear-seat back cushion, under the back seat, under the carpeting, toward the radio.

11. If you are installing a SYN-TECH II radio that is equipped with the Standard Control Head (model 70-0001), a loudspeaker is built in and you may skip this step. If the radio is equipped with the 70-0002 Deluxe Control Head, the Remote Speaker must be installed as follows:

11.1 With its mounting bracket attached, find a location to mount the 70-2355 Remote Speaker. It should be mounted such that its grill faces the operator without obstruction; otherwise, the higher frequency sounds, which attribute most to intelligibility, will be attenuated. The mounting bracket must fit against a flat surface and that surface must be sturdy enough to support the speaker.

11.2 Remove the bracket from the speaker and use it as a template to mark and drill three 3/32-inch holes for the 1-inch screws provided. Secure the bracket and speaker.

11.3 Pull the 12-pin Accessory plug off of the radio and extract the wire jumper between pins 5 and 6.

11.4 Insert the speaker wires into pins 4 and 6 of the Plug. Replace the Accessory Plug onto the radio.

12. Find a convenient position for the Hand-Microphone, which will hold its hang-up clip. Use the clip for a template, then drill three 5/64-inch holes. Secure the clip with the screws provided.

13. Slide the SYN-TECH II radio into its mounting bracket, connect the antenna cable to Antenna Jack J502 on the rear of the radio and connect the DC Power Cord to the DC Power Jack J506 that is also on the rear of the radio. Position the radio and tighten the two securing knobs.

14. Place the Hand Microphone in its clip and connect its plug to Microphone Jack P317 on the front panel.

15. Turn on the radio and verify proper operation. The antenna can be checked with a through-line wattmeter that measures both forward and reflected RF power.

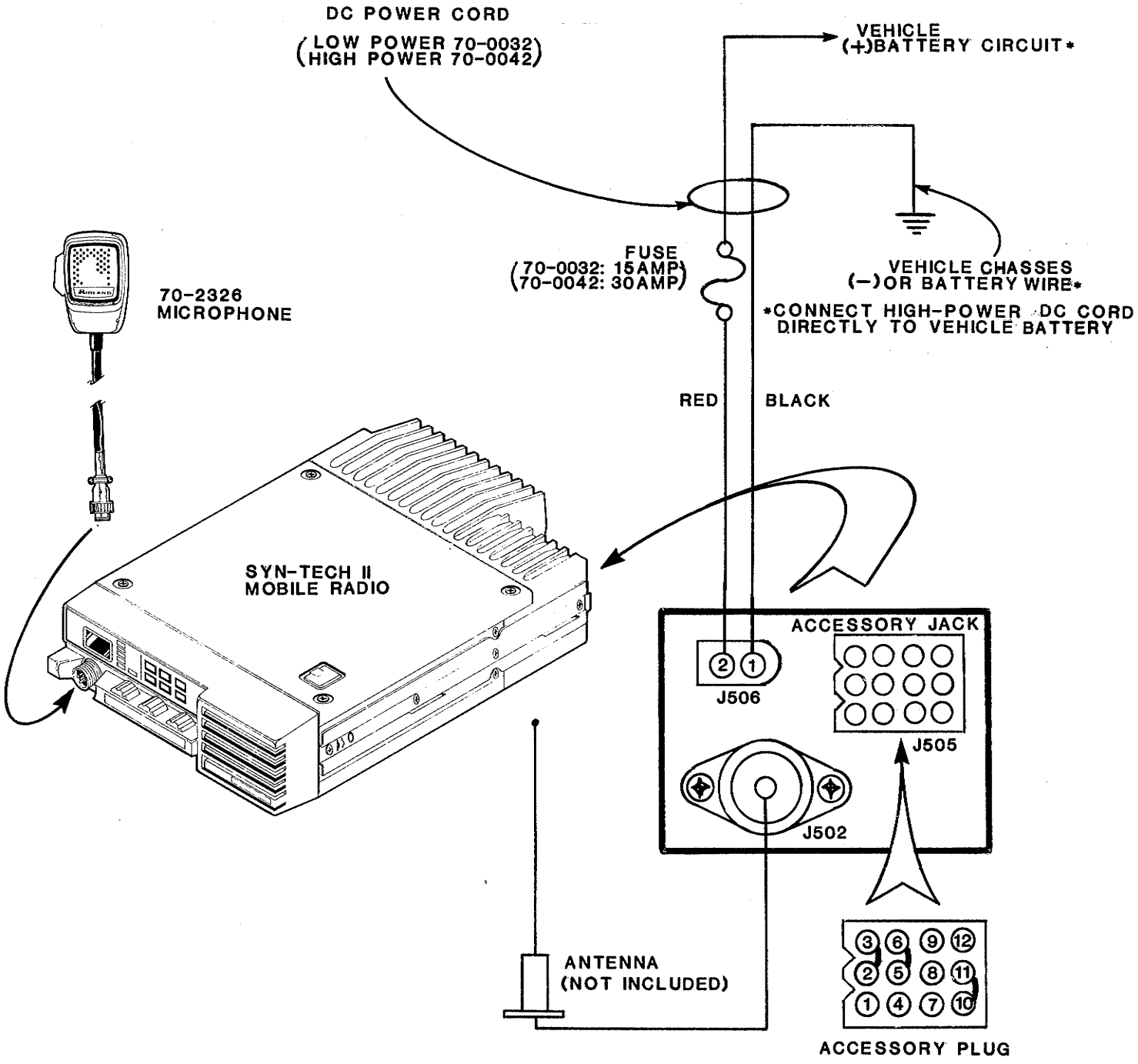


FIGURE 3.1 — UNDER-DASH WIRING

TRUNK-MOUNT

Configured for remote mounting, the SYN-TECH II mobile radio is split into two units. The front panel, that contains the operator controls, pushbuttons, and display, is separated from the TX/RX Unit that contains the transmitter and receiver circuitry. The two units are connected by the multiconductor Control Cable. The Control Head mounts within the operator's reach, such as under the dashboard; and the TX/RX Unit mounts in an out-of-the-way location, such as the vehicle trunk.

Although methods of mounting the radio depend greatly on the layout of the vehicle interior and the operator's preferences; the following steps outline general installation without options:

USE CAUTION WHEN DRILLING HOLES AND CONNECTING WIRES TO AVOID PERSONAL INJURY OR DAMAGE TO THE VEHICLE OR RADIO.

1. Unpack all items that need to be installed: the SYN-TECH II TX/RX Unit and its Control Head, mounting brackets and hardware, the Hand-Microphone, the Power Cord, the Control Cable, and the Remote Speaker (speaker not included with 70-0001 Standard Control Head configurations). An antenna that operates in the customer's frequency band is also needed.

2. Inspect the vehicle and plan where these items will mount and where wiring will route and connect. DO NOT INSTALL THE SYN-TECH II IN POSITIVE GROUND VEHICLES.

3. Position the radio, first. It must be secured to a somewhat flat surface that is solid and strong enough to hold the weight of the radio under stress of vibration. Common locations are in the trunk or under a seat.

4. Place the mounting tray on the radio, then hold the assembly in the desired location to verify fit. Allow room for the wiring and connectors.

5. Remove the mounting tray from the radio and use it as a template for marking the bolt holes. Mark four hole positions in the largest square pattern possible within the available mounting area, then drill four 9/64-inch holes.

6. Use the 3/8-inch self-tapping screws and lockwashers provided to secure the mounting tray.

HIGH POWER RADIOS: If you are installing a high power radio (models 70-052x, 70-056x, 70-385x, 70-485x, 70-565x, 70-665x, 70-935x, or 70-980x), skip to step 8.

7. LOW POWER RADIOS ONLY (models 70-050x, 70-055x, 70-060x, 70-066x, 70-342x, 70-442x, 70-530x, 70-630x, 70-915x, or 70-970x):

7.1 Find the fuse block of the vehicle. In most passenger cars, it is located under the dashboard on the driver's side, against the firewall. Find an unused terminal lug that connects to the battery circuit. Use a voltmeter to verify that 12 Volts is present with the vehicle ignition switch off. Avoid splicing into wires under the dashboard because they may lead to an item that produces much electrical noise, such as a fan. If an unused terminal cannot be found on the fuse block, it is best to connect to the positive (+) battery wire under the hood.

7.2 Locate a good ground connection. Vehicle chassis should be ground, and a large bolt that secures large metal framework of the vehicle body to more metal framework often is an adequate connection to the chassis.

7.3 Unwrap the DC Power Cord and position the plug so that it will reach its receptacle on the radio with six inches of additional length. Route the wires away from electronic and electro-mechanical equipment and respective wiring so that noise pick-up is minimized.

7.4 Bring the black wire to the ground bolt and cut to needed length. Attach a ring-lug to the wire, then secure it under the bolt. NOTE: If you must connect the red positive wire to the battery, the black negative wire must connect to the battery negative (-) terminal.

7.5 Feed the red wire to the battery-circuit terminal found earlier, attach the appropriate lug on the red wire, and mate. Hide the wire under carpeting and moulding for safety and best appearance. Do not pinch the wire nor route it near sharp metal edges that can wear its insulation.

If you must connect directly to the battery, find a feed-hole in the firewall that does not have other electrical wires passing through it (for avoiding noise pickup) where you can route both black and red radio wires into the engine compartment. Twist the wires together, then route them through the feed-hole to the battery. If the wires must cross sides, pass them along the front of the engine compartment to maintain distance from the firewall where most noise-generating electronic equipment is mounted.

7.6 Splice the red wire to the positive (+) battery wire — do not attach it to the battery post where corrosion exists. Attach a ring-lug to the black wire and secure it under the bolt that holds the battery-to-body connecting wire.

7.7 Skip to step 9.

8. HIGH POWER RADIOS ONLY:
Because of high-current requirements, the DC Power Cord is made of heavier wires that must be connected directly to the vehicle battery as follows:

8.1 Unwrap the DC Power Cord and position the plug so that it will reach its receptacle on the radio with six extra inches of wire length.

8.2 Twist the two Power Cord wires together, then feed them to the firewall under the dashboard. Hide the wires under carpeting and moulding for safety and best appearance. Do not pinch the wires nor route them near sharp metal edges that can cut or wear insulation. Route the wires away from electronic and electro-mechanical equipment and respective wiring so that noise pick-up is minimized.

8.3 Find a feed-hole in the firewall that does not have other cabling going through it (for avoiding noise pickup), for routing both black and red radio wires into the engine compartment. Continue routing the wires to the battery. If the wires must cross sides, pass them along the front of the engine compartment to maintain distance from the firewall where most noise-generating electronic equipment is mounted.

8.4 Splice the red wire to the positive (+) battery wire — do not attach it to the battery post where corrosion exists. Attach a ring-lug to the black wire and secure it under the bolt that holds the battery-to-body connecting wire.

9. Feed the Control Cable from the TX/RX unit to the Control Head, then connect it to each. Hide the cable under carpeting and moulding for safety and best appearance. Do not pinch the cable nor route it near sharp metal edges that can cut or wear its insulation.

10. Find the best location for the antenna. This depends greatly on the type of antenna used and appearance limitations. Best performance is obtained when the antenna is mounted on the largest and highest horizontal metallic surface, such as the rooftop center. The center of an automobile trunklid is second best. A rule-of-thumb: find a horizontal metal surface spreads in all directions as far as the antenna is high, but away from the engine.

11. Mount the antenna in accordance to instructions provided with it, and route its wire to the radio. If the antenna is mounted on the trunklid, use tie-wraps to secure the wire neatly and keep it out of the trunk-lid hinges.

12. If you are installing a SYN-TECH II radio that is equipped with the Standard Control Head (model 70-0001), a loudspeaker is built in and you may skip this step. If the radio is equipped with the 70-0002 Deluxe Control Head or the 70-0007 Small Remote Control Head, the Remote Speaker must be installed as follows:

12.1 With its mounting bracket attached, find a location to mount the 70-2355 Remote Speaker. It should be mounted such that its grill faces the operator without obstruction; otherwise, the higher frequency sounds, which attribute most to intelligibility, will be attenuated. The mounting bracket must fit against a flat surface and that surface must be sturdy enough to support the speaker.

12.2 Remove the bracket from the speaker and use it as a template to mark and drill three 3/32-inch holes for the one-inch screws provided with the speaker. Secure the bracket and speaker.

12.3 Insert the speaker wires into pins 4 and 6 of the 12-pin Control-Head Accessory Plug.

13. Connect the Control-Head Accessory Plug (P319) onto the backside of the Control Head and connect the TX/RX Unit Accessory Plug (P505) onto the backside of the TX/RX Unit. As shipped, P319 has two wire jumpers; P505 has three.

14. Find a convenient position for the Hand-Microphone, which will hold its hang-up clip. Use the clip for a template, then drill three 5/64-inch holes. Secure the clip with the screws provided.

15. Slide the SYN-TECH II radio into its mounting bracket, connect the antenna cable to J502 and connect the DC Power Cord to J506. Both jacks are on the rear of the radio. Position the radio and tighten the two securing knobs.

16. Place the Hand Microphone in its clip and connect its plug to Microphone Jack P317 on the front panel.

17. Turn on the radio and verify proper operation. The antenna can be checked with a through-line wattmeter that measures both forward and reflected RF power.

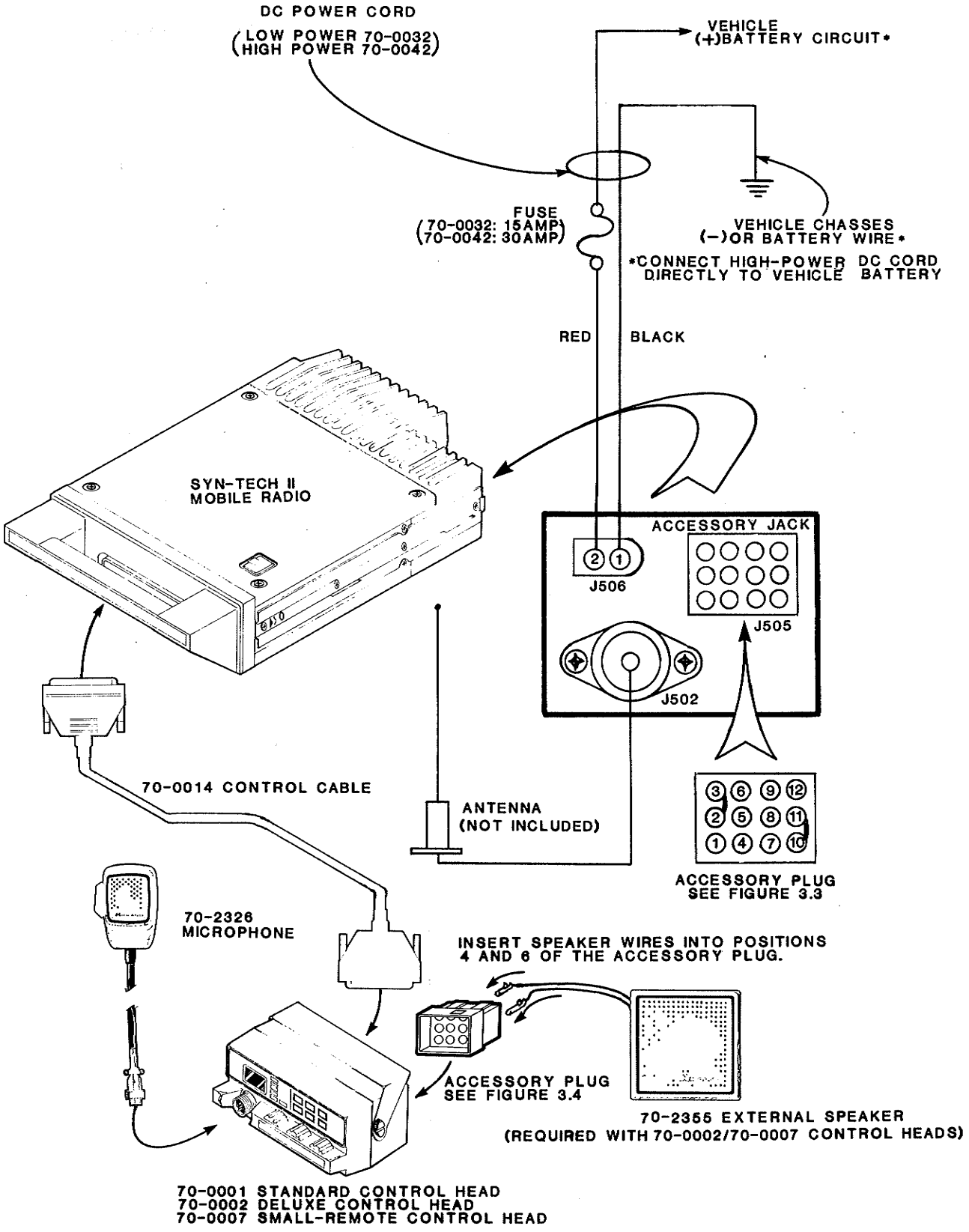
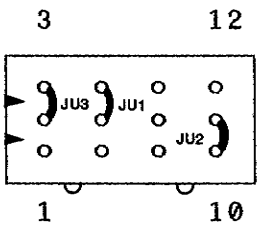
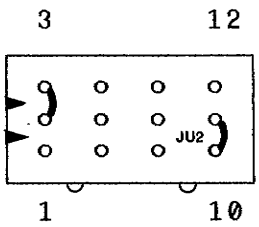
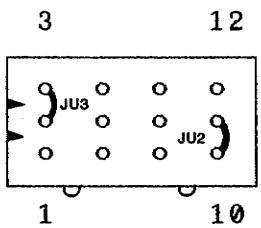
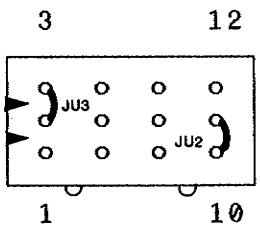
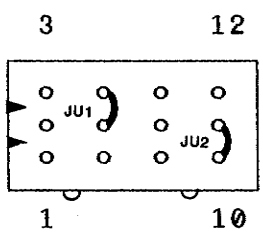
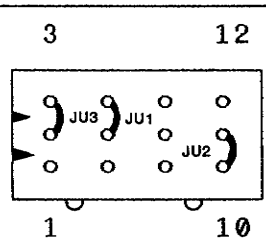
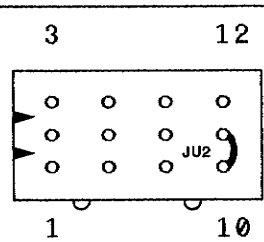
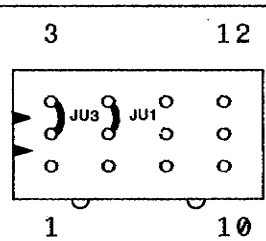
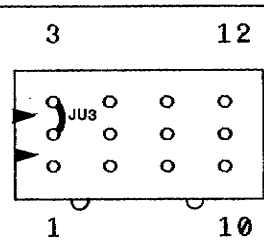
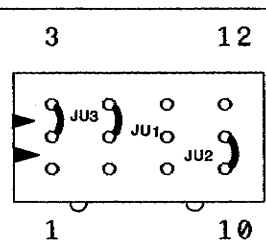
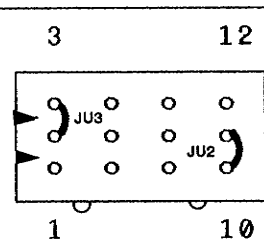
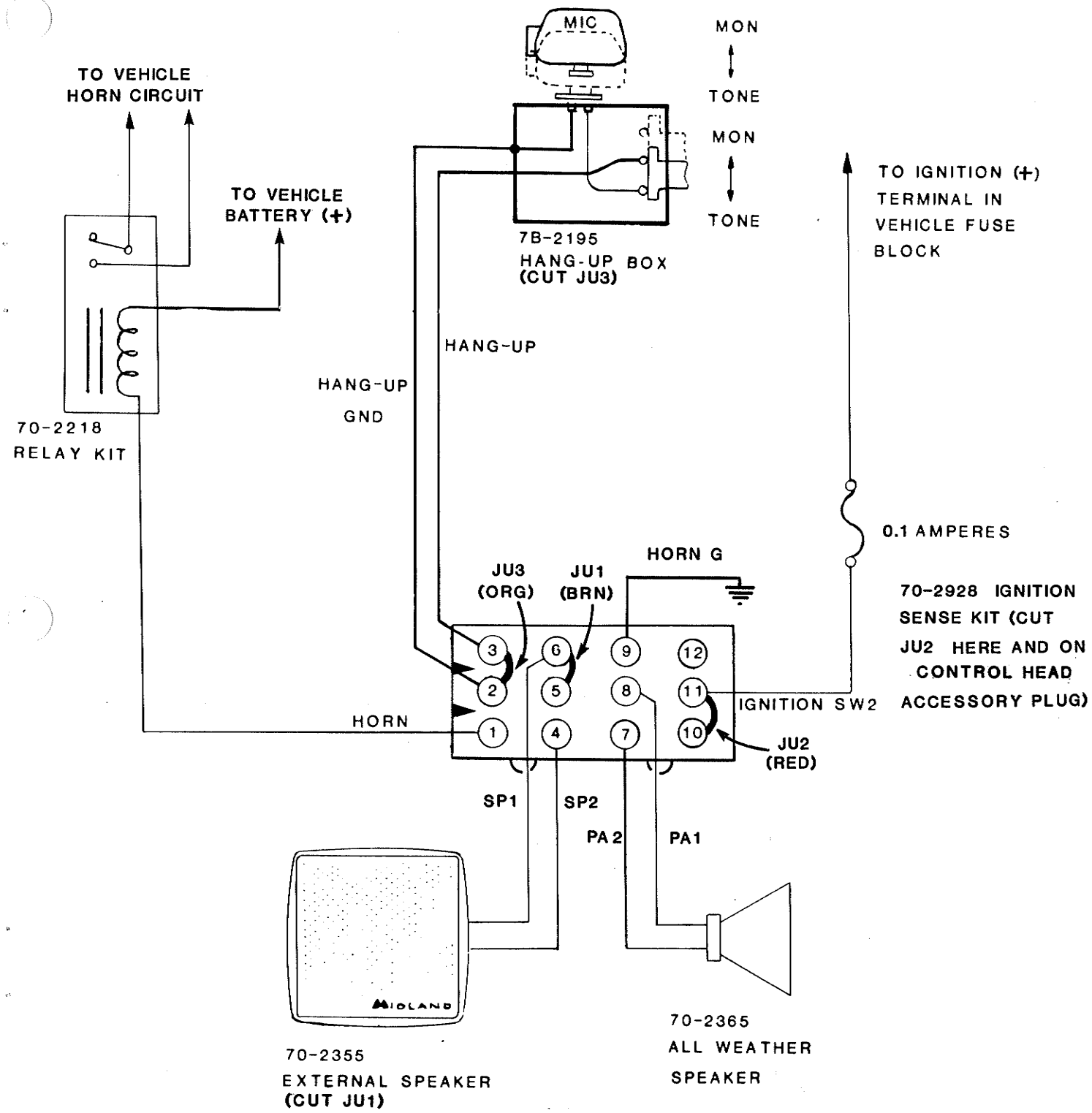


FIGURE 3.2 — TRUNK-MOUNT WIRING

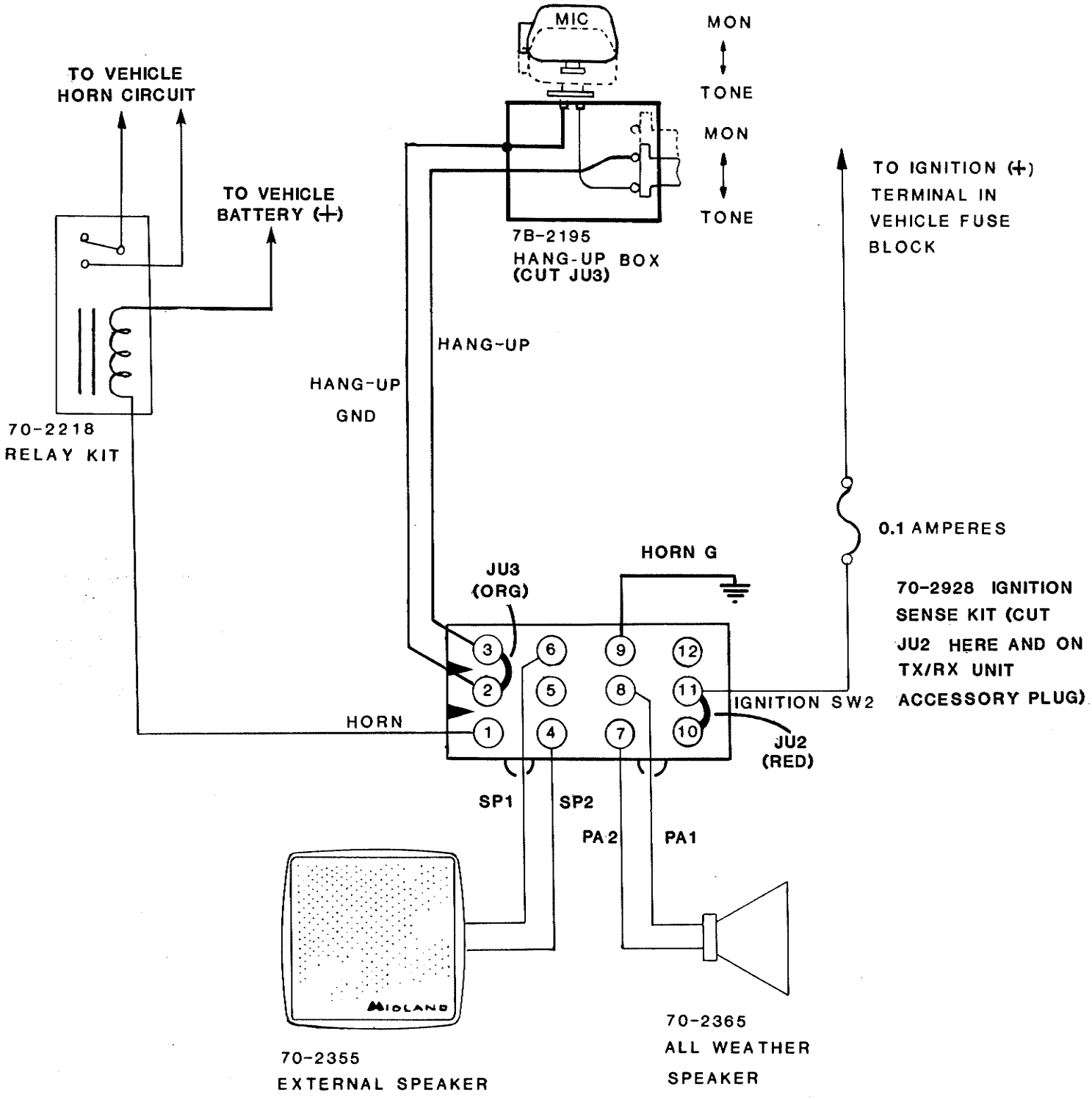
ACCESSORY PLUG JUMPERING

EQUIPMENT CONFIGURATION	ACCESSORY CONNECTION	P505 TX/RX UNIT	P319 CONTROL HEAD (Trunk-mount only)
STANDARD	———		
with EXTERNAL SPEAKER	P505 pins 4,6 OR P319 pins 4,6		
UNDER-DASH with HANG-UP BOX	P505 pins 2,3		———
TRUNK-MOUNT with HANG-UP BOX	P319 pins 2,3		
with IGNITION SENSING	P505 pin 11 OR P319 pin 11		
with HORN RELAY	P505 pins 1,9 OR P319 pins 1,9		



CAUTION: DO NOT GROUND ANY SPEAKER WIRES.
BOTH LEADS ARE ELECTICALLY LIVE.

FIGURE 3.3 — TX/RX UNIT ACCESSORY PLUG (P505) WIRING



CAUTION: DO NOT GROUND ANY SPEAKER WIRES.
BOTH LEADS ARE ELECTICALLY LIVE.

FIGURE 3.4 — CONTROL-HEAD ACCESSORY PLUG (P319) WIRING
(Trunk-mount radios only)

ELIMINATING RADIO INTERFERENCE

Occasionally, one must contend with interference from somewhere in the automobile. Interference problems are solved by understanding the interference and its path into the transceiver, locating its source logically, then eliminating it the simplest way available.

Interference either conducts into the transceiver directly, or is induced into it, or both. Conducted interference passes through the DC power leads or accessory wiring of the radio. Radiated interference, which can originate from anywhere in the vehicle, simply produces noise voltages on conductors inside the radio or its antenna. See Figure 3.5.

Conducted interference is simple noise voltage present in the vehicle electrical system. With many electrical devices turning on and off in a vehicle, current spikes produce voltage drops across wire resistances; thus, voltage transients appear throughout the electrical system. Connecting the radio power leads to this noisy electrical system applies the noise voltage directly to the radio. Most noise voltage is attenuated by power-line filters within the SYN-TECH II radio; but, spikes that are severe enough may become audible.

While interference conducted through power leads affects only transceiver audio circuitry; induced interference occurs when an electromagnetic field penetrates the radio. Induced interference often imitates receiver I.F. frequencies or channel frequencies, and thus invades the receiver through the antenna. If an electromagnetic field is strong enough, it can induce noise currents on radio accessory and power wiring.

IDENTIFYING THE INTERFERENCE

The first step toward eliminating interference is to identify and characterize it. Listening to the noise can tell a lot. For example: if the noise heard varies with engine speed, its source must be related to the engine; such as the alternator, ignition system, or tachometer.

Because you are dealing with frequency-modulated equipment, determination of whether the noise is at receiver-sensitive frequencies is easy: with all squelch circuits open, simply apply an unmodulated signal to the transceiver that is strong enough (10mV at the Antenna Jack) to overcome any high frequency noise signal that could invade the receiver. If noise stops, see Eliminating Radiated Interference below. If noise remains, interference is at low frequencies that can enter only by proximity coupling to radio wiring or direct conduction.

Next, power the radio with an independent 12-Volt power source (such as another car battery). If the noise remains, it is inductively coupled into radio accessory, power, or control wiring. Isolate by moving wiring and/or the radio while listening for changes in the

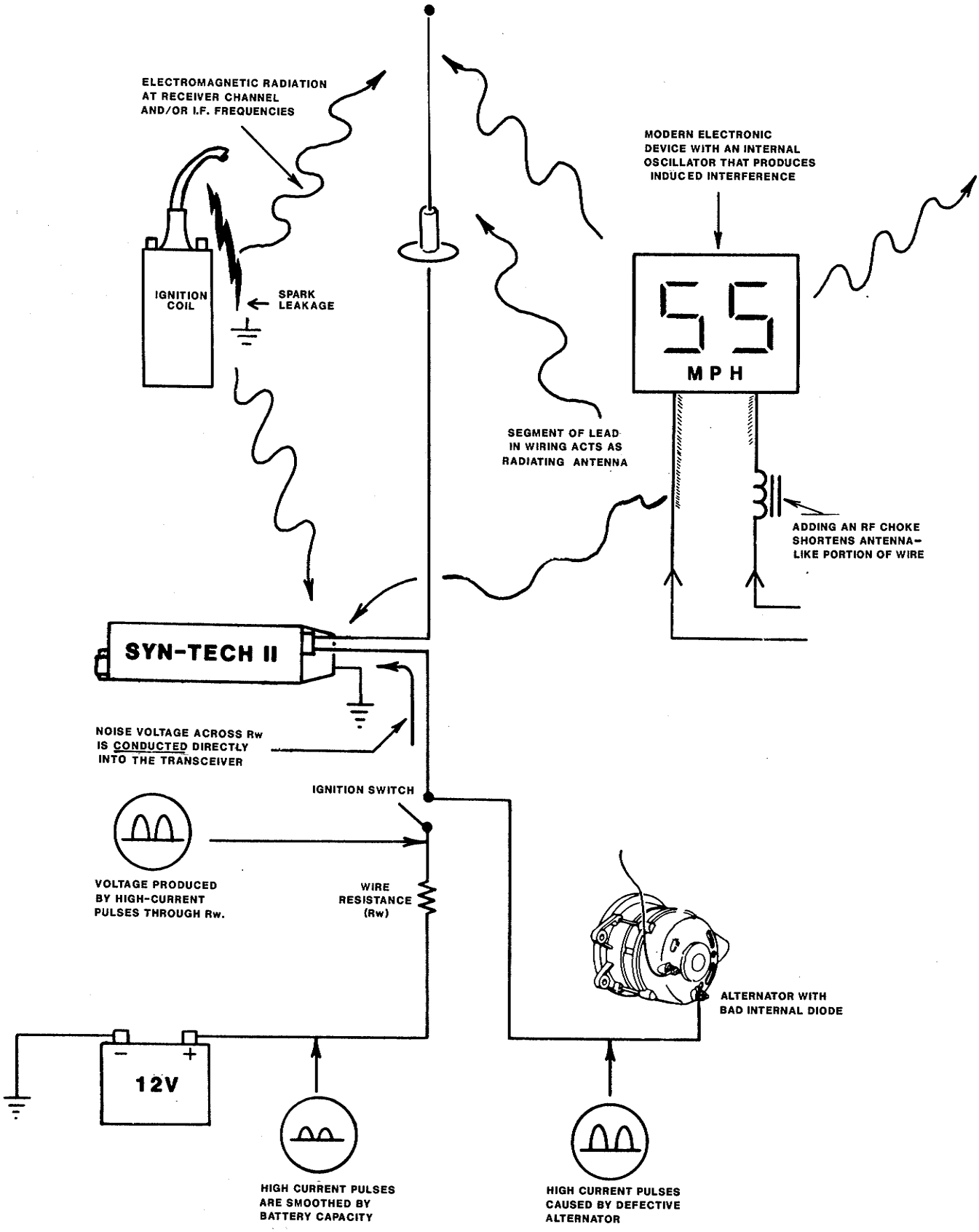


FIGURE 3.5 — INTERFERENCE PATHS

noise level. If noise stopped when you connected the independent power source, noise voltages are conducting through on the positive circuit or the ground (see Eliminating Conducted Noise).

ELIMINATING CONDUCTED NOISE

If noise voltage is present on the power leads, there may be defective equipment in the vehicle electrical system that needs repair. An alternator with a bad diode has a large current ripple on its output which produces a whine in the transceiver that varies in pitch with engine speed. Its current capacity is limited, but vehicle operation will not be noticeably impaired. Lights that dim during large current demands make good signs of such a defect.

Another possible source of conducted interference is a fan motor in the same circuit to which the radio is connected. Because a fan also induces interference, confirm that noise is conducted into the radio (see Identifying the Interference). If the interference is conducted into the DC power leads of the radio, find a power connection point in the electrical system for the transceiver that is further from the fan circuit.

Noise voltages can also add to the radio DC power input via the ground path. This is a condition where a high, noisy current shares the ground path of the radio equipment. For example:

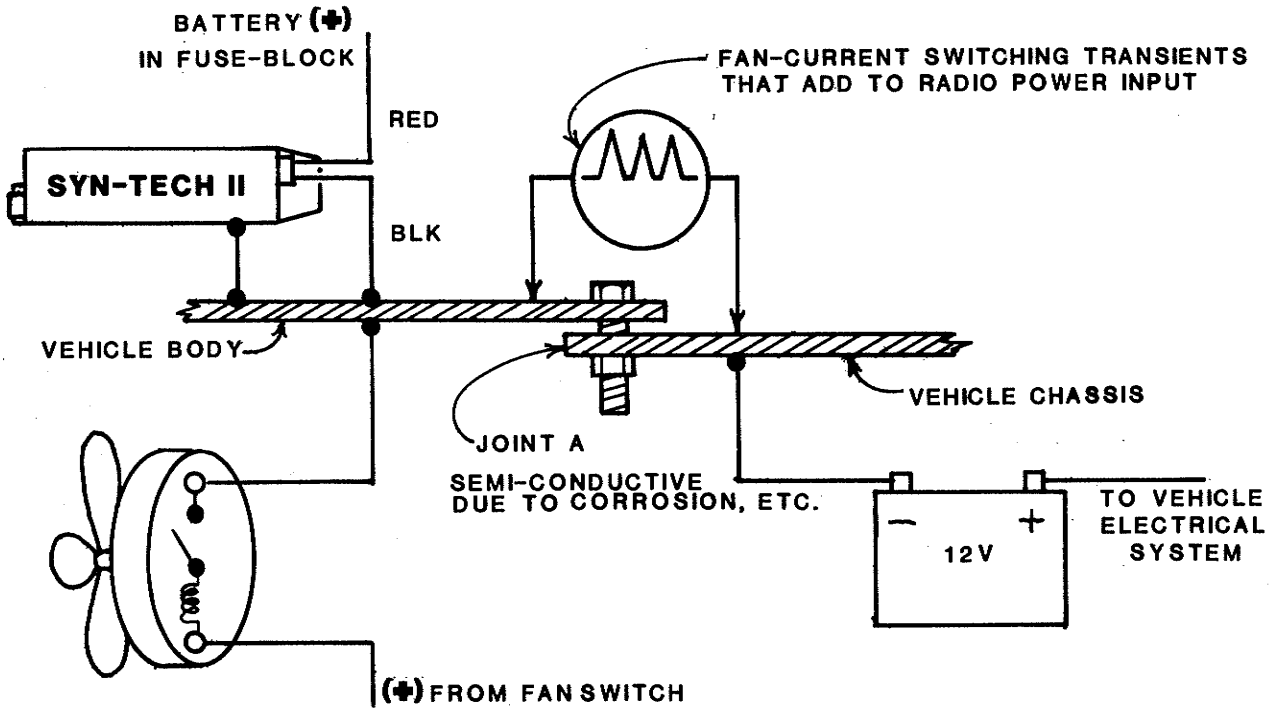
> Ground current of a fan motor finds its way to the vehicle battery through segments of metal body a frame assemblies (see Figure 3.6). If the electrical bond between two parts is weak, and the radio ground current must also travel through this weak joint, a voltage drop induced across the joint by the fan current will appear at the radio power plug.

To avoid a noisy ground, connect radio ground closer to the vehicle battery.

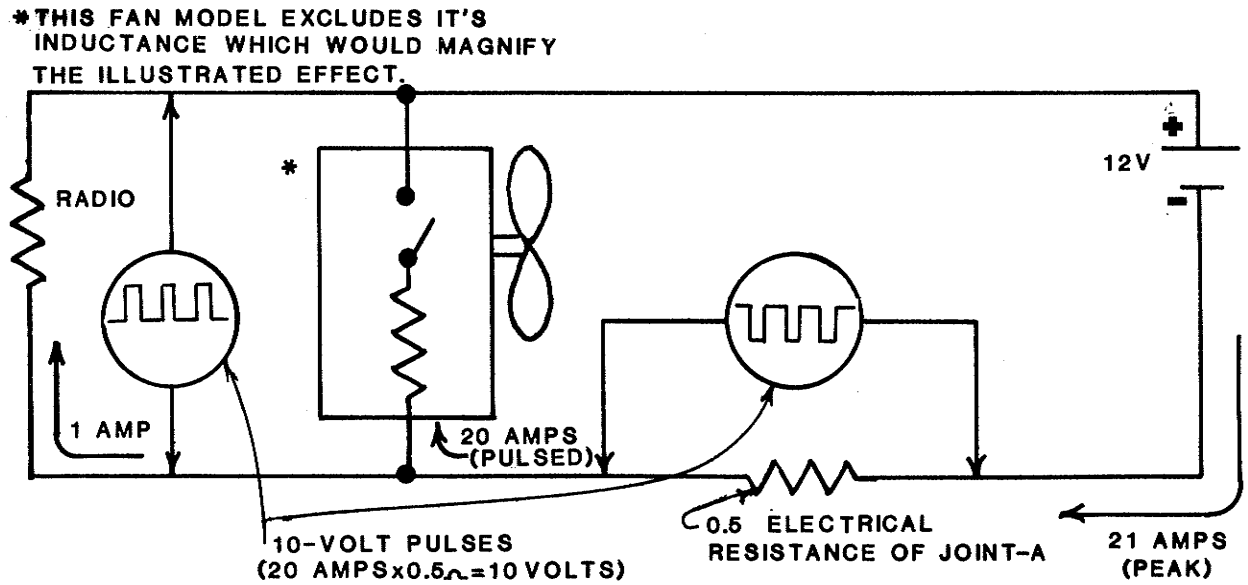
ELIMINATING RADIATED INTERFERENCE

If DC power source substitution proves interference is not conducted into the power leads, two likely sources of radiated interference are sparks and high frequency oscillators. Modern vehicles utilize many electronic accessories and systems that may produce a hash or whine in the transceiver. Oscillators within these devices, that sometimes are poorly shielded, may radiate an electromagnetic field at frequencies many multiples of the oscillator frequency.

Again, listen to the noise to learn about its source. Unless the interfering automobile accessory is part of engine operation, the noise won't vary with engine speed. The interfering accessory can be isolated by temporarily removing power to it and checking for absence of noise.



GROUND PATH



EQUIVALENT CIRCUIT

FIGURE 3.6 — A NOISY GROUND

Because lead-in wires of an automotive device can become radiating antennas, induced interference is more often radiated from the automobile accessory wiring than the accessory itself. Such interference can be inductively coupled into nearby radio power and accessory wiring or radiated toward the antenna.

Verify that the radio wiring does not run next to, nor parallel with, vehicle wiring. Move the wiring to identify and/or solve this problem.

If necessary, RF chokes can be connected in series with the 'hot' lead-in wires of the interfering device; close to its housing to kill the antenna effect. Usually, 'hot' wires can be identified if noise volume changes with wire movement.

Radiated interference may also enter through the antenna. This can be verified by substituting the antenna and its cable with a 50-ohm RF dummy load and short cable. The dummy load is necessary to properly balance the receiver input and give comparable results. If the noise stops, interference was entering the antenna. The only way to solve this sort of interference problem is to eliminate radiation at the source with RF chokes as described above. Sometimes, positioning the antenna further from the interfering accessory may help.

ELIMINATING INTERFERENCE FROM SPARKS

Sparks produce electromagnetic energy over a large area of the RF spectrum. This energy usually invades the receiver input through the antenna; therefore, the problem must be resolved at the source.

Modern vehicles use higher voltage ignition systems. As a result, electrical leakage occurs more easily through cracks and contaminants. If the interference produces a buzz while the engine is idling, and the buzz increases in pitch with engine speed, sparks are leaking to ground before distribution to the spark-plug wires. Check the ignition coil, its high voltage wire, and distributor cap for signs of arcing through cracks and burns or over dirt.

If the interference produces a repetitive popping sound while the engine is idling, and it increases in rate with engine speed, a single spark plug or wire are suspect. Check the distributor cap, spark plug wires, and spark plugs for cracks, burns, and dirt.

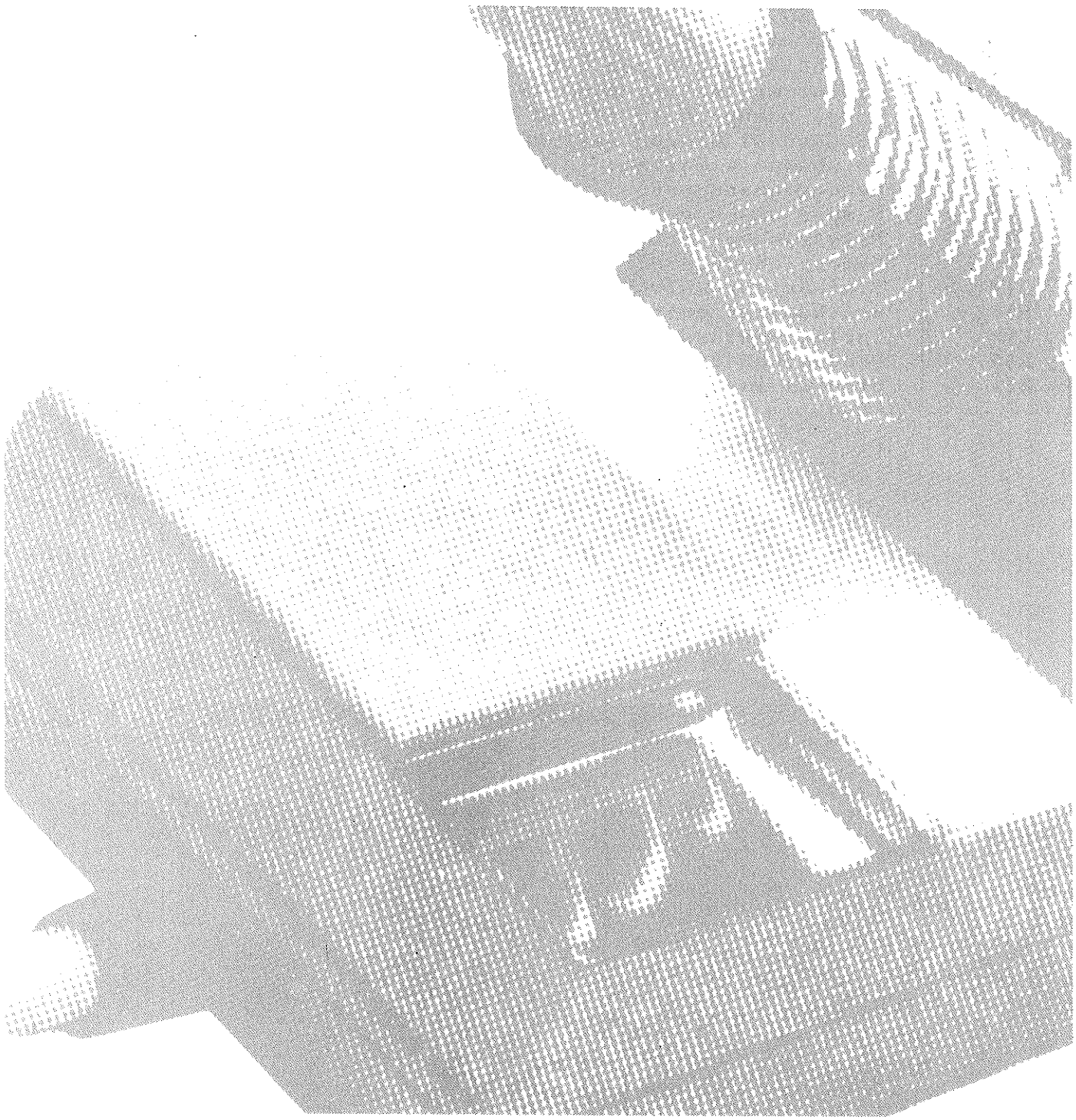
Spark plug and ignition coil wires are made with suppressive (resistive) conductors to reduce electromagnetic radiation. Older vehicles may not be equipped as such. Use an ohmmeter to verify.

Interference from sparks produced by fan moter brushes produces a whine that varies with fan speed. Badly worn brushes or bearings cause excessive sparks; therefore, replacement may be necessary. A 0.1 uF coaxial capacitor can be connected to the positive lead as close to the motor as practical to reduce radiated interference. The capacitor body must connect securely to the grounded motor housing.

NOTES

Section 4

REPAIRS



SYN-TECH II TRANSCEIVER ERROR CODES

When the SYN-TECH II radio is turned on, it performs a self-test that reports success by illuminating all displays and indicators momentarily. If a problem occurs, an error code appears in the channel display with an identifiable beep.

CODE	MEANING
E00	Microcomputer error - Master Program ROM
E01	Microcomputer error - RAM
E02	Model number not defined in programming Data-Packet
E03	No Channel Groups defined
E04	No channels defined
E05	Memory-check error
E06	Memory-check error
E07	Memory-check error
E08	Memory-check error
E10	Synthesizer unlocked at center frequency
E11	Synthesizer unlocked
E12	Duplex synthesizer unlocked
E50	Programmer interface error
E51	Cloning interface error

STATIC PRECAUTIONS

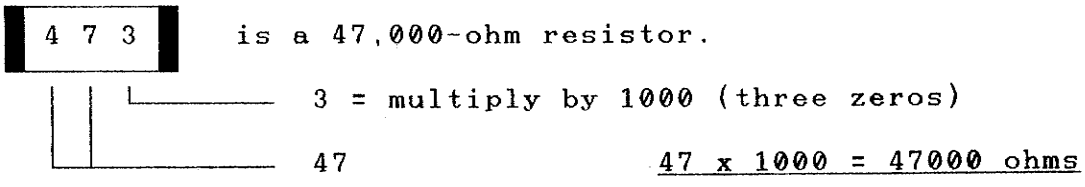
Many of the components utilized in the transceiver are susceptible to high electrical currents caused by high-voltage discharge — even when they are mounted on a printed circuit board. Before handling components and circuit boards, always take measures to avoid static potentials.

Any two objects can develop large static-electricity potentials between them as they move about. When two charged objects connect through metal or semi-conductive material, instantaneous discharge current can be very large. If discharging current is allowed to pass through an electronic component, either through its leads or through one lead to its case, the component could be damaged. The damage may only diminish component endurance which would not produce immediately visible anomalies. As the component is later subjected to stresses during equipment use, it will finally fail. Modern semiconductors used in Syn-Tech II equipment contain internal protection diodes that absorb most static discharges; but, if discharge current is large enough, component damage could still result.

To insure against component damage from static discharge; equalize static potentials of all objects in the work area. Since the workbench and equipment is grounded; everything else must be grounded — the soldering iron, the equipment being worked on, tools, and the person doing the work. Usually, there isn't a need to wire oneself to the workbench; just touch bench ground before anything else when sitting down and repeat occasionally.

CHIP RESISTOR IDENTIFICATION

Chip resistors used in the SYN-TECH II typically are black with white numerals or white with blue numerals. Resistance in ohms can be determined from value markings as follows:



DIODE AND TRANSISTOR CONFIGURATIONS

The following applies to most surface-mounted diodes and transistors used in the SYN-TECH II radio.

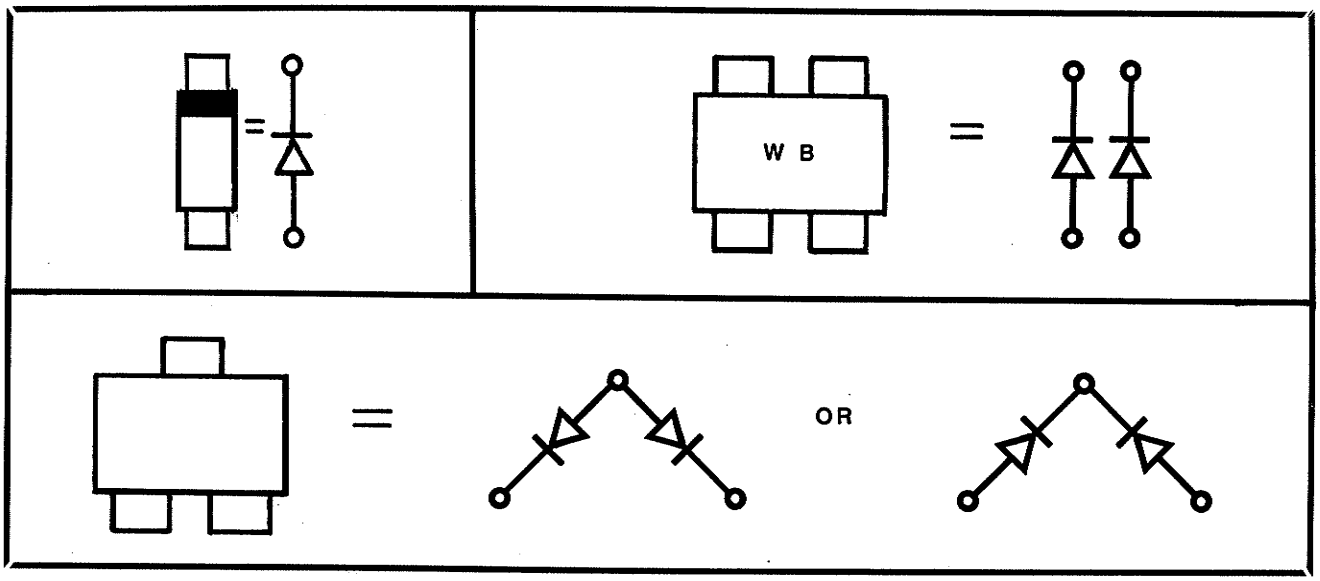


FIGURE 4.1 — SURFACE-MOUNT DIODES

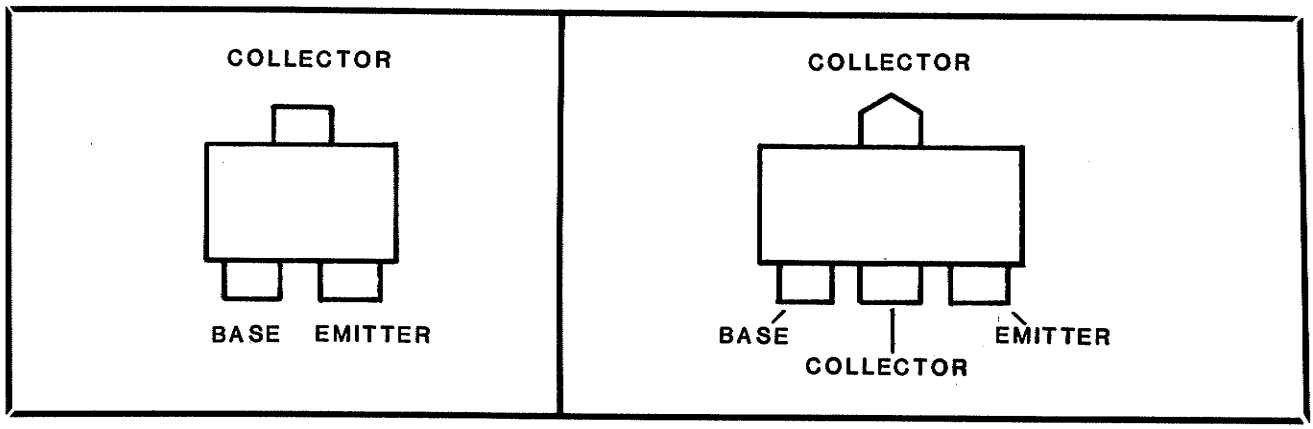


FIGURE 4.2 — SURFACE-MOUNT TRANSISTORS

CHIP CAPACITOR IDENTIFICATION

Chip capacitors used in the SYN-TECH II typically are brown, green or white and marked with one alphabetical character followed by a numerical multiplier. On larger-size chip capacitors, bars above, below, or beside these characters define temperature characteristic.

NOTE: Because of critical factors such as Q and tolerence; do not substitute any chip capacitors used in the PA Module nor the receiver preselector. Use direct replacement parts that are available from MIDLAND.

FIRST DIGIT				SECOND DIGIT	
ALPHABET CHARACTER	NUMERICAL VALUE	ALPHABET CHARACTER	NUMERICAL VALUE	NUMERICAL CHARACTER	MULTIPLIER VALUE
A	1.0	T	5.1	0	1.0
B	1.1	U	5.6		
C	1.2	V	6.2	1	10
D	1.3	W	6.8		
E	1.5	X	7.5	2	100
F	1.6	Y	8.2		
G	1.8	Z	9.1	3	1000
H	2.0	a	2.5		
J	2.2	b	3.5	4	10,000
K	2.4	d	4.0		
L	2.7	e	4.5	5	100,000
M	3.0	f	5.0		
N	3.3	m	6.0	8	0.01
P	3.6	n	7.0		
R	4.3	t	8.0	9	0.1
S	4.7	y	9.0		

Example: A 1 is a 10 pF capacitor.

1 = multiply by 10

A = 1.0

NOTES

MIDLAND

RADIO CORPORATION

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(Info correct as of 2/10/2006)