ASYNCHRONOUS COMMUNICATIONS ADAPTOR/MODEM 9402

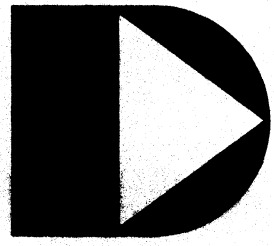
Product Specification

August 6, 1976

Model Code No. 60098-01

Supercedes 60098

DATAPOINT CORPORATION



The leader in dispersed data processing ™

DATAPOINT CORPORATION

PRODUCT SPECIFICATION

8/06/76

ASYNCHRONOUS COMMUNICATION ADAPTOR/MODEM 9402

1.0 GENERAL DESCRIPTION

The Datapoint 9402 Asynchronous Communications Adaptor, consisting of a communications interface and integral medium-speed modem, provides the Datapoint Processor user the capability of binary serial asynchronous data communications over the switched (DDD) telephone network or dedicated (leased) telephone circuits.

The adaptor accomplishes in both directions (transmission and reception) the conversion between the internal parallel input/output bus data used by the processor and serial start/stop data in the form of frequency-shift keyed tones used for communication over telephone lines.

The 9402 main data channel is capable of data rates to 1200 bits/second over the switched telephone network or unconditioned dedicated (leased) telephone lines. Over dedicated, conditioned telephone lines, operation to 1800 bits/second is possible. The main channel tone frequencies are compatible with Bell 202C, 202D, 202R or equivalent modems. A supervisory (reverse) data channel is provided which always operates in the direction opposite the main channel. The reverse channel may be used at rates to 150 bits/second in conjunction with another 9402 or may be operated in a mode compatible with the slower Bell 202-type reverse channels.

Character format and data rate for transmission and reception are completely under program control, as are line control functions and automatic dialing and answering operations.

2.0 SYSTEM REQUIREMENTS

2.1 Unit Compatibility

The 9402 operates with either a Datapoint 5500 or 2200/1100 of any memory size. Interface is to the Datapoint input/output bus. A maximum of two interface adaptor devices such as the 9402 may be connected to the input/output bus, since units of this type are supplied power from the Datapoint Processor. Provisions for power and physical housing for more than two devices are available.

2.2 Telephone Network

2.2.1 Switched (DDD) Telephone Network

For connection of the 9402 to the switched telephone network, a Data Access Arrangement (DAA) is required. The 9402 is designed to operate with the Bell 1001B (CBT), 1001D, 58118 or equivalent DAA's. The DAA should be installed without a power supply since the 9402 supplies power for the unit. Due to the higher baud rates utilized by the 9402 main channel, transmission for main channel data may occur in only one direction at any time over two wire switched network circuits. The supervisory (reverse) channel may be used for data transmission in the opposite direction at rates to 150 bits/second. The maximum main channel data rate over a switched network connection is 1200 baud.

2.2.2 Dedicated Telephone Lines

Dedicated (leased) telephone circuits are used in applications where higher main channel data rates are required or when connection of points in the communications system cannot be accomplished via the switched network. Leased lines may be either two-wire or four-wire circuits and may be used to connect two or more points in a system. Operation over two-wire circuits still requires that the 9402 main data channel be utilized in only one direction at any time, but simultaneous transmission and reception of main channel data is possible with four-wire circuits.

Since leased lines are not part of the switched network, no Data Access Arrangements are required.

For main channel data rates up to 1200 bits/second, a type 3002 leased telephone facility without conditioning may be used. Operation at rates up to 1800 bits/second is possible with a 3002 channel with C2 conditioning.

Two-wire point-to-point leased lines are similar to switched network circuits; the main data channel may be used in only one direction at a time. Four-wire point-to-point leased lines however, allow continuous, simultaneous transmission and reception of main channel data.

2.2.2.1 Multipoint Networks

Leased line networks for connection of three or more points are available in both two and four-wire configurations. These multipoint networks are employed for polling applications where one master station transmits to all remote stations simultaneously and one remote station is selected for transmission to the master station. If the network is two-wire, only one station may use the main channel for data transmission at any time. Four-wire operation allows continuous transmission from the master station to all remotes, and simultaneous transmission from the selected remote station to the master.

3.0 TECHNICAL CHARACTERISTICS

3.1 Specifications

Data Rates: (Programmable transmit and receive)

Main Channel - Up to 1200 bits/second (Dial network or unconditioned 3002 leased telephone lines)
Up to 1800 bits/second (3002 leased line with C2 conditioning)

Reverse Channel - Up to 150 baud

Data Format: Serial, Asynchronous; 1 start bit, 5, 6, 7, or 8 data bits and 1 or 2 stop bits per character (programmable)

Data Modulation Method: Frequency Shift Keying (Both channels). Frequency Assignments (non-inverted):

	Main Channel	Reverse Channel
Mark (1)	1200 Hz	387 Hz (Bell reverse channel frequency)
Space (0)	2200 Hz	470 Hz

Answer Tone Transmission and Reception (Programmable):

2025 Hz; Reception requires tone presence for greater than 250 msec.

Telephone Line Interface: Transformer coupled 600 ohms resistive (two or four-wire).

Transmit Level (Main Channel, Reverse Channel, and Answer Tone): 0 dbm to -12 dbm; adjustable in 2 db steps.

Receive Level (Both Channels): +4 dbm to -40 dbm; adjustment required.

Line Configurations: 2-wire or 4-wire.

Operating Modes:

1) Simultaneous main channel transmission and reception - 4-wire only.

2) Transmission in one channel simultaneous with reception in the other channel -2-wire.

3) Transmission and reception in main channel (non-simultaneous) and on-off keying of supervisory channel (Bell 202 compatible).

Clear to Send Delay: 200 +/-20 msec, 60 +/-6 msec, 30 +/-3 msec, and 15 +/-1.5 msec (strap selectable).

Receiver Squelch: Inhibits carrier acquisition for one-half CTS delay time (100, 30, 15, or 7.5 msec).

Main Channel Carrier Detect: Acquisition time 40 +/- 10 msec or 12 +/- msec (strap selectable); Release (Drop) time 12 +/-2 msec.

Supervisory Channel Carrier Detect: Acquisition Time 40 +/-10 msec; Release (Drop) time 12 +/-2 msec.

Carrier Soft Turn Off (main channel only): One fourth CTS delay following RTS transition to false state: 50 msec, 15 msec, 7.5 msec, or 4 msec.

3.1.1 General

Aside from the automatic dialing and answering functions performed by the 9402, its main functions are data transmission and reception. These functions are depicted in basic form in Figure 3-1.

3.1.2 Transmission

A character transferred from tne processor via the input/output bus to the Adaptor is first placed in the transmit character buffer. It is then transferred to the serial transmit register where start and stop bit(s) are appended to the character and conversion to bit serial form occurs.

If a character is presently being processed by the serial transmit register, the next character remains in the transmit character buffer until processing is completed. The output of the serial transmit registser (Transmit Data) is applied to tne modem transmitter, where it controls the frequency of the tone transmitted on the telephone line. If the modem is conditioned for transmission using main channel frequencies, the state of this line keys the frequency of the transmitted tone between 1200 Hz (`mark` or `1`) and 2200 Hz (`space` or `0`). If transmission is in the supervisory (reverse) channel, the tone is keyed between 387 Hz (`mark` or `1`) and 470 Hz (`space` or `0`). The modem transmitter, under program control, may also transmit a 2025 Hz tone which is used in the automatic answering operation.

3.1.3 Reception

The modem receiver accepts frequency-shift keyed tones from the telephone line in either the main channel or reverse channel frequency bands (frequencies described above) and converts these to serial binary data. This serial data line (Receive Data) is applied to tne serial receive register, where the start and stop bits are stripped and each character is assembled into parallel form. Following this assembly process, the character is transferred to tne receive character buffer, where it awaits transfer to the processor via the input/output bus. The modem receiver may also be conditioned for receipt of the 2025 Hz tone transmitted from tne answering station during tne automatic dialing operation.

In two-wire operation, the modem transmitter output and receiver input are both connected to the telephone line, and transmission and reception occur in different bands. In four-wire operation, the transmitter output and receiver input are connected to separate lines, allowing simultaneous transmission and reception in the main frequency band.

3.2 Programming Considerations

Figure 3-2 indicates tne programming interface for tne 9402, showing sources and destinations of all input, output and command operations.

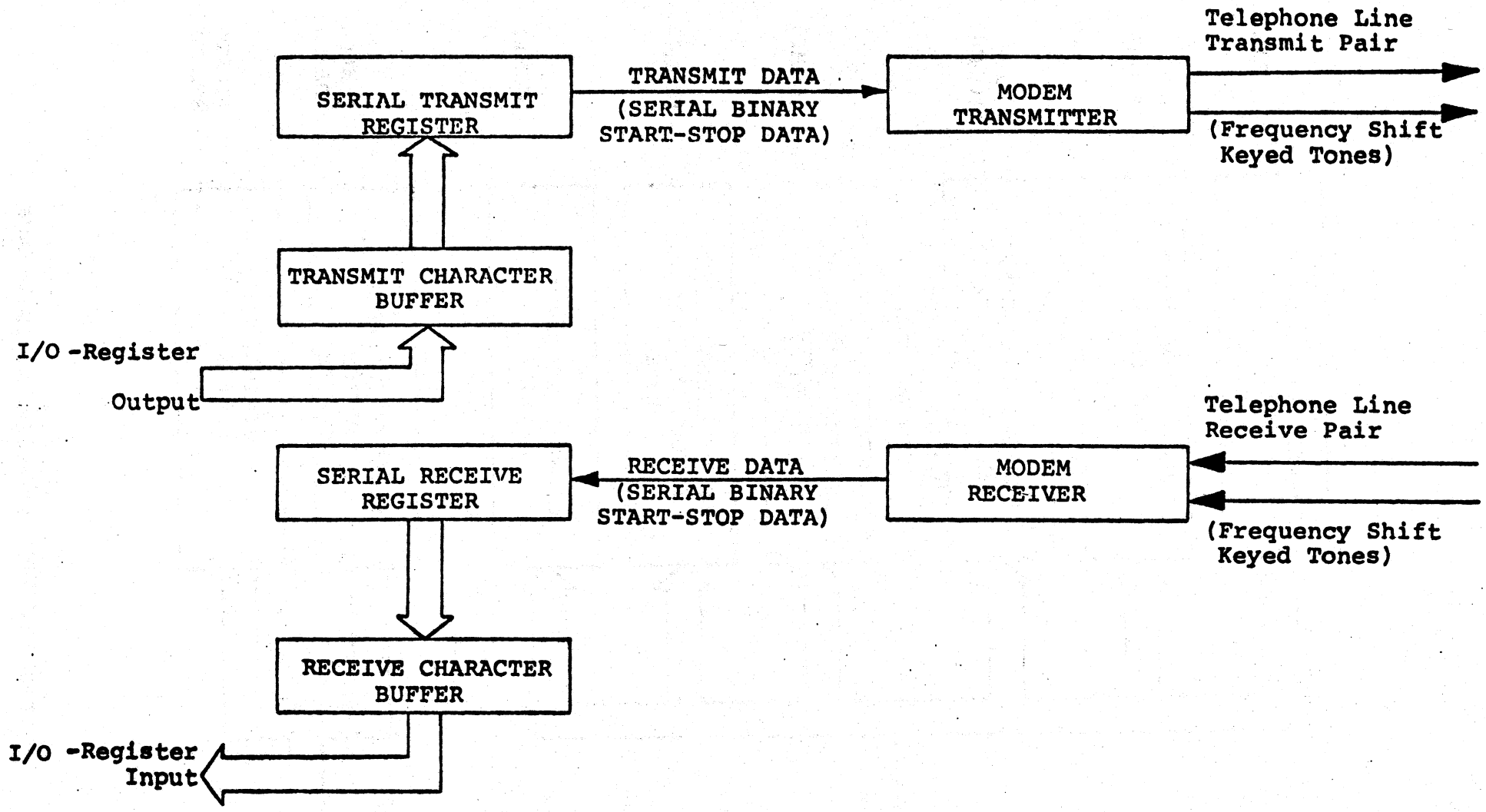


FIGURE 3-1 9402 BASIC FUNCTIONAL DIAGRAM

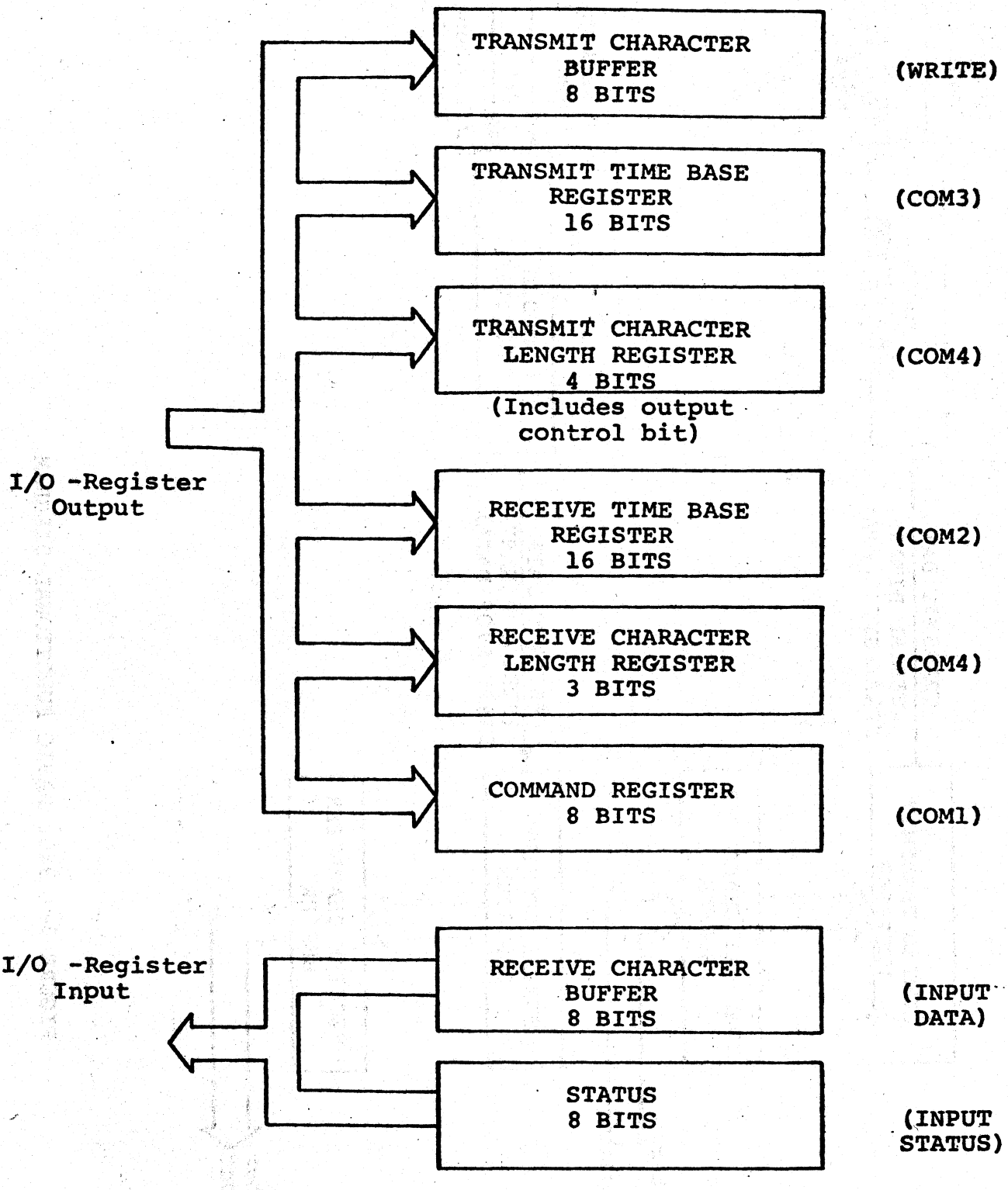


FIGURE 3-2 9402 PROGRAMMING INTERFACE

3.2.1 Device Address

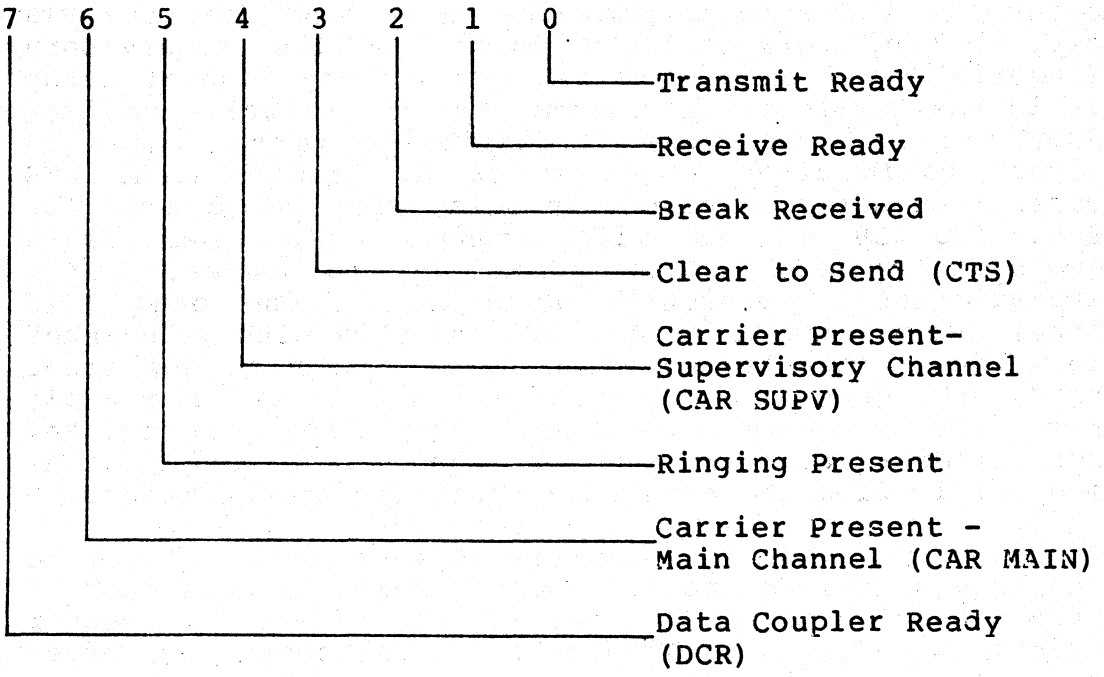
Each device connected to the processor input/output bus is assigned a unique address, allowing the processor to selectively communicate with each device while only that device is addressed. The 9402 is factory-wired with an address of 322 (octal) but this strapped address may be modified if required.

The 9402 is addressed by the program by setting the I/O-register to 322 (octal) and executing an EX ADR instruction.

3.2.2 Status

After addressing the 9402, execution of an INPUT instruction loads the 9402 status into the I/O-register of the processor. Status word bit assignments are as follows:

9402 STATUS WORD



Description of Status Bits:

Bit 0 - Transmit Ready: The true (1) state of this bit indicates that the transmit character buffer is empty and can accept another character for transmission. When a new character is accepted by the 9402 for transmission the Transmit Ready bit goes false (0) until that character is transferred to the serial transmit register. Characters should not be transferred to the 9402 unless the Transmit Ready bit is true.

Bit 1 - Receive Ready: The true (1) condition of this bit indicates that the receive character buffer is full (a character has been received). If the processor does not read the character prior to reception of a new character, the new character will move into the receive buffer, destroying the previous character. After execution of an INPUT instruction while in data mode, the Receive Ready bit will go false (0) until another character is received.

Bit 2 - Break Received: The true (1) condition of this bit indicates that the Receive Data line from the modem has been in the `space` (0) state for more than one character time.

Bit 3 - Clear-to-send (CTS): The true condition of this bit indicates that the 9402 modem is prepared to accept data for transmission in either the main or reverse channel as determined by the RTS and SUPV command register bits and the `Supervisory Channel Enable/Disable` strap option. Transmission always occurs in the main channel frequency band when the RTS bit is true; transmission occurs in the supervisory (reverse) band only when the Supervisory Channel strap is in the Enable position, the RTS bit is false and the SUPV bit is true. When transmission is to begin (in either band) after a period of no transmission, CTS comes true after a selectable delay time (strappable for 200, 60, 30 or 15 milliseconds), and goes false immediately when transmission is to cease. When transmission is presently occurring in one band (CTS true) and the state of the RTS and SUPV bits is changed to indicate that transmission is to change to the other band, CTS goes false immediately and comes true again after the strapped delay time. This delay is required for stabilization of the telephone line and distant modem following the change in transmission conditions.

Any time the RTS command register bit changes to the true state, indicating the beginning of main channel transmission after a period of reverse channel transmission or of no transmission, CTS comes true after the strapped delay time. During this time, the main channel `mark` frequency (1200 Hz) is transmitted and when CTS comes true, data may be presented by the processor for transmission. When the RTS bit goes false, CTS goes false immediately and the modem transmits a `soft carrier turn-off` signal for one-fourth the strapped CTS delay time.

This 880 Hz tone is recognized by the distant modem as an out-of-band signal and allows it to terminate its reception without producing spurious received data. Following the soft carrier tone, transmission ceases unless the modem is now conditioned for reverse channel transmission (SUPV bit true and `Supervisory Channel` strap in the `Enable` position). In this case, the reverse channel `mark` tone (387 Hz) is transmitted for the remaining three-fourths of the CTS delay time. At the end of the delay, CTS comes true again, indicating that the modem is ready for data transmission in the supervisory (reverse) channel.

Finally, if the SUPV command bit comes true following a period when both RTS and SUPV have been false (no transmission in either channel; CTS false), CTS comes true after the strapped delay time. In this case the reverse channel `mark` tone is transmitted during the entire delay. Data may then be presented for transmission when CTS comes true.

Bit 4 - Carrier Present - Supervisory Channel (CAR SUPV): The true (1) state of this bit indicates that the 9402 modem is conditioned for reverse channel reception and is receiving valid tones in that band. The modem receiver is conditioned for reverse channel reception only when the RTS command register bit is true and the Supervisory Channel strap is in the Enable position. CAR SUPV comes true after reception of valid tones for approximately 40 milliseconds, and goes false if valid tones are not received for any period exceeding 12 milliseconds.

When RTS changes from the false to the true state, the modem receiver is `squelched` for one-half the CTS delay time discussed previously. During this squelch time, the modem receiver is inhibited from detecting reverse band tones and CAR SUPV will come true 40 msec after the end of the squelch period if valid reverse channel tones are being received. The squelch function allows the telephone line to stabilize following the change in transmission conditions before detection of reverse channel tones is begun.

If the `Receiver Clamp` strap option is used, the Receive Data Signal between the modem receiver and the serial receive register is `clamped` (forced) to the mark state during periods when CAR SUPV is false (while the receiver is conditioned for reverse channel reception). This prevents spurious data produced by the modem receiver during periods when valid tones are not being received from causing characters to be assembled and setting the Receive Ready status bit.

Bit 5 - Ringing Present: The true (1) condition of this bit indicates that the Data Access Arrangement has detected a ringing signal on the telephone line. This bit is true during the ringing portion of a ring cycle (approximately 1 to 2 seconds) and false (0) during the remainder of the ring cycle (2 to 4 seconds).

Bit 6 - Carrier Present - Main Channel (CAR MAIN): The true (1) condition of this bit indicates that the modem receiver is conditioned for reception in the main channel and tnat valid tones are being received in that band.

The receiver is conditioned for main channel reception when the RTS bit is false if the `Supervisory Channel` strap is in the `Enable` position. If the strap is in the `Disable` position, the receiver is always conditioned for main channel reception. In the first case (strap in `Enable` position), the modem receiver is squelched (as described above) for one-half the CTS delay time after RTS changes to the false state, during which time main channel tone detection is inhibited. Following the squelch period, CAR MAIN comes true after receipt of valid main channel tones for approximately 40 milliseconds, and returns false if these tones are not detected for any period of time exceeding 12 milliseconds. In the second case (receiver always conditioned for main channel reception) the squelch function is inhibited.

Normally, the acceptable frequency range for carrier detection includes both the mark (1200 Hz) and space (2200 Hz) main channel frequencies so that carrier may be acquired on tones which are being frequency shift keyed.

As a strap option, the acquisition time may be reduced to 12 milliseconds for certain applications. In this case, only tones near the main channel mark frequency (1200 Hz) are recognized as valid, but after initial acquisition, operation reverts to normal, implying that the acceptable frequency range includes both mark and space frequencies and that the carrier loss time is 12 milliseconds. However, should carrier be lost (CAR MAIN changes to false) during transmission of data from the distant modem due to telephone line disturbance or noise, carrier cannot be reacquired on reception of data-keyed tones, and CAR MAIN will return to the true state only when a steady mark tone is receive for a period exceeding 12 milliseconds. For this reason, this `fast-acquisition` option is recommended only for dedicated lines where disturbances and noise are less frequent than on the switched network.

If the `Receiver Clamp` strap option is used, the Receive Data signal between the modem receiver and the serial receive register is `clamped` (forced) to the mark state during periods when CAR MAIN is false (when the receiver is conditioned for main channel reception).

Bit 7 - Data Coupler Ready (DCR):
1) When originating a call, the true (1) condition of this bit indicates that a dial tone is present and the dialing operation may proceed; during dialing, this bit is false. Following dialing this bit returns to the true condition after a 2 to 5 second delay (this does not necessarily indicate that the called station has answered).

2) After answering a call, the true condition of this bit indicates that the modem is connected to the telephone line through the Data Access Arrangement.

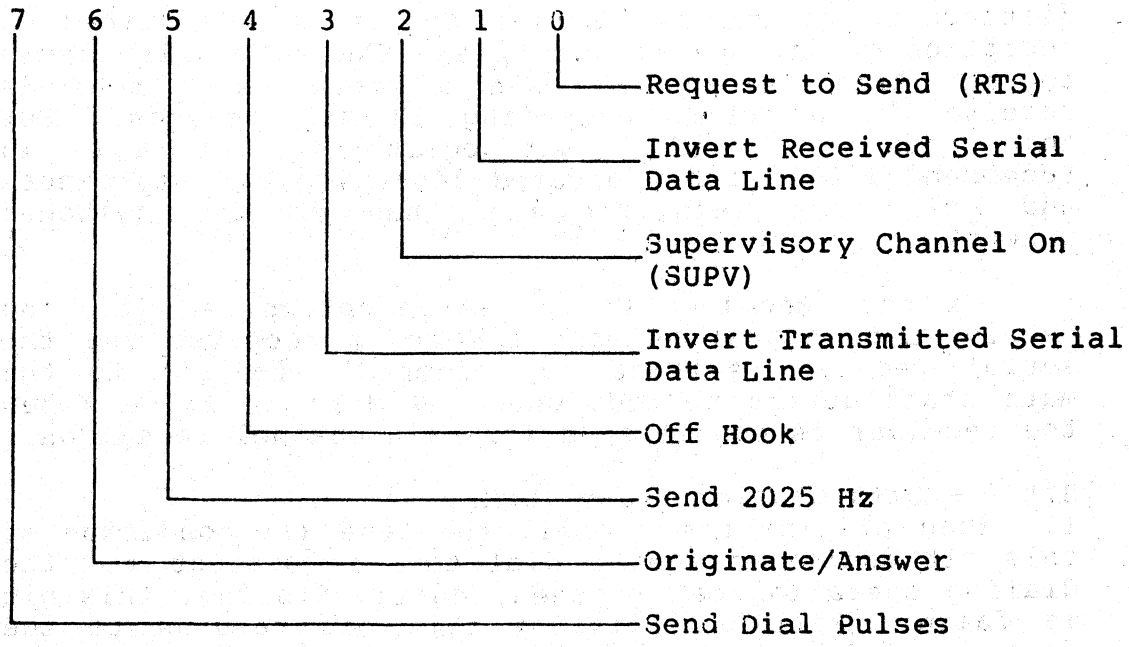
3.2.3 Data Input

Addressing the 9402 and executing the EX DATA instruction places the Adaptor in data mode and execution of an INPUT instruction then transfers the character in the receive character buffer into the processor I/O-register. Execution of this data transfer sets the status word Receive Ready bit false until a new character is received. In order to read 9402 status following the data transfer, it is necessary to re-address the Adaptor or execute and EX STATUS instruction while the Adaptor is addressed to return to status mode.

3.2.4 COM1 Command

Execution of the EX COM1 instruction while the 9402 is addressed causes the 8-bit command register in the 9402 to be loaded with the contents of the processor I/O-register. The following is a description of the function of each command register bit:

9402 COMMAND WORD EX COM4



Bit 0 - Request to Send (RTS): A true (1) bit in this position conditions the 9402 internal modem for transmission in the main channel frequency band. Further discussion concerning the use of this bit in conjunction witn the SUPV bit follows below.

Bit 1 - Invert Received Serial Data: A true (1) bit in this position causes inversion of the Receive Data line between the modem and the serial receive register. This bit is normally set false (0) unless inverted data is being received from the distant modem.

Bit 2 - Supervisory Channel On (SUPV): A true (1) bit in this position conditions the modem transmitter for transmission in the supervisory (reverse) channel frequency band if the RTS bit is false and the `Supervisory Channel` strap is in the `Enable` position. Otherwise, (RTS true or strap in the `Disable` position) the SUPV bit is ignored by the modem, allowing only main channel transmission.

Transmission of data in the main and supervisory (reverse) channels alternately is accomplished by putting the `Supervisory Channel` strap in the `Enable` position and leaving the SUPV bit set true at all times. Then, transmission of data occurs in the main channel when RTS is true and in the reverse channel when RTS is false. In this case, the RTS bit also conditions the modem receiver to the band opposite that used for transmission. At each transition of RTS (true or false), the CTS status bit goes false and returns true after the strapped delay time. Data may be presented for transmission in the appropriate channel when CTS is true. For operation compatible with the Bell 202 on/off reverse channel, data is not transmitted in the reverse channel. The 9402 reverse channel `mark` tone (387 Hz) is the Bell 202 reverse channel frequency, so this tone is merely turned on or off by the SUPV bit while RTS is false.

Following the transfer from the processor to the 9402 of the last character to be transmitted in the present data channel (main or reverse), the state of the RTS and SUPV bits should not be changed (to select a new channel or to cease transmission) until the last character has been serialized and transmitted. This processing requires one character time plus approximately 2 to 3 milliseconds after the last character enters the serial transmit register.

Bit 3 - Invert Transmitted Serial Data: A true (1) bit in this position causes inversion of the Transmit Data line between the serial transmit register and the modem. This bit is normally set false except during a dialing operation.

Bit 4 - Off-Hook: A true (1) bit in this position initiates and maintains a connection between the 9402 and the switched telephone network through the DAA. Resetting this bit to false causes the DAA to terminate (hang up) the connection.

Bit 5 - Send 2025 Hz: A true (1) bit in this position causes the modem to transmit a 2025 Hz tone on the telephone line for the purpose of disabling echo suppressors. This bit is normally set for 1 to 3 seconds following automatic answering of a call before data transmission or reception is begun. Bits 0 (Request to Send) and 2 (Supervisory Channel On) should be set false (0) while bit 5 is true.

Bit 6 - Originate/Answer: A true (1) bit in this position places the modem in `originate`. This bit should be set true after the 9402 has completed an automatic dialing operation. In originate mode, all modem functions are inhibited (no transmission occurs and the CTS, CAR MAIN and CAR SUPV status bits are all false) until the presence and then the loss of the 2025 Hz answer tone transmitted from the answering station is detected by the modem receiver. Continuous presence of this tone for at least 250 msec before its disappearance is required for this function. Detection of the answer tone is indicated by the true state of the CAR MAIN status bit; at the completion of the answer tone detect operation the CTS status bit comes true after the CTS delay time if either the RTS command register bit is true or the SUPV command register bit is true and the `Supervisory Enable` strap is in the `Enable position. At this time Bit 6 may be set false for the duration of the connection.

Bit 7 - Send Dial Pulses: A true (1) bit in this position places the 9402 in automatic dialing mode. In dialing mode, the transmit character buffer and serial transmit register are used for the generation of dial pulses to be applied to the Data Access Arrangement. After the `Off-Hook` command register bit has been set false for a period of time sufficient to insure that a previous connection is terminated (usually 2 to 5 seconds), the 9402 is configured for dialing by setting the `Off-Hook`, `Invert Transmit`, and `Send Dial Pulses` command register bits. After delaying a period of time sufficient to acquire a dial tone (the DCR status bit may be used for this purpose, since it comes true 2 to 5 seconds later but this bit does not actually reflect presence of dial tone), the digits of the dial number are generated by transmission of the character 340 (octal) a number of times corresponding to the digit, i.e., the digit `5` is dialed by transmission of five 340 characters. Following a delay of at least 600 msec, the next digit may be dialed. The transmission rate for this operation is 100 bits per second and the transmit character format is 1 start bit, 8 data bits, and 1 stop bit. Following the dialing operation, the `Send Dial Pulses` and `Invert Transmit` command register bits should again be set false.

3.2.5 COM2, COM3 Commands

The COM2 and COM3 commands are used, respectively, to set the 9402 receive and transmit base registers. These two 16-bit registers determine the receive and transmit bit rates. These rates are independent, allowing data transmission and reception at different rates. Given a bit rate (bps) the following formula is used to determine the time base number, N, to be entered into the transmit or receive register:

$$N=65,536 -\left(\frac{76,800}{bps}\right)$$

This number N can be converted to a 16-bit binary number and divided into two 8-bit words. The first COM2 (COM3) instruction executed after addressing the 9402 transfers the contents of the processor I/O-register into the most significant 8 bits of the receive (transmit) time base register and the following COM2 (COM3) executed transfers the I/O-register contents to the 8 least significant bits of the receive (transmit) time base register.

The octal codes for some frequently used rates are listed on the following page.

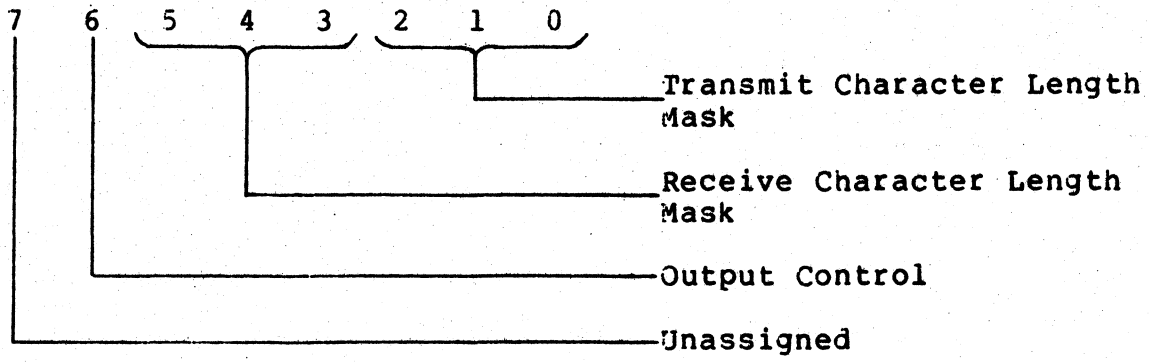
TIME-BASE TABLE

RECEIVE	EX COM2	EX COM2
TRANSMIT	EX COM3	EX COM3
BAUD RATE	1st MASK WORD	2nd MASK WORD
100	375(Dialing	000
110	375	106
220	376	243
440	377	121
150	376	000
300	377	000
600	377	200
1200	377	300
1800	377	325

3.2.6 COM4 Command

Execution of the EX COM4 instruction after addressing the 9402 transfers the contents of the processor I/O-register to the character length register. The contents of this register determine the transmit and receive character lengths and number of stop bits.

9402 COMMAND WORD EX COM4



The following tables describe the functions of the mask bits:

TRANSMITTED CHARACTER LENGTH MASK BITS

MASK BIT POSITION 210	START UNITS	INFORMATION UNITS	STOP UNITS	I/O-REGISTER CODE BIT POSITIONS 76543210
000	1	8	1	87654321
001	1	8	2	87654321
010	1	7	1	7654321
011	1	6	1	654321
100	1	5	1	54321
101	-	-	-	----
110	-	-	-	----
111	-	-	-	----

RECEIVED CHARACTER LENGTH MASK BITS

MASK BIT POSITION 543	START UNITS	INFORMATION UNITS	STOP UNITS	I/O-REGISTER CODE BIT POSITIONS 76543210
000	1	8	1 or more	87654321
001	1	8	1 or more	87654321
010	1	7	1 or more	7654321x
011	1	6	1 or more	654321xx
100	1	5	1 or more	54321xxx
101	-	-	--	----
110	-	-	--	----
111	-	-	--	----

When codes having 5, 6, or 7 information units are to be transmitted, the remaining high-order bits in the character byte must be coded to 1.

When a two-unit stop pulse is required for characters having 5, 6, or 7 information bits, the next larger character length is used; the remaining high-order bits (all coded 1) form the stop pulses.

When received characters contain 5, 6, or 7 information bits, the remaining low-order bits (as shown above) must be disregarded.

Bit 6, Output Control, determines whether characters transferred from the processor to the 9402 are transmitted by the modem or are transmitted to the RS-232 serial output line. Bit 6 is set true (1) during periods of transmission on the RS-232 output line and is set false (0) otherwise.

3.2.7 EX WRITE Command

Execution of the EX WRITE instruction after addressing the 9402 transfers the contents of the processor I/O-register to the transmit character buffer. This transfer resets the status word Transmit Ready bit until the character is transferred to the serial transmit register. EX WRITE is used to transfer characters to the 9402 for transmission over the telephone line, to an attached RS-232 receive-only device (such as a 9292), and to the DAA (for use as dial pulses).

4.0 PHYSICAL DESCRIPTION

The 9402 is mounted in an injection-molded, high-strength, two-part housing. Color and style are coordinated with the Datapoint Processor. The rear of the housing is designed to attach directly to the rear of a Datapoint console. It can also be wall or surface mounted in any position. Figure 4-1 provides complete dimensions.

5.0 ENVIRONMENTAL REQUIREMENTS

The 9402 is designed to operate without special considerations for heating or cooling. The operating range is 4 to 32 degrees C (40 to 90 degrees F), 10 to 95% humidity without condensation. The 9402 generates approximately 70 BTU/Hour.

6.0 INTERFACE REQUIREMENTS

6.1 Datapoint Processor Interface

The 9402 interfaces to the Datapoint processor input/output bus via the J1 connector. Connection is made from J1 to the processor input/output connector or the J2 connector of another input/output device by means of a 9010 or 9011 cable. J2 on the 9402 is connected in parallel with J1 for connection of additional input/output devices in `daisy-chain` fashion. Operating power is supplied to the 9402 from the processor via the J1 connector.

6.2 DAA Interface

Connection to the DAA is made to the J3 connector on the 9402 via a 9430, 9431, or 9432 cable. The 9430 cable connects only to the DAA. The 9431 cable is used for simultaneous connection to a DAA and a 9292 Printer. The 9432 cable is used for connection to a DAA and to a receive-only EIA standard interface device. The J3 interface is provided through an Amphenol 17-10500-1 connector. Pin assignments and signal names are as follows:

LEAD	FUNCTION	BELL DAA NAME	COLOR/ NUMBER	INPUT/OUTPUT
2	Ground	-V,C	White 10	------
3	Off-Hook	OH	Gray 9	Output
4	+25 volts	+V	Violet 8	Output
5	DA (Line connection Requested)	DA	Blue 7	Output
6	Ring Indicator	RI	Green 6	Input
7	Data Coupler Ready	CCT or DM	Yellow 5	Input
9,12	4-Wire Receive Pair	Receive	Dark Brown, Black 2,1	Input
10,11	2-Wire Half Duplex or 4-wire Transmit Pair	DT, DR	Orange Red 4,3	Both

7.0 OPTIONS

7.1 Address Selection

The 9402 is wired at the factory for input/output address 322 (octal). This address may be modified by changing four jumper wires in the communications interface portion of the unit.

7.2 Modem Jumper Options:

(Factory settings shown in parenthesis)

a) (Two-wire) or four-wire operation (2 jumpers).

b) (Enable) or Disable Supervisory Channel
Note: `Enable` position labeled HDX and `Disable` position labeled FDX on modem printed circuit board.

c) Clear-to-Send delay: (200 msec), 60 msec, 30 msec, or 15 msec.

d) Receive Carrier Acquisition Time: (40 msec) or 10 msec.

e) Receiver Clamp: (In) or Out.

f) Transmit Level: Odbm, -2dbm, -4dbm, -6dbm, (-8dbm), -10dbm, -12dbm.

7.3 Multi-Unit Installation

For systems requiring more than two communication adaptor devices (such as the 9402) which draw power from the processor, a card tray which can accommodate up to ten of these devices is available under model number 9450. In this case, the 9453 communications adaptor (cards only) is used in place of the 9402.

7.4 External RS-232 Device

An external RS-232 interface receive-only device such as the Datapoint 9292 Printer may be connected to the 9402 through J3 and operated as described previously. For connection of the 9402 to the DAA and a 9292, a 9431 cable is available. For connection of the 9402 to the DAA and a standard RS-232 interface device a 9432 cable is available. Caution should be exercised in connection of external RS-232 devices to insure interface compatibility with the 9402, or damage to the 9402 and/or the external device may result. If external devices other than the 9292 Printer or cables other than the two specified above are used, the factory should be consulted to verify that the interface is correct.

8.0 PARTS LIST

QUANTITY	ITEM
1	9402 Communications Adaptor
1	Diagnostic Program
1	User's Guide
1	9402 Product Specification
1	9010 Universal I/O Cable
1	9430-9402 to DAA Cable

Note: This parts list is for reference only and is superceded by the current Datapoint Shipping List at time of shipment.

9.0 VERSION DIFFERENCES

9.1 General

Older versions of the 9402 Asynchronous Communications Adaptor contain a different internal modem from currently manufactured units. Some differences exist between the two modems, but generally, except for certain special application, it is possible to design communications systems and programs which will operate with either version.

This product specification pertains to the 9402 with a new version internal modem. Areas of operation in which the old version differs from the new versions are described below.

9.2 Detailed Specification Differences

Note: The following sub-paragraphs describe the opertion of the old version 9402 (unless otherwise noted).

9.2.1

Telephone line interface is two-wire only, precluding four-wire applications and the ability to use the main data channel for simultaneous transmission and reception. Four-wire operation may be provided, however, by special order (consult factory or Datapoint representative).

9.2.2

The 2025 Hz answer tone detector allows the remaining modem functions to be enabled when the tone has been received for approximately 400 milliseconds. At this time transmission begins in the band determined by the RTS and SUPV command register bits. Approximately 40 milliseconds later, the CAR MAIN status bit comes true if the modem receiver is conditioned for main channel reception (RTS or SUPV false). CTS comes true at the end of the CTS delay time following detection of the answer tone.

The new modem (as described previously) inhibits all modem functions until the answer tone is detected and then disappears. This assures that the distant (answering) station has completed transmission of the answer tone and is ready to transmit and receive data. Note that when using an older modem, the detection of the answer tone and enabling of the modem transmit and receive functions generally occurs while the distant station is still transmitting the answer tone and is therefore not prepared to transmit or receive data.

9.2.3

The old version modem contains no jumper options. Referring to Section 7.2 `Modem Jumper Options`, the old modem characteristics are fixed as follows:

a) Two-wire operation only (except by special arrangement with factory).

b) Supervisory channel is directly controlled by SUPV command register bit (equivalent to strap in `Enable` position).

c) Clear to Send delay is 200 milliseconds if the SUPV command register bit is true. When RTS changes from true to false, the 880 Hz main channel `soft carrier turn-off` tone is transmitted for 50 milliseconds, then the supervisory channel 387 Hz `mark` tone is transmitted for 150 milliseconds before CTS comes true. When RTS changes from false to true, a supervisory channel `soft carrier turn-off` tone (330 Hz) is transmitted for 50 milliseconds followed by the main channel `mark` tone (1200 Hz) for 150 milliseconds before CTS comes true. The newer version modem does not transmit the supervisory channel turn-off tone; instead, the main channel `mark` tone is transmitted for the full CTS delay time.

When SUPV is false, CTS comes true 150 milliseconds after RTS changes from false to true. The main channel `mark` tone is transmitted during this time. When RTS changes from true to false, the main channel `soft carrier turn-off` tone is transmitted for 50 milliseconds and then transmission ceases.

d) Carrier acquisition time is fixed at 40 milliseconds for both main and supervisory channel. Drop (release) time is 12 milliseconds in both cases. There is not `fast acquisition` mode.

e) The `Receive Data` clamp feature is always enabled.

f) The transmit level is continuously adjustable from +4 dbm to -12 dbm by means of a potentiometer.

9.2.4

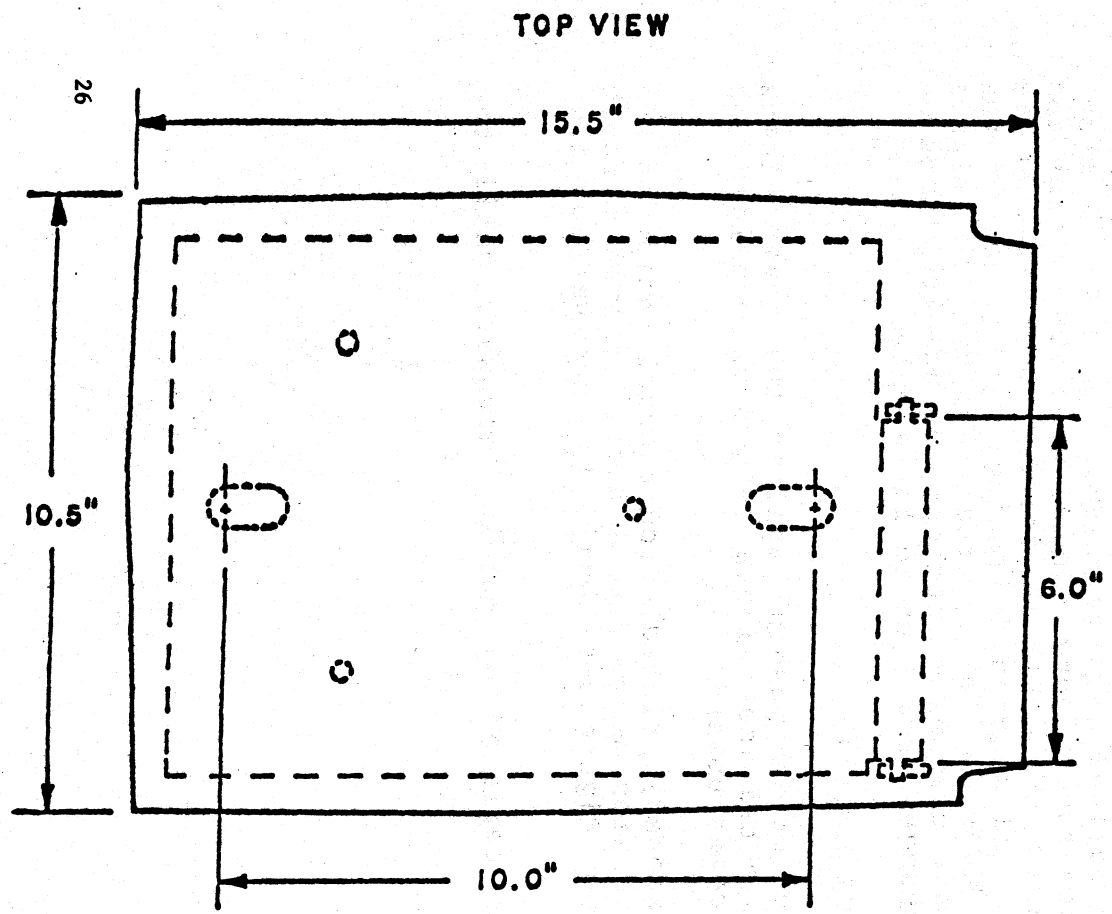
Receiver conditioning is determined by the states of the RTS and SUPV command register bits. If SUPV is true, reception is in the supervisory channel when RTS is true and in the main channel when RTS is false. The receiver is squelched for 50 milliseconds following any changes of the RTS bit. When SUPV is false, the receiver is always conditioned for main channel reception; the squelch function occurs when RTS changes from true to false only.

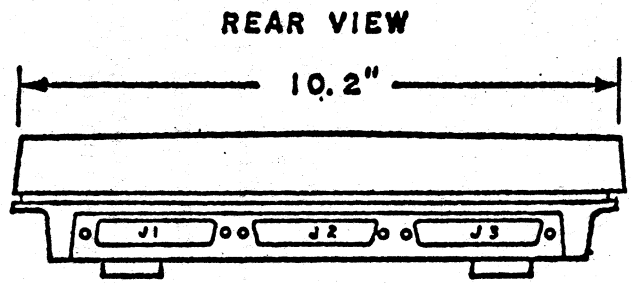
9.3 Version Determination

Remove the cover by pushing against the cover clamps with a pointed objected (see Figure 4-1, 9402 Housing) and then pulling the cover upward.

The upper (exposed) printed circuit board inside is the modem. The old version modem has a small printed circuit board attached (see Figure 9-1) while the new version does not.

The cover is replaced by pushing downward until the clamps engage.





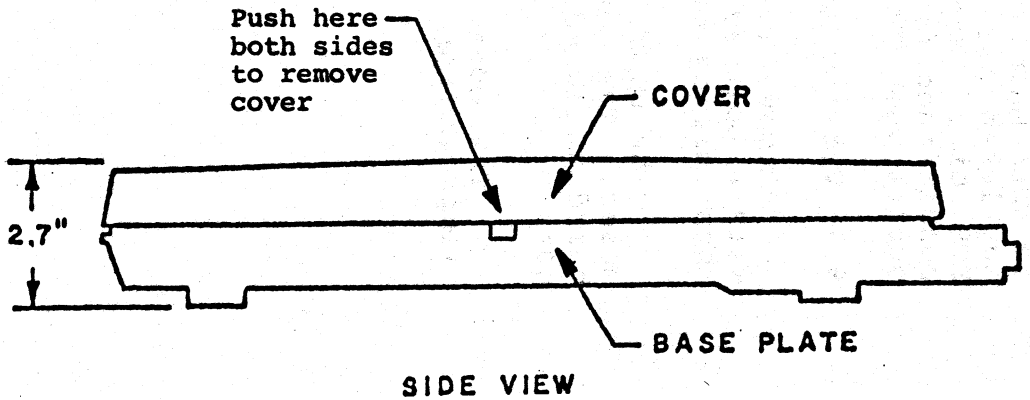


Figure 4-1 9402 Housing

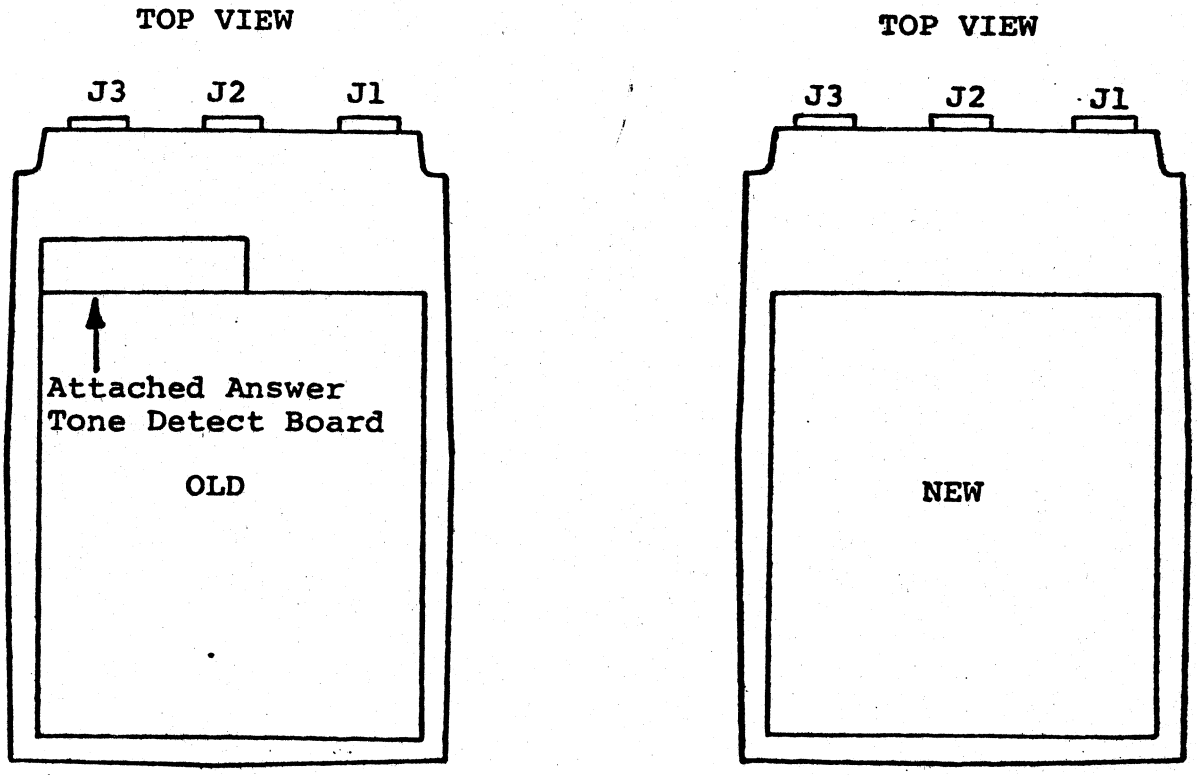


FIGURE 9-1 9402 VERSION COMPARISON