**DATAPOINT CORPORATION**
Product Specification

1.0 General Description

The 9900-404 Synchronous Communications Adaptor (9404) is an external device that interfaces Datapoint processors with a synchronous modem equivalent to a Bell 201 series Dataset. Using 9405 option, the 9404 may be used in conjunction with an asynchronous modem.

  1. Input/Output System compatibility with all Datapoint processors.
  2. Capability of self-test without the use of a modem or any other outside circuitry.
  3. Ability to use the Adaptor with an asynchronous modem if the 9405 clock option is installed.

Synchronous communications capability increases the rate of data communications over standard Bell System type 2001 (alternate voice/data) switched lines to 2000 baud -- as compared to 1200 baud with most asynchronous systems. Using unswitched lines type 3002 (data only) with C2 conditioning, rates of 2400 baud are standard. This increase in available baud rate is due to a more complex modulation technique required by synchronous communications -- Differential Phase Shift Keying (DPSK) -- which has widely replaced the Frequency Shift Keying (FSK) commonly used in asynchronous communications. Synchronous communication is more efficient, allowing a higher percentage of bits in a transmission to be information bits.

Because synchronous communication allows a higher percentage of information bits, it is sometimes desirable to employ synchronous communications even when synchronous modems are not available. In this situation, the 9900-712 clock option can be installed in the 9900-404 to allow use of the synchronous

A 9404 Synchronous Communications Adaptor
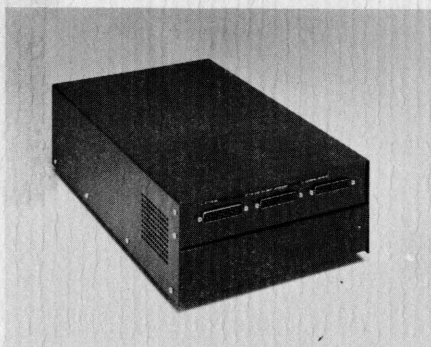
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communications adaptor with an asynchronous modem capable of 600 or 1200 baud operation. In addition, if the modem can be switched between the two rates, a signal is supplied to select the desired modem rate. A complete discussion of the clock option may be found in section 7.3. Comments elsewhere in this specification apply to the 9900-404 without clock option.

Synchronous systems, like any data system operating near the maximum signalling rate of a communications channel, are susceptible to a higher error rate than systems operating at slower speeds. Therefore, error detection is a significant consideration for reliable and efficient application of synchronous communications. The 9900-404, in addition to providing an interface between the Datapoint processor and a synchronous modem, is largely devoted to automatically generating or checking the Block Check Character used by most EBCDIC systems. The Block Check Character is generated by a checking polynomial function especially suited for detecting errors encountered in synchronous communications over voice grade lines.

The 9900-404 performs the automatic error detection functions by recognition of EBCDIC control characters consistent with the format described in
General Information
Binary Synchronous Communications
IBM Systems
Reference Library, A27-3004

The automatic error detection feature is selectable as a programmable option. It is designed specifically to be used with systems using EBCDIC data and control characters; however, it may be used in an application where the data is any information code, the control characters are EBCDIC, and the BSC Transparent Text format is followed.

If the automatic error detection function is not selected, the system may be programmed for processor generated and detected error checking codes to meet alternate systems requirements. This mode is selected by setting the ASCII bit true in the COM1 command word; this imposes the requirement that stations transmitting to the 9900-404 precede each transmission with two ASCII "SYN" characters.

2.0 Systems Requirements

2.1 Systems Components

The 9900-404 interfaces the Datapoint 2200* with a customer provided synchronous modem equivalent to the Bell System 201 type Dataset. The modem connects directly or through a Data Access Arrangement to the telecommunications network, and in most applications has an auxiliary handset interconnected with the network and the modem control circuitry for the purpose of voice communication.

*Note: In the remainder of this Product Specification, 'Datapoint 2200' is used to refer to either a 2200 Dispersed Processor or any Datapoint processor of later vintage. It is understood that definitions and specifications are identical for operation with any of them.

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The 9900-404 derives its power from the Datapoint 2200 and interfaces with the I/O bus through a 2200-160 or 2200-162 Universal I/O cable connected between J1 of the 9900-404 and the external I/O connector of the 2200. The modem RS-232 interface connector and J3 on the 9900-404 are connected with a 9900-425 cable. (See Section 6 for cable description and pin assignment.) The 9900-425 will interface the 9900-404 communications adaptor with modems that adhere to the standard EIA pin assignments. Up to 14 external devices may connect to the 2200 I/O bus in daisy chain fashion with a Universal I/O cable from J2 of the 9900-404 to J1 on the next device, and so on.

Since operating power for the 9900-404 is supplied from the Datapoint 2200, only two communications adaptors such as the 9900-404 may be connected to the I/O bus. If more than two adaptors are required, power and housing are available in the form of the 2200-450 Multiple Communications Adaptor Card Tray (holds 10 adaptors) or the 2200-455 Multiple Communications Adaptor Housing (holds 4 adaptors).

When used in either of these multiple adaptor housings, the adaptor consists only of a printed circuit board and is available under model code 9900-456.

The interconnection of the modem, telephone handset and telephone lines is determined by the exact configuration used and the required interfacing specified by those equipment manufacturers.

2.2 Systems Configuration

The most common synchronous communications link is a 2-wire switched (dialed) voice grade line, or a private (unswitched) 2-wire voice grade line. Two-wire links require that only one station transmit at a time, and there is a required delay of 150 to 200 milliseconds between transmissions from different stations.

Four-wire private unswitched lines may be used and will yield 4800 baud data rates without conditioning. Four-wire lines permit full duplex operation where one station transmits on one pair of wires and receives on the other pair of wires. Full duplex implies simultaneous transmission in both directions. However, in most applications one station is sending data,

and the other station returns acknowledgments of receipt or requests for retransmission between transmissions of the sending station's message. This is done the same as in a 2-wire application, except there is no significant delay because the direction of transmission on either line is not reversed.

Higher data rates can be obtained with more specialized lines and appropriate modems. The 9900-404 will interface with modems operating up to 20,000 baud without special options (all timing is derived from the modem and processor programming).

2.3 Modem Options

The customer has several options to specify when ordering modems or Datasets for a desired communications link. The following options pertain to Bell Systems type 201 and 208 Datasets for 2 or 4-wire 2000 baud, 2400 baud, and 4800 baud configurations.

Available Options	Required for Datapoint 9900-404
Internal timing or external timing	- Internal timing
EIA (RS 232) interface or contact interface	- EIA interface
With alternate voice or without alternate voice	- Alternate voice required on 2-wire switched lines for manual dialing and manual or automatic answer. Not required for private 2-wire or 4-wire unswitched installation unless voice option is desired.
Permanent unattached answer or selective unattended answer	- Either optional on switched 2-wire lines; either requires alternate voice option. Not applicable to private unswitched 2 or 4-wire lines.
With automatic calling or without automatic calling	- Without automatic calling
Half-duplex operation	- Either as required (2-wire), or full-duplex (4-wire)
Continuous carrier or carrier controlled by Request to Send	- 2-wire, carrier controlled by Request to Send. 4-wire either
With New Sync or without New Sync	- Without New Sync
201/A-2000 Baud or 201/B-2400 Baud	- 201A can be used on 2- or 4-wire switched or private lines. 201B can be used on 2- or 4-wire unswitched private lines.
201C-2400 Baud	- either switched or private lines.
208A-4800	- private lines.
208B-4800	- either switched or private lines.

3.0 Technical Description

3.1 Specification List

Data Rates	- Up to 20,000 Baud
Timing Requirements	- Derived from modem and processor
Information Codes	- 8-bit Characters
Receiver Synchronous Code	- 2 ASCII or EBCDIC "SYN" Characters
PAD Characters required at end of Received Transmission	- EBCDIC requires 1 PAD, ASCII requires no PAD
Order of bit transmission and reception	- First bit A0, last A7
Error Detection	- Automatic CRCC generation and checking when EBCDIC selected
CRC Polynomial	- $X^{16} + X^{15} + X^2 + 1$

Character Codes Recognized	A7	A6	A5	A4	A3	A2	A1	A0
ASCII SYN	0	0	0	1	0	1	1	0
EBCDIC SYN	0	0	1	1	0	0	1	0
SOH	0	0	0	0	0	0	0	1
STX	0	0	0	0	0	0	1	0
ETX	0	0	0	0	0	0	1	1
ETB	0	0	1	0	0	1	1	0
ITB	0	0	0	1	1	1	1	1
ENQ	0	0	1	0	1	1	0	1
DLE	0	0	0	1	0	0	0	0

CRCC Accumulation:

Refer to IBM Systems reference library,
A27-3004 General Information Binary
Synchronous Communications

3.2 Definition of External Command Strobes

COM1 - Strobes a command word from the
Datapoint 2200 A-Register to a control register
in the 9900-404.

A0..........Request to Send
A1..........Data Terminal Ready
A2..........1 = ASCII, 0 = EBCDIC
A3..........Unassigned
A4..........Unassigned
A5..........Rate Select
A6..........Unassigned
A7..........Unassigned

COM2 - Used instead of write for control
"DLE".

COM3 - New sync.

COM4 - Strobes A3 thru A0 of the 2200 A-
Register into a test register.

ADDRESS - Normal definition ref. 2200
Reference Manual.

STATUS - Normal definition ref. 2200
Reference Manual.

DATA - Normal definition ref. 2200 Reference
Manual.

WRITE - Normal definition ref. 2200
Reference Manual.

INPUT - Normal definition ref. 2200 Reference
Manual.

3.2.1 COM1 - Command Word

COM1 is to be issued whenever the condition
of the bits in the COM1 Command Word is to
be changed and the Command Word is in the
A-register. Issuing the COM1 Command Word
will reset all the control circuitry operated by
the character recognition decoder.
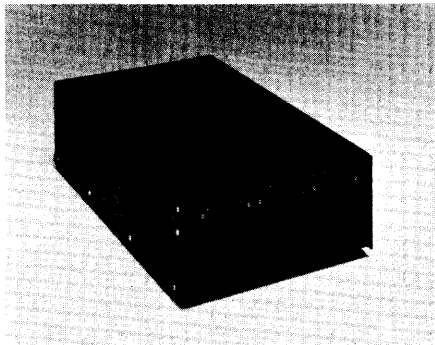
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A0 Request to Send

When TRUE (1), REQUEST TO SEND places
the 9900-404 in the transmit, mode. A0 should
be made TRUE to initialize a transmission.
Data and control characters should then be
delivered to the 9900-404 in response to
WRITE READY. REQUEST TO SEND
should be made FALSE (0) immediately
following the delivery of the fifth PAD
character at the end of a transmission. (One
complete PAD character and most of a second
will be transmitted.)

A1 Data Terminal Ready

When DATA TERMINAL READY is TRUE
(1) and the dataset is in the DATA mode
(DATA SET READY status bit TRUE),
DATA TERMINAL READY maintains the
"off-hook" condition:

a) Permanent Unattended Answering -
DATA TERMINAL READY must be TRUE
prior to an incoming call. DATASET READY
will be set TRUE when a call has been an-
swered.

b) Selective Automatic Answering - For
automatic answering, the "AUTO" key on the
auxiliary set must be depressed. DATA
TERMINAL READY may or may not be
TRUE. If it is TRUE, the call will be an-
swered following the first full ringing cycle and
DATASET READY will be set TRUE.
Otherwise, the call will be answered when
DATA TERMINAL READY is set TRUE.
Data transmission may begin when DATASET
READY is set TRUE.

c) Manual Answering and Dialing -
DATA TERMINAL READY must be set
TRUE before the auxiliary set "DATA" key is
depressed following manual answering or
dialing with the "TALK" key depressed.
DATASET READY will be set TRUE when
data transmission may begin.

d) Disconnect - DATA TERMINAL
READY must be made FALSE (0) for a
minimum of 50 milliseconds to terminate a call
when in the DATA mode.

A2 ASCII/EBCDIC Mode Control

EBCDIC Mode requires two EBCDIC 'SYN'
characters at the beginning of each tran-
smission for received character syn-
chronization. EBCDIC control characters
("SYN," "DLE," "SOH," "STX," "ITB"
("IUS"), "ETB," "ETX," and "ENQ")
are detected by the 9900-404 to control the
automatic generation and checking of the 16
bit CRCC. (Data in any information code
format may be used in TRANSPARENT
TEXT mode.) Refer to IBM-SRL-A27-3004 -
Binary Synchronous Communications: General
Information for control character usage in data
block formatting required for correct CRCC
generation.

ASCII Mode requires two ASCII "SYN"
characters at the beginning of each trans-
mission for Received Character Syn-
chronization. No other control character
recognition is performed by the 9900-404, and
characters are transmitted one for one. In-
formation code type used, clock formatting
and error checking are optional and entirely
under the control of the Datapoint 2200
program.

A2 should be set TRUE (1) if data and control
characters are ASCII, FALSE (0) if EBCDIC is
used.

A4 Rate Control

This bit has no effect unless the 9900-712 clock
option has been installed on the 9900-404 and
it is being used with an asynchronous modem.
In this case, the 9900-712 supplies clock signals
normally obtained from a synchronous modem,
and bit A4 selects whether a 600 or 1200 baud
rate is desired.

This arrangement is used only on the Model
9405, not on the 9404.

0 - Selects 600 baud rate
1 - Selects 1200 baud rate

In addition to selecting the clock rate of the
9900-712 clock option, A4 also controls an
RS-232 signal available at J3 for the purpose of
selecting the modem rate if it is a type that
may be switched between 600 and 1200 baud.

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3.2.2 COM2 - Single "DLE" Write

Whenever the 9900-404 is in the EBCDIC mode and receives "DLE" character from the Datapoint 2200 A-register with an EX WRITE strobe the adaptor will transmit two "DLE" characters. If it is desired to transmit only one "DLE," an EX COM2 strobe is used in place of the EX WRITE.

For all characters other than "DLE," EX COM2 and EX WRITE may be used interchangeably.

3.2.3 COM3 - New SYNC

When consecutive transmissions from the same or separate stations are expected to be received within 100 milliseconds of each other, a COM3 will be issued following the receipt of the last character in each transmission. A one millisecond pulse will be generated to reset the modem bit synchronization and the 9900-404 receiver character synchronization and control circuitry. In 4-wire continuous carrier systems, New Sync must be issued after each transmission is received, unless a COM1 Command Word is used, e.g., to transmit following each received transmission.

3.2.4 COM4 - Test Register

A0..........	Test 0
A1..........	Test 1
A2..........	Test 2
A3..........	Test 3
A4..........	Unassigned
A5..........	Unassigned
A6..........	Unassigned
A7..........	Unassigned

The test register is loaded from the Datapoint 2200 A-register. It is not intended for use in applications programs. It merely controls four RS-232 signals available at J3. These signals are normally used in conjunction with a test connector on J3 and a diagnostic program. They are then used to exercise certain RS-232 inputs at J3.

The correspondence between A-register bit values and RS-232 signal levels for the test register bits is:

A-Register Bit Value	RS-232 Signal Level
0	-3 volts (off)
1	+3 volts (on)

3.3 Description of Status Word

Status Word

A0..........	Write Ready
A1..........	Read Ready
A2..........	End of Block
A3..........	CRC Error
A4..........	Test Input
A5..........	Ring Indicator
A6..........	Carrier On
A7..........	Dataset Ready

A0 Write Ready

WRITE READY will be TRUE (1) during the transmit mode (REQUEST TO SEND "TRUE") when the 9900-404 will accept a character. WRITE READY will first come TRUE after REQUEST TO SEND has been set TRUE and the modem has returned Clear-to-Send. The 9900-404 will then automatically transmit one or more PAD characters (FF Hexidecimal) until the Datapoint 2200 begins delivering characters ("SYN," "SYN," etc.). If the Datapoint 2200 fails at any time to respond to write ready within 7 1/2 bit times (bit time = 1/bitrate), FF (Hexadecimal) will be transmitted.

If WRITE READY is TRUE when REQUEST TO SEND is reset FALSE (0) at the end of a transmitted block (REQUEST TO SEND was not reset immediately after transfer of last "pad" character to the 9900-404), it will remain TRUE while REQUEST TO SEND is FALSE and will be TRUE prematurely when REQUEST TO SEND is next set TRUE. This condition may result in the loss of one of the first transmitted characters. WRITE READY may also be TRUE immediately after power-on, producing the same result. Both of these problems may be eliminated by execution of an EX WRITE before setting REQUEST TO SEND TRUE precéding transmission of a data block.

A1 Read Ready

READ READY will be true when a new character has been received by the 9900-404 and is ready to be presented to the Datapoint 2200. Each character will be presented by the adaptor for one character time (8 bit times). READ READY will be reset by executing an EX DATA, INPUT instruction sequence. This sequence must be executed each time READ READY comes TRUE (even if the character will not be tested or stored) when READ READY is being used to count characters, e.g. when counting the two CRC bytes before checking the error status bit.

READ READY may be true after power-on or if the last character in the previous received block was not taken by the Datapoint 2200. In these cases, the READ READY indication will be erroneous for the first character of the next received block. This condition can be prevented by executing the EX DATA, INPUT sequence immediately after setting REQUEST TO SEND FALSE when changing to receive mode.

*A2 End of Block Detected
        (EBCDIC Only)*

This bit will be set TRUE when the 9900-404 is in EBCDIC and is presenting an end of block control character ("ETB," "ETX," or "ITB," or "ENQ") to be read by the Datapoint 2200.

A3 Error Detected (EBCDIC Only)

This bit represents the results of the CRC check on the last data block received. It will be set TRUE if the two CRC bytes were found to be incorrect, and FALSE if correct. This bit may be checked when the second CRC byte is presented to the Datapoint 2200 (i.e., second character following "ETB," "ETX," or "ITB.") The two CRC bytes must be INPUT by the Datapoint 2200 to reset READ READY.

The ERROR DETECTED bit is unconditionally reset FALSE when the 9900-404 transmits the two CRC bytes (in EBCDIC mode only) at the end of a data block.

Transmission and reception of CRC bytes in EBCDIC mode are the only times the state of this bit changes; ERROR DETECTED is not reset FALSE at power-on and may be TRUE at this time. Transmission of a "dummy" block in EBCDIC mode before beginning actual operation will remove this initial ambiguity.

Note that in ASCII mode this bit has no significance and may be in either state.

A4 Test Input

This status bit is not used by applications programs. It is zero (0) unless the clock option is installed. When the clock option is installed, it represents the condition of an RS-232 signal input from the J3 connector. This signal will normally be one of the 9900-404 RS-232 output signals that is fed back by the test connector when diagnostic programs are being run. The relation between the RS-232 signal and the status bit is:

RS-232	Status Bit Value
-3 volts (off)	1
+3 volts (on)	0

A5 Ring Indicator

The TRUE (1) condition of this bit indicates that an incoming call has been detected. If the Dataset is equipped with "selective automatic

answer" option, the DATA TERMINAL READY COM1 bit should be set TRUE to answer the call.

A6 Carrier On

This bit will be TRUE anytime carrier is present at the receiver of the Dataset; this includes the time when the transmitter is active (REQUEST TO SEND TRUE) in a 2-wire, half-duplex application. Before setting REQUEST TO SEND TRUE, at the beginning of a transmission, this bit should be checked to insure no carriers are present on the line (unless continuous carrier 4-wire operation is used).

A7 Dataset Ready

The TRUE condition of this bit indicates that the Dataset is in the DATA MODE. If the Dataset is equipped with the "selective automatic answer" option, this bit will become TRUE 2-5 seconds after the "REMOTE CONTROL" command word bit is issued to answer a call. With the "permanent automatic answer" option, this bit will come TRUE after the call is answered and before data is to begin. If the call is manually dialed or answered, this bit will come TRUE when the auxiliary set "DATA" key is depressed.

DATASET READY will return to FALSE when the call is disconnected or when the auxiliary set "DATA" key is deselected by depressing another key when a call is in process.

3.4 Control Character Functions

The response of the 9900-404 to control characters depends on whether the ASCII or EBCDIC mode has been selected by the COM1 Command Word.

ASCII Mode

In ASCII mode all characters transmitted by the 9900-404 must be received from the Datapoint 2200 through the A-register. No logical operations are performed on the character stream as it is transmitted.

When receiving characters in ASCII Mode two ASCII "SYN" (00010110) characters must be received to synchronize and activate the receive logic. Once the two "SYN" characters are received the second "SYN" and all succeeding characters are delivered to the Datapoint 2200 without further logical operations on the received character stream. The receiving operation is terminated whenever a transmit operation is initiated in the 9900-404 (REQUEST TO SEND is set TRUE), a NEW SYNC command (COM3) is executed, or if CARRIER ON from the receiving Dataset should go false.

In ASCII mode all error control and other control functions are performed in the
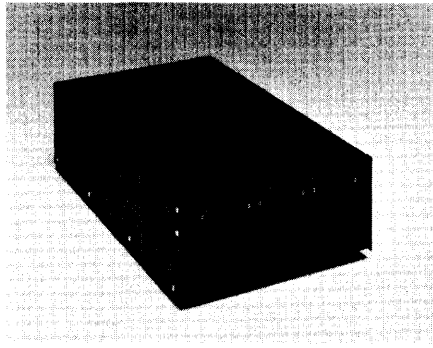
Datapoint 2200 software.

EBCDIC Mode

In EBCDIC mode all characters received from the Datapoint 2200 are transmitted; however, certain other characters are generated within the 9900-404 and inserted in the character stream to support error control and transparency features. (The previously referenced IBM publication should be read for a complete description of the EBCDIC control procedure.) The rules for generating these additional characters further depend on whether the transparency feature has been activated. The transparency mode is activated whenever the character sequence "DLE" "STX" is received from the Datapoint 2200 and the "DLE" character was transferred with an EX COM2 command (See 3.2.2).

In all cases the receipt of the first "STX," "STX" preceded by "DLE," or "SOH" from the Datapoint 2200 initializes the CRC generator.

In the absence of transparency mode, all succeeding characters are accumulated by the CRCC circuitry except the "SYN" character. Receipt of an "ITB," "ETB," or an "ETX" character terminates the CRCC generation and causes two CRC bytes to be transmitted. If an "ENQ" character is received from the Datapoint 2200, the CRCC generation is terminated without transmitting the CRC characters. Once CRCC generation is terminated and the check characters are transmitted, the trans -mission is terminated (See 3.2.1). However, if the CRCC is terminated by an "ITB" character the two check bytes are transmitted, the CRCC generation begins again automatically, and succeeding characters are once more ac-cumulated.

In the event transparency mode is initiated, all control characters are treated as ordinary data characters unless preceded by another "DLE" character. In the event the "DLE" itself ap-pears as data, it should be preceded by another "DLE" (See 3.2.2). Those "DLE" characters used to identify other control characters are not accumulated by the CRCC generator.

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Transparent mode may be initiated with a "DLE" - "STX" sequence after CRCC ac-cumulation has been initiated by an "SOH," "STX," or "ITB" character. Any termination of CRCC accumlation also effects termination of transparency.

When receiving data in the EBCDIC mode, the initial synchronization occurs just as in the ASCII mode except that two EBCDIC "SYN" (00110010) characters are required for syn-chronization. Once synchronized the first "SYN" and all succeeding characters received are transferred to the Datapoint 2200 including any CRC characters received. Whenever CRC characters are received, they are automatically checked by the 9900-404 and bit 3 of the status word is set to indicate the result of the check (See 3.3).

4.0 Physical Description

The 9900-404 is a standard communications adaptor package: two-piece plastic housing with a wiring harness for one printed wiring board and three external cable connectors. Two mounting holes are provided in the base plate.

4.1 Housing Dimensions

Overall Height	2.7 inches
Overall Width	10.5 inches
Overall Length	15.5 inches

4.2 Color

Housing Cover ------White
Housing Base Plate----Brown
Housing Material-----Injection-molded plastic

4.3 Cover Removal

The cover may be removed by inserting a small diameter rod or stylus (approximately 1/16 inch diameter) between the cover and base plate through the notches approximately at the midpoint of the long side of the housing and pressing against an internal spring clip. With the cover removed, the address may be modified or the lamp indicators may be viewed for assistance in systems checkout.
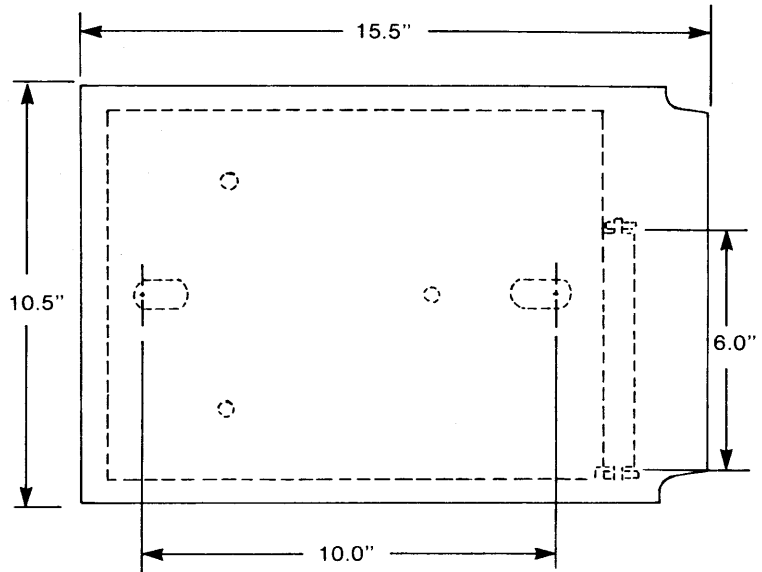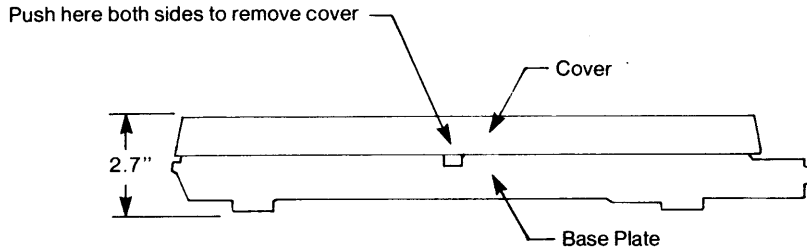
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Rear View
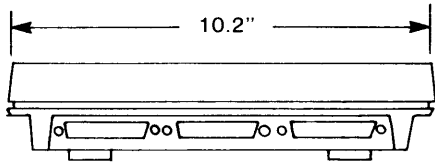
Top View

(Fig. 4-1 Housing Dimensions)

Side View

Push here both sides to remove cover

Cover

Base Plate

4.4 Signal Lamp Location and Description

Label	Description
CAR	*Carrier on:* indicates modem is detecting carrier.
CTS	*Clear to Send:* indicates modem has returned Clear to Send in response to Request to Send.
DSR	*Dataset Ready:* indicates the modem is in the data (Not talk) mode.
DTR	*Data Terminal Ready:* indicates the 9900-404 Data Terminal Ready bit in the command word is true.
RNG	*Ringing:* indicates an unanswered incoming call.
RTS	*Request to Send:* indicates the 9900-404 Request to Send bit in the command word is true, commanding the modem to transmit.
ASCII	*ASCII/EBCDIC Data:* ON indicates ASCII "SYN" characters will character sync the 9900-404 receiver. OFF indicates EBCDIC "SYN" characters will be generated and checked in response to transmitted and received EBCDIC characters.

This lamp reflects the condition of the ASCII/EBCDIC bit in the command word.

Label	Description
ADR	*Addressed:* indicates that the 9900-404 is currently addressed.
XMT	*Transmitting:* indicates Request to Send is true; the modem has returned Clear to Send and transmitter clock signal; and the 9900-404 has received the first character to be transmitted from the Datapoint 2200.
RSYN	*Receiver Character Synched:* indicates the receiver has received the appropriate ASCII or EBCDIC "SYN" "SYN" character sequence. (Reset by Carrier Off, a COM1 strobe, or New Sync.)
DEC	*Decoding:* indicates that the interface is either not in EBCDIC transparent mode or in transparent mode with a control "DLE" detected. When this indicator is on, the decoder will respond to the special characters appropriate to the mode (ASCII/EBCDIC) it is in.
ERR	*Error:* indicates the 9900-404 detected an error when checking the last received CRCC.

Label	Description
NOR	*Normal Text:* indicates the CRCC is being accumulated for a block of normal text.
XPT	*Transparent Test:* indicates the CRCC is being accumulated for a block of transparent text.
ITB	*Intermediate:* indicates that the CRCC is being accumulated for a block other than the first block in a transmission. If the block is Transparent Text, the XPT lamp will also be lit.

5.0 Environmental Requirements

0 C to 50 C (32 F to 122 F)
10% to 95% relative humidity

6.0 Interface Description

The 9900-404 derives its power from the 2200 and interfaces with the 2200 I/O bus through J1. J2 has the same pin assignments as J1 so that additional external device controllers and adaptors may be connected to the 2200 parallel I/O bus by daisy-chaining the devices with Universal I/O cables 2200-160 or 2200-162. J3 provides connection to the RS-232 interface of a 201 type modem using a 9900-425 cable. Connections at J3 and the modem are defined in the following table:

From 9900-404 J3 Pin No.	To Modem Connector Pin No.	Signal Designation
1	1	Protective Ground
24	2	Transmitted Data
41	3	Received Data
40	4	Request to Send
23	5	Clear to Send
12	6	Dataset Ready
2	7	Signal Ground
45	8	Data Carrier Detected
3	14	New Sync
10	15	Serial Clock Transmitter
11	17	Serial Clock Receiver
42	20	Data Terminal Ready
6	22	Ring Indicator
44	23	Rate Select
28,29*		GND
32,33*		+5 volts DC
4*		+25 volts DC
5*		Test 0
9*		Test 1
49*		Test 2
46*		Test 3
16*		Test Input

*Not connected to modem.

7.0 Options

7.1 Address

The 9900-404 device address may be set to any of the 14 available addresses in the field by means of jumpers. The 9900-404 is wired for address 245 (octal) at the factory.

7.2 Processor Selection

One jumper configures the 9900-404 for operation with a Datapoint 2200 or Datapoint 5500.

7.3 9900-712 Clock Option

7.3.1 General Description

The 9900-404 Synchronous Communications Adaptor is normally used to transmit and receive data using a synchronous modem. In certain areas, however, synchronous modems are not available, but it is still desirable to use a synchronous format for the data due to the elimination of start and stop bits and to achieve compatibility with Binary Synchronous Communications systems.

The 9900-712 is an option for the 9900-404 which allows it to be used with asynchronous modems having either a 600 or 1200 baud rate. In addition, if the modem can be switched between the two rates, a signal is supplied to the modem to select the desired rate.
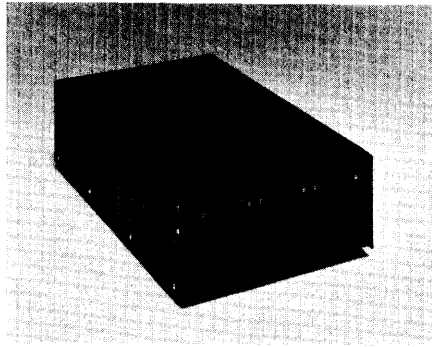
7.3.2 System Requirements

System requirements for the 9900-404 with the 9900-712 Clock Option installed are the same as those for the standard 9900-404 except that the external dataset must be an asynchronous type capable of 600 or 1200 baud operation such as the Bell System 202.

7.3.3 Technical Description

The 9900-712 has only one feature accessible to the programmer - a rate control register. However, a brief description of the internal operation of the device is included, since this may be useful in optimizing system operation.

The 9900-712 provides one bit in the COM1 register in addition to those found in the 9900-404.

7	6	5	4	3	2	1	0

Used in 9900-404

Rate Control

The rate control bit prepares the device for 1200 baud operation if it is set to one (1); setting this bit to zero (0) results in 600 baud operation.

The 9900-712 examines the incoming data and generates a receiver clock which transitions from 0 to 1 in the middle of the data bits. The location of the data bit center is determined by sensing a data transition and counting 128 cycles (1/2 bit time) of a crystal-controlled frequency to determine where the center ought to be. Thereafter, each data bit center is assumed to be 256 counts further along until another data transition is encountered, and the counter is resynchronized.

A data transition causes the bit-center counter to be reset to 0 under either of two circumstances:

1) The transition is the first to occur since transmission ended or power was turned on. The end of transmission is determined by both "Request to Send" and "Clear to Send" going off.

2) No transitions have occurred for 64 or more bit times.

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If transitions have been occurring frequently (less than 64 bit times apart), the counter is reset in a manner that tends to smooth out individual errors in the time of transitions while keeping the receiver clock generally in phase. It does this by taking the number in the counter (treated as a signed two's complement value) at the time of a data transition and dividing it by two.

The net result is that in order to keep the clock synchronized with the data, there must be some transitions in the data, and long strings of all 0's or all 1's should be avoided. If characters containing odd parity bits are transmitted, there will always be at least one transition per character, in EBCDIC mode, a "SYN" character may be inserted periodically, if needed, to provide data transitions.

7.3.4 Physical Description

The 9900-712 consists of a small printed circuit assembly which mounts on standoffs on the 9900-404 Synchronous Communications Adaptor. A plug on the option card fits into a socket on the 9900-404 and provides all necessary power and signal connections between the two boards.

8.0 Shipping List

The following items are shipped with each 9900-404:

Quantity	Item
1	TST404 Tape
1	2200-160 Cable, 2200/External Device 8"
or 1	2200-162 Cable, 2200 External Device 18" is shipped with printer, tape or disk console.
1	9900-425 Cable, Communications Adaptor/External Data Set.
1	9900-404/712 Product Specification
1	Test Connector

Note: This shipping list is included for guidance only; the current Datapoint shipping list shall govern at all times.

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