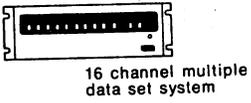


Tom McShane



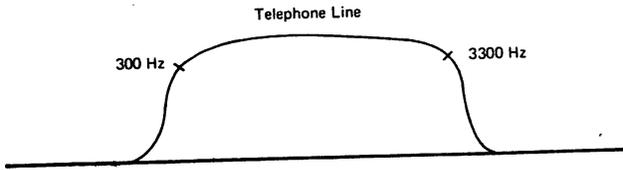
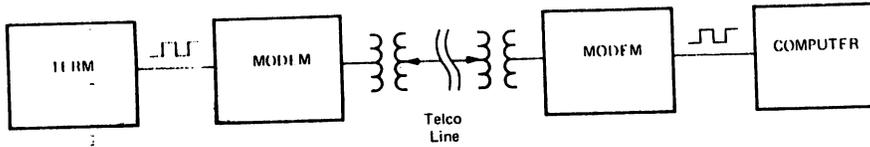
The Vadic Corporation  
505 East Middlefield Road  
Mountain View, CA. 94043  
(415) 965-1620

Telecommunications  
From The  
User's  
Viewpoint

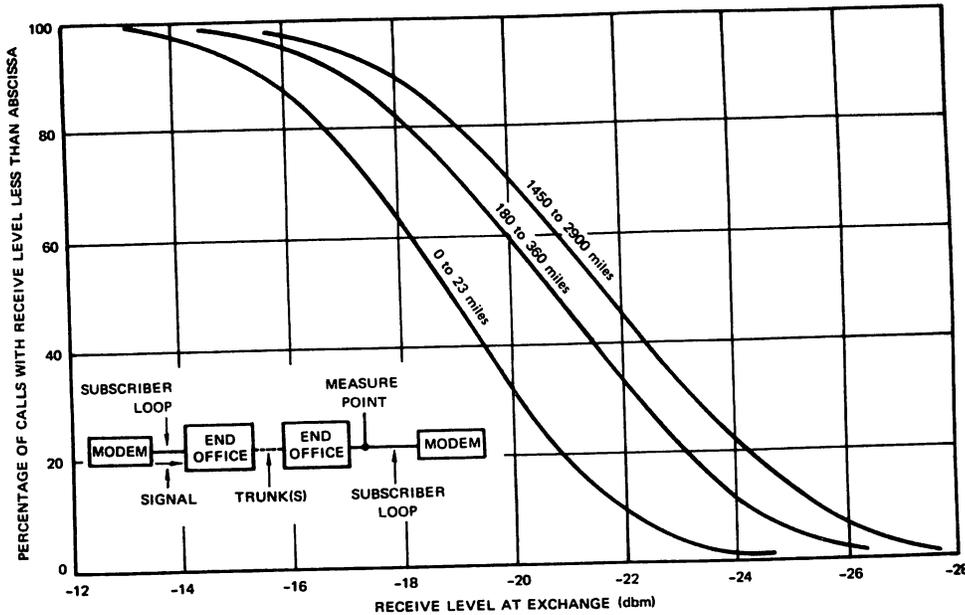
[Faint, illegible text block]



## WHY MODEMS?



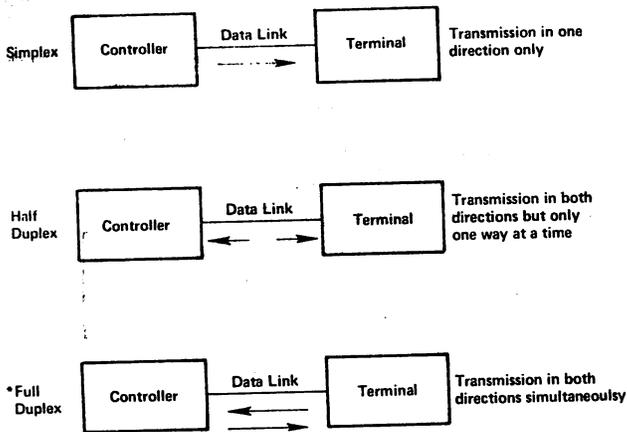
MO-DEM is a contraction of the words modulator - demodulator and is used to condition digital signals for transmission over the telephone network which was designed for analog voice signal transmission. The telephone network has a bandwidth of approximately 300 Hz to 3300 Hz, so the modems used on the telephone network must condition the signals to fit within the band.



End Office Receive Levels on Direct Distance Dial Network

Expected receive level between telephone exchanges on the DDD network is shown on a probabilistic basis. Subscriber loop loss at each end must be added to the interexchange loss.

### Communication Modes



*\*Per ASCII standard full duplex implies that the same data rate exists in both directions simultaneously; i.e., 1200/150 bps is not full duplex, 1200/1200 bps is full duplex.*

Communications terminology can be confusing. When the term "communication mode" is applied to modems the following nomenclature is used:

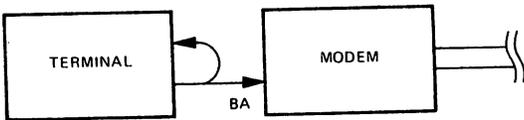
**Simplex** — transmission in one direction only with no way of responding. Your home TV reception of a signal transmitted from the TV station is an example of simplex communication.

**Half Duplex** — transmission in two directions, but only one way at a time. CB radio operators either transmit or receive, but cannot do both simultaneously on a single channel. At the end of transmission it is necessary to advise the other party when through transmitting and ready to receive by saying "over". Then the other operator can begin transmitting.

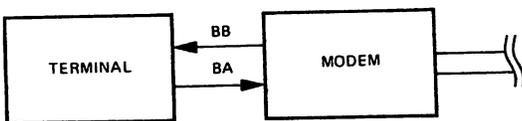
**Full Duplex** — transmission in both directions simultaneously. In the CB example, if two channels were used — one for transmitting and another for receiving — two simultaneous transmissions could be made.

### HALF/FULL DUPLEX OPERATION Terminal or Computer

**Half Duplex**  
(implies that local copy is provided)

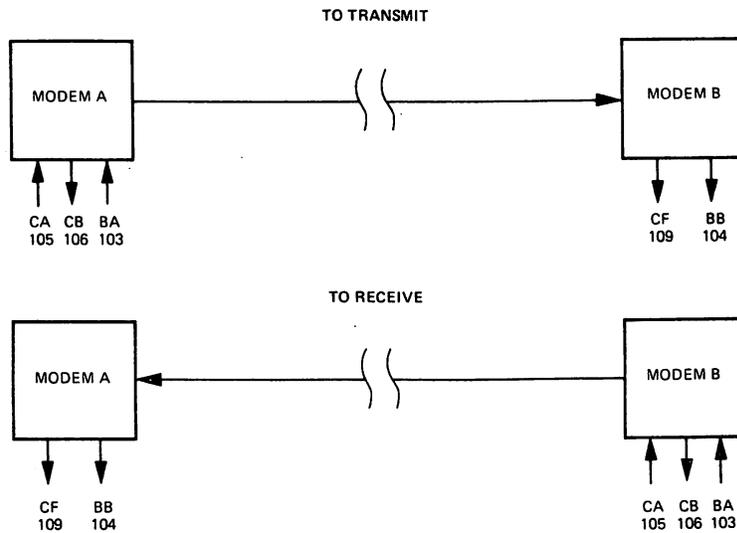


**Full Duplex**  
(implies that no local copy is provided)  
Means no local copy



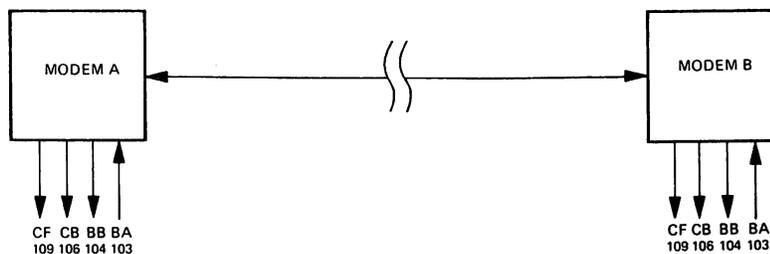
Terminal manufacturers often use the terms half duplex and full duplex to mean whether local copy is provided or whether the far end loops back (echoplexes) that which was transmitted. The presence or absence of local copy has nothing to do with the communications mode of the data link.

## HALF DUPLEX MODE



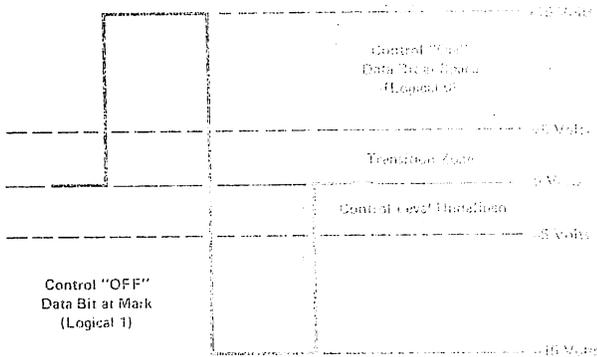
Control signals required to turn on modem A's transmitter and cause modem B's receiver to respond are shown in the top of the slide. The process is reversed in the lower portion.

## FULL DUPLEX MODE



Interface signals for transmitting and receiving data simultaneously are shown at both ends of the full duplex data link.

RS232 Voltage Transition Levels

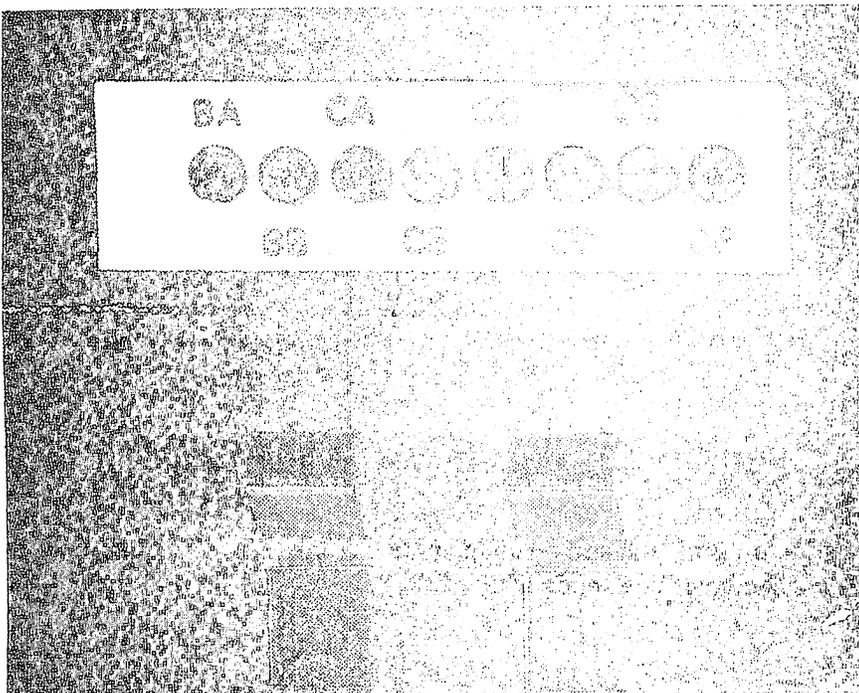


EIA standard RS-232-C defines the interface between data terminal equipment and data communications equipment employing serial binary data. Mechanical and electrical specifications are provided. The slide shows the voltage transition levels at the interface point when a connection exists between the terminal and communications equipment.

The lights display:

- BA Transmit Data (100)
- BB Receive Data (100)
- CA Request to Send (100)
- CB Clear to Send (100)
- CC Data Set Ready (100)
- CD Data Terminal Ready (100/2)
- CE Ring Indicator (100)
- CF Carrier Detector (100)

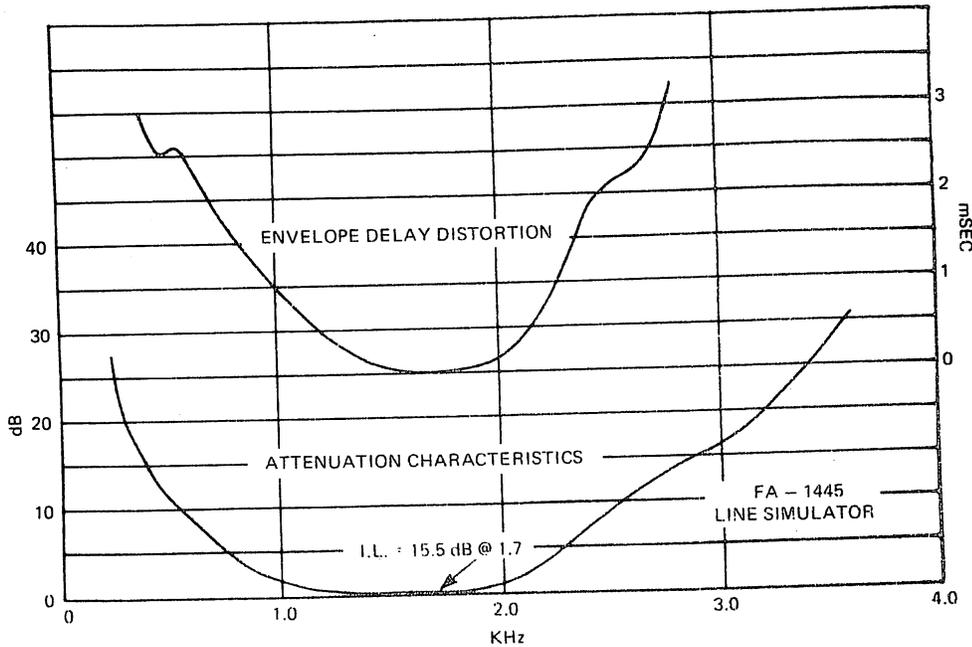
The slide shows the more common EIA interface leads as they appear on the diagnostic panel of VADIC's sixteen channel multi chassis. International designations per CCITT standards appear in parenthesis.



# HOW ARE MODEMS SPECIFIED?

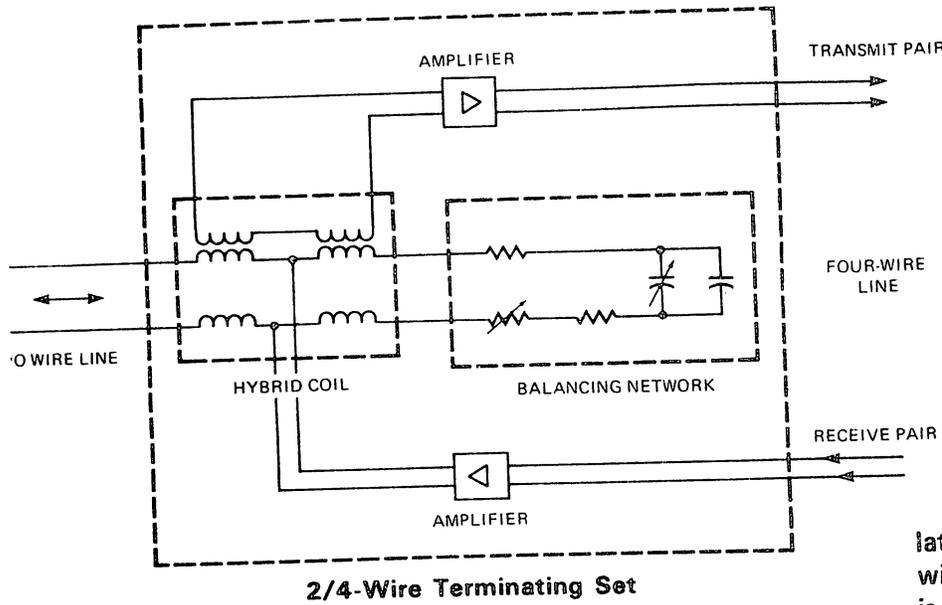
- I. INTERFACE - Computer or Terminal
  - A. RS232C
  - B. Bell Telephone
  - C. IBM
  - D. MIL 188
  - E. CCITT
  - F. Other
  
- II. INTERFACE - Telephone Line
  - A. Dial or switch network
  - B. Private, leased or dedicated line
    - 1. 2 wire
    - 2. 4 wire
  - C. Voice grade
  - D. DDS
  - E. Special Carrier
  
- III. SPEED
  - A. Low speed 0 to 300 BPS
  - B. Medium speed 0 to 1800 BPS
  - C. High speed 2000 to 9600 BPS
  - D. Very high speed 19.6K BPS to 250K BPS
  
- IV. COMMUNICATION MODE
  - A. Simplex
  - B. Half duplex
  - C. Full duplex

Modem specifications include business machine and phone line interface as well as speed, communications mode, and performance criteria.



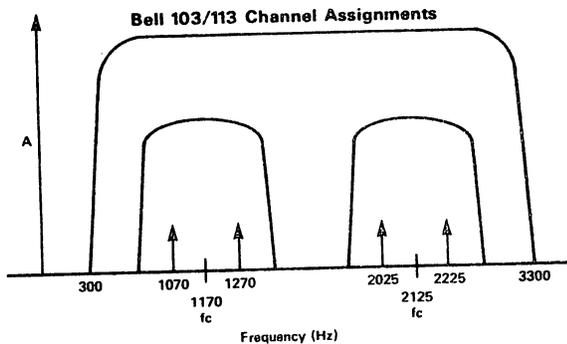
Envelope Delay Distortion & Attenuation  
3002 unconditioned voice grade line

Because different frequencies encounter different amplitude attenuation and propagation delay times through the telephone network, not all of the bandwidth can be utilized for the transmission of digital data. These differences are largely immaterial in voice communications, but can be very detrimental to data transmission, particularly at speeds above 2400 bps.



The subscriber loop is basically a continuous loop of wire without amplifiers. At the central office the transmitted signal (voice or data) is sent to the far end office on a unidirectional channel called the transmit pair. This channel is simplex; one way only due to the audio amplifiers which exist. The far end transmitted signal appears at the near end on the receive pair. The transmit pair and receive pair are referred to by telco personnel as 4-wire lines. Leased circuits can be provided on a 4-wire or 2-wire basis. The latter case involves combining the signals in a 2/4 wire terminating set (hybrid). The subscriber loop is a 2-wire bi-directional channel for dial up calls.

## Bell 103/113

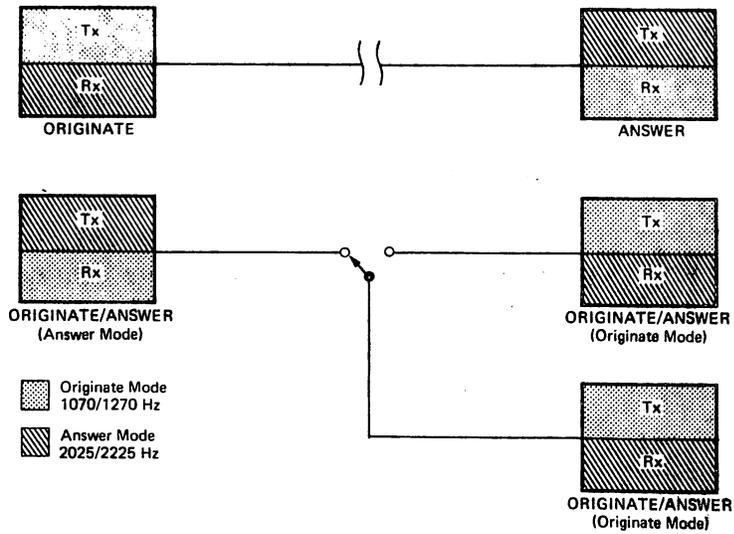


### Specifications

- Data: Serial, binary, asynchronous, full duplex
  - Data Transfer Rate: 0 to 300 bps
  - Modulation: Frequency Shift Keyed (FSK) FM
- | Frequency Assignment: | Originating End               | Answering End                 |
|-----------------------|-------------------------------|-------------------------------|
| Transmit              | 1070 Hz space<br>1270 Hz mark | 2025 Hz space<br>2225 Hz mark |
| Receive               | 2025 Hz space<br>2225 Hz mark | 1070 Hz space<br>1270 Hz mark |
- Transmit Level: 0 to -12 dBm
  - Receive Level: 0 to -50 dBm simultaneous with adjacent channel transmitter at as much as 0 dBm

Specifications and channel assignments for the full duplex 300 bps asynchronous Bell 103/113 modem are shown in this slide.

# 103/113 ORIGINATE/ANSWER



The Bell 103 modem can transmit and receive in either the low or high band. The ability to switch modes has been termed "originate and answer". The Bell 113A operates only in the originate mode; the Bell 113B operates only in the answer mode.

## BELL 103/113 FAMILY 0 to 300 BPS

### DIAL-UP

#### 103A2 or A3

Originate/answer  
Single channel—self contained  
\$25 to \$35/month

#### 103E Data Station—Computer Site

Originate/answer  
40 channels max  
\$25 to \$35/month

#### 113A Terminal Data Set

Originate only  
Single channel—self contained  
\$10 to \$15/month

#### 113B Data Station—Computer Site

Answer only  
20 channel increments—240 max  
\$12 to \$20/month Average \$16 to \$18

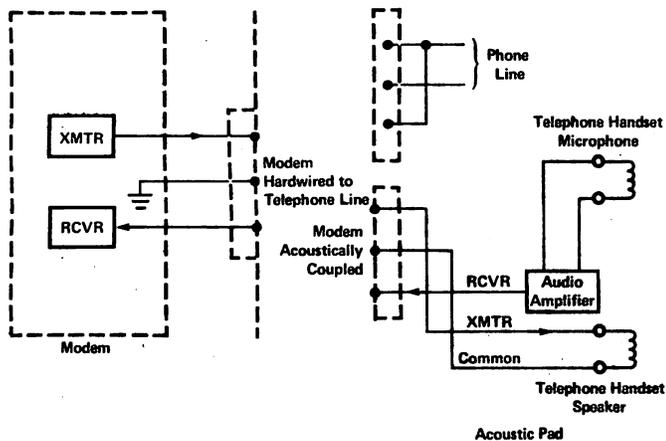
### LEASED LINE

#### 103F

Originate/answer  
Single channel—self contained  
\$25 to \$35/month

Bell 103/113 models and prices are shown in this slide.

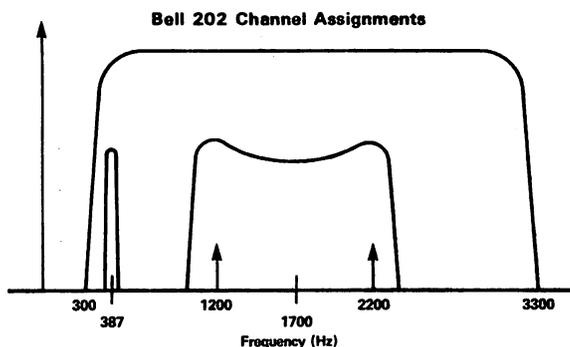
## Acoustic vs. Hardwired Modem



Modems can be directly connected to telephone lines via a "hardwired" electrical connection. Where portability is required low speed modems can be acoustically connected via the transducers in an acoustic pad and the telephone handset. There is usually some performance degradation due to the distortion introduced by transducers reducing the maximum speed capability and receiver sensitivity of acoustic couplers compared with hardwired modems.

Bell's 202 modem provides for 0 to 1200 bps communication over the dial network and 0 to 1800 bps over leased lines with C2 conditioning per Bell's specifications, but in practice the 202's do not require conditioned lines even at 1800 bps. The 202 is half duplex with a two wire circuit (leased or dial up) and full duplex with a 4-wire circuit. Optionally available is a 5 bps reverse channel which operates in the low end of the 300 Hz to 3300 Hz channel and is primarily used for supervisory control. For instance, this channel could be used to transmit an "out of paper" signal from a remote printer back to the CPU to terminate data transmission until the paper could be reloaded in the printer.

## Bell 202

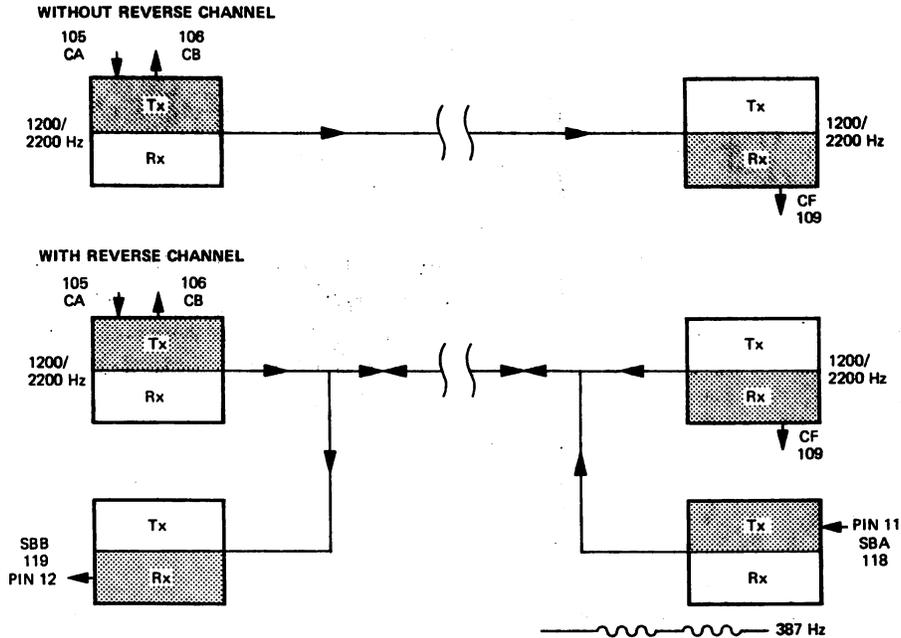


### Specifications

Data:	Serial, binary, asynchronous, half duplex on 2 wire lines
Data Transfer Rate:	0 to 1200 bps - switched network 0 to 1800 bps - leased lines with C2 conditioning Optional 5 bps AM reverse channel transmitter and receiver available for switched network units
Modulation:	Frequency Shift Keyed (FSK) FM
Frequency Assignment:	Mark - 1200 Hz Space - 2200 Hz
Transmit Level:	0 to -12 dBm
Receive Level:	0 to -50 dBm switched network 0 to -40 dBm leased network

A significant factor to consider when using the 202 type modem is the line turnaround time required for switching from the transmit mode to the receive mode. Echo suppressors in the telephone equipment that are required for voice transmission must be turned off by the modem to transmit digital data. These echo suppressors turn on if there is no energy in the band for 100 milliseconds (.1 second). The modem must provide a 200 ms signal to the line to turn off the echo suppressors every time it goes from transmit to receive mode - hence, if short records are being transmitted, such as in a graphic terminal application, the turnaround time can slow your anticipated 1200 baud (120 character/second) throughput to possibly 60 characters/second or less on an actual basis. Also since the CPU must be able to control the Request to Send lead of the Bell 202 for half duplex transmission, you should check your computer specifications to determine if this control is available. Most mini's do not have the capability of supporting half duplex 202, but can support 103 line discipline.

## 202 DIAL UP



This slide shows the interface signals required to operate the half duplex 202 - with or without the reverse channel.

## BELL 202 FAMILY

### DIAL-UP

202C5, 9 or 11

0 to 1200 BPS

Single channel, self contained

Without reverse channel

\$35 to \$50/month

202C6, 10 or 12

0 to 1200 BPS

Single channel, self contained

With reverse channel

\$35 to \$50/month

202S

0 to 1200 BPS

Single channel or up to 8 channels in one housing

Reverse channel optional

\$20 to \$40/month

### LEASED LINE

202D/202R

0 to 1800 BPS

Single channel, self contained

\$35 to \$50/month

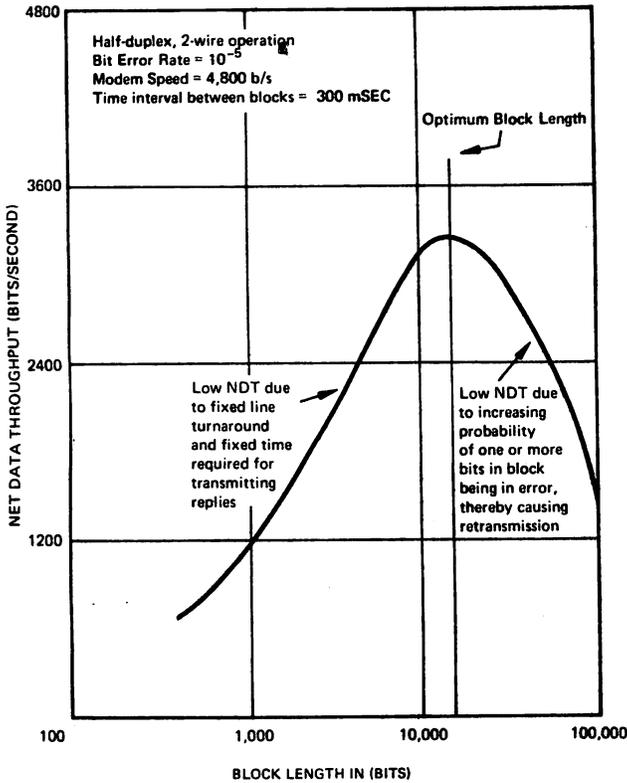
202T

0 to 1800 BPS

Single channel or up to 8 in one housing

\$20 to \$40/month

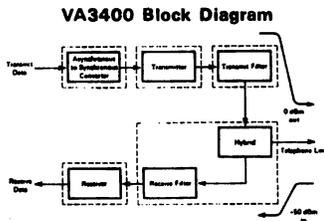
Bell 202 models and prices are shown in this slide.



**Effect of Block Length on Net Data Throughput (NDT)**

This slide shows the effect of block length on net data throughput. The curve is taken from an excellent article on throughput which appeared in the July/August 1974 issue of Data Communications magazine.

## Vadic VA3400



### Specifications

Data: Serial, binary, asynchronous or synchronous, full duplex

Data Transfer Rate: 1200 bps

Modulation: Dibit Phase Shift Keying (DPSK)

Transmit Level: 0 to -12 dBm

Receive Level: -15 to -50 dBm (or 0 to -35 dBm) simultaneous with adjacent channel transmitter at up to 0 dBm

Channel Assignment:

	Originating End	Answering End
Transmit	High Band	Low Band
Receive	Low Band	High Band

### Phase Shift

Dibit	VA3400
00	90°
01	0°
11	180°
10	270°

A block diagram and specification summary of VADIC's full duplex VA3400 modem is shown. This modem operates at 1200 bps full duplex on 2-wire dial up or leased lines. The full duplex line discipline makes it possible to simply change modems and quadruple data speed over the Bell 103.

# VA3400 FEATURES

1200 bps full duplex on dial up or 2 wire leased lines

Full duplex Protocol similar to Bell 103 (V21)

Abort timer disconnect

Loss of carrier disconnect

Remote controlled loopback

Echoplex operation

10:1 Improvement in error rate compared to FSK 1200 bps Modems

Terminal break capability provided

Eliminates half duplex turn around delay

Positive indication of connect status

Simplifies terminal operation

**The slide shows the VA3400 features.**

## Bell 201B/C

### Specifications

Data: Serial, binary, synchronous, half duplex on 2 wire lines

Data Transfer Rate: 2400 bps

Modulation: Dibit Phase Shift Keying (DPSK)

Transmit Level: 0 to -14 dBm

Receive Level: -15 dBm to -50 dBm or 0 dBm to -35 dBm

RTS/CTS Delay: 0, 7.5 msec, or 150 msec

### Phase Shift

Dibit	201B/C	201A
00	45°	0°
01	135°	90°
11	225°	180°
10	315°	270°

Note: 201A 2000 bps dial up lines replaced by 201C.

**Bell 201 modems are 2400 bps synchronous half duplex 2-wire or full duplex 4-wire units that use a modulation scheme similar to the VADIC VA3400. The 201A is an obsolete 2000 bps unit, 201B is primarily for private or leased line applications, and the 201C is for dial up applications.**

# BELL HIGH SPEED All Synchronous

## 201A

2000 BPS  
Single channel, self contained  
Dial-up  
\$55 leased; \$70 dial-up

## 201B

2400 BPS  
Single channel, self contained  
Leased line  
\$55 leased; \$70 dial-up

## 201C

2400 BPS  
Single channel or up to 6, 12 or 30  
In common cabinet  
Dial-up or leased line  
\$55 leased; \$70 dial-up

Bell 201 models and prices are shown in this slide.

## BELL HIGH SPEED

### 203—OBSOLETE

### 208A

4800 BPS  
Single channel, self contained  
Leased line—no conditioning  
\$125/month

### 208B

4800 BPS  
Single channel, self contained  
Dial-up  
\$150/month

### 209A

9600 BPS or multiplexed increments of 2400 bps  
Single channel, self contained  
Leased line, D-1 conditioning  
\$230/month

Bell high speed as well as other Bell modems  
are discussed.

## OTHER BELL MODEMS

### 303 Series

19.2, 50 and 230.4K BPS  
Single channel, self contained  
Special 5000 & 8000 com lines

### 403 Series

Up to 60 Char/Sec  
Single channel, self contained  
Leased or dial-up  
\$40 to \$60/month

# DATA ACCESS ARRANGEMENTS

Manual: CDT - 1000A

Manual only operation  
\$2.00 to \$3.00/month

Automatic: CBS - 1001A or 1001F

Automatic operation  
Voltage interface  
\$6.00 to \$7.00/month

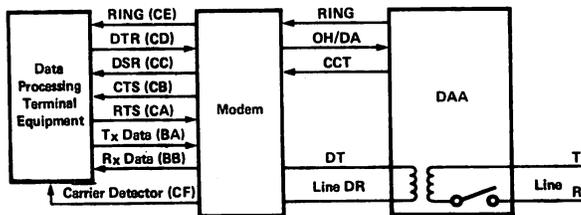
CBT - 1001B or 1001D

Automatic operation  
Contact closure interface  
\$4.00 to \$5.50/month

## Functions

- Protect terminal and modem from line surges
- Provide DC isolation/impedance matching via transformer
- Protect network for excessive power to line
- Perform line transfer—handset to modem and vice versa
- Auto answer/dial (CBT or CBS only)

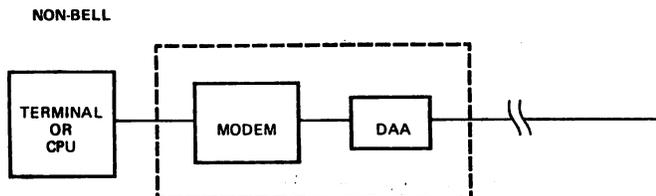
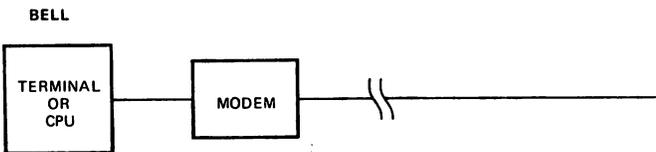
## Typical Automatic DAA Configuration



Connecting a non-telco modem to the switched network has required the use of a protective device called a data access arrangement (DAA). During 1975 the California Public Utilities Commission began certifying non-telco DAA's so that independent manufacturers such as VADIC could connect their equipment to the network via a customer provided (VADIC provided) DAA. The FCC is now proposing that all the state PUC's and telephone companies allow the DAA to be part of the equipment provided by independent manufacturers.

# REPLACING BELL MODEMS

1. Leased line  
No DAA required
2. Dial-up  
DAA required



Until the California PUC decision in mid 1975 the non-Bell modem had to have a separate telco provided DAA connected to it. The Bell modem connected directly to the line, as shown in the top of the slide.

# IBM Line Adapters

## Specifications

**Data:** Serial, binary, asynchronous, half duplex

**Data Transfer Rate:** Limited Distance Adapters - 0 to 134.5 bps (& 600 bps)  
 Leased Line Adapters - 0 to 600 bps  
 Shared Line Adapters - 0 to 134.5 bps

**Modulation:** Frequency Shift Keyed (FSK) FM

## Specifications Summary

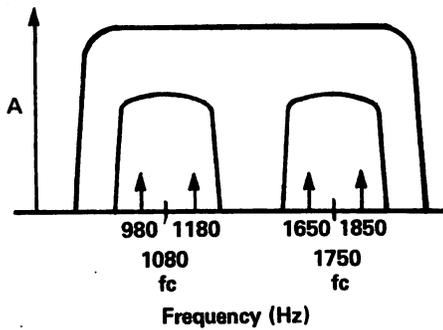
Line Adapter	Type	Max. Miles (km)	Modulation	Bit Rate	2W or 4W	Mark Freq. (Hz)	Space Freq. (Hz)	Input Impedance ohms	Output Impedance ohms	Termination Resistance (ohms)
Limited Distance	1A	4.75 (7.85 km)	FSK	134.5	2W	1170	1830	3000	3000	As Req.
	1B	4W			5000					
	2A1	8.25 (13.1 km)	FSK	134.5	2W	1000	2200	600 or 8200	600 or 8200	As Req.
	2A2	4W						600 or 5000	600 or 5000	
Leased Line	1A	No Limit	FSK	600	2W	1400	2000	600	600	680
	1B	4W								
Shared Line	1A	No Limit	FSK	134.5	2W	820	890	600	600	680
	1B				4W	1230	1400			

IBM manufactures a line of asynchronous modems which they call line adaptors for use on leased lines. The specifications are summarized on the slide.

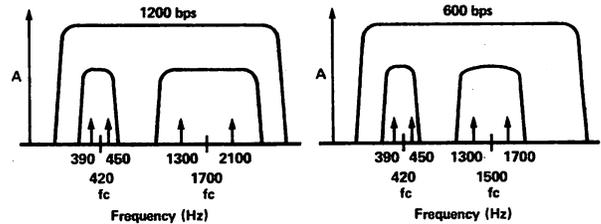
# CCITT Modems

- V21 (0 to 300 bps) (similar to Bell 103/113)
- V23 (0 to 1200 bps) (similar to Bell 202)
- V26 (2400 bps) (similar to Bell 201)

## V21 Channel Assignments



## V23 Channel Assignments

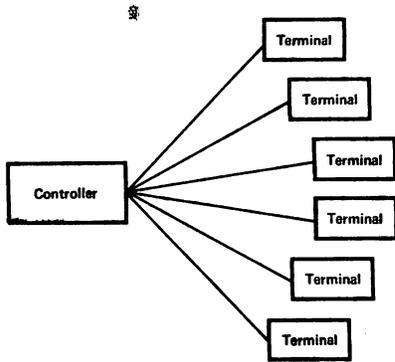


## V26 Data Encoding

DIBITS	Type A Phase Shift	Type B Phase Shift
00	0°	45°
01	90°	135°
11	180°	225°
10	270°	315°

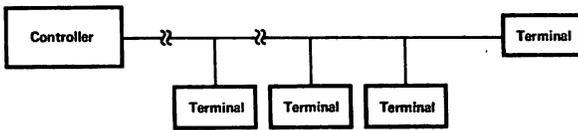
Outside the U. S. data transmission standards are set by the International Telegraph & Telephone Consultative Committee (CCITT) which is a part of the International Telecommunications Union in Geneva. Standards V.21, V.23, and V.26 describe modems similar to the Bell 103, 202, and 201 respectively.

**Point-to-Point Network**

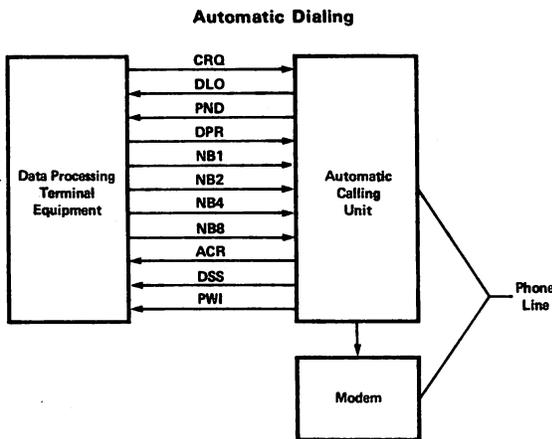


Point-to-point leased line networks are similar to what is shown at the top of the slide. All dial up connections are point-to-point. Multipoint networks have more than one remote station for each central station.

**Multipoint Network**



**Bell 801**



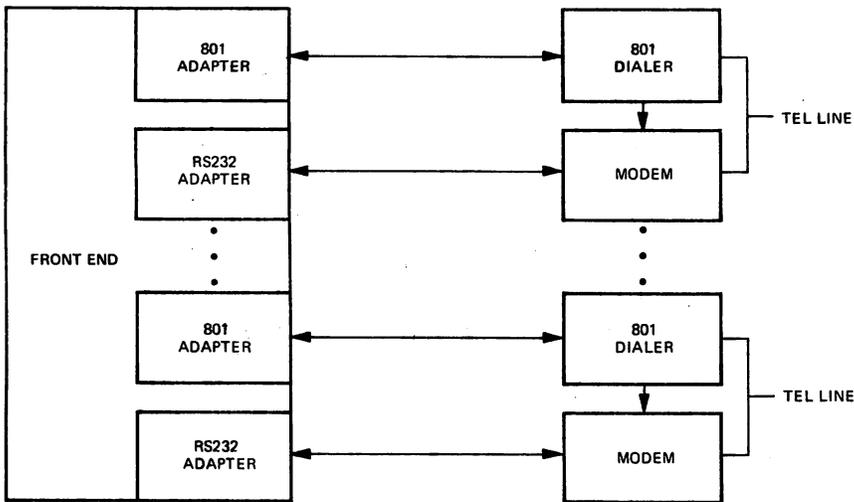
Automatic dialing via the Bell 801 auto calling unit requires a unique interface between the business machine and ACU. This interface is defined in EIA specification RS366. The interface signals are as follows:

- |            |                                 |
|------------|---------------------------------|
| <b>CRQ</b> | <b>Call Request</b>             |
| <b>DLO</b> | <b>Data Line Occupied</b>       |
| <b>PND</b> | <b>Present Next Digit</b>       |
| <b>DPR</b> | <b>Digit Present</b>            |
| <b>NB1</b> | <b>Digit Value 1</b>            |
| <b>NB2</b> | <b>Digit Value 2</b>            |
| <b>NB4</b> | <b>Digit Value 4</b>            |
| <b>NB8</b> | <b>Digit Value 8</b>            |
| <b>ACR</b> | <b>Abandon Call &amp; Retry</b> |
| <b>DSS</b> | <b>Data Set Status</b>          |
| <b>PWI</b> | <b>Power Indication</b>         |

**801A Pulse Dialer**  
 PND on 100 ms times # pulses, then off 1 sec;  
 i.e., approx. 15 sec to dial 10-digit number

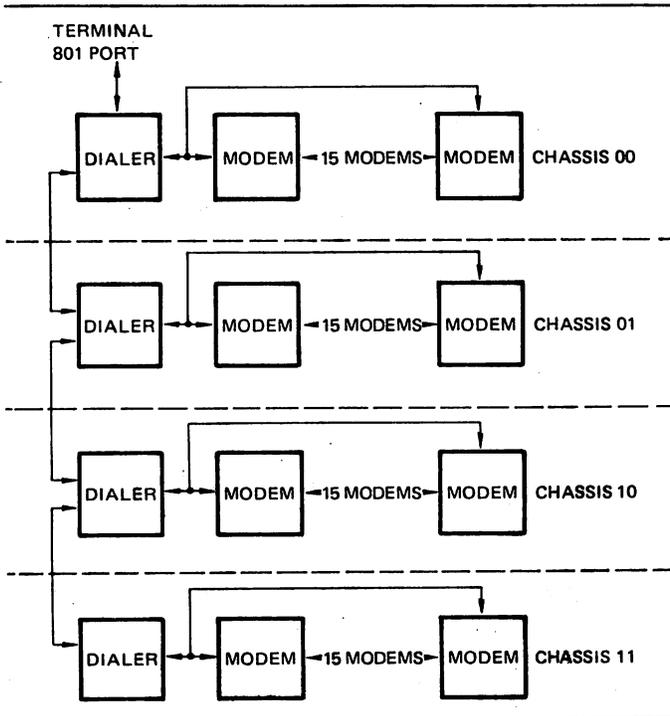
**801C Touch Tone Dialer**  
 PND on 50 msec, then off 70 msec; i.e.,  
 approx. 1 sec to dial 10-digit number

## NORMAL ACU CONFIGURATION



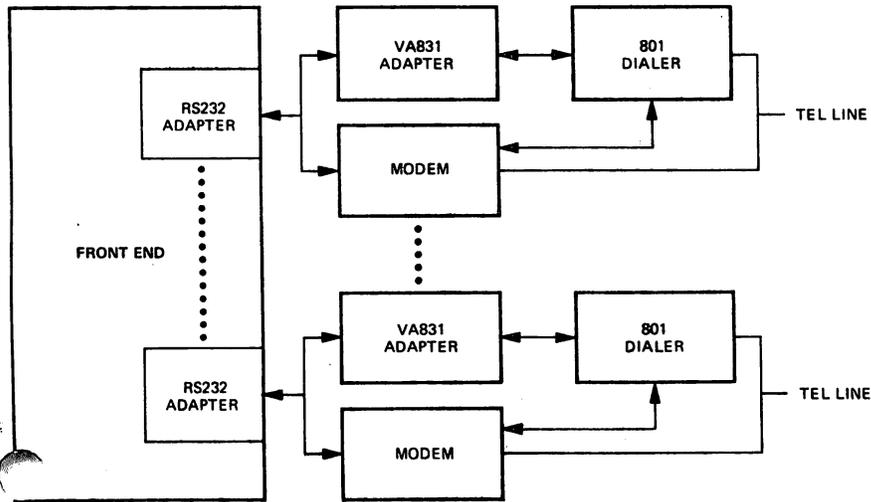
Each 801 auto calling unit requires its own front end 801 RS366 adaptor. A single modem is associated with each dialer. The modem/ACU combination is attached to a single phone line.

## MACS Block Diagram



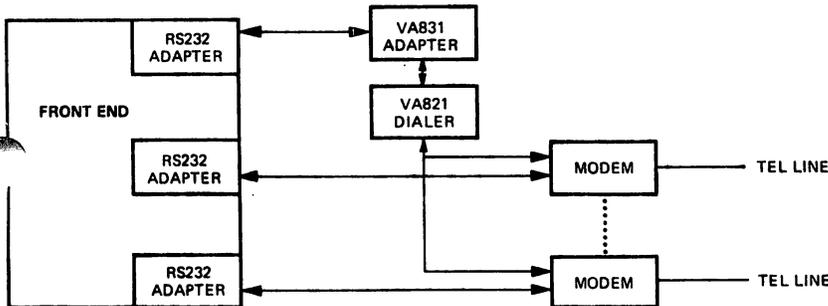
VADIC's multiline automatic calling system is diagramed in this slide. A single RS366 ACU port connects to as many as 60 phone lines. Each MACS dialer, VA821, can handle up to 15 modems.

## SYSTEM WITH RS232 TO RS366 ADAPTER

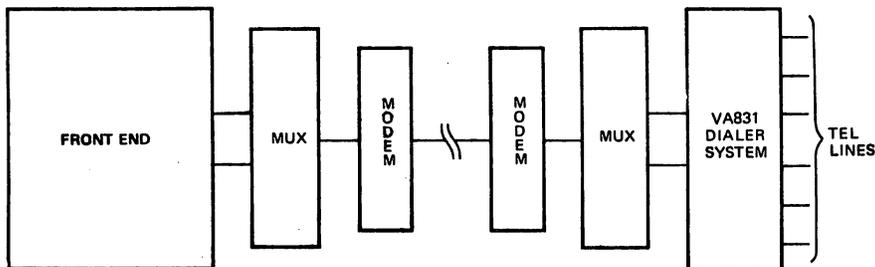


VADIC's VA831 adaptor enables a computer to initiate the dialer and transmit dialing information - digits and supervision - to an 801 pulse or touch tone dialer via an RS232 modem interface. All signaling takes place through characters sent from the computer on Transmit Data, and received by the computer on Received Data.

## SYSTEM USING VA821 MULTILINE DIALER

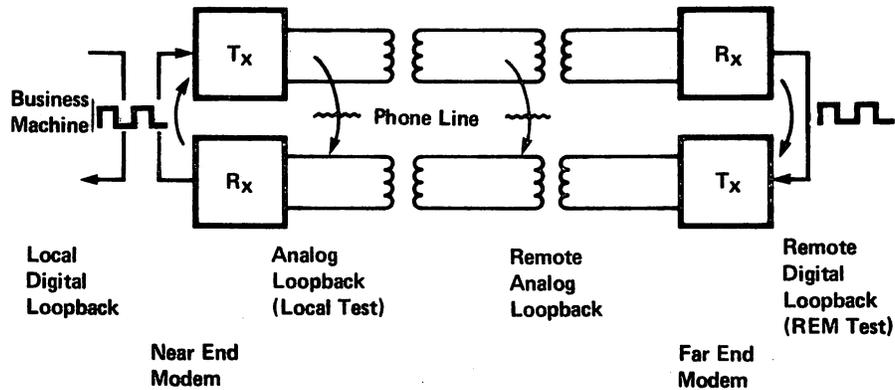


## MULTIPLEXER CONFIGURATION



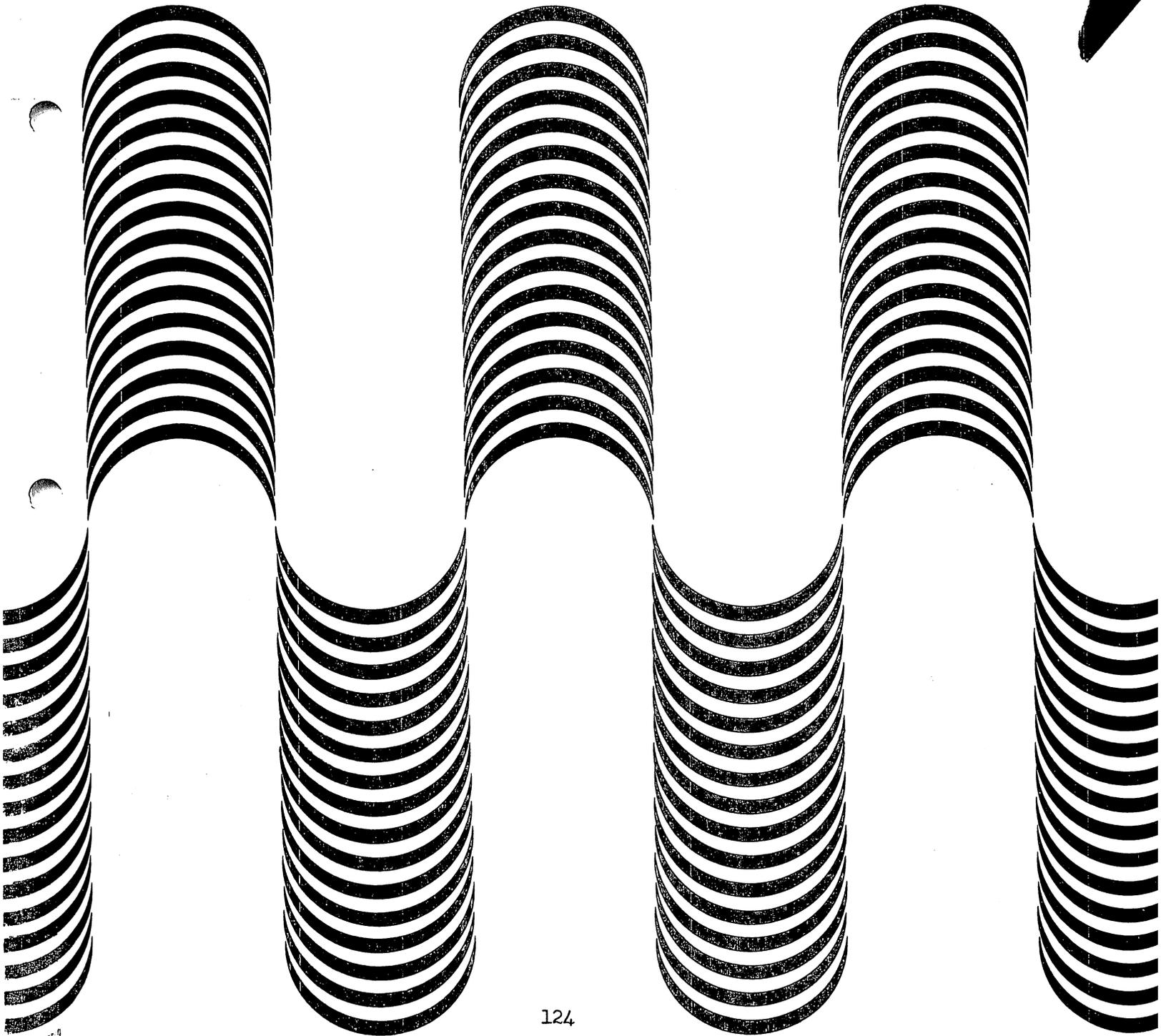
When VADIC's VA821 multiline dialer is used the RS232-RS366 adaptor requires a dedicated RS232 port. The VA831 makes it possible to have automatic calling through a multiplexer port that does not pass 801 interface signals. As shown in the lower portion of the slide, an automatic dialer can be located at the distant end of a multiplexer link, and accessed through a conventional RS232 interface without hardware modifications.

## Diagnostics



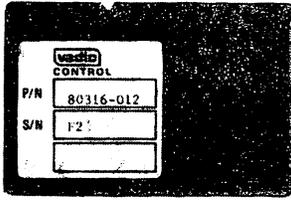
Analog loopback refers to connecting the transmitter's (analog) output to the receiver's input of the same modem. (For full duplex modems the transmitter and receiver must be switched into the same channel since normally they are in opposite channels.) The receiver demodulates the transmitted signal; agreement between transmit and receive data thus confirms that all parts of the modem are working correctly.

Digital loopback refers to connecting the receiver's (digital) output to the transmitter's input. A message sent from the near end modem which is looped back digitally at the far end and successfully received is a complete check that both modems and the communication link are working satisfactorily.



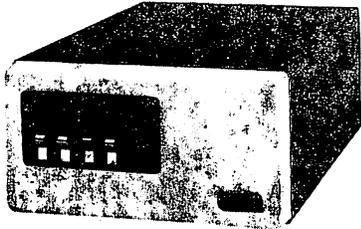
# Vadic Modems—A Whole Family of Modules, Cards & Chassis for OEM's & End-users.

## MODULAR CONCEPT FOR THE OEM



Vadic's data set modules (Bell 103, 202, IBM, CCITT) are specifically designed for incorporation inside remote terminals and data communication systems. The modules combine superior performance and low cost with packaging flexibility that enables rapid and inexpensive custom printed circuit board configuration. Vadic's modules also provide broad applications flexibility—full transmit/receive (with or without reverse channel for the 202 and CCITT data sets), transmit only/receive only operation, switched or leased lines, point-to-point or multipoint. Vadic manufactures custom circuit boards to EOM specifications for interconnect characteristics and physical configuration. All VA300, VA1200, VA2400, VA2700, and VA3400 Series modems as well as automatic dialers are available in custom configurations.

## MDS CONCEPT FOR THE END USER



Picture a whole new generation of computer-connected modem hardware and you've got Vadic's Multiple Data Set System (MDS). There's nothing like it for size, flexibility, and performance. Bell 103, 202, 201 compatible modems, Vadic's unique VA3400, IBM modems, and automatic dialers fit in seven inches of rack space—intermixed in any way. And to put the system even further ahead, we built in display and diagnostic functions that make troubleshooting an entire communications system easy. We didn't stop there. We added a one- and two-channel chassis for terminal clusters and multiplexer sites—with identical diagnostics plus cabinets to hold the modems and associated telephone line connecting equipment. In data communications, Vadic matches both ends of the line.

### VA3400: 1200 BAUD FULL DUPLEX, 2-WIRE MODEM

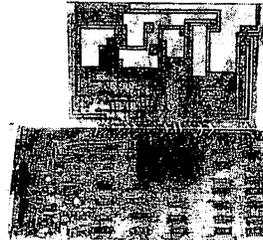
Here's a modem to make you sit back and take note—full duplex, 1200 baud on a two-wire circuit! This precedent setting modem has the speed of a Bell 202, with the simple line protocol of the 103 and can replace either one without any software modifications; it can be used on switched networks or leased lines.

#### IT'S FAST

If your front end and remote terminals are capable of 1200 baud operation, you can make your data system run four times as fast simply by replacing 103's or Vadic VA300's with the VA3400's. Take two minutes to change board straps and a VA3400 can resemble a Bell 202 or VA1200. But since the VA3400 is full duplex, with continuous carrier in both directions, turnaround delay is zero. On some systems this means substantial performance improvement. You can also make it easier to deal with the disconnect and line outage problems so common in half-duplex operations, because the VA3400 incorporates an optional abort timer that disconnects a call if carrier is not detected within 12 seconds of answering a call and a carrier-off disconnect that automatically puts the data coupler on-hook if incoming carrier is lost.

### ASYNCHRONOUS/SYNCHRONOUS

VA3405 modems have an integral asynchronous/synchronous buffer, which allows use of the identical simple line discipline used by Bell 103 or VA300 modems. The VA3410's are synchronous and offer something new if you want to design your 1200 baud system to have higher throughput and lower line costs.



### SWITCHED NETWORK MODEMS

The VA300 family includes modem cards completely compatible with Bell's 103A2, 103E, and 113A/B switched network models. In particular, the VA305C/D card features all the disconnect and control capabilities of the 103E with a bonus—automatic dialing, using Vadic's VA801 type dialer. Applying advanced circuit techniques, Vadic packs full originate/answer operation into the same space taken by answer-only or originate-only models.

### LEASED LINE MODEMS

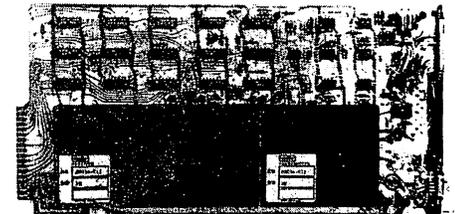
This series also incorporates 103F compatible versions, right down to programmable local test capability. They can be used in originate-only or answer-only modes.

### VA300: 300 BAUD BELL 103 COMPATIBLE MODEM

Vadic's VA300 series features every 103 or 113 configuration offered by Bell, plus system capabilities and options not available from Bell. Standard Vadic transmitter and receiver modules form the analog functions of each unit. We add controls, interfacing, and diagnostics hardware to create a family of modems that give unexcelled performance and flexibility, yet hold their own in price.

### SPECIFICATIONS AND MODELS

There are 12 different models, plus strapping options, in the VA300 Series—for all kinds of switched network and leased line applications.



## VA1200: 1200 BAUD BELL 202 COMPATIBLE MODEM

Vadic's VA1200 Series mirrors the VA300 in concept and scope. Built around Vadic's proven line of 1200 baud transmitter and receiver modules, it offers more than Bell in performance, flexibility, and test capabilities.

### SWITCHED NETWORK UNITS

The VA1200 family covers all Bell 202 configurations, with or without 5-baud reverse channel. All models in the MDS series can also be used with Vadic's VA801 type automatic dialer. With its unique modular construction, Vadic units can be configured for transmit-only or receive-only applications.

### LEASED LINE UNITS

Vadic's VA1200 series also satisfies all 202D- or 202R-compatible requirements, but adds enough flexibility to meet virtually all leased line 1200 or 1800 baud applications. Basic units provide field straps for adjusting Clear-To-Send, carrier detect, soft carrier, and turn-around delays. These control features provide versions for two or four wire connection, point-to-point or multipoint system arrangements.

### NO EQUALIZER

One option Vadic does not require is a strappable equalizer. A new detection method obviates a compromise equalizer for typical phase and amplitude distortion. Operation over both short and long haul circuits is excellent—without field adjustment.



## VA2400 SERIES— BELL 201 COMPATIBLE MODEM

Vadic's VA2400 Series modems provide synchronous data transmission at 2400 bits per second. Vadic's modems utilize unique detection techniques that improve performance and enable rapid carrier acquisition over worst case lines.

### SWITCHED NETWORK MODEMS

The VA2400 family is fully compatible with all Bell 201C configurations plus provides automatic dialing using Vadic's VA801 type dialer.

### LEASED LINE MODEMS

The VA2400 Series also is compatible with all Bell 201B modems. Both 2-wire and 4-wire models are available for use in point-to-point or multidrop applications. RTS/CTS delay is strappable for 7.1 msec to optimize throughput.

### MDS DIAGNOSTICS

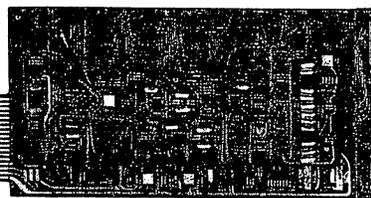
All VA2400 Series modems are completely interchangeable with Vadic's standard packaging and diagnostic hardware. Digital and analog loopback test in-service operation without additional equipment and comprehensive interface display pictures modem and network operation.

### LOW POWER

CMOS circuits are used to minimize power consumption, making the modem ideal for incorporation inside remote terminals or data communications systems.

### SPECIFICATIONS AND MODELS

There are five different models, plus strapping options via pencil switch control, to cover all types of switched network or leased line applications.



## VA2700: IBM COMPATIBLE MODEM

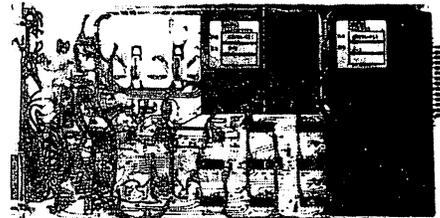
IBM supplies a series of modems, called line adapters, for IBM data communications systems. Vadic offers a complete set of modems compatible with IBM line adapters, but featuring package interchangeability with Bell types and diagnostics unique to Vadic's MDS concept. By adding a free standing cabinet, Vadic can replace and augment IBM 2711 installations.

LDA's—Limited Distance Adapters—for use with privately owned lines of limited length.

SLA's—Shared Line Adapters—up to four pairs of modems can operate independently over one privately owned line, each pair using a different frequency.

LLA's—Leased Line Adapters—IBM's version of modems for lines leased from a common carrier.

These IBM compatible modems can be mixed with all other Vadic modems in any chassis and their diagnostics capabilities are right up with all other MDS modems.



## CCITT COMPATIBLE MODEMS

Vadic also manufactures a complete line of CCITT compatible low and medium speed modems. Contact the factory for information.

## VA801: AUTOMATIC DIALERS

Dialers are numbered VA801A and VA801C, following Bell designations 801A and 801C for pulse and touch-tone automatic calling units, respectively. These units are functional equivalents to Bell dialers, with all strap options available. Computer systems replacing Bell dialers require *NO* software or hardware changes.

### OPERATING FEATURES

Vadic dialers feature all operations necessary for reliable automatic dialing, plus several functions that optimize system performance:

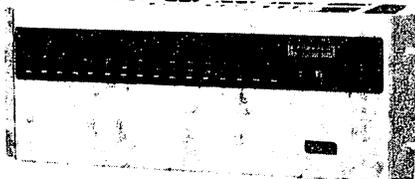
- Positive dial tone detection
- Positive answer tone detection (2025 Hz or 2225 Hz)
- 7 to 90 second abandon call and retry timer
- End of number code detection
- Forced 1½-second hang-up
- Full compatibility with all Bell 103 and 202 type modems
- Field conversion between pulse and touchtone dialers
- Busy detection for early retry
- CBS or CBT Data Couplers
- Tandem Dialing (optional)
- Invalid digit detection



## Vadic Multiple Data Set Systems

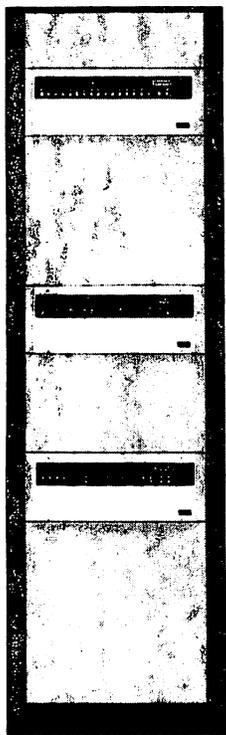
### VA1616: 16 CHANNEL CHASSIS

The VA1616 chassis leads the group. With its capacity to hold up to 16 intermixed Vadic modems, switched or leased line, or automatic dialers in one seven inch high chassis, it is truly a space saver. And of course, redundant power supplies, programmable diagnostics, and selectable front-panel display are part of the package. This means 128 modems—or 48 modems and 48 DAA cards—in a standard Vadic 19-inch wide cabinet!



#### DIAGNOSTICS

Sharp diagnostics figure keenly in Vadic's achievement. We knew we could not just cut Bell's prices—we had to offer maintenance techniques that would make you want Vadic hardware for superior system performance. Our integral test and display system actually replaces telephone company services and hardware. Our customers tell us it's nice to know exactly what's wrong *before* phoning Bell. Look at the VA1616 chassis. With this elegant and powerful control panel at the central site you can:



Display all EIA interface lines from a selected modem  
Test any modem locally  
Test any modem from remote station  
Send built-in test signals to remote, or use for local test  
Busy-out any modem  
Watch dynamic channel status of any modem  
Test remote terminals  
Test telephone lines  
Vadic adds support hardware to the VA1616 that makes life easier for everyone. Standard prewired cabinets with housings for Bell Data Couplers simplify installation, maintenance, and the floor plan.

### VA1601 & 2: 1 & 2 CHANNEL CHASSIS

For the remote terminal end, Vadic matches its MDS with a complete family of standalone modems. These units express the same sense of style and performance that sets the MDS apart. Two basic chassis, the VA1601 and VA1602, accommodate any of over 47 different plug-in modem cards—the entire Bell 103, 202, and 201 compatible line, IBM modems, and Vadic's advanced VA3400 Series.

The VA1601 holds one modem and the VA1602 holds two. Now, add the VA1601ACU automatic calling unit chassis and you have more data communications and packaging flexibility than you can find anywhere.

#### DIAGNOSTICS AND DISPLAY

Even though they look nice and small, each standalone chassis has the same powerful diagnostics as the VA1616.



### VA1601ACU: AUTOMATIC CALLING UNIT

Packaging is in the clean and simple style of other Vadic standalone chassis, but inside there are three cards—any one of the MDS modems, a VA801 Series touchtone or pulse type dialer and an audible line monitor card. Enough room is left for a power supply that can even supply a type CBT data coupler, if necessary.

#### SPECIAL DIAGNOSTICS

To let you always see what the modem and dialer are doing, the VA1601ACU has separate diagnostic indicators for each. The upper row of eight lights monitors the dialer and the lower monitors the modem interface leads. Of course, these diagnostics are in every way up with the rest of Vadic MDS and standalone units. The audible line monitor card and speaker is an added feature that allows you to hear the dial and connect sequence as it actually occurs. A rear panel switch silences it for normal operation.



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