ZM24x Quick-Connect Industrial Modem

User's Manual

Version 1.1
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ZM24x Description

The ZM24 is an industrial-grade modem designed to operate consistently and reliably under extreme electrical and temperature conditions.

Dial-up networks where data transfers are short and connect time is important are ideal for use with the ZM24. Typical connect times are approximately 2.4 seconds. Polled systems and transaction based systems realize much better performance using the ZM24 than when using a 28.8K or 56K modem.

Rugged transient protection and electrical isolation ensure that the ZM24 will function normally under a wide range of operating conditions. The case and electronics are designed to protect the modem from EMI/RFI interference.

A wide input-range power supply allows the modem to operate over any voltage from 5 to 30 Vdc with very low current consumption. Low power consumption makes it ideal for battery operated and solar applications.

ZM24x Operation

Data Format

The modem uses the V.22bis protocol. The baud rate is set for 2400 baud, 8 data bits, no parity and 1 stop bit.

Command Interface

The ZM24 uses a subset of the Hayes AT® command structure. The ZM24 is designed to connect to control and monitoring equipment with minimal effort. Custom interface options are available.

Typical Operation

The following details the setup and operation of a PC using ZM24s in a polled system. For typical operation, switches 3, 4, 5 and 6 are OFF, setting the fastest possible connect time. Switch 10 would be turned ON if verbose responses are desired, or turned OFF if single character responses are desired.

Switch 11 controls the echo – ON for enabled, OFF for disabled. Switch 12 enables auto answer. If auto answer is enabled, the modem will answer a call after the completion of the first ring.

Originate Modem (PC)

Switch 12 is typically turned OFF if auto answer is not required. A standard modem cable may be used to connect the ZM24 to a PC. To call another modem, the following sequence may be used: **ATDT5551212**. No other initialization strings are required.

All commands are terminated by a carriage return. Either the RS-232 DCD signal or the returned ASCII responses (characters or strings) may be used to tell the PC that a connection has been established. The DCD signal will be asserted when the connection has been established and the modem is ready to send and receive data. The PC may then poll the remote equipment.

To hang up, the PC can toggle the RS-232 DTR signal, or issue "+++" (with a 1 second guard time on both sides) and then issue "ATH" to hang up.

Answer Modem (Remote Equipment)

Switch 12 is typically turned ON to enable auto answer. No initialization strings are required. The DCD signal may be used to indicate the presence of a valid connection. When the phone line connection is broken, the ZM24 will automatically hang up.

Hayes AT® is a registered trademark of Hayes Microcomputer Products, Inc.

AT Command Summary

Command	Description
AT	Attention Prefix Precedes all commands except the escape sequence (+++). All commands are terminated by a carriage return (CR).
ATA	Force modem off-hook.
ATDT	Initiate Originate mode and dialing sequence. ZM24 will go off-hook and dial the sequence that follows. Valid digits: 0 – 9, '*', '#', 'A', 'B', 'C', or 'D' Modifiers: ',' – inserts a 2 second delay '/' – inserts a 125ms delay Ignored characters: ' ', '-', '(', ')', '.'
ATE0	Disable character echo in command state. Also set by turning DIP Switch 7 off.
ATE1	Enable character echo in command state. Also set by turning DIP Switch 7 on.
ATH	Hang-up This command causes the modem to go on-hook, and forces a hardware reset.
ATH1	Force modem off-hook without sending data. (Test mode command)
ATI	Identification Returns firmware version number.
ATO	Return to the on-line (connected) state from command state.
ATS	Sets "S" Register (See table of valid S registers.)

ATTA	Test Mode Command Forces modem off-hook, and sends pseudo random data in answer band.
ATTO	Test Mode Command Forces modem off-hook, and sends pseudo random data in originate band.
ATV0	Sets modem for numeric result codes. Also set by turning DIP Switch 6 off.
ATV1	Sets modem for verbose result codes. Also set by turning DIP Switch 6 on.
ATZ	Performs a hardware reset of the modem.
+++	Escape Sequence When connected, the escape sequence returns the modem to the command state. The escape sequence must be preceeded and followed by a 1 second quiet time (no characters received from the RS-232 port).

S Register Summary

ATS0=n   Auto Answer Control
                          Sets number of rings before modem answers an
                          incoming call.
                          0 = auto answer disabled
                          n = 0 – 9

                          This register is initialized on power up based on the
                          DIP Switch 8 setting (see DIP Switch Settings).

ATS7=n   Connection Timeout
                          Sets maximum time for a connection to be established.
                          n = 2 – 255 seconds

                          Default timeout is 30 seconds.

Modem Result Codes

Numeric	Verbose	Description
0	OK	Command executed
1	CONNECT	Return to on-line mode from command mode
2	RING	Ring signal detected
3	NO CARRIER	Carrier signal lost
4	ERROR	Invalid command
5	CONNECT 1200	Modem connected at 1200 Baud
6	NO DIALTONE	No dial tone detected
7	BUSY	Busy signal detected
8	NO ANSWER	No answer from modem being called
10	CONNECT 2400	Modem connected at 2400 Baud

Numeric response codes are enabled by turning DIP Switch 10 OFF, or sending the ATV0 command. Numeric responses are always terminated by an ASCII carriage return character.

Verbose response codes are enabled by turning DIP Switch 10 ON, or sending the ATV1 command. Verbose responses are always terminated by ASCII carriage return – line feed characters.

DIP Switch Settings

Switch	Description
Switch 1 Switch 2	RS-232 Port Baud Rate Select
OFF OFF	1200 Baud
ON OFF	2400 Baud
OFF ON	4800 Baud
ON ON	9600 Baud
Switch 3	RS-232 Link Speed OFF – 2400 Baud, sets V.22bis mode ON – 1200 Baud, sets V.22 mode
Switch 4	Answer Tone Length OFF – 425ms ON – 3000 ms
Switch 5	Answer Tone Delay OFF – 250ms ON – 2025ms Delay between Off-hook and start of answer tone
Switch 6	Connect Delay OFF – 0ms ON – 6827ms
Switch 7	Reserved
Switch 8	Reserved
Switch 9	Reserved (Test Function)
Switch 10	Modem Response Format OFF – Modem sends numeric response codes ON – Modem sends verbose response codes
Switch 11	Echo Control OFF – Character echo in command state disabled ON – Character echo in command state enabled
Switch 12	Auto Answer OFF – Auto Answer disabled (S0=0) ON – Auto Answer enabled (S0=1)

All switches are only read when the modem is powered up. Modem power must cycled if any switch settings are changed.

Connect Time

SW4	SW5	Connect Time
OFF	OFF	2.4 seconds
ON	OFF	5.0 seconds
OFF	ON	4.4 seconds
ON	ON	7.0 seconds

Connect time is the time period between the modem going off-hook and the end of the training sequence. Data may be sent once the 'CONNECT' LED is ON. The RS-232 DCD signal is also asserted at this time.

If SW6 is ON, add 6.8 seconds to the above connect times.

LED Indicators

Indicator	Description
CONNECT	Modem connection has been established.
AUTO ANS	Auto Answer is enabled.
$\rightarrow$	Command Mode: Data is being sent from the RS-232 port to the modem. Connect Mode: Data is being sent from the RS-232 port to the phone line.
$\leftarrow$	Command Mode: Data is being sent from the modem to the RS-232 port. Connect Mode: Data is being sent from the phone line to the RS-232 port.
3 Status LEDs (Upper Right)	Alternating pattern when no RS-232 device is connected. Sequential pattern when RS-232 device is connected. All 3 LEDs will flash 'ON' when an incoming ring signal is detected.

Connectors

Power Connector

Pin	Signal	Description
1	+V	5 to 30 Vdc
2	GND	Common for Pin 1
3	Chassis Ground	Connection to case and DB25 shell.

RS-232 Connector (DCE)

Pin	Signal	Name	Direction	Description
2	TXD	Transmit Data	Input	Used to receive data being sent to telephone network and receiving AT commands.
3	RXD	Receive Data	Output	Used to transmit data being received from the telephone network and send AT command results.
4	RTS	Request To Send	Input	Used by modem to determine if DTE device is ready to send data.
5	CTS	Clear To Send	Output	Asserted by modem to indicate ready to receive data from DTE device.
6	DSR	Data Set Ready	Output	Asserted by modem to indicate operational status.
7	GND	Ground		Electrical ground.
8	DCD	Data Carrier Detect	Output	Asserted when link has been established with another modem. This signal may be monitored instead of waiting for the ASCII "CONNECT" string.
20	DTR	Data Terminal Ready	Input	Used by modem to indicate that an external device is connected to the RS-232 port. Toggling this signal will force modem to hang up.
22	RI	Ring Indicator	Output	Asserted after a ring signal is detected from the telephone line. The RI output is pulsed high for 500ms after the ring signal stops.

ZM24x Specifications

Data Rate	2400 bps (asynchronous) V.22 bis
	1200 bps (asynchronous) V.22
Connect Time	2.4 seconds (typical)
Configuration	Hayes AT® style command structure
Interface	RS-232 DB25 female connector
Phone Line	RJ11 connector

Power (5 to 30 Vdc)

	Idle	Connected (typical values)
5 Vdc	58mA	78mA
8 Vdc	38mA	50mA
12 Vdc	28mA	36mA
24 Vdc	18mA	21mA
30 Vdc	15mA	18mA

Removable 3-pin connector

Operating Temperature Range	-40°C to +85°C
	10% to 90% RH (non-condensing)

Transient Protection

Power Input	Peak Pulse Power – 600 watts (10/100us waveform)
	Peak Surge Current – 100 amps (8.3ms single half sine-wave)
Telephone Line	FCC Part 68 Surge Specifications
RS-232 Port	ESD Protected
	±15kV Human Body Model
	±8kV Contact Discharge
	±15kV Air-gap Discharge
Size	5.0 in. x 5.0 in. x 1.45 in.
Mounting	Optional Mounting Bracket

FCC PART 68 Information

This equipment complies with Part 68 of the FCC Rules and the requirements adopted by ACTA. On the bottom of this equipment is a label that contains, a product identifier in the format US:AAAEQ##TXXXX. If requested, this information must be provided to your telephone company.

A plug and jack use to connect this equipment to the premises wiring and telephone network must comply with the applicable FCC Part 68 rules and requirements adopted by ACTA. A compliant telephone cord and modular plug is provided with this product. It is designed to be connected to a compatible modular jack that is also compliant. See installation instructions for details.

The REN is used to determine the number of devices that may connect to a telephone line. Excessive RENs on a telephone line may result in the devices not ringing in response to an incoming call. In most but not all areas, the sum of the RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to a line, as determined by the total RENs, contact your local telephone company. For product approved after July 23, 2001, the REN for this product is part of the product identifier that has the format US:AAAEQ##TXXXX. The digits represented by ## are the REN without the decimal point (e.q., 03 is a REN of 0.3). For earlier products, the REN is separately shown on the label.

If this equipment (*ZM24x*) causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations or procedures that could affect the proper functioning of your equipment. If they do, you will be notified in advance in order for you to make necessary modifications to maintain uninterrupted service.

If trouble is experienced with this unit, for repair or warranty information, please contact customer service at the address and phone listed below. If the equipment is causing harm to the network, the telephone company may request that you disconnect the equipment until the problem is resolved.

DO NOT DISASSEMBLE THIS EQUIPMENT. It does not contain any user serviceable components.

We recommend the installation of an AC surge arrester in the AC outlet to which this equipment is connected. Telephone companies report that electrical surges, typically lighting transients, are very destructive to customer terminal equipment connected to AC power sources.

ATTN: CUSTOMER SERVICE DEPT.
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