

Application Note #150:

General Operation of Cermetek iModem Products

INTRODUCTION

Cermetek internet modem (iModem) products are designed to facilitate the utilization of machine-to-machine interactions via the internet. After initial setup, iModem machine-to-machine activities proceed transparently with the level of control desired by the user. This includes fully autonomous (i.e., no human intervention) operation by relying on the internal intelligence of the iModem.

Direct machine-to-machine interaction represents the next logical extension of the internet. Using email, information can easily be transferred between systems and can be transmitted/retrieved at will. Internet email provides low cost, near real time multi-path communication. Access is as close as the nearest PSTN (Public Switched Telephone Network) phone line connection.

CONCEPTUAL OVERVIEW OF THE CH21XX iMODEM PRODUCT FAMILY

The iModem product family is intended for embedded applications. A conceptual representation of the iModem in the embedded environment is presented in Figure 1.

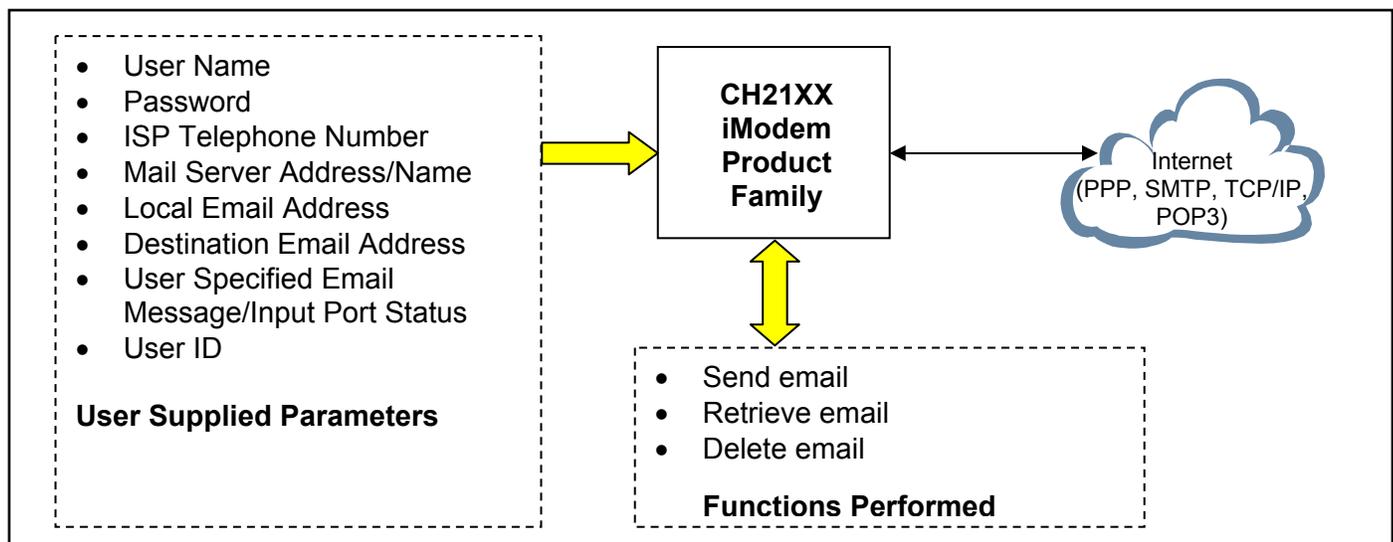


Figure 1. Conceptualized Block Diagram illustrating the Cermetek CH21XX iModem product family performing the embedded internet application function.

Note that Figure 1 indicates input of various internet parameters: user name, user password, ISP telephone number, ISP mail server address, local email address, destination email address and user specified email message/input port status. The ability to program a unique local email address into each iModem affords the user the opportunity to easily create a unique identity for each system containing an iModem product.

The user supplied parameters are loaded into the iModem and permanently stored in its flash memory. The parameter downloading activity is performed via the iModem's RS232 serial interface port utilizing either Cermetek's **iNetWizard**[®] telecommunications software package or, alternatively, one of a variety of commercially available terminal emulation software packages. **iNetWizard**[®] is provided free of charge by Cermetek and runs on any standard PC operating in the Microsoft Windows environment. Cermetek also manufactures a companion CH21XX Evaluation Board that is designed to facilitate the hardware connections required to program the iModem as well as providing a reliable platform to assist with system level debugging.

The CH21XX iModem product utilizes the user supplied parameters to establish an internet connection and either send and/or retrieve email or link to a web site (depending on the specific iModem product). At the completion of the required internet activity, the iModem terminates the internet connection.

DESCRIPTION OF FUNCTIONAL BLOCKS AND DISCUSSION OF BASIC OPERATIONS

Each iModem product consists of the following functional blocks:

1. μ P controller with Network Protocols and Flash ROM.
2. Serial interface buffer.
3. Input/Output interface circuitry.
4. Internal modem.
5. Modem interface circuitry.
6. DAA (Data Access Arrangement) PSTN interface.

Figure 2 contains a schematic drawing illustrating the interconnectivity of the various functional blocks comprising the CH21XX iModem products.

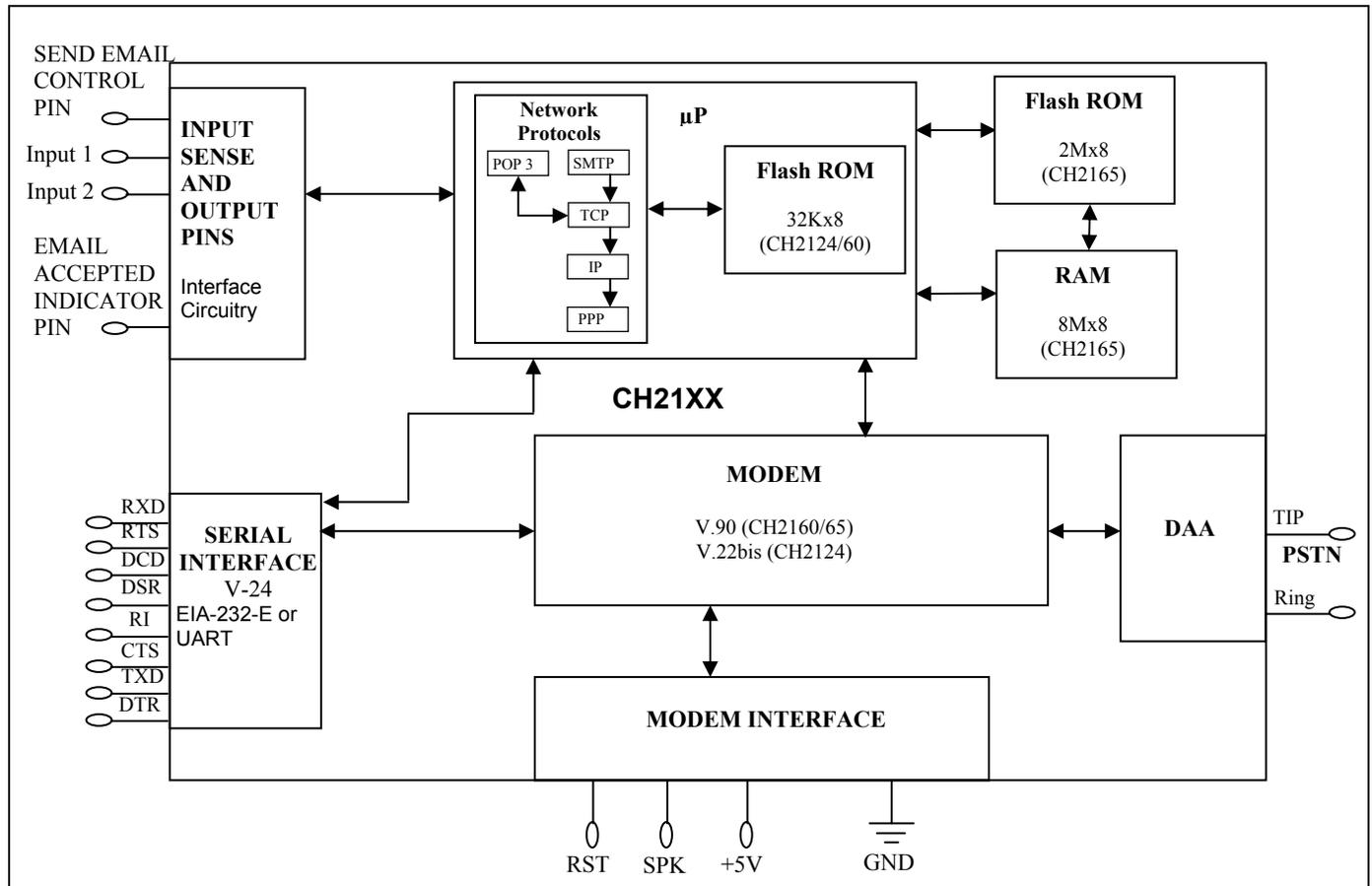


Figure 2. Functional Block Diagram of Cermetek CH21XX iModem Products. Note the additional RAM and ROM provided in the CH2165 iModem product.

Note that each iModem performs the following internet connectivity functions automatically:

1. Dials local access number and connects to local POP (Point of Presence).
2. Authenticates user ID and logs onto the internet via the specified ISP.
3. Sends (Retrieves) email to (from) the address specified using the ISP's SMTP (POP3) Mail Server.
4. Terminates ISP session after all data is sent (or retrieved).
5. Sends appropriate ASCII status messages as email activity progresses. A TTL LOW Pulse is presented at Pin 8 indicating that the ISP Mail Server has accepted the email message.

Control of the internet capabilities of the iModem can be either event driven or initiated and controlled by a system level host processor.

When not utilized in the internet connectivity role, the iModem will function as a standard analog modem.

KEY FEATURE

The user has complete control of the level of autonomy the iModem exercises in the user's application. This is a unique feature of Cermetek's iModem products.

µP Controller. The µP controller performs the required internet operations by interpreting each specific @T[®] command and executing the appropriate internet commands. The necessary internet protocol software is resident in flash ROM. The @T[®] commands function as an extension to the AT command set.

Internal Modem. The internal modem is used to establish a data connection with the ISP. The CH2160/65 contains a V.90 internal modem while the CH2124 contains a V.22bis internal modem. The internal modem can be controlled with Hayes AT commands and is compatible with industry standard communication software. Refer to Cermetek publication, AT Commands and S-Registers, for a more detailed discussion of the Hayes AT commands supported by the iModem product family.

When operating in standard analog modem mode, the maximum Data Terminal Equipment (DTE)/Host system communication speed is established by the maximum speed available from the DTE/Host and is not limited by the iModem product.

IMPORTANT NOTICE

AS DELIVERED FROM THE FACTORY, all @T[®] command communication between the CH2160/65 (CH2124) iModem and the host processor is conducted over the serial interface at 57.6/19.2kbps (2400bps).

Serial Host Interface Buffer. AS DELIVERED FROM THE FACTORY, the CH2160/65 iModem will only communicate with the DTE at 57.6/19.2 kbps and the CH2124 at 2400bps. However, the user may modify the DTE speed with the appropriate @T[®] commands. Refer to Application Note # 155, @T[®] Command Set Description and Usage For CH2124/60 or to Application Note # 325, @T[®] Command Set Description and Usage For CH2165. When the user changes the DTE communication speed to any speed other than the default value set of the factory, the user must ensure that the DTE supports the speed selected. Failure to do so could adversely affect communication with the iModem device or, worst-case, disable communication with the internal µP controller. Refer to Application Note # 158, Cermetek iModem Caveats and Definitions, for a more detailed discussion of this issue.

Refer to Cermetek's High Speed Modem and FAX Family product data sheet for a complete Description of the internal modem's capabilities and functions.

IMPORTANT NOTICE

If the user wants to change the DTE/Host communication speed to any speed other than the factory set speed of 57.6/19.2kbps for the CH2160/65 or 2400bps for the CH2124, the user must first change the DTE speed of the iModem using the appropriate all @T[®] commands before changing the DTE/Host speed. Refer to Application Note # 158, Cermetek iModem Caveats and Definitions, for a more detailed discussion of this issue.

Telephone Line Interface or DAA. High performance modems are extremely sensitive to DAA (Data Access Arrangement) performance. The iModem family includes a unique low distortion DAA designed for optimal performance over all PSTN line conditions thereby achieving the most reliable and best performance PSTN connections.

The iModem family is designed to meet North American telephone standards as set by FCC Part 68 (USA) and CSA CS-03 Part I (Canada). Each iModem product is shipped from the factory with an FCC label indicating FCC registration number and ringer equivalent. The PSTN line interface is UL1950 and CSA C22.2 950 Listed (Third Edition) and will meet 1500 VAC RMS isolation and provide 2122V peak surge protection. Consequently, the iModem family of products satisfies U.S. and Canadian requirements, and will meet other international approval agency requirements that specify these levels of isolation. Note that, with exception of the U.S., most countries (including Canada) require submission of the final product or system containing the iModem to the appropriate governing regulatory agency for approval.

Pins 1 and 2 function as both input and output connections to the PSTN. To maximize field reliability in hostile environments, for Canadian approval, for UL compliance, and also optionally for FCC part 15 compliance, these two pins may be routed through an external network such as that described and in Cermetek Application Note #126, Supplemental PSTN Line Protection.

TELECOMMUNICATIONS SOFTWARE

Communication between the iModem and either the terminal emulation system or the DTE system is conducted over the iModem's serial port. This port is used for iModem programming and for routine communication, and may be used for embedded system debugging.

During evaluation of the iModem, it is desirable to employ a telecommunications software product to facilitate the transmission of information between the iModem and the terminal emulation system/DTE/host system. This link is also useful for monitoring iModem communication. When system level debugging is required, Cermetek recommends terminal emulation products such as MS HyperTerminal or PROCOMM.

iModem programming is required to personalize/customize various internet parameters and is typically a one-time event. Although the user may modify the internet parameters as often as needed, most users modify these parameters very infrequently. Cermetek's **iNetWizard**[®] program has been specifically designed to streamline the iModem programming activity and is the preferred iModem programming method. However, if desired, commercial terminal emulation products such as MS HyperTerminal or PROCOMM may also be utilized to program the iModem.

iNetWizard[®] is an MS Windows based application and is provided free of charge by Cermetek to all iModem customers. Refer to Cermetek Application Note # 159, [Using iNetWizard[®] with CH2124/60](#), for detailed step-by-step accessing instructions. Typical iModem programming examples are also included in Application Note # 159.

PROCOMM is a telecommunications product and is available from Procom Technology, Inc., 58 Discovery, Irvine, CA 92618. PROCOMM contains the terminal emulation program PC PLUS. PC PLUS operates in the standard DOS environment. Application Note #160, [Using PROCOMM with CH2124/60](#), employs a step by step procedure to lead the user through all necessary sequences to setup and activate PROCOMM and to access the terminal emulation program PC PLUS. Typical iModem programming examples are also included in Application Note # 160.

HyperTerminal is standard on MS Windows 95, 97, 2000, ME and XP environments. Refer to Cermetek Application Note #157, [Using MS Windows HyperTerminal](#). Typical iModem programming examples are also included in Application Note # 157.

IMODEM CONTROL AND OPERATION

@T[®] Commands. Cermetek has created a set of **@T[®]** command extensions for control of the internet communication function. These commands operate in the same fashion as the industry standard Hayes AT commands. This common command syntax allows users familiar with the Hayes AT command set to quickly adapt to the **@T[®]** command extensions.

Refer to Application Note 155, [@T[®] Command Set Description and Usage for CH2124/60 iModem Products](#), for a complete description of the **@T[®]** Commands.

iModem Control. The serial **@T[®]** commands are sent over RXD and serial status messages are returned on TXD. All other serial interface lines may be utilized for the convenience of a particular application but are not required by the iModem. Unused outputs from the iModem should be left unconnected. Unused inputs should be tied to the proper logic level. Refer to the appropriate Cermetek product datasheet for a complete list of pin descriptions.

iModem Default Configuration. The CH2124/60 iModem is delivered with a default configuration profile that will allow transmission of emails "right out of the box." Application Note # 156, [CH2124/60 iModem Default Configuration Profile](#), explains in detail each of the default configuration parameters.

The default configuration is provided as a convenience to Cermetek's iModem customers and it enables the user to demonstrate proper operation of the iModem without the need for personalization or customization of the iModem ISP parameters.

The default profile is intended for use on an interim basis and the user should expect that some amount of personalization/customization will be needed to tailor the iModem's performance to the user's specific application requirements. The factory installed default configuration can be modified by the user as desired. For those not familiar with the CH21XX iModem, however, Cermetek recommends a phased strategy starting with simple tasks and building to more elaborate personalized/customized emails.

Note that the default destination email address is **<username@imodem.net>**. this email box is located on the iModem.net ISP. Emails may be view using a standard web browser or retrieved by an iModem product capable of email retrieval/deletion. When retrieving the email using an iModem provided the email is NOT automatically deleted.

The following configuration profile information is preprogrammed into the iModem:

1. ISP account ID and password.
2. Local dial-up ISP (Internet Service Provider's) access phone number, if available.
3. Email destination address.
4. Email subject line.
5. Email message.

For a complete description of the default configuration profile, refer to Application Note # 156. Refer to Cermetek Application Notes #149, 157, 158, 159 and 160 for detailed discussions and examples covering a range of topics including: terminal emulation program setup, ISP configuration profile modifications, send email and retrieve email.

Changing the Default Internet Configuration Profile. The iModem automatically saves all configuration profile modifications invoked by the **@T[®]** commands to internal flash memory when the command is executed. These modifications constitute a permanent change to the user profile and will not be lost when power is removed.

EMAILS TRANSMISSIONS

Initiating Email Transmissions. The CH2124/60 products allow for the initiation of email transmission using any of the following methods:

1. Issue software commands.
2. Assert CH2124/60 SEND pin TTL LOW.
3. If using the CH21XX Evaluation Board, momentarily depress push-button switch S3.

When the email transmission has been accepted by the ISP mail server, the iModem provides a TTL LOW pulse to the SENT pin (Pin 8). This pulse allows the user to set an external status LED or to incorporate alternate hardware monitoring circuitry into their application.

Refer to Application 155, **@T[®] Command Set Description and Usage for CH2124/60 iModem Products**, for a detailed discussion of iModem send mail procedures. Refer to Cermetek Application Notes #149, 157, 158, 159, 160 and Cermetek Publication **iModem Evaluation Board Instructions** for detailed send email examples.

Terminating Emails. The CH2124/60 products allow for the termination of any email transmission (regardless of how the email transmission was initiated) using one of the following methods:

1. Assert CH2124/60 SEND pin TTL LOW during email transmission.
2. If using the CH21XX Evaluation Board, momentarily depress push-button switch S3 during email transmission.

Either method will properly terminate the internet connection with the ISP. **CAUTION:** Turning off the power to the CH21XX will cause the internet connection to hang, and it could take the ISP as long as 15-minutes to terminate the internet connection. Depending on the ISP, a hanging internet connection could cause difficulty for subsequent email transmission attempts until the internet connection has been properly terminated by the ISP."

Cermetek strongly recommends that the user send several trial emails utilizing the default configuration profile contained within the CH21XX iModem to assure proper operation of both the CH21XX iModem and the application containing the iModem. This should be done before attempting to modify the default configuration profile.

EVALUATION ENVIRONMENT: OPERATION OF THE CH2124/60 IMODEM IN AN EMBEDDED INTERNET APPLIANCE APPLICATION

Figure 3 contains a block diagram illustrating the CH2124/60 product in a simple embedded product application. In this figure, the CH21XX Evaluation Board is functioning as the embedded product. The CH21XX Evaluation Board is available from Cermetek and is highly recommended for those not completely familiar with Cermetek's iModem product family.

Referring to Figure 3, there are five elements to the block diagram. Each element is identified with a circled number. The individual blocks are referred to by this number in the following discussion.

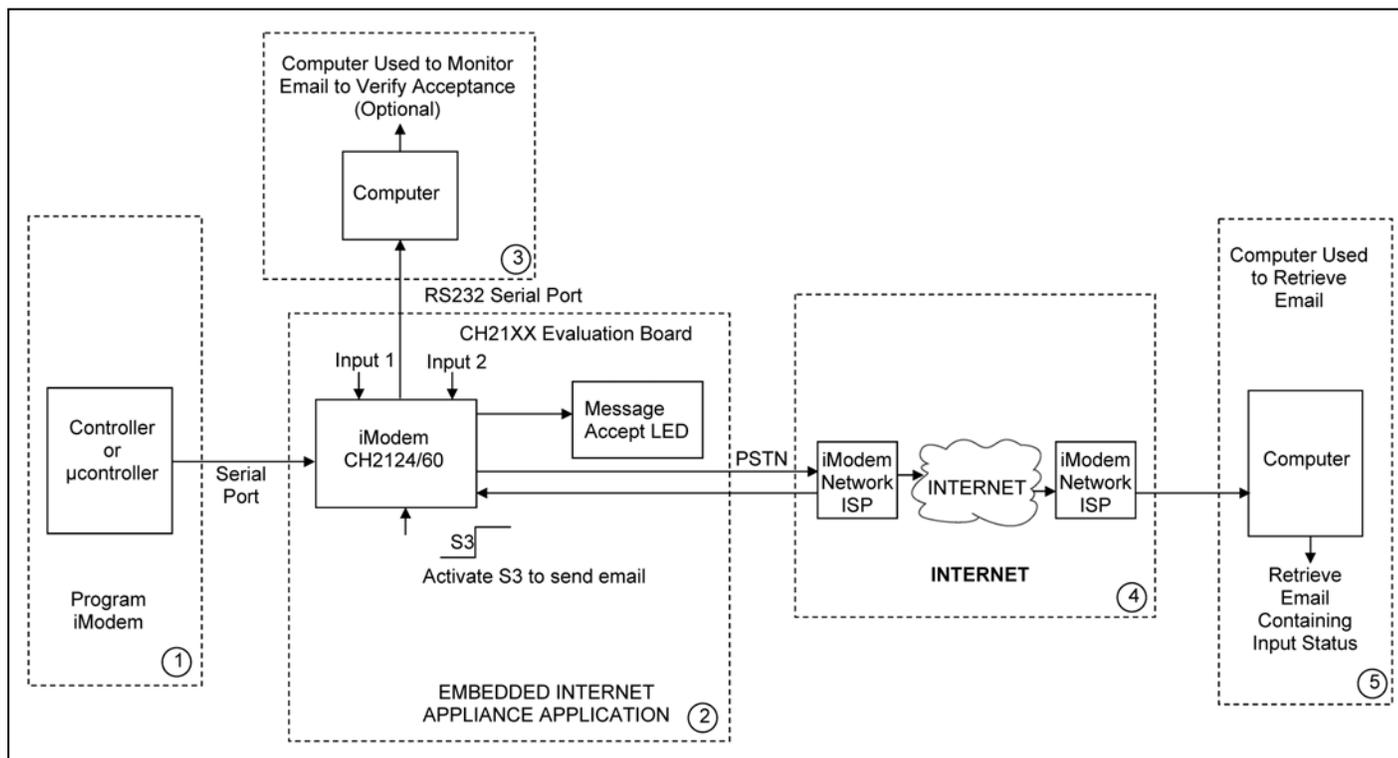


Figure 3. Block diagram illustrating operation of the CH2124/60 iModem product in a simple embedded internet application. Note that the CH2124/60 Evaluation Board is functioning as the embedded application.

Block 1. This block represents the computer or the microcontroller used to program the iModem.

The programming activity involves specifying several internet parameters and is typically a one-time event. Although the internet parameters can be modified by the user as often as needed, most users modify these parameters infrequently.

The iModem is programmed using a telecommunications software package. The preferred method is to use Cermetek's **iNetWizard**[®]. **iNetWizard**[®] is an MS Windows based program and is provided free of charge by Cermetek to all iModem customers. Refer to Cermetek Application Note # 159, Using iNetWizard[®] with CH2124/60, for detailed step-by-step accessing instructions.

Block 2. This block represents the Embedded Internet Appliance application. In the example in Figure 3, the application is the CH21XX Evaluation Board. Refer to applicable Cermetek Publication iModem Evaluation Board Instructions for a detailed discussion of the setup, operation and usage of the specific CH21XX iModem Evaluation Board.

The iModem configuration indicated illustrates the fully autonomous mode of operation. By momentarily depressing switch S3 on the evaluation board, the CH2124/60 sends the pre-programmed email message including the status of input ports INPUT 1 and INPUT 2 and illuminates the SEND LED on the evaluation board. Note that no PC or microcontroller/host intervention is required to send the email message.

When the email message has been accepted by the ISP's SMTP server, a MESSAGE ACCEPTED ASCII activity response message is issued to the computer in Block 3, the previously illuminated SEND LED is cleared and the Message Accepted ACPT LED is illuminated. The user may clear the ACPT LED by momentarily depressing push-button switch S4.

Block 3. An optional computer with monitor screen can be connected to the iModem via the RS232 interface. This allows direct monitoring of all activity response status messages. These messages indicate such things as: DIAL TONE, modem CONNECT, MESSAGE ACCEPT, PSTN line DISCONNECT, and modem HANG UP. Refer to

Cermetek Application Notes 149, 155, 157, 159 and 160 for a more detailed discussion of the response status messages.

Additionally, this computer can be used to compose emails prior to transmission by the iModem as well as to review all emails retrieved by the iModem.

Block 4. This block represents the internet and the ISP gateways required for access to the internet.

Block 5. Retrieval of email messages sent by the CH2124/60 iModem is depicted in Block 5 as being performed by a computer utilizing standard email software (such as Netscape Communicator). The email may alternatively be retrieved by using the CH2124 or CH2160 (Send and Retrieve Email) products without the aid of a computer.

USER EMBEDDED ENVIRONMENT: OPERATION OF THE CH2124/60 IMODEM IN A USER INTERNET APPLICATION

Figure 4 contains a block diagram illustrating the CH2124/60 product in a generic embedded product application. In this figure, there are three basic elements to the block diagram. Each element is identified with a circled number. The individual blocks are referred to by this number in the following discussion.

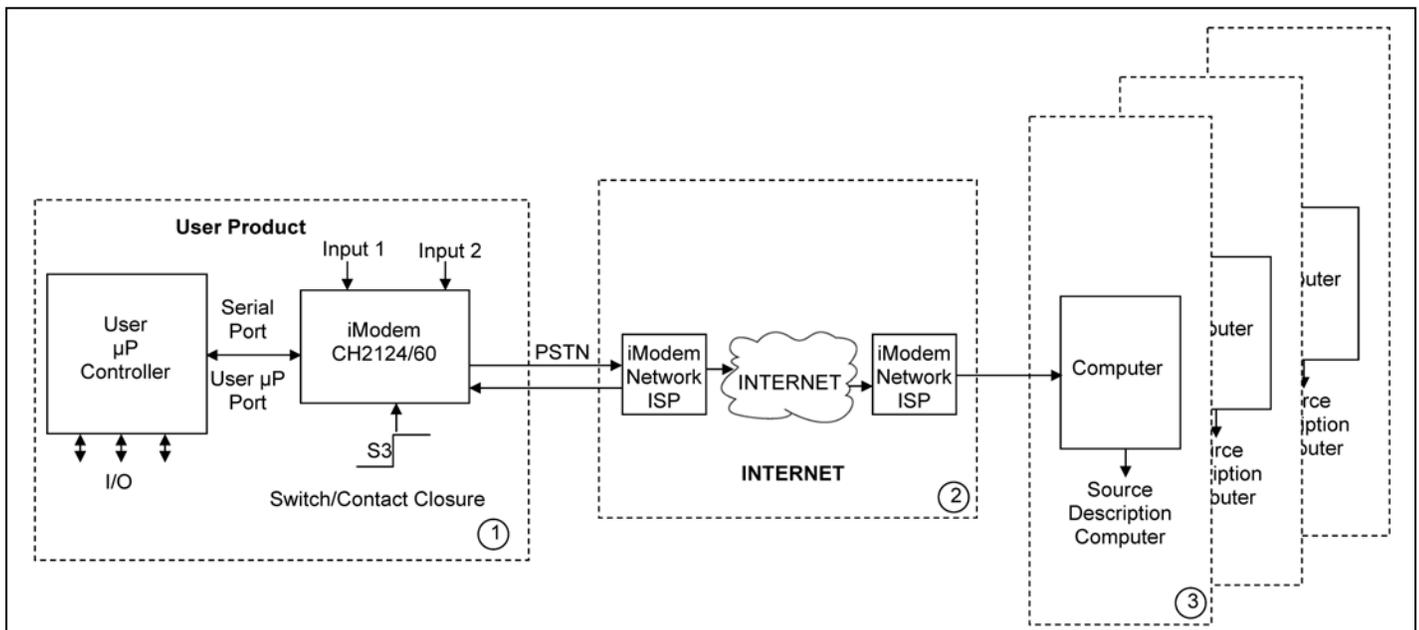


Figure 4. Block diagram illustrating operation of the CH2124/60 iModem product in a simple user internet application.

Block 1. This block represents the user's internet application. Note that the required programming activity is conducted via the user's μ P controller.

The iModem configuration indicated illustrates the incorporation of both the fully autonomous mode of operation and the host controller intervention mode of operation into the users product application. If the user's μ P controller sends the appropriate @T[®] commands to the iModem, then emails are sent. Alternatively, by momentarily setting switch/contact S3 to TTL LOW, the iModem sends the pre-programmed email message including the status of the various iModem input ports without the need for intervention from the user's μ P. The CH2124/60 also provides an output TTL LOW pulse at it's SEND pin indicating that the send email activity is in progress. Note that in either case, a PC is not required to send email messages.

When the email message has been accepted by the ISP's SMTP server, a MESSAGE ACCEPTED ASCII activity response message is issued by the iModem to the user's μ P controller via the serial port and a output TTL LOW pulse is provided at the iModem's SENT pin.

Additionally, during the normal course of internet operation of the iModem, the user's μ P controller is sent various ASCII activity response status messages by the iModem. These messages indicate such things as: DIAL TONE,

modem CONNECT, MESSAGE ACCEPT, PSTN line DISCONNECT, and modem HANG UP. Refer to Cermetek Application Notes 149, 155, 157, 159 and 160 for a more detailed discussion of the response status messages.

Block 2. This block represents the internet and the ISP gateways required for access to the internet.

Block 3. This block represents the transmission of a single email message to multiple email addresses. Retrieval of the email message is performed by the recipient's computer. Alternatively, the CH2124 or CH2160 iModem product may also be used to retrieve the email message.

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