

FEATURES

- Dual function device: Can operate as both a conventional analog modem and an Internet appliance.
- Use with any Non-proprietary commercial or private ISP.
- Use with Cermetek's **iModem Network** ISP with 1000s of local access (POP) numbers world wide.
- Transparent Internet operations with Point-to-Point Protocol (PPP), Password Authentication Protocol (PAP), Challenge Authentication Protocol (CHAP), Domain Name Resolution (DNS), Send Email (SMTP), Retrieve Email (POP3), TCP/IP and UDP to connect to the Internet.
- Authenticated SMTP supported.
- I-Sockets: Open Sockets.
- Send/Retrieve streaming email of unlimited length.
- Send pre-stored email up to 300K bytes from static memory.
- Stored email up to 1.7M bytes in volatile memory.
- Retrieve email messages from POP3 servers.
- Concurrent and multiple SMTP, POP3 and Open Socket connections supported.
- Programmable via V.24 (EIA 232-E), 5 volts serial interface.
- Resident modem supports: V.90, V.34bis, V.34, V.22bis, V.22A/B, V.23, V.21, Bell 212A and 103, (depending on model) and can be used in conventional modem mode.
- Cermetek @[®] AT-like Commands.
- Built-in DAA connects to Telco/PSTN telephone network with 1500 VAC RMS isolation and 2122V peak surge protection.
- UL 60950 and CSA C22.2 950 (Third Edition) Listed, reference UL File E104957 (pending).
- FCC Part 68 Approved (pending)/Industry Canada CSA CS-03 Part I approved (pending).
- Pin-for-Pin compatible with CH2124/60 iModem family and modem CH179X/2056 family.
- Single supply +5 Volt operation.
- Small size: 1.35" x 1.97" x 0.55" (nominal).
- 90 day free trial ISP subscription to provided with each iModem.

INTRODUCTION

Direct machine-to-machine interaction represents the next logical extension of the internet. Cermetek internet modem (iModem) products are designed to leverage the Internet infrastructure for commercial machine-to-

machine interactions. Email allows information to be easily transferred between systems, and provides quick low cost multi-path communication. Replacing conventional modems and long distance telephone lines with local access Internet connections saves money by reducing fixed asset and maintenance costs, and limiting communication expenses.

USER FRIENDLY INTERFACE LAYER

The CH2166 iModem provides a robust and user friendly API ~ application interface ~ tailored to offer high performance in environments with low bandwidth CPUs. It facilitates the implementation of a wide variety of IP applications and insulates the user from complex Internet networking details. This API consists of various @[®] commands that look and feel like conventional modem AT commands. With the @[®] commands, the user can perform all standard SMTP and POP3 email operations, including: composing, sending, retrieving and deleting email messages; plus establish BSD style socket connections. Command results are conveyed via the iModem's V.24 (EIA 232-E) serial interface.

OVERVIEW OF THE CH2166 IMODEM

A conceptual representation of the CH2166 iModem in an embedded environment is presented in Figure 1. As with virtually all Internet enabled devices, the CH2166 iModem requires Internet and ISP configuration parameters. Among those are email addresses, authentication data, and telephone numbers. Configuration parameters may be specified at the time of an internet operation or derived from profiles stored on the CH2166 iModem.

Network Protocol Stack. The CH2166 iModem uses a Network Protocol Stack to perform API commands operations involving Internet interactions. This protocol stack is described in Figure 2.

The organization of the stack greatly reduces the complexity of the commands while providing the user with unbridled access to the power and flexibility of the CH2166. When the CH2166 is functioning as an Internet appliance, multiple iModem applications ~ and activities using those applications ~ can execute concurrently.

When the CH2166 is functioning as an analog modem, the user can only issue standard analog modem commands rather than the complete suite of CH2166 commands. This is because all data flowing from the user to the CH2166 ~ via its RS232 Serial Port ~ is

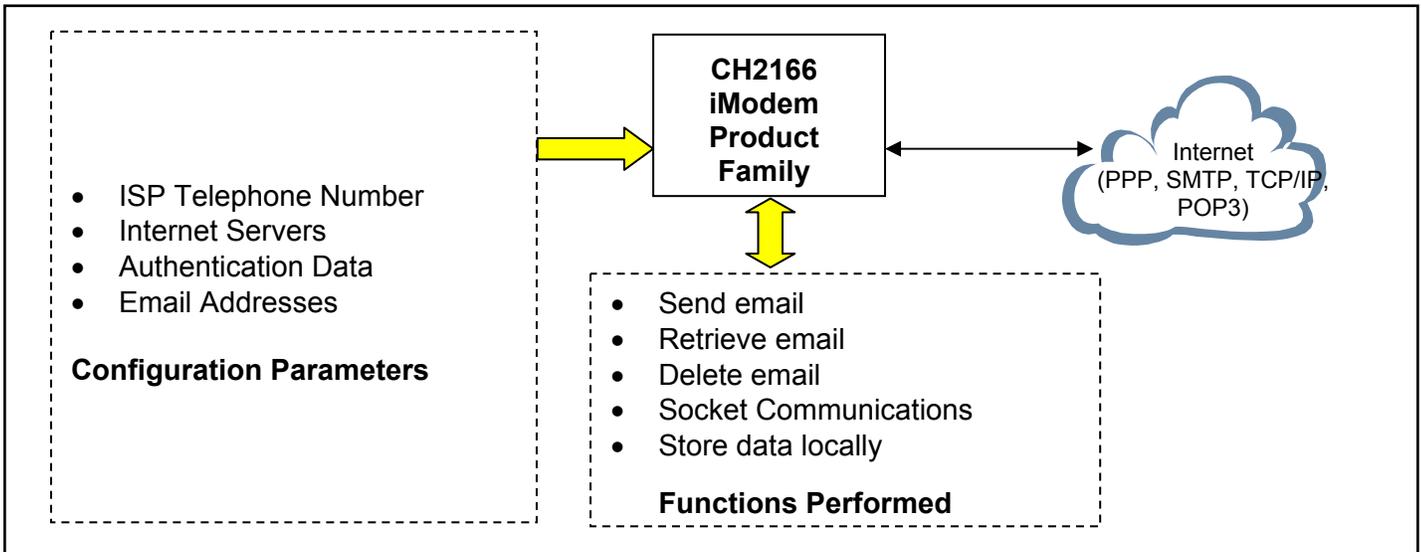


Figure 1. Conceptualized Block Diagram illustrating the Cermetek CH2166 iModem product family performing the embedded internet application function.

routed directly to the CH2166 modem hardware without interpretation, and is per standard modem operational procedures and protocols (i.e., the modem transmits the data out the TIP and RING pins to the PSTN).

Internet Connectivity. The CH2166 iModem uses Application and Link Profiles to manage configuration parameters. Application Profiles contain parameters that apply to all aspects of SMTP and POP3 addressing and network connectivity. Link Profiles contain parameters specific to dialup IP link connectivity.

Standard CH2166 commands enable the user to easily distinguish instances of iModem applications, permit multiple simultaneous TCP connections, and allow virtually all configurable parameters to be specified as part of the command. Quick CH2166 commands, by contrast, allow few parameters to be specified as part of the command but perform all underlying network connectivity operations automatically.

Analog Modem Operation. The CH2166i operates strictly as an analog V.90 modem when this function is selected. It is controlled with industry standard Hayes AT commands in this case. Refer to Cermetek Document # 613-0001, AT Commands and S-Registers, for AT commands supported by the CH2166.

BASIC INTERNET APPLIANCE OPERATION

Session Activity ID. A Session Activity ID is used to uniquely identify each instance of an iModem application when Standard commands are used and Internet Appliance operation is selected.

This allows multiple iModem applications to be easily

identified by the user. Note that Quick Commands do not use Session IDs nor are Session IDs used when Analog Modem Operation is selected.

The user allocates a Session Activity ID by issuing a **@GIDGET** command and frees it by issuing a **@GIDFREE** command. The ID uniquely identifies an application instance as long as it is allocated. Currently, email transmission, email retrieval, email storage, and custom I-Socket applications are supported. Email messages of unlimited length can be sent and retrieved with streaming email. The CH2166 is ideal for applications requiring overlapping Internet operations, storage of large amounts of data (300K bytes static memory and 1.7M bytes volatile memory), and the flexibility of BSD style socket operations.

Application Profiles. The CH2166 stores network connectivity, email address, and authentication configuration parameters in Application Profiles. These AP Profiles are in static CH2166 memory and are unaffected by power loss. A complete list of available Application and Link Profiles can be found in Table II.

AP Profiles can be modified with Profile Management Commands (see Table I), or modified externally with any ASCII editor and then downloaded to the CH2166 via the serial port. Typical PC ASCII editors, such as MS NotePad®, may be used edit these files. Contact Cermetek for Download assistance.

There are four basic Application Profiles:

- **SMTP AP Profile.** This profile supplies SMTP and TCP/IP configuration and email address data, such

USER API INTERFACE						
MODEM API	SMTP API	POP3 API	SOCKETS API		FILE MEMORY MANAGEMENT API	
	SMTP	POP3	SOCKETS INTERFACE	DNS		
	TCP		UDP			
	IP					
	PPP					
MODEM					DYNAMIC MEMORY	STATIC MEMORY

Figure 2. CH2166 Network Protocol Stack.

as the SMTP server name, TCP Port number, and SMTP authentication data if necessary.

- **POP3 AP Profile.** This profile supplies POP3 and TCP/IP configuration and authentication data, such as the POP3 server name and authentication data.
- **I-Socket AP Profile.** This profile supplies configuration and possibly authentication data for custom applications that use I-Sockets. It specifies information such as Internet servers, TCP port numbers and possibly authentication data.
- **Link Profile.** This profile supplies configuration data for dialup IP connections. It specifies information such as telephone numbers and ISP authentication data.

Default AP profiles are provided by Cermetek. Most of the configuration parameters in the AP profiles can be overridden by specifying them as command parameters. Configuration parameters specified as command parameters have precedence over those contained in the AP Profiles.

Command Structure. There are four basic types of CH2166 commands as described below. Standard and Quick commands are used when Internet Appliance operation is selected. Hayes compatible AT commands are used when Analog Modem operation is selected. There are also some auxiliary commands for configuring the device, toggling between Analog Modem and Internet Appliance operation and general file management.

Refer to Table I for a brief description of all commands supported by the CH2166.

- **Standard Commands.** These allow specification of virtually all relevant configuration parameters,

and provide robust flow control. A default iModem AP Profiles is used unless another one is specified.

Both short and long forms of Standard Commands are supported and may be used interchangeably.

- **Quick Commands.** These commands minimize user CH2166 interactions and are provided as a convenience for experimentation and prototyping. A default iModem AP profile is used unless another one is specified. No other instance of an iModem application can be executing when one of these commands is used (i.e., No Session Activity ID is used with these commands.)
- **Device Function Selection Commands.** These commands are used to select Internet Appliance or Analog Modem operation. They are specialized commands that toggle CH2166 device function between the two kinds of operation. No Session Activity ID is used with these commands.
- **File Management Commands.** The CH2166 supports numerous internal file management commands. These commands manage files stored in both static and volatile memory. Both short and long forms of the commands are supported and may be used interchangeably.

Command Architecture. The structure of Application and Link profiles makes it possible access the contents for the entire set of associated Application and Link profiles by referencing only a single profile name (i.e, Profiles in the same set or suite contain transparent internal linkage). Parameters specified as part of a command have precedence over those specified in a profile. Command results, diagnostics, and error notifications are conveyed to the user via the serial port.

Send and Retrieve Email. The CH2166 has the ability to send and retrieve email of unlimited length. Once a streaming email transmission session is set up, the

user just sends data to the CH2166 ~ one line at a time ~ for as long as desired. The **@ETXDEND** command is used to end the streaming email session. Alternatively, data in files on the CH2166 can be sent with the **@ETXFILE** command.

Storage Memory. A total of 300K bytes of Flash RAM or static memory is available for permanent storage of files on the CH2166. There is also 1.7M bytes of volatile memory or dynamic RAM available for temporary file storage on the CH2166.

Email messages may include files from either static or dynamic RAM memory, at the user's discretion.

Refer to Cermetek document, CH2166: Commands, Profiles and Examples, for more details.

iModem Hardware Configuration. Each CH2166 iModem contains a fully functional 56kbps modem and the hardware and firmware needed for Internet connectivity and functionality. The unique architecture of Cermetek iModems enables the CH2166 iModem to operate as either an Internet Appliance or as a high reliability Analog Modem.

The CH2166 iModem Family of products are pin compatible with the CH179X and CH2056 modem products. Referring to Figure 3, the CH2166 iModem Family consists of an industrial grade high speed modem module and a μ P controller with associated internal logic. The μ P controller and the logic provide all the functions required for internet communication via standard PSTN telephone lines. The CH2166 contains an additional 8 Mbytes of RAM and 2 Mbytes of Flash RAM.

Required External Connections. The CH2166 iModem requires an external RJ-11C jack for the PSTN line connection. An ITU-T V.24 serial interface is required when host processor control of the iModem is required in the specific application. All retrieved emails are presented to the host system for further processing and/or retention via the serial interface.

Approvals. The CH2166 iModem Family is FCC Part 68 approved, UL 60950 and CSA C22.2 950 (Third Edition) listed and Industry Canada CS-03 approvable.

Physical Dimensions. The modules are designed for PCB through-hole mounting and are 1.35" x 1.97" x 0.55" in size.

iMODEM EVALUATION BOARD

Cermetek manufactures a companion evaluation board that is designed to simplify the hardware connections required to program the iModem as well as providing a reliable platform to assist with system level debugging.

Contact Cermetek and ask for the CH2166 iModem Evaluation Board.

iMODEM CONTROL METHODOLOGIES

@ commands are conveyed from the user environment to the CH2166 via the serial port. The CH2166 processes received commands based on configuration parameters specified as part of the command, and in the effective Link and Application profiles. Parameters specified as part of a command have precedence over those in profiles. See Table I for a summary of available **@** Commands. User Control of operations that involve networking or communications falls into the following general categories:

- **Passive Network Control.** Operations are initiated with a single command and the underlying networking and communications operations are automatically performed without user interactions. This type of control applies mostly to Quick commands which do not use a Session Activity ID.
- **Active Network Control.** Individual Commands ~ usually Standard Commands ~ are used to perform networking and communications operations such as establishing and releasing TCP connections. This type of control allows CH2166 networking and communications operations to be distributed in a way that is tailored to needs of the user's application.

Passive Network Control. The type of control requires that the user simply monitor the result of the operation corresponding to a CH2166 command. (i.e. The host does not participate in networking or communications operations.) After the user issues a CH2166 command, the CH2166 generates a POSTED message to indicate the operation has started. Subsequently the CH2166 will automatically handle all aspects of the operation and report the outcome when it is complete. Consequently, the host CPU has much spare bandwidth because it only needs to monitor the operation outcome. The CH2166 generates an OK message to report a successful operation and an ERROR message with a diagnostic code otherwise.

Configuration parameters are derived from Application and Link profiles and specified with commands as with all other **@** commands. Execution of a CH2166 email command typically involves the following steps. The User ~ host processor ~ issues the appropriate **@** command. The CH2166 establishes dialup/PSTN and PPP connections with the ISP and performs any necessary authentication. The CH2166 establishes a TCP connection and SMTP connection with an email server. The CH2166 transfers the email message over the TCP connection. The CH2166 releases all

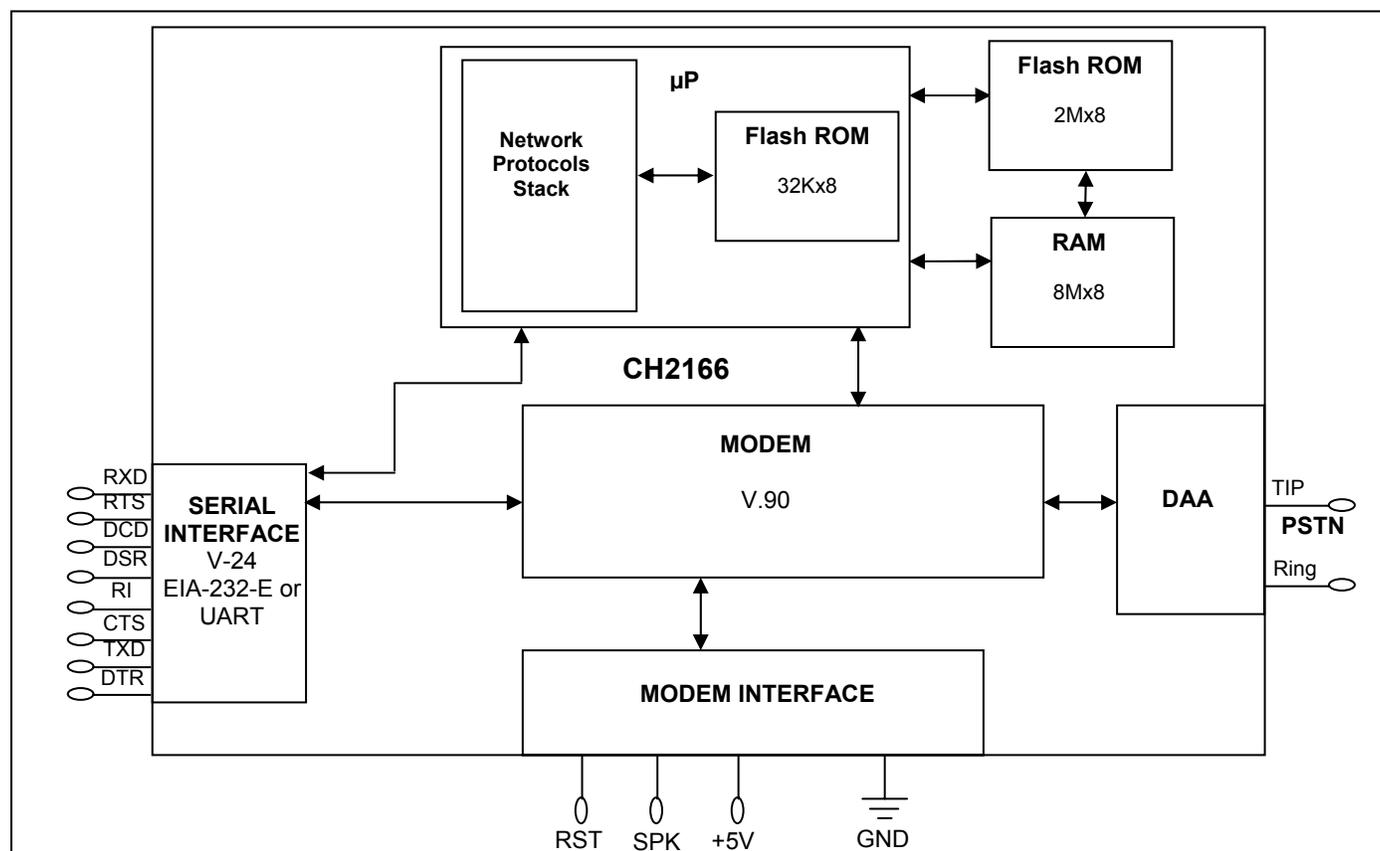


Figure 3. Functional Block Diagram of Cermetek CH2166 iModem Products.

connections and notifies the user of the operation outcome by issuing an OK or ERROR response over the serial port.

Active Network Control. The user issues individual CH2166 commands and is notified of their outcome as in the Passive Network Control case. The essential difference is that commands are used to perform specific operations such as establishing an SMTP server connection or transferring an email message. The typical sequence of commands used to transfer an email message is as follows:

1. Issue a command to begin an SMTP session.
2. Issue a command to establish a TCP connection and the underlying ISP dialup connection with an SMTP server.
3. Issue a command to transfer a file containing an email message.
4. Issue a command to release the TCP and all other connections.
5. Issue a command to end the SMTP session.

A Session Activity ID is used to identify the instance of the iModem email transmission session. The CH2166 issues a POSTED message to indicate execution of each command has started, and an OK or ERROR to notify the user of the command outcome.

IMODEM TRANSACTION EXAMPLES

The following examples are intended to illustrate general usage of the CH2166. For a more detailed discussion of the commands, refer to Cermetek document, [CH2166: Commands, Profiles and Examples](#).

In the following examples, **Enter** indicates the command or instruction(s) sent to the CH2166 from the Host Controller via the CH2166's serial interface port. **Result** indicates a response generated by the CH2166 and sent to the Host Controller via the CH2166's serial interface port (or the action taken by the CH2166). Commands, actions, are in bold; descriptions/explanations are non-bolded.

IMPORTANT NOTE

AS DELIVERED FROM THE FACTORY, the CH2166 default DCE speed is set at 19.2K bps, 8-N-1. Be sure to configure the host processor (DCE) to match these parameters or the CH2166 will not properly communicate with the host.

PROFILE MANAGEMENT EXAMPLES

The CH2166 comes from the factory with pre-configured Application and Link profiles which are listed in table II. Application profiles apply to Internet applications such as SMTP, and Link profiles apply ISP dialup connectivity and authentication. The default iModem profile is configured to work with Cermetek's ISP and its Internet servers.

The user can customize profiles using with Profile Management commands listed in Table. Note that these commands do not use a Session Activity ID.

IMPORTANT NOTE

All profile changes made with the **@ETXC**, **@ERXC**, and **@LINKC** commands are permanent and unaffected by power loss.

SMTP Application profiles may be customized by issuing the **@ETXC** command with the parameters to be modified. An OK response from the CH2166 indicates the parameter changes have been successfully completed (i.e., a POSTED message from the CH2166 indicates execution of the command has started).

POP3 Application profiles may be customized by issuing the **@EXRC** command with the parameters to be modified. POSTED and OK responses from the CH2166 have the same significance as with the **@ETXC** command above.

Link Profiles may be customized by issuing the **@LINKC** command with the parameters to be modified specified on the command line. POSTED and OK responses from the CH2166 have the same significance as with the **@ETXC** and **@ERXC** above.

Examples 1A, 1B and 1C illustrate the use of the **@ERXC**, **@ETXC**, and **@LINKC** commands to modify profile parameters.

IMPORTANT NOTE

The **@ETXC**, **ERXC**, and **@LINKC** command options are case sensitive.

EXAMPLE 1A. Change the SMTP server authentication method used in the UUNET Application Profile.

Enter: **@ETXC: PROFILE=smtp.uunet
AUTH_METHOD=ANY<CR>**
Result: **POSTED:** Indicates the CH2166 has begun executing the command.
Result: **OK:** The CH2166 indicates the command succeeded.

EXAMPLE 1B. Change the POP3 server to be used in the UUNET Application Profile.

Enter: **@ERXC: PROFILE=pop3.uunet
SERVER=TEXT-pop3.pop.net<CR>**
Result: **POSTED:** Indicates the CH2166 has received and begun executing the command.
Result: **OK:** The CH2166 indicates the command succeeded

EXAMPLE 1C. Change the local ISP access telephone number in the UUNET Link Profile.

Enter: **@LINKC: LEVEL=LINK
PROFILE=link.imodem.uunet
PHONE=9,1,408,555,1212<CR>**
Result: **POSTED:** Indicates the CH2166 has received and begun executing the command.
Result: **OK:** TheCH2166 indicates the command succeeded.

EMAIL TRANSMISSION EXAMPLES

Each email file stored on the CH2166 has a unique name. The user must specify the file name when issuing a command to send a email file.

Examples 2A and 2B below illustrate alternative methods for sending an email message. In Example 2A, a Quick Command is used, and in Example 2B Standard Commands are used.

EXAMPLE 2A. Send an existing file containing email with a Quick Command The CH2166 will use the default iModem SMTP Application profile since one is not specified The file **test** does not contain email header information (i.e., TO:, FROM:, SUBJECT:, etc.) Consequently header data will be derived from the application profile.

Enter: **@QTM: FILE=test<CR>**
Result: **POSTED:** Indicates the CH2166 has received and begun executing the command
Result: **OK: Mail sent.** The CH2166 indicates that email message **test** has been sent successfully and the dialup and all protocol connections have been released.

EXAMPLE 2B. Send an existing file containing email with a sequence Standard Commands. A Session Activity ID is used to uniquely identify this instance of the email transmission application. The CH2166 will use the default iModem SMTP application profile as in the previous example,. and the file **test** does not

contain email header information (i.e., TO:, FROM:, SUBJECT:)

Enter: @GIDGET: TX_MAIL<CR>
Result: POSTED: Operation started.
 Indicates the CH2166 has received and begun executing the command.

Result: OK[1]: E-Mail Transmission Session ID Allocated. The CH2166 indicates Session Activity ID 1 has been successfully allocated.

Enter: @ETXCONN[1]: <CR>
Result: POSTED[1]: Operation started.
 Indicates the CH2166 has received and begun executing the command.

Result: OK[1]: E-Mail Transmission Service Ready. The CH2166 indicates that IP connectivity with the ISP is successfully established. Also, the requisite underlying PSTN and PPP connections are established.

Enter: @ETXFILE[1]: FILE=test<CR>
Result: POSTED[1]: Operation started.
 Indicates the CH2166 has received and begun executing the command..

Result: OK[1]: E-Mail successfully sent The CH2166 indicates that email transmission succeeded.

Enter: @ETXDISC[1]:<CR>
Result: POSTED[1]: Operation started.
 Indicates the CH2166 has received and begun executing the command.

Result: OK[1]: E-Mail transmission service finished. The CH2166 indicates the IP connection and the underlying protocol and PSTN telephone connections are released

Enter: @GIDFREE[1]:<CR>
Result: POSTED[1]: Operation started.
 Indicates the CH2166 has received and begun executing the command.

Result: OK[1]: E-Mail Transmission Session ID freed. The CH2166 indicates the Session Activity ID has been released.

Note that in Example 2A all the requisite underlying operations occurred transparently after the @QTM command was issued to the CH2166. By contrast, in Example 2B, a sequence of Standard Commands were used to perform the same task. Also, a Session Activity ID was allocated ~ via the @GIDGET command ~ and used to email transmission application instance. All necessary configuration parameters were derived from the default iModem SMTP application profile in both cases.

In example 2B, the test email file was sent with the @ETXFILE command after IP connectivity was established. The @ETXDISC released the IP link and all other protocol and physical connections. Note that

the IP Link ~ and the underlying PSTN/PPP connection ~ would have been preserved if another application instance had been using the IP Link.

Sending Streaming Email. The user can send streaming email by issuing the @QTX Quick Command; or by issuing the Standard @ETXDSTART command to initiate the streaming email session and a series of @EXTDEND commands to send lines of data. See Examples 3A and 3B.

EXAMPLE 3A. Send a streaming email message with a Quick Command. Email header information ~ TO:, FROM:, SUBJECT:, etc. ~ is defined from the default iModem SMTP application profile.

Enter: @QTX:<CR>
Result: POSTED: Indicates the CH2166 has received and begun executing command.

Result: OK: Begin sending E-Mail. The CH2166 indicates streaming email transmission can begin. All the necessary protocol and PSTN connections are established. Subsequently, the user issues lines of ASCII data. The <CTL>D indicates the end of the email message.

Enter: This is a test message<CR>
Enter: sent using the Streaming<CR>
Enter: Email CH2166 Quick<CR>
Enter: Command.<CR>
Enter: <CTL>D
Result: OK: Mail sent. The CH2166 indicates that streaming email message has been sent successfully. All protocol and PSTN connections are released.

EXAMPLE 3B. Send streaming email using a sequence of Standard Commands. A Session Activity ID is allocated and used to identify this instance of iModem email transmission application. All necessary parameters except the destination email address are derived from the default iModem SMTP application.

Enter: @GIDGET: TX_MAIL<CR>
Result: POSTED: Operation started. Indicates the CH2166 has received and begun executing the command.

Result: OK[2]: Session ID Allocated. The CH2166 indicates that Session Activity ID 2 has been successfully allocated.

Enter: @ETXCONN[2]: <CR>
Result: POSTED[2]: Operation started.
 Indicates the CH2166 has received and begun executing the command.

Result: OK[2]: E-Mail transmission Service Ready. The CH2166 indicates that IP connectivity is successfully established. Also, the underlying protocol and PST telephone connections are established.

Enter: @ETXDSTART[2]:
TO=xxxx@yyy.com<CR>

Result: POSTED[2]: Operation started.
Indicates the CH2166 has received and begun executing the command.

Result: OK[2]: Ready to start streaming email.
The CH2166 indicates that streaming email transmission data can begin and that an SMTP server connection is established.

IMPORTANT NOTE

The @EXTDATA command must be executed for each line of ASCII data to be sent.

Enter: @ETXDATA[2]: This is a<CR>

Result: POSTED[2]: Operation started.
Indicates the CH2166 has received and begun executing the command.

Result: OK[2]: Data sent. CH2166 indicates that ASCII data has been sent.

Enter: @ETXDATA[2]: test.<CR>

Result: POSTED[2]: Operation started.
Indicates the CH2166 has received and begun executing the command.

Result: OK[2]: Data sent. CH2166 indicates that ASCII data has been sent.

Enter: @ETXDEND[2]: <CR>

Result: POSTED[2]: Operation started.
Indicates the CH2166 has received and begun executing the command.

Result: OK[2]: Streaming email completed.
The CH2166 indicates the streaming email message has been successfully sent and the SMTP server connection is released.

Enter: @ETXDISC[2]: <CR>

Result: POSTED[2]: Operation started.
Indicates the CH2166 has received and begun executing the command.

Result: OK[2]: E-mail Transmission service finished. The CH2166 indicates that all protocol connections and PSTN telephone connections are released. In the case another application instance is using the IP Link, the IP Link and underlying protocol and telephone connections are not released.

Enter: @GIDFREE[2]: <CR>

Result: POSTED[2]: Operation started.
Indicates the CH2166 has received and begun executing the command.

Result: OK[2]: E-Mail transmission ID released. The CH2166 indicates that Session Activity ID is released.

Retrieving Email. All email messages cached by the POP3 server are numbered starting with 1. The numbers are an ascending sequence of integers without gaps.

The CH2166 can retrieve email from any POP3 server which conforms to the relevant Internet RFCs and does not use proprietary email protocols. The user must specify a valid message number. A list of valid message numbers can be obtained with the Standard @ERXLIST Command.

The data in an email message is conveyed to the user via the CH2166 serial port as it arrives from the POP3 server.

EXAMPLE 4A. Retrieve email message number 1 with a Quick Command. The necessary configuration parameters are derived from the default iModem POP3 Application Profile.

Enter: @QRX: MSG=1<CR>

Result: POSTED: Indicates the CH2166 has received and begun executing the command.

Result: OK: Connected to E-Mail Retrieval Server. The CH2166 indicates that a POP3 server connection is established and authentication succeeded. Lines of ASCII data will arrive one at a time as they arrive until a <CTL>D character is received.

Result: This is test data from email<CR>
message 1.<CR>
Best Regards.<CR>
<CTL>D<CR>

Result: END: Email retrieval succeeded. The CH2166 indicates that retrieval of message 1 is complete and successful. Also, all protocol and PSTN telephone connections are released.

<CTL>D ~ the <EOT> character ~ is the message termination character.

EXAMPLE 4B. Retrieve email message number 1 with a sequence of Standard Commands. A Session Activity ID is used to identify this instance of iModem email retrieval application. All necessary parameters are derived from the default iModem POP3 application profile.

Enter: @GIDGET: RX_MAIL<CR>

Result: POSTED: Operation started. Indicates the CH2166 has received and begun executing the command.

Result: OK[3]: E-Mail Retrieval Session ID Allocated. The CH2166 has allocated Session Activity ID 3.

Enter: @ERXQCONN[3]: <CR>

Result: **POSTED[3]: Operation started.** Indicates the CH2166 has received and begun execution of the command.

Result: **OK[3]: E-Mail connection established.** The CH2166 indicates a POP3 server connection is established and authentication succeeded. Also, the other underlying protocol connections and a PSTN telephone connection are established.

Enter: **@ERXLIST[3]: format=LONG <CR>**
List the email messages currently cached on the POP3 server.

Result: **OK[3]: Operation started.** Indicates the CH2166 has received and begun executing . The list of cached messages will follow.

Result: **START[3]:**

Result: **L[3]: 1 1024 Mon, 1 Jan 2004 14:12:10 -0800 <joe@isp.com> Livestock**

Result: **L[3]: 2 2099 Mon, 1 Jan 2004 14:12:20 -0800 <mae@isp.com> Stock**

Result: **L[3]: 3 3125 Mon 1 Jan 2004 14:12:30 -0800 <bill@isp.net> Watches**

Result: **END[3]:** The **END** message from the CH2166 indicates that the list is complete and the operation succeeded.

IMPORTANT NOTE

The CH2166 requires the user to specify the maximum number of data bytes that can be retrieved with a single **@ERXDATA** command to prevent buffer overflows. The valid range is from 1 to 1000.

Enter: **@ERXMAIL[3]: MSG=1 MAX=128 <CR>**

Result: **POSTED[3]:** Operation started Indicates the CH2166 has received and begun executing the command.

Result: **OK[3]: Ready to retrieve E-Mail data.** The CH2166 indicates that the message number is valid and the user can begin retrieving data 1 with the **@ERXDATA** command. A maximum of 128 bytes can be retrieved in a single operation.

Enter: **@ERXDATA[3]:**

Result: **POSTED[3]: Operation Started.**

Result: **OK[3]: 17: This is data from<CR>**

Enter: **@ERXDATA[3].**

Result: **POSTED[3]: Operation Started.**

Result: **OK[3]: 11: message 1.<CR>**

Enter: **@ERXDATA[3]**

Result: **POSTED[3]: Operation Started.**

Result: **END[3]: E-Mail Message retrieved.** The CH2166 indicates the email message is completely and successfully retrieved.

Enter: **@ERXDISC[3]:<CR>**

Result: **POSTED[3]: Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK[3]: E-Mail connection released.** The CH2166 indicates the POP3 server, all other protocol, and the PSTN telephone connections are released. An exception is the case where another application instance is using the IP link. In that case the IP link and underlying protocol and PSTN telephone connection are preserved.

Enter: **@GIDFREE[3]:<CR>**

Result: **POSTED[3]: Operation started.** CH2166 indicates that the command has been received and action has been taken.

Result: **OK[3]: E-Mail Retrieval Session ID released.** CH2166 indicates that Session Activity ID is released.

In example 4A the **@QRX** Quick Command is used to perform the same task as a sequence of Standard commands in example 4B. In example 4B, the **@ERXQCONN** is the command that actually initiates email message retrieval.

The difference between example 4A and 4B is that the **@ERXCONN** Standard command is used to establish a POP3 server connection before email is retrieved. This allows the user to issue a **@ERXLIST** command and determine what messages are cached before attempting to retrieve a message.

Delete Email. The user can delete a single or multiple email messages with the **@ERXDELETE** command as long as the message numbers are known.

EXAMPLE 5. Delete email messages 2 - 4 (inclusive) using sequence of Standard Commands. The Session Activity ID identifies this instance of the iModem email retrieval application. The default iModem POP3 application profile is used to derive all the necessary parameters.

Enter: **@GIDGET: RX_MAIL<CR>**

Result: **POSTED: Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK[3]: E-Mail retrieval Session ID Allocated.** The CH2166 indicates that Session Activity ID has been allocated.

Enter: **@ERXQCONN[3]: <CR>**

Result: **POSTED[3]: Operation started.** Indicates the H2166 has received and begun executing the command .

Result: **OK[3]: Connected to E-Mail Retrieval Server.** The CH2166 indicates a POP3

server connection is established and authentication succeeded.

Enter: @ERXDELETE[3]: LIST=2-4<CR>
Result: POSTED[3]: **Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: OK[3]: **Message Deleted <CR>** The CH2166 indicates that the email messages have been flagged for deletion. Messages are not actually deleted unless the @ERXDISC command succeeds.

Enter: @ERXDISC[3]:<CR>
Result: POSTED[3]: **Operation started.** Indicates the CH2166 has received and begun executing.

Result: OK[3]: **E-Mail connection released.** The CH2166 indicates the POP3 server and TCP connections are released. Also, the IP Link and underlying PSTN telephone are released unless they are being used by another application instance. Finally this message confirms that messages 2 – 4 are deleted from the POP3 server.

Enter: @GIDFREE[3]:<CR>
Result: POSTED[3]: **Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: OK[3]: **E-Mail Retrieval Session ID freed released.** The CH2166 indicates that Session Activity ID is freed.

OPEN SOCKET: I-SOCKET EXAMPLES

The following examples illustrate general usage of CH2166 I-SOCKETS. I-SOCKETS provide virtually the same functionality as Berkley Sockets (BSD). For a more detailed discussion of the commands, refer to Cermetek document, [CH2166: Commands, Profiles and Examples](#).

In the following examples, **Enter** indicates the command or instruction(s) sent to the CH2166 from the Host Controller. **Result** indicates what the CH2166 sends back to the Host Controller (or the action taken by the CH2166). Commands, actions, results are in bold; descriptions/explanations are non-bolded.

I-SOCKETS Definition. Generally, sockets provide a well known set of functions for performing TCP/IP communications and related operations. I-SOCKETS have the same TCP/IP connection management capabilities as BSD style sockets and virtually the same semantics. The only significant difference is that a user initiates SOCKETS operations by issuing I-SOCKETS commands over the CH2166 serial port rather calling subroutines. Similarly, the results of I-SOCKETS

operations are conveyed to the user via the CH2166 serial port.

I-SOCKETS Discussion. The most common use of I-SOCKETS is for custom iModem applications to exchange data with Internet servers over a TCP/IP connection. The following information must be known before this is possible:

1. The IP address or Symbolic Name of the target Internet server.
2. The TCP port number of the target application on that server.

Additionally, a CH2166 I-Sockets Session Activity ID is required.

EXAMPLE 6. Send and Receive data using with I-Sockets. In this case a POP3 server connection is established and all parameters except the server name and TCP port number are derived from the AT&T Link profile.

Enter: @GIDGET: ISOCKET<CR>
Result: POSTED: **Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: OK[1]: **I-SOCKET Session ID Allocated.** The CH2166 indicates that Session Activity ID is allocated for this instance of an I-Socket application.

Enter: IS_SOCKET[1]: **RMAX=5000 TMAX=5000<CR>**

Result: POSTED[1]: **Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: OK[1]: **Socket Allocated.** The CH2166 indicates a BSD style socket descriptor has been successfully allocated and associated with the Session Activity ID. Also, the maximum time for a socket read or write operation to complete is 5000 milliseconds.

Enter: IS_IPCONNECT[1]: **PROFILE=LINK.ATT<CR>**

Result: POSTED[1]: **Operation started.** CH2166 indicates that the command has been received and action has been initiated.

Result: OK[1]: **IP Link is up.** The CH2166 indicates an IP Link with the ATT ISP is established. This includes establishing the underlying PPP and PSTN telephone connections.

Enter: IS_GETHOSTBYNAME[1]: **NAME=postoffice.att.net<CR>**

Result: POSTED[1]: **Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK[1]: 65.200.205.193.** The CH2166 indicates the POP3 server IP address is 65.200.205.193.

Enter: **IS_CONNECT[1] PORT=110 SERVER=IPV4-65.200.205.193<CR>**

Result: **POSTED[1]: Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK[1]: TCP socket connected.** The CH2166 indicates a TCP connection with the POP3 server is established.

IMPORTANT NOTE

The CH2166 requires the user to specify the maximum number of bytes of data which may be retrieved by each **IS_RECV** command. This is necessary to prevent buffer overruns. A value of at least 128 bytes is recommended.

Enter: **IS_RECV[1]: MAX=256<CR>**

Result: **POSTED[1]:** Indicates the CH2166 has received and begun executing the command.

Result: **OK[1] 20:OK+ POP3 greeting.<CR><LF>** The CH2166 outputs the 20 byte POP3 server greeting over the serial port.

Enter: **IS_SEND[1] 6:quit<CR><LF>**

Result: **POSTED[1]: Operation started.** Indicates the CH2166 has received and begun execution of the command.

Result: **OK[1] 6: <CR>**. The CH2166 indicates 6 bytes of data were successfully transmitted.

Enter: **IS_RECV[1]: MAX=256<CR>**

Result: **POSTED[1]: Operation Started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK[1] 9:OK+ Bye<CR><LF>** The CH2166 outputs the 9 byte POP3 server sign off message. This terminates the POP3 server connection.

Enter: **IS_CLOSE[1]:<CR>**

Result: **POSTED[1]:** Indicates the CH2166 has received and begun executing the command.

Result: **OK[1]: TCP socket released.<CR>** The CH2166 indicates the TCP connection and the socket descriptor are both released.

Enter: **IS-IPRELEASE[1]:<CR>**

Result: **POSTED[1]: Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK[3]: IP Link is Down.** The CH2166 indicates that IP link and underlying

PSTN telephone connection are released.

Enter: **@GIDFREE[1]:<CR>**

Result: **POSTED[1]: Operation started.** Indicates the CH2166 has received and begun executing the command .

Result: **OK[1]: I-Socket Session ID freed.** The CH2166 indicates that Session Activity ID is freed.

ANALOG MODEM OPERATION

This section describes operation of the CH2166 as a stand alone analog modem. Additionally, several examples are provided that illustrate its usage as a Modem. The CH2166 supports Hayes compatible commands which are listed in the TIA/EIA 602-A standard and described in the ITU-T V.250 standard. For a more detailed discussion of the commands, refer to Cermetek document, [CH2166: Commands, Profiles and Examples](#).

Device Function. The CH2166 is a dual function device. It can operate as an Analog Modem or as an Internet Appliance. However, these two operations are mutually exclusive and can not be intermingled.

Internet Appliance operation is the default CH2166 function. The **@IMENTER** command selects CH2166 Analog Modem operation. No Session ID is required for Modem Operation. During Modem Operation only modem AT commands and operations, and the selection of Internet Appliance operation are possible.

As with all modems, when in Analog Modem Operation the CH2166 function in either of the following two modes: Data Mode or Command Mode. In Data Mode, there is no interpretation of data flowing through the CH2166 serial port. In Command Mode, the CH2166 interprets all ASCII strings flowing through the serial port as industry standard Hayes AT commands (which it tries to execute). All AT commands supported by the CH2166 are listed in the Cermetek Document # 613-0001, [AT Commands and S-Registers](#).

Successful execution of the **@IMENTER** command selects Analog Modem operation and puts the CH2166 in Command mode. Several AT commands can switch the CH2166 to Data mode: for example, the **ATD** command. Consistent with industry standard modem operation, the CH2166 can be toggled from Data Mode to Command Mode by entering the **+++** string while in Data Mode. Also, the CH2166 can be toggled from Command Mode back to Data Mode with the **ATO** command under the appropriate conditions.

The **@IMEXIT** command is used to select Internet Appliance operation during Analogue Modem operation and can only be entered when the CH2166 is in Command Mode.

AT Command Format. CH2166 modem commands consist of three elements:

1. The attention sequence,
2. The commands themselves and
3. A terminating carriage return.

EXAMPLE 7A. Tone dial a telephone number.

Enter: ATDT1234567<CR>

Result: Modem goes off-hook

AT [Commands]<CR>.

Where: **AT** represents attention sequence. **A** and **T** may be either upper or lower case but must be the same case. **[Command]** represents command strings.

Where: **<CR>** represents carriage return (ASCII 13 or HEX 0D)

<LF> represents line feed (ASCII 10 or HEX 0A)

Automatic Answering. The CH2166 can be configured to automatically answer an incoming phone call by setting register **S0** to an integer value between 1 and 255. This is only possible when Analog Modem operation is selected.

EXAMPLE 7B. Set CH2166 to answer after 3 incoming rings.

Enter: AT S0=3<CR>

Result: OK

When **S0** is set to 0, the CH2166 will not auto-answer.

IMPORTANT NOTE

The CH2166 can only answer an incoming call when Analog Modem Operation has been selected with via the **@IMENTER** command.

EXAMPLE 7C. Set the CH2166 to answer after 2 incoming rings. Assume Activity Session ID 1 is allocated and Internet Appliance operation is selected.

Enter: @GIDFREE[1]<CR>

Result: **POSTED: Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK[1]: Session ID freed.** The CH2166 indicates the Session Activity ID is freed.

Enter: @IMENTER: <CR>

Result: **POSTED: Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK: Modem Operation Initiated.** The CH2166 indicates Analog Modem operation is successfully selected.

Enter: AT<CR> Modem attention sequence.

Result: **OK** Command accepted.

Enter: @IMEXIT<CR>

Result: **POSTED: Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK: iModem Operation Initiated.** The CH2166 indicates Internet Appliance operation is successfully selected.

APPLICATION PROFILE EXAMPLES

The CH2166 uses Application Profiles containing configuration parameters, such as Login IDs, Passwords, email addresses, etc.; and other parameters needed for network connectivity operations. Cermetek provides default iModem profiles for the standard iModem applications: email transmission and retrieval. If another profile is not specified, the default iModem application profile supplies parameters during CH2166 command execution and is the effective profile. Otherwise, the specified profile is the effective profile and supplies parameters during CH2166 parameter execution. Cermetek customizes standard Application profiles upon customer request.

Configuration parameters can be overridden by specifying them as part of a command. Parameter values specified as part of a CH2166 **@** command remain effective for the lifetime of any protocol connection resulting from execution of the command. The examples below illustrate how parameters are specified as part of a command.

EXAMPLE 8A. In this case, the destination email address is specified as part of **@QTM** command. The email file is sent with this Quick Command. All configuration parameters except the destination email address are derived from the default iModem SMTP application profile. The email file is **test**. And does not contain email header information ~ TO:, FROM:, SUBJECT:, etc.

Enter: @QTM: FILE=test

TO=staff@cermetek.com<CR>

Result: **POSTED:** Indicates the CH2166 has received and begun executing the command.

Result: **OK: Mail sent.** The CH2166 indicates that email message **test** has been sent successfully and all protocol and telephone connections are released.

EXAMPLE 8B. In this case the ISP telephone number is specified as part of **@QTM** command. The email file is sent with this Quick Command. The email file to be sent is **test** and all configuration parameters except the telephone number are derived from the default iModem SMTP application profile.

Enter: @QTM: FILE=test
TO=staff@cermetek.com<CR>

Result: **POSTED:** Indicates the CH2166 has received and begun executing the command.

Result: **OK: Mail sent.** The CH2166 indicates that email message **test** has been sent successfully and all protocol and telephone connections are released.

EXAMPLE 8C. In this case the user specifies the ISP telephone number as part of @ETXCONN command and the destination email address is specified with the @ETXFILE command. The email file is sent with a sequence Standard Commands. All configuration parameters except the ISP telephone number and destination email address are derived from the default iModem SMTP application profile.

Enter: @GIDGET: TX_MAIL<CR>

Result: **POSTED: Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK[1]: E-Mail transmission Session ID Allocated.** The CH2166 indicates a Session Activity ID is allocated.

Enter: @ETXCONN[1]: PHONE=9,123-4567<CR>

Result: **POSTED[1]: Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK[1]: E-Mail connection established.** The CH2166 indicates that IP connectivity is established. This includes establishment of a PSTN telephone connection.

Enter: @ETXFILE[1]: FILE=test
TO=staff@cermetek.com<CR>

Result: **POSTED[1]: Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK[1]: File sent.** The CH2166 indicates the file has been successfully sent and the SMTP server connection is released.

Enter: @ETXDISC[1]:<CR>

Result: **POSTED[1]: Operation started.** Indicates the CH2166 has received and begun executing the command.

Result: **OK[1]: E-Mail connection released.** The CH2166 indicates all protocol and telephone connections are released.

DESCRIPTION OF FUNCTIONAL BLOCKS AND DISCUSSION OF BASIC OPERATIONS

Each CH2166 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. V.90 Internal modem.
5. Modem interface circuitry.
6. DAA (Data Access Arrangement) PSTN interface.
7. Additional Flash RAM.
8. Additional RAM.

Figure 3 contains a block diagram illustrating the interconnectivity of the various functional blocks comprising the CH2166 iModem products.

The iModem can perform the following Internet connectivity operations:

1. Establish an IP/PPP/PSTN dialup connection with an ISP.
2. Authenticate with an ISP, and a POP3 or SMTP server.
3. Sends and Retrieve email in conjunction with SMTP and POP3 servers

iModem Internet operations are initiated and controlled by a system level host processor. Refer to Table III for a complete set of pin descriptions.

When Internet Appliance operation is not selected, the iModem functions as a standard analog modem.

μ P Controller. The μ P controller performs the required internet operations by interpreting each specific @[®] command and executing the appropriate internet commands. The necessary internet protocol firmware is resident in flash RAM. The @[®] commands function as an extension to the industry standard Hayes AT command set.

Internal Modem. The internal modem is used to establish a data connection with the ISP. The CH2166 contains a V.90 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 command communication between the CH2166 iModem and the host processor (DCE) is conducted over the serial interface at 19.2kbps (8-N-1).

CH2166 DCE Speed. AS DELIVERED FROM THE FACTORY, the CH2166 iModem will only communicate with the DCE at 19.2 kbps (8-N-1). However, the user may modify the DCE speed with the appropriate **AT** commands. For a more detailed discussion of the commands, refer to Cermetek document, CH2166: Commands, Profiles and Examples.

Serial Host Interface Buffer. The iModem utilizes a serial V.24 EIA 232-E 5V interface to communicate with the internal modem and to communicate with the internal μ P. Signal levels are TTL rather than RS-232C level compatible, which allows direct connection of the HS Modem to the host's UART without level translating circuitry. The CH2166 is controlled by sending serial commands over TXD and by monitoring serial status messages returned on RXD.

Speaker Interface. The SPK output reflects the receiver analog input and provides a signal that can be used to monitor call progress. The SPK signal can drive a 300-ohm load directly. Typically, the SPK signal is input into an audio power amplifier and the amplifier, in turn, drives the speaker coil. Figure 5 indicates one method of driving an external 8-ohm speaker.

Telephone Line Interface or DAA. 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 CH2166 iModem is designed to meet North American telephone standards as set by FCC Part 68 (USA) and Industry Canada CS-03 Part I (Canada). Each iModem product is shipped from the factory with an FCC label indicating the FCC registration number and ringer equivalent. The PSTN line interface is UL1950 and CSA listed. 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.

Pins 1 and 2 function as both input and output connections to the PSTN. To maximize field reliability in hostile environments, to ensure UL compliance, and also optionally for FCC part 15 compliance, these two pins may be routed through an external network such as that briefly described in figure 3 or as described in more detail in Cermetek Application Note # 126, Supplemental PSTN Line Protection.

PHONE LINE CONNECTION GUIDELINES

1. The iModem must be mounted in the final assembly such that it is isolated from exposure to any hazardous voltages within the assembly.

Adequate separation and restraint of cables and cords must be provided.

The circuitry from the iModem to the telephone interface must be provided in wiring that carries no other circuitry other than that specifically allowed in the FCC rules (such as A and A1 leads).

2. Connection to the PSTN line should be made through an RJ-11C jack.
3. PCB traces from the iModem's RING and TIP pins to the RJ-11C jack must be 0.1 inch spacing or greater to one another and 0.2 inch spacing or greater to all other traces. The traces should have a nominal width of 0.020 inches or greater.
4. The RING and TIP PCB traces should be as short as possible and oriented to prevent coupling with other high speed or high frequency signals present on the host circuit PCB.
5. No additional circuitry other than that shown in Figure 3 may be connected between the iModem module and the RJ-11C jack. Doing so will invalidate the conveyed FCC approval.
6. The iModem, the RJ-11C jack, the interfacing circuitry and all PCB traces must be contained on a PCB with a 94 V-0 flammability rating.
7. The supplied FCC registration label must be applied visibly on the outside of the product.
8. The product's User Manual must provide the user with instructions for connection and use as recommended in the FCC Registration Section below.

CANADIAN APPROVALS

The iModem family is approvable for use by DOT to CSA CS-03 Part I. However, per Canadian procedures, approval can only be granted after the iModem has been installed into the end product. Typically, Canadian approval is obtained by submitting the final end product to an independent test house or consultant for evaluation. The test house/consultant then forwards the test results and applicable documents to the regulatory agency. Cermetek offers a list of consultants to assist with this process.

IMODEM HANDLING AND ASSEMBLY RECOMMENDATIONS

The iModem contains static-sensitive components and should only be handled by personnel and in areas that are properly protected against static discharge.

HIGH SPEED INTERNET MODEM FAMILY

CH2166

- Send/Retrieve Email. Unlimited Email, V.90

There are two mounting techniques that are recommended for physically connecting the iModem to a PCB:

1. Direct soldering.
2. Sockets.

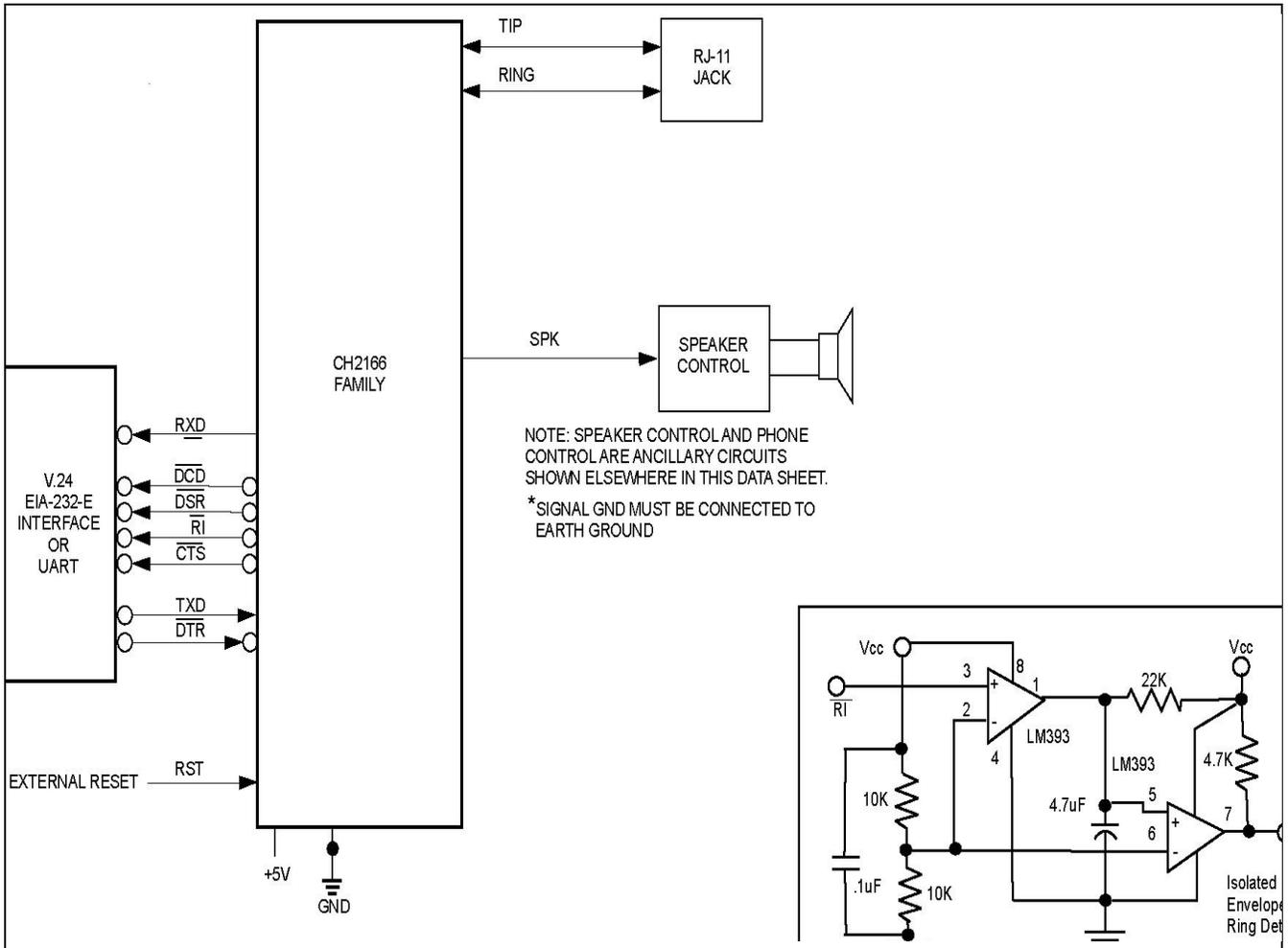


Figure 4. HS Modem Family Application Diagram.

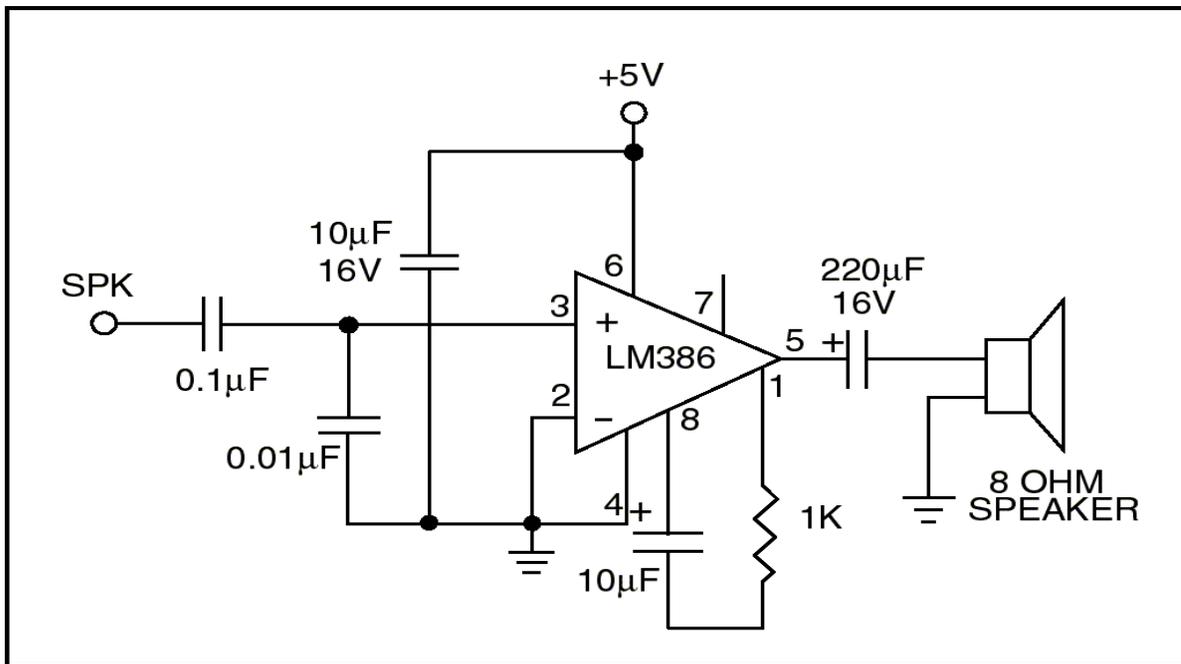


Figure 5. Speaker Control Circuit.

Table I. Summary of Available Commands By Category for CH2166.

Command	Command Description and Syntax
Quick Commands	
@QST	Purpose: To store an E-Mail message. Syntax: @QST: VOLATILE FILE=<FILE_NAME> TO=<RECIPIENT> FROM=<SOURCE> SUBJECT=<TITLE>
@QTM	Purpose: To send a stored E-Mail message. Syntax: @QTM: FILE=<FILE_NAME> INTERNAL PROFILE=<PROFILE_NAME> TO=<RECIPIENT> FROM=<SOURCE> SUBJECT=<TITLE>
@QTX	Purpose: To send a streaming E-Mail message. Syntax: @QTX: PROFILE=<PROFILE_NAME> TO=<RECIPIENT> FROM=<SOURCE> SUBJECT=<TITLE>
@QRX	Purpose: To retrieve an email message from a POP3 E-Mail server. Syntax: @QRX: MSG=<MSG_NO> PROFILE=<PROFILE_NAME>]
CH2166 Management Commands	
@ETXC	Purpose: To modify SMTP AP Profiles and to set the SMTP configuration parameters. This command may only be executed when no Session IDs have been allocated. All parameters are optional, only specified parameters will be changed all others will remain unchanged. Syntax: @ETXC: PROFILE=<SMTP_PROFILE> SERVER=<IPV4 or TEXT>-<SERVER ADDRESS> FROM=<EMAIL SOURCE ADDRESS> TO=<EMAIL DESTINATION ADDRESS>, <ADDITIONAL EMAIL DESTINATION ADDRESS(ES)> AUTH_METHOD=<AUTHENTICATION METHOD> ID=<USER ID> PW=<USER PASSWORD>
@ERXC	Purpose: To modify POP3 AP Profiles and to set the POP3 configuration parameters. This command may only be executed when no Session IDs have been allocated. All parameters are optional, only specified parameters will be changed all others will remain unchanged. Syntax: @ERXC: PROFILE=<POP3_PROFILE> SERVER=<IPV4 or TEXT>-<SERVER ADDRESS> ID=<USER ID> PWD=<USER PASSWORD>

Table I. Summary of Available Commands By Category for CH2166 (continued).

Command	Command Description and Syntax
@LINKC	Purpose: To modify Link Profiles. Syntax: @LINKC: LEVEL=<PROFILE TYPE> PROFILE=<PROFILE NAME> PHONE=<LOCAL ACCESS POP NUMBER> RAW=<RAW LOGIN ID> RAW_PWD=<RAW LOGIN PASSSSWORD> PPP_AUTH_METHOD=<PPP AUTHENTICATION PROTOCOL> PPP_ID=<PPP ID> PPP_SECRET=<PPP PASSWORD or CHAP SECRET>
File Management Commands	
@ESCLOSE	Purpose: To close a local file. Syntax: @ESCLOSE[ID]: FILE=<FNAME>
@ESDELETE	Purpose: To delete local files. Syntax: @ESDELETE[ID]: FILE=<FNAME> TYPE=<FTYPE>
@ESLIST	Purpose: List all local files by name and identify whether volatile or static (i.e., non-volatile). Syntax: @ESLIST[ID]: TYPE=<FTYPE> FORMAT=<DTYPE> FILE=<FNAME>
@ESOPEN	Purpose: To open a local file for either reading and/or writing. Syntax: @ESOPEN[ID]: FILE=<FNAME> <VOLATILE> MAX=<DMAX> <CREATE> FROM=<FDATA> TO=<TDATA> SUBJECT=<SDATA>
@ESRDATA	Purpose: To read data from an opened file. Syntax: @ESRDATA[ID]
@ESWDATA	Purpose: To write to an opened file. Syntax: @ESWDATA[ID]: <DATA>
Socket Commands	
@ISOCKET	Purpose: To allocate a socket. This usage is consistent with the Berkley Sockets Library definitions. Syntax: @ISOCKET[ID]: RXMAX=<RX_MS> TXMAX=<TX_MS>
@ISTXD	Purpose: To send data over a TCP connection. Syntax: @ISTXD[ID]<DLEN> :<DATA>
@ISIPADD	Purpose: To get the IP address of a host system using DNS. Syntax: @ISIPADD[ID] NAME=<SYMBOLIC SERVER NAME>:

Table I. Summary of Available Commands By Category for CH2166 (continued).

Command	Command Description and Syntax
@ISCLOSE	Purpose: To release a TCP and/or socket connection. Syntax: @ISCLOSE[ID]: HOST=<NAME>
@ISRXD	Purpose: To receive data over a TCP connection. Syntax: @ISRXD[ID]: MAX=<DLEN>
@ISHOSTIP	Purpose: To get the TCP port and IP Address of the local iModem system. Syntax: @ISHOSTIP[ID]
@ISHOST	Purpose: To get local iModem system name. Syntax: @ISHOST[ID]
@ISCONN	Purpose: To establish a TCP connection. Syntax: @ISCONN[ID]: PROFILE=<PNAME> PORT=<DEST_PORT> SERVER=<IPV4 or TEXT>.<SERVER ADDRESS>
@ISABORT	Purpose: To force the release of a TCP connection and any underlying dialup IP link. Syntax: @ISABORT[ID]
@ISIPCONN	Purpose: To establish a dialup IP link. Syntax: @ISIPCONN[ID]: PROFILE=<PNAME> PHONE=<TNO> RAWLOG=<RDATA> LINKLOG=<LDATA>
@ISIPREL	Purpose: To release an IP link. Syntax: @ISIPREL[ID]
@ISBIND	Purpose: To bind local address to a socket. Syntax: @ISBIND[ID]: PORT=<SOURCE_PORT> ADD=<SOURCE_IP>
CH2166 Management Commands	
@VMAGENT	Purpose: To set the unit ID string. This command may only be executed when no Session IDs have been allocated. Syntax: @VMAGENT: SET=<UNIT_ID_STRING>
@VMAGENT	Purpose: To display the unit ID string. This command may only be executed when no Session IDs have been allocated. Syntax: @VMAGENT: GET

Table I. Summary of Available Commands By Category for CH2166 (continued).

Command	Command Description and Syntax
Session Management Commands	
@GIDGET	Purpose: To allocate Session IDs for application session activities and instances. Syntax: @GIDGET: <APPLICATION_ID>
@GIDFREE	Purpose: To release a Session ID. Syntax: @GIDFREE[ID]
EMAIL Transmission Commands	
@ETXFILE	Purpose: To send a stored E-Mail file as an email message. Syntax: @ETXFILE[ID]: FILE=<FNAME> <INTERNAL> PROFILE=<PNAME> SUBJECT=<SDATA> FROM=<SOURCE> TO=<T0LIST>
@ETXDSTART	Purpose: To begin streaming E-Mail transmission. Syntax: @ETXDSTART[ID]: PROFILE=<PNAME> SUBJECT=<SDATA> FROM=<SOURCE> TO=<T0LIST>
@ETXDEND	Purpose: To end streaming E-Mail transmission. Syntax: @ETXDEND[ID]
@ETXDATA	Purpose: To send streaming E-Mail data. Syntax: @ETXDATA[ID]: User supplied ASCII data
@ETXCONN	Purpose: To establish an IP Link connection for E-Mail transmission. Syntax: @ETXCONN[ID]: PROFILE=<PNAME> SERVER=<IADD> PORT=<SPORT> AUTH_METHOD=<SAUTH> SERVLOG=<SDATA> DIALUP=<TRUE/FALSE> PHONE=<TNO> RAWLOG=<RDATA> LINKLOG=<LDATA>
@ETXQCONN	Purpose: To establish an E-Mail server connection with preconfigured address data. Syntax: @ETXQCONN[ID]: PROFILE=<PNAME>
@ETXDISC	Purpose: To Release an E-Mail IP Link. Syntax: @ETXDISC[ID]

Table I. Summary of Available Commands By Category for CH2166 (continued).

Command	Command Description and Syntax
POP3 and Email Retrieval Commands	
@ERXQUERY	Purpose: Query POP3 server about message attributes. Syntax: @ERXQUERY[ID]: LIST=<MLIST>FORMAT=<FTYPE>
@ERXLIST	Purpose: List E-Mail messages on POP3 server. Syntax: @ERXLIST[ID]: FORMAT=<FTYPE>
@ERXDATA	Purpose: To retrieve an E-Mail message data. Syntax: @ERXDATA[ID]
@ERXMAIL	Purpose: Retrieval an E-Mail message by message number. Syntax: @ERXMAIL[ID]: MSG=<MSG_NO> MAX=<NBYTES>
@ERXDELETE	Purpose: Delete an E-Mail message. Syntax: @ERXDELETE[ID]: LIST=<MLIST>
@ERXCONN	Purpose: To establish an E-Mail POP3 server connection. Syntax: @ERXCONN[ID]: PROFILE=<PNAME> SERVER=<IADD> PORT=<SPORT> SERVLOG=<SDATA> DIALUP=<TRUE/FALSE> PHONE=<TNO> RAWLOG=<RDATA> LINKLOG=<LDATA>
@ERXQCONN	Purpose: To establish an E-Mail POP3 server connection with preconfigured address data. Syntax: @ERXQCONN[ID]: PROFILE=<PNAME>
@ERXDISC	Purpose: To release an E-Mail POP3 server connection. Syntax: @ERXDISC[ID]
iModem/Modem Mode Commands	
@IMENTER	Purpose: To Enter iModem/Modem mode. No session ID required Syntax: @IMENTER
@IMEXIT	Purpose: To Exit iModem/Modem mode. CH2166 MUST be in Command Mode to execute this command. Syntax: @IMEXIT

Table II. Summary of Available Application and Link Profiles.

Profile Name	Description and Comments
smtp.imodem.default	Purpose: Default Application Profile for Cermetek ISP SMTP server.
pop3.imodem.default	Purpose: Default Application Profile for Cermetek ISP POP3 server.
link.imodem.default	Purpose: Default Link Profile for Cermetek Dial-up POP connection.
smtp.att	Purpose: Generic Application Profile for AT&T ISP SMTP server.
pop3.att	Purpose: Generic Application Profile for AT&T ISP POP3 server.
link.att	Purpose: Generic Link Profile for AT&T Dial-up POP connection.
smtp.sbc	Purpose: Generic Application Profile for SBC ISP SMTP server.
pop3.sbc	Purpose: Generic Application Profile for SBC ISP POP3 server.
link.sbc	Purpose: Generic Link Profile for SBC Dial-up POP connection.
smtp.lmi	Purpose: Generic Application Profile for LMI ISP SMTP server.
pop3.lmi	Purpose: Generic Application Profile for LMI ISP POP3 server.
link.lmi	Purpose: Generic Link Profile for LMI Dial-up POP connection.
smtp.earthlink	Purpose: Generic Application Profile for Earthlink ISP SMTP server.
pop3.earthlink	Purpose: Generic Application Profile for Earthlink ISP POP3 server.
link.earthlink	Purpose: Generic Link Profile for Earthlink Dial-up POP connection.
smtp.uunet	Purpose: Generic Application Profile for UUNET ISP SMTP server.
pop3.uunet	Purpose: Generic Application Profile for UUNET ISP POP3 server.
link.uunet	Purpose: Generic Link Profile for UUNET Dial-up POP connection.

Direct Soldering. The iModem may be wave soldered onto a circuit card. All iModem products are sealed and will not be harmed by industry standard wave soldering processes.

Socketing. The socket approach to mounting eliminates cleaning and desoldering concerns. When the socket is used, it must make a solid connection to all pins. Failure to do so will cause unreliable or intermittent operation. Also, steps should be taken to assure that the module remains tightly seated in the socket after the end product is shipped. Cermetek recommends the 50 pin strip socket CES-150-01-T-S by Samtec. Refer to Application Note# 130, [Summary of Recommend Supplies](#), for a list of supplies and associated contact information.

FCC REGISTRATION

All CH2166 iModem products are registered with the FCC under Part 68. To maintain the validity of the registration, notice of the restrictions the FCC places on the iModem and its use must be served to the end user of the product containing the iModem.

In addition to restriction notification, the FCC requires that Cermetek make all repairs to all products in the

iModem family. If repairs are necessary after installation of the iModem and the end product has been delivered to the end user, the end product must be returned to the end product supplier where the iModem can be removed and then forwarded to Cermetek for repair. The following notice is recommended and should be included in the end product's user manual.

FOR YOUR USER'S MANUAL

The Part 68 rules require the following (or equivalent) be provided to the end user of the equipment containing an iModem device.

Type of Service: The (insert end product name) is designed to be used on standard device telephone lines. It connects to the telephone line by means of a standard jack called the USOC RJ-11C (or USOC RJ45S). Connection to telephone-company-provided coin service (central office implemented systems) is prohibited. Connection to party lines service is subject to state tariffs.

Changes in Attestation Procedure for Plugs and Jacks: (Name of applicant) attests that the network interface plugs or jacks used on this equipment comply with and will continue to comply with the mechanical

requirements specified in Part 68, Sub-part F, specifically the dimensions, tolerances and metallic plating requirements. The compliance of these connectors will be assured by purchase specifications and incoming inspection. Documentation of such specifications and/or inspections will be provided by the FCC within 30 days of their request for the same.

Telephone Company Procedure: The goal of the telephone company is to provide the best service it can. In order to do this, it may occasionally be necessary for the telephone company to make changes to their equipment, operations or procedures. If these changes might affect service provided to the users or the operation of the user's equipment, the telephone company will give the user notice, in writing, to allow the users to make any changes necessary to maintain uninterrupted service.

In certain circumstances, it may be necessary for the telephone company to request information from the users concerning the equipment which the user has connected to the telephone line. Upon request of the telephone company, provide the FCC registration number and the ringer equivalence number (REN); both of these items are listed on the equipment label. The sum of all of the REN's on the user's telephone lines should be less than five in order to assure proper service from the telephone company. In some cases, a sum of five may not be useable on a given line. Consult your telephone provider.

If Problems Arise: If any of the user's telephone equipment is not operating properly, the user should immediately remove it from the user telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When practical, they will notify the user in advance of this disconnection. If advance notice is not feasible, the user will be notified as soon as possible.

When the user is notified, the user will be given the opportunity to correct the problem and informed of their right to file a complaint with the FCC. Contact the local telephone service provider if any questions arise concerning the telephone service.

In the event repairs are ever needed on the (insert your product name), they should be performed by (insert your company name), or an authorized representative or (insert your company name). For information contact: (insert your company address).

DEFAULT STATUS, PERFORMANCE AND SPECIFICATIONS

Prior to delivery, Cermetek installs into each CH2166 iModem the following default Configuration Profile:

Default Connect Speeds (DCE) is 19,200bps (8-N-1)

Serial port data rate auto baud enabled
 Bell 212A operation at 1200bps
 Parity – none
 Auto answer disabled
 Command echo ON
 All result codes enabled – except \REL codes
 Wait for dial tone before dialing – 2 seconds
 Dials with touch-tone (T)
 Detects busy signal (ATX4)
 Full word result codes – non-extended
 Pulse dial make/break ratio = 39/61-10pps
 Test timer set to 0 seconds, test modes disabled
 Inactivity timer set to 0 minutes
 CTS always active
 DSR is ignored
 DCD is ignored
 RTS to CTS delay - .01 seconds
 DTR always active – hang up after transition
 Long space disconnect disabled
 Speaker enabled but off when receiving carrier
 Speaker volume set to low
 Local modem will not grant RDL request from remote modem
 Guard tones disabled
 Minimum DTR pulse width = .05 seconds
 Ring count – 00
 Escape code character = 43 (+)
 Flash to on hook = 70 msec
 Auto speed detection enabled
 DTE connect speed, connect messages
 Back space character = 08 (BS) Carriage return character = 13 (CR)
 Line feed Character = 10 (LF)
 Duration of wait for dial tone = 2 seconds
 Duration of wait for carrier after dialing = 50 seconds
 Carrier detect response time = 0.6 seconds
 Escape code guard time = 1 second
 Length of use after comma = 2.0 seconds
 Last carrier to hang up delay = 1.4 seconds
 DTMF interdigit delay = .095 seconds
 Auto sync address or address detection = 0
 Connection detected at DTE – Highest speed 38,400kbps
 Auto retrain enabled – 30 seconds attempts
 MNP error correction mode can be negotiated (&Q5)
 MNP – non-extended service selected
 MNP error correction block size is 128 characters selected
 Data compression – negotiation enabled
 Transmit break length is 0.3 seconds
 All breaks are transmitted in sequence with data
 Serial port flow control enabled = RTS/CTS
 XON/XOFF flow control characters selected

Table III. CH2166 iModem Family Pin Description.

PIN	NAME	I/O	FUNCTION
1	RING	I/O	Directly connects to the telephone line's Ring lead through a user supplied RJ-11C jack.
2	TIP	I/O	Directly connects to the telephone line's TIP lead through a user supplied RJ-11C jack.
3	NC	---	NO CONNECTION.
4	NC	---	NO CONNECTION.
5	SPK	O	SPEAKER. Audio output for speaker. See speaker control diagram.
6	NC	---	NO CONNECTION.
7	NC	---	NO CONNECTION.
8	NC	---	NO CONNECTION.
9	NC	---	NO CONNECTION.
10	TXD	I	TRANSMIT DATA. Serial transmit data input. Marking, or a binary 1 condition is indicated by a HIGH.
11	RXD	O	RECEIVE DATA. Serial Receive data output. Received marking or a binary 1 condition is indicated by a HIGH.
12	NC	---	NO CONNECTION
13	$\overline{\text{DTR}}$	I	DATA TERMINAL READY INPUT. Active LOW. Switching off DTR can either return modem to command state, disconnect phone call, or reset modem. DTR should be set LOW when not in use.
14	$\overline{\text{DSR}}$	O	DATA SET READY. LOW indicates handshaking with a remote modem in progress, and/or the data carrier of a remote modem has been detected.
15	$\overline{\text{RI}}$	O	RING INDICATION. This signal follows the frequency of the ringing signal and is normally about 20 to 40 Hz for 2 seconds on with 4 second off.
16	$\overline{\text{CTS}}$	O	CLEAR-TO-SEND. Output always LOW. Reserved for flow controls with FAX option. Not active, let float.
17	$\overline{\text{DCD}}$	O	DATA CARRIER DETECT. LOW indicates a data carrier from a remote modem has been detected. Must enable with AT&C1 Hayes command.
18	NC	---	NO CONNECTION
19	VCC	---	DC SUPPLY. 5V \pm 5% required.
20	GND	---	GROUND. Note: Noise should be less than 25mV peak to peak.
21	RST	I	RESET. Active HIGH. This input must be asserted HIGH for at least 10ms to reset the modem. RESET is then returned to LOW for normal operation. If no system reset is available, let this pin float to enable internal reset.
22	$\overline{\text{RTS}}$	I	REQUEST TO SEND. Active Low. Used for flow control. Should be tied Low when using SEND pin and when using @T commands for CH2160 only.

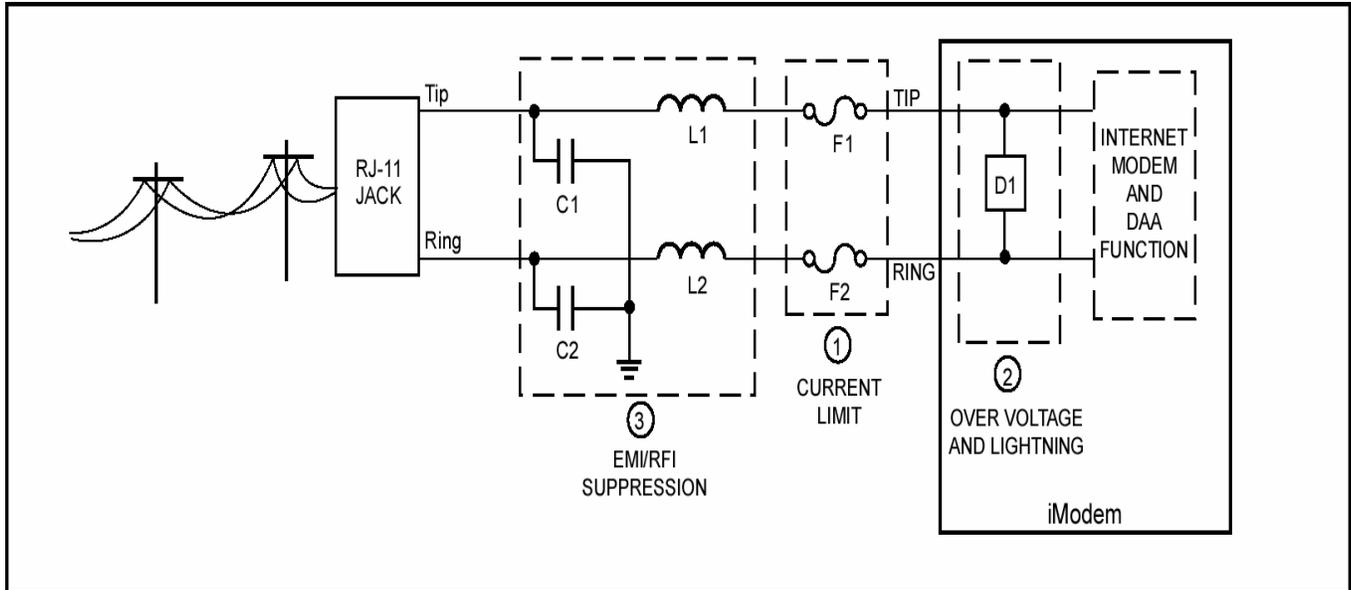


Figure 6. PSTN Line Interface for all iNet Appliance Products.

1. Currently Limiting PSTN Protection Line Device.

Current limiting devices are mandatory to meet UL safety standards. To maintain conveyed FCC Part 68 approval, the current limiting components identified as F1 and F2 in dashed Box #1 must also survive FCC Part 68 surge testing. Refer to Cermetek Application Note #126, [Supplemental PSTN Line Protection](#), for more details. Refer to Application Note # 130, [Summary of Recommended Suppliers](#), for a list of suppliers and associated part numbers.

- A. A PTC (rated at 0.15 amps) is preferred because it resets automatically upon removal of the current flow. Fuse devices are also acceptable. Refer to Application Note #130 for a complete list of recommended vendors and associated part numbers.
- B. Resistors (10Ω carbon film or 1/8 watt minimum) may be used in Canada, as Canada has no requirements that PSTN equipment be operational after a Type B surge test.
- C. Although Industry Canada CS-03 Part 1 (Canada) follows the requirements of FCC Part 68 (USA), Cermetek recommends contacting DOT (Canada) and/or a certified independent lab to verify compliance. For Canada, use either 10Ω resistors (carbon film or SMD parts 1/8 watt minimum) as described in paragraph B above.

2. Over Voltage and Lightning Protection.

- A. Surge Protection is provided by internal circuitry (see Figure 3). No additional external components are required to maintain conveyed FCC Part 68 approval.
- B. In most environments, 2 terminal surge suppressors are adequate. For severe environments, use an external 3 terminal device with an earth ground.

3. EMI/RFI Suppression.

No external EMI/RFI noise suppression circuitry is required to maintain conveyed FCC Part 68 approval. However, additional suppression, if required for other reasons, may be added as described below in Sections 3A-3B without adversely affecting FCC Part 68 approval.

- A. To provide adequate EMI/RFI suppression, the capacitor/inductor network contained in dashed Box #3 should be located as close to the RJ-11C jack as possible. Further, this network should be provided with an excellent ground path to the chassis.
- B. Capacitors C1 and C2 should not exceed 0.005μf. They must have a rating of 1.5KV and typically are 0.001μf ± 20%. Inductors L1 and L2 may be either individual inductors or a dual inductor. Refer to Application Note #130 for a complete list of recommended vendors and associated part numbers. For UL applications, choose capacitors and inductors that are UL 1950 listed. The actual values of the components used may vary depending on the end product design.

Table IV. Analog Characteristics.

NAME	TYPE	CHARACTERISTICS	VALUE
SPK	O(DF)	Minimum Load Maximum Capacitive Load Output Impedance Output Voltage D.C. Offset	300ohm 0.01 μ f 10ohm 2.5 \pm 1.6V <20mV

Table V. Summary CH2166 iModem Family of Products.

Model	Summary of Features	Operating Temperature
CH2166	Send and Retrieve Streaming Email. Email Send Control Pin Full Function, V.90, 56Kbps, FCC Part 68 Approved, UL 1950 listed.	0°C to 70°C

Table VI. CH2166 iModem Electrical Specifications.

Symbol	Characteristic	Min.	Typ.	Max.	Units
V _{CC}	Positive Supply Voltage	4.5	5.0	5.5	V
I _{CC} Off Hook	Nominal Operating Current @ V _{CC} = 5.5V when modem is Off Hook		300.0		mA
V _{IH}	High Level Input Voltage @ 5.0V	2.0		3.5	V
V _{IL}	Low Level Input Voltage @ 5.0V	1.0		2.2	V
\overline{V}_{IH}	High Level Input Voltage (Excluding IN1, IN2, SEND) @ 5.0V	2.0		3.5	V
\overline{V}_{IL}	Low Level Input Voltage (Excluding IN1, IN2, SEND) @ 5.0V			0.8	V
VT+	Positive Hysteresis Threshold for RESET Pin		2.9		V
VT-	Negative Hysteresis Threshold for RESET Pin		1.98		V
V _{OH}	High Level Output (Including SENT) with I _{OH} = 0.5mA	2.4			V
V _{OL}	Low Level Output (Including SENT) with I _{OL} = 1.6mA			0.6	V
I _{IN}	Input Leakage Current (TXD, DTR, RTS)			100	μ A
I _{IL}	Input Current (RST, IN1, IN2, SEND)			1.0	μ A
C _P	Capacitive Load (\overline{TXD} , DTR, RTS) Capacitive Load (RTS)			10 8	pF pF

Table VII. CH2166 iModem Electrical Specifications.

Parameter	Minimum	Typical	Maximum	Units	Comments
Off Hook Impedance	20			Mohm	
Trans Hybrid Loss		25		dB	600 Ohm, RXA, TXA
Ring Voltage Loop		15		V _{PP}	On 48VDC line voltage for sustained periods
Line Loop Current - (Off Hook)		20	60	mA	
Return Loss @ 1000 Hz		15		dB	600 Ohm
Ring Frequencies	20	40	60	Hz	
Receiver Insertion Gain	-0.5	0.0	+0.5	dB	
Transmit Power		-9.5		dBm	600 Ohm- Data Mode
First Character After Reset See Note 1	25.0			sec	Delay
Inter Character Delay	20	50		msec	Between all command characters
Command Delay	100	200		msec	Between all AT commands
Minimum Reset Pulse	1			µsec	If user supplied

Note: 1. All CH2166 iModem devices re-load operating firmware upon reset and then perform an internal self-check. The CH2166 will not respond to commands issued during this sequence.

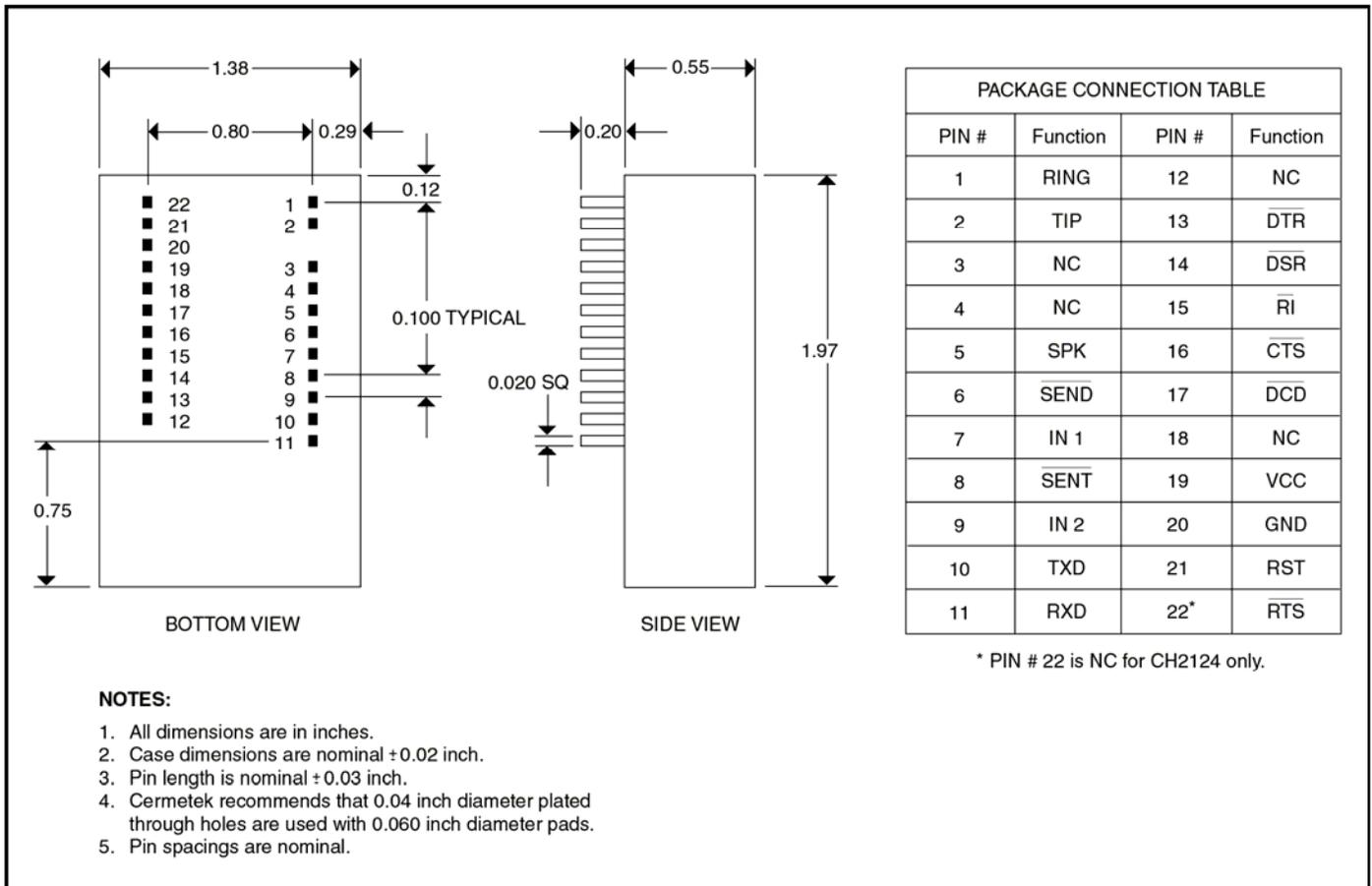


Figure 7. Physical Dimensions and Pin Functions for CH2166 Product Family.

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Cermetek provides the user with a FCC (USA) and IC (Canada) Approved or Approvable device. However, Cermetek does not have influence over nor knowledge of the specific user application environment. Therefore, for FCC and IC Approved or Approvable devices, the user assumes all risk for maintaining compliance to registration.

Printed in U.S.A

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