AT+i ™

CO110PC Programmer's Manual

Version 7.6

September 2004

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Revision History 20-5100-07_6		
Version	**Date**	**Description**
7.6	Sep. 2004	First Release of AT+i Protocol subset for CO110PC. Based on AT+i Programmer's Manual revision 7_4b.

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1 AT+i Command Set

1.1　AT+i Command Guidelines

The AT+i commands for Internet mode operations used to control the iChip Internet Controller are defined in this section. The AT+i commands are an extension to the basic industry-standard AT Command Set. AT+i commands shall be parsed and acted upon by the iChip controller.

The ASCII ISO 646 character set (CCITT T.50 International Alphabet 5, American Standard Code for Information Interchange) is used for the issuance of commands and responses. Only the low-order 7 bits of each character are used for commands or parameters; the high-order bit is ignored. Upper case characters are equivalent to lower case characters.

1.2　AT+i Command Format

An AT+i command line is a string of characters sent from a Host to the iChip controller while it is in the command state. The command line has a prefix, a body, and a terminator. Each command must begin with the character sequence AT+i and must be terminated by a carriage return (<CR>). Commands entered in upper-case or lower-case are accepted.

The AT+i command body is restricted to printable ASCII characters (032 - 126). The command terminator is the ASCII <CR> character. The command line interpretation begins upon receipt of the carriage return character (an exception to this rule are the AT+iSSND and AT+iFSND commands). When ECHO is enabled, the <CR> (Carriage Return) character is echoed as a 2-character sequence: <CR><LF> (Carriage Return + Line Feed).

Characters within the AT+i command line are parsed as commands with associated parameter values.

iChip does not support editing of command lines using the backspace character. Backspace characters are treated as data characters without further processing.

If a syntax error is found anywhere in a command line, the remainder of the line will be ignored and the I/ERROR result code will be returned.

Commands will only be accepted by iChip once the previous command has been fully executed, which is normally indicated by the return of an appropriate result code.

1.3　Escape Code Sequence

While iChip is in Internet mode, attending to the Internet communications, it is possible to break into the data communications and abort the Internet mode in an orderly manner. This is achieved by sending iChip a sequence of three ASCII '+' characters ('+++') after a half second silence period. In response to this, iChip will shut down the Internet communications, terminate data transmission to the host and respond with an 'I/ERROR(056)' message and return to command mode. A maximum delay of 10mSec

may still exist from the time the '+++' escape sequence was transmitted until iChip cuts off the transmission to the host.

1.4   Auto Baud Rate Detection

iChip supports auto baud rate detection on the host serial communications line. After power-up, iChip will go in to auto baud mode when the BDRF parameter contains 'a'. The AT+iBDRA command forces iChip into auto baud mode while it is already in operation.

In auto baud mode, iChip expects an 'A' or 'a' character. This is usually the first character sent, since a meaningful command is always prefixed by 'AT+I' in Command mode.

The host may send an 'a' or 'A' to iChip to allow it to determine the host's baud rate. It may also send a complete 'AT+I' command. In any case the iChip will detect the 'A' or 'a' character, determine the correct baud rate and configure iChip's serial channel during the stop-bit. Thus, the serial port will always receive the next character at the correct baud rate. The 'A' itself is retained as well. iChip supports auto baud rate detection for baud rates: 2400, 4800, 9600, 19200, 38400, 57600 and 115200 bits per second.

When the BDRF parameter contains a (fixed) baud rate, iChip will initialize to the specified baud rate without entering the auto baud mode. Commands issued by the host must be sent using that baud rate in order to be recognized. In this case, iChip may be forced into auto baud mode by holding the special input signal low for not more than five seconds after power-up.

When the BDRM (modem baud rate) parameter contains an 'a' value, iChip assumes the attached modem has the auto baud rate feature. Once the host⇔iChip baud rate is determined the iChip⇔Modem baud rate will be set to the same. Otherwise, any other value in BDRM will be used as a fixed baud rate to the modem.

1.5   Reset via Serial Link

Issuing a 'BREAK' signal on the Host serial link will effectively RESET the iChip. A 'BREAK' signal is issued by transmitting a LOW (zero value) for a period that is longer than 23 bits at the current baud rate. Considerably lowering the host baud rate (300 baud or less) and transmitting a binary zero will in effect generate a 'BREAK' signal. After a 'BREAK' signal is issued, iChip requires 4 seconds to complete the reset cycle before commands may be issued.

When iChip is configured for auto baud rate (AT+iBDRF=a), the 'BREAK' method is especially useful to force iChip back into auto baud rate mode when iChip and the host loose sync.

1.6   Reset via Forced Watchdog Activation

iChip includes an internal watchdog mechanism. When enabled, the internal watchdog circuitry will physically RESET the iChip device if the iChip firmware does not execute

in an orderly manner as expected. The AT+iWDR command forces the watchdog circuitry to instigate a RESET condition, as a means to reset the iChip device with an AT+i command from the host.

1.7   Internet Session Hang-up Procedure

When completing a dialup Internet session, iChip will automatically execute a modem hang-up procedure:
1. The DTR line is dropped
2. After a 1 Sec. Delay iChip raises the DTR.
3. If the modem responded to the DTR drop with a "No Carrier" ➔ Done.
4. Otherwise, iChip issues a '+++' to the modem.
5. Followed by, 'ATH'

1.8   Modem Startup

After power-up and baud rate determination, iChip will issue the AT<CR> command to the modem to verify that the modem exists and is responding.

1.9   Optional Firmware Revisions

The CO110PC iChip device has a baseline firmware revision with support for basic Internet functionality. Optional firmware revisions exist, that enhance the baseline functionality, as follows:

   a. **SNET**: Adds SerialNET functionality to the baseline firmware.
   b. **ESFT**: Adds Email-Send and FTP functionality to the baseline firmware.

Some commands and parameters are restricted to a specific optional firmware version. When this is the case, it is listed in this manual under the 'Scope' category as:
   a. Scope: CO110PC/SNET
   b. Scope: CO110PC/ESFT

All other commands and parameters exist in the baseline and are common to all firmware versions.

2 General Format

AT+i*<cc>*[*<del>*[*<parameter>*]…]*<CR>*

<cc> (or <par>)	: 2-4 letter command code (*<cc>*) or parameter name (*<par>*)
<del>	: Delimiter: '=', '~', '?', ':', ','
<parameter>	: Optional parameter or data. If *<parameter>* contents includes a *<del>*, as defined above, it must be enclosed in single (') or double (") quotes. The terminating *<CR>* is considered as a terminating quote as well.
<CR>	: Carriage-Return Line terminator (ASCII 13)

2.1   AT+i Commands by Category

Command	Function	Parameters/Description
AT+i	Command Prefix	Required to precede all commands
Host Interface		
E*n*	Echo Mode	*n*=0 - Do not echo host characters *n*=1 - Echo all host characters.
Parameter Database Maintenance		
<par>=*value* or <par>:*value* or <par>~*value*	Update Parameter Value	Update parameter *par* to a new *value*. The updated value is stored in volatile memory (RAM). If iChip looses power, the updated value is lost. Use the AT+iPARS command to retain updated values indefinitely. For description of all available parameters see section 4.3
<par>?	Read parameter	Parameter value is returned.
FD	Factory Defaults	Restores all parameters to Factory Defaults.
PARS	Store Parameter Updates to Nonvolatile Memory	Stores all parameter value updates to the nonvolatile parameter database in Flash.
PARD	Drop Parameter Updates	Drops all parameter value updates, effectively restoring to the value stored in the nonvolatile parameter database.
Status Report		
RP<i>	Request Status report	Returns a status report value based on <I>.
Connection		
BDRA	Auto baud mode	Forces the iChip into auto baud rate detection mode.
UP	Connect to Internet	This command forces iChip to go online, establish an Internet session and optionally register its IP address.
TUP	Triggered Internet Session Mode	This command enters a mode, where iChip will go online in response to triggers from external signals. It also supports a special "Always Online" mode.
DOWN	Disconnect from Internet	This command forces the iChip to terminate an Internet session and go offline.
PING	PING a remote system	Send PING message and wait for its echo response.
WDR	RESET iChip	This command forces a H/W Reset to iChip by utilizing the internal watchdog circuitry.

Command	Function	Parameters/Description
Email Send Immediate		
[!]EOA:*<text>*	Send textual Email immediate	Defines the textual contents of the Email body. Following this command several text lines may be sent in sequence. Sending a CR.CR (line containing only a period) terminates the text body.
HTTP Client Download		
[!]RLNK[:<URL>]	Retrieve Link	Retrieve a file from a URL on a Web server. If <URL> is not specified, use the URL stored in the URL parameter.
SerialNET		
[!]SNMD	Activate SerialNET mode	Activate the iChip's dedicated Serial to Network "SerialNET" mode.
File Transfer Protocol (FTP)		
FOPN	Open FTP Link	Open an FTP command socket to a remote FTP server. If the iChip is not online, it shall be connected. Once an FTP link is established it may be used to carry out operations on the server's file system.
FDL	FTP Directory Listing	Retrieve the remote FTP server's file directory listing. The full, server dependant, listing is returned.
FDNL	FTP Directory name list	Retrieve the remote FTP server's file directory listing. Only file names are returned.
FMKD	FTP Make Directory	Creates a directory on the remote FTP server.
FCWD	FTP Change Directory	Commands the remote FTP server to change it's current directory.
FSZ	FTP File Size	Report an FTP File size.
FRCV	FTP File Receive	Download a file from the remote FTP server.
FSTO	FTP File Store	Open a file for upload to the remote FTP server. If the file already exists it shall be overwritten.
FAPN	FTP File Append	Open a file on the remote FTP server for appending. If the file does not already exists it shall be created.
FSND	FTP File Send	Send data to a file on the remote FTP server. The file must have been opened for with a previous call to FSTO or FAPN.
FCLF	FTP Close File	Close the currently open file on the FTP server. Any data uploaded to the file with FSND commands will be retained on the server.
FDEL	FTP Delete File	Delete a file from the remote FTP server's file system.
FCLS	FTP Close	Close the FTP link.

Command	Function	Parameters/Description
Socket Interface		
STCP:<host>,<port> [,<lport>]	Socket TCP	Open and connect a TCP socket. If the iChip is not online, it shall be connected. The responding system is assumed to be a server "listening"" on the specified socket. Responds with a handle to the socket.
SUDP: <host>,<rport> [,<lport>]	Socket UDP	Open, connect, and optionally bind a UDP socket. If the iChip is not online, it shall be connected. Responds with a handle to the socket.
LTCP: <port>,<backlog>	Listen Socket	Open a TCP listen socket on <port>. Allow a maximum of <backlog> concurrent connections. Responds with a handle to the socket. Maximum 2 listen sockets supported.
LSST:<hn>	Listen Socket Status	Responds with a list of active socket handles accepted for listen socket identified by handle <hn>.
SST:<hn>	Single Socket Status	Responds with the status of a single socket identified by handle <hn>. Subset of RP4 Report.
SSND[%]: <hn>,<sz>:<stream>	Socket Send	Send a byte stream of size <sz> to the socket identified by handle <hn>. '%' flags auto flush socket.
SRCV:<hn>[,<max>]	Socket Receive	Receive a byte stream from the socket identified by handle <hn>. Accept maximum <max> bytes. If <max> is not specified, all available bytes are retrieved.
GPNM:<hn>	Get Peer Name	Retrieve Peer Name (<IP>:<Port>) of a remote connection to a TCP/UDP socket specified by the socket handle <hn>.
SDMP:<hn>	Dump socket buffer	Dump all buffered data currently accumulated in a socket's input buffer. The socket remains open.
SFSH[%]:<hn>	Flush Socket's Outbound Data	Flush (immediately send) accumulated data in a socket's outbound buffer. If the '%', flush-and-acknowledge flag, is specified, iChip will wait for the peer to acknowledge receipt of the TCP packet.
[!]SCLS:<hn>	Close Socket	Close a TCP/UDP socket. If the socket was the only open socket and the stay-online flag ('!') was not specified, the iChip will terminate the Internet session and go offline.

Command	Function	Parameters/Description
Special Modem Command		
MCM	Modem Command	Sends an AT command(s) to the modem.
Remote Firmware Update		
FU	Firmware Update	Enters local monitor mode for firmware upload.

Table 2-1 AT+i Commands by Category

3 AT+i Result Code Summary

Response String		Denotation		
I/OK		Command was successfully executed.		
I/BUSY		iChip device Busy. Command discarded.		
I/DONE		iChip completed Internet activity. Returned to command mode.		
I/ONLINE		iChip device completed an Internet activity and returned to command mode. iChip will issue this response when it has remained on-line as a result of the stay-online flag (!).		
I/ERROR(*nnn*)	*nnn*	Command Error Encountered. Command Discarded.		
	41	*Illegal delimiter*	63	*~CTSH needs to be LOW to change to H/W flow control.*
	42	*Illegal value*	64– 66	***RESERVED***
	43	*CR expected*		
	44	*Number expected*		
	45	*CR or ',' expected*	67	*Command ignored as irrelevant*
	46	*DNS expected*	68	***RESERVED***
	47	*':' or '~' expected*	69	*Timeout on host communication*
	48	*String expected*	70	*Modem failed to respond*
	49	*':' or '=' expected*	71	*No dial tone response*
	50	*Text expected*	72	*No carrier modem response*
	51	*Syntax error*	73	*Dial failed*
	52	*',' expected*	74	*Modem Connection with ISP lost.*
	53	*Illegal command code*	75	*Access denied to ISP server*
	54	*Error when setting parameter*		
	55	*Error when getting parameter value*		
	56	*User abort*		
	57	*Error when trying to establish PPP*		
	58	*Error when trying to establish SMTP*	80	*No suitable message in mailbox*
			81	*Unable to locate SMTP server*
			82	*SMTP server timed out*
	61	*Internal memory failure*	83	*SMTP failed*
	62	*User aborted the system*	84-86	***RESERVED***

I/ERROR (*nnn*)	*nnn*	*…Continued*		
	87	*Web Server IP registration failed*	111	*Serial data overflow*
	88	*Socket IP registration failed*	112	*Command illegal when modem online*
	90	*IP registration failed for all methods specified*	115	*SerialNET could not be started due to missing parameters*
			200	*Socket does not exist*
	94	*In "Always Online" mode, connection was lost and reestablished*	201	*Socket empty on receive*
	95	*A Watchdog reset event had occurred and restarted iChip*	202	*Socket not in use*
	96	*A remote host, that had taken over iChip through the LATI port, had disconnected*	203	*Socket Down*
	97	*Reserved*	204	*No available sockets*
	98	*Reserved*	205	*~~Socket receive buffer full~~ Obsolete*
			206	*PPP open failed for socket*
	100	*Error restoring default parameters*	207	*Error creating socket*
	101	*No ISP access numbers defined*	208	*Socket send error*
	102	*No USRN defined*	209	*Socket receive error*
	103	*No PWD entered*	210	*PPP down for socket*
	104	*No DNS defined*	211	*~~TCP down for socket~~ Obsolete. Use 203.*
			212	*Socket flush error*
			213	*~~Socket pwait no UDP error~~ Obsolete*
			214	*~~Socket pwait error~~ Obsolete*
	108	*TOA (addressee)not defined*	215	*No carrier error on socket operation*
	109	*REA (return Email address) not defined*	216	*General exception*
	110	*SMTP server not defined*	217	*Out of Memory*
			218	*An STCP (Open Socket) command specified a local port number that is already in use.*

I/ERROR (*nnn*)	*nnn*	*...Continued*		
	300	*HTTP server unknown*	500	*Communications Platform Not Available*
	301	*HTTP server timeout*	501	*Communications Platform already Active*
	302	*HTTP failure*	502	**RESERVED**
	303	*No URL given*	503	**RESERVED**
	304	*Bad HTTP host name*	504	**RESERVED**
	305	*Bad HTTP port number*	505	*Cannot open additional FTP session – all FTP handles in use*
	306	*Bad URL address*	506	*Not an FTP session handle*
	307	*URL address too long*	507	*FTP server not found*
			508	*Timeout when connecting to FTP server*
			509	*Failed to login to FTP server (bad username or password or account)*
			510	*FTP command could not be completed*
			511	*FTP data socket could not be opened*
			512	*Failed to send data on FTP data socket*
			513	*FTP shutdown by remote server*
	401	*No IP address*		
			561	*Remote peer closed the SerialNET socket*
			570	*PING destination not found*
			571	*No reply to PING request*

Table 3-1 AT+i Result Code Summary

<u>Note</u>: All iChip response strings are terminated with <CR><LF>

4 Report Status

4.1   +iRP -   Report Status

Syntax: AT+iRP*i*   Return Appropriate Status Message.

Parameters: *i* = 0, 1, 2, 4, 5, 7

Scope: iChip CO110PC

Command Options:
   i=0   Returns the iChip part number.
   i=1   Returns the current firmware revision and date.
   i=2   Returns the connection status.
   i=3   Reserved.
   i=4   Returns iChip socket status.
   i=5   Returns unique serial number.
   i=6   Reserved.
   i=7   Returns socket-buffers utilization bitmap. iChip's DTRH
              signal (pin 63) can be used to signal socket buffer status
              changes in hardware. This signal is raised when new data
              in one or more sockets is available. It is lowered when
              any socket is read.
   i=8   Reserved.

Default: None

Result code:
   Status Message   if *i* = 0, 1, 2, 4, 5 or 7; Followed by I/OK.
   I/ERROR   Otherwise.

Status Message Format:

Report Option	Format
0	CO*nnn*PC-*ii* *nnn* – Version number; *ii* – Interface code: S- Serial

1	IC*mmmTss* *<firmware date> <firmware option>*
	mmm – Major Version; *T* – Version type code; *ss* – Sub-version
	<firmware option>: Empty for baseline firmware
	                 (SNET) for SerialNET option
	                 (ESFT) for Email-send & FTP option

2	Status string: `"`**`Modem data`**`<CR/LF>"`
	                 `"`**`Command mode`**`<CR/LF>"`
	                 `"<CR/LF>`**`Connecting to ISP`**`<CR/LF>"`
	                 `"<CR/LF>`**`Connected to ISP`**`<CR/LF>"`
	                 `"<CR/LF>`**`Closing PPP`**`<CR/LF>"`
	                 `"<CR/LF>`**`Establishing SMTP`**`<CR/LF>"`
	                 `"<CR/LF>`**`Sending Email`**`<CR/LF>"`
	                 `"<CR/LF>`**`Establishing HTTP`**`<CR/LF>"`
	                 `"<CR/LF>`**`Carrier Lost`**`<CR/LF>"`

3	*Reserved*
4	I/(*<sock0sz>*, *<sock1sz>*, … ,*<sock9sz>*) *sock<i>sz* >=0 : Number of bytes pending in socket's input buffer <0 : Negative value of Socket's Error code
5	nnnnnnnn – Hexadecimal representation of iChip serial number.
6	Reserved

7	I/*xxxx*
	    xxxx – 16 bit Hex Value Bitmap
	
	    A bit set to '1' indicates that the corresponding socket contains buffered data, which needs to be read by the host.
	
	{ bit: 15, ..., 7, ..., 0 ; socket: 9 8 7 6 5 4 3 2 1 0 }

8	Reserved

Table 4-1 Report Status Message Format

The bitmap table in option 7:

bit	15							7								0
socket							9	8	7	6	5	4	3	2	1	0

5 Connection

5.1   +iBDRA - Forces iChip into Auto Baud Rate Mode

Syntax: AT+iBDRA   Forces the iChip into 'auto baud' mode. The
                                 following 'A', 'AT' or 'AT+i' command (in any
                                 combination of upper or lower case) from the host
                                 will synchronize on the host's baud rate.

          Parameters: None.

          Scope: iChip CO110PC

        Command Options:
                iChip supports auto baud rate detection for baud rates:
                2400, 4800, 9600, 19200, 38400, 57600 and 115200 bits per
                second.

        Result code:
                I/OK   This result code will be sent using the previous
                                    baud rate.

5.2   +iUP -   Initiate Internet Session

Syntax: AT+iUP[:*n*]   Initiate an Internet session by going online and establishing a PPP Internet connection. Once online, optionally go through an IP registration process according to *n*.

    Parameters: $n = 0..1$

    Default: $n = 0$

    Scope: iChip CO110PC

    Command Options:

        n=0   Go online and establish a PPP Internet connection.

        n=1   Go online, establish a PPP Internet connection and carry out the IP registration process according to the relevant registration option parameters.

    Result code:

        I/ONLINE   After successfully establishing an Internet Session and completing the IP registration (if requested).

        Or

        I/ERROR   If iChip could not go online and establish an Internet session or could not complete the requested IP registration.

5.3   +iTUP -   Triggered Internet Session Initiation

Syntax: AT+iTUP:<*n*>   Enter triggered Internet session initiation mode.

    Parameters: *n* = 0..2

    Scope: iChip CO110PC

    Command Options:

n=0	Disable triggered Internet session initiation mode.
n=1	Enter triggered Internet session initiation mode. Upon receiving a H/W signal trigger (Modem RING or MDSEL signal pulled low) establish a PPP Internet connection and carry out the IP registration process according to the relevant registration option parameters. If any characters are received on the host port prior to receiving a H/W signal, iChip will exit this mode and function normally. In this case, to reinstate this mode, issue AT+iTUP=1 again, reset iChip by issuing the AT+iDOWN command or recycle power.
n=2	Always online. Whenever iChip is offline, it will automatically attempt to establish a PPP Internet connection and possibly carry out the IP registration process, according to the relevant registration option parameters.

iChip will disregard this mode and remain offline if:

1. The MDSEL signal was pulled low during power up.
2. The host had issued the '+++' Escape sequence.

Power must be recycled or the AT+iDOWN command issued for this command to take effect. If iChip is in auto baud rate mode (BDRF=a), iChip will wait for the 'a' character on the host serial port, to resolve the baud rate after rebooting, before going online. Therefore it is recommended to set a fixed baud rate in this case.

Notes: 1. In this mode, iChip will not go offline after a completion of any successful or unsuccessful Internet session started by the host, even if the stay online flag is not used.

2. When a carrier lost event is detected, iChip will automatically retry to establish a connection (without performing a software reset), with the following exception: if at the time of the detection the host was waiting for a reply from iChip or was in the process of sending binary data (SSND or FSND) iChip will report error code 094, as soon as it can and only then try to re-establish the connection. In all other cases, iChip will give the host no indication of losing the carrier. In the event of carrier lost, iChip will close any open TCP active sockets, but it will leave UDP sockets and TCP passive (Listen) sockets intact and update their local IP if a new IP is assigned after

establishing a new PPP connection. iChip will NOT close any open Internet sessions (FTP sessions for example), nor release the handle of the active TCP sockets, giving the host a chance to read the session errors and get buffered incoming data from active TCP sockets.

3. When the PFR is larger than 0 and the PDSn parameters are configured, iChip will verify that it is online by sending PING messages to the PING destination servers defined in PDSn at a polling frequency defined by PFR. If both PING destination servers do not respond, iChip will conclude that the Internet connection has failed and will try to reestablish an Internet connection, as described above for the case of a lost carrier signal.

Result code:

      I/OK   if *n* is within limits.

       Or

      I/ERROR   Otherwise.

5.4   +iDOWN -Terminate Internet Session

Syntax: AT+iDOWN   Terminate an ongoing Internet session, go
                                             offline, and return to Command mode. This
                                             command is useful following a command where
                                             the stay-online flag (!) was specified.
                                             All open sockets shall be closed.
                                             iChip effectively executes a software reset.

           Parameters: None.

           Scope: iChip CO110PC

           Result code:
                I/OK

             Followed by
                I/ERROR   After terminating the current Internet session
                                             when the command caused iChip to abort an on-
                                             going Internet activity or close an active socket.

                  Or
                I/DONE   After terminating the current Internet session.
                                             Allow a 2.5 sec. delay for iChip re-initialization
                                             following an Internet mode session.

5.5   +iPING -   Send a PING Request to a Remote Server

Syntax: AT+iPING:*<host>*   Sends a two byte ICMP PING request packet to the remote host defined by *host*.

      Parameters: *<host>* = Logical name of the target host or a host IP address.

      Scope: iChip CO110PC

      Command Options:
         <host>   The host name may be any legal Internet-server name, which can be resolved by iChip's DNS (Domain Name Server) settings. The host name may also be specified as an absolute IP address given in DOT form.

      Result code:
         I/<RRT>   Upon successfully receiving an ICMP PING reply from the *host*, the round trip time in milliseconds is returned (*RRT*). iChip will allow up to *<PGT>* milliseconds for a PING reply. If a reply will not be received within *<PGT>* milliseconds, iChip will send two more PING requests, allowing *<PGT>* milliseconds for a reply on each of the requests before reporting an error.

         I/ERROR   Otherwise.

5.6   +iWDR -   Force Watchdog RESET

Syntax: AT+iWDR   Forces iChip to perform a hard RESET by
                                       means of its internal watchdog circuit.

                                       After performing a hard RESET, iChip will:
                                       1. Restore the host serial port to the baud
                                           rate in effect when the WDR command
                                           was issued, regardless of the BDRF
                                           parameter value.
                                       2. A modem hang-up process will be
                                           performed to resolve the possible case
                                           where the modem was online when the
                                           RESET occurred.
                                       3. A BREAK condition is forced on the
                                           TXDH signal, to notify the host that a
                                           watchdog reset has occurred.

            Parameters: None.

            Scope: iChip CO110PC

            Result code:
                  I/OK

---

6 Email Send

6.1   +iEOA - Accept ASCII-Coded Lines for Immediate Email Send

Syntax: AT+i[!]EOA:*<text lines>*   Define a plain-text Email body.
                 Parameters: *<text lines>* = Plain-text Email body. The Email body
                                                             contains <CR/LF> terminated ASCII character strings.
                                                             <text lines> must be terminated by a '.' (Dot character)
                                                             in the 1st column of an otherwise empty line.

              Scope: iChip CO110PC/ESFT

              Command Options:

                    <text lines> ::= {<ASCII text line><CRLF> …}<CRLF>**.**<CRLF>

                                                             EOA uses the specified SMTP server to send the
                                                             Email message.
                                                             Depending on the setting of the FLW parameter, the
                                                             flow control mode is either software or hardware.
                                                             Under software flow control mode the Host processor
                                                             must respond to iChip's flow control characters. The
                                                             flow control protocol is detailed in the "Host ➔ iChip
                                                             Software Flow Control" section later in this
                                                             document.
                                                             Under hardware flow control the ~CTS/~RTS RS232
                                                             control signals must be connected and the host must
                                                             respond to iChip's ~CTS signal. The host may send
                                                             data only when the ~CTS signal is asserted (active
                                                             low).

                         !   Stay On-Line after completing the command

              Result code:
                    I/OK   After all text lines have been received and
                                                             terminated by the '.' line.
                    I/ERROR   If a memory overflow has occurred before all text
                                                             lines have been received.
              Followed by
                    I/DONE   After successfully sending the Email. Allow a 2.5
                                                             sec. delay for iChip re-initialization following an
                                                             Internet mode session.
                         or
                    I/ONLINE   After successfully sending the Email, if the stay-
                                                             online flag (!) was specified.
                         or
                    I/ERROR   If some error occurred during the send session.

---

7 HTTP Client Interface

7.1   +iRLNK - Retrieve Link

Syntax: AT+i[!]RLNK[:*URL*]   Retrieve a file from a URL.
                  Parameters: *URL* = Optional URL address, which specifies the
                                      host, path and source-file that will be retrieved.
                                      URL address syntax:
                                      "<Protocol>://<host>[[:<port>]/[<abs_link>]/]"

             Scope: iChip CO110PC
             Command Options:
                        <protocol> = http
                        <host> =   Host name or IP address.
                        <port> =   0..65535 (If not specified, defaults to 80).
                        <abs_link> = Path, filename and file extension of the file to
                                      retrieve on the designated host.
                        !   Stay On-Line after completing the command

             Default: Uses the URL address stored in the URL
                                  parameter.

             Result code:
                  I/OK   When command has been received and about to be
                              processed.
                  I/ERROR   Otherwise.
             Returns:
                  I/<sz><CR><LF>
               Followed by
                  <binary data stream>
                Where,
                  <sz> is the exact size of the <binary data stream> to follow.
                  If <sz> is unknown, iChip returns I/0, followed by the data stream.
                  When this is the case, the host must monitor for a timeout condition of
                  at least 5 seconds without any data being transmitted before seeing one
                  of the terminator lines described under 'Followed by'.

             Followed by:
                  I/DONE   After successfully retrieving the file. Allow a 2.5
                              sec. delay for iChip re-initialization following an
                              Internet mode session.
                  or
                  I/ONLINE   After successfully retrieving the file, if the stay-
                              online flag (!) was specified.
                  or
                  I/ERROR   - Otherwise. (Always proceeded by 5 sec. silence).

---

8 SerialNET Mode Initiation

8.1   +iSNMD - Activate SerialNET Mode

Syntax: AT+i[!]SNMD   Activate SerialNET mode.

       Parameters: None.

       Scope: iChip CO110PC/SNET

       Command Options:

          !   Optional "Auto-Link" mode. When this flag is specified, iChip will immediately go online when activating SerialNET mode (even when serial data has not yet arrived). If the LPRT (Listen Port) parameter is defined, iChip will open the listen port and await a connection. If LPRT is not defined, but HSRV (Host Server) is defined, iChip will immediately open a SerialNET socket link to the server.

       Result code:
         I/OK   If all minimum required parameters for SerialNET mode operation are defined (HSRV or LPRT and for iChip also – ISP1, USRN, PWD)
         I/ERROR   Otherwise.

       Followed by

         I/DONE   After successfully activating SerialNET mode, allow a 2.5 sec. delay for iChip re-initialization.

Note: To terminate SerialNET mode, issue the ESC sequence or power-cycle iChip with the MDSEL signal held low. After exiting SerialNET mode, iChip will return to normal AT+i Command mode.

9 File Transfer Protocol (FTP)

9.1 +i[@]FOPN - FTP Open Session

Syntax: AT+i[@]FOPN:<*server*>[,<*port*>]:<*user*>,<*pass*>[,<*accnt*>]

Open an FTP link to an FTP Server

Parameters: <*server*> = Logical name of the FTP or the
                                server's IP address.
                    <*port*> = Optional FTP port in the range
                                0..65535.
                    <*user*> = FTP User's name.
                    <*pass*> = FTP User's password.
                    <*accnt*> = Optional FTP Account.

Scope: iChip CO110PC/ESFT

Command Options:
        <*server*>   The server name may be any legal Internet server name,
                        which can be resolved by iChip's DNS (Domain Name
                        Server) settings. The server name may also be specified
                        as an absolute IP address given in DOT form.
        <*port*>   Specifies the FTP server's "listening" port. If not
                        specified, port 21 (decimal) is assumed.
        <*user*>   User's name string. This must be a registered user on the
                        FTP server. Some servers allow anonymous login, in
                        which case *user*=anonymous.
        <*pass*>   Password to authenticate user. If special characters are
                        used, the password should be specified within quotes. It
                        is customary that servers which allow anonymous login
                        will request an Email address as a password.
        <*accnt*>   Some FTP servers require an account in order to allow a
                        certain subset of the commands. In this case, the account
                        name must be specified when opening the FTP link.
        @ flag   The optional '@' is used to flag the "Force PASV"
                        mode. When '@' is specified, iChip will only use the
                        PASV method when opening a data socket to *server* for
                        FTP data transfer.

        Result code:
            I/<FTP handle>   Upon successfully connecting to the FTP Server
                                and authenticating the user, a socket handle is
                                returned. The handle <FTP handle> is used to
                                reference the FTP Session in all following FTP
                                commands.
            I/ERROR   Otherwise.

9.2   +iFDL -   FTP Directory Listing

Syntax: AT+iFDL:*<F_hn>*[,*<path>*]   Return a full FTP directory listing.

Parameters: *<F_hn>* = An open FTP Session handle.
<path> = Directory or filename wild card.

Scope: iChip CO110PC/ESFT

Command Options:

<F_hn>   Must have been obtained by a previous execution of an AT+iFOPN command during the current Internet mode session.

<path>   Optional directory name or filename wild card. If *<path>* is a directory, that directory's files shall be listed. If it is a filename wild card, only matching filenames in the current directory shall be listed.
If *<path>* is not specified, the current directory shall be listed in full.

Result code:

I/OK   To acknowledge successful receipt of the command.

I/ERROR   If *<F_hn>* is not an open FTP Session or otherwise some error has occurred.

Returns:

A list of filenames with file attributes. Each file is listed on a separate line, terminated by <CR/LF>. The file data line syntax is FTP server dependant.

Followed by:

I/ONLINE   After successfully retrieving the directory list.

9.3   +iFDNL - FTP Directory Names Listing

Syntax: AT+iFDNL:*<F_hn>*[,*<path>*]   Return the FTP directory name list

Parameters: *<F_hn>* =   An open FTP Session handle.
                                        <path> =   Optional directory or filename
                                                      wild card.

Scope: iChip CO110PC/ESFT

Command Options:
    <F_hn>   Must have been obtained by a previous
                                        execution of an [AT+iFOPN](#) command during
                                        the current Internet mode session.
    <path>   Optional directory name or filename wild card.
                                        If *<path>* is a directory, that directory's files
                                        shall be listed. If it is a filename wild card, only
                                        matching filenames in the current directory shall
                                        be listed.
                                        If *<path>* is not specified, the current directory
                                        shall be listed in full.

Result code:
    I/OK   To acknowledge successful receipt of the
                                        command.
    I/ERROR   If *<F_hn>* is not an open FTP Session or
                                        otherwise some error has occurred.

Returns:
    A bare list of filenames. Each file name is listed on a separate
    line, terminated by <CR/LF>. No attributes are returned in
    addition to the filename.

Followed by:
    I/ONLINE   After successfully retrieving the directory list.

9.4   +iFMKD - FTP Make Directory

Syntax: AT+iFMKD:<F_hn>,<path>   Create a new directory on FTP server's file system.

    Parameters: *<F_hn>* =   An open FTP Session handle.
                                            <path> =   directory pathname.

    Scope: iChip CO110PC/ESFT

    Command Options:
        <F_hn>   Must have been obtained by a previous execution of an AT+iFOPN command during the current Internet mode session.
        <path>   Directory name. A new directory will be created under the current directory, as indicated by *path*. If path includes nonexistent subdirectories, some FTP servers will create them as well.

    Result code:
        I/OK   To acknowledge successful completion of the command.
        I/ERROR   If *<F_hn>* is not an open FTP Session or otherwise some error has occurred.

9.5   +iFCWD - FTP Change Working Directory

Syntax: AT+iFCWD:*<F_hn>*,*<path>*   Change the current FTP working directory

Parameters: *<F_hn>* = An open FTP Session handle.
                            <path> = New directory path name.

Scope: iChip CO110PC/ESFT

Command Options:
    <F_hn>   Must have been obtained by a previous
                            execution of an AT+iFOPN command during
                            the current Internet mode session.
    <path>   Absolute or relative path name of the new
                            directory. The special directory ".." signifies
                            "directory up".

Result code:
    I/OK   After successfully changing the working
                            directory.
    I/ERROR   Otherwise.

9.6   +iFSZ -   FTP File Size

Syntax: AT+iFSZ:*<F_hn>,<path>*   Report an FTP file size

        Parameters: *<F_hn>* = An open FTP Session handle.
                                      <path> = File path name.

        Scope: iChip CO110PC/ESFT

        Command Options:
                <F_hn>   Must have been obtained by a previous
                                      execution of an AT+iFOPN command during
                                      the current Internet mode session.
                <path>   Absolute or relative path name of the remote
                                        file.

        Result code:
                I/*<file size>*   iChip reports *path*'s file size in bytes if the file
                                        exists and the FTP server supports the file-size
                                        FTP command.

                                        Followed by:
                                                I/OK

                I/ERROR   Otherwise.

9.7 +iFRCV - FTP Receive File

Syntax: AT+iFRCV:*<F_hn>,<path>* Download a file from an FTP server.

Parameters:	*<F_hn>* = An open FTP Session handle. *<path>* = File path name.
Scope:	iChip CO110PC/ESFT

Command Options:

<F_hn>	Must have been obtained by a previous execution of an AT+iFOPN command during the current Internet mode session.
<path>	Absolute or relative path name of the remote file.

Result code:

I/OK	When command has been received and about to be processed.
I/ERROR	If *<F_hn>* is not an open FTP Session or otherwise some error has occurred.

Followed by:

I/ERROR	If the FTP RECV command could not be processed.

-or-

I/*<sz>*<CR><LF>
Followed by:
    <data stream>

Where,

<sz> is the exact size (in bytes) of the *<data stream>* to follow. If *<sz>* cannot be determined, iChip returns I/0, followed by the data stream. When this is the case, the host must monitor for a timeout condition of at least 5 seconds without any data being transmitted before seeing the 'I/ONLINE' to deduce that the data stream is complete.
If *<sz>* was reported but a transmission error occurred, preventing iChip from returning all *<sz>* data bytes, an I/ERROR command will be issued after a 5 seconds non-transmission period. See FTP Receive Flow Diagram.

Followed by:

I/ONLINE	After successfully retrieving the file contents

9.8   +iFSTO - FTP Open File for Storage

Syntax: AT+iFSTO:*<F_hn>*,*<path>*[,*<sz>*]

Open a remote FTP server file for upload.

Parameters: *<F_hn>* = An open FTP Session handle.
<path> = Destination file path name.
<sz> = Optional size in bytes to reserve for the
file on the remote FTP server.

Scope: iChip CO110PC/ESFT

Command Options:
<F_hn>   Must have been obtained by a previous
execution of an AT+iFOPN command during
the current Internet mode session.
<path>   Absolute or relative path name of the remote
destination file.

Following this command data is transferred to the remote file
using one or more +iFSND commands. The file transfer is
complete by issuing a +iFCLF (FTP File Close) command.

Result code:
I/OK   If file *<path>* was successfully open for writing
on the FTP server.
I/ERROR   Otherwise.

9.9 +iFAPN - FTP Open File for Appending

Syntax: AT+iFAPN:<*F_hn*>,<*path*>[,<*sz*>]

Open an existing remote FTP server file for Append.

Parameters: <*F_hn*> = An open FTP session handle.
<*path*> = File path name.
<*sz*> = Size in bytes to reserve for the file on server.

Scope: iChip CO110PC/ESFT

Command Options:
<*F_hn*>   Must have been obtained by a previous execution of an AT+iFOPN command during the current Internet mode session.
<*path*>   Absolute or relative path name of the remote destination file.

Following this command data is transferred to the remote file using one or more +iFSND commands. The file transfer is complete by issuing a +iFCLF (FTP File Close) command.

Result code:
I/OK   If file <*path*> was successfully open for appending on the FTP server.
I/ERROR   Otherwise.

9.10 +iFSND - FTP Send File Data

Syntax: AT+iFSND:<*F_hn*>,<*sz*>:<*stream…*>

Upload data to a remote FTP server file.
Only valid after a successful AT+iFSTO or
AT+iFAPN command.

Parameters: <*F_hn*> = An open FTP session handle.
<*sz*> = The exact size of the data stream that
follows.
<*stream*> = a byte stream of size <*sz*>
composing the remote file contents.

Scope: iChip CO110PC/ESFT

Command Options:
<*F_hn*>   Must have been obtained by a previous
execution of an AT+iFOPN command during
the current Internet mode session.
<*stream*>   An 8-bit byte stream of exactly size <*sz*>. If
<*sz*> is larger than 256 bytes, iChip assumes
Host flow control. Depending on the setting of
the FLW parameter, the flow control mode is
either software or hardware. Under software
flow control mode, the Host processor must
respond to iChip's flow control characters. The
flow control protocol is detailed in the "Host ➔
iChip Software Flow Control" section later in
this document. When software flow control is
active, it is recommended to set iChip to Echo-
Off mode.
Under hardware flow control, the ~CTS/~RTS
RS232 control signals must be connected and
the host must respond to iChip's ~CTS signal.
The host may send data only when the ~CTS
signal is asserted (active low).

Several consecutive +iFSND commands may be issued in
sequence to create a larger aggregate of data to be sent.
The File transfer is complete by issuing a +iFCLF (FTP Close
File) command.

Result code:
I/OK   After <*sz*> bytes have been transferred
successfully to the FTP server.
I/ERROR   Otherwise.

9.11   +iFCLF - FTP Close File

Syntax: AT+iFCLF:*<F_hn>*   Close File Downloaded to a remote FTP server
                                                file.
                                                Only valid after a successful AT+iFSTO or
                                                AT+iFAPN command and optional AT+iFSND
                                                commands.

        Parameters: *<F_hn>* = An open FTP session handle.

        Scope: iChip CO110PC/ESFT

        Command Options:
            <F_hn>   Must have been obtained by a previous
                                       execution of an AT+iFOPN command during
                                       the current Internet mode session.

        Result code:
            I/OK   After successfully closing the file.
            I/ERROR   Otherwise.

9.12   +iFDEL - FTP Delete File

Syntax: AT+iFDEL:*<F_hn>*,*<path>*   Delete a remote FTP file

Parameters: *<F_hn>* = An open FTP session handle.
<path> = File path name.

Scope: iChip CO110PC/ESFT

Command Options:
<F_hn>   Must have been obtained by a previous execution of an AT+iFOPN command during the current Internet mode session.
<path>   Absolute or relative path name of the remote destination file to delete.

Result code:
I/OK   After successfully deleting the remote file.
I/ERROR   Otherwise.

9.13 +iFCLS - FTP Close Session

Syntax: AT+i[!]FCLS:<*F_hn*>   Close the FTP link

    Parameters: <*F_hn*> = An open FTP session handle.

    Scope: iChip CO110PC/ESFT

    Command Options:
        <*F_hn*>   Must have been obtained by a previous
                             execution of an AT+iFOPN command during
                             the current Internet mode session.

!	Stay On-Line after completing the command

    Result code:
        I/OK   When command has been received and about to
                             be processed.

    Followed by:
        I/DONE   When the FTP link was the last open socket and
                             after successfully closing the FTP link.
                             Allow a 2.5 sec. delay for iChip re-initialization
                             following an Internet mode session.
        or
        I/ONLINE   After successfully closing the FTP link, when
                             additional sockets are still active or the stay-online
                             flag (!) was specified
        or
        I/ERROR   Otherwise.

10 Direct Socket Interface

10.1   +iSTCP - Open and Connect a TCP Socket

Syntax: AT+iSTCP:*<host>*,*<port>*[,*<lport>*]   Opens a TCP (Transmission Control Protocol) client socket and attempts to connect it to the specified *<port>* on a server defined by *<host>*.

Parameters: *<host>* = Logical name of the target server or a host IP address.
<port> = 0..65535, target port
<lport> = Optional local port on iChip.

Scope: iChip CO110PC

Command Options:
<host>   The server name may be any legal Internet-server name, which can be resolved by the iChip's DNS (Domain Name Server) settings. The server name may also be specified as an absolute IP address given in DOT form.
<port>   It is assumed that the server system is "listening" on the specified port.
<lport>   May be optionally specified to force iChip to use *lport* as the local port when opening the TCP socket. If unspecified, iChip will allocate a port from its internal pool[1].

Result code:
I/<sock handle> Upon successfully opening and connecting the TCP socket to the *<host>*:*<port>*, a socket handle is returned. The socket handle <sock handle> is in the range 0..9 and is used to reference the socket in all following socket commands.
I/ERROR   Otherwise.

Note [1]: iChip uses port range [1025 .. 2048] when assigning default local ports. The host should refrain from specifying local ports in this range to ensure that Error 218 is not generated as a result of requesting local ports that overlap internal assignments.

10.2 +iSUDP - Open a Connectionless UDP Socket

Syntax: AT+iSUDP:*<host>*,*<rport>*[,*<lport>*]

Opens a UDP (User Datagram Protocol) socket and sets the remote system's <host>:<port> address.

Parameters:

<host> = Logical name of the target server or a host IP address. Or, 0.0.0.0 to open a non-connected socket.

<rport> = Remote port number to send to. Or, 0 to open a non-connected socket.

<lport> = Optional local UDP port to use.

Scope: iChip CO110PC

Command Options:

<host>   The remote system's name may be any legal Internet server name, which may be resolved by the iChip's DNS (Domain Name Server) settings. The server name may also be specified as an absolute IP address given in DOT form. When the <host> is defined, the resulting UDP socket will be created and connected. If <host>='0.0.0.0', the socket is created but remains unconnected. The first UDP packet to arrive will automatically latch the senders IP port, in effect connecting the socket.

<rport>   Specifies the remote system's port.

<lport>   Specifies the local port to use. If unspecified, iChip will allocate a port from its internal pool.

Result code:

I/<sock handle> Upon successfully opening and connecting the UDP socket to the *<host>*:*<port>*, a socket handle is returned. The socket handle <sock handle> is in the range 0..9 and is used to reference the socket in all following socket commands.

I/ERROR   Otherwise.

10.3   +iLTCP - Open a TCP Listen Socket

Syntax: AT+iLTCP:*<port>,<backlog>*   Opens a TCP listen socket on the local IP
                                                                 address and the specified port *<port>*.
                                                                 <backlog> specifies the maximum number
                                                                 of remote concurrent connections allowed
                                                                 through the listen socket.

   Parameters: *<port>* = 0..65535
                                                  <backlog> = 1..10

   Scope: iChip CO110PC

   Command Options:
          <port>   Listening port to be used by a remote system
                                             when connecting to iChip.
          <backlog>   Specifies the maximum number of active
                                             connections that may be concurrently
                                             established through the listen socket.

          Once the listen socket is open, it will automatically *accept*
          remote *connect* requests until the maximum allowed. When a
          remote system connects through the listen socket, a new TCP
          socket is spawned internally and is ready to send and receive
          data. See the AT+iLSST command for details on retrieving the
          handles of active sockets connected through a listen socket.
          When a connected socket is closed, the listen socket will allow a
          new connection in its place.

   Result code:
          I/<sock handle> Upon successfully opening a TCP listen socket,
                                     a socket handle is returned. The socket handle
                                     <sock handle> is in the range 10..11 and is used
                                     to reference the socket in all following socket
                                     commands.
          I/ERROR   Otherwise.

10.4   +iLSST - Get a Listen Socket's Active Connection Status

Syntax: AT+iLSST:*<hn>*   Retrieve handles of active socket connections, established through the listen socket identified by *<hn>*.

Parameters: *<hn>* = A TCP listen socket handle of an open listen socket.

Scope: iChip CO110PC

Command Options:
<hn>   Must have been obtained by a previous AT+iLTCP command during the current Internet session.

Result code:
$I/(<hn_1>,…,<hn_{Backlog}>)$

A list of active socket handles. The list shall contain <backlog> elements, where <backlog> was used when opening the listen socket identified by *<hn>*.
Where,

$<hn_i> >= 0$: A handle to an active connected socket
$= -1$: No connection has been established.

I/ERROR   If *<hn>* is not an open listen socket, or otherwise some error occurred.

10.5   +iSST -   Get a Single Socket Status Report

Syntax: AT+iSST:*<hn>*   Retrieve a socket status report for a single socket. This is a subset of the general AT+iRP4 report command.

   Parameters: *<hn>* = A TCP/UDP socket handle.

   Scope: iChip CO110PC

   Command Options:
        <hn>   Must have been obtained by a previous execution of an AT+iSTCP or AT+iSUDP command during the current Internet mode session. Or a socket *accepted* by a listen socket.

   Result code:
        I/(*<sockstat>*)
                Where,
                        <sockstat> >= 0 : Number of bytes pending in socket *<hn>*'s input buffer
                                    <   0 : Socket Error code

        I/ERROR   If some error occurred.

10.6   +iSCS -   Get a Socket Connection Status Report

Syntax: AT+iSCS:*<hn>*   Retrieve a socket's connection status report.

    Parameters: *<hn>* = A TCP/UDP socket handle.

    Scope: iChip CO110PC

    Command Options:
     <hn>   Must have been obtained by a previous
          execution of an AT+iSTCP or AT+iSUDP
          command during the current Internet mode
          session. Or a socket ***accepted*** by a listen socket.

    Result code:
     I/(<sockstat>)
       Where,
         <sockstat> =   000 : Socket is connected and with
                 no associated errors.
             <   0 : Socket Error code

     I/ERROR   If some error occurred.

10.7 +iSSND[%] -   Send a Byte Stream to a Socket

Syntax: AT+iSSND[%]:*<hn>*,*<sz>*:*<stream>*

	Send a byte stream of size *<sz>* to the socket specified by the socket handle *<hn>*.
Parameters:	*<hn>* = A TCP/UDP socket handle of an open socket. *<sz>* = The exact size of the byte stream that follows. *<stream>* = a byte stream of size *<sz>* to be sent to the specified socket.
Scope:	iChip CO110PC

Command Options:

<hn>	Must have been obtained by a previous execution of an AT+iSTCP or AT+iSUDP command during the current Internet mode session. Or a socket *accepted* by a listen socket.
<sz>	0..4GB.
<stream>	An 8-bit byte stream of exactly size *<sz>*. If *<sz>* is larger than 256 bytes, iChip assumes Host flow control. Depending on the setting of the FLW parameter, the flow control mode is either software or hardware. Under software flow control mode, the Host processor must respond to iChip's flow control characters. The flow control protocol is detailed in the "Host ➔ iChip Software Flow Control" section later in this document. Under hardware flow control, the ~CTS/~RTS RS232 control signals must be connected and the host must respond to iChip's ~CTS signal. The host may send data only when the ~CTS signal is asserted (active low).
'%' flag	When the auto-flush ('%') flag is specified, the socket is automatically flushed immediately after receiving the *<stream>*. Otherwise, data will be transmitted to the Internet only in integral quantities of the specified MTU (Maximum Transfer Unit) or when the AT+iSFSH command is issued.

Result code:

I/OK	After *<sz>* bytes have been transferred successfully to the socket's output buffer.
I/ERROR	Otherwise.

10.8   +iSRCV - Receive a Byte Stream from a Socket's Input Buffer

Syntax: AT+iSRCV:*<hn>*[,*<max>*]   Receive a byte stream from the TCP/UDP socket specified by the socket handle *<hn>*. Receive data is valid only if it already resides in iChip's socket input buffer at the time this command is issued.

    Parameters: *<hn>* = A TCP/UDP socket handle of an open socket.
<max> = Optionally specifies the maximum number of bytes to transfer. Additional bytes may remain in the socket input buffer following this command.

Scope: iChip CO110PC

Command Options:
    <hn>   Must have been obtained by a previous execution of an AT+iSTCP or AT+iSUDP command during the current Internet mode session. Or a socket ***accepted*** by a listen socket.
    <max>   If *<max>* is not specified, all available bytes residing in the socket input buffer shall be returned.

Result code:
    I/ERROR   If *<hn>* is not an open socket, or otherwise some error occurred.

Returns:
    I/<sz>[:<binary data stream>]
    Where,

        <sz> is the exact size of the binary data stream to follow.
If the socket input buffer is empty, iChip returns I/0. In this case the ':' and *<binary data stream>* are omitted.
<sz> is guaranteed to be equal or less than *<max>*, when specified.

10.9 +iGPNM - Get Peer Name for a Specified Socket

Syntax: AT+iGPNM:*<hn>*   Retrieve Peer Name (<IP>:<Port>) of a remote
                                          connection to a TCP/UDP socket specified by
                                          the socket handle *<hn>*.

         Parameters: *<hn>* = A TCP/UDP socket handle of an open
                                          socket.

         Scope: iChip CO110PC

         Command Options:
              <hn>   Must have been obtained by a previous
                                          execution of an AT+iSTCP or AT+iSUDP
                                          command during the current Internet mode
                                          session. Or a socket *accepted* by a listen socket.

         Result code:
              I/(<IP>:<Port>)
                        Where,
                                          <IP> is the remote peer's IP address, and
                                          <Port> is the remote peer's port for this
                                          connection.

              I/ERROR   If *<hn>* is not an open socket handle, or
                                          otherwise some error occurred.

10.10 +iSDMP - Dump Socket Buffer

Syntax: AT+iSDMP:*<hn>*   Dump all buffered data currently accumulated in a socket's inbound buffer. The socket remains open.

  Parameters: *<hn>* = A TCP/UDP socket handle of an open socket.

  Scope: iChip CO110PC

  Command Options:
    <hn>   Must have been obtained by a previous execution of an AT+iSTCP or AT+iSUDP command during the current Internet mode session. Or a socket *accepted* by a listen socket.

  Result code:
    I/OK   If *<hn>* is a handle to an open socket.
    I/ERROR   Otherwise.

10.11 +iSFSH[%] -   Flush Socket's Outbound Data

Syntax: AT+iSFSH[%]:*<hn>*   Flush (immediately send) accumulated data in a
                                          socket's outbound buffer.

            Parameters: *<hn>* = A TCP/UDP socket handle of an open
                                          socket.

            Scope: iChip CO110PC

            Command Options:
                <hn>   Must have been obtained by a previous
                                          execution of an AT+iSTCP or AT+iSUDP
                                          command during the current Internet mode
                                          session. Or a socket *accepted* by a listen socket.
                '%' flag   When the flush-and-acknowledge ('%') flag is
                                          specified and *<hn>* is a TCP socket handle,
                                          iChip will both flush and wait for the peer
                                          receipt acknowledgment of all outstanding
                                          outbound data.
                                          Common errors associated with this flag are 215
                                          (carrier lost) and 203 (socket closed by peer in
                                          an orderly manner or did not receive ACK after
                                          10 tries to retransmit unacknowledged data).

            Result code:
                I/OK   If *<hn>* is a handle to an open socket and, when
                                          <hn> is a TCP socket handle, all outbound data
                                          has been received (and when '%' flag specified
                                          also acknowledged) by peer.
                I/ERROR   Otherwise.

10.12 +iSCLS - Close Socket

Syntax: AT+i[!]SCLS:*<hn>*   Close a TCP/UDP socket. If the socket was the only open socket and the stay-online flag ('!') was not specified, iChip will terminate the Internet session and go offline.

 Parameters: *<hn>* = A TCP/UDP socket handle of an open socket.

Scope: iChip CO110PC

Command Options:
        <hn>   Must have been obtained by a previous execution of an AT+iLTCP, AT+iSTCP or AT+iSUDP command during the current Internet mode session. Or a socket *accepted* by a listen socket.

                            A socket will always be flushed before being closed. TCP sockets are disconnected from the remote host server in an orderly manner.

        !   Stay On-Line after completing the command

Result code:
        I/OK   If *<hn>* is a handle to an open socket.
        I/ERROR   Otherwise.

Followed by:
        I/DONE   After successfully closing the last open socket. Allow a 2.5 sec. delay for iChip re-initialization following an Internet mode session.
        or
        I/ONLINE   After successfully closing the socket, while additional sockets are still open or if the stay-online flag (!) was specified.

        or
        I/ERROR   Otherwise.

11 Special Modem Commands

11.1   +iMCM -   Issue Intermediate Command to Modem

Syntax: AT+iMCM   Enter Modem Command mode.

          Parameters: None.

          Scope: iChip CO110PC

          Command Options: If the modem is online, iChip will put the modem in
                                   command mode by issuing the '+++' escape
                                   sequence. Then iChip will enter Modem Command
                                   mode. In this mode, all following commands shall
                                   be transferred as-is to the modem. Modem replies
                                   shall be relayed back to the host processor. iChip
                                   will not implement any translations or functional
                                   handling of the commands. Modem Command mode
                                   will be exited after the host issues the ATO
                                   command. iChip will transfer the ATO command to
                                   the modem and relay the modem's response back to
                                   the host.
                                   Modem command shall also be exited if the host issues an
                                   AT+i followed by a <CR>. In this case, iChip will just
                                   reply with I/OK.
          Returns:
                  Modem's response(s), including command echo, if it is enabled.

              Followed by
                  I/OK   When the modem successfully returns online.
                   Or
                  I/ERROR   If modem was unable to go back online.

12 IP Registration

When iChip goes online in a dial-up or cellular environment, it is normally assigned a dynamic IP address during PPP establishment. Since a different IP address is usually assigned every session, it is not practical to use iChip as a server, since the clients do not know what IP address to use. Furthermore, under these restrictions, there is no practical way to know if a specific system is online or offline.

To overcome this problem, iChip incorporates built-in procedures designed to register its IP address on a server system each time it goes online. Once registered, client systems may interrogate the servers in order to verify the online status of a specific system and retrieve its currently assigned IP address. The IP registration process is governed by several AT+i parameters. Once these parameters are configured, iChip will register its IP address accordingly when it goes online as a result of an explicit AT+i command (AT+iUP) or as a result of automated Internet session establishment procedures, such as a triggered Internet session or when going online as a SerialNET mode server.

In cases where the iChip uses a NAT gateway to the Internet, it may be configured to register the NAT's IP address and a special port that is linked to the iChip in the NAT's configuration. See details in the RRRL parameter description. When this is the case, the RRRL parameters (IP and port) will be used instead of the local IP and port values that iChip is assigned, in both registration methods (RRSV and RRWS).

iChip includes two IP registration methods:

12.1 Socket Registration

iChip registers itself by opening a socket to a registration server and sending its ID information and current IP address. When iChip's RRSV parameter contains a value, iChip will establish a socket to the server defined in RRSV during the registration procedure. When a socket is established, iChip will transmit its ID information and current IP address (or the RRRL) in the following format:

"iChip-<D/L/S> S/N:<RP5> version: <RP1> HN:<HSTN> IP:<IPA or RRRL> Port:<LPRT or 80 or 0>"

The registration socket is then closed.

12.2 Web Server Registration

iChip registers itself by "surfing" to a Web server with its ID information and current IP address as parameters. If the RRWS parameter contains a URL (of a registration Web server), iChip will register its ID information and IP using the URL, by issuing a GET command along with a fixed format parameter line:

"<RRWS path>?SN=<RP5>&IP=<IPA or RRRL>&WPt=<0 or the port defined in RRRL>&HN=<HSTN>".

The Web server must contain a CGI, .asp page, exe, etc., which will make use of these parameters to register the iChip.

If several registration parameters are configured, iChip will go through multiple registration processes. If more than one registration process fails, iChip will return an I/ERROR result describing the first failure encountered. If all registrations fail, iChip will return I/ERROR(90).

13 Flow Control

13.1 Host ➔ iChip Software Flow Control

When issuing an AT+iSSND command to transfer data to a socket, an AT+iEOA command to transfer an Email, or an AT+iFSND command to transfer a file, the host transfers a binary data stream to iChip. At times, this stream may be very large. Once iChip establishes a connection, it acts as a pipeline, transferring data received from the host to the Internet. However, the data rates at the host and Internet ends are not always balanced. This happens for several reasons:

1. While iChip is logging on to the Internet and establishing a connection, the host proceeds to send its data stream to iChip. During this time iChip receives data from the host, but cannot send it out.
2. When using a TCP/IP socket, iChip may need to retransmit packets.
3. Host and modem baud rates may differ.

The amount of buffer space available in iChip to accommodate for this imbalance is limited. Therefore, a flow control scheme is required to regulate host⇔iChip communications. The FLW iChip parameter is set to reflect the preferred flow control mode.

The software driven, flow control protocol, is defined as follows:

1. While the host is transferring the binary stream, following the +iSSND, +iEOA or +FSND prefixes, iChip will issue a 'WAIT' control character when it needs to pause the host. The host application is required to monitor its serial receive line and pause the transmission when a 'WAIT' control character is received.
2. To resume the host transmission, iChip will issue a 'CONTINUE' control character. The host is required to monitor its receive line after being paused in anticipation of this control character. Once received, the host may continue to transfer the data stream.
3. If an error occurs during the Internet session while the host is transferring the data stream (or while paused), iChip will issue an 'ERROR' control character if some error occurred. Immediately after issuing this control character, iChip will abort the Internet session and issue an 'I/ERROR (error number)' string. The host must cease transmitting the data stream when the 'ERROR' control character is received.

The control characters are defined as:

Control	ASCII Dec	ASCII Hex	Mnemonic
WAIT	22	0x16	SYN
CONTINUE	24	0x18	CAN
ERROR	5	0x5	ENQ

Table 13-1 Software Flow Control Characters

13.2   Software Flow Control Diagram During FTP Send
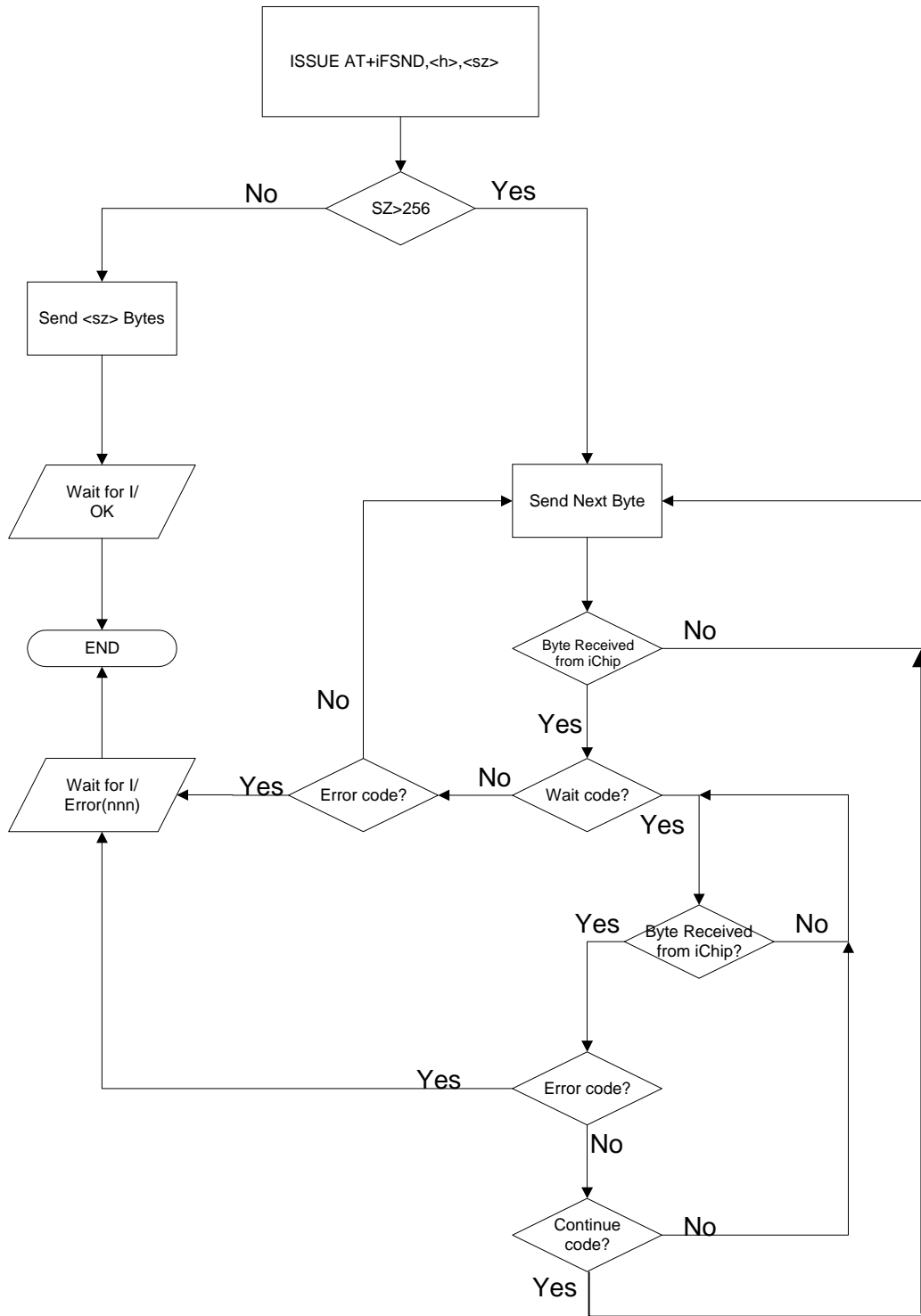
Figure 13-1 Software Flow Control in FTP Send

13.3   Software Flow Control During a Socket Send

When a 'WAIT' control is sent to the host during a socket send (AT+iSSND) command, it is automatically followed by a RP4 socket status in the following syntax:

I/(<*sock0sz*>, <*sock1sz*>, … ,<*sock9sz*>)<CR/LF>

See the AT+iRP command for a full description.

While the host is waiting for the 'CONTINUE' control, it may analyze the sockets' input buffer status. If the host detects a need to execute a socket receive command to empty one or more socket input buffers, it may escape the current SSND command by issuing a '*Pause*' sequence immediately after receiving the 'CONTINUE' control. The '*Pause*' sequence is defined as: ½ second of silence followed by '---' (three consecutive minus-sign characters). iChip will respond by prematurely terminating the SSND command, including flushing the current socket if the '%' flag was specified. Following this, the 'I/OK' will be issued and the host may issue the required SRCV command in addition to any other operations it needs to execute. The host may return to the preempted socket at any time and issue a new SSND command to send out the balance of data.

13.4 Software Flow Control Diagram during Socket Send
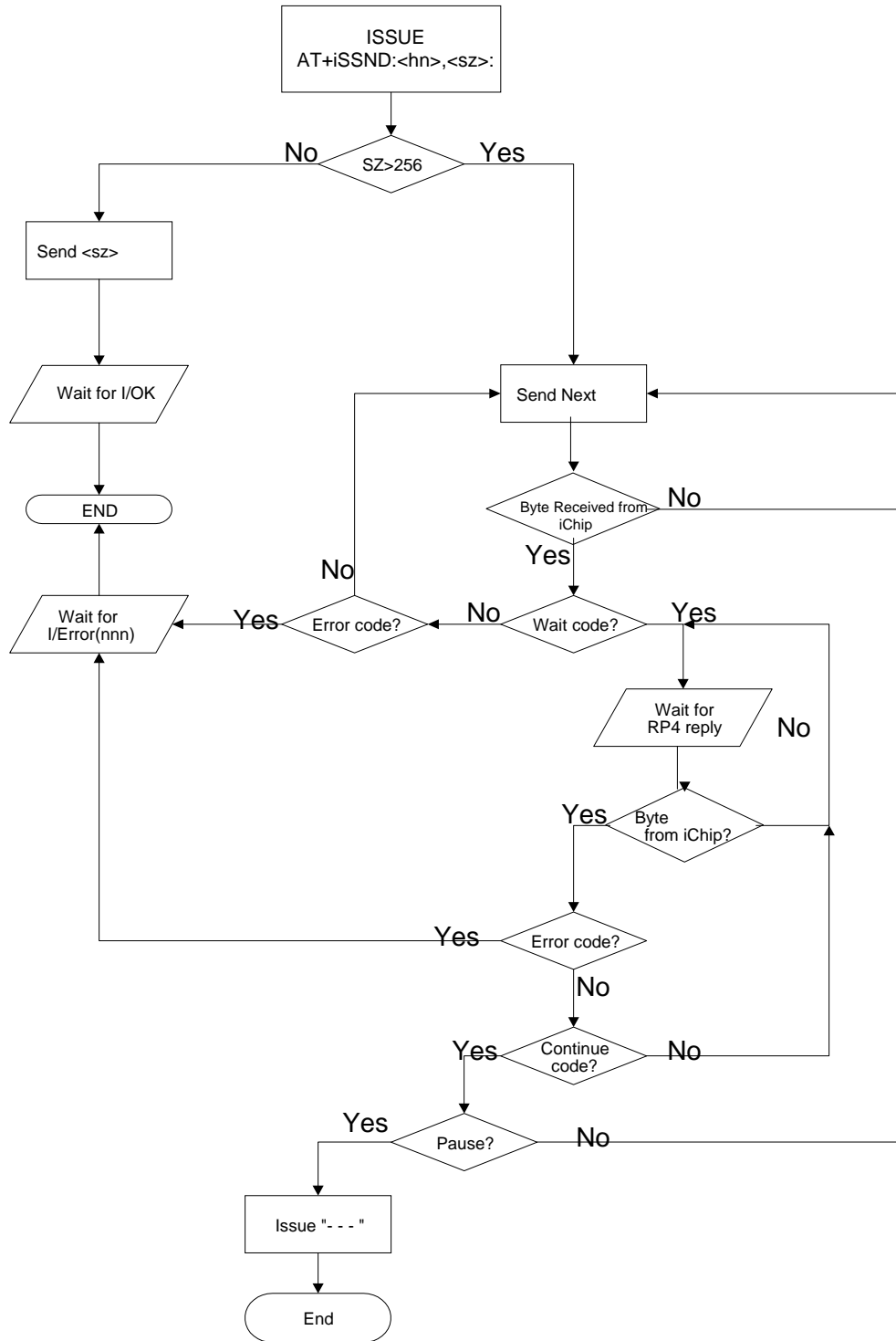
Figure 13-2 Software Flow Control in Socket Send

13.5   Host ➔ iChip Hardware Flow Control

As an alternative to the software flow control method, which requires some software attention on behalf of the host, iChip offers a hardware flow control mode. This mode is selected by setting iChip's FLW parameter Bit 0, using the AT+iFLW command. Note that to set FLW Bit 0, the ~CTSH signal needs to be LOW (Enabled), otherwise iChip will return I/ERROR(063). This convention safeguards iChip from lockup, which may arise if FLW Bit 0 is set while the ~CTSH signal is constantly HIGH.

For hardware flow control to operate properly, the ~CTS and ~RTS signals between the host and iChip UARTS must be interconnected.

iChip ~CTSH and ~RTSH may be shorted to circumvent H/W flow control.

Under this mode, iChip will assume that the host transmission may be paused by de-asserting the ~CTS signal. The host must adhere to this convention. Most UARTs support hardware flow control; however, if this is not the case, iChip's ~CTS signal should be monitored by the host software on a general purpose I/O.

The host may also pause the iChip by de-asserting its ~CTS signal.

If a transmission error occurs during processing of a send command (SSND, EOA, FSND), iChip shall accept all remaining characters pertaining to the current command (as specified by the *<sz>* parameter) before returning the relevant I/ERROR response.
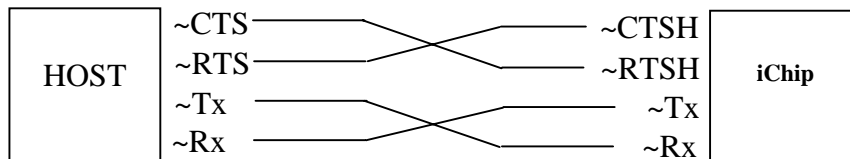
Figure 13-3 Minimum Hardware Flow Control Connections

14 iChip Firmware Update

iChip CO110PC only accepts firmware updates directly over its local serial port. iChip's boot loader contains a permanent, preprogrammed monitor that governs the firmware update procedure. To update iChip's firmware, it is necessary to activate its monitor using one of two methods:

1. Issue the AT+iFU (Firmware Update command)
2. Apply power to iChip while the –FUSEL signal (pin 44) is held LOW.

When iChip's monitor is activated, the CO110PC firmware update utility may be used to update a new firmware version.

Connect One's iChipConfig WIN/PC Utility Version 2.3.38 and up supports CO110PC firmware update. The iChipConfig Utility attempts to activate monitor mode by issuing the AT+iFU command at a fixed baud rate of 115 Kbps. Therefore, iChip must either be in 115K baud rate or in auto baud rate to respond to this activation. If the iChipConfig Utility does not succeed to communicate with iChip's monitor mode, it will display a dialog box requesting the local operator to power-up iChip with the –FUSEL (pin 44) signal held LOW. For more information, see the iChipConfig Utility User's Manual.

15 iChip RAS Server

15.1 Introduction

iChip features an internal RAS server, which makes it possible to dial into iChip, using an active modem platform. With this feature, a remote dialer may dial into iChip and, when configured as a RAS (Remote Access Server), iChip will answer the call and negotiate a PPP connection.

iChip's RAS supports acknowledging an IP address request from the remote dialer side, as well as assigning a default IP address. All other iChip IP protocol functionality will be enabled, allowing the host to issue Internet protocol AT+i commands based on the PPP connection. Note, however, that since iChip is not connected to an actual ISP in this mode, iChip will not have access to the public Internet and, thus, only direct connections between iChip and the connected PPP client will be possible.

15.2 RAS Parameters

Three parameters govern the use of iChip's RAS server:

i.   RAU   - RAS Login User Name
   The RAU parameter defines the allowable user name for login purposes when iChip answers an incoming call as a RAS. The remote dialer must specify the correct user name and matching password in order to successfully complete the PPP connection. This parameter must have a non-empty value for the RAS feature to be enabled. Otherwise, when RAU is empty, iChip's RAS is effectively disabled. When RAU contains the special character, '', the RAS is enabled but no authentication is required.*

ii.   RAP   - RAS Login Password
   The remote dialer must provide the correct password in order to successfully complete the PPP connection. When the RAP parameter is empty or contains, '', any password string will be accepted, in effect nullifying the authentication process.*

iii.   RAR   - Number of RINGs before picking up the line
   When iChip's RAS feature is enabled, the RAR parameter defines the number of RINGs that must arrive before iChip picks up the line and transfers control to its RAS.

15.3   RAS Theory of Operation

When a remote client dials into iChip, the modem RING strings are transferred by iChip (which defaults to transparent mode) to the host. When the RAS feature is enabled (RAU contains a value), iChip will pick up the line and negotiate a PPP connection by issuing the ATA (modem) command after RAR RING strings have been received. If the host chooses to manage a direct (modem-to-modem) data connection, it may pick up the line before RAR 'RING' strings have arrived by issuing the 'ATA' modem command.

During RAS PPP negotiations, iChip will reply only to '+++' (Escape sequence) and AT+iRP*n* commands. Specifically, iChip will reply "Connecting as RAS" to the AT+iRP2 (iChip Status) command. The Escape sequence may be used to abort the RAS session at any time. The AT+iRP2 command is the only means for the host processor to determine that a PPP session is in progress. iChip manages the RAS protocol internally and does not transfer any information to the host. Any other commands that may be received from the host will be disregarded by iChip.

Once the PPP connection has been fully negotiated and established, iChip will respond to all AT+i commands as when it is online. Specifically, iChip will reply "RAS Connected" to the AT+iRP2 command.

As part of the PPP negotiation, iChip will assign itself the default IP address 192.168.0.1 and allocate 192.168.0.2 as the client IP address. However, if the client requests a specific IP address, iChip will always grant the client's request and use the client's IP minus 1 as its own IP address.

The following restriction to the minus 1 rule will apply: if the IP requested by the client minus 1 is an IP address that ends with 0x00 or 0x255 as the last nibble, iChip will assign itself with the client's IP plus 1 instead of minus 1. This is done to assure that the IP iChip assigns itself will never violate the rule that defines that a network or host IP segment may not be all binary 1s, nor all binary 0s.

15.3.1 Auto PPP RAS Mode

iChip allows combining RAS and direct modem-to-modem communication sessions. A special mode, named Auto PPP RAS, supports dialing into iChip with a PPP dialer or a regular modem.

Auto PPP RAS mode is enabled by enabling RAS mode **and** adding a +100 offset to the RAR parameter, where [<*RAR*>-100] determines the number of RINGS after which iChip will automatically pick up the line and negotiate a PPP connection. The host processor may instruct the modem to pick up the line beforehand by issuing the ATA (modem) command or by setting the modem to auto-answer after less than [<*RAR*>-100] RING strings. This is normally done in order to manage a direct modem-to-modem (non PPP) communication session.

When iChip is in the Auto PPP RAS mode, it will monitor the data stream following the modem "CONNECT" line. If the first character transmitted by the remote end is '~' (0x7E), iChip will defer to PPP negotiation. The '~' will be the last character transmitted to the host end to signal that iChip has taken over the negotiations. Upon this event, iChip will continue to negotiate a PPP connection internally in a manner similar to the procedure that occurs when iChip picks up the line after receiving <*RAR*> 'RING' strings. If, however, the first character received from the calling end after the "CONNECT" line is not a '~' (0x7E), iChip will remain in Transparent mode, and a regular modem-to-modem data session will transpire.

15.3.2 SerialNET Mode

The RAS may also be enabled while iChip is in SerialNet mode. In this case, however, the modem 'RING' strings will not be forwarded to the host serial port. Once the PPP connection is established, iChip will proceed to act as it would after receiving a RING event and creating a PPP connection to a remote RAS server. That is, a listen socket will be established on the LPRT socket, available for a SerialNET connection. This provides an alternative means to 'wake-up' a SerialNET server device.

15.3.3 Lost Carrier

When iChip is online as a result of a RAS connection and the Carrier signal is lost (due to an error or due to the PPP client closing the connection), iChip will check if the host used the PPP connection (tried to open an internet session) during the connection. If the host did not use the connection or iChip was in SerialNET mode, iChip will silently perform software reset and no indication of the disconnection will be given to the host. Otherwise, if the host did use the connection, iChip will act as if this was a regular session created by the host that was terminated with a lost Carrier signal. The error code will be returned to the host on the next command that requires the use of the connection and only then will a software reset be performed.

15.3.4 Restrictions

Modem 'RING' strings will not be detected while the baud rate between iChip and the host is not yet established. This means that, in order to use the RAS feature, one of following must apply:

1. BDRF was set to a fixed value (3-9 or h).
2. iChip is in SerialNET mode with its baud rate defined by the SNSI parameter.
3. An 'a' or 'A' was previously received from the host serial port and iChip has determined the host's baud rate.

16 SerialNET Theory of Operation

16.1 Introduction

iChip SerialNET mode extends a local asynchronous serial link to a TCP or UDP socket across the Internet. Its main purpose is to allow simple devices, which normally interact over a serial line, to interact in a similar fashion across a network, without requiring any changes in the device itself. In order to achieve this, SerialNET mode defines a set of associated operational parameters, which define the nature of the desired network connection. When iChip is put in SerialNET mode, it acts as a router between the device's serial port and the network.

Devices that communicate with a terminal over a serial link fall into three major categories: Output only (i.e. printers), Input only (i.e. controllers) and interactive (bi-directional communications). The latter are subdivided further into **clients** and **servers**. Generally, clients initiate communications by sending service demands to a server, while servers respond to client demands.

SerialNET mode reacts differently to client or server devices. When a client device initiates communications, SerialNET mode must establish a network connection to a remote server before data may flow between the two systems. On the other hand, when a remote client needs to invoke a device, the remote client first contacts iChip and SerialNET is invoked to create a communication flow to the local server device.

SerialNET mode in iChip includes components to handle both server and client local devices. The iChip under SerialNET mode will route full-duplex data between a networked terminal and both types of devices.

16.2 SerialNET Mode

iChip's SerialNET mode is established by first defining all related parameters using AT+i commands, followed by a special "Enter SerialNET Mode" AT+i command.

Once in SerialNET mode, no additional AT+i commands may be sent, as the host serial link will be dedicated to raw local-device data. In this mode, auto baud rate is also disabled, since it cannot be guaranteed that the device will issue an 'a' or 'A' as its first character. Thus, a predefined fixed baud rate must be specified before switching over to SerialNET mode.

SerialNET mode will extend across power down, since it is assumed that once acting in this mode, iChip will not normally be connected to an AT+i aware host.

SerialNET mode may be terminated by: (a) applying power to the iChip with the MDSEL signal pulled low for less than 5 seconds; or (b) issuing the ESC sequence defined as <half second Delay> followed by "+++" (3 '+' characters) through the serial port. When one of these events occurs, iChip shall reboot after terminating SerialNET mode. At this point, iChip reverts to its normal operational mode and again responds to AT+i commands.

16.3   Server Devices

Server devices linger until approached by a remote client. The remote client must know iChip's IP and Listen port address in order to establish communications.

A dial-up device is normally offline and must thus be awakened to go online at a precise moment. Moreover, once it connects to the Internet, it usually receives a dynamic IP address. This address must be communicated in some way to the client device in order to establish a link across the Internet. iChip resolves these problems by supporting a wake-up call and automatically implementing one or two IP registration procedures. This allows a client to wake up an iChip in SerialNET mode and retrieve its dynamic IP address from a registration server.

iChip waits for a 'RING' signal on the modem to trigger it into activity. In this case, the remote client device dials directly into iChip and hangs up after two rings. When contacted, iChip (under SerialNET mode) waits for the 'RING' to subside and then dials into its ISP and connects to the Internet.

If the RRSV parameter contains a server name and port number, iChip will register its IP address using the Socket registration method.

If the RRWS parameter contains a URL, iChip will register its IP address using the Web server registration method.

Once connected, iChip transfers all arriving data from the local device over the serial link. Device responses are routed back to the initiating client. Data will flow freely between the two systems until a predefined activity termination event is triggered, upon which the remote connection is dropped.

iChip's MDSEL signal (see iChip) may be lowered to GND to emulate the RING event. This is useful for testing and debugging purposes of the SerialNET connection procedure or as a means to cause iChip to activate the ring-response procedure as a result of some TTL hardware signal.

16.4   Client Devices

Client devices initiate communications to a server. When a client device first sends data on its serial link, iChip (in SerialNET mode) buffers the incoming data bytes and attempts to establish a connection to a remote server. After going online, iChip will perform an IP registration process, according to the RRSV and RRWS parameters. Once the socket connection is established, iChip transmits the buffered data collected during the connection period. The MBTB parameter dictates the maximum number of bytes to buffer. If additional bytes are received on the serial port before the connection is established, they will be discarded.

The remote server's IP address and port number are part of the SerialNET mode configuration parameters. Once a data connection is established, data can flow freely between the local client device and the remote server. If a connection cannot be obtained,

eventually the client device's data will be discarded (similar to the case of a device transmitting serial data without a serial cable connected).

Data continues to flow until a predefined activity termination event is triggered, upon which the remote connection is dropped.

16.5   Automatic SerialNET Server Wake-up Procedure

A SerialNET client may be configured to wake up a remote SerialNET server provided it has its phone number. The SPN parameter is used to store this wake-up number. When SPN contains a phone number and no Host Server Name and/or IP address are defined, the SerialNET client will try to retrieve them from the registration Email of a remote SerialNET server. When characters are received from the host port, the SerialNET client will dial the SerialNET server and then hang up, causing the server to connect to its ISP, send a registration Email containing its IP address and local port, and open a listen socket on that port.

The client, after waking up the server, connects to its ISP and starts polling the predefined mailbox for the server's registration Email. Once this Email arrives, the client opens a socket to the IP address and port defined in the Email. The SWT (SerialNET Wakeup Timeout) parameter will define how long iChip will wait for this procedure to conclude before stopping. Data will then flow until a predefined activity termination event is triggered, upon which the remote connection is dropped.

16.6   Transmit Packets

Data originating in the local device is buffered, packetized and transmitted to the remote system over the network. Packets are formed as a result of meeting at least one of the following criteria:

1. A predetermined amount of bytes have been received from the local link (MCBF).
2. The TCP/IP connection MTU was met.
3. A predetermined flush character has been received (FCHR).
4. A predetermined inactivity timeout event was triggered (MTTF).

Until one of these events occurs, data is buffered in iChip. When an event occurs, a packet is transmitted. The event parameters are configured by setting AT+i parameters prior to initiating SerialNET mode. When a UDP connection is used, data packets are atomic, maintaining their original size. When a TCP connection is used, packets may be combined before being actually transmitted. This follows from the stream nature of the TCP protocol.

Data originating in the remote system is routed to the local device as it is made available.

Flow control may be governed locally using hardware flow control only.

16.7   Completing a SerialNET Session

A SerialNET session is complete when one of the following occurs:
1. The local device transmitted the disconnection string, as defined in the DSTR parameter.
2. Following an inactivity timeout, as defined in the IATO parameter.

iChip will go offline when the SerialNET session is terminated.

16.8   SerialNET Failed Connection

If iChip fails to establish a SerialNET connection, SerialNET mode will be deactivated for a delay period defined in the SNRD parameter.

16.9   Local Serial Port Configuration

Prior to entering SerialNET mode, iChip's local serial port may be configured to comply with a wide range of devices by assigning a value to the SNSI parameter.

Serial port configuration entails settings to:
Baud rate:	2400, 4800, 9600, 19200, 38400, 56K or 115K bits per second
Bits/byte:	7 or 8
Parity:	None, Even or Odd
Stop Bit:	1 or 2
Flow Control:	None(0) or Hardware(1)

16.10   Activation Command

iChip shall be forced into SerialNET mode by issuing the following command:

   AT+i[!]SNMD

If the minimal SerialNET parameters are defined, iChip will reply with 'I/OK', followed by I/DONE.

If iChip was online when this command was issued, it will close the Internet session in an orderly manner. This includes closing all open sockets and disconnecting from the ISP.

When iChip boots up in SerialNET mode, it will set the host serial channel to the fixed baud rate and serial interface parameters defined in the SNSI parameter.

In an iChip dial-up environment, the modem is polled for the 'RING' string. If the ring-response server parameter (RRSV) contains a value, iChip will wait for the 'RING' strings to subside and connect to the Internet. Once online, it will establish a socket to the address in RRSV (if defined). The transmission contains the dynamic IP address received from the ISP and its Listen port on which iChip has an open listen socket, ready to serve the remote client.

iChip will go offline if one of the following events occurs:

1. The remote peer closed the SerialNET socket
2. The IATO parameter was defined and timed-out
3. The terminating string defined in the DSTR parameter was received

When the optional '!' ("Auto-Link" mode) flag is specified, iChip will immediately go online in response to the AT+i!SNMD command. In this case, if one of the terminating events occurs, iChip will not go offline. Rather, the SerialNET socket will be closed while iChip will stay online.

iChip will exit SerialNET mode when one of the Escape procedures is activated (see preceding paragraph). The BDRF parameter will then govern iChip's baud rate mode.

17 File Transfer Protocol (FTP) Theory of Operation

17.1   Introduction

The FTP client component in iChip extends iChip's general-purpose sockets to incorporate an additional, dedicated socket for FTP activities. From the host's perspective, the FTP capabilities are a logical extension of the capabilities of Email and direct socket manipulation.

As in all other iChip protocol implementations, host involvement in the specifics of FTP is kept minimal. iChip needs to deal with non-standard FTP issues, such as possible differences between FTP server responses, on its own. Multi stage FTP protocol sequences are atomized under iChip control to minimize complexity and need for host processor intervention.

The FTP protocol is described in RFC 959.

17.2   iChip FTP Client Command Set

Open FTP link to FTP Server
- Retrieve File List from Server
- Change Directory on Server
- Retrieve File Contents from Server
- Open a New File on Server
- Open an existing File on Server for Append
- Send Binary Data to an open File on Server
- Close a File on Server After Binary Data Send
- Delete File on Server
- Close FTP Session

17.3   iChip FTP Client Operation Mode

FTP specifies several operational modes. The RFC calls for a minimum implementation, which should be observed by all FTP servers. iChip restricts its operation mode to the minimum implementation to assure best intersystem compatibility.

Character Types:	ASCII Non-print
Structure:	File
Mode:	Stream

17.4   FTP Command Socket

The FTP command socket is normally on port 21 (decimal) of an FTP server. However, other ports may be specified to support special cases.

17.5   FTP Receive Flow
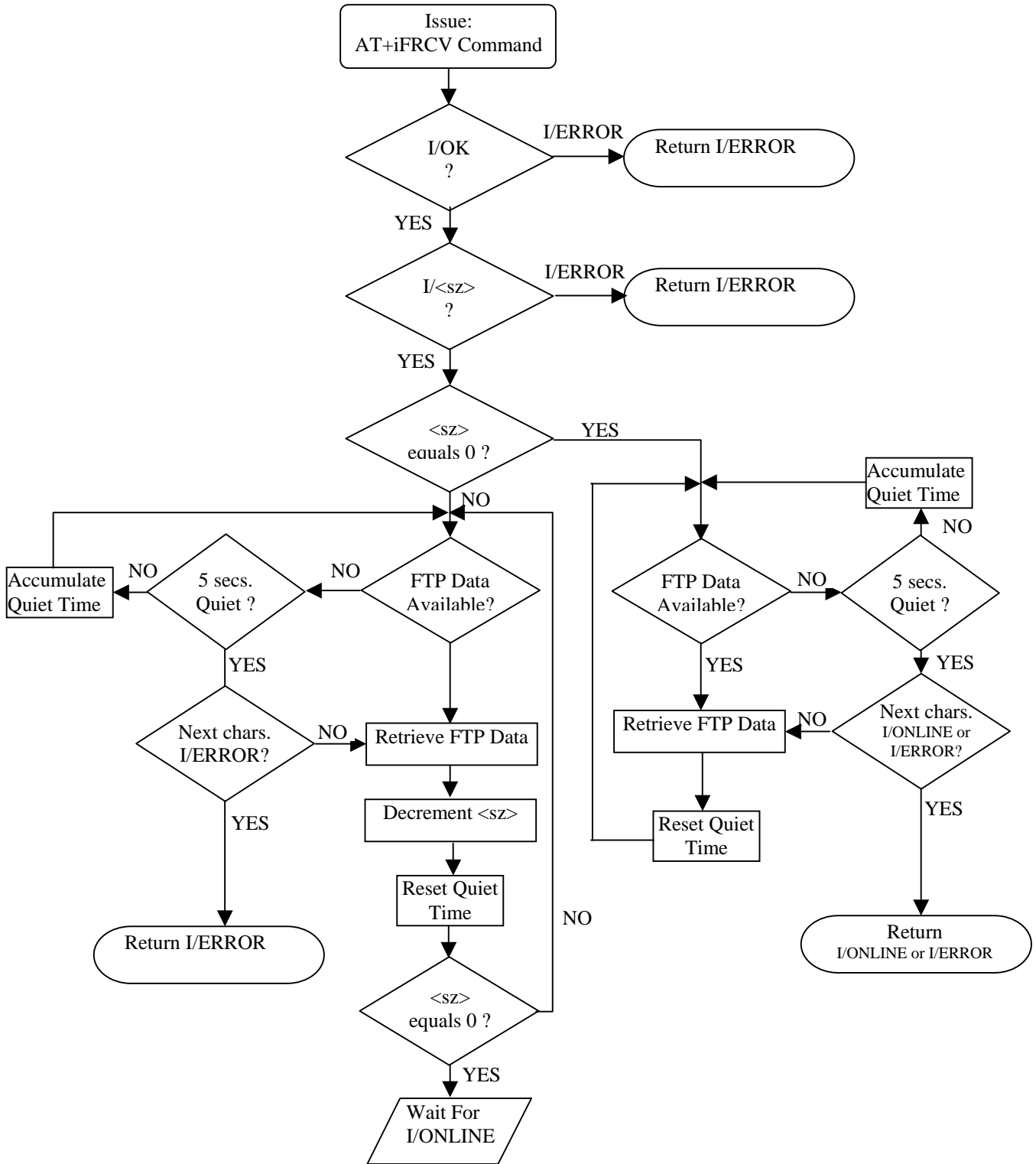
Figure 17-1 FTP Receive Flowchart

18 Remote AT+i Service

18.1   Introduction

The LATI parameter allows configuring iChip to maintain a communication channel, which supports interacting with iChip from a remote location, using the AT+i command set, as if the commands are administered through the local serial port. When LATI is set to a non-zero value, iChip will open a TCP listen socket on port *<LATI>* after the PPP connection is established. This listen socket may be used to connect to iChip's remote AT+i service.

18.2   Remote AT+i Commands

When a remote client connects to iChip's LATI socket, iChip redirects the socket's data flow to the AT+i parser, in effect allowing the socket to take over the parser. Any data coming from the socket will be processed by iChip as if it came from the host serial port and the replies will be returned to the socket instead of being sent to the host serial port. iChip will reply with an "I/BUSY" to commands coming from the host serial port, while the remote client is connected.

An exception to this is the "+++" Escape sequence. On detection of "+++" from the host serial port, iChip will close the remote connection and reboot.

If iChip was in the process of performing some Internet activity initiated by the host at the time the remote client connected, iChip will allow this activity to end and the final reply to reach the host before passing control over the parser to the remote client.

18.3   Closing a Remote AT+i Session

To close a remote AT+i session, the remote client can choose to issue AT+iDOWN via the socket. In response to this, iChip will restart. Only I/OK will be returned over the socket before it is closed by iChip. Alternatively, the remote client may close the socket in order to disconnect, leaving iChip's Internet session as is. In the latter case, iChip will return control over the parser to the local host port. The LATI listen will remain active, available to service additional remote connections.

Note: '+++' sent over the LATI socket will **not** be recognized as an Escape Sequence.

18.4   Caveats and Restrictions

   a. When iChip is in auto baud rate detection mode (after restarting with BDRF='a' or in response to the AT+iBDRA command), a remote AT+i session cannot be established, even if the LATI parameter contains a port value.
   b. During a remote AT+i session, the remote client taking over the parser cannot make use of iChip's mechanisms of Hardware or Software flow control, which exist for the local host port. The only mechanism iChip will use is this mode is TCP level flow control (using the TCP window).

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19 Nonvolatile Parameter Database

19.1   Parameter Descriptions

Parameter	Type	Range	Default	Scope	Description
Operational					
XRC	Byte	0..4	4	iChip 110	Extended Return code. Same as ATXn.
DMD	Byte	0..2	0	iChip 110	Modem Dial Mode: ATD<*m*> *m*: **T**one (0); **P**ulse (1); None (2)
MIS	String	126 chars	"AT&FE0V1X4Q0&D2M1L3\r"	iChip 110	Modem initialization string. May contain several consecutive AT commands.
MTYP	Byte	0..9	0	iChip 110	Modem Type Designator
WTC	Byte	0..255	45	iChip 110	Wait Time Constant. Initialization constant for modem's S7 register. Defines a timeout constant for a variety of modem activities.
TTO	INT	0..3600	0	iChip 110	TCP Timeout. Number of seconds to wait before returning a timeout error on a TCP transaction.
PGT	Unsigned INT	0-65535	0 [mSec]	iChip 110	Timeout to resend a PING request.
MPS	Byte	0..3	0 (1500)	iChip 110	Max PPP Packet Size.
TTR	INT	0..65535	3000 [mSec]	iChip 110	Timeout to resend an unacknowledged TCP packet over PPP, in milliseconds.
BDRF	Byte	1..8	'a' (Auto)	iChip 110	Sets the iChip⇔Host to a fixed baud rate.
BDRM	Byte	1..8	'a' (Auto)	iChip 110	Sets the iChip⇔modem baud rate to a fixed baud.
LATI	INT	0-65535	0(Disabled)	iChip 110	Remote AT+i Service, port number.
FLW	Byte	0..7	0 (S/W)	iChip 110	Flow Control Mode.
PSE	Byte	0..1	0(Disabled)	iChip 110	Set Power-Save Mode: Disabled(0); Enabled(1)
WDM	Byte	0..4	0(Disabled)	iChip 110	Watch Dog Activation Mode.
SDM	Byte	0..7	0(All Enabled)	iChip 110	Service Disable Bit-map.
DF	Byte	0..1	0	iChip 110	IP Protocol "Don't Fragment" Bit.

Parameter	Type	Range	Default	Scope	Description
ISP Connection					
ISPn	Phone #	96chars	NULL	iChip 110	ISP's access phone number. <n>:1..2
ATH	Byte	0..2	1 (PAP)	iChip 110	Use CHAP(2), PAP(1) or Script(0) authentication.
USRN	String	64chars	NULL	iChip 110	ISP Connection User name.
PWD	String	64chars	NULL	iChip 110	ISP Connection Password.
RDL	Byte	0..20	5	iChip 110	Number of Redial tries.
RTO	Byte	0..3600	180	iChip 110	Timeout before redialing [seconds].
Server Profiles					
DNSn	IP address		0.0.0.0	iChip 110	Domain Name Server IP address. <n>:1..2
SMTP	String	64chars	NULL	iChip 110 /ESFT	SMTP server name.
SMA	Byte	0..1	0(None)	iChip 110 /ESFT	Define SMTP Authenticated Method: 0(None) 1(Login authentication)
SMU	String	64chars	NULL	iChip 110 /ESFT	SMTP Authentication User Name.
SMP	String	64chars	NULL	iChip 110 /ESFT	SMTP Authentication Password.
PDSn	String	64chars	NULL	iChip 110	Set iChip's PING Destination servers, used for online status verification.
PFR	INT	0-65535	0(Disabled)	iChip 110	Set PING destination server polling-Frequency.
Email Format					
SBJ	String	96chars	NULL	iChip 110 /ESFT	Contents of the Email subject field.
TOA	String	64chars	NULL	iChip 110 /ESFT	Email Addressee.
TO	String	96chars	NULL	iChip 110 /ESFT	Addressee Description/Name in Email header.
REA	String	64chars	NULL	iChip 110 /ESFT	Return Email Address.
FRM	String	96chars	NULL	iChip 110 /ESFT	Sender Description/Name in Email header.
CCn	String	64chars	NULL	iChip 110 /ESFT	Alternate Addressee (CC: field) <n>:1..4

Parameter	Type	Range	Default	Scope	Description
HTTP					
URL	String	128 chars	None.	iChip 110	URL string used for subsequent +iRLNK commands to upload Web pages and files.
RAS Server					
RAR	Byte	2..20	4	iChip 110	Number of RINGs after which iChip will activate its internal RAS Server.
RAU	String	64chars	NULL	iChip 110	RAS Login User Name.
RAP	String	64chars	NULL	iChip 110	RAS Login Password.
IP					
IPA	IP address		0.0.0.0	iChip 110	IP address assigned to iChip.
IP Registration					
RRMA	String	64 chars	NULL	iChip 110	Set the Email address to use for dynamic IP address registration after going online.
RRSV	String	64 chars	NULL	iChip 110	Set the server name/IP and port to contact for dynamic IP address registration after going online.
RRWS	String	128 chars	NULL	iChip 110	Set the Web Server URL used for dynamic registration after going online.
RRRL	String	64 chars	NULL	iChip 110	Set the Return Link IP address to use when performing an IP address registration behind a NAT.
HSTN	String	64 chars	NULL	iChip 110	iChip's Network Host Name. Is included in all IP registration methods.

Parameter	Type	Range	Default	Scope	Description
SerialNET Mode					
HSRV	String	64 chars	NULL	iChip 110 /SNET	Set the remote host server name/IP and port.
DSTR	String	8 chars	NULL	iChip 110 /SNET	Set the disconnection string template.
LPRT	Unsigned INT	0-65535	0	iChip 110 /SNET	Set the SerialNET mode listen socket.
MBTB	INT	0-2048	0`	iChip 110 /SNET	Max bytes to buffer while iChip is establishing a connection.
MTTF	Unsigned INT	0-65535	0 (None)	iChip 110 /SNET	Max inactivity timeout in milliseconds before flushing the SerialNET socket.
FCHR	Byte	1 char	0 (None)	iChip 110 /SNET	Flush character. When received, SerialNET socket will be flushed.
MCBF	INT	0-1460	0 (None)	iChip 110 /SNET	Max. characters before flushing the SerialNET socket.
IATO	INT	0-32768	0 (None)	iChip 110 /SNET	Inactivity timeout in seconds before closing the SerialNET connection.
SNSI	String	9 chars	"5,8,N,1,0"	iChip 110 /SNET	SerialNET mode Serial interface configuration. Defines baud, bits, parity, stop and flow control.
STYP	Byte	0..1	0 (TCP)	iChip 110 /SNET	Set the SerialNET mode socket type. 0 (TCP) or 1 (UDP).
SNRD	INT	0..3600	0 (No Delay)	iChip 110 /SNET	Delay time in seconds before re'enabling SerialNET mode after a failed connection.
PTD	INT	0..65535	0 (No Filter)	iChip 110 /SNET	Specifies the number of Packets to Drop during a SerialNET session.

Table 19-1 Nonvolatile Parameter Database

19.2   +iFD -   Restore all Parameters to Factory Default

Syntax: AT+iFD   Restore iChip's nonvolatile parameter database
                                        values to factory defaults.

    Parameters: None.

    Scope: iChip CO110PC

    Command Options:

                                        Each of iChip's nonvolatile parameters,
                                        described in the following section, has an
                                        associated default value. This command restores
                                        all parameters to the default value.
                                        An exception to this are the MIS (Modem Init
                                        String), and RPG (Remote Parameter
                                        Group/Password), which will always retain the
                                        last set value.
    Result code:
      I/OK   After restoring parameters to default value

19.3   +iPARS - Store all Parameter Updates to Nonvolatile Database

Syntax: AT+iPARS   Store all parameter value updates, currently in
                                 memory, to the nonvolatile parameter database.
                                 (Parameter values are updated with AT+i
                                 assignment commands: AT+i<param>=<value>).
                                 Following this command, all current value updates
                                 will become permanent and shall retain their value
                                 after iChip is powered off.

        Parameters: None.

        Scope: iChip CO110PC

        Result code:
            I/OK   After storing all parameter values.

19.4   +iPARD - Drop all Parameter Updates Currently in Memory

Syntax: AT+iPARD   All parameter value updates, currently in memory, are dropped. Following this command, all parameters shall revert to the valued stored in the nonvolatile database.

        Parameters: None.

        Scope: iChip CO110PC

        Result code:
           I/OK   After dropping all parameter value updates.

19.5   Parameter Access Commands

19.5.1 +iXRC -   Extended Result Code

Syntax: AT+iXRC=*n*   Extended Result Code. Same as ATXn. This command selects which subset of the result messages will be used by the modem to inform the Host of the results of commands.

Parameters: *n* = 0 .. 4

Command Options:

For a detailed description of the command options see the ATXn command in the AT command set manual for the modem in use.

Default: 4

Scope: iChip CO110PC
Result code:
  I/OK   If *n* is within limits.
  I/ERROR   Otherwise.

AT+iXRC?   Report the current Extended Result Code used when dialing the ISP.
The reply is followed by I/OK.

19.5.2 +iDMD - Modem Dial Mode

Syntax: AT+iDMD=*n*   Permanently set the modem dial mode to Tone, Pulse, or None. This parameter defines the dial character *m* used when issuing the ATD*m* dial command to the modem.

Parameters: *n* = 0 .. 2

Command Options:
n = 0   Use Tone dialing (*m*=T).
n = 1   Use Pulse dialing (*m*=P).
n = 2   Use modem's default dialing (*m*='').

Default: 0 (Tone Dialing)

Scope: iChip CO110PC
Result code:
I/OK   If *n* is within limits.
I/ERROR   Otherwise.

AT+iDMD?   Report the current modem dial mode used when dialing the ISP.
The reply is followed by I/OK.

19.5.3 +iMIS - Modem Initialization String

Syntax: AT+iMIS=*str[;str...]*   Permanently set the Modem Initialization String.

Parameters: *str* = Modem initialization string.

Command Options:
str="   Empty: No modem initialization string defined.
str=<string> *string* will be used as the modem initialization string. If *string* contains special characters, such as quotation marks (' or "), these may be included in *string* by prefixing each special character with a backslash ('\'). For example: "AT+CGCONT,\"IP\",\"INTERNET\"". *string* must include the AT prefix and the modem reply is expected to include 'OK'.

MIS may include several consecutive modem commands, separated by a semicolon. Each command must begin with 'AT' and its modem reply must include 'OK'. iChip will send each 'AT' command separately, followed by <CR> and wait for the 'OK' before proceeding.

Default: 'AT&FE0V1X4Q0&D2M1L3'
Note: *This default value is shipped from the factory. The [AT+iFD](#) command does not restore MIS to this value.*

Scope: iChip CO110PC

Result code:
I/OK   If *str* is an empty or a legal string.
I/ERROR Otherwise.

AT+iMIS?   Report the current modem initialization string. If the modem initialization string is empty, only <CRLF> will be returned. The reply is followed by I/OK.

19.5.4 +iMTYP - Set Type of Modem Connected to iChip

Syntax: AT+iMTYP=*n*   Set the modem type

Parameters: *n* = 0 .. 9

Command Options: *n* = 0 Standard Hayes-compatible Dial-up Modem
                     n = 1 Reserved.
                     n = 2 GSM Modem
                     n = 3 AMPS CM900
                     n = 4 Falcom GSM Modem
                     n = 5 Reserved
                     n = 6 Standard 2400 baud modem (increased timeout)
                     n = 7 GSM 536 (limit packets to 536 bytes)
                     n = 8 Reserved
                     n = 9 Wavecom Fastrack Cellular Modem
         +100   Add 100 to any modem type to prohibit iChip from issuing an ATZ to the modem before dialing the ISP when an Internet session is activated. This is useful if the modem needs to be initialized manually before an Internet session.
Note that an ATZ will be issued when the session is terminated.

Default: *n* = 0 Standard, Hayes compatible

Scope: iChip CO110PC

Result code:
        I/OK   If *n* is within limits.
        I/ERROR   Otherwise.

AT+iMTYP?   Returns current modem type designator.
                    The reply is followed by I/OK.

Note 1: Configure the iChip to work with GPRS modems as follows:

        1. AT+iMTYP=2 – GSM/GPRS modem type
        2. AT+iXRC=0 – blind dialing
        3. AT+iISP1=<*ISP/Provider dial number*> (usually *99**1#)4.
           AT+iMIS="AT+CGDCONT=1,IP,<*Proxy*>"

Note 2:   Changing from Modem type 4 (Falcom GSM Modem):

When iChip is configured with MTYP=4 (Falcom GSM Modem), the MTYP parameter must first be changed to the special value 99 before it maybe changed to some other value.

19.5.5 +iWTC - Wait Time Constant

Syntax: AT+iWTC=*n*   This parameter is used to set the modem register
                                        S7 to the required value (using the "ATS7=*n*"
                                        command).

       Parameters: *n* = 0..255

       Command Options: The WTC parameter defines a timeout constant for
                                        a variety of modem activities. For a detailed
                                        description of this parameter see the ATS7=*n*
                                        command in the AT command set manual for the
                                        modem in use.

       Default: 45 (seconds)

       Scope: iChip CO110PC

       Result code:
           I/OK   If *n* is within limits.
           I/ERROR   Otherwise.

    AT+iWTC?   Report the current Wait Time Constant used.
                                        The reply is followed by I/OK.

19.5.6 +iTTO -   TCP Timeout

Syntax: AT+iTTO=*n*   Permanently set the number of seconds iChip will allot an Internet transaction to complete before returning the timeout error.

           Parameters: *n* = 0..3600 [seconds]

           Command Options: The TTO parameter defines the timeout constant for Internet transactions. iChip will return with a timeout error for any TCP/UDP/IP transaction that didn't complete properly within $n\pm10\%$. Timeout measurement is defined between receipt of an AT+i command and an iChip response to the host. Timeout measurement begins only after establishing a PPP connection. Furthermore, an additional 10-15 seconds may be required to allow iChip to disconnect the modem.
$n = 0$ is a special case where internal timeout constants will be used.

           Default: 0 (use iChip's factory default timeout values)

           Scope: iChip CO110PC

           Result code:
                I/OK   If *n* is within limits.
                I/ERROR   Otherwise.

        AT+iTTO?   Report the current Internet transaction timeout used. The reply is followed by I/OK.

19.5.7 +iPGT -   PING Timeout

Syntax: AT+iPGT=*n*   Permanently set the timeout in milliseconds, after
                                          which iChip will reissue a PING request that has
                                          not been replied to.

      Parameters: $n = 0..65535$ [milliseconds]

      Command Options: After issuing a PING request, in response to the
                                          AT+iPING command, iChip will wait up to *n*
                                          milliseconds for a reply. If a reply is not received,
                                          iChip will reissue the PING request.
                                          $n = 0$ is a special case where a timeout of 2 seconds
                                             is used.

      Default: 0 (use iChip's factory default 2 seconds timeout)

      Scope: iChip CO110PC

      Result code:
            I/OK   If *n* is within limits.
            I/ERROR   Otherwise.

    AT+iPGT?   Report the current PING transaction timeout used.
                                          The reply is followed by I/OK.

19.5.8 +iMPS -   Max PPP Packet Size

Syntax: AT+iMPS=*n*   Limit the size of an outgoing PPP packet in dial-up environments. In effect, the MPS parameter limits iChip's MTU (Maximum Transfer Unit).

Parameters: $n = 0 .. 3$

Command Options: $n = 0$ 1500 bytes
$n = 1$ 256 bytes
$n = 2$ 536 bytes
$n = 3$ 1024 bytes

Default: $n = 0$

Scope: iChip CO110PC

Result code:
I/OK   If *n* is within limits.
I/ERROR   Otherwise.

AT+iMPS?   Returns current value.
The reply is followed by I/OK.

19.5.9 +iTTR -   TCP Retransmit Timeout

Syntax: AT+iTTR=*n*   Set the timeout, in milliseconds, after which an
                                        unacknowledged TCP packet will be retransmitted
                                        over a PPP connection by iChip.

    Parameters: *n* = 0 .. 65535

    Default: 3000 milliseconds

    Scope: iChip CO110PC

    Result code:
        I/OK   if *n* is within limits
        I/ERROR   Otherwise.

    AT+iTTR?   Report the current value.
                                        The reply is followed by I/OK.

19.5.10 +iBDRF - Define a Fixed Baud Rate on Host Connection

Syntax: AT+iBDRF=*n*   Set the baud rate on host serial connection. This parameter is saved to nonvolatile memory and activated only after power-up.

        Parameters: n = 3 .. 9 or 'a' or 'h'

        Command Options:

            n = a set baud rate to 'Autobaud'
            n = 3 set baud rate to 2400
            n = 4 set baud rate to 4800
            n = 5 set baud rate to 9600
            n = 6 set baud rate to 19200
            n = 7 set baud rate to 38400
            n = 8 set baud rate to 57600
            n = 9 set baud rate to 115200
            n = h set baud rate to 230400

        When BDRF is set to 'a', iChip will boot in auto baud rate mode. In this mode, iChip will synchronize on the first 'a' or 'A' character sent (normally as part of an AT or AT+i command) and detect its baud rate. The detected baud rate will prevail until the iChip is power-cycled or issued the AT+iBDRA command.

        Default: 'a' (Autobaud)

        Scope: iChip CO110PC

        Result code:
          I/OK   If *n* is within limits. iChip will continue operating in the current baud rate setting. Further power-ups will initialize the baud rate to the new selected value, until a different AT+iBDRF command is issued.

          I/ERROR   Otherwise

      AT+iBDRF?   Returns the code for the specified fixed baud rate. The reply is followed by I/OK.

19.5.11   +iBDRM- Define a Fixed Baud Rate on iChip⇔ Modem Connection

Syntax: AT+iBDRM=*n*   Set the baud rate on modem connection. This
                                parameter is saved to nonvolatile memory and
                                activated after **every power-up**.

            Parameters: 3 .. 9 or 'a' or 'h'

            Command Options:

                                n = a set baud rate to 'Autobaud'
                                n = 3 set baud rate to 2400
                                n = 4 set baud rate to 4800
                                n = 5 set baud rate to 9600
                                n = 6 set baud rate to 19200
                                n = 7 set baud rate to 38400
                                n = 8 set baud rate to 57600
                                n = h set baud rate to 230400

            Default: 'a' (auto baud). The iChip⇔ modem connection
                                will be set to the same baud rate as that detected on
                                the host⇔ iChip connection.

            Scope: iChip CO110PC

            Result code:
                I/OK   If *n* is within limits. iChip will continue operating
                                in the current baud rate setting. Further power-up
                                will initialize the baud rate to the new selected
                                value, until a different AT+iBDRM command is
                                issued.

                I/ERROR   Otherwise.

        AT+iBDRM?   Returns the code for the specified fixed modem
                                baud rate.
                                The reply is followed by I/OK.

19.5.12   +iLATI -   TCP/IP Listen Socket to Service Remote AT+I commands

Syntax: AT+iLATI=*port*   Sets the Remote AT+i service Listen port number.
                                         When connected to the Internet, opens a TCP/IP
                                         listen socket on the local IP address and the
                                         specified *port*.

           Parameters: *port* = 0..65535

           Command Options:
                   port=0   Remote AT+i service disabled.
                   port=<portnum>   Listening port to be used by a remote system
                                               when connecting to iChip in order to send
                                               AT+i commands over the Internet.

           The Listen socket will *accept* one remote *connect* request. When a
           remote system connects through the listen socket, iChip will disable
           its local host serial port and spawn a new TCP/IP socket, ready to
           receive AT+i commands. AT+i response strings will be transmitted
           back to the same socket.

           When the connected socket is closed, the local host serial port
           will be re-enabled and the listen socket will be ready to *accept* a
           new connection. The remote end may also issue the AT+iDOWN
           command to force iChip to disconnect and reboot.

          Default: 0 (Disabled)

          Scope: iChip CO110PC

          Result code:
                  I/OK   Upon successfully opening the remote AT+i
                                           service TCP/IP listen socket.
                  I/ERROR   Otherwise.

          AT+iLATI?   Returns current AT+i service Listen port number.
                                   The reply is followed by I/OK.

19.5.13 **+iFLW - Set Flow Control Mode**

Syntax: AT+iFLW=*n*   Set the flow control mode.

Parameters: *n* = 0 .. 7

Command Options:

n =   Bitmapped flags:
Bit 0   0 = Host S/W flow control, using
Wait/Continue control characters.
1 = Host H/W flow control based on
~CTS/~RTS hardware signals.

Bit 1   0 = No Modem flow control.
1 = Modem H/W flow control based on
~CTS/~RTS hardware signals.

Bit 3   Reserved.

Default: '0' (Host S/W flow control, No modem H/W flow
control).

Scope: iChip CO110PC

Result code:
I/OK   If *n* is within limits. See Note.
I/ERROR   Otherwise.

AT+iFLW?   Returns current flow control mode.
The reply is followed by I/OK.

Note: When setting Bit 0 (Host H/W flow control), the ~CTSH signal must be LOW
(Enabled). Otherwise, iChip will return I/ERROR(063).

19.5.14   +iPSE -   Set Power Save Mode

Syntax: AT+iPSE=*n*   Enable or Disable iChip's Power Save Mode

       Parameters: *n* = 0..1

       Command Options:

                n = 0   Disable Power Save mode.

                n = 1   Enable Power Save mode. When Power Save mode is enabled, iChip will automatically shutdown most of its circuits after a period of 5 seconds without any activity on the host or modem serial ports. Renewed activity on the serial ports will restore iChip to full operational mode.

       Default: 0 (Disabled)

       Scope: iChip CO110PC

       Result code:
          I/OK   If *n* is within limits.
          I/ERROR   Otherwise.

      AT+iPSE?   Report the currently Power Save mode setting. The reply is followed by I/OK.

19.5.15 +iWDM - Set Watchdog Activation Mode

Syntax: AT+iWDM   Set iChip's Watchdog operation mode

Parameters: $n = 0..4$

Command Options: $n = 0$ Disabled Watchdog Function
                   $n = 1$ Reserved for future use.
                   $n = 2$ Enable Internal Watchdog circuit.
                   $n = 3$ Reserved for future use.
                   $n = 4$ Reserved for future use.

After the Watchdog circuit is enabled, firmware stability and proper execution will be monitored. In the event that the firmware crashes or does not execute properly, the Watchdog circuit will generate a hard RESET.

Once iChip restarts, it will:
1. Restore the host serial port to the baud rate in effect when the WDR command was issued, regardless of the BDRF parameter value.
2. A modem hang-up process will be performed to resolve the possible case where the modem was online, when the RESET occurred.
3. A BREAK condition is forced on the TXDH signal, to notify the host that a Watchdog reset has occurred.

Default: 0(Disabled)

Scope: iChip CO110PC

Result code:
          I/OK   If n is within limits.
          I/ERROR   Otherwise.

AT+iWDM?   Report the currently Watchdog activation setting. The reply is followed by I/OK.

19.5.16   +iSDM -   Service Disabling Mode

Syntax: AT+iSDM=*n*   Set the Service Disabling mode bits.

Parameters: *n* = 0 .. 7

Command Options:
   n =   Bitmapped flags:
      Bit 0   Disable iChip's response to ICMP ECHO (PING) requests.
               When this bit is set, iChip will not respond to any PING requests,
               thereby eliminating the possibility of a PING attack on iChip

Default: '0' (All services enabled).

Scope: iChip CO110PC

Result code:
      I/OK   If *n* is within limits.
      I/ERROR   Otherwise.

AT+iSDM?   Returns current Service Disabling mode.
                         The reply is followed by I/OK.

19.5.17 +iDF -   IP Protocol "Don't Fragment" Bit Value

Syntax: AT+iDF=*n*   Set the value of the "Don't Fragment" bit used in all subsequent IP packets.

   Parameters: *n* = 0..1

   Command Options:

                      n = 0   IP packets transmitted may be fragmented by routers.

                      n = 1   IP packets transmitted may not be fragmented by routers.

   Default: 0

   Scope: iChip CO110PC

   Result code:
        I/OK   If *n* is within limits.
        I/ERROR   Otherwise.

   AT+iDF?   Report the current IP protocol "Don't Fragment" bit setting.
                       The reply is followed by I/OK.

19.5.18   +iISPn -   Set ISP Phone Number

Syntax: AT+iISP*n*=*dial-s*   Permanently set the ISP's access phone numbers. Use *n*=1 to set the ISP's primary access phone number.
Use *n*=2 to set the ISP's alternate number. The alternate number is dialed after exhausting all redial attempts of the primary number.

         Parameters: *n* = 1..2
dial-s = Telephone number string, composed of digits, ',', '-', 'W', 'w', '*', '#', '!' or ' '. See description of the standard ATD command. Note: If a character that is defined as a Delimiter is used within the dial string, the string must be entered between apostrophes.

         Command Options:
             dial-s=''   Empty access number.
             dial-s=<*number*>   *number* will be set as ISP access number.

         Default: Empty. No permanent ISP access number defined.

         Scope: iChip CO110PC

         Result code:
             I/OK   If *dial-s* is a legal phone number string.
             I/ERROR   Otherwise.

     AT+iISP*n*?   Report the current value of the ISP's primary/alternate access numbers. If the number does not exist, only <CRLF> is returned. The reply is followed by I/OK.

19.5.19   +iATH -   Set PPP Authentication Method

Syntax: AT+iATH=v Permanently set Authentication method to v.

      Parameters: $v = 0 .. 2$

      Command Options:
         v=0   Use script driven authentication (Obsolete).
         v=1   Use PAP authentication.
         v=2   Use CHAP authentication.

      Default: 1 (PAP)

      Scope: iChip CO110PC.

      Result code:
         I/OK   If v is within limits.
         I/ERROR   Otherwise.

    AT+iATH?   Report the current setting of the authentication
                   method.
                   The reply is followed by I/OK.

19.5.20   +iUSRN - Define Connection User Name

Syntax: AT+iUSRN=*user*   Permanently set connection User Name.
        Parameters: *user* = User name to be used when logging on to
                            the ISP.

        Command Options:
            user="   Empty: No user-name defined.
            user=<*user-name*> *user-name* will be used to login to the ISP.

        Default: Empty. No user name defined. The login user name
                            may be defined ad-hoc.

        Scope: iChip CO110PC

        Result code:
            I/OK   If *user* is an empty or a legal ISP login name.
            I/ERROR   Otherwise.

      AT+iUSRN?   Report the current login user name. If the user
                          name does not exist only <CRLF> will be returned.
                          The reply is followed by I/OK.

19.5.21   +iPWD -   Define Connection Password

Syntax: AT+iPWD=*pass*   Permanently set connection password.
             Parameters: *pass* = Password to be used when logging on to the ISP.

             Command Options:
                 pass="   Empty: No password defined.
                 pass=<*password*>   *password* will be used to login to the ISP.

             Default: Empty. No password defined. The login password may be defined ad-hoc.

             Scope: iChip CO110PC

             Result code:
                 I/OK   If *password* is an empty or a legal ISP login password.
                 I/ERROR   Otherwise.

         AT+iPWD?   Report the current login password. The reported value will consist of '*' characters. The number of '*' characters shall reflect the number of characters in the actual password. If a password does not exist only <CRLF> will be returned.
                                         The reply is followed by I/OK.

19.5.22   +iRDL -   Number of Times to Redial ISP

Syntax: AT+iRDL=*n*   Permanently set the number of times to redial ISP.

           Parameters: *n* = number of redial attempts to the ISP. If the ISP number is busy or the ISP does not pick up the line, the system will attempt to redial the ISP after a delay period as defined in the RTO parameter. If all redial attempts are exhausted, an attempt to dial the alternate ISP number will be made, if an alternate number exists. In the event that the number is busy or the ISP does not respond, the system will attempt to redial up to *n* times, as with the primary ISP number. If all redial attempts are exhausted the system will quit with the error message: 'All Redial Attempts Failed'.
If the ISP does not pickup the line, iChip will timeout and determine a redial situation after the number of seconds stored in the **WTC** iChip parameter.

        Command Options:
             n =   0 .. 20

        Default: 5

        Scope: iChip CO110PC

        Result code:
             I/OK   If *n* is within limits.
             I/ERROR   Otherwise.

      AT+iRDL?   Report the current value of the number of times to redial ISP.
The reply is followed by I/OK.

19.5.23   +iRTO -   Delay Period Between Redials to ISP

Syntax: AT+iRTO=*n*   Permanently set delay period, in seconds, between
                                            redials to ISP.

          Parameters: *n* = number of seconds to delay before redialing the
                                            ISP, after a busy signal or in the event that the ISP
                                            did not answer the call. iChip will enforce a
                                            minimal 5 second delay for values of *n* less than 5
                                            seconds.

          Command Options:
                                            n = 0 .. 3600

          Default: 180 [seconds]

          Scope: iChip CO110PC

          Result code:
               I/OK   If *n* is within limits.
               I/ERROR   Otherwise.

        AT+iRTO?   Report the current number of seconds to delay
                                            before redialing the ISP.
                                            The reply is followed by I/OK.

19.5.24   +iDNSn - Define Domain Name Server IP Address

Syntax: AT+iDNSn=IP   Permanently set the Domain Name Server IP Address.
                                   Use n=1 to define the Primary IP address of the
                                   Domain Name Server associated with the ISP
                                   Use n=2 to define the Alternate IP address.
                                        IP ::= <nnn>.<nnn>.<nnn>.<nnn>
                                             Where,
                                                  <nnn>: [000..255]

            Parameters: $n = 1..2$

            Command Options:
                 IP =0.0.0.0   Empty: No DNS defined.
                 IP =IP add.   *IP add.* will be used to communicate to the Domain
                                   Name Server on the Internet.

            Default: Empty. No DNS defined. The DNS must be defined ad-hoc.
                                   iChip will retrieve a DNS IP to an empty DNS from the
                                   ISP, if the ISP supports RFC 1877 (PPP Extensions for
                                   Name Server Addresses).

            Scope: iChip CO110PC

            Result code:
                 I/OK   If *IP* is an empty or legal IP address.
                 I/ERROR   Otherwise.

     AT+iDNSn?   Report the current main/alternate DNS address.
                                   If no DNS address exists 0.0.0.0 will be returned.
                                   The reply is followed by I/OK.

**Note: This parameter may be omitted when Email, HTTP, FTP or other servers are
defined as IP addresses rather than symbolic names.**

19.5.25 +iSMTP - Define SMTP Server Name

Syntax: AT+iSMTP=*server*   Permanently set the SMTP Server Name or IP.

             Parameters: *server* = An SMTP server name or IP address.
Server names must be resolvable by the primary or alternate DNS.

             Command Options:
                server = "   Empty: No server name defined.
                server = <*SMTP_SRVR*>   *SMTP_SRVR* will be used to locate and establish an SMTP connection when sending Email messages. If *SMTP_SRVR* is a symbolic name a DNS server will be used to resolve the IP address.
Define +iSMA, +iSMU and +iSMP if the SMTP server requires authentication.

             Default: Empty. No SMTP server defined. To send Email messages, the SMTP server name must be defined ad-hoc.

             Scope: iChip CO110PC/ESFT

             Result code:
                I/OK   If *server* is an empty or legal IP address or SMTP server name.
                I/ERROR   Otherwise.

          AT+iSMTP?   Report the current SMTP server name. If a server name does not exist only <CRLF> will be returned. The reply is followed by I/OK.

19.5.26   +iSMA -   SMTP Authentication Method

Syntax: AT+iSMA=v Permanently set SMTP authentication method.

Parameters: v = 0 or 1

Command Options:
v=0   SMTP authentication will be disabled.
v=1   iChip will support the "AUTH LOGIN" SMTP authentication method, if forced by SMTP server.

Default: 0 (SMTP authentication disabled)

Scope: iChip CO110PC/ESFT

Result code:
I/OK   if v = 0 or 1
I/ERROR   Otherwise.

AT+iSMA?   Report the current value of the SMTP authentication method.
The reply is followed by I/OK.

19.5.27   +iSMU -   Define SMTP Login User Name

Syntax: AT+iSMU=*user*   Permanently set Authenticated SMTP login User
                                             Name.
              Parameters: *user* = User name to be used when logging on to an
                                             SMTP server that requires authentication (if SMA
                                             is set to a non zero value).

              Command Options:
                   user="   Empty: No SMTP authentication user-name
                                                   defined.
                   user=<user-name> *user-name* will be used to login to an
                                                   authenticated SMTP server.

              Default: Empty. No user name defined.

              Scope: iChip CO110PC/ESFT

              Result code:
                   I/OK   If *user* is an empty or a legal SMTP login name.
                   I/ERROR   Otherwise.

         AT+iSMU?   Report the current SMTP login user name. If the
                                             user name does not exist only <CRLF> will be
                                             returned. The reply is followed by I/OK.

19.5.28   +iSMP -   Define SMTP Login Password

Syntax: AT+iSMP=*pass*   Permanently set authenticated SMTP login
                                          password.

        Parameters: *pass* = Password to be used when logging on to an
                                          SMTP server that requires authentication.

        Command Options:
            pass="   Empty: No SMTP authentication password
                                          defined.
            pass=*<password>*   *password* will be used to login to an
                                          authenticated SMTP server.

        Default: Empty. No password defined.

        Scope: iChip CO110PC/ESFT

        Result code:
            I/OK   If *password* is an empty or a legal SMTP login
                                          password.
            I/ERROR   Otherwise.

    AT+iSMP?   Report the current SMTP login password. The
                                          reported value will consist of '*' characters. The
                                          number of '*' characters shall reflect the number of
                                          characters in the actual password. If a password
                                          does not exist only <CRLF> will be returned.
                                          The reply is followed by I/OK.

19.5.29 **+iPDS*n* - Define PING Destination Server**

Syntax: AT+iPDS*n*=*Server*   Permanently set the PING destination server name or IP.
Use *n*=1 to define the primary destination server.
Use *n*=2 to define the secondary destination server.

Parameters: *n* = 1..2
Server = A network server name or IP address.

Command Options:
    Server=''   Empty. No PING destination Server defined.
    Server=<nps> The server name or IP address, *nps,* will be PING'ed in order to verify iChip's online status, when iChip is in "Always Online" mode. If the primary server does not respond, iChip will try the secondary server (if it exists). When both servers do not respond to PING requests, iChip will retry to establish the connection by going offline and then online again.

Default: Empty. No PING destination servers defined.

Scope: iChip CO110PC

Result code: I/OK

AT+iPDS*n*?   Report the current value of PDS*n*. If PDS*n* is empty, an empty line containing only <CRLF> will be returned.
The reply is followed by I/OK.

19.5.30   +iPFR -   PING Destination Server Polling Frequency

Syntax: AT+iPFR=*n*   Permanently set the time interval, in seconds, upon
                                            which iChip will issue a PING request to one of the
                                            PING destination servers.

      Parameters: *n* = 0..65535 [seconds]

      Command Options:

      Default: 0 (Disabled PING polling)

      Scope: iChip CO110PC

      Result code:
            I/OK   If *n* is within limits.
            I/ERROR   Otherwise.

    AT+iPFR?   Report the current PING polling interval used.
                                            The reply is followed by I/OK.

19.5.31   +iSBJ -   Email Subject Field

Syntax: AT+iSBJ:*subject*   Permanently set Email header 'Subject:' field.

        Parameters: *subject* = Contents of subject field.
        Command Options:
            subject="   Empty string. 'Subject:' Field in
                                              Email header will be left empty.
            subject=<*subject string*>   The 'Subject:' field in the Email
                                              header will contain *subject string*

        Default: Empty.

        Scope: iChip CO110PC/ESFT

        Result code:
            I/OK   If *subject* is an empty or legal string.
            I/ERROR   Otherwise.

      AT+iSBJ?   Report the current contents of the 'Subject:'
                            parameter. If no subject is defined, only <CRLF>
                            will be returned.
                            The reply is followed by I/OK.

19.5.32 +iTOA - Define Primary Addressee

Syntax: AT+iTOA=*Email@*   Permanently set Email addressee.

    Parameters: *Email@* = Email addressee. This is the default
                               Email addressee, which will be used to direct
                               Email messages sent by iChip.

    Command Options:
        Email@="   Empty address: No addressee defined.
        Email@=<addr>   *addr* will be used as a destination address for
                               future Email SEND commands (+iEOA).

    Default: Empty. No addressee defined.

    Scope: iChip CO110PC/ESFT

    Result code:
        I/OK

AT+iTOA?   Report the current value of the Email addressee. If
                           the addressee does not exist, an empty line
                           containing only <CRLF> will be returned.
                           The reply is followed by I/OK.

19.5.33   +iTO -   **Email 'To' Description/Name**

Syntax: AT+iTO:*to*   Permanently set Email header 'To:' description.

        Parameters: *to* = Contents of 'To:' description/name field.
        Command Options:

                to=''   Empty string.
                to=<*to_str*>   The 'To:' description field in the Email header will contain *to_str*.

        Default: Empty.

        Scope: iChip CO110PC/ESFT

        Result code:
                I/OK   If *to* is an empty or legal string.
                I/ERROR   Otherwise.

      AT+iTO?   Report the current contents of the *to* parameter. If the *to* parameter is empty, only <CRLF> will be returned.
                                      The reply is followed by I/OK.

19.5.34 +iREA - Return Email Address

Syntax: AT+iREA=*Email@*   Permanently set the Return Email Address. This is
                                                             the Email address that will be used when replying
                                                             to this Email.

          Parameters: *Email@* = Email addressee.

          Command Options:
                  Email@="   Empty address: No return address defined.
                  Email@=<addr> *addr* will be used as the return Email address.

          Default: Empty. No return Email address defined. The return
                                                  Email address will be defined ad-hoc.

           Scope: iChip CO110PC/ESFT

          Result code:
                  I/OK

      AT+iREA?   Report the current value of the return Email
                                                address. If the return Email address does not exist,
                                                an empty line containing only <CRLF> will be
                                                returned.
                                                The reply is followed by I/OK.

19.5.35   +iFRM -   Email 'From' Description/Name

Syntax: AT+iFRM:*from*   Permanently set Email header 'From:' description.

        Parameters: *from* = Contents of 'From:' description field.

        Command Options:
            from="   Empty string.
            from=<*from string*>   The 'From:' description field in the
                                             Email header will contain *from*
                                             string.

        Default: Empty.

        Scope: iChip CO110PC/ESFT

        Result code:
            I/OK   If *from* is an empty or legal string.
            I/ERROR   Otherwise.

    AT+iFRM?   Report the current contents of the *from* parameter.
                              If the *from* parameter is empty, only <CRLF> will
                              be returned.
                              The reply is followed by I/OK.

19.5.36   +iCCn -   Define Alternate Addressee <n>

Syntax: AT+iCC*n*=*Email@*   Permanently set alternative addressee.

        Parameters: *n* = 1..4
                                 Email@ = Email addressee. This is the Email
                                 address, which will be used to copy Email
                                 messages sent by iChip to the primary addressee
                                 list.

        Command Options:
           Email@="   Empty address: Alternate addressee *n* not
                                 defined.
           Email@=<*addr*> *addr* will be used as alternate Email addressee
                                 n.

        Default: Empty. No alternate addressees defined.

        Scope: iChip CO110PC/ESFT

        Result code:
           I/OK

    AT+iCCn?   Report the current value of alternate addressee *n*. If
                            the alternate addressee does not exist only
                            <CRLF> will be returned.
                            The reply is followed by I/OK.

19.5.37   +iURL -   Default URL Address

Syntax: AT+iURL=*URLadd*   Permanently set the URL address string used for downloading Web pages and files.

Parameters: *URLadd* = URL address string.

Command Options:
>   *URLadd ="*   Empty: No URL address string defined.
>   *URLadd =<str>*   *str* will be used as the URL address string when downloading a Web page or file.

The URL address format is:
<Protocol>://<host>[[:<port>]/[<absolute_link>]/]

Where,

>   <protocol>   -- HTTP
>   <host>   -- Web Server Name: IP address or server name resolved by DNS.
>   <port>   -- Port number on server. Default: 80.
>   <absolute link> -- Absolute path name of Web page or file on server.

Default: None.

Scope: iChip CO110PC

Result code:
>   I/OK   If *URLadd* is an empty or a legal URL address string.
>   I/ERROR   Otherwise.

AT+iURL?   Report the current URL address string. If the URL address is empty, only <CRLF> will be returned. The reply is followed by I/OK.

19.5.38 +iRAR - RAS RINGs

Syntax: AT+iRAR=*n*   Permanently set the number of RINGs that will activate iChip's internal RAS, if RAU is not empty.

Parameters: *n* = number of RINGs iChip will detect before answering an incoming call and activating its internal RAS.
If *n* is set to a value greater than 100 and an incoming call is picked up by the host or the modem after less than n-100 RINGs, iChip will activate its internal RAS.
The RAS server will negotiate a PPP connection if a '~' is received as the first character from the modem after the CONNECT line to indicate a PPP packet. Otherwise, iChip will revert to transparent mode communications, allowing the host to conduct direct modem-to-modem data transfer.

Command Options:
n =   2 .. 20
+100   Add 100 to any RAR value to force iChip to activate its internal RAS even if the call was picked up by the host or the modem (if a '~' is received as the first character from the modem after the CONNECT line to indicate a PPP packet).

Default: *n* = 4

Scope: iChip CO110PC

Result code:
I/OK   If *n* is within limits.
I/ERROR   Otherwise.

AT+iRAR?   Returns RAR's current value.
The reply is followed by I/OK.

19.5.39   +iRAU -   Define RAS Login User Name

Syntax: AT+iRAU=*user*   Permanently set RAS login User Name.
                  Parameters: *user* = User name to be used for authentication
                                                  when accepting a call from a PPP client connecting
                                                  to iChip's internal RAS.

                  Command Options:
                          user="   Empty: iChip's internal RAS is effectively
                                                       disabled.
                          user =*<user-name>*   *user-name* will be used to establish login rights
                                                       of a remote PPP client connection to iChip's
                                                       internal RAS.
                          user ="*"   A user name will not be required to authenticate
                                                       a remote PPP client connection to iChip's
                                                       internal RAS. Effectively unrestricting remote
                                                       access.

                  Default: Empty. iChip's internal RAS is effectively disabled.

                  Scope: iChip CO110PC

                  Result code:
                          I/OK   If *user* is an empty or a legal login user name.
                          I/ERROR   Otherwise.

          AT+iRAU?   Report the current RAS login user name. If the user
                                           name does not exist only <CRLF> will be returned.
                                           The reply is followed by I/OK.

19.5.40   +iRAP – Password for RAS Authentication

Syntax: AT+iRAP=*Pass*   Permanently set the RAS Password.

          Parameters: *Pass* = Password to be used for login authentication, when accepting a call from a PPP client connecting to iChip's internal RAS.

          Command Options:

             Pass ='' or *Pass="*"*   A *password* will not be required to authenticate a remote PPP client connection to iChip's internal RAS.

             Pass =<password>   *password* will be used to restrict access of a remote PPP client connection to iChip's internal RAS.

          Default: Empty. No Password defined.

          Scope: iChip CO110PC

          Result code:

             I/OK   If *pass* is an empty or legal Password.
             I/ERROR   Otherwise.

       AT+iRAP?   Report the current RAS Password. If a Password does not exist, only <CRLF> will be returned. The reply is followed by I/OK.

19.5.41   +iIPA – Active IP Address

Syntax: AT+iIPA?   Reports the active IP address.

      Parameters: None.

      Scope: iChip CO110PC

      Note: The IP address is always 0.0.0.0 when the iChip is offline.

19.5.42   +iHSRV - Host Server Name/IP

Syntax: AT+iHSRV=*server_name:port*

Permanently set the host server name or IP and port number to be used in SerialNET mode.

Parameters: *server_name* = A server name or IP address. Server names must be resolvable by the primary or alternate DNS.
port = 0..65535

Command Options:

server_name="	Empty: No server name defined. Serial data transmitted from device in SerialNET mode will be ignored until a remote client accesses iChip.
server_name=<*server*>	*server* will be used in SerialNET mode to locate and establish a connection when serial data is transmitted from the device. The server name may be any legal Internet server name, which can be resolved by the iChip's DNS (Domain Name Server) settings. The server name may also be specified as an absolute IP address given in DOT form.
port=<*port number*>	It is assumed that the host server is "listening" on *port number*.

Default: Empty.

Scope: iChip CO110PC/SNET

Result code:

I/OK	If *server_name* is an empty or legal server name and *port* is within limits.
I/ERROR	Otherwise.

AT+iHSRV?   Report the current host server and port as: <*server*>:<*port*>. If a server name does not exist only <CRLF> will be returned.
The reply is followed by I/OK.

19.5.43   +iDSTR - Define Disconnection String for SerialNET Mode

Syntax: AT+iDSTR:*disconnect_string*

Permanently set SerialNET device disconnection string.
iChip will also go offline following this event.

Parameters:

disconnect_string =

String expected on serial link to signal socket disconnection.

Command Options:

disconnect_string= " Empty string – The connection will never be terminated due to a string arriving on serial link.

disconnect_string=*<string>*

string received on serial link will signal socket disconnection.
string is composed any mix of printable ASCII characters and characters represented by 2 hexadecimal digits as: \x*hh*, where *h* is a hexadecimal digit 0..9 or A..F. Hexadecimal representation allows specifying non-printable characters.

Default: Empty.

Scope: iChip CO110PC/SNET

Result code:
    I/OK   If *disconnect_string* is an empty or legal string.
    I/ERROR   Otherwise.

AT+iDSTR?   Report the current contents of the *disconnect_string* parameter. If the *disconnect_string* parameter is empty, only <CRLF> will be returned.
The reply is followed by I/OK.

19.5.44   +iLPRT - SerialNET Device Listen Port

Syntax: AT+iLPRT=*n*   Permanently set the port number on which iChip
                                    will listen for client connections in SerialNET
                                    mode.

    Parameters: $n = 0 – 65535$

    Default: 0 (no port)

    Scope: iChip CO110PC/SNET

    Result code:
      I/OK   if *n* is within limits
      I/ERROR   Otherwise.

    AT+iLPRT?   Report the current value of the SerialNET device
                                    listen port.
                                    The reply is followed by I/OK.

19.5.45 +iRRSV - Ring Response Host Server Name

Syntax: AT+iRRSV=*server_name:port*

Permanently set the IP registration server name or IP and port number.

Parameters: *server_name* = A server name or IP address. Server names must be resolvable by the primary or alternate DNS.
port = 0..65535

Command Options:
server_name="   Empty: No IP registration server name defined.
server_name=<ip_registration_server>
ip_registration_server will be used to locate and establish a connection after iChip establishes an Internet session connection. The dynamically assigned IP address will be sent to the server in ASCII form, after which the socket will be closed. See Socket IP Registration.

port=<port number>
It is assumed that the host server is "listening" on *port number*.

Default: Empty. No server defined.

Scope: iChip CO110PC

Result code:
I/OK   if *ring_response_server* is an empty or legal server name and *port* is within limits.
I/ERROR   Otherwise.

AT+iRRSV?   Report the current IP registration server name and port number. If a server name does not exist only <CR/LF> will be returned.
The reply is followed by I/OK.

19.5.46   +iRRWS - Ring Response Web Server

Syntax: AT+iRRWS=*url*   Permanently set the IP registration Web server
                                                        URL.

         Parameters: *url* = The Web Server URL to use for registration
                                                        after going online.

         Command Options:
              url = ''   Empty: No IP registration URL defined.
              url = *<Reg_URL>*

                           Reg_URL will be used to dynamically register
                                                        iChip's IP and Port after going online. See
                                                        Web Server IP Registration.

         Default: Empty. No Registration Web server defined.

         Scope: iChip CO110PC

         Result code:
              I/OK   if *Reg_URL* is an empty or legal URL string.
              I/ERROR   Otherwise.

      AT+iRRWS?   Report the current IP registration Web server
                                                        URL. If a URL does not exist only <CR/LF> will
                                                        be returned.
                                                        The reply is followed by I/OK.

19.5.47   +iRRRL - Ring Response Return Link

Syntax: AT+iRRRL=*IP[:Port]*   Permanently set the IP registration Return Link IP
and Web Port.

Parameters: *IP* = IP address to use for registration after going
online.
Port = Port number to assign to iChip's listen
port.

See <u>Description of RRRL</u> when registering IP.

Command Options:
IP = 0.0.0.0   Empty: No Return Link defined.
IP = *<IP_add>*   *IP_addr* will be used when registering after
establishing an Internet session, rather than the
iChip's actual local IP address. This is useful
when iChip receives an internal IP address behind
a NAT. Assigning the NAT's IP address to
IP_addr will allow reaching iChip from the
Internet. In SerialNET, the <u>LPRT</u> parameter may
be pre-configured in the NAT to connect to the
iChip device. See <u>SerialNET Server Devices</u>.
Port = *Web_port*   Optional port to map iChip's Web server in order
to allow surfing iChip across a NAT in association
with *IP_addr*.

Default: 0.0.0.0. No return link IP and Port defined.

Scope: iChip CO110PC
Result code:
I/OK   if *IP* is a legal IP address and *Port* is a legal IP
port number.
I/ERROR   Otherwise.

AT+iRRRL?   Report the current return link IP and port.
The reply is followed by I/OK.

19.5.48   +iHSTN – iChip Host Name

Syntax: AT+iHSTN=*host*   Permanently set the iChip's Network Host Name.

            Parameters: *host* = Symbolic Host Name string.

            Command Options:
                host = ''   Empty: Do not attempt to register a
                                        symbolic host name.

                host = *<NAME>*   *NAME* will be stored as iChip's Host name.
                                        NAME will be included in all IP registration
                                        method formats.

            Default: Empty. No network Host name defined.

            Scope: iChip CO110PC

            Result code:
                I/OK   If *host* is empty or a string.
                I/ERROR   Otherwise.

        AT+iHSTN?   Report the current Host name.
                                    The reply is followed by I/OK.

19.5.49   +iMBTB - Max Bytes To Buffer

Syntax: AT+iMBTB=*n*   Permanently set max bytes to buffer while iChip is
                                             establishing an Internet connection.

        Parameters: *n* = number of bytes to buffer while establishing
                                             the connection in SerialNET mode.

        Command Options:

                                             n = 0 .. 2048

        Default: 0 – No Buffering

        Scope: iChip CO110PC/SNET

        Result code:
            I/OK   If *n* is within limits.
            I/ERROR   Otherwise.

    AT+iMBTB?   Report the current setting of max bytes to buffer.
                                             The reply is followed by I/OK.

19.5.50 +iMTTF - Max Timeout To Socket Flush

Syntax: AT+iMTTF=*n* Permanently set max inactivity timeout before flushing the SerialNET socket.

Parameters: *n* = number of milliseconds of inactivity on serial link to signal socket flush in SerialNET mode.

Command Options:

n = 0 .. 65535

Default: 0 – No timeout

Scope: iChip CO110PC/SNET

Result code:
I/OK If *n* is within limits.
I/ERROR Otherwise.

AT+iMTTF? Report the current timeout before SerialNET socket flush in milliseconds.
The reply is followed by I/OK.

19.5.51   +iFCHR - Flush Character

Syntax: AT+iFCHR=*flush_chr*   Permanently set flush character in SerialNET
                                        mode.

> Parameters: *flush_chr* = character received on serial link to
>   signal socket flush in SerialNET mode.
>
> Command Options:
>   *flush_chr* = ' '   Empty: No Flush character defined. The
>   SerialNET socket will not be flushed as a
>   result of receiving a special flush
>   character.
>   *flush_chr* =   'a' – 'z' | 'A' – 'Z' | '0' – '9' | <hex_char>
>   where,
>   <hex_char> = \x<hh>
>   <hh>   = 00-FF
>
> Default: Empty – No flush character defined
>
> Scope: iChip CO110PC/SNET
>
> Result code:
>   I/OK   If *flush_chr* is empty or a legal character
>   representation.
>   I/ERROR   Otherwise.

AT+iFCHR?   Report the current flush character.
                           The reply is followed by I/OK.

19.5.52 +iMCBF - Maximum Characters Before Socket Flush

Syntax: AT+iMCBF=*n*   Permanently set max number of characters before flushing the SerialNET socket.

      Parameters: *n* = maximum number of characters received on the serial link before flushing the SerialNET socket.

      Command Options:

            n = 0 .. 1460

      Default: 0 – No timeout

      Scope: iChip CO110PC/SNET

      Result code:
           I/OK   If *n* is within limits.
           I/ERROR   Otherwise.

   AT+iMCBF?   Report the current maximum number of characters before flushing the SerialNET socket.
The reply is followed by I/OK.

19.5.53   +iIATO - Inactivity Timeout

Syntax: AT+iIATO=*n*   Permanently set maximum inactivity timeout in seconds to signal socket disconnection in SerialNET mode. When signaled, iChip will close the connected SerialNET communication socket. iChip will go offline following this event.

Parameters: *n* = number of seconds of inactivity, on a connected SerialNET socket, to signal socket disconnection.

Command Options:

n = 0 .. 32768

When iChip is in Server SerialNET mode (LPRT defined) and it goes online, in response to a triggering event: RING signal, MMSEL signal pulled low or AT+I!SNMD -- timeout calculation commences only after the iChip opens the Listen port.

Default: 0 – No timeout limit

Scope: iChip CO110PC/SNET

Result code:
    I/OK   If *n* is within limits.
    I/ERROR   Otherwise.

AT+iIATO?   Report the current inactivity timeout in seconds to signal socket disconnection in SerialNET mode. The reply is followed by I/OK.

19.5.54   +iSNSI - SerialNET Device Serial Interface

Syntax: AT+iSNSI=*settings_str*   Permanently set serial interface settings for
                                          SerialNET mode.

Parameters: *settings_str* = Serial link settings in SerialNET
                                             mode.

Command Options:

settings_str="<baud>,<data_bits>,<parity>,<stop_bits>,<flow>"
where,
   <baud>   = 0..9
   <data_bits>   = 7 | 8
   <parity>   = N | E | O
   <stop_bits>   = 1 | 2
   <flow>   = 0 | 1

The following table summarizes supported baud rates:

Baud Code	Baud Rate	Baud Code	Baud Rate
0	300	5	9600
1	600	6	19200
2	1200	7	38400
3	2400	8	57600
4	4800	9	115200

Default: "5,8,N,1,0" – baud rate 9600bps, 8 bits, No parity,
                                 1 stop bit, no flow control.

Scope: iChip CO110PC/SNET

Result code:
      I/OK   If *settings_str* is a valid serial link setting string.
      I/ERROR   Otherwise.

AT+iSNSI?   Report the current serial settings string.
                    The reply is followed by I/OK.

19.5.55   +iSTYP - SerialNET Device Socket Type

Syntax: AT+iSTYP=*v*   Permanently set SerialNET socket type to *v*.

    Parameters: v = 0 or 1

    Command Options:
                v=0   TCP
                v=1   UDP

    Default: 0 (TCP)

    Scope: iChip CO110PC/SNET

    Result code:
            I/OK   if *v* = 0 or 1
            I/ERROR   Otherwise.

        AT+iSTYP?   Report the current value of the SerialNET socket type.
                              The reply is followed by I/OK.

19.5.56 +iSNRD - SerialNET Device Re-initialization Delay

Syntax: AT+iSNRD=*n*   Permanently set SerialNET mode re-initialization
                                 delay in seconds.

Parameters: *n* = number of seconds iChip will pause before re-
                                 initializing SerialNET mode after a failed attempt
                                 to establish a socket connection to the peer or a
                                 connection related fatal error. A new SerialNET
                                 connection will only be attempted after SerialNET
                                 re-initializes. The SNRD delay will not be in effect
                                 as a result of an Escape Sequence ('+++').

Command Options:
                                 n = 0 .. 3600

Default: 0 – No delay

Scope: iChip CO110PC/SNET

Result code:
    I/OK   If *n* is within limits.
    I/ERROR   Otherwise.

AT+iSNRD?   Report the current SerialNET re-initialization delay
                                 in seconds.
                                 The reply is followed by I/OK.

19.5.57 +iPTD - SerialNET Packets To Discard

Syntax: AT+iPTD=*n* Set the number of packets to be cyclically discarded in a SerialNET mode session. A packet is defined as the group of characters received on the serial link, meeting one (or more) of the socket flush conditions defined (+iFCHR, +iMTTF, +iMCBF).

Parameters: *n* = 0 – 65535

Default: 0 – No packet filtering. All data is transferred.

Scope: iChip CO110PC/SNET

Result code:
I/OK if *n* is within limits.
I/ERROR Otherwise.

AT+iPTD? Report the current value.
The reply is followed by I/OK.