TERIDIAN SEMICONDUCTOR CORP.

Simplifying System Integration™

Teridian V.22 *bis* Linux Softmodem for 73M1822/73M1922 MicroDAA User Guide

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1 Introduction

The Teridian V.22BIS Softmodem is a V.22bis, V.22, V.23, V.21, Bell 212A, 103, and 202 modem algorithm. It includes the signal processing functions as well as an “AT” command interpreter.

1.1 Use of this Document

It is assumed that the reader has basic familiarity with microprocessors, firmware and data communications. Prior experience with modems is not assumed but would be useful.
This document presents all the features included in the TSC V.22BIS Softmodem in terms of software.

1.2 Language and Terminology

To a large extent, telecommunications and, by extension, data communications, has developed a terminology distinct from the rest of the electronics engineering community. The lack of worldwide standards until recent years has also hampered the adoption of widely accepted terms. North America, dominated by the earlier influence of Bell Telephone, has developed terminology, which differs from that now used by the ITU, the industry group responsible for setting international standards. As international data exchange grows in importance, the ITU can be expected to grow in influence, even in North America. For that reason we have chosen to use the ITU terminology in most cases. There will be some exceptions to our use of ITU terms. For example, "mark" (one) and "space" (zero) are much shorter than "binary one" and "binary zero" and these have been used where appropriate. Also, we may use Bell terminology when discussing Bell specifications. The North American terminology is so pervasive that it is used by default in areas where the ITU has yet to venture.

1.3 Registered Trademarks

Throughout this manual, we wish to acknowledge the following: Hayes, Hayes AT, Smartcom and Smartmodem are registered trademarks of Hayes Microcomputer Products; IBM, IBM PC, IBM AT, and PS/2 are registered trademarks of IBM; MNP is a registered trademark of Microcom; Tri-state is a registered trademark of National Semiconductor Corporation.

2 User Guide

The modem firmware supports a variation of the Hayes AT command set as its DTE interface. Originating, answering and setting up the various options are performed by sending one or more AT commands to the modem from the DTE. A brief description of the AT command syntax and the AT commands supported follows.

2.1 The AT Command Format

Instructions sent to the modem are referred as “AT commands” because they are always preceded by a prefix composed of the two characters “AT” that are used to get the “ATtention” of the modem. Provided that the correct connections have been made (refer to the data sheet), the TSC Softmodem will use those two characters to determine the transmission rate, the data length as well as the parity used by the DTE. Most of the AT commands have selectable parameters and related values. Every AT command will have the following format:

<AT><Command>{Argument}{=n}<Enter>

AT - Attention code
Command - A command consists of one letter
Argument - Optional information that further defines the command
=n - Used when setting a register

You may "string" commands together in one command line as long as the total length of the command line does not exceed 63 bytes. The attention code, AT, is only required at the beginning of the command line. If no argument is provided with a command that takes a numerical argument, an argument of zero is assumed. For example, the following commands are identical:

ATH<Enter> or ATH0 <Enter>

NOTE: Information in "angle" brackets <> must be included as part of the command line, while information in "curly" braces {} may or may not be necessary as part of the command line.

NOTE: the +++ and A/ commands are neither preceded by AT nor followed by <CR>.

The TSC Softmodem requires time before it is ready to accept another command after responding with “OK”. When multiple AT commands are used back to back, the user must wait until after the ‘OK<Enter>_’ response from the modem from the previous command before the modem is ready to take another command. This wait time should be a least 10 ms. All commands except “D”, “A”, and “O” return an “OK”.

The following description uses these conventions:

- All allowed parameters are shown.
- → specifies the default value when applicable.

A Answer

Causes the modem to immediately go on-line (off-hook) in the Answer mode and attempt to handshake regardless of the value of register S0. This command gives you a method of manually answering an incoming phone call. For restrictions, see also the R command.

A/ Repeat Last Command

The A/ command causes the modem to re-execute the last command or command sequence that was issued.

A/ and +++AT are the only commands that are neither preceded by AT nor followed by <Enter>.

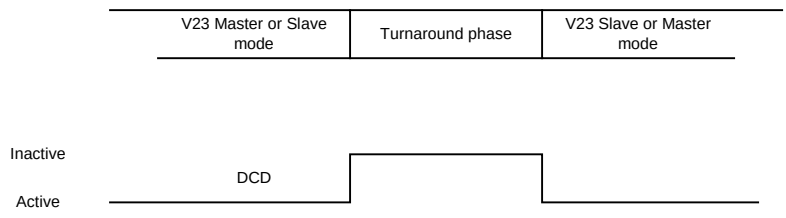
B Communication Standard Selection

→	B0	ITU V22bis, V22 or V21 operation
	B1	Bell 212A or Bell 103 operation (also V.22bis for 2400 bps operation)
	B2	V23 – 75bps transmission, 1200bps reception – Master mode
	B3	V23 – 1200bps transmission, 75bps reception – Slave mode
	B4	Bell 202 – 1200bps reception
	B5	Bell 202 – 1200bps transmission
	B6	V23 4-Wire – 1200bps receive and transmit
	B7	V23 4-Wire – 1200bps receive and transmit (same as B6)
	B8	Bell 202 4-Wire – 1200bps receive and transmit
	B9	Bell 202 4-Wire – 1200bps receive and transmit (same as B8)
	B10	Selects 1200 bps V.23 Half duplex mode (V23H). B10 and B11 are the same
	B11	Selects 1200 bps V.23 Half duplex mode (V23H). B10 and B11 are the same.

C Data Carrier Detect Signal (DCD) Monitoring

→	C0	$\overline{DCD}$ always ON
	C1	$\overline{DCD}$ ON in presence of qualified carrier signal
	C2	$\overline{DCD}$ ON in presence of raw carrier signal

During V23 turnaround phases, the $\overline{DCD}$ signal is OFF if C1 or C2 options selected



D Dial

This command puts the modem into originate mode and instructs the modem to dial the phone number expressed by the string argument n...n. The number will be dialed with either tones or pulses depending on how the last number was dialed. On power up, this command will default to pulse dialing. (See the note in DT[n...n] command.) The allowable arguments for n...n differ for pulse and tone dialing; see the descriptions under DT[n...n] and DP[n...n].

n	*0-9 digit*
n	A-D, *, # are only allowed during Tone dialing.

Dial String Modifiers

P	Pulse dial the digits that follow.
R	Modem uses answer mode frequencies after dialing the number. Allows dialing up an originate-only modem. Busy detect is disabled during reverse dial.
T	Tone dial the digits that follow.
;	A ";" (semicolon) causes the modem to go back into the Command State, allowing you to enter other commands while on-line. To do this, the semicolon must be the last character in the command line.
,	When inserted in a dialing string, a "," (comma) causes the modem to pause. The default time for the pause is two seconds, and can be changed by modifying register S8.
@	A @ (commercial "at" symbol) causes the modem to wait up to 30 seconds for a 5 second period of quiet before proceeding. This is often used to detect the end of a prerecorded message. The default wait time is 30 seconds, and can be changed by modifying register S7. Result Codes 7 and 8 will be reported regardless of which Result Code Set is selected.
!	An ! (exclamation mark) causes a "hook flash." This simulates hanging up for 1/2 second and then reconnecting. It is typically used for transferring calls.
W	Causes the modem to wait for a dial tone for a specified length of time before proceeding. The default is 8 seconds, and can be changed by modifying register S66. Result Code 6 will always be included regardless which Result Code Set is selected.
S	S-register modification. See S[r]=[n] command.
J	PTT Test. See J[n] command.

E Echo Command

	E0	Command echo disabled
→	E1	Command echo enabled

F Load Factory default Configuration

Replace the current active configuration with the factory standard configuration stored in memory

G Guard Tone Selection

→	G0	*No guard tone*
	G1	550Hz guard tone enabled
	G2	1800Hz guard tone enabled

H Hook Control

→	H0	*On-hook (hang up)*
	H1	Off-hook (connect to phone line)

I Identification

I0	*Returns product identification code*
I3	Returns firmware revision number
I4	Returns copyright notice

Returns TSC Softmodem information

J PTT test

J0	*Stop J test in progress*
J1	Transmit DTMF tones specified by registers S12 and S13
J2	Transmit Answer tone or Calling tone specified by register S13 and S27
J3	Transmit modulation specified by registers S14, S30 and S60
J4	Transmit silence (quiet mode)
J5	Wait (To set up the wait time use J5.[n]. [n] is in 1/10 ms)
J6	Detect CAS and DTMF tones off hook(requires host polling of register S65)*
J7	Analog Interface Test Mode: Loops back the TXAP-TXAN signal to RXA through external components to check if everything is wired correctly. Returns OK, or ERROR. Signal Levels are specified with S113, S114-S115.
J8	Goes off-hook and wait for CAS tone. If a CAS is detected, send an ack and detect a US CID .

*An alternate (preferred) method of detecting DTMF tones is available though usage of the Caller ID DTMF detection mode. Refer to DTMF tones detection chapter at the end of this document.

K DTE-DCE Flow Control

→	K0	*Flow control disabled*
	K3	RTS/CTS flow control (hardware flow control)
	K4	Xon/Xoff control (software flow control)

In Asynchronous mode, $\overline{CTS}$ is turned inactive as soon as at least 15 bytes are in the 32 byte transmit buffer. $\overline{CTS}$ is turned back active when less than 4 bytes are in the buffer. $\overline{RTS}$ status is only acknowledged by the TSC Softmodem, thus starting or stopping data transmission to the DTE, if data are received by the DCE. Receive Data is not buffered by the TSC Softmodem.

L Fast Connect

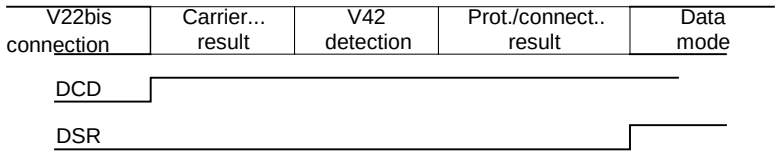
→	L0	*Disable Fast Connect*
	L1	Disable 2100 Hz answer tone and billing delay
	L2	2 second billing delay enabled with no 2100 Hz answer tone
	L3	400 ms answer tone and billing delay enabled

N Data Set Ready ($\overline{DSR}$) signal Monitoring

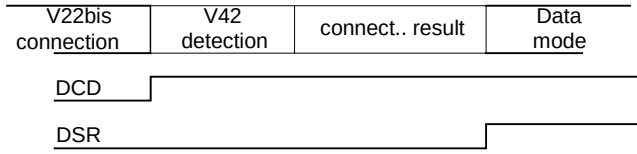
→	N0	$\overline{DSR}$ always ON
	N1	$\overline{DSR}$ is OFF in the idle state and when in a test mode. $\overline{DSR}$ circuit is turned ON at start of the handshaking process. $\overline{DSR}$ is turned OFF when hang-up process is started.
	N2	$\overline{DSR}$ is OFF in the idle state and when in a test mode. $\overline{DSR}$ circuit is turned ON at the end of handshake after issuing the “CONNECT” result code. $\overline{DSR}$ is turned OFF when hang-up process is started.

The following shows the actions of $\overline{DCD}$ and $\overline{DSR}$ as viewed at the RS232 connector (inverted from pins) during the connection process under different conditions.

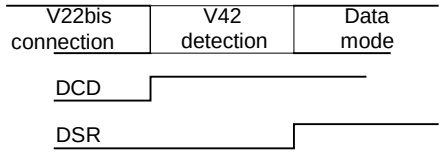
1) Mode V22bis, Protocol enabled (through S25), Extended result codes.



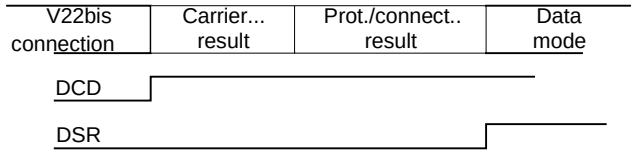
2) Mode V22bis, Protocol enabled (through S25), Normal result codes.



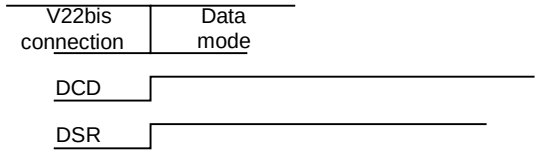
3) Mode V22bis, Protocol enabled (through S25), No result codes.



4) Mode V22bis, No Protocol, Extended result codes.



5) Mode V22bis, No Protocol, No result codes.



O On-Line

→	O0	If you have returned to Command state from Data state without breaking a connection, the O0 command will return you on-line (Data state)
	O[1-7] Retrain	
	O1	Similar to O0, but also causes the modem to initiate an equalizer retrain sequence
	O2	Enables the modem to respond to a remote request for retrain
	O3	Disables the modem to respond to a remote request for retrain
	O4	Enables speed negotiation
	O5	Disables speed negotiation

O6 Enables rate change to 1200 bps

O7 Enables rate change to 2400 bps

The O[n] command is used to go back on-line when the command state was entered by issuing the +++ escape sequence or turning $\overline{DTR}$ from ON to OFF with the appropriated S-Register setting in effect. The O[n] command applies only to asynchronous operation.
Note: If commands O0 or O1 are given to the modem while not connected, it will respond with ERROR.

P Pulse Dial

Causes the modem to pulse dial.
The P modifier can be issued in conjunction with the dial command, or alone, to designate the method used for subsequent dialing.

Q Result Codes Control

→ Q0 *Result codes enabled*

Q1 Result codes disabled

Refer also to the V[n] and X[n] commands.

R Data Terminal Ready ($\overline{DTR}$) Action

→ R0 Modem ignores $\overline{DTR}$

R1 Modem assumes the Command State when $\overline{DTR}$ transitions from ON to OFF

R2 Modem goes on-hook (hangs up), disables the Auto Answer mode, and assumes the Command State when $\overline{DTR}$ transitions from ON to OFF. Turning $\overline{DTR}$ back ON will enable auto-Answer mode.

R3 Modem is reset when $\overline{DTR}$ transitions from ON to OFF

R4 Enable V.23 Turnaround in Master Mode (On to Off $\overline{DTR}$ transition starts the turnaround). Turnaround is done via $\overline{RTS}$ in all other R command settings.

R5 Power Down with $\overline{DTR}$ toggle (need hard reset)

The R[n] command selects how the Data Terminal Ready ($\overline{DTR}$) signal is used by the modem.

S S Register Monitoring

S[r]?	The S[r]? command requests the modem to report the current value of register [r]. These registers are used to set up various operating parameters of the modem as explained in Chapter 5. The value reported is in decimal notation.
S[r]$	The S[r]$ command requests the modem to report the current value of register [r]. The value reported is in hexadecimal notation.
S[r]???	The S[r]???… command requests the modem to report the current value of [r] and successive registers. The values are reported in decimal notation. The number of registers reported corresponds to the number of ? (question marks) given to the modem. For an example: S10??? will report the values stored in the registers S10, S11, S12.
S[r]$$$	The S[r]$$$… command requests the modem to report the current value of [r] and successive registers. The values are reported in hexadecimal notation. The number of registers reported corresponds to the number of $ (dollar signs) given to the modem. For an example: S10$$$ will report the values stored in the registers S10, S11, S12.
S[r]=[n]	S[r]=[n] Set S-Register Value r = 0 to 104 n = 0 to 255 The S[r]=[n] command allows you to set (modify) the value of any of register [r] to new value [n]. The value [n] is entered in decimal notation.
S[r]=n.$n.n.$n…	The S[r]=n.$n.n.$n… command allows you to set (modify) the value of any of [r] and successive registers to the new values n (decimal notation) or $n (hexadecimal notation). For an example: S10=$F0.128.$EC.25 will set register S10=F0 (hexadecimal), S11=128 (decimal), S12=EC (hexadecimal), and S13=15 (decimal). All hexadecimal values must be entered in as a two digit hex value. For example enter $0A instead of $A.
S[r]+[n]	The S[r]+[n] command sets bits in [r] S register by ORing the [n] value and the value currently in the S Register.
S[r]-[n]	The S[r]+[n] command clears bits in [r] S register by ANDing the [not n] value and the value currently in the S Register. All bits set in the mask [n] will be cleared in the S register.

T Tone Dial

Causes the modem to tone dial.
The T modifier can be issued in conjunction with the dial command, or alone, to designate the method used for subsequent dialing.

V Verbose/Numeric Result Codes Selection

	V0	Numeric result codes – *Format <CR>digit(s)<CR>*
→	V1	Verbose result codes – *Format <CR><LF>word<CR><LF>*
	V2	Numeric result codes - *Format <CR><LF>digit(s)<CR><LF>*

Refer also to the Q[n] and X[n] commands

Y Asynchronous/Synchronous Mode Selection

	Y0	Asynchronous mode. No speed buffering, no protocol.
	Y1	Synchronous mode. No speed buffering, no protocol.
	Y4	Quasi-Synchronous mode. Allows the transmission and reception of synchronous data through an asynchronous DTE by stripping off start and stop bits on transmission and adding them on reception (See V42 operation).
→	Y6	Asynchronous with speed buffering. Allows fixed DTE-DCE speed so applications do not need to change the communications rate based on connection results.

W Extended Result Codes Selection

→

W0 Do not return extended result codes (40-80). The message CONNECT followed by the data rate between the DTE and the modem will be sent to the DTE

W1 The CONNECT message will report the DTE speed then enable the carrier and extended result codes

W2 The CONNECT message will report the DCE speed. All extended result codes are disabled

Result codes

Numeric value	Verbose value	Numeric value	Verbose value
0	OK	13	CONNECT 7200
1	CONNECT	14	LINE-IN-USE
2	RING	22	CONNECT 75/1200
3	NO CARRIER	23	CONNECT 1200/75
4	ERROR	*Extended Results Codes:*	
5	CONNECT 1200	40	CARRIER 300
6	NO DIALTONE	41	CARRIER 600
7	BUSY	44	CARRIER 1200/75
8	NO ANSWER	45	CARRIER 75/1200
9	CONNECT 600	46	CARRIER 1200
10	CONNECT 2400	47	CARRIER 2400
11	CONNECT 4800	70	PROTOCOL:NONE
12	CONNECT 9600	77	PROTOCOL:LAP-M

X Result Codes Set and Dialing Capabilities Selection

	X0	Enable Result Codes 0-4, 14
	X1	Enable Result Codes 0-5, 10-14
	X2	Enable Result Codes 0-6, 10-14
	X3	Enable Result Codes 0-5, 7, 10-14
→	X4	Enable Result Codes 0-7, 10-14
	X5	Enable Result Codes 0-5, 10-14 and detect BUSY at OFF HOOK
	X6	Enable Result Codes 0-6, 10-14 and detect BUSY at OFF HOOK
	X7	Enable Result Codes 0-5, 7, 10-14 and detect BUSY at OFF HOOK
	X8	Enable Result Codes 0-7, 10-14 and detect BUSY at OFF HOOK

See Result Codes table under W command.

	Pre Dial			*Post Dial*		
	W0	**W1**	**W2**	**W0**	**W1**	**W2**
X0	0, 2 – 4, 14	0, 2 – 4, 14	0, 2 – 4, 14	0 – 1, 3 – 4, 14	0–1, 3–4, 14	0–1, 3–4, 14
X1	0, 2 – 4, 14	0, 2 – 4, 14 + ext.	0, 2 – 4, 14	0 – 1, 3 – 5, 9 – 14, 22, 23	0–1, 3–5, 9–14, 22, 23 + ext.	0–1, 3–5, 9-14, 22, 23
X2	0, 2, 4, 6, 14	0, 2, 4, 6, 14 + ext.	0, 2, 4, 6, 14	0 – 1, 3 – 5, 9 - 14, 22, 23	0–1, 3–5, 9–14, 22, 23 + ext.	0–1, 3–5, 9-14, 22, 23
X3	0, 2 – 4, 14	0, 2 – 4, 14 + ext.	0, 2 – 4, 14	0 – 1, 3 – 5, 7, 9 - 14, 22, 23	0–1, 3–5, 7, 9–14, 22, 23 + ext.	0–1, 3–5, 7, 9-4, 22, 23
X4	0, 2, 4, 6, 14	0, 2, 4, 6, 14 + ext.	0, 2, 4, 6, 14	0 – 1, 3 – 5, 7, 9 - 14, 22, 23	0–1, 3–5, 7, 9–14, 22, 23 + ext.	0–1, 3–5, 7, 9–14, 22, 23
X5	0, 2 – 4, 7, 14	0, 2 – 4, 7, 14 + ext.	0, 2 – 4, 7, 14	0 – 1, 3 – 5, 9 - 14, 22, 23	0–1, 3–5, 9–14, 22, 23 + ext.	0–1, 3–5, 9-14, 22, 23
X6	0, 2, 4, 6 - 7, 14	0, 2, 4, 6 - 7, 14 + ext.	0, 2, 4, 6 - 7, 14	0 – 1, 3 – 5, 9 - 14, 22, 23	0–1, 3–5, 9–14, 22, 23 + ext.	0–1, 3–5, 9-14, 22, 23
X7	0, 2 – 4, 7, 14	0, 2 – 4, 7, 14 + ext.	0, 2 – 4, 7, 14	0 – 1, 3 – 5, 7, 9 - 14, 22, 23	0–1, 3–5, 7, 9–14, 22, 23 + ext.	0–1, 3–5, 7, 9-14, 22, 23
X8	0, 2, 4, 6 - 7, 14	0, 2, 4, 6 - 7, 14 + ext.	0, 2, 4, 6 - 7, 14	0 – 1, 3 – 5, 7, 9 - 14, 22, 23	0–1, 3–5, 7, 9–14, 22, 23 + ext.	0–1, 3–5, 7, 9-14, 22, 23

Y Asynchronous/Synchronous Mode Selection

Y0	Asynchronous mode. No speed buffering, no protocol.
Y1	Synchronous mode. No speed buffering, no protocol.
Y4	Quasi-Synchronous mode. Allows the transmission and reception of synchronous data through an asynchronous DTE by stripping off start and stop bits on transmission and adding them on reception (See V42 operation).
Y6	Asynchronous with speed buffering. Allows fixed DTE-DCE speed so applications do not need to change the communications rate based on connection results.

→

Z Reset

The Z command resets the modem. The Z command is equivalent to a power cycle. Additional commands are not allowed in the command string.

@C Configure Registers

The @C command modifies the MicroDAA™ register value.

@C[r]=[n], Set Register Value r = 0 to 31($1F), n = 0 to 255($FF)	The @C[r]=[n] command allows you to set (modify) the value of any of MicroDAA™ register [r] to new value [n]. The value [n] and [r] can be either in decimal(no prefix) or hexadecimal($ prefix) notation.
@C[r]=n.$n.n.$n… command allows you to set (modify) the value of any of [r] and successive registers to the new values n (decimal) or $n (hexadecimal).	The @C[r]=n.$n.n.$n… command allows you to set (modify) the value of any of [r] and successive registers to the new values n (decimal) or $n (hexadecimal). For an example: @C$10=$0F.128.$EC.25 will set Register $10=$F0, Register $11=128 (decimal), Register $12=$EC and S13=15 (decimal). All hexadecimal values must be entered in as a two digit hex value. For example enter $0A instead of $A.
@C[r]+[n] command sets bits in [r] register by ORing the [n] value and the value currently in the Register.	The @C[r]+[n] command sets bits in [r] register by ORing the [n] value and the value currently in the Register.
@C[r]-[n] command clears bits in [r] register by ANDing the [not n] value and the value currently in the Register.	The @C[r]-[n] command clears bits in [r] register by ANDing the [not n] value and the value currently in the Register. All bits set in the mask [n] will be cleared in the register.

@D Dump Registers

The @D command dumps entire MicroDAA™ registers.

@L[n] Set Lease Line Operation

Lease line operation is designated by S89 bit 2

n = 1 Sets lease line bit

n = 0 Clears lease line bit

@Z Escape to OS

Terminates the softmodem application gracefully and goes to Linux prompt.
To return to Softmodem application from the linux prompt, type “tsc_1922_CRLF” from the root directory.

+++ Escape Sequence

During a data connection, the escape command (+++) returns you to Command state without terminating the data connection so you can enter AT commands. The TSC Softmodem supports the TIES (Timing Independent Escape Sequence) escape, not the patented Hayes escape. The +++ must be followed by a valid AT command for the escape to be recognized. If a non-AT command follows the +++, the modem will return to the data mode. Giving the TSC Softmodem a “+++AT” is also valid for escaping to the on-line command state.

2.2 S-Registers

2.2.1 S-Register Overview

The S register set found in the TSC Softmodem is modeled after the Hayes S-registers, but differ in many respects. The Hayes register set has evolved over time to support added features, and the TSC Softmodem has many features not found in other modems. As is true for the AT commands, the Hayes format is loosely followed, but it should not be assumed that software driver configurations written for another modem will work without some modifications. Closely examine the register set and assure the commands sent to the TSC Softmodem will give the intended actions.

The S-Registers allow you to customize the modem's operation. For example, you can use S-Registers to determine how many times the telephone will ring before the modem answers, how long the modem will wait for a dial tone before aborting a dialing sequence, how long the modem will pause during a "pause" command, and so on. S-Registers are changed with the S[r]=[n] command.

You can check your S-Register settings any time you are in Command State. To check an S-Register setting, enter a command consisting of the S-Register you want to check followed by a question mark. For example, to check how long the modem will wait for a dial tone before aborting a call, type in the following command:

AT S6? <Enter>

The screen will display the current setting of S-Register S6.

To change an S-Register setting, enter a command consisting of the S-Register, an equal (=) sign, and the desired value (in decimal). For example, to set the modem to answer after three rings, type the following command:

AT S0=3 <Enter>

Note: For more details on the commands to check or modify S-Registers see the S command under the paragraph “AT” command set.

List Of S-Registers

The S-Registers you can change with the S[r]=[n] command, or whose value you can check with the S[r]? command, are listed below:

2.2.1.1 TR30.2-Style Control and Status Registers

S0 Auto Answer

	n	0 –255
→	0	Auto answer disabled
	1-255	Auto answer mode on selected number of rings

This register specifies the ring on which the modem will answer. A value of 1 to 255 will place the modem in auto-answer mode and cause it to answer on that many rings detected.

S1 Ring Count

	n	0 –255
→	0	No valid rings detected

When the modem is set for Auto-Answer, register S1 keeps track of the number of times the phone rings. After the end of ring-on time, the S1 register is reset to 0 after the sum of S56 and S58 seconds has elapsed.

S2 Escape Code Character

	n	0 – 127 (ASCII)
→	43	ASCII “+”
	>127	Escape feature disabled

S3 Carriage Return Character

	n	0 – 127 (ASCII)
→	13	<CR>

This character terminates both the command line and the result codes.

S4 Line Feed Character

	n	0 –127 (ASCII)
→	10	<LF>
	0	Suppress <LF> after the <CR> in a result code

Applicable only when verbose mode (V1) is selected.

S5 Backspace Character

	n	0 –32 and 127 (ASCII)
→	8	<BS>

S6 Wait Before Blind Dial

Country selection dependent (S99)

	n	1 – 255 seconds
→	2	2 seconds

When X0, X1 or X5 mode is selected, the modem will dial after the time set in S6 has elapsed since going off hook.

S7 Wait For Carrier After Dial

	n	0 – 254 seconds
→	50	50 seconds

The S7 register performs two functions. It sets the maximum time between dialing and responding to an incoming carrier signal. It also sets the duration of the pause generated by the W dial string modifier.

S8 Pause Time For Comma

	n	1 – 254 seconds
→	2	2 seconds

The S8 register sets the number of seconds the modem will pause during a pause created by a "," (comma) in the dialing sequence.
The effective time will range from (n-1) to n seconds.

S9 Carrier Detect Response Time

	n	1 – 254 in 100 ms unit
→	6	600 ms

The S9 register sets how long a carrier signal must exist before the modem issues a carrier detect response.
Note: Carrier detection while the modem is in the on-line state is governed by the times specified by S9 and S10. The DCD is the carrier detect indicator. If the carrier signal goes off, DCD goes off within 20 ms. If the carrier returns, CD turns on within 20 ms after the carrier has been on continuously for the time specified by S9. If CD is off for the time specified by S10, then carrier is lost and the modem hangs up. If S10 is set to 255, the modem will not hang up.

S10 Lost Carrier Hang Up Delay

	n	0 – 254 in 100ms unit
→	14	1.4 second
	255	Carrier detect status ignored, no hang up

The S10 register sets (in 10ths of a second) the delay time between loss of carrier and the modem hanging up. After the S10 delay time, the modem hangs up and returns to Command State and the modem sends the NO CARRIER response.

Country support

S99 Preset Country Selection

	0	CTR21
→	1	USA / Canada
	33	France
	34	Spain
	39	Italy
	44	United Kingdom
	49	Germany
	61	Australia
	81	Japan
	86	China
	886	Taiwan
	82	S. Korea

S99 provides an easy way to set up the TSC Softmodem for different countries with a single command. This command sets the dial tone and busy tone detection parameters as well as the DTMF and pulse timing, DCIV settings, and AC impedance. Normally no other commands are required to match a selected country's requirements. Transmission levels and detection threshold can be adjusted through other S registers compensate if your DAA specifications require further changes.
Since the S99 register affects multiple registers, it should be set at the beginning of the AT string, but never preceding the F command (i.e. ATFS99=1… is OK, but not ATS99=44F)

Originate functions

Dialing functions

S11 DTMF Ton/Toff Dialing Speed

Country selection dependent (S99)

	n	20 – 211 in ms
→	70	Ton = Toff = 70 ms

The S11 register sets the duration and spacing of touch-tones for tone dialing. (Setting this value lower than 50 may produce inaccurate dialing.) This register does not affect pulse dialing.

S12 DTMF / Twist Dial Register

→ 32 D digit selected, 2dB twist.

Selects the digit to be dialed as well as the desired twist between the low and the high frequency. For normal operation, only the twist needs to be set once. The digit will be filled automatically. For test operation, both the twist and the digit must be filled. See J command.

	Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
	N/A	Twist 2	Twist 1	Twist 0	DTMF3	DTMF2	DTMF1	DTMF0
	DTMF3	**DTMF2**	**DTMF1**	**DTMF0**	**Digit**	**Low tone**	**High Tone**	
→	0	0	0	0	D	941	1633	
	0	0	0	1	1	697	1209	
	0	0	1	0	2	697	1336	
	0	0	1	1	3	697	1477	
	0	1	0	0	4	770	1209	
	0	1	0	1	5	770	1336	
	0	1	1	0	6	770	1477	
	0	1	1	1	7	852	1209	
	1	0	0	0	8	852	1336	
	1	0	0	1	9	852	1477	
	1	0	1	0	0	941	1336	
	1	0	1	1	*	941	1209	
	1	1	0	0	#	941	1477	
	1	1	0	1	A	697	1633	
	1	1	1	0	B	770	1633	
	1	1	1	1	C	852	1633	

	Twist2	**Twist1**	**Twist0**	**Relative level**
	0	0	0	No twist, 0 dB nominal.
	0	0	1	low frequency 1 dB below the high frequency tone.
→	0	1	0	low frequency 2 dB below the high frequency tone.
	0	1	1	low frequency 3 dB below the high frequency tone.
	1	0	0	low frequency 4 dB below the high frequency tone.
	1	0	1	low frequency 5 dB below the high frequency tone.
	1	1	0	low frequency 6 dB below the high frequency tone.
	1	1	1	low frequency 7 dB below the high frequency tone.

S13 DTMF-Data / Transmit Attenuation

→	16	0dB nominal for call progress and data, +2dB nominal for DTMF

Attenuation level can go from +4.0 dB to –11.0 dB from nominal.
DTMF gain increments have to be a minimum of 1dB, while for CP/Data the minimum is 2dB gain increments.

	DTMF				CP / Data				Level
	Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	**Gain/Atten**
	0	0	1	0	X	0	1	0	+4.0 dB
	1	0	1	0	X	0	1	0	+3.0 dB
→DTMF	0	0	0	1	X	0	0	1	+2.0 dB
	1	0	0	1	X	0	0	1	+1.0 dB
→CP/Data	0	0	0	0	X	0	0	0	0.0 dB
	1	0	0	0	X	0	0	0	-1.0 dB
	0	1	1	1	X	1	1	1	-2.0 dB
	1	1	1	1	X	1	1	1	-3.0 dB
	0	1	1	0	X	1	1	0	-4.0 dB
	1	1	1	0	X	1	1	0	-5.0 dB
	0	1	0	1	X	1	0	1	-6.0 dB
	1	1	0	1	X	1	0	1	-7.0 dB
	0	1	0	0	X	1	0	0	-8.0 dB
	1	1	0	0	X	1	0	0	-9.0 dB
	0	0	1	1	X	0	1	1	-10.0 dB
	1	0	1	1	X	0	1	1	-11.0 dB

S85 DTMF- DAC transmit level coefficient

	n	60 – 127
→	60	Default value.

This coefficient affect the transmit value, thus the overall transmit level of the DTMF tones, sent to the DAC. A higher value, yet increasing the DTMF level transmitted, also increases the level of signal distortion. This coefficient only affects DTMF transmission.
Refer to the “Transmit levels at 3.3V operations” application note for further details.

S32 Pulse Dial Make Time

Country selection dependent (S99)

	n	1 – 211 in ms unit
→	39	39 ms

S33 Pulse Dial Break Time

Country selection dependent (S99)

	N	1 – 211 in ms unit
→	61	61 ms

S34 Pulse Dial Inter-digit Time

Country selection dependent (S99)

	N	1 – 211 in 10 ms unit
→	75	750 ms

S72 Pulse Map \ CID control \ Black Listing control

Country selection dependent (S99)

→	64	10 pulses for 0; D pulses for D from 1 to 9; no CID, no blacklisting
	Bit 1-0	
→	00	10 pulses for 0; D pulses for D from 1 to 9
	01	10 pulses for 0; 10-D pulses for D from 1 to 9
	10	D+1 pulses for D from 0 to 9
	Bit 2	Set user control on V24 outputs (CTS, RI…) – See Application Notes -
	Bit 3	Enables CID wetting pulse through RELAY signal
	Bit 4	Japanese Caller ID – Off hook CID processing -
	Bit 5	Japanese Caller ID – Marks start the CID preamble -
→	Bit 6	Reserved
	Bit 7	Black Listing option enabled

Sets the relation between the digit D and the digit pulse dialed.

S92 Status Register 4

→	4	pulse dialing allowed.

Bit	Value	
Bit 0		Reserved
Bit 1		Reserved
Bit 2	0	Pulse dialing disabled
→	1	Pulse dialing enabled

All others bits are reserved.

S86 Flash (!) / On Time

	n	1 – 211 in 10 ms unit
→	50	500 ms

S87 Flash (!) / Off Time

	n	1 – 211 in 10 ms unit
→	50	500 ms

Note:

See also S14 and S22

S120 Accepted Answer Tone Frequencies

Enables control over what the modem will qualify as answer tone. By default, the modem functions as it has in the past. (Default = $35)

→	Bit 0	1650Hz – V21 Marks (default)
	Bit 1	1300Hz – V23 Marks
→	Bit 2	2100Hz – ITU Answer Tone (default)
	Bit 3	Reserved
→	Bit 4	2225Hz – Bell Answer Tone (default)

	Bit 5	2250Hz – S0 (default)
	Bit 6	Reserved
	Bit 7	Reserved

S121 Answer Tone Qualify Time

The value of this register extends the answer tone qualification time beyond the 155ms minimum in 10ms units.

n	0-255, but do not over-extend to maintain stability.

Call progress functions

S29 Extended Result Code/ Cadence Status

Country selection dependent (S99)

→	136	See following. A bit set to 1 selects the function.	
		Bit1/0	
→	Bit 1/0	00	Do not return extended result codes (40 - 80). The message CONNECT followed by the data rate between the DTE and the modem will be sent to the DTE (W0 command)
		01	The CONNECT message will report the DTE speed then enable the carrier and extended result codes (W1 command)
		10	The CONNECT message will report the DCE speed. All extended result codes are disabled (W2 command)
		11	Connection messages are muted
	Bit 2	X	Reserved
	Bit 3	0	Escape sequence disabled
→		1	Escape sequence enabled
→	Bit 4	0	Alternate cadence for dial tone
		1	Dual cadence for dial tone
→	Bit 5	0	Alternate cadence for busy tone
		1	Dual cadence for busy tone
→	Bit 6	0	Alternate cadence for ring
		1	Dual cadence for busy ring
	Bit 7	0	Continuous dial tone disabled
→		1	Continuous dial tone enabled

S73 Configuration and Status Register 1

→	32	Sets different configuration. A bit set to 1 selects the function.
	Bit 0	Enable teletel SEP codes in V.23 PAVI mode
	Bit 1	Low power standby idle mode enabled
	Bit 2	Reserved
	Bit 3	Reserved
	Bit 4	Reserved
→	Bit 5	CLI 125 mS AT command delay enabled (disable this option for faster response time to AT commands).
	Bit 6	Adaptive dialing enabled
	Bit 7	Reserved

S66 Dial Tone / Wait For Dial Tone Time

	n	1 – 254 in second
→	8	8 seconds

Sets the maximum number of seconds the modem waits for dial tone.

S67 Dial Tone / Qualify Dial Tone Time

Country selection dependent (S99)

	n	0 – 254 in 10 ms unit
→	120	1.2 second

Sets the minimum duration for dial tone.

S35 Dial Tone / Cadence A Minimum On Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

S36 Dial Tone / Cadence A Maximum On Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit

→	0	0 ms

S37 Dial Tone / Cadence A Minimum Off Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

S38 Dial Tone / Cadence A Maximum Off Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

S39 Dial Tone / Cadence B Minimum On Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

S40 Dial Tone / Cadence B Maximum On Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

S41 Dial Tone / Cadence B Minimum Off Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

S42 Dial Tone / Cadence B Maximum Off Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

S23 Busy Detection Cadence Cycle Count

→	3	3 busy cadence cycles selected.

Defines how many busy cadence cycles before sending the busy result code.

S43 Busy Tone / Cadence A Minimum On Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	10	400 ms

S44 Busy Tone / Cadence A Maximum On Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	15	600 ms

S45 Busy Tone / Cadence A Minimum Off Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	10	400 ms

S46 Busy Tone / Cadence A Maximum Off Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	15	600 ms

S47 Busy Tone / Cadence B Minimum On Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

Country selection dependent (S99)

S48 Busy Tone / Cadence B Maximum On Time

	n	0 – 255 in 40 ms unit
→	0	0 ms

Country selection dependent (S99)

S49 Busy Tone / Cadence B Minimum Off Time

	n	0 – 255 in 40 ms unit
→	0	0 ms

Country selection dependent (S99)

S50 Busy Tone / Cadence B Maximum Off Time

	n	0 – 255 in 40 ms unit
→	0	0 ms

Country selection dependent (S99)

S20 Call Progress Selection

→	17	Imprecise tones detection only.

	Busy tone bits 7-4/ Dial tone bits 3-0				
	Bit 7/3	**Bit 6/2**	**Bit 5/1**	**Bit 4/0**	**Function**
→	0	0	0	1	Detect Imprecise tones ONLY.
	0	0	1	0	Detect All Precise tones ONLY.
	0	1	0	0	Detect Any of the Precise tones.

Country selection dependent (S99)

S88 Imprecise Filter Selection

→	0	Filter 280-680Hz selected for pre and post dialing

Bits 3-0 Pre dial imprecise filter selection (dial tone)

Bits 7-4 Post dial imprecise filter selection (busy tone)

Value Frequency range

	0	280Hz – 680Hz
	1	370Hz – 500Hz
	2	240Hz – 580Hz
	3	200Hz – 650Hz
	15	User defined filter

S19 Precise Call Progress Selection

Country selection dependent (S99)

→	195	350Hz and 440Hz are dial tones; 440Hz and 620Hz are Busy tones.

Defines which precise tones constitute a dial tone and which constitute a busy tone (related bit must be set to one). High nibble defines dial tone and low nibble defines busy. See also S63.

→	Bit 0	Selection of 350Hz as a dial tone
→	Bit 1	Selection of 440Hz as a dial tone
	Bit 2	Selection of 480Hz as a dial tone
	Bit 3	Selection of 620Hz as a dial tone
	Bit 4	Selection of 350Hz as a busy tone
	Bit 5	Selection of 440Hz as a busy tone
→	Bit 6	Selection of 480Hz as a busy tone
→	Bit 7	Selection of 620Hz as a busy tone

S63 Precise Call Progress Detect

→	0	See following.

Bit 0	Detected f0 (350 Hz).
Bit 1	Detected f1 (440 Hz).
Bit 2	Detected f2 (480 Hz).
Bit 3	Detected f3 (620 Hz).
Bit 4	Detected 2130 Hz.
Bit 5	Detected 2750 Hz.
Bit 6	Busy tone detection enabled.
Bit 7	Call Progress filter #1 detect bit.

S75 Pre Dial Call Progress Imprecise Detect Level

Country selection dependent (S99)

	n	1 - 96
→	30	-45dBm threshold.

S75 determines at what minimum level imprecise call progress tones are detected before dialing. A larger value corresponds to a lower signal level. The dBm level depends on the DAA used.

dBm0	S75-S78	dBm0	S75-S78	dBm0	S75-S78	dBm0	S75-S78
-25	3	-31	6	-37	12	-43	24
-26	3	-32	7	-38	14	-44	27
-27	4	-33	8	-39	15	-45	30
-28	4	-34	9	-40	17		
-29	5	-35	10	-41	19		
-30	5	-36	11	-42	22		

S76 Post Dial Call Progress Imprecise Detect Level

Country selection dependent (S99)

	n	1 - 96
→	30	-45dBm threshold.

S76 determines at what minimum level imprecise call progress tones are detected after dialing.
Refer to table under S75.

S77 Pre Dial Call Progress Precise Detect Level

Country selection dependent (S99)

	n	1 - 96
→	30	-45dBm threshold.

S77 determines at what minimum level precise call progress tones are detected before dialing.
Refer to table under S75.

S78 Post Dial Call Progress Precise Detect Level

Country selection dependent (S99)

	n	1 - 96
→	30	-45dBm threshold.

S78 determines at what minimum level precise call progress tones are detected after dialing. Refer to table under S75.

S15 Calling Tone Off Time

	n	0 – 255 in 100 ms unit
→	17	1.7 second

Calling tone is defined as a 1300Hz tone. See S28 / bit 7 for enabling/disabling calling tone

S16 Calling Tone On Time

	n	0 – 255 in 10 ms unit
→	60	600 ms

Calling tone is defined as a 1300Hz tone. See S28 / bit 7 for enabling/disabling calling tone

Data functions

S30 Data Modulation Selection

→	108	See following. Precedence is from the highest to the lowest connection data rate.

	Bit	Value	Mode
	0	1	4-Wire mode
	1	2	Bell202
→	2	4	V22bis
→	3	8	V22
	4	16	Bell212
→	5	32	Bell103
→	6	64	V21
	7	128	V23

S31 Data Modulation Status

→ 0 Default value until connection is established

Bit	Value	Mode
0	1	Successful 4-Wire connection
1	2	Successful Bell 202 connection
2	4	Successful V22bis connection
3	8	Successful V22 connection
4	16	Successful Bell 212 connection
5	32	Successful Bell 103 connection
6	64	Successful V21 connection
7	128	Successful V23 connection

S119 Wait Before Connect

Allows programmable delay between completion of handshake and connect (ready for data). User should be careful; Host will have to complete delay period before transmitting data. Setting the value at this register will affect timing for all modes. Resolution is in 10 ms increments. The Default delay times are as follows:
QAM Answer Mode = 200 ms
PSK Answer Mode = 770 ms
PSK Originate Mode = 770 ms
FSK Originate Mode = 300 ms

NOTE: Special mode when S119 = $FF (Default), uses same value of wait as in the past.

S124 V23 Half Duplex Enable

Enables half duplex “ping-pong” mode. (Default = 0)

Bit 0	0	Selects V.23H 1200/75 bps Asymmetric Duplex mode.
	1	Selects V.23H 1200 bps Half Duplex mode.
Bit 1-7	Reserved	

S25 Protocol Selection

→	0	No protocol detection selected. Modem looks for ODP/ADP on connection. This is used when the host does not do the initial protocol detection.

Bit 0	1	Disconnect if no protocol is detected
Bit 1	1	V42-LAPM protocol selected. This option enables the ODP/ADP sequence detection support within the TSC Softmodem if not supported by the host processor.

When a connection is made and the selected protocol is detected an appropriate result code is returned:

PROTOCOL: NONE or ‘70’
PROTOCOL: LAPM or ‘77’

If 1.5 seconds after CARRIER is established, and no protocol is detected, PROTOCOL: NONE or result code ‘70’ will be sent.

S79 FSK Originate Carrier Detect Level

	n	1 – 96
→	35	-45dBm threshold.

S79 determines at what minimum level carrier is detected for originating FSK. A larger number corresponds to a lower signal level threshold.

S80 FSK Answer Carrier Detect Level

	n	1 – 96
→	35	-45dBm threshold.

S80 determines at what minimum level carrier is detected for answering FSK. A larger number corresponds to a lower signal level threshold.

S81 PSK Originate Carrier Detect Level

	n	1 – 96
→	40	-45dBm threshold.

S81 determines at what minimum level carrier is detected for originating PSK. A larger number corresponds to a lower signal level threshold.

S82 PSK Answer Carrier Detect Level

	n	1 – 96
→	35	-45dBm threshold.

S82 determines at what minimum level carrier is detected for answering PSK. A larger number corresponds to a lower signal level threshold.

S83 QAM Originate Carrier Detect Level

	n	1 – 96
→	40	-45dBm threshold.

S83 determines at what minimum level carrier is detected for originating QAM. A larger number corresponds to a lower signal level threshold.

S84 QAM Answer Carrier Detect Level

	n	1 – 96
→	35	-45dBm threshold.

S84 determines at what minimum level carrier is detected for answering QAM. A larger number corresponds to a lower signal level threshold.

S117 Inactivity Timeout

	n	0 – 255 in seconds
→	0	Feature disabled

This register sets the Inactivity timeout for data mode. If there is no transmitted or received data for the duration of this timer the modem will terminate the call.

Black Listing function

S105 Pre Call attempt delay

	n	1 – 254 in seconds
→	5	5 seconds

Delay prior attempting a call (after an ATD… command is issued)

S106 Delay between 1st and 2nd attempt

	n	1 – 254 in seconds
→	5	5 seconds

Delay between 1st and 2nd call attempt to the same number in a series.

S107 Delay between Nth and N+1th attempt

	n	1 – 254 in seconds
→	60	60 seconds

Delay between Nth and N+1th call attempt to the same number in a series.

S108 Maximum successive failed attempts

	N	1 – 254 in unit
→	15	15 consecutive failed call attempts

Sets the maximum number of successive failed call attempts allowed.

S109 Delay between series

	N	0 – 254 in minutes
→	0	Disabled – only 1 series allowed

Sets the delay before another series of call attempts is allowed.

Answering functions

S123 Software Ring Detect

This register controls the ring amplitude threshold and selects hardware or software ring detection. (Default = 0)

Bits 0-6	Ring Amplitude Detection Threshold. Lower value detects lower amplitude ring signal.
Bit 7	1 = No frequency checking, enables phonex operation 0 = Frequency and amplitude checking, normal operation.

Special Values for S123:

=0	Disable soft ring detect, use hardware ring.
=255	Auto detect phonex mode, the modem will automatically detect an user phonex system and configure itself accordingly.
=1–127	Force soft ring detection with frequency qualification for non-Phonex operation. Recommend value of 7 (or 2 for very Low Amplitude and Frequency detection).
128–254	Force soft ring detection with no frequency qualification for Phonex operation. Recommend value of 170.

S17 Ring / Minimum Frequency Detection

Country selection dependent (S99)

	n	0 – 253 in Hz
→	10	10 Hz

Assumes a half wave detection circuit.
Note: The values need to be doubled if a full wave detector is used.

S18 Ring / Maximum Frequency Detection

Country selection dependent (S99)

	n	1 – 254 in Hz
→	75	75 Hz

Assumes a half wave detection circuit.
Note: The values need to be doubled if a full wave detector is used.

S51 Ring / Cadence A Minimum On Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	40	1.6 s

S52 Ring / Cadence A Maximum On Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	60	2.4 s

S53 Ring / Cadence A Minimum Off Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	80	3.2 s

S54 Ring / Cadence A Maximum Off Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	120	4.8 s

S55 Ring / Cadence B Minimum On Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

S56 Ring / Cadence B Maximum On Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

S57 Ring / Cadence B Minimum Off Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

S58 Ring / Cadence B Maximum Off Time

Country selection dependent (S99)

	n	0 – 255 in 40 ms unit
→	0	0 ms

S74 Billing Delay Time

Country selection dependent (S99)

	n	20 – 254 in 100 ms unit
→	20	2 seconds

This register sets the duration of billing delay in units of 100 ms.

Caller ID functions

S95 Caller ID configuration

→	136	CID disabled
	Bit 0	Dual Tone Alert Signal expected
	Bit 1:2	Number (0-3) of Line Reversal or Ring Pulse Alert Signals expected before Caller ID.
→	Bit 3	CID between 1st and 2nd ring
	Bit 4	Caller ID enabled. Applies only to On-Hook/Offline/Type I Caller ID.
	Bit 5	0= FSK, 1 = DTMF based signaling for CID
	Bit 6	Enables using USR11 to measure DC offset when entering Idle state

→ Bit 7 Enables using USR11 output to enable an external signal path for CID. Bit 7 = 0 sets continuous CID mode where S95 bits 0, 1, 2, and 3 are ignored. Also enables using USR 11 output to signal DAA to enter idle line signaling state for LIU-E detection.

Special modes:

S95 = 0X01 0000B	Continuous FSK Caller ID mode.
S95 = 0X110000B	Continuous DTMF - send detected digits to DTE without "CID:" message.
S95 = 10011001B	Detect US Type 1 and Type2 Snoop CID simultaneously. In this mode the modem may automatically modify S72 register bit 5 to look for Dots (Type1) or marks (Type 2 Snoop).

S118 Caller ID Ring Interrupt Delay

Disables ring interrupt detection for the specified period of time during CID enable/disable transitions, measured in ms. Default = 20

=n is disable time in mS.

Line In Use and Parallel Pick Up detection functions

S89 Parallel Pick-up Energy Detection (Default=0)

0 PPU disabled

Bit	Value	
Bit 1,0	00-11	N command value
Bit 2	0	Reserved
Bit 3	1	PPU Energy (PPU-E) detection enabled
Bit 4	1	Inverts ring input polarity for PPU-V (Default is RingB active low)
Bit 5	1	Inverts ring input polarity for LIU-V (Default is RingB active low)
Bit 6	1	VFI fast connect originate handshake when specifying Bell 212 only in S30. This works for Bell 212A and V.22 when S30 is set only for Bell 212A. Other modes cannot be specified in S30. Will send FLAGS as part of the handshake when Y1 or Y4 is selected.
Bit 7	1	Reserved

S110 Line-In-Use/Parallel Pick Up Configuration Register

→ 112 No LIU or PPU enabled.

Bit	Value	
Bit 0	1	Enables Off-Hook Voltage sensing Parallel pick-up det. (PPU-V)

	Bit 1	1	Enables On-Hook Line-In-Use Voltage sensing detection (LIU-V)
	Bit 2	1	Enables On-Hook Line-In-Use Energy sensing detection (LIU-E)
	Bit 3	1	Enables Call-Waiting Caller-ID option. This bit applies only to Off-Hook/Online/Type II Caller-ID.
→	Bit 4	1	Enables high impedance TXAN/TXAP while looking for CID
→	Bit 5	1	Enables receive gain (20 dB) while looking for CID
→	Bit 6	1	Enables using USER10 output to signal DAA to activate on-hook LIU sensing
	Bit 7	1	Enables Long Space Disconnect. When enabled, the TSC Softmodem sends 3.5 seconds of NULL characters before disconnecting upon reception of an on hook command from the host; and disconnects upon reception of 1.5 second of NULL characters from the remote modem.

S111 Line-In-Use Settling time

	n	0 –254 in 10ms unit
→	20	200ms

This register sets the settling time to wait, after the LIU sensing circuit is enabled, before sampling LIU signal. This is used for both on-hook (Voltage sensing LIU) and off-hook (PPU) detection.

S112 Line-In-Use Energy detection Wait

	n	0 –254 in 100ms units
→	20	2 seconds

This register sets the qualify time that Energy must remain below threshold.

S113 Line-In-Use Energy Detection Threshold

	n	0 – 95
→	60	Default value.

Sets the Threshold for the voice Energy. Lower number means higher signal threshold. The value of 0 would effectively never detect and higher than 95 would always detect. This register is also use by (**J7**) test mode as a minimum carrier detect threshold.

S116 Parallel-Pick-Up Energy detection Threshold

	n	72, 80, 90.
→	72	1 db energy loss threshold
	Value	Energy loss detected
	72	1 dB loss of energy detection
	80	2 dB loss of energy detection
	90	3 dB loss of energy detection

This register sets the Threshold for PPU to detect loss of Energy compared to the energy level at the time of connection.

S122 Parallel Pick Up Debounce Timer

Sets the duration of the parallel pick-up debounce timer in 10ms increments.

=n times 10mS.

S14 General Modem Status Register 1

→	170	See following.	

S14 reflects the status of certain options.

	Bit	Value	
			In data mode
→	Bit 0	0	Clear channel for receiver.
		1	Receive channel speed buffered.
			In Call progress mode
→	Bit 0	0	Single cadence A or B detection
		1	Double Dual cadence detection
	Bit 1	0	No echo
→		1	Echo on
→	Bit 2	0	Result codes enabled
		1	Result codes disabled
	Bit 3	0	Numeric result codes

→		1	Verbose result codes
→	Bit 4	0	No match
		1	First cadence of double cadence matched
	Bit 5	0	Touch tone dialing
→		1	Pulse dialing
→	Bit 6	0	Not connected
		1	Connected
	Bit 7	0	Answer
→		1	Originate

S21 General Modem Status Register 2

→	1	See following.	

Bit	Value	
Bit 0	0	Keypress abort disable.
→	1	Keypress abort enable.
→ Bit 1	0	Use debounced carrier detect
	1	Use raw carrier detect (set by C2 command).
→ Bit 2	0	Disable V.23 turnaround via DTR toggle.
	1	Enable V.23 turnaround via DTR toggle (set by R4 command).
→ Bits 4/3	00	Modem ignores DTR (Default) (R0)
	01	Modem assumes the Command State when DTR transitions from ON to OFF (R1).
	10	Modem goes on hook, disables Auto Answer and assumes the Command State when DTR transitions from ON to OFF (Auto Answer can be enabled by transitioning DTR from OFF to ON) (R2).
	11	Modem is reset when DTR transitions from ON to OFF (R3).
→ Bit 5	0	$\overline{\text{DCD}}$ always ON (equivalent to C0 command).
	1	$\overline{\text{DCD}}$ ON indicates the presence of CD (equivalent to C1 command).
→ Bit 6	0	No RTS / CTS DTE flow control.
	1	RTS / CTS DTE flow control (equivalent to K3).
→ Bit 7	0	No XON / XOFF DTE flow control.
	1	XON / XOFF DTE flow control (equivalent to K4).

S22 General Modem Status Register 3

→	54	See following

	Bit 2	Bit 1	Bit 0	Synchronous/Asynchronous control
	0	0	0	Y0 Asynchronous mode
	0	0	1	Y1 Synchronous mode
	1	0	0	Y4 Pseudo-synchronous mode
→	1	1	0	Y6 Asynchronous with speed buffering

	Bit 6	Bit 5	Bit 4	Bit 3	Select result codes
	0	0	0	1	X0 Enable Result Codes 0-4.
	0	0	0	0	X1 Enable Result Codes 0-5, 10.
	0	0	1	0	X2 Enable Result Codes 0-6, 10.
	0	1	0	0	X3 Enable Result Codes 0-5, 7, 10.
→	0	1	1	0	X4 Enable Result Codes 0-7, 10. (Default)
	1	0	0	0	X5 Enable Result Codes 0-5, 10, and detect BUSY at OFF HOOK.
	1	0	1	0	X6 Enable Result Codes 0-6, 10, and detect BUSY at OFF HOOK.
	1	1	0	0	X7 Enable Result Codes 0-5, 7, 10, and detect BUSY at OFF HOOK.
	1	1	1	0	X8 Enable Result Codes 0-7, 10, and detect BUSY at OFF HOOK.

→	**Bit 7**	0	Pulse dialing make/break ration = 39/61
		1	Pulse dialing make/break ration = 33/67

S26 Data Mode Control Register

→	0		See following
	Bit 0		Forces rate change to 1200bps
→	Bit 1	0	Disables speed negotiation during a retrain request
		1	Enables speed negotiation during a retrain request
→	Bit 2	0	Disables automatic retrain requests
		1	Enables an automatic retrain request to be negotiated
→	Bit 3	0	Disables retrain request response
		1	Enables the modem to respond to a retrain request

→	Bit 4	0	Select 1800 Hz guard tone to be generated during answer mode handshake
		1	Select 550 Hz guard tone to be generated during answer mode handshake
→	Bit 5	0	Disables guard tone generation
		1	Enables guard tone generation
→	Bit 6	0	Disable V.23 turnaround
		1	Enable V.23 turnaround
→	Bit 7	0	Tx 1200 bps (Bell 202 and V.23 slave mode)
		1	Rx 1200 bps (Bell 202 and V.23 master mode)

S27 Call Progress Transmit Register

→	0	See following.	
→	Bit 0	0	Send “0FFh” characters in pseudo sync (Y4)
		1	Do not send “0FFh” characters in pseudo sync (Y4)
→	Bit 1	0	Do not transmit 1100Hz
		1	Transmit 1100Hz
→	Bit 2	0	Do not transmit 1300Hz
		1	Transmit 1300Hz
→	Bit 3	0	Do not transmit 2100Hz
		1	Transmit 2100Hz
→	Bit 4	0	Do not transmit 2225Hz
		1	Transmit 2225Hz
	Bit 5		Disconnect bit
→	Bit 6	0	CCITT V22bis, V22, V21, V23 (B0 command)
		1	Bell 103, Bell 202, Bell 212A (B1 command)
→	Bit 7	0	Protocol selection not done
		1	Protocol selection done

Order of precedence is as follows from highest to lowest: Bit 1, Bit 2, Bit3, Bit 4

S28 Fast Connect Status and Calling Tone Enable Register

→	50	See following.	
	Bit 0	1	AGC enable
→	Bit 1	X	Reserved
	Bit 2	X	Reserved
	Bit 3	1	Synchronous mode (set by Y1 and Y4)
	Bit 4	1	Answer tone enable
→	Bit 5	1	Billing delay enable
→	Bit 6	1	400ms answer tone at 1200bps
	Bit 7	1	Calling tone enable

S60 Test Control Register

→	0	See following		
	Bit 2	**Bit 1**	**Bit 0**	**Function**
→	0	0	0	Data mode
	0	0	1	Send Marks
	0	1	0	Send Spaces
	0	1	1	Send Dotting
	1	0	0	Send S1
	1	0	1	Send S0
	1	1	0	Send Dotting ‘A’
	1	1	1	Send Flags (07Eh)

	Bit 3	1	Enable detection of dial tone
		0	Disable detection of dial tone
→	Bit 4	0	Disables the scrambler
		1	Enables the scrambler
→	Bit 5	0	Disables the de-scrambler
		1	Enables the de-scrambler
	Bit 6	1	Enable RLDB mode
		0	Disable RLDB mode
	Bit 7	1	Enable ALB mode
		0	Disable ALB mode

S61 Signal detect Register 1

→	0	See following. Read only.
	Bit 0	Reserved
	Bit 1	Remote digital loopback detect bit. This bit will be set when a remote digital loopback request has been detected.
	Bit 2	Carrier detect bit. This bit will be set when conditions for V.24 circuit 104 (DCD) have been met by the modulation mode being used.
	Bit 3	Wait for Calling Tone before sending Answer Tone
	Bit 4	Energy detect bit. This bit will be set if the receive level is above a certain threshold.
	Bit 5	S1 Detect bit. This will be set if S1 (unscrambled 110011..) is detected. This bit is also used to detect a retrain request if connected in V.22bis or V.22
	Bit 6	USB1 Detect bit. This will be set if USB1 (unscrambled binary ones) is detected. This bit is also used to detect a remote digital loopback request if connected in V.22bis or V.22
	Bit 7	Reserved

S62 Signal detect Register 2

→	0	See following. Read only.
	Bit 0	Detected 1650 Hz (V.21 answer marks)
	Bit 1	Detected 1300 Hz.
	Bit 2	Detected 2100 Hz (ITU answer tone)
	Bit 3	reserved
	Bit 4	Detected 2225 Hz (Bell answer tone)
	Bit 5	Detected 2250 Hz (comp. USB1).
	Bit 6	Detected 1100 Hz (fax calling tone). Detect changes to 1270 Hz at the end of answer Call Progress.
	Bit 7	Detected 1300 Hz (data calling tone). Detect changes to 980 Hz at the end of answer Call Progress.

S65 DTMF Detect Register

→ 0 See following
Bit 7 indicates a valid DTMF detection. A register value of zero indicates no detect for the polled application. Bits 6 - 4 are reserved. Bits 3 - 0 indicate the tone pair detected. Works with command J6 and bit 7 have to be set in order to be valid. The following tables define DTMF decoding:

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Valid	N/A	N/A	N/A	DTDET3	DTDET2	DTDET1	DTDET0

DTMF Detect bits					**Dialed**	**Tone Pair Detected**	
Det Valid	**DTDET 3**	**DTDET 2**	**DTDET 1**	**DTDET 0**	**Digit**	**Low Tone (Hz)**	**High Tone (Hz)**
1	0	0	0	0	D	941	1633
1	0	0	0	1	1	697	1209
1	0	0	1	0	2	697	1336
1	0	0	1	1	3	697	1477
1	0	1	0	0	4	770	1209
1	0	1	0	1	5	770	1336
1	0	1	1	0	6	770	1477
1	0	1	1	1	7	852	1209
1	1	0	0	0	8	852	1336
1	1	0	0	1	9	852	1477
1	1	0	1	0	0	941	1336
1	1	0	1	1	*	941	1209
1	1	1	0	0	#	941	1477
1	1	1	0	1	A	697	1633
1	1	1	1	0	B	770	1633
1	1	1	1	1	C	892	1633

S68 Test Timer

→ 0 0 second.

Times how long the self-tests should run in seconds.

S69 Test Error Count

→	0	No error

Keeps count of how many errors occur during the self-test.

S70 Auto Retrain Threshold

Forces auto retrain if threshold is below the mean square error.

Default = 16

S90 RTS to CTS Turnaround Delay

	n	0 – 255 in 10ms unit
→	2	20 ms turnaround delay

When the N0 command has been issued, register S90 defines the time interval between an OFF to ON transition of $\overline{RTS}$ and when the modem turns $\overline{CTS}$ ON. The S90 setting applies to Synchronous modes only.

S114 Maximum carrier detect threshold (High Byte)

	n	0 - 255
→	80	Default value

Sets the maximum carrier detect threshold used by (J7) test mode. Higher value may indicate open circuit in either TXAP or TXAN signals to RXA. See S115.

S115 Maximum carrier detect threshold (Low Byte)

	n	0 - 255
→	80	Default value

Sets the maximum carrier detect threshold used by (J7) test mode. Higher value may indicate open circuit in either TXAP or TXAN signals to RXA. See S114.

2.3 Application Notes for the TSC Softmodem

Resetting the TSC Softmodem

A reset of the TSC Softmodem can be performed three different ways:

- A power-on reset
- Reset Button (similar to power on reset)
- Start the soft modem from Linux prompt

Call Progress Detection

The TSC Softmodem has expanded call progress detection capabilities. In addition to the capability of detecting some precise tones (see S19), the TSC Softmodem implements some imprecise call progress capabilities (wide frequency bandwidth filters). Each call progress tone can be monitored and validated according to the following parameters:

- Frequency
- Level
- Cadence

The TSC Softmodem has 4 preset frequency filters. At least one range of frequencies will meet the requirements for call progress detection worldwide. The selection of the filter that will apply during either the pre-dial phase (dial tone) or during the post-dial phase (busy tone) is made through the Imprecise filter template register, S88.
The detection bandwidth of the preset filters are:

- 280Hz √ 680Hz
- 370Hz √ 500Hz
- 240Hz √ 580Hz
- 200Hz √ 650Hz

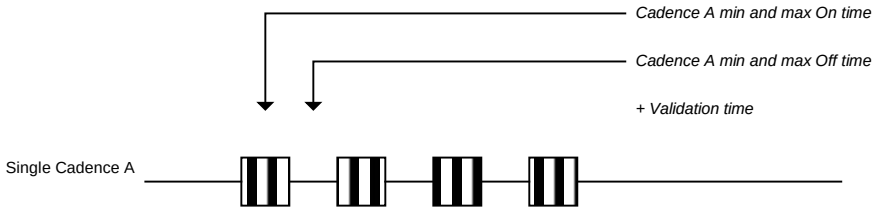
In addition, it is possible for a user defined frequency filter. Contact your local TERIDIAN representative for further details on that function.

Once the frequency filter has been chosen, the threshold of detection needs to be set through registers S75 and S76. Due to the variety of requirements for different countries, there is the provision to select a different threshold for both the pre dial and post dial phase. The range of detection thresholds allowed are from –25dBm down to –60dBm. Please note that level detection results may vary due to different line interface implementations.

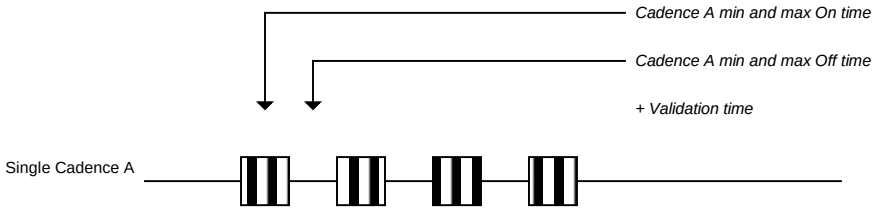
After the frequency ranges have been selected, the last step is to select the proper cadence of the call progress tones we are about to detect. The TSC Softmodem features an expanded support for cadence detection in order to meet requirements worldwide. There are four different types of cadences defined in the TSC Softmodem. Each parameter for those cadences can be selected by the user to modify the detection criteria.

Continuous cadence:
The tone is continuously present and provided that it meets the requirements for frequency and level, it will be considered as a valid call progress tone after a certain time of validation (see S67 or S23). This is the standard cadence for dial tone detection in most cases.

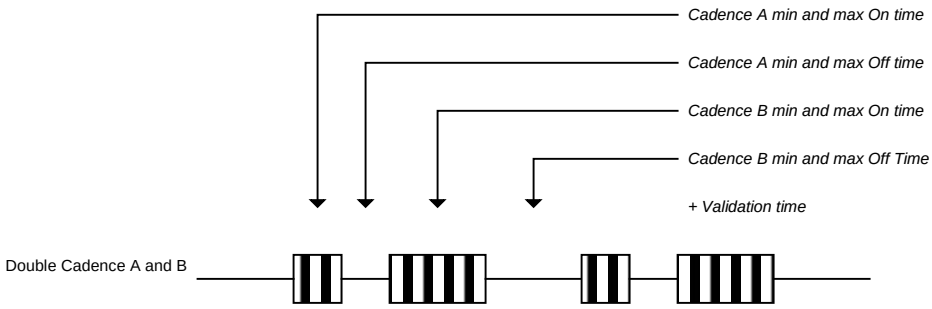
Single cadence A:
The cadence has a regular On and Off time, A, and provided that it meets the requirements for frequency and level, it will be considered as a valid call progress tone after a certain time of validation (see S67 or S23).



Single cadence B:
The cadence has a regular On and Off time, B, and provided that it meets the requirements for frequency and level, it will be considered as a valid call progress tone after a certain time of validation (see S67 or S23).



Double cadence:
The cadence has a regular On and Off time, A, followed by a On and Off time, B, and provided that it meets the requirements in terms of frequency and level, it will be considered as a valid call progress tone after a certain time of validation (see S67 or S23). An example of this is the cadence for the Italian dial tone.



Built in Country Support

Since the TSC Softmodem is intended to address all the certification requirements worldwide, it has been provided with completely flexible features and parameters that can be modified to adapt to virtually any telephone network in the world and any certification requirements.
Manually setting all the parameters can often be exhausting due to the wide range of requirements that need to be changed for a specific country. The TSC Softmodem has been provided with a built in set of parameters to address many countries, allowing the user to program all the parameters of the TSC Softmodem required for specific country through one single register,S99.

The countries supported are:

- USA/Canada (FCC68)
- CTR21 (CTR21/TBR21)
- France (ETS300-001)
- Spain (ETS300-001)
- Italy (ETS300-001)
- United Kingdom (ETS300-001)
- Germany (ETS300-001)
- Australia (TS001/TS002/TS004)
- Japan (NTT/Telephone service interfaces)
- South Korea
- China
- Taiwan

Between brackets is the official document from which the parameters have been extracted. It should be noted that such regulations sometimes give a range of value rather than one specific value. The TSC Softmodem implements values that not only comply with the regulation but also insure a proper behavior in the field based on TERIDIAN's extensive experience in modem applications.

Any country not listed can be supported by selecting the country most similar and modifying the required parameters.

Country implemented (all timing is in seconds and levels in dBm; see S99 register descriptions) China and Taiwan are identical to USA, except for China transmit level.

	USA Canada	CTR21	France	UK	Italy	Germany	Japan	Australia	Spain	Affected register
S99=	1	0	33	44	39	49	81	61	34	S99
Impedance	00	01	01	01	01	01	00	11	01	ACZ1:0
DC MASK	10	10	10	10	10	10	00	11	10	DAA1:0
Wait for blind dial time	2	4	2	4	4	4	4	4	4	S6
Billing_delay	2	2	2	2	2	2	2	2	2	S74
DTMF_speed	0.070	0.080	0.085	0.085	0.085	0.085	0.085	0.085	0.150	S11
Pulse dial make time	0.039	0.033	0.033	0.033	0.040	0.039	0.033	0.033	0.033	S32
Pulse dial break time	0.061	0.067	0.067	0.067	0.060	0.061	0.067	0.067	0.067	S33
Pulse dial interdigit time	0.750	0.850	0.900	0.850	0.880	0.850	0.850	0.850	0.900	S34
Pulse dial map	0	0	0	0	0	0	0	0	0	S72
Imprecise dial tone filter	280/680	240/580	370/500	240/580	370/500	240/580	240/580	240/580	240/580	S88
Imprecise Dial tone detection level	-45	-42	-38	-38	-38	-38	-38	-38	-38	S75
Precise Dial tone detection level	-45	-45	-40	-45	-40	-45	-45	-45	-40	S77
Dial tone type	Imprecise	Imprecise	Imprecise	Imprecise	Imprecise	Imprecise	Imprecise	Imprecise	Imprecise	S20
Dial tone precise freq. 350Hz selected	Sel.	-	Sel.	-	Sel.	-	-	-	Sel.	S19
Dial tone precise freq. 440Hz selected	Sel.	-	-	Sel.	-	Sel.	Sel.	Sel.	-	S19
Dial tone precise freq. 480Hz selected	-	-	Sel.	-	Sel.	-	-	-	-	S19
Dial tone precise freq. 620Hz selected	-	-	-	Sel.	-	-	-	-	Sel.	S19
Dialtone qualification time	1.2	1.0	0.8	0.8	2.0	0.8	1.0	1.0	1.0	S67
Continuous Dial tone	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	S29
Cadenced Dial tone	CadenceA or B	Double cadence	Cadence A or B	Cadence A or B	Double cadence	Cadence A or B	Cadence A or B	Cadence A or B	Cadence A or B	S29
min_on_A_dt	0.000	0.160	0.000	0.000	0.160	0.000	0.000	0.000	0.800	S35
Max_on_A_dt	0.000	0.240	0.000	0.000	0.240	0.000	0.000	0.000	1.200	S36
min_off_A_dt	0.000	0.160	0.000	0.000	0.160	0.000	0.000	0.000	0.080	S37
Max_off_A_dt	0.000	0.240	0.000	0.000	0.240	0.000	0.000	0.000	0.120	S38
min_on_B_dt	0.000	0.480	0.000	0.000	0.480	0.000	0.000	0.000	0.240	S39

max_on_B_dt	0.000	0.720	0.000	0.000	0.720	0.000	0.000	0.000	0.400	S40
min_off_B_dt	0.000	0.800	0.000	0.000	0.800	0.000	0.000	0.000	0.000	S41
max_off_B_dt	0.000	1.200	0.000	0.000	1.200	0.000	0.000	0.000	0.040	S42
Imprecise busy tone filter	280/680	240/580	370/500	240/580	370/500	240/580	240/580	240/580	240/580	S88
Imprecise busy tone detection level	-45	-45	-45	-45	-50	-55	-45	-45	-45	S76
Precise busy tone detection level	-45	-45	-45	-45	-50	-55	-45	-45	-45	S78
Busy tone type	Imprecise	Imprecise	Imprecise	Imprecise	Imprecise	Imprecise	Imprecise	Imprecise	Imprecise	S20
Busy tone precise freq. 350Hz selected	-	-	Sel.	-	Sel.	-	-	-	-	S19
Busy tone precise freq. 440Hz selected	-	-	-	-	-	Sel.	Sel.	Sel.	Sel.	S19
Busy tone precise freq. 480Hz selected	Sel.	-	Sel.	Sel.	Sel.	-	-	-	Sel.	S19
Busy tone precise freq. 620Hz selected	Sel.	-	-	-	-	-	-	-	-	S19
Cadenced busy tone	CadenceA or B	CadenceA or B	CadenceA or B	CadenceA or B	CadenceA or B	CadenceA or B	CadenceA or B	CadenceA or B	CadenceA or B	S29
min_on_A_busy	0.400	0.400	0.400	0.240	0.400	0.360	0.400	0.280	0.160	S43
max_on_A_busy	0.600	0.600	0.600	0.520	0.600	0.600	0.600	0.440	0.320	S44
min_off_A_busy	0.400	0.400	0.400	0.240	0.400	0.360	0.400	0.280	0.160	S45
max_off_A_busy	0.600	0.600	0.600	0.520	0.600	0.600	0.600	0.440	0.320	S46
min_on_B_busy	0.000	0.000	0.000	0.000	0.000	0.080	0.000	0.000	0.000	S47
max_on_B_busy	0.000	0.000	0.000	0.000	0.000	0.240	0.000	0.000	0.000	S48
min_off_B_busy	0.000	0.000	0.000	0.000	0.000	0.360	0.000	0.000	0.000	S49
max_off_B_busy	0.000	0.000	0.000	0.000	0.000	0.600	0.000	0.000	0.000	S50
ring_min_Hz	10	10	10	10	10	10	10	10	10	S17
ring_max_Hz	75	75	75	75	75	75	75	75	75	S18
Cadenced ring	CadenceA or B	CadenceA or B	CadenceA or B	Double cadence	CadenceA or B	CadenceA or B	CadenceA or B	Double cadence	CadenceA or B	S29
min_on_A_ring	1.600	0.800	1.200	0.320	0.800	0.720	0.800	0.320	1.200	S51
max_on_A_ring	2.400	1.200	1.800	0.480	1.200	1.200	1.200	0.480	1.800	S52
min_off_A_ring	3.200	3.200	3.000	0.120	3.200	3.200	1.600	0.080	2.400	S53
max_off_A_ring	4.800	6.000	4.000	0.280	5.000	6.000	2.400	0.280	3.600	S54
min_on_B_ring	0.000	0.000	0.000	0.320	0.000	0.000	0.000	0.320	0.000	S55
max_on_B_ring	0.000	0.000	0.000	0.480	0.000	0.000	0.000	0.480	0.000	S56
min_off_B_ring	0.000	0.000	0.000	1.600	0.000	0.000	0.000	1.600	0.000	S57
max_off_B_ring	0.000	0.000	0.000	2.400	0.000	0.000	0.000	2.400	0.000	S58

V23 Operation

In addition to the standard V23 recommendation, the TSC Softmodem also adds a special feature referred to as V23 PAVI operation. This feature implements the mechanism to allow the swapping or turn-around of the transmission channels during communications. Transmission speed may then be monitored dynamically during a connection; the transmitter at 75 bps may become the transmitter at 1200 bps, and vice versa.

The process of switching from transmission at 75 bps to 1200 bps is referred as Back to Main Channel Turnaround.
The process of switching from transmission at 1200 bps to 75 bps is referred as Main to Back Channel Turnaround.

V23 PAVI operation includes also a Teletel option that is characterized by the transmission of some special characters during communications.

The mechanism of this operation is described in the following document:

"Spécifications Techniques d'Utilisation du Minitel 1B" - Edition of Nov 1986 -
Edited by :

Ministère des Postes et des Télécommunications
Direction Générale des Télécommunications
Direction des Affaires Commerciales et Télématiques

If you are interested by further details on the V23 operation in the TSC Softmodem, please request the related application note entitled "73M2901_V23_Operation" from your local TERIDIAN's representative.

Line in Use/Parallel Pick Up Detection Support

A modem may share the phone line with other equipment such as telephone sets or emergency equipment (alarms, etc) and may be programmed to place a call without notifying the customer. Some standards require that the unattended modem have low priority on the line. Therefore the modem should not be allowed to seize the line if the line is in use by any other equipment and should release the line as soon as any other equipment tries to place a call. The TSC Softmodem supports two methods of detecting Line-In-Use; by looking at the battery voltage from the central office and by detecting energy on the line from other devices or voice, before going off hook. The TSC Softmodem also detects another device going off hook in parallel with the modem by sensing the drop in voltage caused by the parallel device. When these features are active the modem will immediately relinquish the line to the other device and send a message to the host informing it of the event or condition (LIU-V, LIU-E, PPU-E or PPU-V).

The Line-in-Use/Parallel Pick-up feature of the TSC Softmodem provides the designer support for these features with only a minimum of additional hardware.

If you are interested by further details on the Line In Use/Parallel Pick-up detection support in the TSC Softmodem, please request the related application note entitled "73M2901CL_AN_LIU-PPU_Rx.x" from your local TERIDIAN representative.

DTMF Tone Detection

The TERIDIAN TSC Softmodem provides two different methods for detecting DTMF tones being exchanged on the phone line.

1st method:

This method is implemented though a specific detection mode enabled by the J6 command. Once the device has entered this mode, the host processor is required to poll continuously the S65 register in order to detect a valid DTMF tone. It is possible to increase the polling frequency by disabling the CLI delay in register S73 (ATS73-32). This method halted by the J0 command requires the device to be off hook.

2nd method:

Use of the DTMF based caller ID feature can be exploited to detect DTMF tones. In that mode, enabled by setting the register S95 (ATS95=48), the decoded DTMF tones are sent automatically to the host on the RXD lead. This mode does not require the modem to be off hook, however an AC coupled signal path must be provided from Tip/Ring to RXA (See Caller ID application note).

SMS Applications

The TSC Softmodem has been optimized for SMS and V.23 half duplex in general. There are several enhancements that have been added to the TSC Softmodem to make it more compatible with SMS, including faster turn around and demodulator settling. Normally the modem will be used in the “clear channel” mode (Y0), but this is not mandatory. Speed buffering (Y6) at 4800/9600bps using XON/XOFF (K4) can also be used instead of Y0 and 1200bps. RTS/CTS (K3) flow control cannot be used because these signals are being used to control the V23HD carrier. The TSC Softmodem modem is typically initialized with the command string: ATY0B10S73-32C2S10=255 this is broken out as follows:

Y0	clear channel mode (1200 bps)
B10	V.23 HDX gated by RTS
S73-32	no 125ms wait between commands
C2	DCD follows the raw received carrier
S10=255	disable loss of carrier timeout

The following two sequences are typical of how the TSC Softmodem should be used in a communications session. A SMS session can be quite complicated as described in the referenced documentation, so this example should not be interpreted to be all that is required. There are various signal times and time-outs that also need to be observed and these all have there own decision trees that need to be accounted for.

Polling of CTS-DCD signals is necessary. CTS indicates that modem is ready to send data. DCD indicate that receive data is valid. CTS, DCD and RTS are all low true signals at the RS232.
RTS-ON to CTS-ON response time is controlled by S90 (range 10ms to 2.55s).
RTS-OFF to CTS-OFF is <4ms
Using C2 carrier option, DCD will turn on after receiving carrier for 10-20ms.

Case 1: SM-TE TSC Softmodem (Master) to SM-SC (Slave) transmission sequence for a SMS message

1. Set the Local Host serial data rate to 1200bps
2. The Local Host controls the V23 carrier with RTS signal
3. Turn off RTS (to start modem as a receiver and prevent sending carrier)
4. Send ATY0B10S73-32C2S10=255 to initialize the TSC Softmodem modem
5. ATDTnnn.. (TE dials SMS-SC)
6. Modem will display "Connect 1200" with CTS off and DCD off
7. Modem waits for V23 carrier from SM-SC
8. Wait for DCD on (SM-SC carrier received)
9. Detect channel seizure and mark from V.23 receive data
10. Wait for DLL_SMS_EST signal and DCD turn off (SM-SC switched to receive mode)
11. Turn on RTS (to switch modem to transmit mode)
12. Wait for CTS on to indicate TSC Softmodem is ready to send data
13. Transmit DLL_SMS_INFO_MO originate message to SM-SC
14. Turn off RTS (to switch modem to receive mode)
15. Wait for DCD on (SM-SC carrier is being received)
16. Detect ACK1 message from SM-SC or time-out. The slave will include the TL confirmation or rejection message in the payload, or a null message if the timer expires.
17. Wait per SMS timing and DCD turn off (SM-SC switched to receive mode)

SMS Applications continued

18. Turn on RTS (to switch TSC Softmodem modem to transmit mode)
19. Wait for CTS on
20. Transmit DLL_SMS_ENQ message if the ACK1 was a null message or next DLL_SMS_INFO_MO to send another data frame
21. Turn off RTS (to switch modem to receive mode)
22. Wait for DCD on
23. Detect DLL_SMS_ACK1 again from SM-SC if the ACK1 was a null last time or DLL_SMS_ACK0 for the SMS_INFO_MO frame just received.
24. (Assuming DLL_SMS_ACK0 was received above) Wait per SMS timing and DCD turn off (SM-SC switched to receive mode)
25. Turn on RTS (to switch TSC Softmodem modem to transmit mode)
26. Wait for CTS on
27. Transmit DLL_SMS_REL message to end session
28. Turn off RTS (to switch TSC Softmodem modem to receive mode)
29. Wait for DCD on
30. Detect DLL_SMS_ACK1 message from SM-SC acknowledging the end of the session.

END

Case 2: SM-SC to TE transmission of a SMS

1. Set the Local Host serial data rate to 1200bps
2. The Local Host controls the V23 carrier with RTS signal
3. Turn off RTS (to prevent sending carrier too early)
4. ATY0B10C2S73-32S10=255S0=2 (Auto answer on 2 rings)
5. Modem auto answer SMS-SC call after S0 rings
6. Modem will display "Connect 1200" with CTS off and DCD off
7. Turn on RTS (to switch modem to transmit mode)
8. Wait for CTS on
9. Prepare to send the DLL_SMS_EST signal from the SM-TE. From the Local Host send the “+++ATS60=3” escape sequence to modem to switch to the on-line command mode along with the ATS60=3 command to set the modem to transmit alternating 0/1s
10. Wait for 240 ms and then the ATO command to turn off the alternating pattern and start to transmit a MARK signal for 70ms.
11. Turn off RTS (to switch TSC Softmodem modem to receive mode)
12. After completion of the Channel Seizure & MARK signal transmission, from the Local Host send ATS60=0O to return to the data mode
13. Wait for DCD on
14. Receive DLL_SMS_INFO_MT message from SM-SC (SM message information) There may be multiple messages and ACKn’s if segmented messages are sent.

SMS Applications continued

15. Wait per SMS timing and DCD turn off (SM-SC switched to receive mode)
16. Turn on RTS (to switch modem to transmit mode)
17. Wait for CTS on
18. Transmit DLL_SMS_ACK1 message to SM-SC
19. Turn off RTS (to switch modem to receive mode)
20. Wait for DCD on
21. Receive DLL_SMS_REL message from SM-SC
22. Wait per SMS timing and DCD turn off (SM-SC switched to receive mode)
23. Turn on RTS (to switch modem to transmit mode)
24. Wait for CTS on
25. Transmit DLL_SMS_ACK0 message to SM-SC acknowledging the end of the session

END

A couple of things should be noted in the procedures above. Although detailed only in the SM_SC to SM-TE connection, the TSC Softmodem is put into a mode that sends patterns during the handshake to generate the alternating 0/1 and Marks (steps 9 and 10 above). This is also necessary every time the line is turned around and the carrier is sent. The reason for this using the test pattern generator for the alternating pattern is that the modem only sends asynchronous data and to send this by using the equivalent character, “U”, there can be some distortion of the waveform. By using the transmit alternate pattern a symmetrical continuous waveform is guaranteed. The pattern transmission stops automatically when the modem is put back into the data mode. To send the Marking pattern simply do not send data for 70 ms (constant marks are sent when there is no data). If a normal frame were being sent instead of the DLL_SMS_EST signal, the Message Type, Message Length, Payload and Checksum would follow the Marks. This same procedure must be done each time a pattern is sent.

It may take some time to fully comprehend the SMS protocols, but after studying the ETSI documentation it will all start to fall into place. Any robust half duplex protocol should contain a similar structure to SMS, but there is a lot of room for variation. It is important that enough time is allowed for the carriers to turn around and there should be a way to easily recognize the beginning of the data packets. If these functions are missing, the chances for errors increase.

3 S-Register Index

4 Related Documentation

The following 73M1x22 documents are available from Teridian Semiconductor Corporation:

73M1822 Demo Board User's Manual
73M1922 Layout Guidelines
73M1x22 Worldwide Design Guide
Teridian V.22BIS Linux Softmodem for 73M1822/73M1922 MicroDAA User Guide (this document)
Evaluation System with Linux Softmodem for 73M1x22 MicroDAA User Guide

5 Contact Information

For more information about Teridian Semiconductor products or to check the availability of the 73M1822 or 73M1922, contact us at:

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For a complete list of worldwide sales offices, go to http://www.teridian.com.

Revision History

Date	Revision	Description
10/10/2006	1.0	First Publication.
3/11/2009	1.4	Miscellaneous edits, new features.
4/7/2009	1.5	Miscellaneous edits.