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B	RDODC1357	Updated to support DM LCM Project	7/14/2009	Rick Wilson	James Parker
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ACCU-CHEK Combo Aviva, Performa, ACCU-CHEK Expert Aviva, Performa

Communications Protocol Developer's Guideline

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Table of Contents

1 Purpose

The purpose of this document is to provide the minimum communication protocol for external developers to extract results from an ACCU-CHEK® blood glucose meter. The audiences of this document are software development professionals who are interested in developing an interface between Roche Diagnostics ACCU-CHEK meter and an external host.

This document only provides information for Roche Diagnostics ACCU-CHEK® Combo and ACCU-CHEK® Expert meters. Other Roche Diagnostic meters are addressed in separate CPDG documents.

2 Disclaimer

The developer using this document to extract data from a Roche Diagnostics meter assumes all responsibility for conforming to this standard. Data extracted from a Roche Diagnostics meter is not to be manipulated by an external process. Data should be used only for transmission to a central repository or data analysis system. Roche Diagnostics is not responsible for inaccurate or misdiagnosis of a patient condition due to mishandling of data extracted from a Roche Diagnostics blood glucose meter.

3 Definitions

bG – Abbreviation for **b**lood **G**lucose.
cG – Term used to refer to test run with control solution.
Host – Device communicating to meter, such as a PC.
IR – Infrared light
Monitor – A blood Glucose monitor, referred to as a meter.
Number – Any sequence of numeric characters (‘0’-‘9’).
Date – A string of fixed length ASCII characters that form a date using YYMMDD format.
Time – A string of fixed length ASCII characters that represent a time using HHMMSS format.
Function – A single ASCII character used as a sub-division of a command.
Fixed Hex Word – Any string of 4 ASCII characters that a hexadecimal number can be formed.
Fixed Hex Double Word – Any string of 8 ASCII characters that a hexadecimal number can be formed.
Hex Word – Any string of 1 to 4 ASCII characters that a hexadecimal number can be formed.
Fixed Hex Byte – Any string of 2 ASCII characters that a hexadecimal number can be formed.
Hex Byte – Any string of 1 to 2 ASCII characters that a hexadecimal number can be formed.
String – Any string of printable ASCII characters.
Float – Any String of 1 to 4 characters that a floating point number can be formed from. A decimal point is included in the string.
Signed Number – Any sequence of numeric characters (‘0’-‘9’) preceded by a “+” or a “-“.

4 References

4.1 Manuals

ACCU-CHEK Aviva Combo User Manual
ACCU-CHEK Performa Combo User Manual
ACCU-CHEK Aviva Expert User Manual
ACCU-CHEK Performa Expert User Manual

4.2 Cables

ACCU-CHEK Infrared Cable (IR-210B Infrared Adapter by TekRam Technology)
Roche Diagnostics Cat. No. 3183408

ACCU-CHEK Universal Cable: Roche Diagnostics Cat. No. 03062678001
This document does not provide information for connection to the Roche Diagnostics USB interface cable.

5 Document Legend

Legend:		Example	Description
{ }	Hex value represented using ASCII	{4A}	Two bytes, '4' and 'A', are placed into the data stream.
< >	Serial Control Character	<CR>	Carriage return is placed into stream.
[ ]	Hex value	[4A]	4A hex gets placed into stream.

→ From host to instrument

← From instrument to host

^ Control character – Press character on keyboard while holding the CTRL key down.

Serial Control Characters:

<STX> = [02]	<ACK> = [06]	<LF> = [0A]	<ETX> = [03]
<TAB> = [09]	<NAK> = [15]	<CR> = [0D]	<EOT> = [04]
<CAN> = [18]			

Key Points

Input and Output parameters are <TAB> delimited.

All BG results are transmitted in mg/dL units. If mmol/L units are desired, then they **must** be converted using the formula: 1 mmol/L = 18.02 mg/dl.

6 ACCU-CHEK Meter Protocol

6.1 Communication Requirements and Serial Port Settings

The ACCU-CHEK meter serial communications are at **9600** baud with **8** data bits, **1** start bit, **1** stop bit and **NO** parity checking. The ACCU-CHEK meter communicates via Infrared (IR). In order for a Host to communicate with the meter, an IR Cable must be attached to the PC. Cables for this function are available from Roche Diagnostics. The ACCU-CHEK meter **must be in Communication mode** to allow serial communications. From the "My Data" menu screen select "Data Transfer" to get the meter into Communication mode. The automatic power off time is 2 minutes.

The protocol shall only support half-duplex communications. When switching from receiving to transmitting, the meter shall insert a 10ms delay before transmitting. When switching from transmitting to receiving, the meter shall expect 10ms delay from the host.

When the meter is receiving data frames, the meter requires a two-millisecond delay between each character. When the meter is transmitting data frames, an inter-character delay may be present.

6.2 Protocol Command Structure

Each command consists of at least a command (one character) and a command terminator. The number of parameters for each command and the allowed parameter range are specified in the command reference.

The meter will echo back each command character and each single parameter character to increase the reliability of the communication protocol as soon as it is received. The command terminator is not echoed back.

Commands can be accepted or rejected by the meter. If the meter accepts the command sent from the host, it will answer with an <ACK> directly after receiving the command terminator.

The meter shall reject commands by sending a <NAK> (after receiving the command terminator) if one of the following cases happened:

- the meter receives an unknown command
- the meter receives unexpected characters within the parameters
- the meter receives invalid number of parameters for the command
- one of the parameters is outside its allowed range
- the meter is in an error state, i.e., the status register is not zero

After receiving an accepted command and answering with <ACK> the firmware starts to execute the command.

After executing the command, the meter will send another <ACK or NAK> indicating successful/faulty completion of the command. Any problems while executing the command shall lead to storing the appropriate error number and answering with a <NAK>, otherwise the answer shall be an <ACK>.

If an error occurs in communication mode because of a wrong command or during the execution of the command, the firmware shall send a <NAK> as command response to the host and enter an error state. If the meter is in an error state, it will reject all commands by sending a <NAK> after receiving the command terminator until the error status is read out and cleared. The 'Read and Clear' command is the

only command accepted by the meter if it is in an error state. See Section 9 Status Register Values for definition of error codes.

6.2.1 DATA BLOCKS

Upload and download data shall be transferred in data blocks controlled by <STX> and <ETX or EOT> characters. These data blocks will have the following format:

<STX>{# of bytes}<TAB>Data<TAB>{CRC}<ETX or EOT>

STX:	STX is the start of packet indicator.
# of bytes:	This is a two-byte ASCII string containing the number of data bytes, including the Tabs, as a hexadecimal number.
TAB:	Used for Field delimitation.
Data:	A stream of ASCII characters
TAB:	Used for Field delimitation.
CRC:	This is a two-byte ASCII string containing the 8-bit checksum value as a hexadecimal number.
ETX:	ETX is used if more data blocks will be sent.
EOT:	EOT is used if this is the last data block to be sent.

6.2.2 MULTIPLE DATA BLOCKS

In upload mode, the host has to send an <ACK or NAK> after each received data block. If the host sends, other characters, the meter aborts upload and sets the status to [FD], Aborted Command. In case of NAK the meter has to repeat the last data block. The host is notified that the meter has no more data blocks to send by the EOT terminator.

6.2.3 CHECKSUM CALCULATOR

To assure a reliable data transfer process, data blocks are protected by an 8-bit checksum (CRC). The checksum (CRC) is computed by bitwise XORing the data bytes with the previous checksum value. The initial value is [6E]. Only the <TAB>s and the data bytes are included in the checksum calculation, <STX> and # of bytes are not.

	STX	Length		TAB	Data					TAB	CRC		ETX/EOT
Data	<STX>	0	7	<TAB>	A	v	i	v	a	<TAB>	2	7	<EOT>
(Hex)	[02]	[30]	[37]	[09]	[41]	[76]	[69]	[76]	[61]	[09]	[32]	[37]	[04]
CRC	Initial value is [6E]			[67]	[26]	[50]	[39]	[4F]	[2E]	[27]			

6.2.4 COMMAND INTERRUPTION

The host as the communication master has the possibility to interrupt the meter receiving commands by sending a <CAN> character. This cancel command might be necessary e.g. after receiving an unexpected byte echo or wanting to abort a lengthy results download.

In this case the meter shall:

- Throw away all received command/parameter characters,

- Answer a <NAK> to the host,
- Wait for new commands from the host.

At this time, the Host will have to issue the Read and Clear Status Command before issuing any other commands.

The meter is capable of sending a <CAN>. If this happens, the meter will immediately send a <NAK> following the <CAN> and then return to command processing mode waiting for the next command.

6.3 Normal Sequence of Commands for Data Extraction

Example of initialization sequence required by ACCU-CHEK Infrared Cable*

Host Sends	Description
Set DTR := True Set RTS := False Wait (50 us) Send Control Byte = [14] Set RTS := True Set DTR := True; Wait (50 us);	[14] sets baud rate to 9600 and sets output pulse to 1.6 ms. See device technical spec for more information.

***No initialization sequence is needed for use with the ACCU-CHEK Universal Cable. However, it may be necessary to send a different initialization sequence if a different IR device (dongle) is used.**

Example of communication required for data extraction.

Host Sends	Meter Replies	Description
<CAN>	<NAK>	Initial communications
[0B] <CR> <ACK>	[0B] <ACK> <STX>Response<EOT> <ACK>	Read and clear Status
[43] [09] [31] <CR> <ACK>	[43] [09] [31] <ACK> <STX>Response<EOT> <ACK>	Read Software Version command
[43] [09] [34] <CR> <ACK>	[43] [09] [34] <ACK> <STX>Response<EOT> <ACK>	Read Model number command
[43] [09] [33] <CR> <ACK>	[43] [09] [33] <ACK> <STX>Response<EOT> <ACK>	Read Serial number command
[53] [09]	[53] [09]	Read bG units command

[33] <CR> <ACK>	[33] <ACK> <STX>Response<EOT> <ACK>	
[60] <CR> <ACK>	[60] <ACK> <STX>Response<EOT> <ACK>	Get number of results stored
[61] [09] [xx] [09] [yy] <CR> <ACK>	[61] [09] [xx] [09] [yy] <ACK> <STX>Response<ETX> or <EOT> <ACK>	Extract meter records from memory
[1D] <CR>	[1D] <ACK> <ACK>	Power down command

*** Response includes # of bytes, <TAB>, data, <TAB> and CRC**
*** xx is the first requested result record and yy is the last requested result record.**

7 Commands Reference

7.1 Example of Commands with Parameters

Example of Commands with parameters			
Command Character This section contains the command character.	*This section contains a general description of the command.*		
This section contains the command character plus, if present, the command sub-function. Both the command and the function are one character separated by a <TAB>.	**Input/Output Name** This column contains the name of the given parameter.	**Input/Output Type** This column contains the data type information. The data types are defined in Section 3 Definitions.	**Input/Output Range** This column contains limits or range of the given parameter.
	This section typically contains an example of the command, plus additional information such as notes and sources.		

8 ACCU-CHEK Meter Commands

8.1 Connect – <CAN>

Command Character <CAN>	The <CAN> command is used to initialize communication with the meter. <CAN> may also be used to interrupt commands in process.
	Example: Turn on the meter. →<CAN> ←<NAK> **Note:** The host must issue the Read and Clear Status command ([0B]) to clear the NAK response. If the <CAN> command is issued again, a <NAK> character is returned.

8.2 Power Down – [1D]

Command Character [1D]	The [1D] command shall power down the meter to "off" state.
	Example: **Turn off the meter, power down in "off" state.** →[1D] ←[1D] →<CR> ←<ACK> ←<ACK>

8.3 Read & Clear Status – [0B]

Command Character [0B]	The [0B] command shall read and clear the meter status.	
Output Name Status Register	**Output Type** Fixed Hex Word	**Output Range** 0000H – FFFFH
Example: Initial instrument communications established →[0B] ←[0B] →<CR> ←<ACK> ←<STX>{LEN}<TAB>{ASCII Data}<TAB>{CRC}<EOT> →<ACK> ←<ACK> **Note:** The status register values are defined in the "Status Register Values" section of this document. See section 9 for error code descriptions.		

8.4 Configuration – [43] or 'C'

Command Character [43] or 'C'	The [43] or 'C' commands shall be used to read information about the meter's configuration.
C<TAB>1 — Read software version number	The C<TAB>1 command shall return the meter software version number.

Output Name	Output Type	Output Range
Software Version	String	1 – 7 characters

Example: Version number = 4.11

→C
←C
→<TAB>
←<TAB>
→1
←1
→<CR>
←<ACK>
←<STX>{LEN}<TAB>4.11<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

C<TAB>2 — Read meter hardware version number	The C<TAB>2 command shall return the meter's hardware version.

Output Name	Output Type	Output Range
Hardware Version	String	1 – 8 characters

Example: Version number = DM.01

→C
←C
→<TAB>
←<TAB>
→2
←2
→<CR>
←<ACK>
←<STX>{LEN}<TAB>DM.01<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

8.4 Configuration – [43] or 'C'

C<TAB>3 — Read instrument serial number

The C<TAB>3 command shall return the meter's serial number.

Output Name	Output Type	Output Range
Serial Number	String	1 – 11 characters

Example: Serial number = 70000001

→C
←C
→<TAB>
←<TAB>
→3
←3
→<CR>
←<ACK>
←<STX>{LEN}<TAB>70000001<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

C<TAB>4 — Read model number

The C<TAB>4 command shall return the meter's model number.

Output Name	Output Type	Output Range
Model Number	String	1 – 7 characters

Example: Model number = 535

→C
←C
→<TAB>
←<TAB>
→4
←4
→<CR>
←<ACK>
←<STX>{LEN}<TAB>535<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

8.4 Configuration – [43] or 'C'

C<TAB>5 — Read transmit time (in sec) for max. records @ 9600 baud

The C<TAB>5 command shall return the time to transmit the maximum number of records at 9600 baud.

Output Name	Output Type	Output Range
Max. Transmit Time	Number	0 – 65535

Example: Transmit time = 91 seconds

→C
←C
→<TAB>
←<TAB>
→5
←5
→<CR>
←<ACK>
←<STX>{LEN}<TAB>091<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

Note: The transmit time reported is based on a theoretical model and will vary from the actual time.

C<TAB>6 — Read maximum number of records that can be stored

The C<TAB>6 command shall return the sum of the maximum number of control records and bG records that can be stored.

Output Name	Output Type	Output Range
Max. Number of Records	Number	0 – 1100

Example: Maximum number of records = 1100

→C
←C
→<TAB>
←<TAB>
→6
←6
→<CR>
←<ACK>
←<STX>{LEN}<TAB>1100<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

8.4 Configuration – [43] or 'C'

C<TAB>b — Determine Type of meter (Combo or Expert).	The C<TAB>b command shall return the 0 if meter is an ACCU-CHEK® Expert Meter and return 1 if the meter is an ACCU-CHEK® Combo meter.		
	Output Name Meter Type	**Output Type** Number	**Output Range** 0 – 1 0 – Expert 1 – Combo
	Example: Meter Type = Expert →C ←C →<TAB> ←<TAB> →b ←b →<CR> ←<ACK> ←<STX>{LEN}<TAB>0<TAB>{CRC}<EOT> →<ACK> ←<ACK>		

8.5 Instrument Name – [49] or 'I'

Command Character [49] or 'I'	The [49] or 'I' command shall be used to read the instrument name.		
	Output Name Name	**Output Type** String	**Output Range** 1 – 32 characters
	Example: Name = DM Aviva →I<CR> ←I<ACK> ←<STX>{LEN}<TAB>DM Aviva<TAB>{CRC}<EOT> →<ACK> ←<ACK> **Note**: The 'DM Aviva' in this example may vary by model number. This is an example only.		

8.6 Read Setup – [53] or 'S'

Command Character [53] or 'S'	The [53] or 'S' commands shall allow the host to extract the meter settings from the meter.		
S<TAB>1 — Read date	The S<TAB>1 command shall read the date.		
	Output Name Date	**Output Type** Date	**Output Range** 090101 – 311231 Date format is YYMMDD
	Example: Date = February 3, 2009 →S ←S →<TAB> ←<TAB> →1 ←1 →<CR> ←<ACK> ←<STX>{LEN}<TAB>090203<TAB>{CRC}<EOT> →<ACK> ←<ACK>		
S<TAB>2 — Read time	The S<TAB>2 command shall read the time.		
	Output Name Time	**Output Type** Time	**Output Range** 000000 – 235959 Time format is 24-hour (HHMMSS)
	Example: Time = 3:45 PM →S ←S →<TAB> ←<TAB> →2 ←2 →<CR> ←<ACK> ←<STX>{LEN}<TAB>154500<TAB>{CRC}<EOT> →<ACK> ←<ACK>		

8.6 Read Setup – [53] or 'S'

S<TAB>3 — Read units

The S<TAB>3 command shall read the display units.

Output Name	Output Type	Output Range
Units	String	"mg/dl" or "mmol/l"

Example: Units = mg/dl

→S
←S
→<TAB>
←<TAB>
→3
←3
→<CR>
←<ACK>
←<STX>{LEN}<TAB>mg/dl<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

S<TAB>6 — Read Patient Hypo. Threshold

The S<TAB>6 command shall return the Hypo level.

Output Name	Output Type	Output Range
Hypo. Threshold	Number (mg/dl)	50 – 90

Example: Hypo. Threshold = 66 mg/dl

→S
←S
→<TAB>
←<TAB>
→6
←6
→<CR>
←<ACK>
←<STX>{LEN}<TAB>66<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

Note: The Output Range is 54 – 90 mg/dl for a meter that was configured as a mmol/l meter.

8.6 Read Setup – [53] or 'S'

S<TAB>7 — Read Selected Language

The S<TAB>7 command shall read the selected language.

Output Name	Output Type	Output Range
Selected Language	Number	1 – 7, A, C, D, F, G, H, I, J, M, N, O, Q 1 = German 2 = English 3 = French 4 = Spanish 5 = Italian 6 = Dutch 7 = Swedish A = Portuguese C = Norwegian D = Finnish F = Danish G = Czech H = Hungarian I = Slovenian J = Russian M = Polish N = Slovakian O = Brazilian Portuguese Q= Romanian

Example: **Language = English**

→S
←S
→<TAB>
←<TAB>
→7
←7
→<CR>
←<ACK>
←<STX>{LEN}<TAB>2<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

8.6 Read Setup – [53] or 'S'

S<TAB>8 — Read date format

The S<TAB>8 command shall read the date format.

Output Name	Output Type	Output Range
Date Format	Number	3 3 = DDMMMYY

Example: Date Format = DDMMMYY

→S
←S
→<TAB>
←<TAB>
→8
←8
→<CR>
←<ACK>
←<STX>{LEN}<TAB>3<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

Note: The meter always return 3 for this command because only one date format is supported. (DDMMMYY; for example: 01Jan09.)

S<TAB>9 — Read time format

The S<TAB>9 command shall read the time format.

Output Name	Output Type	Output Range
Time Format	Number	1 – 2 1 = 24 2 = 12

Example: Time Format = 12-Hour

→S
←S
→<TAB>
←<TAB>
→9
←9
→<CR>
←<ACK>
←<STX>{LEN}<TAB>2<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

8.6 Read Setup – [53] or 'S'

S<TAB>H — Read Insulin Increment	The S<TAB>H command shall read the insulin increment setting.		
	Output Name	**Output Type**	**Output Range**
	Insulin Increment	Number	0 – 2 0 = 0.1 1 = 0.5 2 = 1.0
	Example: **Insulin Increment = 1.0** →S ←S →<TAB> ←<TAB> →H ←H →<CR> ←<ACK> ←<STX>{LEN}<TAB>2<TAB>{CRC}<EOT> →<ACK> ←<ACK>		

S<TAB>Q — Read Stored Languages

The S<TAB>Q command shall return the language IDs for the stored languages. The meter can contain from 1 to 4 languages in its non-volatile memory. This command returns the language ID for each language that is stored.

Output Name	Output Type	Output Range
Language IDs	Number	1 – 7, A, C, D, F, G, H, I, J, M, N, O, Q 1 = German 2 = English 3 = French 4 = Spanish 5 = Italian 6 = Dutch 7 = Swedish A = Portuguese C = Norwegian D = Finnish F = Danish G = Czech H = Hungarian I = Slovenian J = Russian M = Polish N = Slovakian O = Brazilian Portuguese Q= Romanian

Example: The meter has the following languages stored: English, German, French, and no language stored in its 4th Language Section.

→S
←S
→<TAB>
←<TAB>
→Q
←Q
→<CR>
←<ACK>
←<STX>{LEN}<TAB>2<TAB>1<TAB>3<TAB><TAB>{CRC}<EOT>
→<ACK>
←<ACK>

8.6 Read Setup – [53] or 'S'

S<TAB>T — Read Carb Units

The S<TAB>T command shall read the Carb Units setting.

Output Name	Output Type	Output Range
Carb Units	Number	0, 1, 4, 5 0 = Grams 1 = BE 4 = CC 5 = KE

Example: **Carb Units = Grams**

→S
←S
→<TAB>
←<TAB>
→T
←T
→<CR>
←<ACK>
←<STX>{LEN}<TAB>0<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

S<TAB>[6D] — Read Bolus Advice Status

The S<TAB>[6D] command shall return the bolus advice status.

Output Name	Output Type	Output Range
Advice Status	Number	0 – 1 (0 = disabled)

Example: **Advice Status = Disabled**

→S
←S
→<TAB>
←<TAB>
→[6D]
←[6D]
→<CR>
←<ACK>
←<STX>{LEN}<TAB>0<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

S<TAB>[6E] — Read Key Lock Status	The S<TAB>[6E] command shall return the key lock status.		
	Output Name	**Output Type**	**Output Range**
	Key Lock Status	Number	0 – 1 (0 = disabled)
	Example: **Key Lock Status = Disabled** →S ←S →<TAB> ←<TAB> →[6E] ←[6E] →<CR> ←<ACK> ←<STX>{LEN}<TAB>0<TAB>{CRC}<EOT> →<ACK> ←<ACK>		
S<TAB>[6F] — Read Setup Wizard Done Status	The S<TAB>[6F] command shall return the Setup Wizard Done status.		
	Output Name	**Output Type**	**Output Range**
	Setup Wizard Done Status	Number	0 – 1 (0 = not done)
	Example: **Setup Wizard Not Done** →S ←S →<TAB> ←<TAB> →[6F] ←[6F] →<CR> ←<ACK> ←<STX>{LEN}<TAB>0<TAB>{CRC}<EOT> →<ACK> ←<ACK>		

8.6 Read Setup – [53] or 'S'

S<TAB>[70] — Read Bluetooth Control Status

The S<TAB>[70] command shall read the Bluetooth control status.

Output Name	Output Type	Output Range
Bluetooth Control Status	Number	0 – 1 (0 = Bluetooth off)

Example: **Bluetooth Control Status = Off**

→S
←S
→<TAB>
←<TAB>
→[70]
←[70]
→<CR>
←<ACK>
←<STX>{LEN}<TAB>0<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

Note: This command is for ACCU-CHEK® Combo meters only. ACCU-CHEK® Expert meters support this command and always return zero.

S<TAB>[71] — Read Key Click Status

The S<TAB>[71] command shall return the key click status.

Output Name	Output Type	Output Range
Key click Status	Number	0 – 1 (0 = Key click disabled)

Example: **Key click Status = Disabled**

→S
←S
→<TAB>
←<TAB>
→[71]
←[71]
→<CR>
←<ACK>
←<STX>{LEN}<TAB>0<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

S<TAB>[72] — Read Beeper Volume

The S<TAB>[72] command shall return the beeper volume setting.

Output Name	Output Type	Output Range
Beeper Volume	Number	0 – 3 0 = Off 1 = Low 2 = Medium 3 = High

Example: **Beeper Volume = Low**

→S
←S
→<TAB>
←<TAB>
→[72]
←[72]
→<CR>
←<ACK>
←<STX>{LEN}<TAB>1<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

S<TAB>[73] — Read Vibrate Status

The S<TAB>[73] command shall read the vibrate status.

Output Name	Output Type	Output Range
Vibrate Status	Number	0 – 1 (0 = Vibrate disabled)

Example: **Vibrate Status = Disabled**

→S
←S
→<TAB>
←<TAB>
→[73]
←[73]
→<CR>
←<ACK>
←<STX>{LEN}<TAB>0<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

S<TAB>[74] — Read bG Reminder	The S<TAB>[74] command shall return the bG Reminder Status, bG Reminder Threshold, and bG Reminder Duration for a selected bG Reminder Type.		
	Input Name	**Input Type**	**Input Range**
	bG Reminder Type	Number	0 – 2 0 = After high bG 1 = After low bG 2 = After meal
	Output Name	**Output Type**	**Output Range**
	bG Reminder Status	Number	0 – 1 (0 = disabled)
	bG Reminder Threshold	Number (mg/dl or grams)	*Thres Min – Thres Max* For After high bG, the populated range is 120–350 mg/dl or for a mmol/L configured meter 117–351 mg/dl. For After low bG, the populated range is 050–100 mg/dl or for a mmol/L configured meter 54–100 mg/dl. For After meal, the populated range is 000–024 grams.
	bG Reminder Time Duration	Time	*Dur Min – Dur Max* For After high bG, the range is 010000–060000. For After low bG, the range is 000500–003000. For After meal, the range is 010000–040000.

8.6 Read Setup – [53] or 'S'

Example: **bG Reminder After high bG Enabled, Threshold = 200 mg/dl, bG Reminder Time Duration = 2 hours and 45 minutes.**

→S
←S
→<TAB>
←<TAB>
→[74]
←[74]
→<TAB>
←<TAB>
→0
←0
→<CR>
←<ACK>
←<STX>{LEN}<TAB>1<TAB>200<TAB>024500<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

Note 1: The bG Reminder Time Duration, for the After High bG and After Meal reminders, the minutes shall be a multiple of a quarter hour and the seconds value shall be zero. The bG Reminder Time Duration, for the After Low bG reminder, the minutes shall be a multiple of 5 minutes and the seconds value shall be zero.

Note 2: For the bG Reminder Threshold, the Meter shall return <TAB><TAB> if its value has not been set up.

Note 3: For the bG Reminder Time Duration, for the after High bG reminder, the Meter shall return <TAB><TAB> if its value has not been set up.

8.6 Read Setup – [53] or 'S'

S<TAB>[75] — Read Alarm Clock

The S<TAB>[75] command shall read the Selection and Time for a selected Alarm Clock.

Input Name	Input Type	Input Range
Alarm Clock Number	Number	0 – 7 0 = Alarm Clk 1 . . . 7 = Alarm Clk 8

Output Name	Output Type	Output Range
Selection	Number	0 – 3 0 = Off 1 = bG Test 2 = Injection (Expert meters only) 3 = Other
Time	Time	000000 – 234500

Example: **Alarm Clock 3 set for bG Test at 8:15 AM**

→S
←S
→<TAB>
←<TAB>
→[75]
←[75]
→<TAB>
←<TAB>
→2
←2
→<CR>
←<ACK>
←<STX>{LEN}<TAB>1<TAB>081500<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

Note: For the Time, the minutes shall be a multiple of a quarter hour and the seconds value shall be zero. "000000" shall be returned for the Time if the time has not been set.

S<TAB>[76] — Read Date Reminder

The S<TAB>[76] command shall return the Reminder Status, Time Set Status, Date, and Time for a selected Reminder Type.

Input Name	Input Type	Input Range
Reminder Type	Number	0 – 1 0 = Dr. Visit 1 = Lab Test

Output Name	Output Type	Output Range
Reminder Status	Number	0 – 1 (0 = disabled)
Time Set Status	Number	0 – 1 0 = No 1 = Yes
Date	Date	030101 – 311231
Time	Time	000000 – 234500

Example: **Dr. Visit Reminder set for 3:45 PM, June 17, 2007**

→S
←S
→<TAB>
←<TAB>
→[76]
←[76]
→<TAB>
←<TAB>
→0
←0
→<CR>
←<ACK>
←<STX>{LEN}<TAB>1<TAB>1<TAB>070617<TAB>154500<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

Note: For the Time, the minutes shall be a multiple of a quarter hour and the seconds value shall be zero. “000000” shall be return for the Time if the time has not been set.

8.6 Read Setup – [53] or 'S'

S<TAB>[77] — Read Infusion Set Reminder	The S<TAB>[77] command shall read the Status and Interval for the Infusion Set Reminder.		
	Output Name	**Output Type**	**Output Range**
	Status	Number	0 – 1 (0 = disabled)
	Interval	Number	0 – 2 0 = 1 day 1 = 2 days 2 = 3 days
	Example: **Infusion Reminder Enabled and set for 2 days** →S ←S →<TAB> ←<TAB> →[77] ←[77] →<CR> ←<ACK> ←<STX>{LEN}<TAB>1<TAB>1<TAB>{CRC}<EOT> →<ACK> ←<ACK> **Note:** This command is only intended for ACCU-CHEK® Combo meters.		

S<TAB>[78] — Read Bolus Advice Timeblock	The S<TAB>[78] command shall return the Time, Minimum and Maximum bG Values, Carb Ratio Insulin Value and Carb Ratio Carb Values, and Insulin Sensitivity Insulin Value and Insulin Sensitivity bG Values for a selected Bolus Advice Timeblock.		
	Input Name	**Input Type**	**Input Range**
	Bolus Advice Timeblock	Number	0 – 7 0 = Timeblock 1 . . . 7 = Timeblock 8
	Output Name	**Output Type**	**Output Range**
	End Time	Time	000000 – 233000
	Minimum bG Value	Number (mg/dl)	050 – 140
	Maximum bG Value	Number (mg/dl)	100 – 300
	Carb Ratio Insulin Value	Float (units)	0.1 – 50.0
	Carb Ratio Carb Value	Number (grams)	001 – 240
	Insulin Sensitivity Insulin Value	Float (units)	00.1 – 50.0
	Insulin Sensitivity bG Value	Number (grams)	001 – 999

8.6 Read Setup – [53] or 'S'

Example: **Bolus Advice Timeblock 2: End Time = 4:30 PM,**
Min bG = 30 mg/dl, Max bG = 250 mg/dl,
Carb Ratio Insulin Value = 4.5 units,
Carb Ratio Carb Value = 110 grams,
Insulin Sensitivity Insulin Value = 23.0 units,
Insulin Sensitivity bG Value = 800 mg/dl

→S
←S
→<TAB>
←<TAB>
→[78]
←[78]
→<TAB>
←<TAB>
→1
←1
→<CR>
←<ACK>
←<STX>{LEN}<TAB>163000<TAB>030<TAB>250<TAB>04.5<TAB>110<TAB>23.0<TAB>800<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

Note 1: If the Bolus Advice Timeblock Number corresponds to a timeblock that is not set up, the meter will NAK the command and update the Status Register with Invalid Parameter (F8H). The seconds value of the End Time is always set to zero.

Note 2: For the Carb Ratio Carb Value, the Meter shall return <TAB><TAB> if its value has not been set up.

Note 3: For the Insulin Sensitivity bG Value, the Meter shall return <TAB><TAB> if its value has not been set up.

Note 4: The Output Ranges for mmol/L configured meters are: Minimum bG Value 54-144 mg/dl and Maximum bG Value 100 – 270 mg/dl.

8.6 Read Setup – [53] or 'S'

S<TAB>[79] — Read Health Event Value	The S<TAB>[79] command shall read the Health Event Value for a selected Health Event.		
	Input Name Health Event Number	**Input Type** Number	**Input Range** 0 – 4 0 = Exercise 1 1 = Exercise 2 2 = Stress 3 = Illness 4 = Premenstrual
	Output Name Health Event Value	**Output Type** Signed Number (%)	**Output Range** "-50" – "+50" or "00"
	Example: **Health Event Number 2, Stress = -13%** →S ←S →<TAB> ←<TAB> →[79] ←[79] →<TAB> ←<TAB> →2 ←2 →<CR> ←<ACK> ←<STX>{LEN}<TAB>-13<TAB>{CRC}<EOT> →<ACK> ←<ACK>		

S<TAB>[80] — Read Bolus Advice Options

The S<TAB>[80] command shall return the Bolus Advice Options Meal Excursion (Meal Rise), Active Timeout, Offset Timeout, and Snack Limit values.

Output Name	Output Type	Output Range
Meal Excursion (Meal Rise)	Number (mg/dl)	050 – 200
Active Timeout	Time	013000 – 080000
Offset Timeout	Time	004500 – Active Timeout Value
Snack Limit	Number (grams)	00 – 24

Example: **Bolus Advice Meal Excursion = 70 mg/dl, Active Timeout = 3 hours 45 minutes, Offset Timeout = 2 hours 00 minutes, Snack Limit = 14 grams**

→S
←S
→<TAB>
←<TAB>
→[80]
←[80]
→<CR>
←<ACK>
←<STX>{LEN}<TAB>070<TAB>034500<TAB>020000<TAB>14<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

Note 1: For Active Timeout and Offset Timeout, the minutes shall be a multiple of a quarter hour and the seconds value shall be zero.

Note 2: For the Snack Limit, the Meter shall return <TAB><TAB> if its value has not been set up.

8.6 Read Setup – [53] or 'S'

S<TAB>[82] — Read Patient Hyper bG threshold

The S<TAB>[82] command shall read the Patient Hyper bG threshold.

Output Name	Output Type	Output Range
Hyper bG Threshold	Number (mg/dl)	180 – 350

Example: **Hyper bG Threshold = 200 mg/dl**

→S
←S
→<TAB>
←<TAB>
→[82]
←[82]
→<CR>
←<ACK>
←<STX>{LEN}<TAB>200<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

Note: The Output Range for a mmol/L configured meter is: 180- 351 mg/dl.

S<TAB>[83] — Read Energy Units

The S<TAB>[83] command shall return the Energy Units setting.

Output Name	Output Type	Output Range
Energy Units	Number	0 – 2 0 = Cal 1 = KCal 2 = KJ

Example: **Energy Units = Calories**

→S
←S
→<TAB>
←<TAB>
→[83]
←[83]
→<CR>
←<ACK>
←<STX>{LEN}<TAB>0<TAB>{CRC}<EOT>
→<ACK>
←<ACK>

8.6 Read Setup – [53] or 'S'

S<TAB>[84] — Read Max Bolus Value	The S<TAB>[84] command shall read the Max Bolus Value.		
	Input Name Selection	**Input Type** Number	**Input Range** 0
	Output Name Max Bolus Value	**Output Type** Float (Insulin Units)	**Output Range** 00.0 – 50.0
	Example: **ICT Max Bolus Value = 23.5 units** →S ←S →<TAB> ←<TAB> →[84] ←[84] →<TAB> ←<TAB> →0 ←0 →<CR> ←<ACK> ←<STX>{LEN}<TAB>23.5<TAB>{CRC}<EOT> →<ACK> ←<ACK> **Note:** This command is only available on ACCU-CHEK® Expert meters. ACCU-CHEK® Combo meters do not support this command. **Note 2:** For the Max Bolus Value, the Meter shall return <TAB><TAB> if its value has not been set up.		

8.7 Change Setup – [0C]

Command Character [0C]	The [0C] commands shall allow the host to alter the settings of the meter.		
[0C]<TAB>1 — Set date	The [0C]<TAB>1 command shall set the meter's date.		
	Input Name Date	**Input Type** Date (YYMMDD)	**Input Range** 090101 – 311231
	Example: Set date to February 10, 2009 →[0C] ←[0C] →<TAB> ←<TAB> →1 ←1 →<CR> ←<ACK> →<STX>{LEN}<TAB>090210<TAB>{CRC}<EOT> ←<ACK> **Note:** Setting the meter to an invalid date will result in a meter error.		
[0C]<TAB>2 — Set time	The [0C]<TAB>2 command shall set the meter's time.		
	Input Name Time	**Input Type** Time (HHMMSS)	**Input Range** 000000 – 235959
	Example: Set time to 3:45 PM →[0C] ←[0C] →<TAB> ←<TAB> →2 ←2 →<CR> ←<ACK> →<STX>{LEN}<TAB>154500<TAB>{CRC}<EOT> ←<ACK> ←<ACK>		

8.7 Change Setup – [0C]

[0C]<TAB>7 — Set Language

The [0C]<TAB>7 command shall set the selected language.

Input Name	Input Type	Input Range
Selected Language	Number	1 – 7, A, C, D, F, G H, I, J, M, N, O, Q 1 = German 2 = English 3 = French 4 = Spanish 5 = Italian 6 = Dutch 7 = Swedish A = Portuguese C = Norwegian D = Finnish F = Danish G = Czech H = Hungarian I = Slovenian J = Russian M = Polish N = Slovakian O = Brazilian Portuguese Q= Romanian

Example: Set Language to English (a stored language)

→[0C]
←[0C]
→<TAB>
←<TAB>
→7
←7
→<CR>
←<ACK>
→<STX>{LEN}<TAB>2<TAB>{CRC}<EOT>
←<ACK>
←<ACK>

Note: If the Selected Language Parameter is set to a number that does not correspond to any of the languages stored in the meter, the meter shall NAK the command and updates the Status Register with INVALID_PARAMETER (F8H).

8.7 Change Setup – [0C]

[0C]<TAB>9 — Set time format	The [0C]<TAB>9 command shall set the meter's time format.		
	Input Name Time Format	**Input Type** Number	**Input Range** 1 – 2 1 = 24 2 = 12
	Example: Set time format to 12-Hour →[0C] ←[0C] →<TAB> ←<TAB> →9 ←9 →<CR> ←<ACK> →<STX>{LEN}<TAB>2<TAB>{CRC}<EOT> ←<ACK> ←<ACK>		
[0C]<TAB>[71] — Set Key Click Status	The [0C]<TAB>[71] command shall set the key click status		
	Input Name Key Click Status	**Input Type** Number	**Input Range** 0 – 1 (0 = disable)
	Example: **Disable Key Click** →[0C] ←[0C] →<TAB> ←<TAB> →[71] ←[71] →<CR> ←<ACK> →<STX>{LEN}<TAB>0<TAB>{CRC}<EOT> ←<ACK> ←<ACK>		

8.7 Change Setup – [0C]

[0C]<TAB>[72] — Set Beeper Volume

The [0C]<TAB>[72] command shall set the beeper volume.

Input Name	Input Type	Input Range
Beeper Volume	Number	0 – 3 0 = Off 1 = Low 2 = Medium 3 = High

Example: Set Beeper Volume to Low

→[0C]
←[0C]
→<TAB>
←<TAB>
→[72]
←[72]
→<CR>
←<ACK>
→<STX>{LEN}<TAB>1<TAB>{CRC}<EOT>
←<ACK>
←<ACK>

Note: Due to safety concerns, the meter does not allow the user interface to disable both the vibrator and beeper.

It is **highly recommended** that host applications ensure that the vibrator and beeper are not both disabled. The meter does not enforce this through the serial interface.

8.7 Change Setup – [0C]

[0C]<TAB>[73] — Set Vibrate Status

The [0C]<TAB>[73] command shall set the vibrate status.

Input Name	Input Type	Input Range
Vibrate Status	Number	0 – 1 (0 = disable)

Example: Set Vibrate status to Disabled.

→[0C]
←[0C]
→<TAB>
←<TAB>
→[73]
←[73]
→<CR>
←<ACK>
→<STX>{LEN}<TAB>0<TAB>{CRC}<EOT>
←<ACK>
←<ACK>

Note: Due to safety concerns, the meter does not allow the user interface to disable both the vibrator and beeper.

It is **highly recommended** that host applications ensure that the vibrator and beeper are not both disabled. The meter does not enforce this through the serial interface.

8.8 Enable/Disable Timers – [5A] or 'Z'

Command Character [5A] or 'Z'	The 5A or Z command shall toggle the meter's timeout timers.		
Z<TAB>0 — Disable selected timeouts	The Z<TAB>0 command shall disable the selected timeouts.		
	Input Name Timers	**Input Type** Function	**Input Range** '0' – '9', 'A' – 'F'
	Example: Disable all timeouts →Z ←Z →<TAB> ←<TAB> →0 ←0 →<TAB> ←<TAB> →F ←F →<CR> ←<ACK> ←<ACK> **Note**: The '0' in this command is the digit zero and not the letter 'O'. The input parameter is a bit mapped of the four available timeouts. The bits are mapped as follows: 0 - Disable auto-power off timer 1 - Disable command timeout 2 - Disable data exchange timeout 3 - Disable inter-character timeout		

8.8 Enable/Disable Timers – [5A] or 'Z'

Z<TAB>1 — Enable selected timeouts

The Z<TAB>1 command shall enable selected timeouts.

Input Name	Input Type	Input Range
Timers	Function	'0' – '9', 'A' – 'F'

Example: Enable all timeout

→Z
←Z
→<TAB>
←<TAB>
→1
←1
→<TAB>
←<TAB>
→F
←F
→<CR>
←<ACK>
←<ACK>

Note 1: The input parameter is a bit mapped of the four available timeouts. The bits are mapped as follows:

Bit 0 - Enable auto-power off timer
Bit 1 - Enable command timeout
Bit 2 - Enable data exchange timeout
Bit 3 - Enable inter-character timeout

Note 2: Auto-power off timeout – If the meter goes more than 120 seconds without a button, strip or command being sent it automatically shuts down.

8.9 Obtain Number of Results – [60]

Command Character [60]	The [60] command shall return the number of results stored in the meter.		
	Output Name Number Records	**Output Type** Number	**Output Range** 0 – 1100
	Example: Number of results = 1100 →[60] ←[60] →<CR> ←<ACK> ←<STX>{LEN}<TAB>1100<TAB>{CRC}<EOT> →<ACK> ←<ACK> **Note:** Corrupted, Blank, and pump data only records are not transmitted, however are included in the total number of records.		

8.10 Send Results from Start to End – [61] or 'a'

Command Character [61] or 'a'	The [61] or 'a' command shall return the requested bG results, cG results, carb data, and insulin data.		
	Input Name Start Value End Value	**Input Type** Number Number	**Input Range** 1 – Number of records stored 1 – Number of records stored
	Output Name Glucose value Time Date Flags DM Data Block	**Output Type** Number (mg/dl) or empty Time (HHMM) Date (YYMMDD) Fixed Hex Double Word Empty or see definition below	**Output Range** 0 – 999 0000 – 2359 010101 – 311231 See bit pattern below. Empty or see definition below

8.10 Send Results from Start to End – [61] or 'a'

Example: Read 10 results starting with result 1

→[61]
←[61]
→<TAB>
←<TAB>
→1
←1
→<TAB>
←<TAB>
→1
←1
→0
←0
→<CR>
←<ACK>
←<STX>{LEN}<TAB>120<TAB>2359<TAB>030612<TAB>00000010<TAB><TAB>{CRC}<ETX>
→<ACK>
…
←<STX>{LEN}<TAB>120<TAB>1234<TAB>030612<TAB>00000020<TAB><TAB>{CRC}<EOT>
→<ACK>
←<ACK>

Note 1: The flags field will transmit all zeros if no flags are set.

Note 2: Corrupted, blank, or pump data only records are not transmitted, however are included in the total number of records.

Note 3: For bG records, if the Glucose Value does not exist, the [61] command shall return an empty Glucose Value (<TAB><TAB>).

Note 4: For cG records, the [61] command shall return an empty DM Data Block.

Note 5: bG and cG results shall be transmitted in the reverse order in which they were stored.

8.10 Send Results from Start to End – [61] or 'a'

	DM Data Block:	
	Number of Data Blocks	If the record contains DM data blocks, the first field shall be the number of data blocks that will follow.
	Meal Time Information	If the record contains Meal Time information, the DM data block shall contain <TAB>37<TAB>*event code*<TAB><TAB><TAB><TAB> where *event code* is 1 for premeal, 2 for post meal, 4 for bedtime, 74 for other.
	Health Event Information	If the record contains Health Event information, the DM data block shall contain <TAB>37<TAB>health event <TAB><TAB><TAB><TAB> where health event is 75 for Exercise 1, 76 for Exercise 2, 29 for Stress, 73 for Premenstrual, 20 for Fasting, and 31 for Illness.
	Meal Time and Health Event Information	If both Meal time and Health Event information exists for a record, the DM data block shall contain <TAB>37<TAB>event code<TAB> <health event><TAB><TAB><TAB> where event code is 1 for premeal, 2 for post meal, 4 for bedtime, 74 for other and where health event is 75 for Exercise 1, 76 for Exercise 2, 29 for Stress, 73 for Premenstrual, 20 for Fasting, and 31 for Illness.

8.10 Send Results from Start to End – [61] or 'a'

	Carb Amount Information	If the record contains Carbohydrate information, the DM data block shall contain <TAB>12<TAB>value<TAB> where value is 3 characters representing the amount of carbohydrates in grams.
	Pen/Syringe Insulin Bolus	If the record contains Insulin Bolus information, the DM data block shall contain <TAB>34<TAB>1<TAB>29<TAB>insulin dosage<TAB> where insulin dosage is in the Float format (1 to 4 characters containing a decimal point).
	Pen/Syringe Insulin Basal	If the record contains Insulin Basal information, the DM data block shall contain <TAB>34<TAB>2<TAB>30<TAB>insulin dosage<TAB> where insulin dosage is in the Float format (1 to 4 characters containing a decimal point).

Example of a result record with a DM data block:

bG result was 120 mg/dl; it occurred at 11:59 PM on June 12, 2003, Bed time event; Health Event is Illness, Pen Syringe Insulin bolus with an amount of 4.5 IU.

Result Packet:
<STX>{LEN}<TAB>120<TAB>2359<TAB>030612<TAB>00000000<TAB>2<TAB>37<TAB>4<TAB>31<TAB><TAB><TAB>34<TAB>1<TAB>0<TAB>4.5<TAB>{CRC}<ETX>

Flags:

0x00000000	No flags
0x00000004	Result too low
0x00000008	Result too high
0x00000010	Control solution level 2

8.10 Send Results from Start to End – [61] or 'a'

	0x00000020	Control solution level 1
	0x00000040	Result out of temperature range
	0x00000200	Result below hypo
	0x00000800	User's result below his personal target range or control result below control's target range
	0x00001000	User's result above his personal target range or control result above control's target range
	0x00008000	Control not identified
	0x00020000	Result above hyper
	0x00040000	Before Meal (Flag not used in all models)
	0x00080000	After Meal (Flag not used in all models)

8.11 Reset Results Memory – [52] or 'R'

Command Character [52] or 'R'	The [52] or 'R' command shall clear results memory.
	Example: Clear results memory →R ←R →<CR> ←<ACK> ←<ACK> **Note:** This function clears all results memory. This includes bG results, cG results, and Bolus Advice history.

9 Status Register Values

Status Value (hex)	Status Register Value Meaning
0000h	No Errors
0001h – 00EFh	Internal Meter Errors
00F0h	Command Canceled
00F1h	STX Expected Error
00F2h	Length Expected Error
00F3h	Not used.
00F4h	Not Used
00F5h	Not used.
00F6h	IR Data Overrun
00F7h	Invalid Number of Bytes
00F8h	Invalid Parameter
00F9h	Invalid Number of Parameters
00FAh	Receive Buffer Full
00FBh	Communication Timeout
00FCh	Command Not Implemented
00FDh	Command Aborted
00FEh	Not Valid Command
00FFh	Initial Communication
0100h – 0430h	Internal Meter Errors
0431h	Bolus Advice Setup Error
0432h – 0440h	Internal Meter Errors
0441h	Setup Wizard Setup Error
0442h – FFFFh	Internal Meter Errors